339
4/4/68

1.7

MASTER

This document is
PUBLICLY RELEASABLE

H. Kinner
Authorizing Official
Date: 10/20/09

health and safety laboratory

FALLOUT PROGRAM
QUARTERLY SUMMARY REPORT

April 1, 1968

UNITED STATES ATOMIC ENERGY COMMISSION
NEW YORK, N. Y. 10014

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

Printed in the United States of America

Available from

Clearinghouse for Federal Scientific and Technical Information

National Bureau of Standards, U. S. Department of Commerce

Springfield, Virginia 22151

Price: Printed Copy \$3.00; Microfiche \$0.65

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

HEALTH AND SAFETY LABORATORY

FALLOUT PROGRAM
QUARTERLY SUMMARY REPORT

(December 1, 1967 through March 1, 1968)

LEGAL NOTICE

This report was prepared as an account of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in this report, or that the use of any information, apparatus, method, or process disclosed in this report may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in this report.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

Prepared by

Edward P. Hardy, Jr.
Joseph Rivera

Environmental Studies Division

Preceding reports in this series:

HASL-42, -51, -65, -77, -84, -88,
-95, -105, -111, -113, -115,
-117, -122, -127, -131, -132,
-135, -138, -140, -142, -144,
-146, -149, -155, -158, -161,
-164, -165, -171, -172, -173,
-174, -181, -182, -184, and -193.

April 1, 1968

UNITED STATES ATOMIC ENERGY COMMISSION
New York Operations Office

FALLOUT PROGRAM
QUARTERLY SUMMARY REPORT

April 1, 1968

ABSTRACT

This report presents current data from the HASL Fallout Program, The Division of Biological and Medical Research at Argonne National Laboratory, the National Radiation Laboratory in New Zealand, the Institute of Nuclear Sciences in New Zealand, and EURATOM Joint Nuclear Research Centre. Radionuclide levels in stratospheric air, surface air, fallout, milk, other diet components, and tap water, are given in tabular form. The initial section consists of interpretive reports and notes covering the following topics: comparison of fallout collectors, stratospheric radioactivity levels through January 1968, isolation of radioactive particles in fallout, an ocean fallout experiment, and predicted Sr-90 levels in diet components. A bibliography of recent publications related to radionuclide studies is also presented.

Table of Contents

Introduction

Page

Part I - Interpretive Reports and Notes

I - 1

Has the HASL Ion-Exchange Column Been Seriously in Error?
by H. L. Volchok, Health & Safety Laboratory, USAEC

I - 2

Isolation of "Hot" Radioactive Particles from Particulate
Matter Collected at Argonne, Illinois and Forth Worth,
Texas
by S.S. Brar, G. Svihla, D.M. Nelson, and P.F. Gustafson
Division of Biological and Medical Research, Argonne
National Laboratory

I - 17

Ocean Fallout: The Bahama Banks Experiment
by H.L. Volchok, Health and Safety Laboratory, USAEC

I - 27

Project Airstream
by P. W. Krey and B. Krajewski, Health and Safety
Laboratory, USAEC

I - 33

1959 - 1960 Atmospheric Radioactivity Program

I - 208

Strontium-90 in Tri-City Diets: Results for 1966 and
1967 and Comparison with Predictions
by J. Rivera, Health and Safety Laboratory, USAEC

Part II - HASL Fallout Program Data

II - 1

1. Fallout Deposition

II - 2

1.1 Monthly Precipitation

II - 2

1.11 Sr⁹⁰ and Sr⁸⁹ at 156 World Land Sites

II - 2

1.12 Fission Product and Activation Product Radionuclides at Selected Sites

II - 2

1.2 Sr⁹⁰ and Sr⁸⁹ at Atlantic Ocean Weather Stations

II - 2

2. Radionuclides in Surface Air by H. L. Volchok and M. Kleinman

II - 3

3. Radiostrontium in Milk and Tap Water

II - 3

4. Sr⁹⁰ in Tri-City Diets: Second, Third and Fourth Quarters - 1967 by J. Rivera

II - 3

Table of Contents, cont'd

	<u>Page</u>
Part III - <u>Data from Sources Other than HASL</u>	III - 1
1. National Radiation Laboratory, Department of Health Christchurch, New Zealand Environmental Radioactivity in New Zealand Quarterly Report for July-September 1967; NRL F.26	III - 2
2. Department of Scientific and Industrial Research The Institute of Nuclear Sciences, Lower Hutt, New Zealand "Radioisotopes in Rainwater" a. Results for May to August 1967 b. Results for September to December 1967	III - 26
3. Division of Biological and Medical Research Argonne National Laboratory "Cs-137 in Various Chicago Foods (collection month January 1968) by S.S. Brar and D.M. Nelson	III - 29
4. EURATOM Joint Nuclear Research Centre Ispra Establishment: Protection Service Site Survey and Meteorology Section, Quarterly Report	III - 34
Part IV - <u>Recent Publications Related to Radionuclide Studies</u>	IV - 1
<u>Appendix</u>	
A. Sr^{90} and Sr^{89} in Monthly Deposition at World Land Sites	A - 1
B. Radiostrontium Deposition at Atlantic Ocean Weather Stations	B - 1
C. Radionuclides in Surface Air	C - 1
D. Radiostrontium in Milk and Tap Water	D - 1
E. Table of Conversion Factors	E - 1
F. Table of Radionuclides	F - 1

List of Tables
Part II
HASL Fallout Program

<u>Table</u>	<u>Page</u>
<u>Fallout Deposition</u>	
1. a. Sr ⁹⁰ and Sr ⁸⁹ in Monthly Deposition at World Land Sites	Appendix A - 4
b. Fission Product and Activation Product Radionuclides in Monthly Deposition at Selected Sites	II - 6
c. Radiostrontium Deposition at Atlantic Ocean Weather Stations	
BRAVO Station	Appendix B - 3
CHARLIE Station	" B - 4
DELTA Station	" B - 5
ECHO Station	" B - 6
<u>Surface Air Sampling Program</u>	
2. a. HASL Surface Air Sampling Stations	Appendix C - 5
b. Gross Gamma Concentrations in Surface Air	" C - 7
c. Manganese-54 Concentrations in Surface Air	" C - 12
d. Iron-55 Concentrations in Surface Air	" C - 16
e. Strontium-89 Concentrations in Surface Air	" C - 20
f. Strontium-90 Concentrations in Surface Air	" C - 25
g. Zirconium-95 " " "	" C - 30
h. Cadmium-109 " " "	" C - 35
i. Cesium-137 " " "	" C - 38
j. Barium-140 " " "	" C - 42
k. Cerium-141 " " "	" C - 43
l. Cerium-144 " " "	" C - 46
m. Plutonium-238 " " "	" C - 51
n. Plutonium-239 " " "	" C - 54
3. <u>Milk and Tap Water</u>	
a. The Sr ⁹⁰ to Calcium Ratio in Milk: NYC - liquid	Appendix D - 2
b. The Sr ⁹⁰ to Calcium Ratio in Milk: Perry, N. Y. powdered	" D - 2
c. Sr ⁹⁰ in New York City Tap Water	" D - 4
d. The Cs ¹³⁷ to Sr ⁹⁰ Ratio in New York City Tap Water	" D - 4
<u>Food</u>	
4. a. Strontium-90 in Tri-City Diets: Second Quarter - 1967	II - 27
b. Strontium-90 in Tri-City Diets: Third Quarter - 1967	II - 28
c. Strontium-90 in Tri-City Diets: Fourth Quarter - 1967	II - 29

List of Figures
Part II
HASL Fallout Program

Figure

Page

Fallout Deposition

1. a. HASL Monthly Fallout Sampling Network	Appendix A-2
b. Monthly Deposition of Sr-90 in New York City	Appendix A-3

Milk and Tap Water

2. a. Sr ⁹⁰ in Powdered Whole Milk - Perry, New York	Appendix D-3
b. Sr ⁹⁰ in Liquid Whole Milk - New York City	Appendix D-3
c. Sr ⁹⁰ in New York City Tap Water	Appendix D-5

Food

3. Average Daily Sr ⁹⁰ Intake at New York City, Chicago
and San Francisco	II-30

Introduction

Every three months, the Health and Safety Laboratory issues a report summarizing current information obtained at HASL pertaining to fallout. This report, the latest in the series, contains information that became available during the period from December 1, 1967 to March 1, 1968. The next report is scheduled for publication July 1, 1968. Preceding reports in the series, starting with HASL-42, "Environmental Contamination from Weapons Tests", and continuing through HASL-51, -65, -77, -84, -88, -95, -105, -111, -113, -115, -117, -122, -127, -131, -132, -135, -138, -140, -142, -144, -146, -149, -155, -158, -161, -164, -165, -171, -172, -173, -174, -181, -182, -183, -184, and -193 (this report); may be purchased from the Clearinghouse for Federal Scientific and Technical Information, National Bureau of Standards, U. S. Department of Commerce, Springfield, Virginia 22151.

To give a more complete picture of the current fallout situation and to provide a medium for rapid publication of radionuclide data, these quarterly reports often contain information from other laboratories and programs, some of which are not part of the general AEC program. To assist in developing, as rapidly as possible, provisional interpretations of the data, special interpretive reports and notes prepared by scientists working in the field of fallout are also included from time to time. Many of these scientists are associated in some way with the general AEC program. Information developed outside of HASL is identified as such and is gratefully acknowledged by the Laboratory. In this report, data from the EURATOM Joint Nuclear Research Center at Ispra, the National Radiation Laboratory in New Zealand, the Division of Biological and Medical Research at Argonne National Laboratory, and the Institute of Nuclear Sciences in New Zealand, are given.

A portion of the radiochemical analyses are carried out by commercial laboratories under contract to the HASL Environmental Studies and Radiochemistry Divisions. The results of these analyses are reported as part of HASL's regular fallout program. The contractor analytical laboratories which provided data are Nuclear Science and Engineering Corporation, Pittsburgh, Pennsylvania; Isotopes, Inc., Westwood, New Jersey; Radiochemistry, Incorporated, Louisville, Kentucky; Tracerlab, Division of LFE, Richmond, California; Controls for Radiation, Inc., Cambridge, Massachusetts; Hazleton-Nuclear Science Corporation, Palo Alto, California; Food, Chemical and Research Laboratories, Inc., Seattle, Washington; Tracerlab, Division of LFE, Waltham, Massachusetts, and U. S. Testing Co., Inc., Richland, Washington.

This report is divided into four main parts:

1. Interpretive Reports and Notes
2. HASL Fallout Program Data
3. Data from Sources Other than HASL
4. Recent Publications Related to Radionuclide Studies

PART I

INTERPRETIVE REPORTS

AND

NOTES

X HAS THE HASL ION-EXCHANGE COLUMN BEEN SERIOUSLY IN ERROR?

by Herbert L. Volchok (HASL)

For the past several years there have been indications that some of the Sr-90 fallout measurements made by the Health and Safety Laboratory (HASL) may have been systematically in error. In a recent paper, Pudovkina (1) statistically analyzed Sr-90 deposition data from various networks, and concluded that at levels of 1 mCi per square mile per month and higher the HASL data are consistently lower than those of other countries by about 20%.

The low bias in the HASL Sr-90 data was also recognized some time ago by scientists at the Atomic Energy Research Establishment (AERE) in Great Britain. After consultation with HASL a comprehensive intercomparison program was initiated. In this study both laboratories compared collection systems as well as analytical procedures. It is expected that the results of this program will be reported shortly.

In this report an attempt has been made to utilize all of the other existing Sr-90 fallout data as a means of evaluating the relative efficiencies of the various collection networks; and presumably thereby help clarify the particular HASL problem.

To briefly summarize the background; HASL maintains a monthly fallout collection network consisting of about 150 stations throughout the world (2). Of these, some 25% are steep walled stainless steel "pots" and the remainder are plastic ion-exchange column-funnel collectors. These have been described in detail (3,4).

The experience at HASL has convincingly shown that the pot is a much more ideal fallout collector in that, once in the pot, losses of precipitation or dust are highly unlikely. As a remote type field device, however, the pot suffers in that at the end of each month, the catch must be quantitatively transferred to some sort of container for shipment back to HASL. This requires rinsing with both acid and distilled water in addition to very careful policing to insure that all of the

material is transferred. For this reason the ion exchange system of collecting Sr-90 fallout was adapted at HASL as the primary off site collector.

The ion exchange collection system is based upon a design described by Aler and Edvarson in 1957 (5), and modified at HASL. The device is simply a plastic funnel 12" in diameter, which screws onto a plastic tube containing the ion exchange resin. Initially, the HASL columns were packed with both anion exchange resin, (the chloride form of Amberlite IRA 400) and cation exchange resin, (the hydrogen form of Dowex 50 X-12). In recent years the anion collections have been discontinued and only the Dowex 50 is now used, in the 50 to 100 mesh size.

The instructions to the field sites using the ion exchange collection system, stipulate that sufficient rinsing must be made in the absence of rain, so that the resin not be allowed to dry. A "U" tube is provided from the exit nipple of the column, so that no water flows out of the system unless the column is completely immersed. Only through evaporation, if no water is added for several days, can the resin dry out. Should the resin dry and shrink, there is a possibility of channeling through the column during a subsequent rain storm, with consequent partial loss of Sr-90.

In addition, the instructions state that at the end of each monthly sampling period the plastic funnel atop the column is to be wiped clean of dust with a tissue which is then to be added to the top of the column. This step is designed to account for any fallout material which was not previously rinsed into the column.

There is little question that when properly maintained in the field, the ion-exchange column system is as valid a collector of Sr-90 fallout as the pot. This is best illustrated by the record of the New York City site, maintained on the roof of HASL (6). From February 1964 through September 1966, duplicate pots and ion-exchange columns were exposed and analyzed monthly. The yearly totals of the averages are shown in Table 1. These data suggest that the two differ by less than 5%, an amount which could easily be accounted for by the statistical errors of the analyses.

Table 1

Average Sr-90 in New York City Pot and Column Samples

(values in mCi per km²)

<u>Year</u>	<u>Pot</u>	<u>Column</u>	<u>Column/Pot</u>
1964 (10 months)	12.27	12.18	0.99
1965	5.53	5.35	0.97
1966 (9 months)	<u>2.11</u>	<u>2.07</u>	<u>0.98</u>
Total (31 months)	19.91	19.60	0.98

The only additional sites at which direct comparison of the HASL pot and ion-exchange column collections can be made are six others in the United States. At these sites, both collectors were operated for varying lengths of time, primarily in the early 1960's. The monthly data for these collections can be found in reference 2. Table 2 summarizes the results for the total periods of the exposures of both devices at these sites plus the New York City total from Table 1. Also included in Table 2 are the approximate mean annual precipitation amounts at these stations, for the years of the collections.

No obvious correlation of the column to pot ratio can be discerned with either mean annual precipitation or total Sr-90 fallout. In the next to the last column of Table 2 are listed the fraction of the months of observation during which the deposition rate exceeded 0.39 mCi per km² per month (or 1 mCi per mi² per month). Again no clear correlation with the column to pot ratio can be seen. While this does not directly refute the contention of Pudovkina (1) that the disagreement between pot and column is worse at these sites at fallout rates of greater than 1 mCi per mi² per month, it would seem to indicate that this observation is not particularly useful for determining the overall precision of Sr-90 fallout determination at any of these stations.

Additional evidence of the relative efficiency of the ion exchange system as a Sr-90 fallout collector can be inferred by comparison with data of collections by other nations, where the two collectors are at the same sites. Because of complications due to different types of collecting devices and changes in programs, in the following section of this report the comparisons are separated by countries.

UNITED KINGDOM - HASL COMPARISON

There have been a number of sites at which United Kingdom, Atomic Energy Research Establishment (AERE) fallout collectors and HASL's have been exposed simultaneously. For the HASL column these include Suva in the Fiji Islands and Singapore, and pots at Pretoria, South Africa and Melbourne, Australia (7). Hong Kong and Lagos, Nigeria were sampled very sporadically in the HASL program and therefore are not useful for comparison. Comparison with the Melbourne site can only be made for the period 1960 through 1963 since subsequent Melbourne samples, although reported in the HASL Quarterly, were obtained with Australian collectors. These data are discussed in a later section.

Table 3 summarizes the AERE-HASL comparisons for both Sr-90 deposition and the relative precipitation. The weighted average of the ratio AERE/HASL funnel indicates HASL lower by 35% with no parallel bias in the precipitation ratios. The comparison of AERE data with the HASL pot (Table 3B) is somewhat more complicated. Most of the difference in the Sr-90 at the Pretoria site can be accounted for by the similar bias in precipitation. At Melbourne however, where precipitation was essentially identical for the two systems, a 14% bias is observed, the AERE being higher.

The AERE system of fallout collection consists of a 10 inch diameter plastic funnel mounted above a plastic bottle containing carrier solution. Their procedure (8)

consists of measuring the concentration of Sr-90 in the collector and computing the deposition by multiplying by the rainfall obtained from a nearby gauge. Thus the AERE values will always tend to be high due to evaporation. It is not practical to reasonably estimate the magnitude of these losses, but merely judging from the experience on the HASL roof, evaporation losses from the recording rain gauge often exceeds 2 or 3 cm per month. Naturally the real effect of these losses on the computed Sr-90 deposition depends upon such factors as humidity, rainfall frequency, winds, etc.

Based upon the foregoing it is concluded that the observed differences in the AERE and HASL Sr-90 deposition data is probably the result of errors in both systems. If it is assumed that the HASL pot is correct, then based upon the Melbourne result in Table 3B, the AERE collector is 14% high. The HASL column, 35% lower than the AERE collectors (see Table 3B) can therefore be shown to be biased only 18% low.

CANADA - HASL COMPARISON

At two sites in Canada, Goose Bay, Newfoundland and Moosonee, Ontario, both the Department of National Health and Welfare of Canada (DNHW) and HASL have made simultaneous collections and analyses of Sr-90 deposition from 1963 through 1965 (9). Table 4A summarizes the comparative totals. Again a clear bias is indicated with the Canadian system averaging 17% higher than the HASL ion exchange collections.

The DNHW collection system consists of 6 inch diameter steep walled pots with plastic liners. The liners are returned to the laboratory along with the deposited material for thorough removal of any absorbed cations. No systematic bias would be suggested from such a procedure and it is therefore concluded that the comparison in Table 4 is valid and hence the HASL ion exchange column data are indeed low.

NEW ZEALAND - HASL COMPARISON

At Wellington, New Zealand, simultaneous collections were carried out by both the New Zealand National Radiation Laboratory (NZNRL) and HASL for 78 months from 1961 through 1967 (10). The results are set out in Table 4B. Once again the HASL columns appear to be biased low, this time by about 28%. The New Zealand collections are made in a 30 cm diameter by 30 cm high stainless steel pot at ground level. Strontium carrier is added to the pot before sampling commences and the pots are never allowed to evaporate to dryness. Based on this description of the procedure employed by the NZNRL it is once again concluded that the HASL column data is probably low.

OTHER COMPARISONS

Fortunately, a few simultaneous collections have been carried out by other pairs of laboratories, at identical sites. Since the beginning of 1964, the Australian fallout researchers, the Atomic Weapons Tests Safety Committee (AWSTC) have been collecting Sr-90 deposition with their own ion exchange system. Samples are analyzed at HASL and AWSTC, and the data has continued to be reported in the HASL Quarterlies. Hence, the results from Melbourne and Brisbane since 1964 can be used to compare with the AERE results from those stations. Table 5A lists these comparisons.

Similarly, United Kingdom (AERE) and New Zealand (NZNRL) Sr-90 deposition data are comparable from the collections at Fiji Island, Suva, for the period 1961 through 1966. This comparison is shown in Table 5B.

Once more in Tables 5A and 5B, as in Table 3, the AERE data seem to be biased high. These comparisons lend further support to the contention that the British

AERE results alone can not be relied upon as reference points. If it is assumed that both the Australian and New Zealand results are correct then the weighted combined result, as shown at the bottom of Table 5 suggests that the AERE data average about 16% high, in good agreement with the result derived earlier by comparison with the HASL pot. If the AERE/HASL comparison in which HASL was 35% (see Table 3) low is corrected by that amount, then the residual low bias of 17% must be attributed to the HASL system.

Table 6 summarizes the results of the 4 groups of comparisons with the HASL ion-exchange column collections, including the value derived from the AERE-HASL comparison. Weighting each of the ratios by the number of cases (months), a final mean of 1.17 was computed; hence, on the average, the Sr-90 data derived from the HASL column collections were low by 17%. This is in general agreement with the conclusion of Pudovkina (1).

The major reason for the low Sr-90 results from the HASL ion-exchange fallout collections, is very probably improper maintenance during the sampling period. As mentioned earlier, the design of this system calls for daily rinsing and a rinse and wipe at the end of each monthly period. From a number of random visits to field stations in the last few years, we have become increasingly aware that few if any of them follow these instructions carefully. It appears that at least two factors lead to low results under improper care; (a) the ion exchange resin dries out, and losses of Sr-90 occur in the next storm due to channeling through the bed or loss of effectiveness of the resin, and (b) dry material in the funnel, whether dry fallout or residue from evaporation of rain in the funnel, may not wash down into the column. Some experiments are being conducted at this time to better define the magnitude of these factors. While new instructions have been sent to

every field site encouraging the personnel to properly rinse and wipe the funnels, it is feared that many will again lapse back into less than perfect maintenance after a period. Therefore, as a result of the information obtained by the experiments in progress, some design modifications to the system may be forthcoming which will hopefully preclude the necessity for the rinsing and wiping.

The most obvious impact of this bias in the HASL fallout data is realized in evaluation of worldwide Sr-90 fallout, and in consideration of the total material balance of that nuclide (11,12). In correcting the global fallout data a factor was computed for each ten degree latitude band based upon the fraction of all the collectors in that band which employ columns, i.e. at 50°-60° north all are columns while at 40°-50° north only 58% are columns, and the rest are pots. As a result of this calculation a weighted correction factor for each hemisphere was derived; 1.13 for the Northern Hemisphere, and 1.14 for the Southern Hemisphere. Table 7 lists the corrected annual and cumulative Sr-90 deposition for each hemisphere.

The figures in Table 7 are now in much better agreement with the comparable data from the AERE of Great Britain (7) listed in the final column of the table. It should also be pointed out this additional increment of Sr-90 fallout resulting from correction of the HASL global deposition estimates decreases the "inventory deficiency" by almost one third.

References

1. Pudovkina, I. B.
United Nations Document A/AC.82/G/L.1202
2. Appendix to USAEC Report HASL-193, Part A, April (1968)
3. Welford, G. A. and Harley, J. H.
A New Method for Collection of Fallout Material from Nuclear Detonations
USAEC Report HASL-42, October (1958)
4. Welford, G. A. and Collins, W. R.
An Evaluation of Existing Fallout Collection Methods
Science 131, 3416, June (1960)
5. Aler, B. and Edvarson, K.
United Nations Document A/AC.82/R.52, April (1957)
6. Ong, L. D. Y.
Further Statistical Testing of the Equivalence of Pot and Ion Exchange
Column Sr-90 Samples
USAEC Report HASL-173, October (1966)
7. Cambray, R. S., Fisher, E.M.R., Brooks, W. L. and Peirson, D. H.
Radioactive Fallout in Air and Rain Results to the Middle of 1967
United Kingdom AERE Report R-5575 (1967)
8. Cambray, R. S.
Personal Communication
9. Data from Radiation Protection Programs
Department of National Health and Welfare, Ottawa, Canada
10. Environmental Radioactivity in New Zealand - Quarterly Report, April-June 1967
National Radiation Laboratory, Christchurch, New Zealand
Reprinted in HASL Quarterly No. 184
11. Volchok, H. L.
Worldwide Deposition of Sr-90 Through 1966
USAEC Report HASL-183, October (1967)
12. Volchok, H. L. and Krey, P. W.
Implications of Changes in the Global Strontium-90 Budget
J. of Geophysical Research 72, 20, October (1967)

Table 2

Comparison of Sr-90 Collections in Pots and Columns

(values in mCi per km²)

Site	No. of Months	Years	Approx. Annual Precip. (cm)	Pot	Column	G*	Pot/Column
New York, N. Y.	43	1964-1966	88	19.91	19.60	22	1.02
Richmond, Calif.	24	1961-1963	35	11.68	10.99	29	1.06
Westwood, N. J.	48	1960-1963	88	43.82	40.14	58	1.09
Pittsburgh, Pa.	41	1960-1963	93	25.00	21.30	43	1.17
Houston, Texas	23	1961-1963	136	14.34	12.16	50	1.18
Louisville, Ky.	34	1958-1961	105	10.94	8.36	24	1.31
Palo Alto, Calif.	19	1962-1964	47	10.59	7.66	37	1.38
Weighted Average							1.13

* G signifies the percent of observed months with fallout rate in excess of 0.39 mCi per km² (or 1 mCi per mi²)

Table 3

Comparison of Sr-90 Collections by the United Kingdom (AERE)
and (a) The HASL Column (b) The HASL Pot

(values in mCi per km²)

<u>A. Column Sites</u>	<u>Years</u>	<u>Months</u>	<u>AERE</u>	<u>HASL</u>	<u>Ratio AERE/HASL</u>	
					<u>Deposition</u>	<u>Precipitation</u>
Fiji, Suva	1961-1966	66	11.53	8.66	1.33	0.89
Singapore	1961-1966	69	6.17	4.53	1.36	0.84
Weighted Average					1.35	
 <u>B. Pot Sites</u>						
South Africa, Pretoria	1965-1967	27	3.56	2.30	1.55	1.40
Australia, Melbourne	1960-1963	48	5.29	4.63	1.14	0.99

Table 4

Comparison of Sr-90 Collections by
(A) Canada and the United States (B) New Zealand and the United States

(values in mCi per km²)

Site	Years	Months	DNHW	NZNRL	HASL	Ratio
(A)						
Newfoundland, Goose Bay	1963-1964	9	1.32		1.37	0.96
Ontario, Moosonee	1963-1965	32	32.15		26.11	1.23
Weighted Average						1.17
(B)						
New Zealand, Wellington	1961-1967	78		13.30	10.37	1.28

Table 5

Comparison of Sr-90 Collections by
(A) Australia and the United Kingdom (B) New Zealand and the United Kingdom

(values in mCi per km²)

Site	Years	Months	AWTSC	NZNRL	AERE	Ratio
(A)						
Australia, Melbourne	1964-1967	42	5.96		6.50*	1.09
Australia, Brisbane	1964-1967	42	5.34		6.11*	1.14
Weighted Average						1.12
(B)						
Fiji, Suva	1961-1966	54		7.87	9.63	1.22
Total Weighted Average						1.16

* 1966 and 1967 data were derived from Cs-137 analyses by the factor 1.5

Table 6

Summary of Comparisons of Sr-90 Deposition Collections

<u>Comparison</u>	<u>No. of Months</u>	<u>Ratio</u>
HASL Pot/HASL Column	232	1.13
British AERE/HASL Column (derived)	210	1.17
Canadian DNHV/HASL Column	41	1.17
New Zealand NZNRL/HASL Column	78	1.28
Weighted Average		1.17

Table 7

Annual and Cumulative Worldwide Sr-90 Deposition

(values in megacuries)

	<u>Annual Deposition</u>			<u>Cumulative Deposit</u>			
	<u>Northern Hemisphere</u>	<u>Southern Hemisphere</u>	<u>Total</u>	<u>Northern Hemisphere</u>	<u>Southern Hemisphere</u>	<u>Total (HASL)</u>	<u>Total (AERE)</u>
Pre-1958				1.7	0.6	2.3	2.1
1958	0.74	0.31	1.05	2.39	0.89	3.28	2.89
1959	1.10	0.19	1.29	3.43	1.06	4.49	4.28
1960	0.26	0.17	0.43	3.60	1.20	4.80	4.58
1961	0.35	0.19	0.54	3.86	1.36	5.22	5.02
1962	1.45	0.31	1.76	5.21	1.64	6.85	6.90
1963	2.62	0.33	2.95	7.70	1.93	9.63	9.61
1964	1.66	0.44	2.10	9.17	2.32	11.49	11.58
1965	0.78	0.36	1.14	9.72	2.62	12.34	12.33
1966	0.33	0.21	0.54	9.81	2.76	12.57	12.53

X ISOLATION OF "HOT" RADIOACTIVE PARTICLES FROM PARTICULATE
MATTER COLLECTED AT ARGONNE, ILLINOIS, AND FORT WORTH, TEXAS

by

S. S. Brar, G. Svihla, D. M. Nelson, and P. F. Gustafson

Division of Biological and Medical Research
Argonne National Laboratory
Argonne, Illinois

The continuing effort⁽¹⁾ measures the fallout from nuclear tests conducted in the atmosphere by several nations. Nuclear fallout, in general, consists of fission and activation products of varying half-lives. As nuclear test debris begins to circle the globe after an explosion, these radioactive nuclides can be used to study (a) their atmospheric transport, and (b) their movement through the biosphere and ultimately to man. The medium half-life nuclides, such as ^{140}Ba - ^{140}La and ^{95}Zr - ^{95}Nb are well suited to study (a) while long-lived (^{137}Cs , ^{90}Sr , etc.) nuclides can be utilized to study (b).

In order to accomplish this, we have been collecting particulate matter from the air on asbestos-base filter papers and measuring gamma-ray emitting nuclides by the use of 4" x 4" NaI(Tl) crystal. These measurements are made in low background shields and the quantitative results are obtained through computer analysis⁽²⁾ of the data.

In August 1967, a sudden rise in radioactivity of particulate matter collected was observed in some filter collections but not in others. A careful analysis of these filters revealed that this rise was due to the presence of an occasional "hot" particle. It was of interest to determine some of the physical characteristics of these particles: therefore,

their isolation from other particulate matter in the sample was essential. Mamura et al.⁽³⁾ used elaborate procedures to isolate highly radioactive particles from non-radioactive dust, but did not give details other than that a Geiger-Mueller (G-M) counter was used in conjunction with a microscope and a needle. Consequently a method, to be described below, was developed for the isolation of small radioactive "hot" particles.

Through a survey by a G-M counter, the particle was localized on a small area of the filter paper. No-screen X-ray film and filter paper with a particle on it were placed in one corner of an exposure holder for the duration of the exposure. An exposure of one hour was adequate, if a particle showed an activity of approximately 100 counts/minute at a distance of 2 mm from a thin end-window GM-counter. The corner of the holder was used to conveniently align two adjacent sides of the film with two adjacent sides of the filter paper -- a procedure as easy as stacking two cards of slightly different size into one corner of a box. After processing, the film and paper could be realigned with each other with sufficient accuracy to locate the particle within about 2 mm of its actual location by merely superimposing the adjacent sides of the film and paper as they had been during exposure. A 5-mm square of the filter paper with the "hot" particle at its approximate center was then cut and placed on a microscope slide with its exposed side towards the observer. A piece of Saran Wrap (a thin household-plastic film) about 1.5 x 4 cm was placed over the filter paper, rubbed in contact, and then peeled off in an attempt to transfer the "hot" particle from the filter

paper to the plastic film in a dry "printing" process and at the same time reduce the number of non-radioactive particles associated with it. Usually, three pieces of plastic film were used in this printing process and each was placed on a separate microscope slide. Either a G-M counter or a NaI(Tl) crystal detector was used to locate the slide with the "hot" particle. If the particle had been transferred to one of the plastic films, several more attempts were made to transfer it to another clean piece of Saran Wrap. If the particle did not transfer and remained imbedded in the filter paper, more drastic measures were necessary (to be described later).

If the radioactive particle was transferred from the filter paper to the plastic film, the film was then placed particle-side-down over a very small drop of immersion oil on a microscope slide and smoothed down with a finger. After several registration marks were made on the slide-and-Saran Wrap area with a marking pen, the slide was ready for autography. No-screen X-ray film, cut into 25 x 75 mm strips, was clamped in contact with the slide using a felt or foam plastic pressure pad to insure good contact and lessen the danger of slide breakage. After an exposure of an hour or two in a light tight container, the clamped slide was removed in a photographic dark room for exposure to a small light source for a very short time in such a manner that the registration marks made earlier served as a negative. In effect the film was slightly fogged, except where it was protected from exposure by ink marks. After processing, the film was placed in register under the slide and the particle

located with the aid of a low or medium power microscope objective. Photomicrographs were made with a 100 x 1.32 n.a. CP1 Leitz objective and Orthomat camera.

When the radioactive particle would not transfer to the Saran Wrap plastic, because it was too deeply imbedded in the filter paper, the paper was cut into halves repeatedly and each time the non-radioactive half was discarded, until only a piece about 0.5 mm square remained. This was placed in a small drop of immersion oil on a microscope slide, teased apart with needles, and then covered with Saran Wrap. Autoradiography was then used to locate the particle. Since there was much debris present at this stage, it was desirable to get rid of most of it. This was done by cutting through the Saran Wrap to isolate a square of about 3 mm on a side, with the particle at its approximate center. The remaining film was peeled off, discarded, and the slide was carefully cleaned without disturbing the small square under which the radioactive particle was trapped. A small drop of oil was placed near the small square of plastic, the plastic was lifted with fine forceps and slid across the oil to disperse the remaining particles more widely. The small piece of plastic was then used as a squeegee to spread the oil with its contained particles over about half the slide. On the chance that the radioactive particle might still be attached to the piece of plastic, it was left on the slide and the small piece of plastic and the oil film were then covered with a 25 x 75 mm piece of Saran Wrap to permit autoradiography and a brief exposure to light for registration purposes, as described

earlier. If necessary, this last step was repeated until the radioactive particle was sufficiently isolated from any other particles, so that it could be identified with confidence.

In Figure 1 are photomicrographs of seven particles. These isolated particles are nearly spherical in shape and yellowish or reddish brown in color, ranging from almost transparent, through translucent, to opaque. All show evidence of having been formed of aggregations of small molten particles, and some had satellites, as described by Benson et al. ^(4,5) A summary of physical characteristics of these particles is given in Table I. The color of individual particles is not given because of its variability both under different lighting conditions and observations by different observers. Three individuals described particle 2 as yellow, while four described it as various shades of red. An attempt to use Loquin's CHROMOTAXIA, ⁽⁶⁾ a color index, was unsuccessful.

During the five-month collection period (August - December) only eight particles were collected with activities high enough to permit their ready isolation for microscopic inspection. One particle was lost at the first stage of isolation. It apparently was transferred to the X-ray film and lost during processing. To prevent this loss, perhaps the isolation procedure should be started by covering the filter paper with Saran Wrap.

Particle 6 originally had the highest activity and for this reason was selected for the first attempt at isolation, using dissecting needles. Isolation proceeded to a point where only a few particles remained in a

very small drop of immersion oil. When an attempt to divide the drop into two portions was made, the active particle stuck to the needle. It was not dislodged by washing in oil, xylene, or acetone. It was not dislodged by friction on a piece of paper, nor was it dislodged by polishing the needle on a piece of fine abrasive paper, until the needle was held at an angle that permitted the particle to be dislodged from its very tip. At first, the shielding effect of the needle, while being exposed to a GM counter to determine the presence of radioactivity, seemed to indicate that the particle was on one side of the needle. After the particle was dislodged it was recovered by using the "Saran Wrap method," even though many more particles (abrasive) were present than had been present originally. During the isolation process a portion of the particle was lost. Photomicrograph number 6 of Figure 1 reveals structure of the particle that may partially explain these effects; e.g., sticking to the needle, loss of a portion of the particle, and fallout at a time when most particles of that size (but of greater density) had already fallen out.

Particles isolated by Mamuro et al.⁽³⁾ ranged from 6.9 to 13.9 μ in diameter with activities of from .32 to 4.8 $m\mu Ci$. Their particles are significantly larger than those isolated in this study. Benson et al.⁽⁴⁾ isolated particles with diameters of 2 μ or more, but an examination of their graphs shows that most particles were about 6 μ in diameter, with only a few under 3 μ .

Radioactive particles with activities of about 100 counts per minute (as measured by a thin end-window GM-counter from a distance of about 2 mm) or greater can be isolated for examination microscopically, by the comparatively simple technique described.

The fission product activity of the first three particles was mainly $^{95}\text{Zr} - ^{95}\text{Nb}$ and ^{141}Ce while the next three showed $^{95}\text{Zr} - ^{95}\text{Nb}$ only. The last particle contained $^{95}\text{Zr} - ^{95}\text{Nb}$, ^{141}Ce and $^{140}\text{Ba} - ^{140}\text{La}$, in addition to other short-lived nuclides. These activity results suggest that the last particle was collected shortly after it was created while the first six were not. (This work was supported by the U. S. Atomic Energy Commission.)

REFERENCES

1. Gustafson, Philip F., and Sarmukh S. Brar. Environmental Radiation Studies. Argonne National Laboratory Biological and Medical Research Division Annual Report, 1964. ANL-6971, p. 83.
2. Nelson, D. M., M. H. Dipert, and P. F. Gustafson. Computer programs for gamma-ray analysis. Argonne National Laboratory Biological and Medical Research Division Annual Report, 1965. ANL-7136, p. 323.
3. Mamuro, T., A. Fujita, T. Matsunami and K. Yoshikawa. Microscopic examination of highly radioactive fallout particles. Nature 196: 529-531 (1962).
4. Benson, P., C. E. Gleit, and L. Leventhal. Physical characteristics of single particles from high-yield air bursts. Radioactive fallout from nuclear weapons tests, AEC symposium series 5; pp. 98-107 (1965).
5. Benson, P., C. E. Gleit, and L. Leventhal. Radiochemical fractionation characteristics of single particles from high-yield air bursts. Radioactive fallout from nuclear weapons tests, AEC symposium series 5; pp. 108-118 (1965).
6. Locquin, M. Chromotaxia, Terreaux Freres, Lyon, France 1958.

Table I

Date of Collection	Place of Collection	Photomicro- graph Number	Particle Diameter Microns	^{95}Zr pCi [†]	^{141}Ce pCi [†]	^{140}Ba pCi [†]
First half Aug. '67	Argonne, Illinois	5	3.25	163	48	0
13-15 Sept. '67	Argonne, Illinois	3	2.75	28	10	0
18-20 Sept. '67	Argonne, Illinois	6	3.5	23	4	0
23-26 Sept. '67	Fort Worth, Texas	1	2.0	30	0	0
29 Sept. to 2 Oct. '67	Argonne, Illinois	2	2.25	43	0	0
29 Sept. to 2 Oct. '67	Argonne, Illinois	4	3.0	44	0	0
31 Dec. '67	Argonne, Illinois	7	10	335*	*	140*

* Other short-lived nuclides present.

† Activity on date of collection.

Fig. 1. Photomicrographs of radioactive fallout particles isolated from air sampling filters. Details in text and Table I. Numbers 1-7 correspond with those of Table I. Photo 8, scale equals 10 microns.

X OCEAN FALLOUT: THE BAHAMA BANKS EXPERIMENT

by Herbert L. Volchok (HASL)

The question of whether or not debris from atmospheric nuclear tests has been deposited disproportionately into the oceans, relative to the continental land masses, still remains unresolved. The substance of the dispute revolves about the observation that the total amount of Sr-90 contained in approximately the top 300 meters of the oceans broadly agrees with the amount expected, based upon land measurements (1,2). Hence, in so far as the presence of Sr-90 in deeper water can be demonstrated, the fallout over the oceans must be greater than that over land.

The enigma concerning the alleged presence of Sr-90 in the mid and deep ocean has its roots in a number of studies. Measurements indicating that Sr-90 has penetrated to substantial depths have been reported by various investigators (3,4,5,6). Others however (7,8) concluded that rapid deep penetration of substantial fractions of the Sr-90 entering the sea did not occur, and that in the equatorial Atlantic, measurable Sr-90 activities were not to be found below 500 meters. Further, observations of the natural C-14 (9) and Tritium (10) as a function of depth in the sea also casts doubt on the possible deep occurrence of Sr-90.

One of the primary reasons for the continued interest in discovering the true amount and rate of ocean fallout is apropos of the need for accurate information about the global inventory of weapons produced Sr-90 (11). The total amount of Sr-90 deposited on the earth's surface is inferred from data gathered in the programs of fallout collection at land stations. These data are regionally extrapolated over the oceanic bodies (12,13) by assuming that, except for precipitation differences, the fallout is the same per unit area as for the adjacent land. Since more than two thirds of the earth's surface is water, if this extrapolation is inaccurate, the computed worldwide inventories of Sr-90 may be seriously in error.

Broecker et al (1) attempted to make a direct comparison of the Sr-90 fallout on the sea with that on land, utilizing the situation in the shallow waters of the Great Bahama Bank. This area, located south-east of the tip of Florida, is unique in that the size is large enough, more than 100 km by 200 km so as not to be influenced by the surrounding islands. The rather uniform and shallow depth of the water on the bank, averaging about 4 meters, almost surely guarantees complete vertical mixing of the Sr-90 deposited in the water.

The most unusual feature of this area however is the temporary isolation of this water from the open ocean. Utilizing the concentration of bomb produced C-14, Broecker and Takahashi (14) were able to estimate the mean residence times of the water on the bank. Some samples had apparently been on the bank for as long as six months.

By subtracting the Sr-90 concentration found in samples from the open sea from the values on the bank, the deposition for the period of isolation on the bank was computed (1). This was compared with the fallout observed at adjacent land sites and average values for all land stations in the same latitude region. The result qualitatively indicated that no difference in Sr-90 fallout could be discerned, within a factor of two.

In order to systematically check this conclusion and improve the accuracy of the observations, the Health and Safety Laboratory (HASL), in cooperation with the Government of the Bahamas, has erected a fixed platform on the Great Bahama Bank, as a locus for a series of experiments. The platform, named the HASL Dolphin, is located about 100 miles southwest of Miami, at $24^{\circ}59'$ north latitude and $78^{\circ}45'$ west longitude, and was erected by a contractor, Marine Acoustical Services of Miami, Florida. Figure 1 shows the general area of the Dolphin in the Bahamas.

Figure 2 is a view of the entire HASL Dolphin. The wooden deck, standing about 12 feet above mean water level, is 4 feet wide and 8 feet long. At present, in addition to the radar reflector and flashing light mounted on the railing, three fallout collectors and a rain gauge occupy the deck area.

Routine maintenance and sampling at the Dolphin is carried out monthly by another Florida contractor, Sea Research and Development Inc. At the end of each month seawater is sampled in the Gulf Stream enroute to the platform and at the Dolphin site. Samples from both areas are analyzed for Sr-90 and the bank sample is also analyzed for C-14 to establish the time since that water moved onto the bank. At the platform the deposition fallout samples are collected and the rain gauge read monthly.

The HASL Dolphin was erected in late June of 1967, and has been visited every month since. The only major problem so far encountered has been an invasion by sea birds, using the Dolphin as a roost and badly fouling the rain and fallout collectors with excrement. An electrical system for discouraging this misuse of government equipment was designed and installed, and on the basis of a one month test, appears to be completely effective.

By systematically sampling and analyzing both the sea, and the precipitation at this fixed point on the Great Bahama Bank and utilizing rainfall measurements and fallout data from neighboring island stations, the relationship suggested by the earlier study (1) may be refined to reveal whether or not a real bias in Sr-90 fallout does in fact exist over the ocean; and if so, the magnitude of this effect.

References

1. Broecker, W. S., Rocco, G. G., Volchok, H. L.
Strontium-90 Fallout: Comparison of Rates over Ocean and Land
Science 152, 639-640 (1966)
2. Report of the United Nations Scientific Committee on the Effects of
Atomic Radiation, General Assembly, 21st Session
Supplement #14 (A/6314) 1966
3. Bowen, V. T. and Sugihara, T. T.
Oceanographic Implications of Radioactive Fallout Distributions in the
Atlantic Ocean: From 20°N to 25°S from 1957-1961
J. of Marine Research 23, 2 (1965)
4. Bowen, V. T., Noshkin, V. E. and Sugihara, T. T.
Transport of Sr-90 Towards the Equator at Mid-depths in the Atlantic Ocean
Nature 212, 5060, October (1966)
5. Nagaya, Y.
Some Fallout Radionuclides in Deep Waters Around Japan
J. of Radiation Research, The Japan Radiation Research Society
Chiba, Japan, March (1965)
6. Popov, N. J.
Evaluation of the Total Quantity of Sr-90 in the World Ocean
Publication of the State Committee on the Uses of Atomic Energy
USSR, Moscow (1965)
UNSCEAR Report A/AC.82/G/L.1081
7. Rocco, G. G., Broecker, W. S.
The Vertical Distribution of Cesium-137 and Strontium-90 in the Oceans
J. Geophysical Research 68, 4501-4512 (1963)
8. Broecker, W. S., Bonebakker, E. R., Rocco, G. G.
The Vertical Distribution of Cesium-137 and Strontium-90 in the Oceans
J. Geophysical Research 71, pg. 1999-2003 (1966)
9. Broecker, W. S.
Radioisotopes and the Rate of Mixing Across the Main Thermoclines of the Ocean
J. of Geophysical Research 71, 24, December (1966)
10. Ostlund, H. G. and Rinkel, M. O.
Study of Advective and Convective Processes in the Atlantic Equatorial
Current System by Use of Natural Tritium
Technical Report, September 1967
Institute of Marine Sciences, University of Miami
11. Volchok, H. L. and Krey, P. W.
Implications of Changes in the Global Strontium-90 Budget
J. of Geophysical Research 72, 20, October (1967)

12. Volchok, H. L.
Worldwide Deposition of Sr-90 Through 1964
USAEC HASL-161, July 1, 1965
13. Cambray, R. S., Fisher, E.M.R., Brooks, W. L. and Peirson, D. H.
Radioactive Fallout in Air and Rain - Results to the Middle of 1967
United Kingdom Atomic Energy Authority AERE Report R-5575 (1967)
14. Broecker, W.S. and Takahashi, T.
Calcium Carbonate Precipitation on the Bahama Banks
J. of Geophysical Research 71, 6, March (1966)

X PROJECT AIRSTREAM
=

by Philip W. Krey (HASL)
Barbara Krajewski (HASL)

Project Airstream is HASL's study of radioactivity in the lower stratosphere employing the RB-57F aircraft as a sampling platform. The aircraft are flown by the 58th Weather Reconnaissance Squadron under the direction of the 9th Weather Wing of the Air Weather Service. This project is a follow-on of the Defense Atomic Support Agency's Project Stardust except that Airstream's sampling missions are limited to only one per season.

The data in this report cover the missions flown in August and November 1967 and in January 1968. Previous reports containing results from this program are given in references 1 and 2.

FLIGHT SCHEDULE

Airstream missions are scheduled for early February, May, August and November with a $\pm$ one month slippage. However, each mission must be completed within a nine day interval. The first Airstream mission was flown in August 1967. The flight trajectory and anticipated altitude coverage of an Airstream mission is shown in Figures 1 and 2, respectively. Figure 1 reflects the 2° shift to the west in the flight track of the January 1968 mission between 5°N and 10°S as compared to the two earlier missions.

The coverage in Figure 2 extends almost continuously at the indicated altitudes from 75°N to 51°S latitude except for a slight gap between 10°S to 16°S . Each mission is accomplished by conducting return flights northward and southward from each of the four Air Force Bases of operation:

Eielson AFB	$64^{\circ} 40'\text{N}$	$147^{\circ} 06'\text{W}$
Kirtland AFB	$35^{\circ} 03'\text{N}$	$106^{\circ} 36'\text{W}$
Albrook AFB	$08^{\circ} 57'\text{N}$	$79^{\circ} 34'\text{W}$
Mendoza AFB	$32^{\circ} 49'\text{N}$	$68^{\circ} 47'\text{W}$

The gap may be closed at the lower altitudes by sampling during redeployment of aircraft from Mendoza AFB after the mission is completed. Redeployment sampling from the other remote bases to the home base at Kirtland AFB may also provide data on the short term variability of the radioactive environment and on the representativeness of the sampling program.

AIR FILTER SAMPLES

Air filter samples are collected along the flight track at latitude increments of approximately 3 to 4° at each of the prescribed altitudes using the U-1 foil system. This system permits the sequential insertion of up to 12 IPC #1478 filter papers (diameter 16-3/8") into the sampling duct near the bomb bay on the right side of the aircraft. The volume of air sampled by each filter is calculated by the methods developed under Project Stardust and are reported as standard cubic meters (SCM) under the ICAO standard atmosphere (760 mm Hg and 15° C).

TOTAL GAMMA AND GAMMA SPECTRUM MEASUREMENTS

Upon arrival at HASL, the filters are coded, logged and quartered. The entire sample (or a representative fraction if the activity is too high) is folded and placed in a plastic box, 8 cm x 6.5 cm x 3.1 cm deep, for gamma spectrometric analysis on an 8" x 4" NaI(Tl) crystal. The total gamma activity is integrated between 100 Kev and 3.0 Mev, and the gamma concentration is reported as counts per minute (cpm) per 100 SCM on the counting date. The complex spectrum is then submitted for computer resolution by least squares fitting into its component members.

RADIOCHEMICAL ANALYSIS

Based upon the gamma measurements, quadrants of the filters are combined into appropriate composites which are sent to contractor laboratories for detailed radiochemical analyses including the following nuclides.

Fe-55	Ce-144
Sr-89	Pb-210
Sr-90	Po-210
Zr-95	Pu-238
Cd-109	Pu-239, 240
Ce-141	

At the present time, Tracerlab of Richmond, California is performing these analyses. Nuclide concentrations from radiochemical analyses are reported as picocuries per 100 standard cubic meters of air (pCi/100 SCM) at collection time with the following two exceptions. Fe-55 is reported on October 15, 1961, and Cd-109 on July 9, 1962. These two dates are the assumed or actual times of injection of most of the Fe-55 and Cd-109 in the stratosphere. To convert pCi/100 SCM to disintegrations per minute per 10^3 standard cubic feet multiply by 0.629.

One standard deviation of the counting error for all data in this report is less than $\pm 20\%$ and usually less than $\pm 10\%$ unless annotated with these symbols:

A : One standard deviation of the counting error is between $\pm 20 - 50\%$.

B : One standard deviation of the counting error is between $\pm 51 - 100\%$.

* : Activity is not detectable. This designation is applied to data when an equal to or less than value ($\leq$) is reported or when one standard deviation of the counting error is greater than $\pm 100\%$.

? : The nuclide concentration of a specific sample is considered suspect because it is inconsistent with the concentration of the same nuclide in adjacent samples in space and time or because it is inconsistent with other nuclides in the same sample.

The nuclide activity for each sample is corrected for the normal radiochemical parameters such as chemical yield and detection efficiency, but it is important to note that a blank adjustment is also made. The value of the adjustment is determined for each nuclide by analyzing a number of blank samples, that is, samples containing no activity. Any activity detected in blank samples represents the contamination introduced into the sample by the laboratory reagents and equipment. The average blank value for each nuclide with its measure of uncertainty is then subtracted from the sample activity.

RADON SAMPLES

Radon samples are recovered by inserting the HASL radon sampler into the normal gas sampling system (P system) of the aircraft. The HASL sampler consists of a 190 gram charcoal trap housed within a 13" diameter sphere (Figure 3). The charcoal used was specially selected for its low radium contamination and yielded <0.3 picocuries of radon per trap at equilibrium. Laboratory tests in a high altitude test chamber have shown the charcoal to be greater than 80 percent retentive for radon at an air influent rate of 100 liters per minute provided that the air temperature is below -18°C (3). Radon breakthrough of the trap occurred when the total volume of air sampled by the trap exceeded 10 SCM. Several measurements have shown that the temperature of the charcoal in the trap while sampling is not widely different from that of the ambient air at sampling altitudes, so that the temperature requirement is readily satisfied.

The volume of air routinely sampled by each trap is about 6 SCM. The installation and operation of the radon sampler have been described earlier (1). Special shipping procedures bring the radon samplers back to HASL as soon as possible after sampling. The radon is then de-emanated from the traps and assayed in low level ionization chambers.

Blank radon samplers are routinely scheduled to define the levels of radon contamination injected into the sampler by normal handling and laboratory analyses. These blank samplers are normally configured in the aircraft, but the compressors to which they are connected are never activated and no air is purposely drawn through the samplers.

RESULTS

STRATOSPHERIC CONCENTRATIONS OF GAMMA EMITTERS

Some suspicion presently exists as to the accuracy of the results from the HASL gamma spectrum resolution program. In addition, a number of other operational errors in calculating Zr-95 data were uncovered in earlier reports. Consequently, all gamma spectral data reported in references 1 and 2 should be considered with reservation.

However, a preliminary comparison of 17 samples analyzed for Zr-95 and Ba-140 by both gamma spectrum resolution and radiochemical separation has shown that, on the average, the two techniques exhibit reasonable agreement for these two nuclides. The spectrum results for Zr-95 show a -17 percent bias with a one standard deviation uncertainty of ± 18 percent. Ba-140 spectrum results exhibit a -36 percent bias with a one standard deviation of ± 15 percent. With corrections for operational errors but with no bias adjustments, the Zr-95 and Ba-140 concentrations derived from the spectral resolution of the August 1967 samples are given in Table 1. Three special flights were conducted in early October 1967 to obtain additional information on the distribution of fresh debris from the 6th Chinese nuclear test (2). The revised Zr-95 and Ba-140 concentrations from these special flights are reported in Table 2. Zr-95 concentrations for the November 1967 mission are listed in Table 3. There are no Ba-140 data in Table 3 because Ba-140 was not measurable in any of the November samples. Total gamma concentrations are also included in Tables 1, 2 and 3. The Zr-95 concentration profile with latitude and altitude for August and November are plotted in Figures 4 and 5. These concentrations and all Zr-95 data reported by HASL gamma spectroscopy reflect the levels of the Zr-95 - Nb-95 mixture radioassayed on counting date as pure Zr-95 and decayed to sampling date with a 65 day half life.

The total gamma concentrations from the third Airstream mission in January 1968 are given in Table 4 and plotted in Figure 6. Computer resolution of these data is incomplete, and only a partial list of the Zr-95 concentrations is available in Table 4

The data in Tables 1 through 4 are grouped according to flights north and south of the four Air Force Bases of operation. Within each group, the data are then reported with decreasing altitude of collection. In Figures 4 through 7, average tropopause heights are indicated. These heights were estimated from the data logs of each Airstream flight.

RADIOCHEMICAL ANALYSES OF COMPOSITE SAMPLES

The radiochemical results of the composite samples from the August 1968 Airstream mission are given in Table 5 and the Sr-90 concentrations are plotted in Figure 7. The composite samples are grouped in Table 5 on the same basis as the other tables in this report with the stipulation that the mid-point of the latitude interval serves as the reference for the latitude assignment. The fractions of each individual filter making up the composite are listed immediately below the composite sample number. The collection parameters of the composite sample and the contractor laboratory performing the analyses are given prior to the nuclide concentrations.

In some cases the composite sample was radioassayed at HASL before being submitted for radiochemistry. For these samples, the total gamma concentration on counting date and the Zr-95 and Ba-140 concentrations from the HASL gamma spectrum program on sampling date are also reported in Table 5.

QUALITY CONTROL

To evaluate the contractor's performance in radiochemical analyses, HASL routinely submits blind duplicates, blanks and standards. The duplicates are identical composites submitted with different code numbers. The blanks are unexposed filters supplied by the Air Force. Standards are blank filters onto which calibrated solutions of various nuclides have been evaporated.

These calibrated solutions are available from a number of sources (i.e. Radiochemistry Center, IAEA, Nuclear Chicago) and are recalibrated at HASL. Generally, the agreement between HASL's measurement and the reported value is very good. HASL does not calibrate for Pb-210 directly, and the supplier's value is accepted. While HASL does calibrate for Po-210, the equilibrium value of Po-210 calculated from the supplier's Pb-210 result is used.

The results from the quality control samples for the August 1967 mission are given in Table 6. The standards suggest that, in general, the accuracy of the radiochemical analyses is within ± 15 percent of the anticipated values. The Po-210 results are atypical in Table 6 revealing a negative bias of -25 percent. Efforts are continuing to more precisely define the accuracy of analyses for each nuclide and to reduce the error term to less than ± 10 percent.

The blank values in Table 6 demonstrate that there is either no measurable laboratory contamination or, as for Sr-90, Ce-141 and Ce-144, so little as to be insignificant relative to the quantities present in the samples.

The two sets of duplicates in Table 6 indicate that on the average the precision of analyses for most nuclides is within ± 10 percent except for Ce-141 and Pb-210. These two nuclides suggest an imprecision of ± 25 and ± 15 percent respectively. The duplicate Zr-95 results from the HASL gamma spectrum program are also given in Table 6 and follow a similar behavior. The activity levels for Cd-109 and Ba-140 are too low to permit an evaluation of the reproducibility of analyses.

CONTAMINATION OF RADON SAMPLERS

Consideration of the radon levels measured in many of the blank and routine samples flown during previous Airstream missions (1,2) suggested that tropospheric air may have passed through the samples even when the compressors to which they were connected were not activated. During pre-flight check out before engine

start-up, the power switch to the P system is usually left in the "on" position. This allows the heating blankets on the solenoid valves in the P system to warm up as soon as the jet engines are started, and minimizes the probability of valve freeze-up at the low temperature of the stratosphere. However, this also opens the air inlet valve in the wing of the aircraft, so that about 14 psig pressure is applied to the P system as soon as the jet engine starts. Consequently, if the compressor leaks, the sampler will begin to effectively collect radon from the troposphere as soon as the temperature reaches -18°C or below.

To test this concept, 14 psig of N_2 gas was applied to the upstream side of the sampling compressors in two aircraft (Nos. 292 and 294) and of a spare system in the 58 WRS maintenance shop at Kirtland AFB. In all cases, leakage occurred through the compressors in the "off" position in excess of one liter per minute. The major leak apparently occurred through the rings of the compressor down into the oil sump and escaped through the oil relief valve.

Four radon samplers were shipped to Kirtland AFB for further tests of this leakage problem. Sampler #28 was never removed from its shipping container, but merely returned to HASL. Sampler #27 was installed in aircraft No. 292 for almost 6 hours. The jet engines of the aircraft were not started, and no air was moved through the P system. Sampler #25 was installed as a blank in a normal configuration in aircraft No. 294; sampler #26 was also installed as a blank in aircraft No. 294 although the male outlet valve was disconnected. Because the male outlet is a quick disconnect valve, this essentially closes off the outlet of the sampler preventing any air from flowing through the sampler.

Aircraft No. 294 departed Albuquerque, New Mexico on January 5, 1968 at 40,000 feet in the troposphere and deployed to Carswell, Texas. The pilot then climbed to 50,000 feet into the stratosphere and returned to Albuquerque. Two

sampling bottles were pumped by a separate compressor on the return flight at 10,000 feet to simulate normal sampling conditions, but theoretically none of this air passed through either of the blank traps aboard. The radon content of these samplers corrected to the midpoint of collection are:

<u>Sampler #</u>	<u>pCi Rn-222</u>
25	29.8
26	2.6
27	0.31
28	0

It is apparent that radon contamination does not enter the system during shipment because sampler #28 contained no measurable radon activity. Some radon contamination may be injected into the samplers by inserting them into the P system lines as indicated by the analyses of sampler #27. This is surprising as is the observation that a small amount of moisture was also found in this sampler.

The leakage of troposphere air through the blank sampler and compressor under normal configuration is readily seen by the high radon content of sampler #25. Little or no leakage should have occurred through sampler #26, and the measured content was a factor of 10 lower than sampler #25. The content of sampler #26 was not equal to or less than that of sampler #27 probably because of a slight failure in the sealing of the male quick disconnect outlet valve. Failure of this kind in Project Airstream has not been uncommon. These tests confirm that compressor leakage of tropospheric air has been the prime source of contamination to the HASL radon samplers, and Rn-222 concentrations from previous Airstream missions should generally be disregarded.

A solenoid valve has been installed inside the spherical housing of the sampler upstream of the charcoal trap which should eliminate this leakage problem on future flights. The solenoid will be in the normally closed position but will open when the compressor to which the sampler is connected is activated.

JANUARY 1968 RADON COLLECTIONS

To combat the problem of tropospheric air leakage through the radon samplers, the 58th WRS was requested for the January 1968 mission only, not to apply power to the P system until just prior to sampling, and to turn power off after sampling was completed. This kept the air intake valve closed during ascent and descent, and theoretically prevented engine bleed air from being pushed through the radon sampler except at the programmed sampling altitudes. This procedure also risked the possibility that the P system solenoid valves would freeze before the heating blankets were turned on. Tests at HASL indicated that, when pre-flushed with dry N₂ gas as is the normal pre-flight check-out of the P system, the solenoid valves functioned properly at temperatures below -80°C.

In addition to the engine bleed supply, there is a second source of air for the P system of the aircraft. This second source is a probe which extends about 2 feet from the nose of the aircraft and through which air is forced by the forward velocity of the aircraft. HASL fabricated a special probe tip to maximize radon sampling. This special tip was modeled after the normal RB-57F probe tip with the following three differences. The HASL probe tip: 1) was several inches shorter, 2) had a 3/8" diameter bore, and 3) was not heated.

Two radon samplers were flown from Kirtland AFB during the January 1968 mission configured with the probe air intake to compare with simultaneously collected engine bleed radon samplers. It was hoped that the probe air system equipped with the modified probe tip would collect enough radon to demonstrate whether the engine compressor of the engine bleed system was adding some radon contamination to the samplers.

The radon-222 concentrations corrected to the midpoint of sampling for the January 1968 mission are given in Table 7. Proper records were not kept of the radon samplers flown from Albrook AFB, Panama Canal Zone, so that no unequivocal

assignment of samplers to specific flights can be made. However, only one radon collection from Albrook AFB was even partially successful. This was the 15.2 km sample collected close to the tropopause north of Albrook AFB. Sampler #15 had the highest radon content of all samplers from Albrook AFB, and this sampler was arbitrarily assigned to this partially successful collection in Table 7. Table 8 lists the radon content of all the other Albrook samplers corrected to 1200 Z January 19, 1968 which is about the midpoint of the three day sampling interval at Albrook. Because no air was drawn through the samplers in Table 8, they are all essentially blanks.

There is evidence that much of the high failure rate of radon sampling from Albrook AFB is due to the excessively cold equatorial stratosphere. The low temperature may have increased the viscosity of the oil in the compressor which would then overload and short out the compressor motor upon start-up. The cause of other failures in Tables 7 and 8 is not understood although some may have been attributable to faulty pressure regulators in the P system. If this is the case, it is not clear why faulty regulators were more prevalent in the January 1968 than in earlier Airstream missions, unless the special procedure concerning power to the P system had some effect. The modified radon sampler with the solenoid valve will permit the practice of applying power to the P system on the ground for future flights. It will be of interest to observe whether the frequency of failures tentatively assigned to faulty regulators decreases for such flights. In addition, all missions in the equatorial stratosphere should have some supplemental heating of the compressor oil.

DISCUSSION

ACTIVITY CONCENTRATION CONTOURS

While the revised Zr-95 concentrations for the August 1967 mission listed in Table 1 and plotted in Figure 4 are about a factor of 1/2 of the earlier reported values, the latitude and altitude pattern is not significantly changed and closely follows the behavior of the total gamma concentrations (2). Similarly, the Zr-95 concentrations from the November 1967 mission shown in Figure 5 also correlate well with the total gamma concentrations for that mission. These patterns reflect a poleward and downward transport of debris in the Northern Hemisphere from the Chinese 6th Nuclear test (June 17, 1967) during the autumn of 1967.

The total gamma concentration contours shown in Figure 6 for the January 1968 mission illustrate an extension of this same trend. By this time, Chic 6 debris had continued its poleward and downward transport such that the maximum concentration occurred about 15 km north of 60°N latitude. The cell of relatively high activity previously observed above 18 km in the 20-40°N latitude interval still persists in January 1968, although there is an apparent poleward skewing of this cell.

Assuming that the Chic 6 debris follows the $t^{-1.2}$ decay expression, the maximum gamma concentrations in January 1968 corrected for decay are less than those observed in November 1967. This decrease aside from what had been transferred to the troposphere during the latter part of 1967, suggests that by January 1968 most of the debris from this event resided within the province of Airstream and no large reservoir of this debris existed at higher altitudes. This conclusion has, on balance, been verified by the data from the High Altitude Balloon Program (to be published).

The distribution of Sr-90 concentrations in August 1967 illustrated in Figure 7 shows the early effects of Chic 6 debris (shaded areas) superimposed upon a normal stratospheric structure of relatively old weapon test debris. This structure of relatively old weapon test debris resembles the pattern developed by Project Stardust during early 1967 (4) and suggests that there is little discontinuity in the measurements of stratospheric radioactivity between Projects Stardust and Airstream.

FRACTIONATION

Sample 19A collected at 18.3 km on August 5, 1967 directly above the latitude of detonation of the Chinese 6th Nuclear test sampled very high concentrations of fresh debris from that event. These concentrations are so high that pre-Chic 6 debris contributed less than 10 percent, and the nuclide ratios from this sample can be examined without adjustment for old weapon test debris. Several nuclide ratios for this sample are shown in Table 9, corrected to shot date along with the anticipated ratios from a megaton detonation (5). Except for Ba-140/Sr-90, the agreement between the measured and anticipated ratios is very good indicating little fractionation in the major portion of the cloud from this shot. If the Ba-140 result from the HASL gamma spectrum analysis is adjusted for the -36 percent bias which was observed earlier, the Ba-140/Sr-90 ratio becomes 1340 which is in fair agreement with the expected ratio of 1170.

RADON CONCENTRATIONS

All solenoid valves in the P system apparently functioned normally in spite of specific instructions regarding power to the heating blankets. In addition there was no indication of any serious ice blockage in the unheated HASL probe tip during its two flights from Kirtland AFB probably because of its large bore. However, as indicated in Table 7, only one SCM of air was collected by the probe system which does not appear to be adequate for routine collections. It is interesting that the

two probe samples (#'s 25 and 27 on aircraft no. 294) collected at different latitudes and altitudes contained identical total radon-222 and gave equivalent Rn-222 concentrations.

The engine bleed samples (#'s 26 and 36) collected simultaneously with the probe samples also demonstrated internally consistent radon collections. However, the Rn-222 concentration of the probe samples were about 3 to 4 times higher than the equivalent engine bleed samples. While the engine bleed system on aircraft no. 294 was operated to eliminate tropospheric air leakage, no such precaution is possible with the probe air system. The ram-jet pressure on the probe tip in the troposphere may have caused some air leakage through the compressor giving rise to the higher Rn-222 concentrations from the probe samples.

These comparison samples indicate that the engine bleed system for flights from Kirtland AFB in aircraft no. 294 contributed little or no contamination. The relative integrity of the radon samples from this aircraft is more forcefully illustrated by the results of sample #'s 38 and 28. Sample #38 was a failure in that essentially no air was collected; instead, it serves as an ideal blank. The analyses shows no measurable Rn-222 in the sample. Rn-222 in sample #28 was collected between 39-47°N at 15.2 km from a total of 7.35 SCM and was barely detectable.

These results are encouraging in that some credence can be placed in the Rn-222 data from aircraft no. 294 flights out of Kirtland AFB in January 1968. However, they are discouraging because they indicate that this sampling system may not collect enough Rn-222 for precise measurement at altitudes of 15 km and above.

Similar conclusions can be made from Table 7 regarding the integrity of most of the radon samples flown from Mendoza AFB in aircraft nos. 291 and 299. Omitting sample #21, the concentrations observed at 15.2 km and above were generally less than 0.005 pCi/SCM. At 13.7 km, the maximum observed concentration can be about

0.02 pCi/SCM. This poorer sensitivity at the lower altitude derives from the smaller volume of air sampled by the slow pumping of sample #18. The one measurable concentration of 1.7 pCi/SCM from sample #21 collected at 15.2 km north of Mendoza AFB could result from the sampling of high tropospheric air along the flight track. The tropopause height along this track on collection day according to the flight data log was about 15 km.

It is clear from the other data in Table 7 that the sampling location of the radon samplers are not nearly so important as the aircraft in which they are flown. The samples collected by aircraft nos. 292 and 293 from Eielson AFB are good illustrations. Extremely high Rn-222 concentrations were encountered by aircraft no. 293 which are seriously inconsistent with the results from aircraft no. 292 at neighboring altitudes. For example, it is virtually inconceivable that the Rn-222 concentrations at 18.3 to 19.2 km south of Eielson AFB on January 19, 1968 could be a factor of 10 higher than the concentrations at 13.7 to 15.2 km in the same region.

The ultimate extrapolation of this concept is the results from the blank sample #'s 31 and 35 flown in aircraft no. 288 from Kirtland AFB. Sampler #31 through which no air was purposely drawn had the highest radon content (40.7 pCi) of any sample reported in Table 7. Similarly sampler #35 contained more Rn-222 than most samples derived from as much as 6 SCM of stratospheric air. A re-analysis of these blank samplers gave their normal background levels demonstrating the absence of any radon-bearing radium in the samplers.

The Rn-222 contents of the blank samples from Albrook AFB in Table 8 reflect varying degrees of radon contamination in the two aircraft flown from this base. This variation is important because it illustrates that the contamination from a particular aircraft is not fixed, but will vary with conditions. Even if the correct assignments of the Albrook samplers were known, the conditions responsible

for this variation would probably not be known. In reality then, the lack of sampler assignment at Albrook did not seriously hamper the interpretive effort.

At least three possibilities exist for the inordinately high Rn-222 content of the blank and some of the other samplers. The first is that contact with high levels of debris from previous nuclear weapons tests may give rise to Ra-226 contamination in some parts of the P system. This contamination, if it exists, must be limited to the last several contacts because several of the aircraft, notably nos. 291, 294 and 299 in Table 7, show little if any contamination. Making several other assumptions, one can calculate that Rn-222 contamination from this source is 3 to 4 orders of magnitude too low to explain the observed data.

A second possibility is that an accumulation of soil particles has built up within the P system. If an average Ra-226 content of soil is about 1 pCi/g (5), about 40 grams of soil must be involved to yield the results from sample #'s 3, 4 and 31 in Table 7. It is difficult to understand how this relatively large quantity of soil could be deposited within the P system of some aircraft and essentially no deposition exist in others.

The third possibility, which appears to be most reasonable, should have been corrected by the mode of operation during this January 1968 mission. By not turning power on to the P system until just prior to sampling at programmed altitude, and then by switching power off at the end of sampling, it was hoped that leakage of tropospheric air through the samples would be eliminated. This, indeed, seemed to be the case for a number of flights as indicated above. However, if the navigator inadvertently failed to follow this procedure exactly, or if the air intake valve from the engine compressor leaked, this precaution would not have been realized.

This tropospheric air leakage concept can explain not only the high blank values but also the large differences in contamination between samplers on the

same flight. If tropospheric air is applied to the P system under pressure, much of the air will follow the path of least resistance. If the compressor to which the blank sampler is connected has a greater leakage rate than the compressors which were subsequently activated in the stratosphere, it is conceivable that the blank sampler will contain more Rn-222 than other samplers on the same flight. Modified radon samplers with a normally closed solenoid valve in the inlet line should eliminate this problem in the future by preventing any P system air from passing through the sampler until the programmed sampling altitude.

References

1. Krey, P. W.
Project Airstream
USAEC Report HASL-183, October (1967)
2. Ibid, USAEC Report HASL-184, January (1968)
3. Harley, N. H. and Harley, J. H.
Stratospheric Radon Sampling
HASL Technical Memorandum 65-14 (1965)
4. Telegadas, K.
The Seasonal Stratospheric Distribution of Cadmium-109, Plutonium-238
and Strontium-90
USAEC Report HASL-184, January (1964)
5. Fisenne, Isabel (HASL)
Private communication (1968)

Fig. 1 - Project Airstream Flight Trajectory

Fig. 2 - Project Airstream Latitude - Altitude Coverage

Fig. 3

I - 52

HASL Radon Sampler

Fig. 4 - Revised Zr-95 Concentration Profile - August 1967

I - 53

REVISED Zr-95 pCi/SCM - AUG 1967

Fig. 5 - Zr-95 Concentration Profile - November 1967

Fig. 6 - Total Gamma Concentration Profile - January 1968

Fig 7 Sr^{90} Concentration Profile - August 1967

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 19.2 KM

SAMPLE #	193	194	195
FLIGHT #	288	288	288
DATE	8/ 3/67	8/ 3/67	8/ 3/67
BEGIN-			
TIME	2100	2124	2200
LAT.	75-00N	72-00N	68-00N
LONG.	143-00W	143-25W	144-30W
END-			
TIME	2124	2200	2230
LAT.	72-00N	68-00N	64-00N
LONG.	143-25W	144-30W	147-00W
VOL. OF AIR	1.91	2.86	2.38
(100 SCM)			
GROSS GAMMA/	178	164	155
M/100 SCM			
COUNT DATE	9/14/67	9/14/67	9/15/67

PC/100 SCM

ZR-95	*	8.	5.A
BA-140	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 18.3 KM

SAMPLE #	192	191	190
FLIGHT #	288	288	288
DATE	8/ 3/67	8/ 3/67	8/ 3/67
BEGIN-			
TIME	2030	1957	1931
LAT.	72-00N	68-00N	64-00N
LONG.	143-25W	144-30W	147-00W
END-			
TIME	2050	2030	1957
LAT.	75-00N	72-00N	68-00N
LONG.	143-00W	143-25W	144-30W
VOL. OF AIR (100 SCM)	1.91	3.15	2.43
GROSS GAMMA/ M/100 SCM	193	190	218
COUNT DATE	09/14/67	9/14/67	09/13/67

PC/100 SCM

ZR-95	7.A	4.A	32.
BA-140	*	*	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 15.2 KM

SAMPLE #	104	105	106
FLIGHT #	292	292	292
DATE	8/ 3/67	8/ 3/67	8/ 3/67
BEGIN-			
TIME	2342	13	47
LAT.	75-00N	72-00N	68-00N
LONG.	143-00W	143-20W	144-30W
END-			
TIME	13	47	118
LAT.	72-00N	68-00N	64-00N
LONG.	143-20W	144-30W	147-00W
VOL. OF AIR (100 SCM)	5.77	6.37	5.77
GROSS GAMMA/ M/100 SCM	4160	3140	2770
COUNT DATE	8/29/67	8/29/67	8/29/67

PC/100 SCM

ZR-95	35300.	2800.	2440.
BA-140	1460.	933.	1010.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 12.2 KM

SAMPLE #	103	102	101
FLIGHT #	292	292	292
DATE	8/ 3/67	8/ 3/67	8/ 3/67
BEGIN-			
TIME	2312	2227	2140
LAT.	72-00N	68-00N	64-00N
LONG.	143-20W	144-30W	147-00W
END-			
TIME	2342	2312	2227
LAT.	75-00N	72-00N	68-00N
LONG.	143-00W	143-20W	144-30W
VOL. OF AIR (100 SCM)	7.92	12.20	13.80
GROSS GAMMA/ M/100 SCM	277	131	132
COUNT DATE	08/29/67	8/29/67	8/29/67

PC/100 SCM

ZR-95	172.	46.	151.
BA-140	81.	*	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 19.2 KM

SAMPLE #	176	175	174
FLIGHT #	288	288	288
DATE	8/ 4/67	8/ 4/67	8/ 4/67
BEGIN-			
TIME	2154	2135	2055
LAT.	62-00N	60-00N	56-51N
LONG.	145-00W	140-30W	135-30W
END-			
TIME	2211	2154	2135
LAT.	64-00N	62-00N	60-00N
LONG.	145-50W	145-00W	140-30W
VOL. OF AIR	1.51	1.68	3.54
(100 SCM)			
GROSS GAMMA/	132	148	152
M/100 SCM			
COUNT DATE	9/13/67	9/13/67	9/13/67

PC/100 SCM

ZR-95	6. A	9.	*
BA-140	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 18.3 KM

SAMPLE #	99	171	98	172	97	173
FLIGHT #	292	288	292	288	292	288
DATE	7/29/67	8/ 4/67	7/29/67	8/ 4/67	7/29/67	8/ 4/67
BEGIN-						
TIME	2219	1927	2151	1945	2115	2008
LAT.	62-00N	64-00N	60-00N	62-00N	56-51N	60-00N
LONG.	145-00W	145-50W	140-40W	145-00W	135-33W	140-30W
END-						
TIME	2245	1945	2219	2008	2151	2043
LAT.	64-40N	62-00N	62-00N	60-00N	60-00N	56-51N
LONG.	147-06W	145-00W	145-00W	140-30W	140-40W	135-30W
VOL. OF AIR (100 SCM)	2.73	1.85	2.94	2.36	3.78	3.44
GROSS GAMMA/ M/100 SCM	952	254	176	194	1110	174
COUNT DATE	08/29/67	9/13/67	08/29/67	09/12/67	08/29/67	9/13/67
				PC/100 SCM		
ZR-95	739.	82.	25.	3.A	628.	4.A
BA-140	201.	*	*	*	392.	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 15.2 KM

SAMPLE #	183	182	181
FLIGHT #	292	292	292
DATE	8/ 4/67	8/ 4/67	8/ 4/67
BEGIN-			
TIME	2204	2137	2105
LAT.	62-00N	60-00N	56-51N
LONG.	145-00W	140-40W	135-35W
END-			
TIME	2220	2204	2137
LAT.	64-00N	62-00N	60-00N
LONG.	145-45W	145-00W	140-40W
VOL. OF AIR	3.16	5.33	6.44
(100 SCM)			
GROSS GAMMA/	7590	4500	3730
M/100 SCM			
COUNT DATE	9/13/67	9/13/67	9/13/67

PC/100 SCM

ZR-95	10200.	5740.	4530.
BA-140	1810.	1090.A	832.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 13.7 KM

SAMPLE #	117	116	178	115	179	114	180
FLIGHT #	288	288	292	288	292	288	292
DATE	7/29/67	7/29/67	8/ 4/67	7/29/67	8/ 4/67	7/29/67	8/ 4/67
BEGIN-							
TIME	2205	2140	1933	2115	1953	2040	2021
LAT.	64-00N	62-00N	64-00N	60-00N	62-00N	56-45N	60-00N
LONG.	145-30W	141-20W	145-45W	140-00W	145-00W	135-40W	140-40W
END-							
TIME	2217	2205	1953	2140	2021	2115	2100
LAT.	64-40N	64-00N	62-00N	62-00N	60-00N	60-00N	56-51N
LONG.	147-06W	145-30W	145-00W	141-20W	140-40W	140-00W	135-35W
VOL. OF AIR (100 SCM)	2.68	5.59	45.60	5.59	6.46	7.82	8.80
GROSS GAMMA/ M/100 SCM	708	894	87	375	866	2170	590
COUNT DATE	9/ 7/67	9/ 7/67	9/13/67	9/ 7/67	9/13/67	9/ 7/67	9/13/67
				PC/100 SCM			
ZR-95	132.	846.	18.	351.	1020.	2550.	676.
BA-140	437.A	*	*	187.	204.	714.A	*

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 13.7 KM

SAMPLE #	113	112
FLIGHT #	288	288
DATE	7/29/67	7/29/67
BEGIN-		
TIME	2033	1950
LAT.	56-45N	52-00N
LONG.	135-40W	129-30W
END-		
TIME	2040	2033
LAT.	56-45N	56-45N
LONG.	135-40W	135-40W
VOL. OF AIR	1.62	10.80
(100 SCM)		
GROSS GAMMA/	9880	10200
M/100 SCM		
COUNT DATE	09/07/67	09/07/67
ZR-95	11400.	9300.
BA-140	5260.	5050.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 18.3 KM

SAMPLE #	18	19	20	21
FLIGHT #	289	289	289	289
DATE	8/ 5/67	8/ 5/67	8/ 5/67	8/ 5/67
BEGIN-				
TIME	1941	2029	2121	2156
LAT.	47-27N	44-00N	40-00N	36-30N
LONG.	122-15W	115-53W	110-00W	107-50W
END-				
TIME	2029	2121	2156	2210
LAT.	44-00N	40-00N	36-30N	35-00N
LONG.	115-53W	110-00W	107-50W	106-47W
VOL. OF AIR (100 SCM)	1.32	0.16	3.89	0.38
GROSS GAMMA/ M/100 SCM	3710	150000	2830	21400
COUNT DATE	09/20/67	09/20/67	8/16/67	09/20/67
				PC/100 SCM
ZR-95	4710.	173000.	2340.	24800.
BA-140	1420.	83300.	338.	10200.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 16.8 KM

SAMPLE #	17	16	15	14
FLIGHT #	289	289	289	289
DATE	8/ 5/67	8/ 5/67	8/ 5/67	8/ 5/67
BEGIN-				
TIME	1819	1727	1652	1637
LAT.	44-00N	40-00N	36-30N	35-00N
LONG.	115-53W	110-00W	107-50W	106-47W
END-				
TIME	1909	1819	1727	1652
LAT.	47-27N	44-00N	40-00N	36-30N
LONG.	122-15W	115-53W	110-00W	107-50W
VOL. OF AIR	7.15	7.82	5.35	2.40
(100 SCM)				
GROSS GAMMA/	1960	1410	1310	2920
M/100 SCM				
COUNT DATE	8/16/67	8/16/67	8/16/67	8/16/67
				PC/100 SCM
ZR-95	1610.	870.	867.	302.
BA-140	340.	300.	270.	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 15.2 KM

SAMPLE #	185	186	187	188
FLIGHT #	288	288	288	288
DATE	8/ 5/67	8/ 5/67	8/ 5/67	8/ 5/67
BEGIN-				
TIME	2126	2210	2305	2344
LAT.	47-24N	44-00N	40-00N	36-30N
LONG.	122-19W	116-45W	110-30W	107-50W
END-				
TIME	2210	2305	2344	2358
LAT.	44-00N	40-00N	36-30N	35-03N
LONG.	116-40W	110-30W	107-50W	106-36W
VOL. OF AIR (100 SCM)	8.63	11.10	8.15	2.85
GROSS GAMMA/ M/100 SCM	764	450	99	63
COUNT DATE	09/13/67	9/13/67	9/13/67	9/13/67
ZR-95	819.	450.	99.	PC/100 SCM 55.
BA-140	367.	177.	*	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 13.7 KM

SAMPLE #	111	110	109	108
FLIGHT #	288	288	288	288
DATE	7/29/67	7/29/67	7/29/67	7/29/67
BEGIN-				
TIME	1900	1810	1710	1635
LAT.	48-00N	44-00N	40-00N	36-50N
LONG.	122-50W	116-30W	110-20W	108-10W
END-				
TIME	1950	1900	1810	1710
LAT.	52-00N	48-00N	44-00N	40-00N
LONG.	129-30W	122-50W	116-30W	110-20W
VOL. OF AIR (100 SCM)	13.10	13.70	15.90	9.70
GROSS GAMMA/ M/100 SCM	2210	1240	3520	237
COUNT DATE	9/ 7/67	09/07/67	08/29/67	8/29/67
				PC/100 SCM
ZR-95	2140.	1110.	265.	157.
BA-140	1100.	921.	195.	91.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 18.3 KM

SAMPLE #	10	9	8	7
FLIGHT #	289	289	289	289
DATE	8/ 4/67	8/ 4/67	8/ 4/67	8/ 4/67
BEGIN-				
TIME	2128	2047	2014	1949
LAT.	32-00N	29-00N	26-00N	24-00N
LONG.	099-00W	094-40W	091-15W	089-00W
END-				
TIME	2230	2128	2047	2014
LAT.	35-00N	32-00N	29-00N	26-00N
LONG.	106-50W	099-00W	094-40W	091-15W
VOL. OF AIR	1.70	4.50	3.61	2.78
(100 SCM)				
GROSS GAMMA/	13500	3780	6090	5040
M/100 SCM				
COUNT DATE	09/21/67	8/15/67	8/15/67	8/15/67
				PC/100 SCM
ZR-95	8610.	954.	918.	642.
BA-140	3680.	198.A	378.	442.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 16.8 KM

SAMPLE #	3	4	5	6
FLIGHT #	289	289	289	289
DATE	8/ 4/67	8/ 4/67	8/ 4/67	8/ 4/67
BEGIN-				
TIME	1651	1759	1842	1920
LAT.	35-00N	32-00N	29-00N	26-00N
LONG.	106-50W	099-00W	094-40W	091-15W
END-				
TIME	1759	1842	1920	1945
LAT.	32-00N	29-00N	26-00N	24-00N
LONG.	099-00W	94-40W	091-15W	089-00W
VOL. OF AIR (100 SCM)	2.58	6.57	5.81	3.82
GROSS GAMMA/ M/100 SCM	1070	2890	3100	3930
COUNT DATE	09/21/67	8/15/67	8/15/67	8/15/67
				PC/100 SCM
ZR-95	786.	1440.	719.	650.
BA-140	264.	699.	370.	386.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 19.2 KM

SAMPLE #	82	83	84	85	86
FLIGHT #	298	298	298	298	298
DATE	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67
BEGIN-					
TIME	1605	1647	1729	1800	1829
LAT.	24-00N	20-00N	16-00N	16-00N	10-00N
LONG.	89-00W	86-00W	83-15W	81-50W	80-15W
END-					
TIME	1647	1729	1800	1829	1843
LAT.	20-00N	16-00N	13-00N	10-00N	08-50N
LONG.	86-00W	85-15W	81-50W	80-15W	79-30W
VOL. OF AIR (100 SCM)	3.83	3.93	2.91	2.73	1.34
GROSS GAMMA/ M/100 SCM	365	150	103	87	216
COUNT DATE	9/ 6/67	9/ 6/67	9/ 6/67	9/ 6/67	08/02/67
				PC/100 SCM	
ZR-95	189.	39.	25.	24.	85.
BA-140	64.A	*	*	*	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 18.3 KM

SAMPLE #	32	33	34	35	36
FLIGHT #	298	298	298	298	298
DATE	8/ 8/67	8/ 8/67	8/ 8/67	8/ 8/67	8/ 8/67
BEGIN-					
TIME	1626	1716	1758	1828	1858
LAT.	24-00N	20-00N	16-00N	13-00N	10-00N
LONG.	89-00W	86-00W	83-15W	81-50W	80-10W
END-					
TIME	1716	1758	1828	1858	1910
LAT.	20-00N	16-00N	13-00N	10-00N	8-57N
LONG.	86-00W	83-15W	81-50W	80-10W	79-35W
VOL. OF AIR (100 SCM)	5.10	4.36	3.17	3.13	1.25
GROSS GAMMA/ M/100 SCM	823	1670	851	1210	640
COUNT DATE	08/23/67	8/24/67	8/24/67	8/24/67	8/24/67
				PC/100 SCM	
ZR-95	2130.	988.	492.	643.	316.
BA-140	*	533.	257.	344.	139.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 16.8 KM

SAMPLE #	31	30	29	28	27
FLIGHT #	298	298	298	298	298
DATE	8/ 8/67	8/ 8/67	8/ 8/67	8/ 8/67	8/ 8/67
BEGIN-					
TIME	1533	1452	1424	1353	1341
LAT.	20-00N	16-00N	13-00N	10-00N	8-57N
LONG.	86-00W	83-15W	81-50W	80-10W	79-35W
END-					
TIME	1614	1535	1452	1424	1353
LAT.	24-00N	20-00N	16-00N	13-00N	10-00N
LONG.	89-00W	86-00W	83-15W	81-50W	80-10W
VOL. OF AIR (100 SCM)	6.06	6.10	4.14	4.53	1.79
GROSS GAMMA/ M/100 SCM	1450	1150	1430	838	1840
COUNT DATE	8/23/67	8/28/67	8/23/67	8/23/67	8/23/67
PC/100 SCM					
ZR-95	788.	673.	1020.	508.	357.
BA-140	363.	318.	321.	250.	120.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 15.2 KM

SAMPLE #	81	80	79	78	77
FLIGHT #	298	298	298	298	298
DATE	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67
BEGIN-					
TIME	1504	1420	1350	1317	1305
LAT.	20-00N	16-00N	13-00N	10-00N	08-50N
LONG.	86-00W	83-15W	81-50W	80-15W	79-30W
END-					
TIME	1545	1504	1420	1350	1317
LAT.	24-00N	20-00N	16-00N	13-00N	10-00N
LONG.	89-00W	86-00W	83-15W	81-50W	80-15W
VOL. OF AIR (100 SCM)	8.20	9.16	6.44	7.11	2.67
GROSS GAMMA/ M/100 SCM	365	338	590	379	599
COUNT DATE	9/ 6/67	9/ 6/67	9/ 6/67	9/ 6/67	9/ 6/67
				PC/100 SCM	
ZR-95	296.	239.	390.	267.	430.
BA-140	*	288.	411.	255.	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 19.2 KM

SAMPLE #	62	61	60	59	58
FLIGHT #	293	293	293	293	293
DATE	8/ 3/67	8/ 3/67	8/ 3/67	8/ 3/67	8/ 3/67
BEGIN-					
TIME	1812	1739	1703	1623	1544
LAT.	07-00N	3-00N	01-00S	05-00S	09-00S
LONG.	79-35W	79-40W	79-25W	79-04W	78-31W
END-					
TIME	1826	1812	1739	1703	1623
LAT.	08-47N	07-00N	03-00N	01-00S	05-00S
LONG.	79-35W	79-35W	79-40W	79-25W	79-04W
VOL. OF AIR (100 SCM)	1.29	2.98	3.26	3.50	3.43
GROSS GAMMA/ M/100 SCM	170	164	429	100	183
COUNT DATE	8/20/67	08/28/67	08/28/67	08/28/67	08/28/67
				PC/100 SCM	
ZR-95	57.	22.	8250.	12.	21.
BA-140	*	*	4150.	15.A	28.A

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 18.3 KM

SAMPLE #	73	72	71	70
FLIGHT #	294	294	294	294
DATE	8/ 6/67	8/ 6/67	8/ 6/67	8/ 6/67
BEGIN-				
TIME	1942	1908	1831	1753
LAT.	03-00N	01-00S	05-00S	09-09S
LONG.	79-40W	79-10W	78-05W	76-55W
END-				
TIME	2017	1942	1908	1831
LAT.	07-00N	03-00N	01-00S	05-00S
LONG.	79-35W	79-40W	79-10W	78-05W
VOL. OF AIR (100 SCM)	3.96	3.97	4.35	4.34
GROSS GAMMA/ M/100 SCM	95	105	87	112
COUNT DATE	9/ 1/67	9/ 1/67	9/ 1/67	9/ 1/67
				PC/100 SCM
ZR-95	19.	9.	7.	12.
BA-140	*	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 16.8 KM

SAMPLE #	49	53	48	54	47	55	46
FLIGHT #	298	293	298	293	298	293	298
DATE	7/31/67	8/ 3/67	7/31/67	8/ 3/67	7/31/67	8/ 3/67	7/31/67
BEGIN-							
TIME	2027	1247	1947	1303	1909	1337	1831
LAT.	07-00N	08-47N	03-00N	07-00N	01-00S	03-00N	05-00S
LONG.	079-35W	79-35W	79-40W	79-35W	79-10W	79-40W	78-05W
END-							
TIME	2042	1303	2027	1337	1947	1411	1909
LAT.	08-50N	07-00N	07-00N	03-00N	03-00N	01-00S	01-00S
LONG.	79-30W	79-35W	79-30W	79-40W	79-40W	79-25W	79-10W
VOL. OF AIR (100 SCM)	2.42	2.54	6.51	5.34	6.25	5.31	6.14
GROSS GAMMA/ M/100 SCM	272	137	445	205	368	131	488
COUNT DATE	8/25/67	8/25/67	8/25/67	08/28/67	8/25/67	08/28/67	8/25/67
				PC/100 SCM			
ZR-95	155.	77.	277.	122.	196.	70.	256.
BA-140	85.	22.A	186.	137.	68.A	92.	335.

A:COUNTING ERROR IS 20-50 PER CENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 16.8 KM

SAMPLE #	56	95	45	57	94
FLIGHT #	293	296	298	293	296
DATE	8/ 3/67	8/ 8/67	7/31/67	8/ 3/67	8/ 8/67
BEGIN-					
TIME	1141	1944	1755	1443	1913
LAT.	01-00S	05-00S	09-09S	05-00S	09-09S
LONG.	79-25W	78-05W	076-55W	79-04W	76-55W
END-					
TIME	1443	2025	1831	1520	1944
LAT.	05-00S	01-00S	05-00S	09-00S	05-00S
LONG.	79-04W	79-13W	78-05W	78-31W	78-05W
VOL. OF AIR (100 SCM)	5.24	6.50	5.62	5.93	4.92
GROSS GAMMA/ M/100 SCM	190	215	587	354	487
COUNT DATE	08/28/67	09/07/67	8/25/67	08/28/67	9/ 7/67
				PC/100 SCM	
ZR-95	112.	*	286.	203.	308.
BA-140	113.	*	415.	217.	226.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 19.2 KM

SAMPLE #	125	126	127	128	129
FLIGHT #	294	294	294	294	294
DATE	8/ 4/67	8/ 4/67	8/ 4/67	8/ 4/67	8/ 4/67
BEGIN-					
TIME	1645	1714	1746	1823	1858
LAT.	15-25S	19-00S	23-00S	27-00S	31-00S
LONG.	75-20W	74-05W	72-30W	70-50W	68-50W
END-					
TIME	1714	1746	1823	1858	1914
LAT.	19-00S	23-00S	27-00S	31-00S	32-50S
LONG.	74-05W	72-30W	70-50W	68-50W	68-47W
VOL. OF AIR (100 SCM)	2.64	2.97	3.39	3.09	1.41
GROSS GAMMA/ M/100 SCM	117	107	112	110	148
COUNT DATE	09/08/67	9/15/67	09/08/67	9/ 8/67	9/ 8/67
				PC/100 SCM	
ZR-95	9.	6.	6.	4.A	7.A
BA-140	*	*	*	*	*

A:COUNTING ERROR IS 20-50 PER CENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 18.3 KM

SAMPLE #	138	139	140	141	142
FLIGHT #	294	294	294	294	294
DATE	8/ 3/67	8/ 3/67	8/ 3/67	8/ 3/67	8/ 3/67
BEGIN-					
TIME	2015	2042	2116	2150	2225
LAT.	15-25S	19-00S	23-00S	27-00S	31-00S
LONG.	75-20W	74-15W	72-30W	70-50W	68-47W
END-					
TIME	2042	2116	2150	2225	2241
LAT.	19-00S	23-00S	27-00S	31-00S	32-50S
LONG.	74-15W	72-30W	70-50W	68-50W	68-47W
VOL. OF AIR	3.04	3.79	3.70	3.82	1.75
(100 SCM)					
GROSS GAMMA/	92	105	135	125	154
M/100 SCM					
COUNT DATE	9/11/67	9/11/67	9/11/67	9/11/67	09/11/67
				PC/100 SCM	
ZR-95	8.	7.	4.A	6.	7.A
BA-140	*	*	*	*	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 16.8 KM

SAMPLE #	44	43	93	137	42	92	136
FLIGHT #	298	298	296	294	298	296	294
DATE	7/31/67	7/31/67	8/ 8/67	8/ 3/67	7/31/67	8/ 8/67	8/ 3/67
BEGIN-							
TIME	1655	1620	1739	1937	1544	1705	1858
LAT.	15-21S	19-00S	19-00S	19-00S	23-00S	23-00S	23-00S
LONG.	75-10W	73-55W	73-50W	74-15W	072-30W	72-30W	72-30W
END-							
TIME	1755	1655	1817	2010	1620	1739	1937
LAT.	09-09S	15-21S	15-21S	15-25S	19-00S	19-00S	19-00S
LONG.	76-55W	75-10W	75-10W	75-20W	073-55W	73-50W	74-15W
VOL. OF AIR (100 SCM)	9.35	5.29	5.92	5.05	5.51	5.30	6.01
GROSS GAMMA/ M/100 SCM	374	47	523	118	132	339	93
COUNT DATE	8/25/67	8/25/67	9/ 7/67	9/11/67	8/25/67	09/28/67	9/11/67
				PC/100 SCM			
ZR-95	181.	15.	331.	60.	44.	330.	42.
BA-140	246.	*	240.	*	42.	258.	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 16.8 KM

SAMPLE #	41	91	135	90	134	133
FLIGHT #	298	296	294	296	294	294
DATE	7/31/67	8/ 8/67	8/ 3/67	8/ 8/67	8/ 3/67	8/ 3/67
BEGIN-						
TIME	1503	1625	1818	1545	1739	1721
LAT.	27-00S	27-00S	27-00S	31-00S	31-00S	32-50S
LONG.	070-50W	70-50W	70-50W	68-50W	68-50W	68-47W
END-						
TIME	1544	1705	1858	1625	1818	1739
LAT.	23-00S	23-00S	23-00S	27-00S	27-00S	31-00S
LONG.	072-30W	72-30W	72-30W	70-50W	70-50W	68-50W
VOL. OF AIR (100 SCM)	6.15	6.10	6.18	5.94	5.97	2.66
GROSS GAMMA/ M/100 SCM	136	213	114	202	90	116
COUNT DATE	08/24/67	09/28/67	9/11/67	9/ 6/67	9/ 8/67	9/ 8/67
				PC/100 SCM		
ZR-95	24.	167.	40.	75.	34.	33.
BA-140	*	140.	24.A	37.A	*	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 16.2 KM

SAMPLE # 40
FLIGHT # 298
DATE 7/31/67
BEGIN-
TIME 1421
LAT. 31-00S
LONG. 063-50W
END-
TIME 1503
LAT. 27-00S
LONG. 070-50W
VOL. OF AIR 6.32
(100 SCM)
GROSS GAMMA/ 99
M/100 SCM
COUNT DATE 08/24/67

PC/100 SCM

ZR-95 8.
BA-140 *

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 15.2 KM

SAMPLE #	69	124	68	123	67	122	66
FLIGHT #	294	294	294	294	294	294	294
DATE	8/ 6/67	8/ 4/67	8/ 6/67	8/ 4/67	8/ 6/67	8/ 4/67	8/ 6/67
BEGIN-							
TIME	1618	1601	1538	1523	1457	1442	1416
LAT.	19-00S	19-00S	23-00S	23-00S	27-00S	27-00S	31-00S
LONG.	74-55W	74-05W	72-30W	72-30W	70-55W	70-50W	68-50W
END-							
TIME	1655	1636	1618	1601	1538	1523	1457
LAT.	15-20S	15-25S	19-00S	19-00S	23-00S	23-00S	27-00S
LONG.	75-10W	75-20W	74-55W	74-05W	72-30W	72-30W	70-55W
VOL. OF AIR (100 SCM)	8.04	7.60	8.69	8.25	8.68	8.82	8.50
GROSS GAMMA/ M/100 SCM	522	381	1840	303	1270	238	1020
COUNT DATE	9/ 1/67	9/ 8/67	9/ 1/67	9/ 8/67	9/ 1/67	9/ 8/67	9/ 1/67
				PC/100 SCM			
ZR-95	301.	267.	1080.	210.	711.	160.	556.
BA-140	109.A	277.	1180.	214.	758.	169.	228.A

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 15.2 KM

SAMPLE #	121	120
FLIGHT #	294	294
DATE	8/ 4/67	8/ 4/67
BEGIN-		
TIME	1401	1345
LAT.	31-00S	32-50S
LONG.	68-50W	68-47W
END-		
TIME	1442	1401
LAT.	27-00S	31-00S
LONG.	70-50W	68-50W
VOL. OF AIR	8.50	3.26
(100 SCM)		
GROSS GAMMA/	223	552
M/100 SCM		
COUNT DATE	9/ 7/67	9/ 7/67

PC/100 SCM

ZR-95	143.	379.
BA-140	*	428.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 19.2 KM

SAMPLE #	168	167	166	165	164
FLIGHT #	296	296	296	296	296
DATE	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67
BEGIN-					
TIME	1905	1828	1746	1711	1646
LAT.	35-00S	39-00S	43-00S	47-00S	50-00S
LONG.	68-47W	68-13W	68-47W	67-30W	68-35W
END-					
TIME	1922	1905	1828	1746	1711
LAT.	32-50S	35-00S	39-00S	43-00S	47-00S
LONG.	68-47W	68-25W	68-13W	68-47W	67-30W
VOL. OF AIR (100 SCM)	1.55	3.38	3.52	3.37	2.27
GROSS GAMMA/ M/100 SCM	129	109	144	124	118
COUNT DATE	9/13/67	09/28/67	09/28/67	9/12/67	9/12/67
PC/100 SCM					
ZR-95	*	3.A	6.	5.A	4.A
BA-140	*	*	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 18.3 KM

SAMPLE #	159	160	161	162	163
FLIGHT #	296	296	296	296	296
DATE	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67
BEGIN-					
TIME	1414	1433	1507	1541	1614
LAT.	32-50S	35-00S	39-00S	43-00S	47-00S
LONG.	68-47W	68-25W	68-13W	67-47W	67-30W
END-					
TIME	1433	1507	1541	1614	1640
LAT.	35-00S	39-00S	43-00S	47-00S	50-00S
LONG.	68-25W	68-13W	67-47W	67-30W	68-35W
VOL. OF AIR (100 SCM)	2.12	3.77	3.71	3.41	2.78
GROSS GAMMA/ M/100 SCM	117	111	132	158	93
COUNT DATE	9/12/67	9/12/67	9/12/67	9/12/67	9/12/67
				PC/100 SCM	
ZR-95	*	6.	3.A	7.	*
BA-140	*	*	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 15.2 KM

SAMPLE #	155	154	153	152	151
FLIGHT #	294	294	294	294	294
DATE	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67
BEGIN-					
TIME	1917	1851	1816	1740	1714
LAT.	35-00S	39-00S	43-00S	47-00S	50-00S
LONG.	68-25W	68-10W	67-50W	67-50W	68-40W
END-					
TIME	1945	1927	1851	1816	1740
LAT.	32-50S	35-00S	39-00S	43-00S	47-00S
LONG.	68-47W	68-25W	68-10W	67-50W	67-50W
VOL. OF AIR	3.58	7.17	6.81	6.77	4.97
(100 SCM)					
GROSS GAMMA/	363	432	126	79	158
M/100 SCM					
COUNT DATE	9/12/67	9/12/67	9/12/67	9/12/67	9/12/67
				PC/100 SCM	
ZR-95	260.	280.	8.	14.	7.
BA-140	*	304.	*	*	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 1
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN AUGUST 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 13.7 KM

SAMPLE #	146	147	148	149	150
FLIGHT #	294	294	294	294	294
DATE	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67	8/ 2/67
BEGIN-					
TIME	1430	1448	1526	1604	1640
LAT.	32-50S	35-00S	39-00S	43-00S	47-00S
LONG.	68-47W	68-25W	68-10W	67-50W	67-50W
END-					
TIME	1448	1526	1604	1640	1709
LAT.	35-00S	39-00S	43-00S	47-00S	50-00S
LONG.	68-25W	68-10W	67-50W	67-50W	68-40W
VOL. OF AIR (100 SCM)	4.42	9.24	8.93	8.50	6.67
GROSS GAMMA/ M/100 SCM	2490	1520	1460	341	149
COUNT DATE	9/11/67	9/12/67	9/12/67	9/12/67	09/12/67
				PC/100 SCM	
ZR-95	1940.	1180.	1090.	189.	42.
BA-140	2440.	1370.	1360.	181.	64.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 19.2 KM

SAMPLE #	268	269	270	271	272
FLIGHT #	295	295	295	295	295
DATE	10/ 5/67	10/ 5/67	10/ 5/67	10/ 5/67	10/ 5/67
BEGIN-					
TIME	1936	2008	2042	2112	2145
LAT.	49-16N	47-00N	44-35N	42-04N	39-26N
LONG.	87-20W	91-40W	95-25W	99-00W	102-15W
END-					
TIME	2008	2042	2112	2145	2217
LAT.	47-00N	44-35N	42-04N	39-26N	36-40N
LONG.	91-40W	95-25W	99-00W	102-15W	105-15W
VOL. OF AIR	2.63	2.80	2.58	2.82	2.74
(100 SCM)					
GROSS GAMMA/	40700	29000	30900	31100	36300
M/100 SCM					
COUNT DATE	10/26/67	10/26/67	10/26/67	10/26/67	10/26/67
				PC/100 SCM	
ZR-95	39600.	*	33300.	31600.	34200.
BA-140	*	*	721.A	680.A	*

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 18.3 KM

SAMPLE #	247	248	249	250	251
FLIGHT #	295	295	295	295	295
DATE	10/ 9/67	10/ 9/67	10/ 9/67	10/ 9/67	10/ 9/67
BEGIN-					
TIME	1847	1915	1948	2019	2050
LAT.	49-20N	47-00N	44-30N	42-00N	39-25N
LONG.	87-30W	91-30W	95-25W	99-00W	102-15W
END-					
TIME	1915	1948	2019	2050	2122
LAT.	47-00N	44-30N	42-00N	39-25N	36-40N
LONG.	91-30W	95-25W	99-00W	102-15W	105-15W
VOL. OF AIR (100 SCM)	2.93	3.53	3.31	3.31	3.44
GROSS GAMMA/ M/100 SCM	53200	41400	27300	24600	26600
COUNT DATE	10/25/67	10/25/67	10/25/67	10/25/67	10/25/67
				PC/100 SCM	
ZR-95	49700.	36800.	26300.	24100.	26200.
BA-140	1100.A	*	412.A	516.A	422.A

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 16.8 KM

SAMPLE #	267	266	265	264	263
FLIGHT #	295	295	295	295	295
DATE	10/ 5/67	10/ 5/67	10/ 5/67	10/ 5/67	10/ 5/67
BEGIN-					
TIME	1845	1815	1744	1715	1643
LAT.	47-00N	44-35N	42-04N	39-26N	36-40N
LONG.	91-40W	95-25W	99-00W	102-15W	105-15W
END-					
TIME	1915	1845	1815	1744	1715
LAT.	49-16N	47-00N	44-35N	42-04N	39-26N
LONG.	87-20W	91-40W	95-25W	99-00W	102-15W
VOL. OF AIR (100 SCM)	4.11	4.03	4.48	4.18	4.99
GROSS GAMMA/ M/100 SCM	5960	5330	2080	1620	1350
COUNT DATE	10/26/67	10/26/67	10/26/67	10/26/67	10/26/67
PC/100 SCM					
ZR-95	12700.	5560.	2300.	1970.	1800.
BA-140	170.A	90.A	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 15.2 KM

SAMPLE #	246	245	244	243	242
FLIGHT #	295	295	295	295	295
DATE	10/ 9/67	10/ 9/67	10/ 9/67	10/ 9/67	10/ 9/67
BEGIN-					
TIME	1805	1735	1703	1631	1556
LAT.	47-00N	44-30N	42-00N	39-25N	36-40N
LONG.	91-30W	95-25W	99-00W	102-15W	105-15W
END-					
TIME	1834	1805	1735	1703	1631
LAT.	49-20N	47-00N	44-30N	42-00N	39-25N
LONG.	87-30W	91-30W	95-25W	99-00W	102-15W
VOL. OF AIR (100 SCM)	5.51	5.77	6.37	6.30	7.11
GROSS GAMMA/ M/100 SCM	6210	2910	1090	1140	361
COUNT DATE	10/25/67	10/25/67	10/25/67	10/25/67	10/25/67
PC/100 SCM					
ZR-95	5940.	2950.	976.	1150.	390.
BA-140	*	*	*	*	*

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 19.5 KM

SAMPLE # 261
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 2005
LAT. 31-15N
LONG. 100-05W
END-
TIME 2035
LAT. 31-20N
LONG. 100-25W
VOL. OF AIR 0.32
(100 SCM)
GROSS GAMMA/ 11900
M/100 SCM
COUNT DATE 11/30/67

PC/100 SCM

ZR-95 19100.
BA-140 *

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 18.6 KM

SAMPLE # 260
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1929
LAT. 31-05N
LONG. 100-30W
END-
TIME 1959
LAT. 31-20N
LONG. 100-25W
VOL. OF AIR 0.39
(100 SCM)
GROSS GAMMA/ 16900
M/100 SCM
COUNT DATE 11/30/68

PC/100 SCM

ZR-95 25900.
BA-140 *

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 17.7 KM

SAMPLE # 259
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1854
LAT. 31-15N
LONG. 100-10W
END-
TIME 1928
LAT. 31-00N
LONG. 100-00W
VOL. OF AIR 3.83
(100 SCM)
GROSS GAMMA/ 8540
M/100 SCM
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 8790.
BA-140 *

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 16.8 KM

SAMPLE # 258
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1830
LAT. 31-20N
LONG. 100-05W
END-
TIME 1851
LAT. 31-50N
LONG. 100-35W
VOL. OF AIR 3.32
(100 SCM)
GROSS GAMMA/ 1690
M/100 SCM
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 1590.
BA-140 *

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 15.9 KM

SAMPLE # 257
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1808
LAT. 31-25N
LONG. 99-55W
END-
TIME 1828
LAT. 31-35N
LONG. 100-00W
VOL. OF AIR 3.70
(100 SCM)
GROSS GAMMA/ 889
M/100 SCM
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 925.
BA-140 *

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 14.9 KM

SAMPLE # 256
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1745
LAT. 31-15N
LONG. 100-10W
END-
TIME 1805
LAT. 31-45N
LONG. 100-05W
VOL. OF AIR 4.55
(100 SCM)
GROSS GAMMA/ 327
M/100 SCM
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 374.
BA-140 *

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 14.0 KM

SAMPLE # 255
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1723
LAT. 31-30N
LONG. 100-10W
END-
TIME 1743
LAT. 31-20N
LONG. 100-00W
VOL. OF AIR 4.93
(100 SCM)
GROSS GAMMA/ 1080
M/100 SCM
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 109.
BA-140 *

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 13.7 KM

SAMPLE # 254
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1700
LAT. 31-35N
LONG. 100-45W
END-
TIME 1720
LAT. 31-40N
LONG. 100-10W
VOL. OF AIR 5.15
(100 SCM)
GROSS GAMMA/ 374
M/100 SCM
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 36.
BA-140 *

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 2
TOTAL GAMMA, ZR-95 AND BA-140 CONCENTRATIONS IN SPECIAL OCTOBER 1967 FLIGHTS

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 12.2 KM

SAMPLE # 253
FLIGHT # 295
DATE 10/ 7/67
BEGIN-
TIME 1638
LAT. 31-45N
LONG. 101-03W
END-
TIME 1658
LAT. 31-30N
LONG. 100-50W
VOL. OF AIR 5.69
(100 SCM)
GROSS GAMMA/
M/100 SCM 1000
COUNT DATE 10/25/67

PC/100 SCM

ZR-95 106.
BA-140 *

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 19.2 KM

SAMPLE #	313	314	315
FLIGHT #	288	288	288
DATE	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-			
TIME	2208	2248	2308
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-20W	144-30W
END-			
TIME	2245	2308	2338
LAT.	71-00N	68-00N	64-34N
LONG.	143-20W	144-30W	147-48W
VOL. OF AIR	0.79	0.43	2.48
(100 SCM)			
GROSS GAMMA/	22800	44200	46400
M/100 SCM			
COUNT DATE	02/07/68	02/07/68	11/20/67

			PC/100 SCM
ZR-95	51000.	50600.	40300.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 18.3 KM

SAMPLE #	312	311	310
FLIGHT #	288	288	288
DATE	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-			
TIME	2132	2106	2042
LAT.	71-00N	68-00N	65-00N
LONG.	143-20W	144-30W	146-35W
END-			
TIME	2202	2132	2106
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-20W	144-30W
VOL. OF AIR	3.18	0.68	2.43
(100 SCM)			
GROSS GAMMA/	42800	29400	41600
M/100 SCM			
COUNT DATE	11/19/67	02/07/68	11/19/67
ZR-95	39900.	34100.	44300.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 15.2 KM

SAMPLE #	320	321	322
FLIGHT #	293	293	293
DATE	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-			
TIME	2148	2226	2255
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-00W	144-30W
END-			
TIME	2226	2255	2324
LAT.	71-00N	68-00N	65-00N
LONG.	143-00W	144-30W	146-30W
VOL. OF AIR	6.91	5.19	5.19
(100 SCM)			
GROSS GAMMA/	16200	17300	6110
M/100 SCM			
COUNT DATE	11/16/67	11/17/67	11/17/67
ZR-95	4220.	16000.	13400.

PC/100 SCM

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF EIELSON
(75N-64N)
ALTITUDE 12.2 KM

SAMPLE #	319	318	317
FLIGHT #	293	293	293
DATE	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-			
TIME	2056	2023	1950
LAT.	71-00N	68-00N	65-00N
LONG.	143-00W	144-30W	146-30W
END-			
TIME	2139	2056	2023
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-00W	144-30W
VOL. OF AIR (100 SCM)	11.80	9.14	9.08
GROSS GAMMA/ M/100 SCM	742	1330	1020
COUNT DATE	11/16/67	11/16/67	11/16/67
ZR-95	741.	1310.	1010.

PC/100 SCM

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 19.2 KM

SAMPLE #	338	337	336	335
FLIGHT #	288	288	288	288
DATE	11/ 4/67	11/ 4/67	11/ 4/67	11/ 4/67
BEGIN-				
TIME	0003	2340	2306	2232
LAT.	61-00N	59-00N	56-00N	53-00N
LONG.	139-00W	135-30W	131-20W	128-00W
END-				
TIME	0053	0003	2340	2306
LAT.	65-00N	61-00N	59-00N	56-00N
LONG.	148-00W	139-00W	135-30W	131-20W
VOL. OF AIR	4.19	0.48	2.93	2.62
(100 SCM)				
GROSS GAMMA/	24300	11300	38200	42700
M/100 SCM				
COUNT DATE	11/22/67	02/07/68	11/22/67	11/22/67
ZR-95	24400.	32700.	37700.	PC/100 SCM 42500.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 18.3 KM

SAMPLE #	309	308	330	331	332
FLIGHT #	288	288	288	288	288
DATE	11/ 6/67	11/ 6/67	11/ 4/67	11/ 4/67	11/ 4/67
BEGIN-					
TIME	1953	1947	2002	2024	2056
LAT.	60-00N	61-30N	61-00N	59-00N	56-00N
LONG.	139-05W	140-00W	139-00W	135-30W	131-20W
END-					
TIME	2042	1953	2024	2056	2125
LAT.	65-00N	61-00N	59-00N	56-00N	53-00N
LONG.	146-35W	139-05W	135-30W	131-20W	138-00W
VOL. OF AIR (100 SCM)	1.23	0.61	2.34	0.85	3.17
GROSS GAMMA/ M/100 SCM	16300	39300	4490	4470	13800
COUNT DATE	03/02/68	11/17/67	11/21/67	02/07/68	12/08/67
ZR-95	48300.	36200.	4520.	PC/100 SCM 10500.	16600.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 15.2 KM

SAMPLE #	295	349	294	348	293	347	292
FLIGHT #	293	293	293	293	293	293	293
DATE	11/ 2/67	11/ 5/67	11/ 2/67	11/ 5/67	11/ 2/67	11/ 5/67	11/ 2/67
BEGIN-							
TIME	2300	0003	2236	2339	2203	2309	2127
LAT.	61-00N	61-00N	59-00N	59-00N	56-00N	56-00N	53-00N
LONG.	139-00W	139-05W	135-40W	135-45W	131-30W	131-30W	127-50W
END-							
TIME	0025	0044	2300	0003	2236	2339	2203
LAT.	64-40N	64-34N	61-00N	61-00N	59-00N	59-00N	56-00N
LONG.	147-06W	149-00W	139-00W	139-05W	135-40W	135-45W	131-30W
VOL. OF AIR	3.95	7.24	4.39	1.06	6.10	1.42	6.65
(100 SCM)							
GROSS GAMMA/	1540	16900	2510	8210	1310	2320	1320
M/100 SCM							
COUNT DATE	02/07/68	11/22/67	11/14/67	02/08/68	11/14/67	02/08/68	11/14/67
				PC/100 SCM			
ZR-95	3970.	17100.	2510.	19800.	1340.	5740.	1240.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 15.2 KM

SAMPLE # 346
FLIGHT # 293
DATE 11/ 5/67
BEGIN-
TIME 2232
LAT. 53-00N
LONG. 127-55W
END-
TIME 2309
LAT. 56-00N
LONG. 131-30W
VOL. OF AIR 7.38
(100 SCM)
GROSS GAMMA/ 387
M/100 SCM
COUNT DATE 11/22/67

ZR-95 449.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 13.7 KM

SAMPLE #	340	341	342	343
FLIGHT #	293	293	293	293
DATE	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67
BEGIN-				
TIME	1946	1951	2017	2049
LAT.	61-30N	61-00N	59-00N	56-00N
LONG.	140-00W	139-05W	135-45W	131-30W
END-				
TIME	1951	2017	2049	2124
LAT.	61-00N	59-00N	56-00N	53-00N
LONG.	139-05W	135-45W	131-30W	127-55W
VOL. OF AIR (100 SCM)	0.93	6.16	7.92	8.74
GROSS GAMMA/ M/100 SCM	6230	3230	515	50
COUNT DATE	11/22/67	11/22/67	11/22/67	11/22/67
				PC/100 SCM
ZR-95	7070.	3710.	580.	57.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 19.2 KM

SAMPLE #	334	356	357	358	359	360	361
FLIGHT #	288	292	292	292	292	292	292
DATE	11/ 4/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-							
TIME	2210	2021	2043	2110	2134	2158	2222
LAT.	51-00N	49-00N	47-00N	45-00N	43-00N	41-00N	39-00N
LONG.	126-00W	124-00W	121-25W	118-01W	115-07W	111-41W	108-47W
END-							
TIME	2232	2043	2110	2134	2158	2222	2258
LAT.	53-00N	47-00N	45-00N	43-00N	41-00N	39-00N	35-00N
LONG.	128-00W	121-25W	118-01W	115-07W	111-41W	108-47W	106-50W
VOL. OF AIR (100 SCM)	1.81	2.09	2.66	2.37	0.59	2.49	3.70
GROSS GAMMA/ M/100 SCM	23000	29500	19400	18100	8810	14800	3220
COUNT DATE	11/22/67	11/30/67	11/30/67	11/30/67	02/10/68	11/22/67	03/02/68
				PC/100 SCM			
ZR-95	22700.	31900.	20300.	19200.	19600.	15600.	9460.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 18.3 KM

SAMPLE #	333	355	354	353	352	351	472
FLIGHT #	288	292	292	292	292	292	294
DATE	11/ 4/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 9/67
BEGIN-							
TIME	2125	1942	1915	1850	1821	1754	1915
LAT.	53-00N	47-00N	45-00N	43-00N	41-00N	39-00N	39-02N
LONG.	128-00W	121-25W	118-01W	115-07W	111-41W	108-47W	108-48W
END-							
TIME	2144	2004	1942	1915	1850	1821	1953
LAT.	51-00N	49-00N	47-00N	45-00N	43-00N	41-00N	35-00N
LONG.	126-00W	124-00W	121-25W	118-01W	115-07W	111-41W	106-50W
VOL. OF AIR (100 SCM)	2.09	0.64	3.26	3.02	3.50	3.25	4.45
GROSS GAMMA/ M/100 SCM	14200	7190	7480	4500	5770	4400	3370
COUNT DATE	11/22/67	02/08/68	12/01/67	12/01/67	12/01/67	12/08/67	01/05/68
*							
ZR-95	14400.	16800.	8280.	PC/100 SCM 5030.	6460.	5350.	5630.

A:COUNTING ERROR IS 20-50 PER CENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 15.2 KM

SAMPLE #	291	345	368	289	290	367	288
FLIGHT #	293	293	292	293	293	292	293
DATE	11/ 2/67	11/ 5/67	11/ 7/67	11/ 2/67	11/ 2/67	11/ 7/67	11/ 2/67
BEGIN-							
TIME	2053	2157	1944	1943	2016	1909	1913
LAT.	50-00N	50-00N	47-00N	45-00N	47-00N	45-00N	43-00N
LONG.	125-00W	125-00W	121-25W	117-35W	121-20W	118-00W	114-30W
END-							
TIME	2127	2232	2022	2016	2053	1944	1943
LAT.	53-00N	53-00N	50-00N	47-00N	50-00N	47-00N	45-00N
LONG.	127-50W	127-55W	125-15W	121-20W	125-00W	121-25W	117-35W
VOL. OF AIR (100 SCM)	1.59	7.35	7.49	6.37	6.93	7.03	5.79
GROSS GAMMA/ M/100 SCM	1260	144	650	459	2290	278	412
COUNT DATE	02/07/68	11/22/67	12/11/67	11/13/67	11/13/67	12/08/67	11/13/67
				PC/100 SCM			
ZR-95	3000.	168.	848.	425.	2330.	357.	401.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 15.2 KM

SAMPLE #	366	287	365	286	364	471	363
FLIGHT #	292	293	292	293	292	294	292
DATE	11/ 7/67	11/ 2/67	11/ 7/67	11/ 2/67	11/ 7/67	11/ 9/67	11/ 7/67
BEGIN-							
TIME	1838	1844	1812	1814	1744	1823	1725
LAT.	43-00N	41-00N	41-00N	39-00N	39-00N	35-00N	37-00N
LONG.	115-05W	111-20W	111-45W	108-45W	108-50W	106-50W	108-50W
END-							
TIME	1909	1913	1838	1844	1812	1901	1732
LAT.	45-00N	43-00N	43-00N	41-00N	41-00N	39-02N	38-00N
LONG.	118-00W	114-20W	115-05W	111-20W	111-45W	108-48W	108-10W
VOL. OF AIR (100 SCM)	6.36	5.60	5.34	6.02	5.85	7.95	1.46
GROSS GAMMA/ M/100 SCM	88	360	42	270	41	242	128
COUNT DATE	12/08/67	11/13/67	12/08/67	11/08/67	12/08/67	12/18/67	12/08/67
				PC/100 SCM			
ZR-95	113.	346.	*	236.	57.	301.	169.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 13.7 KM

SAMPLE #	344	369	370	371	372	373	374
FLIGHT #	293	292	292	292	292	292	292
DATE	11/ 5/67	11/ 7/67	11/ 7/67	11/ 7/67	11/ 7/67	11/ 7/67	11/ 7/67
BEGIN-							
TIME	2124	2027	2106	2138	2208	2233	2301
LAT.	53-00N	50-00N	47-00N	45-00N	43-00N	41-00N	39-00N
LONG.	127-55W	125-15W	121-25W	118-00W	115-05W	111-45W	108-50W
END-							
TIME	2153	2106	2138	2208	2233	2301	2338
LAT.	50-00N	47-00N	45-00N	43-00N	41-00N	39-00N	35-00N
LONG.	125-00W	121-25W	118-00W	115-05W	111-45W	108-50W	106-50W
VOL. OF AIR (100 SCM)	7.53	9.80	7.38	7.37	6.06	7.00	9.19
GROSS GAMMA/ M/100 SCM	26	162	158	69	22	32	8
COUNT DATE	11/22/67	12/09/67	12/09/67	12/09/67	12/09/67	12/08/67	02/27/68
				PC/100 SCM			
ZR-95	29.	201.	170.	87.	27.	40.	13.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 19.2 KM

SAMPLE #	493	492	491	490	489
FLIGHT #	292	292	292	292	292
DATE	11/ 8/67	11/ 8/67	11/ 8/67	11/ 8/67	11/ 8/67
BEGIN-					
TIME	2155	2122	2044	2001	1938
LAT.	33-00N	31-00N	29-00N	26-00N	24-00N
LONG.	102-15W	98-10W	94-37W	91-15W	89-00W
END-					
TIME	2235	2155	2122	2044	2001
LAT.	35-00N	33-00N	31-00N	29-00N	26-00N
LONG.	106-40W	102-15W	98-10W	94-37W	91-15W
VOL. OF AIR (100 SCM)	3.71	0.77	3.64	1.00	2.19
GROSS GAMMA/ M/100 SCM	4150	2210	6700	3900	9090
COUNT DATE	12/15/67	02/27/68	12/15/67	02/27/68	12/15/67
				PC/100 SCM	
ZR-95	5460.	6200.	8610.	10700.	11400.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 18.3 KM

SAMPLE #	473	275	485	276	486	277	487
FLIGHT #	294	290	292	290	292	290	292
DATE	11/ 9/67	10/31/67	11/ 8/67	10/31/67	11/ 8/67	10/31/67	11/ 8/67
BEGIN-							
TIME	1953	1607	1719	1640	1756	1710	1827
LAT.	35-00N	33-00N	33-00N	31-00N	31-00N	29-00N	29-00N
LONG.	106-50W	102-00W	102-15W	098-00W	98-10W	094-35W	94-37W
END-							
TIME	2032	1640	1756	1710	1827	1750	1908
LAT.	33-00N	31-00N	31-00N	29-00N	29-00N	26-00N	26-00N
LONG.	102-00W	098-00W	98-10W	094-35W	94-37W	091-20W	91-15W
VOL. OF AIR (100 SCM)	4.46	3.55	4.25	3.29	3.56	4.57	2.36
GROSS GAMMA/ M/100 SCM	3120	29300	2060	16700	2130	3610	1690
COUNT DATE	12/15/67	11/08/67	01/09/68	11/08/67	01/09/68	11/08/67	02/16/68
				PC/100 SCM			
ZR-95	4030.	25400.	3540.	14900.	3640.	3240.	4330.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 18.3 KM

SAMPLE #	278	488
FLIGHT #	290	292
DATE	10/31/67	11/ 8/67
BEGIN-		
TIME	1750	1908
LAT.	26-00N	26-00N
LONG.	091-20W	91-15W
END-		
TIME	1815	1931
LAT.	24-00N	24-00N
LONG.	089-00W	89-00W
VOL. OF AIR	2.93	2.68
(100 SCM)		
GROSS GAMMA/	2870	2690
M/100 SCM		
COUNT DATE	11/08/67	01/09/68

PC/100 SCM

ZR-95	2740.	4770.
-------	-------	-------

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 16.8 KM

SAMPLE #	483	482	299	481	300	480	301
FLIGHT #	293	293	291	293	291	293	291
DATE	11/ 9/67	11/ 9/67	10/31/67	11/ 9/67	10/31/67	11/ 9/67	10/31/67
BEGIN-							
TIME	2220	2144	1622	2111	1651	2036	1728
LAT.	33-00N	31-00N	31-00N	29-00N	29-00N	26-00N	26-00N
LONG.	102-12W	98-12W	098-00W	94-35W	094-45W	91-15W	091-20W
END-							
TIME	2301	2220	1651	2144	1728	2111	1754
LAT.	35-00N	33-00N	29-00N	31-00N	26-00N	29-00N	24-00N
LONG.	106-50W	102-12W	094-45W	98-12W	091-20W	94-35W	089-00W
VOL. OF AIR (100 SCM)	6.45	5.63	4.17	5.16	5.60	5.44	4.33
GROSS GAMMA/ M/100 SCM	187	191	225	188	353	238	185
COUNT DATE	01/09/68	01/05/68	11/15/67	12/18/67	11/15/67	01/05/68	11/15/67
				PC/100 SCM			
ZR-95	332.	313.	237.	254.	390.	403.	208.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 16.8 KM

SAMPLE # 479
FLIGHT # 293
DATE 11/ 9/67
BEGIN-
TIME 2011
LAT. 24-00N
LONG. 89-00W
END-
TIME 2036
LAT. 26-00N
LONG. 91-15W
VOL. OF AIR 3.89
(100 SCM)
GROSS GAMMA/ 419
M/100 SCM
COUNT DATE 12/18/67

ZR-95 512.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 16.2 KM

SAMPLE # 298
FLIGHT # 291
DATE 10/31/67
BEGIN-
TIME 1549
LAT. 33-00N
LONG. 102-00W
END-
TIME 1622
LAT. 31-00N
LONG. 098-00W
VOL. OF AIR 5.49
(100 SCM)
GROSS GAMMA/ 296
M/100 SCM
COUNT DATE 11/14/67

ZR-95 325.

PC/100 SCM

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 15.2 KM

SAMPLE #	470	274	475	476	477	478
FLIGHT #	294	290	293	293	293	293
DATE	11/ 9/67	10/31/67	11/ 9/67	11/ 9/67	11/ 9/67	11/ 9/67
BEGIN-						
TIME	1741	1535	1753	1831	1902	1942
LAT.	33-00N	34-30N	33-00N	31-00N	29-00N	26-00N
LONG.	102-00W	105-00W	102-12W	98-12W	94-35W	91-15W
END-						
TIME	1823	1607	1831	1902	1942	2003
LAT.	35-00N	33-00N	31-00N	29-00N	26-00N	24-00N
LONG.	106-50W	102-00W	98-12W	94-35W	91-15W	89-00W
VOL. OF AIR	8.78	5.20	7.80	6.36	8.25	4.33
(100 SCM)						
GROSS GAMMA/	144	9290	39	38	40	84
M/100 SCM						
COUNT DATE	01/05/68	11/08/67	12/18/67	12/18/67	12/18/67	12/18/67
				PC/100 SCM		
ZR-95	186.	8570.	9.	45.	48.	106.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 19.2 KM

SAMPLE #	376	377	378	379	380
FLIGHT #	289	289	289	289	289
DATE	11/ 4/67	11/ 4/67	11/ 4/67	11/ 4/67	11/ 4/67
BEGIN-					
TIME	1758	1831	1901	1932	2002
LAT.	24-00N	21-00N	18-00N	15-00N	12-00N
LONG.	089-00W	086-30W	084-25W	082-50W	081-15W
END-					
TIME	1831	1901	1932	2002	2023
LAT.	21-00N	18-00N	15-00N	12-00N	09-00N
LONG.	086-00W	084-25W	082-50W	081-15W	079-40W
VOL. OF AIR (100 SCM)	3.23	0.71	2.90	2.76	2.03
GROSS GAMMA/ M/100 SCM	139000	2680	71700	369	1280
COUNT DATE	12/12/67	02/27/68	12/12/67	12/12/67	12/12/67
ZR-95	16900.	7930.	9400.	PC/100 SCM 452.	1620.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 18.3 KM

SAMPLE #	279	375	280	584	281	583	282
FLIGHT #	290	289	290	289	290	289	290
DATE	10/31/67	11/ 4/67	10/31/67	11/ 4/67	10/31/67	11/ 4/67	10/31/67
BEGIN-							
TIME	1815	1716	1852	1644	1925	1614	1952
LAT.	24-00N	21-00N	21-00N	18-00N	18-00N	15-00N	15-00N
LONG.	089-00W	086-30W	087-30W	084-25W	084-30W	082-50W	082-50W
END-							
TIME	1852	1749	1925	1716	1952	1644	2020
LAT.	21-00N	24-00N	18-00N	21-00N	15-00N	18-00N	12-00N
LONG.	087-30W	089-00W	084-30W	086-30W	082-50W	084-25W	081-20W
VOL. OF AIR (100 SCM)	4.38	3.87	3.95	3.94	3.22	3.69	3.33
GROSS GAMMA/ M/100 SCM	2220	73100	1470	2440	537	4	1640
COUNT DATE	11/08/67	12/12/67	11/08/67	01/10/68	11/08/67	12/15/67	11/08/67
				PC/100 SCM			
ZR-95	2090.	9150.	1350.	4950.	471.	3.A	1570.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 18.3 KM

SAMPLE #	582	283	397
FLIGHT #	289	290	289
DATE	11/ 4/67	10/31/67	11/ 7/67
BEGIN-			
TIME	1546	2020	1839
LAT.	12-00N	12-00N	09-00N
LONG.	081-15W	081-20W	079-35W
END-			
TIME	1614	2050	1911
LAT.	15-00N	09-00N	12-00N
LONG.	082-50W	079-40W	081-42W
VOL. OF AIR	3.39	0.89	3.88
(100 SCM)			
GROSS GAMMA/	430	1000	579
M/100 SCM			
COUNT DATE	12/15/67	02/27/68	12/12/67
ZR-95	380.	3070.	619.

PC/100 SCM

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 16.8 KM

SAMPLE #	302	433	303	434	304	435	305
FLIGHT #	291	298	291	298	291	298	291
DATE	10/31/67	11/ 4/67	10/31/67	11/ 4/67	10/31/67	11/ 4/67	10/31/67
BEGIN-							
TIME	1754	1705	1828	1736	1902	1808	1931
LAT.	24-00N	24-00N	21-00N	21-00N	18-00N	18-00N	15-00N
LONG.	089-00W	89-00W	086-30W	86-30W	084-25W	84-25W	082-50W
END-							
TIME	1828	1736	1902	1808	1931	1835	2001
LAT.	21-00N	21-00N	18-00N	18-00N	15-00N	15-00N	12-00N
LONG.	086-30W	86-30W	084-25W	84-25W	082-50W	82-50W	081-20W
VOL. OF AIR (100 SCM)	5.78	5.37	5.78	5.42	4.97	4.61	5.17
GROSS GAMMA/ M/100 SCM	148	733	5900	308	5450	49	4
COUNT DATE	11/15/67	12/13/67	11/15/67	12/13/67	11/15/67	12/13/67	11/15/67
ZR-95	141.	973.	5980.	PC/100 SCM 382.	5590.	60.	3.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 16.8 KM

SAMPLE #	436	437
FLIGHT #	298	298
DATE	11/ 4/67	11/ 4/67
BEGIN-		
TIME	1835	1904
LAT.	15-00N	12-00N
LONG.	82-50W	81-20W
END-		
TIME	1904	1936
LAT.	12-00N	09-00N
LONG.	81-20W	79-40W
VOL. OF AIR	5.02	5.46
(100 SCM)		
GROSS GAMMA/	752	12
M/100 SCM		
COUNT DATE	12/16/67	03/02/68
ZR-95	1970.	26.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 15.2 KM

SAMPLE #	432	431	430	429	394
FLIGHT #	298	298	298	298	289
DATE	11/ 4/67	11/ 4/67	11/ 4/67	11/ 4/67	11/ 7/67
BEGIN-					
TIME	1626	1555	1525	1456	1640
LAT.	21-00N	18-00N	15-00N	12-00N	12-00N
LONG.	86-30W	84-25W	82-50W	81-20W	081-42W
END-					
TIME	1659	1626	1555	1525	1721
LAT.	24-00N	21-00N	18-00N	15-00N	09-00N
LONG.	89-00W	86-30W	84-25W	82-50W	079-35W
VOL. OF AIR (100 SCM)	7.43	7.07	6.75	6.61	9.02
GROSS GAMMA/ M/100 SCM	72	131	25	229	1640
COUNT DATE	12/13/67	12/12/67	12/12/67	01/10/68	12/11/67
ZR-95	96.	134.	*	PC/100 SCM 404.	2520.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 19.2 KM

SAMPLE #	446	445	444	443
FLIGHT #	289	289	289	289
DATE	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-				
TIME	1729	1655	1622	1557
LAT.	01-00N	03-00S	07-00S	10-00S
LONG.	79-40W	78-45W	77-45W	77-00W
END-				
TIME	1804	1729	1655	1622
LAT.	05-00N	01-00N	03-00S	07-00S
LONG.	79-30W	79-40W	78-45W	77-45W
VOL. OF AIR	3.49	3.39	3.31	2.45
(100 SCM)				
GROSS GAMMA/	164	167	119	151
M/100 SCM				
COUNT DATE	12/16/67	12/16/67	01/05/68	12/16/67
				PC/100 SCM
ZR-95	142.	108.	75.	87.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 18.3 KM

SAMPLE #	396	439	440	441	442
FLIGHT #	289	289	289	289	289
DATE	11/ 7/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-					
TIME	1806	1345	1418	1452	1525
LAT.	05-00N	05-00N	01-00N	03-00S	07-00S
LONG.	079-37W	79-30W	79-40W	78-45W	77-45W
END-					
TIME	1838	1418	1452	1525	1551
LAT.	09-00N	01-00N	03-00S	07-00S	10-00S
LONG.	079-35W	79-40W	78-45W	77-45W	77-00W
VOL. OF AIR (100 SCM)	3.66	3.90	3.99	3.87	1.53
GROSS GAMMA/ M/100 SCM	390	341	273	163	124
COUNT DATE	12/11/67	12/16/67	12/16/67	12/16/67	02/27/68
ZR-95	390.	303.	275.	PC/100 SCM 139.	189.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 16.8 KM

SAMPLE #	412	404	411	405	410	406	409
FLIGHT #	298	298	298	298	298	298	298
DATE	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-							
TIME	1909	1437	1834	1512	1759	1549	1725
LAT.	05-00N	05-00N	01-00N	01-00N	03-00S	03-00S	07-00S
LONG.	79-35W	79-35W	79-35W	79-35W	78-40W	78-40W	77-40W
END-							
TIME	1958	1512	1909	1549	1834	1628	1759
LAT.	09-00N	01-00N	05-00N	03-00S	01-00N	07-00S	03-00S
LONG.	79-30W	79-35W	79-35W	78-40W	79-35W	77-40W	78-40W
VOL. OF AIR	8.58	5.76	6.12	6.23	5.81	6.39	5.63
(100 SCM)							
GROSS GAMMA/	77	44	94	53	81	29	65
M/100 SCM							
COUNT DATE	01/10/68	12/12/67	12/12/67	12/12/67	12/12/67	03/02/68	12/12/67
				PC/100 SCM			
ZR-95	126.	19.	96.	33.	81.	57.	45.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 16.8 KM

SAMPLE #	407	408
FLIGHT #	298	298
DATE	11/ 6/67	11/ 6/67
BEGIN-		
TIME	1628	1658
LAT.	07-00S	10-00S
LONG.	77-40W	77-00W
END-		
TIME	1654	1725
LAT.	10-00S	07-00S
LONG.	77-00W	77-40W
VOL. OF AIR	4.35	4.70
(100 SCM)		
GROSS GAMMA/	99	84
M/100 SCM		
COUNT DATE	12/12/67	12/12/67

PC/100 SCM

ZR-95	91.	44.
-------	-----	-----

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 15.2 KM

SAMPLE #	395	399	400	401	402
FLIGHT #	289	289	289	289	289
DATE	11/ 7/67	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67
BEGIN-					
TIME	1722	1451	1529	1608	1650
LAT.	09-00N	05-00N	01-00N	03-00S	07-00S
LONG.	079-35W	079-34W	079-37W	078-40W	077-44W
END-					
TIME	1758	1529	1608	1650	1720
LAT.	05-00N	01-00N	03-00S	07-00S	10-00S
LONG.	079-37W	079-37W	078-40W	077-44W	077-00W
VOL. OF AIR (100 SCM)	8.11	8.00	8.12	8.84	6.32
GROSS GAMMA/ M/100 SCM	76	34	168	29	264
COUNT DATE	12/11/67	12/12/67	12/12/67	12/12/67	02/15/68
				PC/100 SCM	
ZR-95	107.	16.	250.	33.	734.

A:COUNTING ERROR IS 20-50 PER CENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 19.2 KM

SAMPLE #	521	522	523	524	525
FLIGHT #	299	299	299	299	299
DATE	11/ 8/67	11/ 8/67	11/ 8/67	11/ 8/67	11/ 8/67
BEGIN-					
TIME	1618	1654	1724	1752	1825
LAT.	16-00S	20-00S	23-00S	26-00S	29-00S
LONG.	75-00W	73-35W	72-30W	71-20W	69-50W
END-					
TIME	1654	1724	1752	1825	1903
LAT.	20-00S	23-00S	26-00S	29-00S	33-00S
LONG.	73-35W	72-30W	71-20W	69-50W	68-50W
VOL. OF AIR (100 SCM)	3.43	2.88	2.67	3.11	3.54
GROSS GAMMA/ M/100 SCM	116	131	144	73	156
COUNT DATE	01/18/68	12/19/67	12/19/67	12/19/67	12/19/67
ZR-95	100.	73.	47.	PC/100 SCM *	66.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 18.3 KM

SAMPLE #	520	519	518	517	529
FLIGHT #	299	299	299	299	291
DATE	11/ 8/67	11/ 8/67	11/ 8/67	11/ 8/67	11/ 8/67
BEGIN-					
TIME	1537	1507	1445	1414	1448
LAT.	20-00S	23-00S	26-00S	29-00S	29-00S
LONG.	73-35W	72-30W	71-20W	69-50W	70-00W
END-					
TIME	1613	1537	1507	1445	1529
LAT.	16-00S	20-00S	23-00S	26-00S	33-00S
LONG.	75-00W	73-35W	72-30W	71-20W	68-45W
VOL. OF AIR	4.25	3.58	2.63	3.69	5.00
(100 SCM)					
GROSS GAMMA/	136	162	147	135	123
M/100 SCM					
COUNT DATE	12/19/67	12/19/67	12/19/67	01/10/68	01/09/68
				PC/100 SCM	
ZR-95	76.	36.	125.	139.	99.

A:COUNTING ERROR IS 20-50 PER CENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 16.8 KM

SAMPLE #	576	577	578	579	516	580
FLIGHT #	291	291	291	291	299	291
DATE	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 8/67	11/ 6/67
BEGIN-						
TIME	1615	1650	1725	1755	1350	1825
LAT.	16-00S	20-00S	23-00S	26-00S	31-00S	29-00S
LONG.	75-00W	73-35W	72-25W	71-20W	67-30W	69-50W
END-						
TIME	1650	1725	1755	1825	1414	1855
LAT.	20-00S	23-00S	26-00S	29-00S	29-00S	33-00S
LONG.	73-35W	72-25W	71-20W	69-50W	69-50W	68-55W
VOL. OF AIR	5.70	5.54	4.75	4.69	3.59	4.69
(100 SCM)						
GROSS GAMMA/	83	83	100	124	112	100
M/100 SCM						
COUNT DATE	12/19/67	01/08/68	12/19/67	12/19/67	01/09/68	01/08/68
				PC/100 SCM		
ZR-95	37.	75.	95.	73.	108.	69.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 15.2 KM

SAMPLE #	575	574	573	572	571	528
FLIGHT #	291	291	291	291	291	291
DATE	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 8/67
BEGIN-						
TIME	1530	1458	1428	1357	1335	1359
LAT.	20-00S	23-00S	26-00S	29-00S	31-00S	33-00S
LONG.	73-35W	72-25W	71-20W	69-50W	68-50W	68-45W
END-						
TIME	1610	1530	1458	1428	1357	1436
LAT.	16-00S	20-00S	23-00S	26-00S	29-00S	29-00S
LONG.	75-00W	73-35W	72-25W	71-20W	69-50W	70-00W
VOL. OF AIR	8.45	6.75	6.50	6.38	4.53	7.32
(100 SCM)						
GROSS GAMMA/	25	35	50	66	117	53
M/100 SCM						
COUNT DATE	12/19/67	12/19/67	12/19/67	01/08/68	12/19/67	02/27/68
				PC/100 SCM		
ZR-95	26.	*	49.	71.	99.	96.

A: COUNTING ERROR IS 20-50 PER CENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 19.2 KM

SAMPLE #	556	555	554	553	552	551
FLIGHT #	299	299	299	299	299	299
DATE	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-						
TIME	1839	1814	1749	1724	1659	1646
LAT.	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-						
TIME	1914	1839	1814	1749	1724	1659
LAT.	33-00S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR (100 SCM)	3.21	2.30	2.23	2.21	2.15	1.10
GROSS GAMMA/ M/100 SCM	108	96	78	102	120	144
COUNT DATE	01/05/68	01/05/68	01/05/68	12/20/67	12/20/67	12/12/67
				PC/100 SCM		
ZR-95	6.	7.A	6.	6.A	*	18.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 18.3 KM

SAMPLE #	530	545	546	547	548	549	550
FLIGHT #	291	299	299	299	299	299	299
DATE	11/ 8/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67	11/ 6/67
BEGIN-							
TIME	1529	1436	1441	1506	1530	1555	1620
LAT.	33-00S	36-15S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-							
TIME	1605	1441	1506	1530	1555	1620	1637
LAT.	37-00S	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR	4.36	0.56	2.74	2.63	1.33	2.68	1.76
(100 SCM)							
GROSS GAMMA/	103	141	139	114	1950	11	32
M/100 SCM							
COUNT DATE	01/10/68	12/20/67	12/20/67	12/20/67	02/16/68	12/20/67	12/20/68
				PC/100 SCM			
ZR-95	45.	*	*	50.	22.	4.A	8.A

A:COUNTING ERROR IS 20-50 PER CENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 15.2 KM

SAMPLE #	527	569	568	567	566	565	564
FLIGHT #	291	291	291	291	291	291	291
DATE	11/ 8/67	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67
BEGIN-							
TIME	1350	1807	1740	1713	1645	1621	1603
LAT.	34-15S	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-							
TIME	1359	1835	1807	1740	1713	1645	1621
LAT.	33-00S	33-00S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR (100 SCM)	1.78	1.43	5.46	5.48	5.66	4.85	3.64
GROSS GAMMA/ M/100 SCM	52	157	99	136	139	158	147
COUNT DATE	01/09/68	02/14/68	12/20/67	12/20/67	12/20/67	12/20/67	01/18/68
				PC/100 SCM			
ZR-95	41.	219.	78.	113.	31.	112.	100.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 3
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN NOVEMBER 1967

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 13.7 KM

SAMPLE #	558	559	560	561	562	563
FLIGHT #	291	291	291	291	291	291
DATE	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67	11/ 5/67
BEGIN-						
TIME	1325	1342	1412	1441	1509	1538
LAT.	35-00S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-						
TIME	1342	1412	1441	1509	1538	1603
LAT.	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR (100 SCM)	3.97	7.12	6.88	6.60	3.36	5.79
GROSS GAMMA/ M/100 SCM	184	140	114	91	47	56
COUNT DATE	12/19/67	12/19/67	12/19/67	01/18/68	02/16/68	12/20/67
				PC/100 SCM		
ZR-95	126.	96.	43.	76.	67.	44.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF EIELSON
(75N-64N)
ALTITUDE 19.2 KM

SAMPLE #	590	591	592
FLIGHT #	292	292	292
DATE	1/18/68	1/18/68	1/18/68
BEGIN-			
TIME	2143	2218	2249
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-20W	144-30W
END-			
TIME	2218	2249	2310
LAT.	71-00N	68-00N	65-50N
LONG.	143-20W	144-30W	145-50W
VOL. OF AIR (100 SCM)	0.82	0.72	0.48
GROSS GAMMA/ M/100 SCM	3130	3360	2920
COUNT DATE	02/19/68	02/06/68	02/06/68
ZR-95	3190.	2830.	2470.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF EIELSON
(75N-64N)
ALTITUDE 18.3 KM

SAMPLE #	589	588	587
FLIGHT #	292	292	292
DATE	1/18/68	1/18/68	1/18/68
BEGIN-			
TIME	2102	2035	2003
LAT.	71-00N	68-00N	65-00N
LONG.	143-20W	144-30W	146-45W
END-			
TIME	2136	2102	2035
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-20W	144-30W
VOL. OF AIR (100 SCM)	3.88	0.77	0.88
GROSS GAMMA/ M/100 SCM	2410	1060	1040
COUNT DATE	02/01/68	02/06/68	02/19/68

PC/100 SCM

ZR-95 807.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF EIELSON
(75N-64N)
ALTITUDE 15.2 KM

SAMPLE #	605	606	607
FLIGHT #	293	293	293
DATE	1/18/68	1/18/68	1/18/68
BEGIN-			
TIME	2040	2106	2137
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-25W	144-30W
END-			
TIME	2106	2137	2203
LAT.	71-00N	68-00N	65-00N
LONG.	143-25W	144-30W	146-40W
VOL. OF AIR (100 SCM)	1.25	1.51	1.25
GROSS GAMMA/ M/100 SCM	13600	12800	15300
COUNT DATE	02/01/68	02/19/68	02/01/68
ZR-95	13500.	15400.	15500.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF EIELSON
(75N-64N)
ALTITUDE 12.2 KM

SAMPLE #	604	603	602
FLIGHT #	293	293	293
DATE	1/18/68	1/18/68	1/18/68
BEGIN-			
TIME	1953	1915	1850
LAT.	71-00N	68-00N	65-00N
LONG.	143-25W	144-30W	146-40W
END-			
TIME	2033	1953	1915
LAT.	75-00N	71-00N	68-00N
LONG.	143-00W	143-25W	144-30W
VOL. OF AIR (100 SCM)	11.30	10.60	6.73
GROSS GAMMA/ M/100 SCM	545	3100	2010
COUNT DATE	02/01/68	02/01/68	02/13/68

PC/100 SCM

ZR-95 530.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 19.2 KM

SAMPLE #	601	600	599	598	597
FLIGHT #	293	293	293	293	293
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-					
TIME	2255	2233	2158	2124	2110
LAT.	61-00N	59-00N	56-00N	53-00N	57-00N
LONG.	139-00W	135-40W	131-30W	128-00W	126-00W
END-					
TIME	2340	2255	2233	2158	2124
LAT.	65-00N	61-00N	59-00N	56-00N	53-00N
LONG.	147-00W	139-00W	135-40W	131-30W	128-00W
VOL. OF AIR (100 SCM)	1.02	0.50	3.17	0.77	1.27
GROSS GAMMA/ M/100 SCM	1500	6760	6910	6510	905
COUNT DATE	02/19/68	02/19/68	02/01/68	02/06/68	02/01/68
ZR-95		6620.		PC/100 SCM 5910.	7770.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 18.3 KM

SAMPLE #	586	593	594	596	595
FLIGHT #	292	293	293	293	293
DATE	1/18/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-					
TIME	1913	1923	1948	2046	2016
LAT.	61-00N	61-00N	59-00N	53-00N	56-00N
LONG.	139-00W	139-00W	135-40W	128-00W	131-30W
END-					
TIME	2003	1948	2016	2107	2046
LAT.	65-00N	59-00N	56-00N	57-00N	53-00N
LONG.	146-45W	135-40W	131-30W	126-00W	128-00W
VOL. OF AIR (100 SCM)	1.38	0.68	0.76	2.21	0.83
GROSS GAMMA/ M/100 SCM	3830	8490	8070	10100	9010
COUNT DATE	02/13/68	02/13/68	02/19/68	02/01/68	02/06/68
				PC/100 SCM	
ZR-95	3590.	9410.		9010.	8570.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 15.2 KM

SAMPLE #	617	616	615	614
FLIGHT #	292	292	292	292
DATE	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-				
TIME	2346	2322	2249	2216
LAT.	61-00N	59-00N	56-00N	53-00N
LONG.	139-00W	135-40W	131-30W	127-55W
END-				
TIME	0043	2346	2322	2249
LAT.	65-00N	61-00N	59-00N	56-00N
LONG.	147-00W	139-00W	135-40W	131-30W
VOL. OF AIR (100 SCM)	2.78	1.16	3.12	6.42
GROSS GAMMA/ M/100 SCM	1410	9480	9650	4220
COUNT DATE	02/20/68	02/06/68	02/01/68	02/01/68
				PC/100 SCM
ZR-95	16400.	9550.		

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF EIELSON
(64N-53N)
ALTITUDE 13.7 KM

SAMPLE #	608	609	610	611
FLIGHT #	292	292	292	292
DATE	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-				
TIME	1935	1948	2013	2048
LAT.	62-15N	61-00N	59-00N	56-00N
LONG.	140-40W	139-00W	135-40W	131-30W
END-				
TIME	1948	2013	2048	2103
LAT.	61-00N	59-00N	56-00N	53-00N
LONG.	139-00W	135-40W	131-30W	127-55W
VOL. OF AIR (100 SCM)	0.76	1.44	2.01	0.88
GROSS GAMMA/ M/100 SCM	9070	8130	7710	8440
COUNT DATE	02/19/68	02/01/68	02/19/68	02/19/68
ZR-95	10700.	7910.	9030.	PC/100 SCM 10100.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 19.2 KM

SAMPLE #	713	714	715	716	717	718
FLIGHT #	288	288	288	288	288	288
DATE	1/15/68	1/15/68	1/15/68	1/15/68	1/15/68	1/15/68
BEGIN-						
TIME	2039	2059	2125	2151	2215	2239
LAT.	49-00N	47-00N	45-00N	43-00N	41-00N	39-00N
LONG.	124-00W	121-20W	117-35W	114-20W	111-25W	108-50W
END-						
TIME	2059	2125	2151	2215	2239	2316
LAT.	47-00N	45-00N	43-00N	41-00N	39-00N	35-00N
LONG.	121-20W	117-35W	114-20W	111-25W	108-50W	106-50W
VOL. OF AIR (100 SCM)	0.49	0.62	2.48	2.29	2.32	3.60
GROSS GAMMA/ M/100 SCM	3410	1570	721	930	1540	10
COUNT DATE	02/21/68	02/27/68	02/28/68	02/28/68	03/01/68	03/01/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 18.3 KM

SAMPLE #	712	711	710	709	708	707	704
FLIGHT #	288	288	288	288	288	288	288
DATE	1/15/68	1/15/68	1/15/68	1/15/68	1/15/68	1/15/68	1/21/68
BEGIN-							
TIME	2009	1940	1913	1849	1824	1815	1906
LAT.	47- N	45- N	43-00N	41- N	39-00N	38- N	39-03N
LONG.	121-20W	117-32W	114-20W	111-25W	108-50W	108-15W	108-50W
END-							
TIME	2039	2009	1940	1913	1849	1824	1944
LAT.	49- N	47- N	45- N	43- N	41- N	39- N	35-03N
LONG.	124- W	121-20W	117-35W	114-20W	111-25W	108-50W	106-50W
VOL. OF AIR (100 SCM)	0.86	0.83	0.77	0.69	0.71	0.26	1.07
GROSS GAMMA/ M/100 SCM	8690	4290	2770	4300	4870	7080	10000
COUNT DATE	02/21/68	02/21/68	02/21/68	02/21/68	02/21/68	02/21/68	02/20/68
				PC/100 SCM			
ZR-95	10900.	5480.	3570.	5500.	6230.	9200.	11000.

A:COUNTING ERROR IS 20-50 PER CENT
B:COUNTING ERROR IS 51-100 PERCENT
*:NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 15.2 KM

SAMPLE #	613	695	694	693	692	691	690
FLIGHT #	292	294	294	294	294	294	294
DATE	1/19/68	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68
BEGIN-							
TIME	2151	1940	1915	1855	1828	1800	1750
LAT.	50-40N	47-00N	45-00N	43-00N	41-00N	39-00N	38-00N
LONG.	125-40W	117-10W	114-00W	111-30W	111-20W	108-50W	108-20W
END-							
TIME	2216	2055	1940	1915	1855	1828	1800
LAT.	53-00N	50-00N	47- N	45- N	43- N	41-00N	39-00N
LONG.	127-55W	125-00W	117-10W	114-00W	111-30W	111-20W	108-50W
VOL. OF AIR (100 SCM)	1.24	7.10	2.42	1.94	2.63	5.46	1.94
GROSS GAMMA/ M/100 SCM	3270	1450	6160	7060	4600	3040	3660
COUNT DATE	02/19/68	02/20/68	02/20/68	02/20/68	02/20/68	02/20/68	02/20/68
ZR-95	3850.	1600.		PC/100 SCM 8080.	5210.	3550.	

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 15.2 KM

SAMPLE # 703
FLIGHT # 288
DATE 1/21/68
BEGIN-
TIME 1815
LAT. 35-03N
LONG. 106-50W
END-
TIME 1853
LAT. 39-03N
LONG. 108-50W
VOL. OF AIR 1.85
(100 SCM)
GROSS GAMMA/ 1660
M/100 SCM
COUNT DATE 02/20/68

ZR-95 1970.

PC/100 SCM

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF KIRTLAND
(53N-35N)
ALTITUDE 13.7 KM

SAMPLE #	612	696	697	698	699	700
FLIGHT #	292	294	294	294	294	294
DATE	1/19/68	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68
BEGIN-						
TIME	2123	2100	2135	2218	2244	2308
LAT.	53-00N	50-00N	47-00N	45-00N	43-00N	41-00N
LONG.	127-55W	125-00W	120-20W	115-30W	113-20W	111-20W
END-						
TIME	2147	2135	2218	2244	2308	2336
LAT.	50-45N	47- N	45- N	43- N	41- N	39-00N
LONG.	125-45W	120-20W	115-30W	113-20W	111-20W	108-50W
VOL. OF AIR (100 SCM)	5.60	2.05	2.55	1.65	1.48	1.70
GROSS GAMMA/ M/100 SCM	212	1570	1460	1930	2920	3060
COUNT DATE	02/01/68	02/20/68	02/20/68	02/20/68	02/20/68	02/20/68
				PC/100 SCM		
ZR-95	2110.	1700.	1580.		3410.	3520.

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 19.2 KM

SAMPLE #	680	679	678	677	676
FLIGHT #	288	288	288	288	288
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-					
TIME	0010	2336	2306	2229	2205
LAT.	33-00N	31-00N	29-00N	26-00N	24-00N
LONG.	102-00W	98-00W	94-40W	91-15W	89-00W
END-					
TIME	0049	0010	2336	2306	2229
LAT.	35-00N	33-00N	31-00N	29-00N	26-00N
LONG.	106-50W	102-00W	98-00W	94-46W	91-15W
VOL. OF AIR (100 SCM)	3.75	3.27	2.74	3.65	2.42
GROSS GAMMA/ M/100 SCM	2010	135	6240	52	12500
COUNT DATE	02/20/68	02/16/68	02/16/68	02/16/68	02/16/68
				PC/100 SCM	
ZR-95	2410.				

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 18.3 KM

SAMPLE #	705	671	672	673	674	675
FLIGHT #	288	288	288	288	288	288
DATE	1/21/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-						
TIME	1944	1938	1953	2026	2056	2133
LAT.	35-03N	33-30N	33-15N	31-00N	29-00N	26-00N
LONG.	106-50W	103-30W	102-20W	98-00W	94-40W	91-13W
END-						
TIME	2022	1948	2026	2056	2133	2157
LAT.	33-00N	33-15N	31-00N	29-00N	26-00N	24-00N
LONG.	102-00W	102-20W	98-00W	94-40W	91-15W	89-00W
VOL. OF AIR (100 SCM)	1.07	1.16	3.85	3.51	4.36	2.83
GROSS GAMMA/ M/100 SCM	5790	1790	4390	4250	3100	8200
COUNT DATE	02/21/68	02/14/68	02/14/68	02/14/68	02/14/68	02/14/68
ZR-95			4800.	PC/100 SCM 4750.	3470.	

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 16.8 KM

SAMPLE #	669	668	667	666	665
FLIGHT #	294	294	294	294	294
DATE	1/20/68	1/20/68	1/20/68	1/20/68	1/20/68
BEGIN-					
TIME	2139	2107	2032	1952	1926
LAT.	33-00N	31-00N	29-00N	26-00N	24-00N
LONG.	102-00W	97-10W	94-42W	91-15W	089-00W
END-					
TIME	2217	2139	2107	2032	1952
LAT.	35-00N	33-00N	31-00N	29-00N	26-00N
LONG.	106-35W	102-00W	97-10W	94-42W	091-15W
VOL. OF AIR (100 SCM)	5.53	4.73	5.24	5.98	3.89
GROSS GAMMA/ M/100 SCM	2390	4590	206	193	1430
COUNT DATE	02/14/68	02/14/68	02/14/68	02/14/68	02/14/68
				PC/100 SCM	
ZR-95		5000.	2290.		

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF KIRTLAND
(35N-24N)
ALTITUDE 15.2 KM

SAMPLE #	702	661	662	663	664
FLIGHT #	288	294	294	294	294
DATE	1/21/68	1/20/68	1/20/68	1/20/68	1/20/68
BEGIN-					
TIME	1732	1704	1743	1815	1853
LAT.	33-05N	31-00N	31-00N	29-00N	26-00N
LONG.	102-00W	102-00W	97-10W	94-42W	91-15W
END-					
TIME	1815	1743	1815	1853	1919
LAT.	35-03N	31-00N	29-00N	26-00N	24-00N
LONG.	106-50W	97-10W	94-42W	91-15W	89-00W
VOL. OF AIR (100 SCM)	2.09	7.49	6.23	7.58	5.07
GROSS GAMMA/ M/100 SCM	2110	3500	1940	130	40
COUNT DATE	02/20/68	02/13/68	02/13/68	02/13/68	02/13/68
PC/100 SCM					
ZR-95	2480.	3760.	2120.		

A: COUNTING ERROR IS 20-50 PER CENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 19.2 KM

SAMPLE #	732	733	734	735	736
FLIGHT #	296	296	296	296	296
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68
BEGIN-					
TIME	1546	1616	1648	1718	1748
LAT.	24-00N	21-00N	18-00N	15-00N	12-00N
LONG.	89-00W	86-30W	84-25W	82-50W	81-20W
END-					
TIME	1616	1648	1718	1748	1821
LAT.	21-00N	18-00N	15-00N	12-00N	9-00N
LONG.	86-30W	84-25W	82-50W	81-20W	79-36W
VOL. OF AIR (100 SCM)	2.78	2.97	2.80	2.80	3.08
GROSS GAMMA/ M/100 SCM	2010	1140	2850	2090	1430
COUNT DATE	03/04/68	03/05/68	03/05/68	03/05/68	03/05/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 18.3 KM

SAMPLE #	731	730	729	728	737
FLIGHT #	296	296	296	296	296
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/21/68
BEGIN-					
TIME	1502	1432	1400	1330	1423
LAT.	21-00N	18-00N	15-00N	12-00N	12-00N
LONG.	86-30W	84-25W	82-50W	81-20W	81-24W
END-					
TIME	1535	1502	1432	1400	1454
LAT.	24-00N	21-00N	18-00N	15-00N	9-00N
LONG.	89-00W	86-30W	84-25W	82-50W	79-40W
VOL. OF AIR (100 SCM)	4.01	3.65	3.89	3.65	3.75
GROSS GAMMA/ M/100 SCM	1750	1610	683	1210	541
COUNT DATE	03/04/68	03/04/68	03/04/68	03/04/68	03/05/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 16.8 KM

SAMPLE #	723	724	725	726	727
FLIGHT #	298	298	298	298	298
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68
BEGIN-					
TIME	1506	1545	1622	1651	1723
LAT.	24-00N	21-00N	18-00N	15-00N	12-00N
LONG.	89-00W	86-30W	84-25W	82-49W	81-20W
END-					
TIME	1545	1622	1651	1723	1758
LAT.	21-00N	18-00N	15-00N	12-00N	09-00N
LONG.	86-30W	84-25W	82-49W	81-20W	079-35W
VOL. OF AIR (100 SCM)	6.10	5.93	4.80	5.45	5.99
GROSS GAMMA/ M/100 SCM	89	251	797	153	375
COUNT DATE	03/04/68	03/04/68	03/04/68	03/04/68	03/04/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF ALBROOK
(24N-09N)
ALTITUDE 15.2 KM

SAMPLE #	722	721	720	719	740
FLIGHT #	298	298	298	298	296
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/21/68
BEGIN-					
TIME	1421	1348	1316	1246	1613
LAT.	21-00N	18-00N	15-00N	12-00N	9-00N
LONG.	86-30W	84-25W	82-49W	81-20W	79-40W
END-					
TIME	1457	1421	1348	1316	1646
LAT.	24-00N	21-00N	18-00N	15-00N	12-00N
LONG.	89-00W	86-30W	84-25W	082-49W	81-24W
VOL. OF AIR (100 SCM)	7.09	6.73	6.52	6.19	7.30
GROSS GAMMA/ M/100 SCM	53	146	179	565	4
COUNT DATE	03/04/68	03/04/68	03/01/68	03/01/68	03/05/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 19.2 KM

SAMPLE #	749	748	747	746	745
FLIGHT #	296	296	296	296	296
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-					
TIME	1819	1743	1709	1636	1608
LAT.	5-00N	1-00N	3-00S	7-00S	10-00S
LONG.	80-16W	80-55W	81-40W	81-13W	80-00W
END-					
TIME	1853	1819	1743	1709	1636
LAT.	9-00N	5-00N	1-00N	3-00S	7-00S
LONG.	79-30W	80-16W	80-55W	81-40W	81-13W
VOL. OF AIR (100 SCM)	3.11	3.30	3.04	3.00	2.60
GROSS GAMMA/ M/100 SCM	51	69	156	353	830
COUNT DATE	03/05/68	03/05/68	03/05/68	03/05/68	03/05/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 18.3 KM

SAMPLE #	738	741	742	743	744
FLIGHT #	296	296	296	296	296
DATE	1/21/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-					
TIME	1454	1337	1414	1451	1529
LAT.	9-00N	5-00N	1-00N	3-00S	7-00S
LONG.	79-40W	80-16W	80-55W	81-40W	81-13W
END-					
TIME	1530	1414	1451	1529	1600
LAT.	5-00N	1-00N	3-00S	7-00S	10-00S
LONG.	79-37W	80-55W	81-40W	81-13W	80-00W
VOL. OF AIR (100 SCM)	4.25	4.39	4.39	4.68	3.75
GROSS GAMMA/ M/100 SCM	670	18	25	44	53
COUNT DATE	03/05/68	03/05/68	03/05/68	03/05/68	03/05/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 16.8 KM

SAMPLE #	758	757	756	755	754
FLIGHT #	298	298	298	298	298
DATE	1/20/68	1/20/68	1/20/68	1/20/68	1/20/68
BEGIN-					
TIME	1749	1712	1631	1550	1521
LAT.	5-00N	1-00N	3-00S	7-00S	10-00S
LONG.	80-15W	81-00W	81-40W	81-15W	80-00W
END-					
TIME	1826	1749	1712	1631	1550
LAT.	9-00N	5-00N	1-00N	3-00S	7-00S
LONG.	79-35W	80-15W	81-00W	81-40W	81-15W
VOL. OF AIR (100 SCM)	6.45	6.45	6.98	6.98	4.93
GROSS GAMMA/ M/100 SCM	13	22	40	45	41
COUNT DATE	03/07/68	03/07/68	03/06/68	03/06/68	03/06/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF ALBROOK
(09N-09S)
ALTITUDE 15.2 KM

SAMPLE #	739	750	751	752	753
FLIGHT #	296	298	298	298	298
DATE	1/21/68	1/20/68	1/20/68	1/20/68	1/20/68
BEGIN-					
TIME	1538	1242	1321	1400	1441
LAT.	5-00N	5-00N	1-00N	3-00S	7-00S
LONG.	79-37W	80-15W	81-00W	81-40W	81-15W
END-					
TIME	1613	1321	1400	1441	1511
LAT.	9-00N	1-00N	3-00S	7-00S	10-00S
LONG.	79-40W	81-00W	81-40W	81-15W	80-00W
VOL. OF AIR (100 SCM)	7.30	8.28	8.28	8.70	6.37
GROSS GAMMA/ M/100 SCM	9	6	13	17	23
COUNT DATE	03/05/68	03/05/68	03/05/68	03/05/68	03/06/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 19.2 KM

SAMPLE #	802	803	804	805	806
FLIGHT #	299	299	299	299	299
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68
BEGIN-					
TIME	1643	1718	1748	1817	1851
LAT.	16-00S	20-00S	23-00S	26-00S	29-00S
LONG.	75-00W	73-35W	72-30W	71-20W	69-55W
END-					
TIME	1718	1748	1817	1851	1925
LAT.	20-00S	23-00S	26-00S	29-00S	33-00S
LONG.	73-35W	72-30W	71-20W	69-55W	68-55W
VOL. OF AIR (100 SCM)	4.22	2.94	2.72	3.09	3.04
GROSS GAMMA/ M/100 SCM	61	74	95	68	84
COUNT DATE	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 18.3 KM

SAMPLE #	801	800	799	798	797	810
FLIGHT #	299	299	299	299	299	299
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68	1/19/68
BEGIN-						
TIME	1556	1528	1500	1435	1425	1910
LAT.	20-00S	23-00S	26-00S	29-00S	30-00S	29-00S
LONG.	73-35W	72-30W	71-20W	69-55W	69-25W	69-00W
END-						
TIME	1638	1556	1528	1500	1435	1943
LAT.	16-00S	20-00S	23-00S	26-00S	29-00S	33-00S
LONG.	75-00W	73-35W	72-30W	71-20W	69-55W	68-50W
VOL. OF AIR (100 SCM)	5.01	3.54	3.36	2.91	1.18	3.87
GROSS GAMMA/ M/100 SCM	50	46	80	79	63	98
COUNT DATE	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 16.8 KM

SAMPLE #	778	779	780	781	782
FLIGHT #	291	291	291	291	291
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68
BEGIN-					
TIME	1610	1647	1715	1739	1803
LAT.	16-00S	20-00S	23-00S	26-00S	29-00S
LONG.	75-00W	73-35W	72-28W	71-17W	70-00W
END-					
TIME	1647	1715	1739	1803	1845
LAT.	20-00S	23-00S	26-00S	29-00S	33-00S
LONG.	73-35W	72-28W	71-17W	70-00W	685-40W
VOL. OF AIR (100 SCM)	6.25	4.59	3.89	3.83	6.69
GROSS GAMMA/ M/100 SCM	31	35	87	61	75
COUNT DATE	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

NORTH OF MENDOZA
(09S 33S)
ALTITUDE 15.2 KM

SAMPLE #	777	776	775	774	773	809
FLIGHT #	291	291	291	291	291	299
DATE	1/18/68	1/18/68	1/18/68	1/18/68	1/18/68	1/19/68
BEGIN-						
TIME	1524	1456	1428	1356	1336	1830
LAT.	20-00S	23-00S	26-00S	29-00S	31-05S	33-00S
LONG.	73-35W	72-28W	71-17W	70-00W	68-53W	68-50W
END-						
TIME	1600	1524	1456	1428	1346	1903
LAT.	16-00S	20-00S	23-00S	26-00S	30-03S	29-00S
LONG.	75-00W	73-35W	72-28W	71-17W	69-25W	69-00W
VOL. OF AIR (100 SCM)	7.86	6.15	6.07	6.93	2.13	6.98
GROSS GAMMA/ M/100 SCM	9	5	10	19	41	71
COUNT DATE	03/12/68	03/11/68	03/11/68	03/11/68	03/11/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 19.2 KM

SAMPLE #	795	794	793	792	791	790
FLIGHT #	299	299	299	299	299	299
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-						
TIME	1537	1513	1447	1422	1355	1339
LAT.	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-						
TIME	1613	1537	1513	1447	1422	1355
LAT.	32-50S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-52W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR (100 SCM)	3.48	2.32	2.41	2.25	2.40	1.45
GROSS GAMMA/ M/100 SCM	74	81	92	92	113	125
COUNT DATE	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 18.3 KM

SAMPLE #	811	784	785	786	787	788	789
FLIGHT #	299	299	299	299	299	299	299
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-							
TIME	1943	1125	1137	1157	1225	1249	1315
LAT.	33-00S	36-10S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-50W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-							
TIME	2017	1137	1157	1225	1249	1315	1332
LAT.	37-00S	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-50W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR (100 SCM)	3.99	1.43	2.38	3.22	2.62	2.76	1.80
GROSS GAMMA/ M/100 SCM	103	11	128	89	97	88	95
COUNT DATE	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 15.2 KM

SAMPLE #	808	771	770	769	768	767	766
FLIGHT #	299	291	291	291	291	291	291
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-							
TIME	1826	1904	1836	1809	1739	1714	1650
LAT.	33-30S	37-00S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-50W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-							
TIME	1830	1938	1904	1836	1809	1739	1714
LAT.	33-00S	33-00S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-50W	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR	0.84	6.85	5.66	5.32	5.91	4.92	4.66
(100 SCM)							
GROSS GAMMA/	330	82	42	104	70	88	87
M/100 SCM							
COUNT DATE	03/12/68	03/11/68	03/11/68	03/12/68	03/12/68	03/12/68	03/12/68

TABLE 4
TOTAL GAMMA AND ZR-95 CONCENTRATIONS IN JANUARY 1968

SOUTH OF MENDOZA
(33S 50S)
ALTITUDE 13.7 KM

SAMPLE #	760	761	762	763	764	765
FLIGHT #	291	291	291	291	291	291
DATE	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68	1/19/68
BEGIN-						
TIME	1354	1419	1446	1516	1551	1623
LAT.	34-38S	37-00S	40-00S	43-00S	46-00S	49-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
END-						
TIME	1404	1446	1516	1551	1623	1643
LAT.	35-15S	40-00S	43-00S	46-00S	49-00S	51-00S
LONG.	68-45W	68-45W	68-45W	68-45W	68-45W	68-45W
VOL. OF AIR (100 SCM)	2.29	6.32	7.29	8.39	7.05	4.38
GROSS GAMMA/ M/100 SCM	69	56	22	55	48	59
COUNT DATE	03/07/68	03/07/68	03/07/68	03/07/68	03/08/68	03/08/68

RADIOCHEMICAL ANALYSIS OF AUGUST 1967 COMPOSITES

NORTH OF EIELSON
19.2 KM

SAMPLE NO. 227
COMPOSED OF: 1/2: 0174
0175
0176
0193
0194

MIDPOINT OF
COLLECTION:

DATE 8/ 4/67
LAT. 56N-75N
LONG. 135W-145W
VOL. OF AIR 5.750
(100 SCM)

PC/100 SCM

LAB: TLW

SR-89	*
SR-90	35.700
CD-109	1.9148
CE-144	18.800
PB-210	0.1088
PD-210	0.116
PU-238	1.401
PU-239	0.575

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF EIELSON
18.3 KM

SAMPLE NO. 231
COMPOSED OF: 3/4: 0190
0191
0192

MIDPOINT OF
COLLECTION:

DATE 8/ 3/67
LAT. 64N-75N
LONG. 143W-147W
VOL. OF AIR 5.620
(100 SCM)

PC/100 SCM

LAB: TLW

SR-89 *
SR-90 61.300
CD-109 2.622A
CE-144 34.300
PB-210 0.293A
PD-210 0.257
PU-238 1.601
PU-239 0.955

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

SAMPLE NO. 104A
COMPOSED OF: 1/4:0104234
1/4:0104
0105
0106105A
1/4:0105MIDPOINT OF
COLLECTION:

DATE	8/ 3/67	8/ 3/67	8/ 3/67
LAT.	75N-72N	64N-75N	72N-68N
LONG.	143W-143W	143W-147W	143W-144W
VOL. OF AIR (100 SCM)	1.440	4.480	1.590
GROSS GAMMA (CPM/100 SCM)		2050.000	
COUNT DATE		10/19/67	
			PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	3880.000
BA-140	1100.000A

* * * * *

LAB:	TLW	TLW	TLW
SR-89	851.000	702.000	507.000
SR-90	45.100	55.500	54.300
CD-109	*	*	*
CE-141	1840.000	1460.000	864.000
CE-144	532.000	486.000	462.000
PB-210	0.664A	0.873	0.774A
PO-210	0.508	0.748	0.678
PU-238	0.448	0.549	0.683
PU-239	0.737	0.891	0.921

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

SAMPLE NO. 232
COMPOSED OF: 1/2:0101
0102

MIDPOINT OF
COLLECTION:

DATE 8/ 3/67
LAT. 64N-72N
LONG. 143W-147W
VOL. OF AIR 13.000
(100 SCM)
GROSS GAMMA 80.800
(CPM/100 SCM)
COUNT DATE 10/18/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95 127.000
BA-140 *

* * * * *

LAB: TLW

SR-89 3.8988
SR-90 14.700
CD-109 *
CE-144 21.600
PB-210 0.475
PD-210 0.327
PU-238 0.147
PU-239 0.221

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

SAMPLE NO. 228
COMPOSED OF: 1/2:0097
0098
0099

MIDPOINT OF
COLLECTION:

DATE 7/29/67
LAT. 56N-65N
LONG. 135W-147W
VOL. OF AIR 4.730
(100 SCM)
GROSS GAMMA 440.000
(CPM/100 SCM)
COUNT DATE 10/18/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95 579.000
BA-140 *

* * * * *

LAB: TLW

SR-89 91.000
SR-90 67.600
CD-109 *
CE-141 238.000A
CE-144 110.000
PB-210 0.362A
PO-210 0.329
PU-238 1.366
PU-239 1.029

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 5 (cont'd)

SOUTH OF EIELSON
15.2 KMSAMPLE NO. 183A
COMPOSED OF: 1/4:0183229
1/2:0181
0182MIDPOINT OF
COLLECTION:

DATE	8/ 4/67	8/ 4/67
LAT.	62N-64N	57N-62N
LONG.	145W-145W	135W-145W
VOL. OF AIR (100 SCM)	0.790	5.890

GROSS GAMMA
(CPM/100 SCM) 3260.000

COUNT DATE 10/18/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95 6550.000

BA-140 *

* * * * *

LAB:	TLW	TLW
SR-89	1170.000	691.000
SR-90	78.800	47.500
CD-109	*	*
CE-141	3440.000	1610.000
CE-144	1550.000	733.000
PB-210	0.987B	1.114
PD-210	0.931	0.834
PU-238	0.773	0.487
PU-239	1.384	0.837

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

SAMPLE NO.	230	233
COMPOSED OF:	1/2:0115	1/4:0112
	0116	0113
		0114

MIDPOINT OF
COLLECTION:

DATE	7/29/67	7/29/67
LAT.	60N-64N	52N-60N
LONG.	140W-145W	129W-140W
VOL. OF AIR (100 SCM)	5.590	5.060
GROSS GAMMA (CPM/100 SCM)	420.000	4370.000
COUNT DATE	10/19/67	10/19/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	696.000	8430.000
BA-140	*	3590.000A

* * * * *

LAB:	TLW	TLW
SR-89	161.000	2060.000
SR-90	24.500	57.200
CD-109	*	*
CE-141		3470.000
CE-144	106.000	1060.000
PB-210	0.791	0.991
PO-210	0.585	0.704
PU-238	0.268	0.448
PU-239	0.371	1.136

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF KIRTLAND
18.3 KM

SAMPLE NO.	18A	19A
COMPOSED OF:	1/4:0018	1/4:0019

MIDPOINT OF
COLLECTION:

DATE	8/ 5/67	8/ 5/67
LAT.	47N-44N	44N-40N
LONG.	122W-115W	115W-110W
VOL. OF AIR (100 SCM)	1.320	1.460

PC/100 SCM

LAB:	TLW	TLW
SR-89	900.000	43500.000
SR-90	73.700	632.000
CD-109	*	*
CE-141	1830.000	83100.000
CE-144	737.000	23000.000
PB-210	0.5778	0.5388
PD-210	0.468	0.476
PU-238	0.989	0.716
PU-239	1.273	13.900

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF KIRTLAND
16.8 KM

SAMPLE NO.	222A	222B
COMPOSED OF:	1/4:0003	1/4:0003
	0014	0014
	0015	0015
	0016	0016
	0017	0017

MIDPOINT OF
COLLECTION:

DATE	8/ 5/67	8/ 5/67
LAT.	32N-47N	32N-47N
LONG.	99W-122W	99W-122W
VOL. OF AIR (100 SCM)	8.260	8.260
GROSS GAMMA (CPM/100 SCM)	613.000	562.000
COUNT DATE	10/19/67	10/18/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	1070.000	927.000
BA-140	*	*

* * * * *

LAB:	TLW	TLW
SR-89	157.000	168.000
SR-90	33.000	34.300
CD-109	1.0498	1.2378
CE-141	358.000	549.000
CE-144	153.000	125.000
PB-210	0.642	0.743
PO-210	0.494	0.528
PU-238	0.408	0.393
PU-239	0.532	0.560

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF KIRTLAND
15.2 KM

SAMPLE NO.	224	223
COMPOSED OF:	1/2:0185	3/4:0187
	0186	0188

MIDPOINT OF
COLLECTION:

DATE	8/ 5/67	8/ 5/67
LAT.	47N-40N	35N-40N
LONG.	122W-110W	110W-106W
VOL. OF AIR	9.870	8.250
(100 SCM)		
GROSS GAMMA		51.900
(CPM/100 SCM)		
COUNT DATE		10/18/67
		PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	83.500
BA-140	*

* * * * *

LAB:	TLW	TLW
SR-89	174.000	10.600
SR-90	17.200	3.919
CD-109	*	*
CE-144	98.200	16.900
PB-210	1.584	1.671
PD-210	0.932	0.780
PU-238	0.153	0.035
PU-239	0.285	0.060

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF KIRTLAND
13.7 KM

SAMPLE NO.	226A	226B	225
COMPOSED OF:	1/4:0110	1/4:0110	1/4:0108
	0111	0111	0109

MIDPOINT OF
COLLECTION:

DATE	7/29/67	7/29/67	7/29/67
LAT.	44N-52N	44N-52N	37N-44N
LONG.	116W-129W	116W-129W	108W-116W
VOL. OF AIR (100 SCM)	6.700	6.700	6.410
GROSS GAMMA (CPM/100 SCM)	1180.000	1150.000	197.000
COUNT DATE	10/18/67	10/18/67	10/18/67
			PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	2120.000	1980.000	307.000
BA-140	908.000A	*	*
		* * *	* * *

LAB:	TLW	TLW
SR-89	533.000	537.000
SR-90	30.100	31.300
CD-109	*	*
CE-141	941.000	1100.000
CE-144	277.000	263.000
PB-210	0.680	0.770
PO-210	0.493	0.507
PU-238	0.305	0.329
PU-239	0.549	0.574

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

SAMPLE NO. 220
 COMPOSED OF: 1/4: 0008
 0009
 0010
 0020
 0021

MIDPOINT OF
COLLECTION:

DATE 8/ 4/67
 LAT. 26N-40N
 LONG. 91W-110W
 VOL. OF AIR 5.090
 (100 SCM)
 GROSS GAMMA 3060.000
 (CPM/100 SCM)
 COUNT DATE 10/19/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA
 ZR-95 5500.000
 BA-140 *

* * * * *

LAB: TLW

SR-89	1320.000
SR-90	74.900
CD-109	2.181B
CE-141	3100.000
CE-144	787.000
PB-210	0.732
PO-210	0.584
PU-238	0.845
PU-239	1.313

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

SAMPLE NO. 221
 COMPOSED OF: 1/4:0004
 0005
 0006

MIDPOINT OF
COLLECTION:

DATE 8/ 4/67
 LAT. 24N-32N
 LONG. 99W- 89W
 VOL. OF AIR 4.050
 (100 SCM)
 GROSS GAMMA 780.000
 (CPM/100 SCM)
 COUNT DATE 10/19/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95 1260.000
 BA-140 *

* * * * *

LAB: TLW

SR-89 294.000
 SR-90 31.000
 CD-109 *
 CE-141 436.000
 CE-144 187.000
 PB-210 1.179
 PO-210 0.752
 PU-238 0.387
 PU-239 0.510

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF ALBROOK
19.2 KM

SAMPLE NO. 213
COMPOSED OF: 3/4: 83
84
85

MIDPOINT OF
COLLECTION:

DATE 8/ 2/67
LAT. 20N-10N
LONG. 86W- 80W
VOL. OF AIR 7.180
(100 SCM)

PC/100 SCM

LAB:	TLW
SR-89	14.500A
SR-90	44.300
CD-109	1.869B
CE-144	31.900
PB-210	0.535
PO-210	0.444
PU-238	0.691
PU-239	0.747

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

SAMPLE NO.	216	215
COMPOSED OF:	1/2:0007	3/4: 34
	0032	35
	0033	36

MIDPOINT OF
COLLECTION:

DATE	8/ 6/67	8/ 8/67
LAT.	20N-26N	16N- 8N
LONG.	86W- 91W	83W- 79W
VOL. OF AIR (100 SCM)	6.120	5.660
GROSS GAMMA (CPM/100 SCM)	915.000	
COUNT DATE	10/19/67	

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	1460.000
BA-140	*

* * * * *

LAB:	TLW	TLW
SR-89	368.000	207.000
SR-90	52.700	45.800
CD-109	1.716B	2.041B
CE-141	637.000	365.000
CE-144	250.000	131.000
PB-210	0.849	0.805
PO-210	0.645	0.634
PU-238	0.668	0.578
PU-239	0.910	0.794

A:COUNTING ERROR IS 20-50 PERCENT

B:COUNTING ERROR IS 51-100 PERCENT

*:NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF ALBROOK
16.8 KM

SAMPLE NO. 218
 COMPOSED OF: 1/2:0029
 0030
 0031

MIDPOINT OF
COLLECTION:

DATE 8/ 8/67
 LAT. 13N-24N
 LONG. 81W- 89W
 VOL. OF AIR 8.150
 (100 SCM)
 GROSS GAMMA 626.000
 (CPM/100 SCM)
 COUNT DATE 10/18/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95 945.000
 BA-140 *

* * * * *

LAB: TLW

SR-89 254.000
 SR-90 26.000
 CD-109 *
 CE-141 658.000
 CE-144 151.000
 PB-210 1.483
 PO-210 0.873
 PU-238 0.247
 PU-239 0.432

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF ALBROOK
15.2 KM

SAMPLE NO. 219
COMPOSED OF: 1/2: 77
78
79
80
81

MIDPOINT OF
COLLECTION:

DATE 8/ 2/67
LAT. 8N-24N
LONG. 79W- 89W
VOL. OF AIR 16.790
(100 SCM)

PC/100 SCM

LAB: TLW
SR-89 89.800
SR-90 5.360
CD-109 *
CE-144 53.700
PB-210 0.939
PD-210 0.555
PU-238 0.053
PU-239 0.142

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 5 (cont'd)

SOUTH OF ALBROOK
19.2 KM

SAMPLE NO. 212
COMPOSED OF: 3/4: 60
61
62
86

MIDPOINT OF
COLLECTION:

DATE 8/ 3/67
LAT. 1S-10N
LONG. 79W- 80W
VOL. OF AIR 6.650
(100 SCM)

PC/100 SCM

LAB:	TLW
SR-89	14.000B
SR-90	67.600
CD-109	1.963B
CE-144	54.500
PB-210	0.820
PO-210	0.675
PU-238	0.815
PU-239	1.057

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 5 (cont'd)

SOUTH OF ALBROOK
18.3 KM

SAMPLE NO. 214
COMPOSED OF: 3/4:0072
0073

MIDPOINT OF
COLLECTION:

DATE 8/ 6/67
LAT. 1S- 7N
LONG. 79W- 79W
VOL. OF AIR 5.950
(100 SCM)

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA
ZR-95 18.200
BA-140 *

TABLE 5 (cont'd)

SOUTH OF ALBROOK
16.8 KM

SAMPLE NO. 217
COMPOSED OF: 1/2: 27
28
47
48
49

MIDPOINT OF
COLLECTION:

DATE 8/ 4/67
LAT. 1S-13N
LONG. 79W- 81W
VOL. OF AIR 10.750
(100 SCM)

PC/100 SCM

LAB: TLW
SR-89 79.700
SR-90 12.300
CD-109 *
CE-141 247.000
CE-144 66.200
PD-210 0.678
PU-238 0.173
PU-239 0.279

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

SAMPLE NO.	209	204
COMPOSED OF: 3/4:	58	1/2: 0126
	59	0127
	125	0128
		0129

MIDPOINT OF
COLLECTION:

DATE	8/ 3/67	8/ 4/67
LAT.	1S-19S	19S-33S
LONG.	74W- 79W	74W- 68W
VOL. OF AIR	7.180	5.430
(100 SCM)		
GROSS GAMMA		94.800
(CPM/100 SCM)		
COUNT DATE		10/19/67
		PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	4.646
BA-140	*

* * * * *

LAB:	TLW	TLW
SR-89	*	*
SR-90	68.400	51.500
CD-109	2.0528	2.337A
CE-144	43.900	29.400
PB-210	0.755	0.379A
PO-210	0.791	0.332
PU-238	1.416	2.573
PU-239	1.097	0.778

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF MENDOZA
18.3 KM

SAMPLE NO.	210	205
COMPOSED OF: 3/4:	7	1/2: 0139
	71	0140
	138	0141
		0142

MIDPOINT OF
COLLECTION:

DATE	8/ 4/67	8/ 3/67
LAT.	1S-19S	19S-33S
LONG.	74W- 79W	74W-168W
VOL. OF AIR (100 SCM)	8.800	6.530
GROSS GAMMA (CPM/100 SCM)		103.000
COUNT DATE		10/19/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	5.174
BA-140	*

* * * * *

LAB:	TLW	TLW
SR-89	*	*
SR-90	51.600	54.100
CD-109	1.676B	2.252A
CE-144	25.700	33.800
PB-210	0.896	0.576A
PO-210	0.760	0.490
PU-238	1.015	2.569
PU-239	0.803	0.821

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

SAMPLE NO.	211	206
COMPOSED OF: 1/2:	44	1/2:0133
	45	0134
	46	0135
	93	0136
	94	0137

MIDPOINT OF
COLLECTION:

DATE	8/ 4/67	8/ 3/67
LAT.	1S-15S	15S-33S
LONG.	73W- 78W	68W- 75W
VOL. OF AIR (100 SCM)	15.980	12.940
GROSS GAMMA (CPM/100 SCM)		71.100
COUNT DATE		10/19/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	40.400
BA-140	*

* * * * *

LAB:	TLW	TLW
SR-89	79.200	15.700A
SR-90	16.300	21.100
CD-109	*	*
CE-144	60.700	22.100
PB-210	1.108	0.926
PD-210	0.745	0.669
PU-238	0.278	0.727
PU-239	0.323	0.348

A: COUNTING ERROR IS 20-50 PERCENT

B: COUNTING ERROR IS 51-100 PERCENT

*: NOT DETECTABLE

TABLE 5 (cont'd)

NORTH OF MENDOZA
15.2 KM

SAMPLE NO.	207	208
COMPOSED OF:	1/2:0066	1/2:0120
	0067	0155
	0068	
	0069	

MIDPOINT OF
COLLECTION:

DATE	8/ 6/67	8/ 3/67
LAT.	15S-31S	31S-35S
LONG.	68W- 75W	68W- 68W
VOL. OF AIR (100 SCM)	16.960	3.420
GROSS GAMMA (CPM/100 SCM)	581.000	285.000
COUNT DATE	10/19/67	10/18/67
		PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	776.000	360.000
BA-140	*	*

* * * * *

LAB: TLW

SR-89	197.000
SR-90	12.500
CD-109	0.7458
CE-141	614.000
CE-144	131.000
PB-210	0.837
PO-210	0.527
PU-238	0.431
PU-239	0.422

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

TABLE 5 (cont'd)

SOUTH OF MENDOZA
19.2 KM

SAMPLE NO. 200
COMPOSED OF: 1/2: 164
165
166
167
168

MIDPOINT OF
COLLECTION:

DATE 8/ 2/67
LAT. 50S-33S
LONG. 67W- 68W
VOL. OF AIR 7.150
(100 SCM)

PC/100 SCM

LAB: TLW

SR-89 *
SR-90 51.800
CD-109 2.334A
CE-144 28.900
PB-210 0.284A
PO-210 0.249
PU-238 2.766
PU-239 0.772

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

TABLE 5 (cont'd)

SOUTH OF MENDOZA
18.3 KM

SAMPLE NO. 201
COMPOSED OF: 1/2: 159
160
161
162
163

MIDPOINT OF
COLLECTION:

DATE 8/ 2/67
LAT. 32S-50N
LONG. 67W- 68W
VOL. OF AIR 7.900
(100 SCM)

PC/100 SCM

LAB: TLW

SR-89 *
SR-90 56.500
CD-109 2.558A
CE-144 31.800
PB-210 0.431
PD-210 0.370
PU-238 2.773
PU-239 0.847

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

SAMPLE NO. 202
COMPOSED OF: 1/2: 0151
0152
0153
0154

MIDPOINT OF
COLLECTION:

DATE 8/ 2/67
LAT. 35S-50S
LONG. 67W- 68W
VOL. OF AIR 12.860
(100 SCM)
GROSS GAMMA 148.000
(CPM/100 SCM)
COUNT DATE 10/19/67

PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95 94.900
BA-140 *

* * * * *

LAB: TLW

SR-89 36.600A
SR-90 41.100
CD-109 2.062A
CE-144 38.400
PB-210 0.770
PD-210 0.550
PU-238 1.914
PU-239 0.643

A: COUNTING ERROR IS 20-50 PERCENT
B: COUNTING ERROR IS 51-100 PERCENT
*: NOT DETECTABLE

SAMPLE NO.	146A	203
COMPOSED OF: 1/2:	146	1/2: 0147 0148

MIDPOINT OF
COLLECTION:

DATE	8/ 2/67	8/ 2/67
LAT.	32S-35S	35S-43S
LONG.	68W- 68W	67W- 68W
VOL. OF AIR (100 SCM)	2.210	9.090
GROSS GAMMA (CPM/100 SCM)		919.000
COUNT DATE		10/18/67
		PC/100 SCM

HASL-COMPUTER RESOLUTION OF GAMMA RAY SPECTRA

ZR-95	1250.000
BA-140	966.000

* * * * *

LAB:	TLW	TLW
SR-89	545.000	315.000
SR-90	15.500	30.700
CD-109	*	*
CE-141	1580.000	1160.000
CE-144	344.000	193.000
PB-210	1.110	0.822
PO-210	0.678	0.587
PU-238	0.456	1.138
PU-239	0.748	0.771

A: COUNTING ERROR IS 20-50 PERCENT
 B: COUNTING ERROR IS 51-100 PERCENT
 *: NOT DETECTABLE

Table 6

Quality Control Samples

Assigned Collection		dpm/sample $\pm$ percent standard deviation										^(a)	
HASL #	Date		Sr-89	Sr-90	Cd-109	Ce-141	Ce-144	Pb-210	Po-210	Pu-238	Pu-239	Zr-92	Ba-140
T-													
<u>Standards</u>													
237	8/5/67	Added	2540	375	767	2650	900	4.37	4.37	7.70	4.00		
		Found	2770 $\pm$ 5	338 $\pm$ 7	675 $\pm$ 3	2820 $\pm$ 9	888 $\pm$ 2	4.58 $\pm$ 24	3.30 $\pm$ 4	7.22 $\pm$ 4	3.40 $\pm$ 6		
		% Deviation	+ 8.9	- 10	- 12	+ 6.4	- 1.3	+ 4.8	- 24	- 6.3	- 15		
238	7/29/67	Added	2880	374	907	3230	794	5.61	5.61	6.30	3.04		
		Found	2900 $\pm$ 4	304 $\pm$ 5	774 $\pm$ 3	3480	775 $\pm$ 2	5.59 $\pm$ 20	4.22 $\pm$ 3	6.34 $\pm$ 4	2.62 $\pm$ 6		
		% Deviation	+ 0.8	- 23	- 15	+ 7.6	- 2.4	- 0.3	- 25	+ 0.7	- 14		
<u>Blanks</u>	11	8/5/67	*	1.49 $\pm$ 28	*	44.6 $\pm$ 58	15.4 $\pm$ 12	*	*	*	*		
<u>pCi/100 SCM</u>													
<u>Duplicates</u>													
222-A	8/5/67		158	33.3	1.068	361	155	0.648	0.499	0.412	0.537	1080	*
222-B	8/5/67		169	34.6	1.258	554	126	0.750	0.533	0.396	0.567	936	*
% Deviation from Average			$\pm$ 6.7	$\pm$ 3.8	-	$\pm$ 42	$\pm$ 21	$\pm$ 14	$\pm$ 6.6	$\pm$ 4.0	$\pm$ 5.4	$\pm$ 14	-
226-A	7/29/67		538	30.4	*	950	280	0.686	0.498	0.307	0.554	2140	916A
226-B	7/29/67		542	31.6	*	1110	265	0.777	0.512	0.332	0.579	2000	*
% Deviation from Average			$\pm$ 0.04	$\pm$ 3.9	-	$\pm$ 16	$\pm$ 5.5	$\pm$ 12	$\pm$ 2.8	$\pm$ 7.8	$\pm$ 4.4	$\pm$ 6.8	-

(a) Analyses by HASL gamma ray spectroscopy

Rn-222 Concentrations, January 1968

Direction	Trap #	Aircraft Date	Lat.	Alt. (KM)	Net pCi Rn-222	Vol. of Air (SCM)	pCi Rn SCM	Sample Type	Remarks
N of Eielson	3	-293/1-18	65-73 N	12.2	38.4 ± .23	5.81	6.6 ± .04	Bleed	
"	4	"	75-67 N	15.2	34.8 ± .18	6.19	5.6 ± .03	"	
N of Eielson	1	-292/1-18	61-66 N	18.3	2.86 ± .06	6.35	0.45 ± .01	"	
"	2	"	75-68 N	19.2	2.24 ± .04	4.05	0.55 ± .01	"	
S of Eielson	5	-292/1-19	61-58 N	13.7	0.85 ± .06	6.04	0.14 ± .01	"	
"	6	"	51-58 N	15.2	1.35 ± .06	6.44	0.21 ± .01	"	
S of Eielson	7	-293/1-19	61-52 N	18.3	10.4 ± .1	6.14	1.7 ± .02	"	
"	8	"	51-60 N	19.2	11.0 ± .1	6.44	1.7 ± .02	"	
N of Kirtland	25	-294/1-18	50-44 N	13.7	0.30 ± .02	1.13	0.26 ± .02	Probe	Comparison
"	26	"	"	"	0.64 ± .03	7.01	0.091 ± .004	Bleed	
"	28	"	39-47 N	15.2	0.04 ± .02	7.35	0.005 ± .003	"	
N of Kirtland	29	-288/1-18	39-46 N	18.3	Lost	6.01	----	"	
"	30	"	49-40 N	19.2	3.8 ± .06	6.72	0.56 ± .01	"	
"	31	"	---	---	40.7 ± .2	0	----	Bleed Blank	
S of Kirtland	27	-294/1-20	33-28 N	15.2	0.30 ± .02	0.91	0.33 ± .02	Probe	Comparison
"	36	"	"	"	0.64 ± .06	6.50	0.098 ± .01	Bleed	
"	38	"	---	16.8	< 0.03	0	----	"	Failure
S of Kirtland	33	-288/1-19	33-26 N	18.3	19.3 ± .1	5.24	3.7 ± .1	"	
"	34	"	24-33 N	19.2	3.38 ± .06	7.07	0.48 ± .01	"	
"	35	"	---	---	9.20 ± .10	0	----	Bleed Blank	
N of Albrook	15	-298/1-18	12-24 N	15.2	179 ± 0.5	2.92	61.3 ± .2	Bleed	Slow Pumper
N of Mendoza	21	-291/1-18	29-16 S	15.2	1.26 ± .04	0.74	1.7 ± .06	Bleed	Slow Pumper
"	22	"	---	---	< 0.3	0	----	"	Failure
N of Mendoza	23	-299/1-18	29-20 S	18.3	< 0.03	5.84	< 0.005	"	
"	24	"	16-33 S	19.2	< 0.03	5.10	< 0.006	"	
S of Mendoza	18	-291/1-19	37-51 S	13.7	< 0.03	1.41	< 0.02	"	Slow Pumper
"	19	"	51-43 S	15.2	< 0.03	5.99	< 0.005	"	
S of Mendoza	17	-299/1-19	37-44 S	18.3	< 0.02	0	----	"	Failure
"	20	"	51-33 S	19.2	< 0.03	0.32	< 0.09	"	Slow Pumper

Table 8

Rn-222 Content of Albrook Samplers. January 19, 1968

<u>Radon Sampler</u> <u>#</u>	<u>pCi Rn-222</u> <u>1200 Z</u>
9	7.30 ± 0.10
10	3.66 ± 0.06
11	4.53 ± 0.07
12	0.74 ± 0.03
13	3.61 ± 0.07
14	11.4 ± 0.1
16	0.08 ± 0.04

Table 9

Chic 6 Debris Nuclide Ratios from Sample 19-A

<u>Ratio</u>	<u>Sample 19-A</u>	<u>Reference</u>
Sr-89/Sr-90	135	147
Zr-95/Sr-90	204	226
Ba-140/Sr-90	856	1170
Ce-141/Sr-90	377	398
Cr-144/Sr-90	41	47.6

✓ 46
1959-1960 ATMOSPHERIC RADIOACTIVITY PROGRAM

Introduction:

A program of atmospheric sampling and radiochemical analysis was undertaken during 1959-1960 to determine the distribution of nuclear debris by means of filter collection of airborne radioactive particulate matter on IPC-1478 paper⁽¹⁾ carried by aircraft.

Most sampling was conducted in the Alaskan region in the troposphere and lower stratosphere. Some tropospheric samples from about 10°N to 22°N latitude in the vicinity of Hawaii and some lower stratospheric samples from about 30°N to 40°N over the western U.S.A. were collected. Also a limited sampling program was conducted in the vicinity of 40°S, Argentina, to obtain atmospheric samples in the lower stratosphere from the Southern Hemisphere.

An integral part of this program involved the radiochemical analysis of the filter paper for individual radio-isotopes. This part of the project was conducted at government laboratories, designated Lab. A and Lab. B. In comparing the Lab. A data with Lab. B data, Lab. A noted that their tungsten-181 (W-181) and tungsten-185 (W-185) values were consistently lower. These low values are attributed to losses occurring during carrier-free dissolutions. Although the Lab. A tungsten data were low they are internally consistent with respect to the ratio of W-181 to W-185, for this reason, they have been included.

This program is part of a cooperative effort of the U.S. Department of Defense, Atomic Energy Commission and Environmental Science Services Administration.

(1) The Institute of Paper Chemistry, A Study of the Filtration and Permeability Characteristics of IPC-1478 Filter Paper, DASA 1168, February 13, 1960.

Description of Tables:

Date	Date (GCT) on which the filter was extracted from the aircraft, immediately after landing.
Altitude	Pressure altitude (in thousands of feet) at which sampling was performed.
Tropopause	Height of tropopause (in thousands of feet) as reported by a nearby radiosonde station.
Isotopic Data	All data are reported in units of disintegrations per minute per 1000 standard cubic feet of air. In many instances a filter paper was split and duplicate radiochemical analyses were performed. For those cases more than one number is reported under the appropriate laboratory.

The following table lists the decay constants used and the dates used in correcting the data for radioactive decay:

Isotope	Half-life (Days)	Decay Constant (Days ⁻¹)	Data Corrected to
Be-7	53.0	0.0131	Collection Date
Sr-89	53.0	0.0131	Jan. 1, 1959
Sr-90	10104	0.0000686	Collection Date
Zr-95	63.6	0.0109	Jan. 1, 1959
Cs-137	9708	0.0000714	Collection Date
Ce-144	282	0.00246	Jan. 1, 1959
W-181	120	0.00578	Aug. 15, 1958
W-185	76.2	0.00910	Aug. 15, 1958

Unless otherwise indicated, the precision of the radiochemical analysis is within 3%. Standard errors in the analysis greater than 3% are indicated by a lower case letter following the value in accordance with the following code:

a	3-10%
b	11-20%
c	21-40%
d	41-100%
e	> 100%

ND indicates the isotope was not detected in resolvable amounts.

() indicates that data were reported as unreliable

Table 1. 1959 Radioactivity Data

Region: Alaska, ~65°N-85°N, ~155°W

Sampling Altitude, 10,000 Ft.

Date	Tropopause Height	Sr-89 Lab. #	Sr-90 Lab. #	Zr-95 Lab. #	Co-137 Lab. #	Co-144 Lab. #	W-181 Lab. #	W-183 Lab. #	W-181/W-183 Lab. #
<u>January</u>									
20	35	96	2.5	180	-	76	-	95	-
27	36	110	3.2	190	-	93	-	85	-
<u>February</u>									
4	29	33	0.8	39	-	28	-	31	-
12	33	49	1.4	86	-	37	-	43	-
18	34	13	0.3	(28)	-	12	-	16	-
<u>March</u>									
4	29	63	1.4	(200)	-	63	73	96	0.76
10	25	110	2.6	200	-	82	67	89	0.75
18	29	97	2.3	180	-	74	60	79	0.76
26	30	62	1.1	96	-	(51)	39	50	0.78
<u>April</u>									
3	30	160	3.5	270	-	120	53	69	0.77
8	30	110	2.2	150	-	80	46	60	0.77
22	32	240	5.8	380	-	170	110	(120)	(0.92)
<u>May</u>									
1	34	330	6.8	520	-	230	120	160	0.75
6	34	330	6.6	400	-	250	110	140	0.79
13	30	75	1.5	(170)	-	65	48	60	0.80
21	30	180	3.9	280	-	140	83	110	0.75
27	31	260	8.1	400	-	180	100	130	0.77
<u>June</u>									
3	33	190	4.3	320	-	150	88	110	0.80
10	33	150	3.9	240	-	110	67	100	0.67
17	38	180	4.3	280	-	130	180	230	0.78
24	34	64	(0.5)	100	-	46	27	36	0.75
30	35	90	2.3	160	-	56	(58)	54	(1.07)
<u>July</u>									
7	34	83	2.2	120	-	99	33	46	0.72
14	29	76	2.1	100	3.1	56	31	41	0.76
21	34	55	1.5	74	2.5	37	35	46	0.76
28	33	53	1.6	78	2.6	39	35	46	0.76
<u>August</u>									
4	30	73	2.2	87	3.9	56	49	63	0.78
12	37	42	1.4	56	2.4	33	38	47	0.81
18	35	-	-	51	1.8	25	30	41	0.73
25	35	35	1.2	38	2.1	27	36	46	0.78
<u>September</u>									
2	33	12	0.5	16	0.7	11	15	19	0.79
8	36	18	0.7	25	1.2	15	22	28	0.79
15	34	12	0.5	17	0.8	8.8	16	20	0.80
22	30	12	0.5	14	0.9	11	18	23	0.78
29	40	17	0.7	21	1.2	14	22	29	0.76
<u>October</u>									
5	30	7.5	0.3	8.4	-	5.8	11	14	0.79
15	30	7.8	0.3	11	0.6	6.8	11	14	0.79
20	34	11	0.5	14	0.8	8.4	16	21	0.76
27	33	7.4	0.4	10	0.6	6.8	12	17	0.71
<u>November</u>									
4	33	8.8	0.5	12	0.9	9.1	15	22	0.68
10	35	8.5	0.4	12	0.7	8.0	15	20	0.75
24	29	2.8	0.2	4.5	0.3	2.9	5.8	7.7	0.75
<u>December</u>									
2	31	3.5	0.3	6.2	0.5	4.4	9.4	13	0.72
8	29	4.6	0.3	6.5	0.4	4.8	9.0	12	0.75
16	30	3.7	0.2	5.6	0.4	3.8	8.2	10	0.82
22	29	3.7	0.3	5.6	0.6	5.9	13	15	0.87

Table 2. 1959 Radioactivity Data

Region: Alaska, ~65°N-86°W, ~155°W

Altitude, 18,000 Ft.

Date	Tropopause Height	Sr-89		Sr-90		Zr-95	Cs-137		Cs-144		W-181		W-185		W181/W185	W181/W185
		Lab. A	Lab. B	Lab. A	Lab. B	Lab. B	Lab. A	Lab. B	Lab. A	Lab. B	Lab. A*	Lab. B	Lab. A*	Lab. B	Lab. A	Lab. B
January																
20	35	-	210	-	5.5	400	-	-	-	170	-	-	-	200	-	-
27	36	-	230	-	6.7	390	-	-	-	180	-	-	-	170	-	-
February																
4	29	-	39	-	0.9	69	-	-	-	33	-	-	-	36	-	-
12	33	-	87	-	2.4	140	-	-	-	66	-	-	-	77	-	-
18	34	-	38	-	0.9	(81)	-	-	-	33	-	-	-	46	-	-
March																
4	29	-	87	-	1.9	(280)	-	-	-	86	-	100	-	130	-	0.77
10	25	-	180	-	4.3	340	-	-	-	140	-	110	-	150	-	0.73
18	29	-	180	-	4.3	320	-	-	-	140	-	110	-	150	-	0.73
26	30	-	90	-	1.6	140	-	-	-	(74)	-	57	-	74	-	0.77
April																
3	30	-	190	-	4.3	330	-	-	-	140	-	64	-	84	-	0.76
8	30	-	180	-	3.7	250	-	-	-	140	-	76	-	100	-	0.76
22	32	-	280	-	6.9	460	-	-	-	210	-	131	-	140	-	0.94
May																
1	34	-	450	-	9.4	730	-	-	-	320	-	169	-	220	-	0.77
6	34	-	340	-	6.8	400	-	-	-	250	-	110	-	140	-	0.79
13	30	-	260	-	5.3	(590)	-	-	-	230	-	167	-	210	-	0.80
21	30	-	470	-	10	730	-	-	-	370	-	220	-	280	-	0.79
27	31	-	430	-	8.4	650	-	-	-	300	-	165	-	210	-	0.79
June																
3	33	-	430	-	9.6	710	-	-	-	330	-	200	-	250	-	0.80
17	18	-	330	-	7.7	500	-	-	-	240	-	320	-	420	-	0.76
24	34	-	120	-	(1.0)	190	-	-	-	84	-	70	-	66	-	1.06
30	35	-	200	-	5.2	370	-	-	-	130	-	(130)	-	74	-	(1.75)
July																
7	34	-	160	-	4.2	230	-	-	-	110	-	63	-	87	-	0.72
14	29	-	98	-	2.7	130	-	3.9	-	73	-	49	-	64	-	0.77
21	34	-	110	-	3.0	150	-	5.0	-	76	-	72	-	95	-	0.76
28	33	-	130	-	4.0	190	-	6.2	-	95	-	84	-	110	-	0.76
August																
4	30	-	89	-	2.7	110	-	4.8	-	68	-	60	-	76	-	0.79
12	37	-	74	-	2.5	97	-	4.2	-	58	-	66	-	83	-	0.80
18	35	-	-	-	-	68	-	2.5	-	34	-	41	-	55	-	0.75
25	35	41b	45	2.1	1.6	49	3.2	2.7	44	35	26b	47	36	60	0.72b	0.78
September																
2	33	26	28	0.9	1.1	36	1.4	1.6	21a	24	12	34	18	44	0.67	0.77
8	36	-	25	-	0.9	34	-	1.6	-	20	-	31	-	39	-	0.79
15	34	-	19	-	0.7	26	-	1.2	-	14	-	25	-	31	-	0.81
22	30	29a	26	1.2	1.2	32	2.0	2.1	25	24	28a	41	37	51	0.76a	0.80
29	40	-	16	-	0.7	21	-	1.1	-	14	-	22	-	28	-	0.79
October																
5	30	-	16	-	0.7	18	-	-	-	12	-	23	-	30	-	0.77
15	30	-	15	-	0.7	22	-	1.1	-	13	-	22	-	27	-	0.81
20	34	58	19	1.0	0.8	25	1.3	1.4	15	15	21	29	30	38	0.70	0.76
27	33	-	13	-	0.7	19	-	1.1	-	13	-	23	-	30	-	0.77
November																
4	33	ND	9.8	0.6	0.6	14	0.8	1.0	10	10	ND	17	ND	25	-	0.68
10	35	-	11	-	0.6	15	-	0.9	-	10	-	19	-	26	-	0.73
18	31	7.5d	12	0.7	0.6	19	1.2	1.1	12	11	12a	22	16a	29	0.75a	0.76
24	29	-	6.0	-	0.4	9.3	-	0.7	-	6.0	-	12	-	16	-	0.75
December																
2	31	-	6.3	-	0.5	11	-	0.8	-	8.1	-	17	-	23	-	0.74
8	29	22c	27	1.6	1.6	38	2.5	2.3	29	28	45a	33	63	69	0.71a	0.77
16	30	-	8.3	-	0.5	12	-	0.8	-	8.4	-	19	-	23	-	0.83
22	29	-	5.6	-	0.5	8.2	-	0.8	-	8.8	-	19	-	22	-	0.86
28	23	14c	-	0.7	-	-	1.1a	-	12	-	ND	-	22	-	-	-

* Low values, see text.

Table 3. 1959 Radioactivity Data

Region: Alaska, ~65°N-70°N, ~155°W

Altitude, 40,000 Ft.

Date	Tropopause Height	Be-7 Lab. A	Sr-89 Lab. A Lab. B		Sr-90 Lab. A Lab. B		Zr-95 Lab. B	Ce-137 Lab. A Lab. B		Ce-144 Lab. A Lab. B		W-181 Lab. A* Lab. B		W-185 Lab. A* Lab. B		W181/W185 Lab. A Lab. B	
January																	
14	31	-	-	-	-	-	22600	-	-	-	11900	-	-	-	6250	-	-
20	35	450a	6440a	6020	200	-	5860	350	-	5150a	2880	6290a	-	8640	6110	0.73a	-
27	36	590	14600	16700	360	-	16400	560	-	9830	10900	4710a	-	6310	7170	0.75a	-
February																	
4	29	-	-	3850	-	110	4990	-	-	-	2450	-	-	-	4500	-	-
11	29	-	-	13200	-	280	-	-	-	-	9720	-	-	-	9620	-	-
18	34	700a	18400	18900	450a	-	24500	710	-	13100a	11800	5130	-	6680	9130	0.77	-
25	34	-	-	27300	-	510	-	-	-	-	17200	-	-	-	10500	-	-
March																	
4	29	-	-	10900	-	230	16300	-	-	-	7770	-	5870	-	7970	-	0.74
6	24	660a	11700	-	340	-	-	540	-	8840	-	4990	-	6620	-	0.75	-
11	25	-	-	9900	-	290	15800	-	-	-	6970	-	4800	-	6310	-	0.76
18	29	840a	15100a	17200	-	320	22000	660	-	11100a	11100	3050	4510	4120	5950	0.74	0.76
25	33	-	-	11400	-	210	-	-	-	-	7770	-	4990	-	6740	-	0.74
April																	
3	30	540a	8410	10500	250	200	14600	390	-	6130	7370	3950	4450	5460a	6250	0.72a	0.71
8	30	-	-	9250	-	210	12600	-	-	-	-	-	4990	-	6800	-	0.73
May																	
6	34	500	4360	5990	160	140	7530	240	-	3370	4050	2410	5130	3450	6620	0.70	0.77
June																	
3	33	-	-	3630	-	130	5150	-	-	-	2740	-	3570	-	4630	-	0.77
10	33	-	-	2370	-	93	3090	-	-	-	1680	-	2500	-	3460	-	0.72
30	35	490	2710	2850	110	90	3600	180	-	2180	2200	1130a	2150	1470	3090	0.77a	0.70
July																	
14	29	510a	1790a	1850	87	84	2110	140	110	1620	1620	1560a	2650	2050a	3530	0.76a	0.75
21	34	-	-	2230	-	100	2360	-	131	-	1600	-	2440	-	3260	-	0.75
28	33	-	-	1620	-	73	1920	-	122	-	1300	-	2170	-	2910	-	0.75
August																	
4	30	-	-	1300	-	61	1550	-	100	-	1190	-	1870	-	2610	-	0.78
12	37	320	1370	1390	60	59	1640	100	100	1100	1110	1180a	1750	1610	2200	0.73a	0.80
18	35	-	-	1120	-	55	1520	-	93	-	970	-	1590	-	1880	-	0.85
25	35	390a	860	920	44	43	970	75	79	840	780	1050	1490	1400	1910	0.75	0.78
September																	
2	33	320	1000	-	52a	-	1180	89	87	950	930	1290	1730	1720	2200	0.75	0.79
8	36	-	-	1090	-	52	1140	-	92	-	-	-	1710	-	2270	-	0.75
15	34	-	-	1270	-	61	1610	-	110	-	1070	-	2160	-	2770	-	0.78
22	30	380	690a	660	39	32	770	63	51	680	550	430a	1130	560	1430	0.77a	0.79
29	40	-	-	950	-	48	1430	-	93	-	1000	-	2310	-	-	-	-
October																	
5	30	-	-	600	-	34	790	-	59	-	610	-	1140	-	1480	-	0.77
15	30	-	-	920	-	55	1300	-	95	-	930	-	1860	-	2460	-	0.76
20	34	380	660	600	30	32	760	49	56	560	510	580	1050	820	1560	0.67	0.71
27	33	-	-	650	-	35	870	-	57	-	620	-	1160	-	1530	-	0.76
November																	
4	33	430	640	620	42a	39	900	66	67	710	680	270	1440	380	1980	0.71	0.74
10	35	-	-	420	-	24	610	-	41	-	460	-	770	-	1050	-	0.73
18	31	520	850	1070	64	58	1240	110	110	1100	990	530	1480	-	1980	-	0.75
24	29	-	-	800	-	52	1190	-	91	-	880	-	1480	-	2040	-	0.73
December																	
2	31	-	-	930	-	62	1120	-	92	-	830	-	1380	-	1880	-	0.73
8	29	560	860	930	-	70	1330	120	110	1150	1110	1330	1520	1720	1980	0.77	0.77
14	30	-	-	1050	-	81	1690	-	140	-	1350	-	1710	-	2280	-	0.75
22	29	-	-	320	-	23	920	-	49	-	640	-	740	-	980	-	0.76
31	20	160	660	-	42a	-	-	61	-	680	-	660	-	910	-	0.73	-

* Low values, see text.

Table 4. 1959 Radioactivity Data

Region: Alaska, ~70°N, ~155°W

Sampling Altitude, Various

Date	Sampling Altitude	Tropopause Height	Be-7	Sr-89		Sr-90		Zr-95	Cs-137		Ce-144		W-181		W-185		W181/W185	
			Lab. A	Lab. A	Lab. B	Lab. A	Lab. B	Lab. B	Lab. A	Lab. B	Lab. A	Lab. B	Lab. A*	Lab. B	Lab. A*	Lab. B	Lab. A	Lab. B
<u>February</u>																		
4	45	29	700	12500	-	350	-	-	590	-	8910	-	4890	-	6440	-	0.76	-
<u>April</u>																		
15	35	29	-	-	8560	-	190	14000	-	-	-	5950	-	3770	-	4680	-	0.81
22	38	32	380m	10700m	9180	280	220	(10800)	460	-	7970	6500	3840	3620	5350m	5010	0.72a	0.72
29	45	33	-	-	3580	-	(140)	4650	-	-	-	2790	-	3920	-	5380	-	0.73
<u>May</u>																		
13	45	30	-	-	2400	-	(100)	3070	-	-	-	1950	-	3570	-	4460	-	0.80
20	45	32	380m	1740	2100	83	78	2760	140	-	1490	1630	1800	3010	2560	3750	0.74	0.80
27	45	31	-	-	2700	-	110	3700	-	-	-	2130	-	3100	-	4050	-	0.77
<u>June</u>																		
17	45	38	570	1800	2060	92	81	2770	150	-	1590	1760	1600	1260	2270	(1660)	-	(0.76)
24	45	34	-	-	2080	-	89	2080	-	-	-	1610	-	2280	-	(3460)	-	(0.66)
<u>July</u>																		
7	45	34	530	1800	1890	88	79	1910	150	-	1590	1760	2110m	2340	2810	3270	0.75a	0.72

~70°N, ~155°W			Be-7	Sr-89	Sr-90	Zr-95	Cs-137	Ce-144	W-181	W-185	W181/W185
			Lab. A	Lab. A	Lab. A	Lab. A	Lab. A	Lab. A	Lab. A*	Lab. A*	Lab. A
<u>February</u>											
27	20	33	<45	210	5.0	390	8.6	170m	140	190	0.74
26	35	30	540	13000	310	21200m	490	9780	4610	5310m	0.87
27	45	33	520	19100	440	30800m	770	13500	4390	5780	0.76
<u>March</u>											
4	20	29	53	430	11	780m	18	350	250	320	0.78
5	35	25	420	12400	290	18100	450	8580	4180	5590	0.75
12	45	25	850m	5950	250	7640	410	4890	7920m	10180m	0.78a
<u>April</u>											
10	50	28	280	2580	180	2600	330	2730	850	1160	0.73
10	60	28	500	2510	170	2400	310	2510	1580m	2040m	0.77a
11	65	33	1070	2880m	160	1860	310m	2600	2450	3390m	0.72a
17	50	27	520	2970	170	2850	310	2660	3080	4450	0.69
18	60	27	670m	1660	160	2330m	270	2470	3150	4200	0.75
17	65	27	600	1590	150	2090m	260m	2320	3080	4240	0.73
<u>October</u>											
3	18	34	-	17b	0.7	3.7a	1.3	14	14	12a	0.92a
2	25	34	-	20m	1.1	31	1.9	22	38	54a	0.70m
2	40	34	620m	610m	39	920	64	670	920	1280	0.72
9	15	32	-	17a	0.8	NR	1.4	15	NR	7.8a	-
9	25	32	-	22b	0.9	NR	1.6	19	NR	15	-
10	40	32	430	590	36	190m	61	650	380	510m	0.74
14	15	32	-	9c	0.6	NR	0.9	13	NR	15	-
14	25	32	64m	7	4.2	NR	6.6	80	82	100	0.82
15	40	30	470	830b	48	160m	68	770	250	330	0.76
2	50	34	470	1410m	86	1110	150	1390	1300m	1770	0.73
3	60	34	970	2290b	180	1580	310	2750	980	1410	0.70
3	64	34	980m	3100	230	1170	400	3390	750	980	0.77
10	50	32	530	1140	92	190m	150	1510m	630	860	0.73
10	60	32	830	1310b	180	NR	180	2700	68	100	0.68
10	65	32	1000m	810c	160	1350	240	2560	52a	88	0.59
14	50	32	590m	1670c	120	930	200	1820	900	1310	0.69
14	60	32	950	1340	180	600	280	2660	170	240	0.71
15	65	30	590	440	92	580	150	1480	37a	63	0.59m

~70°N-90°N, ~155°W

<u>May</u>											
14	37	23	490m	13300	320	12300	510	9110	4750	6250	0.76
14	38	28	520	11900	280	13300	470	8040	3780	4850	0.78
14	39	26	440	9180	250	13600	410	6230	4130	5870	0.70
14	40	22	440m	7420	210	9160	360	5090	2360	3140	0.75

Table 3. Radioactivity Data
Region: Western USA
Hawaii
Argentina
Sampling Altitude, Various

Western USA, ~30-40°N, ~105°W											
Date 1959	Sampling Altitude	Tropopause Height	Ba-7 Lab. A	Sr-89 Lab. A	Sr-90 Lab. A	Zr-95 Lab. A	Ce-137 Lab. A	Ce-144 Lab. A	W-181* Lab. A	W-185* Lab. A	W181/W185 Lab. A
<u>October</u>											
2	60	44	390	1350	120a	1010	190	1740	1250	1560	0.80
2	64	44	410	2170a	160	300	260	2470	2120a	2880	0.74a
8	60	44	440	1130	110	800	170	1680	1170	1600a	0.73a
9	67	44	320a	1410	180	1580	290	2970	2620	3570	0.73
<u>Hawaii, ~10°N-22°N, ~158°W</u>											
<u>April</u>											
8	10	40	17a	56	1.4	56	2.3	41	20	27	0.74
<u>May</u>											
12	10	42	12a	121	3.1	200	5.2	93a	59	75	0.77
<u>June</u>											
16	10	45	< 3	31	0.9	1.1	1.4	23	16	24	0.67
<u>July</u>											
17	10	46	< 4	20	0.1	NR	NR	3.3	2.1a	< 3	< 0.70a
<u>November</u>											
6	10	40	-	2.3c	0.2	5.3	0.2	2.7	4.8b	7.4	0.65b
<u>Argentina, ~40°S, ~60°W</u>											
<u>April</u>											
3	40	30	130	58b	6.5a	72	11	89	340a	430	0.79a
3	50	30	200a	75a	14	98	25	180	520	670	0.78
10	60	34	220	NR	23	100a	38	250	250	310a	0.81a
10	68	34	300	NR	28	90b	47	330	700	870	0.80
<u>May</u>											
15	40	32	190	50b	9.3	80a	16	120	420	570	0.74
15	50	32	490	NR	18	64a	31	210a	410	520	0.79
8	60	32	290	NR	27a	134	44	270	250a	350	0.71a
8	66	32	700	NR	27	70	46	330	110	ND	-
<u>June</u>											
12	40	32	200a	NR	7.9	14a	13	95	220	280	0.79
12	50	32	120a	NR	9.3	31	15	120a	340	450	0.76
5	60	34	240a	NR	27	88	43	300	240	290	0.83
5	69	34	250a	NR	25	28b	41	310a	25a	< 40	< 0.62a
<u>July</u>											
10	40	38	230a	NR	9.5	19a	16	120	250	310	0.81
10	50	38	120a	NR	12.7	44a	21	160	340	480	0.71
16	60	36	-	NR	4.2	38a	6.6	48	93	110	0.85
16	68	36	210a	NR	47	43	71	590	530	460	1.15
<u>August</u>											
4	40	36	-	NR	9.2	86a	16	120	300	390	0.77
4	50	36	85	NR	12	57a	19	150a	240	320a	0.75a
6	60	34	140a	NR	41	480	67	530a	940	1150	0.82
6	70	34	270a	NR	57	520a	86	760	640	810a	0.79a

*Low values, see text.

Table 6. 1960 Radioactivity Data

Region: Alaska: ~65°W-85°W, ~155°W

Sampling Altitude, 10,000 Ft.

Date	Tropopause Height	Sr-89 Lab. B	Sr-90 Lab. B	Zr-95 Lab. B	Ce-137 Lab. B	Ce-144 Lab. B	W-181 Lab. B	W-185 Lab. B	W181/W185 Lab. B
<u>January</u>									
3	32	6.5b	0.4	9.3	-	6.3	13	16	0.81
5	35	9.3c	0.5	14	1.0	9.2	17	22	0.77
7	28	7.6c	0.5	12	-	7.1	16	20	0.80
10	25	3.7c	0.2	6.0	-	3.5	7.6a	10	0.76a
12	28	4.7b	0.3	7.6	0.5	5.4	9.7a	12	0.81a
14	25	4.8b	0.2	7.4	-	4.3	7.5a	9.4	0.80a
17	30	5.7d	0.5	12	-	8.6	15	20	0.75
19	30	5.5c	0.4	13	0.7	ND	14b	19	0.76b
<u>Sampling Altitude, 18,000 Ft.</u>									
<u>January</u>									
3	32	14	0.8	21	-	14	28	35	0.80
5	35	10	0.6	16	1.1	10	18	25	0.72
7	28	16	1.0	24	-	15	33	41	0.80
10	25	16b	1.0	26a	-	15	33a	44	0.75a
12	28	14	0.9	23	1.6	16	29a	38	0.76a
14	25	8.5b	0.4	11	-	7.5	13a	16	0.81
17	30	11	1.0	25	-	17	31	39	0.79
19	30	13a	1.0	29	1.7	-	35b	45	0.78b
26	34	4.4c	0.3	7.6	0.6	5.3	8.6	12	0.72
<u>February</u>									
3	30	ND	1.1	23	1.7	18	31	39	0.79
10	28	14b	0.8	23	1.4	14	23	29	0.79
17	28	22a	1.6	32	1.8	27	47a	58	0.81a
25	36	26b	0.7	24	1.2	11	16a	25	0.64a
<u>March</u>									
2	31	58b	1.2	37	1.6	19	25a	40a	0.62a
9	32	77b	1.4	50	2.6	24	35	48	0.73
16	28	ND	1.2	89	1.9	18	25	32	0.78
22	31	-	-	172	3.8	36	49	64	0.77
<u>April</u>									
4	26	17b	0.8	50	-	13	16	20	0.80
12	27	11d	1.2	43	1.9	22	30	37	0.81

Table 7. 1960 Radioactivity Data

Region: Alaska; ~65°N-70°N, ~155°W

Sampling Altitude, 40,000 Ft.

Date	Tropopause Height	Be-7 Lab. A	Sr-89 Lab. A Lab. B		Sr-90 Lab. A Lab. B		Zr-95 Lab. A Lab. B		Cs-137 Lab. A Lab. B		Ce-144 Lab. A Lab. B		W-181 Lab. A* Lab. B		W-185 Lab. A* Lab. B		W181/185 Lab. A	W181/185 Lab. B
January																		
5	35	-	-	730	-	70	-	1340	-	120	-	1110	-	1270	-	1590	-	0.80
12	28	-	-	1250b	-	89	-	1690	-	160	-	1300	-	1300	-	1670	-	0.78
19	30	-	-	330c	-	48	-	870	-	74	-	-	-	810	-	1000	-	0.81
26	34	-	-	920a	-	58	-	1250	-	100	-	1010	-	1100b	-	1590a	-	0.69b
February																		
4	31	-	-	ND	-	78	-	1500	-	130	-	1200	-	1100	-	1420	-	0.77
10	29	-	-	1000c	-	77	-	1510	-	140	-	1280	-	1050	-	1370	-	0.77
16	34	580b	-	900c	-	83a	-	1370	-	140b	-	1410a	-	1130	-	1360	-	0.83
26	36	-	-	590d	-	71	-	1060	-	-	-	1130	-	820	-	1150	-	0.71
March																		
2	31	-	-	600c	-	65	-	1220	-	110	-	1050	-	1200	-	1620	-	0.74
9	32	-	-	980b	-	77	-	1190	-	140	-	1290	-	1040	-	1410	-	0.74
17	30	-	-	ND	-	69	-	1380	-	120	-	1270b	-	1000b	-	1400b	-	0.71a
22	31	-	-	-	-	-	-	1200	-	130	-	1250	-	940	-	1260	-	0.75
30	29	-	-	-	-	-	-	1410	-	84	-	1390	-	850	-	1160	-	0.73
April																		
5	27	-	-	730d	-	53	-	900	-	82	-	980	-	660	-	900	-	0.73
12	27	-	-	1300d	-	64	-	1100	-	(120)	-	1230	-	830	-	1180	-	0.70
19	29	620a	ND	-	77	-	-	1290	-	110	-	1420b	-	(870)	-	1480	-	(0.59)
May																		
17	33	-	ND	-	41	-	-	840a	-	72	-	700a	-	(470)	-	820	-	(0.57)
June																		
20	32	350b	ND	-	38	-	-	1100c	-	68	-	690	-	(420)	-	970	-	(0.43)
July																		
18	35	320a	ND	-	27	-	-	730a	-	46	-	480b	-	280a	-	310a	-	0.90a
August																		
16	34	330a	ND	-	17	-	-	1000a	-	31	-	360a	-	200	-	280a	-	0.71a
September																		
20	34	400a	ND	-	22	-	-	880a	-	37	-	440b	-	210a	-	320a	-	0.66b
October																		
17	33	270a	ND	-	11	-	-	ND	-	22	-	250a	-	120a	-	ND	-	-
November																		
17	33	280	ND	-	13	-	-	ND	-	25	-	290b	-	150a	-	ND	-	-
December																		
19	31	470	ND	-	36	-	-	290a	-	63	-	770a	-	290a	-	ND	-	-

*Low values, see text.

~~X~~ ⁹⁰Strontium in Tri-City Diets;
Results for 1966 and 1967 and Comparison with Predictions

by Joseph Rivera (HASL)

In FRC Report #6(1) predictions were made of the concentrations of Sr-90 in the total diet, and in certain diet components, that might be expected in the United States during 1964 and 1965. These predictions were based largely on data obtained from the HASL tri-city diet studies through mid 1964. A description of the formulas used to make these estimates and a comparison of predicted and observed results for 1964 and 1965, together with forecasts for 1966 and 1967 were presented in HASL-173⁽²⁾. In the present report a summary of the data on the Sr-90 content of the diet in New York City, Chicago, and San Francisco during 1966 and 1967 will be given and a comparison with predicted values will be made.

Results

A detailed description of the aims, methods, and results of the tri-city diet studies through 1963 was given in HASL-147⁽³⁾. Results of the analyses of diet components, and estimates of the daily intake of Sr-90 at the three cities during 1966 and 1967 are shown in Table 1.

As in previous years the highest daily intakes of Sr-90 were in New York City, the lowest were in San Francisco, and Chicago had intermediate Sr-90 diet levels. The persistent relative levels of Sr-90 intakes among the three cities is shown graphically in Figure 1. From this figure it can also be seen that the general downward trend in Sr-90 intake levels from the peak values experienced in 1963 and 1964, which began in 1965, continued through 1966 and 1967 although the rate of decrease appears to have diminished.

Predictions and Observations

From the data in Table 1, the concentrations of Sr-90 in the diet categories for which predictions were made in HASL-173 were calculated. These results along with observed Sr-90 fallout rates and cumulative deposition for 1966 and 1967 are listed below (all values are for New York City):

	<u>Predicted</u>		<u>Observed</u>	
	<u>Fallout (S, mCi/km²; R, mCi/km²/yr)</u>			
	S	R	S	R
1966	82	2.6	82	2.4
1967	81	0.81	82	1.6
	<u>Milk (pCi/gCa)</u>			
1966	21		12	
1967	21		10	
	<u>Flour (pCi/kg)</u>			
1966	7		12	
1967	5		6.5	
	<u>Fruits and Vegetables (pCi/gCa)</u>			
1966	55		40	
1967	54		59	
	<u>Total Diet (pCi/gCa)</u>			
1966	25		18	
1967	22		17	

It can be seen that except for milk, there was reasonable agreement between the observations and predictions.

Prediction Models

The methods used in HASL-173 to predict Sr-90 concentrations in specific diet components and in the total diet, were variations of those first suggested by E. Tajima (4) for use by the United Nations Scientific Committee on the Effects of Atomic Radiation.

The approach assumes that the concentrations of Sr-90 in a given food is directly proportional to the fallout rate and to the cumulative deposit of Sr-90 in the soil. The sources of Sr-90 contamination are therefore assumed to be direct deposition and root uptake. Various methods have been used to determine the proportionality factors needed for calculating the Sr-90 concentrations of particular foods for specific conditions. A summary of these methods and estimates of proportionality factors made by different investigators over the last several years for different foods has recently been given by Russel and Burton (5). One of the chief limitations of the approach, in general, lies in the fact that the proportionality factors relating Sr-90 concentrations in foods to the fallout rate (Pr) and to the cumulative deposit of Sr-90 (Pd) are not constant with time. The accuracy of predictions based on this method depends therefore on how rapidly the factors change and of course, on the accuracy of predicted fallout rates and cumulative Sr-90 deposition. For example, the failure of the method to yield reasonable predictions for the Sr-90 content of milk during 1966 and 1967 was due to an overestimate of the soil factor Pd. The factor used in HASL-173 based on data obtained through 1963 was 0.26 while the true factor was probably about 0.15.

The rate of change of the factors Pd and Pr can be seen from the following table which lists the values calculated from data available at different times. The average percent difference between calculated and observed milk Sr-90/Ca ratios (relative error) is also shown as an indication of "goodness" of fit.

Factors for Predicting Sr^{90}/Ca in Milk from $M = \text{PdS} + \text{PrR}$

	<u>Pd</u>	<u>Pr</u>	<u>Avg rel. error</u>
1957-1960	0.25	0.47	7%
1957-1961	0.21	0.58	11%
1957-1962	0.22	0.43	7%
1957-1963	0.20	0.58	14%
1957-1964	0.19	0.61	10%
1957-1965	0.19	0.59	9%
1957-1966	0.16	0.69	12%
1957-1967	0.14	0.75	13%

For the next year or so the soil factor (Pd) for milk predictions can be expected to remain at about 0.15. Since the fallout rate for the next few years is expected to be low ($<1 \text{ mCi Sr}^{90}/\text{km}^2/\text{yr}$), in the absence of large scale nuclear weapons tests milk Sr-90 concentrations in New York City should continue to be about 12 pCi/gCa.

Values of Pd and Pr for the total diet using data from 1960 to 1967 were 0.23 and 0.71 respectively. These are not radically different from the previously estimated values of 0.26 and 0.52 for Pd and Pr. For the next few years we can therefore expect diet Sr^{90}/Ca ratios in New York City of about $0.23 \times 80 = 18 \text{ pCi/gCa}$.

Long term extrapolations from empirical models based on data accumulated over relatively short periods are, of course, potentially subject to great error. It would appear however that since the cumulative Sr-90 deposit presently in soils will probably become less available for root uptake with time, due to penetration to deeper layers of the soil, or to chemical reactions which tend to complex Sr and render it unavailable to plants, predictions of future Sr-90 levels in the diet taking $\text{Pd} \approx 0.23$ will probably give upper limits to the true values.

REFERENCES

- (1) "Revised Fallout Estimates for 1964-1965 and Verification of the 1963 Predictions"
Federal Radiation Council Report #6, October 1964
- (2) Rivera, J.
USAEC Report HASL-173, October (1966), I-75
- (3) Rivera, J. and Harley, J. H.
USAEC Report HASL-147, July (1964)
- (4) Tajima, E. cited in United Nations Scientific Committee on Effects of Atomic Radiation, Suppl. #17 (A/3838) New York, 1958, p. 104
- (5) Russell, R.S. (Editor)
Radioactivity and Human Diet
Chapter 13 (Russell and Burton)
Pergamon Press, New York

Table 1

STRONTIUM-90 IN TRI-CITY DIETS - 1966 AND 1967

	<u>Kg/yr</u>	<u>gCa/yr</u>	Average Values - 1966						Average Values - 1967					
			NEW YORK CITY		CHICAGO		SAN FRANCISCO		NEW YORK CITY		CHICAGO		SAN FRANCISCO	
			<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>
MILK	221	234.5	13.4	2973	10.7	2376	3.6	801	10.5	2330	6.9	1530	2.9	641
FRESH FRUIT	68	12.9	4.6	315	3.4	230	1.9	130	11.3	772	4.5	305	3.4	231
FRESH VEGETABLES	43	15.3	14.6	627	12.4	533	3.1	135	24.4	1048	12.3	528	3.9	167
ROOT VEGETABLES	17	6.3	10.1	172	9.9	169	8.4	143	17.1	290	8.2	139	5.8	99
POTATOES	45	4.9	8.6	389	5.9	265	1.8	79	8.0	362	10.1	455	2.3	104
MACARONI	3	0.6	9.7	29	10.0	30	6.3	19	5.7	17	6.7	20	5.0	15
RICE	3	1.0	3.0	9	2.7	8	2.0	6	2.7	8	2.0	6	2.0	6
FRUIT JUICES	19	1.7	9.7	185	3.8	73	2.3	44	5.8	111	4.0	76	3.6	69
CANNED VEGETABLES	20	4.2	11.7	234	10.7	213	3.5	70	10.7	213	11.8	235	4.6	72
CANNED FRUIT	26	1.3	2.2	57	2.1	54	1.4	36	1.8	48	2.0	52	1.2	30
DRIED BEANS	3	3.1	10.0	30	20.3	61	15.7	47	29.0	87	12.7	38	15.0	45
FLOUR	43	8.6	15.9	683	14.3	612	5.6	238	11.6	497	10.7	459	3.4	145
BAKERY PRODUCTS	37	39.2	14.0	517	13.5	501	7.0	261	6.2	230	9.6	354	5.8	215
WHOLE GRAIN PRODUCTS	11	10.1	34.4	378	25.5	281	18.3	201	15.4	169	26.6	293	12.8	141
MEAT, FISH, POULTRY, EGGS	115	38.8	2.7	312	2.2	258	1.4	156	2.8	319	2.1	236	0.9	105
TOTAL		383		6907		5661		2362		6491		4726		2103
pCi Sr ⁹⁰ /day				18.9		15.5		6.5		17.8		12.9		5.8
pCi Sr ⁹⁰ /gCa				18		15		6.2		17		12		5.5

Figure 1

DAILY INTAKE OF STRONTIUM-90

PART II

~~X~~ HASL FALLOUT PROGRAM DATA

1. Fallout Deposition

1.1 Monthly Precipitation

1.11 Sr^{90} and Sr^{89} in Monthly Deposition at World Land Sites

Precipitation and dry fallout are collected over monthly periods at stations in the United States and overseas. The samples are analyzed for strontium-90, and strontium-89 when it is expected to be present. A description of the sampling network and available data for each site are given in the Appendix, Section A.

1.12 Fission Product and Activation Product Radionuclides in Monthly Deposition at Selected Sites

At a number of stations in the United States, monthly precipitation and dry fallout collections have been analyzed for radiostrontium and other nuclides of interest to the Atomic Energy Commission.

Multi-nuclide analyses of monthly deposition at these sites were discontinued as of July 1967. The complete data are presented on the following pages II-4 through II-25.

Only the table of plutonium data, p. II-25, will be repeated in future quarterly reports, as deposition samples will continue to be collected and analyzed for Pu-238 and Pu-239,240 at New York City and Melbourne, Australia.

1.2 Radiostrontium Deposition at Atlantic Ocean Weather Stations

Measurements of radiostrontium in precipitation and dry fallout collections at four U. S. Coast Guard stations in the North Atlantic Ocean are carried out for comparison with land stations in the same latitude band. A description of the stations and available data are given in the Appendix, Section B.

2. Surface Air Sampling Program:

The Health and Safety Laboratory has been collecting surface air particulate samples at stations in the Western Hemisphere since January 1963. The filters are analyzed for a number of fission and activation product radionuclides. A description of the program and available data are given in the Appendix, Section C. Henceforth the surface air data will appear in the Appendix of each quarterly report. Interpretive reports dealing with the surface air data will be published at least annually in the main body of the report.

3. Radiostrontium in Milk and Tap Water:

Strontium-90 levels in milk distributed in New York City and tap water sampled at the Health and Safety Laboratory have been measured on a monthly basis since 1954. These data are summarized in tabular and graphical forms in the Appendix, Section D.

4. Strontium-90 in Tri-City Diets:

Quarterly estimates of the annual dietary intake of Sr-90 of New York City, Chicago, and San Francisco residents, have been made based on analyses of foods purchased at these three cities every three months since March 1960. A further description of this program and available data are presented on pages II-26 through II-28.

1. ✓ Fallout Deposition

1.12 Fission Product and Activation Product Radionuclides in Monthly Deposition at Selected Sites

Other radionuclides in addition to strontium-90 and strontium-89 have been analyzed in monthly precipitation at selected sites. These sites and the associated analytical laboratory are given below:

<u>Site</u>	<u>Laboratory</u>
Westwood, N. J.	Isotopes, Inc. (Westwood, N. J.)
Appleton, Wisc.	" " " "
Chattanooga, Tenn.	" " " "
Pittsburgh, Pa.	Nuclear Science & Engineering Corp. (Pittsburgh, Pa.)
Louisville, Ky.	Radiochemistry, Inc. (Louisville, Ky.)
Houston, Texas	Tracerlab, A Div. of LFE (Richmond, Calif.)
Richmond, Calif.	" " " " " "
Oklahoma City, Okla.	Hazleton-Nuclear Science Corp. (Palo Alto, Calif)
Palo Alto, Calif.	" " " "
Seattle, Washington	Food, Chemical & Research Labs., Inc. (Seattle, Wash.)
New York City	Health and Safety Laboratory, USAEC, NYO

The radionuclide measurements in monthly precipitation expressed as millicuries per square kilometer are given in the tables starting on p. II-6. A separate listing has been made for each nuclide and the available data are given under the appropriate site heading. The first table consists of monthly precipitation measurements made at each site. Data for the following radionuclides are covered in the tables.

<u>Radionuclides</u>	<u>Type</u>
Mn-54	neutron activation product
Fe-55	" " "
Sr-89	fission product
Sr-90	" "
Zr-95	" "
Rh-102	neutron activation product
Ru-103	fission product
Ru-106	" "
Cd-109	neutron activation product
Sb-124	" " "
Sb-125	fission product
Cs-137	" "
Ba-140	" "
Ce-141	" "
Ce-144	" "
Pu-238	
Pu-239,240	

Data for other radionuclides not reported here, were presented in the July 1, 1966 Quarterly, HASL-146. The identification and data page for each of these radionuclides are as follows:

<u>Radionuclide</u>	<u>Type</u>	<u>Site</u>	<u>Sampling Period</u>	<u>(HASL-146) Page</u>
Cs-136	fission product	Richmond, Calif.	9/61 - 6/62	17
Pm-147	" "	Richmond, Calif.	7/61 - 8/61	17
		Westwood, N. J.	7/61 - 8/61	34
		Pittsburgh, Pa.	7/61 - 8/61	45
W-185	neutron activation product	Richmond, Calif.	6/58 - 6/60	16
Tl-204	" "	Westwood, N. J.	7/62 - 6/63	168
Pu-238		Richmond, Calif.	7/61 - 6/63	17 & 18
Pu-239		" "	7/61 - 6/63	" "
		Louisville, Ky.	2/60 - 6/63	28
		Westwood, N. J.	2/60 - 6/63	34 & 35
		Pittsburgh, Pa.	2/60 - 6/63	44 & 46
		Houston, Texas	1/60 - 6/63	55 & 56

RADIONUCLIDES IN MONTHLY PRECIPITATION
Precipitation Amount
in cm

<u>Year</u>	<u>Month</u>	<u>New York</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Louisville</u>	<u>Houston</u>	<u>Richmond</u>
1957	Jan.	3.99					
	Feb.	6.35					
	Mar.	5.21					
	Apr.	11.46					
	May	9.32					
	June	4.22					
	July	4.22		11.46			
	Aug.	7.29		1.24			
	Sept.	7.64		11.73			
	Oct.	8.30		4.93			
	Nov.	11.30		5.51			
	Dec.	13.36		12.52			
	Total	92.66					
1958	Jan.	9.63	16.31	8.64			
	Feb.	7.57	-	2.54			
	Mar.	8.10	12.50	8.53			16.86
	Apr.	15.60	16.20	9.83			--
	May	8.26	10.10	9.83		3.94	*
	June	6.48	4.83	7.62		5.33	--
	July	9.35	7.06	21.51		4.93	*
	Aug.	5.99	10.95	13.54		16.36	*
	Sept.	11.28	6.76	11.02	7.19	22.61	0.13
	Oct.	13.87	11.99	2.13	4.19	14.99	0.53
	Nov.	4.70	8.79	7.95	7.04	4.19	*
	Dec.	3.18	2.74	3.00	3.02	1.37	4.50
	Total	104.01	108.23	106.14			
1959	Jan.	5.94	6.76	7.11	14.00	14.17	11.23
	Feb.	4.29	5.56	10.18	7.01	15.52	15.54
	Mar.	9.58	9.55	6.35	5.41	2.13	2.06
	Apr.	4.85	8.20	9.27	4.27	17.58	1.12
	May	3.38	2.74	7.42	11.23	19.05	*
	June	10.67	13.87	9.14	2.82	16.56	*
	July	10.87	15.77	8.43	6.63	20.75	*
	Aug.	11.30	14.73	8.94	13.21	17.75	*
	Sept.	2.82	6.15	3.58	1.22	10.77	7.39
	Oct.	12.26	16.15	11.66	8.28	12.42	*
	Nov.	10.72	10.80	7.87	10.54	3.68	*
	Dec.	11.78	11.76	7.29	9.58	14.45	4.11
	Total	98.46	122.04	97.24	94.20	164.83	41.45
1960	Jan.	6.10	7.95	7.34	6.48	4.95	13.97
	Feb.	11.25	12.45	5.26	10.95	10.13	11.76
	Mar.	7.52	5.44	4.09	6.15	--	6.22
	Apr.	7.75	10.13	4.04	2.97	2.16	2.67
	May	7.54	6.86	11.96	8.94	2.24	0.84
	June	4.42	3.81	8.92	25.68	36.52	*
	July	21.06	21.16	7.34	5.05	13.92	*
	Aug.	15.90	17.09	6.35	4.55	18.85	*
	Sept.	13.66	17.65	7.82	7.62	4.72	*
	Oct.	7.16	6.58	4.90	4.01	27.56	0.71
	Nov.	7.75	7.52	3.50	8.51	12.01	12.85
	Dec.	7.72	5.23	7.01	5.18	17.07	1.96
	Total	117.83	121.84	78.53	96.09	150.13	50.98
1961	Jan.	4.78	7.52	2.29	6.12	11.28	7.57
	Feb.	10.06	8.97	7.64	13.31	16.41	3.00
	Mar.	10.74	12.34	9.35	19.38	4.67	7.09
	Apr.	12.90	15.67	8.74	12.27	6.15	2.51
	May	9.14	7.09	8.61	22.86	9.12	0.99
	June	7.26	4.95	10.74	9.12	21.77	*
	July	12.50	17.35	10.36	14.73	21.87	*
	Aug.	7.95	13.89	8.33	2.34	8.20	0.20
	Sept.	4.32	9.35	4.27	3.76	20.04	0.76
	Oct.	5.61	5.23	7.85	5.08	0.53	0.23
	Nov.	6.88	7.49	8.18	10.74	14.48	12.65
	Dec.	7.72	8.79	5.18	9.55	2.24	3.05
	Total	99.86	118.64	91.54	129.26	136.76	38.05

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Precipitation Amount ~ cont'd
in cm.

Year	Month	New York	Westwood	Pittsburgh	Louisville	Houston	Richmond	Appleton	Chattanooga	Oklahoma City	Palo Alto	Seattle
1962	Jan	6 65	7 49	5 16	10 24	3 18	3 02					
	Feb	9 50	11 28	9 04	16 71	1 52	22 56					
	Mar	7 54	11 61	7 67	9 09	1 52	2 16					
	Apr	7 62	8 56	11 58	3 66	12 22	0 79					
	May	3 20	3 20	6 60	7 37	2 92	*					
	June	9 47	15 98	4 09	15 09	18 80	*					
	July	4 24	3 28	8 05	1 65	7 04	*					
	Aug	14 50	18 97	6 35	5 28	7 04	0 25					
	Sept	7 87	8 76	17 42	9 35	10 08	0 25					
	Oct	8 00	11 94	5 46	11 94	7 92	16 59					
	Nov	10 01	12 71	3 53	4 06	14 43	2 29					
	Dec	5 74	7 24	5 94	6 91	12 01	8 38				6 04	
	Total	94 36	120 02	91 09	101 35	98 68	56 29					
1963	Jan	4 90	5 31	5 00	3 00	7 85	11 30				8 48	
	Feb	6 48	3 05	6 48	3 22	4 44	5 38				4 80	
	Mar	9 17	10 21	17 40	22 96	1 40	10 08				11 35	
	Apr	3 22	2 41	7 72	4 75	2 34	10 92				10 21	
	May	5 48	7 39	4 22	11 58	1 57	1 14				14 83	
	June	6 91	9 02		10 62	--	*				0 02	
	July	5 56	12 09							15 09	*	4 60
	Aug	8 15	4 57					5 03	2 11	6 22	*	3 99
	Sept	10 03	11 91					9 70	2 39	4 60	0 46	2 39
	Oct	0 36	2 34					1 57	*	0 51	2 51	10 64
	Nov	20 93	11 38					4 29	17 32	5 05	6 96	20 12
	Dec	5 87	3 84					1 45	11 94	1 70	*	12 06
	Total	87 06	83 52								59 62	
1964	Jan	11 73	8 84					2 64	14 30	1 70	8 66	18 77
	Feb	7 44	4 80					0 41	13 97	5 03	0 64	3 18
	Mar	6 33	5 69					4 22	28 96	3 40	3 53	7 54
	Apr	12 93	15 60					6 60	24 97	5 33	0 10	3 38
	May	1 45	2 67					13 51	12 55	9 50	1 32	3 53
	June	6 78	6 23					3 84	8 43	1 73	1 37	7 80
	July	10 59	12 93					14 05	14 17	2 44	*	--
	Aug	0 61	2 54					6 17	15 72	9 50	0 46	2 49
	Sept	4 29	3 25					9 98	7 57	8 89	*	4 72
	Oct	4 39	3 45					0 79	9 73	2 90	2 21	1 65
	Nov	6 48	6 10					5 41	8 86	15 67	8 15	11 38
	Dec	10 57	10 97					1 40	7 57	1 70	13 11	11 38
	Total	83 79	83 09					69 02	166 60	67 79	39 55	75 82
1965	Jan	7 85	6 40					1 73	8 28	5 05	7 42	14 81
	Feb	9 30	7 72					1 93	11 94	2 87	1 93	11 05
	Mar	6 32	3 96					8 00	25 40	3 10	3 89	1 96
	Apr	7 37	4 60					9 55	9 86	6 63	2 79	9 04
	May	4 01	3 40					5 99	7 11	8 61	*	1 27
	June	3 22	4 98					8 15	10 77	4 98	*	0 96
	July	3 38	8 00					6 35	11 46	4 83	*	1 19
	Aug	6 93	11 61					9 42	11 53	12 75	*	3 91
	Sept	4 32	7 72					19 99	11 76	10 64	*	2 11
	Oct	5 49	6 12					4 75	2 26	3 35	*	4 57
	Nov	3 71	4 78					4 72	10 13	0 10	12 29	12 06
	Dec	4 37	4 34					6 70	2 13	6 86	8 13	14 43
	Total	66 27	73 63					87 28	122 55	69 77	36 45	77 36
1966	Jan	6 68	5 26									12 45
	Feb	12 69	9 65									8 25
	Mar	2 39	3 38									12 09
	Apr	6 83	6 98									5 13
	May	10 82	10 29									3 40
	June	2 97	2 11									1 90
	July	3 18	4 34									1 77
	Aug	4 80	3 89									0 25
	Sept	22 40	23 93									3 86
	Oct	11 78	6 83									6 63
	Nov	8 81	11 00									15 52
	Dec	8 08	7 32									20 17
	Total	101 43	94 98									90 22
1967	Jan	3 53	4 29	-- data not available								18 72
	Feb	6 81	6 48	* zero or trace								4 62
	Mar	15 16	15 92									7 87
	Apr	8 76	6 96									6 48
	May	10 36	8 79									1 12
	June	11 78	6 12									2 54
	July	17 75	14 32									
	Aug	15 09										
	Sept	4 67										
	Oct	8 81										
	Nov	6 58										
	Dec	15 44										
	Total	124 74										

RADIONUCLIDES IN MONTHLY PRECIPITATION

Manganese-54 in mCi per km²
decay corrected to 10/15/61

Year	Month	Westwood	Pittsburgh	Richmond	Appleton	Chattanooga	Oklahoma City	Palo Alto	Seattle
1962	Jan.								
	Feb.								
	Mar.								
	Apr.		3.44						
	May		4.71						
	June		2.85						
	July	1.19	5.83						
	Aug.	3.18	0.85						
	Sept.	0.66	1.90						
	Oct.	3.80	1.60						
	Nov.	1.99	2.32						
	Dec.	2.36	3.12						
	Total								
1963	Jan.	5.64	3.29						
	Feb.	5.64	5.29						
	Mar.	7.49	21.69						
	Apr.	8.14	28.06						
	May	10.62	24.51						
	June	10.69							
	July	38.41					11.88	<0.10	4.21
	Aug.	28.22			8.72	2.84	7.80	2.01	12.42
	Sept.	21.62			13.74	3.71	3.40	<1.51	6.48
	Oct.	5.91			7.53	<1.42	1.98	1.19	11.58
	Nov.	--			5.25	2.78	5.29	3.67	11.12
	Dec.	7.80			<2.84	3.98	1.43	0.61	6.87
	Total	150.18							
1964	Jan.	13.01			5.38	8.68	0.90	5.64	10.77
	Feb.	3.29			1.18	16.17	7.26	0.82	4.86
	Mar.	10.62			6.56	14.05	7.87	2.32	10.00
	Apr.	19.49			9.26	30.88	8.26	0.59	11.46
	May	8.11			23.20	17.22	21.15	1.25	13.59
	June	16.06			6.14	10.65	4.98	0.62	9.15
	July	7.68			8.30	7.22	3.38	0.36	6.29
	Aug.	1.48			3.35	1.95	3.12	0.20	2.96
	Sept.	1.50			<1.67	<0.79	3.84	<0.21	2.50
	Oct.	0.58			0.80	0.76	2.81	0.71	1.78
	Nov.	2.81			3.60	1.78	4.05	2.81	4.44
	Dec.	<1.07			1.23	0.82	0.61	3.94	4.40
	Total	85.70			70.62	110.97	68.23	19.47	82.20
1965	Jan.	4.05			1.81	3.83	1.81	4.86	4.82
	Feb.	6.68			0.76	3.39	5.21	2.10	8.41
	Mar.	3.94			3.45	4.63	2.18	1.77	3.49
	Apr.	5.29			9.53	4.86	3.23	5.02	6.14
	May	4.44			8.30	4.94	10.73	0.54	4.25
	June	5.29				3.33	12.39	0.91	1.03
	July								0.72
	Aug.								1.58
	Sept.								
	Oct.								
	Nov.								
	Dec.								
	Total								
1966	Jan.								
	Feb.								
	Mar.								
	Apr.								
	May								
	June								
	July								
	Aug.								
	Sept.								
	Oct.								
	Nov.								
	Dec.								
	Total								

See available 1962 and 1963 data on p. 167, HASL-146

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION

Iron-55 in mCi per km²

decay corrected to 10/15/61

Year	Month	Westwood	Richmond	Appleton	Chattanooga	Oklahoma City	Palo Alto	Seattle
1962	Jan.							
	Feb.							
	Mar.							
	Apr.							
	May							
	June							
	July	<2.78						
	Aug.	5.02						
	Sept.	2.18						
	Oct.	12.16						
	Nov.	3.77						
	Dec.	2.79						
	Total							
1963	Jan.	6.56						
	Feb.	7.10						
	Mar.	26.17						
	Apr.	21.50						
	May	44.78						
	June	52.11						
	July	43.23				10.62	0.26	4.67
	Aug.	17.79		23.24	8.84	8.88	0.94	9.07
	Sept.	13.43		10.04	2.02	1.82	0.34	5.87
	Oct.	6.95		4.32	<0.25	0.96	0.69	13.20
	Nov.	3.48		2.56	2.69	8.53	2.28	6.95
	Dec.	5.71		1.26	6.45	1.52	0.76	--
	Total	248.81						
1964	Jan.	10.46		2.04	6.52	1.78	4.25	14.17
	Feb.	2.10		0.49	11.08	12.27	1.31	4.21
	Mar.	1.38		0.85	1.94	1.17	1.94	16.40
	Apr.	24.70		13.23	57.13	2.28	0.43	11.27
	May	9.65		24.78	22.39	28.37	2.34	7.76
	June	20.61		8.38	13.70	7.84	2.04	3.77
	July	28.32		48.25	33.93	4.90	0.67	3.45
	Aug.	2.68		3.10	5.10	6.68	1.08	2.43
	Sept.	2.36		7.26	2.45	6.10	5.06	2.35
	Oct.	2.40		1.73	2.82	3.85	1.03	1.64
	Nov.	2.42		3.62	2.52	6.33	2.69	4.55
	Dec.	<0.29		2.10	0.99	0.94	4.36	3.77
	Total	107.57		115.83	160.57	82.51	27.20	75.77
1965	Jan.	4.86		1.91	6.18	2.44	5.06	3.56
	Feb.	7.10		1.62	4.79	2.37	1.84	10.31
	Mar.	4.94		4.52	9.50	2.51	3.57	4.59
	Apr.	4.48		8.26	6.37	5.13	4.28	7.56
	May	4.35		6.76	4.40	10.23	1.12	4.44
	June	6.95		5.02	5.75	8.18	1.10	2.04
	July	4.79		2.79	3.28	5.87	1.26	<0.54
	Aug.	3.22		4.71	1.41	8.07	<0.39	2.59
	Sept.	1.40		3.13	1.29	2.96	0.88	1.11
	Oct.	1.74		1.64	1.13	0.80	<0.17	0.92
	Nov.	2.22		2.64	2.52	1.35	5.21	1.82
	Dec.	1.49		1.94	0.96	4.21	1.87	0.02
	Total	47.74		44.94	47.58	54.12	26.75	39.50
1966	Jan.	1.51						0.02
	Feb.	1.36						0.16
	Mar.	2.95						5.79
	Apr.	2.28						6.14
	May	4.16						3.56
	June	0.89						1.42
	July	1.72						1.03
	Aug.	0.86						0.83
	Sept.	0.84						1.07
	Oct.	0.36						0.96
	Nov.	0.48						0.46
	Dec.	0.52						1.89
	Total	17.93						23.33
1967	Jan.	1.25						1.22
	Feb.	0.66						2.26
	Mar.	1.22						2.01
	Apr.	1.31						2.76
	May	1.28						0.28
	June	0.80						2.32
	July	1.08						

See available 1962 and 1963 data on p. 167, HASL-146

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Strontium-89 in mCi per km²
decay corrected to the midpoint of the sampling month

<u>Year</u>	<u>Month</u>	<u>New York</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Louisville</u>	<u>Houston</u>	<u>Richmond</u>
1957	Jan	24 09					
	Feb	4 28					
	Mar	--					
	Apr	--					
	May	4 36					
	June	8 88					
	July	5 83					
	Aug	11 39					
	Sept	7 45		2 24			
	Oct	8 96		3 13			
	Nov	3 40		1 50			
	Dec	4 63		3 13			
	Total	83 27					
1958	Jan	10 46		1 66			
	Feb	7 60		1 47			
	Mar	5 83		2 01			31 54
	Apr	7 02	14 98	5 25			2 62
	May	11 16	12 39	3 47		1 35	4 09
	June	8 14	4 98	13 51		6 60	0 83
	July	6 72	17 02	35 90		13 97	0 54
	Aug	4 63	9 73	15 83		13 12	0 32
	Sept	7 02	7 30	6 60	1 47	5 44	0 50
	Oct	21 69	30 34	5 94	4 13	8 30	0 89
	Nov	10 96	20 57	9 53	4 44	3 01	0 07
	Dec	31 42	9 73	7 41	9 26	7 45	5 44
	Total	132 65					
1959	Jan	14 71	15 63	13 20	37 33	15 86	21 73
	Feb	15 44	13 93	15 76	19 42	15 71	28 02
	Mar	25 56	23 70	23 47	27 56	9 11	4 28
	Apr	29 10	24 36	22 12	16 75	16 37	1 89
	May	2 61	6 06	7 26	13 82	13 20	0 56
	June	8 65	5 71	3 59	2 32	1 92	0 05
	July	0 63	0 82	0 81	1 01	1 15	0 10
	Aug	0 26	0 31	0 30	0 08	0 23	0 02
	Sept	0 05	<0 03	0 01	0 06	0 15	0 04
	Oct	0 05	0 15	0 03	0 15	0 02	0 01
	Nov	0 04	0 12	0 06	0 12	0 10	0 01
	Dec	<0 02	0 23	0 05	0 40	0 07	0 02
	Total	97 12	91 05	108 58	119 02	73 89	56 73
1960	Jan	0 05	<0 02	0 02	0 39	0 03	0 13
	Feb	0 47	0 45	0 21	0 64	0 82	0 13
	Mar	0 12	0 10	0 23	0 59	--	0 94
	Apr	0 15	<0 01	0 08	0 08	0 22	0 02
	May	0 06	<0 02	0 08	0 08	0 01	0 01
	June	0 06	<0 01	0 04	0 07	<0 01	0 01
	July	--	--	--	0 04	--	--
	Aug	--	--	--	--	--	--
	Sept	--	--	--	--	--	--
	Oct	--	--	--	--	--	--
	Nov	--	--	--	--	--	--
	Dec	--	--	--	--	--	--
	Total	0 91	0 61	0 66	1 89	1 09	1 24
1961	Jan	--	--	--		--	--
	Feb	--	--	--		--	--
	Mar	--	--	--		--	--
	Apr	--	--	--		--	--
	May	--	--	--		--	--
	June	--	--	--		--	--
	July	--	--	--		--	--
	Aug	--	--	--		--	--
	Sept	1 67	1 71	0 52	1 15	0 24	0 14
	Oct	10 07	8 22	10 62	7 06	0 64	2 30
	Nov	30 76	37 83	20 69	24 12	8 92	37 67
	Dec	26 13	27 87	23 78	21 46	6 37	11 04
	Total	68 63	75 63	55 61	53 79	16 17	51 15

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Strontium-89 - cont'd
in mCi per Km²
decay corrected to midpoint of sampling month

Year	Month	New York	Westwood	Pittsburgh	Louisville	Houston	Richmond	Appleton	Chattanooga	Oklahoma City	Palo Alto	Seattle
1962	Jan.	24.32	26.17	24.63	36.40	18.18	12.04					
	Feb.	29.30	35.70	22.58	25.24	6.83	42.85					
	Mar.	7.49	15.09	17.68	28.60	7.10	5.56					
	Apr.	19.61	24.28	22.00	7.49	24.09	3.20					
	May	10.81	10.00	12.93	24.59	3.36	0.11					
	June	8.18	9.92	3.81	14.86	13.82	0.20					
	July	6.21	6.48	8.80	5.44	(5.36	0.10					
	Aug.	6.52	6.83	6.18	4.86							
	Sept.	8.07	7.06	11.00	7.22	1.63	0.48					
	Oct.	23.51	30.53	12.93	11.46	10.04	6.87					
	Nov.	16.88	32.04	26.44	23.85	73.34	6.06					
	Dec.	34.51	32.62	22.77	12.51	21.96	14.36					
	Total	195.21	236.72	191.75	202.52	185.71	91.91					
1963	Jan.	27.68	28.45	22.43	16.79	28.95	28.06				29.64	
	Feb.	38.99	19.53	20.69	16.98	23.16	21.50				28.52	
	Mar.	36.79	27.98	39.37	34.86	3.36	35.12				19.92	
	Apr.	--	23.31	27.17	21.69	4.55	23.43				18.06	
	May	16.79	19.99	15.13	40.92	6.29	2.54				4.98	
	June	8.45	8.80		21.77	0.46	0.20				0.47	
	July	7.64	12.42							7.68	0.69	1.37
	Aug.	5.67	4.01					2.81	1.00	1.67	0.92	1.49
	Sept.	2.11	2.58					2.08	0.37	0.60	0.15	0.21
	Oct.	0.08	0.60					0.67	<0.05	0.18	0.14	0.99
	Nov.	1.07	0.59					0.54	0.45	1.21	0.30	0.21
	Dec.	0.42	0.18					0.10	0.38	0.07	0.02	0.41
	Total	145.68	148.44								103.81	
1964	Jan.	0.31	0.26					0.13	0.35	<0.03	<0.16	0.25
	Feb.	--	0.07					<0.04	0.33	0.17	0.03	0.09
	Mar.	--	0.08					0.13	<0.08	<0.14	<0.05	<0.04
	Apr.	--	--					--	--	<0.67	<0.01	<0.03
	May	--	--					--	--	<0.10	<0.05	0.04
	June	--	--					--	--	<0.05	<0.02	<0.04
	July	--	--					--	--	--	--	<0.01
	Aug.	--	--					--	--	--	--	<0.05
	Sept.	--	--					--	--	--	--	<0.02
	Oct.	0.37	<0.15					0.10	1.24	0.69	0.20	0.15
	Nov.	--	0.25					<1.00	<0.32	1.59	0.65	1.43
	Dec.	--	<0.01					<0.03	0.06	0.01	0.08	<0.02
	Total	0.68	<0.82					<1.43	<2.38	<3.45	<1.25	<2.17
1965	Jan.									<0.01	0.02	--
	Feb.									0.03	0.01	--
	Mar.											--
	Apr.											--
	May											<0.05
	June											0.44
	July											0.07
	Aug.											0.07
	Sept.											
	Oct.											
	Nov.											
	Dec.											
	Total											
1966	Jan.											
	Feb.											
	Mar.											
	Apr.											
	May											
	June											
	July											
	Aug.											
	Sept.											
	Oct.											
	Nov.											
	Dec.											
	Total											
1967	Jan.											2.64
	Feb.											1.05
	Mar.											1.54

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Strontium⁹⁰
in mCi per Km²
decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>New York</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Louisville</u>	<u>Houston</u>	<u>Richmond</u>
1957	Jan.	0.10					
	Feb.	0.20					
	Mar.	0.40					
	Apr.	1.85					
	May	0.36					
	June	0.32					
	July	0.32		0.33			
	Aug.	0.19	0.42	0.06			
	Sept.	0.16	0.46	0.06			
	Oct.	0.15	0.31	0.12			
	Nov.	0.16	0.21	0.11			
	Dec.	0.23	0.44	0.24			
	Total	4.44					
1958	Jan.	0.50	0.59	0.26			
	Feb.	0.48	0.28	0.14			
	Mar.	0.34	0.39	0.18			1.44
	Apr.	0.59	0.67	0.39			0.22
	May	1.02	1.08	0.33		0.14	0.22
	June	0.68	0.40	0.98		0.27	0.10
	July	0.61	0.42	0.89		0.21	0.03
	Aug.	0.23	0.43	0.64		0.24	0.01
	Sept.	0.25	0.27	0.26	0.10	0.19	0.03
	Oct.	0.41	0.63	0.21	0.18	0.25	0.03
	Nov.	0.38	0.53	0.28	0.26	0.09	0.01
	Dec.	0.68	0.30	0.29	0.23	0.18	0.15
	Total	6.17	5.99	4.85			
1959	Jan.	0.46	0.54	0.56	0.84	0.47	0.72
	Feb.	0.67	0.56	0.77	0.61	0.71	1.02
	Mar.	1.96	1.81	1.33	1.22	0.55	0.30
	Apr.	2.42	2.43	2.08	1.29	1.58	0.18
	May	0.50	1.02	1.12	1.15	2.32	0.08
	June	1.71	1.46	0.80	0.36	0.37	0.01
	July	0.19	0.68	0.26	0.26	0.34	*
	Aug.	0.26	0.39	0.17	0.11	0.13	*
	Sept.	0.05	0.03	0.02	0.03	0.15	0.04
	Oct.	0.14	0.16	0.14	0.14	0.23	0.01
	Nov.	0.12	0.10	0.14	0.09	0.02	*
	Dec.	0.20	0.13	0.13	0.17	0.08	0.05
	Total	8.68	9.33	7.52	6.27	6.95	2.41
1960	Jan.	0.17	0.10	0.10	0.35	0.06	0.14
	Feb.	0.31	0.26	0.15	0.47	0.24	0.14
	Mar.	0.12	0.14	0.13	0.14	--	0.16
	Apr.	0.16	0.30	0.20	0.22	0.10	0.03
	May	0.28	0.31	0.31	0.46	0.03	0.03
	June	0.16	0.18	0.31	0.50	0.22	*
	July	0.10	0.22	0.18	0.07	0.04	0.01
	Aug.	0.08	0.13	0.09	0.05	0.12	0.01
	Sept.	0.06	0.11	0.06	0.03	0.03	*
	Oct.	0.04	0.05	0.05	0.06	0.09	0.01
	Nov.	0.05	0.05	0.05	0.05	0.04	0.05
	Dec.	0.04	0.03	0.07	0.03	0.06	0.03
	Total	1.57	1.88	1.70	2.43	1.03	0.61
1961	Jan.	0.04	0.07	0.05	0.05	0.10	0.05
	Feb.	0.06	0.10	0.22	0.13	0.18	0.02
	Mar.	0.26	0.31	0.30	0.20	0.09	0.07
	Apr.	0.37	0.61	0.43	0.40	0.26	0.05
	May	0.32	0.26	0.36	0.47	0.06	0.10
	June	0.16	0.18	0.32	0.16	0.16	0.01
	July	0.08	0.15	0.16	0.16	0.10	0.01
	Aug.	0.05	0.08	0.08	0.06	0.08	0.02
	Sept.	0.02	0.06	0.03	0.04	0.03	0.01
	Oct.	0.12	0.12	0.15	0.10	0.01	0.03
	Nov.	0.37	0.45	0.27	0.29	0.15	0.50
	Dec.	0.56	0.56	0.37	0.34	0.14	0.25
	Total	2.41	2.95	2.74	2.40	1.36	1.12

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Strontium-90 in mCi per Km² cont'd
decay corrected to midpoint of sampling month

Year	Month	New York	Westwood	Pittsburgh	Louisville	Houston	Richmond	Appleton	Chattanooga	Oklahoma City	Palo Alto	Seattle
1962	Jan	0 44	0 57	0 51	0 79	0 31	0 32					
	Feb	1 80	1 18	0 80	0 92	0 25	1 64					
	Mar	0 86	0 81	0 87	1 16	0 39	0 26					
	Apr	1 29	2 13	1 49	0 51	1 86	0 29					
	May	1 54	1 02	1 35	1 52	0 17	0 02					
	June	1 56	1 84	0 60	1 55	1 59	0 04					
	July	1 10	1 01	1 46	0 40	0 53	0 03					
	Aug	1 29	1 33	1 24	0 33	0 33	0 02					
	Sept	0 44	0 47	0 59	0 21	0 20	0 03					
	Oct	0 64	1 20	0 53	0 66	0 45	0 41					
	Nov	0 75	0 96	0 61	1 07	0 95	0 12					
	Dec	0 62	1 14	0 73	0 46	0 72	0 39				0 29	
	Total	12 33	13 66	10 78	9 58	7 42	3 57					
1963	Jan	0 92	1 03	0 79	0 66	0 94	0 98				0 87	
	Feb	2 05	1 04	0 90	0 84	1 11	0 97				1 30	
	Mar	0 98	2 43	2 83	2 70	0 37	2 19				1 38	
	Apr	2 10	3 00	3 04	1 53	0 83	2 60				1 85	
	May	1 90	3 79	2 20	5 80	0 96	0 40				0 83	
	June	2 00	2 43		4 02	2 16	0 10				0 11	
	July	5 73	5 17							1 67	0 03	0 49
	Aug	3 78	2 21					1 50	0 58	0 81	0 09	0 69
	Sept	1 62	2 06					1 54	0 37	0 53	0 14	0 93
	Oct	0 09	0 60					0 67	0 05	0 17	0 24	1 04
	Nov	1 79	0 98					0 94	0 78	0 45	0 48	1 49
	Dec	0 83	0 55					0 20	0 61	0 16	0 06	1 07
	Total	23 79	25 29								7 38	
1964	Jan	1 04	1 04					0 59	1 29	0 18	0 74	1 51
	Feb	2 10	0 42					0 12	1 85	1 03	0 10	0 57
	Mar	1 83	1 35					0 82	1 88	1 41	0 58	1 41
	Apr	4 74	2 58					1 35	4 40	1 33	0 05	1 54
	May	0 52	0 86					2 46	2 11	2 34	0 22	1 87
	June	2 55	2 39					0 77	1 43	0 73	0 12	1 15
	July	1 28	1 07					1 19	0 86	0 46	0 03	0 68
	Aug	0 39	0 43					0 71	0 72	0 34	0 08	0 33
	Sept	0 23	0 11					0 65	0 19	0 42	0 01	0 30
	Oct	0 29	0 31					0 38	0 43	0 36	0 10	0 18
	Nov	0 32	0 34					0 45	0 21	0 46	0 33	0 80
	Dec	0 56	0 08					0 16	0 05	0 04	0 49	0 62
	Total	15 85	10 98					9 65	15 42	9 50	2 85	10 96
1965	Jan	0 38	0 42					0 16	0 38	0 14	0 37	0 50
	Feb	0 76	0 66					0 14	0 54	0 54	0 13	1 23
	Mar	0 82	0 54					0 54	0 82	0 15	0 34	0 32
	Apr	1 01	0 87					1 47	0 89	0 55	0 44	0 71
	May	0 43	0 51					1 24	0 66	1 22	0 02	0 43
	June	0 63	1 10					0 78	0 64	1 10	0 04	0 21
	July	0 55	0 62					0 32	0 39	0 63	0 02	0 10
	Aug	0 39	0 34					0 51	0 16	0 71	0 02	0 25
	Sept	0 11	0 15					0 27	0 12	0 17	0 02	0 09
	Oct	0 18	0 18					0 17	0 08	0 06	*	0 11
	Nov	0 15	0 18					0 20	0 25	0 07	0 55	0 22
	Dec	0 11	0 13					0 17	0 06	0 44	0 18	0 26
	Total	5 52	5 70					5 97	4 99	5 78	2 13	4 42
1966	Jan	0 12	0 14									0 22
	Feb	0 17	0 11									0 24
	Mar	0 28	0 40									0 46
	Apr	0 45	0 43									0 28
	May	0 56	0 69									0 38
	June	0 16	0 19									0 15
	July	0 09	0 15									0 12
	Aug	0 12	0 05									0 02
	Sept	0 22	0 12									0 08
	Oct	0 08	0 03									0 05
	Nov	0 08	0 08									0 16
	Dec	0 10	0 06									0 14
	Total	2 43	2 45									2 30
1967	Jan	0 16	0 12									0 11
	Feb	0 11	0 07									0 09
	Mar	0 17	0 20									0 18
	Apr	0 24	0 19									0 14
	May	0 31	0 17									0 02
	June	0 13	0 07									0 05
	July	0 18	0 10									
	Aug	0 12										
	Sept	0 04										
	Oct	0 04										
	Nov	0 05										
	Dec	0 09										
	Total	1 64										

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Zirconium-95
in mCi per Km²
decay corrected to midpoint of sampling month

Year	Month	Westwood	Pittsburgh	Houston	Richmond	Appleton	Chattanooga	Oklahoma City	Palo Alto	Seattle
1961	Jan									
	Feb									
	Mar									
	Apr									
	May									
	June									
	July									
	Aug									
	Sept	20 46	0 52	1 45	13 66					
	Oct	21 38	20 23	3 47	2 59					
	Nov	61 37	29 41	23 93	29 22					
	Dec	52 11	33 93	--	--					
	Total									
1962	Jan	41 69	22 27	8 11	--					
	Feb	50 57	20 23	6 56	20 26					
	Mar	18 80	22 35	32 42	10 77					
	Apr	32 23	32 12	50 95	--					
	May	15 59	26 90	10 73	0 02					
	June	22 20	3 80	77 97	0 93					
	July	14 32	16 87	(60	0 52					
	Aug	25 59	21 85	(	0 40					
	Sept	11 31	21 92	22 27	1 22					
	Oct	45 55	34 93	29 22	13 01					
	Nov	37 02	35 05	42 07	15 56					
	Dec	79 13	30 76	51 72	28 14					
	Total	394 00	289 05	339 62	90 83					
1963	Jan	48 25	27 52	28 52	41 69					
	Feb	27 95	22 43	32 08	27 29					
	Mar	47 86	43 23	9 65	51 72					
	Apr	38 60	37 06	19 30	52 50					
	May	49 79	20 42	15 44	10 30					
	June	22 69		17 18	1 58					
	July	33 20					6 83	0 11	2 41	
	Aug	--				--	4 55	3 31	0 50	4 77
	Sept	8 07				7 49	2 70	1 97	0 68	3 40
	Oct	2 04				2 20	<1 58	1 13	0 61	3 00
	Nov	--				2 15	1 33	1 06	1 03	2 22
	Dec	1 74				0 50	1 67	0 04	0 27	1 63
	Total	280 39								
1964	Jan	1 60			0 93	2 12	0 22	2 67	1 15	
	Feb	0 42			0 15	1 68	0 97	0 55	0 06	
	Mar	1 03			0 61	--	0 13	0 18	0 66	
	Apr	1 87			0 98		3 34	0 21	0 05	0 77
	May	0 34			0 97		1 04	0 60	0 09	0 51
	June	0 52			0 26		0 49	0 10	0 08	0 32
	July	0 23			0 29		0 23	0 08	0 04	0 15
	Aug	0 13			0 15		0 15	0 08	0 02	0 03
	Sept	<0 03			0 11		0 03	0 07	0 02	0 05
	Oct	0 05			0 43		0 74	0 36	0 11	0 12
	Nov	0 65			0 29		*	0 32	0 20	0 34
	Dec	<0 10			0 04		<0 03	0 03	0 05	0 09
	Total	6 97			5 21	9 85	3 17	4 06	5 05	
1965	Jan	0 16			<0 12	<0 14	*	*	0 01	
	Feb	<0 04			<0 18	<0 05	*	*	0 02	
	Mar	<0 03			<0 02	<0 06	<0 02	<0 03	0 02	
	Apr	<0 06			<0 04	<0 03	<0 01	<0 03	<0 02	
	May	0 35			2 73	0 69	1 06	0 06	<0 01	
	June	0 82			0 36	0 66			0 60	
	July								0 07	
	Aug								0 03	
	Sept									
	Oct									
	Nov									
	Dec									
	Total									
1966	Jan									
	Feb									
	Mar									
	Apr									
	May									
	June									
	July									
	Aug									
	Sept									
	Oct									
	Nov									
	Dec									
	Total									
1967	Jan									
	Feb									
	Mar									

-- data not available
* zero or trace

4 25
1 97
0 80

RADIONUCLIDES IN MONTHLY PRECIPITATION

Rhodium-102
in mCi per Km²

<u>Year</u>	<u>Month</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Richmond</u>
1960	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July	0.00020		
	Aug.	0.00016		
	Sept.	0.00012		
	Oct.	0.00090		
	Nov.	0.00128		
	Dec.	0.00034		
	Total			
1961	Jan.	0.00080		
	Feb.	0.00018		
	Mar.	0.00536		
	Apr.	0.00525		
	May	0.00945		
	June	0.00510		
	July	0.00183	*	
	Aug.	0.00100	*	<0.02
	Sept.	0.00080	*	<0.01
	Oct.	0.00037	0.03	<0.02
	Nov.	0.00052	0.01	<0.02
	Dec.	0.00055	<0.03	<0.05
	Total			
1962	Jan.	0.00087	<0.01	0.46
	Feb.	0.00180	*	<0.23
	Mar.	--	<0.02	--
	Apr.	0.00128	0.06	--
	May	0.00048	<0.15	--
	June	0.00159	0.02	0.07
	July	0.00094		
	Aug.	0.00096		
	Sept.	0.00032		
	Oct.	0.00161		
	Nov.	0.00036		
	Dec.	0.00022		
	Total			
1963	Jan.	0.00024		
	Feb.	0.00028		
	Mar.	0.00038		
	Apr.	0.00051		
	May	--		
	June	0.00044		
	July	0.00033		
	Aug.	<0.00010		
	Sept.	<0.00010		
	Oct.	<0.00007		
	Nov.	0.00005		
	Dec.	<0.00005		
	Total			
1964	Jan.	<0.00007		
	Feb.	0.00006		
	Mar.	0.00008		
	Apr.	0.00008		
	May	0.00007		
	June	0.00003		
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			

-- data not available

* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
 Ruthenium-103
 in mCi per Km²
 Decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>Richmond</u>
1961	Jan.	
	Feb.	
	Mar.	
	Apr.	
	May	
	June	
	July	
	Aug.	<0.10
	Sept.	1.18
	Oct.	6.79
	Nov.	24.04
	Dec.	10.62
	Total	
1962	Jan.	9.26
	Feb.	<77.20
	Mar.	--
	Apr.	--
	May	--
	June	--
	July	--
	Aug.	--
	Sept.	0.89
	Oct.	11.39
	Nov.	10.04
	Dec.	17.91
	Total	
1963	Jan.	61.37
	Feb.	35.51
	Mar.	34.93
	Apr.	--
	May	--
	June	<2.77
	July	
	Aug.	
	Sept.	
	Oct.	
	Nov.	
	Dec.	

-- data not available
 * zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
 Ruthenium-106
 in mCi per Km²
 decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Richmond</u>
1960	Jan.			
	Feb.			
	Mar.			
	Apr.			
	May			
	June			
	July		0.75	
	Aug.		2.50	
	Sept.		0.31	
	Oct.		1.12	
	Nov.		0.25	
	Dec.		0.28	
	Total			
1961	Jan.		0.11	
	Feb.		0.38	
	Mar.		0.58	
	Apr.		0.51	
	May		0.81	
	June		0.68	
	July	1.08	0.38	
	Aug.	0.32	0.23	*
	Sept.	0.34	0.18	0.03
	Oct.	0.92	2.16	0.37
	Nov.	3.09	3.24	3.59
	Dec.	5.33	4.98	2.40
	Total			
1962	Jan.	5.25	7.53	4.63
	Feb.	15.13	12.54	17.37
	Mar.	2.95	12.31	3.39
	Apr.	19.14	26.75	4.52
	May	6.76	16.64	0.25
	June	20.38	4.75	0.64
	July			0.41
	Aug.			0.15
	Sept.			0.40
	Oct.			3.60
	Nov.			1.46
	Dec.			4.60
	Total			
1963	Jan.			13.74
	Feb.			10.50
	Mar.			30.38
	Apr.			34.00
	May			20.88
	June			3.67
	July			
	Aug.			
	Sept.			
	Oct.			
	Nov.			
	Dec.			
	Total			

-- data not available
 * zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION

Cadmium-109 in mCi per km²

decay corrected to 7/9/62

<u>Year</u>	<u>Month</u>	<u>New York</u>	<u>Westwood</u>	<u>Appleton</u>	<u>Chattanooga</u>	<u>Oklahoma City</u>	<u>Palo Alto</u>	<u>Seattle</u>
1964	Jan.							
	Feb.							
	Mar.							
	Apr.							
	May							
	June							
	July							
	Aug.							<0.20
	Sept.							<0.02
	Oct.							<0.04
	Nov.							<0.05
	Dec.							<0.03
	Total							
1965	Jan.							<0.03
	Feb.		<0.01	<0.01	<0.01			0.04
	Mar.		<0.01	<0.02	<0.03	<0.02	<0.01	0.04
	Apr.		<0.01	<0.01	<0.01	<0.04	<0.01	<0.01
	May		<0.01	<0.02	<0.01	0.21	<0.01	<0.04
	June		<0.04	<0.02	<0.01	0.05	<0.02	<0.04
	July		<0.01	<0.01	<0.03	<0.01	<0.01	0.06
	Aug.		0.14	<0.01	<0.01	<0.01	<0.01	<0.03
	Sept.		<0.02	<0.01	<0.01	<0.01	<0.01	<0.02
	Oct.		<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	Nov.		<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
	Dec.	0.0018	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	Total							
1966	Jan.	0.0018	0.16					<0.02
	Feb.	<0.0021	<0.011					0.04
	Mar.	<0.0054	<0.008					0.02
	Apr.	0.0170	<0.006					0.04
	May	0.0054	<0.009					<0.01
	June		<0.016					0.05
	July		<0.009					0.03
	Aug.		<0.011					<0.03
	Sept.		0.034					0.06
	Oct.		<0.011					0.04
	Nov.		<0.013					<0.05
	Dec.		<0.012					0.01
	Total							
1967	Jan.		<0.009					<0.02
	Feb.		<0.014					0.03
	Mar.		<0.014					0.04
	Apr.		<0.015					0.04
	May		<0.012					0.03
	June		<0.014					<0.03
	July		<0.012					

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Antimony-124
in mCi per Km²
decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Richmond</u>	<u>Appleton</u>	<u>Chattanooga</u>	<u>Oklahoma City</u>	<u>Palo Alto</u>	<u>Seattle</u>
1962	Jan.								
	Feb.								
	Mar.								
	Apr.		<1.08						
	May		<0.69						
	June		--						
	July	0.17	0.22						
	Aug.	0.10	<0.12						
	Sept.	0.14	0.06						
	Oct.	0.06	0.09						
	Nov.	0.03	0.08						
	Dec.	0.04	0.06						
	Total								
1963	Jan.	<0.15	0.12						
	Feb.	0.17	<0.12						
	Mar.	0.06	0.30						
	Apr.	0.06	0.12						
	May	<0.03	0.05						
	June	0.02					*	*	<0.98
	July	0.32					*	*	<0.32
	Aug.	<0.49			<0.11	0.08	*	*	0.23
	Sept.	<0.10			<0.66	<0.05	*	*	0.23
	Oct.	<0.10			<0.26	<0.32	*	*	0.37
	Nov.	<0.57			<0.59	<1.35	*	*	<0.69
	Dec.	--			--	<0.18	*	*	
	Total								
1964	Jan.	<0.17			--	--	*	*	
	Feb.	<0.22			<0.42	<0.23	*	*	
	Mar.	<0.15			<0.29	<0.45	*	*	
	Apr.								
	May								
	June								
	July								
	Aug.								
	Sept.								
	Oct.								
	Nov.								
	Dec.								

See available data for 1962 and 1963 on p. 167, HASL-146

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
 Antimony-125
 in mCi per Km²
 decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>Oklahoma City</u>	<u>Palo Alto</u>
1963	Jan.		
	Feb.		
	Mar.		
	Apr.		
	May		
	June		
	July	1.26	0.02
	Aug.	0.77	0.06
	Sept.	0.69	0.17
	Oct.	0.21	0.25
	Nov.	0.86	0.33
	Dec.	0.25	0.15
	Total		
1964	Jan.	0.14	0.58
	Feb.	0.74	0.11
	Mar.	1.03	0.32
	Apr.	1.47	0.07
	May	2.67	0.18
	June	0.68	0.08
	July	0.15	0.06
	Aug.	0.53	0.08
	Sept.	0.34	--
	Oct.	0.28	0.08
	Nov.	0.37	0.17
	Dec.	0.05	0.30
	Total		

-- data not available
 * zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Cesium-137 in mCi per km²
decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>New York</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Houston</u>	<u>Richmond</u>	<u>Appleton</u>	<u>Chattanooga</u>	<u>Oklahoma City</u>	<u>Palo Alto</u>	<u>Seattle</u>
1961	Jan.										
	Feb.										
	Mar.										
	Apr.										
	May										
	June										
	July		0.24	0.29		0.02					
	Aug.		0.20	0.15		0.02					
	Sept.		0.16	0.06		0.02					
	Oct.		0.25	0.27		0.04					
	Nov.		0.76	0.46		0.70					
	Dec.		0.98	0.65		0.28					
	Total										
1962	Jan.		1.05	--		0.46					
	Feb.		1.82	--		2.20					
	Mar.		1.19	1.88		0.50					
	Apr.		3.16	3.75		0.50					
	May		1.46	2.68		0.04					
	June		3.25	1.07		0.08					
	July		1.20	2.31		0.07					
	Aug.		1.88	--		0.05					
	Sept.		0.68	0.96		0.08					
	Oct.		1.83	0.83		0.62					
	Nov.		1.13	0.95	1.73	0.22					
	Dec.		--	1.10	1.27	0.70					
	Total					5.52					
1963	Jan.		1.48	1.23	--	1.62					
	Feb.		1.33	1.51	2.08	1.60					
	Mar.		3.54	5.02	0.77	4.05					
	Apr.		4.21	5.48	7.91	4.21					
	May		5.67	3.85	19.26	0.62					
	June		3.54		5.17	0.17					
	July		6.68					2.84	0.05	0.52	
	Aug.		4.71				2.16	1.02	1.71	0.20	0.89
	Sept.		3.37				2.49	0.64	0.76	0.25	1.23
	Oct.		0.99				1.36	0.12	0.35	0.34	0.81
	Nov.		1.88				1.69	1.62	0.97	0.74	1.58
	Dec.		0.63				0.17	1.16	0.30	0.15	1.85
	Total		38.03								
1964	Jan.		2.00			1.05	2.02	0.26	0.90	2.12	
	Feb.	3.13	0.95			0.25	4.01	1.72	0.24	0.94	
	Mar.	2.73	2.50			1.50	4.79	1.88	0.69	1.87	
	Apr.	7.06	4.48			2.37	9.65	2.14	0.15	1.90	
	May	0.68	1.36			4.17	3.26	4.17	0.43	2.40	
	June	3.70	4.13			1.31	2.52	1.01	0.14	1.73	
	July	1.65	1.86			2.29	1.27	0.68	0.07	1.02	
	Aug.	0.57	0.63			1.20	0.80	0.79	0.12	0.53	
	Sept.	0.19	0.29			1.13	0.34	0.58	0.04	0.57	
	Oct.	0.30	0.46			0.30	0.45	0.51	0.14	0.29	
	Nov.	0.37	0.45			0.70	0.16	0.64	0.45	0.88	
	Dec.	0.55	0.02			0.26	0.13	0.11	0.67	0.91	
	Total		19.13			16.53	29.40	14.49	4.04	15.16	
1965	Jan.	0.45	0.71			0.22	0.65	0.20	0.45	0.78	
	Feb.	1.01	1.11			0.22	0.89	0.68	0.19	1.55	
	Mar.	0.76	0.64			0.60	0.92	0.24	0.46	0.51	
	Apr.	1.39	1.23			2.08	1.22	0.65	0.54	0.94	
	May	0.63	0.68			1.41	1.13	1.56	0.62	0.59	
	June	0.55	1.42			1.02	0.81	1.48	0.08	0.25	
	July	0.73								0.19	
	Aug.	0.47								0.39	
	Sept.	0.13									
	Oct.	--									
	Nov.	--									
	Dec.	0.19									
	Total										
1966	Jan.	0.20									
	Feb.	0.28									
	Mar.	0.35									
	Apr.	0.49									
	May	0.55									
	June										
	July										
	Aug.										
	Sept.										
	Oct.										
	Nov.										
	Dec.										

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Barium-140
in mCi per Km²
decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Houston</u>	<u>Richmond</u>	<u>Seattle</u>
1958	Jan.					
	Feb.					
	Mar.				134.33	
	Apr.				7.57	
	May				5.02	
	June				0.36	
	July				1.91	
	Aug.				0.51	
	Sept.				--	
	Oct.				--	
	Nov.				0.19	
	Dec.					
	Total					
1959						
1960						
1961	Jan.					
	Feb.					
	Mar.					
	Apr.					
	May					
	June					
	July					
	Aug.					
	Sept.	33.97	2.54	9.38	8.22	
	Oct.	29.03	23.39	--	--	
	Nov.	69.48	22.85	--	--	
	Dec.	25.36	9.22	22.38	--	
	Total					
1962	Jan.	3.90	3.79	8.18	2.83	
	Feb.	2.39	1.37	1.11		
	Mar.			1.11		
	Apr.					
	May					
	June					
	July					
	Aug.					
	Sept.			12.27		
	Oct.			1.64		
	Nov.			34.32		
	Dec.			275.22		
	Total					
1963						
1964	Jan.					
	Feb.					
	Mar.					
	Apr.					
	May					
	June					
	July					
	Aug.					
	Sept.					
	Oct.					0.83
	Nov.					1.66
	Dec.					

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Cerium-141
in mCi per Km²
decay corrected to midpoint of sampling month

<u>Year</u>	<u>Month</u>	<u>Westwood</u>	<u>Pittsburgh</u>	<u>Houston</u>	<u>Richmond</u>	<u>Seattle</u>
1961	Jan					
	Feb					
	Mar					
	Apr					
	May					
	June					
	July					
	Aug				1 48	
	Sept	19 69	1 41	1 99	13 43	
	Oct	12 12	20 84	*	23 93	
	Nov	59 83	35 90	*	43 62	
	Dec	21 08	39 76	--	13 43	
	Total					
1962	Jan	15 02	24 70	--	*	
	Feb	23 66	31 27	< 0 77	*	
	Mar	6 45	35 90	*	*	
	Apr	1 33	23 93	*	*	
	May	1 35	20 07	*	*	
	June	< 4 25	3 16	*	*	
	July	< 2 97	< 23 93	{<2 32	*	
	Aug	< 4 63	28 56		*	
	Sept	9 73	30 76	< 3 86	*	
	Oct	37 25	41 69	26 25	< 8 26	
	Nov	36 24	82 60	143 59	17 79	
	Dec	26 13	44 00	49 41	27 37	
	Total					
1963	Jan	< 5 52	26 44	29 45	33 97	
	Feb	< 4 09	13 74	25 98	16 21	
	Mar	16 91	*	< 11 58	*	
	Apr	< 6 36	*	< 8 68	*	
	May	< 17 91	*	*	< 2 56	
	June	< 4 40		< 11 97	< 2 56	
	July					
	Aug					
	Sept					
	Oct					
	Nov					
	Dec					
	Total					
1964	Jan					
	Feb					
	Mar					
	Apr					
	May					
	June					
	July					
	Aug					
	Sept					
	Oct					0 83
	Nov					1 23
	Dec					--
	Total					
1965	Jan					--
	Feb					--
	Mar					--
	Apr					--
	May					4 32
	June					1 97
	July					1 31
	Aug					1 30
	Sept					
	Oct					
	Nov					
	Dec					
	Total					
1966	Jan					
	Feb					
	Mar					
	Apr					
	May					
	June					
	July					
	Aug					
	Sept					
	Oct					
	Nov					
	Dec					
	Total					
1967	Jan					76 8
	Feb					2 82
	Mar					1 89

-- data not available
* zero or trace

RADIONUCLIDES IN MONTHLY PRECIPITATION
Cerium-144 in mCi per Km²
decay corrected to midpoint of sampling month

Year	Month	Westwood	Pittsburgh	Louisville	Houston	Richmond	Appleton	Chattanooga	Chickamauga	Wiley P.	Fort Rife	Seattle
1960	Jan	0 80			0 97	2 38						
	Feb	0 51	1 05	0 09	2 12	1 14						
	Mar	0 43	0 86	0 26	--	1 35						
	Apr	1 12	1 08	0 83	1 10	0 24						
	May	1 37	1 42	0 09	0 48	0 19						
	June	0 76	1 41	0 22	1 21	0 05						
	July	--	0 62	1 10	0 55	0 06						
	Aug	0 49	0 40	0 69	1 03	0 06						
	Sept	0 44	0 28	0 26	0 34	0 04						
	Oct	0 20	0 22	0 21	0 13	0 14						
	Nov	0 14	0 17	0 28	0 23	0 20						
	Dec	0 14	0 23	0 13	0 22	0 12						
	Total	6 40	7 74	4 16	8 38	5 97						
1961	Jan	0 24	0 14	0 24	0 30	0 20						
	Feb	0 27	0 64	0 41	0 46	0 09						
	Mar	1 07	0 92	0 68	0 35	0 30						
	Apr	1 20	1 32	1 41	0 72	0 18						
	May	0 83	0 85	1 53	0 33	0 48						
	June	0 68	0 80	0 54	0 66	0 08						
	July	0 86	0 37		0 28	0 17						
	Aug	0 61	0 23		0 39	0 04						
	Sept	1 25	0 19		0 55	1 18						
	Oct	3 22	3 21		0 70	1 27						
	Nov	15 59	8 14		7 84	20 84						
	Dec	20 77	10 77		--	10 85						
	Total	46 59	27 58		12 58	35 68						
1962	Jan	19 18	18 68		--	9 26						
	Feb	31 50	24 63		8 99	14 05						
	Mar	18 61	29 88		29 84	10 04						
	Apr	42 07	49 41		69 87	7 33						
	May	19 11	36 82		7 91	0 67						
	June	47 48	10 50		52 88	0 87						
	July	19 11	31 07		8 49	0 66						
	Aug	25 48	19 30			3 53						
	Sept	8 84	13 59		16 17	1 13						
	Oct	27 95	12 97		15 48	9 84						
	Nov	18 76	23 31		37 60	5 44						
	Dec	28 56	21 23		25 21	15 29						
	Total	304 65	291 39		272 44	78 11						
1963	Jan	23 20	22 62		27 91	34 08						
	Feb	27 91	24 70		35 56	27 52						
	Mar	57 13	78 61		14 67	60 22						
	Apr	74 50	66 78		27 40	73 73						
	May	78 40	48 64		26 52	12 43						
	June	44 78			32 04	2 79						
	July	71 80							23 35	0 36	5 40	
	Aug	48 76							15 86	1 64	11 77	
	Sept	36 40							8 96	2 71	12 55	
	Oct	11 27							2 62	2 29	14 01	
	Nov	20 81							14 98	5 02	4 71	16 33
	Dec	11 58							4 98	15 25	5 60	2 03
	Total	505 98										
1964	Jan	22 31			9 92	19 80			2 38	6 52	19 07	
	Feb	7 14			2 09	27 99			14 55	3 31	7 53	
	Mar	18 99			9 65	36 59			12 35	6 68	12 85	
	Apr	29 26			16 79	64 85			15 13	2 20	14 71	
	May	8 53			28 99	26 36			31 11	4 21	12 27	
	June	24 01			7 37	12 97			9 65	2 04	8 57	
	July	10 31			13 59	9 73			4 25	0 46	6 02	
	Aug	3 00			7 41	11 00			4 63	0 34	3 00	
	Sept	1 85			6 37	--			3 26	0 15	2 70	
	Oct	0 95			1 72	3 63			2 29	0 64	1 67	
	Nov	1 88			3 17	1 85			3 44	1 99	3 82	
	Dec	0 06			1 06	0 50			0 44	2 67	3 44	
	Total	128 29					108 13	215 27	103 48	31 41	95 65	
1965	Jan	2 47			1 28	2 39			0 67	1 71	3 01	
	Feb	2 71			0 80	2 94			1 93	0 59	5 52	
	Mar	2 22			2 49	3 61			0 84	1 31	1 81	
	Apr	3 90			0 66	--			1 79	1 52	2 59	
	May	1 91			4 40	2 57			3 85	0 17	1 69	
	June	3 94			3 17	2 83			4 28	0 24	0 90	
	July	1 95			1 71	1 35			2 58	0 11	0 54	
	Aug	1 15			1 73	0 56			2 31	0 05	1 20	
	Sept	0 48			0 83	0 32			0 63	0 10	0 37	
	Oct	0 52			0 47	0 27			0 21	0 03	0 38	
	Nov	0 47			0 42	0 55			0 24	1 24	1 02	
	Dec	0 27			0 47	0 20			1 74	0 66	0 50	
	Total	21 99					18 43	17 79	21 07	7 73	19 53	
1966	Jan	0 34									0 42	
	Feb	0 36									0 43	
	Mar	0 69									0 81	
	Apr	0 59									0 58	
	May	1 26									0 60	
	June	0 40									0 29	
	July	0 18									0 27	
	Aug	0 10									0 11	
	Sept										0 10	
	Oct										0 13	
	Nov										0 40	
	Dec										0 19	
	Total										4 33	
1967	Jan										0 81	
	Feb										0 64	
	Mar										0 40	
	Apr										0 19	
	May										0 12	
	June										0 08	

RADIONUCLIDES IN MONTHLY PRECIPITATION

PLUTONIUM in mCi per Km²

Year	Month	Pu-238				Pu-239,240			
		New York	Westwood ⁽¹⁾	Seattle ⁽¹⁾	Melbourne	New York	Westwood	Seattle ⁽¹⁾	Melbourne
1965	Jan.								
	Feb.								
	Mar.								
	Apr.								
	May								
	June								
	July								
	Aug.								
	Sept.								
	Oct.								
	Nov.			0.0007				0.0046	
	Dec.	0.00009		0.0005		0.00322		0.0016	
Total									
1966	Jan.	0.00012		<0.0002		0.00349		0.0027	
	Feb.	0.00030		<0.0002		0.00319		0.0013	
	Mar.	0.00012		0.0008		0.00202		0.0137	
	Apr.	0.00018		0.0180		0.00460		0.0074	
	May	0.00057		0.0038	0.00005	0.00446		0.0086	0.00014
	June	0.00017		0.0120	0.00031	0.00224		0.0053	0.00057
	July	0.00030	0.0003	0.0006	---	0.00249	0.0038	0.0016	---
	Aug.	0.00027	0.0008	<0.0004	0.00041	0.00221	0.0009	0.0006	0.00048
	Sept.	0.00021	0.0022	0.0006	0.00049	0.00146	0.0018	0.0019	0.00051
	Oct.	0.00017	0.0005	<0.0002	0.00280	0.00176	0.0004	0.0014	0.00280
	Nov.	0.00015	0.0014	<0.0040	0.00100	0.00082	0.0009	0.0013	0.00084
	Dec.	0.00027	0.0006	0.0007	0.00224	0.00147	0.0004	0.0023	0.00148
Total		0.00283				0.03021		0.0481	
1967	Jan.	0.00014	0.0026	0.0001	0.00067	0.00167	0.0015	0.0006	0.00044
	Feb.	0.00020	0.0020	0.0014	0.00028	0.00192	0.0010	0.0009	0.00018
	Mar.	0.00034	0.0024	0.0011	0.00030	0.00199	0.0023	0.0002	0.00011
	Apr.	0.00154	0.0045	0.0020	0.00046	0.00519	0.0025	<0.0001	0.00018
	May	0.00091	0.0045	0.0008	0.00048	0.00306	0.0018	<0.0001	0.00021
	June	0.00057	0.0019	0.0010	0.00041	0.00129	0.0009	<0.0002	0.00021
	July	0.00245	0.0019	--	0.00072	0.00257	0.0005	--	0.00049

R A T I O S

Year	Month	Pu ²³⁸ /Pu ^{239,240}				Pu ^{239,240} /Sr ⁹⁰			
		New York	Westwood ⁽¹⁾	Seattle ⁽¹⁾	Melbourne	New York	Westwood	Seattle ⁽¹⁾	Melbourne
1965	Nov.			0.143				0.021	
	Dec.	0.028		0.288		0.029		0.006	
1966	Jan.	0.034		<0.085		0.029		0.012	
	Feb.	0.094		<0.169		0.012		0.005	
	Mar.	0.059		0.056		0.007		0.030	
	Apr.	0.039		2.4		0.012		0.026	
	May	0.128		0.44	0.34	0.010		0.023	
	June	0.075		2.3	0.55	0.014		0.035	
	July	0.120	0.068	0.37	--	0.028	0.026	0.013	
	Aug.	0.121	0.804	--	0.84	0.016	0.018	0.030	
	Sept.	0.142	1.23	0.32	0.97	0.007	0.016	0.024	
	Oct.	0.098	1.19	--	1.00	0.029	0.012	0.028	
	Nov.	0.18	1.61	--	1.20	0.016	0.011	0.008	
	Dec.	0.18	1.47	0.32	1.51	0.015	0.007	0.017	
1967	Jan.	0.08	1.72	0.12	1.51	0.017	0.013	0.006	
	Feb.	0.12	1.95	1.56	1.53	0.019	0.019	0.007	
	Mar.	0.17	1.01	5.80	2.69	0.010	0.012	0.001	
	Apr.	0.30	1.44	22.6	2.57		0.013	<0.001	
	May	0.30	2.55	13.8	2.26		0.010	0.003	
	June	0.44	2.77	5.19	1.92		0.009	0.004	
	July	0.95	4.23	--	1.46		0.004	--	

(1) values suspect
-- data not available

4. Tri-City Diet Studies - Second, Third and Fourth Quarters - 1967

by J. Rivera - (HASL)

Quarterly estimates of the annual dietary intake of Sr-90 of New York City, Chicago and San Francisco residents have been made based on the analyses of foods purchased at these cities every three months since March 1960. The foods purchased were grouped in nineteen categories prior to ashing for analysis. Starting in 1965, to reduce the number of analyses required for this program, only 14 of the diet categories were analyzed on a quarterly basis. From data obtained over a four-year period the contribution of eggs, poultry, fresh fish, shellfish, and meat to the total annual intake of Sr-90 was about 5%, therefore this amount was added to the computed intake of Sr-90 from the 14 categories analyzed to obtain quarterly estimates of annual Sr-90 intake at the three cities.

The results of the analyses of foods and estimates of the intake of Sr-90 at each of the cities made this way are shown in Table 4a, 4b and 4c. The estimated average daily intakes of Sr-90 at each of the cities since the tri-city diet studies began are shown in Figure 3.

Details of the sampling methods and a description of the results of these studies obtained through 1963 may be found in HASL-147 (HASL Contributions to the Study of Fallout in Food Chains, Joseph Rivera and John Harley, July 1, 1964).

Table 4a

STRONTIUM-90 IN TRI-CITY DIETS - SECOND QUARTER - 1967

	<u>kg/yr</u>	<u>gCa/yr</u>	CHICAGO <u>pCi/kg</u>	4/67 <u>pCi/yr</u>	NEW YORK CITY 5/67 <u>pCi/kg</u>	<u>pCi/yr</u>	SAN FRANCISCO 6/67 <u>pCi/kg</u>	<u>pCi/yr</u>
MILK	221	234.5	9.5	2100	10.4	2298	4.4	972
FRESH FRUIT	68	12.9	2.6	177	11.8	802	2.6	177
FRESH VEGETABLES	43	15.3	13.1	563	33.7	1449	4.2	181
ROOT VEGETABLES	17	6.3	9.0	153	19.1	325	7.6	129
POTATOES	45	4.9	6.6	297	9.8	441	1.7	77
MACARONI	3	0.6	8.1	24	3.9	12	6.5	20
RICE	3	1.0	1.8	5	1.9	6	2.4	7
FRUIT JUICES	19	1.7	4.8	91	7.1	135	4.4	84
CANNED VEGETABLES	20	4.2	15.4	308	6.8	136	4.7	94
CANNED FRUIT	26	1.3	2.1	55	1.5	39	1.8	47
DRIED BEANS	3	3.1	31.7	9	8.7	26	30.7	92
FLOUR	43	8.6	8.5	366	8.8	378	4.5	194
BAKERY PRODUCTS	37	39.2	3.6	133	8.2	303	12.0	444
WHOLE GRAIN PRODUCTS	11	10.1	12.5	138	19.6	216	21.3	234
MEAT, FISH, POULTRY, EGGS	115	38.8	-	233*	-	346*	-	145*
TOTAL		383		4652		6912		2897
pCi Sr ⁹⁰ /day				12.7		18.9		7.9
pCi Sr ⁹⁰ /g Ca				12		18		7.6

*Estimated as 5% of total intake.

Table 4b

STRONTIUM-90 IN TRI-CITY DIETS - THIRD QUARTER - 1967

	<u>kg/yr</u>	<u>gCa/yr</u>	<u>CHICAGO 7/67</u>		<u>NEW YORK CITY 8/67</u>		<u>SAN FRANCISCO 9/67</u>	
			<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>
MILK	221	234.5	6.2	1370	12.9	2851	2.1	464
FRESH FRUIT	68	12.9	4.6	313	5.3	360	1.9	129
FRESH VEGETABLES	43	15.3	-	528**	15.7	675	2.8	120
ROOT VEGETABLES	17	6.3	5.1	87	30.0	510	6.7	114
POTATOES	45	4.9	-	455**	12.1	545	2.3	104
MACARONI	3	0.6	5.9	18	6.4	19	5.0	15
RICE	3	1.0	2.9	9	1.8	5	1.9	6
FRUIT JUICES	19	1.7	3.8	72	6.0	114	3.0	57
CANNED VEGETABLES	20	4.2	7.4	148	9.3	186	5.2	104
CANNED FRUIT	26	1.3	1.2	31	1.5	39	0.6	16
DRIED BEANS	3	3.1	13.7	41	62.5	188	10.4	31
FLOUR	43	8.6	13.0	559	11.4	490	3.0	129
BAKERY PRODUCTS	37	39.2	16.1	596	-	230**	3.5	130
WHOLE GRAIN PRODUCTS	11	10.1	39.9	439	-	169**	8.8	97
MEAT, FISH, POULTRY, EGGS	115	38.8	-	246*	-	341*	-	79*
TOTAL		383		4912		6822		1595
pCi Sr ⁹⁰ /day				13.5		18.7		4.4
pCi Sr ⁹⁰ /g Ca				13		18		4.2

*Estimated as 5% of total intake

**Estimated from other sampling dates

Table 4c

STRONTIUM-90 IN TRI-CITY DIETS - FOURTH QUARTER - 1967

	<u>kg/yr</u>	<u>gCa/yr</u>	<u>CHICAGO 10/67</u>		<u>NEW YORK CITY 11/67</u>		<u>SAN FRANCISCO 12/67</u>	
			<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>	<u>pCi/kg</u>	<u>pCi/yr</u>
MILK	221	234.5	6.0	1326	8.3	1834	1.6	354
FRESH FRUIT	68	12.9	3.7	252	13.7	932	1.2	82
FRESH VEGETABLES	43	15.3	6.1	262	38.5	1656	4.5	194
ROOT VEGETABLES	17	6.3	8.1	138	9.8	167	2.1	36
POTATOES	45	4.9	-	455**	9.3	419	2.9	131
MACARONI	3	0.6	5.1	15	5.1	15	3.0	9
RICE	3	1.0	1.9	6	3.7	11	1.5	5
FRUIT JUICES	19	1.7	3.2	61	3.2	61	1.6	30
CANNED VEGETABLES	20	4.2	13.2	264	10.1	202	2.4	48
CANNED FRUIT	26	1.3	2.1	55	1.0	26	1.0	26
DRIED BEANS	3	3.1	12.5	38	28.6	86	16.9	51
FLOUR	43	8.6	8.8	378	14.0	602	3.1	133
BAKERY PRODUCTS	37	39.2	9.1	337	5.2	192	2.8	104
WHOLE GRAIN PRODUCTS	11	10.1	14.4	158	15.6	172	3.6	40
MEAT, FISH, POULTRY, EGGS	115	38.8	-	197*	-	336*	-	65*
TOTAL		383		3942		6711		1308
pCi Sr ⁹⁰ /day				10.8		18.4		3.6
pCi Sr ⁹⁰ /g Ca				10		18		3.4

*Estimated as 5% of total intake.

**Estimated from other sampling dates.

Figure 3

DAILY INTAKE OF STRONTIUM-90

PART III

DATA FROM SOURCES OTHER THAN HASL

Numerous fallout studies are conducted by other organizations in the United States and abroad. Some of these are sent to the editors for dissemination in these HASL Quarterly reports. Submitted data are reproduced essentially as received and no interpretation by HASL is attempted.

	<u>Page</u>
1. National Radiation Laboratory, Department of Health Christchurch, New Zealand Environmental Radioactivity in New Zealand Quarterly Report for July-September 1967; NRL F.26	III - 2
2. Department of Scientific and Industrial Research The Institute of Nuclear Sciences, Lower Hutt, New Zealand "Radioisotopes in Rainwater" a. Results for May to August 1967 b. Results for Sept. to Dec. 1967	III - 26
3. Division of Biological and Medical Research Argonne National Laboratory "Cs-137 in Various Chicago Foods (Collection month Jan. 1968) by S. S. Brar and D. M. Nelson	III - 29
4. EURATOM Joint Nuclear Research Centre Ispra Establishment: Protection Service Site Survey and Meteorology Section, Quarterly Report	III - 34

DEPARTMENT OF HEALTH

QUARTERLY REPORT
JULY — SEPTEMBER 1967

ENVIRONMENTAL RADIOACTIVITY IN NEW ZEALAND

AND

RESULTS OF EXTENDED MONITORING OF FALLOUT
FROM FRENCH NUCLEAR TESTS IN THE PACIFIC

NATIONAL RADIATION LABORATORY
P.O. BOX 1456, CHRISTCHURCH, NEW ZEALAND

SYMBOLS UNITS AND EQUIVALENTS

UNITS OF RADIOACTIVITY

Ci	Curie	3.7×10^{10}	disintegrations per second
mCi	millicurie	10^{-3}	Curies
pCi	picocurie	10^{-12}	Curies 2.22 disintegrations per minute

UNITS OF LENGTH, AREA, VOLUME AND MASS
AND THEIR EQUIVALENTS IN THE IMPERIAL SYSTEM

cm	centimetre	0.394 inches
km ²	square kilometre	0.386 square miles
m ³	cubic metre	35.31 cubic feet
litre	litre	0.880 quart
g	gram	0.0353 ounce

NOTES

1. Unless otherwise noted, all times given in this report are New Zealand Standard time i.e. G.M.T. + 12 hours.

2. Radioactive fallout in rain is expressed as:

(a) Deposition - millicuries per square kilometre (mCi/km²)

(b) Concentration - picocuries per litre (pCi/litre)

$$\text{Concentration (pCi/litre)} = \frac{\text{deposition (mCi/km}^2\text{)}}{\text{rainfall (cm)}} \times 100$$

Multiply mCi/km² by 2.59 to obtain mCi/sq. mile.

3. The levels of strontium-90 contamination in food and bone are given in "Strontium Units" i.e. picocuries strontium-90 per gram of calciumpCi Sr⁹⁰/g Ca.

Similarly caesium-137 results are given as picocuries of caesium-137 per gram of potassium.....pCi Cs¹³⁷/g K.

One litre of whole milk contains approximately:

1.2 g of calcium

1.4 g of potassium.

CONTENTS

	PAGE
LOCATION OF COLLECTING STATIONS IN NEW ZEALAND, FIG. 1a	2
LOCATION OF MONITORING AND COLLECTING STATIONS IN THE PACIFIC, FIG 1b	3

SUMMARY

GRAPHICAL SUMMARY OF LONG TERM MEASUREMENTS FIG. 2	4
(A) RESULTS OF ROUTINE MONITORING OF FALLOUT DURING THIRD QUARTER 1967	5
(B) RESULTS OF EXTENDED MONITORING OF FALLOUT FROM FRENCH NUCLEAR TESTS IN THE PACIFIC	7
(C) HAZARD ASSESSMENT	9

SECTION A - RESULTS OF ROUTINE MONITORING OF FALLOUT DURING SECOND QUARTER 1967

Total Beta Activity of Air Samples, Table 1	12
Total Beta Activity of Weekly Rainwater Collections, Table 2 ..	12
Strontium-90 in Rain, Table 3	13
Strontium-89 in Rain, Table 4	14
Strontium-90, Strontium-89 and Caesium-137 in Milk, Table 5	15

SECTION B - RESULTS OF EXTENDED MONITORING OF FALLOUT FROM FRENCH NUCLEAR TESTS IN THE PACIFIC

Total Beta Activity of Daily Air Filter Samples, Table 1.	16
Total Beta Activity of Daily Air Filter Samples, Fig. 1	17
Total Beta Activity of Weekly Rainwater Samples, Table 2	18
Average Daily Deposition of Fission Products, Fig. 2	20
Iodine-131 in Milk, Table 3	21
Iodine-131 in Cattle Thyroids, Table 4	21
Iodine-131 in Cattle Thyroids, Fig. 3	22

LOCATION OF COLLECTING STATIONS ESTABLISHED BY THE NATIONAL RADIATION LABORATORY FOR AIR (A), BONE (B), MILK (M), RAINWATER (R), SOIL (S), AND THYROIDS (T) SAMPLES IN NEW ZEALAND. Where more than one type of collection is performed (e.g. weekly and monthly rainwater collection) the appropriate symbol is shown twice. Collection areas not confined to a single location but extending over part of a province or district are shown thus NAME

FIG. 1b

LOCATION OF MONITORING AND COLLECTING STATIONS ESTABLISHED BY THE NATIONAL RADIATION LABORATORY ON PACIFIC ISLANDS. GAMMA RADIATION MONITORING STATIONS (G), AND COLLECTING STATIONS FOR AIR (A), AND RAINWATER (R), AND MILK (M) SAMPLES ARE MARKED * Officially proclaimed danger zone shown thus

FIG. 2

SUMMARY OF LONG TERM MEASUREMENTS

SUMMARY

GENERAL

In SECTION A, the results of routine monitoring of fallout during the third quarter 1967 are given.

In SECTION B, the results of extended monitoring of fallout from the French nuclear tests in the Pacific are given. Three nuclear devices were exploded at Mururoa in the Tuamotu Archipelago during this year's test series. The reported dates of these tests were 6 June, 28 June and 3 July (New Zealand Standard Time). The locations of collecting and monitoring stations and types of samples collected are shown in Fig.1a for New Zealand, and Fig.1b for the Pacific Area.

Our extended monitoring programme commenced on 1 June and results were given in the previous report No.NRL. F25 for all samples which had been received and measured up to about the end of August. This covered the period of greatest interest. Subsequent results up to the end of September, when this extended monitoring programme terminated are given in this report. The graphical presentation of these results, however, has been brought up to date and is given for the entire extended monitoring period in this report.

In this summary a distinction is made between the levels of radioactivity due to long-lived radionuclides (which are of major significance in assessing health hazards) and short-lived radionuclides from the recent nuclear tests in the Pacific which, although showing increased levels of radioactivity during limited periods, are of less significance in assessing health hazards. The measurement of Strontium-89 in routine rain and milk samples has been continued since July 1966. Although these measurements are part of the extended monitoring programme, the results are included in Section A where comparisons are made with Strontium-90 levels.

The evaluation of potential health hazard is discussed in this summary. As was anticipated the results for September, the concluding month of the extended monitoring programme, were not of great significance and the overall evaluation of environmental contamination from the 1967 nuclear tests remains substantially as given in the previous report.

(A) RESULTS OF ROUTINE MONITORING OF FALLOUT DURING THIRD QUARTER 1967

TOTAL BETA ACTIVITY

Fission products in air and rainwater which had fallen to pre-test levels (1966 tests) during the second quarter of 1967 showed significant increases during the third quarter 1967 following the resumption of atmospheric testing in June.

STRONTIUM-89

Strontium-89 levels in rain and milk samples, which were at about minimum detectable levels during the second quarter 1967, also showed significant increases during the third quarter 1967.

STRONTIUM-90 AND CAESIUM-137

The levels of these long-lived fallout products have increased during this quarter.

SUMMARY Cont.

The country-wide average deposition of Strontium-90 in rain has increased from 0.13 mCi/km² during the second quarter to 0.24 mCi/km² during the third quarter. This level is about one fifth of the highest level previously recorded during the first quarter 1965.

The country-wide average level of Strontium-90 in milk has increased from 5.0 Strontium Units during May-June to 7.4 Strontium Units during July-August. The July-August level is less than one half of the highest level previously recorded which was 15.9 Strontium Units during July-August 1964.

The country-wide average level of Caesium-137 in milk has decreased from 32 pCi/gK during the second quarter to 24 pCi/gK during the third quarter. This level is less than one third of the highest level previously recorded which was 81 pCi/gK during the first quarter 1965.

The following table compares values obtained for this period with values for the previous period:

FISSION PRODUCTS IN AIR		- MEASUREMENTS AT SELECTED STATIONS	
		2nd Quarter 1967	3rd Quarter 1967
Total Beta	) Auckland Wellington Christchurch	0.03	0.13
Activity		0.02	0.08
pCi/m ³		0.03	0.09

FISSION PRODUCTS IN RAIN		- MEASUREMENTS AT SELECTED STATIONS	
		2nd Quarter 1967	3rd Quarter 1967
Total Beta	) Greymouth Christchurch	4.7	36.4
Activity		1.7	5.3
mCi/km ²			

STRONTIUM RADIOISOTOPES IN RAIN		- COUNTRY-WIDE AVERAGE		-	9 STATIONS
		2nd Quarter 1967	3rd Quarter 1967		
Strontium-90*, Deposition	mCi/km ²	0.13	0.24		
Strontium-90, Concentration	pCi/litre	0.6	0.9		
Strontium-89*, Deposition	mCi/km ²	<0.1	3.2		
Ratio Strontium-89/Strontium-90		1	12		

STRONTIUM RADIOISOTOPES IN MILK		- COUNTRY-WIDE AVERAGE		-	9 STATIONS
		May-Jun.	July-Aug.		
Strontium-90	pCi/g Ca	5.0	7.4		
Strontium-89	pCi/g Ca	1	28		
Ratio Strontium-89/Strontium-90		<1	4		

CAESIUM-137 IN MILK		- COUNTRY-WIDE AVERAGE		-	9 STATIONS
		2nd Quarter 1967	3rd Quarter 1967		
Caesium-137	pCi/g K	32	24		

* These values are the sums of the monthly depositions during the quarter.

SUMMARY Cont.

(B) RESULTS OF EXTENDED MONITORING OF FALLOUT FROM FRENCH NUCLEAR TESTS IN THE PACIFIC

GAMMA RAY RADIATION MONITORING

No gamma ray radiation readings exceeding 0.3 mR/hr (the lowest reporting level set for this monitoring service) were reported from any of the six Pacific Island stations where these measurements were made.

TOTAL BETA ACTIVITY OF DAILY AIR FILTER SAMPLES

The results of measurements on daily air filter samples are tabled for September and graphed for the entire monitoring period in Section B. Transient increases in air radioactivity have been detected at all stations during the monitoring period. The daily results have been averaged over each calendar month for each station and are summarized here:

AIR FILTERS	1967 AVERAGE MONTHLY AIR ACTIVITY - pCi/m ³			
	June	July	August	September
Nandi, Fiji	0.06	0.73	0.54	0.18
Suva, Fiji	0.06	0.65	0.53	0.25
Apia, Samoa	1.40	2.49	0.45	0.24
Auckland	0.03	0.07	0.24	0.09
Wellington	0.02	0.05	0.14	0.05
Christchurch	0.05	0.06	0.16	0.06

The highest monthly averages recorded during last year's monitoring programme were:

4.40 pCi/m ³	at Nandi	during September	1966
0.66 " " "	Auckland	" October	1966
0.38 " " "	Wellington	" "	1966
0.44 " " "	Christchurch	" "	1966

Suva, Fiji and Apia, Samoa were included in the 1967 air monitoring programme for the first time. Comparisons cannot therefore be made for these two stations. The results show that fission product levels in air filter samples have been significantly lower this year. The highest daily level recorded this year was 30 pCi/m³ at Apia, Samoa on 14 July after the second and third nuclear explosions of 28 June and 3 July respectively. The levels of fission products in air are discussed further under "Hazard Assessment" in this Summary.

TOTAL BETA ACTIVITY OF WEEKLY RAINWATER SAMPLES

Further results of measurements of weekly rainwater samples for fission product deposition are tabled in Section B, where the graphical presentation of these results for the entire monitoring period is also included.

Increased levels have been detected at most stations during the extended monitoring period. The highest levels recorded are given in the following table:

SUMMARY Cont.

STATION	COLLECTION PERIOD	AVERAGE DAILY DEPOSITION DURING THE COLLECTION PERIOD mCi/km ²
Tarawa	15 July - 22 July	19.8
Funafuti	8 July - 14 July	15.6
"	14 July - 17 July	105.9
Aitutaki	9 July - 14 July	21.9

The concentration of fission products in rain (which is used for hazard assessment, based on maximum permissible levels in drinking water) is calculated from the total deposition and total rainfall for each month for each station. These values have been given in Section B, Table 2 of the previous Report No. N.R.L. F.25, and are concluded in Section B, Table 2 of this report. For the three stations of greatest interest the values of fission product concentration in rainwater are given in the following table (a) for the month or period of highest concentration and (b) for the entire monitoring period.

STATION	PERIOD OF HIGHEST CONCENTRATION	CONCENTRATION pCi/litre	ENTIRE MONITORING PERIOD	CONCENTRATION pCi/litre
Tarawa	1 July - 29 July	1,830	1 June - 30 Sept.	523
Funafuti	1 July - 29 July	1,528	1 June - 23 Sept.	530
Aitutaki*	30 June - 21 July	2,185	2 June - 21 July	602

The levels of fission products in rainwater are further discussed under "Hazard Assessment" in this Summary.

* Due to transport difficulties, no further results are available for Aitutaki. It is expected that the final evaluation of average concentration over the entire monitoring period will give lower values for this station.

IODINE-131 IN MILK

The levels of iodine-131 in milk from seven New Zealand Collecting Stations and from Suva, Fiji and Apia, Samoa were listed in Section B, Table 3 of the previous Report No. N.R.L.25, and are continued in Section B, Table 3 of this report.

The levels in New Zealand milk have been significantly lower during the 1967 monitoring period, compared with the levels during the 1966 monitoring period. The highest level for an individual sample this year was 14 pCi/litre compared with 36 pCi/litre last year. The country-wide average over the period June-September 1967 inclusive was less than 5 pCi/litre, which is the minimum recording level. In 1966 the country-wide average over the period July-December inclusive was 7 pCi/litre.

In Suva, Fiji iodine-131 was first detected in milk on 29 June. A peak level of 151 pCi/litre was recorded on 27 July. Levels subsequently dropped to less than 5 pCi/litre by the end of August. The average level over the period 15 June-28 September was 23 pCi/litre.

SUMMARY Cont.

In Apia, Samoa iodine-131 was first detected in milk on 16 June with a significant rise to 161 pCi/litre. Levels then decreased until 21 July when there was another significant rise to 346 pCi/litre. A peak level occurred on 25 July at 708 pCi/litre. Levels had dropped to less than 5 pCi/litre by 8 September. The average level over the period 16 June - 18 September was 68 pCi/litre.

The levels of iodine-131 in milk are further discussed under "Hazard Assessment" in this Summary.

IODINE-131 IN CATTLE THYROIDS

Because of the enhanced sensitivity of detection of iodine-131 in animal thyroids, these samples have been used as an indicator of the arrival of iodine-131 in New Zealand during the present monitoring operations. Iodine-131 has been detected in cattle thyroids from all of the eight collecting stations within New Zealand. The results are continued and graphed in Section B. The first indications of iodine-131 occurred in cattle slaughtered on 19 June. The highest individual station level, 169 pCi/g, occurred in cattle slaughtered at Westport on 14 August. The highest level recorded last year was 726 pCi/g at Gore on 31 October. The country-wide average level reached a maximum of 55 pCi/g on 14 August and values have been falling steadily since then reaching minimum detectable levels by the end of October.

(C)

HAZARD ASSESSMENT

STRONTIUM-90

The derivation of potential health hazard from fallout results is a complex problem. However, the significance of observed levels of strontium-90 can be readily understood by comparing these levels with the recommendations made by the British Medical Research Council on the "permissible levels" for the concentration of strontium-90 in human bone. A "cautionary level" was set at one half of the "permissible level" and the Council stated that this "cautionary level" would not be exceeded if the following levels were maintained indefinitely in the diet:

400 Strontium Units for individuals in the general population,
or 130 Strontium Units as averaged for the population as a whole.

Because the strontium-90 level in the total diet (expressed in Strontium Units) differs relatively little from that in milk, some guidance on the general situation in New Zealand may be provided by comparing the levels in New Zealand milk with the "cautionary level" set by the Council. In doing this, however, it must be emphasized that the "cautionary level" refers to continuous lifetime exposure. Average levels over an extended period, such as one year, are therefore more meaningful than individual results. The all station average for New Zealand milk for the 12 months ending August 1967 (6.6 Strontium Units) is thus less than:

6% of the "cautionary level" for the whole population, or
3% of the "permissible level" for the whole population.

SUMMARY Cont.

CAESIUM-137

The British Research Council has not provided a permissible level for caesium-137 in milk. For the general population it is possible to derive such a "permissible level" by applying a number of conversion factors to the permissible level in drinking water accepted for radiation workers. It has been assumed that one third of the daily intake of caesium-137 comes from milk, that the average consumption is 0.5 litres per day and that the permissible level for the general population is 1/30 of that for a radiation worker. The figure so derived is 7,000 pCi/g K.

The all station average for New Zealand milk for the 12 months ending September 1967, (33 pCi/g K) is thus about 0.5% of the above "permissible level" for the whole population.

TOTAL BETA ACTIVITY

The permissible levels of total beta activities in air and water, due to mixed fission products, have not been set by international agreement but are based on published evaluations of the health hazards of mixed fission products of various ages.^(1,2) For the purpose of assessing the hazards of environmental contamination resulting from the current Pacific testing we have adopted the most cautious values listed for bomb debris between 10 and 80 days old.

These adopted values are:

For air 300 pCi/m³)
For water 6,000 pCi/litre) for continuous use by the general public.

In Air

Apia, Samoa was the station with the highest levels of fission products in air during the current extended monitoring programme. The average levels for June-September 1967 were 1.40, 2.49, 0.45, and 0.25 pCi/m³ respectively, giving a four monthly average level of 1.15 pCi/m³. This level is less than 0.4% of the "permissible level" for continuous breathing by the entire population.

In Rainwater

Tarawa and Funafuti were the stations with the highest concentration of fission products in rainwater during the entire extended monitoring programme. During the period June-September 1967 the average concentration was about 530 pCi/litre at each station. This level is approximately 9% of the maximum permissible concentration for continuous consumption. Over the entire year 1967 the average concentration would be expected to be about one third of this value or approximately 3% of the permissible concentration.

SUMMARY Cont.

IODINE-131

In October 1961 the British Medical Research Council specified that an acceptable dose would not be exceeded in any age group of the population unless an average concentration of iodine-131 of 130 pCi/litre in milk was exceeded over a period of one year, or higher concentrations were maintained for correspondingly shorter times.

The British Medical Research Council now states, however, that further information has become available which indicates that the original figure of 130 pCi/litre was unduly cautious, and that a more appropriate "acceptable level" of iodine-131 now appears to be 200 pCi/litre as an average intake over a period of one year.

The country-wide average level of iodine-131 in New Zealand milk during the monitoring period was below the minimum recording level i.e. less than 5 pCi/litre. For the entire year 1967 the average level would be less than 0.5% of the "acceptable level" for any age group.

In Suva, Fiji and Apia, Samoa the average levels of iodine-131 in milk during the monitoring period June-September inclusive were 23 and 68 pCi/litre respectively. For the entire year 1967 the average values will be about one third of these values:

i.e. For Suva, Fiji	approximately 4%)	of the "acceptable level" for any age group.
For Apia, Samoa	approximately 11%)	

-
1. A. H. Booth, "Guide Levels in Radiation Protection Programs", Data from Radiation Protection Programs, Vol. 4, No. 2, February 1966. Department of National Health and Welfare, Ottawa, Canada.
 2. D. L. Summers and M. C. Gaske, "Maximum Permissible Activity (MPA) for Fission Products in Air and Water", Health Physics, Vol. 4, pp. 289-292 (1961).

SECTION A

RESULTS OF ROUTINE MONITORING OF FALLOUT
DURING THIRD QUARTER 1967

TABLE 1.* TOTAL BETA ACTIVITY OF AIR SAMPLES In Picocuries per Cubic Metre Four Days after Collection			
1967	Auckland	Wellington	Christchurch
July	0.07	0.05	0.06
August	0.24	0.14	0.16
September	0.09	0.05	0.06
Average for 3rd Quarter	0.13	0.08	0.09

* Individual daily values for July and August were given in Section B, Report No. N.R.L.25; and for September, are given in Section B of this report.

TABLE 2. ** TOTAL BETA ACTIVITY OF WEEKLY RAINWATER COLLECTIONS Four Days After Collection					
AT	DATE OF COLLECTION		DEPOSITION mCi/km ²	RAINFALL cm	CONCENTRATION pCi/litre
	FROM	TO			
GREYMOUTH	1.7.67	29.7.67	2.1	8.05	25
	29.7.67	2.9.67	30.8	38.41	80
	2.9.67	30.9.67	3.5	7.29	48
	3rd Quarter 1967		36.4	53.75	68
CHRISTCHURCH	30.6.67	28.7.67	0.6	0.48	130
	28.7.67	1.9.67	3.1	7.69	40
	1.9.67	29.9.67	1.6	6.66	24
	3rd Quarter 1967		5.3	14.83	36

** Individual weekly values for July and August were given in Section B, Report No. N.R.L.25; and for September, are given in Section B of this report.

TABLE 3

STRONTIUM-90 IN RAIN THIRD QUARTER 1967

COLLECTING STATIONS	DEPOSITION mCi/km ²			RAINFALL cm			CONCENTRATION pCi/litre		
	July	Aug.	Sept.	July	Aug.	Sept.	July	Aug.	Sept.
<u>New Zealand</u>									
Kaitia	0.06	0.11	0.13	10.1	17.3	8.1	0.6	0.6	0.7
Auckland	0.03	0.12	0.10	7.4	8.9	10.3	0.4	1.4	1.0
New Plymouth	(0.13)*	0.24	0.09	21.5	27.7	7.4	(0.6)*	0.9	1.2
Havelock North	0.03	0.05	0.05	4.6	6.5	5.4	0.7	0.7	0.9
Wellington	0.07	0.12	0.06	9.7	22.8	9.1	0.7	0.5	0.6
Greymouth	0.07	0.20	0.06	11.2	34.8	9.1	0.6	0.6	0.7
Christchurch	0.01	0.03	0.03	0.5	7.7	6.7	2.1	0.5	0.5
Dunedin	0.07	0.02	0.04	1.3	2.8	6.8	5.0	0.8	0.5
Invercargill	0.04	0.07	0.06	5.0	9.8	5.6	0.8	0.7	1.1
<u>Country-Wide Averages</u>									
Monthly	0.06	0.11	0.07	7.9	15.4	7.6	1.3	0.7	0.8
Quarterly		0.24***						0.9	
<u>Pacific Islands</u>									
Suva, Fiji	0.06	0.08	**	7.5	4.1	**	0.7	1.9	**
Rarotonga	0.10	*	0.04	12.0	*	2.2	0.8	*	1.6

* No sample (or where a result has been given within brackets, this has been estimated for averaging purposes).

** Sample being measured - result not available for this report.

*** This value is the sum of the monthly depositions during the quarter.

TABLE 4 STRONTIUM-89 IN RAIN THIRD QUARTER 1967						
COLLECTION STATIONS	DEPOSITION mCi/km ² (at mid-month)			RATIO Strontium-89/Strontium-90		
	July	Aug.	Sept.	July	Aug.	Sept.
<u>New Zealand</u>						
Kaitia	0.5	3.0	1.4	8	28	11
Auckland	0.1	2.4	1.0	4	20	10
New Plymouth	*	4.4	0.8	*	19	10
Havelock North	<0.1	1.1	0.4	2	23	9
Wellington	2.0	2.5	0.4	29	20	7
Greymouth	1.2	3.2	0.7	18	16	11
Christchurch	<0.1	0.6	0.1	1	18	3
Dunedin	*	0.3	0.2	*	14	6
Invercargill	0.2	1.1	0.4	5	17	7
<u>Country-Wide Averages</u>						
Monthly	0.6	2.1	0.6	9	19	8
Quarterly		3.2***			12	
<u>Pacific Islands</u>						
Suva, Fiji	3.2	2.7	**	57	35	**
Barotonga	13.2	*	0.4	132	*	11

* No result available.

** Sample being measured - result not available for this report.

*** This value is the sum of the monthly depositions during the quarter.

TABLE 5 STRONTIUM-90, STRONTIUM-89 AND CAESIUM-137 IN MILK 1967						
COLLECTING STATIONS	STRONTIUM-90 pCi/g Ca	STRONTIUM-89* pCi/g Ca	CAESIUM-137 pCi/g K			
	July - Aug.	July - Aug.	July	Aug.	Sept.	Average July-Sept.
Northland	6.8**	50**	N.S.	32	30	31
Auckland	6.3	27	18	30	34	27
Waikato	6.5	24	26	37	40	34
Taranaki	12.1	84	51	109	97	86
Palmerston North	5.1	17	3	<1	4	3
Wellington	5.9	21	4	17	12	11
Greymouth	19.1	21	22	26	20	23
Christchurch	2.1	<1	<1	2	3	2
Dunedin	3.0	4	<1	4	3	3
Country-wide Averages of these results	7.4	28	16	29	27	24
For 12 months ending	Aug.1967, 6.6		Sept.1967, 33			

* At mid-sampling time.

** Aug. sample only.

N.S. No sample.

Section B

RESULTS OF EXTENDED MONITORING OF FALLOUT
FROM FRENCH NUCLEAR TESTS IN THE PACIFIC

TABLE 1 CONTINUED: TOTAL BETA ACTIVITY OF DAILY AIR FILTER SAMPLES
STATED IN PICOCURIES PER CUBIC METRE ON DAY OF MEASUREMENT

COLLECTION: From 9.00a.m. on the date shown to 9.00a.m. on the following day. Stated in New Zealand Standard Time, i.e. G.M.T. + 12 hours.

MEASUREMENT: Routinely 4 days after the end of collection. Where this is not possible due to delays in transit, the number of days elapsed between the end of collection and measurement is given in brackets after the measurement.

Sept. 1967	Nandi, Fiji	Suva, Fiji	Apia, Samoa	Auckland	Wellington	Christchurch
1	0.45	0.37	0.52	0.16	0.08	0.05
2	0.21	0.10	0.60(5)	0.12	0.02	0.03
3	0.44	0.44	0.78	0.03	0.02	0.04
4	0.53(3)	0.48(3)	0.96(3)	0.06(3)	0.02(3)	0.02(3)
5	0.36(5)	0.43(5)	0.51(5)	0.04(5)	<0.01(5)	<0.01(5)
6	0.33(5)	0.34(6)	0.25(5)	0.04(5)	0.01	0.02
7	0.30	0.40(5)	0.45	0.04	0.09	0.04
8	0.28	0.04	0.25	0.05(6)	0.09	0.10
9	0.14	0.15	0.09(11)	0.07(5)	0.03	0.06
10	0.20	0.11	0.13(10)	0.08	0.06	0.05
11	<0.01(3)	0.21(3)	0.23(9)	0.05(3)	0.02(3)	0.06(3)
12	0.01(5)	0.11(5)	0.16(8)	0.20(5)	<0.01(5)	0.06(5)
13	0.07	0.04	0.09(5)	0.10	0.07	0.10
14	0.15	0.40(5)	0.14	0.05	0.05	0.09
15	0.05	0.32	0.21	0.07	0.04	0.07
16	<0.01	0.12	0.22(5)	0.14	0.06	0.06
17	<0.01	0.17	0.16	0.12	0.14	0.13
18	0.17(3)	0.35(3)	0.14(3)	0.10(6)	0.11(3)	0.13(3)
19	0.09(5)	0.16(5)	0.10(5)	0.04(5)	0.02(5)	0.06(5)
20	0.04	0.08	0.12	0.06(5)	0.05	0.05
21	0.15	0.19	0.16	0.16	0.03	0.03
22	0.20	0.16(5)	0.07	0.10(5)	0.04	0.03
23	0.05	0.10	0.10(5)	0.06	0.02	0.03
24	0.15	0.29	0.11	0.07	0.04	0.03
25	0.22(3)	0.41(3)	0.09(3)	0.12(3)	0.04(3)	0.06(3)
26	0.26(5)	0.40(5)	0.04(5)	0.14(5)	0.08(5)	0.07(5)
27	0.12	0.31	0.06	0.12	0.09	0.08
28	0.14	0.27(6)	0.05	0.15	0.04	0.04
29	0.09	0.24(5)	0.15	0.10	0.07	0.06
30	0.08	N.S.	0.15(9)	0.15	0.07	0.06
Average	0.18	0.25	0.24	0.09	0.05	0.06

N.S. No Sample

TOTAL BETA ACTIVITIES OF DAILY AIR FILTER SAMPLES

Stated in pCi/m^3 on 4th day after collection unless otherwise noted in table 1

FIG 1.

TABLE 2 CONTINUED: TOTAL BETA ACTIVITY OF WEEKLY RAINWATER SAMPLES
STATED IN MILLICURIES PER SQUARE KILOMETRE AT TIME OF MEASUREMENT

NOTE: The normal collection period for each rainwater sample is 7 days. For some collections, however, the period may be longer or shorter than 7 days due to heavy rainfall or sample transport requirements. An additional column has been introduced in Table 2, therefore, giving the average daily deposition over the collection period. The graphical presentation of these results shows the average daily deposition over the collection period.

AT	Date of Collection From To	Date of Measurement	Rainfall cm	Total Beta Activity mCi/km ²	Average Daily Deposition mCi/km ²	Concentration pCi/litre
TARAWA	27 Aug. - 2 Sept.	19 Sept.	0.79	0.5	0.09	
	2 Sept. - 9 "	19 "	5.77	1.9	0.27	
	9 " - 16 "	27 "	0.38	0.2	0.03	
	27 Aug. - 16 Sept.		6.94	2.6		37
	16 Sept. - 18 Sept.	S A M P L E L O S T				
	18 Sept. - 23 Sept.	27 Sept.	0.08	0.2	0.03	
	23 " - 30 "	9 Oct.	1.57	0.4	0.05	
FUNAFUTI	18 Sept. - 30 Sept.		1.65	0.6		36
	30 Aug. - 9 Sept.	20 Sept.	2.44	1.1	0.11	
	9 Sept. - 16 "	16 Oct.	3.51	0.7	0.10	
	16 " - 23 "	27 Sept.	4.98	0.8	0.12	
NANDI, FIJI	30 Aug. - 23 Sept.		10.93	2.6		24
	28 Aug. - 4 Sept.	19 Sept.	7.19	2.6	0.37	
	4 Sept. - 10 Sept.	19 "	0.18	0.2	0.04	
	10 " - 18 "	22 "	1.45	0.2	0.03	
	18 " - 25 "	3 Oct.	3.18	0.5	0.08	
	25 " - 2 Oct.	9 "	1.63	0.3	0.05	
SUVA, FIJI	28 Aug. - 2 Oct.		13.63	3.8		28
	31 Aug. - 7 Sept.	14 Sept.	1.63	1.5	0.22	
	7 Sept. - 14 "	26 "	6.32	1.8	0.25	
	14 " - 21 "	28 "	17.75	1.2	0.17	
	21 " - 28 "	5 Oct.	2.72	2.6	0.37	
SAMOA	31 Aug. - 28 Sept.		28.42	7.1		25
	2 Sept. - 9 Sept.	19 Sept.	1.29	0.7	0.10	
	9 " - 16 "	20 "	1.12	0.5	0.07	
	16 " - 23 "	5 Oct.	0.53	0.5	0.07	
	23 " - 30 "	9 "	9.73	1.0	0.14	
	2 Sept. - 30 Sept.		12.67	2.7		21

TABLE 2 (Continued)

AT	Date of Collection From To	Date of Measurement	Rainfall cm	Total Beta Activity mCi/km ²	Average Daily Deposition mCi/km ²	Concentration pCi/litre
NIUE	11 Aug. - 18 Aug.	-	4.39	S A M P L E L O S T		
	18 Aug. - 25 Aug.	4 Oct.	0.84	1.1	0.16	
	25 " - 2 Sept.	2 Oct.	0.61	2.3	0.29	
	18 Aug. - 2 Sept.		1.45	3.4		234
	2 Sept. - 8 Sept.	2 Oct.	0.91	1.6	0.27	
	8 " - 15 "	4 "	1.65	0.8	0.11	
	2 Sept. - 15 Sept.		2.56	2.4		94
	15 " - 23 "		0.13	S A M P L E L O S T		
TONGA	23 " - 29 "	1 Nov.	1.57	0.70	0.10	
	1 Sept. - 8 Sept.	19 Sept.	2.03	1.3	0.18	
	8 " - 15 "	20 "	4.04	1.3	0.19	
	15 " - 24 "	2 Oct.	6.60	2.1	0.24	
	1 Sept. - 24 Sept.		12.67	4.7		37
AITUTAKI	NO FURTHER RESULTS					
BAROTONGA	23 Aug. -	-	N O S A M P L E			
	- 7 Sept.	-	N O S A M P L E			
	7 Sept. - 14 Sept.	4 Oct.	TRACE	1.7	0.25	
	14 " - 21 "	12 "	0.61	1.8	0.26	
	21 " - 28 "	12 "	1.32	1.4	0.19	
	7 Sept. - 28 Sept.		1.93	4.9		254
GREYMOUTH	2 Sept. - 9 Sept.	14 Sept.	0.15	0.3	0.04	
	9 " - 16 "	26 "	3.05	0.9	0.12	
	16 " - 23 "	28 "	2.18	0.7	0.10	
	23 " - 30 "	6 Oct.	1.91	1.6	0.23	
	2 Sept. - 30 Sept.		7.29	3.5		48
CHRISTCHURCH	1 Sept. - 8 Sept.	14 Sept.	4.17	0.5	0.07	
	8 " - 15 "	20 "	1.32	0.5	0.08	
	15 " - 22 "	26 "	0.08	0.1	0.02	
	22 " - 29 "	4 Oct.	1.09	0.5	0.07	
	1 Sept. - 29 Sept.		6.66	1.6		24

AVERAGE DAILY DEPOSITION OF FISSION PRODUCTS DURING THE COLLECTION PERIODS SHOWN. Stated in m^2/km^2 on day of measurement as given in table 2

FIG 2

TABLE 3 CONTINUED: IODINE-131 IN MILK, STATED IN PICOCURIES
PER LITRE AT NOON ON DAY OF COLLECTION

DATE	AUCKLAND	NEW PLYMOUTH	WELLINGTON	GREYMOUTH	CHRISTCHURCH	DUNEDIN	INVERCARGILL
Sept. 1	-	-	8	<5	-	-	5
" 4	<5	-	<5	N.S.	-	-	<5
" 6	<5	-	-	N.S.	-	-	<5
" 8	-	-	-	N.S.	-	-	-
" 11	-	-	-	<5	-	-	-
" 13	-	<5	<5	-	-	-	-
" 15	<5	-	-	N.S.	-	-	-
" 18	-	-	-	N.S.	N.S.	-	-

DATE	SUVA, FIJI	DATE	APIA, SAMOA
Sept. 8	<5	Sept. 8	<5
" 14	-	" 11	-
" 21	-	" 14	<5
" 28	-		

TABLE 4 CONTINUED: IODINE-131 IN CATTLE THYROIDS, STATED IN PICOCURIES
PER GRAM WET WEIGHT, AT TIME OF SLAUGHTER

DATE	NORTHLAND (MOEREWA)	HAMILTON (HOROTIU)	NEW PLYMOUTH (WAITARA)	HASTINGS (TOMOANA)	PALMERSTON NORTH (LONGBURN)	WESTPORT	CHRISTCHURCH (ISLINGTON)	GORE
Sept. 4	13.7	24.5	27.0	17.9	28.5	32.9	<0.1	5.4
11	18.6	10.7	16.8	11.7	17.0	9.2	0.3	1.8
18	10.4	3.5	4.9	5.0	5.0	11.1	2.5	4.9
25	6.0	3.8	5.1	4.6	4.1	5.0	N.S.	1.6
Oct. 2	3.8	2.7	2.9	1.8	3.4	1.3	1.1	4.9
9	1.7	1.4	1.7	1.8	2.6	1.9	0.7	1.3
16	0.6	0.5	0.5	0.9	0.9	1.6	0.3	0.7
24	0.3	0.4	0.2	0.3	0.6	N.S.	N.S.	0.5
30	0.4	-	-	<0.1	0.3	-	N.S.	N.S.

- Not Detectable

N.S. No Sample

FIG. 3 I 131 IN CATTLE THYROIDS.

Activity in pCi/gram (wet weight) at time of slaughter.
Results for eight stations.

2. Department of Scientific and Industrial Research

The Institute of Nuclear Sciences

Lower Hutt, New Zealand

RADIOISOTOPES IN RAINWATER:

Results for

May through August 1967

September through December 1967

INS 50/113/-WJM

RADIOISOTOPES IN RAIN WATER

Report No. 70

Period: May to August

Station: Gracefield, Lower Hutt, New Zealand S41°14' E174°55'

Stainless steel collector
1 ft diameter

Sampling Period		Activity microcuries/sq mile			Ba ¹⁴⁰ /Sr ⁹⁰	Cs ¹³⁷ /Sr ⁹⁰	Rain inches	Remarks
Start	Finish	Sr ⁹⁰	Ba ¹⁴⁰	Cs ¹³⁷				
5 - 1	6 - 1	180 ± 30 70*		240 ± 79 93*		1.33	3.43	monthly pot sample
accumulated total or average for '67		820 320	200 ± 300 90*	1510 583*		1.84	18.85	
6 - 1	7 - 3	78 ± 10 30*	542 ± 43 210*	181 ± 71 70*	7.05	2.34	3.12	monthly pot sample
accumulated total or average for '67		898 350*	752 300*	1690 653*		1.89	21.97	
7 - 3	8 - 1	300 ± 22 116*	55,600 ± 480 21,600*	230 ± 76 89*	185	0.77	3.44	monthly pot sample
accumulated total or average for '67		1200 466*	56,350 21,900*	1920 742*	47	1.61	25.41	
8 - 1	9 - 1	400 ± 10 155*	14,800 ± 700 5750*	384 ± 60 150*	37	0.86	9.41	monthly pot sample
accumulated total or average for '67		1600 621*	71,150 26,650*	2304 892*	44.5	1.44	34.82	

* Microcuries per square kilometer

Note: errors quoted are purely counting errors and do not include experimental errors
or calibration uncertainties.

RADIOISOTOPES IN RAIN WATER

INS 50/113/-WJM

Report No 71

Period: September - December

Station: Gracefield Lower Hutt, New Zealand S41°14' E174°55'

Stainless steel collector
1 ft diameter

Sampling Period		Activity microcuries/sq mile			Ba ¹⁴⁰ /Sr ⁹⁰	Cs ¹³⁷ /Sr ⁹⁰	Rain inches	Remarks
Start	Finish	Sr ⁹⁰	Ba ¹⁴⁰	Cs ¹³⁷				
9 - 1	10 - 1	216 ± 15 84*	720 ± 330 280*	210 ± 86 82*	3.33	0.98	3.32	monthly pot sample
accumulated total or average '67		1816* 705	71,870 20,930*	2514 974*	39.8	1.39	38.14	
10 - 2	11 - 1	196 ± 14 76*		142 ± 14 55*		0.73	2.12	monthly pot sample
accumulated total or average for '67		2012* 780		2656* 1030		1.30	40.26	
11 - 1	12 - 1	350 ± 16 136*		212 ± 7.5 82*		0.61	5.69	monthly pot sample
accumulated total or average for '67		2362* 916		2868* 1112		1.22	45.95	
12 - 1	1 - 2	365 ± 30 141*		157 ± 14 61*		0.43	2.20	monthly pot sample
accumulated total or average 1967		2727* 1057		3025* 1172		1.12	48.13	

* Microcuries per square kilometer

Note: errors quoted are purely counting errors and do not include experimental errors
or calibration uncertainties.

Cs-137 in Various Chicago Foods

(Collection Month January, 1968)

S. S. Brar and D. M. Nelson

Division of Biological and Medical Research

Argonne National Laboratory

Argonne, Illinois

Since April, 1961, the Cs-137 and potassium content of the Chicago portion of the Tri-City Diet Sampling program has been determined ^{1,2,3,4} in bulk food samples by gamma-ray spectrometry.

The results of January, 1968 quarter are tabulated below in Tables I, II, and III.

Table I

Item	Potassium g/kg	Cesium-137 pCi/kg
White Bread (Dry)	1.8	22
Whole Wheat Bread (Dry)	4.3	37
Eggs	1.4	6
Fresh Vegetables:		
Cabbage	2.2	T
Lettuce	2.6	T
Spinach	8.3	*
Peas (frozen)	2.1	9
Stringbeans	2.5	22
Tomatoes	2.6	13
Root Vegetables (Fresh):		
Carrots	4.1	18
Onions	2.1	T
Turnips	2.4	T
Milk (Fresh)	1.6	14
Poultry Muscle	2.6	15
Fresh Fish (Frozen):		
Lake Fillet	3.5	1858
Ocean Fillet	2.9	14
Halibut	4.0	48

* Sample contaminated with fresh fission products

Item	Potassium g/kg	Cesium-137 pCi/kg
Flour (White)	1.3	41
Macaroni	2.1	36
Rice	1.0	6
Meat Muscle:		
Beef	3.2	20
Pork	3.5	31
Shellfish:		
Oysters	.6	5
Shrimps	2.0	T
Dried Beans	14.9	20
Fresh Fruits:		
Apples	1.1	12
Bananas	3.8	T
Berries	2.1	9
Oranges	2.1	18
Potatoes	3.8	14
Canned Fruits:		
Apple Sauce	.8	13
Peaches	1.2	T
Pears	.7	7
Pineapple	1.2	16
Canned Juices:		
Grapefruit	1.7	12
Orange	2.1	41
Pineapple	1.6	21
Tomato	2.7	T
Canned Vegetables:		
Peas	1.2	8
Stringbeans	.9	T
Tomatoes	2.5	6
Baby Foods:		
Canned Milk	3.1	23
Formula Milk	2.2	27
Cereals	6.2	70
Fruits	1.0	5
Meats	1.9	14
Vegetables	1.9	11

T < 5 pCi/kg

Table II
Cs-137 in Chicago Diets

(Adults)

January, 1968

	Potassium		^{137}Cs	Potassium		^{137}Cs
	kg/yr	g/kg	pCi/kg	g/yr	pCi/yr	
White Bread	37	1.4	18	52	666	
Whole Wheat Bread	11	3.4	30	37	330	
Eggs	16	1.4	6	22	96	
Fresh Vegetables	43	3.4	9	146	387	
Root Vegetables	17	2.8	6	48	102	
Milk	221	1.6	14	354	3094	
Poultry	17	2.6	15	44	255	
Fresh Fish	8	3.5	202	28	1616	
Flour	43	1.3	41	56	1763	
Macaroni	3	2.1	36	6	108	
Rice	3	1.0	6	3	18	
Meat	73	3.4	26	248	1898	
Shellfish	1	1.3	T	1	----	
Dried Beans	3	14.9	20	45	60	
Fresh Fruit	68	2.3	9	156	612	
Potatoes	45	3.8	14	171	630	
Canned Fruit	26	1.0	9	26	234	
Fruit Juices	19	2.0	19	38	361	
Canned Vegetables	20	1.5	5	3	100	
Total/yr				<u>1484</u>	<u>12330</u>	
Total/day				4.1	34	

Table III
Cs-137 in Chicago Diets
(Infants)
January, 1968

	Potassium		^{137}Cs	Potassium		^{137}Cs
	kg/yr	g/kg	pCi/kg	g/yr	pCi/yr	
Evaporated Milk	137	3.1	23	425	3151	
Formula Milk	37	2.2	27	81	999	
Cereals	8	6.2	70	50	560	
Fruits	23	1.0	5	23	115	
Meats	17	1.9	14	32	238	
Vegetables	23	1.9	11	44	253	
Total/yr				<hr/> 655	<hr/> 5316	
Total/day				1.8	15	

References:

- (1) S. S. Brar et al., USAEC Report No. Hasl-146, Cs-137 in Various Chicago Diets, pp. 225-232, July 1, 1964.
- (2) J. Rivera and J. J. Kelly, USAEC Report No. Hasl-144, Cs-137 in Tri-City Diets, p. 228, April 1, 1964.
- (3) J. Rivera and J. H. Harley, USAEC Report No. Hasl-147 Contributions to the Study of Fallout in Food Chains, pp. 31,23,33,34 and 35 July, 1964.
- (4) S. S. Brar and D. M. Nelson, USAEC Report No. Hasl-184 Cs-137 in Various Chicago Foods, pp. III-54 to III-58 July 1, 1967.

4.

EURATOM JOINT NUCLEAR RESEARCH CENTRE

ISPRA ESTABLISHMENT

Protection Service

Site Survey and Meteorology Section

QUARTERLY REPORT

The Euratom Ispra Establishment is located in Northern Italy 58 Km NW away from Milan and 14 Km W from Varese.

The activity levels shown in this report represent weapons-test fallout, and do not reflect any contamination from the site.

SAMPLE COLLECTION

a. Air

Air is drawn by pumps through paper filters at the rate of, at least, 250 m^3 / day, measured by gas meter.

The single daily filters are measured for gross beta radioactivity and then pooled to give monthly samples, for gamma spectrometry and radiochemical analyses.

b. Wet and dry deposition

These samples are collected monthly by means of 1 m^2 stainless steel funnels (one in Milan and four at Ispra), having the bottom always covered with deionized water. The collected water is evaporated and the dry residue analysed.

c. Milk

Milk is collected twice a week in four small local dairies and daily at the milk supply station of Milan to give 8 to 15 liters / month. About six liters dry matter are submitted to gamma spectrometry and two liters ashed for radiochemical determination of strontium-90.

CHEMICAL PROCEDURES AND COUNTING TECHNIQUES

- a. Strontium-90 is separated by the fuming nitric acid precipitation and then purified through hydroxides and chromates precipitations. The activity of the final strontium carbonate and yttrium oxalate precipitates is measured in low level anticoincidence beta counters.
- b. Cesium-137 is measured by direct gamma spectrometry on the unprocessed or dried samples and, whenever it is necessary, by gamma spectrometry after chemical separation. This is performed by filtration of the solution, obtained dissolving the sample, through a thin AMP (ammonium molybdophosphate) layer, by which cesium is retained. Details of this procedure may be found in the paper by E. Van der Stricht issued on "Radiochemical Acta" 3, 193-199 (1964).
- c. Gamma emitting nuclides are measured by direct gamma spectrometry, using, also the spectrum stripping technique.
- d. Plutonium-239+240 is separated by anion exchange and electro-deposition; details of the procedure may be found in the paper by M.C. de Bortoli: "Radiochemical determination of plutonium in soil and other environmental samples", Anal. Chem. 39, 375 (March 1967).

The activity is measured in a Frish grid ionisation chamber connected to a multichannel analyser.

EXTRAPOLATION OF THE DATA

Except when otherwise stated, the data presented in this report are extrapolated to the last day of the collecting period.

SITE: I S P R A

LAT. 45° 49' N

LONG. 8° 37' E

ALT. 250 m

AIR RADIOACTIVITY1967

Month	Gross beta pCi/m ³	⁹⁰ Sr 10 ⁻³ pCi/m ³	⁸⁹ Sr 10 ⁻³ pCi/m ³	¹³⁷ Cs 10 ⁻³ pCi/m ³	²³⁹ Pu 10 ⁻⁵ pCi/m ³	²³⁸ Pu 10 ⁻⁵ pCi/m ³
January	0.12	1.4	7.1	2.1	2.2	0.23
February	0.26	2.7	30	4.7	3.8	0.61
March	0.20	3.0	31	4.8	6.3	1.9
April	0.16	2.9	24	5.2	7.3	2.8
May	0.12	3.9	18	6.0	9.0	3.4
June	0.06	2.9	3.8	4.7	5.9	1.7
July	0.06	2.2	b	3.5	4.5	1.6
August	0.05	1.4	b	2.2	3.2	1.8
September	0.06	1.4	b	2.2	3.7	1.6
October	0.09	1.2	b	1.3	2.3	1.2
November	0.06	0.68	b	0.85	1.7	0.61
December	0.10	1.2	1.5	0.95	3.4	1.0

b - Below detection limit

SITE: I S P R A

LAT. 45° 49' N

LONG. 8° 37' E

ALT. 250 m

MONTHLY FALLOUT DEPOSITION1967

Month	Gross beta (1)		Strontium-90		⁸⁹ Sr	Cesium-137		²³⁹ Pu	²³⁸ Pu	precipitation
	mCi/Km ²	pCi/l	mCi/Km ²	pCi/l	mCi/Km ²	mCi/Km ²	pCi/l	μCi/Km ²	μCi/Km ²	mm
January	1.5	190	0.030	3.8	0.18	0.074	9.2	n	n	8.0
February	5.7	94	0.18	3.0	1.9	0.24	4.0	n	n	60.6 (2)
March	6.5	40	0.23	1.4	2.6	0.39	2.4	n	n	163.8
April	3.3	45	0.16	2.2	1.3	0.27	3.7	2.2	0.64	73.0
May	6.0	33	0.47	2.5	1.8	0.68	3.7	9.3	3.8	184.6
June	0.82	18	0.11	2.4	0.084	0.16	3.6	2.1	0.80	45.0
July	1.9	13.2	0.19	1.3	0.040	0.28	1.9	3.8	1.8	143.8
August	1.5	10.0	0.17	1.1	0.048	0.33	2.2	2.9	1.5	150.0
September	3.1	16.7	0.18	1.0	0.086	0.28	1.5	3.0	1.6	186.0
October	1.3	9.8	0.054	0.4	0.053	0.072	0.5	1.1	0.48	132.0
November	1.1	5.3	0.050	0.2	0.056	0.084	0.4	1.5	0.63	209.2
December	1.0	53	0.027	1.3	0.057	0.046	2.2	1.1	0.40	20.8

(1) = Potassium-40 equivalent (40 mg/cm²)

(2) = Snow 46.0 cm

n = Measurement not performed

SITE: MILANO

LAT. 45° 28' N

LONG. 9° 12' E

ALT. 131 m

MONTHLY FALLOUT DEPOSITION1967

Month	Gross beta (1)		Strontium-90		⁸⁹ Sr	Cesium-137		Precipitation
	mCi/Km ²	pCi/l	mCi/Km ²	pCi/l	mCi/Km ²	mCi/Km ²	pCi/l	mm
January	1.6	76	0.056	2.7	0.25	0.066	3.1	21.0
February	3.4	47	0.12	1.6	1.2	0.19	2.7	73.0
March	5.0	185	0.24	8.9	2.6	0.37	14	27.0
April	3.9	73	0.15	2.8	1.1	0.36	6.8	53.2
May	2.0	53	0.16	4.2	0.48	0.28	7.4	38.0
June	1.2	16	0.11	1.4	0.078	0.24	3.1	76.8
July	1.3	18.9	0.070	1.0	0.024	0.21	3.1	68.6
August	1.7	11.9	0.15	1.1	b	0.30	2.1	142.4
September	0.18	4.9	s	-	s	s	-	37.0
October	0.27	5.4	0.016	0.3	b	0.033	0.7	50.0
November	1.5	12	0.059	0.5	0.027	0.068	0.5	126.6
December	2.1	53	0.036	0.9	0.17	0.049	1.2	39.6

(1) = Potassium-40 equivalent (40 mg/cm²).

b = Below detection limit.

s = Sample lost.

STRONTIUM-90 AND CESIUM-137 IN SOIL

FEBRUARY 1967

Sampling site	Lat. (N)	Long. (E)	Alt. (m)	Strontium-90		Cesium-137	
				pCi/g (x)	mCi/Km ²	pCi/g (x)	mCi/Km ²
Angera	45°46'35"	8°35'48"	210	0.82	93	0.71	81
Barza	45°47'45"	8°36'53"	213	0.97	77	1.5	119
Brebbia	45°49'30"	8°38'40"	223	0.60	54	0.80	72
Golasecca (xx)	45°42'30"	8°39'26"	243	0.72	67	1.2	111
Ispira	45°49'05"	8°37'20"	205	0.84	60	1.4	100
Malgesso	45°49'40"	8°40'38"	295	0.80	59	1.4	103
Monvalle	45°51'30"	8°37'20"	209	0.78	73	1.4	80
Osmate	45°47'15"	8°39'10"	330	1.1	81	1.9	139
Pallanza	45°55'40"	8°32'58"	202	1.3	101	2.4	185
Paruzzaro	45°45'00"	8°31'43"	305	1.2	79	2.2	146
Solcio	45°49'00"	8°33'03"	209	1.2	98	2.2	180
Taino	45°45'30"	8°37'30"	272	1.2	70	2.2	128
Travedona	45°48'20"	8°41'28"	260	1.8	110	2.2	135
Varano Borghi	45°46'30"	8°41'50"	270	1.3	83	2.2	140

(x) - These data have been rounded off to two digits, whereas the mCi/Km² values are given as obtained by multiplication.

(xx) - Site previously indicated as "Diga Miorina".

PART IV

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES

Albert, R. E., Lippmann, M., Spiegelman, J., Liuzzi, A. and Nelson, N.

The Deposition and Clearance of Radioactive Particles in the Human Lung
Arch. Environ. Health, 14, January 1967

Barney, J. E.

The Meaning of "Sensitivity" in Trace Analysis II.
Talanta, 14, No. 11, November 1967

Belanger, L. F., Belanger, C. and Semba, T.

Technical Approaches Leading to the Concept of Osteocytic Osteolysis
Clinical Orthopaedics & Related Research, 54, Sec. III - Sept.-Oct. 1967

Bernhard, M.

Studies on the Radioactive Contamination of the Sea
(Annual Report 1966)

CNEN Report No. RT/BIO (67)35, EURATOM-CNEN, Brussels

Black, S.C., Archer, V.E., Dixon, W.C. and Saccomanno, G.

Correlation of Radiation Exposure and Lead-210 in Uranium Miners
Health Physics, 14, No. 2, February 1968

Bloch, R., Shatkay, A. and Saroff, H.

Fabrication and Evaluation of Membranes as Specific Electrodes for Calcium Ions

Biophysical Journal, 7, No. 6, November 1967

Bogen, D. C.

Rapid Determination of Strontium-90 in Urine
Health Physics, 14, No. 2, February 1968

Bermann, F. J.

Influence of Grazing Intensity on Cesium-137 Levels in Milk
J. of Dairy Science, 50, No. 12, December 1967

Blanchard, R. L. and Kearney, J. W.

Natural Radioactivity and ¹³⁷Cs in Alaskan Caribou and Reindeer Samples

Environmental Science & Technology, 1, No. 11, November 1967

Boulenger, R.

Rapport D'Avancement Du Department

"Mesure Et Controle Des Radiations" - Annee 1966

La Retombée Radioactive Mesurée a Mol, R.2429

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Broecker, W. S. and Cromwell, P. H.

Radium-226 and Radon-222: Concentration in Atlantic and Pacific Oceans
Science, 158, No. 3806, December 8, 1967

Bronner, F.

Some Problems in the Compartmental Analysis of Calcium Metabolism
Transactions of the New York Academy of Sciences, 29, No. 4, 1967

Bulletin of the Atmospheric Radioactivity - No. 47
October-December 1966

Japan Meteorological Agency, Tokyo, November 1967

Butler, F. E.

Separation of Uranium from Iron and Other Contaminating Metals
Health Physics, 14, No.2, February 1968

Cerrai, E., Schreiber, B. and Triulzi, C.

Vertical Distribution of Sr⁹⁰, Ce-144, Pm-147, and Eu-155 in Coastal
Marine Sediments

Energia Nucleare, 14, No. 10, October 1967

Clark, W. E. and Whitby, K. T.

Concentration and Size Distribution Measurements of Atmospheric Aerosols
and a Test of the Theory of Self-Preserving Size Distributions.
J. of the Atmospheric Sciences, 24, No. 6, November 1967

Cohn, S. and Gusmano, E.

Kinetics of Strontium and Calcium Skeletal Metabolism in the Rat
Proceedings of the Society for Experimental Biology & Medicine, 126, No. 1, Oct 1967

Buchan, W.E. and Charlson, R. J.

Cosmic Ray-Produced Radionuclides as Tracers of Atmospheric Precipitation
Processes
Science, 159, No. 3811, January 12, 1968

Dyson, E. D. and Whitehouse, W. J.

Composition of Trabecular Bone in Children and its Relation to Radiation
Dosimetry
Nature, 217, No. 5128, February 10, 1968

Fabricand, B.P., Imbimbo, E.S. and Brey, M.E.

Atomic Absorption Analyses for Ca, Li, Mg, K, Rb, and Sr at two Atlantic
Ocean Stations
Deep-Sea Research, 14, No. 6, December 1967

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Fedorov, G.A., Konstantinov, I.E., Skotnikova, O.G. and Malahov, S.G.
Investigation of Fallouts of Cd-109 in Some Places of the Soviet Union
in 1964-1965

Atomnaya Energiya, 23, No. 3, September 1967

Field, A. C. and Suttle, N. F.

Retention of Calcium, Phosphorus, Magnesium, Sodium and Potassium by the
Developing Sheep Foetus

J. of Agricultural Science, 69, Part 3, December 1967

Fischer, H. F., et al

Measurements of Radioactivity at Different Altitudes of the Atmosphere
During Arrival and Passage of Fresh Fission Products

Atompraxis, 13, No. 10, 1967

Friend, B.

Nutrients in U. S. Food Supply. A Review of Trends, 1909-1913 to 1965

The American Journal of Clinical Nutrition, 20, No. 8, August 1967

Garn, S. M., Rohmann, C.G. and Wagner, B.

Bone Loss as a General Phenomenon in Man

Federation Proceedings, 26, No. 6, November-December 1967

Gibbs, W. J., Moroney, J. R., Stevens, D. J. and Titterton, E. W.

Fallout over Australia from Nuclear Weapons Tested by France in Polynesia
During June and July 1967

The Australian J. of Science, 30, No. 6, December 1967

Gloebe, B., Muth, H. and Oberhausen, E.

Intake and Excretion of Natural Radionuclides Pb^{210} and Po^{210} by Humans

Strahlentherapie, 131, pp 218-26, 1966, ANL Trans, 458

CFSTI. NBS, U. S. Dept. of Commerce

Goldin, A. S.

Report on Radioactivity

Journal of the Association of Official Analytical Chemists, 50, No. 4, August 1967

Gross, M.G.

Sinking Rates of Radioactive Fallout Particles in the North East Pacific Ocean,
1961-1962

Nature, 216, No. 5116, November 18, 1967

Gruppo Nazionale Misure Radioattivit Dell'Aria

July and August 1967

Prot. - GNMRA 364/RS/117, Rome, ITALY

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Grzybowska, D.

^{144}Ce + ^{144}Pr , ^{137}Cs and ^{90}Sr Content in Soil in Poland in the Year 1964
Report No. CLOR 663/D, Warszawa, Poland

Haubermann, W. and Schreiber, H.

Investigations about the Sr^{90} Contents in Soils
Atompraxis 13(7), July 1967

Hansen, R. O. and Stout, P. R.

Isotopic Distributions of Uranium and Thorium in Soils
Soil Science, 105, No. 1, January 1968

Hart, H. and Spencer, H.

Rate of Initial Entry of Ca^{47} and Sr^{85} from the Intestine into the
Vascular Space
Proceedings of the Soc. for Experimental Biology & Medicine, 126, No. 2, 1967

Harrison, J., Hitchman, A. and Finlay, J.

Calcium Determinations in Kinetic Studies: II. Blood and Urine Specific
Activity Determinations
Clinical Chemistry, 13, No. 9, September 1967

Hamilton, R. A. and Paren, J. G.

Influence of Radioactive Fallout on the Atmospheric Potential
Gradient
Meteorological Magazine, 96 81-5 (March 1967)

Haubermann, W. and Schreiber, H.

Untersuchungen über die Verteilung von Strontium-90 in Erdboden
Atompraxis, 13, No. 7, 1967

Hegsted, D. M.

Mineral Intake and Bone Loss
Federation Proceedings, 26, No. 6, November-December 1967

Hickey, J.L.S. and Campbell, S.C.

Mathematical Model for Determining Low Radium-226 Body Burdens from
Radon-222 in the Breath
Health Physics, 14, No. 2, February 1968

Hjerpe, C. A.

Influence of dietary Magnesium on Metabolism of Calcium and Magnesium
in Sheep
American J. of Veterinary Research, 29, No. 1, January 1968

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Isenstark, J.L. and Lafferty, W.
Medical Radiological Practice in New Orleans: Estimates and Characteristics
Visits, Examinations, and Genetically Significant Dose.
Radiology, 9, No. 2, February 1968

Israel, H.
Loss of Bone and Remodeling-Redistribution in the Craniofacial
Skeleton with Age
Federation Proceedings, 26, No. 6, Nov-Dec 1967

Kennedy, J. S. and Nordberg, W.
Circulation Features of the Stratosphere Derived from Radiometric
Temperature Measurements with the TIROS VII Satellite
J. of the Atmospheric Sciences, 24, No. 6, November 1967

Kohl, H. and King, J. W.
Atmospheric Winds Between 100 and 700 km and their Effects on the
Ionosphere
J. of Atmospheric & Terrestrial Physics, 29, No. 9, September 1967

Krey, P. W.
Plutonium-238 from the SNAP-9A Burnup
CONF-670-602 (Annual Mtg of ANS, San Diego) June 11-15 1967

Kaufman, J. and Oklander, M.
Automated Atomic Absorption Spectrophotometry: II. The Determination of
Serum Magnesium
Clinical Chemistry, 13, No. 9, September 1967

Klein, B., Kaufman, J. and Oklander, M.
Automated Atomic Absorption Spectrophotometry: III. Calcium in Urine
and Spinal Fluid
Clinical Chemistry, 13, No. 9, Sept 1967

Kaye, S. V. and Crossley, Jr., D.A.
Radiotungsten Retention by Two Insect Species
Health Physics, 14, No. 2, February 1968

Komatsu, T.
Decontamination of Radioactive Water by Coprecipitation with Titanium
Hydroxide
J. Water Pollut. Contr. Federation, 39, January 1967

Lamerton, L. F. and MacMahon, B.
Epidemiological Studies in Human Radiobiology
Bulletin of the World Health Organizations, 36, No. 3, 1967

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Lengemann, F. W., Wentworth, R. A. and Hiltz, F. L.
Predicting the Cesium-137 Intake from Milk of a Human Population after
a Single, Short-term Deposition of the Radionuclide
Health Physics, 14, No. 2, February 1968

Liboff, A.R. and Shamos, M. H.
Ultra-low Levels of Terrestrial Ionization
Nature, 217, No. 5129, February 17, 1968

Lindblom, G.
Fallout Gamma-Emitting Radionuclides in Air, Precipitation, and the Human
Body up to Spring 1967
Issued by the Research Institute of National Defence,
Stockholm Sweden, FOA 4 Rapport A-4495-28, December 1967

Lloyd, Elizabeth
Relative Binding of Strontium and Calcium in Protein and Non-protein
Fractions of Serum in the Rabbit
Nature, 217, No. 5126, January 27, 1968

Mahlum, D. D. and Sikov, M. R.
Distribution of Cerium-144 in the Fetal and Newborn Rat
Health Physics, 14, No. 2, February 1968

Marshall, J. H. and Onkelinx, C.
Radial Diffusion and Power Function Retention of Alkaline Earth
Radioisotopes in Adult Bone
Nature, 217, No. 5130, February 24, 1968

Mattern, F.C.M., Drost, R. and Strackee, L.
Sr-90 and Cs-137 in the Human Diet in the Netherlands During 1966
Report RA-30, National Institute of Public Health, The Netherlands (Bilthoven)

Martin, A.
A Comparison of Some Bone Ashing Techniques
Health Physics, 13, No. 12, December 1967

Miyake, Y. and Saruhashi, K.
On the Radio-carbon Age of the Ocean Waters
Papers in Meteorology and Geophysics, 17, No. 3, 1966

Mott, C.J.B. and Nye, P. H.
Contribution of Adsorbed Strontium to its Self-Diffusion in a Moisture-
Saturated Soil
Soil Science, 105, No. 1, January 1968

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Mori, I.

Rapid Separation of Sr^{90} - Y^{90} , Pb^{212} - Bi^{212} by Thin Layer Electrophoresis
on Short Cut Pieces of Chromatosheet
Japan Analyst, 16, No. 12, December 1967

Madshus, K. and Stromme, A.

Levels of Cs-137 in Norwegian Lamb and Sheep 1964-1965
Acta Vet. Scand. 8, 1967, p. 71-75

Myhill, J.

Investigation of the Effect of Data Error in the Analysis of Biological
Tracer Data
Biophysical Journal 7, No. 6, November 1967

Pak, C. Y. and Bartter, F.C.

Ionic Interaction with Bone Minerals. III. Reversible Calcium Exchange
with Bone Powder
Proceedings of the Society for Experimental Biology & Medicine, 126, No. 1
October 1967

Pasternack, B. S. and Heller, M. B.

Genetically Significant Dose to the Population of New York City for
Diagnostic Medical Radiology. A Dosimetric and Statistical Study
Radiology, 90, No. 2, February 1968

Penfil, R. L., Brown, M. L.

Genetically Significant Dose to the U. S. Population from Diagnostic
Medical Roentgenology, 1964
Radiology, 90, No. 2, February 1968

Pribilla, O.

Contamination of Human Tissues and a Standard Diet with Fallout Radio-
activity During 1958-1966
Bundesministerium fur Wissenschaftliche Forschung
Report K-67-70, 1967

Patrick, G., Carr, T. and Humphreys, E.

Inhibition by Alginates of Strontium Absorption Studied in vivo and
in vitro
International J. of Radiation Biology, 12, No. 5, 1967

Posner, A. S.

Relationship between Diet and Bone Mineral Ultrastructure
Federation Proceedings, 26, No. 6, November-December 1967

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

- Preston, A., Jefferies, D.F. and Dutton, J.W.R.
The Concentrations of Cs-137 and Sr-90 in the Flesh of Brown Trout
Taken from Rivers and Lakes in the British Isles Between 1961 and
1966: The Variables Determining the Concentrations and their Use
in Radiological Assessments
Water Research, 1, 1967 pp 475-496
- Paterson, N.
Relative Constancy of 24-hour Urine Volume and 24-hour Creatinine
Output
Clinical Chimica Acta, 18, No. 1, October 1967
- Penna-Franca, E., Fiszman, M., Lobao, N., Costa-Ribeiro, C.,
Trindade, H., Dos Santos, P. L. and Batista, D.
Radioactivity of Brazil Nuts
Health Physics, 14, No. 2, February 1968
- Plato, P., Menker, F. and Dauer, M.
Computer Model for the Prediction of the Dispersion of Airborne
Radioactive Pollutants
Health Physics, 13, No. 10, October 1967
- Pensko, J.
Variations of the Gamma-Ray Background Dose Rates and Atmospheric
Radon Concentration in Warsaw
Atompraxis, 13, No. 7, 1967
- Pavlotskaya, F. I. and Tyuryukanova, E. B.
On Influence of Natural Conditions on Content and Distribution of
Radioactive Strontium in Soil Cover
Atomnaya Energiya, 23, No. 3, September 1967
- Quackenbush, F. and Rund, R.
The Continuing Problem of Sampling
J. of the Association of Official Analytical Chemists,
50, No. 5, October 1967
- Rundo, J., Taylor, B.T., Booker, D.V., Newton, D. and Scargill, D.
Attenuation in the Chest Wall of 20 keV X-Rays from an Inhaled Radioactive
Aerosol
Nature, 217, No. 5129, February 17, 1968
- Riel, G. K.
Concentration of Radioactive Isotopes in Environmental Water Measured
by Underwater Gamma Spectrometry
AD-648810, Naval Ordnance Lab, White Oak, Md. 12/20/66

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Radioactivity in Surface and Coastal Waters of the British Isles
Technical Report FRL-1
Ministry of Agriculture, Fisheries & Food Fisheries Radiobiological Lab
Lowestoft, Suffolk, England, October 1967

Data from Radiation Protection Programs
Radiation Protection Division, 5, No. 10, October 1967
Dept of National Health & Welfare, Ottawa, Canada

Data from Radiation Protection Programs
Radiation Protection Division, 5, No. 11, November 1967
Dept of National Health & Welfare, Ottawa, Canada

Data from Radiation Protection Programs
Radiation Protection Division, 5, No. 12, December 1967
Dept of National Health & Welfare, Ottawa, Canada

Rao, M.N., Yoshikawa, K., Thein, M., Clark, R. S. and Kuroda, P.K.
Radiochemical and Physical Characteristics of Single Fallout Particles
Health Physics, 14, No. 2, February 1968

Rapport D'Activite and Annexe Au Rapport Mensuel
September, October and November 1967
SCPRI B.P. n° 35, 78 Le Vesinet

Ray, R.D., Kawabata, M. and Galante, J.
Experimental Study of Peripheral Circulation and Bone Growth: Part III.
Clinical Orthopaedics and Related Research, No. 54, Sec. III
September - October 1967

Results of Environmental Radioactivity Measurements in the Community
Countries in 1966 - Air Fallout - Water
EUR 3602, EURATOM, Directorate for Health & Safety, Brussels, Nov 1967

Richmond, C.R. and Furchner, J. E.
Cesium-137 Body Burdens in Man: January 1956 to December 1966
Radiation Research 32, No. 3, 1967

Rimshaw, S.J. and Ketchen, E.E.
Strontium-90 Data Sheets
ORNL-4188, December 1967

RECENT PUBLICATIONS RELATED TO RADIONUCLIDE STUDIES - cont'd

Rissmann, S.

Measurements of the Natural Activity and Fission Products of Air
Kernenergie, 10: 198-201 (June 1967) in German

Rudolph, R. A. and Rasmussen, K. L.

Determination of Serum and Urine Calcium
Clinica Chimica Acta, 18, No. 2, November 1967

Russell, R.S. and Ellis, F.B.

Estimation of the Distribution of Plant Roots in Soil
Nature, 217, No. 5128, February 10, 1968

Strelow, F.W.E., VanZyl, C. R. and Nolte, C. R.

Separation of Alkaline Earth Elements by Cation-exchange Chromatography
in Ammonium Malonate Media
Analytical Chimica Acta, 40, No. 1, January 1, 1968

Schumann, G.

Investigations on Radioactive Aerosols
Chem.-Ing.-Tech. 39, 966-71 (August 1967) in German

Shleien, B.

Suggested Procedures for the Sampling and Measurement of Airborne
Radon-222
NERHL-67-7, Northeastern Radiological Health Lab, Winchester, Mass.

Studies on Environmental Radioactivity in Finland 1966

Annual Report SFL-A8, October 1967
Institute of Radiation Physics, Helsinki

Smith, R. W.

Dietary and Hormonal Factors in Bone Loss
Federation Proceedings, 26, No. 6, November-December 1967

Samachson, J.

Mechanism for the Exchange of the Calcium in Bone Mineral
Nature, 216, No. 5111, October 14, 1967

Thompson, J.C., Alexander, R. R., Comar, C. L.

Dietary Sr-90 Reductions through Food Substitutions in the Fruit and
Vegetable Category
Jour. of Nutrition, 91, March (1967)