UNCLASSIFIED

AD NUMBER

364 669

CLASSIFICATION CHANGES

TO Unclassified

FROM Confidential
Restricted Data

AUTHORITY

J.B. Wood, Hq DNA/IMTS, 19941007

THIS PAGE IS UNCLASSIFIED

UNCLASSIFIED

AD NUMBER

364 669

NEW LIMITATION CHANGE

TO

Approved for Public Release;
Distribution Unlimited.
** Stmt: A
** Code: 1

FROM

N/A

AUTHORITY

J.B. Wood, DNA/IMTS, 941007

THIS PAGE IS UNCLASSIFIED

REPRODUCTION QUALITY NOTICE

This document is the best quality available. The copy furnished to DTIC contained pages that may have the following quality problems:

- Pages smaller or larger than normal.
- Pages with background color or light colored printing.
- Pages with small type or poor printing; and or
- Pages with continuous tone material or color photographs.

Due to various output media available these conditions may or may not cause poor legibility in the microfiche or hardcopy output you receive.

☐ If this block is checked, the copy furnished to DTIC contained pages with color printing, that when reproduced in Black and White, may change detail of the original copy.

~~CONFIDENTIAL~~

POR-2516
(WT-2516)

364669

Operation

ROLLER COASTER

PROJECT OFFICERS REPORT—PROJECT 5.2/5.3b

RADIOBIOLOGICAL, RADIOCHEMICAL, AND PHYSIOCHEMICAL ANALYSES (U)

W. J. Major, Project Officer

R.A. Wessman

Tracerlab
Richmond, California

GROUP-1
Excluded from automatic downgrading and declassification.

~~RESTRICTED DATA~~

This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.

Issuance Date: August 24, 1965

All distribution of this report is controlled. Qualified DDC users shall request through Director, Defense Atomic Support Agency, Washington, D.C. 20301

~~CONFIDENTIAL~~

SECURITY MARKING

The classified or limited status of this report applies to each page, unless otherwise marked.
Separate page printouts MUST be marked accordingly.

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

NOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

~~CONFIDENTIAL~~

POR-2516
(WT-2516)

OPERATION ROLLER COASTER

PROJECT OFFICERS REPORT—PROJECT 5.2/5.3b

RADIOBIOLOGICAL, RADIOCHEMICAL, AND PHYSIOCHEMICAL ANALYSES (U)

W.J. Major, Project Officer
R.A. Wessman

Tracerlab
Richmond, California

All distribution of this report is controlled. Qualified DDC users shall request through Director, Defense Atomic Support Agency, Washington, D.C. 20301

GROUP-1
Excluded from automatic downgrading and declassification.

RESTRICTED DATA

This document contains restricted data as defined in the Atomic Energy Act of 1954. Its transmittal or the disclosure of its contents in any manner to an unauthorized person is prohibited.

This publication is the author(s) report to Director, Defense Atomic Support Agency; Director, Division of Military Application, Atomic Energy Commission; and Director, Atomic Weapons Research Establishment, United Kingdom Atomic Energy Authority, of the results of atomic weapons experimentation sponsored jointly by the United States-United Kingdom. The results and findings are those of the author(s) and not necessarily those of the Department of Defense, Atomic Energy Commission, or United Kingdom Atomic Energy Authority. Accordingly, reference to this material must credit the author(s). This document is under the control of the Department of Defense and, as such, may only be reclassified or withdrawn from circulation as appropriate by the Defense Atomic Support Agency; Atomic Energy Commission, Division of Operational Safety; or the Atomic Weapons Research Establishment.

DEPARTMENT OF DEFENSE
Washington, D.C. 20301

ATOMIC ENERGY COMMISSION
Washington, D.C. 20545

ATOMIC WEAPONS RESEARCH ESTABLISHMENT
Aldermaston, Berkshire, England

~~CONFIDENTIAL~~

Inquiries relative to this report may be made to

Director, Defense Atomic Support Agency
Washington, D. C. 20301

When no longer required, this document may be destroyed in accordance with applicable security regulations.

DO NOT RETURN THIS DOCUMENT

ABSTRACT

Data on the plutonium and uranium content of biological and physical samples, collected and isolated from non-nuclear detonations of plutonium bearing weapons under various storage situations, are presented. A precision tracer (Pu-236) procedure was developed for the rapid analysis of the plutonium, which was non-uniformly distributed in these samples. A fluorimetric procedure was developed for the rapid analysis of uranium.

Measurement of the plutonium content was accomplished by equilibration of tracer with sample plutonium, radiochemical purification, tracer yielding, and alpha pulse-height analysis. This method ensured a high degree of accuracy, high sensitivity, and freedom from interference from other alpha emitters.

Over 4,000 radiobiological, radiochemical, and fluorimetric analyses are tabulated. The analyses were performed at Tracerlab's western division in three isolated laboratories plus separated counting facilities. Accurate laboratory analysis of all samples was achieved with no personnel contamination or cross-contamination of samples. Procedures for radiochemical analyses, handling of special problems, techniques of Alpha Pulse Height Analysis, quality control measures, and additional data based on radiochemical analysis and radiometric measurements are presented.

CONFIDENTIAL

PREFACE

We are grateful to Dr. K. Stewart of the United Kingdom and Professor R. Wilson of the University of Rochester for their helpful suggestions.

CONFIDENTIAL

CONTENTS

ABSTRACT ---------- 5

PREFACE ---------- 6

CHAPTER 1 INTRODUCTION ---------- 11

1.1 Objectives ---------- 11
1.2 Background ---------- 11
1.3 Facilities ---------- 12
1.4 Services and Material ---------- 14
1.5 Personnel ---------- 16

CHAPTER 2 PROCEDURES ---------- 18

2.1 Sample Inventory ---------- 18
2.2 Projected Activity Levels ---------- 19
2.3 Sample Processing ---------- 22
2.4 General Laboratory Methods ---------- 28
2.5 Preparation of Tracer ---------- 43
2.6 Activity Measurements ---------- 46
2.7 Calculations ---------- 50

CHAPTER 3 DATA PRESENTATION ---------- 52

3.1 Discussion ---------- 52
3.2 Biological Data ---------- 52
3.3 Physical Data ---------- 54
3.4 Miscellaneous Data ---------- 57
3.5 Control Data ---------- 58
3.6 Data Summation ---------- 59

CHAPTER 4 CONCLUSIONS AND LABORATORY RESULTS ---------- 61

4.1 Conclusions ---------- 61
4.2 Laboratory Results ---------- 62

APPENDIX A DETAILED LOCATION OF PHYSICAL STATIONS --- 67

APPENDIX B RADIOBIOLOGICAL, RADIOCHEMICAL, AND PHYSIOCHEMICAL PROCEDURES FOR Pu^{239}, PU^{240}, AND URANIUM IN VARIOUS SAMPLES ----- 75

CONFIDENTIAL

APPENDIX C SAMPLE DATA SHEETS ---------- 127

APPENDIX D TECHNICAL PAPER FOR HANFORD SYMPOSIUM AND 9TH ANNUAL MEETING HEALTH PHYSICS SOCIETY ---------- 130

APPENDIX E DATA TABLES FOR PU^{239}, PU^{236} AND URANIUM (U_3O_8) IN PHYSICAL, BIOLOGICAL, TRACER, AND QUALITY CONTROL SAMPLES ---------- 149

APPENDIX F EQUIPMENT AND PLOT OF TYPICAL SPECTRUM -- 266

REFERENCES ---------- 271

TABLES

2.1 Selected TG-57 Data for Plutonium Activity ---------- 20
2.2 Total Counting Time Required to Give Listed Error ---------- 47
3.1 Animal Tissues with Greatest Pu Content ---------- 55
D.1 Effect of Sample Size on Pu Recovery ---------- 144
E.1 Radiochemical Analysis of Roller Coaster Samples, Double Tracks ---------- 152
E.2 Radiochemical Analysis of Roller Coaster Samples, Clean Slate I ---------- 172
E.3 Radiochemical Analysis of Roller Coaster Samples, Clean Slate II ---------- 185
E.4 Radiochemical Analysis of Roller Coaster Samples, Clean Slate III ---------- 205
E.5 Radiochemical Analysis of Biological Samples, Dogs ---------- 225
E.6 Radiochemical Analysis of Biological Samples, Sheep ---------- 234
E.7 Radiochemical Analysis of Biological Samples, Burros ---------- 245
E.8 Estimated Activity Expenditure of Project 2.6c "A" Samples in Particle Analysis ---------- 251
E.9 Plutonium and Uranium Analysis of Roller Coaster Distilled Water Samples, Clean Slate I ---------- 253
E.10 Plutonium and Uranium Analyses of Roller Coaster Distilled Water Samples, Clean Slate II ---------- 254
E.11 Plutonium and Uranium Analyses of Roller Coaster Distilled Water Samples, Clean Slate III ---------- 255
E.12 Tracer Standardization Results ---------- 257
E.13 Radiochemical Analysis of Roller Coaster Biological Quality Control Samples ---------- 258
E.14 Radiochemical Analyses of TLW Biological Quality Control Samples ---------- 260
E.15 Radiochemical Analysis of Roller Coaster Physical Quality Control Samples ---------- 261

CONFIDENTIAL

E.16 Radiochemical Analyses of TLW Physical Quality Control Samples ---------- 263
E.17 Number of Analyses of Biological Samples for Plutonium and Uranium ---------- 264
E.18 Number Analyses of Physical Samples for Plutonium and Uranium ---------- 265

FIGURES

A.1 Clean Slate igloos ---------- 67
A.2 Fixed surface instrument array ---------- 68
A.3 Fixed surface instrument array ---------- 69
A.4 Movable surface instrument array ---------- 70
A.5 Movable balloon-supported instrument array ---------- 71
A.6 Details of balloon curtain at 2,000-foot radius ---------- 72
A.7 Details of balloon curtain at 13,000-foot radius ---------- 73
A.8 Details of balloon curtain at 50,000-foot radius ---------- 74
D.1 Reflux apparatus for biological sample ---------- 145
D.2 Chemical dissolution, separation, and purification sequential scheme ---------- 146
D.3 Plutonium electroplating sequential scheme ---------- 147
D.4 Typical spectra, biological sample ---------- 148
F.1 Reflux apparatus for biological sample ---------- 267
F.2 Frisch-Grid chambers ---------- 268
F.3 TMC multichannel analyzer ---------- 269
F.4 Typical spectra, biological sample ---------- 270

CONFIDENTIAL

CHAPTER 1
INTRODUCTION

1.1 OBJECTIVE

The objectives of Project 5.2b (Radiobiological Analysis) was to provide accurate laboratory analysis of animal tissue, bone material, and metabolism samples for plutonium and uranium content. Plutonium analyses were performed on all samples and uranium analyses on approximately ten percent except Clean Slate II, dogs and sheep, which required uranium analyses on most samples. The uranium analyses were representative of sample and animal types.

The object of Project 5.3b (Radiochemical and Physiochemical Analysis) was to provide accurate laboratory analysis of air, deposition, water, vegetation, sticky wire, and soil samples for plutonium and uranium content. Plutonium analyses were performed on all samples and uranium on approximately 10 percent, representative of sample types.

1.2 BACKGROUND

The personnel associated with Project 5.2/5.3b did not participate in the field phases of operation Roller Coaster. Reference is given therefore, to other projects for a description of operational events and sample collection for laboratory analyses. The scope of

GROUP 1
Excluded from automatic downgrading and declassification

this project was to provide facilities, services and materials to carry out the dual objectives listed above.

1.3 FACILITIES

Laboratory: The radiobiological, radiochemical, and physiochemical analyses of the field collections for plutonium and uranium are one of the prime sources of evaluative data for Project Roller Coaster. The samples collected represent individually, and totally, large sums of money and scientific effort. For this reason, analyses were performed with great care, attention to detail, and utmost precision. Only those techniques which resulted in unequivocal data were used. Particular attention was given to the problem of cross-contamination. Two techniques were employed. The first was sequential processing, starting with low level samples and proceeding to the higher level samples, the second involved the physical separation of high, intermediate, and low level facilities. Both techniques were used in series. The lowest of high level samples were processed initially in the intermediate level facilities. For high level samples, a special wing of the main laboratory building was employed for initial separation and aliquoting, followed by processing in the intermediate laboratory. All low level samples were processed in a separate low level laboratory.

Counting and Calculations: These facilities were located in an isolated wing of the building. Advanced counting and calculation techniques used by Traceriab for a number of years were employed. Detailed procedures are given in the reference.

Each sample for Pu analysis was counted on a 2π methane-

CONFIDENTIAL

this project was to provide facilities, services and materials to carry out the dual objectives listed above.

1.3 FACILITIES

Laboratory: The radiobiological, radiochemical, and physiochemical analyses of the field collections for plutonium and uranium are one of the prime sources of evaluative data for Project Roller Coaster. The samples collected represent individually, and totally, large sums of money and scientific effort. For this reason, analyses were performed with great care, attention to detail, and utmost precision. Only those techniques which resulted in unequivocal data were used. Particular attention was given to the problem of cross-contamination. Two techniques were employed. The first was sequential processing, starting with low level samples and proceeding to the higher level samples, the second involved the physical separation of high, intermediate, and low level facilities. Both techniques were used in series. The lowest of high level samples were processed initially in the intermediate level facilities. For high level samples, a special wing of the main laboratory building was employed for initial separation and aliquoting, followed by processing in the intermediate laboratory. All low level samples were processed in a separate low level laboratory.

Counting and Calculations: These facilities were located in an isolated wing of the building. Advanced counting and calculation techniques used by Tracerlab for a number of years were employed. Detailed procedures are given in the reference.

Each sample for Pu analysis was counted on a 2π methane-

CONFIDENTIAL

flow, internal alpha counter to determine its range of activity. This information was then used to preset the precision (alpha pulse height analysis) counting time and to prevent mixup of samples. The range of counts was limited by dilutions to approximately 2,000 cpm. The range of counts in the original sample was 0 to 10^8. Counts per minute was converted to dpm by standard calculation procedures given in the references.

The technique of accurate alpha pulse height analysis depends on such factors as: preparation of high quality standards, calibration and maintenance of the equipment and routine background, and operational checks of counting instruments. Six Tracerlab Frisch Grid Chambers were employed for plutonium alpha detection. Three Technical Measurements Corporation multi-channel analyzers were used for readout. Four Frisch Grid Chambers were connected to one multi-channel analyzer by dividing the full range into four quadrants. The Frisch Grid Chambers were routinely operated in this manner.

The results of the alpha pulse height analysis are presented on tape. A graphical plot was made of this information where shape and resolution of alpha peaks were marginal. The various corrections and factors were applied to the data and the final result calculated as concentration per sample.

A computer program for data tabulation was developed. The program simplified new data insertion and provided for printing of results rapidly and economically. An IBM card punch, located in a room adjacent to the counting room, was employed for transcribing raw data.

CONFIDENTIAL

Storage: All biological samples were stored in a specially built walk-in freezer located in the v level laboratory. The unit was large enough to store all the sample freezer boxes with adequate spacing for easy access. The physical samples were stored in metal, office-type file cabinets with fabricated security locks. Mounted samples, following analyses, were stored in locked file cabinets in the counting room. Unused portions of samples were stored on shelves in a locked stockroom located adjacent to the intermediate level laboratory.

1.4 SERVICES AND MATERIALS

Services and materials were provided to perform a research project consisting of plutonium and uranium analysis on the following variety of sample matrices:

Casella Impactor Discs

Casella Impactor Filters

Andersen Sampler Discs

Andersen Sampler Filters

Total Air Samples

Total Air Samples Disposable

Sequential Air Samples

Balloon Wire Swipes

Water Samples

Vegetation (Sagebrush)

Deposition Samples

Soil Samples

Biological Samples

CONFIDENTIAL

Services and materials were provided to assure that resultant data was most meaningful to the requirements of Project Roller Coaster and that biweekly progress reports giving accrued results were submitted to Director, DASA. This included:

(1)* Use of new glassware for each analysis.

(2)* Isolation of personnel and facilities for varying levels of activity.

(3) Constant monitoring of muffle furnaces, hoods, work tables, floors, etc., by trained monitors under supervision of a Certified Health Physicist.

(4)* Utilization of Plutonium ^{236} tracer techniques on all samples to assure measurable and accurate yields on all samples.

(5)* Analyses of all plutonium samples by alpha spectroscopy.

(6)* Complete dissolution of each sample prior to purification.

(7) Establishment of reagent blanks less than 0.1 alpha dpm $\pm$ 100% and less than 5×10^{-9} grams for plutonium and uranium respectively.

(8) Laboratory monitoring of stippled plates of dissolved samples as a means of sample separation by activity level and preventing sample mixup.

(9)* Electrodeposition of plutonium on platinum discs as the final step of the analysis.

---

* These procedural techniques were stipulated by the Roller Coaster Radiochemistry Referee Team and were conditions of the contract.

CONFIDENTIAL

(10) Storage of unused portions of samples and all mounted samples for a period of one year or until notification was received by the Contracting Officer, whichever came first.

(11) Continuous Tracerlab staff evaluation monitoring of a quality control program.

1.5 PERSONNEL

Tracerlab provided all the personnel for the services described under Section 1.4. These included the following and their responsibilities:

(1) Evaluation Staff: General conduct of the project, monitoring of the quality control program, and review of periodic reports.

(2) Project Officer (1): Supervision of the project operation, health and safety standards, review of all data, writing of periodic reports, liaison with cognizant Roller Coaster officials.

(3) Radiobiologist (1): Operation of radiobiological laboratory and sample accountancy.

(4) Physiochemist (1): Operation of two physiochemical labortories and sample accountancy.

(5) Radiobiological Technicians (3): Radiobiological analyses of physical samples.

(6) Physiochemical Technicians (3):- Physiochemical analyses of physical samples.

(7) Uranium Technician (1): Uranium analyses and calculations.

CONFIDENTIAL

(8) Health Physicist (1): Routine monitoring of work areas and waste materials.

(9) Radiometrics Head (1): Review counting and calculations.

(10) Counting Technician (1): Count plutonium samples.

(11) Calculation Clerks (2): Calculate plutonium counting data.

(12) Computer Data Clerk (1): Punch and proofread computer data.

(13) Electronics Technician (1): Maintain counting instrumentation.

CHAPTER 2

PROCEDURES

2.1 SAMPLE INVENTORY

Biological: The samples arrived by government air freight at the Alameda Air Terminal in Oakland, California, on 20 September 1963. They were contained in 12 polyfoam freezer boxes weighing approximately 50 pounds per box. All the boxes appeared to be in good condition and a receipt for the same was given to the DASA courier who had accompanied the samples from Kirtland Air Force Base, Albuquerque, New Mexico. The boxes were transported to Tracerlab by truck and placed in the walk-in freezer unit in the low level laboratory, awaiting inventory instructions from cognizant DASA security personnel. On 26 September 1963, the contents were inventoried in the presence of a DASA security officer. All samples not clearly marked were re-tagged and returned to their original containers. A separate log book was established, and the following week a quality control program was iniated. Quadruplicate analyses were run on all reagent materials and a low level background established. A tracerlab code number was assigned each sample.

Physical: The samples were delivered to Tracerlab by Tracerlab's Health Physics Officer at intervals spanning a three-week period, starting in mid-October 1963. The samples were contained in heavy-duty cardboard boxes, doubly wrapped. All boxes appeared

CONFIDENTIAL

to be in good condition. The Double Tracks samples arrived first, followed by Clean Slate I, II, and III. The samples were placed in the combination security files in the intermediate level laboratory and inventoried in the presence of the Tracerlab Security Officer. A separate log book was established and a Tracerlab code number assigned each sample. All samples were clearly marked and identification presented no problems. A quality control program was initiated shortly after arrival of the samples. This program was purposely delayed until after final sample inventory to determine if any contamination of the laboratory had occurred. Quadruplicate analyses on reagent materials and laboratory swipes were run and a low level background established.

2.2 PROJECTED ACTIVITY LEVELS

Biological: Based on the results of TB-57 (Reference 1)*, the majority of tissues were expected to be low in total plutonium content. The range would be from almost undetectable to thousands of dpm of plutonium in the nasal mucosa and GI tract (Table 2.1). Because of the spread between activity levels, extreme care was taken in the preparation and processing of the low level tissue samples. As far as the receiving laboratory was concerned, these samples represented no problem in plutonium handling. Since activity in a sample might be distributed unevenly, the entire sample was always analyzed.

* (Also, see References 2 through 8.)

CONFIDENTIAL

TABLE 2.1 SELECTED TG-57 DATA FOR PLUTONIUM ACTIVITY IN DOGS

Tissue	Mean Weight (Grams)	DPM/Gm Magnitude	DPM/Organ
Spleen	23.9	0.1	2.4
GI tract plus Contents	548.6	10	5500
Liver	309.0	0.01	3.1
Lung	76.6	0.5	38
Trachea	11.9	1	12
Right Femur	34.7	0.1	3.5
Rib	4.6	1	4.6
Hilar Lymph Node	0.45	10	4.5
Mediastinal Lymph Nodes	0.31	10	3.1
Nasal Mucosa	Not Analyzed		

The levels of uranium at 500, 5000, 7500, and 17,500 feet animal positions corresponding to the plutonium are, based on extrapolation from TG-57 data, proportional to the ratio of uranium to plutonium in the test device. Thus in samples very low in Pu content, the uranium level was expected to be near the limits of detection of the fluorimeter.

Physical: The sources of plutonium and uranium from the Roller Coaster tests were soils and various types of collection devices (surface and airborne), such as filters, impactors, and sticky plates; all located at various distances from the detonation crater, based on TG-57 data. The activity levels were expected to range from 0 to 10^7

CONFIDENTIAL

dpm. Particulates of all sizes were expected to be in various matrices. The plutonium and uranium would vary in chemical composition from metals to various alloys, oxides, and salts produced in the heat and pressure of the explosion. Projected activity levels for various sample types are given below.

(1) Crater Samples: The crater samples will be extremely high level with most of the activity near the surface. In TG-57, 80 square-inch samples were taken to a depth of two feet and sectioned into 1/4-inch increments. At the surface, this amounted to a milligram of plutonium per 25 grams of soil.

(2) Soil Samples: The samples from soil cores and surface fallout were spread out over many square miles. Three levels of surface samples (corresponding to those observed in TG-57) were considered, i.e., 500, 40, and 2.6 $\mu g/M^2$ at distances of 500, 1000, and 2000 feet, respectively. An 80-square-inch (0.0515 M^2) surface sample yields 25, 2, and 0.13 μg plutonium, respectively. These sample sizes were more than ample for uranium fluorescence and radiochemical analysis. Uranium in Nevada soil has been determined. The levels range from 0.1 to 6.0 $\mu g/g$ of soil, which represents an appreciable normal uranium background.

(3) Filter and Impactor Exit Filter Samples: The levels of filter activity observed in TG-57 for fallout samples at various distances were less than one microgram of Pu at 1000 feet and 0.01 μg at 25,000 feet.

(4) Sticky Samples: The targets of the various impactor jets as well as fallout plates employ an alkyd resin surfacing to retain the

CONFIDENTIAL

particulates as they impact or fall out on the surface. The levels of Pu activity observed on these surfaces were estimated to be of the same order of magnitude as the air filter, or in the case of sticky plates, equivalent soil samples.

2.3 SAMPLE PROCESSING

Handling Techniques: Advantage was taken of information locating the field position of the sample with respect to ground zero and the gross alpha counting data supplied with each sample. Samples were screened and rough assayed to confirm the accompanying data. The handling facilities themselves were checked routinely and blank samples processed to confirm the ambient levels.

As indicated in Table 2.1, the biological samples generally constituted the lowest level samples and were processed in the low level laboratory.
lowest level samples and were processed in the low level laboratory.
Those biological samples having a probable higher Pu content were processed in an isolated section of the low level laboratory. In contrast, the debris samples, potentially several orders of magnitude higher in plutonium content even at the 250,000-foot distance, were treated as high level samples and processed separately until their Pu content was established.

Techniques gained through experience for prevention of cross contamination and mixing in the laboratory were employed. In particular, these techniques included proper recording and marking of each sample by the analyst at every stage in the process. All reagents used in this work were made up fresh in new containers and designated accordingly. New glassware was used for every analy-

CONFIDENTIAL

sis in the spirit of Item 4, of the guidelines supplied in the DASA RFP 3-63. When muffle furnaces were employed, each sample was covered to remove the possibility of flake out. Hoods, laboratory surfaces, and other exposed areas were cleaned routinely and monitored for possible alpha contamination. The unused portions of samples were returned to the original containers when possible, checked for proper labeling, and stored in a locked cabinet until notification of disposition was received from the contracting officer. Similarly, both the counting discs and planchets (stored in individual envelopes or pillboxes) and the original counting data were retained until notified by the contracting officer. Blanks, spikes, duplicates, and actual standards as required were analyzed and furnished to referees or the agency designated by DASA.

Security and Accountability: Several means of assuring adequate security and accountability of all biological and physical samples were investigated. The methods given below offered the most effective operation.

(1) Biological and physical samples inventoried by two persons and sample numbers initialed by each on inventory sheets.

(2) Active Inventory: Biological and physical samples withdrawn from inventory (by convenience, activity level, and event) recorded in separate logs, assigned a consecutive Tracerlab number, and initialed by custodian.

(3) Each sample assigned a card at start of analysis, card initialed by analyst at start of every major step (preparation, tracer addition, dissolution, and purification).

CONFIDENTIAL

(4) Sample card information duplicated in sample log.

(5) After decontamination sample assigned a data sheet, pertinent information entered, and sample transferred to counting room.

(6) Sample recorded and initialed by counting room custodian in a special counting room log with a consecutive number matching that in the chemistry log.

(7) Sample stored in security file and final calculations processed by Tracerlab's normal red dot doublecheck.

(8) Final data reviewed by counting room supervisor, project officer, and department manager.

(9) Following final review of the raw data, a tabulation of all values was made by animal numbers (for biological samples) and arc location (for physical samples).

Production Operation: The following procedures were employed to achieve maximum production.

(1) Different analyst assigned to each phase of the production operation on a rotation basis.

(2) Samples prepared for dissolution in batch type operation.

(3) Tracer added in batch type operation.

(4) Samples solubilized in batch type operation.

(5) Samples decontaminated in continuous operation (samples were processed by pairs. Thus, it was possible to precipitate, centrifuge, extract, etc., several sets of samples in a continuous operation eliminating dead time).

(6) Plated samples monitored for approximate yield.

CONFIDENTIAL

(7) Plated samples inspected and data sheet prepared by custodian.

(8) Samples 2 π counted to estimate requir d alpha pulse height analysis time and to provide a double check on final result.

(9) Production schedules set for each analyst and weekly results posted.

Preparation: The treatment of the physical samples varies according to the nature of the collection media. These divide into three types: a heterogeneous mixture of soil and debris, air and surface fallout, and resuspended particulates collected on organic filters and similar material adhering to sticky plates. Because of the high levels of plutonium alpha activity expected, all field and laboratory procedures were reviewed with regard to preventing cross contamination and preserving the integrity of the samples. The level of uranium was not hazardous but similar precautions apply.

The samples for radiochemical and uranium fluorimetric analysis were categorized at the time of receipt of the samples. The samples were already grouped at the test site. Similar levels of alpha activity were handled together and precautions against cross contamination were maintained. Because of the relatively high levels of alpha activity, some samples were processed in glove boxes.

All samples were ultimately reduced to the levels required for laboratory operations and stored or processed as scheduling permitted. Dilutions were made such that no aliquot contained more than 4000 dpm.

CONFIDENTIAL

Sample Control: Strict sample control was instituted in order to be sure that samples were not misplaced, delayed, or processed with samples of different activity magnitude. As mentioned earlier, many samples received for processing contained designations as to general activity level and sampling location. This information was useful in routing the sample to the proper dissolution laboratory. Locations of particulate samplers consisting of six-stage Andersen impactors, five-stage Casella impactors, total air samplers, and sticky cylinders, are given for reference in Figures A. 2 through A. 8.

Figure A. 1 shows Clean Slate igloo dimensions.

For each lot of samples received, a sample check-off sheet was initiated containing sample numbers and due dates. It was reproduced and distributed to the key personnel along the processing route. These personnel checked off the samples as they were processed, and thus continuous check on sample status was maintained. In addition, a sample processing card and sheet (mentioned in Section 2. 3) was initiated for each sample. The card contained pertinent chemical information and followed the sample through dissolution and decontamination. The processing sheet, in addition to the card information, contained spaces for recording all data needed to calculate the analytical results. Spaces were provided for sample size, sample aliquots, tracer aliquots, etc. It also contained sample routing instructions and followed the sample from decontamination through calculations. A typical processing sheet is included in Appendix C. When final calculations were completed and reviewed by the project officer, the data was transcribed to IBM cards for the preparation of a computer report.

CONFIDENTIAL

Quality Control: In order to maintain high quality standards, the analytical work of this laboratory was closely controlled. This control was maintained in the laboratory and in the counting room. Blank samples were processed completely through chemistry and counting to determine if there was any laboratory contamination. Known plutonium samples (standards prepared by adding a Pu-239 spike to a matrix material similar to those being processed) were similarly cycled through the laboratory to check on procedures and counting geometry factors. In addition, standard and calibration samples furnished by DASA referee personnel were processed to assure results of all Roller Coaster contractor laboratories were comparable. Beta gamma, and alpha activities of electrodeposited alpha samples of solutions of pure Pu^{239} and mixed Pu^{239} were cross-counted among Air Force and AEC laboratories during the Roller Coaster analyses period. Periodic blank samples were also cross-counted.

The techniques used in maintaining high quality standards for uranium analysis are specified in the detailed Fluorimetric Determination Procedure included in Appendix B. Blanks, standard solutions, and spiked unknowns were analyzed with each batch of 20 samples. A routine review of the results of all samples processed was performed by the project leader or his delegated assistants. All counting data was reviewed to asertain that alpha spectrometer runs were good as to alpha peak resolution, that the alpha peaks were properly shaped without undue tailing of one peak into the next, and that the base area of the peak was properly defined. Other aspects of the sample

CONFIDENTIAL

run were checked such as adequate chemical yield, clean weightless electrodeposits on Pu sample plates, etc. Any discrepancies were reported to the project leader on the QUALITY CONTROL - SAMPLE DEFICIENCY REPORT form for appropriate action. A copy of this form is attached in Appendix C.

2.4 GENERAL LABORATORY METHODS

Discussion: The material presented in this section describes, in general, radiochemical techniques used by Tracerlab for a number of years for determining Pu-239 and uranium in various sample types. In particular, Pu-236 tracer yielding for all plutonium analyses was employed. Radiochemical techniques were such that yields greater than 60% were generally obtained. Separation of uranium and plutonium was carried out on every sample. Furthermore, all plutonium samples were measured by pulse height analysis techniques, with high sensitivity and assurance of no interference by other alpha emitters. The counting error had a precision of 10% for the low counting samples when economically feasible and 3% or better for the more active samples.

The recovery efficiency for uranium was checked on each analysis according to the techniques described in "SCTM 369-59(51) Test Group 57 Radiochemistry", by R. J. Everett and R. W. Drake. All samples were completely dissolved. An aliquot, usually 10% of the total dissolved solution, was taken from samples requiring uranium analysis. When required, an extraction was performed to remove quenching agents such as copper and iron cations. The total uranium was determined by a fluorescence technique in a Jarrell-Ash

CONFIDENTIAL

Fluorimeter.

The biologicals presented some unique challenges both in dissolution and purification. Prior to the start of the project, an exhaustive literature survey was made and consultations held with individuals learned in the bioassay field on the problem subject. Most of the information and procedures offered, however, dealt with organics less than 50 grams in weight. Very little was known about analyzing pound size samples for plutonium and uranium. It was decided, therefore, to combine modified Tracerlab biological procedures with those in the literature, to fit the situation. A lengthy development program produced the detailed radiochemical and fluorimetric procedures given in Appendix B.

A technical paper, "Routine Determination of Plutonium by Tracer Techniques in Large Biological Samples," based on our biological development work, was presented at the Hanford Symposium on "Inhaled Radioactive Particles and Gases" and at the 9th annual Health Physics Society in Cincinnati, Ohio. A copy of the paper is given in Appendix D.

The biological samples were processed concurrently with the physical samples, which were arranged in order of Double Tracks, Clean Slate I, II, and III. The techniques for dissolution, separation, purification, are described in the following paragraphs. It should be mentioned that a given procedure does not necessarily cover every chemical or counting situation. Often one or more samples among identical types required special treatment.

Biological Sample Dissolution: The biological dissolution procedures employed resulted in the least loss of sample. Wet versus dry dissolution was experimentally compared. Dry ashing of most biological samples, although convenient and inexpensive, results in loss of sample by spattering, mechanical entrainment, and polymerization and formation of insoluble oxides of Pu. This is especially true of samples which have high organic-to-ash ratios. In these cases it may be difficult or impossible to recover all of the sample plutonium from the walls of the ashing container. Loss occurring at this stage may result in inaccurate sample yielding. Bone samples have a low organic-to-ash ratio, and the ash serves as a carrier to prevent loss of Pu during dry ashing. The bone ash is bulky and easily removed from the ashing container by dissolving in acid and then is equilibrated with Pu tracer. Wet dissolution in the presence of Pu-236 tracer allows exchange of sample Pu with tracer and control over excessive temperatures, thus preventing formation of insoluble oxides and polymers. Wet dissolution was routinely performed, using a refluxing apparatus (Figures F.1 through F.3) or open beakers, by an experienced chemist. All samples processed for plutonium analyses employed Pu^{236} tracer for yielding. The tracer activity was normally aliquoted such that it was within a factor of five of the expected sample activity but a minimum of 15 dpm. The tracer was always added at the start of dissolution except for bone samples. Dissolution of the biological samples varied with the tissue or metabolism type and size. A brief discussion of each is given below.

(1) Small tissues (<2 ounces): Samples were placed in ap-

CONFIDENTIAL

propriate sized beakers (250 to 400 ml), organ activity was estimated from the data in TG-57, and appropriate tracer added. Each sample was covered with HNO_3 and the mixture boiled to low volume. Fuming HNO_3 and $HClO_4$ were added and the mixture again boiled to low volume. When the HNO_3 was driven off and the $HClO_4$ concentrated by boiling, an exothermic reaction took place and moderate foam swelled up inside the beaker. The reaction could be controlled by the addition of HNO_3, but with small organics this was not usually necessary. Further boiling produced a clear solution containing only minor amounts of salts which were solubilized on dilution. Care was taken to avoid evaporation to dryness since formation of explosive perchlorate salts would result.

(2) Medium Tissues (2 ounces to 3 pounds): Samples were placed in appropriate sized beakers (1 to 4 liters) and tracer added. Each sample was covered with HNO_3 and boiled to low volume. Sulphuric acid was added to char the organic and the mixture fumed to low volume twice until a deep red solution was obtained. Fuming HNO_3 was added and the solution boiled to low volume. Nitric acid and $HClO_4$ were added in that order and the solution boiled to low volume. Sulphuric acid was again added and the solution boiled to low volume to drive off all $HClO_4$ which forms explosive mixtures with the cupferron — $CHCl_3$ reagent added later to extract plutonium and uranium. The dissolution of the samples in this category was done by the $HClO_4$ H_2SO_4 method rather than the H_2SO_4 reflux method since the former was much faster. Also the amount of organic present at the time of $HClO_4$ addition was small and any exothermic reaction (occurring

CONFIDENTIAL

when hot concentrated $HClO_4$ is mixed with organic matter) was minimal.

(3) Large Tissues (> 3 pounds): Most of the samples in this category were dissolved in four-liter beaker; a few tissues had to be divided into two or more sections to fit. To eliminate the thawing process, an electric knife was used for the division. Tracer, K_2SO_4, Hg catalyst, and antifoam agent was added to each section. Enough H_2SO_4 was added to cover the sample, and an inverted 6-inch funnel, held by a ring stand, was placed inside the beaker. The sample was placed on an individual hot plate (covered with asbestos to avoid cracking of beaker at ensuing high temperatures) and heated at low temperature until a black tar mixture was obtained. The heat was increased until the tar turned to, in order, black jelly, black liquid, red liquid, clear solution. During high-temperature heating the H_2SO_4 refluxed and the inverted funnel was raised or lowered to control the action. Asbestos wrapped around the beaker increased the temperature and reflux conditions. A trace of carbonaceous material left on the beaker and funnel walls after refluxing was removed by $HClO_4$ cleansing and boiling. However, the formation of metal organic salts from the $HClO_4$ precluded good decontamination and H_2SO_4 washings were substituted. The remaining H_2SO_4 was finally fumed to wet dryness. Since many samples were processed simultaneously the billows of heavy, toxic SO_3, $HClO_4$, and nitrous oxide fumes outside the lab created a potential health problem. A multi-vacuum apparatus, leading to a large polyethylene carboy filled with a dilute base, trapped most of the fumes. The balance were solubilized in a water-

CONFIDENTIAL

scrubber apparatus attached to the outside hood vents. Distillation and condensation of the acid fumes was also tried inside the hood and found to be effective. During H_2SO_4 evaporation large amounts of inorganic salts (from the combination of the acid radical and the minerals in the animal organ) precipitated out of the acid solution. Since these salts interfered with later decontamination of Pu and U, a procedure was developed in which the heavy elements were reduced with $NH_2CH \cdot HCl$ and extracted from the bulk salts with cupferron and $CHCL_3$. As a result of this modification clear plates and good yields were obtained.

(4) Bone Samples (All Sizes): All bone samples were dried in a drying oven overnight to reduce smoking and popping during the ashing operation. Following the drying process the bones were cut as required and ashed at 500°C overnight in Corningware (Corningware is glazed and eliminates ash sticking to the walls). The ash, salts, and low smoke content of bones obviated swelling and entrainment loss of Pu (as contrasted to animal organ samples). The ash was transfered quantitatively to a beaker and dissolved in HCl. Tracer was added at this point rather than at the start to assure equilibration and accurate yield. Losses of U as well as Pu in ashed bone samples are prevented by the heavy ash content. The solution was boiled to low volume and the plutonium and uranium extracted from the large amounts of salts by the cupferron - $CHCl_3$ method mentioned earlier. The extracted material was boiled to low volume and reboiled with $HClO_4$ to wet dryness. In the larger bone samples, a white residue appeared at this point and a second extraction was necessary. A few ml of HCl was added to the final wet dry $HClO_4$ mixture prior to the second extraction. An attempt was made to remove Pu from an acid solution on a $Zr_3(PO_4)_4$

CONFIDENTIAL

precipitate. However, the yields were lower and plates extremely dirty, distorting the alpha energy spectrum. This procedure was discarded early for the extraction.

(5) Metabolism Samples (All Sizes): Urine and feces samples were analyzed similarly except urine samples were first evaporated to wet dryness (after tracer addition). Both types of samples were then covered with HNO_3 and boiled to low volume. Fuming HNO_3 was added and the solution cautiously evaporated to dryness. When the samples were near dryness, ignition occurred and the residue burned slowly with the evolution of nitrous oxide fumes. After the pyrotechnic flame had subsided the residue was taken up with HNO_3 and $HClO_4$ and boiled to low volume as in the medium tissue procedure. Sulphuric acid was added and the mixture boiled to drive off $HClO_4$ prior to the extraction with cupferron-$CHCl_3$.

Biological Sample Purification: After dissolution, the sample was purified. Purification is necessary to decontaminate the sample from other radionuclides present and secondly to separate plutonium from macro amounts of all other elements. The final product is a weightless, contaminant-free invisible deposit of plutonium. The preparation of a weightless deposit yields sharp, well-resolved alpha peaks. The procedure is simple, well-established, and with normal care results in high yield. The basic steps in the procedure are $Fe(OH)_3$ precipitation, ion-exchange separation, and electroplating onto a polished platinum disc. The plated sample is placed in a small labeled metal container and is counted by alpha pulse height analysis.

The purification of the larger biological and bone samples pre-

CONFIDENTIAL

sented some special problems. Off color (white) $Fe(OH)_3$ precipitates, acid dissolution residues, and violent $NaBrO_3$ oxidation reactions often occurred if a hexone extraction was employed. Removal of salts in the cupferron - $CHCl_3$ extraction immediately following dissolution eliminated most of the problems described. As mentioned earlier, some bone samples required two additional cupferron - $CHCl_3$ extractions to prevent large $CaOH$-$CaPO_4$ precipitates occurring in the first step in purification. Purification of a biological sample sometimes required large volumes of $CHCl_3$ and several days of an analyst's time.

Physical Sample Dissolution: All physical samples processed for plutonium analysis employed Pu-236 tracer for yielding. Tracer additions were similar to those of the biological analyses except where large dilutions were necessary. Heavy soil samples were set aside pending investigation of a partial dissolution procedure. Wet chemistry techniques (using HF) were employed on samples containing small amounts of soil. Filter and sticky film samples were treated with fuming nitric and perchloric to destroy organic matter and then with HF to dissolve any silicates present. Physical samples, as biological, were treated with H_2SO_4 - $HClO_4$ to assure equilibration of tracer and sample Pu.

Dissolution of the physical samples varied with sample type and size. Generally HF treatment was required to remove silicates and all of the dissolutions were started or transferred to teflon beakers. A brief discussion of those types giving dissolution

CONFIDENTIAL

problems are listed below (HF disc boiling avoided, prevent U pickup).

(1) Cassella and Andersen Discs: No special obstacles were encountered until the end of the normal dissolution procedure. A white residue was observed on the surface of some of the discs after removal from the acid dissolver solution and subsequent air drying. The residue was checked for activity but none was apparent. As a precaution, the glass disc was rinsed into the original beaker with a 1N $HF-HNO_3$ solution which removed all traces of the residue.

(2) Sticky Films, Method No. 1: The sample was covered with fuming HNO_3 and boiled to low volume. The procedure was repeated until the solution turned from black to a dull red (usually required approximately one liter of fuming HNO_3). Perchloric acid was added and the mixture boiled to low volume. An exothermic reaction occurring at this point was allowed to go to completion. Further boiling produced a clear solution.

(3) Sticky Films, Method No. 2: The sample was covered with fuming HNO_3 and boiled to low volume. The process was repeated 2 or 3 times and the mixture allowed to dry and ignite on the last time. Ignition was encouraged by dropwise addition of fuming HNO_3 and heat. Final dissolution of the carbon black sample was accomplished with addition of $HClO_4$. Limited exothermic reaction occurred in this step.

(4) Sticky Films: Method No. 3: Approximately 5 ml of CH_3OH was added and the sample ignited with a Fischer burner. Fuming HNO_3 and $HClO_4$ were added after ignition was completed and mixture boiled to low volume. If the sample contained appreciable

CONFIDENTIAL

amounts of dirt, bumping occurred. Addition of 3 to 5 ml of H_2SO_4 eliminated this bumping in boiling to low volume (some foaming occurred at this point). Finally, HF was added to effect complete dissolution of the dirt. This method proved to be the most economical timewise and in consumption of reagent. No loss of sample was evident by activity measurements of filter collections of the fumes.

(5) Total Air (TAS): These samples were usually dissolved in fuming HNO_3 and charred, followed by a fuming HNO_3 - $HClO_4$ dissolution. Samples with appreciable amounts of dirt required HF treatments.

(6) Total Air Disposable (TASD): Samples were relatively bulky* and required several acid dissolutions. The samples were treated with fuming HNO_3 and charred. A sticky ring remained on the wall of the teflon beaker which was dissolved by boiling with H_2SO_4 and $HClO_4$. Nitric acid and HF were added after the last $HClO_4$ reaction and the sample boiled to low volume.

(7) Small Soil Samples ($<$ 5 gms): Dissolution of soils was done almost entirely in teflon beakers due to required HF treatments. Fuming HNO_3 was first added to cover the sample and the sample boiled until yellow fumes were no longer evident (bumping occurs at too low a volume). Perchloric acid was added and the mixture boiled to wet dryness. Little reaction occurs during this step. Fuming HNO_3 was added to cool the mixture and HF added (15 to 25 ml for each 5 gms of soil, 1 ml at a time to control reaction) until low foaming reaction subsided. The mixture was boiled until a clear solution was

* Not normal, but backing stuck to filter.

CONFIDENTIAL

obtained. All the sample except water soluble salts and a trace of hard silica (the latter showed no measurable activity) went into solution after acid boiling. Dilution of the acid solution (250 ml for each 10 gms of soil) dissolved all residues but the hard silica.

(6) Large Soil Samples (>5 gms): The physical samples were of greater variety but generally easier to dissolve than the biologicals with the exception of those containing heavy dirt. All of the soil samples, (approximately 60) received for analyses contained 1 to 6 pounds of dirt and sand. Samples this size can be dissolved with large quantities of acids and a lengthy digestion period. The complicating factor, however, is dissolution of the water soluble salts which precipitate during the acid digestion (salting out process). For example, dissolution of 10 grams (453.6 gms equal 1 pound of soil) requires an ultimate dilution of 250 ml to dissolve the water-soluble salts. A proportionately greater dilution is needed for larger samples. Obviously, the Pu-239 activity in a workable aliquot of an infinitely large dilution would be barely detectable even on hot samples. It seemed desirable therefore, to develop a method for separating the Pu compounds from the bulk of the soil. Flotation agents were tried on the premise the heavier plutonium bearing particles would separate from bulk soil by gravity centrifugation. The so-called soils, however, apparently had components equal or greater in density to plutonium compounds since 95% of the material was deposited in the bottom of the centrifuge cone. Perhaps the soils were heavy dense volcanic ash.

Following the flotation procedure a tracer and tracer-free partial dissolution of the soils was attempted and the results were highly suc-

CONFIDENTIAL

cessful. In this method, eight 50 gram samples from Clean Slate II and III soil throwout collections were treated in a manner similar to total dissolutions of small soil samples except the reaction was stopped after approximately one fourth (30 minutes of dissolution time required) of the soil was dissolved. Approximately 50 ml of f-HNO_3 and saturated H_3BO_4 was added and the mixture boiled to wet dryness. Hydrochloric acid additions with boiling were repeated until the HNO_3 was destroyed. Care was taken to avoid excessive foaming and swelling of the heavy scum which appeared at low volume. The mixture was transferred to a large sized poly bottle with HCl washing and diluted to the half full mark with H_2O. Hydroxylamine-HCl, $CHCl_3$ and cupferron reagent were added, the mixture stirred vigorously, and centrifuged to separate the phases. Approximately 95% of the now dark CH_3Cl_3 layer was removed with a transfer pipet, care being taken not to disturb the interface scum. The extraction was repeated until the $CHCl_3$ layer was colorless (usually required 4 to 6 extractions). The extracted collections were evaporated at low heat to a heavy sludge (light flaming occasionally occurred in the sludge). Dilute HNO_3 (6N) was added to the sludge and the mixture boiled to a heavy black tar. If bumping occurred HCl was added. Nitric acid was added, the mixture boiled to wet dryness, and the procedure repeated with f-HNO_3 until the tar turned a black liquid. Perchloric acid was added and a resulting slow exothermic reaction allowed to go to completion. The solution was boiled until perchlorate salts precipitated. Most of the salts were dissolved by repeated boiling with aqua regia. Remaining salts were washed with

CONFIDENTIAL

H_2O and boiled in fuming HNO_3 - HCl. The solutions were combined and diluted to the mark in a volumetric flask with fuming HNO_3 and H_2O.

The residue from each of the partial dissolutions was completely dissolved in a manner similar to that for the small soil samples. Results of the eight samples showed approximately 95% of the plutonium was extracted. Subsequent experiments, however, show that partial dissolution must be restricted to sample sections of 200 gms or less because of dilution and extraction limitations.

(9) Liquid Water: The water samples were contained in glass bottles. The cap had been sealed with tape but most of the bottles had leaked rather badly. The pH of each sample was determined with a Beckman pH meter. The volume of the sample was measured in a graduated cylinder. All of the samples contained appreciable amounts of algae and dirt. A suspension aliquot of each sample was centrifuged and a stippled plate activity measurement made of each supernate. Aliquots from samples showing activity in the centrifuge supernate were filtered through a millipore filter and the filtrate analyzed by alpha pulse height analysis. The millipore filter was leached with successive additions of 0.1N HCl over a 48-hour period. Each leach was filtered through a new millipore and the filtrate analyzed by 2π counting of a stippled plate. The millipore filters from some of the leached samples were dissolved, purified, and analyzed by alpha pulse height analysis.

A separate suspension aliquot of several of the samples was analyzed by cupferron - $CHCl_3$ extraction at neutral pH and counted by alpha spectroscopy.

CONFIDENTIAL

The contents of five bottles were totally dissolved and analyzed by standard Roller Coaster radiochemical methods, including alpha pulse height analysis. Acid rinses of bottles were also analyzed.

All the analyses were for plutonium content and some for uranium.

Physical Sample Purification: The majority of the physical samples were purified, following dissolution, in a routine manner by the purification procedure given in Appendix B. Physical Samples with heavy dirt, however, required several cupferron-$CHCl_3$ extractions and alternate $NaOH$-Na_2CO_3 NH_4OH precipitations to free the plutonium compounds from excessive salt concentrations. In samples containing large amounts of Fe, a brown residue appeared on the resin purification column. This residue was dissolved during HCl elution. A trace of insoluble salts sometimes formed in the purified solution (tentatively identified as aluminum and titanium oxides) but contained no activity.

Electroplating: A rapid electrodeposition procedure was used to obtain from the purified sample a weightless, invisible deposit of plutonium on a platinum disc. A plating time of 10 minutes was usually required. The disc was 5 mils thick with a mirror finish, precut to 2.2 cm in diameter. The electrodeposition cell, designed by our laboratory, limited the plating solution exposure to a glass tower, teflon gasket, and platinum disc.

An excess of solution during the plating operation can result in as much as 70% loss of activity. The optimum volume of the plating solution was found to be approximately 4 ml which represents about 1/4

CONFIDENTIAL

inch of liquid in the plating cell. In general, those samples having heavy dirt at first produced dirty plates. Changing lab reagents, plating solutions, and re-extracting the sample with hexone just prior to plating did little to improve plate quality. Cupferron -$CHCl_3$ extraction, baking the water extractant with successive additions of aqua regia, and resin column purification produced clean plates. Dirty plates also occurred when any residual organic material was not destroyed or when extraction was incomplete. Rinsing the plates with distilled water and flaming improved plate quality.

Stippled Plates: All samples with field monitor activity levels above a certain range were dissolved tracer free and a stippled aliquot measured for approximate activity. If the high activity value was confirmed, a dilution was made and tracer added to the aliquot. This prevented mis-match of Pu-239 activity and tracer so that one alpha peak was not swamped by the other in the pulse height spectra.

Odors: Last but not least was the problem of nefarious odors emanating from the dissolved large tissues and especially metabolism samples. Fortunately, the odors from tissues were all but eliminated by $HClO_4$ type dissolution and H_2SO_4 refluxing methods. Boil-downs of urine and feces samples, though often produced a pungent odor in the lab. A resourceful chemist purchased a Buddha incense burner, and the resulting atmosphere was satisfactory to everyone's olfactory senses.

Uranium Separation: A uranium separation from plutonium was made in each plutonium analysis by a basic carbonate precipitation which carries plutonium. The uranium carbonate complex is soluble

CONFIDENTIAL

under these conditions. However, if due to sample impurities, the uranium does not solubilize completely, it will not interfere with the measurement of Pu-239 (5.0 to 5.2 Mev integration limits) in an alpha pulse height analysis since uranium alphas fall at a lower energy. In the procedures outlined, the uranium separated in the plutonium procedure was not used for analysis. The uranium analysis was performed with sufficient sensitivity on another aliquot of the dissolved sample.

Assuming 1 μg of natural uranium to be present in a sample containing 10 dpm Pu-239, an unexpectedly high ratio, the following sample activities can be expected:

Nuclide	cpm	Alpha Energy
U-238	0.26	4.18 Mev
U-235	0.01	4.40 "
U-234	0.25	4.75 "
Pu-239	3.47	5.14 "
Pu-238	-	5.48 "
Pu-236	-	5.75 "

The closest Pu and U alphas, as is evident, are sufficiently separated in energy.

2.5 PREPARATION OF TRACER

The tracer employed in yielding plutonium isotopes is Pu-236 (made by the d, n reaction on highly purified U-235). The Pu-236 was prepared in a cyclotron irradiation and chemically purified at Traceriab. Approximately 20,000 dpm was aliquoted and pulse-height analyzed to determine isotopic purity and percent Pu-239, 240 pres-

CONFIDENTIAL

ent, if any. Corrections to subsequent samples were applied if any Pu-239, 240 was found in the tracer. Previous experience has shown that on high purity Pu-236, the ratio of Pu-239/Pu-236 is about 1×10^{-5}. The importance of any correction depends on the Pu-239, 240 activity in the sample analyzed. Once the purity of the tracer had been established, two stock solutions were standardized at about 400 and 20 dpm/ml. A choice of stock for each analysis depended on the anticipated activity of the individual sample.

Ionic Pu-236 tracer has shown a tendency to polymerize and/or form oxides on standing or in the presence of trace quantities of organics. This can result in incomplete equilibration with other Pu radioisotopes and loss of yield. Preparation of Pu-236 standards from a concentrated stock solution, therefore, included an $HClO_4$ treatment to destroy organics and solubilize all tracer activity. Residual amounts of the acid were left in the standard solutions to hold the tracer in a soluble form.

The tracer was standardized by isotopic dilution and exhaustive electrodeposition. In both methods, a suitable aliquot was withdrawn from stock, electrodeposited on a platinum disc, and counted. In exhaustive electrodeposition the plating solution was reduced in volume and any remaining plutonium again electrodeposited. This process was repeated until further electrodeposition produced no change in disc activity. Summation of the electrodepositions gave the tracer concentration. Four to eight determinations were normally averaged to yield a final value. Concentrations were usually determined to plus or minus 2%.

CONFIDENTIAL

In isotopic dilution a spike of National Bureau of Standards stock solution* (99.97% pure) was added, for yielding, to nine aliquots of the purified Pu-236 stock solution. The spike and tracer were equilibrated by evaporation with H_2SO_4 and $HClO_4$ and electrodeposited on the platinum disc. The plated samples were counted and the Pu-236 concentration calculated after Pu-239 yielding.

Exhaustive electrodeposition gave an average concentration of 25.0 ± 0.38 dpm/ml Pu-236 for four aliquots. Isotopic dilution gave an average of 25.7 ± 0.26 dpm/ml for nine aliquots. Experience has shown that the first method is susceptible to low results due to sequential handling losses. This point has been confirmed by standardization of the tracer using a combination of both techniques on the same aliquots of tracer.

It was anticipated that the Pu-236 tracer might change concentration over a period of time due to a combination of factors, primarily evaporation of the media and/or deposition of the tracer on the walls of the polyethylene storage bottle. To minimize this error, aliquots of the standardized stock solutions were added to several small polyethylene storage bottles and acidified with 6N HCl.

To insure that the accuracy of the tracer standardization was maintained, a set of two exhaustive electrodepositions was performed after five months. (See Tracer Standardization Procedure in Appendix B for method). The set of two platings had to agree within 2.5% and their average within 2% of the previous standardization, or further platings and/or complete restandardization was necessary.

* An analysis of the NBS standard (listed as 99.97% pure) on our Mass Spectrometer gave the following isotopic composition; 94.386 weight % Pu-239, 5.271 weight % Pu-240, and 0.343 weight % Pu-241. The Pu-239, Pu-240 alpha disintegration rate of the solution was calculated from this data.

CONFIDENTIAL

2.6 ACTIVITY MEASUREMENTS

Counting: Each plutonium sample was electroplated on a 5-mil platinum disc (for best peak resolution) and counted on an alpha pulse height analyzer. The disc was ignited to remove any residual deposit, since resolution decreases proportionately with an increase in deposit thickness. In order to utilize existing equipment, the outputs from four Frisch Grid Chambers were connected to one multi-channel analyzer by dividing the full range of the analyzer (256 channels) into quadrants of 64 channels each. The instrument controls were adjusted so that the sixty four channels covered the entire energy range of the plutonium isotopes. The amplifier controls were adjusted to cover the range 4.5 to 6.0 Mev which included Pu-238 (5.49 Mev), Pu-239 (5.15 Mev), and Pu-240 (5.15 Mev) and Pu-236 (5.75 Mev) tracer. This amplifier gain setting gave a scale factor of approximately 37 Kev per channel, and each isotope present was registered over a spread of about ten channels. Optimum gain settings discriminated against activity energies outside the Pu-236, 239 energy region. The result was a pure spectra of Pu-236, 238, 239. Even slightly dirty plates showed minimum straggling in the valley region of the spectrum. Occasionally a small alpha peak from the U-232 decay daughter of the tracer was seen if a sample was recounted several weeks after chemical decontamination. However, the U-232 peak, located at an independent energy, in no way interfered with the analysis. Samples with low yields or poor spectra were reworked.

A disposable metal collimating ring, surrounding each sample

CONFIDENTIAL

disc, was used with each sample to preclude the counting of degraded alpha particles. Some loss in counting efficiency resulted but was offset by improved peak contours and distinct separation of alpha energy peaks. The resolution (full width at half-maximum) of the four Frisch-Grid chambers including disc collimation was 0.88% at 5.15 Mev. The alpha peak counting efficiency was approximately 35%.

The counting time for an unknown sample was determined by the isotope having the lowest activity. A total collected count of this isotope which gave a standard statistical counting error of 10% was considered satisfactory. However, if possible, a total collected count giving a standard error of 3% was obtained. The tracer yield was determined to an error of 3%.

Table 2.2 indicates the variables involved in the choice of counting time. Counting times of much greater than 1000 minutes were not economically justified. Also samples with adequate yields showing no Pu-239 activity after 40 minutes of counting time were reported as such with a standard error for the background count of the instrument.

TABLE 2.2 TOTAL COUNTING TIME REQUIRED TO GIVE LISTED ERROR*

Activity	3% Error	5% Error	10% Error
10 cpm	111	40	10
1 "	1110	400	100
0.1 "	11100	4000	1000

*Background for alpha pulse analyzer is virtually negligible, ranging from 0.006 to 0.01 cpm.

CONFIDENTIAL

Determination of Geometry: A geometry factor is used to convert the observed counting rate of an unknown sample to absolute disintegrations per minute (dpm). The geometry factor is defined as the observed corrected counting rate divided by the absolute disintegration rate of a calibrated plutonium standard source. The observed counting rate of a sample always contains the following inherent losses.

(1) 2π Geometry: The geometry is restricted to 2π steradians by virtue of a flat disc mounting.

(2) Collimation Loss: Described in counting section.

Analysis of Pulse Height Data: A short run of a calibrated plutonium standard source was made before and after the analysis of an unknown plutonium sample. This procedure gave an evaluation of the counting geometry and resolution of the instrument including any channel shifting of the alpha peak, in this interval of time.

After counting a sample, a Pulse Height Graph sheet was used to make a graphical plot of the data as needed. Channel counts on the ordinate were plotted versus channel number and/or energy on the abscissa. From this graph, together with the data tape, an analysis of the isotope peaks was carried out utilizing the attached processing sheet. In selecting the group of channels representing each isotope peak, the following points were considered:

(1) Width of Isotope Peak Base: Since each isotope peak which represents a single alpha particle energy is theoretically of the same contour, its base will cover the same number of channels with only the height of the peak differing in each base. The peak

CONFIDENTIAL

contour may be represented approximately by a Gaussian distribution curve as described in the references.

(2) Low Energy Tail: The low energy tail of each isotope peak will continue down to zero energy. However, no counts less than 1% of the peak height are added to the totalized peak count. The totalized count of the calibrated plutonium standard source is evaluated in the same manner.

(3) Background: On low counting samples, it is necessary to correct for background. This correction is compiled from a statistical summation of consecutive background determinations and is subtracted empirically in the peak energy region, from a knowledge of the isotopes present and of their peak contours.

(4) Peak Resolution: The resolution is determined by the width of the peak contour and will determine the possibility of detecting isotope peaks in close proximity. Resolution may be mathematically denoted as the peak width at its mid-height divided by the peak energy, each value expressed in the same energy units. The resolution for selected analysis is calculated in order to determine the amount of instrument drift. The desired resolution was always better than 1.5 percent.

(5) Instrument Drift: Drift is defined as the percentage change in peak resolution during an analysis. It is evidenced by a broadening of the peak contour and, in extreme cases, will give rise to excessive peak overlap. The amount of drift will indicate the degree of instrument stability during an extended analysis. Repeat analyses will be indicated if the amount of drift impairs good peak resolution.

CONFIDENTIAL

Alpha Spectroscopy Quality Control: The reliability of the alpha pulse height analysis system must be checked periodically regardless of the observed reliability. Day to day standards of instrument operation are measured by observing the before and after runs of the standards (see counting reference for details). The width and energy location of the standard and sample isotope peaks base must correspond. A drift of more than 1 percent at five Mev between the two is cause for instrument repair.

In addition, a background spectrum must be taken at least once per month (and more often if contamination is suspected). The background, taken in the region of 4.0 to 6.2 Mev, must match the sample isotope peak base, and shall not exceed five counts per hour. Any excess is reason for determination of the cause of the background and removal of the source.

The counting efficiency of the instrument is checked monthly by counting a calibrated three-peak alpha source containing Pu-239, Am-241 and U-233. The source is counted in the energy region of 4.5 to 5.7 Mev.

The individual peak efficiency is checked by integrating the peaks and comparing with the assigned isotopic dpm values of the source. A divergence of more than 1 percent from the assigned values on subsequent efficiency checks is cause for further investigation and/or maintenance as necessary.

2.7 CALCULATIONS

Plutonium Isotopes: The results of the alpha pulse-height analyses are presented on printed tape. A graphical plot of a typical

CONFIDENTIAL

spectrum is illustrated in Figure F.4. The energy calibration line was calculated from the pre-and post-counting energy calibrations of the counting chamber. A summation was made of counts under each isotope peak present. These counts were corrected for low energy tail, background, peak resolution, and instrument drift. The plutonium content of the sample was calculated by:

$$\text{Pu-239, 240 (dpm)} = \frac{\text{counts Pu-239, 240} \times \text{dpm Pu-236}}{\text{Counts Pu-236}}$$

Plutonium-239 and Pu-240 could not be calculated separately as their alpha energies were too close to resolve with a Frisch-Grid Chamber.

The counting efficiency of each Frisch-Grid Chamber was measured, using a high precision alpha standard, and it was not necessary to calculate a yield separately to determine the plutonium content. However, the yield was always determined as a quality control measure in order to assess the efficiency of the chemistry procedure. The yield was calculated by:

$$\text{Pu-236 yield} = \frac{\text{dpm Pu-236 recovered}}{\text{dpm Pu-236 added} \times \text{Pu-236 decay factor}}$$

<u>Uranium</u>: The results of the fluorimetric analyses are presented as milliamps on the Jarrell-Ash fluorimeter. Milliamps are converted to μg U_3O_8/ total sample by:

$$U_3O_8\ (\mu g/\text{ total sample}) = \frac{(\text{Ma sample} - \text{Ma bkg.}) \times Cf}{\%\ \text{yield} \times \text{aliquot factor}}$$

where: Cf = calibration factor from std. calib. curve

$$\%\ \text{yield} = \frac{(\text{Ma spike} - \text{Ma bkg.}) \times Cf - (\text{Ma sample} - \text{Ma bkg.}) \times Cf}{\mu g\ U_3O_8\ \text{spike}}$$

CONFIDENTIAL

CHAPTER 3

DATA PRESENTATION

3.1 DISCUSSION

Tables E.1 through E.13 contain the plutonium and uranium data for the Physical, Biological, and Quality Control Samples. Also included are counting time, yield, and rework information. The tables are a summation of all the bi-weekly reports plus new data generated since the last bi-weekly report. New data are starred. A key to the sample types precedes the tables.

3.2 BIOLOGICAL DATA

Tables E.5 through E.7 contain the plutonium and uranium data for the Biological samples. Tables are listed by animal type. The data are listed by tissue type and number. All plutonium values are reported as dpm Pu-239, 240/total sample. All uranium values are reported as $\mu g\ U_3\ O_8$ total sample. A counting error in dpm was assigned each Pu-239, 240 value and the data presented in orders of magnitude. The error assignment as well as the base value is in terms of the given power. Pertinent information relative to the analysis appears in the remarks column. Zero or negative values were included, accompanied by the counting error; but never was the positive numerical value of the latter less than the negative value. In most instances, the statistical precision of the data meet requirements set by the referee team. In general, most of the yields exceeded 50%. A few samples with low yields were either reworked

CONFIDENTIAL

or counted for longer periods to assure good statistical accuracy. Uranium data were derived from 10% aliquots and are listed opposite the Pu-239, 240 value for a given sample.

The dog and sheep data are given for the Double Tracks or Clean Slate II events, the burro on Double Tracks only. Since exact animal location was not available, no attempt was made to correlate laboratory analytical data with field information. Comparisons were made among tissue types, metabolism samples, animals, and events for Pu and U content as follows:

(1) Dog Tissues: Most of the Pu was concentrated in the G.I. Tract, lung, trachea, and nasal mucosa. On the average, the G.I. Tract was a factor of approximately 10^2 greater than any of the other three tissues. The activity in the four tissues ranged from <1 to 1.63×10^4 dpm. The U concentration in most tissues was less than 1 μg per sample and showed little tendency to follow the Pu. For example, the tissue with the highest U value, 2.88 μg in the lung of Animal 1020, contained only 3.36 dpm of Pu.

(2) Sheep Tissues: The Pu was found principally in the trachea, G.I. Tract, Lung, and Nasal Mucosa. In general, where the Pu was distributed among these tissues, it was divided fairly equally. However, more of the lung samples contained appreciable amounts of Pu. Activity values in the sheep tissues mentioned ranged from <1 to 5.45×10^2. Similarly to the dog samples, U concentration was usually less than 1 μg and did not necessarily follow the Pu. The tissues of three samples, 2050, 2052, 2127, were the highest in uranium but low in plutonium.

CONFIDENTIAL

(3) Burro Tissues: Most of the Pu was concentrated in the lungs, but appreciable amounts were detected in some liver, hilar node, and G.I. tract samples. Also one bone, kidney, and trachea showed appreciable Pu. The lung-to-liver ratio ranged from near unity in a few samples to 55 in Sample 3043. Very few uranium analyses were run on burro tissues. All were less than 1 μg.

(4) Metabolism samples: All the analyses in this category were performed on sheep eliminations. Most of the metabolism data showed high values relative to the animal tissues. The data ranged from approximately 10^1 to 10^4 dpm per sample. Neither urine nor feces values necessarily dominated the Pu content of a given animal sample. Uranium analyses were not required of metabolism samples.

(5) Animals: The G.I. tract of the dog samples and burro lungs dominated the Pu content of all animal tissues. Uranium data was too low, in most instances, to make a significant comparison among animals. Average values for tissues containing the largest amounts of Pu are given below in Table 3.1 in dpm per sample.

(6) Event: Only three sheep lung samples from Clean Slate II contained appreciable amounts of Pu. All other large values were in Double Tracks data.

3.3 PHYSICAL DATA

Tables E.1 through E.4 contain the plutonium and uranium data for the physical samples. Tables are listed by event. The data are listed by sample position in the test pattern with corresponding

CONFIDENTIAL

TABLE 3.1 ANIMAL TISSUES WITH GREATEST Pu CONTENT

	Dog	Sheep	Burro
Bone			$2.0 \times 10^{1*}$
Kidney			$3.6 \times 10^{1*}$
Liver			5.3×10^{1}
Lung	4.8×10^{1}	9.0×10^{1}	5.52×10^{2}
Hilar Node			$5.6 \times 10^{1*}$
Trachea	$2.4 \times 10^{2*}$	$2.2 \times 10^{1*}$	$1.7 \times 10^{1*}$
G.I. Tract	2.7×10^{3}	2.4×10^{2}	$3.2 \times 10^{1*}$
Nasal Mucosa	9.8×10^{1}	$1.6 \times 10^{2*}$	

*Based on one or two analyses only. All other values average of several analyses.

TLW collection and analysis number. Pretest and offsite data appear at the end of each table. The statements concerning data reporting and counting precision under the previous section apply to the physical data. Yields were rarely below 60% except for a few samples with heavy dirt. Uranium analyses were performed on aliquots to 10% of the sample and are listed opposite their Pu-239, 240 counterparts. Pertinent information relative to the analysis is footnoted. The ratio of Pu-239, 240 by radiochemical analysis to the field monitor value is given in the last column. To be meaningful, any radiochemical or field monitor value from 0-to-1 dpm/total sample was arbitrarily assigned a 1-dpm value for the ratio calculation. In such instances, the ratio was preceded with a computer approximate sign (CA).

The field positions of physical samples were well documented and an attempt was made to correlate some of the data by event as follows:

CONFIDENTIAL

(1) Doubletracks: In general, deposition contours determined from radiochemical analyses of aluminum collectors and deposition films agreed with those established by alpha field surveys. A moderate amount of activity was detected, however, outside the contour of the P and R arcs as far as Station 068 on the right side. The Casella and Andersen disc numbers showed mixed results with regard to their internal system. In some instances, the plutonium content decreases progressively with successive stages, but often the second and third stages have values higher than the first. Uranium-to-plutonium ratios were somewhat erratic and were higher than expected The uranium content does not follow the plutonium in many cases, particularly in values from far out arc locations. Radiochemical-to-field monitor plutonium ratios were within a factor of unity in general with deviation orders of magnitude in either direction for many analyses. Particularly noticeable were the high ratios of some aluminum collectors and deposition films.

(2) Clean Slate I: Deposition contours were determined from deposition films and agreed in general with contours from alpha survey readings. Moderate activity appeared outside the contour on Arc H as far as Stations 024 on the left and 038 on the right. The Casella's and Andersen's showed most of the activity to be concentrated in the first impactor stage followed by a decrease of activity with successive stages. Uranium-to-plutonium ratios were erratic, but, in general, lower than those in the Double Tracks event. Radiochemical-to-field monitor plutonium ratios were usually within a factor of unity. A few exceptions were apparent, but orders of

CONFIDENTIAL

magnitude deviations were much less frequent than in Double Tracks.

(3) Clean Slate II: Deposition contours determined from Arcs B to L deposition films and aluminum collectors are consistent with alpha survey readings. Deposition data from Arcs E and F showed moderate activity outside the contour at stations 014 and 090, respectively. Activity data from the Casella's and Andersen's resembled that of the Clean Slate I event. Also, uranium-to-plutonium ratios were similar to those of Clean Slate I. Radiochemical-to-field monitor plutonium ratios were similar to Clean Slate I.

(4) Clean Slate III: Deposition contours were determined from Arcs B to L deposition films and were consistent with alpha survey readings. Moderate activity appeared outside the contour on Arc B as far as Station 100. The Casella and Andersen data followed the pattern of Clean Slate I and II.

Uranium-to-plutonium ratios were similar to those of Clean Slate I and II. Radiochemical-to-field monitor plutonium ratios were consistent within a factor of five of unity, except in Arcs E to L and some soil fractions, both of which contained values ranging from 2 to 500.

3.4 MISCELLANEOUS DATA

Estimated Activity Expenditure: Table E.8 contains a data listing, by arc location, of estimated plutonium activity losses of project 2.6C "A" samples. "A" samples refer to those Casella's and Andersen's whose first and second stages were combined for particulate analyses and later transferred to this project for radiochemical analysis. Therefore, to obtain a better value for the

CONFIDENTIAL

"A" samples, each value in Table E.8 should be added to its counterpart in Tables E.1 to E.5.

Distilled Water Samples: Tables E.9 through E.11 contain the plutonium and uranium data for the distilled water samples. Tables are listed by event and data by arc location. All Pu values are given as dpm/total sample volume. In general, leach filtrate values decreased with successive leaches except for the last leach which spanned a greater time period. Particularly interesting, with respect to plutonium solubility, are the high values for aliquots in which Pu was extracted at neutral pH. The residues of five glass bottles in which water samples were stored were found to contain 1 to 22% of the activity of the original contents.

Tracer Standardization: Table E.12 lists the results of isotopic dilution and exhaustive plating analyses of solutions containing Pu-239 and/or Pu-236. Good agreement among analyses is apparent from the standard deviation column.

3.5 CONTROL DATA

Biological: Table E.13 contains Roller Coaster plutonium quality control data listed by Rochester collection number with corresponding TLW analysis number. All the data are reported as dpm Pu-239, 240/total sample. Also included are yield and counting time for each analysis. The samples were blanks or spiked samples, and the data indicate the latter since few show less than 99 dpm/total sample.

Table E.14 contains TLW internal plutonium and uranium quality control data listed by TLW analysis number and sample type. All the data, excepting three Pu values, are near the detection limits of the measuring instrument. The base values for the three

CONFIDENTIAL

exceptions show less than 1 cpm and are not considered significant. Simulated blanks of beef liver and hamburger were analyzed, early in the program, for plutonium content and found to contain less than 1 dpm. The data was not recorded since it provided little useful information.

Physical: Table E.15 contains Roller Coaster plutonium control data listed by arc location with corresponding TLW collection and analysis number. All values are the results of investigation of sample aliquoting by partial dissolution-extraction methods or analyses of solutions forwarded by the Roller Coaster Three team. All the data are reported as dpm Pu-239, 240/total sample for soil samples and dpm/ml for solutions. Partial dissolution would appear to a valid procedure based on the small amounts of activity left in the residue. The solution activity range from 0.01 to 4.84×10^3 dpm/ml.

Table E.16 contains TLW internal plutonium and uranium quality control data listed by TLW analysis number and sample type. All the laboratory blanks were near the detection limits of the measuring instrument. Analysis of a sample (previously analyzed in our mass spectrometer) for Pu-239, 240 content, using our low and high level Pu-236 standards, reconfirmed the Pu-236 standardization values. Mass spec values are given for comparison in the remarks column.

3.6 DATA SUMMATION

Biological: Table E.17 contains a tabulation of all the biologi-

CONFIDENTIAL

cal analyses. Data are listed by animal and tissue type. A total of 744 plutonium and 87 uranium analyses had been performed at the conclusion of the project.

Physical: Table E.18 contains a tabulation of all the physical analyses. Data are listed by event and sample type. A total of 2607 plutonium and 598 uranium analyses had been performed at the conclusion of the project.

CONFIDENTIAL

CHAPTER 4

CONCLUSIONS AND LABORATORY RESULTS

4.1 CONCLUSIONS

The conclusions on the data generated in 5.2/5.3b projects are limited to sample processing and surface inspection of the results, since, in regard to the latter, it is the function of the evaluation team to interpret the significance of the data. The following are applicable to our projects:

(1) All samples received for analysis have been inventoried and accounted for.

(2) Adequate procedures for sample processing and accurate analysis were developed.

(3) Facilities and personnel were fully utilized to maintain the desired production schedule.

(4) The requirements of the referee team were not unduly restrictive and have been met in most instances.

(5) Tracer techniques were employed and found to be highly satisfactory.

(6) Most of the plutonium in the tissue biological samples was concentrated in the G. I. Tracts of the dogs and lungs of the burros. Metabolism samples from sheep eliminations ranged from approximately 10^1 to 10^4 dpm per sample.

(7) Double Tracks animals showed higher Pu content than Clean

CONFIDENTIAL

Slate II animals. Only three sheep lung samples from Clean Slate II contained appreciable amounts of plutonium.

(8) Plutonium data of the physical samples is fairly consistent with that of alpha field surveys and field monitor values with some deviations noted.

(9) Uranium values are erratic in some instances and do not necessarily follow the plutonium values.

(10) Casella and Andersen samples are fairly consistent in showing an activity decrease with successive stages. Deviations are occasionally noted in the second and third stages where values are higher than expected.

4.2 LABORATORY RESULTS

The results listed below pertain to our laboratory experiment with the biological and physical samples. Several improvements were made and others are suggested.

(1) Biological samples were difficult to identify since fluids from the animal had often obscured the writing on the paper-type tag. The sample should be doubly wrapped in poly bags by sealing the sample in one bag and covering with another. The outside bag should then be labeled with a Dymo punch. The double bag would also prevent samples from freezing together, necessitating complete thawing before processing.

(2) Many of the samples were heavy in iron content and a rapid method for removing this element was needed. Experiments with a nitrated ion-exchange column resulted in a procedure superior to hexone extraction in all phases.

(3) The large biological samples usually required a lengthy thawing period before they could be cut, even with an electric knife. It is desirable to eliminate the thawing process entirely since it consumes an analyst's time; a special heating setup is required, spread of contamination is a risk, and overpowering odors develop. An electrically heated knife is now on the market and all reports indicate it would cut the frozen samples easily.

(4) The urine samples were collected on Kimpac, which contained large amounts of dirt. The dirt seems to have an affinity for the plutonium in the urine, and extraction procedures had to be employed to obtain a good yield. A method of collection to eliminate the dirt would be desirable.

(5) Several samples had to be reworked to obtain better yields. At first, all the tailings were scavenged for missing plutonium; however, experience showed 95% of this activity was always in the aqueous discard of the first extraction. It is not economically feasible to spend time scrounging for the remaining 5%.

(6) The biological samples occupied relatively large amounts of space and had to be kept in a frozen state over a long period of time. An oversized, walk-in freezer, adequately lighted, is recommended for easy access to samples and sequential handling.

(7) Fluorimetric analysis for uranium may be performed directly on the dissolved sample. However, experience has shown quenching occurs if the sample is not chemically pure. Three extractions at the start, to remove interfering ions, is recommended.

CONFIDENTIAL

(8) Uranium, as plutonium, is lost during chemical processing and should be yielded. Use of U-233 tracer, or analysis, in duplicate with one part containing a spike of uranium standard is suggested. The latter was employed in this project.

(9) Acid dissolutions in large volume are extremely corrosive to all types of metal hoods and exhaust systems. Even coating the metal with an acid resistant paint is only a temporary cure. Several other types of hoods and blowers have been investigated since the start of the project, and a polypropylene system with an internal scrubber appears to offer the best performance. Resistance to normal hot plate temperatures and all acids, including $HClO_4$, is touted by vendors of these hoods and blowers. The scrubber system is needed to remove noxious acid fumes and to wash out potentially explosive collections of nitrate and perchlorate dust mixtures. A movable safety shield should be installed in each hood, wit. above normal ventilation, to remove the copious quantities of acid fumes being generated.

(10) Near the midpoint of the project a computer program was developed to incorporate additional information such as samples, yields, counting times, etc. This method of reporting provided for rapid transcription of new data to tabular form, reducing the delays of typing, proofreading, and copying. It is recommended to institute the computer program at the start to save the typing effort.

(11) The bonus benefit of the cupferron - $CHCl_3$ portion of partial dissolution procedures may be its application to water and urine analyses. The cupferron - $CHCl_3$ extraction process, primarily independent of sample pH, may be the best method for determining soluble plutonium content of a water-algae-dirt solution.

CONFIDENTIAL

(12) The quality of the plated sample is extremely important to the validity of the data. A plate which has a scum on it, is bent, scorched, or scratched may distort the alpha spectrum to a point where the results are marginal. In addition to the radiochemical purification techniques mentioned earlier, it was determined that good plate quality most often resulted from proper flaming. The plate should be thoroughly washed with triple distilled H_2O and flamed at high temperature over a Fischer burner for two minutes and the process repeated once. Flaming with methanol is not desirable, as it will sometimes produce plates with a white scum.

(13) Dissolution of the biological samples as rapidly as possible is recommended since freezer failure is always a possibility. Samples can be stored for purification at a later date.

(14) In future projects of this type, it might be expedient to analyze biological samples in order of animal number and physical samples by arc location. This should reduce the many man hours that were expended in cross referencing animal numbers and arc locations with TLW field and analysis numbers.

(15) Near the end of the project an opportunity arose to compare plutonium spectra of platinum with stainless-steel-mounted samples. Two hundred stainless steel plutonium mounts were counted, using collimation and a plutonium standard mounted on stainless. In general, the stainless mounts showed well defined peaks but a broader base, indicating a loss of resolution. Also, the Pu-236 and Pu-239 alpha peaks of the stainless samples occurred at a lower energy, showing a 3 to 7 channel shift downward for each isotope.

CONFIDENTIAL

(16) The final measurement in the radiochemical analysis for Pu-239 is taken from the alpha spectrum of the electrodeposited sample. The sample Pu-239 and Pu-238 activity must be matched to the Pu-236 tracer to prevent interference between peaks.

In tracer techniques for Pu-239 analysis, the accuracy of the results are only as accurate as the standardization of the Pu-236 tracer. It is recommended that the value of cpm per dpm per unit volume of tracer be accurately and precisely determined, for the detector to be used in obtaining alpha spectra of the final sample plates. It is also recommended that specifications be set up for quality control and preventative maintenance procedures for the detector and electronic equipment; and methods of spectra interpretation. These should be rigidly designed to assure good resolution of the alpha peaks. Detector backgrounds should be rigidly controlled at a predetermined level by frequent detector background runs and limiting the total amount of activity allowed in the detector. Recounting or rework of the sample should be done, as required, to adhere to the specifications.

CONFIDENTIAL

APPENDIX A
DETAILED LOCATION OF PHYSICAL STATIONS

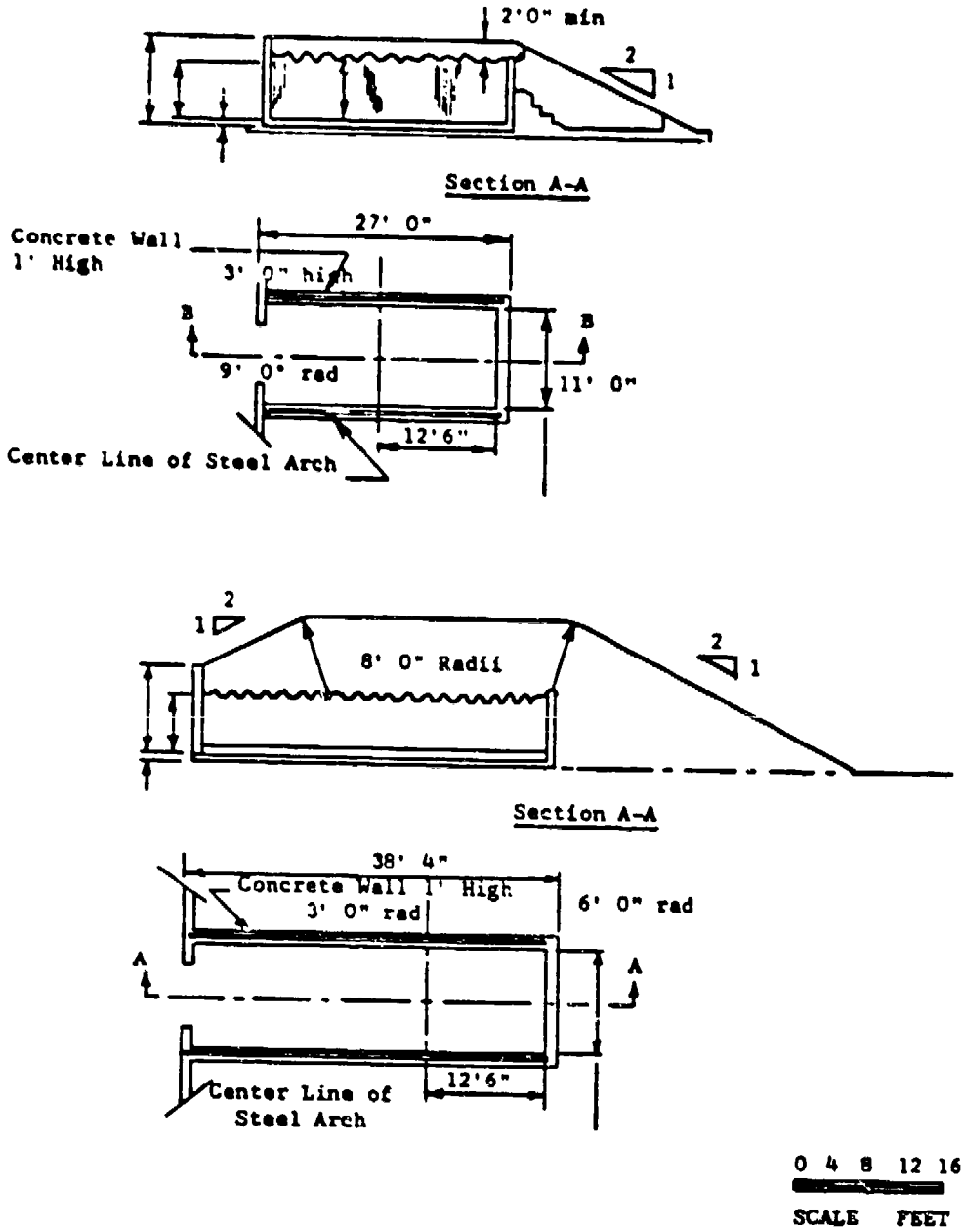


Figure A.1 Clean Slate igloos.

CONFIDENTIAL

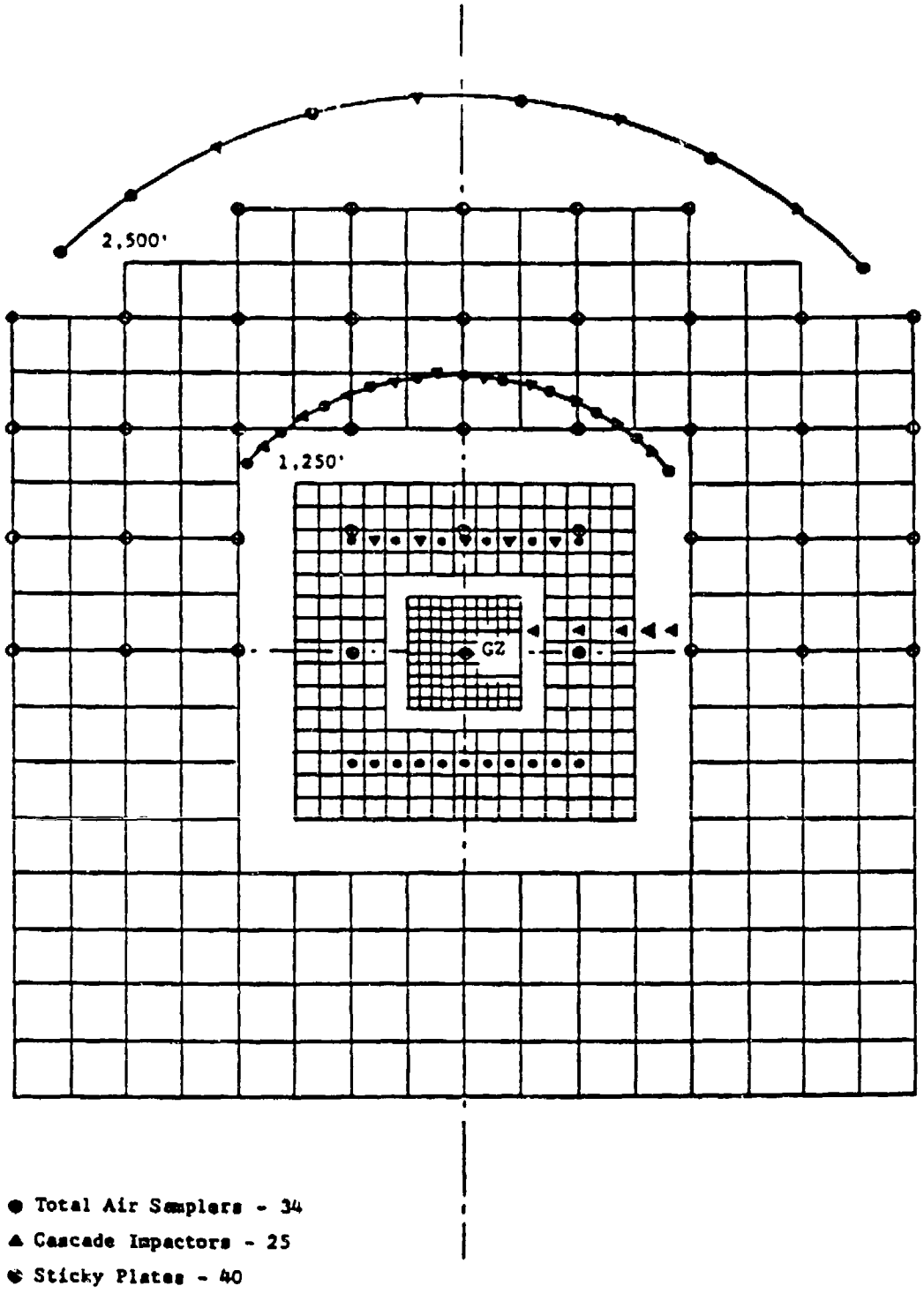


Figure A.2 Fixed surface instrument array (−2,000 to + 2,500 feet).

CONFIDENTIAL

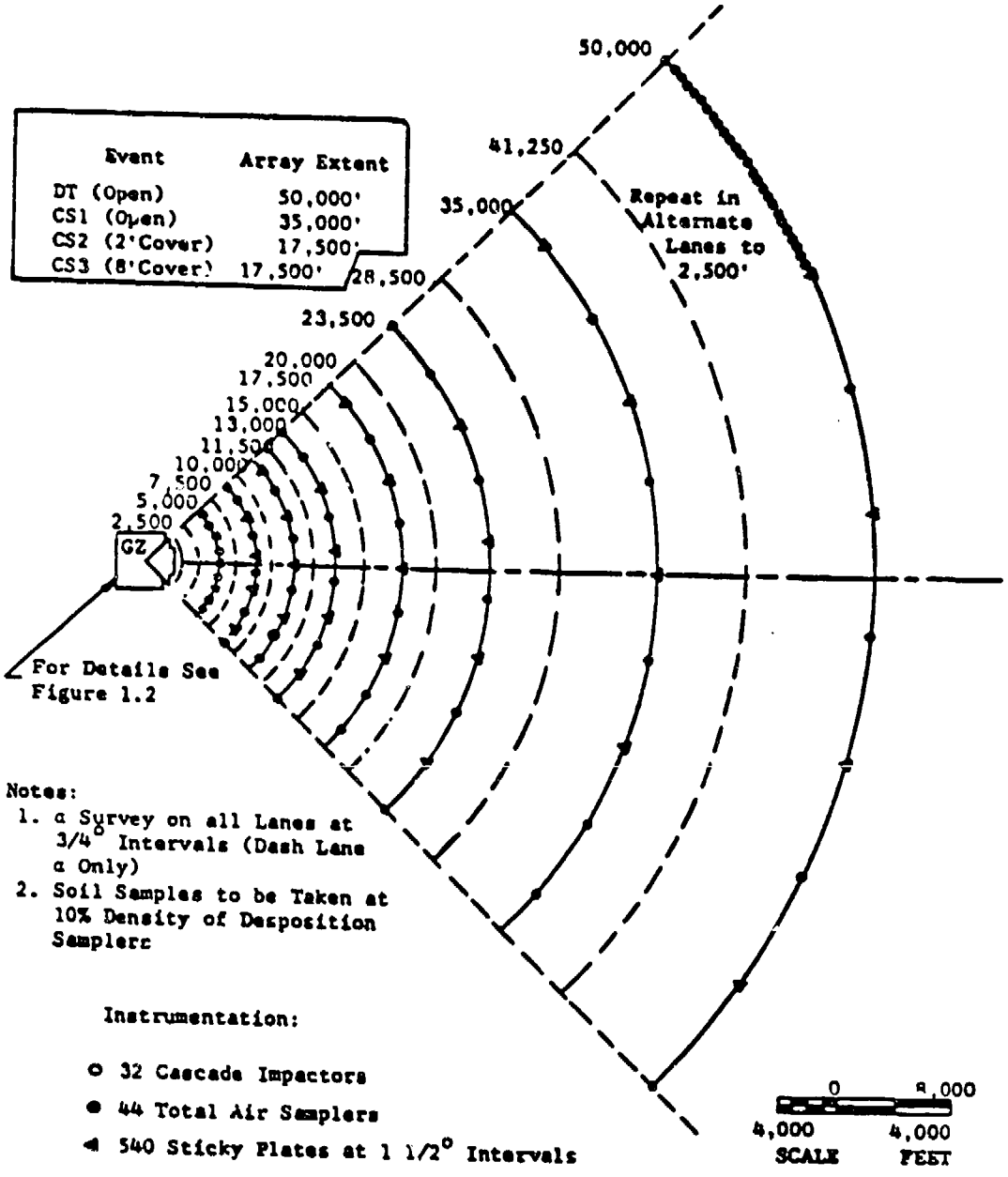
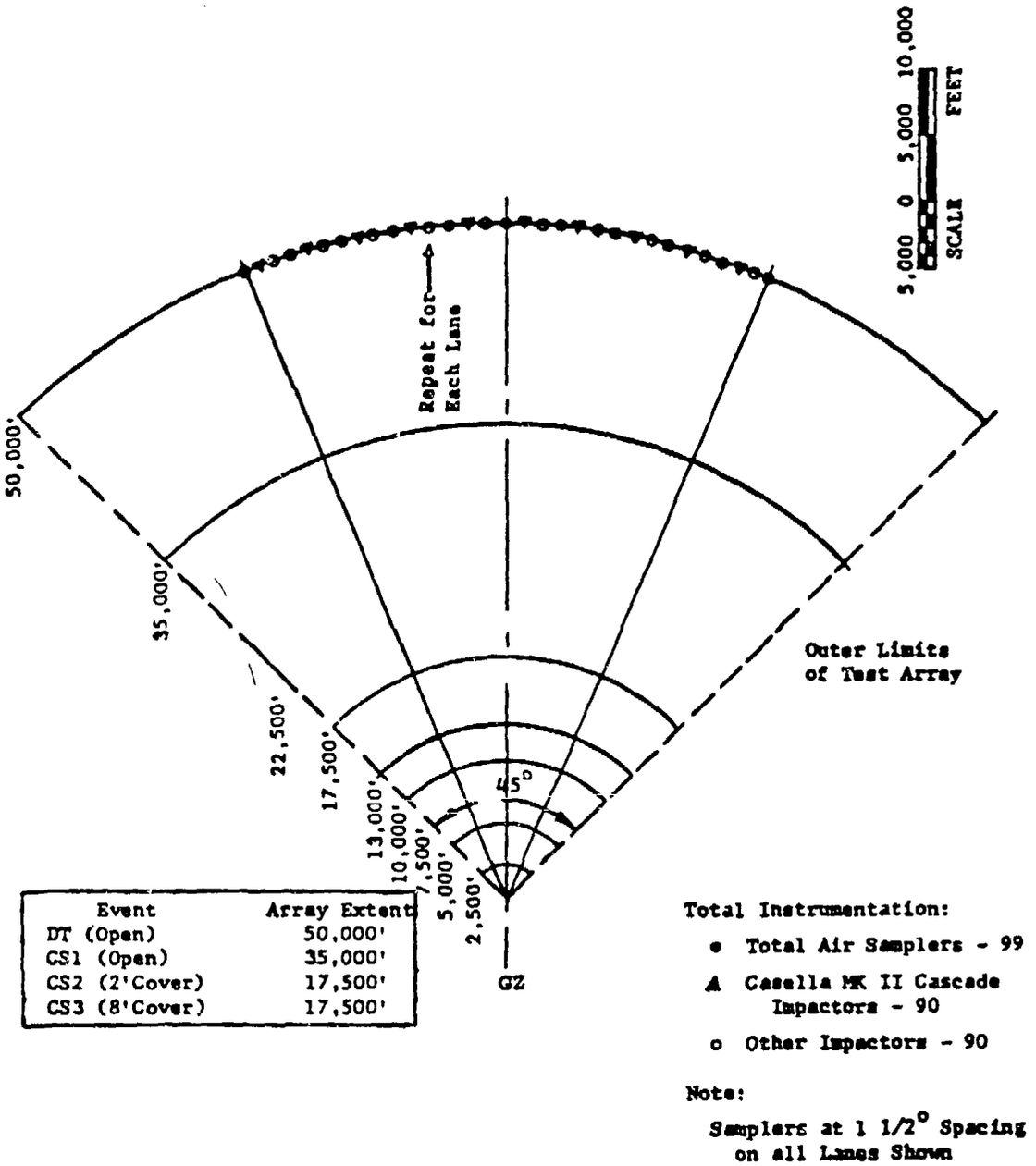


Figure A.3 Fixed surface instrument array (+ 2,500 to + 50,000 feet).

CONFIDENTIAL



Event	Array Extent
DT (Open)	50,000'
CS1 (Open)	35,000'
CS2 (2'Cover)	17,500'
CS3 (8'Cover)	17,500'

Total Instrumentation:

- ● Total Air Samplers - 99
- ▲ Casella MK II Cascade Impactors - 90
- o Other Impactors - 90

Note:

Samplers at 1 1/2° Spacing on all Lanes Shown

Figure A.4 Movable surface instrument array (+ 2,500 to + 50,000 feet).

CONFIDENTIAL

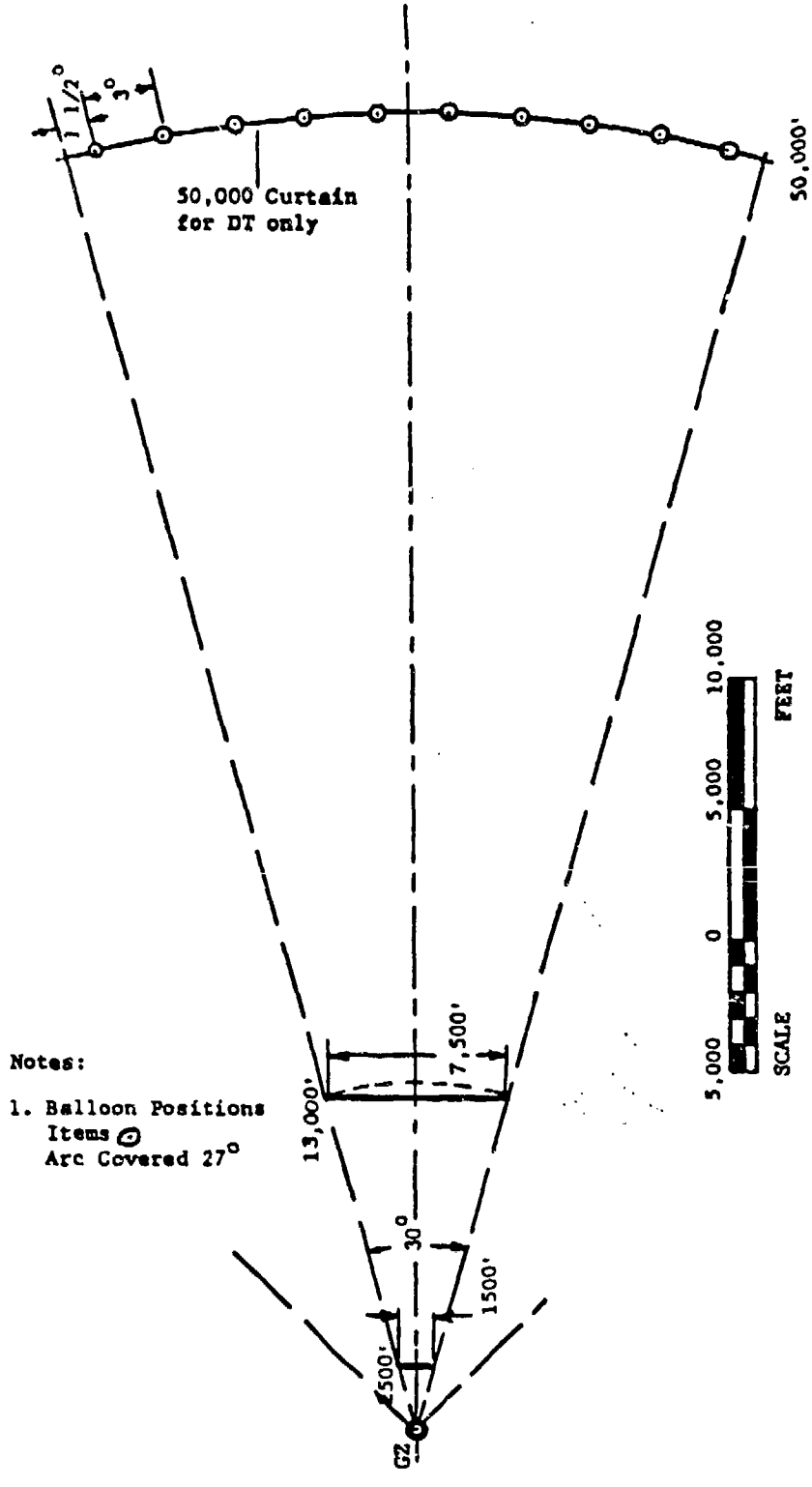


Figure A.5 Movable balloon-supported instrument array.

CONFIDENTIAL

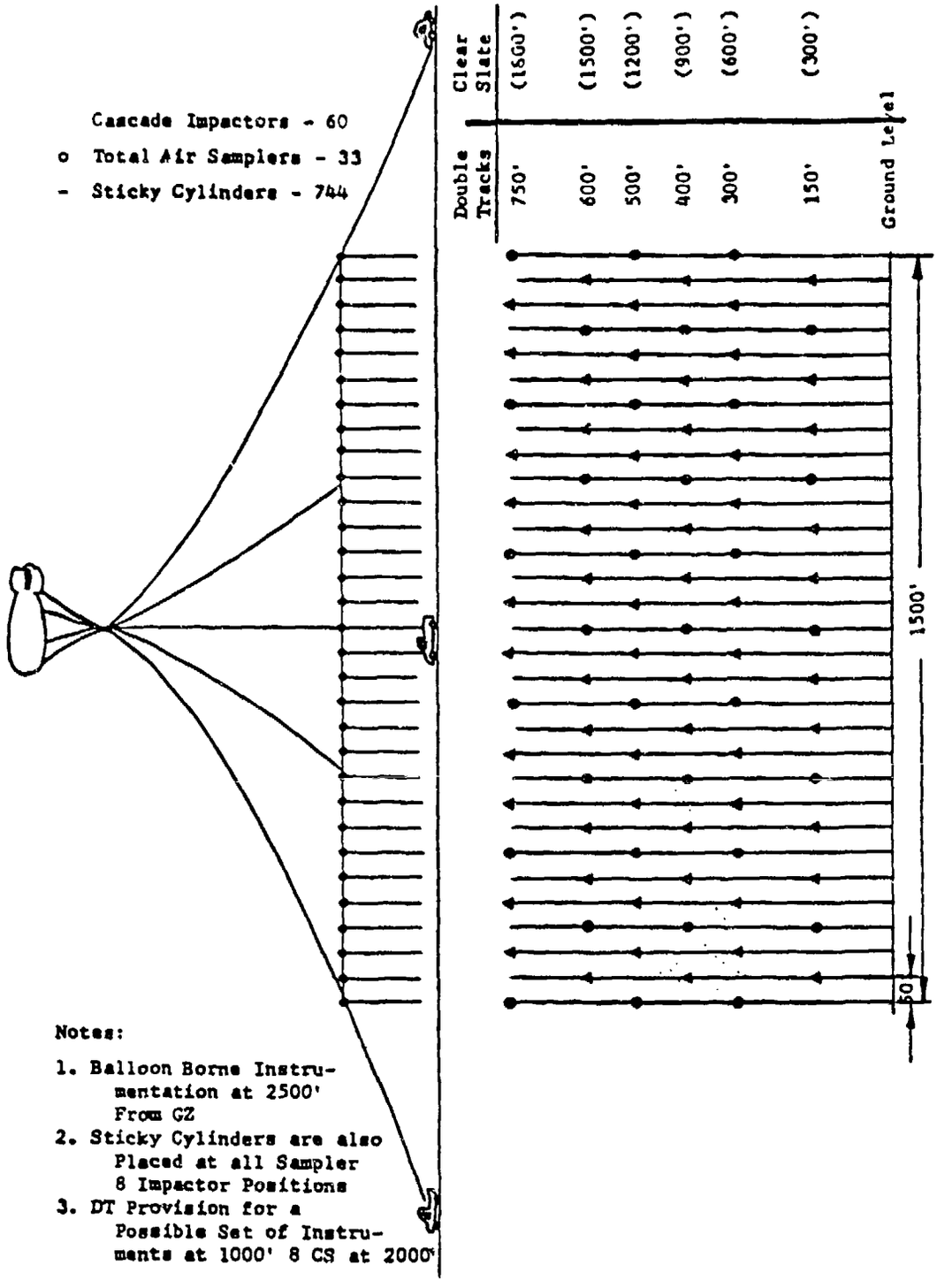


Figure A.6 Details of balloon curtain at 2,000-foot radius.

CONFIDENTIAL

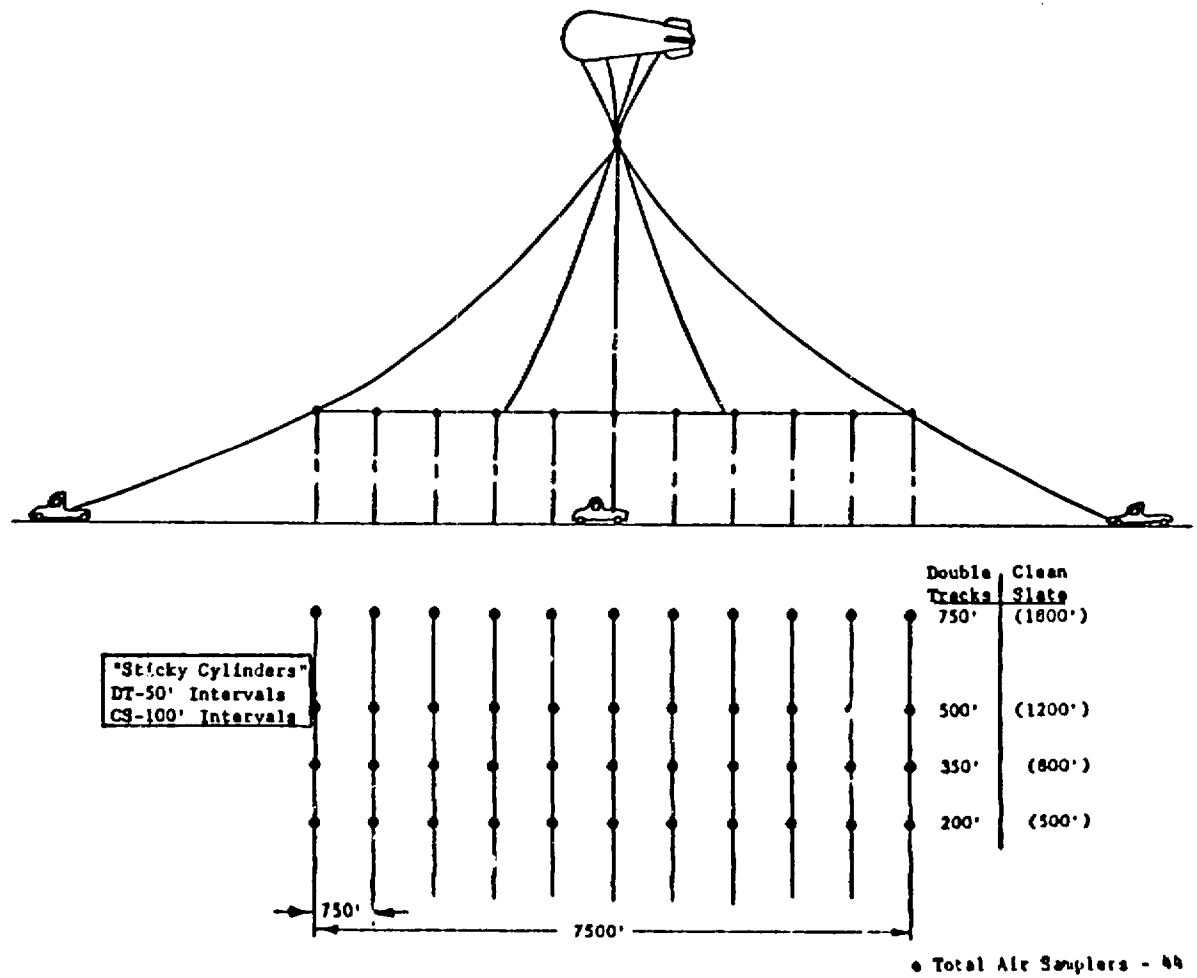


Figure A.7 Details of balloon curtain at 13,000-foot radius (never operable).

CONFIDENTIAL

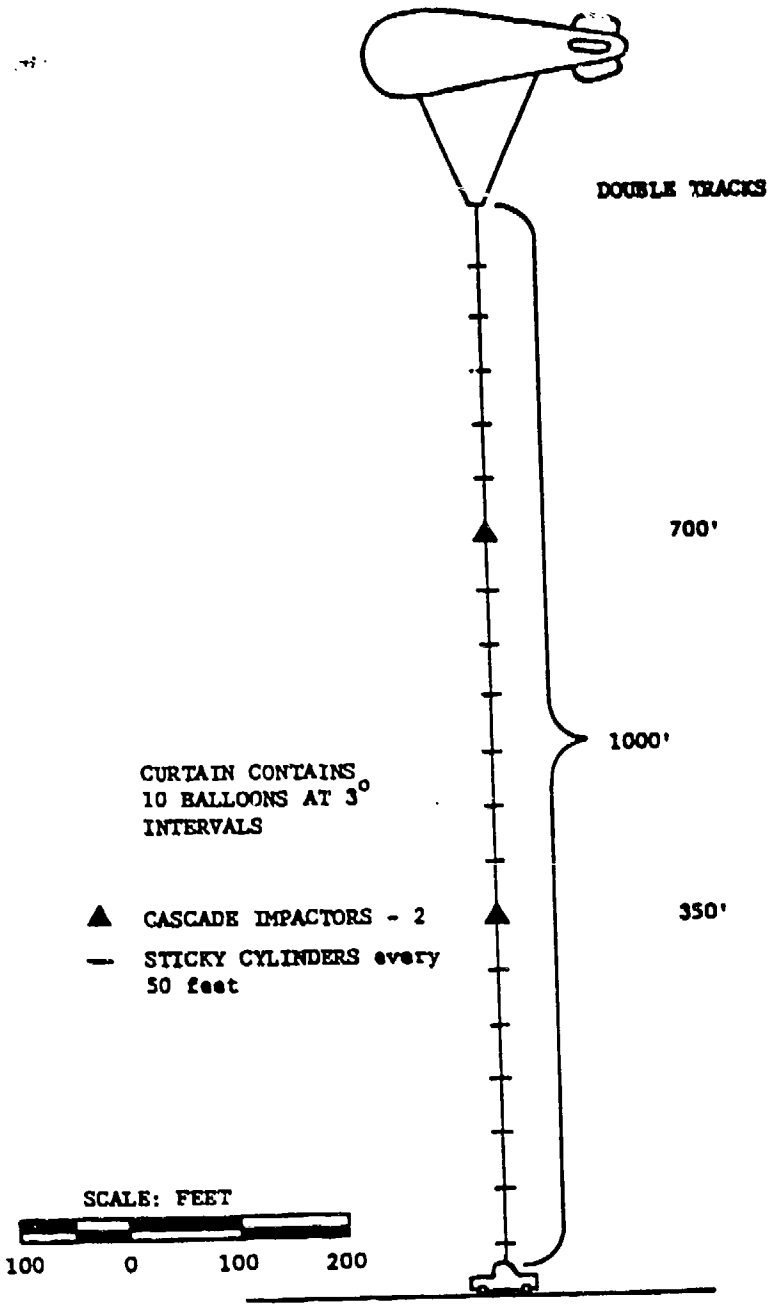


Figure A.8 Details of balloon curtain at 50,000-foot radius.

CONFIDENTIAL

APPENDIX B
RADIOBIOLOGICAL, RADIOCHEMICAL, AND PHYSIOCHEMICAL PROCEDURES FOR PU^{239}, PU^{240}, AND URANIUM IN VARIOUS SAMPLES

Pu-239 DISSOLUTION PROCEDURE — CASELLA IMPACTOR DISC*

1. Place Casella impactor glass disc in an appropriate size teflon beaker (Note a).

   a. If the sample monitors <4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3, a small aliquot is pipetted into a 40ml centrifuge cone, and an appropriate amount of tracer is added.

2. Add enough fuming HNO_3 to wet all of the sample. Heat on a hot plate until the sample has dissolved.

3. Remove from hot plate and add about 6 ml 78 percent $HClO_4$ for every 100 ml fuming HNO_3 added in step 2. Heat on hot plate until exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).

   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.

4. Remove the glass disc with teflon forceps and rinse with 1N HNO_3–1N HF adding washings to teflon beaker (note c).

   c. If a white residue remains on the disc, rinse twice more with the 1N HNO_3-1N HF solution adding washings to teflon beaker. If the sample does not contain any insoluble material at this point omit steps 5 through 8.

5. Add 10 ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable

CONFIDENTIAL

amounts of dirt, repeat HF treatment at least once.

6. Add 4 ml saturated H_3BO_3 and boil for 3 minutes.

7. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.

8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6, and 7.

9. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

---

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

1. Place the sample or aliquot in a suitably sized pyrex beaker (note a) or teflon beaker if sample is small.
   a. If the sample monitors < 4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40 ml centrifuge cone, and an appropriate amount of tracer is added.
2. Add enough fuming HNO_3 to wet all of the sample. Heat on a hot plate until the sample has dissolved.
3. Remove and add about 10 ml 78 percent $HClO_4$ for every 100 ml fuming HNO_3 added in step 2. Heat on hot plate until an exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).
   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.
4. Transfer the contents of the beaker to a teflon beaker (note c) by means of a transfer pipet. Wash the beaker with several 6N HNO_3 washes, scrubbing the sides and bottom with a polyethylene policeman. Perform at least two washes with 3-ml aliquots of 1N HNO_3 - 1N HF.
   c. If started in teflon, omit step 4 but add a few ml HNO_3. If the sample does not contain any insoluble material at this point, omit steps 5 through 8.
5. Add 10 ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable amounts of dirt, repeat HF treatment at least once.
6. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for 3 minutes.
7. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.

8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6, and 7.
9. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

---

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

1. Place Andersen sampler glass disc in an appropriate size teflon beaker (Note a).

   a. If the sample monitors <4000 alpha cpm, add Pu-239 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3, a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.

2. Add enough fuming HNO_3 to wet all of the sample. Heat on a hot plate until the sample has dissolved.

3. Remove from hot plate and add about 6 ml 78 percent $HClO_4$ for every 100-ml fuming HNO_3 added in step 2. Heat on hot plate until exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).

   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.

4. Remove the glass disc with teflon forceps and rinse with 1N HNO_3 - 1N HF adding washings to teflon beaker (note c).

   c. If a white residue remains on the disc, rinse twice more with the 1N HNO_3 - 1N HF solution adding washings to teflon beaker. If the sample does not contain any insoluble material at this point omit steps 5 through 8.

5. Add 10-ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable amounts of dirt, repeat HF treatment at least once.

6. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for three minutes.

7. If residue remains, wash with portions of warm Aqua Regia until it dissolves.

8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6, and 7.

9. Transfer the solution to a 40 ml centifuge cone and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Place the sample or aliquot in a suitably sized pyrex beaker (note a) or teflon beaker if sample is small.

   a. If the sample monitors <4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.

2. Add 1/3 volume fuming HNO_3, boil to dryness, and char. Repeat until only small amount of carbon is left (the sample will dissolve but not decompose in fuming HNO_3).

3. Remove from hot plate and add about 6 ml 78 percent $HClO_4$ for every 100-ml fuming HNO_3 added in step 2. Heat on hot plate until exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).

   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.

4. Transfer the contents of the beaker to a teflon beaker (note c) by means of a transfer pipet. Wash the beaker with several 6N HNO_3 washes, scrubbing the sides and bottom with a polyethylene policeman.. Perform at least two washes with 3-ml aliquots of 1N HNO_3 - 1N HF

   c. If started in teflon, omit step 4 but add a few ml HNO_3. If the sample does not contain any insoluble material at this point, omit steps 5 through 8.

5. Add 10 ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable amounts of dirt, repeat HF treatment at least once.
6. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for 3 minutes.
7. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.
8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6, and 7.
9. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

---

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

1. Place the sample or aliquot in a suitably sized pyrex beaker (note a) or teflon beaker if sample is small.

   a. If the sample monitors < 4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6 N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.

2. Add 1/3 volume fuming HNO_3. Boil on a hot plate to dryness and char. Repeat once and take up in 1/3 volume fuming HNO_3.

3. Remove from hot plate and add about 10 ml 78 percent $HClO_4$ for every 100 ml fuming HNO_3. Heat on hot plate until an exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).

   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and can be remedied by addition of more acid.

4. After the reaction has subsided, add 5 ml H_2SO_4 and 10 ml HNO_3. Boil to wet dryness and repeat. Take up with 10 ml fuming HNO_3. Repeat the evaporation and take up with another 10 ml of fuming HNO_3. Boil solution to approximately 5 ml (note c).

   c. If insoluble sulfates are present transfer solution to a centrifuge cone and centrifuge. Save the supernate and wash the residue with 6N HCl. Add the washings to the supernate. Discard the residue.

5. Transfer the contents of the beaker to a teflon beaker (note d) by means of a transfer pipet. Wash the beaker with several 6 N HNO_3 washes, scrubbing the sides and bottom with a polyethylene policeman. Perform at least two washes with 3 ml aliquots of 1 N HNO_3 - 1N HF.

CONFIDENTIAL

d. If started in teflon, omit step 5 but add a few ml HNO_3. If the sample does not contain any insoluble material at this point, omit steps 6 through 9.

6. Add 10 ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable amounts of dirt, repeat HF treatment at least once.
7. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for 3 minutes.
8. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.
9. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 6, 7, and 8.
10. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

---

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

1. Place the sample** or aliquot in a suitably sized pyrex beaker (note a) or teflon beaker if sample is small.

   a. If the sample monitors $<$ 4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If $>$4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.

2. Add enough fuming HNO_3 to wet all of the sample. Heat on a hot plate until the sample has dissolved.

3. Remove from hot plate and add about 6 ml 78 per cent $HClO_4$ for every 100 ml fuming HNO_3 added in step 2. Heat on hot plate until exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).

   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.

4. Transfer the contents of the beaker to a teflon beaker (note c) by means of a transfer pipet. Wash the beaker with several 6N HNO_3 washes, scrubbing the sides and bottom with a polyethylene policeman. Perform at least two washes with 3 ml aliquots of 1N HNO_3 - 1N HF.

   c. If started in teflon, omit step 4 but add a few ml HNO_3. If the sample does not contain any insoluble material at this point, omit steps 5 through 8.

5. Add 10-ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable

amounts of dirt, repeat HF treatment at least once.

6. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for 3 minutes.

7. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.

8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6, and 7.

9. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

---

*If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

**The sequential tape is cut into equal sections. In order to monitor the various sections, unroll the tape carefully and pass the exposed side under a sensitive lab detector. Record on the chemical processing form activity levels and/or physical spots on the tape. Cut the tape into appropriate sections.

1. Place the sample or aliquot in a suitably sized pyrex beaker (note a) or teflon beaker if sample is small.

   a. If the sample monitors <4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3, a small aliquot is pipetted into a 40-ml centrifuge cone and an appropriate amount of tracer added.

2. Add 3 ml CH_3OH, ignite, and cover beaker with a speedy vap. After burning is completed, cover residue with fuming HNO_3 and boil to wet dryness. Repeat the fuming HNO_3 - evaporation step. Take up in approximately 1/4 volume fuming HNO_3.

3. Remove and add about 10 ml 78 percent $HClO_4$ for every 100 ml fuming HNO_3 added in step 2. Heat on hot plate until an exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3, pouring acid carefully down wall of beaker (note b).

   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.

4. Transfer the contents of the beaker to a teflon beaker (note c) by means of a transfer pipet. Wash the beaker with several 6N HNO_3 washes, scrubbing the sides and bottom with a polyethylene policeman. Perform at least two washes with 3 ml aliquots of 1N HNO_3 - 1N HF and heat on hot plate.

   c. If started in teflon, omit step 4 but add a few ml HNO_3. If sample does not contain any insoluble material at this point, omit steps 5 through 8.

5. Add 10 ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable amounts of dirt, repeat HF treatment at least once.
6. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for 3 minutes.
7. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.
8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6 and 7.
9. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

---

* if uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure

A-Filtered Aliquot

1. Determine the pH of the sample with a Beckman pH meter.
2. Pipet a 25-ml aliquot of the clear liquid onto a millipore filter and allow the solution to drain thoroughly into an appropriate container. Do not wash the filter.
3. Pipet 1 ml of the filtrate into a 40-ml centrifuge cone and save, for the determination of uranium.
4. Add an appropriate amount of tracer to remaining filtrate.
5. Add 10 ml HNO_3 and 1 ml $HClO_4$ and boil to $HClO_4$ fumes. Cool and transfer to a 40-ml tube. Proceed with step 1 of Pu-239 Purification Procedure.

B-Extracted Aliquot

1. Stir the sample and pipet a representative 25-ml aliquot into a 16-ounce plastic bottle. Adjust the pH slightly with NH_4OH to offset the acidity (6N) of the tracer in the next step.
2. Add an appropriate amount of tracer to the sample aliquot.
3. Proceed with step 1 of Extraction Procedure using 5 ml neutralized $NH_2OH \cdot HCl$ and 25 ml $CHCl_3$ portions for extractions.

C-Total Sample

1. Pour sample into a large teflon beaker and wash the container with H_2O adding washing to the beaker. Add an appropriate amount of tracer.

CONFIDENTIAL

2. Boil to low volume and add 150 ml fuming HNO_3 and 25 ml $HClO_4$. Boil to $HClO_4$ fumes.

3. Add 50 ml fuming HNO_3 and 10 ml HF. Boil to low volume and add 1 to 2 ml sat. H_3BO_3 and 10 ml HNO_3. Boil to approximately 5 ml and transfer to 40-ml centrifuge cone. Proceed to step 1 of Pu-239 Purification Procedure.

D-Glass Bottle Decontamination

1. Rinse the container from Part C, above, three times with hot Aqua Regia and pour the washing into a large teflon beaker.

2. Rinse the bottle with 1N HNO_3 - 1N HF adding the rinse to the Aqua Regia wastes. Rinse with H_2O and add washes to beaker.

3. Add an appropriate amount of tracer, then proceed with step 2, part C above.

E-Millipore Filter

1. Remove the millipore filter from Part A above, or Part G below, carefully with forceps and place in a small teflon beaker. Add an appropriate amount of tracer.

2. Add 75 ml of fuming HNO_3 and 15 ml $HClO_4$. Boil to $HClO_4$ fumes and proceed with step 3, Part C above.

F-Centrifuge Supernate

1. Stir the sample and pipet approximately 25 ml into a 40-ml centrifuge cone.

CONFIDENTIAL

2. Centrifuge and pipet 1 ml of the supernate onto a labelled stainless steel disc and evaporate to dryness under a heat lamp.
3. Place in metal container and submit for 2 π counting.

G-Leached Supernate

1. Stir the sample and quickly pipet a 25-ml aliquot onto a millipore filter and allow the supernate to drain thoroughly into an appropriate container.
2. Remove the filter with forceps, place in a beaker containing a measured volume of 0.1N HCl. Stir intermittently for a measured period and pour the solution onto a fresh filter and catch the filtrate in another container.
3. Repeat step 2 combining filters for measured periods up to 48 hours.
4. Pipet a 250 λ aliquot from each filtrate fraction onto a labelled stainless steel disc and evaporate to dryness under a heat lamp.
5. Place in a metal container and submit for 2 π counting.
6. Pipet a 1-ml aliquot, from selected filtrate fractions, into a 40-ml centrifuge cone and save for uranium analysis.

---

*If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

1. Add sample to a suitably sized teflon beaker (note a). Add 30 ml HF and 10 ml HNO_3. After initial exothermic reaction has ceased, boil to dryness (or until spattering starts).

   a. If the sample monitors < 4000 alpha cpm, add Pu^{236} tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.

2. Repeat HF treatment until no change in the sample crud is perceived.

3. Add 30 ml $HClO_4$, 10 ml HNO_3, and 10 ml HF. Boil to strong fumes of $HClO_4$. Remove from hot plate and cool.

4. Rinse down the sides of the beaker with 6N HNO_3, add 3 ml H_3BO_3 and boil to low volume. Take up in 6N HNO_3 and heat gently.

5. If a residue is still present, centrifuge, add 20-ml portions of 6N HNO_3 to residue and warm. (Watch for bumping!) Combine washings and supernate if all residue has dissolved (note b).

   b. A residue which persists will sometimes dissolve with repeated Hot Aqua Regia treatment (maximum 3). If this treatment fails, put sample into a flask and add 1/3 volume fuming HNO_3. Add H_2O and shake vigorously, venting flask periodically.

6. If residue still remains, centrifuge, and repeat steps 2 through 5 on the residue (note c).

   c. A trace of hard silica final remains for some samples. The amount of activity associated with this residue was found to be insignificant.

7. Transfer the solution from step 5 to a centrifuge cone and proceed with step 1 of Pu-239 PURIFICATION PROCEDURE.

*If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Add sample to a suitably sized teflon beaker. Rinse container with 1N HNO_3 - HF and add to sample (note a.) Add 20 ml HF for each 5 grams of soil. After initial exothermic reaction has ceased, boil to dryness (or until spattering starts).

   a. If the sample monitors <4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alph cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3, a small aliquot is pipetted into a 40 ml centrifuge cone, and an appropriate amount of tracer is added.

2. Repeat HF treatment until no change in the sample crud is perceived.

3. Add 30 ml $HClO_4$, 10 ml HNO_3, and 10 ml HF. Boil to strong fumes of $HClO_4$. Remove from hot plate and cool.

4. Rinse down the wall of the beaker with 6N HNO_3 and Sat. H_3BO_3 and boil to low volume. Take up with 50 ml HCl and boil with repeated additions until HNO_3 is gone (note b).

   b. Avoid low volume, as excessive foaming and swelling will occur.

5. Cool and transfer the solution to a poly bottle (250 to 500 ml depending on the sample size) and proceed with step 1 Pu-239 EXTRACTION PROCEDURE.

* If uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized uranium (duplicate the extraction procedure with this aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Remove the sample from its polyethylene bag and place in a 600 to 800-ml beaker. Rinse the plastic bag with HNO_3 and add the washings to the beaker.
2. Pipet an appropriate amount of Pu-236 tracer and add enough HNO_3 to cover the sample. Heat gently and boil the solution to a small volume.
3. Cool the solution and add 50 ml fuming nitric and 50 ml $HClO_4$. Heat gently until the vigorous exothermic $HClO_4$ reaction starts. Remove the beaker from the hot plate and allow the reaction to go to completion.
4. Fume the solution to a small volume and transfer to a centrifuge cone.
5. Centrifuge and decant the supernate into the dissolution beaker. Leach and decant the residual sand several times with hot HNO_3. Centrifuge each leach, combining supernates (note a).**
   a. Save the residue for extraction of residual plutonium in the event of a low sample yield.

6. Evaporate the combined supernates to a small volume and continue with step 1. Pu-239 PURIFICATION PROCEDURE (note b).

   b. If heavy insoluble salts occur after evaporation proceed with step 1 Pu-239 EXTRACTION PROCEDURE **.

---

* If uranium analysis is required, transfer the sample, after dissolution into an appropriate volumetric flask, and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

** If uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized uranium (duplicate the extraction procedure with aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Add sample to a suitably sized teflon beaker (note a). Add 30 ml HF and 10 ml HNO_3. After initial exothermic reaction has ceased, boil to dryness (or until spattering starts).

   a. If the sample monitors < 4000 alpha cpm, add Pu^{236} tracer aliquot before adding sample. If > 4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of trace is added.

2. Repeat HF treatment until no change in the sample crud is perceived.

3. Add 30 ml $HClO_4$, 10 ml HNO_3, and 10 ml HF. Boil to strong fumes of $HClO_4$. Remove from hot plate and cool.

4. Rinse down the sides of the beaker with 6N HNO_3, add 3 ml H_3BO_3 and boil to low volume. Take up in 6N HNO_3 and heat gently.

5. If a residue is still present, centrifuge, add 20-ml portions of 6N HNO_3 to residue and warm. (Watch for bumping!) Combine washings and supernate if all residue has dissolved (note b).

   b. A residue which persists will sometimes dissolve with repeated hot Aqua Regia treatment (maximum 3). If this treatment fails, put sample into a flask and add 1/3 volume fuming HNO_3. Add H_2O and shake vigorously, venting flask periodically.

6. If residue still remains, centrifuge, and repeat steps 2 through 5 on the residue (note c).

   c. A trace of hard silica final remains for some samples. The amount of activity associated with this residue was found to be insignificant.

7. Transfer the solution from step 5 to a centrifuge cone and proceed with step 1 of* Pu-239 PURIFICATION PROCEDURE.

*If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Add sample to a suitably sized teflon beaker. Rinse container with 1N HNO_3- HF and add to sample (note a.). Add 20 ml HF-HNO_3 for each 5 gms of soil. After initial exothermic reaction has ceased, boil to dryness (or until spattering starts).

   a. If the sample monitors <4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If >4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.

2. Repeat HF treatment until no change in the sample crud is perceived.
3. Add 30 ml $HClO_4$, 10 ml HNO_3, and 10 ml HF. Boil to strong fumes of $HClO_4$. Remove from hot plate and cool.
4. Rinse down the sides of the beaker with 6N HNO_3 and Sat. H_3BO_3 and boil to low volume. Take up with 50 ml HCl and boil with repeated additions until HNO_3 is gone (note b.).

   b. Avoid low volume as excessive foaming and swelling will occur.

5. Cool and transfer the solution to a poly bottle (250 to 500 ml depending on sample size) and proceed with step 1 Pu-239 EXTRACTION PROCEDURE.

---

* If uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized uranium (duplicate the extraction procedure with this aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Place the sample or aliquot in a suitably sized pyrex beaker (note a) or teflon beaker if sample is small.
   a. If the sample monitors $<$4000 alpha cpm, add Pu-236 tracer aliquot before adding sample. If $>$4000 alpha cpm, the dissolution is done tracer free, the solution diluted to an accurate volume to obtain a final acidity of 6N HNO_3 a small aliquot is pipetted into a 40-ml centrifuge cone, and an appropriate amount of tracer is added.
2. Add enough fuming HNO_3 to wet all of the sample. Heat on a hot plate until the sample has dissolved.
3. Remove and add about 10 ml 78 percent $HClO_4$ for every 100 ml fuming HNO_3 added in step 2. Heat on hot plate until an exothermic reaction begins. Remove beaker from hot plate and allow reaction to proceed, controlling it by the addition of 1 to 10 ml portions of fuming HNO_3 pouring acid carefully down wall of beaker (note b).
   b. At times the reaction ceases and the solution turns black. This is caused by the supply of fuming HNO_3 becoming exhausted and is remedied by addition of more acid.
4. Transfer the contents of the beaker to a teflon beaker (note c) by means of a transfer pipet. Wash the beaker with several 6N HNO_3 washes, scrubbing the sides and bottom with a polyethylene policeman. Perform at least two washes with 3 ml aliquots of 1N HNO_3 - 1N HF.
   c. If started in teflon, omit step 4 but add a few ml HNO_3. If the sample does not contain any insoluble material at this point, omit steps 5 through 8.
5. Add 10 ml HF and evaporate to wet dryness. Do not allow sample to bake dry at any time during the procedure. If sample contains appreciable amounts of dirt, repeat HF treatment at least once.
6. Add 4 ml saturated H_3BO_3 and 8 ml HNO_3 and boil for 3 minutes.
7. If residue remains, wash with portions of warm 6N HNO_3 until it dissolves.

CONFIDENTIAL

8. Transfer any undissolved residue to the teflon beaker quantitatively with HNO_3 washes and repeat steps 5, 6, and 7.
9. Transfer the solution to a 40-ml centrifuge cone and proceed with step 1 Pu-239 Purification Procedure.

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 PU-239 Purification Procedure.

CONFIDENTIAL

1. Place the sample in an appropriate corningware oven dish, cover and dry at 110° C overnight. Transfer dish to a muffle furnace and ash at 600°C overnight.

2. Remove, cool, and grind the bone ash with a glass stirring rod or pestle.

3. Dissolve the pulverized ash in concentrated HCl at low heat on the hot plate (note a).

   a. If more than a trace of insoluble material is present, the following steps must be performed.

      (1) Decant solution into a beaker. Transfer solid residue to a platinum dish. Evaporate to dryness under a heat lamp.

      (2) Add (at least 3 times the amount of residue) solid Na_2CO_3. Fuse at 900°C in a muffle furnace for 10 minutes.

      (3) Dissolve in HCl and transfer to sample beaker. Continue with step. 5.

4. Transfer the solution to a poly bottle(2 liter acid bottle for large bones), with a transfer pipet.

5. Wash the crucible with hot concentrated HCl and add washings into the bottle.

6. Proceed with step 1 of the Pu-239 EXTRACTION PROCEDURE.

---

* If uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized uranium (duplicate the extraction procedure with this aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Remove the frozen sample from its polyethylene bag and place in a small (250 to 400 ml) beaker. Rinse the plastic bag with HNO_3 and add the washings to the beaker.
2. Pipet an appropriate amount of Pu-236 tracer and add enough HNO_3 to cover the sample. Heat gently and boil the solution to a small volume.
3. Cool the solution and add 50 ml fuming HNO_3 and 50 ml $HClO_4$. Heat gently until the vigorous exothermic $HClO_4$ reaction starts. Remove the beaker from the hot plate and allow the reaction to go to completion.
4. Fume the solution to a small volume and transfer to a centrifuge cone.
5. Proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

* If uranium analysis is required, transfer the sample, after dissolution, into an appropriate volumetric flask and dilute carefully to the mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Remove the frozen sample from its polyethylene bag and place in an appropriate size beaker. Rinse the plastic bag with HNO_3 and add the washings to the beaker.
2. Add an appropriate amount of Pu-236 tracer and enough HNO_3 to cover the sample. Heat gently and boil the solution to a low volume.
3. Cool and add enough H_2SO_4 to raise the level of solution in the beaker to approximately 1 inch. Heat gently until a vigorous reaction starts, then remove from the hot plate until the reaction subsides.
4. Fume this solution (black liquid) to a small volume and heat with HNO_3 until the solution turns red and finally clears. Add fuming HNO_3 and $HClO_4$ and fume to a small volume. Add H_2SO_4 and fume to low volume to drive off the $HClO_4$ (note a).
   a. $HClO_4$ forms explosive mixture with cupferron-$CHCl_3$ reagent, added later to extract plutonium and uranium from precipitated salts, and must be removed.
5. Cool, transfer the solution to a poly bottle (250 to 500 ml depending on sample size), and proceed with step 1 of the Pu-239 Extraction Procedure.

---

* If uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized uranium (duplicate the extraction procedure with this aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

ORGANIC TISSUE *

1. Remove the frozen sample from its polyethylene bag and allow it to thaw for a few minutes under a heat lamp. If the sample shape or size is such that it will not fit in the bottom half of a four-liter beaker, cut the sample into appropriate sections and place each section in a separate beaker. Rinse the plastic bag with HNO_3 and add the washings to the beaker.
2. Add enough H_2SO_4 to completely cover the sample. Pipet an appropriate amount of Pu-236 tracer (within a factor of five of the expected sample activity but a minimum of 15 dpm) into each beaker and add approximately 5 grams K_2SO_4 and 2-3 drops Hg metal. Spray the sample with Dow-Corning Ant.-foam A silicone defoamer.
3. Attach the stem of an inverted 6-inch funnel to a ring stand and clamp and lower the funnel mouth into the beaker. Secure a few inches above the sample.
4. Digest the sample gently with low heat until a black tarry mixture is obtained. Increase the heat gradually and reflux until the mixture is a clear solution. The tarry mixture will turn to a black jelly, black liquid, red liquid, and finally, a clear solution. Raise or lower the funnel during dissolution to control the reflux action. Wash down any carbonaceous material on the beaker and funnel walls with H_2SO_4.
5. Evaporate the H_2SO_4 until salts start forming. Remove the funnel and add HNO_3 cautiously to cool the solution. If the sample had been divided into

sections for the dissolution, combine the sections into one beaker and evaporate to low volume. Cool, transfer the sample with water to a 2-liter acid bottle, and proceed with step 1 Pu-239 EXTRACTION PROCEDURE.

* If uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized uranium (duplicate the extraction procedure with this aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40-ml centrifuge cone, and proceed with step 1 Pu-239 PURIFICATION PROCEDURE.

1. Place the sample in a 4-liter beaker, rinsing the container with H_2O and HNO_3. Add an appropriate amount of Pu-236 tracer.
2. Cover the beaker with a speedy-vap and boil to wet-dryness on a hot plate. Cover the sample with HNO_3 and boil to low volume.
3. Add 100 to 200 ml fuming HNO_3 and cautiously evaporate the solution to wet dryness (note a).
   a. At near dryness, ignition occurs and the residue carbonizes.
4. Cool and rinse the speedy-vap and the sides of the beaker with approximately 100 ml HNO_3. Add 75 ml and $HClO_4$ and fume the mixture to dense $HClO_4$ fumes to destroy residual organic matter.
5. Add 200 ml H_2SO_4 and fume the mixture to low volume to drive off all the $HClO_4$. Cool and transfer to a 2-liter acid bottle.
6. Continue with step 1 Pu-239 Extraction Procedure.

---

* If Uranium is required, withdraw a representative aliquot after dissolution and spike it with a known amount of standardized Uranium (duplicate the extraction procedure with this aliquot). Transfer the remaining sample into a volumetric flask after extraction, and dilute to mark with H_2O. Pipet an appropriate aliquot into a centrifuge cone and save for uranium analysis. Evaporate the remainder of the volumetric solution to low volume, transfer to a 40 ml centrifuge cone, and proceed with step 1 Pu-239 Purification Procedure.

1. Transfer the mounted Plutonium sample to a small teflon beaker. Add 20 ml fuming HNO_3 and 10 ml HF and boil to low volume.
2. Remove disc with teflon forceps and rinse with 1 N HNO_3 - 1 N HF adding washes to beaker.
3. Dry the disc under a heat lamp and check for residual activity. Repeat stripping process if significant activity is detected.
4. Boil solution to wet dryness, add 10 drops of H_3BO_3 and 2 ml HNO_3, and boil to wet dryness.
5. Transfer the sample to a glass beaker with 6 N HNO_3 and proceed with step 4 of the Pu-239 Purification Procedure.

Pu-239 EXTRACTION PROCEDURE

1. Dilute the sample (note a) contained in poly or acid bottle, to 2/3 volume with H_2O. Add an appropriate amount of Sat. $NH_2OH \cdot HCl$ and $CHCl_3$ (note b). Stir at high speed with a mechanical stirrer for a few minutes. Add 50 to 100 ml 6% cupferron reagent and stir again at high speed for 5 minutes.

   a. The sample solution must be in approximately 1N HCl free of NO_3^-. Boil solution in HCl if necessary and dilute with H_2O.

   b.

Large tissues -	100 ml	Sat.	$NH_2OH \cdot HCl$,		150 ml.	$CHCl_3$
Medium tissues -	50 "	"	"	"	100 ml.	"
Large Soils -	10 "	"	"	"	50 ml.	"
Small Soils -	5 "	"	"	"	25 ml.	"

2. Centrifuge to separate the phases. Add a few drops of aerosol solution to reduce foaming between layers. Transfer the $CHCl_3$ phase, using a transfer pipet to a 400-ml beaker. Repeat the extraction, without the addition of more cupferron, until the $CHCl_3$ phases are colorless.

3. Boil the $CHCl_3$ collections to low volume, (approximately 3 ml) and allow the contents to cool. Rinse the walls of the beaker with HNO_3 and boil to approximately 3 ml. Repeat the rinse with fuming HNO_3 and boil to low volume (avoid dryness) (note c).

   c. Repeat fuming HNO_3 cycle for soil samples until solution turns a clear red color.

CONFIDENTIAL

4. Add 25 ml fuming HNO_3 & 25 ml $HClO_4$. Cautiously heat until an exothermic $HClO_4$ reaction begins. Remove the beaker from the hot plate and allow the reaction to go to completion.

5. Fume the $HClO_4$ to low volume (note d). Cool the solution and transfer with water washes to a centrifuge cone.

   d. A white residue often appears at this point in large bone samples. Repeat the extraction in this event.

6. Continue with Step 1 Pu-239 PURIFICATION PROCEDURE.

Pu-239 PURIFICATION PROCEDURE

1. To the sample contained in a centrifuge cone, add 10 mg Fe^{+3} unless the sample is known to contain that much. Digest in a hot water bath for 10 minutes and carefully add 19N NaOH (pellets may be required if the volume is too large) until the solution is basic (note a). Add 3 ml saturated Na_2CO_3 and digest in a hot water bath 10 minutes. Centrifuge and decant supernate to waste. Dissolve the precipitate in HNO_3 and dilute to approximately 15 ml.

   a. Do not make the solution too basic, as Fe is amphoteric.

2. Make the solution basic with NH_4OH and digest the precipitate in a hot water bath for 10 minutes. Centrifuge and decant the supernate to waste. Wash the precipitate twice with 10-ml portions of H_2O containing 1 drop NH_4OH.

3. Dissolve the precipitate in a minimum of HNO_3 and add 5 ml 6N HNO_3 (note b).

   b. An insoluble brown precipitate sometimes persists if iron is present in excess. However, during the HCl column additions in steps 5 and 6 this precipitate dissolves, changing from brown to blue green. Addition of more HCl finally destroys the blue green color.

4. Prepare a 100 to 200 mesh Dowex 1-X 10 resin column by adding approximately 1/2 inch of resin to a tubulated glass column, 12 mm I. D. and 85 mm in length, containing a Dacron wool plug at the bottom. Insert another plug at the top and precondition the column with 10 ml 6N HNO_3.

5. Pour the solution from step 3 onto the column. Wash the centrifuge tube with 20 ml 6N HNO_3, followed by 10 ml HCl and add the washings to the column.

6. Allow the column to drain and elute the plutonium into a 50-ml beaker with 30 ml of freshly prepared HCl-NH_4I (approximately 50 mg NH_4I per 30 ml HCl).

CONFIDENTIAL

7. Evaporate the elute to approximately 2 ml and add 2 ml HNO_3 to destroy I. Add 3 ml $HClO_4$ and evaporate to wet dryness. Repeat with 5 ml Aqua Regia.

8. Take up the residue in 1 ml HCl and evaporate to dryness. Do not bake. Rotate the beaker to insure complete dryness. Add 2 ml HCl, boil to 1 ml and transfer to a prepared electroplating cell (note c). Rinse the beaker with two 1/2-ml HCl washes and one 1/2-ml water wash. Transfer each wash to the plating cell (note d) and proceed with step 1 of Pu-239 ELECTROPLATING PROCEDURE.

   c. The platinum disc and anode must be freed of any grease film by rinsing several times with acetone and alcohol. Write the sample identification on the back of the disc. Ignite to red heat in a Fisher burner flame. The electroplating cell must be clean and free of any foreign material. Check for leakage before use.

   d. Keep the plating solution at minimum volume during this transfer and also during the titration.

CONFIDENTIAL

Pu-239 ELECTROPLATING PROCEDURE

1. Add drop methyl red indicator. Add NH_4OH dropwise until the indicator shows the solution to be basic (yellow). Add 2N HCl dropwise until the solution is just acid. Add 1 drop in excess.
2. Place the sample on a Sargent-Slomin electrolytic analyzer. Adjust the rotating anode to approximately 1/4 inch above the platinum disc. Plate for 20 minutes at a starting current of 2.5 amp and approximately 5 volts. The current may fluctuate during the plating period. Check occasionally and adjust the current to maintain 2.6 amp throughout the plating operation.
3. At the end of the electroplating period, add 1 ml NH_4OH. Stir for 15 seconds. Turn off the current and stirrer. Remove the anode from the plating solution.
4. Immediately transfer the plating solution into the beaker used for evaporation. Rinse the inside of the plating cell 3 times with water washes. Combine the washes with the plating solution in the beaker.
5. Dismantle the plating cell and remove the platinum disc. Rinse with alcohol and ignite the disc to red heat.
6. Place disc in a lined and labeled tin box and submit for alpha pulse height analysis.

CONFIDENTIAL

1. Divide the aliquot set aside for uranium determination into two equal portions and transfer to an appropriate glass beaker. Add an appropriate uranium spike (for yielding) to one portion (note a).

   a. If the aliquot is taken from a cupferron-$CHCL_3$ extraction sample, do not spike or divide it. Analyze concurrently with the aliquot spike prior to extraction.

2. Evaporate the solution to low volume and dilute to 5 ml with 2N HNO_3. Transfer to a centrifuge cone and saturate with NH_4NO_3 crystals.

3. Add 10 ml hexone and stir at high speed for 5 minutes. Transfer the hexone layer to a fresh centrifuge cone.

4. Repeat step 3 twice with 5-ml additions of hexone and combine organic phases.

5. Scrub the hexone phase twice with a saturated solution of NH_4NO_3 to remove Pu and other heavy elements and discard aqueous phase.

6. Back extract the uranium twice with two 5-ml additions of water and transfer the aqueous phases to a 50-ml glass beaker. Boil to wet dryness, add 5 ml Aqua Regia, and boil to wet dryness. Repeat Aqua Regia step (note b).

   b. Aqua Regia destroys residual hexone and NH_4NO_3 which may be carried through the back extraction.

7. Take up solution in 6N HNO_3 and proceed with step 1 Fluorimetric Determination of Uranium (note c).

   c. If the fluorimetric analyses is delayed, store the solution in concentrated HNO_3.

CONFIDENTIAL

1. Evaporate the sample to 1 ml and transfer to a platinum fusion dish (note a) resting on a Nichrome wire screen-ring holder. Evaporate the sample to dryness under a heat lamp.

   a. The fusion dishes are formed from satin finish 90% Pt-10% Ir alloy discs (0.015 inch thick by 0.748 ± 0.001 inch diameter) in a special forming die (0.750 inch diameter). The new dishes are cleaned by boiling in a 1-to-1 mixture of H_2SO_4 and HNO_3 and then rinsed thoroughly in water and distilled water. They are then fused twice with NaF-LiF flux and washed before their initial use.

2. Start a blast burner and by regulation of the air supply, stabilize the flame to 800°C. Position the dish holder above the flame, add 1/2 gm NaF-LiF Flux (note b) to the dish and ignite to a bright red heat for 3 minutes (note c). Allow to cool in place for 15 minutes and transfer to a 12-hole uranium dish container. Transfer the dish to a calibrated Jarrell-Ash fluorimeter (note d), within 2 hours and record the milliamps. Convert reading to μ gram per total sample using a calibration curve (note e) and calculation factors.

   b. The flux powder from which pellets are formed for fusion is composed of 98% NaF-2% LiF mixed intimately. This is made up in one-pound batches in order to insure uniformity in day-to-day use. A satisfactory bath of flux will show 0.010 μg or less per 0.5-gram pellet. The purest NaF available gives 0.003 μg. The pellets are formed in a TLW pellet-maker, fabricated from

CONFIDENTIAL

pyrex glass, and adjusted to deliver a 0.50 ± 0.01 gram pellet. The pellet-maker is gently pressed for about ten times into the flux powder container, and a spatula is used to flatten the bottom of the pellet.

c. The flux will melt within one minute if the flame is correctly adjusted and the fusion is continued for three minutes after the last of the flux has melted. At the end of the fusion, turn off the air and gas simultaneously.

d. The Jarrell-Ash fluorimeter is operated and maintained according to the supplied manual. To prepare for a series of readings, push the receptacle slide to the front stop. The instrument reference source is now under the ultraviolet light and the meter circuit is switched to the 0.001 scale. The voltage is adjusted so as to give a reading of 100 divisions. Adjust the reference to zero and enter blank and read. Remove blank, enter sample, and record reading. Check reference reading between each sample and zero if necessary. Record all necessary data.

e. The fluorometer is calibrated prior to sample analysis and daily thereafter. The initial calibration is performed by analyzing 100 λ spikes of standardized uranium solutions. The standard uranium solution used for spiking and standard measurement ranges from 0.050 to 8.24 μg U_3O_8 ml. These concentrations are aliquoted to allow readings on the fluorimeter to be made on the 0.001-1 scale. A calibration curve is plotted from the scale

CONFIDENTIAL

readings. Blanks with the multiplier phototube operating at about 400 volts show a typical reading as follows:

Scale	0.001	Instrument standard set on 100 div.
Blank:	0.019 divisions or 0.006 μg	

Daily calibrations are performed by analyzing 100 λ spikes of 0.973 and 1.46 μg U_3O_8 per ml standardized uranium solutions. If the initial and daily calibration curves are mismatched a new calibration curve is prepared as in Step 2.

3. Remove the dish from the fluorimeter and discard the fluoride pellet. Clean the disc by boiling once in 0.1N HCl, twice in H_2O, and fusing with NaF-LiF flux. Repeat acid and water treatment, rinse with H_2O, and place disc face down on a clean paper towel to dry. The disc is now ready for the next sample.

---

* The sensitivity of this method is 0.001 μg of U_3O_8. Reproducibility is approximately 5%.

The production of Pu-236 is accomplished by deuteron bombardment of U-235 in an accelerator by the following reaction:

$$\text{U-235 (d, n) Np-236}$$

$$\text{Np-236} \xrightarrow{22\ \text{hr}} \text{Pu-236}$$

In order to obtain Pu-236 free of Pu-238 and Pu-239, the U-235 must be 99+ percent pure.

The deuteron energy should be between 12 to 17 mev. The target is U-235 foil about 200 mg/cm^2 thick and with an area of approximately 1 inch square, depending on beam size. This is about one gram U-235.

After bombardment, the Np-236 is allowed to decay and Pu-236 milked off by appropriate chemical procedures.

Since fissionable material is being irradiated, the target must be sandwiched with aluminum foil. It is desirable to have a sealed target containing an inert atmosphere and having its own water cooling lines.

The surrounding foil means a deuteron energy of about 25 mev is required, this being degraded by the foil to the 12 to 17 mev range.

1. When a new stock of Pu^{236} is received, transfer the solution to a 50-ml lusteroid cone and add ~5 mg La^{+3} and ~5 mg Fe^{+3}.
2. Make the solution basic with NH_4OH. Let stand 3 minutes and centrifuge. Wash the hydroxides with 10 ml water. Discard the supernate and wash. Dissolve the hydroxide in 3 drops of HNO_3.
3. Dilute to 10 ml with water. Heat the solution for 3 minutes on a 75° C water bath. Add 20 mg $NaHSO_3$ a little at a time, to insure complete reduction. Continue to heat for 5 minutes. Add 10 drops HF with stirring, and heat for a few minutes. Cool and centrifuge. Wash the LaF_3 with 2 ml 1N HCl · 1N HF. Discard the supernate and wash.
4. Slurry the LaF_3 in 1 ml saturated H_3BO_3 and heat on a 75° C water bath for a few minutes. Add 1 ml HCl and 1 ml water and continue to heat on the water bath to obtain a clear solution. Dilute to 10 ml with water. Add ~2 mg Fe^{+3}.
5. Repeat steps 2, 3, and 4. Do not add Fe to the repeated step 4.
6. Add NH_4OH to precipitate $La(OH)_3$. Digest in a hot water bath for a few minutes. Centrifuge, and wash the precipitate with 5 ml water containing 1 drop NH_4OH. Discard the supernate and wash.
7. Dissolve the $La(OH)_3$ in 1 ml HCl and 2 drops HNO_3. Heat the solution for 3 minutes in a hot water bath. Cool the solution in an ice bath, and saturate with HCl gas. Allow to come to room temperature.
8. Transfer the solution to a prepared Dowex AG 1-X8 (100 to 200 mesh) column. Prepare an eluting solution containing 15 ml HCl and 1/2-ml HNO_3. Rinse the tube with several 1-ml portions of this solution. Transfer these washes to the column. Wash the column with the

CONFIDENTIAL

remaining solution in 2-ml portions. Wash with 15 ml HCl in 2-ml portions. Discard the effluents and washes.

9. Prepare an eluting solution containing 20 ml HCl and 75 mg NH_4I. Elute the Pu from the column into a 50-ml beaker with 2-ml portions of this solution, allowing the first 2-ml portion to pass through. Add the second 2-ml portion and plug the top of the column with a piece of pressure-sensitive tape for 5 minutes. Remove the tape and continue to elute in 2-ml portions. Pass through 6 ml of HCl in 2-ml portions.

10. Evaporate the solution in the 50-ml beaker just to dryness with addition of HNO_3 in order to drive off all iodine. Take up the activity in 6N HCl. Transfer the activity to a polyethylene bottle using 6N HCl washes. Add sufficient 6N HCl to give a concentration of ~3000 dpm per ml.

11. Transfer the contents of the 3000 dpm per ml concentrated stock solution to an appropriate size glass beaker. Add 10 mg Fe^{+3}, 4 ml H_2SO_4, and ~2 ml $HClO_4$. Evaporate to SO_3 fumes.

12. Wash the sides of the beaker with HCl and evaporate to near dryness. Take up in 1-2 ml HCl and transfer to a 40-ml centrifuge cone with H_2O + HCl washes.

13. Ppt $Fe(OH)_3$ with NH_4OH and centrifuge. Wash ppt with H_2O containing a few drops NH_4OH and centrifuge. Dissolve the $Fe(OH)_3$ in a few drops HNO_3 and dilute to 5 ml with 6N HNO_3. Add ~1/2-ml saturated $NaBrO_3$ solution.

14. Warm on hot water bath a few minutes. Saturate the solution with NH_4NO_3 crystals, add 5 ml hexone and stir with a mechanical stirrer 3 minutes. Repeat hexone extraction twice adding Sat. $NaBrO_3$ and more NH_4NO_3 crystals as necessary.

15. Wash the hexone phases by stirring with 5-ml 6N HNO_3 for 1 minute and discard the washes. Back extract the Pu with three 5-ml additions of 0.1N HNO_3. Transfer the aqueous phase to a 50-ml glass beaker.

16. Add 10-ml HCl and boil to wet dryness. Repeat HCl addition and evaporation twice. Take up with 10-ml 6N HCl. Transfer contents to 250-ml poly bottle, and dilute to ~250 ml with 6N HCl.

17. Add one ml of Con $HClO_4$ and cap tightly. The activity value should be ~4.4×10^3 dpm/ml. Label R.C. Pu^{236} Master Stock Solution.

18. Pipet exactly 10 ml of the R.C. Pu^{236} Master Stock Solution into a 2000-ml volumetric flask and add 10 ml Con $HClO_4$. Dilute to the mark with 6N HCl.

19. Transfer the solution (not quantitatively) into eight clean, dry 250-ml poly bottles and cap tightly. The activity value should be ~22 dpm/ml in each poly bottle. Label R.C. Pu^{236} Low Level Stock Solution. Circle caps and bottles with green label on tape.

20. Pipet exactly 200 ml of the R.C. Pu^{236} Master Stock Solution into a 2000-ml volumetric flask and add 10 ml $HClO_4$. Dilute to the mark with 6N HCl.

21. Transfer the solution (not quantitatively) into eight clean, dry 250-ml poly bottles and cap tightly. The activity value should be ~440 dpm/ml. Label R.C. Pu^{236} High Level Stock Solution. Circle caps and bottles with red label on tape.

CONFIDENTIAL

1. Pipet 1 ml each of R.C. Pu^{236} Low Level and High Level Stock Solution into an electroplating cell (usually process duplicate aliquots). Add 1/2 ml HCl.
2. Add 1 drop methyl red indicator. Add NH_4OH dropwise until the indicator shows the solution to be basic (yellow). Add 2N HCl dropwise until the solution is just acid. Add 1 drop in excess.
3. Place the sample on the Sargent-Slomin electroplater. Adjust the platinum anode (note a) to approximately 1/4-inch above the platinum disc (Note b). Plate for 10 minutes at a starting current of 2.5 amps and about 5 volts. The current may fluctuate during the plating period. Check occasionally and adjust the current to maintain 2.6 amps throughout the plating period.
   a. The same platinum anode, glass tower, and washer is used through three successive platings of a given aliquot.
   b. The platinum disc and anode must be freed of any grease film by rinsing several times with acetone and alcohol. Write the sample identification on the back of the disc. Ignite to red heat in a Fisher burner flame. The electroplating cell must be clean and free of any foreign material. Check for leakage before use.
4. At the end of the electroplating period, add 1 ml NH_4OH. Stir for 15 seconds. Turn off the current and stirrer. Remove the anode from plating solution.
5. Immediately transfer the plating solution into a 50-ml beaker. Rinse the inside of the plating cell three times with water washes. Combine the washes with the plating solution in the beaker.

6. Dismantle the plating cell and remove the platinum disc. Rinse with alcohol and ignite the disc to red heat; cool.
7. Place sample in a lined and labeled tin box and submit for counting analysis.
8. Evaporate the solution to approximately 3 ml. Add 3 ml HNO_3 and 1 ml HCl. Evaporate to wet dryness. Repeat the HNO_3-HCl treatment twice.
9. Pick up in 1 ml HCl and take to dryness. Do not bake. Rotate the beaker to insure complete dryness. Add 2 ml HCl, boil to 1 ml, and transfer to the same electroplating cell using a new platinum disc as the cathode. Rinse the beaker with two 1/2-ml HCl washes and one 1/2-ml water wash. Transfer each wash to the plating cell (note c).
   c. Keep the plating solution at minimum volume during this transfer and also during the titration.
10. Repeat steps 2 through 9 to obtain second plate.
11. Repeat steps 2 through 7 to obtain third plate.
12. The three successive platings from each aliquot are counted on a calibrated alpha spectrometer. The total Pu^{236} dpm on each plate is added to determine the average Pu^{236} tracer concentration. Calculate the tracer stock concentration as of January 1 of the current year.

1. Pipet 1 ml each of R.C. Pu^{236} Low Level and High Level Stock Solution and 1 ml each of Pu^{239} Stock Solution (~90 dpm) into two 50-ml beakers.
2. Add 10 ml of H_2O, 1 ml Con. $HClO_4$, 2 ml Con. H_2SO_4, 10 mg Fe^{+3} and evaporate to dryness.
3. Wash the sides of the beaker with HCl and evaporate to near dryness. Take up in 1-2 ml HCl and transfer to a 40-ml centrifuge cone with H_2O and HCl washes.
4. Ppt $Fe(OH)_3$ with NH_4OH and centrifuge. Wash ppt with H_2O containing a few drops NH_4OH and centrifuge. Dissolve the $Fe(OH)_3$ in a few drops HNO_3 and dilute to 5 ml with 6N HNO_3. Add ~1/2 ml saturated $NaBrO_3$ solution.
5. Warm on hot water bath a few minutes. Saturate the solution with NH_4NO_3 crystals, add 5 ml hexone and stir with a mechanical stirrer 3 min. Repeat hexone extraction twice adding Sat. $NaBrO_3$ and more NH_4NO_3 crystals as necessary.
6. Wash the hexone phases by stirring with 5 ml 6N HNO_3 for 1 min and discard the washes. Back extract the Pu with three 5 ml additions of 0.1N HNO_3. Transfer the aqueous phase to a 50-ml glass beaker.
7. Evaporate the solution containing the heavy element tracer and activity to approximately 1 ml. Add 1 ml HNO_3 and 1 ml HCl. Evaporate to wet dryness. Repeat the HNO_3 - HCl treatment twice (Note a).
   a. Repetition of HCl-HNO_3 treatment is not necessary for the plating of uranium.

CONFIDENTIAL

8. Pick up in 1 ml HCl and take to dryness. Do not bake. Rotate the beaker to insure complete dryness. Add 2 ml HCl, boil to 1 ml, and transfer to a prepared electroplating cell (note b). Rinse the beaker with two 1/2-ml HCl washes and one 1/2-ml water wash. Transfer each wash to the plating cell (note c).

   b. The platinum disc and anode must be freed of any grease film by rinsing several times with acetone and alcohol. Write the sample identification on the back of the disc. Ignite to red heat in a Fisher burner flame. The electroplating cell must be clean and free of any foreign material. Check for leakage before use.

   c. Keep the plating solution at minimum volume during this transfer and also during the titration.

9. Add 1 drop methyl red indicator. Add NH_4OH dropwise until the indicator shows the solution to be basic (yellow). Add 2N HCl dropwise until the solution is just acid. Add 1 drop in excess.

10. Place the sample on the Sargent-Slomin electroplater. Adjust the anode to not more than 1/4 inch above the platinum disc. Plate for 10 to 15 minutes at a starting current of 2.5 amps and about 5 volts. The current may fluctuate during the plating period. Check occasionally and adjust the current to maintain 2.6 amps throughout the plating period (notes d and e).

   d. Fifteen minutes plating time is required for Pa.

   e. Twenty minutes plating time is required for T.P. (Am-Cm) samples.

11. At the end of the electroplating period, add 1 ml NH_4OH. Stir for 15 seconds. Turn off the current and stirrer. Remove the anode from plating solution.
12. Immediately transfer the plating solution into the beaker used for evaporation. Rinse the inside of the plating cell 3 times with water washes. Combine the washes with the plating solution in the beaker.
13. Dismantle the plating cell and remove the platinum disc. Rinse with alcohol and ignite the disc to red heat; cool. Check yield on laboratory alpha counter before submitting sample to the counting room.
14. Place sample in a lined and labeled tin box and submit for counting analysis.
15. Determine the Pu^{236} to Pu^{238} and Pu^{239} ratios by alpha pulse height analysis. A correction factor for the very small amount of Pu^{238} and Pu^{239} added to each sample is determined from this data.

CONFIDENTIAL

APPENDIX C
SAMPLE DATA SHEETS

QUALITY CONTROL - SAMPLE DEFICIENCY REPORT Sample No. _____ Isotope _____

To be initiated by first employee to become aware of deficiency and then reported to supervisor!
(Fill out in pencil)

DEFICIENCY (Circle numbers applicable)

1. Replicate nonagreement, $\sigma = \pm$ _____ %.
2. Results different from expected value.
3. Calculation error.
4. Calculations double checked in error
5. Data transcription mixup.
6. Faulty counters.
7. Computer processing.
8. Sample contaminated.
9. Sample cross contaminated.
10. Low chemical yield (<40%).
11. High chemical yield (>90 %).
12. Samples mislabeled.
13. Poor sample mount or plate.
14. Other (explain).

RESPONSIBILITY (List person(s) who will initial form when notified)

1. Calculation
2. Counting
3. Electronics
4. Decontamination
5. Separation
6. Activity or carrier aliquoting
7. Other

REASON FOR DEFICIENCY

_____

_____

_____

DISPOSITION

1. Recount (circle) LBG, MEW, Gross α, α spec, P-20, γ-spec.
2. Rework (indicate method)
3. Reweigh (indicate method)
4. New Aliquot

ROUTING FOR APPROVAL AND ACTION (Circle applicable people)

RM RS WM JAS PAB (RAW) Other _____

CONFIDENTIAL

TYPICAL DATA RESULTS FOR TISSUE WITH MEASURABLE PU-239 CONTENT — CHEMISTRY

Sample Desig [illegible]

Prep by DWB Date 12/4/63 Tracer by DWB Date 12/4/63 Diss'n by JHA Date 12/4/63 Decon by DEH Date 12/4/63

Estimated Pu^{239} 20-30 dpm Tracer Req'd 25 dpm Monitor Count 47 Est Yield 92%

Dilution 500 ml Uranium Aliq 50 ml Sample Aliq 450 ml Sample Frac 1.0

Sample Sections 1 Vol. Tracer/Sect. 1.0 ml Conc Tracer 25.74 dpm/ml Total Tracer 25.74 dpm

Diss'n Type TRACER Plate Qual dented (clean) sl. dirty mod dirty heavy dirt scorched scratched

Strip. Act. None

COUNTING

Inst 2 x 2 Date 351.834-63 Minutes Run 30 Total Counts 641.7

21.39 (Gross cpm) − 0.13 (Bgd cpm) = 21.52 (Net cpm) × 1.942 (S.F.) = 41.8 dpm

Net cnts (Pu^{236} Pu^{239})/Geoxtime = 39.5 dpm

ALPHA PULSE HEIGHT ANALYSIS FOR PU

T 4 STG 5 Min. Run 240 Date 342-940-63

Pu^{236} Tracer		Pu^{239}	
Total counts in channels 45-56	= 1281	Tot. counts in channels 8-18	= 2079
Background	= 1	Background	= 1
Counts from	= —	Counts from	= —
Net Counts	= 1280	Net Counts	= 2078 ± 2.2%

(84.72)(25.74)(0.786) = 1714 (A) (time x Geo tracer (dpm) corr)

(84.72)(0.747)(1.0) = 63.27 (B) (time x Geo x yield x aliq)

Net counts/A = 0.747 yield

Net Counts/B = 22.84 dpm

% Error = 2.8

Error (dpm) = ± 1.18

% Total Error = 5.6

TRACER FRACTIONS

L. Sample Activity (dpm)	0-50		50-90	
L. Tracer Addition (dpm)	40		80	
H. Sample Activity (dpm)	90-2000	2000-4000		
H. Tracer Addition (dpm)	400	800	*	

* > 4000 requires aliquot

C-2

REMARKS

Chemistry SLIGHTS OFF - 10 318 (Cont'd. use)

Counting SPECTRA WELL defined

Calculations —

REVIEWED BY: [illegible] RAW

CONFIDENTIAL

Sample Desig RDT-167

TYPICAL DATA RESULTS FOR TISSUE WITH UNDETECTABLE PU-239 CONTENT CHEMISTRY

Prep by D. B Date 2/26/64 Tracer by DWB Date 2/26/64 Diss'n by LRA Date 3/1/64 Decon by DSH Date 3/6/64

Estimated Pu^{239} 0-20 dpm Tracer Req'd 20 dpm Monitor Count 18 Est. Yield 89%

Dilution None Uranium Aliq None Sample Aliq Total Sample Sample Frac 1.0

Sample Sections 1 Vol. Tracer/Sect. 1.0 ml Conc. Tracer 20.18 dpm/ml Total Tracer 20.18 dpm

Diss'n Type Tracer Plate Qual. dented (clean) sl. dirty mod. dirty heavy dirt scorched scratched

Stip. Act. None

2π COUNTING

Inst 2 π 5 Date 089.885-64 Minutes Run 50 Total Counts 270

9.00 (Gross cpm) - 0.23 (Bgd. cpm) - 8.77 (Net cpm) x 1.938 (S.F.) = 17.0 dpm

Net cnts (Pu^{236} Pu^{239})/Geoxtime = 16.2 dpm

ALPHA PULSE HEIGHT ANALYSIS FOR PU

T 3 STG 5 Min. Run 600 Date 091.265-64

Pu^{236} Tracer		Pu^{239}	
Total counts in channels	= 3428	Tot. counts in channels	= 12 ± 3
Background	= 2	Background	= 4 ± 2
Counts from	= —	Counts from	= —
Net Counts	= 3426	Net Counts	= 8 ± 62.5%
(211.8)(20.18)(0.942) time x Geo tracer(dpm) corr	= 4026 A	(211.8)(0.85)(1.0) time x Geo x yield x aliq.	= 180.2 B
Net counts/A	= 0.851 yield	Net Counts/B	= 0.044 dpm
% Error	= 1.7%	Error (dpm)	= ± 0.028
		%Total Error	= 62.5

TRACER FRACTIONS

Sample Activity (dpm)	0-50		50-90
Tracer Addition (dpm)	10		80
Sample Activity (dpm)	90-2000	2000-4000	
Tracer Addition (dpm)	400	800	

> 4000 requires aliquot

REMARKS

Chemistry Sample wt 1.4023 (Dog Trachea)

Counting No Activity Apparent in Pu-239 Region of Spectra

Calculations

REVIEWED BY [illegible]

C-3

CONFIDENTIAL

APPENDIX D
TECHNICAL PAPER FOR HANFORD SYMPOSIUM
AND 9TH ANNUAL MEETING HEALTH PHYSICS
SOCIETY

ROUTINE DETERMINATION OF PLUTONIUM BY TRACER TECHNIQUES IN LARGE BIOLOGICAL SAMPLES *

by

W. J. Major, R. A. Wessman, R. Melgard, L. Leventhal

Technical Services Division
Tracerlab, A Division of Laboratory for Electronics, Inc.
2030 Wright Avenue
Richmond, California

ABSTRACT

A precision tracer procedure was developed for the rapid analysis of non-uniformly distributed plutonium in large biological samples. Liver, lung, kidney, lymph node, trachea, gastrointestinal tract, nasal mucosa, pharyngeal mucosa, bone, urine and feces samples from burros, sheep, and dogs (exposed to plutonium aerosols) were assayed for plutonium. The chemical procedure consisted of: equilibration of sample plutonium with ^{236}Pu tracer, wet ashing by refluxing with H_2SO_4 and a catalyst; extraction of plutonium from bulk salts with cupferron-chloroform; purification with ion-exchange resins; and electrodeposition on platinum. These procedures minimized the requisite volume of acids and avoided the violent exothermic reactions of some wet ashing procedures. Problems associated with dry ashing, such as loss of the radioisotope by entrainment in solid carbon particles, and formation of insoluble oxides of plutonium, were avoided. Also, the need for the large ashing furnaces was obviated.

* This report is based on work performed under Contract DA-49-146-XZ-192, Mod 4, between the Defense Atomic Support Agency and Tracerlab, A Division of Laboratory for Electronics, Inc.

CONFIDENTIAL

Measurement of the plutonium content was accomplished by tracer yielding and alpha pulse-height analysis. This method ensured a high degree of accuracy, high sensitivity, and freedom from interference from other alpha emitters. A typical chemical yield was 55%, and the counting precision was within 3%. Limits of detection were approximately 0.05 dpm for a thousand-minute count.

INTRODUCTION

Procedures for the determination of picocurie amounts of plutonium in biological materials are abundant in the literature. Inherent drawbacks to these procedures are: procedures are limited to specific types and amounts of samples; dissolution and purification losses are erratic, usually requiring calibration of chemists (Reference 9); and the chemical procedure must often be revised for each sample. Weiss and Shipman (Reference 10) have used ^{237}Pu tracer to follow procedural steps in urinalysis. Painter (Reference 11) has used ^{238}Pu tracer to follow activity distribution in dogs. In neither case, however, was the tracer used to yield another isotope of plutonium.

Attempts to minimize plutonium losses sometimes result in a product which contains interfering alpha emitters such as the ^{241}Am daughter of ^{241}Pu, present in many plutonium samples. Hollstein (Reference 12) mentions contamination from uranium and Weiss and Shipman mention ^{232}Th, ^{238}U, ^{231}Pa, and ^{237}Np contamination in urine samples. Other workers such as Sanders and Leidt (Reference 13) have expressed dissatisfaction with processing methods. Kooi and Hollstein (Reference 14) were dissatisfied with erratic plutonium recovery and the inapplicability of available procedures to water containing large concentrations of iron or calcium.

By means of a ^{236}Pu tracer technique, we have successfully determined sub micro amounts of plutonium in nuclear debris,

CONFIDENTIAL

atmospheric filters, soil, dry fallout, rainwater, food, environmental samples, and neutron-activated materials for the past twelve years. In this procedure a known quantity of ^{236}Pu is equilibrated with sample plutonium, and ^{236}Pu as well as the heavier plutonium isotopes are later determined by alpha spectrometry. Positive identification of all isotopes and an accurate correction for processing losses are assured. The method is adaptable to most samples containing plutonium, since ^{236}Pu is usually absent.

This tracer method has been combined with an appropriate bioassay procedure for routine determination of non-uniformly distributed plutonium in large biological samples. In a recent program burros, sheep, and dogs were exposed to plutonium aerosols to simulate uptake, deposition, retention, and translocation of plutonium in humans exposed to plutonium aerosols from a non-nuclear detonation. Over 600 liver, lung, kidney, lymph node, trachea, gastrointestinal tract, nasal mucosa, pharyngeal mucosa, bone, urine, and feces samples from the animals were analyzed by our lab for plutonium content. These samples ranged from a few ounces to 15 pounds and contained from 0 to 60,00 dpm of $^{239,\ 240}Pu$.

EXPERIMENTAL

Preparation of ^{236}Pu Tracer

The ^{236}Pu tracer was prepared in a cyclotron irradiation and chemically purified at Tracerlab. No measureable $^{239,240}Pu$ or ^{238}Pu was apparent after purification. Both exhaustive electrodeposition and isotopic dilution methods were used to standardize the tracer.

In exhaustive electrodeposition, four aliquots were withdrawn from the purified stock and the tracer electrodeposited on a platinum disc.

CONFIDENTIAL

The plates were counted without collimators in our Frisch grid chambers and tracer activity corrected for chamber counting efficiency. Electrodeposition and counting were repeated on the plating supernate until a plate relatively free of activity was obtained. Three platings were usually required. Summation of the electrodepositions gave the tracer concentration.

In isotopic dilution a spike of National Bureau of Standards $^{239,240}Pu$ stock solution* (99.97% pure) was added, for yielding, to nine aliquots of the purified ^{236}Pu stock solution. The spike and tracer were equilibrated by evaporation with H_2SO_4 and $HClO_4$ and isolated by the procedure described below. The plated samples were counted and the ^{236}Pu concentration calculated after ^{239}Pu yielding.

Exhaustive electrodeposition gave an average concentration of 25.0 ± 0.38 dpm/ml ^{236}Pu for the four aliquots. Isotopic dilution gave an average 25.7 ± 0.26 dpm/ml for the nine aliquots. Experience has shown that the first method is susceptible to low results due to sequential handling losses. This point has been confirmed by standardization of the tracer, using a combination of both techniques on the same aliquots of tracer.

Sample Dissolution

The choice of dry or wet ashing is often a matter of personal preference or of facilities available. Comar (Reference 15) discusses the relative merits of each and usually favors dry ashing. Greenberg (Reference 16) recommends the convenience of dry ashing. Wet-versus-dry ashing was

*An analysis of the NBS standard (listed as 99.97% pure) on our Mass Spectrometer gave the following isotopic composition: 94.386 weight % ^{239}Pu; 5.271 weight % ^{240}Pu; and 0.343 weight % ^{241}Pu. The ^{239}Pu, ^{240}Pu alpha disintegration rate of the solution was calculated from this data.

CONFIDENTIAL

experimentally compared. Dry ashing resulted in losses from spattering and physical entrainment of plutonium in solid carbon particles. It was assumed the greatest losses would occur in samples having high organic-to-ash ratios, such as soft tissues. Losses from the formation of difficultly soluble compounds of plutonium at high ashing temperatures were also suspected. Toribara and Predmore (Reference 17) found urine, bone, and soft-tissue ash readily soluble in strong HCl, while fecal and food ash contained a difficultly soluble residue which sometimes trapped 97% of the plutonium, requiring a drastic leaching and fusion for dissolution.

In dry ashing, sample plutonium and tracer cannot be equilibrated until after the ashing process; and losses occurring at this stage result in inaccurate sample yielding. Wet ashing of tissue and fluid samples in the presence of ^{236}Pu tracer was tried and gave the desired results. The procedure, and adaption of the Kjeldahl method, utilized the oxidizing power of concentrated sulfuric acid, a mercury catalyst, and refluxing at high temperatures. The apparatus consisted simply of large beakers covered with inverted funnels (Figure D.1). Unaccountable sample plutonium losses were eliminated by addition of the tracer at the start. Equilibration of sample plutonium and tracer was assured by dissolution of the sample in the strongly oxidizing media. Requisite volumes of acids and violent exothermic reactions of some wet ashing procedures were minimized. After a clear solution was obtained, the excess acid was evaporated.

Bone samples were dry ashed, since they have a low organic-to-ash ratio, and the ash serves as a carrier to prevent loss of plutonium during high-temperature ashing. The bone ash was easily removed from the ashing container by acid dissolution and then equilibrated with plutonium tracer.

CONFIDENTIAL

Plutonium Isolation

The residue from wet ashing usually contained large amounts of inorganic salts. Most of the bulk salts were separated by extracting the plutonium, reduced to the trivalent state with hydroxlamine hydrochloride, into a cupferron-chloroform solution. The extraction was a scaled-up version of the method outlined by Beaufait and Lukens (Reference 9) and Langham. (Reference 18) The residual salts were further reduced by co-precipitation of plutonium with $Fe(OH)_3$ from a hot basic carbonate solution and then from an ammoniacal solution.

The plutonium was separated from iron and traces of other metallic ions by ion-exchange resin-absorption and elution with $HCl-NH_4I$. (Reference 19) The eluent was evaporated to low volume and treated with HNO_3, $HClO_4$, and HCl to remove iodine and residual resin particles. If a residue persisted, the sample was recycled through the chemistry procedure, as a visible residue at this point would result in a dirty plate in the procedure below.

A rapid electrodeposition procedure reported by Mitchell (Reference 20) was used to obtain from the clear solution a weightless, invisible deposit of plutonium on a platinum disc with a plating time of 10 minutes. The disc was 5 mils thick, with a mirror finish, pre-cut to 2.2 cm in diameter. The electrodeposition cell, designed by our laboratory, limited the plating solution exposure to the glass tower, teflon gasket, and platinum disc.

Sequential outlines of the sample processing are given (Figures D.2 and D.3, and a detailed chemical procedure is appended.

Activity Measurements

Each electrodeposited plutonium sample was counted on an alpha pulse-height analyzer. For this purpose, the outputs from four Frisch grid chambers (Tracerlab Model RLD-1) were connected

CONFIDENTIAL

to one multi-channel analyzer (Technical Measurements Corp., Model CN-110) by dividing the full range of 256 channels into quadrants of 64 channels each.

The chamber was calibrated for alpha energy using a multi-peak alpha source containing ^{239}Pu, ^{241}Am, and ^{236}Pu (Tracerlab R-37 Alpha Spectrometer Kit). The calibration was made immediately before and after each sample was counted. This provided a check for instrument drift during the sample counting interval. The instrument controls were adjusted so that the 64 channels covered an energy range of 4.5 to 6.0 Mev. This range included the isotope energies of ^{239}Pu (5.14 Mev), ^{240}Pu (5.16 Mev), ^{238}Pu (5.49 Mev), and ^{236}Pu (5.75 Mev). The amplifier gain setting gave a scale factor of 37 Kev per channel. Each isotope present was registered over a spread of approximately ten channels.

A disposable metal collimating ring, surrounding each sample disc, was used with each sample to preclude the counting of degraded alpha particles. Some loss in counting efficiency resulted but was offset by improved peak contours and distinct separation of alpha energy peaks. The resolution (full width at half-maximum) of the four Frisch Grid chambers, including disc collimation, was 0.88% at 5.15 Mev. The alpha peak counting efficiency was approximately 35%.

The counting time for an unknown sample was determined by the isotope having the lowest activity. If activity levels permitted, the lowest activity peak was counted to a standard error of within 3%. The maximum counting time for any sample was limited to 1000 minutes.

Calculation of $^{239,240}Pu$

The results of the alpha pulse-height analyses are presented on printed tape. A graphical plot of a typical spectrum for a tissue con-

CONFIDENTIAL

taining a moderate amount of ^{239}Pu is illustrated in Figure D.4. The energy calibration line was calculated from the pre-and postcounting energy calibrations of the counting chamber. A summation was made of counts under each isotope peak present. These counts were corrected for low energy tail, background, peak resolution, and instrument drift. The plutonium content of the sample was c. lculated by:

$$^{239,240}Pu \text{ dpm} = \frac{\text{counts } ^{239,240}Pu \times \text{dpm } ^{236}Pu}{\text{counts } ^{236}Pu}$$

^{239}Pu and ^{240}Pu could not be calculated separately, as their alpha energies were too close to resolve with a Frisch-Grid Chamber.

The counting efficiency of each Frisch-Grid Chamber was measured, using a high precision alpha standard, and it was not necessary to calculate a yield to determine the plutonium content. However, the yield was usually determined as a quality control measure in order to assess the efficiency of the chemistry procedure.

Quality Control

The biological specimens, received in the form of frozen samples sealed in plastic bags, were stored in a walk-in freezer prior to processing. Samples were analyzed in a low-level radiochemical laboratory to prevent contamination from outside sources and processed with adequate spacing using all new glassware to prevent cross-contamination. The few samples which were expected to be higher in plutonium content, by virtue of their exposure, were processed separately.

All reagents were made up fresh and analyzed for any laboratory blank. Simulated samples (prepared by adding a ^{236}Pu spike to a matrix similar to the animal specimens) were analyzed to check on procedures. The laboratory blanks were effectively background. For an optimum

CONFIDENTIAL

sample counting time of 1,000 minutes, the blanks were found to be in the region of 0.05 dpm, which is the limit of detection for the instrument.

All activity measurements were performed in an isolated and controlled area. The background count rate and counting efficiency of each Frisch-Grid Chamber was checked periodically. In the $^{239,240}Pu$ energy region, the background count was approximately 0.001 cpm.

RESULTS

Based on the samples analyzed, the reflux wet ashing-tracer procedure has been found to be successful. It was moderately time-consuming and expensive, however. Ordinarily 3 to 5 days were required to dissolve 16 to 20 large tissue samples. A combination of HNO_3, H_2SO_4, fuming-HNO_3 and $HClO_4$ dissolutions in open beakers was substituted for smaller samples. (Reference 21)

A tabulation of radiochemical yields are listed in Table D.1. Generally, samples 0.1 to 4 ounces and 4 to 14 ounces averaged 55% and 48%, respectively. Samples 1 to 9 pounds averaged approximately 50%. Yields from samples up to 15 pounds are still to be determined. Averages reported include some low yield samples which were processed before our procedures had been fully developed. Recent data show improved yields in all sample categories.

The use of tracer did not lessen the difficulties of recovering such minute amounts as 0.1 dpm (7×10^{-13} grams) of plutonium from pounds of material. Losses of sample plutonium are always a possibility, but with addition of tracer, these losses are positively known. Thus, if the entire sample was lost due to undetected processing irregularities, the sample was reported as lost and not as zero dpm of plutonium.

The sample activities measured in this program are not germane to this paper, since samples came from both exposed and unexposed

CONFIDENTIAL

animals. Some animal organs were found to contain levels of plutonium below our limits of detection, which is nominally 0.05 dpm. The lowest samples showed activity from 0.05 to 0.10 dpm.

Variations in yields introduced no special problems, since each sample was individually yielded. However, 50 to 70% was considered most desirable for obtaining optimum sensitivity. The fluctuations in yields emphasize the inaccuracies which would have resulted had the work been done without tracer. Also, in retrospect, an adequate tracer-free plutonium assay procedure would have been very difficult to develop.

ACKNOWLEDGEMENTS

The valuable contributions of our scientists in this program are too numerous to credit. However, the authors wish to thank Dr. C. E. Gleit, D. W. Billings, C. E. Ensor, and Mrs. D. E. Hawkinson, for their exceptional assistance.

CHEMICAL PROCEDURE

1. Remove the frozen sample from its polyethylene bag and allow it to thaw for a few minutes under a heat lamp. If the sample shape or size is such that it will not fit in the bottom half of a four-liter beaker, cut the sample into appropriate sections and place each section in a separate beaker. Rinse the plastic bag with HNO_3 and add the washings to the beaker.
2. Add enough H_2SO_4 to completely cover the sample. Pipet an appropriate amount of ^{236}Pu tracer (within a factor of five of the expected sample activity but a minimum of 15 dpm) into each beaker and add approximately 5 grams K_2SO_4 and 2 to 3 drops Hg metal. Spray the sample with Dow-Corning Antifoam A silicone defoamer.
3. Attach the stem of an inverted 6-inch funnel to a ring stand and clamp and lower the funnel mouth into the beaker. Secure a few inches above the sample.
4. Digest the sample gently with low heat until a black tarry mixture is obtained. Increase the heat gradually and reflux until the mixture is a clear solution. The tarry mixture will turn to a black jelly, a black liquid, a red liquid, and finally, a clear solution. Raise or lower the funnel during dissolution to control the reflux action. Wash down any carbonaceous material on the beaker and funnel walls with H_2SO_4.
5. Evaporate the H_2SO_4 until salts start forming. Remove the funnel and add HNO_3 cautiously to cool the solution. If the sample had been divided into sections for the dissolution, combine the sections into one beaker and evaporate to low volume. Cool and transfer the sample with water to a large polyethlene bottle

CONFIDENTIAL

or a 2-liter acid bottle. Dilute to approximately 500 ml.

6. Add 10 ml sat. $NH_2OH \cdot HCl$ to the diluted sample and about 50 ml $CHCl_3$. Stir with a mechanical stirrer for 1 minute at high speed. Add 75 to 100 ml 6% aqueous solution of cupferron and stir again at high speed for 5 minutes.

7. Transfer the mixture into four 250-ml polyethlene bottles and centrifuge to separate the phases. Transfer the $CHCl_3$ extracts with a transfer pipet to a 400-ml beaker, taking care not to disturb the interfaces. Repeat the extraction, without addition of more cupferron, until the $CHCl_3$ phases are colorless.

8. Boil the $CHCl_3$ collections to low volume (approximately 3 ml) and allow contents to cool. Rinse down the sides of the beaker with HNO_3 and boil to approximately 3 ml. Rinse the sides with fuming nitric and boil down again (avoid dryness). Add 10 ml fuming nitric and 25-30 ml $HClO_4$. Cautiously heat until an exothermic $HClO_4$ reaction begins. Remove the beaker from the hot plate and allow the reaction to go to completion.

9. Fume the $HClO_4$ to low volume. Cool the solution and transfer with water washes to a 40-ml centrifuge cone.

10. Add 10 mg Fe unless the sample is known to contain that much or more. Add 19N NaOH until the solution is basic to precipitate metal ions. Add 5 ml sat. Na_2CO_3 solution and digest the precipitate in a hot water bath for 10 minutes. Centrifuge and decant the supernate to waste. Dissolve the precipitate in HNO_3 and dilute to approximately 30 ml.

11. Make the solution basic with NH_4OH and digest the precipitate in a hot water bath for 10 minutes. Centrifuge and decant the supernate to waste. Wash the precipitate twice with 10-ml portions of H_2O containing 1 drop NH_4OH.

12. Dissolve the precipitate in a minimum of HNO_3 and add 10 ml 6N HNO_3.

13. Prepare a 100 to 200 mesh Dowex 1-X 10 resin column by adding approximately 1/2 inch of resin to a tubulated glass column, 12 mm I.D. and 85 mm in length, containing a Dacron wool plug at the bottom. Insert another plug at the top and pre-condition the column with 40 ml 6N HNO_3.

14. Pour the solution from step 12 onto the column. Wash the centrifuge tube with 20 ml 6N HNO_3, followed by 20 ml HCl and add the washings to the column.

15. Allow the column to drain and elute the plutonium into a 50-ml beaker with 30 ml of freshly prepared HCl-NH_4I (approximately 50 mg NH_4I per 30 ml HCl).

16. Evaporate the eluate to approximately 5 ml and add 5 ml HNO_3 to destroy I^-. Add 3 ml $HClO_4$ and evaporate to wet dryness.

17. Take up the residue in 1 ml HCl and evaporate to dryness. Do not bake. Rotate the beaker to insure complete dryness. Add 2 ml HCl, boil to 1 ml, and transfer to a prepared electroplating cell (note a). Rinse the beaker with two 1/2-ml HCl washes and one 1/2-ml water wash. Transfer each wash to the plating cell (note b).

    a. The platinum disc and anode must be freed of any grease film by rinsing several times with acetone and alcohol. Write the sample identification on the back of the disc. Ignite to red heat in a Fisher burner flame. The electroplating cell must be clean and free of any foreign material. Check for leakage before use.

    b. Keep the plating solution at minimum volume during this transfer and also during the titration.

CONFIDENTIAL

18. Add drop methyl red indicator. Add NH_4OH dropwise until the indicator shows the solution to be basic (yellow). Add 2N HCl dropwise until the solution is just acid. Add 1 drop in excess.

19. Place the sample on a Sargent-Slomin electrolytic analyzer. Adjust the rotating anode to approximately 1/4 inch above the platinum disc. Plate for 10 minutes at a starting current of 2.5 amp and approximately 5 volts. The current may fluctuate during the plating period. Check occasionally and adjust the current to maintain 2.6 amp throughout the plating operation.

20. At the end of the electroplating period, add 1 ml NH_4OH. Stir for 15 seconds. Turn off the current and stirrer. Remove the anode from the plating solution.

21. Immediately transfer the plating solution into the beaker used for evaporation. Rinse the inside of the plating cell 3 times with water washes. Combine the washes with the plating solution in the beaker.

22. Dismantle the plating cell and remove the platinum disc. Rinse with alcohol and ignite the disc to red heat.

23. Place disc in a lined and labeled tin box and submit for alpha pulse height analysis.

CONFIDENTIAL

TABLE D.1 EFFECT OF SAMPLE SIZE ON PU RECOVERY

Sample Weight Range	Tissue *	Number of Samples	Pu Recovery Range	Pu Recovery Average
Ounces			%	%
0.2- 0.3	Hilar Node (D)	12	44-74	61
0.3- 0.4	Hilar Node (S)	9	21-62	43
0.2- 0.9	Hilar Node (B)	12	33-77	60
0.4- 0.8	Phar. Mucosa (D)	15	37-75	65
0.7- 0.8	Nasal Mucosa (D)	2	50-79	65
1.1- 1.6	Trachea (D)	9	39-85	58
1.4- 2.3	Kidney (D)	14	24-88	51
1.7- 3.2	Phar. Mucosa (B)	6	32-68	49
2.4- 3.6	Lungs (D)	9	28-64	49
3.3- 4.0	Kidney (S)	6	40-72	55
4.8- 6.4	Liver (S)	17	26-80	47
5.3- 8.5	Controls	26	24-74	52
6.1- 7.3	Bone (S)	18	24-69	42
7.8-14.	Liver (D)	10	30-77	50
Pounds			%	%
0.9- 1.1	Trachea (B)	5	42-70	56
1.0- 2.5	Kidney (B)	16	21-80	49
1.9- 3.3	Bone (B)	24	23-75	54
3.6-10.2	Lung (B)	3	34-75	52
4.4- 8.9	Liver (B)	10	37-57	48
	TOTAL	223	21-88	52

* D = Dog, S = Sheep, B = Burro

CONFIDENTIAL

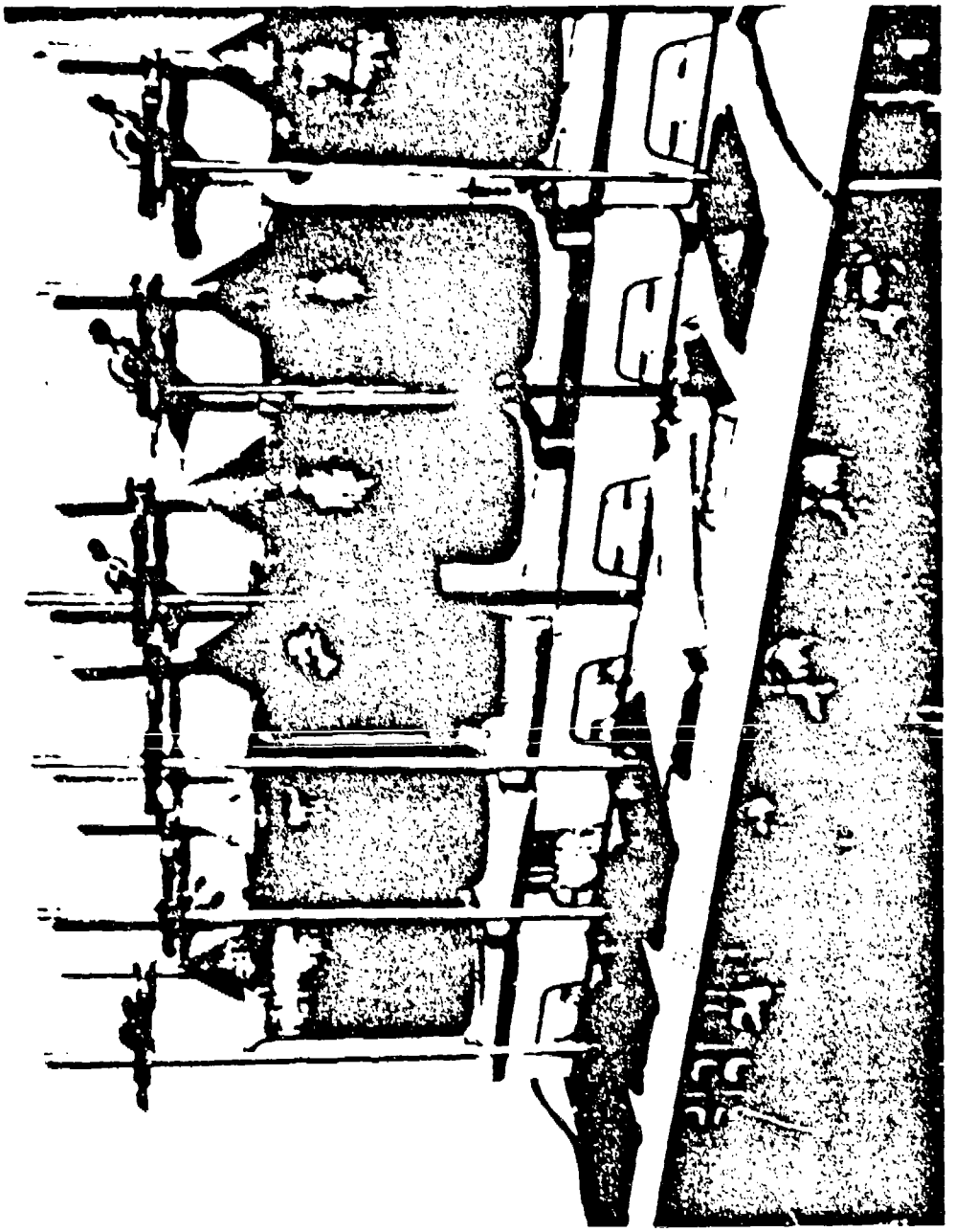


Figure D.1 Reflux apparatus for biological sample. (Tracerlab photo)

CONFIDENTIAL

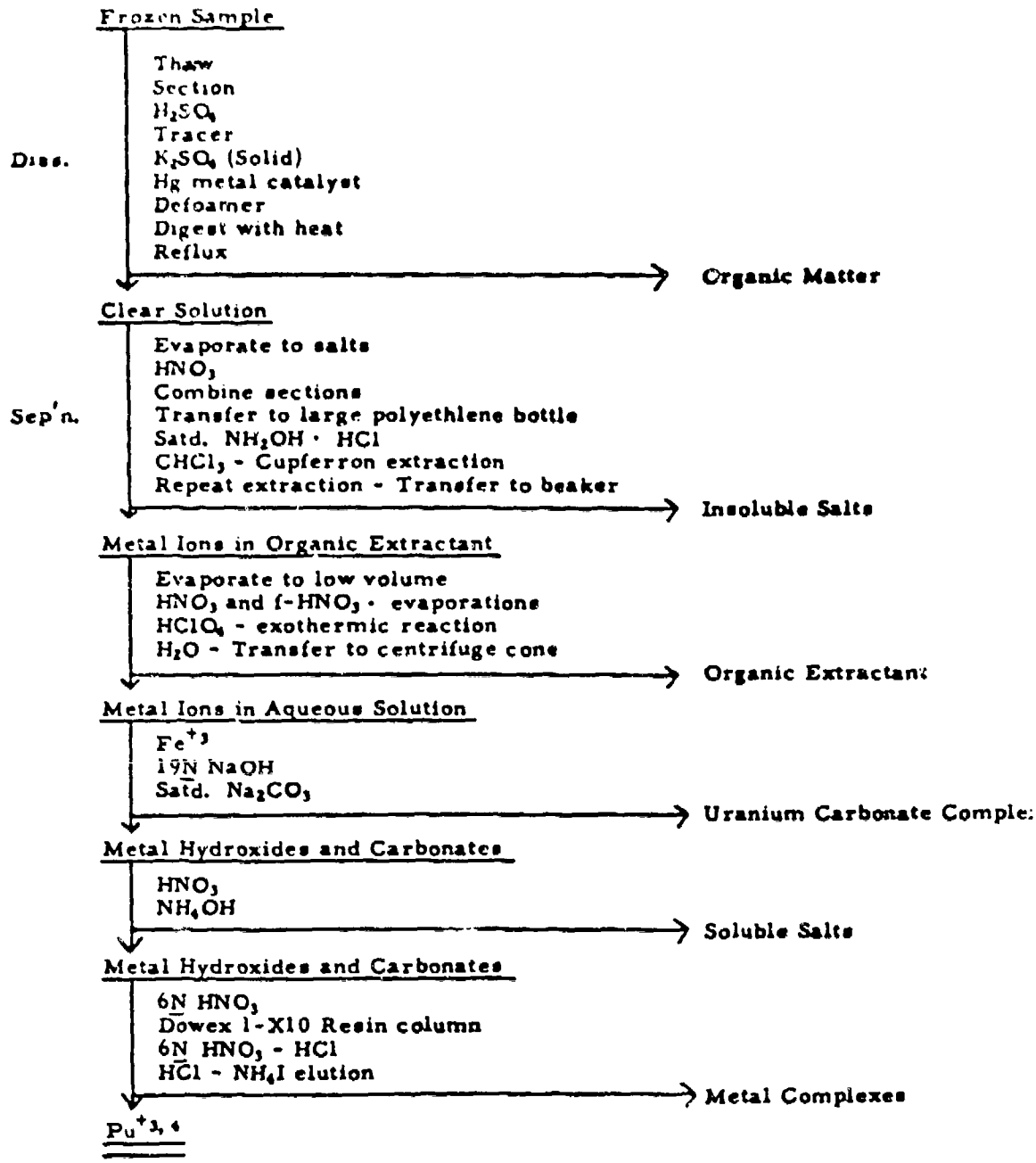


Figure D.2 Chemical dissolution, separation, and purification sequential scheme.

CONFIDENTIAL

$Pu^{+3,4}$

Evaporate to low volume
HNO_3 and $HClO_4$
Evaporate to wet dryness
HCl
Evaporate to dryness
HCl, evaporate to 1ml
Transfer to electroplating cell containing platinum disc

$Pu^{+3,4}$ in plating cell

Methyl Red Indicator
NH_4OH
2N HCl - ph adjustment
Transfer onto an electrolytic analyzer

Cell in electrolytic analyzer

Anode adjustment - 1/4 inch above disc
Current - 2.5 amps., 5 volts
Plate 10 - 20 minutes
NH_4OH
Remove anode
H_2O wash
Remove platinum disc
EtOH
Ignite

PuO_2

Figure D.3 Plutonium electroplating sequential scheme.

CONFIDENTIAL

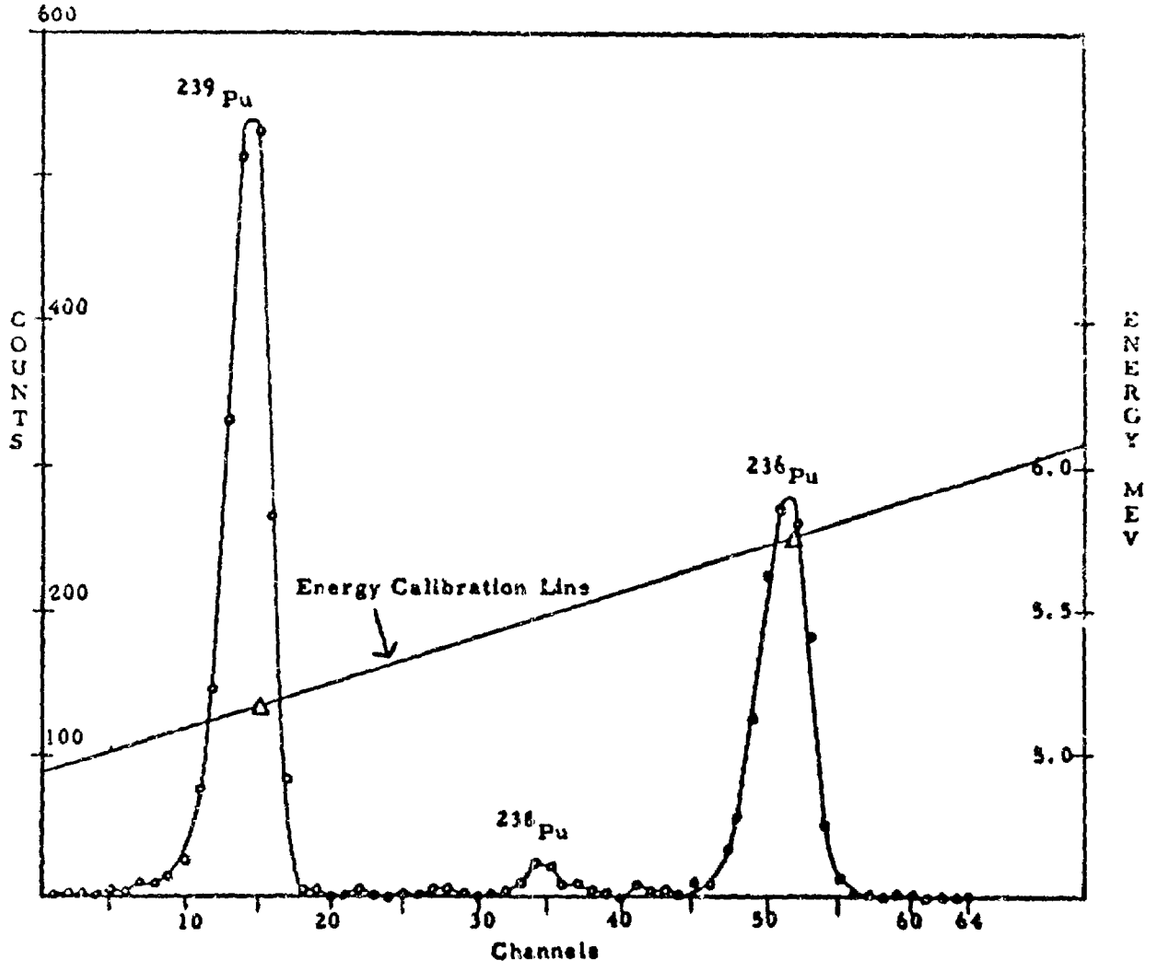


Figure D.4 Typical spectra biological sample (burro liver).

CONFIDENTIAL

APPENDIX E
DATA TABLES FOR PU^{239}, PU^{238} AND URANIUM (U_3O_8) IN PHYSICAL, BIOLOGICAL, TRACER, AND QUALITY CONTROL SAMPLES

KEY TO PHYSICAL SAMPLE TYPE

TLW Anal. Desig.	Sample Type
CCD	Casella Disc
CCF	Casella Filter
CAD	Andersen Disc
CAF	Andersen Filter
CTA	Total Air Sample
CTD	Total Air Sample Disposable
CSA	Sequential Air Sample
CDS	Deposition Sample
CQC	Soil Samples (Quality Control)
CWS	Water Samples
CAC	Aluminum Collectors
CVS	Vegetation (Sagebrush)
CSF	Soil Fractions
CBS	Balloon Wire Swipes

CONFIDENTIAL

KEY TO BIOLOGICAL SAMPLE TYPE

TLW Anal. Desig.	Sample Type
RDB	Dog Bone
RDK	" Kidney
RDL	" Liver
RDR	" Lung
RDH	" Hilar Node
RDT	" Trachea
RDS	" G. I. Tract
RDP	" Pharyngeal Mucosa
RDN	" Nasal Mucosa
RSB	Sheep Bone
RSK	" Kidney
RSL	" Liver
RSR	" Lung
RSH	" Hilar Node
RST	" Trachea
RSS	" G. I. Tract
RSN	" Nasal Mucosa
RSU	" Urine
RSF	" Feces

CONFIDENTIAL

KEY TO BIOLOGICAL SAMPLE TYPE (2)

TLW Anal. Design	Sample Type
RBB	Burro Bone
RBK	" Kidney
RBL	" Liver
RBR	" Lung
RBH	" Hilar Node
RBT	" Trachea
RBS	" G. I. Tract
RBP	" Pharyngeal Mucosa
RBN	" Nasal Mucosa

CONFIDENTIAL

TABLE E.1 RADIOCHEMICAL ANALYSIS OF ROLLER COASTER PHYSICAL SAMPLES, DOUBLE TRACKS

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
GZ	AH-C5	9E14	CAC- 376	3.08±0.07E 07		81.2	2C	1.7E 03
	C6	9E15	377	1.29±0.03E 07		64.4	2C	2.9E 01
	AJ-C7		378	1.29±0.03E 08		63.1	2C	1.7E 03
	BL-C9		379	2.96±0.08E 07		55.3	2C	9.6E 00
	BO-14	8C19	CDS-1719	3.46±1.38E 00		81.9	4C	3.9E 00
A	066	2526-A	CCD-2160	4.70±0.07E 03	1.13	56.C	6C	1.2E 00
	066	B	2206	2.42±0.06E 02	1.89*	53.7	6C	4.CE-02
	070	9E15	CAC- 380	1.16±0.03E 07		55.8	2C	2.6E C2
C	060		381	5.49±0.12E 07		71.3	2C	1.CE 02
	060		2069	2.91±0.07E 07		71.9	2C	
D	05C		382	8.43±0.20E 06		63.6	2C	1.9E 03
	064	2920-A	CAD-2164	2.74±0.08E 01	14.7	74.8	2CC	3.CE-C2
	064	B	2210	6.77±0.24E 02	0.535	33.6	3C	4.3E-01
	068	2922-A	CCD-2165	2.99±0.06E 03	33.5	38.9	5C	6.6E-01
	068	B	2211	2.69±0.05E 03	6.50	65.9	3C	9.1E-01
E	058	9624-A	2168	1.08±0.03E 02	0.172	42.9	2CC	
	058	B	2215	1.44±0.04E 02	0.168	48.1	6C	
	058	9698-A	2175	5.77±0.01E 03	2.86	10.C	6C	
	058	B	2219	1.70±0.23E 00	0.0610	36.2	2CC	
	058	9659-A	CTA-2176	1.92±0.08E 02	1.44	31.4	4C	
	064	9656-B	CCD-2216	3.92±0.09E 02	0.665	46.5	6C	
	060-1	9651-1	1835	7.27±0.13E 03		81.9	3C	2.6E 00
	2	2	1836	3.84±0.13E 01		70.4	1CC	3.8E-01
	3	3	1837	4.66±0.22E 00		58.7	5CC	1.9E-01
	4	4	1838	1.10±0.08E 00		83.8	5CC	9.CE-C2
	5	5	CCF-1839	2.18±0.21E 00		57.8	20C	3.6E-01
G	05C-1	9677-1	CCD-1855	9.88±0.24E 02		89.9	2C	8.9E-01
	2	2	1856	2.49±0.08E 01		85.2	2CC	4.8E-01
	3	3	1857	3.80±0.26E 00		33.4	5CC	1.6E-01

Note: All Physical and Biological activity results are given for the total sample except the "A" samples (identified in Table E.13) and transferred from Project 2.6c for radiochemical analyses. These are deficient by the approximate amounts listed in Table E.13. Data were not combined since in 2.6c, processing particles were not precisely analyzed or an unknown faction of the sample was removed.

*New data this report

CONFIDENTIAL

TABLE 2.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R-9E WORK)	COUNT TIME	ANALYSION
G	050-4	9677-4	CCD-1858	2.35±0.09E 01		60.6	200	6.5E-01
	5	5	CCF-1859	8.14±1.37E-01		52.2	200	8.0E-01
	052-1	9666-1	CCD-1846	5.61±0.19E 02		86.4	10	8.7E-01
	2	2	1847	4.30±0.12E 01		87.5	100	2.2E-01
	3	3	1848	2.69±0.10E 01		58.4	200	5.6E-01
	5	5	CCF-1849	6.35±0.31E 00		80.8	300	6.4E 00
	052-1	9667-1	CCD-1850	2.72±0.08E 01		82.8	200	4.0E-01
	2	2	1851	7.27±0.38E 00		35.9	500	7.3E 00
	3	3	1852	4.42±0.22E 00		88.1	300	5.5E-01
	4	4	1853	9.99±1.00E-01		85.5	300	1.0E 00
	5	5	CCF-1854	1.07±0.10E 00		87.0	300	9.0E-02
	052-1	9678-1	CCD-1860	3.01±0.06E 03		85.6	20	1.3E 00
	2	2	1861	4.92±0.14E 01		75.3	100	4.5E-01
	3	3	1862	1.63±0.09E 01		32.2	200	4.1E-01
	4	4	1863	3.19±0.27E 00		54.7	200	2.7E-01
	5	5	CCF-1864	3.23±0.13E 00		64.3	900	1.6E-01
	054-1	9664-1	CCD-1841	1.14±0.03E 03		76.5	20	9.8E-01
	2	2	1842	1.57±0.02E 02		60.6	200	6.7E-01
	3	3	1843	1.02±0.04E 02		75.6	40	4.5E-01
	4	4	1844	1.03±0.06E 01		54.0	200	3.2E-01
	5	5	CCF-1845	1.52±0.05E 01		87.7	200	2.4E-01
	054-1	9696-1	CCD-1885	2.91±0.09E 01		44.2	200	2.7E-01
	2	2	1886	1.10±0.03E 02		68.6	60	6.0E-01
	3	3	1887	9.97±0.19E 02		86.6	30	1.0E 00
	4	4	1888	1.16±0.05E 01		72.2	200	2.4E-01
	5	5	CCF-1889	1.50±0.03E 01		56.3	900	5.4E-01
	056	9663	CTD-1840	1.18±0.03E 03		37.0	40	1.3E 00
	056-1	9680-1	CCD-1865	2.71±0.06E 03		88.2	20	1.2E 00
	2	2	1866	1.39±0.04E 02		80.5	40	6.6E-01

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
G	056-3	9680-3	CCD-1867	6.24±0.15E 01		36.5	200	3.3E-01
	4	4	1868	1.32±0.08E 01		36.1	200	2.6E-01
	5	5	CCF-1869	1.72±0.09E 01		33.5	200	3.6E-01
	058	9660-A	CCD-2170	4.84±0.17E 02	4.44	32.5	40	4.6E 02
	058	8	2214	5.01±0.10E 01	0.308	68.6	200	
	058	9661-A	CTA-2171	1.76±0.05E 03	10.8	47.5	20	
	060-1	9694-1	CCD-1880	3.51±0.10E 03		63.0	20	9.2E 00
	2	2	1881	1.87±0.05E 02		68.4	40	1.2E 00
	3	3	1882	8.78±0.29E 01		59.8	60	5.5E-01
	4	4	1883	2.25±0.40E 01		02.8	200	4.7E-01
	5	5	CCF-1884	1.98±0.07E 01		70.2	200	5.6E-01
	062-1	9683-1	CCD-1870	2.60±0.06E 03		77.2	20	5.5E-01
	2	2	1871	1.61±0.03E 03		89.2	30	4.0E-01
	3	3	1872	1.30±0.02E 03		83.9	40	3.3E-01
	4	4	1873	3.59±0.09E 02		89.6	20	1.0E 00
	5	5	CCF-1874	3.79±0.12E 02		81.5	20	3.3E-01
	064	9656-A	CCD-2169	4.69±0.07E 03	3.74	56.8	60	
	064	9668-B	2217	6.42±0.13E 01	0.273	49.6	200	
	064-1	9684-1	1875	4.23±0.07E 03		83.5	40	8.6E-01
	2	2	1876	3.52±0.06E 03		87.2	40	3.5E-01
	3	3	1877	2.53±0.08E 03		75.4	10	
	4	4	1878	6.12±0.20E 02		87.7	10	4.5E-01
	5	5	CCF-1879	9.10±0.19E 02		79.7	30	3.5E-01
H	060	2723-A	CCD-2161	1.96±0.07E 03	3.11	18.7	40	1.0E 00
	060	8	2207	4.62±0.12E 02	1.48	53.6	40	6.1E-01
	064	8C19	COS-1720	1.03±0.12E 00		82.0	500	8.0E-04
I	055-1	9647-1	CCD-1825	6.03±0.18E 02		93.8	20	7.1E-01
	2	2	1826	9.88±0.28E 01		33.4	100	3.1E-01
	3	3	1827	4.81±0.13E 01		35.5	200	2.5E-01

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
I	055-4	9647-4	CCD-1828	1.40±0.04E 01		76.3	4CC	2.1E-01
	5	5	CCF-1829	1.27±0.06E 01		48.1	20C	2.3E-01
	057-1	9629-1	CCD-1820	2.03±0.05E 03		85.6	2C	7.2E-01
	2	2	1821	3.78±0.11E 02		87.5	2C	5.CE-01
	3	3	1822	1.65±0.03E 02		45.2	2CC	3.2E-01
	4	4	1823	2.93±0.12E 01		35.C	20C	3.2E-01
	5	5	CCF-1824	1.25±0.03E 03		77.3	2C	3.9E-01
	057-1	9649-1	CCD-1830	9.04±0.22E 02		88.9	2C	
	2	2	1831	6.79±0.16E 02		83.C	2C	1.CE 00
	3	3	1832	2.14±0.04E 02		91.9	6C	5.CE-01
	4	4	1833	5.95±0.18E 01		58.6	1CC	4.4E-01
	5	5	CCF-1834	5.95±0.14E 01		86.6	1CC	3.3E-01
	059	9691-A	CTA-2174	1.40±0.03E 03	7.50	31.4	5C	
	061	9669-A	2173	2.25±0.04E 03	3.74	35.C	6C	
	061	9668-A	CCD-2172	1.54±0.03E 03	2.02	34.9	5C	
J	058	2612-A	CAD-2162	4.26±0.10E 02	2.37	61.6	4C	1.6E-01
	058	8	2208	4.95±0.11E 02	0.555	64.4	4C	2.7E-01
L	034	8C49	CDS-1723	4.88±0.11E 04		81.7	2C	
	034-3		1724	6.04±0.46E 00		48.2	4CC	1.CE-02
	4		1725	2.35±0.08E 01		65.7	4CC	2.3E 01
	5		1726	1.48±0.04E 02		21.3	5CC	
	046-1		1727	4.38±0.12E 01		65.1	50C	
	2		1728	1.54±0.04E 04		46.6	2C	1.5E 04
	3		1729	5.53±0.15E 04		51.4	2C	5.5E 04
	4		1730	7.54±0.18E 04		64.1	2C	7.5E 04
	5		1731	1.88±0.03E 04		60.3	4C	3.6E 00
	070		1732	3.30±0.08E 03		39.4	4C	1.6E 00
	070-1		1733	4.77±0.17E 02		58.9	4C	4.6E 02
	2		1734	1.17±0.06E 01		49.3	4CC	1.2E 01

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
L	070-3	8C49	CDS-1735	2.67±0.09E 01		71.4	3CC	2.7E C1
	4		1736	3.33±0.13E 01		48.5	4CC	3.3E C1
	5		1737	1.86±0.10E 01		81.8	2CC	3.CE-C2
	1C8	8C19	1721	1.28±0.21E 00		68.5	2CC	1.3E CO
N	030	2829	CTA- 241	8.00±6.00E-02		40.3	9CC	CA 1.CE CO
	032-1	2884-1	CCD- 126	-3.00±6.00E-02		78.4	2CC	CA 1.CE CO
	2	2	127	-2.00±3.00E-02		77.2	2CC	CA 1.CE CO
	3	3	128	-2.00±6.00E-02		75.3	20C	CA 1.CE CO
	4	4	129	1.00±6.00E-02		76.8	4CC	CA 1.CE CO
	5	5	CCF- 130	2.82±0.12E 01		13.1	1CCC	2.2E CO
	034-1	2899-1	CAD- 334	-0.50±1.00E-01		72.4	8C	CA 6.CE-04
	2	2	335	2.40±0.90E-01		56.5	3CC	CA 2.6E-02
	3	3	336	0.00±0.05E 00		61.5	3CC	CA 1.CE-03
	4	4	337	1.80±0.60E-01		65.2	3CC	CA 1.CE-C2
	6	6	338	1.00±0.60E-01		71.7	3CC	CA 5.CE-03
	7	7	CAF- 339	1.50±0.90E-01		76.7	20C	CA 5.CE-C2
	036	2833	CTA- 242	2.48±0.12E 00		57.7	9CC	CA 2.CE CO
	040	2832	CTD- 386	0.90±1.20E-01		38.C	2CC	5.CE-C3
	042	2826	CTA- 240	3.99±0.32E 00		53.3	2CC	3.3E-C1
	044-1	2887-1	CCD- 131	1.01±0.01E 03		76.1	7C	2.5E CO
	2	2	132	1.13±0.04E 01		76.C	4CC	2.8E CO
	3	3	133	2.11±0.14E 00		80.5	4CC	CA 2.CE CO
	4	4	134	1.90±0.70E-01		80.4	2CC	CA 1.CE CO
	5	5	CCF- 135	3.00±4.50E-02		79.5	2CC	CA 1.CE-02
	046-1	2889-1	CAD- 328	2.30±0.60E-01		8C.5	3CC	CA 1.CE 00
	2	2	329	7.00±5.00E-02		74.4	4CC	CA 1.CE CO
	3	3	330	7.40±0.90E-01		63.1	4CC	CA 1.CE CO
	4	4	331	1.05±0.30E 00		38.7	4CC	CA 1.CE 00
	6	6	332	5.00±1.00E-01		32.3	4CC	CA 1.CE CO

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
N	046-7	2889-7	CAF- 333	3.00±0.80E-01		64.0	300	CA 1.0E 00
	048	2836	CTA- 243	2.07±0.04E 02		70.8	100	8.6E-01
	050-1	2898-1	CCD- 141	3.41±0.04E 03		79.1	60	3.2E 00
	2	2	142	3.72±0.13E 01		75.1	200	2.2E 00
	3	3	143	3.03±0.24E 00		26.6	700	CA 3.0E 00
	4	4	144	4.48±0.22E 00		46.7	700	CA 4.0E 00
	5	5	CCF- 145	2.23±0.15E 00		49.5	700	CA 2.0E 00
	050-1	3576-1	CCD- 146	4.12±0.05E 03		71.8	60	CA 3.0E 00
	2	2	147	4.28±0.14E 01		79.1	200	1.1E 00
	3	3	148	1.87±0.08E 01		73.4	200	1.1E 00
	4	4	149	2.35±0.21E 00		42.0	400	CA 2.0E 00
	5	5	CCF- 150	6.46±0.35E 00		82.6	200	1.6E 00
	052-1	2885-1	CAD- 322	2.65±0.12E 01		59.5	200	6.5E-01
	2	2	323	4.35±0.19E 00		53.5	800	3.1E-01
	3	3	324	1.39±0.06E 01		65.3	300	6.1E-01
	4	4	325	6.79±0.49E 00		77.5	100	2.1E-01
	6	6	326	4.10±0.23E 00		74.3	300	1.3E-01
	7	7	CAF- 327	4.76±0.18E 00		66.5	800	3.7E-01
	054	2839	CTA- 244	7.50±0.20E 01		63.3	100	4.2E-01
	056-1	2894-1	CCD- 136	1.15±0.01E 03		80.0	70	3.4E-01
	2	2	137	4.95±0.15E 01		81.6	200	5.5E 00
	3	3	138	2.36±0.08E 01		91.1	200	2.6E 00
	4	4	139	5.07±0.27E 00		82.8	200	1.3E 00
	5	5	CCF- 140	5.53±0.33E 00		80.6	200	2.6E 00
	062-1	2641-1	CCD- 66	8.84±0.12E 02		65.0	70	2.6E 00
	2	2	67	1.64±0.02E 02		77.1	200	1.4E 00
	3	3	68	8.49±0.16E 01		82.7	600	1.2E 00
	4	4	69	1.87±0.04E 01		77.5	700	1.1E 00
	5	5	CCF- 70	4.05±0.13E 01		78.9	200	5.6E-01

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
N	064-1	2828-1	CAD- 310	3.28±0.12E 01		74.7	200	1.6E 00
	2	2	311	1.53±0.05E 02		76.6	30	1.1E 00
	3	3	312	2.72±0.04E 02		74.1	100	1.1E 00
	4	4	313	1.56±0.03E 02		81.5	80	1.2E 00
	6	6	314	5.60±0.17E 01		81.1	200	CA 5.6E 01
	7	7	CAF- 315	6.00±0.17E 01		58.7	200	1.3E 00
	066	2500	CTA- 247	7.49±0.20E 02		75.8	20	4.5E-01
	066	8042	CDS-1007	1.58±0.04E 04		69.5	20	2.3E 00
	068	2837-A	CCD-2163	5.43±0.11E 02	2.81	78.5	40	7.4E-01
	068-3	3	2127	1.47±0.04E 02	0.189*	75.5	200	1.5E 00
	4	4	2128	2.96±0.12E 01	0.895	77.1	100	9.2E-01
	5	5	CCF-2129	4.21±0.15E 01	0.515*	50.1	200	6.7E-01
	070-1	2831-1	CAD- 316	3.30±0.07E 01		62.4	800	1.6E 00
	2	2	317	7.91±0.31E 01		77.1	60	8.5E-01
	3	3	318	2.87±0.09E 02		84.7	20	1.1E 00
	4	4	319	1.06±0.04E 02		75.8	60	1.1E 00
	6	6	320	3.98±0.16E 01		77.2	90	4.7E-01
	7	7	CAF- 321	4.70±0.09E 01		69.5	800	1.5E 00
	072	2886	CTA- 245	1.94±0.06E 02		78.7	30	3.6E-01
	074-1	2830-1	CCD- 71	4.24±0.14E 01		80.8	200	3.5E 00
	2	2	72	9.41±0.18E 01		75.0	600	4.1E 00
	3	3	73	3.47±0.07E 01		75.9	600	1.5E 00
	4	4	74	7.67±0.22E 00		69.8	900	4.0E-01
	5	5	CCF- 75	8.92±0.22E 00		73.0	900	7.0E-01
	078	2890	CTA- 246	2.42±0.10E 01		77.4	100	3.5E-01
	080-1	2827-1	CCD- 61	3.95±0.09E 01		61.3	600	1.3E 00
	2	2	62	4.94±0.11E 01		65.5	600	9.2E-01
	3	3	63	8.12±0.22E 00		77.2	900	CA 8.0E 00
	4	4	64	2.38±0.10E 00		86.5	900	CA 3.0E-01

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYSIS
N	080-5	2827-5	CCF- 65	3.63±0.12E 00		82.6	1000	9.0E-01
P	006-1	2006-1	CCD- 1	5.00±4.00E-02		83.3	1000	1.0E-02
	2	2	2	4.95±0.15E 00		78.7	1000	7.0E-01
	3	3	3	6.42±0.18E 00		74.3	1000	4.0E-01
	4	4	4	9.10±0.60E-01		75.5	1000	2.0E-01
	5	5	CCF- 5	8.97±0.22E 00		80.9	1000	1.3E 00
020		2014	CTO- 383	7.00±1.00E-01		65.5	400	8.1E 00
032		8045	CDS- 407	5.58±0.15E 04		70.4	20	3.2E 00
032-1		2082-1	CCD- 46	2.70±1.90E-01		30.7R	200	CA 1.0E 00
	2	2	47	2.60±0.21E 00		82.7	200	CA 3.0E 00
	3	3	48	1.90±0.30E-01		73.3	900	5.0E-02
	4	4	49	1.20±1.30E-01		81.2	200	3.0E-02
	5	5	CCF- 50	4.10±1.00E-01	0.420	51.5	200	8.0E-03
034		8045	CDS- 408	4.34±0.11E 04		71.9	20	9.3E-01
034-1		2018-1	CCD- 11	3.00±4.00E-02		61.0	1000	7.0E-03
	2	2	12	3.06±0.13E 00		64.0	1000	CA 3.0E 00
	3	3	13	1.60±0.40E-01		64.6	1000	4.0E-02
	4	4	14	0.60±2.60E-01		37.8	1000	CA 1.0E 00
	5	5	CCF- 15	2.10±0.40E-01		62.8	1000	6.0E-03
034-1		2080-1	CAD- 286	2.15±0.07E 01		80.5	300	CA 2.1E 01
	2	2	287	1.33±0.06E 01		77.4	300	1.5E 00
	3	3	288	5.00±6.00E-02		73.8	300	CA 1.0E 00
	4	4	289	1.41±0.10E 00		48.6	900	CA 1.0E 00
	6	6	290	5.20±0.90E-01		59.3	300	CA 1.0E-01
	7	7	CAF- 291	3.00±2.60E-01		40.0	300	CA 1.0E 00
036		2049	CFA- 233	8.89±0.45E 00		74.1	200	3.7E-01
036		8045	CDS- 409	1.14±0.02E 05		71.2	20	1.1E 01
038			410	1.22±0.03E 05		47.7	20	1.5E 00
038-1		2079-1	CCD- 41	6.70±0.41E 00		40.5	200	1.2E 00

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANALYSTS
P	038-2	2C79-2	CCD- 42	3.30±0.08E 01		45.1	1CCC	2.1E CO
	3	3	43	7.24±0.52E 00	0.221	41.7	2CC	6.CE-C1
	4	4	44	6.10±1.20E-01		48.2	2CC	CA 1.CE CO
	5	5	CCF- 45	1.52±0.17E 00		63.7	2CC	6.CE-C2
	040-1	2C77-1	CAD- 280	2.22±0.07E 02		80.2	2C	1.5E CO
	2	2	281	6.26±0.21E 01		84.6	1CC	9.5E-01
	3	3	282	3.49±0.14E 01		58.7	2CC	9.7E-01
	4	4	283	9.20±0.53E 00		44.2	3CC	6.6E-01
	6	6	284	3.44±0.21E 00		69.1	4CC	5.CE-C2
	7	7	CAF- 285	3.23±0.22E 00		70.5	3CC	6.CE-C1
	042	2C16	CTA- 231	4.93±0.14E 01		75.4	1CC	5.1E-01
	042	8C45	CDS- 411	1.06±0.02E 05		77.5	2C	4.4E CC
	044		412	8.03±0.21E 04		69.6	2C	1.8E CO
	044-1	2C89-1	CCD- 51	1.66±0.01E 03		74.5	1CC	3.CE CO
	2	2	52	7.36±0.11E 01		76.1	100C	4.3E 00
	3	3	53	1.19±0.06E 01		58.7	2CC	3.CE CO
	4	4	54	3.70±0.28E 00		67.7	2CC	9.CE-C1
	5	5	CCF- 55	1.24±0.06E 01		69.8	2CC	1.6E-C1
	046-1	2C90-1	CAD- 304	1.22±0.04E 02		75.7	4C	8.CE-01
	2	2	305	3.60±0.14E 01		63.5	2CC	8.8E-01
	3	3	306	1.40±0.04E 02		72.6	4C	9.8E-C1
	4	4	307	2.56±0.10E 01		66.5	2CC	9.2E-01
	6	6	308	5.33±0.47E 00		35.9R	2CC	3.CE-01
	7	7	CAF- 309	8.46±0.49E 00		59.3	2CC	8.5E-01
	046-A	8C45	CDS-1054	6.28±0.16E 04		72.7	2C	1.6E CC
	B		413	7.57±0.24E 04		66.6	1C	5.4E 01
	048	2C45	CTD- 384	1.09±0.01E 03		77.0	5C	7.8E-01
	050	8C45	CDS- 414	5.55±0.15E 04		63.2	2C	3.4E CO
	052-1	2C87-1	CAD- 298	2.04±0.04E 03		60.4	2C	1.CE CC

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL /MON
P	052-2	2C87-2	CAD- 299	1.14±0.04E 02		78.4	7C	1.2E 00
	3	3	300	9.34±0.33E 01		74.8	7C	1.CE CO
	4	4	301	3.06±0.12E 01		46.8	3CC	1.1E CO
	6	6	302	2.02±0.08E 01		60.4R	3CC	1.4E 00
	7	7	CAF- 303	1.72±0.08E 01		60.3	2CC	7.CE-01
	054	2C19	CTA- 232	4.22±0.13E 02		73.5	2C	3.2E-01
	054-A	8C45	CDS-1055	5.32±0.13E 04		74.0	2C	1.CE 00
	B		415	6.18±0.16E 04		51.1	1C	1.4E 01
	056		416	3.72±0.08E 04		60.7	1C	8.CE 00
	056-1	2C54-1	CCD- 36	2.03±0.07E 02		59.2	2CC	2.7E 00
	2	2	37	1.06±0.04E 02		57.3	2CC	8.8E CO
	3	3	38	8.11±0.25E 01		69.C	3CC	1.2E 00
	4	4	39	1.03±0.05E 01		67.2	2CC	1.3E 00
	5	5	CCF- 40	4.02±0.12E 01		70.8	3CC	4.1E-01
	058	8C45	CDS- 417	3.41±0.08E 04		54.6	1C	9.4E CO
	058-1	2C84-1	CAD- 292	5.00±0.09E 02		75.3	5C	4.CE 00
	2	2	293	2.10±0.03E 02		79.C	7C	2.2E 00
	3	3	294	1.41±0.05E 02		67.3	7C	1.7E 00
	4	4	295	5.40±0.16E 01		64.8	4CC	3.CE CO
	6	6	296	4.45±0.14E 01		85.2	2CC	CA 4.4E 01
	7	7	CAF- 297	2.28±0.09E 01		57.7	2CC	7.3E-01
	060	2C8L	CTA- 236	3.06±0.10E 02		77.2	2C	4.CE-01
	060-1	2C53-1	CCD- 31	1.45±0.01E 03		77.6	1CC	2.9E CO
	2	2	32	1.36±0.04E 02		82.7	2CC	1.7E 01
	3	3	33	3.95±0.09E 01		70.5	6CC	1.3E 00
	4	4	34	7.89±0.43E 00		66.9	2CC	2.CE 00
	5	5	CCF- 35	2.03±0.10E 01	0.910	23.4	5CC	8.CE-01
	062	8C45	CDS-1053	2.01±0.06E 04		54.1	2C	1.3E CO
	062-1	2C20-1	CCD- 16	5.50±0.07E 02		64.6	1CC	1.6E 00

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON %
P	062-2	2020-2	CCD- 17	1.14±0.02E 02		75.1	600	7.1E 00
	3	3	18	2.70±0.05E 01		84.0	1000	2.2E 00
	4	4	19	4.58±0.15E 00		71.9	1000	1.1E 00
	5	5	CCF- 20	1.06±0.07E 01		35.9	300	1.2E 00
	064-1	2041-1	CAD- 256	1.02±0.02E 03		75.4	20	1.5E 00
	2	2	257	1.03±0.03E 02		75.3	50	8.1E-01
	3	3	258	8.45±0.27E 01		84.5	50	8.2E-01
	4	4	259	3.27±0.12E 01		80.7	100	7.4E-01
	6	6	260	6.46±0.42E 00		57.2	200	4.0E-01
	7	7	CAF- 261	1.40±0.07E 01		58.8	200	7.0E-01
	066	2418	CTA- 239	2.38±0.07E 02		79.6	30	3.6E-01
	068	8045	CDS- 418	5.96±0.14E 03		69.8	10	1.4E 00
	068-1	2043-1	CCD- 21	3.18±0.04E 02		77.6	200	2.6E 00
	2	2	22	8.39±0.17E 01		72.2	600	1.0E 00
	3	3	23	1.37±0.08E 01	0.860	46.0	200	1.2E 00
	4	4	24	3.88±0.13E 00		78.8	1000	9.7E-01
	5	5	CCF- 25	7.64±0.19E 00		82.5	1000	2.5E-01
	072	2085	CTA- 237	5.03±0.16E 01		76.1	100	3.5E-01
	074	2083	CYD- 385	1.03±0.02E 02		72.9	200	4.6E-01
	074-1	2047-1	CCD- 26	2.30±2.60E-01		86.0	200	6.0E-02
	2	2	27	4.00±8.00E-02		74.2	300	CA 1.0E 00
	3	3	28	4.60±0.80E-01		76.6	200	CA 1.0E 00
	4	4	29	0.90±1.10E-01		77.5	200	CA 1.0E 00
	5	5	CCF- 30	1.26±0.13E 00		80.5	300	1.6E-01
	076-1	2044-1	CAD- 262	3.64±0.06E 02		61.2	100	1.5E 01
	2	2	263	4.17±0.15E 01		78.6	100	9.5E-01
	3	3	264	1.98±0.10E 01		52.3	200	3.4E 00
	4	4	265	4.25±0.38E 00		41.1	200	4.7E-01
	6	6	266	1.37±0.08E 00		74.2	900	CA 1.0E 00

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL /MON
P	076-7	2C44-7	CAF- 267	2.03±0.20E 00		66.4	2CC	1.CE-C1
	078	2C78	CTA- 235	4.42±0.18E 01		73.3	8C	5.CE-01
	082-1	2C48-1	CAD- 268	2.41±0.08E 02		62.6	2C	1.4E 00
	2	2	269	4.70±0.30E 00		75.5	2CC	CA 5.CE 00
	3	3	270	3.90±0.15E 01		77.5	1CC	6.5E-01
	4	4	271	6.20±0.63E 00		25.5	2CC	CA 6.CE 00
	6	6	272	1.75±0.20E 00		77.7	3CC	CA 2.CE 00
	7	7	CAF- 273	3.64±0.24E 00		64.C	3CC	2.CE-01
	0E4	2C52	CTA- 234	4.83±0.14E 01		72.6	1CC	4.4E-C2
	086-1	2C15-1	CCD- 6	8.65±0.13E 01		75.7	1CCC	2.CE 00
	2	2	7	2.35±0.05E 01		52.7	1CCC	2.CE 00
	3	3	8	2.93±0.11E 00		73.3	1CCC	CA 3.CE 00
	4	4	9	3.00±0.40E-01		75.4	1CCC	CA 1.CE-01
	5	5	CCF- 10	1.03±0.06E 00		84.C	1CCC	7.CE-C1
	0E8-1	2C51-1	CAD- 274	6.90±0.90E-01		83.C	3CC	CA 1.CE 00
	2	2	275	3.88±0.33E 00		70.C	2CC	1.5E-C2
	3	3	276	5.85±0.30E 00		80.3	3CC	CA 6.CE CO
	4	4	277	1.35±0.13E 00		78.4	3CC	CA 1.CE CO
	6	6	278	5.40±0.80E-01		79.1	3CC	CA 1.CE CO
	7	7	CAF- 279	1.07±0.34E 00		24.3	2CC	8.CE-01
	0E8-1	2C91-1	CCO- 56	0.40±1.00E-01		65.3	4CC	CA 1.CE CO
	2	2	57	5.00±7.00E-02		75.0	4CC	1.CE-C2
	3	3	58	1.31±0.12E 00		74.2	4CC	3.CE-01
	4	4	59	2.50±0.60E-01		76.2	4CC	CA 1.CE 00
	5	5	CCF- 60	5.10±1.00E-01		81.4	2CC	CA 1.CE CO
	0S0	2C88	CTA- 238	1.30±0.18E 00		68.8	2CC	2.CE-01
	110	8C20	CDS-1722	1.37±1.03E 00		82.5	4C	1.4E 00
R	0CC	2S29	CTO- 387	2.55±0.27E 00		48.6	2CC	5.CE-01
	014	2S30	388	6.86±0.14E 01		77.5	2CC	5.5E-C1

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R-RE WORK)	COUNT TIME	ANAL/MON
R	026-1	2931-1	CCD- 76	4.65±0.05E 02		78.0	200	2.5E 00
	2	2	77	1.02±0.01E 02		71.3	300	2.2E 00
	3	3	78	8.16±0.24E 01		74.5	300	1.5E 00
	4	4	79	8.94±0.46E 00	0.800	33.3	500	1.6E 00
	5	5	CCF- 80	2.30±0.05E 01		76.5	800	1.4E 00
	030	2932	CTA- 248	4.32±0.11E 02		71.6	30	4.5E-01
	034	8C44	CDS- 393	7.53±0.18E 04		62.5	10	1.7E 01
	034-1	2958-1	CAD- 364	1.82±0.05E 02		81.8	30	1.4E 00
	2	2	365	2.68±0.08E 02		70.7	30	1.4E 00
	3	3	366	1.95±0.06E 02		72.2	30	1.2E 00
	4	4	367	1.01±0.03E 02		70.4	100	1.2E 00
	6	6	368	4.13±0.13E 01		57.1	400	2.3E 00
	7	7	CAF- 369	4.59±0.17E 01		60.8	200	1.1E 00
	036	8C44	CDS- 394	4.22±0.11E 04		70.4	20	2.4E 00
	038		395	4.93±0.07E 04		85.3	20	5.6E 00
	040	2938	CTD- 389	1.23±0.02E 03		30.2	60	4.7E-01
	040	8C44	CDS- 396	4.16±0.06E 04	0.620	73.5	20	5.0E-01
	040-1	2944-1	CAD- 346	1.97±0.06E 01		79.7	400	1.5E 00
	2	2	347	1.27±0.04E 02		77.1	60	1.5E 00
	3	3	348	1.33±0.06E 02		30.5	200	1.5E 01
	4	4	349	6.55±0.26E 01		60.8	100	2.0E 00
	6	6	350	2.71±0.12E 01		46.1	200	2.7E 00
	7	7	CAF- 351	3.02±0.09E 01		72.1	200	9.2E-01
	042	2959	CTA- 252	1.42±0.03E 02		77.9	100	5.6E-01
	042	8C44	CDS- 397	3.25±0.08E 04		53.3	10	1.5E 01
	044		398	2.52±0.06E 04		52.4	10	4.5E 00
	046		399	2.12±0.05E 04		55.8	10	9.6E 00
	048	2963	CTA- 253	6.03±0.18E 01		78.7	80	4.2E-01
	048	8C44	CDS- 400	1.12±0.03E 04		63.6	20	7.3E 00

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
R	050-1	2S36-1	CCO- 81	6.97±0.17E 00		81.0	1000	CA 7.0E 00
	2	2	82	1.79±0.06E 01		80.4	300	4.5E 00
	3	3	83	1.14±0.03E 01		83.2	900	CA 1.1E 01
	4	4	84	2.02±0.04E 01		80.2	500	2.2E 00
	5	5	CCF- 85	1.47±0.15E 00		78.0	200	CA 1.0E 00
	052-1	2S48-1	CAD- 352	3.20±1.40E-01		33.6	400	CA 1.0E 00
	2	2	353	1.74±0.16E 00		48.5	400	CA 2.0E 00
	3	3	354	1.78±0.17E 00		40.2	400	CA 2.0E 00
	4	4	355	1.00±0.14E 00		42.0	400	CA 1.0E 00
	6	6	356	5.00±1.20E-01		41.8	400	CA 1.0E-01
	7	7	CAF- 357	3.80±0.60E-01		75.5	400	CA 1.0E 00
	054	2S46-A	CCO-2167	3.33±0.08E 02	8.10	66.7	40	4.0E-01
	054	8	2213	1.16±0.03E 02	4.275*	64.3	60	6.5E-01
	054	8C44	CDS- 401	1.19±0.02E 04		46.7	20	4.1E 00
	056		402	1.06±0.02E 04		50.4	20	4.8E 00
	058		1008	9.68±0.27E 03		63.2	20	2.4E 00
	058-1	2S51-1	CAD- 358	4.05±0.11E 02		80.0	100	8.6E 00
	2	2	359	4.31±0.08E 02		80.2	50	4.6E 00
	3	3	360	3.50±0.09E 02		81.4	100	6.7E 00
	4	4	361	1.46±0.05E 02		54.7	200	5.2E 00
	6	6	362	8.92±0.29E 01		67.6	200	6.5E 00
	7	7	CAF- 363	7.84±0.20E 01		74.8	400	3.3E 00
	060	2S42	CTA- 249	8.94±0.12E 02		78.7	50	3.8E-01
	060	8C44	CDS- 403	7.44±0.17E 03		47.7	20	1.7E 00
	062		404	8.83±0.22E 03		72.5	200	CA 8.0E 03
	062-1	2S40-1	CCO- 86	3.07±0.03E 02		73.0	200	1.5E 00
	2	2	87	3.18±0.05E 02		71.4	100	3.0E 00
	3	3	88	2.12±0.03E 02		74.2	100	1.8E 00
	4	4	89	6.97±0.23E 01		67.0	200	5.4E 00

*New data this report.

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
R	062-5	2940-5	CCF- 90	4.13±0.14E 01		72.0	200	1.5E 00
	066	3578	CTA- 255	8.53±0.22E 02		74.3	20	4.3E-01
	066-A	8044	CDS- 405	7.87±0.20E 03		53.5	20	1.1E 01
	B		739	6.36±0.19E 03		65.3	20	1.3E 00
	068	2954	CTD- 390	9.07±0.15E 02	0.125	68.5	50	7.6E-01
	068	8044	CDS- 406	5.29±0.10E 03		20.4	50	1.5E 00
	070-1	2962-1	CAD- 370	2.47±0.06E 02	0.0510	67.1	40	1.7E 00
	2	2	371	4.44±0.16E 02	0.0710	67.5	20	2.0E 00
	3	3	372	3.97±0.08E 02	0.0850	71.7	50	1.5E 00
	4	4	373	1.67±0.05E 02	0.421	67.3	80	2.3E 00
	6	6	374	8.84±0.26E 01	0.720	68.1	200	2.6E 00
	7	7	CAF- 375	9.80±0.29E 01	1.12	68.6	60	1.1E 00
	072	2966	CTA- 254	5.13±0.13E 02		71.2	20	3.5E-01
	074-1	2960-1	CCD- 106	4.88±0.06E 02		77.4	100	1.4E 00
	2	2	107	4.06±0.06E 02		75.3	100	1.6E 00
	3	3	108	3.29±0.05E 02		77.7	100	3.4E 00
	4	4	109	3.22±0.06E 01		73.7	800	1.7E 00
	5	5	CCF- 110	4.57±0.17E 01		61.6	200	2.7E 00
	078	2952	CTA- 251	4.07±0.12E 02		74.4	20	3.7E-01
	080	2969	CTD- 392	1.63±0.02E 03		74.5	50	4.6E-01
	080-1	2961-1	CCD- 111	1.23±0.02E 02		77.8	500	2.2E 00
	2	2	112	4.34±0.07E 02		81.4	70	3.7E 00
	3	3	113	1.13±0.02E 02		74.4	300	1.5E 00
	4	4	114	2.60±0.04E 01		83.0	1000	2.0E 00
	5	5	CCF- 115	5.85±0.06E 01		64.1	1000	3.1E 00
	082	2934-A	CAD-2166	4.34±0.26E 00	4.67	78.1	200	6.0E-03
	082	B	2212	6.42±0.37E 01	0.181	51.0	30	8.0E-02
	086-1	2964-1	CCD- 116	1.64±0.02E 02		74.5	300	2.3E 00
	2	2	117	2.57±0.04E 02		72.4	100	2.3E 00

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
R	086-3	2964-3	CCD- 118	1.44±0.02E 02		82.3	5CC	2.5E 00
	4	4	119	3.36±0.10E 01		70.3	3CC	1.6E CC
	5	5	CCF- 120	5.32±0.09E 01		82.8	9CC	1.4E 0C
	088-1	2937-1	CAD- 340	3.87±0.14E 01		62.2	2CC	1.3E 00
	2	2	341	1.33±0.06E 01		63.4	2CC	1.5E 00
	3	3	342	9.53±0.63E 00		40.4	2CC	9.CE-C1
	4	4	343	5.67±0.21E 01		70.3	1CC	1.5E CC
	6	6	344	8.10±0.32E 01		75.2	6C	1.1E 00
	7	7	CAF- 345	9.85±0.37E 00		72.2	4CC	4.CE-01
	090	2945	CTA- 250	7.53±0.14E 02	0.222	65.8	5C	3.5E-C1
	092	2967	CTD- 391	7.13±0.21E 02		66.8	2C	4.4E-C1
	092-1	2953-1	CCD- 96	1.88±0.03E 02		67.5	1CC	1.4E 00
	2	2	97	3.11±0.05E 02		73.4	1CC	2.5E 00
	3	3	98	1.16±0.02E 02		80.1	3CC	3.CE CC
	4	4	99	3.03±0.05E 01		83.5	9CC	1.3E CC
	5	5	CCF- 100	3.56±0.06E 01		105.	9CC	1.7E 00
	098-1	2957-1	CCD- 101	4.14±0.06E 01		77.8	1CCC	1.2E CO
	2	2	102	1.04±0.03E 02	1.11	62.C	2CC	1.6E CC
	3	3	103	5.92±0.21E 01		30.0	2CC	1.6E CO
	4	4	104	1.33±0.06E 01		64.3	2CC	1.2E 00
	5	5	CCF- 105	3.38±0.15E 01		47.8	2CC	1.3E 00
	104-1	2950-1	CCD- 91	3.78±0.07E 01		73.0	9CC	1.5E CC
	2	2	92	1.28±0.03E 02		62.5	3CC	1.7E 0C
	3	3	93	2.48±0.05E 01		83.0	8CC	2.6E 00
	4	4	94	1.20±0.05E 01		80.8	2CC	3.CE CO
	5	5	CCF- 95	1.61±0.07E 01		83.1	2CC	CA 1.6E 01
	106-1	2968-1	CCD- 121	1.29±0.13E 00	2.06	42.8	5CC	CA 1.CE CO
	2	2	122	4.27±0.16E 01		58.9	2CC	4.6E 00
	3	3	123	1.70±0.08E 01		59.8	2CC	1.5E 00

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANALYSIS
R	1C6-4	2568-4	CCD- 124	1.83±0.18E 00		75.5	200	CA 2.0E 00
	5	5	CCF- 125	6.92±0.40E 00		69.8	200	1.5E 00
BAL	L5,P17	2507-A	CCD-2177	1.00±0.03E 04	5.61	13.5	60	7.0E-02
	L5,P17	B	2209	1.01±0.02E 04	1.07	51.5	40	3.5E-01
	L7,P9	2443-A	CTA-2158	2.95±0.07E 02	1.14	10.7	300	3.0E 02
	L8,P21	2151-A	CCD-2157	1.33±0.02E 04	7.15	07.0R	300	1.2E 00
	L8,P21	B	2204	8.08±0.15E 03	3.93	37.8R	60	2.8E 00
** BBAL	L6,P13	2482-A	2159	1.13±0.03E 03	1.44	10.8	100	1.7E 00
	L6,P13	B	2205	2.46±0.06E 02	0.166	56.0	60	6.5E-01
OA	CMR-1A	9706	CVS-2076	5.99±0.35E 00		65.8R	200	
	1B		2077	8.47±0.40E 00		80.4	200	
	2A		2078	4.50±0.34E 00		12.6	1000	
	2B		2079	7.35±0.37E 00		75.5	200	
	4A		2080	2.57±0.24E 00		53.2	200	
	4B		2081	6.16±0.36E 00		64.2	200	
	1A	9720	2082	1.93±0.05E 03		24.2	500	
	1B		2083	3.58±0.13E 02		14.7	500	
	2A		2084	2.78±0.08E 03		60.0	100	
	2B		2085	7.07±0.22E 03		60.6	100	
	4A		2086	2.69±0.09E 02		70.2	100	
	4B		2087	4.14±0.09E 01		44.8R	700	
	11A		2088	5.78±0.11E 01		46.0R	700	
	11B		2089	1.11±0.06E 01		46.6	200	
	12A		2090	5.45±0.13E 02		76.5	200	
	12B		2091	9.91±0.31E 02		36.6	200	
	STK-10	10012	CDS-1078	8.63±1.15E 00		79.3	200	2.0E-03
	10A		1079	9.20±2.10E-01		80.4	100	CA 2.0E-02
	11		1080	4.63±1.09E 00		83.3	20	1.5E-02
	11A		1081	7.60±6.10E-01		74.4	20	8.0E-04

**Sample inadvertently combined with TB-F_2 2305B in chemistry.

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
OA	STK-12	1CC12	CDS-1082	1.10±0.69E 00		81.7	2C	5.CE-C3
	12A		1083	4.80±1.80E-01		76.8	1CC	CA 1.CE-02
	13		1084	1.28±0.04E 01		63.1	5CC	2.CE-01
	13A		1085	5.30±1.60E-01		75.8	1CC	CA 1.CE-C2
	14		1086	1.70±0.30E 00		83.4	1CC	1.CE-C1
	14A		1087	8.70±1.80E-01		79.2	1CC	CA 1.CE-02
	15		1130	4.86±0.30E 00		69.5	2CC	1.CE-01
	16	1CC13	1131	9.20±2.90E-01		70.2	7C	1.CE CO
	16A		1132	2.15±0.19E 00		73.7	2CC	4.CE-03
	17		1133	3.69±0.14E 01		80.2	10C	CA 3.CE 01
	17A		1134	6.31±0.42E 00		47.7	2CC	6.2E CO
	18		1135	3.25±0.23E 00		73.0	2CC	
	18A		1136	1.67±0.06E 01		68.4	2CC	1.7E C1
	19		1137	2.65±0.10E 01		72.2	2CC	5.1E-C1
	19A		1138	6.09±0.22E 01		70.4	1CC	1.2E 00
	20	1CCC5	1077	1.72±0.06E 02		71.3	2CC	9.CE-C2
	36	1CCC7	1076	1.44±0.05E 02		74.8	2C	3.CE-C1
	71	1CC10	1056	7.96±0.25E 03		69.2	2C	6.4E-C1
	72		1057	6.49±0.20E 03		79.3	2C	1.CE CO
	73		1058	6.94±0.22E 03		73.1	2C	8.7E-C1
	74		1059	5.29±0.17E 03		78.8	2C	8.1E-C1
	75		1060	6.60±0.23E 03		73.4	2C	2.6E 00
	76		1061	3.07±0.11E 03		74.7	2C	7.7E-01
	77		1062	3.81±0.13E 03		75.5	2C	2.CE CC
	78		1063	3.67±0.13E 03		74.7	2C	1.CE CC
	79		1064	4.18±0.14E 03		75.5	2C	9.3E-C1
	80		1065	4.11±0.14E 03		80.3	2C	3.CE CO
	81		1066	2.25±0.09E 02		71.5	2C	2.2E-C1
	82		1067	2.95±0.10E 02		74.3	7C	CA 3.CE C2

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
OA	STK-83	1CC10	CDS-1068	4.98±0.13E 02		74.7	1CC	CA 4.CE-C1
	84		1069	8.12±0.25E 02		81.4	7C	CA 8.1E 02
	85		1070	1.33±0.04E 03		65.5	2C	2.7E 00
	86		1071	1.32±0.03E 03		71.7	2C	2.6E 00
	87		1072	1.47±0.04E 03		76.4	2C	2.9E C0
	250	1CC09	1073	1.03±0.03E 04		73.4	2C	1.CE C0
	251		1074	5.41±0.16E 03		70.8	2C	1.8E 00
	252		1075	6.20±0.16E 03		79.1	2C	2.6E 00
PCMR	2-1-5	NONE	CSF-1890	1.66±0.07E 02	7.24	17.1	5CC	3.CE-C3
	6		1891	5.15±0.21E 01	8.31	91.5	2CC	1.CE-03
	7		1892	5.25±0.12E 02	14.6	43.6	1CC	2.CE-02
	8		1893	1.50±0.04E 03	31.7	41.4	2CC	1.1E-C1
	9		1894	3.32±0.11E 02	11.0	40.1	2CC	3.CE-C2
	10		1895	4.73±0.12E 02	25.6	21.2	2CC	4.CE-C2
	11		1896	2.63±0.09E 03	6.95	49.4	3C	4.CE-02
	2-5		1897	2.93±0.29E 01	11.6	39.5	2CC	2.CE-03
	6		1898	1.08±0.03E 04	19.3	29.2	3C	1.2E CC
	7		1899	4.39±0.06E 03	31.0	90.6	5C	1.3E 00
	8		1900	1.31±0.04E 03	2.50	26.4	2CC	3.3E-01
	9		1901	5.67±0.20E 02	2.34	84.8	2C	8.4E-01
	10		1902	2.82±0.43E 00	7.41	68.7	2CC	4.CE-C2
	11		1903	3.58±0.08E 02	3.45	86.3	20C	1.6E-C1
	4-5		1904	2.17±0.06E 03	15.9	45.9	2CC	3.1E 00
	6		1905	6.40±0.29E 01	13.0	39.0	2CC	6.CE-02
	7		1906	5.43±0.21E 01	28.8	60.3	2CC	1.9E-C1
	8		1907	1.02±0.11E 01	4.78	21.7	2CC	7.CE-02
	9		1908	1.55±0.25E 00	47.2	59.2	2CC	2.CE-02
	10		1909	9.44±1.61E-01	1.41	87.5	2CC	1.3E-C1
	11		1910	8.34±0.43E 01	4.87	53.8	2CC	5.6E-01

CONFIDENTIAL

TABLE E.1 (CONTINUED)

ARC LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANALYSIS
PCMR 2-6-6	NONE	CSF-1911	5.54±0.41E 00	4.85	84.0	200	4.4E-01
7		1912	1.45±0.31E 00	2.08	71.7	200	1.4E-01
8		1913	4.96±0.24E 01	5.85	34.7	200	5.2E 00
9		1914	9.28±0.55E 00	1.96	36.8	500	1.1E 00
10		1915	8.72±0.53E 00	4.86	82.3	200	7.3E-01
11		1916	2.01±0.23E 01	46.8	47.0	200	9.0E-02
7-9		1917	7.91±3.59E-01	7.19	82.1	200	1.0E-02
6		1918	2.57±0.06E 02	1.62	86.9	200	7.1E-01
7		1919	3.79±0.13E 01	16.9	79.9	200	1.1E-01
8		1920	1.47±0.06E 01	11.4	88.9	200	5.0E-02
9		1921	4.64±0.46E 01	5.02	* 26.4	200	1.8E-01
10		1922	4.30±0.36E 00	1.40	81.8	200	2.0E-02
11		1923	4.67±0.22E 01	53.5	43.9	200	4.0E-02
8-9		1924	5.52±0.40E 00	11.8	87.3	200	7.0E-02
6		1925	8.30±0.27E 01	19.9	14.6	900	3.8E-01
7		1926	1.34±0.04E 02	15.0	79.6	200	5.9E-01
8		1927	2.02±0.08E 01	11.1	79.9	300	1.2E-01
9		1928	3.13±0.10E 02	40.5	40.8	200	1.8E 00
10		1929	9.26±0.60E 01	36.4	31.9	200	5.6E-01
11		1930	3.12±0.20E 01	55.2	41.2	500	4.0E-02
9-9		1931	3.79±0.73E-01	0.946	80.8	500	2.0E-02
6		1932	8.72±0.25E 01	3.35	73.4	200	1.7E 00
7		1933	8.54±0.32E 01	2.53	45.2	200	1.9E 00
8		1934	2.28±0.12E 01	8.41	22.7	500	3.8E-01
9		1935	1.31±0.04E 02	2.73	20.4	500	1.4E 00
10		1936	9.99±0.33E 01	10.7	59.9	200	3.3E-01
11		1937	2.44±0.16E 01	93.9	56.9	500	1.0E-02
11-9		1938	1.75±0.04E 02	1.31	82.4	200	5.9E 00
12-9		1939	8.93±0.25E 02	42.3	49.0	200	1.2E 01
PCMR 2-12-6	NONE	CSF-1940	2.04±0.06E 03	9.26	50.8	200	
7		1941	8.30±0.17E 02	1.39	88.9	200	1.8E 01
8		1942	4.65±0.10E 02	28.4	84.1	200	1.6E 01
9		1943	1.47±0.04E 02	3.00	52.8	200	7.8E 00
10		1944	1.51±0.04E 02	6.74	85.0	200	1.2E 01
11		1945	3.34±0.07E 02	29.0	92.9	200	2.6E 00

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.2 RADIOCHEMICAL ANALYSIS OF ROLLER COASTER PHYSICAL SAMPLES, CLEAN SLATE I

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANALYSIS
GZ	BI-16-1	3367-1	CCD-1646	1.35±0.96E-01		72.6	200	1.4E-01
	2	2	1647	8.60±1.25E-01		79.0	200	8.6E-01
	3	3	1648	1.41±0.15E 00		84.2	200	1.4E 00
	4	4	1649	4.97±0.28E 00		39.5	500	6.2E-01
	5	5	CCF-1650	1.91±0.08E 01		63.4	200	1.9E 01
	BK-C6	9835	CAC-1415	4.20±0.09E 07		78.6	20	
	C9		1417	3.90±0.08E 07		80.5	20	
	10		1418	1.70±0.05E 06		30.0	20	
B	008	3088	CTA-1564	1.01±0.06E 01	0.0592	39.0	200	2.5E 00
	020	8123	CDS-1139	1.25±0.03E 06		70.0	20	1.1E 01
	024		1140	6.30±0.10E 06		73.4	20	7.7E 00
	028	8089	1738	1.97±0.08E 02		81.4	200	4.0E-04
	028	8123	1141	4.69±0.10E 06		81.6	20	8.6E 00
	034-2	3247-2	CAD-1630	7.54±5.66E-01		36.6	40	7.5E-01
	3	3	1631	2.27±0.20E 00		65.4	200	4.5E-01
	4	4	1632	0.00±0.47E 00		28.5	40	1.0E 00
	6	6	1633	2.94±2.34E-01		46.5	40	2.9E-01
	7	7	CAF-1634	1.71±0.06E 01		68.4	200	1.7E 01
	036	8123	CDS-1142	1.67±0.04E 04		73.1	20	2.1E 00
	060	3097	CTA-1565	4.54±0.33E 00	0.0370	56.5	200	5.7E-01
D	016-1	2615-1	CAD-1607	2.29±0.89E-01		72.5	300	1.0E-02
	2	2	1608	1.84±0.10E 01		31.3	200	1.8E 01
	3	3	1609	0.27±1.07E-01		44.3	200	3.0E-02
	4	4	1610	5.30±5.30E-02		66.8	200	5.0E-02
	5	5	1611	6.57±0.32E 00		38.5	500	6.6E 00
	7	7	CAF-1612	0.00±0.22E 00		50.6	50	1.0E-01
	020	8123	CDS-1143	1.71±0.04E 04		72.1	20	2.0E 00
	022		1144	2.02±0.05E 05		69.5	20	2.1E 00
	024		1145	7.73±0.17E 05		80.2	20	5.4E 00

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
C	028	8123	CDS-1146	1.53±0.04E 05		68.1	20	2.7E 00
	030		1147	3.49±0.10E 06	115.	53.5	20	3.0E 00
	032		1148	1.18±0.03E 05		71.6	20	1.3E 00
	036		1149	1.03±0.01E 04		74.5	50	
F	024	8124	1150	6.65±0.18E 04		67.3	20	3.0E 00
	026		1151	4.21±0.11E 05		72.6	20	1.5E 00
	030	8089	1739	7.22±0.26E 01		46.0	200	5.0E-05
	030	8124	1152	3.35±0.08E 05		67.6	20	3.5E 00
	030		CAC-2070	5.34±0.11E 07		51.5	40	
	032		CDS-1153	1.78±0.04E 04		72.6	20	5.7E-01
	034		1154	9.01±0.23E 03		69.4	20	1.4E 00
	038-1	2588-1	CCD-1602	0.00±0.14E 00		79.7	50	1.0E 00
	2	2	1603	0.00±0.18E 00		78.7	40	2.5E-01
	3	3	1604	1.91±1.91E-01		74.3	40	2.5E-01
	4	4	1605	0.00±0.20E 00		69.2	40	1.0E 00
	5	5	CCF-1606	0.00±0.14E 00		77.6	50	2.5E-01
H	024	8124	CDS-1155	1.94±0.05E 04		74.8	20	3.1E 00
	026		1156	2.39±0.06E 05		75.1	20	1.6E 01
	028		1157	1.30±0.04E 06		61.6	20	8.4E 00
	030		1158	1.71±0.05E 06		59.6	20	1.5E 00
	034		1159	1.27±0.01E 04		79.0	50	4.0E 00
	038		1160	2.61±0.84E 03		69.6	20	6.8E-01
	042	3526	CTA-1663	8.49±1.33E-01		58.4	200	2.1E-01
	044-1	3402-1	CCD-1651	3.20±4.80E-02		82.1	200	8.0E-03
	2	2	1652	0.32±1.28E-01		59.0	100	3.0E-02
	3	3	1653	5.04±0.18E 01		43.1	200	1.3E 01
	4	4	1654	8.50±8.50E-02		45.5	200	2.5E-01
	5	5	CCF-1655	2.28±1.01E-01		74.6	100	6.0E-02
J	000	3500	CTD-1566	1.70±0.17E 00		35.0	500	1.7E 00

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MON
J	020	3492	CTA- 425	4.45±0.33E 00		39.6	4CC	CA 4.CE 00
	022-1	2676-1	CAD- 717	1.10±0.70E-01		76.1	2CC	CA 1.CE CO
	2	2	718	6.00±4.00E-02		78.C	3CC	CA 1.CE-01
	3	3	719	4.00±6.00E-02		68.7	2CC	CA 1.CE 00
	4	4	720	4.30±1.30E-01		65.2	2CC	CA 2.CE-01
	6	6	721	1.10±0.80E-01		54.5	3CC	CA 2.CE-C1
	7	7	CAF- 722	1.80±0.70E-01		77.6	2CC	CA 5.CE-02
	024-1	2663-1	CCD- 181	4.70±1.00E-01		39.4	3CC	CA 1.CE CO
	2	2	182	0.40±1.00E-01		36.3	4CC	CA 1.CE-02
	3	3	183	1.80±0.80E-01		57.2	4CC	CA 1.CE-C1
	4	4	184	0.00±0.05E 00		61.3	4CC	CA 1.CE-01
	5	5	CCF- 185	1.90±0.70E-01		81.C	2CC	2.6E 00
	026-1	2656-1	CCD-1623	4.76±3.57E-01		59.5	4C	1.CE 00
	2	2	1624	-5.00±7.50E-02		56.5	2CC	1.CE CO
	3	3	1625	1.68±0.18E 00		75.C	2CC	4.2E-01
	4	4	1626	5.70±5.70E-02		74.3	2CC	7.CE-03
	5	5	CCF-1627	2.78±1.04E-01		68.C	2CC	4.CE-03
	028-1	2675-1	CAD- 711	1.11±0.03E 03		68.8	2C	6.2E CC
	2	2	712	9.50±1.00E-01		45.7	2CC	CA 1.CE 00
	3	3	713	2.70±1.10E-01		65.1	2CC	CA 1.CE 00
	4	4	714	7.00±6.00E-02		79.8	2CC	CA 1.CE 00
	6	6	715	0.00±0.03E 00		70.C	2CC	1.CE CO
	7	7	CAF- 716	5.10±1.20E-01		69.5	2CC	CA 1.CE 00
	032-1	2657-1	CCD- 166	2.12±0.04E 02		78.8	2CC	4.CE-01
	2	2	167	3.39±0.24E 00		58.2	3CC	1.CE 00
	3	3	168	6.60±1.20E-01		49.C	3CC	CA 1.CE CO
	4	4	169	1.20±1.60E-01		30.1	2CC	CA 1.CE-02
	5	5	CCF- 170	8.00±7.00E-02		45.C	6CC	CA 1.CE-02
	034-1	2673-1	CAD- 699	5.66±0.23E 01		56.C	2CC	2.6E 00

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MOM
J	034-2	2673-2	CAD- 700	0.80±1.00E-01		73.1	2CC	CA 3.CE-01
	3	3	701	4.00±5.00E-02		73.[illegible]	4CC	CA 1.CE 00
	4	4	702	1.00±0.60E-01		62.[illegible]	4CC	CA 1.CE 00
	6	6	703	9.00±4.00E-02		68.0	4CC	CA 1.CE 00
	7	7	CAF- 704	6.10±1.80E-01		79.6	10C	CA 2.CE-02
	036	3489	CTA-1561	7.87±0.32E 01		28.4	2CC	1.3E 00
	038-1	2658-1	CCD- 171	6.00±0.70E-01		54.5	6CC	CA 1.CE-01
	2	2	172	2.00±1.30E-01		36.3	2CC	CA 1.CE 00
	3	3	173	1.30±1.20E-01		69.3	3CC	CA 1.CE 00
	4	4	174	1.44±0.20E 00		46.7	2CC	8.CE-01
	5	5	CCF- 175	4.10±8.10E-02		58.1	2CC	CA 2.CE-03
	040-1	2674-1	CAD- 705	6.35±0.21E 01		75.0	2CC	4.5E 00
	2	2	706	1.60±0.50E-01		71.7	40C	CA 1.CE 00
	3	3	707	1.80±0.30E-01		67.3	1CCC	CA 1.CE 00
	4	4	708	5.00±4.00E-02		72.0	5CC	CA 1.CE 00
	6	6	709	1.20±0.40E-01		71.5	5CC	CA 1.CE 00
	7	7	CAF- 710	2.20±0.70E-01		81.2	2CC	CA 5.CE-02
	042	3490	CTA- 424	7.15±0.19E 02		77.3	2C	1.CE 00
	042-1	2684-1	CAD- 723	1.76±0.19E 00		72.3	2CC	CA 2.CE 00
	2	2	724	1.76±0.26E 00		35.6	2CC	CA 2.CE 00
	3	3	725	2.30±1.60E-01		36.5	2CC	CA 1.CE 00
	4	4	726	4.50±0.90E-01		65.0	2CC	CA 1.CE 00
	6	6	727	2.50±1.00E-01		69.6	3CC	CA 2.CE-01
	7	7	CAF- 728	2.60±1.30E-01		72.3	1CC	CA 1.CE 00
	044-1	2661-1	CCD- 176	5.40±0.32E 00		55.7	3CC	CA 5.CE 00
	2	2	177	2.20±0.80E-01		42.3	3CC	CA 1.CE 00
	3	3	178	1.70±1.10E-01		41.5	2CC	CA 4.CE-02
	4	4	179	7.20±1.30E-01		38.6	3CC	CA 1.CE 00
	5	5	CCF- 180	1.50±0.80E-01		62.2	2CC	CA 1.CE 00

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MON
J	048	3496	CTA- 426	4.70±0.80E-01		53.2	400	1.0E-01
	052	3502	CTD-1567	8.62±0.58E 00		37.5	200	2.2E 00
L	022-1	2653-1	CAD- 687	1.13±0.13E 00		67.3	300	5.1E-01
	2	2	688	2.40±1.10E-01		44.6	400	CA 1.0E 00
	3	3	689	1.20±0.60E-01		73.8	400	CA 2.0E-02
	4	4	690	9.00±4.00E-02		70.6	400	CA 2.0E-02
	6	6	691	5.00±4.00E-02		72.0	500	CA 6.0E-03
	7	7	CAF- 692	3.60±0.50E-01		75.4	500	CA 1.0E-01
	024-1	2643-1	CCD- 161	7.00±7.00E-02		47.5	200	CA 1.0E-02
	2	2	162	0.90±1.00E-01		53.8	200	CA 1.0E 00
	3	3	163	1.30±0.60E-01		45.3	600	CA 3.0E-02
	4	4	164	0.70±1.30E-01		57.4	300	CA 2.0E-02
	5	5	CCF- 165	1.95±0.18E 00		81.0	200	2.0E-02
	028-1	2654-1	CAD- 693	2.60±0.07E 03		67.3	20	1.6E 01
	2	2	694	5.80±0.20E-01		83.5	200	1.0E-01
	3	3	695	2.60±0.50E-01		67.0	500	CA 1.0E 00
	4	4	696	2.60±0.90E-01		76.5	200	CA 1.0E 00
	6	6	697	1.40±0.50E-01		56.5	500	CA 1.0E 00
	7	7	CAF- 698	2.00±6.00E-02		75.7	200	CA 1.0E 00
	030	3514	CTA- 429	6.00±1.00E-01		51.2	400	1.0E-01
	030-2	8127-2	CDS-1742	1.66±0.05E 04		62.4	20	7.1E 00
	3	3	1743	3.10±0.10E 03		65.8	20	3.6E 00
	4	4	1744	1.53±0.03E 04		36.6	40	9.1E 00
	5	5	1745	8.56±0.21E 03		38.1	40	2.1E 00
	032-1	2632-1	CCD-1613	1.31±0.05E 01		83.6	200	1.2E 00
	2	2	1614	4.16±2.08E-01		81.3	50	2.5E-01
	3	3	1615	4.25±2.13E-01		80.0	50	1.0E-01
	4	4	1616	0.88±1.77E-01		79.8	40	1.0E-01
	5	5	CCF-1617	3.77±0.75E-01		81.8	200	4.0E-03

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
L	034-1	2633-1	CCD- 151	1.20±0.80E-01		59.3	4CC	CA 3.CE-C2
	2	2	152	2.00±6.00E-02		63.1	2CC	CA 5.CE-03
	3	3	153	2.00±1.20E-01		38.C	4CC	CA 3.CE-02
	4	4	154	1.01±0.40E 00		13.9	4CC	CA 1.CE CO
	5	5	CCF- 155	1.40±0.80E-01		77.8	2CC	CA 5.CE-C3
	036	3516	CTA- 430	3.30±1.10E-01		36.3	4CC	CA 1.CE 00
	038-1	2634-1	CCD- 156	1.10±0.06E 01		49.6	2CC	1.4E 00
	2	2	157	0.00±0.09E 00		52.9	2CC	1.CE 00
	3	3	158	4.10±3.00E-01		48.6	2CC	CA 1.CE CC
	4	4	159	3.00±9.00E-02		41.5	2CC	CA 1.CE 00
	5	5	CCF- 160	8.00±9.00E-02		63.1	2CC	CA 1.CE 00
	040-1	2647-1	CAD- 681	1.00±0.06E 01		51.1	2CC	CA 1.1E C1
	2	2	682	0.00±0.06E 00		59.CR	4CC	1.CE CO
	3	3	683	6.00±4.00E-02		77.4	5CC	CA 1.CE 00
	4	4	684	2.00±4.00E-02		66.9	4CC	CA 1.CE 00
	6	6	685	1.00±3.00E-02		75.1	5CC	CA 1.CE CO
	7	7	CAF- 686	1.28±0.27E 00		73.2	1CC	9.CE-C3
	042	3508	CTA- 428	3.98±0.16E 01		70.0	1CC	1.CE 00
	042-2	8127-2	CDS-1746	7.73±0.53E 00		35.2	5CC	7.7E 00
	3	3	1747	6.08±0.40E 00		44.6	5CC	7.CE-03
	4	4	1748	3.88±0.10E 02		60.2	2CC	3.9E C2
	5	5	1749	3.58±0.11E 01		77.7	3CC	3.4E 01
	044-1	2645-1	CCD-1618	6.44±0.18E 01		63.1	2CC	1.4E 01
	2	2	1619	1.73±3.45E-01		41.0	4C	1.CE 00
	3	3	1620	3.67±2.75E-01		71.1	4C	1.CE CO
	4	4	1621	2.56±1.17E-01		55.2	2CC	1.CE 00
	5	5	CCF-1622	4.79±4.79E-01		44.4	4C	1.CE-01
	C46-1	8127	COS-1750	5.18±0.57E 00		74.7	2CC	5.2E 00
	2	8127-2	1751	2.00±0.24E 00		82.9	2CC	2.CE CO

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
L	046-3	8127-3	CDS-1752	5.77±0.43E 00		36.6	5CC	7.CE-03
	4	4	1753	2.30±0.29E 00		65.7	2CC	2.3E 00
	5	5	1754	1.68±0.08E 01		76.6	2CC	2.CE-02
	046-8	8125	1169	9.77±0.27E 02		77.1	6C	
	048	3507	CTA- 427	3.73±0.16E 01		68.7	1CC	CA 1.2E 00
	048	3520	CTD-1662	6.32±0.17E 01		69.5	2CC	8.3E-01
	050-1	8127-1	CDS-1755	7.24±0.53E 00		66.5	2CC	7.2E 00
	2	2	1756	2.65±0.37E 00		46.2	2CC	2.7E 00
	3	3	1757	2.79±0.17E 00		58.4	9CC	2.6E 00
	4	4	1758	3.80±0.17E 00		55.6	14CC	3.6E 00
	5	5	1759	8.85±0.88E 00		53.5	2CC	8.6E 00
N	020	3569	CTA- 432	1.08±0.18E 00		41.4	2CC	CA 1.CE 00
	022-1	3348-1	CAD- 742	3.00±9.00E-02		58.0	2CC	CA 1.CE 00
	2	2	743	4.20±2.10E-01		33.6	2CC	CA 1.CE 00
	3	3	744	1.10±0.80E-01		61.3	3CC	CA 5.CE-01
	4	4	745	1.10±0.80E-01		65.3	2CC	CA 1.CE 00
	6	6	746	2.00±1.00E-01		40.2	4CC	CA 4.CE-02
	7	7	CAF- 747	1.90±1.10E-01		76.2	2CC	CA 2.CE-02
	026	3572	CTA- 434	2.10±1.00E-01		62.0	2CC	3.CE-02
	026-1	3336-1	CCD- 216	3.00±1.10E-01		29.6	4CC	CA 2.CE-02
	2	2	217	4.80±1.10E-01		51.7	2CC	CA 1.CE 00
	3	3	218	1.00±0.80E-01		74.2	2CC	CA 1.CE 00
	4	4	219	1.20±0.80E-01		70.8	2CC	CA 1.CE-02
	5	5	CCF- 220	3.00±6.00E-02		72.7	2CC	CA 1.CE 00
	028-1	3346-1	CAD-1640	1.67±0.91E-01		78.0	2CC	1.CE-02
	2	2	1641	7.73±0.28E 01		29.2	3CC	7.7E 01
	3	3	1642	1.50±0.94E-01		62.8	2CC	2.5E-01
	4	4	1643	2.78±0.99E-01		59.4	2CC	2.8E-01
	6	6	1644	1.07±0.61E-01		77.1	2CC	6.CE-03

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
N	028-7	3346-7	CAF-1645	1.20±1.20E-01		49.0	200	2.0E-03
	030	8089	CDS-1740	1.71±0.05E 02		49.5R	300	2.0E-03
	032-1	3334-1	CCD- 211	9.00±6.00E-02		49.5	500	CA 2.0E-02
	2	2	212	2.50±1.00E-01		37.3	500	CA 6.0E-02
	3	3	213	3.70±2.90E-01		34.4	400	CA 1.0E 00
	4	4	214	8.10±1.50E-01		45.1	200	CA 4.0E-02
	5	5	CCF- 215	6.60±1.00E-01		80.7	200	1.0E-02
	036	3573	CTA- 435	1.16±0.04E 02		85.5	20	7.4E-01
	040	3568	1664	9.15±0.72E 00		25.8	200	5.2E 00
	040-1	3349-1	CAD- 748	2.00±0.70E-01		49.2	400	CA 1.0E 00
	2	2	749	9.00±7.00E-02		54.6	400	CA 2.0E-02
	3	3	750	0.30±1.00E-01		35.6	300	1.0E 00
	4	4	751	2.50±2.10E-01		19.2	400	CA 1.0E 00
	6	6	752	1.00±0.70E-01		56.8	300	CA 1.0E-01
	7	7	CAF- 753	4.00±1.40E-01		70.1	90	1.0E-02
	042	3571	CTA- 433	4.20±4.20E-01		51.1	200	CA 1.0E 00
	046-1	3351-1	CAD- 754	1.51±0.07E 01		68.5	200	3.0E 00
	2	2	755	1.60±1.60E-01		24.4	400	CA 4.0E-02
	3	3	756	0.20±1.00E-01		37.7	300	CA 1.0E 00
	4	4	757	9.00±9.00E-02		61.2	200	CA 2.0E-02
	6	6	758	9.00±6.00E-02		74.2	400	2.5E-01
	7	7	CAF- 759	2.00±4.00E-02		83.5	200	CA 2.0E-03
	048	3558	CTA- 431	5.20±1.30E-01		38.2	200	CA 1.0E 00
O	042	8126	CDS-1170	1.32±0.03E 04		65.3	20	
	046-A		1171	1.87±0.04E 03		72.4	30	
P	002	3062	CTA-1561	3.15±0.23E 00	0.0902	75.0	200	3.2E 00
	020	3067	CTD-1315	2.83±0.12E 00	0.0680	69.1	900	1.5E-01
	024-1	3322-1	CCD-1635	5.62±1.46E-01		71.6	200	5.6E-01
	2	2	1636	4.22±1.20E-01		74.2	200	4.2E-01

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANALYSION
P	024-3	3322-3	CCD-1637	1.37±0.78E-01		76.2	20C	1.4E-01
	4	4	1638	9.10±1.30E-01		85.2	2CC	1.1E-01
	5	5	CCF-1639	1.03±0.69E-01		82.6	2CC	5.CE-C3
	026	3C66	CTA- 420	1.15±0.19E 00		41.C	.2CC	1.4E-01
	030	3C68	421	1.16±0.18E 00		43.6	2CC	1.CE-01
	030	8C89	CDS-1741	8.89±0.40E 00		71.3	5CC	1.CE-04
	034-1	3318-1	CCD- 201	2.13±0.09E 01		60.2	2CC	1.8E CO
	2	2	202	1.50±0.13E 00		72.C	4CC	4.CE-01
	3	3	203	6.60±1.30E-01		30.S	4CC	CA 1.CE 00
	4	4	204	0.70±1.00E-01		34.5	2CC	CA 1.CE-C2
	5	5	CCF- 205	2.80±1.10E-01		44.C	2CC	CA 1.CE CO
	036	3C60	CTA- 419	2.37±0.07E 02		81.2	3C	4.3E-01
	040-1	3316-1	CCD- 196	2.73±0.09E 02		79.7	2C	2.2E 00
	2	2	197	1.85±0.08E 01		54.7	2CC	4.6E 00
	3	3	198	1.04±0.14E 00		35.6	4CC	3.CE-C1
	4	4	199	2.70±1.10E-01		52.4	2CC	CA 1.CE 00
	5	5	CCF- 200	0.80±1.30E-01		28.2	2CC	CA 1.CE 00
	042	3C71	CTA- 422	1.61±0.03E 02		77.7	8C	6.CE-01
	044-1	3329-1	CCD- 206	5.43±0.22E 01	0.235	62.8	5C	7.CE-C1
	2	2	207	4.37±0.13E 01	0.220	65.4	1CC	2.CE-01
	3	3	208	2.62±0.24E 00	0.210	60.8	2CC	CA 2.CE 00
	4	4	209	0.40±1.70E-01	0.180	28.C	2CC	CA 3.CE-C2
	5	5	CCF- 210	3.00±1.10E-01	0.221	55.3	2CC	CA 1.CE CO
	048	3C73	CTD-1628	3.76±0.12E 01		68.5	2CC	4.5E-01
	054	3C72	CTA- 423	3.64±0.16E 01	0.142	62.7	1CC	9.CE-01
	C60	3C65	1562	9.36±0.48E 00	1.70	60.8	2CC	7.8E-01
	114	3C76	CTD-1563	3.17±0.27E 00		27.2	5CC	7.5E-C1
BAL	L11,P6	5294	CBS-1442	3.25±0.07E 05		85.6	2C	1.3E CO
	L11,P22		1444	3.05±0.06E 04		83.8	2C	1.1E 00

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
BAL	L12,P5	5284	CBS-1434	4.12±0.09E 04		74.7	2C	1.8E 00
	L12,P7		1436	6.06±0.14E 05		77.5	2C	1.2E 00
	L12,P9		1438	2.72±0.05E 05		79.7	2C	1.4E 00
	L12,P19		1440	4.73±0.09E 04		84.4	2C	1.3E 00
	L13,P9	5298	1448	5.92±0.09E 05		84.2	4C	1.6E 00
	L14,P18	5297	1446	1.28±0.03E 05		68.1	2C	1.6E 00
	L15,P17-1	3434-1	CCD-1656	3.43±0.08E 02		72.1	4C	2.8E 00
	2	2	1657	2.93±0.07E 01		55.1	5CC	5.6E-01
	3	3	1658	6.28±0.21E 01		45.1	2CC	1.4E 00
	4	4	1659	1.6 0.07E 01		64.2	2CC	2.6E-01
	5	5	CCF-1660	1.7 0.06E 01		42.4	5CC	1.4E 00
	L18,P21	3449-A	CCD-2180	1.69±0.05E 03	3.70*	15.6	6C	1.1E 00
	L18,P21-3	3	2130	5.07±0.12E 02	0.582	75.5	3C	4.4E 00
	4	4	2131	1.87±0.07E 01	0.492	76.6	2CC	4.7E 00
	5	5	CCF-2132	7.75±0.43E 00	0.0103	63.2	2CC	1.5E 00
	L19,P9	3C13-A	CTA-2178	4.79±0.13E 04	16.7	03.6R	3CC	
	L25,P9	3C38-A	2179	1.21±0.00E 05	108.	82.7	2CC	
	L29,P9	3466-A	CCD-2181	1.41±0.01E 04	6.20	36.4	1CC	2.7E 00
	L29,P9-3	3	2133	1.10±0.09E 00	0.0305	70.0	5CC	1.4E-01
	4	4	2134	6.38±0.36E 00	0.564	69.7	2CC	1.6E 00
	5	5	CCF-2135	8.68±0.83E-01	0.00700	75.5	5CC	8.7E-01
MOB	KM-C07-1	3597-1	CCD- 221	1.30±0.02E 03		74.1	2C	5.2E 00
	2	2	222	0.00±0.06E 00		43.4	2CC	1.0E 00
	3	3	223	1.32±0.08E 01		24.6	4CC	CA 1.3E 01
	4	4	224	4.50±4.90E-01		22.5	3CC	CA 1.0E 00
	5	5	CCF- 225	7.00±9.00E-02		70.4	2CC	CA 1.0E 00
	C11-1	3CC5-1	CCD- 186	7.75±0.01E 02		81.8	2C	4.5E 00
	2	2	187	4.60±0.90E-01		39.4	4CC	CA 1.0E 00
	3	3	188	1.90±1.10E-01		63.6	2CC	CA 5.0E-02

*New data this report.

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
MOB	KM-C11-4	3CC5-4	CCD- 189	1.23±0.15E 00		64.6	2CC	CA 0.CE 00
	5	5	CCF- 190	-0.50±1.00E-01		29.2	40C	CA 1.CE-02
	C12-1	3C06-1	CCD- 191	5.66±0.19E 01		72.5	2CC	4.7E 00
	2	2	192	2.30±1.00E-01		47.C	2CC	CA 1.CE 00
	3	3	193	7.50±4.90E-01		77.1	2CC	CA 1.CE 00
	4	4	194	1.30±0.90E-01		54.8	2CC	CA 1.CE 00
	5	5	CCF- 195	1.50±0.80E-01		65.C	20C	CA 1.CE CO
	C13-1	3CC9-1	CAD- 729	1.64±0.04E 03	0.279	64.8	2C	4.2E CO
	2	2	730	3.77±0.27E 00	0.0650	56.5	3CC	2.7E-01
	3	3	731	7.30±1.20E-01		77.9	2CC	CA 2.1E-01
	4	4	732	8.00±4.00E-02		71.5	7CC	CA 1.1E-01
	6	6	733	2.00±3.00E-02		75.2	7CC	CA 2.CE-C1
	7	7	CAF- 734	1.70±1.30E-01	0.181	27.7	20C	3.CE-02
	C14-1	3C10-1	CAD- 735	4.05±0.09E 03		73.C	2C	8.1E 00
	2	2	736	1.69±0.04E 03		77.8	30C	3.4E C2
	3	3	737	4.00±7.00E-02		64.3	1CC	CA 1.CE CO
	4	4	738	0.00±0.06E 00		82.C	1CC	1.CE 00
	6	6	740	6.00±9.00E-02		76.2	10C	CA 1.CE 00
	7	7	CAF- 741	0.00±0.05E 00		76.C	20C	CA 1.CE-C2
	C66-1	3599-1	CCD- 226	1.80±0.06E 02		78.1	1CC	5.2E CO
	2	2	227	3.30±1.10E-01		67.6	20C	CA 1.CE-C1
	3	3	228	3.00±2.60E-01		26.1	3CC	CA 1.CE 00
	4	4	229	2.40±1.00E-01		62.1	2CC	CA 1.CE 00
	5	5	CCF- 230	-2.00±4.00E-02		62.5	2CC	CA 1.CE CO
OA	CMR-A3A	97C7	CVS-2092	7.12±0.61E 00		27.5R	20C	
	A3B		2093	5.01±0.20E 00		55.2	80C	
	A4A		2094	1.21±0.04E 01		44.8	5CC	
	A4B		2095	3.45±0.25E 00		28.5	6CC	
	A5B		2097	3.34±0.20E 00		51.3	5CC	

CONFIDENTIAL

TABLE E.2 (CONTINUED)

APC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANALYSIS
OA	CHR-A3A	9721	CVS-2098	1.62±0.05E 02		16.3	600	
	A3B		2099	1.24±0.04E 02		10.2	1000	
	A4A		2100	1.13±0.03E 01		67.7	700	
	A4B		2101	2.13±0.04E 01		71.1	100	
	A5A		2102	5.36±0.16E 02		72.4	100	
	A5B		2103	4.32±0.11E 02		61.7	200	
	STK-813	9524	CDS-1161	3.08±0.07E 03		77.4	100	2.4E 00
	814		1162	5.20±0.19E 03		78.5	40	5.0E 00
	815		1163	4.84±0.37E 03		62.5	100	4.1E 00
	816		1164	1.77±0.04E 04		80.2	100	1.1E 01
	817		1165	1.05±0.08E 04		81.5	100	1.0E 01
	818		1166	3.12±0.08E 04		68.6	100	3.1E 01
	819		1167	3.77±0.09E 04		74.2	100	3.7E 01
	820		1168	4.80±0.11E 04		78.4	100	4.8E 01
PCMR2-A1-5		NONE	CSF-1946	1.57±0.16E 01	8.32	32.4	500	7.0E-03
	6		1947	6.22±0.20E 01	5.52	78.0	200	1.0E-02
	7		1948	6.61±0.49E 00	24.6	88.4	200	3.0E-03
	8		1949	2.24±0.12E 01	15.5	80.3	200	2.0E-02
	9		1950	6.86±0.66E 00	3.86	18.0	500	1.0E-02
	10		1951	8.09±0.64E 00	14.6	52.5	200	5.0E-03
	11		1952	7.19±0.37E 01	56.6	62.6	200	5.0E-03
	A3-5		1953	6.13±0.25E 01	8.86	79.2	200	7.3E-01
	6		1954	8.21±0.94E 00	26.1	53.5	200	1.1E-01
	7		1955	4.55±0.10E 02	102.	88.2	200	6.1E 00
	8		1956	1.96±0.06E 01	6.54	89.8	500	5.0E-01
	9		1957	1.31±0.07E 01	3.31	85.7	200	7.1E-01
	10		1958	1.55±0.07E 01	17.6	83.1	200	5.9E-01
	11		1959	3.86±0.14E 01	40.5	62.3	200	2.4E-01
	A4-5		1960	1.25±0.19E 01	26.5	28.8	200	1.3E-01

CONFIDENTIAL

TABLE E.2 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (RARE WORK)	COUNT TIME	ANALYSIS
PCMR2-A4-6		NONE	CSF-1961	5.81±0.45E 00	14.7	91.0	200	5.0E-02
	7		1962	4.17±0.24E 00	16.4	89.2	500	1.2E-01
	8		1963	1.00±0.06E 01	6.61	80.1	200	1.4E 00
	10		1964	2.66±1.77E-01	1.31	79.5	200	5.3E-01
	11		1965	3.84±0.23E 00	4.20	86.8	500	3.2E-01
A5-5			1966	8.38±2.21E 00	25.7	64.2	100	1.8E-01
	6		1967	2.69±0.36E 01	24.0	49.7	200	1.7E-01
	7		1968	5.71±3.26E 00	97.2	86.8	40	6.0E-02
	8		1969	6.69±0.24E 01	22.7	88.8	200	1.1E 00
	9		1970	1.77±0.09E 01	18.8	84.5	200	4.2E-01
	10		1971	1.14±0.07E 01	16.5	83.3	200	2.4E-01
	11		1972	7.22±0.21E 01	43.9	67.6	200	3.1E-01

CONFIDENTIAL

TABLE E.3 RADIOCHEMICAL ANALYSIS OF ROLLER COASTER PHYSICAL SAMPLES, CLEAN SLATE II

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MON
GZ	BL-10	9842	CAC-1420	7.10±0.17E 05		65.6	20	1.1E 00
	1	9842-1	2065	9.84±0.27E 06		56.0	20	
	2	2	2059	7.89±0.18E 06		78.8	20	
	5	5	2066	9.97±0.22E 06		79.2	20	
	7	7	2067	1.03±0.01E 07		77.6	40	
	9	9	2068	1.03±0.03E 07		46.6	20	
	-10	10	2060	7.49±0.16E 06		83.2	20	
	-20	20	2061	7.35±0.20E 06		56.1	20	
	-30	30	2062	7.69±0.22E 06		52.4	20	
	-40	40	2063	7.68±0.19E 06		66.6	20	
	-42	42	2064	7.45±0.17E 06		79.6	20	
	BM-C7	4082-A	CTA-2194	2.36±0.06E 04	9.90	58.0	20	2.4E 04
	BO-C4	9842	CAC-1419	1.74±0.04E 06		79.8	20	
	T8-P2	2305-A	CCO-2184	7.12±0.19E 04	24.6	04.6R	200	6.3E 00
A	036	4116-A	CTA-2195	2.29±0.04E 04	2.95*	53.5	40	
	054	2286-A	CCD-2183	1.26±0.02E 04	17.0	11.5	200	4.2E 00
B	030	9842	CAC-1421	3.39±0.08E 06		79.5	20	
	044	2371-A	CCO-2189	8.48±0.28E 02	52.1 *	34.4	30	1.1E 00
	044-3	3	2124	7.97±0.22E 02	0.446 *	77.5	20	5.6E 00
	4	4	2125	3.38±0.06E 02	1.06	68.8	70	2.6E 00
	5	5	CCF-2126	2.16±0.06E 02	0.373 *	57.4	200	2.7E 00
	054	4812-A	CTA-2197	1.05±0.03E 03	4.15	29.7	30	
	060	2370-A	CCO-2188	2.73±0.07E 03	2.36 *	65.0	20	1.5E 00
	060	B	2218	1.21±0.02E 02	0.00	11.8	700	1.7E-01
	068	2369-A	2187	4.19±0.11E 03	9.34	61.5	20	
	068-3	3	2121	6.85±0.20E 02	1.78	74.6	20	3.1E 00
	4	4	2122	4.91±0.15E 02	2.70 *	75.8	20	2.4E 00
	5	5	CCF-2123	1.56±0.04E 02	1.05 *	59.8	70	1.3E 00
C	030	9842	CAC-1422	3.51±0.08E 06		77.6	20	

*New data this report.

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MON
C	040	9792	CAC-1429	2.87±0.07E 07		66.6	20	
	050		1430	1.82±0.04E 07		77.7	20	2.6E 00
	068	8111	CDS-1173	3.36±0.09E 05		27.5	40	3.2E 00
	070		1174	2.92±0.06E 05		80.8	20	1.1E 00
	070	9792	CAC-1431	7.09±0.16E 06		82.2	20	
	072	8111	CDS-1175	2.89±0.08E 05		44.8	20	1.7E 00
	074		1176	2.69±0.06E 05		66.8	20	1.3E 00
	076		1177	2.12±0.04E 05		25.9	70	1.7E 00
	078		1178	1.79±0.02E 05		52.8	70	1.2E 00
	080		1179	1.65±0.04E 05		22.2	50	2.0E 00
	080	9792	CAC-1432	4.03±0.08E 06		76.4	30	
	082	8111	CDS-1180	1.56±0.03E 05		81.0	20	1.3E 00
	084		1181	1.46±0.03E 05		74.6	20	1.7E 00
	086		1182	1.30±0.03E 05		72.5	20	3.0E 00
	088		1183	1.11±0.02E 05		76.5	20	3.2E 00
	090		1184	1.00±0.02E 05		65.7	20	2.7E 00
	090	9792	CAC-1433	2.41±0.04E 06		84.2	30	
	092	8111	CDS-1185	7.90±0.22E 04		67.7	20	1.4E 00
	094		1186	7.38±0.22E 04		60.3	20	3.1E 00
	096		1187	6.61±0.19E 04		65.1	20	8.5E-01
	098		1188	5.67±0.13E 04		73.5	20	1.8E 00
	100		1189	4.52±0.12E 04		66.0	20	1.7E 00
	102		1190	4.02±0.12E 04		54.0	20	1.4E 00
	104		1191	3.12±0.07E 04		72.1	20	1.6E 00
	106		1192	3.03±0.08E 04		73.8	20	1.1E 00
	108		1193	2.61±0.08E 04		67.2	20	6.3E-01
	110		1194	2.05±0.05E 04		70.4	20	1.1E 00
	112		1195	1.65±0.04E 04		77.4	20	9.0E-01
	114		1196	5.79±0.05E 03		67.4	20	3.5E-01

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
D	CC6-1	2228-1	CCD- 441	3.47±0.26E 00		72.5	2CC	CA 4.CE 00
	2	2	442	6.20±1.20E-01		66.2	2CC	CA 2.5E-01
	3	3	443	2.40±0.90E-01		63.2	2CC	CA 1.CE CO
	4	4	444	3.90±1.20E-01		56.6	3CC	CA 2.5E-01
	5	5	CCF- 445	7.00±9.00E-02		80.C	2CC	3.CE-02
	010	8112	CDS-1197	3.44±0.08E 05		63.3	2C	7.5E CO
	012		1198	1.33±0.04E 06		68.4	2C	1.2E C1
	014		1199	4.66±0.11E 06		75.8	2C	1.4E 01
	016		1200	5.83±0.13E 06		78.C	2C	1.6E 01
	018		1201	5.76±0.13E 06		73.6	2C	1.CE 01
	020		1202	4.89±0.08E 06		72.C	4C	7.CE CO
	020-1	3180-1	CAD- 910	3.61±0.09E 04	14.6	72.C	2C	1.5E 01
	2	2	911	2.40±0.07E 03	1.14	58.6	2C	3.4E 00
	3	3	912	2.78±0.10E 01	0.495	68.1	1CC	7.6E-C2
	4	4	913	7.95±0.63E 00	0.151	58.1	1CC	2.CE-C2
	6	6	914	8.10±2.20E-01	0.252	64.8	1CC	2.CE-03
	7	7	CAF- 915	8.90±1.90E-01	0.450	65.8	2CC	CA 3.CE-02
	022-1	2227-1	CCD- 436	1.42±0.04E 03		63.6	2C	3.2E 00
	2	2	437	6.32±0.22E 02		72.3	2C	5.6E 0C
	3	3	438	2.68±0.09E 01		72.C	2CC	3.CE 00
	4	4	439	7.20±1.20E-01		58.6	2CC	CA 1.CE 00
	5	5	CCF- 440	7.70±1.50E-01		76.5	1CC	CA 2.CE-C2
	022	8112	CDS-1203	3.61±0.09E 06		66.5	2C	5.5E CO
	024		1204	3.30±0.07E 06		78.8	2C	4.4C 00
	030	4163-A	CTA-2196	5.39±0.11E 01	0.340	61.4	2CC	CA 5.4E 01
	028	8112	CDS-1205	1.52±0.02E 06		77.7	4C	3.2E CO
	030		1206	1.28±0.03E 06		71.8	2C	3.6E CC
	032		1207	1.10±0.03E 06		68.4	2C	2.6E 00
	032-1	2232-1	CCD- 456	8.67±0.26E 02		73.7	2C	2.3E CO

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R-RE WORK)	COUNT TIME	ANAL/MON
D	032-2	2232-2	CCD- 457	2.04±0.07E 02		66.2	2CC	7.3E 00
	3	3	458	6.75±0.22E 01		76.8	2CC	2.8E 00
	4	4	459	6.81±0.35E 00		75.8	3CC	CA 5.0E-01
	5	5	CCF- 460	4.10±1.10E-01		75.2	2CC	CA 2.0E-02
	034	3182-A	CAD-2190	2.55±0.08E 01	0.896	51.6	2CC	6.0E-02
	034	8112	CDS-1208	8.55±0.19E 05		71.5	2C	2.7E 00
	034-1	2233-1	CCD- 461	4.24±0.14E 01		63.5	3CC	1.8E 00
	2	2	462	1.33±0.03E 02		82.5	2CC	3.1E 00
	3	3	463	1.71±0.05E 01		77.6	4CC	1.4E 00
	4	4	464	3.64±0.25E 00		80.5	2CC	CA 1.0E 00
	5	5	CCF- 465	3.15±0.13E 01		64.4	1CC	6.6E-01
	034-3	3182-3	CAD-2142	2.27±0.22E 00	0.0122	56.7	2CC	1.3E-01
	4	4	2143	1.89±0.05E 01	1.15	71.7	5CC	1.5E 01
	6	6	2144	3.55±0.56E-01	0.674	68.1	5CC	3.6E-01
	7	7	2145	1.25±0.03E 01	0.502	81.0	5CC	7.4E-01
	036	4164	CTA-1274	3.40±1.00E-01		51.0	5CC	1.0E 00
	036	8112	CDS-1209	6.44±0.14E 05		81.3	2C	2.4E 00
	036-1	4151-1	CSA-1458	2.00±0.19E 00		66.0	2CC	2.2E-01
	2	2	1459	6.28±0.20E 01		54.2	2CC	7.2E-01
	3	3	1460	5.74±0.20E 01		45.4	2CC	CA 2.1E 00
	4	4	1461	1.67±0.16E 00		73.5	2CC	8.4E-01
	5	5	1462	5.07±3.38E-01		83.8	4C	CA 5.1E-01
	6	6	1463	6.98±6.98E-02		84.5	2CC	CA 3.0E-02
	7	7	1464	2.09±1.04E-01		67.5	2CC	7.0E-03
	8	8	1465	5.75±4.60E-01		61.6	4C	CA 3.0E-02
	9	9	1466	1.74±0.37E-01		74.7	5CC	CA 6.0E-03
	10	10	1467	2.65±0.09E 01		72.5	2CC	2.4E 00
	038	8112	CDS-1210	6.23±0.15E 05		69.8	2C	2.5E 00
	038-1	2231-1	CCD- 451	1.21±0.03E 03		60.5	2C	3.1E 00

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (%RE WORK)	COUNT TIME	ANAL/MON
0	038-2	2231-2	CCD- 452	1.65±0.06E 01		69.8	400	1.0E 00
	3	3	453	3.70±0.14E 01		61.3	200	1.0E 00
	4	4	454	2.80±0.12E 01		56.0	200	7.0E 00
	5	5	CCF- 455	5.44±0.33E 00		76.1	200	2.5E-01
	040	8112	CDS- 211	5.65±0.13E 05		69.8	20	3.4E 00
	040-1	3183-1	CAD- 916	3.31±0.08E 02		72.4	40	9.5E-01
	2	2	917	2.59±0.06E 01		66.4	700	1.4E 00
	3	3	918	1.51±0.05E 01		76.1	400	1.4E 00
	4	4	919	1.25±0.15E 00		58.2	300	6.2E-01
	6	6	920	5.60±1.10E-01		58.5	200	CA 1.0E 00
	7	7	CAF- 921	4.30±1.50E-01		76.5	100	1.0E-02
	042	4165	CTA-1275	9.18±0.20E 01		77.5	100	4.0E-01
	042	8112	CDS-1212	4.91±0.10E 05		86.0	20	1.8E 00
	044		1213	4.64±0.13E 05		51.0	20	2.3E 00
	044-1	2230-1	CCD- 446	1.01±0.03E 03		75.1	20	2.7E 00
	2	2	447	6.04±0.19E 01		75.1	200	3.8E 00
	3	3	448	4.27±0.28E 00		79.5	200	1.0E 00
	4	4	449	7.70±1.10E-01		71.5	200	CA 5.0E-02
	5	5	CCF- 450	1.60±0.90E-01		76.0	200	CA 6.0E-02
	046	8112	CDS-1214	3.85±0.07E 05		53.7	20	3.5E 00
	048	4147	CSA-1468	1.07±0.03E 02		84.8	200	CA 3.8E-01
	048	4154	CTD-1279	1.97±0.05E 03		81.2	20	9.0E-01
	048	4166	CTA-1276	9.10±0.20E 01		74.0	100	5.0E-01
	048	8112	CDS-1215	3.64±0.08E 05		70.0	20	2.3E 00
	050		1216	3.31±0.08E 05		58.8	20	2.7E 00
	052		1217	2.61±0.06E 05		59.7	20	1.5E 00
	052-1	3186-1	CAD- 928	6.19±0.17E 01		69.6	400	2.2E 00
	2	2	929	3.56±0.10E 01		78.2	400	1.5E 00
	3	3	930	1.27±0.08E 01		25.4	400	9.1E-01

CONFIDENTIAL

TABLE E-3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R-RE WORK)	COUNT TIME	ANAL/MON
D	052-4	3186-4	CAD- 931	5.10±0.20E 00		73.8	6CC	5.1E 00
	6	6	932	2.94±0.14E 00		82.7	6CC	5.5E-01
	7	7	CAF- 933	6.70±0.80E-01		80.7	40C	CA 8.CE-02
	054	4167	CTA-1277	1.34±0.02E 02		78.8	1CC	4.CE-01
	054	8112	CDS-1218	2.48±0.06E 05		60.2	2C	1.CE 00
	056		1219	2.49±0.05E 05		72.3	2C	2.5E 00
	056-1	2238-1	CCD- 486	2.76±0.07E 03		67.8	2C	3.3E 01
	2	2	487	1.70±0.04E 02		66.9	2CC	2.4E 00
	3	3	488	6.98±0.19E 01		61.4	3CC	2.2E 00
	4	4	489	3.62±0.13E 01		67.5	2CC	1.6E 00
	5	5	CCF- 490	1.41±0.11E 00		75.4	4CC	CA 6.CE-02
	058	8112	CDS-1220	2.29±0.06E 05		69.7	2C	1.7E 00
	058-1	3185-1	CAD- 922	2.32±0.06E 02		72.4	4C	1.3E 00
	2	2	923	5.51±0.22E 01		67.4	1CC	1.5E 00
	3	3	924	1.27±0.04E 01		76.4	40C	1.4E 00
	4	4	925	1.75±0.06E 01		68.9	40C	1.1E 00
	6	6	926	3.76±0.26E 00		78.4	2CC	5.4E-01
	7	7	CAF- 927	1.46±0.18E 00		81.6	2CC	5.CE-02
	060	4168	CTA-1278	1.70±0.70E-01		62.7	4CC	1.CE 00
	060-1	2239-1	CCD- 491	4.00±0.70E-01		68.3	30C	CA 1.CE-01
	2	2	492	6.60±0.90E-01		73.8	3CC	CA 1.CE-01
	3	3	493	8.70±1.10E-01		70.5	30C	CA 1.CE 00
	4	4	494	8.00±5.00E-02		61.0	4CC	CA 2.CE-02
	5	5	CCF- 495	8.00±5.00E-02		65.9	4CC	CA 1.CE 00
	062	8112	CDS-1221	1.90±0.05E 05		49.0	2C	1.6E 00
	062-1	2234-1	CCD- 466	1.30±0.70E-01		70.3	2CC	CA 1.CE 00
	2	2	467	7.00±9.00E-02		66.3	2CC	CA 1.CE-01
	3	3	468	2.00±8.00E-02		58.0	2CC	CA 1.CE 00
	4	4	469	1.39±0.16E 00		65.5	2CC	CA 1.CE 00

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
D	062-5	2234-5	CCF- 470	2.60±0.70E-01		83.2	2CC	CA 1.CE-01
	064	8112	CDS-1222	1.85±0.04E 05		71.6	2C	1.1E CO
	064-1	3187-1	CAD- 934	2.48±0.10E 01		19.6	8CC	6.2E 00
	2	2	935	1.10±2.10E-01		66.9	4C	CA 1.CE 00
	3	3	936	1.20±1.20E-01		59.5	4C	CA 1.CE 00
	4	4	937	1.50±1.50E-01		45.5	4C	CA 1.CE CO
	6	6	938	4.89±0.23E 00		41.5	8CC	4.5E 00
	7	7	CAF- 939	9.00±5.00E-02		77.C	3CC	1.CE 00
	066	4158	CTA-1272	1.21±0.13E 00		75.4	2CC	3.CE-01
	066-A	8112	CDS-1223	1.61±0.03E 05		70.6	2C	2.1E CO
	B		1224	1.58±0.03E 05		68.1	2C	2.CE 00
	068		1225	1.53±0.05E 05		38.4	2C	1.6E 00
	068-1	2237-1	CCD- 481	3.22±0.70E-01		47.4	5CC	CA 1.CE 00
	2	2	482	4.00±7.00E-02		63.8	2CC	CA 1.CE CO
	3	3	483	1.15±0.03E 01		42.C	1CCC	3.CE CO
	4	4	484	1.10±0.80E-01		45.8	2CC	CA 1.CE 00
	5	5	CCF- 485	4.00±7.00E-02		72.C	2CC	CA 1.CE-02
	070	8112	CDS-1226	1.48±0.03E 05		68.C	2C	1.6E CC
	072		1227	1.33±0.03E 05		62.8	2C	1.3E 00
	074	4155	CTD-1280	2.19±0.05E 03		81.9	2C	1.6E 00
	074	8112	CDS-1228	1.52±0.03E 05		62.4	2C	1.1E 00
	074-1	2235-1	CCD- 471	2.94±0.12E 03		62.3	2C	2.5E CO
	2	2	472	4.41±0.14E 02		65.5	2C	2.2E 00
	3	3	473	1.74±0.04E 02		78.2	2CC	2.6E 00
	4	4	474	2.00±0.08E 01		72.5	2CC	1.7E CO
	5	5	CCF- 475	1.38±0.05E 01		81.5	2CC	2.CE-01
	076-A	8112	CDS-1229	1.50±0.04E 05		70.5	2C	1.1E 01
	B		1230	1.44±0.04E 05		58.C	3C	1.1E 00
	078	4162	CTA-1273	7.13±0.21E 02	56.9	67.8	2C	6.CE-01

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
D	078	8112	CDS-1231	1.27±0.03E 05		56.3	20	1.4E 00
	080		1232	1.24±0.02E 05		66.8	20	1.2E 00
	082		1233	1.27±0.03E 05		61.0	20	1.7E 00
	086		1234	1.13±0.02E 05		75.5	20	1.7E 00
	088-1	2236-1	CCD- 476	4.44±0.11E 03		81.7	20	9.0E 00
	2	2	477	6.50±0.21E 02		72.2	20	4.3E 00
	3	3	478	1.21±0.03E 02		77.0	200	1.8E 00
	4	4	479	5.76±0.20E 01		72.2	200	1.4E 01
	5	5	CCF- 480	3.18±0.06E 01		76.6	500	7.0E-01
	092	8112	CDS-1236	8.00±0.18E 04		71.1	20	1.9E 00
	094		1237	6.49±0.17E 04		58.1	20	1.2E 00
	096		1238	5.91±0.15E 04		56.3	20	2.5E 00
	098		1239	4.54±0.10E 04		75.5	20	1.1E 00
	100		1240	4.57±0.12E 04		66.4	20	1.6E 00
	102		1241	4.17±0.12E 04		58.2	20	1.9E 00
	104		1242	3.62±0.09E 04		41.8	30	1.1E 00
	106		1243	3.11±0.07E 04		67.5	20	1.2E 00
	108		1244	2.70±0.06E 04		58.4	30	1.3E 00
	110		1245	2.61±0.07E 04		44.5	20	1.4E 00
	112		1246	2.33±0.06E 04		57.0	20	1.2E 00
	114	4157	CTD-1281	3.93±0.11E 03	20.1	71.6	20	7.0E-01
	114	8112	CDS-1247	1.91±0.04E 04		79.5	20	6.3E-01
E	014	8113	1248	5.23±0.11E 05		61.5	20	2.4E 00
	016		1249	2.85±0.07E 06		71.5	20	7.3E 00
	018		1250	5.82±0.09E 06		78.7	40	7.0E 00
	022		1251	5.40±0.14E 06		28.1	40	2.8E 01
	024		1252	3.35±0.09E 06		49.7	20	3.2E 00
	026		1253	2.43±0.06E 06		67.5	20	2.8E 00
	028		1254	1.28±0.03E 06		73.8	20	5.0E 00

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYSIS DATE
E	030	8113	CDS-1255	8.21±0.14E 05		77.6	3C	2.1E 00
	032		1256	5.78±0.13E 05		74.7	2C	2.2E 00
	034		1257	4.44±0.10E 05		76.0	2C	2.6E 00
	036-A		1258	3.81±0.08E 05		77.0	2C	2.4E 00
	B		1259	3.67±0.07E 05		28.6	6C	3.4E 00
	038		1260	3.40±0.06E 05		77.2	3C	2.3E 00
	044-1	9640-1	CCD-2230	5.46±0.14E 03*	5.87 *	77.5	2C	
	2	2	2231	1.92±0.05E 02*	0.161 *	58.6	2CC	1.9E 00
	3	3	2232	8.91±0.22E 01*	0.102 *	76.2	2CC	8.9E-01
	4	4	2233	3.46±0.10E 01*	0.110 *	74.7	2CC	3.5E 01
	5	5	2234	7.42±0.22E 00*	0.246 *	71.2	8CC	7.4E 00
	044-1	9641-1	2235	5.16±0.12E 03*	6.02 *	17.5	1CC	5.2E 01
	2	2	2236	5.72±0.11E 02*	0.120 *	74.1	2CC	5.7E 00
	3	3	2237	6.38±0.07E 01*	0.0220*	74.0	1CCC	6.4E 00
	4	4	2238	5.51±0.06E 01*	0.0320*	67.8	1CCC	5.5E-01
	5	5	2239	3.65±0.13E 00*	50.2 *	75.6	1CCC	3.6E-01
	048-1	9638-1	2220	4.37±0.12E 03*	5.67 *	73.4	2CC	
	2	2	2221	1.05±0.01E 03*	0.201 *	35.8	2CC	
	3	3	2222	1.83±0.02E 02*	0.0310*	59.2	1CCC	1.8E 00
	4	4	2223	4.66±0.06E 01*	0.0220*	63.0	1CCC	4.7E-01
	5	5	2224	1.41±0.03E 01*	0.125 *	63.4	1CCC	1.4E-01
	048-1	9639-1	2225	4.49±0.11E 03*	0.335 *	77.7	2C	
	2	2	2226	1.11±0.03E 03*	0.213 *	64.5	2C	
	3	3	2227	1.84±0.05E 02*	3.62 *	59.0	2CC	1.8E 00
	4	4	2228	3.56±0.15E 01*	0.110 *	39.6	2CC	3.6E 00
	5	5	2229	5.43±0.30E 00*	0.104 *	80.5	2CC	5.0E-02
F	026	8119	CDS-1760	3.59±0.11E 03		80.0	2C	1.2E 00
	026-1	2173-1	CCD-1577	1.16±0.03E 03		88.4	2C	2.3E 00
	2	2	1578	1.14±0.03E 02		86.6	4C	1.3E 00

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL/MON
F	026-3	2173-3	CCD-1579	6.14±0.21E 01		44.5	2CC	1.5E 00
	4	4	1580	1.29±0.05E 01		77.2	2CC	1.6E 00
	5	5	CCF-1581	5.56±1.00E-01		70.0	2CC	1.0E-02
	030	9E42	CAC-1423	2.61±0.06E 06		78.8	2C	
	030-1	8119	CDS-1761	3.16±0.06E 03		76.1	3C	
	2		1762	1.34±0.03E 03		71.3	1CC	1.3E 03
	3		1763	4.02±0.12E 03		75.3	2C	
	4		1764	1.03±0.03E 03		65.2	2C	1.1E 00
	038-4		1765	1.17±0.03E 03		82.8	2C	1.2E 00
	5		1766	2.92±0.09E 03		63.2	2C	1.5E 00
	040	9E46	CAC-1424	8.60±0.18E 06		78.2	2C	
	042-5	8119	CDS-1767	1.76±0.05E 03		71.8	4C	2.0E-02
	046-1		1768	2.18±0.05E 04		69.3	2C	5.0E-01
	2		1769	6.75±0.16E 04		68.2	2C	1.7E 00
	5		1770	6.32±0.18E 03		71.1	2C	1.6E-01
	050	9E46	CAC-1425	1.54±0.03E 06		79.3	2C	
	054-1	8119	CDS-1771	2.96±0.10E 03		62.3	2C	9.5E-01
	058-1		1772	4.03±0.11E 02		50.2	2CC	4.0E 02
	5		1773	1.50±0.06E 03		59.2	2C	1.5E 00
	060	9E46	CAC-1426	1.01±0.02E 06		77.3	2C	
	062-1	8119	CDS-1774	2.94±0.09E 02		48.7	2CC	2.9E 02
	066-1		1775	4.38±0.07E 02		51.8	2CC	2.2E-01
	070	9E46	CAC-1427	5.76±0.13E 05		76.3	2C	
	090		1428	3.37±0.08E 05		66.7	2C	
F	028-1	2256-1	CCD-1597	5.53±0.12E 02		80.7	4C	3.5E 00
	2	2	1598	1.38±0.06E 01		83.3	2CC	3.4E 00
	3	3	1599	1.44±0.07E 01		24.1	5CC	9.0E-01
	4	4	1600	1.02±0.03E 02		58.3	2CC	2.6E 01
	5	5	CCF-1601	2.20±0.16E 00		50.8	5CC	1.2E-01

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
J	032-1	2205-1	CCD-1587	1.08±0.04E 01		83.6	2CC	1.4E 00
	2	2	1588	1.88±0.07E 01		62.4	2CC	6.5E-01
	3	3	1589	2.20±0.19E 00		81.5	2CC	1.1E 00
	4	4	1590	5.00±1.75E-01		47.2	20C	2.CE-02
	5	5	CCF-1591	4.43±2.66E-01		79.9	4C	4.CE-03
	036	4135	CTA-1667	1.46±0.08E 01		35.0	2CC	5.2E-01
	054-1	22C1-1	CCD-1582	2.26±0.06E 02		72.1	4C	2.3E 00
	2	2	1583	2.89±0.09E 01		66.2	2CC	1.4E 00
	3	3	1584	4.80±0.29E 00		74.5	2CC	4.6E 00
	4	4	1585	9.25±1.20E-01		80.4	2CC	1.CE 00
	5	5	CCF-1586	8.71±1.20E-01		71.8	2CC	2.CE-02
L	042	4C76	CTA-1665	7.68±0.17E 02		71.5	4C	4.1E-01
	048	4C77	1666	4.81±0.20E 02		26.3	3C	CA 4.1E-01
	060-1	2222-1	CCD-1592	4.03±0.12E 02		86.8	2C	2.1E 00
	2	2	1593	7.05±0.19E 01		69.4	20C	1.8E 00
	3	3	1594	7.02±0.18E 01		73.5	20C	2.2E 00
	4	4	1595	1.01±0.04E 01		57.5	4CC	8.4E-01
	5	5	CCF-1596	2.81±0.09E 01		71.5	2CC	4.4E-01
BAL	L1,P17	4C22-A	CTA-2192	6.20±4.65E-01	0.593	45.7	4C	6.2E-01
	L2,P5-1	2310-1	CCD- 541	2.00±3.00E-02		67.4	3CC	CA 1.CE 00
	2	2	542	2.80±1.20E-01		47.2	3CC	CA 1.CE 00
	3	3	543	1.88±0.24E 00		35.2	3CC	CA 2.CE 00
	4	4	544	1.40±0.90E-01		41.3	3CC	CA 1.CE 00
	5	5	CCF- 545	0.80±1.00E-01		49.0	2CC	CA 2.CE-02
	L2,P13-1	2314-1	CCD- 546	1.48±0.01E 04	2.63	71.6	2C	6.5E 00
	2	2	547	1.31±0.02E 03	1.59	21.4	5C	3.CE 00
	3	3	548	4.12±0.07E 02	2.64	73.1	6C	4.CE 00
	4	4	549	2.29±0.08E 02	0.182	69.4	1CC	6.5E 00
	5	5	CCF- 550	2.88±0.11E 01		69.2	2CC	1.1E 00

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
BAL	L3,P9	2312-A	CCD-2185	4.24±0.09E 03	8.55	74.2	2C	
	L3,P9-3	3	2115	3.01±0.10E 02	0.436	79.8	2C	8.7E-01
	4	4	2116	3.09±0.11E 01	0.841*	79.6	1CC	1.6E-01
	5	5	CCF-2117	1.39±0.04E 02	0.370*	72.1	2CC	1.4E 00
	L3,P17-1	2307-1	CCD- 531	7.60±1.10E-01		49.6	4CC	CA 1.6E 00
	2	2	532	3.00±5.00E-02		55.2	4CC	CA 1.6E-02
	3	3	533	4.70±0.90E-01		42.1	4CC	CA 1.6E 00
	4	4	534	2.48±0.23E 00		39.4	4CC	CA 2.6E 00
	5	5	CCF- 535	1.90±1.10E-01		44.0	3CC	CA 5.6E-02
	L3,P22	5318	CBS-1456	5.63±0.12E 03		88.8	2C	1.7E 00
	L4,P9	5317	1558	2.52±0.05E 04		83.2	2C	1.8E 00
	L4,P21	4C24-A	CTA-2193	7.76±0.23E 02	0.760*	55.4	2C	
	L4,P22	5317	CBS-1454	2.12±0.04E 04		81.9	2C	3.4E 00
	L5,P1-1	2322-1	CCD- 561	3.12±0.05E 01		67.1	1CCC	3.5E 00
	2	2	562	4.99±0.16E 01		75.1	2CC	1.4E 00
	3	3	563	6.52±0.41E 00		60.6	2CC	CA 6.6E 00
	4	4	564	3.17±0.11E 01		79.6	20C	1.5E 00
	5	5	CCF- 565	4.24±0.17E 01		74.2	1CC	1.4E 00
	L5,P11	5316	CBS-1557	2.63±0.06E 04		78.3	2C	2.6E 00
	L5,P24		1452	5.06±0.11E 04		71.0	2C	3.4E 00
	L6,P11	5315	1450	1.89±0.04E 04		79.8	2C	1.6E 00
	L6,P12		1451	3.66±0.08E 04		85.2	2C	1.7E 00
	L6,P13-1	23C8-1	CCD- 536	7.07±0.21E 02		81.2	2C	5.1E 00
	2	2	537	8.76±0.28E 01		76.2	1CC	1.2E 00
	3	3	538	4.20±0.13E 01		65.3	20C	1.5E 00
	4	4	539	4.44±0.16E 01		54.3	3CC	CA 4.4E 01
	5	5	CCF- 540	4.58±0.30E 00		71.4	2CC	1.6E 00
	L6,P21-1	2321-1	CCD- 556	1.85±0.05E 03		77.7	2C	3.7E 00
	2	2	557	2.93±0.09E 02		72.4	7C	3.3E 00

*New Data this report

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
BAL	L6,P21-3	2321-3	CCD- 558	8.89±0.30E 01		62.2	100	1.6E 00
	4	4	559	8.14±0.28E 01		71.5	100	2.2E 00
	5	5	CCF- 560	2.99±0.19E 00		62.4	400	CA 3.0E 00
	L7,P9	4011-A	CTA-2191	8.10±0.24E 01	1.16	42.7	100	8.1E 01
	L7,P17	4010	1265	0.00±0.04E 00		72.4	400	1.0E 00
	L8,P13-1	2343-1	CCD- 611	1.02±0.02E 02		70.7	400	2.5E 01
	2	2	612	5.57±0.28E 00		59.0	400	1.4E 00
	3	3	613	1.76±0.14E 00		65.8	400	4.0E-01
	4	4	614	4.30±1.30E-01		81.0	100	CA 1.0E 00
	5	5	CCF- 615	2.10±1.40E-01		57.1	100	CA 1.0E 00
	L8,P21-1	2336-1	CCD- 596	1.20±0.15E 00		67.7	200	CA 1.0E 00
	2	2	597	8.59±0.30E 00		44.0	900	8.6E 00
	3	3	598	2.70±1.00E-01		56.8	200	CA 1.0E 00
	4	4	599	4.00±8.00E-02		83.2	90	CA 1.0E-02
	5	5	CCF- 600	5.00±9.00E-02		66.5	90	CA 1.0E-02
	L9,P9-1	2339-1	CCD- 606	2.00±4.00E-02		61.2	200	1.0E 00
	2	2	607	1.30±1.90E-01		41.2	100	1.0E 00
	3	3	608	1.60±1.20E-01		66.5	100	1.0E 00
	4	4	609	0.00±0.06E 00		81.5	100	1.0E 00
	5	5	CCF- 610	2.30±0.80E-01		67.8	100	CA 5.0E-02
	L9,P17-1	2338-1	CCD- 601	-0.40±1.20E-01		80.4	90	CA 1.0E-02
	2	2	602	0.00±0.09E 00		67.7	90	CA 1.0E-02
	3	3	603	1.20±0.70E-01		79.5	200	CA 3.0E-02
	4	4	604	-1.00±1.30E-01		37.1	200	1.0E 00
	5	5	CCF- 605	0.00±0.03E 00		81.8	200	1.0E 00
	L10,P5	4014	CTA-1268	1.20±0.70E-01		80.2	200	1.0E 00
	L10,P13	4012	1266	5.90±0.14E 01		65.3	200	7.4E-01
	L10,P21	4013	1267	2.11±0.18E 00		59.5	400	2.1E 00
	L11,P17-1	2335-1	CCD- 591	2.40±1.20E-01		58.2	200	CA 1.0E 00

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
BAL	L11,P17-2	2335-2	CCD- 592	1.30±1.10E-01		65.6	200	CA 1.0E 00
	3	3	593	4.00±7.00E-02		79.9	200	CA 1.0E-02
	4	4	594	-2.00±4.00E-02		66.4	200	CA 1.0E 00
	5	5	CCF- 595	5.00±5.00E-02		80.0	200	CA 1.0E-02
	L12,P13-1	2334-1	CCD- 586	1.54±0.04E 02		83.6	200	9.0E 00
	2	2	587	7.82±0.34E 00		67.7	400	2.0E 00
	3	3	588	9.30±1.30E-01		65.8	200	2.0E-01
	4	4	589	1.43±0.21E 00		42.1	200	CA 1.0E 00
	5	5	CCF- 590	1.59±0.20E 00		53.4	200	CA 1.0E 00
	L12,P21-1	2331-1	CCD- 576	1.22±0.07E 01		46.3	200	CA 1.2E 01
	2	2	577	1.38±0.18E 00		57.8	200	CA 1.0E 00
	3	3	578	1.25±0.17E 00		54.2	200	3.0E-01
	4	4	579	1.07±0.07E 00		70.8	900	1.3E-01
	5	5	CCF- 580	1.40±0.30E-01		62.5	900	CA 3.0E-02
	L13,P9	4008	CTA-1264	2.18±0.09E 01		20.1	900	2.7E 00
	L14,P1-1	2328-1	CCD- 566	2.24±0.20E 00		45.2	400	CA 2.0E 00
	2	2	567	2.89±0.30E 00		40.9	200	7.0E-01
	3	3	568	4.20±1.00E-01		73.0	200	CA 1.0E 00
	4	4	569	1.93±0.21E 00		53.8	200	5.0E-01
	5	5	CCF- 570	3.17±0.20E 00		28.6	900	CA 3.0E 00
	L14,P5-1	2329-1	CCD- 571	8.00±4.00E-02		58.9	400	CA 1.0E 00
	2	2	572	4.00±5.00E-02		35.6	400	CA 1.0E 00
	3	3	573	7.00±9.00E-02		54.0	200	CA 1.0E 00
	4	4	574	3.21±0.27E 00		59.2	200	CA 3.0E 00
	5	5	CCF- 575	2.30±1.00E-01		58.1	200	CA 1.0E 00
	L15,P17-1	2332-1	CCD- 581	4.00±2.00E-02		61.7	900	CA 1.0E-02
	2	2	582	1.40±0.30E-01		66.2	200	CA 3.0E-02
	3	3	583	3.60±1.80E-01		39.4	200	CA 1.0E 00
	4	4	584	2.00±5.00E-02		70.5	200	CA 1.0E-02

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	ILW COLLECTION NO.	ILW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MON
BAL	L 15,P17-5	2332-5	CCF- 585	5.00±8.00E-02		46.2	2CC	1.CE CO
	L 17,P9-1	2363-1	CCD- 676	9.60±0.20E-01		61.5	2CC	CA 1.CE CO
	2	2	677	0.80±1.30E-01		51.7	1CC	CA 2.CE-02
	3	3	678	4.00±6.00E-02		70.5	2CC	CA 1.CE CO
	4	4	679	1.50±0.90E-01		58.6	2CC	CA 1.CE CO
	5	5	CCF- 680	6.50±1.70E-01		41.5	2CC	CA 1.CE-01
	L 18,P5-1	2359-1	CCD- 666	1.20±1.20E-01		45.7	2CC	CA 1.CE CO
	2	2	667	0.00±0.11E 00		41.7	2CC	1.CE CO
	3	3	668	1.14±0.14E 00		75.5	2CC	CA 1.CE CO
	4	4	669	1.90±1.10E-01		59.0	1CC	CA 5.CE-02
	5	5	CCF- 670	1.50±1.00E-01		52.5	2CC	CA 1.CE CO
	L 18,P21-1	2361-1	CCD- 671	6.00±9.00E-02		63.4	2CC	CA 1.CE-02
	2	2	672	4.00±7.00E-02		51.0	2CC	CA 1.CE CO
	3	3	673	5.30±1.20E-01		43.4	4CC	CA 1.CE-01
	4	4	674	1.40±1.00E-01		29.6	5CC	1.CE CO
	5	5	CCF- 675	0.00±0.07E 00		71.6	2CC	1.CE CO
	L 19,P9	4130	CTA-1271	4.00±0.40E-01		78.4	5CC	1.CE CO
	L 20,P5-1	2354-1	CCD- 646	4.57±0.30E 00		83.0	2CC	5.CE-01
	2	2	647	6.55±0.37E 00		85.7	2CC	8.CE-01
	3	3	648	4.73±0.31E 00		72.3	2CC	1.CE CO
	4	4	649	7.00±7.00E-02		80.0	2CC	CA 2.CE-02
	5	5	CCF- 650	1.40±0.70E-01		68.1	2CC	CA 1.CE CO
	L 20,P13-1	2355-1	CCD- 651	7.67±0.23E 01		82.2	2CC	4.5E 00
	2	2	652	3.10±0.90E-01		69.2	2CC	CA 1.CE-01
	3	3	653	1.70±0.19E 00		58.5	2CC	6.CE-01
	4	4	654	8.00±8.00E-02		73.8	2CC	CA 2.CE-02
	5	5	CCF- 655	1.40±0.70E-01		70.2	2CC	CA 3.CE-02
	L 21,P1-1	2358-1	CCD- 661	1.40±0.70E-01		69.5	2CC	CA 3.CE-02
	2	2	662	1.20±1.00E-01		59.5	2CC	CA 3.CE-02

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
BAL	L21,P1-3	2358-3	CCD- 663	-2.00±6.00E-02		59.0	2CC	CA 5.CE-03
	4	4	664	9.00±7.00E-02		67.1	2CC	CA 2.CE-02
	5	5	CCF- 665	2.00±5.00E-02		52.3	2CC	CA 1.CE 00
	L21,P17-1	2357-1	CCD- 656	2.20±0.90E-01		52.8	2CC	CA 6.CE-02
	2	2	657	1.60±0.90E-01		65.2	2CC	CA 4.CE-02
	3	3	658	-0.40±1.30E-01		49.9	1CC	CA 1.CE-02
	4	4	659	-5.00±5.00E-02		74.3	2CC	CA 1.CE 00
	5	5	CCF- 660	2.40±0.90E-01		63.5	2CC	CA 6.CE-02
	L22,P13	4CC5	CTA-1263	2.44±0.17E 00		80.9	3CC	2.4E 00
	L23,P1-1	2353-1	CCD- 641	5.00±9.00E-02		51.1	2CC	CA 1.CE 00
	2	2	642	3.00±5.00E-02		68.8	2CC	CA 1.CE 00
	3	3	643	2.10±0.80E-01		77.9	2CC	CA 1.CE 00
	4	4	644	3.10±1.00E-01		65.9	2CC	CA 1.CE-01
	5	5	CCF- 645	4.00±7.00E-02		60.8	2CC	CA 1.CE 00
	L25,P9	4C02	CTA-1262	2.87±0.19E 00		79.3	3CC	2.9E 00
	L26,P13-1	2316-1	CCD- 551	3.30±1.10E-01		85.1	2CC	CA 1.CE 00
	2	2	552	0.00±0.08E 00		62.8	2CC	1.CE 00
	3	3	553	6.00±6.00E-02		63.3	2CC	CA 1.CE-02
	4	4	554	1.40±0.70E-01		57.2	4CC	CA 3.CE-02
	5	5	CCF- 555	2.00±0.60E-01		80.2	4CC	CA 2.CE-02
	L27,P17-1	2346-1	CCD- 616	-3.00±6.00E-02		41.0	2CC	CA 1.CE 00
	2	2	617	3.00±9.00E-02		70.8	1CC	CA 1.CE 00
	3	3	618	5.00±4.00E-02		49.9	4CC	CA 1.CE 00
	4	4	619	1.20±1.20E-01		61.7	1CC	CA 1.CE 00
	5	5	CCF- 620	1.10±0.80E-01		63.3	1CC	CA 1.CE-01
	L28,P13	4C17	CTA-1269	1.22±0.05E 01		76.0	2CC	1.2E 01
	L29,P1-1	2350-1	CCD- 626	1.17±0.17E 00		67.8	2CC	CA 1.CE 00
	2	2	627	1.40±1.00E-01		76.5	2CC	CA 3.CE-02
	3	3	628	4.02±0.20E 00		70.1	4CC	5.CE-02

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
BAL	L29,P1-4	2350-4	CCD- 629	4.38±0.37E 00		72.8	2CC	CA 4.CE 00
	5	5	CCF- 630	9.00±8.00E-02		78.5	2CC	CA 2.CE-02
	L29,P9-1	2351-1	CCD- 631	1.77±0.22E 00		74.1	2CC	2.CE-01
	2	2	632	1.04±0.18E 00		52.0	20C	2.5E-01
	3	3	633	2.47±0.21E 00		72.6	2CC	3.CE-01
	4	4	634	1.70±0.70E-01		63.8	2CC	CA 1.CE 00
	5	5	CCF- 635	8.00±6.00E-02		61.0	2CC	CA 1.CE 00
	L29,P17-1	2352-1	CCD- 636	4.00±4.00E-02		74.7	4CC	CA 6.CE-03
	2	2	637	3.00±7.00E-02		48.4	4CC	CA 1.CE 00
	3	3	638	3.00±4.00E-02		59.0	4CC	CA 1.CE 00
	4	4	639	3.00±3.00E-02		65.4	4CC	CA 1.CE 00
	5	5	CCF- 640	0.00±0.07E 00		66.1	2CC	CA 0.CE 00
	L30,P21-1	2349-1	CCD- 621	1.80±1.20E-01		39.1	1CC	CA 1.CE 00
	2	2	622	3.00±6.00E-02		76.4	1CC	CA 1.CE 00
	3	3	623	2.50±1.30E-01		47.4	2CC	CA 1.CE 00
	4	4	624	5.00±5.00E-02		86.7	2CC	CA 1.CE-02
	5	5	CCF- 625	1.30±0.80E-01		82.0	1CC	CA 1.CE-02
	L31,P9	4C18	CTA-1270	8.79±0.71E 00		82.2	2CC	1.CE-02
DBAL	L1,P1	4C26	1575	9.68±0.16E 03	11.5	64.7	4C	6.CE-01
	L1,P1	2366-A	CCD-2186	7.49±0.28E 02	1.39	25.1	4C	2.4E 00
	L1,P1-3	3	2118	2.01±2.01E-01	5.47	76.8	6C	5.CE-02
	4	4	2119	5.57±0.32E 00	1.59	61.2	3CC	1.4E 00
	5	5	CCF-2120	1.25±1.25E-01	0.574	82.6	6C	1.2E-01
	L4,P5	4C23	CTA-1574	3.14±1.11E-01		63.8	2CC	1.CE 01
	L7,P1	4C15	1572	1.49±2.23E-01	0.208	38.1	1CC	1.CE 01
	L13,P1	4CC7	1570	6.37±0.37E 00	0.257	28.2	5CC	8.CE 00
	L13,P17	4CC9	1571	-0.29±1.03E-01	0.193	28.6	1CC	1.CE 01
	L19,P17	4131	1576	4.20±3.15E-01	0.133	27.0	1CC	1.CE 01
	L22,P5	4C04	1568	4.02±1.30E-01	0.454	51.8	2CC	1.CE 01

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
BBAL	L22,P21	4006	CTA-1569	3.10±0.22E 00	0.219	41.8	500	3.1E 01
	L28,P21	4020	1573	3.80±1.19E-01	0.118	49.7	200	1.0E 01
EIC-5-	5	NONE	CSF-1980	7.40±0.23E 04	158.	27.2	30	7.0E 00
	6		1981	1.44±0.04E 05	668.	26.6	30	4.6E 00
	7		1982	7.09±0.19E 04	95.3 *	41.8	20	4.6E 00
	8		1983	3.67±0.11E 04	74.1	15.9	60	3.6E 00
	9		1984	5.05±0.13E 03	143.	27.4	60	9.0E-01
	10		1985	7.86±0.25E 03	14.3	28.1	40	9.0E-01
	11		1986	1.75±0.03E 04	16.1	86.3	20	3.8E-01
	14-5		2001	4.11±0.13E 05	383.	23.0	40	8.0E 00
	6		2002	1.56±0.04E 05	261.	26.1	40	7.6E 00
	7		2003	5.79±0.16E 04	220.	42.2	20	5.0E 00
	8		2004	1.92±0.05E 04	19.4	14.0	90	3.2E 00
	9		2005	1.27±0.03E 03	0.449	59.2	40	4.2E 01
	10		2006	4.78±0.17E 03	0.683	51.0	20	1.7E 00
	11		2007	2.31±0.04E 04	997.	32.0	100	6.3E-01
MOB	DM-C1-1	2277-1	CCO- 511	8.49±0.25E 02		76.5	20	3.6E 00
	2	2	512	4.98±0.16E 01		68.7	300	4.1E-00
	3	3	513	1.40±0.04E 02		82.7	100	3.4E 00
	4	4	514	3.24±0.17E 00		80.4	500	CA 3.0E 00
	5	5	CCF- 515	8.65±0.32E 00		69.3	500	CA 8.0E 00
	C2-1	2279-1	CCO- 521	7.32±0.23E 02		76.6	20	5.1E 00
	2	2	522	1.12±0.03E 02		83.0	200	3.5E 00
	3	3	523	4.16±0.15E 01		67.6	200	2.6E 00
	4	4	524	1.01±0.03E 01		79.2	400	6.3E-01
	5	5	CCF- 525	1.74±0.05E 01		74.6	500	4.0E 00
	C3-1	2274-1	CCO- 496	4.75±0.15E 02		66.1	20	3.3E 00
	2	2	497	7.30±0.26E 01		61.9	200	3.0E 00
	3	3	498	1.59±0.07E 01		62.8	200	1.0E 00

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYSTON
MOB	DM-C3-4	2274-4	CCD- 499	3.40±1.10E-01		52.5	2CC	CA 2.CE-02
	5	5	CCF- 500	8.00±8.00E-02		52.4	2CC	CA 2.CE-02
	C4-1	2278-1	CCD- 516	4.51±0.00E 02		75.6	2C	2.4E CO
	2	2	517	1.82±0.12E 01		36.8	2CC	4.5E CC
	3	3	518	3.31±0.08E 02		77.3	1CC	5.1E 00
	4	4	519	5.80±0.70E-01		66.8	5CC	CA 1.CE 00
	5	5	CCF- 520	4.77±0.79E 00		52.2	5CC	CA 4.CE 00
	C5-1	2275-1	CCD- 501	7.42±0.22E 02		78.6	2C	2.3E CO
	2	2	502	2.26±0.06E 02		80.1	1CC	3.6E CO
	3	3	503	1.67±0.05E 02		75.3	1CC	3.5E 00
	4	4	504	6.80±1.10E-01		81.6	2CC	CA 1.CE CO
	5	5	CCF- 505	1.30±0.60E-01		59.3	5CC	CA 1.CE CO
	C6-1	2280-1	CCD- 526	8.71±0.25E 02		82.1	2C	3.5E 00
	2	2	527	3.36±0.12E 01		25.2	6CC	4.2E 00
	3	3	528	8.70±0.30E 01		62.C	2CC	4.3E CO
	4	4	529	7.74±0.41E 00		40.1	4CC	6.CE-C1
	5	5	CCF- 530	2.70±0.80E-01		45.C	5CC	CA 1.CE 00
	C7-1	2276-1	CCD- 506	7.00±0.22E 02		76.7	2C	3.3E CO
	2	2	507	4.41±0.13E 02		74.2	2C	4.4E 00
	3	3	508	1.52±0.05E 02		66.C	1CC	3.2E CO
	4	4	509	5.50±0.80E-01		52.4	5CC	CA 1.CE-01
	5	5	CCF- 510	8.50±0.90E-01		62.2	4CC	CA 4.CE-02
	17-1	3211-1	CAD- 940	5.14±0.13E 03		72.C	2C	2.7E 00
	2	2	941	6.76±0.21E 01		80.4	2CC	1.4E CC
	3	3	942	2.10±0.09E 01		69.6	2CC	1.CE 00
	6	6	943	1.36±0.14E 00		65.3	3CC	6.EE-01
	7	7	CAF- 944	1.05±0.13E 00		74.7	3CC	4.CE-C2
	18-1	3212-1	CAD- 945	1.27±0.03E 03		75.6	2C	3.5E CO
	2	2	946	5.20±0.35E 00		64.C	2CC	5.EC-01

CONFIDENTIAL

TABLE E.3 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
MOB	DM-18-3	3212-3	CAD- 947	3.03±0.30E 00		46.3	200	CA 3.0E 00
	4	4	948	1.20±2.40E-01		48.2	50	CA 1.0E 00
	6	6	949	1.70±3.40E-01		33.1	50	CA 2.0E-01
	7	7	CAF- 950	1.40±1.00E-01		83.1	100	CA 2.0E-02
	DM-CEN	3581	CTA-1261	1.14±0.04E 01		74.5	300	1.4E 00
	DP-12	2272-A	CCD-2182	1.43±0.04E 03	23.3*	23.6	50	1.6E 00
	3	3	2112	8.70±0.27E 01	0.243	81.2	100	3.6E 00
	4	4	2113	5.08±0.16E 01	6.02	82.6	200	1.6E 00
	5	5	CCF-2114	8.20±1.07E-01	0.759	71.5	300	9.0E-02
OA	CMR-81A	9708	CVS-1469	7.29±0.58E 00		31.2	200	
	81B		1470	1.53±0.04E 01		83.9	500	
	82A		1471	2.78±0.22E 00		72.0	200	
	82B		1472	8.01±0.51E 00		44.7	200	
	83A		1473	7.39±1.02E-01		36.0	600	
	83B		1474	8.49±0.43E 00		16.2	1000	
	81A	9722	2104	2.10±0.06E 04		16.4	100	
	81B		2105	3.11±0.06E 04		34.0	600	
	82A		2106	2.85±0.19E 03		18.2R	100	6.0E-02
	82B		2107	2.29±0.05E 03		55.3	200	
	83A		2108	1.16±0.03E 03		44.6	200	
	83B		2109	1.34±0.03E 03		47.5	200	
PCMR	2-83-5	NONE	CSF-1973	7.98±0.49E 01	58.0 *	39.2	200	1.4E 00
	6		1974	9.86±0.40E 01	31.5	72.6	300	8.0E-01
	7		1975	2.62±0.08E 02	19.5	28.6	200	3.0E 00
	8		1976	1.82±0.06E 03	17.6	34.5	60	2.6E 01
	9		1977	2.33±0.07E 02	23.5	26.3	500	5.6E 00
	10		1978	1.57±0.04E 02	0.954	83.5	200	3.3E 00
	11		1979	5.06±0.14E 02	10.7	82.6	100	3.5E 00

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.4 RADIOCHEMICAL ANALYSIS OF ROLLER COASTER PHYSICAL SAMPLES, CLEAN SLATE III

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANAL /MON
GZ-1	TA-C1-1	5259-1	CCD- 905	1.17±0.03E 06		86.1	2C	8.3E 01
	2	2	906	1.89±0.05E 06		68.3	2C	2.5E 01
	3	3	907	3.67±0.25E 05		62.C	1C	6.5E 01
	4	4	908	2.84±0.06E 03		73.5	2C	1.2E 01
	5	5	CCF- 909	3.89±0.09E 02		56.1R	5CC	4.3E 01
GZ-2	TA-C2-1	5258-1	CCD- 900	1.60±0.04E 06	742.	76.4	2C	1.CE 01
	2	2	901	1.49±0.04E 06	955.	76.4	2C	1.8E 01
	3	3	902	1.75±0.04E 05	55.2	67.C	2C	1.2E 01
	4	4	903	4.97±0.13E 03	2.10	66.8	2C	8.CE CO
	5	5	CCF- 904	5.97±0.18E 01	0.292	64.5	3CC	4.6E 00
GZ-4	TB-C2-1	5256-1	CCD- 895	2.25±0.05E 05		74.5	2C	2.2E 01
	2	2	896	6.60±0.13E 04		82.7	1C	1.5E 01
	3	3	897	9.66±0.10E 03		78.3	2C	1.7E 01
	4	4	898	5.90±0.17E 02		73.8	10C	1.2E 01
	5	5	CCF- 899	7.50±0.24E 00		73.4	7CC	8.3E-01
GZ	BC-C3	5172	CTD-1294	1.49±0.07E 01		79.0	1CC	3.3E-01
	C6-1	4597-1	CAD-1041	4.30±0.13E 02		74.0	1CC	9.3E 00
	2	2	1042	1.70±0.08E 01		70.6	2CC	2.4E 00
	3	3	1043	2.87±0.08E 02		80.2	3CC	7.2E 01
	4	4	1044	1.04±0.08E 00		60.2	5CC	5.2E-01
	6	6	1045	3.72±0.08E 02		66.5	5C	2.6E CO
	7	7	CAF-1046	7.60±1.00E-01		93.2	2CC	CA 7.6E-01
	C7	5173	CTD-1295	1.06±0.10E 00		67.C	5CC	2.1E-01
	C9	5175	1296	6.36±0.23E 01		79.1	5C	1.CE 00
	10-1	4592-1	CAD-1011	5.00±5.00E-02		60.5	3CC	1.CE CO
	2	2	1012	2.81±0.23E 00		76.7	2CC	2.6E 00
	3	3	1013	2.10±0.80E-01		91.8	2CC	CA 2.1E-01
	4	4	1014	9.37±0.34E 00		26.4	13CC	CA 9.CE 00
	6	6	1015	5.00±6.00E-02		61.1	3CC	1.CE CO

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
GZ	BC-1C-7	4592-7	CAF-1016	0.30±1.20E-01		41.8	200	8.0E-02
	13	5177	CTD-1298	6.79±0.25E 01		73.5	90	1.1E 00
	BC-C6	8165-A	CDS-1399	2.45±0.07E 06		48.6	20	4.0E 00
	10		1400	2.51±0.07E 03		53.1	20	3.2E-01
	BE-C4		1398	3.79±0.07E 04		79.9	20	2.2E 00
	BH-C0		1401	6.65±0.21E 03		44.5	20	6.0E-01
	C2		1402	3.47±0.09E 06		64.0	20	4.1E 00
	C4		1403	2.42±0.05E 08		80.3	20	5.5E 00
	12		1404	2.06±0.04E 07		82.3	20	8.0E 00
	BI-C1	5168	CTD-1292	3.11±0.08E 04		75.8	20	4.1E 00
	C1-1	4596-1	CAD-1035	2.40±1.00E-01		72.9	200	2.5E-01
	2	2	1036	9.70±1.00E-01		53.0	500	1.1E-0
	3	3	1037	3.75±0.27E 00		70.9	200	3.8E 00
	4	4	1038	1.24±0.14E 00		77.2	200	CA 1.2E 00
	6	6	1039	4.56±0.30E 00		74.6	200	1.1E 00
	7	7	CAF-1040	4.80±0.16E 01		75.5	200	1.6E 01
	C2-1	4581-1	CCD- 830	5.72±0.10E 03		64.0	30	8.0E 00
	2	2	831	1.62±0.04E 02		77.9	100	2.0E 00
	3	3	832	3.12±0.07E 02		77.1	100	3.8E 00
	4	4	833	1.29±0.07E 01		47.2	200	3.2E 00
	5	5	CCF- 834	2.06±0.28E 00		34.4	200	CA 2.0E 00
	C3-1	4572-1	CCD- 825	2.61±0.07E 05		67.7	20	1.6E 01
	2	2	826	1.38±0.03E 05		66.2	20	8.4E 01
	3	3	827	8.26±0.17E 04		79.5	10	1.6E 01
	4	4	828	2.63±0.04E 04		78.0	20	9.8E 00
	5	5	CCF- 829	5.25±0.22E 01		48.2	200	2.4E 00
	C3-1	4595-1	CAD-1029	5.85±0.16E 05	369.	60.4	20	8.0E 00
	2	2	1030	8.56±0.24E 03	4.83	64.2	20	8.3E 00
	3	3	1031	3.51±0.09E 02	0.268	43.5	40	1.5E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
GZ	B1-C3-4	4995-4	CAD-1032	1.53±0.04E 02	0.188	62.9	5C	1.1E 00
	6	6	1033	9.92±0.21E 01	0.280	63.5	1CC	9.3E-01
	7	7	CAF-1034	4.98±0.18E 01	0.462	61.0	2CC	1.5E 00
	C5	5170	CTD-1293	2.14±0.07E 06	188.	53.8	2C	3.7E 01
	11	5176	1297	6.73±0.14E 04		76.6	2C	1.3E 00
	12-1	4983-1	CCD- 840	5.77±0.13E 03		70.5	2C	4.2E 00
	2	2	841	7.20±0.23E 02		64.0	2C	3.1E 00
	3	3	842	3.30±0.08E 02		62.3	4C	3.1E 00
	4	4	843	3.61±0.09E 02		60.6	4C	3.2E 00
	5	5	CCF- 844	6.00±0.16E 01		80.7	1CC	5.2E-01
	13-1	4993-1	CAD-1017	1.56±0.04E 04		71.6	2C	3.0E 00
	2	2	1018	1.45±0.04E 03		57.9	2C	2.4E 00
	3	3	1019	2.15±0.06E 02		62.5	4C	1.1E 00
	4	4	1020	1.87±0.05E 02		69.5	4C	1.2E 00
	6	6	1021	1.57±0.03E 03		71.6	9C	2.1E 01
	7	7	CAF-1022	6.37±0.22E 01		82.0	7C	9.0E-01
	16-1	4994-1	CAD-1023	9.38±0.15E 03		65.2	4C	4.3E 00
	2	2	1024	1.89±0.05E 02		60.5	1CC	2.3E 00
	3	3	1025	6.77±0.08E 01		72.5	100C	1.6E 00
	4	4	1026	2.23±0.04E 01		78.7	1000	7.4E-01
	6	6	1027	1.51±0.06E 01		75.3	3CC	9.0E-01
	7	7	CAF-1028	6.55±0.26E 00		74.5	5CC	6.6E 00
	17	5180	CTD-1301	2.57±0.04E 01		72.3	120C	5.0E 00
	18-1	4969-1	CCD-1693	0.00±0.19E 00		58.1	5C	1.0E 00
	2	2	1694	9.98±1.65E-01		71.5	2CC	2.5E-01
	3	3	1695	1.19±0.03E 01		81.7	5CC	1.2E 01
	4	4	1696	2.02±0.38E-01		75.7	5CC	
	5	5	CCF-1697	3.23±0.81E-01		58.5R	2CC	2.0E-02
	BK-CC	8165-A	CDS-1405	1.21±0.03E 06		81.7	2C	2.5E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
GZ	BK-C2	8165-A	CDS-1406	5.08±0.11E 07		83.0	2C	1.8E 01
	C4		1407	6.04±0.14E 06		48.0	3C	1.4E 01
	12		1408	5.69±0.17E 06		54.2	2C	5.4E 00
	14		1409	6.97±0.16E 05		72.7	2C	2.1E 00
	BM-C3	8153	1358	3.59±0.05E 07		84.1	6C	5.5E 01
	C4		1359	3.58±0.08E 06		84.[illegible]	2C	2.0E 01
	C4-1	4568-1	CCD- 820	5.05±0.09E 03		72.6	3C	6.7E 00
	2	2	821	3.70±0.07E 03		67.2	3C	6.8E 00
	3	3	822	1.89±0.03E 03		67.2	3C	6.8E 00
	4	4	823	6.71±0.14E 02		83.3	3C	7.2E 00
	5	5	CCF- 824	1.85±0.08E 01		68.5	2CC	2.0E 00
	C4-1	4589-1	CAD-1005	2.10±0.05E 03		74.8	2C	1.3E 00
	2	2	1006	3.74±0.09E 02		70.2	4C	1.0E 00
	6	6	1009	5.17±0.18E 01		72.2	1CC	8.2E-01
	7	7	CAF-1010	4.48±0.13E 01		78.4	1CC	2.8E-01
	C5	8153	CDS-1360	6.61±0.16E 05		30.5	4C	1.2E 01
	C6	4587-A	CAD-2201	4.49±0.16E 02	2.54*	40.6	3C	7.4E-01
	C6	8153	CDS-1361	1.33±0.02E 06		75.4	4C	6.8E 00
	C6-1	4582-1	CCD- 835	6.97±0.16E 03		70.1	2C	6.0E 00
	2	2	836	2.73±0.06E 03		76.1	2C	7.0E 00
	3	3	837	1.30±0.03E 03		64.9	2C	7.8E 00
	4	4	838	2.36±0.05E 03		70.6	2C	7.5E 00
	5	5	CCF- 839	7.76±0.28E 01		62.8	8C	1.0E 00
	C6-3	4587-3	CAD-2150	1.06±0.03E 02	0.0250	64.6	2CC	2.5E 00
	4	4	2151	1.88±0.07E 01	0.577	62.7	2CC	1.1E 00
	6	6	2152	1.78±0.05E 01	0.140	69.8	5CC	4.4E 00
	7	7	CAF-2153	8.50±0.28E 00	1.36	78.6	5CC	2.1E 00
	C7	5184	CTA-2203	7.57±0.24E 02	4.27*	23.6	5C	
	C7	8153	CDS-1362	7.55±0.18E 05		68.8	2C	6.5E 00

*New data this report

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLD COLLECTION NO.	TLD ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
GZ	BM-C8	8153	CDS-1363	7.72±0.19E 05		63.4	2C	6.5E CO
	C8-1	4584-1	CCD- 845	4.29±0.10E 03		80.6	2C	4.5E 00
	2	2	846	1.16±0.28E 02		72.4	2C	4.CE 00
	3	3	847	4.27±0.15E 02		62.6	2C	4.6E CO
	4	4	848	7.46±0.20E 02		74.2	2C	5.7E CO
	5	5	CCF- 849	1.24±0.03E 02		78.2	2CC	2.5E 00
	C8-1	4586-1	CAD- 999	2.69±0.09E 01		71.6	2CC	7.CE-02
	2	2	1000	3.64±0.14E 01		69.C	1CC	5.CE-C1
	3	3	1001	6.32±0.23E 01		71.2	1CC	9.2E-C1
	4	4	1002	1.50±0.05E 02		87.8	1CC	5.CE 00
	6	6	1003	1.05±0.03E 03		71.6	2CC	1.2E 02
	7	7	CAF-1004	1.49±0.05E 01		27.7	5CC	9.3E-C1
	C9	5182	CTD-1302	2.12±0.05E 03		75.3	2C	1.1E CO
	C9	8153	CDS-1364	6.69±0.16E 05		68.6	2C	1.6E 01
	10	4573-A	CCD-2199	2.00±0.03E 03	4.45*	55.5	5C	1.7E 00
	10	8153	CDS-1365	8.96±0.13E 05		77.7	4C	6.CE CC
	10-3	4573-3	CCD-2139	3.13±0.07E 02	1.77	81.3	2CC	4.CE 00
	4	4	2140	2.86±0.08E 02	6.08	76.7	1CC	7.7E 00
	5	5	CCF-2141	1.73±0.07E 01	0.637	61.1	3CC	7.5E-01
	11	5178	CTD-1299	1.34±0.03E 04		83.6	2C	2.5E CO
	11	8153	CDS-1366	1.95±0.06E 06		40.6	2C	3.6E CO
	12-1	4567-1	CCD- 815	6.08±0.10E 03		77.5	3C	4.7E 00
	2	2	816	1.15±0.02E 03		67.7	3C	3.6E 00
	3	3	817	1.40±0.02E 03		66.8	4C	4.7E CC
	4	4	818	1.27±0.02E 03		76.7	4C	6.CE 00
	5	5	CCF- 819	4.68±0.22E 01		35.6	2CC	2.1E 00
	13	5179	CTD-1300	3.25±0.07E 04		76.5	2C	4.2E 00
	13	8153	CDS-1368	3.50±0.07E 06		35.4	5C	4.1E CC
	14		1369	7.75±0.17E 05		80.0	2C	2.5E 00

*New data this report

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
GZ	BM-16	8153	CDS-1370	1.04±0.03E 04		27.8	3C	1.CE 00
	BO-C0		1342	2.66±0.05E 07		77.9	2C	8.9E 00
	C1		1343	5.56±0.08E 07		68.3	5C	2.CE 01
	C2		1344	2.68±0.04E 07		72.7	5C	1.4E 01
	C3		1345	6.60±0.16E 06		65.8	2C	7.5E 00
	C4		1346	1.55±0.04E 06		79.2	2C	2.CE 01
	C5		1347	4.47±0.13E 05		43.1	2C	4.6E 00
	C6		1348	1.02±0.02E 06		75.0	2C	4.7E 00
	C8		1349	7.55±0.17E 05		77.1	2C	3.6E 00
	C9		1350	2.96±0.04E 05		69.8	6C	5.6E 00
	10		1351	4.54±0.12E 05		54.4	2C	3.7E 00
	11		1352	4.89±0.08E 05		75.0	3C	3.7E 00
	12		1353	1.85±0.05E 06		37.0	3C	3.3E 00
	13		1354	1.69±0.04E 06		60.0	2C	3.7E 00
	14		1355	1.90±0.04E 06		82.0	2C	3.6E 00
	15		1356	3.33±0.07E 05		71.4	2C	5.0E 00
	16		1357	3.93±0.09E 04		72.4	2C	1.3E 00
	C8	8158	1776	1.11±0.05E 01		58.5	5CC	1.1E 01
	CM-C5.0	8153	1371	2.85±0.08E 06		55.0	2C	2.1E 00
	C5.1		1372	2.16±0.05E 07		77.9	2C	7.4E 00
	C5.2		1373	3.85±0.09E 07		69.5	2C	8.7E 00
	C5.3		1374	1.33±0.03E 07		68.1	2C	1.1E 01
	C5.4		1375	6.39±0.16E 06		63.6	2C	6.3E 00
	C7.C-A		1376	5.21±0.12E 05		70.8	2C	2.5E 00
	C7.C-B		1377	5.42±0.15E 05		92.6	2C	2.6E 00
	C7.1		1378	4.01±0.10E 05		57.9	2C	3.1E 00
	C7.2		1379	8.50±0.20E 05		66.3	2C	2.5E 00
	C7.3		1380	7.24±0.15E 05		84.4	2C	2.2E 00
	C7.4		1381	3.60±0.05E 05		59.9	6C	4.6E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (CPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
GZ	CM-C9.C	8153	CDS-1382	6.88±0.16E 05		68.2	2C	3.6E 00
	C9.2		1383	2.16±0.03E 05		81.4	4C	
	C9.3		1384	1.35±0.03E 05		52.2	2C	1.2E 00
	C9.4		1385	3.81±0.09E 05		65.0	2C	2.1E 00
	11.0		1336	5.02±0.12E 05		60.3	2C	2.9E 00
	11.1		1387	5.20±0.13E 05		59.9	2C	3.9E 00
	11.2		1388	3.21±0.04E 05		75.7	6C	5.7E 00
	11.3		1389	1.62±0.03E 05		68.5	2C	4.1E 00
	11.4		1390	4.81±0.14E 04		52.7	2C	2.0E 00
	13.0		1391	6.00±0.17E 03		55.9	2C	1.3E-01
	CO-C3.4	8152	1316	3.07±0.06E 06		78.1	3C	5.1E 00
	C5.1		1317	2.39±0.06E 07		75.1	2C	
	C5.2		1318	4.98±0.13E 06		58.8	2C	3.1E 00
	C5.3		1319	3.00±0.07E 06		[illegible]	2C	2.7E 00
	C5.4		1320	1.46±0.04E 05		42.9	2C	2.2E 00
	C7.0		1321	5.96±0.13E 05		76.1	2C	1.4E 00
	C7.1		1322	3.31±0.08E 05		56.2	2C	1.7E 00
	C7.2		1323	3.60±0.09E 05		58.5	2C	1.8E 00
	C7.3		1324	2.99±0.05E 05		73.8	3C	2.0E 00
	C7.4		1325	2.12±0.06E 05		49.8	2C	2.5E 00
	C9.C-A		1326	1.33±0.02E 05		65.3	2C	1.8E 00
	C9.C-B		1327	1.23±0.02E 05		64.6	2C	1.7E 00
	C9.1		1328	1.43±0.03E 05		65.0	2C	1.8E 00
	C9.2		1329	1.60±0.04E 05		27.4	4C	1.9E 00
	C9.3		1330	1.15±0.02E 05		75.7	2C	2.9E 00
	C9.4		1331	1.90±0.05E 05		30.0	3C	1.7E 00
	11.0		1332	1.74±0.04E 05		23.8	4C	3.0E 00
	11.1		1333	1.42±0.02E 05		60.4	4C	2.1E 00
	11.2		1334	9.16±0.26E 04		48.9	2C	2.3E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
GZ	CO-11.3	8152	CDS-1335	9.61±0.20E 04		51.1	4C	3.7E CO
	11.4		1336	5.37±0.15E 04		72.2	2C	7.4E-01
	13.0		1337	2.94±0.06E 04		54.8	4C	1.3E 00
	13.1		1338	2.17±0.06E 04		40.5	2C	2.CE CO
	13.2		1339	7.72±0.21E 03		19.5	6C	1.3E CO
	13.3		1340	2.50±0.08E 03		31.9	3C	6.5E-01
	15.0		1341	3.09±0.07E 02		41.6	1CC	3.CE-01
A	OCO	5160	CTD-1286	2.69±0.08E 05	221.	63.6	2C	1.5E C1
	CC6-1	3258-1	CAO- 951	1.82±0.05E 05		66.8	2C	1.1E 01
	2	2	952	1.25±0.03E 04		72.3	2C	1.1E 01
	3	3	953	6.20±0.13E 02		68.6	1CC	7.4E CO
	4	4	954	1.96±0.06E 02		81.5	1CC	4.5E CO
	6	6	955	1.23±0.04E 02		30.8	2CC	2.4E 00
	7	7	CAF- 956	6.98±0.24E 01		80.8	1CC	2.CE 00
	CC6-1	4957-1	CCD- 770	1.70±0.04E 04		72.9	2C	1.1E 01
	2	2	771	3.27±0.08E 03		64.2	2C	1.2E C1
	3	3	772	1.14±0.01E 03		70.6	5C	7.7E 00
	4	4	773	4.78±0.13E 02		73.1	8C	5.7E 00
	5	5	CCF- 774	1.94±0.09E 01		46.2	2CC	1.5E 00
	012	5163	CTD-1288	2.17±0.05E 05		78.1	2C	1.4E C1
	018-1	3259-1	CAO- 957	1.55±0.04E 04		67.8	2C	5.5E CO
	2	2	958	5.12±0.16E 02		71.6	2C	2.CE 00
	3	3	959	1.44±0.05E 02		65.7	4C	1.2E 00
	4	4	960	7.65±0.31E 01		22.2	2CC	1.4E CO
	6	6	961	5.72±0.20E 01		64.0	2CC	2.CE CO
	7	7	CAF- 962	3.25±0.11E 01		78.8	20C	2.7E 00
	018-1	4962-1	CCD- 795	4.17±0.08E 03		65.1	3C	3.7E 00
	2	2	796	8.24±0.14E 02		79.4	3C	3.2E CO
	3	3	797	1.11±0.02E 03		74.1	3C	6.5E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (RARE WORK)	COUNT TIME	ANAL/MON
A	018-4	4562-4	CCD- 798	1.00±0.01E 03		66.3	4C	5.7E 00
	5	5	CCF- 799	2.79±0.14E 01		37.8	2CC	1.1E CO
	030-1	4563-1	CCD- 800	2.50±0.06E 03		79.9	2C	3.9E 00
	2	2	801	2.86±0.08E 02		71.6	9C	4.2E CO
	3	3	802	1.43±0.02E 02		27.3	13CC	2.7E CO
	4	4	803	2.86±0.11E 01		65.2	2CC	2.9E CO
	5	5	CCF- 804	2.02±0.10E 01		34.9	2CC	2.2E 00
	030	4574-A	CAD-2200	1.07±0.03E 03	14.6	56.8	2C	1.1E 00
	030-3	3	2146	9.60±0.26E 01	0.0100	72.9	2CC	1.3E CO
	4	4	2147	4.59±0.11E 01	0.0155	52.1	5CC	1.6E CO
	6	6	2148	3.67±0.08E 01	0.0110	74.8	5CC	2.6E CO
	7	7	CAF-2149	1.53±0.06E 01	1.65	78.2	20C	6.7E-01
	042-1	3300-1	CAD- 963	1.66±0.04E 03		66.5	2C	1.7E CO
	2	2	964	1.92±0.05E 02		68.7	4C	1.9E 00
	3	3	965	7.48±0.24E 01		69.8	2CC	1.6E CO
	4	4	966	5.12±0.17E 01		75.2	20C	1.2E 00
	6	6	967	4.[illegible]±0.13E 01		61.2	4CC	1.9E CO
	7	7	CAF- 968	2.25±0.08E 01		57.1	4CC	1.9E CO
	042-1	4561-1	CCD- 790	6.02±0.17E 03		60.7	2C	5.4E CO
	2	2	791	1.12±0.02E 03		71.2	3C	4.1E 00
	3	3	792	1.07±0.03E 03		84.4	2C	9.3E 00
	4	4	793	2.85±0.09E 02		77.7	2C	2.7E 00
	5	5	CCF- 794	1.59±0.11E 01		15.0	4CC	8.1E-01
	048	5161	CTD-1287	5.59±0.10E 03		75.0	3C	2.2E 00
	054-1	4575-1	CAD- 969	1.11±0.09E 03		61.3	2CC	2.9E 00
	2	2	970	1.15±0.03E 02		59.0	2CC	1.4E CO
	3	3	971	9.41±0.22E 01		71.3	2CC	1.2E CO
	4	4	972	4.37±0.18E 01		52.7	2CC	1.2E 00
	6	6	973	4.69±0.16E 01		17.5	1CCC	2.1E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANALYMON
A	054-1	4575-1	CAF- 974	2.22±0.09E 01		17.2	100C	8.5E-01
	054-1	4558-1	CCD- 775	2.48±0.06E 03		71.9	2C	4.2E 00
	2	2	776	8.41±0.24E 02		66.8	2C	5.3E 00
	3	3	777	4.82±0.12E 02		77.2	1CC	6.8E 00
	4	4	778	3.81±0.20E 01		34.0	2CC	1.9E 00
	5	5	CCF- 779	1.39±0.06E 01		64.1	2CC	1.5E 00
	060	5164	CTD-1289	1.04±0.03E 03		78.8	2C	2.3E 00
	066-1	4559-1	CCD- 780	1.53±0.04E 03		49.5	2C	3.5E 00
	2	2	781	2.95±0.08E 02		82.3	10C	4.8E 00
	3	3	782	5.87±0.26E 01		50.0	2CC	4.9E 00
	4	4	783	1.95±0.10E 01		55.9	2CC	4.8E 00
	5	5	CCF- 784	9.09±0.46E 00		88.8	2CC	7.0E-01
	066-1	4578-1	CAD- 987	4.39±0.15E 02		73.8	2C	2.6E 00
	2	2	988	7.76±0.27E 01		67.5	1CC	1.4E 00
	3	3	989	3.91±0.14E 01		75.9	2CC	9.0E-01
	4	4	990	2.70±0.16E 01		17.0	4CC	1.1E 00
	6	6	991	2.71±0.10E 01		80.5	2CC	9.7E-01
	7	7	CAF- 992	1.38±0.09E 01		20.7	4CC	1.2E 00
	072	5167	CTD-1291	5.93±0.14E 03		78.1	2C	1.8E 00
	078-1	4565-1	CCD- 805	1.54±0.03E 03		46.8	4C	2.9E 00
	2	2	806	2.30±0.07E 02		76.8	9C	3.4E 00
	3	3	807	9.36±0.26E 01		66.6	2CC	3.3E 00
	4	4	808	1.34±0.02E 02		74.1	3CC	2.6E 00
	5	5	CCF- 809	1.96±0.06E 01		73.6	4CC	1.0E 00
	078-1	4579-1	CAD- 993	1.26±0.04E 03		72.8	9C	2.1E 01
	2	2	994	8.12±0.29E 01		78.3	1CC	1.8E 00
	3	3	995	6.14±0.08E 01		57.8	1CCC	1.1E 00
	4	4	996	3.25±0.04E 01		71.8	1CCC	7.0E-01
	6	6	997	4.35±0.16E 01		34.8	4CC	1.9E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R-RE WORK)	COUNT TIME	ANAL/MON
A	078-7	4579-7	CAF- 998	1.79±0.06E 01		58.8	4CC	1.1E CC
	084	5157	CTD-1284	2.66±0.05E 03		78.0	3C	2.5E 00
	050-1	4566-1	CCD- 810	2.82±0.05E 03		81.7	3C	3.7E 00
	2	2	811	1.38±0.02E 02		71.3	6C	1.CE 00
	3	3	812	3.13±0.08E 02		76.2	8C	3.5E CC
	4	4	813	1.75±0.05E 02		74.0	9C	2.7E CO
	5	5	CCF- 814	2.98±0.09E 01		64.0	4CC	1.1E 00
	050-1	4577-1	CAD- 981	4.47±0.12E 03		70.7	2C	4.2E CO
	2	2	982	1.78±0.05E 02		67.8	4C	1.1E CC
	3	3	983	1.18±0.04E 02		70.8	4C	1.1E 00
	4	4	984	9.40±0.22E 01		72.7	2CC	1.3E CO
	6	6	985	8.01±0.48E 01		20.5	2CC	3.6E CO
	7	7	CAF- 986	3.07±0.09E 01		26.7	1CCC	1.3E CO
	056	5159	CTD-1285	5.07±0.09E 03		80.3	3C	1.5E CC
	102	4564-A	CAD-2198	7.58±0.19E 02	3.64*	31.6	6C	1.3E 00
	102-3	3	CCD-2136	4.08±0.12E 02	1.42	73.1	1CC	3.6E CO
	4	4	2137	1.03±0.03E 02	0.880	71.6	1CC	2.9E CO
	5	5	CCF-2138	3.03±0.07E 01	2.69	55.6	5CC	1.4E 00
	108	5162-A	CTA-2202	9.37±0.33E 02	2.76*	24.0	4C	
	114-1	4560-1	CCD- 785	2.35±0.05E 03		60.4	2C	3.7E CO
	2	2	786	2.92±0.08E 02		71.2	8C	4.0E CC
	3	3	787	1.18±0.04E 02		68.6	1CC	2.4E 00
	4	4	788	5.13±0.20E 01		66.4	2CC	1.8E 00
	5	5	CCF- 789	1.64±0.07E 01		66.6	2CC	1.8E CO
	114-1	4576-1	CAD- 975	7.37±0.21E 02		66.0	2C	2.6E CO
	2	2	976	1.16±0.03E 02		55.5	1CC	1.0E CO
	3	3	977	9.97±0.23E 01		70.7	2CC	1.3E 00
	4	4	978	6.49±0.21E 01		76.5	1CC	9.3E-01
	6	6	979	4.83±0.16E 01		75.3	2CC	5.4E CO

*New data this report

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
A	114-7	4576-7	CAF- 980	1.81±0.06E 01		65.6	400	7.6E-01
	120	5165	CTD-1290	4.98±0.16E 02		76.1	20	1.2E 00
B	034-1	3247-1	CAD-1629	7.03±0.20E 02		70.7	20	4.7E 00
	040	5139	CTD-1716	1.86±0.03E 02		71.1	100	3.7E-01
	068	8154	CDS-1392	5.02±0.14E 04		46.4	20	1.7E 00
	052	5138	CTD-1715	1.61±0.06E 02		29.3	200	2.4E 00
	052	8154	CDS-1393	3.22±0.07E 04		75.4	20	1.3E 00
	056		1394	2.00±0.05E 04		68.8	20	1.2E 00
	100		1395	1.03±0.02E 04		55.7	30	6.9E-01
	104		1396	7.03±0.20E 03		57.3	20	1.3E 00
	108		1397	3.15±0.08E 03		26.2	40	8.0E-01
D	012	5276	CSA-1478	1.15±0.19E 00		78.0	200	CA 1.2E 00
	028-1	5278-1	1498	3.60±0.11E 01		70.8	200	CA 2.1E 00
	2	2	1479	2.44±0.20E 00		76.1	200	CA 2.4E 00
	3	3	1480	5.67±0.31E 00		80.9	200	CA 5.7E 00
	4	4	1481	2.62±0.20E 00		78.3	200	CA 2.6E 00
	5	5	1482	7.76±1.07E-01		82.1	200	CA 7.8E-01
	6	6	1483	7.98±1.10E-01		81.3	200	CA 8.0E-01
	7	7	1484	6.02±0.99E-01		74.4	200	
	8	8	1485	5.43±0.87E-01		84.7	200	
	9	9	1486	9.44±1.12E-01		88.8	200	CA 9.4E-01
	10	10	1487	7.83±0.37E 00		85.5	200	CA 7.8E 00
	11	11	2155	2.23±0.07E 01		79.1	200	CA 5.6E 00
	030	8198	CDS-1777	1.08±0.07E 01		36.0	500	0.0E 00
	034-1	4524-1	CCD-1688	1.45±0.04E 03		22.1	40	7.7E 00
	2	2	1689	2.60±0.62E 00		39.2	50	6.5E-01
	3	3	1690	1.97±0.21E 00		81.5	200	1.6E-01
	4	4	1691	1.22±0.02E 03		75.9	40	1.5E 01
	5	5	CCF-1692	2.26±1.13E-01		66.8	200	6.0E-02

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
D	026-11	4151-11	CSA-2156	0.90±1.81E-01		78.1	4C	CA 9.CE-03
	042	5143	CTA-1717	1.01±0.03E 03		40.8	3C	7.7E 00
	078-1	5277-1	CSA-1488	6.87±0.36E 00		86.6	2CC	CA 6.9E 00
	2	2	1489	5.16±5.16E-02		82.4	2CC	CA 5.CE-02
	3	3	1490	8.80±0.70E-01		86.9	6CC	CA 4.4E-01
	4	4	1491	1.24±0.13E 00		82.0	2CC	CA 6.2E-01
	5	5	1492	0.00±0.17E 00		79.9	4C	CA 1.CE 00
	6	6	1493	8.55±5.70E-02		82.8	2CC	CA 9.CE-02
	7	7	1494	6.78±8.47E-02		83.6	20C	CA 7.CE-02
	8	8	1495	2.26±0.17E 00		88.4	20C	CA 7.5E-01
	9	9	1496	8.18±0.41E 00		84.8	2CC	CA 8.2E 00
	10	10	1497	8.56±0.43E 00		82.2	2CC	CA 8.6E CC
	11	11	2154	1.33±0.04E 01		87.7	5CC	8.3E-01
	1C0	5153	CTD-1718	4.79±0.12E 02		71.3	3C	6.6E-01
F	016-1	8163	CDS-1780	1.51±0.05E 03		70.2	3C	
	2		1781	1.05±0.03E 03		48.4	2CC	1.1E C3
	3		1782	8.72±0.32E 02		73.8	4C	
	4		1783	9.09±0.30E 02		59.9	3C	
	5		1784	1.74±0.06E 03		79.5	1C	
	024-2		1785	1.21±0.03E 03		67.0	3C	
	5		1786	6.63±0.16E 03		76.3	2C	
	026-1	4884-1	CCD-1673	1.19±0.05E 01		68.4	2CC	1.2E 01
	2	2	1674	1.46±0.21E 00		64.8	1CC	3.6E-01
	3	3	1675	5.79±1.70E-01		55.4	1CC	6.CE-01
	4	4	1676	3.90±0.51E-01		84.2	5CC	1.CE-01
	5	5	CCF-1677	5.99±1.82E-01		72.5	2CC	7.CE-02
	030	5052	CTA-1709	1.38±0.03E 03		57.2	3C	1.6E 00
	042-1	8163	CDS-1787	1.38±0.04E 04		58.7	2C	1.3E-01
	2		1788	3.54±0.08E 04		74.5	2C	3.3E-01

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
F	042-3	8163	CDS-1789	2.06±0.06E 04		33.1	2C	2.CE-01
	4		1790	6.13±0.20E 03		58.5	2C	6.CE-02
	5		1791	1.29±0.02E 04		84.7	2C	1.2E-01
	050-1		1792	5.31±0.15E 02		46.1	2CC	6.CE-03
	2		1793	1.95±0.06E 03		65.5	2C	2.CE-02
	4		1794	2.33±0.07E 03		82.0	2C	2.5E-01
	5		1795	3.08±0.10E 03		79.5	2C	3.CE-02
	058-1		1796	2.40±0.06E 02		46.7	3CC	2.4E 02
	2		1797	1.91±0.06E 02		69.6	2CC	1.CE-01
	3		1798	4.60±0.17E 02		77.6	3C	
	4		1799	1.68±0.04E 02		73.5	3CC	1.7E 02
	5		1800	1.07±0.02E 02		82.6	3CC	1.1E 02
	066-2		1801	1.15±0.02E 03		63.5	2CC	1.2E 03
	3		1802	2.09±0.03E 03		79.4	8C	
	4		1803	3.52±0.12E 02		42.8	20C	
	5		1804	4.84±0.14E 02		56.4	2CC	4.6E 02
	074-1		1805	1.96±0.05E 03		71.7	4C	
	2		1806	9.65±0.26E 02		65.6	8C	
	3		1807	3.87±0.12E 02		58.8	6C	
	4		1808	4.99±0.16E 02		75.4	8C	
	5		1809	4.55±0.08E 02		43.9	20C	
	076-1	4893-1	CCD-1678	5.44±0.11E 02		85.4	4C	2.6E 00
	2	2	1679	1.91±0.06E 02		85.1	10C	2.5E 00
	3	3	1680	8.22±0.29E 01		82.1	10C	1.9E 00
	4	4	1681	3.09±0.13E 01		39.6	20C	8.6E-01
	5	5	CCF-1682	2.66±0.13E 01		35.5	20C	7.6E-01
	052-1	8163	CDS-1810	7.36±0.20E 02		52.8	6C	
	2		1811	1.06±0.02E 03		49.4	2CC	
	3		1812	1.78±0.05E 03		71.1	4C	3.6E-01

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
F	052-4	8163	CDS-1813	6.84±0.21E 02		32.1	300	6.6E 02
	5		1814	7.61±0.15E 02		55.6	100	
	102	5058	CTA-1710	3.77±0.12E 01		57.8	100	3.5E-01
	104-1	8163	CDS-1815	4.75±0.09E 02		66.6	100	CA 4.8E 02
	2		1816	5.36±0.18E 01		70.7	200	
	3		1817	9.27±0.26E 01		73.2	200	
	4		1818	8.82±0.23E 01		87.2	200	
	5		1819	1.69±0.06E 02		76.4	80	
G	050	8158	1778	3.70±0.17E 01		44.4	200	3.7E 01
H	030	5036	CTA-1708	4.05±0.08E 02		60.8	60	2.4E 00
	030-1	4838-1	CCD-1668	1.48±0.04E 02		72.6	200	4.6E 00
	2	2	1669	1.26±0.04E 02		40.5	200	4.5E 00
	3	3	1670	2.69±0.08E 02		45.9	200	7.5E 00
	4	4	1671	2.31±0.08E 01		69.8	200	1.2E 00
	5	5	CCF-1672	0.00±0.29E 00		38.1	50	1.0E-02
J	086-1	4914-1	CCD-1683	5.10±0.30E 00		76.0	200	6.4E-01
	2	2	1684	5.06±0.15E 01		60.0	200	1.5E 00
	3	3	1685	3.81±0.09E 01		35.5	500	1.3E 00
	4	4	1686	1.77±0.04E 01		84.6	500	2.2E 00
	5	[illegible]	CCF-1687	1.99±0.08E 01		57.5	200	7.4E-01
	050	5076	CTA-1711	5.81±0.16E 01		55.4	100	3.6E-01
K	076	5093	1712	2.94±0.04E 02		63.7	100	3.6E-01
L	030	5108	1713	1.01±0.14E 00		26.8	500	CA 2.5E-01
	030	8198	CDS-1779	3.11±0.09E 02		50.8	100	2.0E-02
	060	5111	CTA-1312	1.82±0.06E 01		62.0	400	1.1E 00
	066	5114	1314	4.57±0.18E 01		76.2	50	8.2E-01
	074	5119	CTD-1283	8.86±0.35E 01		79.2	30	3.3E-01
	086-1	4944-1	CCD- 760	5.11±0.38E 00		34.4	400	6.0E-01
	2	2	761	5.00±0.16E 01		29.6	400	1.2E 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLH COLLECTION NO.	TLH ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
L	0E6-3	4S44-3	CCD- 762	2.72±0.11E 01		44.6	40C	1.7E 00
	4	4	763	1.15±0.05E 01		54.6	4CC	9.CE-01
	5	5	CCF- 764	3.64±0.35E 00		28.6	4CC	2.CE-01
	0S0	5116	CTA-1714	2.34±0.33E 00		40.6	2CC	8.4E-01
	0S8-1	4S45-1	CCD- 765	1.80±0.50E-01		75.2	4CC	CA 1.CE 00
	2	2	766	4.61±0.32E 00		67.C	2CC	6.CE-01
	3	3	767	4.22±0.36E 00		45.8	2CC	5.CE-01
	4	4	768	1.58±0.18E 00		78.1	2CC	6.CE-C2
	5	5	CCF- 769	1.43±0.22E 00		74.2	10C	3.CE-02
	1C0	5117	CTD-1282	0.00±0.22E 00		64.8	4C	CA 1.CE 00
	1C2	5112	CTA-1313	2.44±0.20E 00		77.4	2CC	3.CE-01
	114	51C7	1311	5.90±3.50E-01		60.1	4C	CA 1.CE 00
BBAL	L3,P13	5370	CBS-2037	2.16±0.03E 04		78.5	4C	7.2E-01
	L3,P2		2038	1.14±0.02E 04		81.6	2C	
	L3,P1		2039	1.28±0.02E 05		68.2	4C	1.5E 00
	EIC-128-5	NONE	CSF-1987	1.02±0.03E 05	94.1	28.1	3C	9.1E 00
	6		1988	1.81±0.05E 05	22.7	37.2	3C	9.CE 00
	7		1989	1.22±0.03E 05	24.9	56.5	2C	7.5E 00
	8		1990	9.97±0. 04	94.2	34.6	4C	9.3E 00
	9		1991	2.77±0.08E 04	1.30	53.6	2C	3.3E 00
	10		1992	1.67±0.03E 04	55.5	35.4	6C	1.7E 00
	11		1993	5.05±0.15E 04	628.	33.5	3C	2.1E-01
	13-5		1994	2.09±0.05E 05	160.	27.5	4C	1.5E 01
	6		1995	5.57±0.13E 05	112.	45.6	3C	
	7		1996	3.66±0.07E 05	558.	50.2	4C	2.1E 01
	8		1997	1.97±0.06E 05	398.	26.8	3C	
	9		1998	9.03±0.22E 04	101.	43.0	3C	8.8E 00
	1C		1999	4.07±0.11E 04	106.	35.1	3C	3.4E 00
	11		2000	9.99±0.31E 04	247.	21.8	4C	1.2E C00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
EIC-14A-	5	NONE	CSF-2008	2.83±0.08E 05	73.8	28.0	3C	2.2E 01
	7		2010	6.07±0.20E 05	295.	* 36.9	2C	3.4E 01
	6		2009	6.44±0.14E 05	896.	40.5	4C	2.2E 01
	8		2011	3.13±0.07E 05	112.	31.5	4C	2.8E 01
	9		2012	7.60±0.14E 04	51.9	68.6	4C	1.2E 01
	10		2013	4.97±0.14E 04	37.6	28.5	4C	7.CE 00
	11		2014	1.24±0.03E 05	3500.	15.0	5C	2.2E 00
MOB	DM-C1-1	5CC5-1	CCD- 875	0.00±0.07E 00		52.6	2CC	CA 1.CE 00
	2	2	876	0.00±0.22E 00		28.5	2CC	CA 1.CE 00
	3	3	877	6.00±8.00E-02		56.7	20C	CA 1.CE 00
	4	4	878	1.20±1.20E-01		39.4	2CC	CA 1.CE CO
	5	5	CCF- 879	6.00±9.00E-02		50.3	2CC	CA 1.CE CO
	C2-1	5CC6-1	CCD- 880	4.20±1.20E-01		76.8	20C	2.5E-01
	2	2	881	4.10±1.50E-01		45.9	20C	CA 1.CE 00
	3	3	882	1.50±0.90E-01		55.0	2CC	CA 1.CE CO
	4	4	883	2.33±0.26E 00		46.1	2CC	CA 2.3E CO
	5	5	CCF- 884	3.20±1.30E-01		62.2	20C	2.5E-01
	C3-1	5C00-1	CCD- 855	4.71±0.13E 01		66.7	4CC	3.9E CO
	2	2	856	1.20±0.90E-01		43.2	4CC	CA 1.CE 00
	3	3	857	1.20±0.70E-01		64.8	4CC	CA 1.CE CO
	4	4	858	6.00±5.00E-02		59.8	4CC	CA 1.CE 00
	5	5	CCF- 859	5.20±1.30E-01		37.5	4CC	CA 1.CE 00
	C4-1	5CC2-1	CCD- 860	7.40±0.45E 00		34.0	4CC	1.8E 00
	2	2	861	8.00±6.00E-02		74.5	4CC	CA 1.CE CO
	3	3	862	2.70±1.50E-01		61.5	1CC	CA 1.CE 00
	4	4	863	3.90±1.70E-01		55.1	10C	CA 2.5E-01
	5	5	CCF- 864	4.00±3.00E-02		56.2	4CC	CA 1.CE 00
	C5-1	5CC4-1	CCD- 870	1.80±0.08E 01		31.9	4CC	2.3E CO
	2	2	871	-0.50±1.60E-01		35.0	2CC	CA 1.CE 00

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (CPM)	URANIUM (MICROGRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
MOB	DM-C5-3	5CC4-3	CCD- 872	9.40±1.60E-01		26.2	4CC	CA 1.CE 00
	4	4	873	1.90±1.90E-01		31.5	2CC	CA 1.CE-01
	5	5	CCF- 874	6.00±9.00E-02		64.4	2CC	CA 1.CE 00
	C6-1	5CC7-1	CCD- 885	9.90±1.20E-01		48.0	4CC	2.5E-01
	2	2	886	1.22±0.18E 00		50.2	20C	CA 1.CE 00
	3	3	887	0.00±0.10E 00		45.5	2CC	CA 1.CE 00
	4	4	888	0.40±1.50E-01		47.6	2CC	CA 1.CE 00
	5	5	CCF- 889	3.20±1.40E-01		49.3	2CC	CA 1.CE 00
	C7-1	5CC3-1	CCD- 865	5.93±0.17E 02		72.5	20C	2.4E 01
	2	2	866	5.54±0.17E 01		83.2	20C	1.7E 00
	3	3	867	4.70±0.11E 01		82.8	4CC	2.5E 00
	4	4	868	5.52±0.28E 00		56.5	4CC	1.4E 00
	5	5	CCF- 869	1.38±0.19E 00		50.4	2CC	3.CE-01
	C8-1	5C14-1	CAD-1047	7.78±0.22E 02		69.7	2C	1.3E 00
	2	2	1048	5.15±0.19E 01		62.4	1CC	7.8E-01
	3	3	1049	1.00±0.07E 01		34.6	2CC	4.2E-01
	4	4	1050	5.77±0.35E 00		55.3	3CC	4.1E-01
	6	6	1051	3.43±0.26E 00		70.1	2CC	3.8E-01
	7	7	CAF-1052	1.62±0.15E 00		88.8	2CC	CA 1.4E 00
	11-1	5CC1-1	CCD-1698	8.45±0.16E 02		81.6	4C	4.1E 00
	2	2	1699	1.48±0.05E 02		84.6	1CC	2.7E 00
	3	3	1700	1.97±0.07E 01		63.6	3CC	2.CE 01
	4	4	1701	1.49±0.18E 00		39.8	3CC	1.5E 00
	5	5	CCF-1702	2.66±0.23E 00		60.5	2CC	2.CE-01
	15-1	4599-1	CCD- 850	1.23±0.03E 03		81.5	2C	2.5E 00
	2	2	851	1.58±0.03E 02		72.3	8C	1.6E 00
	3	3	852	7.08±0.45E 00		54.9	2CC	1.8E 00
	4	4	853	3.17±0.27E 00		61.4	2CC	CA 3.CE 00
	5	5	CCF- 854	9.10±1.40E-01		55.9	2CC	CA 1.CE 00

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=REWORK)	COUNT TIME	ANAL/MON
MOB	OM-16-1	5009-1	CCD- 890	4.34±0.18E 02		75.6	20	2.1E 00
	2	2	891	1.35±0.03E 02		75.5	100	1.6E 00
	3	3	892	3.65±0.33E 00		26.6	400	5.0E-01
	4	4	893	9.70±1.70E-01		40.2	200	1.0E 00
	5	5	CCF- 894	0.60±1.80E-01		29.6	200	CA 1.0E 00
	IM-11-1	5023-1	CCD-1703	1.47±0.07E 01		46.1	200	1.2E 00
	2	2	1704	1.10±0.06E 01		36.2	300	1.1E 01
	3	3	1705	1.18±0.68E-01		51.5	300	1.2E-01
	4	4	1706	1.38±0.92E-01		37.9	300	3.0E-02
	5	5	CCF-1707	7.10±5.70E-02		65.4	300	9.0E-03
OA	CSI-J-CCO	5205	CTD-1303	6.36±0.20E 02		80.2	20	1.3E 00
	K-CCO	5206	1304	2.76±0.07E 03		76.5	20	2.4E 00
	L-CCO	5213	1307	6.33±0.19E 02		84.5	20	2.0E 00
	M-CCO	5212	1306	5.73±0.18E 02		77.4	20	8.7E-01
	N-CCO	5211	1305	8.32±0.26E 02		74.4	20	1.4E 00
	CC6	5217	1310	2.45±0.07E 02		77.0	300	2.5E 02
	012	5216	1309	3.20±0.12E 02		84.6	20	2.0E 00
	018	5215	1308	3.52±0.14E 01		83.2	100	8.6E-01
	CMR-C1A	9709	CVS-1502	7.84±0.44E 00		59.5R	200	
	C1B		1503	1.07±0.05E 01		31.0	600	
	C2A		1504	6.65±0.31E 00		41.5	500	6.6E 00
	C2B		1505	1.63±0.04E 02		69.8	200	
	C3A		1506	1.05±0.13E 00		70.9	200	
	C3B		1507	7.14±0.29E 01		14.4	500	
	C1A	9723	1475	1.40±0.04E 03		05.8	1000	
	C1B		1476	7.42±0.22E 02		40.5	200	
	C2A		1477	6.76±0.26E 01		14.4	600	
	C2B		1499	1.46±0.06E 02		24.6R	200	
	C3A		1500	3.26±0.05E 01		79.5	800	

CONFIDENTIAL

TABLE E.4 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	PU-239,240 ACTIVITY (DPM)	URANIUM (MICRO GRAMS)	YIELD (R=RE WORK)	COUNT TIME	ANALYSIS
OA	CMR-C3B	9723	CVS-1501	6.86±1.23E 01		03.5R	1CC	
PCMR	2-C1-5	NONE	CSF-2015	1.05±0.08E 01	35.2	55.6	2CC	2.CE-02
	6		2016	9.33±0.61E 00	7.64	83.8	2CC	2.CE-02
	7		2017	9.42±0.52E 01	28.4	42.6	2CC	4.6E-01
	8		2018	4.36±0.13E 02	9.12	47.1	2CC	5.3E CO
	9		2019	3.26±0.10E 01	0.358	86.6	2CC	3.3E-01
	10		2020	3.05±0.11E 01	2.14	80.C	2CC	6.1E 01
	11		2021	3.02±0.11E 01	4.03	81.7	2CC	6.7E-01
	C2-5		2022	1.62±0.12E 01	46.0	41.5	2CC	2.5E-01
	6		2023	2.22±0.29E 01	42.1	30.5	2CC	2.CE-02
	7		2024	1.18±0.09E 01	29.4	48.9	20C	2.5E-01
	8		2025	2.92±0.09E 02	3.40	42.2	2CC	9.7E CO
	9		2026	1.15±0.04E 02	14.7	87.7	1CC	4.6E CO
	10		2027	3.89±0.34E 00	1.28	83.8	2CC	1.5E+CO
	11		2028	2.16±0.32E 01	136.	24.6	2CC	4.2E-01
	C3-5		2029	3.60±0.32E 00	15.5 *	88.4	2CC	9.CE-02
	6		2030	8.25±4.13E 00	19.9	68.7	4C	1.CE-01
	7		2031	0.00±5.66E 00	105.	25.C	4C	4.6E 01
	8		2032	2.66±0.28E 00	14.8	82.5	2CC	1.6E-01
	9		2033	1.77±0.21E 00	7.80	89.2	2CC	7.CE-02
	10		2034	3.84±0.17E 01	33.0	23.8	5CC	1.CE CC
	11		2035	3.41±0.14E 01	90.9	42.6	2CC	8.CE-02

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.5 RADIOCHEMICAL ANALYSIS OF BIOLOGICAL SAMPLES, DOGS

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1001 - 1	LEFT FEMUR	RDB 650	1.4 OZS.	0.00±0.25E 00	40	55.5		C.S. II
" 2	KIDNEY	RDK 140	3.0 OZS.	2.12±1.27E-01	100	63.7		C.S. II
" 3	LIVER	RDL 426	13.7 OZS.	3.83±1.41E-01	800	18.7		C.S. II TAGGED X170-3
" 5	HILAR NODE	RDH 214	0.3 OZS.	3.00±3.70E-02	500	76.5		C.S. II
1019 - 1	LEFT FEMUR	RDB 625	1.7 OZS.	2.30±2.30E-01	40	54.8	0.580	C.S. II
" 2	KIDNEY	RDK 428	2.1 OZS.	1.36±0.16E 00	500	34.5	0.224	C.S. II
" 3	LIVER	RDL 421	12.1 OZS.	2.05±0.12E 00	1000	42.0	0.064	C.S. II
" 4	LUNG	RDR 482	3.2 OZS.	5.68±0.27E 00	500	58.4		C.S. II
" 5	HILAR NODE	RDH 401	0.3 OZS.	0.70±1.40E-01	100	40.2	0.563	C.S. II
1020 - 1	LEFT FEMUR	RDB 635	1.4 OZS.	2.10±8.60E-02	400	33.[illegible]	0.567	C.S. II
" 2	KIDNEY	RDK 449	2.1 OZS.	0.00±0.25E 00	60	37.3	0.273	C.S. II FOUND 2/20/64
" 3	LIVER	RDL 392	9.1 OZS.	1.38±0.13E 00	1000	24.4R	0.050	C.S. II
" 4	LUNG	RDR 480	2.9 OZS.	3.36±0.20E 00	500	53.5	2.88	C.S. II
" 5	HILAR NODE	RDH 447	0.3 OZS.	2.40±6.10E-02	500	48.5	0.734	C.S. II
1022 - 1	LEFT FEMUR	RDB 657	1.4 OZS.	0.00±0.17E 00	40	85.4		
" 2	KIDNEY	RDK 150	1.8 OZS.					LOST IN DISS.
" 3	LIVER	RDL 159	10.7 OZS.	2.53±0.93E-01	400	59.2		
" 4	LUNG	RDR 311	3.5 OZS.	5.03±0.16E 01	400	55.8	0.182	
" 5	HILAR NODE	RDH 176	0.3 OZS.	3.82±0.32E 00	1000	12.5R		
" 7	TRACHEA	RDT 141	1.4 OZS.	4.57±0.15E 02	200	56.5		
" 8	G. I. TRACT	RDS 628	6.2 OZS.	3.86±0.14E 02	40	29.1		TAGGED 'CONTENTS EXPOSED'
" 9	P. MUCOSA	RDP 56	0.4 OZS.	5.27±0.36E 00	200	59.4		
" 10	N. MUCOSA	RDN 327	0.6 OZS.	4.76±0.25E 00	600	38.6		
1023 - 1	LEFT FEMUR	RDB 609	1.2 OZS.	9.50±1.33E-01	500	32.3	0.179	C.S. II
" 2	KIDNEY	RDK 396	2.1 OZS.	4.10±5.20E-02	600	45.8	0.144	C.S. II
" 3	LIVER	RDL 425	12.3 OZS.	8.20±0.82E-01	900	36.5	0.209	C.S. II
" 4	LUNG	RDR 485	3.3 OZS.	3.13±0.19E 00	400	64.5	0.335	C.S. II

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1024 - 1	LEFT FEMUR	RDB 655	1.1 OZS.	1.23±2.47E-01	40	57.5		
" 2	KIDNEY	RDK 215	1.7 OZS.	4.74±5.93E-02	400	66.4		
" 3	LIVER	RDL 137	10.5 OZS.					LOST IN DISS.
" 4	LUNG	RDR 334	2.7 OZS.	5.39±0.34E 00	600	27.8R	0.490	
" 5	HILAR NODE	RDH 66	0.2 OZS.	1.50±5.80E-02	300	64.9		
" 7	TRACHEA	RDT 80	1.4 OZS.	2.10±1.20E-01	200	39.4		
" 8	G. I. TRACT	RDS 627	5.8 OZS.	8.56±0.31E 01	40	77.2		
" 9	P. MUCOSA	RDP 169	0.6 OZS.	5.22±6.95E-02	200	67.9		
" 10	N. MUCOSA	RDN 329	0.6 OZS.	1.23±0.78E-01	600	42.2		
1029 - 1	LEFT FEMUR	RDB 649	1.4 OZS.	0.00±0.20E 00	60	50.6		
" 2	KIDNEY	RDK 165	2.0 OZS.	0.00±0.04E 00	400	84.6		
" 3	LIVER	RDL 216	10.0 OZS.	2.25±0.80E-01	400	49.0		
" 4	LUNG	RDR 336	3.6 OZS.	4.58±0.17E 01	300	54.3	0.567	
" 5	HILAR NODE	RDH 175	0.2 OZS.	4.15±0.27E 00	1000	20.4R		
" 7	TRACHEA	RDT 211	1.8 OZS.	2.13±0.09E 01	400	44.3		
" 8	G. I. TRACT	RDS 612	12.0 OZS.	2.55±0.08E 02	50	43.2		
" 9	P. MUCOSA	RDP 61	0.6 OZS.	1.84±1.47E-01	300	60.2		
" 10	N. MUCOSA	RDN 306	0.8 OZS.	2.21±0.10E 01	600	21.6		TAGGED 'VOMITED'
1035 - 1	LEFT FEMUR	RDB 663	1.5 OZS.	0.00±0.20E 00	40	69.8R		
" 2	KIDNEY	RDK 116	2.6 OZS.	3.60±6.00E-02	600	37.2R		
" 3	LIVER	RDL 204	9.3 OZS.	2.51±0.74E-01	400	54.6		
" 4	LUNG	RDR 330	3.0 OZS.	5.17±0.12E 01	600	58.8	0.550	
" 5	HILAR NODE	RDH 153	0.3 OZS.					LOST IN DISS.
" 7	TRACHEA	RDT 174	1.6 OZS.	8.26±1.06E-01	400	55.7		
" 8	G. I. TRACT	RDS 630	5.4 OZS.	1.04±0.02E 02	100	61.9		
" 9	P. MUCOSA	RDP 64	0.4 OZS.	1.12±0.10E 00	600	58.7		
" 10	N. MUCOSA	RDN 326	0.9 OZS.	0.74±1.24E-01	1000	11.4R		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.8 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (CPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1040 - 1	LEFT FEMUR	RDB 660	1.4 OZS.	0.85±1.69E-01	40	83.7		
" 2	KIDNEY	RDK 79	2.1 OZS.	1.22±0.98E-01	200	48.2		
" 3	LIVER	RDL 206	8.5 OZS.	5.28±0.63E-01	900	41.8		
" 4	LUNG	RDR 338	3.1 OZS.	5.58±1.29E-01	300	46.3	0.928	
" 5	HILAR NODE	RDH 55	0.3 OZS.	1.31±1.15E-01	200	72.2		
" 7	TRACHEA	RDT 196	1.1 OZS.	1.63±0.68E-01	400	59.4		
" 8	G. I. TRACT	RDS 622	5.5 OZS.	2.69±0.08E 03	30	41.1		
" 9	P. MUCOSA	RDP 67	0.4 OZS.	1.11±0.12E 00	300	76.9		VOMIT INCLUDED
" 10	N. MUCOSA	RDN 318	0.9 OZS.	7.00±0.33E 00	1000	25.3R		
1041 - 1	LEFT FEMUR	RDB 641	1.6 OZS.	4.93±4.93E-01	40	38.3		
" 2	KIDNEY	RDK 78	2.4 OZS.	3.28±1.79E-01	200	39.6		
" 3	LIVER	RDL 148	12.9 OZS.					LOST IN DISS.
" 4	LUNG	RDR 317	4.0 OZS.	1.37±0.05E 01	400	63.8	0.073	
" 5	HILAR NODE	RDH 200	0.2 OZS.	0.00±0.07E 00	200	69.2		
" 7	TRACHEA	RDT 163	2.2 OZS.	1.04±0.06E 01	200	61.8		
" 8	G. I. TRACT	RDS 633	8.0 OZS.	5.35±0.17E 02	60	23.3		
" 9	P. MUCOSA	RDP 73	0.8 OZS.	4.80±3.80E-02	400	74.2		
" 10	N. MUCOSA	RDN 323	0.8 OZS.	3.83±3.83E-01	70	31.7		
1045 - 2	KIDNEY	RDK 158	3.4 OZS.	4.21±4.21E-01	40	50.5	0.041	C.S. II
1046 - 1	LEFT FEMUR	RDB 608	1.6 OZS.	1.28±0.85E-01	400	36.9		C.S. II
" 2	KIDNEY	RDK 451	2.1 OZS.	1.14±2.27E-01	60	41.6	0.166	C.S. II
" 5	HILAR NODE	RDH 440	0.3 OZS.	0.00±0.10E 00	100	58.7	0.411	C.S. II

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.5 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1050 - 1	LEFT FEMUR	RDB 666	1.4 OZS.	0.00±0.25E 00	40	55.5		
** 2	KIDNEY	RDK 86	1.8 OZS.	2.36±4.72E-02	200	70.6		
** 3	LIVER	RDL 135	10.3 OZS.	0.54±1.08E-01	600	26.1R		
** 4	LUNG	RDR 341	3.4 OZS.	2.55±0.24E 00	600	22.6R	0.082	
** 5	HILAR NODE	RDH 62	0.[illegible] OZS.	1.01±1.01E-01	300	55.1		
** 7	TRACHEA	RDT 82	1.5 OZS.	7.56±0.42E 00	200	68.0		
** 8	G. I. TRACT	RDS 632	5.3 OZS.	1.64±0.04E 04	20	54.0		
** 9	P. MUCOSA	RDP 168	0.5 OZS.	1.64±0.07E 01	200	70.9		
** 10	N. MUCOSA	RDN 309	0.8 OZS.	2.49±0.07E 02	500	36.2		
1054 - 1	LEFT FEMUR	RDB 662	0.9 OZS.	0.00±0.33E 00	40	42.7		
** 2	KIDNEY	RDK 89	1.4 OZS.	-2.30±9.20E-02	500	24.3		
** 3	LIVER	RDL 90	8.5 OZS.	8.50±8.50E-02	300	58.7		
** 4	LUNG	RDR 340	2.2 OZS.	3.63±0.26E 00	700	26.2		
** 5	HILAR NODE	RDH 199	0.2 OZS.	1.24±0.12E 00	500	48.8R		
** 7	TRACHEA	RDT 213	1.0 OZS.	1.16±0.18E 00	1000	11.0		
** 8	G. I. TRACT	RDS 618	4.2 OZS.	3.26±0.06E 03	200	13.3		
** 9	P. MUCOSA	RDP 145	0.3 OZS.	6.14±1.17E-01	1000	12.9R		
** 10	N. MUCOSA	RDN 308	0.7 OZS.	4.14±1.32E-01	400	35.8		
1060 - 1	LEFT FEMUR	RDB 639	1.7 OZS.	1.10±2.21E-01	40	57.0		
** 2	KIDNEY	RDK 81	2.0 OZS.	0.00±0.05E 00	200	48.9		
** 3	LIVER	RDL 149	14.0 OZS.					LOST IN DISS.
** 4	LUNG	RDR 312	3.3 OZS.	9.95±1.34E-01	600	28.5		
** 5	HILAR NODE	RDH 58	0.3 OZS.	5.00±6.30E-02	400	61.5		
** 7	TRACHEA	RDT 142	1.6 OZS.	0.61±1.84E-01	100	44.1		
** 8	G. I. TRACT	RDS 613	1.9 LBS.	5.75±0.63E 00	200	17.4R		
** 9	P. MUCOSA	RDP 74	0.5 OZS.	0.00±0.04E 00	400	67.1		
** 10	N. MUCOSA	RDN 328	0.8 OZS.	1.82±0.73E-01	600	26.0		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1062 - 1	LEFT FEMUR	RDB 617	1.5 OZS.	-0.38±1.53E-01	700	09.9R	0.345	C.S. II
" 2	KIDNEY	RDK 393	2.7 OZS.	3.89±3.89E-01	40	36.4	0.082	C.S. II
" 3	LIVER	RDL 420	14.1 OZS.	1.01±0.14E 00	400	38.8	0.110	C.S. II
" 4	LUNG	RDR 484	3.8 OZS.	2.88±0.23E 00	500	37.0		C.S. II
" 5	HILAR NODE	RDH 441	0.2 OZS.	0.92±1.37E-01	100	61.9	0.311	C.S. II
1067 - 1	LEFT FEMUR	RDB 648	1.0 OZS.	0.96±1.72E-01	60	60.0		
" 2	KIDNEY	RDK 111	1.4 OZS.	0.82±1.03E-01	200	57.5		
" 3	LIVER	RDL 218	7.3 OZS.	2.14±0.83E-01	600	39.1		
" 4	LUNG	RDR 316	2.4 OZS.	1.05±0.05E 01	600	37.4	0.099	
" 5	HILAR NODE	RDH 71	0.3 OZS.	7.60±5.10E-02	300	74.3		
" 7	TRACHEA	RDT 160	1.3 OZS.	9.79±9.79E-02	500	30.2		
" 8	G. I. TRACT	RDS 619	5.3 OZS.	9.85±0.65E 00	200	28.8		
" 9	P. MUCOSA	RDP 88	0.4 OZS.	1.00±0.71E-01	300	69.8		
" 10	N. MUCOSA	RDN 307	0.5 OZS.	8.90±5.60E-02	400	63.6		
1069 - 1	LEFT FEMUR	RDB 661	1.2 OZS.	1.04±2.09E-01	40	67.9R		
" 2	KIDNEY	RDK 139	1.8 OZS.					LOST IN DISS.
" 3	LIVER	RDL 217	8.9 OZS.	6.69±0.94E-01	900	25.9		
" 4	LUNG	RDR 291	3.1 OZS.	1.21±0.19E 00	200	40.8		
" 5	HILAR NODE	RDH 63	0.3 OZS.	1.14±0.16E 00	300	51.5		
" 7	TRACHEA	RDT 83	1.4 OZS.	1.42±0.71E-01	400	54.6R		
" 8	G. I. TRACT	RDS 634	5.2 OZS.	1.15±0.03E 03	100	17.9		
" 9	P. MUCOSA	RDP 110	0.5 OZS.	1.01±0.84E-01	200	70.1		
" 10	N. MUCOSA	RDN 321	0.7 OZS.	0.00±0.09E 00	400	28.5		
1073 - 1	LEFT FEMUR	RDB 616	1.7 OZS.	2.18±1.87E-01	700	12.2R	0.433	C.S. II
" 2	KIDNEY	RDK 446	2.2 OZS.	1.14±1.71E-01	100	45.1	0.112	C.S. II
" 3	LIVER	RDL 427	13.4 OZS.	9.40±1.32E-01	400	37.3	0.695	C.S. II
" 4	LUNG	RDR 481	3.7 OZS.	3.94±0.21E 00	500	54.8	1.16	C.S. II
" 5	HILAR NODE	RDH 437	0.3 OZS.	5.10±3.60E-02	600	64.8	0.230	C.S. II

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.5 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1074 - 1	LEFT FEMUR	RDB 640	1.4 OZS.	1.01±2.02E-01	40	62.2		
" 2	KIDNEY	RDK 113	1.8 OZS.	2.90±4.80E-02	500	54.1		
" 3	LIVER	RDL 203	7.5 OZS.	6.16±1.11E-01	500	27.6R		
" 4	LUNG	RDR 314	2.7 OZS.	1.85±0.85E-01	300	60.2		
" 5	HILAR NODE	RDH 70	0.3 OZS.	0.00±0.04E 00	300	52.4		
" 7	TRACHEA	RDT 151	1.7 OZS.					LOST IN DISS.
" 8	G. I. TRACT	RDS 629	1.9 LBS.	2.32±0.84E 00	60	24.4		
" 9	P. MUCOSA	RDP 75	0.5 OZS.	5.90±4.90E-02	400	72.4		
" 10	N. MUCOSA	RDN 302	0.8 OZS.	3.92±2.24E-01	400	11.2		
1081 - 1	LEFT FEMUR	RDB 637	1.7 OZS.	2.77±1.23E-01	400	23.0		
" 2	KIDNEY	RDK 87	2.1 OZS.	1.78±1.19E-01	200	56.3		
" 3	LIVER	RDL 209	11.0 OZS.	5.38±0.54E-01	900	53.2		
" 4	LUNG	RDR 315	3.6 OZS.	4.91±0.18E 01	400	39.0	0.516	
" 5	HILAR NODE	RDH 77	0.3 OZS.	9.00±9.00E-02	200	68.7		
" 7	TRACHEA	RDT 161	1.6 OZS.	7.74±0.45E 00	200	64.1		
" 8	G. I. TRACT	RDS 615	6.0 OZS.	7.61±0.19E 02	100	17.5		
" 9	P. MUCOSA	RDP 198	0.4 OZS.	1.16±0.31E-01	400	81.6		
" 10	N. MUCOSA	RDN 320	0.8 OZS.	2.64±0.32E 00	900	09.2R		
1087 - 1	LEFT FEMUR	RDB 664	1.5 OZS.	4.06±4.06E-01	40	34.9		
" 2	KIDNEY	RDK 207	2.3 OZS.	0.00±0.31E 00	60	30.4		
" 3	LIVER	RDL 227	10.0 OZS.	4.41±0.64E-01	500	62.8		
" 4	LUNG	RDR 313	3.5 OZS.	6.01±0.17E 01	400	59.6	0.319	
" 5	HILAR NODE	RDH 59	0.2 OZS.	5.60±2.80E-01	600	10.9		
" 7	TRACHEA	RDT 162	1.7 OZS.	1.59±0.19E 00	200	59.2		
" 8	G. I. TRACT	RDS 621	5.4 OZS.	2.75±0.05E 03	100	20.5R		
" 9	P. MUCOSA	RDP 69	0.5 OZS.	1.90±1.90E-01	200	36.8		
" 10	N. MUCOSA	RDN 303	1.0 OZS.	2.25±0.47E-01	900	32.2		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.5 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1094 - 1	LEFT FEMUR	RDB 638	2.0 OZS.	5.07±1.45E-01	400	29.3		
" 2	KIDNEY	RDK 450	2.8 OZS.	2.37±0.47E-01	500	62.2		
" 3	LIVER	RDL 210	12.4 OZS.	1.10±0.29E-01	500	76.9		
" 4	LUNG	RDR 342	4.5 OZS.	1.06±0.03E 02	400	43.1	0.098	
" 5	HILAR NODE	RDH 144	0.3 OZS.	0.00±6.00E 00	40	68.6		
" 7	TRACHEA	RDT 171	2.6 OZS.	2.50±0.09E 01	900	21.4		
" 8	G. I. TRACT	RDS 610	8.0 OZS.	2.38±0.07E 02	50	55.1		
" 9	P. MUCOSA	RDP 68	0.4 OZS.	1.24±0.16E 00	200	64.9		
" 10	N. MUCOSA	RDN 344	1.0 OZS.	1.53±0.07E 01	1000	18.8R		
1096 - 1	LEFT FEMUR	RDB 651	1.3 OZS.	0.00±0.18E 00	40	78.5		
" 2	KIDNEY	RDK 452	2.6 OZS.	5.59±1.49E-01	1000	15.2R		FOUND 2/20/64
" 3	LIVER	RDL 226	10.8 OZS.	3.33±0.93E-01	400	59.1		
" 4	LUNG	RDR 339	3.5 OZS.	1.77±0.64E-01	600	66.5		
" 5	HILAR NODE	RDH 84	0.2 OZS.	-3.80±7.60E-02	200	43.7		
" 7	TRACHEA	RDT 167	2.2 OZS.	4.40±2.80E-02	600	85.1		
" 8	G. I. TRACT	RDS 620	2.5 LBS.	4.80±0.57E 00	200	18.0		TAGGED 'LARGE'
" 9	P. MUCOSA	RDP 57	0.7 OZS.	7.00±8.80E-02	200	67.7		
" 10	N. MUCOSA	RDN 319	0.8 OZS.	1.59±0.17E 00	400	42.5		
1097 - 1	LEFT FEMUR	RDB 624	1.5 OZS.	1.69±2.54E-01	60	60.8	0.435	C.S. II
" 2	KIDNEY	RDK 444	2.2 OZS.	1.76±0.88E-01	400	53.8		C.S. II
" 3	LIVER	RDL 397	10.2 OZS.	8.00±1.08E-01	600	28.8	0.074	C.S. II
" 4	LUNG	RDR 483	3.3 OZS.	3.04±0.21E 00	500	47.3	0.299	C.S. II
" 5	HILAR NODE	RDH 442	0.2 OZS.	-0.55±1.10E-01	100	51.7	0.214	C.S. II

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1099 - 1	LEFT FEMUR	RDB 642	1.7 OZS.	2.05±4.11E-01	40	34.5		
" 2	KIDNEY	RDK 164	2.1 OZS.	9.10±5.50E-02	400	86.6		
" 3	LIVER	RDL 205	12.0 OZS.	6.61±0.66E-01	900	46.7		
" 4	LUNG	RDR 332	4.0 OZS.	1.09±0.06E 01	900	29.7	0.311	
" 5	HILAR NODE	RDH 152	0.2 OZS.					LOST IN DISS.
" 7	TRACHEA	RDT 197	1.6 OZS.	3.11±1.09E-01	400	51.9		TAGGED 'BLOOD IN TRACHEA'
" 8	G. I. TRACT	RDS 626	7.0 OZS.	1.17±0.04E 03	40	17.9		INFO TAG UNREADABLE
" 9	P. MUCOSA	RDP 65	0.4 OZS.	3.86±0.10E 01	600	59.8		
" 10	N. MUCOSA	RDN 324	0.9 OZS.	9.49±0.27E 01	1000	23.9R		
1117 - 1	LEFT FEMUR	RDB 665	1.3 OZS.	0.00±0.50E 00	40	28.4		
" 2	KIDNEY	RDK 138	1.7 OZS.	1.14±2.28E-01	40	62.1		
" 3	LIVER	RDL 134	13.3 OZS.	4.00±0.64E-01	600	45.3R		
" 4	LUNG	RDR 310	3.2 OZS.	3.97±0.19E 00	600	61.0	0.251	
" 5	HILAR NODE	RDH 201	0.2 OZS.	8.88±0.98E-01	400	66.8		
" 7	TRACHEA.	RDT 173	1.5 OZS.	2.01±0.16E 00	400	57.2		
" 8	G. I. TRACT	RDS 623	6.6 OZS.	7.08±0.23E 02	30	34.8		
" 9	P. MUCOSA	RDP 76	0.5 OZS.	1.07±0.05E 01	200	68.7		
" 10	N. MUCOSA	RDN 304	0.7 OZS.	1.49±0.07E 01	400	46.7		
1119 - 4	LUNG	RDR 337	3.8 OZS.	4.70±0.23E 00	600	57.6	0.524	C.S. 13
1125 - 1	LEFT FEMUR	RDB 652	1.0 OZS.	2.87±2.87E-01	40	49.4		
" 2	KIDNEY	RDK 170	1.7 OZS.	.95±1.86E-01	1000	12.2		
" 3	LIVER	RDL 91	7.9 OZS.	4.03±1.68E-01	300	29.6		
" 4	LUNG	RDR 331	2.4 OZS.	3.79±0.21E 00	400	70.6	0.789	
" 5	HILAR NODE	RDH 157	0.2 OZS.	1.03±2.06E-01	40	69.0		
" 7	TRACHEA	RDT 143	1.1 OZS.	6.08±1.33E-01	200	62.1		
" 8	G. I. TRACT	RDS 614	5.3 OZS.	8.33±0.17E 03	40	55.4R		TAGGED 'CONTENTS EXPOSED'
" 9	P. MUCOSA	RDP 85	0.4 OZS.	9.64±1.45E-01	200	57.5		
" 10	N. MUCOSA	RDN 305	0.8 OZS.	9.60±0.94E-01	600	50.7		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.5 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
1132 - 1	LEFT FEMUR	RDB 654	1.5 OZS.	2.38±2.38E-01	40	59.4		
" 2	KIDNEY	RDK 112	2.0 OZS.	9.80±5.40E-02	500	58.8		
" 3	LIVER	RDL 219	10.8 OZS.					LOST IN DISS.
" 4	LUNG	RDR 333	4.1 OZS.	3.18±0.21E 00	400	56.2	0.251	
" 5	HILAR NODE	RDH 60	0.2 OZS.	0.00±0.07E 00	300	63.6		
" 7	TRACHEA	RDT 172	1.8 OZS.	6.10±6.10E-02	400	57.9		
" 8	G. I. TRACT	RDS 611	7.3 OZS.	2.38±0.14E 01	100	27.9		
" 9	P. MUCOSA	RDP 72	0.6 OZS.	1.41±0.40E-01	400	75.5		
" 10	N. MUCOSA	RDN 325	0.7 OZS.	2.80±0.51E-01	1000	31.4R		
1134 - 1	LEFT FEMUR	RDB 636	1.1 OZS.	1.22±0.16E 00	400	36.1	0.888	C.S. II
" 3	LIVER	RDL 136	9.4 OZS.					C.S. II LOST IN DISS
" 5	HILAR NODE	RDH 109	0.2 OZS.	5.40±7.20E-02	200	66.0	0.334	C.S. II
1150 - 1	LEFT FEMUR	RDB 653	1.4 OZS.	0.00±0.32E 00	40	44.5		
" 2	KIDNEY	RDK 166	2.1 OZS.	4.50±3.60E-02	400	88.3		
" 3	LIVER	RDL 220	10.1 OZS.	1.26±0.63E-01	800	36.1		
" 4	LUNG	RDR 335	3.4 OZS.	5.82±0.80E-01	900	27.7	0.781	
" 5	HILAR NODE	RDH 54	0.3 OZS.	0.60±1.00E-01	200	58.8		
" 7	TRACHEA	RDT 212	1.3 OZS.	0.00±0.05E 00	400	57.8		
" 8	G. I. TRACT	RDS 631	5.4 OZS.	2.58±0.07E 03	30	43.0		
" 9	P. MUCOSA	RDP 202	0.4 OZS.	3.19±5.32E-02	400	66.5		
" 10	N. MUCOSA	RDN 154	0.7 OZS.	0.00±0.09E 00	200	50.4		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 RADIOCHEMICAL ANALYSIS OF BIOLOGICAL SAMPLES, SHEEP

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
242 - 1	LEFT FEMUR	RSB 577	5.8 OZS.	1.94±0.55E-01	900	45.4		
" 2	KIDNEY	RSK 514	4.0 OZS.	4.54±4.54E-01	40	46.8		
" 3	LIVER	RSL 504	1.6 LBS.	3.18±0.82E-01	800	35.2		
" 4	LUNG	RSR 571	12.4 OZS.	4.01±0.84E-01	400	40.6		
" 5	HILAR NODE	RSH 517	0.2 OZS.	2.50±3.10E-02	600	80.3		
2005 - 1	LEFT FEMUR	RSB 599	7.8 OZS.	1.15±0.82E-01	500	36.1		
" 2	KIDNEY	RSK 590	3.1 OZS.	1.22±0.70E-01	400	45.2		
" 3	LIVER	RSL 574	1.3 LBS.	4.68±0.30E 00	500	36.8R		
" 4	LUNG	RSR 542	15.2 OZS.	2.40±0.10E 01	500	35.7	2.41	
" 5	HILAR NODE	RSH 605	0.3 OZS.	0.00±0.54E 00	40	26.3		
" 7	TRACHEA	RST 592	3.5 OZS.	1.28±0.51E-01	400	55.3		
" 8	G. I. TRACT	RSS 667	14.9 LBS.	9.07±0.30E 01	800	03.8R		
" 10	N. MUCOSA	RSN 596	3.1 OZS.	2.73±0.08E 02	1000	19.5R		TAGGED 'VOMITED'
2006 - 2	KIDNEY	RSK 510	3.6 OZS.	1.23±2.45E-01	40	57.7		
" 1	LEFT FEMUR	RSB 559	5.2 OZS.	1.57±0.59E-01	500	53.4		
" 3	LIVER	RSL 507	1.1 LBS.	4.01±0.54E-01	900	44.8		
" 4	LUNG	RSR 566	13.3 OZS.	1.03±0.13E 00	400	47.4		
" 5	HILAR NODE	RSH 519	0.3 OZS.	5.30±3.80E-02	600	65.4		
2008 - 1	LEFT FEMUR	RSB 466	6.6 OZS.	6.30±7.90E-02	600	29.8		
" 2	KIDNEY	RSK 370	3.8 OZS.	1.10±2.20E-01	40	64.4		
" 3	LIVER	RSL 358	1.3 LBS.	4.96±0.79E-01	400	55.7		
" 4	LUNG	RSR 556	13.0 OZS.	1.09±0.11E 00	500	44.8		
" 5	HILAR NODE	RSH 287	0.4 OZS.	9.15±3.92E-02	400	60.2		
2012 - 1	LEFT FEMUR	RSB 486	6.5 OZS.	2.15±2.15E-01	40	65.7		
" 2	KIDNEY	RSK 250	3.9 OZS.	4.12±8.24E-02	100	68.8		
" 3	LIVER	RSL 272	1.2 LBS.	3.33±0.80E-01	300	79.7		
" 4	LUNG	RSR 557	1.1 LBS.	5.16±0.59E-01	500	47.8		
" 5	HILAR NODE	RSH 286	0.3 OZS.	-1.15±2.30E-01	40	61.5		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2013 - 1	LEFT FEMUR	RSB 532	5.4 OZS.	2.31±0.46E-01	500	54.4		
" 2	KIDNEY	RSK 369	3.6 OZS.	3.37±3.37E-01	40	63.1		
" 3	LIVER	RSL 275	1.6 LBS.	2.92±0.18E 00	500	58.5		
" 4	LUNG	RSR 545	15.7 OZS.	9.30±0.30E 01	400	48.1		
" 5	HILAR NODE	RSH 280	0.4 OZS.	7.09±4.26E-01	70	28.5		
2015 - 1	LEFT FEMUR	RSB 457	7.4 OZS.	2.96±1.29E-01	1000	15.3		
" 2	KIDNEY	RSK 246	3.4 OZS.	1.62±0.13E 00	900	32.1		
" 3	LIVER	RSL 360	1.1 LBS.	0.00±0.15E 00	60	69.3		
" 4	LUNG	RSR 554	12.6 OZS.	6.20±0.38E 00	400	45.7		
" 5	HILAR NODE	RSH 277	0.3 OZS.	1.91±1.91E-01	200	28.7		
2019 - 1	LEFT FEMUR	RSB 407	6.1 OZS.	0.00±0.18E 00	100	32.0		C.S. II
" 2	KIDNEY	RSK 436	3.7 OZS.	2.65±0.61E-01	300	59.8	0.648	C.S. II
" 3	LIVER	RSL 419	1.6 LBS.	7.34±1.16E-01	200	67.5	0.344	C.S. II
" 4	LUNG	RSR 477	13.4 OZS.	3.93±0.31E 00	500	28.1	1.22	C.S. II
" 5	HILAR NODE	RSH 398	0.3 OZS.	0.69±1.38E-01	100	41.2	0.805	C.S. II
2027 - 1	LEFT FEMUR	RSB 494	6.9 OZS.	5.29±0.99E-01	1000	15.5R		
" 2	KIDNEY	RSK 243	3.9 OZS.	1.97±0.79E-01	900	40.0		
" 3	LIVER	RSL 359	1.4 LBS.	7.30±0.93E-01	400	69.0		
" 4	LUNG	RSR 553	1.0 LBS.	1.02±0.04E 01	400	79.6		
" 5	HILAR NODE	RSH 283	0.3 OZS.	2.01±1.34E-01	400	21.2		
2028 - 4	LUNG	RSR 343	13.3 OZS.	1.08±0.04E 01	600	58.9	0.092	C.S. II
" 5	HILAR NODE	RSH 115	0.2 OZS.	-1.80±3.50E-02	200	67.3	0.270	C.S. II
2030 - 1	LEFT FEMUR	RSB 538	7.3 OZS.	2.07±2.07E-01	50	54.8		
" 2	KIDNEY	RSK 368	4.9 OZS.	4.30±8.59E-02	90	73.3		
" 3	LIVER	RSL 365	1.8 LBS.	3.65±0.84E-01	400	50.5		
" 4	LUNG	RSR 561	13.3 OZS.	5.12±0.29E 00	700	31.4		
" 5	HILAR NODE	RSH 281	0.4 OZS.	2.49±0.92E-01	400	54.1		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2031	URINE	RSU 51	5.2 LBS.	2.53±0.09E 03	50	15.9		DATE UNREADABLE
"	URINE	RSU 489	1.6 LBS.	1.88±0.05E 04	20	47.5		16 MAY
"	URINE	RSU 432	1.0 LBS.	2.37±0.03E 03	100	34.6		17 MAY
"	URINE	RSU 454	1.8 LBS.	1.61±0.03E 03	40	62.3		22 MAY
"	URINE	RSU 266	2.7 LBS.	7.98±0.15E 02	200	20.9R		19 JUNE
"	URINE	RSU 353	2.8 LBS.	5.23±0.15E 02	40	48.2		20 JUNE
"	URINE	RSU 299	3.1 LBS.	2.54±0.12E 01	200	20.5		21 JUNE
"	URINE	RSU 236	2.8 LBS.	2.83±0.05E 03	200	15.8R		22 JUNE
"	FECES	RSF 525	0.5 LBS.	1.91±0.04E 03	300	8.6R		16 MAY
"	FECES	RSF 415	1.1 LBS.	1.42±0.03E 03	300	7.8R		17 MAY
2032 - 1	LEFT FEMUR	RSB 408	6.7 OZS.	2.31±2.31E-01	100	36.8		C.S. II
" 2	KIDNEY	RSK 395	4.5 OZS.	4.10±4.10E-02	300	61.3	0.470	C.S. II
" 3	LIVER	RSL 423	1.5 LBS.	2.01±0.21E 00	500	27.7	0.939	C.S. II
" 4	LUNG	RSR 479	13.5 OZS.	4.30±0.28E 00	800	25.6	0.599	C.S. II
" 5	HILAR NODE	RSH 439	0.2 OZS.	0.00±0.09E 00	100	61.4	0.288	C.S. II
2036	URINE	RSU 461	1.6 LBS.	1.81±0.05E 02	50	61.9		23 MAY
"	URINE	RSU 238	4.6 LBS.	5.61±0.08E 02	800	07.4R		20 JUNE
"	URINE	RSU 389	3.5 LBS.	1.48±0.06E 02	400	04.4R		21 JUNE
"	URINE	RSU 297	3.0 LBS.	4.78±0.02E 03	40	16.1		22 JUNE
"	FECES	RSF 524	0.5 LBS.	9.63±0.25E 02	40	39.7		16 MAY
2039 - 1	LEFT FEMUR	RSB 492	7.8 OZS.	0.00±0.12E 00	1000	13.9R		
" 2	KIDNEY	RSK 248	4.6 OZS.	1.91±1.27E-01	300	46.8		
" 3	LIVER	RSL 364	1.9 LBS.	3.12±0.26E 00	400	36.5		
" 4	LUNG	RSR 547	1.3 LBS.	2.18±0.05E 02	400	78.1		
2047	URINE	RSU 528	1.9 LBS.	3.02±0.11E 01	200	35.1		16 MAY

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2050 - 1	LEFT FEMUR	RSB 410	7.1 OZS.	3.07±4.60E-01	100	18.5	4.68	C.S. II
" 2	KIDNEY	RSK 443	4.6 OZS.	1.44±2.88E-01	40	49.2		C.S. II
" 3	LIVER	RSL 418	1.8 LBS.	2.94±2.94E-01	60	32.1		C.S. II
" 4	LUNG	RSR 474	16.5 OZS.	9.06±0.21E 01	500	63.5		C.S. II
" 5	HILAR NODE	RSH 399	0.2 OZS.	-0.88±1.75E-01	100	32.4	0.928	C.S. II
2052 - 1	LEFT FEMUR	RSB 607	5.5 OZS.	1.89±1.89E-01	70	42.9		
" 2	KIDNEY	RSK 588	3.5 OZS.	1.02±2.04E-01	40	69.5		
" 3	LIVER	RSL 573	1.1 LBS.	1.08±0.16E 00	400	34.1		
" 4	LUNG	RSR 543	1.1 LBS.	5.41±0.34E 00	900	19.8	2.13	
" 5	HILAR NODE	RSH 606	0.4 OZS.	2.50±2.50E-01	40	56.6		
" 7	TRACHEA	RST 591	3.8 OZS.	6.45±1.03E-01	400	41.8		
" 8	G. I. TRACT	RSS 669	8.8 LBS.	2.80±0.11E 01	200	35.5		
" 10	N. MUCOSA	RSN 598	2.9 OZS.	4.86±0.95E-01	700	21.2R		
2057	URINE	RSU 413	2.1 LBS.	2.00±0.06E 01	200	79.2		16 MAY
"	URINE	RSU 534	2.2 LBS.	4.67±0.15E 01	100	63.2		23 MAY
"	FECES	RSF 500	0.9 LBS.	1.50±0.04E 03	200	09.0R		16 MAY
2060 - 1	LEFT FEMUR	RSB 435	7.0 OZS.	1.60±1.60E-01	100	53.1		
" 2	KIDNEY	RSK 245	4.0 OZS.	0.73±1.46E-01	60	64.7		
" 3	LIVER	RSL 242	1.6 LBS.	5.28±1.06E-01	400	33.5		
" 4	LUNG	RSR 546	1.1 LBS.	2.55±0.14E 00	500	74.0		
" 5	HILAR NODE	RSH 288	0.4 OZS.	8.10±4.63E-02	400	68.0		
2064 - 1	LEFT FEMUR	RSB 465	7.3 OZS.	1.28±1.28E-01	300	39.6		
" 2	KIDNEY	RSK 249	3.7 OZS.	3.40±4.25E-02	400	83.3		
" 3	LIVER	RSL 366	1.2 LBS.	3.18±3.18E-01	60	48.6		
" 4	LUNG	RSR 558	1.2 LBS.	3.60±0.29E 00	1000	14.6R		
" 5	HILAR NODE	RSH 279	0.3 OZS.	1.94±1.94E-01	200	28.3		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2087	URINE	RSU 414	2.9 LBS.	1.46±0.04E 03	30	48.5		23 MAY
"	URINE	RSU 405	5.1 LBS.	2.07±0.07E 02	100	15.7		21 JUNE
"	URINE	RSU 354	5.4 LBS.	4.06±0.13E 01	500	16.1		22 JUNE
"	FECES	RSF 471	0.8 LBS.	3.67±0.07E 03	90	30.2		16 MAY
2092	URINE	RSU 548	0.9 LBS.	2.34±0.05E 04	40	46.7		16 MAY
"	URINE	RSU 488	1.4 LBS.	4.68±0.10E 03	60	33.2		17 MAY
"	URINE	RSU 523	4.3 LBS.	3.46±0.10E 02	40	52.0		21 MAY
"	URINE	RSU 462	3.4 LBS.					22 MAY LOST IN DISS.
"	URINE	RSU 499	1.5 LBS.	1.78±0.04E 02	100	50.5		23 MAY
"	URINE	RSU 39	3.8 LBS.	1.02±0.03E 02	200	14.7R		18 JUNE
"	URINE	RSU 388	3.0 LBS.	2.96±0.14E 01	200	19.5		19 JUNE
"	URINE	RSU 52	2.6 LBS.	2.63±0.07E 02	1000	2.9R		21 JUNE BREAKAGE LOSS
"	URINE	RSU 267	3.3 LBS.	4.64±0.15E 01	200	26.2		22 JUNE
"	FECES	RSF 531	0.3 LBS.	1.28±0.02E 02	200	58.6		16 MAY
"	FECES	RSF 434	0.5 LBS.	9.27±0.22E 02	40	54.8		17 MAY
2093 - 1	LEFT FEMUR	RSB 460	7.1 OZS.	7.42±1.42E-01	1000	10.7R		
" 2	KIDNEY	RSK 244	3.8 OZS.	0.76±1.52E-01	60	62.2		
" 3	LIVER	RSL 361	1.2 LBS.	6.81±1.19E-01	500	26.4		
" 4	LUNG	RSR 544	1.2 LBS.	1.12±0.15E 00	500	32.8R		
" 5	HILAR NODE	RSH 284	0.4 OZS.	0.00±0.27E 00	40	51.5		
2095 - 1	LEFT FEMUR	RSB 496	5.7 OZS.	2.07±1.66E-01	300	24.4		
" 2	KIDNEY	RSK 371	3.2 OZS.	0.00±0.13E 00	60	77.5		
" 3	LIVER	RSL 273	1.3 LBS.	5.55±0.78E-01	400	68.9		
" 4	LUNG	RSR 564	13.4 OZS.	4.39±0.34E 00	400	33.7		
" 5	HILAR NODE	RSH 278	0.3 OZS.	0.00±0.17E 00	200	21.8		
2097	URINE	RSU 549	1.1 LBS.	9.94±0.30E 01	60	68.9R		17 MAY
"	FECES	RSF 536	0.8 LBS.	7.97±0.41E 00	300	56.0R		16 MAY

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2100 - 1	LEFT FEMUR	RSB 411	5.1 OZS.	2.10±3.15E-01	100	27.0	1.76	C.S. II
" 2	KIDNEY	RSK 402	4.1 OZS.	0.82±1.02E-01	400	38.4	0.340	C.S. II
" 3	LIVER	RSL 422	1.4 LBS.	8.24±1.07E-01	600	35.5	0.118	C.S. II
" 4	LUNG	RSR 476	12.8 OZS.	4.27±0.27E 00	1000	20.8	0.262	C.S. II
" 5	HILAR NODE	RSH 438	0.3 OZS.	2.50±3.70E-02	400	63.6	0.100	C.S. II
2110 - 1	LEFT FEMUR	RSB 429	5.7 OZS.	1.20±2.41E-01	100	23.6		C.S. II
" 2	KIDNEY	RSK 394	3.7 OZS.	0.52±1.04E-01	90	60.3		C.S. II
" 3	LIVER	RSL 424	1.4 LBS.	4.79±0.77E-01	500	48.0		C.S. II
" 4	LUNG	RSR 475	12.3 OZS.	5.08±0.21E 00	600	67.7		C.S. II
" 5	HILAR NODE	RSH 448	0.3 OZS.	1.19±2.37E-01	40	59.7		C.S. II
2111	URINE	RSU 529	1.9 LBS.	2.30±0.04E 04	60	55.0		16 MAY
"	URINE	RSU 469	1.8 LBS.	5.16±0.16E 03	100	07.9R		17 MAY
"	URINE	RSU 237	5.1 LBS.	3.30±0.06E 02	300	12.4R		18 JUNE
"	URINE	RSU 268	5.0 LBS.	5.50±0.10E 02	200	29.2R		19 JUNE
"	URINE	RSU 349	2.2 LBS.	1.24±0.05E 02	30	65.8		21 JUNE
"	URINE	RSU 241	2.6 LBS.	2.89±0.09E 03	50	19.2R		22 JUNE
"	FECES	RSF 501	0.2 LBS.	4.45±0.14E 01	200	30.4		16 MAY
"	FECES	RSF 491	0.4 LBS.	1.18±0.03E 02	200	17.4		17 MAY
2112 - 1	LEFT FEMUR	RSB 386	5.6 OZS.	1.65±0.51E-01	400	68.8		
" 2	KIDNEY	RSK 191	3.3 OZS.	2.34±0.91E-01	400	57.4		
" 3	LIVER	RSL 376	1.2 LBS.	6.16±0.80E-01	400	80.5		
" 4	LUNG	RSR 380	0.8 LBS.	1.08±0.06E 01	300	40.6R		
" 5	HILAR NODE	RSH 185	0.2 OZS.	0.00±0.61E 00	40	23.2		
" 7	TRACHEA	RST 187	3.8 OZS.	2.94±1.18E-01	400	34.4		
" 8	G. I. TRACT	RSS 670	13.7 LBS.	1.65±0.03E 02	800	08.6R		
" 10	N. MUCOSA	RSN 381	2.9 OZS.	8.05±1.19E-01	1000	16.9R		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.8 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2119 - 1	LEFT FEMUR	RSB 472	6.5 OZS.	0.00±0.17E 00	60	56.0		
" 2	KIDNEY	RSK 247	3.5 OZS.	0.00±0.20E 00	60	48.3		
" 3	LIVER	RSL 362	1.3 LBS.	4.27±0.51E-01	900	49.4		
" 4	LUNG	RSR 562	14.5 OZS.	5.84±0.37E 00	1000	16.1		
" 5	HILAR NODE	RSH 282	0.3 OZS.	1.04±0.52E-01	400	54.7		
2124 - 1	LEFT FEMUR	RSB 569	5.3 OZS.	1.15±2.31E-01	60	40.9		
" 2	KIDNEY	RSK 515	3.8 OZS.	0.00±0.22E 00	40	63.2		
" 3	LIVER	RSL 506	1.6 LBS.	1.16±0.16E 00	400	35.0		
" 4	LUNG	RSR 568	1.1 LBS.	1.40±0.22E 01	60	23.6R		
" 5	HILAR NODE	RSH 516	0.4 OZS.	7.20±0.72E-01	600	71.1		
2127 - 1	LEFT FEMUR	RSB 416	5.8 OZS.	8.30±6.70E-02	400	42.4	2.31	C.S. II
" 2	KIDNEY	RSK 445	3.6 OZS.	1.07±2.13E-01	40	66.4		C.S. II 2 PIECES ONLY
" 3	LIVER	RSL 417	1.6 LBS.	1.75±0.17E 00	1000	18.6	0.423	C.S. II
" 4	LUNG	RSR 478	1.9 LBS.	3.60±0.13E 01	600	28.7	0.316	C.S. II
" 5	HILAR NODE	RSH 400	0.3 OZS.	9.50±5.43E-02	400	58.0	0.262	C.S. II
2128 - 1	LEFT FEMUR	RSB 579	5.2 OZS.	4.94±0.42E 00	600	15.9		
" 2	KIDNEY	RSK 513	3.2 OZS.	8.18±0.97E-01	500	51.2		
" 3	LIVER	RSL 509	1.1 LBS.	2.26±0.14E 00	900	40.0		
" 4	LUNG	RSR 572	15.7 OZS.	3.79±0.13E 01	1000	18.8R		
" 5	HILAR NODE	RSH 520	0.3 OZS.	0.00±0.27E 00	40	52.6		
2129 - 1	LEFT FEMUR	RSB 583	6.3 OZS.	0.00±0.22E 00	100	24.5		
" 2	KIDNEY	RSK 511	4.9 OZS.	0.98±1.14E-01	500	34.7R		
" 3	LIVER	RSL 508	1.9 LBS.	9.47±4.21E-01	100	26.9R		
" 4	LUNG	RSR 567	1.1 LBS.	9.20±1.20E-01	300	61.6R		
" 5	HILAR NODE	RSH 518	0.3 OZS.	-3.60±4.60E-02	500	64.6		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2133	URINE	RSU 223	4.8 LBS.	2.98±0.06E 03	200	08.2R	DATE UNREADABLE 1ST DIGIT 1	
"	URINE	RSU 453	1.7 LBS.	1.57±0.04E 04	30	47.9		16 MAY
"	URINE	RSU 431	4.9 LBS.	2.07±0.05E 03	20	66.4		22 MAY
"	URINE	RSU 28	5.9 LBS.	7.12±0.24E 02	900	13.2R		20 JUNE
"	URINE	RSU 298	4.4 LBS.	6.35±0.15E 02	50	43.8		21 JUNE
"	URINE	RSU 40	4.1 LBS.	7.41±0.26E 02	40	24.8		22 JUNE
"	FECES	RSF 463	0.4 LBS.	1.11±0.03E 03	50	23.7		16 MAY
2134	URINE	RSU 433	1.5 LBS.	6.09±0.15E 03	20	71.0		16 MAY
"	URINE	RSU 522	1.0 LBS.	1.97±0.05E 02	50	73.8		23 MAY
"	URINE	RSU 390	3.7 LBS.	7.12±0.18E 01	500	14.9		19 JUNE
"	URINE	RSU 351	5.4 LBS.	1.05±0.02E 02	600	11.8		21 JUNE
"	URINE	RSU 19	5.2 LBS.	6.67±0.73E 01	1000	01.8R		22 JUNE
"	URINE	RSU 224	3.8 LBS.	3.57±0.10E 01	600	19.9		22 JUNE
"	FECES	RSF 470	0.8 LBS.	1.64±0.05E 03	40	26.0		16 MAY
"	FECES	RSF 490	1.0 LBS.	5.96±0.30E 01	100	17.5		23 MAY
"	FECES	RSF 53	4.8 LBS.					0 + 30 LOST IN DISS.
2137 - 1	LEFT FEMUR	RSB 387	7.3 OZS.	0.53±1.05E-01	100	53.8		
" 2	KIDNEY	RSK 193	4.0 OZS.	5.20±5.20E-02	400	72.2	4 SECTIONS (USUALLY ONLY 3)	
" 3	LIVER	RSL 373	1.3 LBS.	8.60±1.03E-01	400	67.7		
" 4	LUNG	RSR 378	1.1 LBS.	4.24±0.14E 02	600	23.6R	0.185	
" 5	HILAR NODE	RSH 184	0.2 OZS.	7.60±9.50E-02	500	31.1		
" 7	TRACHEA	RST 188	4.2 OZS.	1.18±0.06E 01	700	19.2		
" 8	G. I. TRACT	RSS 671	18.6 LBS.	5.45±0.14E 02	100	12.7R		
" 10	N. MUCOSA	RSN 384	4.4 OZS.	1.21±0.05E 01	1000	19.8		TAGGED "VOMITED"
2139 - 1	LEFT FEMUR	RSB 526	8.4 OZS.	5.33±2.66E-01	50	63.8		
" 2	KIDNEY	RSK 357	4.7 OZS.	-1.04±2.09E-01	60	49.4		
" 3	LIVER	RSL 363	2.2 LBS.	8.12±1.12E-01	1000	18.8R		
" 4	LUNG	RSR 555	1.1 LBS.	8.16±0.85E-01	400	84.1		
" 5	HILAR NODE	RSH 276	0.3 OZS.	5.40±2.08E-01	400	17.0		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.6 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2140 - 1	LEFT FEMUR	RSB 601	6.6 OZS.	0.00±0.28E 00	70	29.0		
" 2	KIDNEY	RSK 589	3.2 OZS.	1.75±3.50E-01	40	40.4		
" 3	LIVER	RSL 575	16.1 OZS.	2.63±0.37E-01	900	59.9		
" 4	LUNG	RSR 540	11.9 OZS.	3.72±0.11E 01	400	53.6	0.297	
" 5	HILAR NODE	RSH 604	0.2 OZS.	7.90±5.20E-02	400	60.1		
" 7	TRACHEA	RST 594	3.7 OZS.	1.67±0.06E 01	400	65.0		
" 8	G. I. TRACT	RSS 668	11.3 LBS.	5.30±0.38E 01	100	11.0R		
" 10	N. MUCOSA	RSN 597	3.0 OZS.	5.97±0.40E 00	1000	13.9		
2148 - 1	LEFT FEMUR	RSB 502	6.9 OZS.	1.40±0.17E 00	400	39.8		
" 2	KIDNEY	RSK 367	4.9 OZS.	4.26±0.79E-01	700	26.9		
" 3	LIVER	RSL 274	1.7 LBS.	2.34±0.63E-01	500	62.8		
" 4	LUNG	RSR 563	15.2 OZS.	3.42±1.00E-01	400	48.5		
" 5	HILAR NODE	RSH 285	0.3 OZS.	0.00±0.26E 00	40	55.2		
2157	URINE	RSU 498	1.7 LBS.	5.66±0.17E 04	20	58.3		16 MAY
"	URINE	RSU 31	5.0 LBS.	1.09±0.03E 03	600	44.7R		8 JUNE
"	URINE	RSU 350	7.4 LBS.	2.34±0.08E 02	300	7.2R		19 JUNE
"	URINE	RSU 406	5.4 LBS.	1.68±0.05E 03	40	28.3		21 JUNE
"	URINE	RSU 355	7.6 LBS.	8.93±0.29E 01	300	16.0R		22 JUNE
"	URINE	RSU 27	5.9 LBS.	4.96±0.17E 03	900	14.0		23 JUNE
"	FECES	RSF 456	0.8 LBS.	9.11±0.24E 03	90	13.5		16 MAY
2171 - 1	LEFT FEMUR	RSB 356	6.3 OZS.	6.10±6.10E-02	600	40.6		C.S. II
" 3	LIVER	RSL 345	1.3 LBS.	5.67±0.85E-01	400	55.0		C.S. II
2172	URINE	RSU 468	1.1 LBS.	4.90±0.08E 03	90	33.3		17 MAY
"	URINE	RSU 32	4.4 LBS.	3.12±0.33E 02	200	06.7R		18 JUNE
"	URINE	RSU 404	3.6 LBS.	5.37±0.16E 02	200	09.5R		21 JUNE
"	URINE	RSU 29	2.9 LBS.	1.84±0.05E 03	1100	15.0R		22 JUNE
"	FECES	RSF 537	0.8 LBS.	1.39±0.02E 03	90	48.2		16 MAY
"	FECES	RSF 530	1.0 LBS.	1.61±0.05E 03	40	21.6		17 MAY

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.8 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
2177 - 1	LEFT FEMUR	RSB 580	5.2 OZS.	2.15±0.14E 00	1400	25.6		
" 2	KIDNEY	RSK 512	3.6 OZS.	0.00±0.22E 00	40	64.0		
" 3	LIVER	RSL 505	1.2 LBS.	5.53±0.12E-01	500	67.2		
" 4	LUNG	RSR 565	14.2 OZS.	6.90±0.95E-01	800	29.5		
" 5	HILAR NODE	RSH 521	0.2 OZS.	1.24±2.48E 01	40	57.1		
2179 - 1	LEFT FEMUR	RSB 391	5.9 OZS.	0.00±0.62E 00	40	22.8R		
" 2	KIDNEY	RSK 190	3.0 OZS.	6.60±6.60E-02	400	59.4		
" 3	LIVER	RSL 374	1.2 LBS.	2.11±0.53E-01	300	63.3		
" 4	LUNG	RSR 377	1.0 LBS.	5.88±0.19E 01	400	30.0	0.342	
" 5	HILAR NODE	RSH 183	0.2 OZS.	8.40±8.40E-02	500	21.2		
" 7	TRACHEA	RST 189	3.6 OZS.	7.65±0.35E 00	700	35.0		
" 8	G. I. TRACT	RSS 673	9.8 LBS.	1.36±0.02E 02	1000	08.6R		
" 10	N. MUCOSA	RSN 382	3.4 OZS.	2.40±0.55E 00	200	10.8R		
2189 - 1	LEFT FEMUR	RSB 584	5.1 OZS.	1.69±2.53E-01	100	32.0		
" 2	KIDNEY	RSK 587	3.5 OZS.	1.32±2.63E-01	40	53.8		
" 3	LIVER	RSL 576	1.3 LBS.	5.80±1.20E-01	600	35.7		
" 4	LUNG	RSR 541	14.2 OZS.	5.19±0.27E 00	500	52.6	0.196	
" 5	HILAR NODE	RSH 603	0.2 OZS.	0.00±0.14E 00	90	45.0		
" 7	TRACHEA	RST 193	3.4 OZS.	0.00±0.61E 00	40	23.2		
" 8	G. I. TRACT	RSS 659	13.0 LBS.	5.40±0.16E 01	1000	06.7R		IDENTIFIED BY ELIMINATION
" 10	N. MUCOSA	RSN 595	3.0 OZS.	4.62±1.76E-01	1000	12.9R		TAGGED 'VOMITED'
2196 - 1	LEFT FEMUR	RSB 372	7.9 OZS.	1.98±0.66E-01	600	44.8		
" 2	KIDNEY	RSK 192	4.6 OZS.	2.95±1.29E-01	1000	15.4R		
" 3	LIVER	RSL 375	1.3 LBS.	8.06±1.05E-01	400	64.4		
" 4	LUNG	RSR 379	1.1 LBS.	7.19±0.25E 01	400	43.1	0.098	
" 5	HILAR NODE	RSH 182	0.2 OZS.	6.05±0.83E-01	500	51.3R		
" 7	TRACHEA	RST 186	4.4 OZS.	2.83±0.12E 01	500	31.8R		
" 8	G. I. TRACT	RSS 672	14.2 LBS.	4.72±0.20E 02	100	05.5R		
" 10	N. MUCOSA	RSN 383	3.6 OZS.	4.75±0.17E 01	1000	16.8R		
2199 - 2	KIDNEY	RSK 114	3.1 OZS.	8.10±8.10E-02	200	43.7R	0.255	C.S. 11

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.8 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
'8'	URINE	RSU 265	4.6 LBS.	3.60±0.13E 01	500	14.2R		DATE UNREADABLE 1ST DIGIT 2
"	URINE	RSU 535	1.5 LBS.	1.28±0.03E 04	20	62.8		16 MAY
"	URINE	RSU 455	2.1 LBS.	4.43±0.10E 03	30	56.1		17 MAY
"	URINE	RSU 403	5.8 LBS.	1.04±0.03E 03	20	10.1R		19 JUNE
"	URINE	RSU 30	4.5 LBS.	6.62±0.19E 01	700	34.[illegible]		22 JUNE
"	FECES	RSF 464	0.7 LBS.	5.54±0.16E 01	300	27.7R		16 MAY
"	FECES	RSF 551	1.1 LBS.	3.19±0.04E 03	200	31.0R		17 MAY
"	FECES	RSF 550	2.7 LBS.	1.00±0.02E 02	200	23.8R		21 MAY
"	FECES	RSF 240	5.8 LBS.					D + 30 LOST IN DISS.

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.7 RADIOCHEMICAL ANALYSIS OF BIOLOGICAL SAMPLES, BURROS

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
3003 - 1	LEFT FEMUR	RBB 292	3.3 LBS.	1.40±0.14E 00	300	67.2		
" 2	KIDNEY	RBK 271	1.7 LBS.	3.03±1.40E-01	200	50.6		TAGGED X25B-2
" 3	LIVER	RBL 260	7.2 LBS.	2.20±0.07E 01	200	68.0		
" 4	LUNG	RBR 578	3.7 LBS.	9.49±0.20E 01	500	38.2		
" 5	HILAR NODE	RBH 234	0.9 OZS.	4.71±0.24E 01	1000	09.1R		
3008 - 1	LEFT FEMUR	RBB 239	2.5 LBS.	1.02±0.10E 00	400	68.2		
" 2	KIDNEY	RBK 95	1.9 LBS.	1.90±0.71E-01	400	59.7		
" 3	LIVER	RBL 118	7.6 LBS.	3.30±0.12E 01	500	23.3R		IDENTIFIED BY ELIMINATION
" 4	LUNG	RBR 497	4.1 LBS.	1.72±0.03E 02	300	63.0		
" 5	HILAR NODE	RBH 47	0.6 OZS.	3.53±2.80E-01	200	76.9		
" 7	TRACHEA	RBT 97	1.1 LBS.	3.37±0.01E 01	200	58.2		
" 8	G. I. TRACT	RBS 646	8.1 LBS.	6.56±0.19E 01	200	39.4R		
" 9	P. MUCOSA	RBP 43	3.2 OZS.	2.00±0.23E 00	200	45.4		
3010 - 1	LEFT FEMUR	RBB 108	2.5 LBS.	6.53±0.88E-01	1000	24.3R		
" 2	KIDNEY	RBK 12	1.4 LBS.	5.40±0.60E-01	1000	50.7		
" 3	LIVER	RBL 15	4.4 LBS.	3.49±0.19E 00	900	34.9		
" 4	LUNG	RBR 412	2.8 LBS.	4.86±0.22E 00	600	47.6		
" 5	HILAR NODE	RBH 5	1.3 OZS.	1.40±8.00E-02	900	65.7		FOUND 10/29/64
3013 - 1	LEFT FEMUR	RBB 117	1.9 LBS.	9.74±3.89E-01	100	27.7		
" 2	KIDNEY	RBK 8	1.2 LBS.	3.18±0.22E 00	1000	25.0		
" 3	LIVER	RBL 14	5.1 LBS.	2.88±0.19E 00	900	30.6		
" 4	LUNG	RBR 409	2.6 LBS.	6.39±0.42E 00	300	37.7		
" 5	HILAR NODE	RBH 1	0.2 OZS.	0.45±1.90E-01	1000	68.7		
3015 - 3	LIVER	RBL 264	5.3 LBS.	1.22±0.06E 01	1000	14.2R		
" 4	LUNG	RBR 570	2.5 LBS.	7.07±0.19E 01	200	65.0R		
3018 - 2	KIDNEY	RBK 170	2.5 LBS.	7.10±1.21E-01	800	18.6		
" 3	LIVER	RBL 178	6.9 LBS.	2.60±0.08E 01	600	27.2R		
" 4	LUNG	RBR 503	3.5 LBS.	9.56±0.25E 02	100	58.9		
" 5	HILAR NODE	RBH 122	0.4 OZS.	-4.00±6.00E-02	200	59.1		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.7 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
3023 - 1	LEFT FEMUR	RBB 120	2.3 LBS.	1.70±0.46E 00	200	18.1		
" 2	KIDNEY	RBK 10	1.7 LBS.	1.06±1.50E-01	1000	18.8		
" 3	LIVER	RBL 17	8.3 LBS.	1.60±0.06E 01	200	56.9		
" 4	LUNG	RBR 459	3.3 LBS.	1.64±0.04E 01	1000	37.6R		
" 5	HILAR NODE	RBH 3	1.0 OZS.	3.92±0.79E-01	900	25.0		
3029 - 2	KIDNEY	RBK 41	2.0 LBS.	4.72±0.49E 00	500	13.8		FOUND 11/29/64
" 3	LIVER	RBL 103	5.2 LBS.	6.86±0.27E 01	600	13.1		
" 5	HILAR NODE	RBH 46	0.4 OZS.	2.46±0.21E 00	200	72.4		
" 6	RIGHT FEMUR	RBB 225	2.2 LBS.	1.59±0.12E 00	500	69.6		
" 7	TRACHEA	RBT 100	1.1 LBS.	1.59±0.22E 00	200	42.9		
" 8	G. I. TRACT	RBS 658	3.4 LBS.	4.29±0.13E 01	200	34.7		TAGGED X258-8
" 9	P. MUCOSA	RBP 45	3.0 OZS.	-0.74±1.48E-01	200	32.0		
3031 - 1	LEFT FEMUR	RBB 105	2.4 LBS.	1.39±0.14E 00	1000	21.6R		
" 2	KIDNEY	RBK 11	1.7 LBS.	1.97±5.10E-01	1000	10.1		
" 3	LIVER	RBL 37	8.1 LBS.	1.31±0.05E 01	600	34.7		
" 4	LUNG	RBR 430	3.1 LBS.	8.68±0.35E 00	600	36.7		
" 5	HILAR NODE	RBH 4	0.1 OZS.	-0.70±4.20E-02	1000	41.8		
3035 - 1	LEFT FEMUR	RBB 104	2.7 LBS.	1.68±0.39E 00	200	18.3		
" 2	KIDNEY	RBK 9	1.5 LBS.	0.29±1.50E-01	1000	29.6		
" 3	LIVER	RBL 20	5.0 LBS.	2.67±0.12E 01	200	35.8		
" 4	LUNG	RBR 385	3.3 LBS.	4.09±0.08E 02	300	59.2		
" 5	HILAR NODE	RBH 2	0.5 OZS.	7.20±9.00E-02	1000	67.3		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.7 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
3039 - 1	LEFT FEMUR	RBB 146	1.9 LBS.	7.85±3.14E-01	200	22.6		
" 2	KIDNEY	RBK 36	1.0 LBS.	0.44±1.10E-01	200	53.7		
" 3	LIVER	RBL 38	4.8 LBS.	1.52±0.07E 01	200	44.2		
" 4	LUNG	RBR 467	2.1 LBS.	1.28±0.06E 02	300	18.4	0.610	
" 5	HILAR NODE	RBH 24	0.5 OZS.	1.91±0.50E-01	1000	59.3		
" 6	RIGHT FEMUR	RBB 177	2.0 LBS.	8.33±2.48E-01	1000	12.6		
" 7	TRACHEA	RBT 155	0.8 LBS.					FOUND 1/9/64 LOST IN DISS.
" 8	G. I. TRACT	RBS 644	5.8 LBS.	3.62±0.11E 01	300	32.3		NUMBER DUPLICATED
" 8	G. I. TRACT	RBS 645	2.5 LBS.	3.71±0.12E 01	200	29.3		NUMBER DUPLICATED
" 9	P. MUCOSA	RBP 35	2.6 OZS.	0.93±1.30E-01	300	51.0		
3041 - 1	LEFT FEMUR	RBB 121	2.9 LBS.	1.99±0.36E 00	200	26.1		
" 2	KIDNEY	RBK 16	1.4 LBS.	1.34±0.17E 00	300	46.7		
" 3	LIVER	RBL 18	6.4 LBS.	2.09±0.14E 01	200	18.2		
" 4	LUNG	RBR 458	2.7 LBS.	3.12±0.13E 01	300	39.1		
" 5	HILAR NODE	RBH 7	0.3 OZS.	4.00±6.00E-03	1000	67.4		
3043 - 1	LEFT FEMUR	RBB 294	2.5 LBS.	1.68±0.16E 00	300	64.8		
" 2	KIDNEY	RBK 258	1.2 LBS.	4.00±0.60E-01	500	59.9		TAGGED X258-2
" 3	LIVER	RBL 301	5.1 LBS.	4.60±0.22E 01	1000	04.7R		
" 4	LUNG	RBR 581	3.4 LBS.	2.53±0.08E 03	300	18.9		
" 5	HILAR NODE	RBH 233	0.3 OZS.	5.50±1.20E-01	400	47.0		
3051 - 1	LEFT FEMUR	RBB 208	2.8 LBS.	1.70±0.14E 00	400	68.1		
" 2	KIDNEY	RBK 96	1.8 LBS.	1.00±0.75E-01	400	50.3		
" 3	LIVER	RBL 106	6.6 LBS.	9.43±0.34E 01	600	10.4		
" 4	LUNG	RBR 495	5.6 LBS.	2.47±0.05E 02	500	25.1R	0.344	
" 5	HILAR NODE	RBH 48	0.2 OZS.	7.60±7.60E-02	200	62.4		
" 6	RIGHT FEMUR	RBB 252	3.1 LBS.	1.85±0.18E 00	200	75.4		
" 7	TRACHEA	RBT 98	1.0 LBS.	7.85±0.33E 01	200	42.1		
" 8	G. I. TRACT	RBS 647	4.9 LBS.	9.50±0.22E 01	200	46.2R		
" 10	N. MUCOSA	RBN 296	5.8 OZS.	1.13±0.08E 01	1000	08.2R		
3053 - 1	LEFT FEMUR	RBB 119	3.2 LBS.	1.71±0.18E 00	1000	16.9R		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.7 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
3055 - 1	LEFT FEMUR	RBB 263	2.0 LBS.	2.01±0.16E 00	400	61.9		
" 2	KIDNEY	RBK 131	2.0 LBS.	3.49±0.73E-01	700	25.5		
" 3	LIVER	RBL 127	8.5 LBS.	7.49±0.50E 01	1000	02.0R		REWORKED TWICE
" 4	LUNG	RBR 533	3.6 LBS.	2.94±0.09E 03	200	25.1		
" 5	HILAR NODE	RBH 126	0.5 OZS.	4.77±0.52E-01	600	78.0		
3074 - 1	LEFT FEMUR	RBB 290	1.7 LBS.	5.20±1.17E-01	200	75.0		
" 2	KIDNEY	RBK 132	1.3 LBS.	6.70±5.20E-02	600	59.4R		
" 3	LIVER	RBL 147	6.8 LBS.	1.59±0.09E 01	500	14.9R		
" 4	LUNG	RBR 539	2.3 LBS.	1.03±0.07E 01	400	21.1		
" 5	HILAR NODE	RBH 125	0.2 OZS.	3.50±5.20E-02	200	67.6		
3075 - 1	LEFT FEMUR	RBB 347	2.4 LBS.	1.60±0.15E 00	400	58.4R		
" 2	KIDNEY	RBK 257	1.3 LBS.	4.79±0.23E 00	400	80.5		
" 3	LIVER	RBL 253	5.0 LBS.	1.35±0.07E 01	400	28.7		
" 4	LUNG	RBR 602	3.1 LBS.	5.38±0.37E 00	1000	12.0		
" 5	HILAR NODE	RBH 228	0.9 OZS.	5.59±2.80E-02	900	67.5		
3100 - 4	LUNG	RBR 582	3.3 LBS.	5.13±0.20E 01	200	28.9		TAGGED X25B-4
3102 - 1	LEFT FEMUR	RBB 322	2.7 LBS.	1.46±0.12E 00	500	65.4		
" 2	KIDNEY	RBK 256	1.6 LBS.	8.64±0.34E 00	500	62.9		
" 3	LIVER	RBL 222	8.6 LBS.	1.26±0.09E 01	900	08.1R		
" 4	LUNG	RBR 560	3.6 LBS.	5.98±0.48E 00	500	16.1R		
" 5	HILAR NODE	RBH 229	0.9 OZS.	-5.80±7.70E-02	400	40.8		
3103 - 2	KIDNEY	RBK 254	1.3 LBS.	1.60±0.29E 00	500	19.1		
" 3	LIVER	RBL 251	5.1 LBS.	5.91±0.31E 01	1000	04.5R		
" 4	LUNG	RBR 585	3.2 LBS.	9.22±0.51E 00	200	50.5		
" 5	HILAR NODE	RBH 231	0.3 OZS.	4.00±5.00E-02	400	76.7		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.7 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
3105 - 1	LEFT FEMUR	RBB 261	2.5 LBS.	1.67±0.22E 00	200	46.0		
" 2	KIDNEY	RBK 128	1.9 LBS.	2.50±1.10E-01	400	43.9		
" 3	LIVER	RBL 195	8.6 LBS.	3.40±0.13E 01	900	10.5R		
" 4	LUNG	RBR 527	4.8 LBS.	6.20±0.23E 01	200	28.9		
" 5	HILAR NODE	RBH 123	0.3 OZS.	1.90±7.60E-02	200	62.0		
3108 - 1	LEFT FEMUR	RBB 352	2.8 LBS.	2.55±0.22E 00	400	37.6		
" 2	KIDNEY	RBK 255	1.3 LBS.	4.42±0.49E-01	800	75.1R		
" 3	LIVER	RBL 289	7.4 LBS.	8.18±0.21E 01	300	42.8R		
" 5	HILAR NODE	RBH 232	0.6 OZS.	1.92±0.44E-01	400	77.8		
3109 - 3	LIVER	RBL 107	5.0 LBS.	5.06±0.16E 01	1000	12.5		TAGGED LIVER, BUT IS LUNG
3113 - 1	LEFT FEMUR	RBB 221	3.0 LBS.	1.94±0.13E 00	800	42.9		
" 2	KIDNEY	RBK 42	1.8 LBS.	3.11±1.12E-01	600	35.6		
" 3	LIVER	RBL 101	5.5 LBS.	5.96±0.25E 01	200	27.8		
" 4	LUNG	RBR 493	5.8 LBS.	5.28±0.14E 01	500	28.7	0.389	
" 5	HILAR NODE	RBH 49	0.5 OZS.	0.84±1.18E-01	200	70.6		
" 6	RIGHT FEMUR	RBB 259	2.9 LBS.	1.75±0.17E 00	200	71.5		
" 7	TRACHEA	RBT 99	1.1 LBS.	1.74±0.06E 01	400	56.4		
" 8	G. I. TRACT	RBS 656	4.4 LBS.	2.78±0.10E 01	200	55.7R		
" 9	P. MUCOSA	RBP 44	1.7 OZS.	1.00±1.30E-01	200	68.4		
3120 - 1	LEFT FEMUR	RBB 102	2.7 LBS.	4.01±3.34E-01	200	17.7		
" 2	KIDNEY	RBK 13	2.0 LBS.	9.81±2.90E-01	1000	06.9		
" 3	LIVER	RBL 21	8.9 LBS.	3.55±0.09E 01	900	21.6		
" 4	LUNG	RBR 348	3.6 LBS.	1.84±0.06E 01	400	56.9		
" 5	HILAR NODE	RBH 6	0.2 OZS.	4.10±8.00E-02	1000	47.9		
3125 - 1	LEFT FEMUR	RBB 300	2.8 LBS.	2.16±0.16E 00	400	57.1		
" 3	LIVER	RBL 293	4.4 LBS.	5.64±0.28E 01	1000	05.4R		
" 4	LUNG	RBR 600	3.2 LBS.	1.10±0.03E 02	300	33.6		TAGGED X25B-4
" 5	HILAR NODE	RBH 235	0.9 OZS.	0.00±0.16E 00	60	59.7		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.7 (CONTINUED)

ANIMAL NO.	SAMPLE TYPE	TLW NO.	WET WEIGHT	PU 239, 240 ACTIVITY (DPM)	COUNT TIME	YIELD (R=RE-WORK)	URANIUM (MICRO GRAMS)	REMARKS
3129 - 1	LEFT FEMUR	RBB 194	2.2 LBS.	1.62±0.14E 00	500	50.3		
3134 - 1	LEFT FEMUR	RBB 269	2.2 LBS.	1.84±0.17E 00	400	50.7		
" 2	KIDNEY	RBK 129	1.9 LBS.	4.51±0.28E 00	700	29.4		
" 3	LIVER	RBL 181	6.4 LBS.	8.69±0.17E 01	1000	21.0R		
" 4	LUNG	RBR 552	2.8 LBS.	7.61±0.49E 00	1000	10.6R		
" 5	HILAR NODE	RBH 124	0.4 OZS.	7.68±1.19E-01	200	67.6		
3144 - 1	LEFT FEMUR	RBB 346	2.4 LBS.	3.89±0.21E 00	500	66.3		
" 2	KIDNEY	RBK 270	1.4 LBS.	3.68±0.11E 01	400	66.3		
" 3	LIVER	RBL 262	4.6 LBS.	5.60±0.17E 01	500	26.9R		
" 4	LUNG	RBR 586	2.9 LBS.	6.42±0.22E 01	300	39.0		
" 5	HILAR NODE	RBH 230	0.4 OZS.	2.18±4.35E-02	400	72.3		
3146 -10	N. MUCOSA	RBN 295	8.3 OZS.	1.0[illegible]±0.1[illegible] 00	1000	06.0R		
3147 - 1	LEFT FEMUR	RBB 156	2.2 LBS.	1.08±0.17E 00	200	45.7		
" 2	KIDNEY	RBK 23	1.6 LBS.	1.09±0.14E 00	1000	21.2		
" 3	LIVER	RBL 92	7.9 LBS.	2.53±0.10E 01	1000	10.2		
" 4	LUNG	RBR 487	4.2 LBS.	1.35±0.05E 01	300	61.5		
" 5	HILAR NODE	RBH 25	0.3 OZS.	8.70±3.00E-02	1000	58.5		
" 6	RIGHT FEMUR	RBB 180	2.2 LBS.	9.79±1.17E-01	500	42.8		
" 7	TRACHEA	RBT 93	0.9 LBS.	1.35±0.16E 00	200	69.8		
" 8	G. I. TRACT	RBS 643	3.4 LBS.	3.36±0.33E 00	200	36.2		
" 9	P. MUCOSA	RBP 34	1.8 OZS.	0.89±1.56E-01	200	53.2		NUMBER DUPLICATED
" 9	P. MUCOSA	RBP 26	2.0 OZS.	2.69±0.15E 00	900	42.0		NUMBER DUPLICATED
3148 - 1	LEFT FEMUR	RBB 133	2.2 LBS.	1.03±0.36E 00	200	22.8		
" 2	KIDNEY	RBK 22	1.9 LBS.	1.06±0.14E 00	1000	21.9		
" 3	LIVER	RBL 50	7.4 LBS.	2.58±0.13E 01	200	27.8		
" 4	LUNG	RBR 473	3.3 LBS.	1.81±0.10E 01	200	30.2		
" 5	HILAR NODE	RBH 33	0.5 OZS.	6.10±3.80E-01	300	49.9		
" 6	RIGHT FEMUR	RBB 179	2.6 LBS.	2.01±0.06E 01	500	61.4		
" 7	TRACHEA	RBT 94	0.9 LBS.	3.61±0.27E 00	300	57.0		

* NEW DATA THIS REPORT

CONFIDENTIAL

TABLE E.8 ESTIMATED ACTIVITY EXPENDITURE OF PROJECT 2.6c "A" SAMPLES IN PARTICLE ANALYSIS

ARC	Location	TLW Collection No.	TLW Analysis No.	Pu-239, 240 Activity (DPM)	Event
A	066	2526A	CCD-2160	7.88E 01	Doubletrack
D	064	2920A	CAD-2164	1.26E 01	"
D	068	2922A	CCD-2165	1.28E 03	"
E	058	9624A	-2168	0.00E 00	"
E	058(2)	9698A	-2175	2.74E 02 -2.16E 03	"
E	058	9699A	CTA-2176	2.01E 01	"
G	058	9660A	CCD-2170	2.28E 02	"
G	058	9661A	CTA -2171	1.74E 02	"
G	064	9656A	CCD-2169	4.90E 02	"
H	060	2723A	2161	8.91E 01	"
I	059	9691A	CTA-2174	2.72E 02	"
I	061	9668A	CCD-2172	4.05E 02	"
I	061	9669A	CTA-2173	2.18E 02	"
J	058(1)	2812A	CAD-2162	1.43 ± 0.03E 01	"
N	068	2837A	CCD-2163	0.00E 00	"
R	054	2946A	-2167	5.57E 01	"
R	082	2934A	CAD-2166	0.00E 00	"
Bal	L5, P17	2907A	CCD-2177	6.16E 02	"
"	L7, P9(1)	2443A	CTA-2158	1.39 ± 0.15E 00	"
"	L8, P21(2)	2151A	CCD-2157	3.89E 02- 1.26E 03	"
B Bal	L6, P13	2482A	2159	2.60E 01	"
Bal	L18, P21	3449A	CCD-2180	0.00E 00	Clean Slate I
"	L19, P9 (2)	3013A	CTA-2178	3.93E 02 - 6.21E 02	"
"	L25, P9 (2)	3038A	2179	2.45E 03 - 3.17E 03	"
"	L29, P9(2)	3466A	CCD-2181	1.09E 02 - 2.29E 02	"

(1) Data determined by precision counting. Values without an error assignment determined by 2 π counting.
(2) A range value indicates an unknown fraction of the sample has been removed.

CONFIDENTIAL

TABLE E.8 (CONTINUED)

ARC	Location	TLW Collection No.	TLW Analysis No.	Pu-239, 240 Activity (DPM)	Event
BM	07	4082A	CTA-2194	5.91E01	Clean Slate II
TB	P2(2)	2305A	CCD-2184	3.47E 01 - 2.44E02	"
A	036(1)	4116A	CTA-2195	5.53 ± 0.19E 01	"
A	054(1)	2286A	CCD-2183	5.43 ± 0.19E01	"
B	044(1)	2371A	-2189	4.47 ± 0.21E 00	"
B	054(1)	4812A	CTA-2197	1.26 ± 0.06E 01	"
B	060(1)	2370A	CCD-2188	8.71 ± 0.30E 00	"
B	068(1)	2369A	-2187	6.00 ± 0.19E 01	"
D	030	4163A	CTA-2196	0.00E 00	"
D	034	3182A	CAD-2190	0.00E 00	"
Bal	L1, P17	4022A	CTA-2192	0.00E 00	"
Bal	L3, P9(1)	2312A	CCD-2185	5.67 ± 0.12E 01	"
Bal	L4, P21	4024A	CTA-2193	0.00E 00	"
Bal	L7, P9	4011A	-2191	0.00E 00	"
B Bal	L1, P1	2366A	CCD-2186	6.29 ± 0.34E 00	"
Mob	DP-12	2272A	CCD-2182	7.21 ± 0.36E 00	"
BM	06	4987A	CAD-2201	0.00E 00	Clean Slate III
BM	07	5184A	CTA-2203	0.00E00	"
BM	10(1)	4973A	CCD-2199	1.26 ± 0.03E 00	"
A	030	4974A	CAD-2200	0.00E 00	"
A	102(1)	4964A	-2198	3.45 ± 0.13E 01	"
A	108	5162A	CTA-2202	0.00E 00	

CONFIDENTIAL

TABLE E.9 PLUTONIUM AND URANIUM ANALYSES OF ROLLER COASTER DISTILLED WATER SAMPLES[1], CLEAN SLATE I

R. C. Sample No.	K-030-3133	K-030-3134	L-018-3128	L-030-3129	L-042-3127
Sample Vol. (Lit.)	0.750	0.700	0.825	0.825	0.750
Sample pH	5.1	5.3		5.3	5.0
Centrif. Supernate	1.34×10^4	2.80×10^3	0.00	4.83×10^3	4.50×10^1
Leach Operation[2]					
Millipore Filtrate	$1.17 \pm 0.02 \times 10^4$	$1.99 \pm 0.04 \times 10^3$		$4.45 \pm 0.14 \times 10^3$	
173 min. Leach Fil.	2.76×10^4	6.72×10^3		5.05×10^4	
400 min. Leach Fil.	5.70×10^3	3.92×10^3		1.88×10^4	
968 min. Leach Fil.	5.70×10^3	3.08×10^3		1.49×10^4	
1273 min. Leach Fil.	1.20×10^3	1.12×10^3		7.26×10^3	
2896 min. Leach Fil.	5.40×10^3	2.24×10^3		2.15×10^4	
Extraction[3]	$2.8 \pm 0.06 \times 10^4$	$7.87 \pm 0.15 \times 10^3$		$4.03 \pm 0.10 \times 10^4$	
Water plus Crud			$1.05 \pm 0.04 \times 10^2$		$6.98 \pm 0.42 \times 10^2$
Bottle Wash[4]			$9.43 \pm 0.94 \times 10^0$		$2.35 \pm 0.05 \times 10^1$
Uranium (Mill. Filtrate)[5]	0.593	9.07		1.40	0.795
Uranium (Bot. Leach)[5]			0.965		1.04
Uranium (Water + Crud)[5]			1.08		1.30

(1) All Pu values are given as dpm/tot. sample vol. Values without an error assignment are stippled samples.

(2) Separate aliquot successively leached with 0.1N HCl volumes of 25 ml with intermittent stirring, and filtering.

(3) Extraction performed on separate aliquot at listed sample pH.

(4) Bottles washed with hot HNO_3-HCl and 1N HNO_3-HF.

(5) All uranium values are given as μg U/total sample volume.

CONFIDENTIAL

TABLE E.10 PLUTONIUM AND URANIUM ANALYSES OF ROLLER COASTER DISTILLED WATER SAMPLES[1], CLEAN SLATE II

R.C. Sample No.	D-010-4175	D-018-4176	D-026-4177	D-034-4178	D-042-4179
Sample Vol. (Lit.)	0.225	0.450	0.450	0.250	0.450
Sample pH	5.3	5.3		5.3	
Centrif. Supernate	1.55×10^{3}	7.47×10^{3}	1.02×10^{4}	4.43×10^{4}***	2.97×10^{3}
Total Sample Act.[2]		9.28×10^{5}	1.32×10^{6}	5.52×10^{5}	2.97×10^{5}
Millipore Filtrate	$3.58\pm0.09\times10^{2}$	$5.98\pm.13\times10^{3}$	$8.29\pm.21\times10^{3}$	$3.94\pm0.12\times10^{4}$	$2.93\pm.11\times10^{3}$
% of Tot. Samp. Act.		0.64	0.07	7.14	0.99
173 min. Leach Fil.	7.36×10^{3}	2.12×10^{5}	1.30×10^{5}	2.93×10^{4}	5.36×10^{4}
% of Tot. Samp. Act.		22.8	9.85	5.31	18.0
400 min. Leach Fil.	1.64×10^{3}	5.58×10^{4}	5.18×10^{4}	9.10×10^{3}	1.73×10^{4}
% of Tot. Samp. Act.		6.01	3.93	1.65	5.83
968 min. Leach Fil.	1.10×10^{3}	4.88×10^{4}	6.90×10^{4}	1.07×10^{4}	1.44×10^{4}
% of Tot. Samp. Act.		5.26	5.25	1.94	4.85
1273 min. Leach Fil.	5.94×10^{2}	2.19×10^{4}	2.94×10^{4}	5.4×10^{3}	7.45×10^{3}
% of Tot. Samp. Act.		2.36	2.23	0.98	2.51
2896 min. Leach Fil.	1.12×10^{3}	5.45×10^{4}	9.33×10^{4}	2.1×10^{4}	1.63×10^{4}
% of Tot. Samp. Act.		5.87	7.07	3.87	5.49
Millipore Filter		$5.29\pm0.14\times10^{5}$	$9.38\pm0.25\times10^{5}$	$4.38\pm0.13\times10^{5}$	$1.86\pm0.05\times10^{5}$
% of Tot. Samp. Act.		57.0	71.1	79.3	62.6
Extraction[3]	$7.47\pm0.17\times10^{3}$	$5.26\pm0.12\times10^{5}$	$6.34\pm0.35\times10^{5}$	$1.63\pm0.05\times10^{5}$	$1.84\pm0.04\times10^{5}$
% of Tot. Samp. Act.		56.7	48.0	29.5	61.9
Uranium (Mill. Filtrate)[4]	0.549	72.9	43.7	112.	68.8
Uranium (Mill. Filter)[4]		396.	590	137.	239.
Uranium (Ext. Aliq.)[4]				27.4	

(1) All Pu values are given as dpm/tot. sample vol. Values (other than tot. sample act.) without an error assignment are stippled samples.

(2) Separate aliquot successively leached with 0.1N HCl volumes of 25 ml with intermittent stirring, and filtering. Tot. sample act. is sum of millipore filtrate and filter, and all leaches.

(3) Extraction performed on separate aliquot at listed sample pH.

(4) All uranium values are given as μg U/total sample volume.

CONFIDENTIAL

TABLE E.11 PLUTONIUM AND URANIUM ANALYSES OF ROLLER COASTER DISTILLED WATER SAMPLES[1], CLEAN SLATE III

R.C. Sample No.	A-012-5249	A-036-5248	A-060-5252	A-084-5251	A-108-5250
Sample Vol. (Lit.)	0.400	0.200	0.300	0.400	0.300
Sample pH	5.9	5.6	5.3	5.3	5.3
Centrif. Supernate	5.04×10^{3}	4.2×10^{1}	5.49×10^{2}	1.78×10^{3}	1.91×10^{3}
Tot. Sample Act. (2)	2.24×10^{6}				
Millipore Filtrate	$8.87\pm0.28\times10^{3}$	$4.46\pm0.19\times10^{2}$	$6.30\pm0.02\times10^{2}$	$1.41\pm0.05\times10^{3}$	$1.51\pm0.05\times10^{3}$
% of Tot. Samp. Act.	0.40				
173 min. Leach Fil.	1.29×10^{5}	6.56×10^{3}	4.44×10^{3}	1.68×10^{4}	1.10×10^{4}
% of Tot. Samp. Act.	5.76				
400 min. Leach Fil.	5.02×10^{4}	2.88×10^{3}	1.56×10^{3}	6.72×10^{3}	3.96×10^{3}
% of Tot. Samp. Act.	2.24				
968 min. Leach Fil.	5.52×10^{4}	2.24×10^{3}	7.20×10^{2}	5.92×10^{3}	2.76×10^{3}
% of Tot. Samp. Act.	2.46				
1273 min. Leach Fil.	3.87×10^{4}	1.28×10^{3}	7.20×10^{2}	2.72×10^{3}	1.68×10^{3}
% of Tot. Samp. Act.	1.73				
2896 min. Leach Fil.	1.08×10^{5}	3.68×10^{3}	2.28×10^{3}	7.04×10^{3}	3.72×10^{3}
% of Tot. Samp. Act.	4.82				
Millipore Filter	$1.85\pm0.05\times10^{6}$				
% of Tot. Samp. Act.	82.6				
Extraction[3]	$1.47\pm0.04\times10^{6}$	$7.66\pm0.19\times10^{4}$	$3.89\pm0.11\times10^{4}$	$8.37\pm0.20\times10^{4}$	$4.98\pm0.12\times10^{4}$
% of Tot. Samp. Act.	65.6				
Uranium (Mill. Filtrate)[4]	718.	10.6	11.2	15.4	10.5
Uranium (Mill. Filter)[4]	645.				

(1) All Pu values are given as dpm/tot. sample vol. Values (other than tot. sample act.) without an error assignment are stippled samples.

(2) Separate aliquot successively leached with 0.1N HCl volumes of 25 ml with intermittent stirring, and filtering. Tot. sample act. is sum of millipore filtrate and filter, and all leaches.

(3) Extraction performed on separate aliquot at listed sample pH.

(4) All uranium values are given as μg U/total sample volume.

CONFIDENTIAL

TABLE E.11 (CONTINUED)

R.C. Sample No.	H-006-5219	H-030-5221	H-054-5224	H-078-5225	H-102-5227
Sample Vol. (Lit.)	0.525	0.500	0.725	0.500	0.700
Sample pH		5.3	5.3		
Centrif. Supernate	$<1.0\times10^{0}$	8.40×10^{2}	1.96×10^{2}	$<1.0\times10^{0}$	$<1.0\times10^{0}$
Leach Operation (2)					
Millipore Filtrate		$7.22\pm0.29\times10^{2}$	$2.12\pm0.13\times10^{2}$		
173 min. Leach Fil.		3.18×10^{4}	6.09×10^{2}		
400 min. Leach Fil.		1.92×10^{4}	3.48×10^{2}		
968 min. Leach Fil.		1.32×10^{4}	1.52×10^{2}		
1273 min. Leach Fil.		6.60×10^{3}			
2896 min. Leach Fil.		1.42×10^{4}	1.52×10^{2}		
Extraction(3)		$6.14\pm0.12\times10^{4}$	4.18×10^{3}		
Water plus Crud	$1.93\pm.09\times10^{2}$			$1.96\pm0.13\times10^{3}$	$7.19\pm0.30\times10^{1}$
Bottle Wash(4)	$1.04\pm0.04\times10^{1}$			$3.31\pm0.07\times10^{1}$	$1.75\pm0.04\times10^{1}$
Uranium (Mill. Filtrate)(5)		Not Detectable	Not Detectable		
Uranium (Bot. Leach)(5)	0.175			0.190	0.745
Uranium (Water plus Crud)(5)	2.44			3.24	1.40

(1) All Pu values are given as dpm/tot. sample vol. Values without an error assignment are stippled samples.

(2) Separate aliquot successively leached with 0.1N HCl volumes of 25 ml with intermittent stirring, and filtering.

(3) Extraction performed on separate aliquot at listed sample pH.

(4) Bottles washed with hot HNO_3-HCl and 1N HNO_3-HF.

(5) All uranium values are given as μg U/total sample volume.

CONFIDENTIAL

TABLE E.12 TRACER STANDARDIZATION RESULTS

Aliquot	Method	Total Tracer Act. (dpm/ml) Pu-236	Ave. Tracer Act. (dpm/ml) Pu-236	Std. Dev. σi
1	Isotopic Dilution	25.57		
2	" "	26.04		
3	" "	26.02		
4	" "	25.38		
5	" "	25.41		
6	" "	25.72		
7	" "	26.13		
8	" "	25.75		
9	" "	25.62		
			25.74	± 1.0%
10	Exhaustive Plating	24.92		
11	" "	24.60		
12	" "	25.37		
13	" "	25.32		
		(Ave 13 Plates)	25.05	± 1.5%
		25.48 ± 1.8%		
		1.026% diff.		
		XII-1		

CONFIDENTIAL

TABLE E 13 RADIOCHEMICAL ANALYSIS OF ROLLER COASTER BIOLOGICAL QUALITY CONTROL SAMPLES

APC	LOCATION	ROC COLLECTION NO.	TLW ANALYSIS NO.	EVENT	TYPE	WT. (GZ)	PU-239,240 ACTIVITY (DPM)	YIELD (R=RE WORK)	COUNT TIME	REMARKS
NONE		1-C	RQC-1	BLK/SPIKE	TISSUE	6.3	1.05±0.03E 03	70.0	2C0	1
		2-C	2			5.9	1.79±0.05E 03	58.7	2C0	1
		3-C	3			5.8	6.53±0.20E 02	66.1	2C0	1
		4-C	4			6.4	2.75±0.08E 03	69.4	2C0	
		5-C	5			5.8	1.32±0.04E 03	48.3	2C0	
		6-C	6			5.9	4.00±0.12E 03	74.3	2C0	
		7-C	7			6.1	9.98±0.35E 01	64.0	2C0	
		8-C	8			6.0	2.17±0.08E 03	42.7	2C0	
		9-C	9			6.7	1.70±0.05E 03	69.5	2C0	
		10-C	10			6.2	1.68±0.05E 03	30.1	2C0	
		11-C	11			7.2	1.01±0.02E 03	66.3	2C0	
		12-C	12			5.6	2.91±0.06E 02	70.0	2C0	
		13-C	13			5.8	6.26±0.16E 02	32.0R	4C0	
		14-C	14			5.8	7.78±0.70E 02	62.7	2C0	
		15-C	15		BONE	5.3	1.82±0.03E 03	28.1R	12C0	
		16-C	16		TISSUE	6.0	5.76±0.18E 02	38.8	2C0	
		17-C	17			5.3	2.27±0.06E 02	62.5	2C0	
		18-C	18			6.6	9.36±0.21E 02	44.7R	4C0	
		19-C	19			5.6	1.76±0.05E 02	34.9		
		20-C	20			5.6	6.89±0.15E 02	51.4	3C0	
		21-C	21			5.7	5.33±0.19E 02	40.1	2C0	
		22-C	22			5.8	3.23±0.10E 03	44.9	2C0	
		23-C	23			5.8	9.53±0.27E 02	66.3	2C0	
		24-C	24			8.5	2.90±0.09E 03	24.4	3C0	
		25-C	25			5.8	6.32±0.18E 02	56.6	2C0	
		26-C	26			5.9	3.17±0.09E 03	49.0	2C0	
		27-C	27			6.6	8.44±0.26E 01	69.7	2C0	
		28-C	28			5.6	3.68±0.12E 02	31.4	2C0	

CONFIDENTIAL

TABLE E.13 (CONTINUED)

ARC	LOCATION	ROC COLLECTION NO.	TLW ANALYSIS NO.	EVENT	TYPE	WT. (OZ)	PU-239,240 ACTIVITY (DPM)	YIELD (R=REWORK)	COUNT TIME	REMARKS
NONE		29-C	ROC-29	BLK/SPIKE	TISSUE	5.4	3.54±0.08E 02	56.3	2C0	
		30-C	30			5.5	2.60±0.08E 02	32.4	2C0	
		31-C	31			6.1	3.76±0.09E 03	60.7	2C0	
		32-C	32			5.8	1.15±0.02E 03	60.4	2C0	
		33-C	33			6.2	3.07±0.07E 03	71.6	2C0	
		34-C	34			5.9	4.55±0.10E 02	71.3	2C0	
		35-C	35			7.6	1.86±0.04E 03	67.0	2C0	
		36-C	36		BONE	6.3	1.25±0.03E 03	24.6	4C0	
		37-C	37			6.2	2.25±0.07E 02	14.9	7C0	
		38-C	38		TISSUE	6.9	2.91±0.06E 03	76.1	2C0	
		39-C	39			5.6	8.05±0.18E 02	82.5	2C0	
		40-C	40			6.4	3.72±0.08E 03	63.6	2C0	
		41-C	41			6.1	4.44±0.18E 00	68.6	7C0	
		42-C	42			6.1	1.32±0.41E 00	72.6	7C0	
		43-C	43		BONE	5.2	1.23±0.11E 00	44.4	7C0	

CONFIDENTIAL

TABLE E.14 RADIOCHEMICAL ANALYSES OF TLW BIOLOGICAL QUALITY CONTROL SAMPLES

TLW Analysis No.	Sample Event	Sample Type	Pu-239,240 Activity (dpm)	Yield R=Rework	Count Time	Remarks
OPS-1	Lab Blank	Urine	1.76 ± 0.24	44.3	200	Chemist Urine Sample
2	" "	"	1.98 ± 0.32	35.1	200	" " "
3	" "	"	0.50 ± 0.34	16.9	200	" " "
4	" "	"	1.74 ± 1.16	4.9	200	" " "
5	" "	"	0.64 ± 0.64	6.6	200	" " "
6	" "	"	0.09 ± 0.09	36.6 R	250	" " "
7	" "	"	0.53 ± 0.40	10.7	200	" " "
8	" "	"	0.53 ± 0.26	21.4	200	" " "
9	" "	"	0.20 ± 0.20	35.6	121	" " "
10	" "	"	0.16 ± 0.16	43.5	121	" " "
11	" "	"	0.00 ± 0.09	30.0	200	" " "
12	" "	"	0.00 ± 0.20	14.5	200	" " "
13	" "	"	0.16 ± 0.16	27.3	200	" " "
14	" "	"	0.07 ± 0.09	51.4 R	300	" " "
15	" "	"	0.19 ± 0.19	22.2	200	" " "
16	" "	"	0.00 ± 0.02	62.0	200	" " "
18	" "	"	0.06 ± 0.06	39.3	900	" " "
19	" "	"	0.22 ± 0.22	47.4	250	" " "
20	" "	"	0.10 ± 0.06	45.0	400	" " "
22	" "	"	0.08 ± 0.10	50.1	220	" " "
L-1	Sim. Blank	Beef Liver	0.004 μg U**	65.0	Fluor.**	Conc/0.2 lb sample
L-2	" "	" "	0.005 "	68.0	"	" " " " "
L-3	" "	" "	0.003 "	--	"	" " " " "
L-4	" "	" "	0.005 "	69.0	"	" 0.3 " "
H-1	" "	Hamburger	0.019 "	--	"	" " " " "
H-2	" "	"	0.010 "	66.5	"	" 0.1 " "
H-3	" "	"	0.005 "	--	"	" 0.2 " "
H-4	" "	"	0.016 "	48.4	"	" " " "

CONFIDENTIAL

TABLE E.15 RADIOCHEMICAL ANALYSIS OF ROLLER COASTER PLYSICAL QUALITY CONTROL SAMPLES

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	EVENT	TYPE	WT. (GMS)	PU-239,240 ACTIVITY (DPM)	YIELD (R=RE WORK)	COUNT TIME	REMARKS
G2	BA-05-A	NONE CQC-	1091	SPIKE	SOIL		1.26±0.03E 05		20	TD
	05-B		1101				1.59±0.05E 05		20	TD
	BB-09		1098			8.83				
	BC-03		1090							
	BD-03		1089							
	BE-06		1100							
	BG-06		1094							
	BH-10-A		1093			5.94	6.06±1.58E 00	43.8	80	TD
	-B		1103			5.94	1.53±0.21E 01	64.7	80	TD
	BI-07		1096							
	BK-08		1097							
	BL-07		1095							
	BM-09		1099							
	BO-05-A		1092			10.47	2.39±0.07E 02	63.5	200	TD
	-B		1102			10.47	1.07±0.40E 01	60.1	200	TD
	CM-09-A	8164	1104	CSII		50.03	1.98±0.05E 04	35.0	20	PD
	-A2		1112			50.03	2.40±0.07E 03	14.9	20	RTD
	CN-09-B		1105			50.02	1.83±0.05E 04	31.9	20	PDE
	CM-09-B2		1113			50.02	1.16±0.05E 03	48.3	20	RTD
	DD-01-A	8188	1108	CSIII		50.02	8.25±0.19E 05	74.2	20	PDE
	-A2		1116			50.02	1.03±0.03E 05	37.8	20	RTD
	-C		1110			CA50	7.74±0.17E 05	68.2	20	PDE
	-C2		1118			CA50	3.55±0.11E 04	54.3	20	RTD
	-B		1109			50.04	9.78±0.22E 05	71.0	20	PDT
	-B2		1117			50.04	1.25±0.04E 05	35.7	20	RTD
	221-A	NONE	221-A	QUAL.	SOL.		6.00±2.00E-02	80.6	1000	DPM/ML
	-B		-B				2.00±1.00E-02	67.5	1000	DPM/ML
	513-A		513-A				2.00±2.00E-02	52.2	1000	DPM/ML
	-B		-B				3.00±2.00E-02	41.4	1000	DPM/ML
	CA-99-A		CA-99-A				2.30±0.04E 01	62.6	1000	DPM/ML

TD = TOTAL DISSOLUTION
PD = PARTIAL DISSOLUTION
RTD = RESIDUE - TOTAL DISSOLUTION
PDE = PARTIAL DISSOLUTION AND EXTRACTION

CONFIDENTIAL

TABLE E.15 (CONTINUED)

ARC	LOCATION	TLW COLLECTION NO.	TLW ANALYSIS NO.	EVENT	TYPE	WT. (GMS)	PU-239,240 ACTIVITY (DPM)	YIELD (R=RE WORK)	COUNT TIME	REMARKS
GZ	CA-99-B	NONE	CQC-CA-99-B	QUAL.	SOL.		2.26±0.04E 01	80.6	1000	DPM/ML
	CB-42-A		CB-42-A				5.08±0.15E 02	76.6	20	DPM/ML
	-B		-B				5.01±0.15E 02	73.4	20	DPM/ML
	-11-A		-11-A				4.68±0.14E 02	73.6	20	DPM/ML
	-B		-B				4.58±0.15E 02	67.4	20	DPM/ML
	CC-30-A		CC-30-A				8.59±0.28E 01	68.3	50	DPM/ML
	-B		-B				8.21±0.24E 01	68.2	70	DPM/ML
	CD-93-A		CD-93-A				4.84±0.08E 03	73.1	20	DPM/ML
	-B		-B				4.83±0.07E 03	77.2	20	DPM/ML
	CA-58-A		CA-58-A				2.17±0.06E 01	31.4	1000	DPM/ML
	-B		-B				2.25±0.05E 01	37.1	1000	DPM/ML
	219-A		219-A				1.00±1.00E-02	56.1	500	DPM/ML
	-B		-B				2.00±2.00E-02	33.9	500	DPM/ML
	733-A		733-A				2.00±2.00E-02	42.2	500	DPM/ML
	-B		-B				1.00±2.00E-02	43.3	500	DPM/ML

TD = TOTAL DISSOLUTION
PD = PARTIAL DISSOLUTION
RTD = RESIDUE - TOTAL DISSOLUTION
PDE = PARTIAL DISSOLUTION AND EXTRACTION

CONFIDENTIAL

TABLE E.16 RADIOCHEMICAL ANALYSES OF TLW PHYSICAL QUALITY CONTROL SAMPLES

TLW Analysis No.	Sample Event	Sample Type	Pu-239, 240 Activity (dpm)	Yield R=Rework	Count Time	Remarks
DWS-1	Lab Blank	Reagents	0.06 ± 0.03	70.6	1000	
TLS-LL-1	Pu-236 Std	Pu-239 Tracer	20.9 ± 0.4/ml	71.6	1000	Pu-239(Mass Spec)=20.8 dpm/ml
TLS-HL-1	" "	" "	1054 ± 17/ml	65.7	60	" " =1052 dpm/ml
"	" "	" "	1028 ± 29/ml	66.4	20	" " =1052 dpm/ml
CBR-1115	Lab Blank	Floor Swipe	0.15 ± 0.15	72.0	360	Floor in front of Hood #1
1119	" "	Bench Swipe	0.86 ± 0.28	80.1	360	Slight Contam. removed
1120	" "	Floor Swipe	0.13 ± 0.12	80.4	300	Floor in front of Hood #2
1121	" "	Bench Swipe	0.20 ± 0.13	84.2	300	
1123	" "	Virg Nev Soil	0.40 ± 0.40	40.4	35	Preshot CS 1 Soil Sample
1124	" "	" " "	0.76 ± 0.30	51.0	300	" " " "
1125	" "	" " "	0.73 ± 0.42	31.1	300	" " " "
1126	" "	Reagents	0.13 ± 0.14	86.3	360	High Level Tracer used
1127	" "	"	0.06 ± 0.14	71.7	360	" " " "
1128	" "	"	0.12 ± 0.13	84.9	200	Low " " "
1129	" "	"	0.11 ± 0.11	78.2	200	" " " "
RRB-1	" "	"	0.33 ± 0.38	38.3	250	" " " "
2	" "	"	0.02 ± 0.09	47.0	250	" " " "
3	" "	"	0.08 ± 0.08	43.3	240	" " " "
4	" "	"	0.14 ± 0.13	58.9	240	" " " "
5	" "	"	0.17 ± 0.17	45.0	150	" " " "
6	" "	"	0.0 ± 0.13	29.3	150	" " " "
7	" "	"	0.04 ± 0.16	29.7	240	" " " "
8	" "	"	0.31 ± 0.27	60.9	240	" " " "
R-1	" "	"	0.001 μg U**	90	Fluor.**	Conc/Total Sample
R-2	" "	"	0.001 " "	"	"	
R-3	" "	"	0.002 " "	"	"	
R-4	" "	"	0.002 " "	"	"	
R-5	" "	"	0.001 " "	"	"	
R-6	" "	"	0.002 " "	"	"	
R-7	" "	"	0.001 " "	"	"	
R-8	" "	"	0.001 " "	"	"	
R-9	" "	"	0.002 " "	"	"	
R-10	" "	"	0.002 " "	"	"	
R-11	" "	"	0.001 " "	"	"	
R-12	" "	"	0.002 " "	"	"	
2907 A-8	" "	"	0.001 " "	"	"	
2907 A-12	" "	"	0.002 " "	"	"	

CONFIDENTIAL

TABLE E.17 NUMBER OF ANALYSES OF BIOLOGICAL SAMPLES FOR PLUTONIUM AND URANIUM

SAMPLE TYPE	DOG		SHEEP		BURRO		NO ANIMAL		TOTAL	
	Pu	U	Pu	U	Pu	U	Pu	U	Pu	U
Bone	31	7	35	3	30				96	10
Kidney	31	7	34	4	27				92	11
Liver	30	6	30	4	30				90	10
Lung	27	20	34	12	29	3			90	35
Hilar Node	30	7	34	6	29				93	13
Trachea	22		8		7				37	
G.I. Tract	21		8		6				35	
Pharyngeal Mucosa	21				6				27	
Nasal Mucosa	21		8		2				31	
Urine			61						61	
Feces			21						21	
R.C. Qual. Control (Tissue)							39		39	
R.C. Qual. Control (Bone)							4		4	
TLW Qual. Control (Urine Blk)							20		20	
TLW Qual. Control (Meat Blk)							8*	8	8	8
Total	234	47	273	29	166	3	71	8	744	87

* Not listed in the data tables of this report

CONFIDENTIAL

TABLE E.18 NUMBER ANALYSES OF PHYSICAL SAMPLES FOR PLUTONIUM AND URANIUM

SAMPLE TYPE	DOUBLETRACK		C.S. I		C.S. II		C.S. III		NO EVENT		TOTAL	
	Pu	U	Pu	U	Pu	U	Pu	U	Pu	U	Pu	U
Casella Samples	262	37	129	12	314	44	197	15			902	108
Anderson Samples	132	12	95	3	46	14	111	15			384	44
Total Air Samples	30	6	27	7	37	18	14				108	31
Total Air Sampler Disp.	11	1	6	2	3		32	2			52	5
Sequential Air Samples					11		24				35	
Deposition Sample	63	1	55	1	104		137				359	2
Water Sample			30	8	44	10	65	14			139	32
Aluminum Collector	8		4		24						36	
Vegetation (Sagebrush)	16		11		12		12				51	
Soil Fractions	56	56	37	37	31	31	52	52			176	176
Balloon Wire Swipes			16*		14*		6*				36*	
R.C. Qual. Control (Soil)					4		6		35		45	
R.C. Qual. Control (Solution)									20		20	
TLW Qual. Control (Lab. Blk)									23	14	23	14
Tracer Standardization (Sol.)									13		13	
Qualification Samples (Soil and Solubility)									28		26	
Misc. (Casella's and Andersen's)	~50**	~50**	~50**	~50**	~50	~50**	~50**	~50**			~200**	~200**
Total	578	213	410	170	644	217	656	198	119	14	2607	598

* Duplicate analyses performed

** Analyses performed on samples received from Eberline Instr. Inc. and Isotopes Inc. but not listed in the data tables of this report.

CONFIDENTIAL

APPENDIX F
EQUIPMENT AND PLOT OF TYPICAL SPECTRUM

CONFIDENTIAL

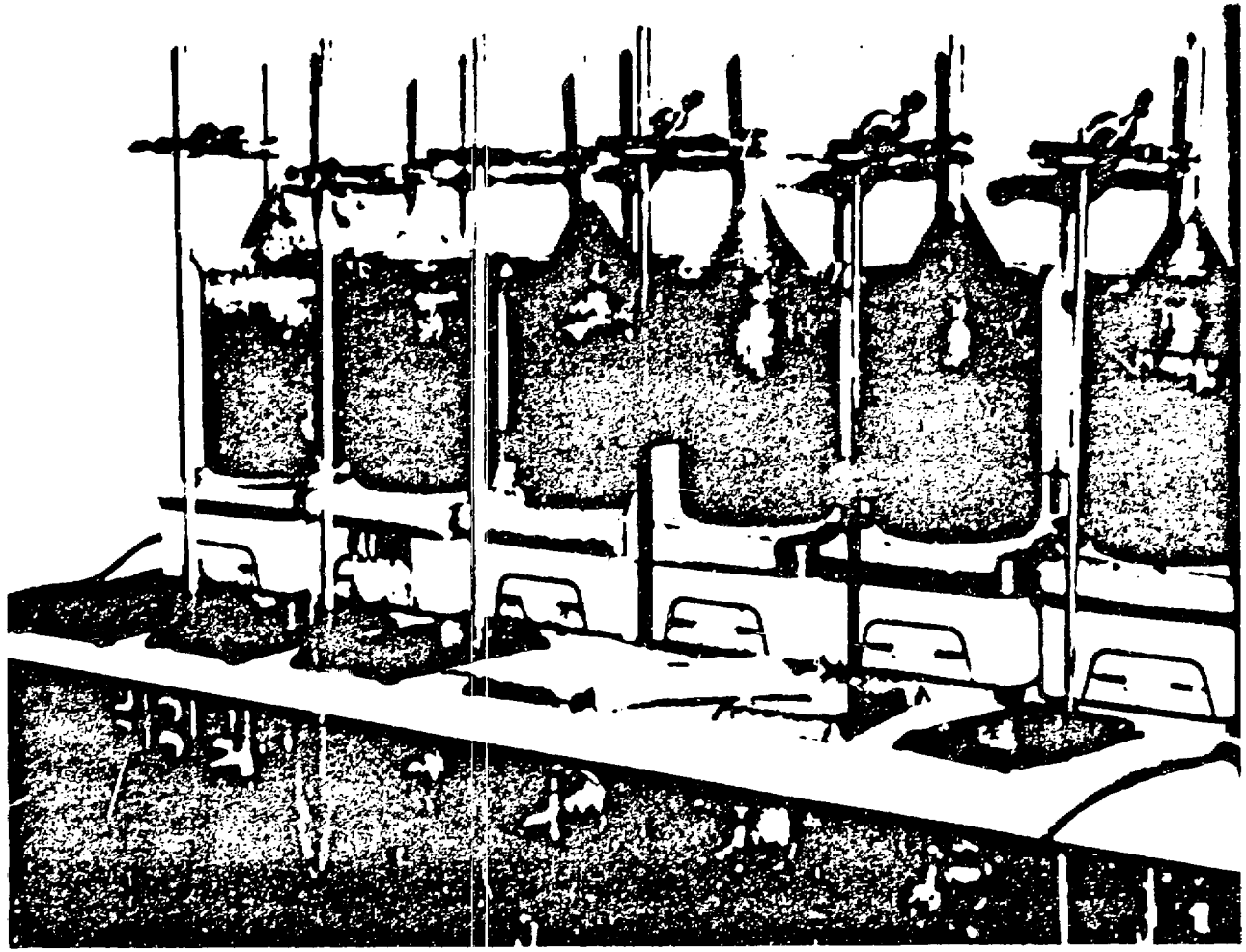


Figure F.1 Reflux apparatus for biological sample.
(Tracerlab photo)

CONFIDENTIAL

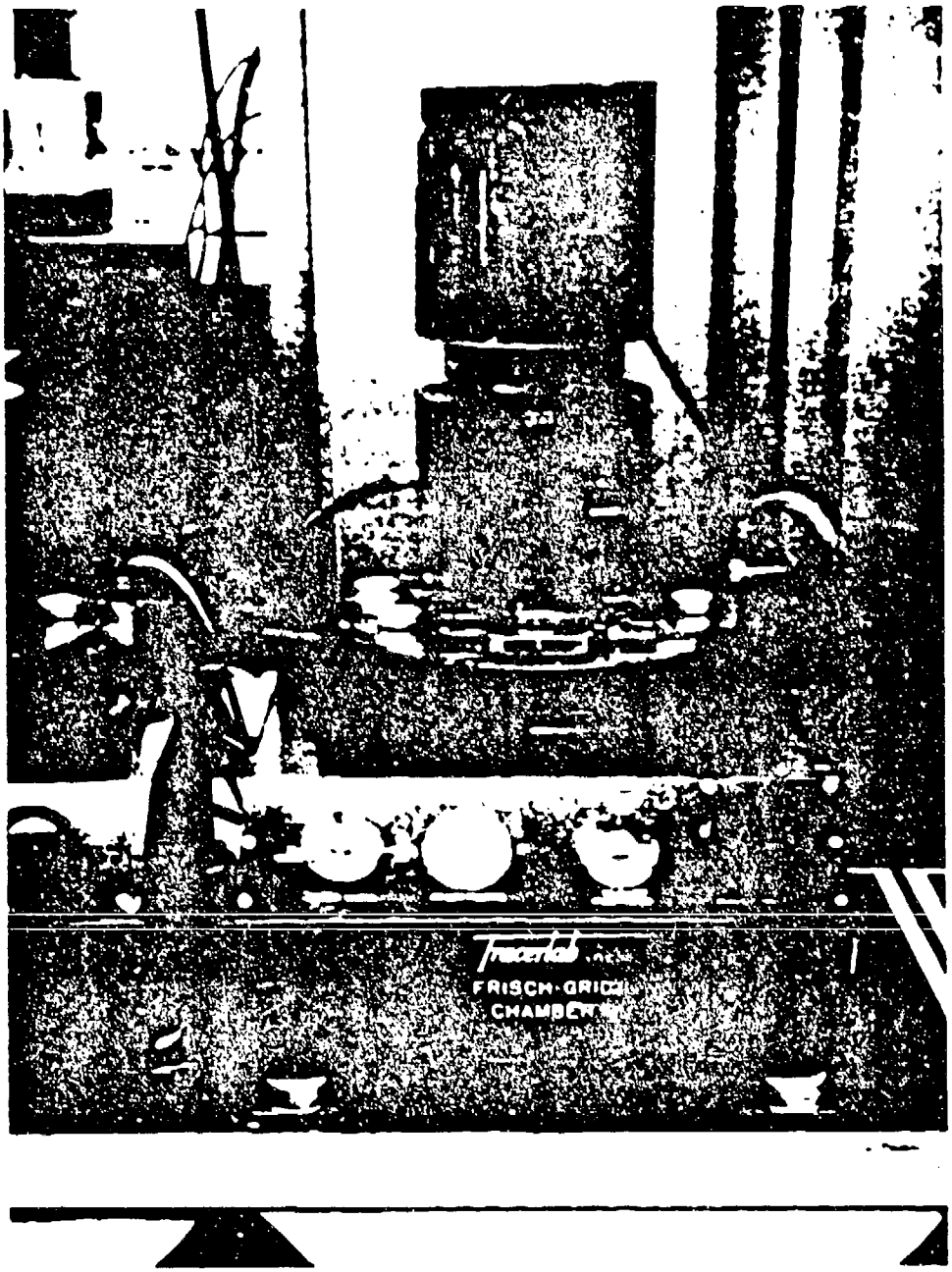


Figure F.2 Frisch-grid chambers. (Tracerlab photo)

CONFIDENTIAL

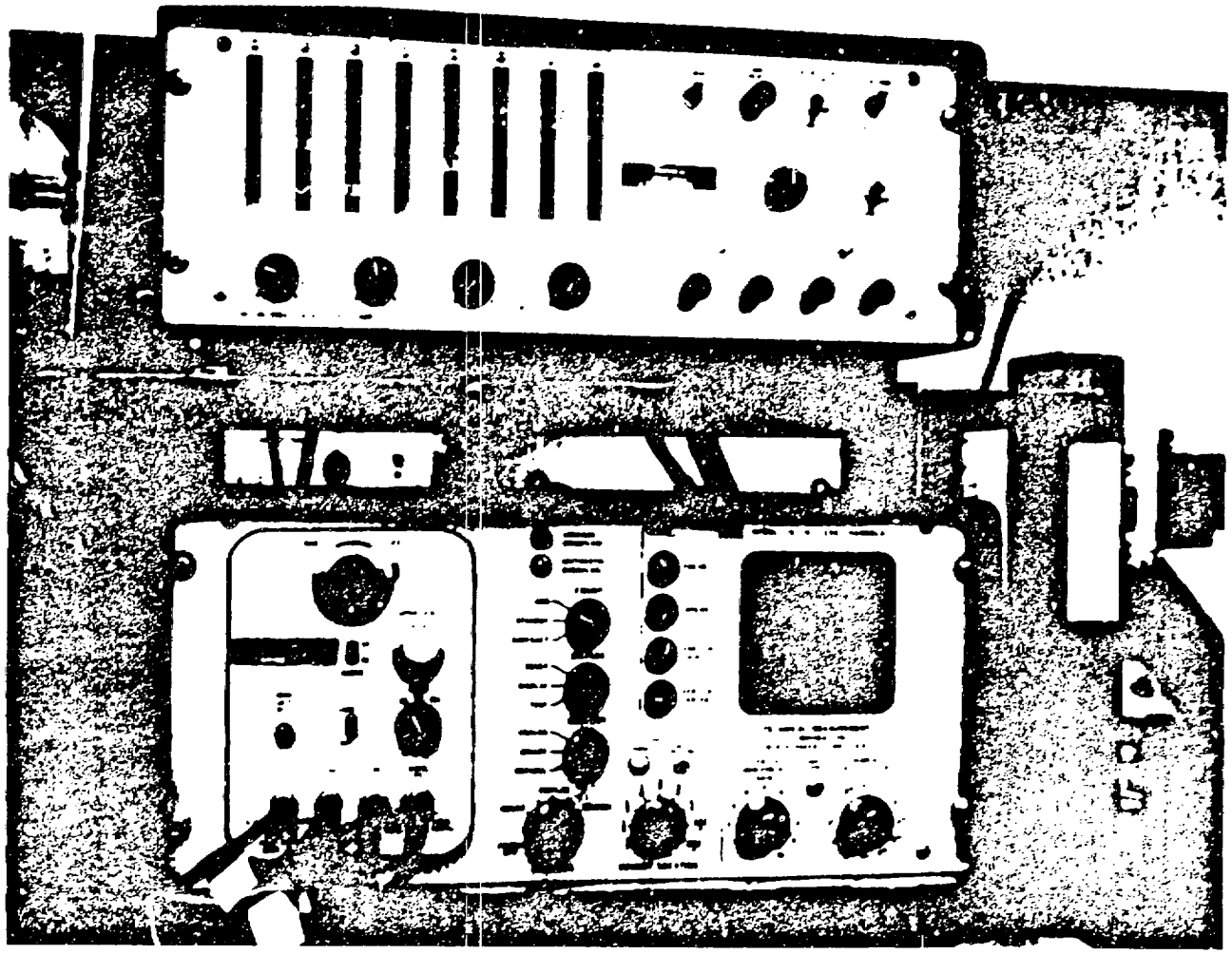


Figure F.3 TMC multichannel analyzer.
(Tracerlab photo)

CONFIDENTIAL

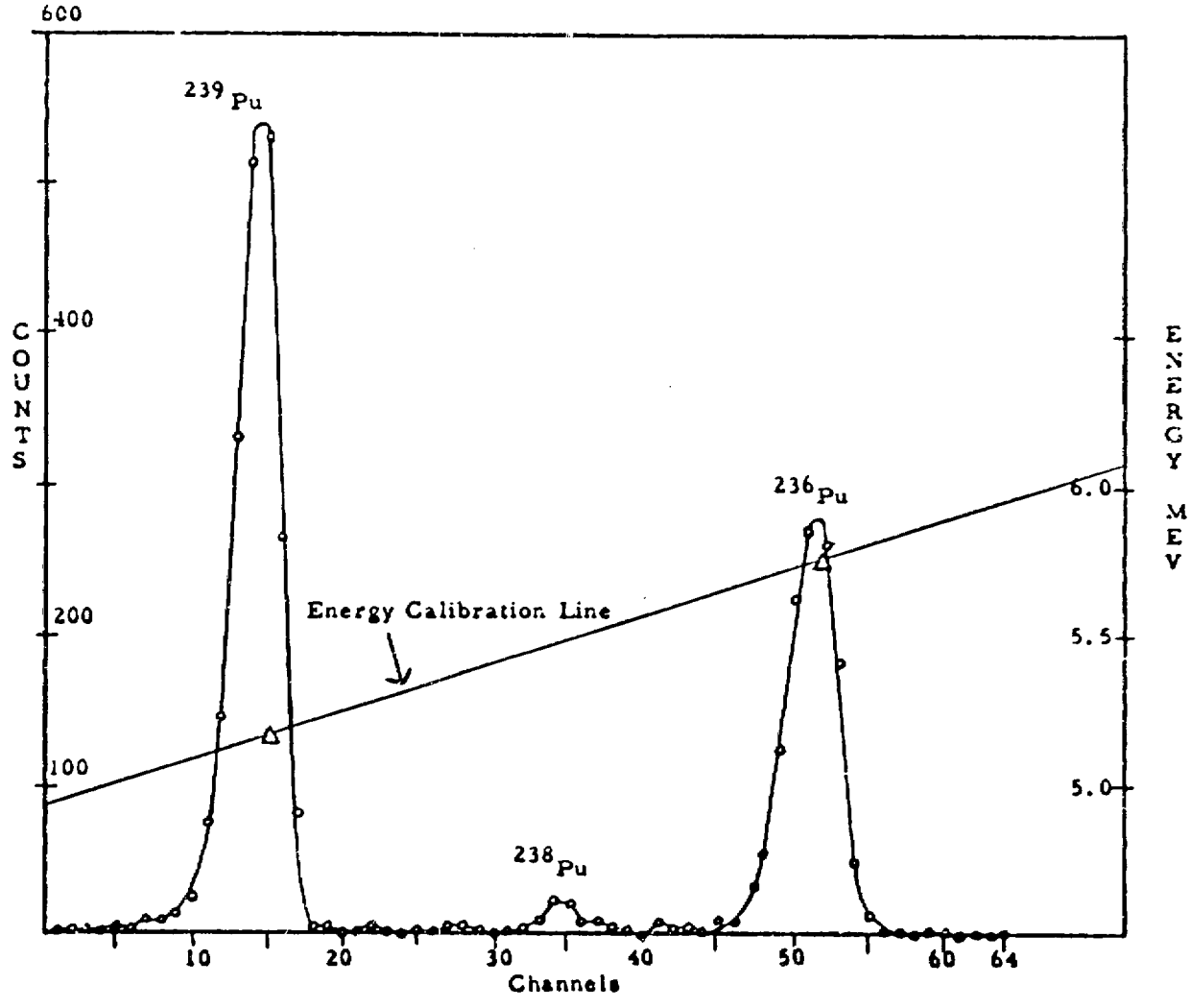


Figure F.4 Typical spectra, biological sample (burro liver).

CONFIDENTIAL

REFERENCES

1. R. H. Wilson, R. G. Thomas and J. Newell Stannard "Biomedical and Aerosol Studies Associated with a Field Release of Plutonium"; Project 72, Operation Plumbbob, WT-1511, February, 1961; Sandia Corporation, Albuquerque, N.Mex.; Unclassified.
2. "Department of Defense Operations Plan for Operation Roller Coaster", March 1963; Headquarters Field Command, Defense Atomic Support Agency, Sandia Base, Albuquerque, New Mex.; Confidential.
3. S. Glasstone, editor; "The Effects of Nuclear Weapons"; Revised Edition 1963; Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.; Unclassified.
4. J. J. Katz and G. T. Seaborg; "The Chemistry of the Actinide Elements"; First Edition, 1957; Methuen and Co., Ltd. London, and John Wiley and Sons, Inc., New York; Unclassified.
5. "Handbook of Chemistry and Physics"; Forty-fourth Edition, 1962-1963; Chemical Rubber Publishing Co., Cleveland, Ohio, Unclassified.
6. G. T. Seaborg; "The Transuranium Elements"; First Edition, 1958; Yale University Press, Addison-Wesley Publishing Co., Inc., Reading, Mass.; Unclassified.
7. Collected Papers on Methods of Analysis for Uranium and Thorium. Geological Survey Bulletin 1006, U. S. Government Printing Office, Washington; 1954.

[redacted]

8. TLW 1070, Tracerlab Counting Room Manual, Nov. 1961.

9. L. J. Beaufait and H. R. Lukens, Handbook of Radiochemical Analysis, Vol. II, 111-114, AEC PB-121689 (March 1952).

10. H. V. Weise and W. H. Shipman, Anal. Chem. 33, 37 (1961).

11. E. Painter et al., Clinical Physiology of Dogs Injected with Plutonium, AECD-2042, CH-.859 (June 1946).

12. U. Hollstein, A. H. M. Hoogma and J. Kooi, Health Phys. 8, 49 (1962).

13. S. M. Sanders and S. C. Leidt, Health Phys. 6, 189 (1961).

14. J. Kooi and U. Hollstein, Health Phys. 8, 41 (1962).

15. C. L. Comar, Radioisotopes in Biology and Agriculture, 160-163, McGraw-Hill Book Company, Inc., New York (1955).

16. A. E. Greenberg, Radiological Health News of State of California, Department of Public Health 3, 1 (January 1964)

17. T. Y. Toribara and C. Predmore, Determination of Plutonium in Biological Samples, papers presented at the Eighth Annual Meeting on Bio-Assay and Analytical Chemistry, 81 (Oct. 18 19, 1962)

18. W. H. Langham, Determination of Plutonium in Human Urine, USAEC, MDDC-1555 (1947).

19. L. Wish and M. Rowell, USNRDL-TR-117 (1956).

20. R. F. Mitchell, Anal. Chem. 32, 326 (1960).

21. G. F. Smith, Analytica Chemica Acta 5, 5 (May 1953).

[redacted]