-6956

ANL-6956

Argonne National Laboratory

THE CHEMICAL ANALYSIS OF Pu, Pu ALLOYS, AND Pu COMPOUNDS: METHODS, TECHNIQUES, SEPARATIONS PROCEDURES, AND PHYSICAL DATA

An Annotated Bibliography of the Literature

by

H. B. Evans and J. O. Karttunen

Printed in USA. Price $4.00. Available from the Clearinghouse for Federal
Scientific and Technical Information, National Bureau of Standards,
U. S. Department of Commerce, Springfield, Virginia

ANL-6956
Chemistry
(TID-4500, 43rd Ed.)
AEC Research and
Development Report

ARGONNE NATIONAL LABORATORY
9700 South Cass Avenue
Argonne, Illinois 60440

THE CHEMICAL ANALYSIS OF Pu, Pu ALLOYS, AND Pu COMPOUNDS: METHODS, TECHNIQUES, SEPARATIONS PROCEDURES, AND PHYSICAL DATA

An Annotated Bibliography of the Literature

by

H. B. Evans and J. O. Karttunen

Chemistry Division

October 1964

Operated by The University of Chicago
under
Contract W-31-109-eng-38
with the
U. S. Atomic Energy Commission

FOREWORD

This bibliography covers essentially all aspects of analytical methodology for plutonium. It goes beyond strictly analytical procedures in order to provide a basis for analytical development work that is still needed on procedures for analyzing new compounds and alloys of plutonium and on new approaches to long-standing problems.

The literature covered includes physical chemistry, separations chemistry, physiological and criticality hazards, health and safety, glovebox construction and operation, and corrosion control--all relating to plutonium. The entries selected are those the compilers considered valuable to persons engaged in all aspects of the analysis of plutonium.

The literature from 1947 through March 1964 was searched and short abstracts prepared especially for this bibliography. The sources used were:

Analytica Chemica Acta

Analytical Chemistry

Chemical Abstracts

Journal of the American Chemical Society

Journal of Chemical Education

Journal of Inorganic and Nuclear Chemistry

Nuclear Science Abstracts

Talanta

The Analyst

and the files at Argonne National Laboratory.

Entries are arranged alphabetically by first author, and a key-word subject index is provided. Journal titles are abbreviated according to the "List of Periodicals," 1961, published by the American Chemical Society. This list also gives the names of publishers and indicates the libraries where the periodicals are retained. A key to the symbols used for the report literature, both foreign and domestic, is presented on the following pages.

FOREWORD

This bibliography covers essentially all aspects of analytical methodology for plutonium. It goes beyond strictly analytical procedures in order to provide a basis for analytical development work that is still needed on procedures for analyzing new compounds and alloys of plutonium and on new approaches to long-standing problems.

The literature covered includes physical chemistry, preparative chemistry, physiological and criticality hazards, health and safety, glove box construction and operation, and corrosion control--all relating to plutonium. The entries selected are those the compilers considered valuable to persons engaged in all aspects of the analysis of plutonium.

The literature from 1947 through March 1964 was searched and short abstracts prepared especially for this bibliography. The sources used were:

Analytica Chimica Acta

Analytical Chemistry

Chemical Abstracts

Journal of the American Chemical Society

Journal of Chemical Education

Journal of Inorganic and Nuclear Chemistry

Nuclear Science Abstracts

Talanta

The Analyst

and the files of Argonne National Laboratory.

Entries are arranged alphabetically by first author, and a permuted subject index is provided. Journal titles are abbreviated according to the "List of Periodicals" 1961, published by the American Chemical Society. This list also gives the names of publishers and indicates the libraries where the periodicals are retained. A key to the symbols used for the report literature, both foreign and domestic, is presented on the following pages.

ORGANIZATIONAL SYMBOLS

Symbol	Full Title of Organization
A	Calif. Univ., Berkeley, Radiation Lab.
AE	Aktiebolaget Atomenergi, Stockholm
AECD	U. S. Atomic Energy Commission Declassified Document
AECL	Atomic Energy of Canada Ltd., Chalk River, Ontario
AEC-tr	Division of Technical Information Extension, AEC
AECU	Division of Technical Information Extension, AEC
AEDC	Arnold Engineering Development Center, Arnold AF Station, Tenn.
AEEW	United Kingdom Atomic Energy Authority, Research Group, Atomic Energy Establishment, Winfrith, Dorset, England
AERE	United Kingdom Atomic Energy Authority, Atomic Energy Research Establishment, Harwell, Berkshire, England
AFSWC	Air Force Special Weapons Center, Kirtland AFB, New Mexico
ANL	Argonne National Laboratory, Argonne, Illinois
BC	Calif. Univ., Berkeley, Radiation Lab.
BMI	Battelle Memorial Inst., Columbus, Ohio
CAPE	Division of Technical Information Extension, AEC (to identify engineering materials)
CC	University of Chicago. Metallurgical Laboratory
CEA	France. Commissariat a-l'Energie Atomique, Paris
CEI	National Research Council of Canada, Atomic Energy Project, Chalk River, Ontario
CF	University of Chicago. Metallurgical Laboratory
CF-(yr-mo)	Oak Ridge National Laboratory, Tennessee
CH	University of Chicago. Metallurgical Laboratory
CI	National Research Council of Canada
CK	University of Chicago. Metallurgical Laboratory
CL	University of Chicago. Metallurgical Laboratory
CN	University of Chicago. Metallurgical Laboratory

Symbol	Full Title of Organization
CONF	Serial number assigned to conferences cataloged by the AEC Division of Technical Information Extension
COO	Chicago Operations Office, AEC
CRC	National Research Council of Canada, Atomic Energy Project, Chalk River, Ontario
CRDC	National Research Council of Canada, Atomic Energy Project, Chalk River, Ontario
CRP	National Research Council of Canada, Atomic Energy Project, Chalk River, Ontario
CRRP	National Research Council of Canada
CT	University of Chicago. Metallurgical Laboratory
DASA	Defense Atomic Support Agency, Washington, D. C.
DEG-Report	United Kingdom Atomic Energy Authority. Development and Engineering Group, Risley, Lancs, England
DP	DuPont de Nemours (E. I.) & Co., Wilmington, Del.
ERDL	Engineer Research and Development Labs., Fort Belvoir, Va.
EUR	European Atomic Energy Community, Nuclear Research Center, Ispra, Italy
EURAEC	United States--Euratom Joint Research and Development Program
GEAP	General Electric Co.
HW	General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
HW-SA	General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
IDO	Idaho Operations Office, AEC
IGO	Gt. Brit. Windscale Works, Sellafield, Cumb., England, Industrial Group Report
IGR	Gt. Brit. Windscale Works, Sellafield, Cumb., England, Industrial Group Report
IS	Ames Laboratory, Ames, Iowa
ISC	Iowa State College, Ames, Iowa
JENER	Joint Establishment for Nuclear Energy Research, Kjeller, Norway
JPRS	Joint Publications Research Service, New York

Symbol	Full Title of Organization
JUL	Kernforschungsanlage, Julich, Germany
K	Carbide and Carbon Chemicals Corp., K-25 Plant, Oak Ridge, Tenn.
KAPL	Knolls Atomic Power Lab., Schenectady, New York
KFK	Kernreaktor Bau-und Betrieb-Gesellschaft, M. H., Karlsruhe, Germany
KR	Norway. Institutt for Atomenergi, Kjeller
LA	Los Alamos Scientific Lab., New Mexico
LADC	Los Alamos Scientific Lab., New Mexico
LAMS	Los Alamos Scientific Lab., New Mexico
LRL	California Research & Development Co., Livermore Research Lab., Livermore, California
LWS	California Research and Development Co., Berkeley, Calif.
MDDC	Manhattan District, Oak Ridge, Tennessee
MLM	Mound Laboratory, Miamisburg Ohio, Operated for USAEC
MND	Martin Co., Nuclear Division, Baltimore
Mon (Letter)	Clinton Labs., Oak Ridge, Tennessee
N	Argonne National Laboratory, Argonne, Illinois
NAA	North American Aviation, Inc., Downey, California
NAA-SR	North American Aviation, Inc., Downey, California
NBL	New Brunswick Lab., AEC, N. J.
NDA	Nuclear Development Associates, Inc., White Plains, N. Y.
NP	Division of Technical Information Extension, AEC. Non-AEC report
NUMEC	Nuclear Materials and Equipment Corp., Apollo, Pennsylvania
NYO	New York Operations Office, AEC
ORNL	Oak Ridge National Laboratory, Tennessee
ORNL-TM	Oak Ridge National Laboratory, Tennessee
PAN	Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw
PG	United Kingdom Atomic Energy Authority, Production Group

Symbol	Full Title of Organization
PGR	United Kingdom Atomic Energy Authority, Production Group
RDB(W)	United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England
RFP	Rocky Flats Plants--operated by Dow Chemical Co. for USAEC
SCR	Sandia Corp., Albuquerque, New Mexico
SCTM	Sandia Corp., Albuquerque, New Mexico
TID	Division of Technical Information Extension, AEC
TRG-Report	United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Research Establishment. Harwell, Berks., England
UCLA	California Univ., Los Angeles
UCRL	Calif. Univ., Berkeley, Lawrence Radiation Lab.
UK	United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks., England
UR	Rochester, N. Y. University
USNRDL	U. S. Naval Radiological Defense Laboratory, San Francisco, Calif.
WAPD	Westinghouse Electric Corp., Atomic Power Division, Pittsburgh
WASH	Atomic Energy Commission, Washington, D. C.
WCAP	Westinghouse Electric Corp., Commerical Atomic Power Activity, Pittsburgh
WSL	United Kingdom Atomic Energy Authority. Windscale Works, Sellafield, Cumb., England
WT	Assigned to reports to the Scientific Director of Joint AEC-DOD weapon tests

ABSTRACTS

1. PREPARATION AND PROPERTIES OF SOME PLUTONIUM SULFIDES AND OXYSULFIDES. B. M. Abraham, N. R. Davidson, E. F. Westrum. National Nuclear Energy Series, Div. IV, Vol. 14B, Transuranium Elements, Pt. I, 814-19, McGraw-Hill Book Company, Inc., New York, 1949.

At approximately 1225°C, PuO_2 in a graphite crucible reacts with H_2S to form Pu_2O_2S. A different X-ray pattern is formed for a chemically identified Pu_2S_3 prepared from $PuCl_3$ and H_2S at 900°C. PuS was thought to be obtained by reduction of PuF_3 with Ca metal in a BaS crucible.

2. ION EXCHANGE BEHAVIOR OF THE TRANSURANIUM ELEMENTS IN $LiNO_3$ SOLUTIONS. S. Adar, R. Sjoblom, R. Barnes, P. Fields, E. Hullet, H. Wilson. J. Inorg. Nucl. Chem. 25, 447-452 (1963).

The distribution coefficients of the trivalent actinide elements Pu, Am, Cm, and Cf between $LiNO_3$ solutions (containing 0.005 M H^+) and Dowex-1 anion resin were measured.

3. ANALYTICAL METHODS SURVEY - AEC MATERIALS MANAGEMENT - CONTRACTOR REPRESENTATIVES MEETING, WASHINGTON, D. C., MAY 7-9, 1956. TID-7516 (Pt. 1).

AEC and contractor representatives met to discuss nuclear materials control. Problems covered included procedures for measurement of U^{235} consumption, coulometric determination of Pu and U, X-ray spectrographic determination of U, and a complexing agent-ammonium phosphate method for the analytical separation of U.

4. A MONITOR FOR URANIUM AND PLUTONIUM IN THE AIR. AEI Eng. 2a, No. 6, 309-11 (Nov - Dec 1962).

An air monitor was developed to exploit the properties of a Si surface-barrier detector featuring background separation, high sensitivity, U-Pu discrimination, and rapid response.

5. THE ION-EXCHANGE PROPERTIES OF SILICA GEL. I. THE SORPTION OF Na^+, Ca^{2+}, Ba^{2+}, UO_2^{2+}, Gd^{3+}, Zr(IV)+Nb, U(IV), and Pu(IV). S. Ahrland, I. Grenthe, B. Noren. Acta Chem. Scand. 14, 1059-76 (1960).

The metal-ion sorption on silica gel was investigated. It acts as an ion exchanger of the weakly acid type. An amount of H ions equivalent to the amount of metal ions sorbed is set free at the sorption on silica gel that has been saturated with H. The amount of metal ions sorbed depends strongly on the pH of the solution. The equilibrium is usually reached within 5 min.

6. RECENT DEVELOPMENTS IN AQUEOUS REPROCESSING OF IRRADIATED URANIUM. S. Ahrland. NP-7672, Oct. 1, 1958.

Recent developments of organic ion exchangers for Pu tail end treatment and use of inorganic exchanger for Pu and U separation are discussed. Consideration is given to using U(IV) for Fe(II) as a reducing agent for Pu(IV). Dual-temperature scrub also deserves closer investigation.

7. THE ANALYSIS FOR PLUTONIUM BY COUNTING METHODS. A. M. Aikin, T. Bruce. CEI-58, June 15, 1953.

The LaF_3 method for Pu was investigated and found to be below 95% of the true value. This is due principally to self absorption of alphas. It was noted that absorption reaches 5% when the sources contain 500 μg of U. It is better in some cases to make a direct mount rather than separate the Pu by LaF_3.

8. ION EXCHANGE RECOVERS PLUTONIUM FROM IRRADIATED FUELS. A. M. Aikin. Chem. Eng. Progress, 53, 82F-85F (1957).

Pilot plant runs are described to demonstrate the extraction of Pu from irradiated U by anion exchange methods.

9. IMPROVEMENTS IN OR RELATING TO PURIFICATION OF PLUTONIUM. L. Airey. British Pat. 905,274, Sept.5, 1962.

The usual oxalate precipitation method for final purification of Pu from irradiated U was modified so that further oxalate precipitations could be carried out. The Pu oxalate precipitate is oxidized by ozone anodic oxygen in HNO_3 solution to decompose the oxalate and dissolve the Pu, and the resulting solution may then be treated again for precipitation of Pu oxalate.

10. TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING SOLVENT FOR INORGANIC NITRATES-V. FURTHER RESULTS FOR THE TETRA- AND HEXAVALENT ACTINIDE NITRATES. K. Alcock, G. F. Best, E. Hesford, H. A. C. McKay. J. Inorg. Nucl. Chem. 6, 328-333 (1958).

Partition coefficients have been determined for (Th, Np, Pu)$(NO_3)_4$ and (U, Np, Pu) $O_2(NO_3)_2$ at trace concentrations in presence of nitric acid, between a tri-n-butyl phosphate (TBP) and an aqueous phase. All are strongly extracted.

11. INVESTIGATION OF THE PuO_2F_2-HF-H_2O SYSTEM (20°C DIAGRAM). I. F. Alenchikova, L. V. Lipis, N. S. Nikolaev. Atomnaya Energ. 10, 592-6 (June 1961).

The complex forming reaction, hydrolysis, and solubility in hydrofluoric acid solution at various temperatures of plutonyl fluorides were studied by means of isothermal solubility of the ternary system PuO_2F_2-HF-H_2O. The presence of the three phases $PuO_2F_2 \cdot H_2O$, $H_2PuO_2F_4 \cdot 4H_2O$, and $PuO_2F_2 \cdot 2H_2O$ was established by electron absorption spectroscopy. The presence of the acid was established by a migration method and by potentiometric titration.

12. STUDY OF THE PHYSICOCHEMICAL PROPERTIES OF PLUTONYL FLUORIDE. I. F. Alenchikova, L. L. Zaitseva, L. V. Lipis, N. S. Nikolayev, V. V. Fomin, N. T. Chebotarev. Russian Jour. of Inorg. Chem. 3, No. 4-6, 178 (1958).

Methods of preparing plutonyl fluoride and its properties were studied. The Pu was determined radiometrically, and its valence state determined by electronic absorption spectra of crystals. Plutonyl fluoride crystal structure is described.

13. A SURVEY OF DEVELOPMENTS IN PLUTONIUM PROCESS CHEMISTRY FOR 1948-1949. H. W. Alter, E. L. Zebroski. KAPL-314, March 17, 1950.

Work at Knolls Atomic Power Laboratory and at Argonne, Hanford, and Oak Ridge is surveyed.

14. ONE-CYCLE PROCESS FOR RECOVERY AND DECONTAMINATION OF PLUTONIUM. H. W. Alter, R. Fowler, J. L. Mewherter. KAPL-1748, Jan. 2, 1957.

The proposed process involves a solvent extraction, cation exchange stage, followed by precipitation of plutonium peroxide with hydrogen peroxide.

15. THE SEPARATION OF PLUTONIUM BY ANION EXCHANGE IN 10M NITRIC ACID SOLUTION. I. PRELIMINARY INVESTIGATION. II. ANALYTICAL APPLICATION TO ROD SOLUTION. G. M. Allison, R. G. Hart. AECL-1372 (PDB-86 and 87). First issued in 1953. Reissued Sept 1961.

Pu(IV) can be adsorbed from 8M HNO_3 on a column of Dowex-1, washed, eluted to Pu(III) with Fe(II), $NH_2OH \cdot HCl$, or H_2SO_4 solutions. To obtain purer Pu, this can be done again. The method can be used in the recovery and purification of Pu, either as an early step or as the final purification stage, and for the use in separating Pu for analytical detection. Time required is 2 hours.

16. THE SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM AS Pu(III). G. M. Allison. AECL-1371 (PDB-57), April 23, 1952.

A sample containing 10-20 mg of Pu is pipetted into a 5-ml volumetric flask containing some 0.5N HNO_3 and 0.5 ml of 10% $NH_2OH \cdot HCl$. The solution is diluted to volume with 0.5N HNO_3, and absorbance is measured at 602 mu after standing 15-30 minutes. Precision is >1%. The method was checked gravimetrically by detection of Pu as PuO_2 and titrimetrically by reduction to Pu(III) with a Jones reductor and titration with $Ce(SO_4)_2$. No interference is encountered from Fe and U in concentrations up to 50% of the Pu concentration.

17. FUEL REPROCESSING SERIES: FUEL REPROCESSING BY AQUEOUS METHODS. E. L. Anderson, Jr. Nucleonics 15, No. 10, 72-77 (1957).

A generalized solvent-extraction flow sheet for the separation of U and Pu from irradiated fuels is presented.

18. THE DETERMINATION OF PLUTONIUM IN URANIUM RECOVERED BY REDOX. W. S. Andrus, D. J. Fisher. KAPL-328, April 11, 1950.

It is desired to analyze Pu to within ±5 parts per 10^9 parts of U. Complete separation from other alpha emitters is required. The method is a modification of the LaF_3 procedure and incorporates a metathesis step before final mounting of the LaF_3 precipitate.

19. CHEMICAL ENGINEERING DIVISION SUMMARY REPORT. JULY, AUGUST, SEPTEMBER 1958. Argonne National Laboratory. ANL-5924, Dec 1958.

A spectrophotometric method for Pu using the nitrate complex is discussed, as well as progress on a polarographic method and an indirect method for Pu where iron is determined with orthophenanthroline. Preliminary work was also done on the determination of Pu with iodide.

20. MASS SPECTROSCOPY AND CRYSTAL STRUCTURE - DIVISION QUARTERLY FOR SEPTEMBER 1, 1949 THROUGH NOVEMBER 30, 1949. Argonne National Laboratory. ANL-4400, Jan. 19, 1950.

Isotopes of V, I, and Pu were examined by mass spectroscopy. It was found that Pu could be analyzed with as little as 2 u gm. It was noted that residual gases are important sources of error owing to differential retardation of the ions during analysis.

21. CHEMICAL ENGINEERING DIVISION SUMMARY REPORT FOR APRIL, MAY, JUNE 1960. Argonne National Laboratory. ANL-6183.

A fusion technique was developed for the dissolution of PuO_2, and analytical methods were developed for the determination of Pu.

22. REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT. JULY 1963. Argonne National Laboratory. ANL-6764, Aug. 15, 1963.

Development progress is reported on fast reactors, liquid-metal-cooled reactors, ZPR-III, ZPR-IV, ZPR-VI, ZPR-VII, Faret, EBR-I, EBR-II, Borax-V, Treat, Fermi Fast Breeder Reactor, magnetohydrodynamic cells, thermionic cells, rocket fuel test reactor, and HiC critical assembly. Nondestructive testing, chemical separation, physics, material development, and nuclear safety are discussed.

23. REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT. OCTOBER 1963. Argonne National Laboratory. ANL-6801, Nov. 15, 1963.

Research and development progress is reported on several reactors, applied nuclear physics, reactor fuels and materials, chemical separation, nuclear safety, and heat engineering research.

24. SURVEY OF SEPARATION PROCESSES. PART I. GENERAL CONCLUSIONS AND COMPARISONS. W. W. Armstrong, E. R. Gilbert, J. O. Maloney. CN-1017 (Del.), Oct. 29, 1943.

The bismuth phosphate, lanthanum fluoride, adsorption-sodium uranyl acetate, and dry fluoride processes were surveyed for their efficiency in recovering Pu in a decontaminated form.

25. SURVEY OF PROCESSES FOR SEPARATION OF THE PRODUCTS OF NUCLEAR REACTORS. J. H. Arnold, M. Benedict, J. A. Finneran, S. Golden, F. B. Grosselfinger. In TID-2502 (Del.), Nuclear Science and Technology, Vol. 1, Issues 1 to 3, April-Dec 1951, pp. 81-97.

The primary objective of the survey was the evaluation of separation processes, for future installations, for recovering and decontaminating Pu and U from irradiated natural U and concentrating the residual radioactive waste.

26. PREPARATIONS OF THIN UNIFORM PLUTONIUM LAYERS. P. M. Aron, L. Z. Malkin. Radiokhimiya 4, 619 (1962).

Deposition of uniform 1.5 cm^2 and 30 μC thin Pu films between two or three layers of perchlorovinyl resin and colloidal layers are described.

27. ISOTOPIC ANALYSIS OF PLUTONIUM BY OPTICAL SPECTROSCOPY. J. Artaud, M. Chaput, S. Gerstenkorn. CEA-1909.

Isotopic analysis of mixtures of Pu^{239} and Pu^{240} was carried out by means of a Fabry-Perot photoelectric spectrometer, the source being a hollow cathode cooled by liquid N. Spectral lines of 4676.46, 4986.78, 5044.57, and 5561.98 A were found suitable. When λ = 5044.57 A was used, the relative precision was ~2% for samples containing 3% Pu^{240}.

28. L'ANALYSE SPECTROGRAPHIQUE DU PLUTONIUM. (Spectrographic Analysis of Plutonium). J. Artaud, M. Chaput, J. Robichet. CEA-1541, 1960.

Methods for the spectrographic determination of impurities in Pu are considered. Applications of the copper spark method, sparking graphite, and fractional distillation in the arc are described.

29. EFFECT OF ALPHA RADIATION ON THE VALENCE OF PLUTONIUM IN NITRIC ACID SOLUTIONS. P. I. Artyukhin, V. I. Medvedovskii, A. D. Gelman. Radiokhimiya 1, 131-5 (1959).

The intial rate of reduction of Pu^{+6} in nitric acid with alpha radiation increases with nitrate concentration and decreases as H^+ increases. The reduction is thought to be due to H_2O_2 and nitrous acid formed as a by-product of alpha radiation.

30. THE DRY CHEMISTRY OF PLUTONIUM. L. B. Asprey. In TID-7683, Plutonium Chemistry Symposium, Chicago, Illinois, Feb. 18, 1963, pp. 28-29.

Recent work on the dry chemistry of plutonium oxides, carbides, hydrides, halides, borides, and a few miscellaneous compounds is surveyed. The preparation and physical properties are discussed.

31. THE CHEMICAL ANALYSIS OF BINARY ALLOYS OF PLUTONIUM WITH ALUMINUM, IRON OR URANIUM. D. H. F. Atkins, E. N. Jenkins. AERE-C/R-2161, Oct 1960.

All the methods depend on the retention of plutonium on an De-Acidite FF anion exchanger column from 7M nitric acid. The alloying elements are determined by conventional means. Pu is recovered from the anion exchange column under reducing conditions and determined by differential absorptiometry.

32. THE DISTRIBUTION OF PLUTONIUM AND FISSION PRODUCTS BETWEEN MOLTEN URANIUM AND MOLTEN URANIUM TRIFLUORIDE-BARIUM HALIDE MIXTURES. F. S. Martin, E. W. Hooper. J. Inorg. and Nuclear Chem. 4, 93-9 (March 1957).

At 1200 to 1400°C, Pu and fission products are extracted from irradiated U on the basis of transition from the metal to the salt phase.

33. PURIFICATION OF PLUTONIUM BY A CHROMATOGRAPHIC METHOD. J. A. Ayres. ISC-49, June 14, 1949.

Materials with activity levels up to 5 Curies were processed in the laboratory, using Amberlite IR-1 for the separation and decontamination of Pu. The yield for a three-column operation was over 99% with decontamination factors of 10^4 to 10^6.

34. MEETING OF THE AEC WASTE PROCESSING COMMITTEE ON JUNE 26-28, 1950. PART II. COPRECIPITATION AS A METHOD OF WASTE DISPOSAL. J. A. Ayres, ed. KAPL-364 (Pt. II), April 25, 1951.

Topics discussed include the removal of Pu from laboratory wastes.

35. A METHOD FOR DETERMINATION OF PLUTONIUM PRODUCTION IN REACTORS. W. Baer, D. Klein, N. Carbone. WAPD-P-699, May 1956.

A radiochemical separation technique for Np was developed to assist in measuring Pu production in reactors.

36. PLUTONIUM AND ITS ALLOYS. K. Q. Bagley. Nucl. Eng. 2, 461-8 (Nov 1957).

The occurrence, availability, extraction, nuclear properties, physical properties, compatibility, fabrication, and handling of Pu and its alloys are described.

37. THE DETERMINATION OF PLUTONIUM ALPHA ACTIVITY IN URINE, FAECES, AND BIOLOGICAL MATERIALS. M. E. D. Bains. AEEW-R-292, July 1963.

Chemical stages are given for isolating Pu for electrodeposition on a stainless steel disc to produce a thin, high-resolution source. The limit of detection is 0.025 $\mu\mu C$ per sample. A scintillator counter was used.

38. RETENTION, TRANSLOCATION, AND EXCRETION OF INHALED PLUTONIUM. N. J. Bair, J. P. Herring, L. A. George. In HW-72500, Hanford Biology Research Annual Report for 1961, Jan. 15, 1962, pp. 61-66.

The retention, translocation, and excretion of Pu in dogs are compared for inhalation of six different plutonium dioxide aerosols and for plutonium nitrate.

39. TITRIMETRIC DETERMINATION OF PLUTONIUM IN PLUTONIUM NITRATE SOLUTIONS. (SILVER REDUCTION SULPHATE METHOD). F. Baker. WSL/M-692A, Aug. 7, 1957.

After removal of HNO_3, the Pu is reduced to the trivalent state using a silver reductor and then titrated to the tetravalent state with standard ceric sulfate solutions.

40. RECENT DEVELOPMENTS IN PLUTONIUM PROCESSING IN THE UNITED STATES. R. D. Baker, J. A. Leary. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 356, United Nations, New York, 1958.

Aqueous and pyrometallurgical processing methods are considered.

41. PLATING OF SOME UNCOMMON METALS. J. Balachandra. Symposium on Electrodeposition Metal Finishing, Proc., Karaikudi, India, 1957, 63-6 (1960).

A survey of the plating processes that have been applied to Ti, Zr, Mo, Be, W, Ru, and Pu.

42. REMOVAL OF INTERNALLY DEPOSITED PLUTONIUM. J. Ballou. In HW-72500, Hanford Biology Research Annual Report for 1961, Jan. 15, 1962, pp. 77-80.

Preliminary tests indicate the complexing agent triethylene-tetramine hexacetic acid (TTHA) is as effective as diethylene-triamine penta-acetic acid (DTPA) when given intraperitoneally, and more effective than DTPA when administered orally.

43. COLLECTED RADIOCHEMICAL PROCEDURES. J. W. Barnes, N. A. Bonner, C. L. Browne, D. C. Hoffman, H. A. Potratz, H. L. Smith, D. Warren, Jacob Kleinberg. AECD-3674, Sept. 10, 1954.

Analytical procedures are presented for the determination of Th^{230}, Pa^{233}, Pu, U^{235}, U^{237}, Am, and Cm.

44. THE EFFECT OF ADDITIVES AND STABILIZERS ON THE EXTRACTION BEHAVIOR OF U(VI) AND Pu(IV) NITRATES WITH TERTIARY AMINES. F. Baroncelli, G. Scibona, M. Zifferero. J. Inorg. Nucl. Chem. 25, 205-13 (March 1963).

The effect of the separate presence of nitrous acid as a stabilizer, and a long-chain alcohol as an additive, was evaluated. The nitrate can depress or enhance the partition coefficient depending on acidity. The additive has only a depressing effect. Together at equal molar concentration, the coefficient is at a maximum.

45. THE EXTRACTION OF Pu(IV) NITRATE BY LONG CHAIN TERTIARY AMINES NITRATES. F. Baroncelli, G. Scibona, M. Zifferero. J. Inorg. Nucl. Chem. 24, 541-546 (Nov 1962).

The acid dependence of the partition coefficient of Pu(IV) nitrate into organic solutions of long-chain tertiary alphatic amine nitrates is attributed to the different extraction behavior of the Pu complexes that are formed in the aqueous phase at different nitric acid concentration. Of the several possible Pu nitrate complexes, only $Pu(NO_3)_4$ and $Pu(NO_3)_6^{-2}$ can undergo extraction to a useful extent.

46. PRECIPITATION OF PLUTONOUS PEROXIDE. J. G. Barrick, J. P. Manion. U. S. Pat. 2,996,352, Aug. 15, 1961.

Hydroxylamine or hydrazine is added to the Pu-containing solution before peroxide is added to precipitate Pu.

47. PROCESS OF ELIMINATING HYDROGEN PEROXIDE IN SOLUTION CONTAINING PLUTONIUM. J. G. Barrick, B. A. Fries. U. S. Pat. 2,954,273, Sept. 27, 1960.

After precipitation of the peroxide of Pu, the supernatant contains appreciable quantities of Pu and peroxide. The peroxide can be eliminated by adding a nitrite or sulfite.

48. AN INTRODUCTION TO THE ANALYTICAL CHEMISTRY OF PLUTONIUM. G. B. Barton. AECD-3531 (HW-28136), June 9, 1953.

Valence states of Pu in aqueous solution are discussed, as related to those of U. The relationship of actinides to chemistry of the more familiar elements is pointed out briefly. The importance of these multiple valence states to analytical procedures is discussed.

49. ION COUNTING AND ACCUMULATION SYSTEM FOR MASS SPECTROMETRY OF VERY SMALL SAMPLES. APPLICATION TO URANIUM AND PLUTONIUM. G. W. Barton, Jr., L. E. Gibson, L. F. Tolman. Anal. Chem. 32, 1599-1601 (Nov 1960).

A system has been devised to permit rapid and precise isotopic analysis of 10^{-8}-gram samples of U and Pu, and of other elements and compounds for which beams of 10^{-18} to 10^{-12} Ampere can be achieved and kept for several minutes.

50. CONCEPTUAL DESIGN OF PYROMETALLURGICAL REPROCESSING PLANT. L. Basel, J. Koslov. Chem. Eng. Progr. 55, Symposium Ser. No. 27, 97-106 (1959).

A pyrometallurgical reprocessing plant, using the oxide-slagging method, can handle 18,000 kg/yr of enriched U alloy at \$79/kg. Partial separation of Pu from fission products is described.

51. SECOND SYSTEM OF THE ARC SPECTRUM OF PLUTONIUM. NEW EVEN LEVELS OF THE I AND II SPECTRA AND THE IONIZATION POTENTIAL OF Pu I. J. Bauche, J. Blaise, M. Fred. Compt. rend. 257 (16), 2260-3 (1963).

52. TECHNICAL AND EXPERIMENTAL ASPECTS OF METAL PRODUCTION ON THE MICROGRAM AND MILLIGRAM SCALE. H. L. Baumbach, S. Fried, Z. V. Jasaitis, P. L. Kirk, H. P. Robinson, P. S. Rosenfels, E. F. Westrum, Jr. CT-3899, May 1946.

Conditions, techniques, and probable mechanism for successful production of small quantities of Pu are described. Five allotropic modifications of Pu have been shown to exist. A study was also made of the reaction of H and Pu.

53. ABSORPTION METHODS FOR THE EXTRACTION AND DECONTAMINATION OF PLUTONIUM. R. H. Beaton, P. R. Fields, T. J. LaChapelle, D. C. Lincoln, I. Sheft. CN-1373, Feb. 23, 1944.

Investigation of a two-cycle, all adsorption, extraction and decontamination process for Pu continued. Use of Amberlite IR-1 extraction cycle is described.

54. COLUMBIC OXIDE ABSORPTION PROCESS FOR SEPARATING URANIUM AND PLUTONIUM IONS. R. H. Beaton. U. S. Pat. 2,894,810, July 14, 1959.

Pu ions in a valence not higher than four is selectively absorbed by passing the solution over hydrated columbic oxide. The Pu can be eluted with 3N nitric acid.

55. ABSORPTION OF PLUTONIUM AND/OR FISSION PRODUCTS FROM AQUEOUS SOLUTION. R. H. Beaton. U. S. Pat. 2,990,243.

A process is described for separating Pu^{4+} and fission products values contained in aqueous solution by passing over an adsorbent composition consisting of 70-100% by weight TiO_2 and ~30% by weight binder. The absorbent composition is calcined at 800 to 1000°C for not over 3 hours.

56. OXIDATIVE METHOD OF SEPARATING PLUTONIUM FROM NEPTUNIUM. L. J. Beaufait, Jr., U. S. Pat. 2,838,366, June 10, 1958.

An aqueous solution containing Pu and Np in valence states not greater than +4 is contacted with dichromate ions, thus oxidizing to Np to a valence state greater than 4+ without oxidizing any substantial amount of Pu, and then forming a carrier precipitate which carries the Pu from solution leaving the Np behind.

57. PLUTONIUM SEPARATION METHOD. L. J. Beaufait, Jr., F. R. Stevenson, G. K. Rollefson. U. S. Pat. 2,860,949, Nov. 18, 1958.

Pu is recovered from neutron-irradiated U by buffering a solution containing the irradiated materials at pH 4-7 and adding sufficient acetate to complex the U and adding ferric nitrate to form a colloid of ferric, Pu, and fission products. Remove and dissolve the colloid in nitric acid, and oxidize the Pu to hexavalent states with permanganate or dichromate. Treat the resultant solution to form a colloid of ferric hydroxide and fission products, leaving the Pu in solution.

58. ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. XI. THE DETERMINATION OF FLUORIDE. G. J. Behling, E. W. Christopherson, L. F. Kendall. HW-20036, Jan. 15, 1951.

A method good for 0.25-2.5 μg of fluoride in Pu is presented. After the sample is dissolved in $HClO_4$ and the fluoride ion is separated by distillation of fluosilicic acid, the fluoride is determined by measuring the intensity of color generated by reaction between fluoride and zirconium salt of p-dimethylamino azophenyl arsonic acid.

59. CAPACITY, CONTROL, AND "TBP STEAM STRIPPING" TRIALS ON A SMALL EVAPORATOR. B. T. Bell, S. S. Grimley. AERE-R-3508. Oct 1960.

The apparatus was used for 99.9% removal of dissolved Bu_3PO_4 from an acid aqueous Pu stream resulting from continuous Bu_3PO_4 extraction.

60. SEPARATION OF URANIUM AND PLUTONIUM OXIDES. G. E. Benedict, W. L. Lyon. U. S. Pat. 3,011,865, Dec. 5, 1961.

A method of separating a mixture of UO_2 and PuO_2 is given which comprises immersing the mixture in a fused NaCl-KCl bath, chlorinating with chlorine or phosgene, and preferentially electrolytically or chemically reducing the UO_2Cl_2 so produced to UO_2 and filtering it out.

61. THE SALT CYCLE PROCESS. G. E. Benedict, W. L. Lyon, L. K. Mudge, J. L. Swanson, M. T. Walling, Jr. HW-SA-1936, Aug 1960.

The salt cycle process is a nuclear fuel processing approach designed for application in compact facilities located at reactor sites. Means are described for separation of Pu from U and for codeposition of the two.

62. FORMATION OF HIGHER ISOTOPES AND HIGHER ELEMENTS BY REACTOR IRRADIATION OF PLUTONIUM-239; SOME NUCLEAR PROPERTIES OF THE HEAVIER ISOTOPES. W. C. Bentley, H. Diamond, P. R. Fields, A. M. Friedman, J. E. Gindler, D. C. Hess, J. R. Huizenga, M. G. Inghram, A. H. Jaffey, L. B. Magnusson, W. M. Manning, J. F. Mech, G. L. Pyle, R. Sjoblom, C. M. Stevens, M. H. Studier. In Proc. Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1955, 7, 261-73, United Nations, New York, 1956.

Thermal neutron, capture cross sections, and fission cross sections are given. Plots are presented for various aspects of long-term irradiation on Pu, including those relating to productivity on breeding ratio for fuel nuclides. The uses of some of the nuclides as neutron sources are discussed.

63. THE HANDLING OF PLUTONIUM HEXAFLUORIDE. P. Berard. CEA-2123, 1962.

The problem of plutonium hexafluoride instability is discussed. A means of detecting Pu^{239} in a metallic apparatus by gamma-ray counting was developed; the sensitivity is of the order of half a milligram, but the precision is very low (about 50%).

64. DETERMINATION OF BISMUTH IN PLUTONIUM-BISMUTH SOLUTIONS. K. S. Bergstresser. LA-1315, Sept. 15, 1951.

Pu is removed by a peroxide precipitation, and the bismuth subsequently precipitated with sodium carbonate. Final ignition of the bismuth is as a phosphate.

65. THE DETERMINATION OF CADMIUM IN PLUTONIUM-CADMIUM SOLUTIONS. K. S. Bergstresser, E. H. Rex. LA-1314, Sept. 15, 1951.

The Pu is separated as the insoluble peroxide, evaporating the alloy containing the Cd, and weighing the latter as a sulfate.

66. SPECTROPHOTOMETRIC DETERMINATION OF MICRO QUANTITIES OF CHLORIDE IN PLUTONIUM METAL. K. S. Bergstresser. LA-2921, May 1963.

Separation from Pu metal is accomplished by heating samples of Pu metal at 900-1000°C in a stream of argon saturated with water at 85°C. The HCl gas is absorbed in an alkaline absorbing solution. Reagents are added to form colored ferric thiocyanate complex in an amount equivalent to the chloride.

67. ELECTROANALYSIS OF COBALT, NICKEL, AND COPPER IN PLUTONIUM SOLUTIONS WITH A MERCURY CATHODE. K. S. Bergstresser. LA-1064, Feb. 3, 1950.

Equipment and analytical procedures are described for the analysis of Co, Ni, or Cu in the presence of Pu by electrodeposition on a mercury cathode. Only submicrogram quantities of Pu remain in the amalgam formed. The analysis of some binary alloys of these metals are described.

68. SPECTROPHOTOMETRIC DETERMINATION OF LANTHANUM IN PLUTONIUM. K. S. Bergstresser. Anal. Chem. 30, 1630-2 (1958).

La in Pu samples can be determined by formation of Pu(VI) in a perchloric acid solution of the sample and precipitation of La with HF. The fluoride precipitate is dissolved in fuming $HClO_4$, and La is precipitated with 8-quinolinol. The La oxinate is dissolved in 0.1N hydrochloric acid and read at 365 mu. The range is 40 to 200 γ of La.

69. COMPARISON OF DIRECT EVAPORATION AND LANTHANUM FLUORIDE METHODS FOR PLUTONIUM RADIOCHEMICAL ANALYSIS. K. S. Bergstresser, R. M. Bradford. LA-1082, March 16, 1950.

The direct evaporation procedure involved little or no separation of Pu from other sample components. This procedure is satisfactory when no more than 300 μg of salt or other nonvolatile substances are contained in sample transferred to plate. Errors due to salt absorption of alpha particles were determined for a series of 16 salts of varying concentrations. For the salts that were studied, errors could not be predicted on the basis of the equation proposed by Bradford, Roberts, and Wahl.

70. EFFECT OF PLUTONIUM ON THE FLUOROMETRIC DETERMINATION OF URANIUM. K. S. Bergstresser. LA-1707, July 1954.

A method for determining microgram quantities of U in presence of Pu is investigated. Fluoresence is measured in chilled solutions of sulfuric acid. No Pu interference was observed due to fluoresence. Limited transmittance of hexavalent plutonium at 513 and 360 mu produces variable negative errors.

71. DETERMINATION OF RUTHENIUM IN PLUTONIUM. K. S. Bergstresser. LA-2025, March 1956.

An analytical procedure for 0.04 to 1.6% Ru in Pu metal was developed. Dissolved samples were transferred as chlorides to a special glass still for separation of Ru as the tetroxide by distillation from boiling perchloric acid. Ru is spectrophotometrically determined at 620 mu using thiourea as a color reagent.

72. DETERMINATION OF TITANIUM IN PLUTONIUM-TITANIUM ALLOYS. K. S. Bergstresser. Anal. Chem. 29, 532 (1957).

Ti can be determined by adding hydrogen peroxide to an $HClO_4$ acid solution of the sample. A colored solution with Ti and a precipitate of Pu are formed simultaneously. The insoluble Pu peroxide is removed by centrifuging before the titanium peroxy complex is measured colorimetrically. A standard deviation of 2 γ is observed for samples containing 50 to 500 γ of Ti and 50 mg of Pu. Th does not interfere, but U and Nb do.

73. DETERMINATION OF THORIUM IN PLUTONIUM-THORIUM ALLOYS. K. S. Bergstresser, M. E. Smith. LA-1839 (Del.), Sept 1954.

Th was used as a reagent in determining Th in Pu-Th in the range 0.01-0.8%. Absorbance values were measured at 545 mu in the presence of Pu(III). Average recoveries for Th were 99.6 ± 1.5%. For small amounts of Th, a separation from Pu was made by precipitating Th as a fluoride using La as a carrier.

74. DETERMINATION OF ZIRCONIUM IN PLUTONIUM-ZIRCONIUM ALLOYS. K. S. Bergstresser. LA-1463, Sept. 5, 1952.

Binary alloys of Pu and Zr were brought into solution by a bisulfate fusion and Zr precipitated with p-bromomandelic acid. Zr was determined as ZrO_2 after ignition at 925°C. The range of standard deviation of quadruplicate determinations was 0.5-1.7 parts per thousand for samples containing 9-15 mg of Zr. Mo, La, Pu(III), and $K_2Cr_2O_7$ do not interfere. Pu(IV) does interfere slightly. Complete recovery was shown by the 95% confidence limits of 99.9 ± 3% for the average of four determinations. Pu(III) in small amounts does not interfere with the colorimetric determination of zirconium by means of zirconium alizarin sulfonate lake.

75. SPECTROPHOTOMETRIC STUDIES OF PLUTONIUM(IV) AND (VI) NITRATES IN METHYL ISOBUTYL KETONE. M. G. Berkman, L. Kaplan. Argonne National Laboratory. ANL-4573, Jan 1951.

Changes in spectra of Pu(IV) solutions in hexone upon addition of tetrabutyl ammonium nitrate are caused by the formation of the stable hexanitrate complex $Pu(NO_3)_6^{-2}$. The similarity of the spectrum of this complex to that formed in the 11M HNO_3 confirms its existence. Pu(VI) nitrate, like uranyl nitrate, is converted to a trinitrate complex by TBAN in hexone. The Pu complex is about as stable as the U complex.

76. STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXVIII. THE DISTRIBUTION OF SOME ACTINIDES AND FISSION PRODUCTS BETWEEN TRIBUTYL PHOSPHATE (TBP) AND AQUEOUS SOLUTIONS OF HNO_3 AND $Ca(NO_3)_2$. B. Bernstrom, J. Rydberg. Acta Chem. Scand. 11, 1173-82 (1957).

The distribution ratios of U^{6+}, Pu^{6+}, Pu^{4+}, Th^{4+}, Ru, Zr^{4+}, Nb^{5+}, La^{3+}, Sr^{2+}, and Ca^{2+} between tributyl phosphate (TBP) and aqueous solutions of varying concentrations of HNO_3 have been determined at room temperature for different (constant) concentrations of $Ca(NO_3)_2$ in the aqueous phase.

77. TECHNIQUE OF PREPARATION OF PLUTONIUM SCREENS FOR SOFT X-RAY SPECTROGRAPHY. L. de Bersuder. CEA-2338, 1963.

Thin films of Pu sandwiched between Al films were obtained.

78. DETERMINATION BY ALPHA SPECTROMETER OF Pu^{239} IN A SPECIMEN OF IRRADIATED NATURAL URANIUM. R. Bertrand. J. Nucl. Energy. Pts. A and B. Reactor Sci. and Technol. 14, 49-50 (April 1961).

A sample after exposure to an integral flux is dissolved in acid and deposited in a thin film on stainless steel plaques. The amount of Pu^{239} is found from the alpha spectra of the sample using U^{234} and U^{238} as internal standards. The method is efficient in the range Pu^{239}/U^{234} intensity ratios from 0.1-1.0. The method may also be used to find depth dependence of Pu^{239} formation in cylindrical bars.

79. TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING SOLVENT FOR INORGANIC NITRATES - III. THE PLUTONIUM NITRATES. G. F. Best, H. A. C. McKay, P. R. Woodgate. J. Inorg. Nucl. Chem. 4, 315-20 (1957).

Pu(IV) and (VI) are readily extractable, whereas Pu(III) is relatively inextractable. Uranyl nitrate is 10-fold more extractable than plutonyl nitrate. Solvates formed appeared to be $Pu(NO_3)_4 \cdot 2TBP$ and $PuO_2(NO_3)_2 \cdot 2TBP$. Salting out with sodium nitrate resulted in a marked increase in extraction. Uranyl nitrate depressed extraction.

80. SOME OBSERVATIONS ON THE EXTRACTION OF NITRIC ACID, URANIUM, AND PLUTONIUM BY TRI-ISONONYLAMINE. U. Bertocci. AERE-R-2933, May 1959.

The reagent was used with xylene as a diluent. Some experiments were also done on back extraction of Pu from the organic phase by reduction to the trivalent state.

81. PLUTONIUM-PROPERTIES AND POTENTIAL USES IN NUCLEAR POWER REACTORS. W. F. Biddle. Metal Ind. 91, No. 14, 293-6 (1957).

Headings of this paper are as follows: Introduction, Historical, Extraction, and Properties.

82. ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. VII. THE CUPFERRON EXTRACTION-COPPER SPARK METHOD. T. K. Bierlein, L. F. Kendall, H. H. Van Tuyl. HW-25074, July 25, 1952.

Pu(III) or (IV) is separated from impurity elements by extracting the cupferride with chloroform. The aqueous phase is evaporated, along with Co internal standard, and placed on Cu electrodes that are sparked to produce the impurity spectrum. The amounts of impurities are determined by comparing the densities of impurity lines with standards.

83. HAZARDS AND EXPERIMENTAL PROCEDURE EVALUATION FOR: STUDIES ON THE POLYMERICATION AND HYDROLYSIS OF PLUTONIUM IN URANYL NITRATE AND NITRIC ACID SOLUTIONS AT ELEVATED TEMPERATURES. R. E. Biggers, D. A. Costanzo. ORNL-TM-580, May 22, 1963.

The polymerization of Pu is briefly reviewed and an experimental program that will provide some data on the polymerization of the Pu in the $UO_2(NO_3)_2$-HNO_3 system is discussed.

84. MEASUREMENT OF ATMOSPHERIC CONTAMINATION BY "DOUBLE MANDARIN." F. Billard, Miribel and J. Pradel. CEA-2085, 1961.

To check the radioactivity of the air in laboratories where Pu is handled, an apparatus known as "Double Mandarin" was devised. This instrument distinguishes Pu dusts from those that carry natural active deposits by making use of the granulometric difference. The separation is based on the use of selective filters placed in series.

85. THE SPECTROGRAPHIC ESTIMATION OF MAJOR-CONSTITUENT PLUTONIUM BY THE IRON FLUX METHOD. F. T. Birks. AERE-C/R-2081, Dec 1956.

Pu has been estimated in solids using a dc arc on Cu electrodes after making a dilution of a sample with a flux consisting of ferric and ammonium sulfates. The concentration range was 0.5-100%, with a coefficient of variation of 6.6% at the 50% level. The index point of equal intensity for the intensity ratio of Pu 2904.3 and Fe 2901.4 was found at 42.2% PuO_2. Estimation of major common impurity elements may be carried out simultaneously with the Pu.

86. METHOD AND MEANS FOR ELECTROLYTIC PURIFICATION OF PLUTONIUM. C. W. Bjorklund, R. Benz, W. J. Maraman, J. A. Leary, K. A. Walsh. U. S. Pat. 2,923,670, Feb. 2, 1960.

A method of electrodepositing pure Pu from a fused salt electrolyte of $PuCl_3$ and alkali metal halides is described. When an Fe cathode is used, the Pu deposit alloys therewith in the liquid state at the 400-600°C operating temperature; such liquid is allowed to drop through holes in the cathode and collect in a Ta cup.

87. THE PREPARATION OF PuP_2O_7 AND $PuPO_4$. C. W. Bjorklund. J. Am. Chem. Soc. 79, 6347-50 (1957).

Monoclinic $PuPO_4$ was prepared by high-temperature dehydration of $PuPO_4 \, x \, H_2O$, or by decomposition of oxalato-phosphate of Pu where the ratio of P to Pu was 1:1. The ratio for PuP_2O_7 was 2:1.

88. REMOVAL OF FISSION PRODUCTS FROM HIGH LEVEL RADIOACTIVE WASTE SOLUTIONS. R. E. Blanco, J. T. Roberts. CF-59-1-32, March 30, 1959.

Several methods are suggested for removing radioactive waste. The methods were limited here to small-scale engineering tests. Emphasis has been placed on removal of Sr^{90}, Cs^{137}, and long-level isotopes of Pu, Cm, and Am.

89. THE SOLUBILITY OF PLUTONIUM SALTS IN AQUEOUS SOLUTIONS UP TO 300°C. B. C. Blanke, E. N. Bousquet, R. H. Steinmeyer. TID-12161, March 10, 1961.

Pu solutions were studied to determine if a salt could be found that was sufficiently soluble in aqueous solution to be used as an aqueous homogeneous fuel.

90. IRRADIATION OF PLUTONIUM FUELS; A SELECTED BIBLIOGRAPHY. M. Bloomfield. NAA-SR-Memo-6271, April 13, 1961.

A bibliography on data pertaining to the irradiation of Pu and Pu alloys, dispersions, and compounds is presented. Information is also presented on physical properties, production, preparation, and reprocessing methods.

91. DENSITY MEASUREMENTS IN GLOVE BOXES WITH DENSITY DATA ON MONOBROMOBENZENE, CAST Th, Th-U, AND Th-Pu ALLOYS. B. Blumenthal. ANL-6671, Sept 1963.

Techniques are described that enable density determinations to be made by the hydrostatic weighing method to ±0.005 g/cc, an improvement by an order of magnitude over prior procedures. The most significant variable is the temperature of the liquid used, PhBr; the liquid temperature is seldom the same as that of the glove-box atmosphere.

92. THE SEPARATION OF SUB-MICROGRAM AMOUNTS OF URANIUM FROM MILLIGRAM AMOUNTS OF IRON, ALUMINUM AND PLUTONIUM. D. G. Boase, J. K. Foreman. Talanta 8, 187-90 (April 1961).

The sample is mixed with a strong hydrochloric acid solution containing hydroiodic acid and passed through a column of anion-exchange resin. Only the U is retained on resin, and it can be eluted with dilute HCL.

93. IN THE COMPLEXOMETRIC DETERMINATION OF PLUTONIUM IN REACTOR FUEL PROCESSING PLANT SOLUTIONS. I. NITRIC ACID SOLUTIONS OF IRRADIATED URANIUM. D. G. Boase, J. K. Foreman, J. L. Drummond. Talanta 9, 53-63 (Jan 1962).

Pu(IV) is extracted by using the quaternary amine Hyamine 1622 dissolved in benzene. The benzene is removed by evaporation, and after dissolution of the residue in acetone, an excess of ethylenediaminetetraacetic acid (EDTA) is added, and the uncomplexed EDTA determined by photometric titration using standard zinc chloride solution and dithizone as an indicator.

94. MICROVOLUMETRIC ASSAY OF PLUTONIUM. H. E. Boaz. LA-507, May 10, 1946.

Plutonium sulfate in 2N H_2SO_4 is reduced to Pu^{+3} with Zn amalgam under a CO_2 atmosphere and is titrated potentiometrically to Pu^{+4} with ceric sulfate. An accuracy of 0.1% is obtained in the range of 2-10 mg.

95. THE M EMISSION SPECTRUM OF X-RAYS OF PLUTONIUM. J. L. Bobin, J. Despres. Compt. rend. 252, 1302-4 (Feb. 27, 1961).

A large part of the M emission spectrum of Pu was examined by means of a Castaing microanalyzer. Experimental evidence points to satellite groups accompanying the more intense rays.

96. A STUDY OF THE DEPOSITION AND RETENTION OF PLUTONIUM DIOXIDE IN RATS. B. B. Boecker. TID-15685, 1959.

Four groups of six, 150- to 175-g female rats were exposed for 45 min to a PuO_2 suspension. The activity range was 65-89 dis/min/cc for the four exposure runs. Several variations of a Pu analytical method, using the direct mixing of the tissue digest solution and silver-activated ZnS, were studied.

97. ON THE ISOLATION OF PLUTONIUM BY A SOLVENT EXTRACTION PROCEDURE. D. H. W. den Boer, Z. I. Dizdar. JENER-45, Oct 1956.

For the final purification TBP, didecyldimethylammonium nitrate, thenoyltrifluoroacetone, and an anion exchanger were tried. The last two compounds gave best results.

98. MICROCALORIMETRIC QUANTITATIVE ANALYSIS OF A MIXTURE OF PLUTONIUM-239 AND PLUTONIUM-240. P. Boivinet, E. Calvet, Y. Ozias. Compt. rend. 254, 2964-6 (April 16, 1962).

The E. Calvet microcalorimeter was used to analyze a mixture of Pu^{239} and Pu^{240} in the form of the oxide PuO_2, sealed in cylinders of irradiated platinum.

99. COMPARISON BETWEEN SPECTRA OF INSTANT SPONTANEOUS NEUTRON FISSION OF Pu^{240} AND INDUCED FISSION OF Pu^{239}. V. I. Bol'shov, L. D. Gordeeva, V. F. Kuznetsov, G. N. Smirenkin. Fiz Deleniya At. Yader, Sb. Statei, 127-33, 1962.

The difference in excitation energies for the compound nuclei was 6.3 MeV.

100. CONCENTRATION OF PLUTONIUM BY CATION EXCHANGE. PART I. NEW ELUTRIANTS. O. D. Bonner, G. A. Burney, F. W. Tober. DP-192, Dec 1956.

Over 99% of the total Pu absorbed on a cation resin was eluted at an average concentration of 43.8 g per liter by a solution of ammonium lactace plus ammonium sulfonate. This elutriant does not evolve gases in the resin bed.

101. RECENT DEVELOPMENTS IN LIGHT SOURCES EXCITED BY MICROWAVES. L. Bovey, H. Wise. AERE-R-2976, July 1959.

A cavity resonator type of exciter gives intense spectra of U and Pu without an auxiliary furnace when tubes containing the iodide are used.

102. A FURNACE FOR OBTAINING OPTICAL SPECTRA OF RADIOACTIVE ELEMENTS. L. F. H. Bovey. J. Sci. Instr. 32, 376-8 (Oct 1955).

The construction and operation of a King-type furnace for exciting spectra are described. Both emission and absorption spectra for U and Pu have been observed within the range 2400-7000 A in the second order of a 3M grating spectrograph.

103. THE OPTICAL SPECTRA OF SOME RARE EARTH AND TRANSURANIC ELEMENTS IN THE 1-3 MICRON REGION. PART II. WAVELENGTH MEASUREMENT AND THE SPECTRUM OF PLUTONIUM(Pu^{239}). L. Bovey, E. B. M. Steers, N. Atherton. AERE-R-2977, Oct 1959.

A method for measuring and comparing the wavelengths of the Pu lines in the 1-3 u region is given, together with an indication of the experimental accuracy. Wavelengths and intensities for Pu lines are listed.

104. GROUND STATE OF THE FIRST SPECTRUM OF PLUTONIUM(Pu I) FROM AN ANALYSIS OF ITS ATOMIC SPECTRUM. L. Bovey, S. Gerstenkorn. J. Opt. Soc. Am. 51, 522-5 (1961).

Data from King furnace work and hyperfine structure and Zeeman studies on the spectra of Pu I have resulted in the derivation of three levels of the 7F term. It is suggested that this term arises from the ground-state electronic configuration $5f^6 7S^2$.

105. A SURVEY OF THE PLUTONIUM SPECTRA IN THE 7,000-10,000 Å REGION. L. Bovey, M. C. J. Barker, A. Ridgeley. AERE-R-3515, Nov 1960.

Wavelengths for the stronger lines in the 7,000-10,000 Å region of the Pu spectrum emitted from a microwave-excited electrode less discharge are listed.

106. EMISSION AND ABSORPTION SPECTRA OF PLUTONIUM EXCITED IN A KING FURNACE. L. Bovey. Spectrochim. Acta 10, 383-94 (1958).

Wavelengths of Pu absorption and emission lines excited in a King-type furnace and photographed in the second order of a 3M grating instrument over the region 2791-6888 Å are listed.

107. PROCESSING OF UC - PuC WITH TRIBUTYL PHOSPHATE. D. F. Bowersox. LAMS-2884, Feb. 4, 1963.

A method for dissolution of carbides and separation of U and Pu by solvent extraction from a salted nitrate system using tributyl phosphate is given.

108. SEPARATION OF NEPTUNIUM AND PLUTONIUM FROM IRRADIATED URANIUM. E. Bretscher, N. Feather, H. V. Halban, L. Kowarski. British Pat. 854,818, Nov. 23, 1960.

Np and its decay product, Pu, are separated from a $UO_2(NO_3)_2 \cdot 6H_2O$-MeCOEt solution by preferential adsorption on charcoal, by displacement of an aqueous phase, and by extraction with NH_4NO_3 solution.

109. SEPARATION AND DETERMINATION OF MICROGRAM QUANTITIES OF ZIRCONIUM. C. E. Bricker, G. R. Waterbury. Anal. Chem. 29, 558-62 (1957).

This procedure can contain a wide variety of metallic ions without interference. Zr is separated by precipitation with p-bromomandelic acid and subsequently determined, using the color reaction with chloranilic acid. The method was specifically developed for Zr in Pu alloys but has been extended into a general procedure for the separation and determination of microgram amounts of Zr.

110. MEASUREMENT OF BODY RADIOACTIVITY. British Journ. Radiol., Suppl. 7, 130 (1957).

Record of conference at Leeds, England, April 1956.

111. SEPARATING PLUTONIUM. British Pat. 765,924, Jan. 16, 1957.

An improved process is described for separating Pu from a mixture of U and fission products including Zr and Nb. The method involves adding Bi and Zr salts as carriers, converting the metals to phosphates, and leaching out the Bi phosphate with 1 ± 0.2N HCl and the Pu phosphate with 9N HCl.

112. RECOVERY OF PLUTONIUM FROM SOLUTIONS. British Pat. 783,601, Nucl. Eng. 3, No. 24, 136 (1958).

The method consists of removing Pu from solutions containing it in a lower oxidation state than the hexavalent form by treating the solution with a fluoride of low solubility in water and which has the property of absorbing Pu. The absorbed Pu is then removed by treatment with a soluble oxalate, carbonate, or bicarbonate.

113. SEPARATION OF PLUTONIUM. British Pat. 798,685, Nucl. Eng. 4, 146, 1959.

Pu, in low irradiated U dissolved in nitric acid, is extracted by precipitating the Pu as a phosphate with bismuth phosphate as a carrier.

114. RECOVERY OF PLUTONIUM. British Pat. 810,541, March 18, 1959.

The U and Pu, along with fission products in nitric acid, are oxidized with $K_2Cr_2O_7$ and then precipitated by adding Na and Mg acetates. This precipitate is filtered, washed, and dissolved in nitric acid. The Pu is selectively reduced with $NaHSO_3$, and UO_2^{++} is precipitated by a second acetate addition. The filtrate containing the Pu is oxidized, and a small amount of U is added for a carrier for another acetate precipitation.

115. PROCESS FOR THE PURIFICATION OF PLUTONIUM SOLUTIONS. British Pat. 826,910, Jan. 27, 1960.

Pu is absorbed on zirconium phosphate, barium iodate, or zeolite. Fission products were eluted from the zirconium phosphate with 0.1M H_3PO_4 and 2M HNO_3. The Pu was removed with 7M HNO_3.

116. IMPROVEMENTS IN OR RELATING TO METHODS OF SEPARATING PLUTONIUM. British Pat. 831,862, April 6, 1960.

Pu(IV) is recovered from nitrate solutions by treatment with a ferric salt in the presence of acetate ions at pH 4.8-5.1 to precipitate basic ferric acetate and carry down the Pu.

117. SEPARATION OF PLUTONIUM AND ALUMINUM FROM ALUMINUM ALLOY FUEL RODS. British Pat. 833,720, April 27, 1960.

Pu and Al are recovered without excessive waste from exhausted Al-Pu-alloy nuclear-reactor fuel rods by heating at 1200-1450° in a vacuum to a constant weight. This residue is suitable for alloying with fresh Al to produce new fuel rods.

118. SEPARATION OF PLUTONIUM. British Pat. 839,190, June 29, 1960.

A method is presented for separating Pu from other substances by absorbing the Pu from solution on zirconium phosphate or barium iodate.

119. SEPARATION OF URANIUM, PLUTONIUM, AND FISSION PRODUCTS. British Pat. 840,105, July 6, 1960.

U and Pu compounds are extracted into bis (butoxyethyl) ether, methyl iso-butyl ketone, or ethylene glycol di-butyl ether with 98% recovery and substantially free of fission products.

120. SEPARATION OF PLUTONIUM. British Pat. 842,591, July 27, 1960.

A process is described for separating Pu from U and fission products by the precipitation of the reduced Pu with bismuth phosphate. The Bi is added in a solution that is 5-10M in nitric acid to a Pu solution that contains phosphate ions.

121. SEPARATION OF PLUTONIUM. British Pat. 843,481, Aug. 4, 1960.

A method for separating Pu from solutions of irradiated U by LaF_3 carrier is given. The formation and settling rate of the carrier is improved by coprecipitation of $PbSO_4$. This method flocculates preformed LaF_3 better than coformed LaF_3.

122. PROCESS OF OXIDIZING PLUTONIUM. British Pat. 847,641, Sept. 14, 1960.

Pu(III) and Pu(IV) in solution are easily oxidized to Pu^{+6} with Ag^{+2}. The oxidizing solution is prepared by dissolving AgO or Ag(II) peroxy nitrate (0.1M) in a cold solution which is 9N HNO_3 and 0.4N $AgNO_3$. Oxidation is about 98% complete in one minute.

123. PLUTONIUM CHELATE COMPOUNDS. British Pat. 849,651, Sept. 28, 1960.

Procedures are described for the synthesis of chelate compounds of trivalent quadrivalent, or sexivalent Pu and β diketones, such as $BZrCH_2$, 3, 5-heptanedione, and acetylacetone. These chelate compounds may be used to remove Pu from the aqueous solution of Pu and U fission products.

124. SEPARATION OF PLUTONIUM. British Pat. 852,151.

Separation of Pu from U by dissolution in nitric acid and adsorption on bismuth phosphate precipitation may be facilitated by reduction of Pu and removal of excess HNO_3 with a reagent, formic acid. Use 1.5 moles formic acid per mole HNO_3 at 75-90°C. Pu may also be adsorbed on Amberlite IR-1 when acid is reduced below 0.5N.

125. SELECTIVE ADSORPTION OF PLUTONIUM BY GROUP IV METAL PHOSPHOSILICATE COMPLEXES. British Pat. 852,501, Oct. 26, 1960.

Pu is selectively adsorbed from solutions containing U and fission products by a complex $(R_3(PO_4)_4)_x \cdot (RSiO_4)_y \cdot (SiO_2nH_2O)_z$, in which R = Ti, Zr, Hf, or Th, and n depends on degree of drying.

126. BISMUTH HYDROXIDE METHOD FOR RECOVERY OF PLUTONIUM. British Pat. 853,311, Nov. 2, 1960.

A method for the recovery of Pu from irradiated U is outlined in which bismuth hydroxide precipitation is used, following the usual bismuth phosphate precipitation method. It will carry Pu in either the reduced or oxidized state.

127. IMPROVEMENTS IN OR RELATING TO SEPARATION OF URANIUM AND PLUTONIUM. British Pat. 855,853, Dec. 7, 1960.

Separation is accomplished by volatile fluorides using BiF_3 or ClF_6 in the presence of a compound of arsenic, antimony, or bismuth, and the resulting UF_6 vapors are collected.

128. PROCESS FOR THE REDUCTION OF PLUTONIUM. British Pat. 862,352, March 8, 1961.

A method for the reduction of Pu(IV) to (III) is given that can be applied to the separation of Pu from U. The reduction is carried out with ascorbic acid, and in the separation procedure, an organic solution of uranyl and Pu(IV) nitrates is contacted with an aqueous ascorbic acid solution. The ascorbic acid should be 1.5 to 15 moles per mole of plutonium nitrate.

129. PLUTONIUM EXTRACTION PROCESS. British Pat. 880,919, Oct. 25, 1961.

The essence of the method is the extraction of Pu in the 4+ oxidation state from an aqueous HNO_3 solution of at least 7M acidity into an organic solution of an alphatic secondary amine and thereafter stripping the Pu from the organic phase with a dilute HNO_3 solution.

130. PLUTONIUM CONCENTRATION AND DECONTAMINATION METHOD. British Pat. 881,151, Nov. 1, 1961.

A process is outlined for concentrating the decontamination Pu from an aqueous HNO_3 solution containing Pu, U, and fission products. The process comprises adjusting the solution to 0.15 to 0.5N HNO_3, converting the Pu to Pu^{3+} (reductant-hydroxylamine sulfate), contacting the solution with a cation exchanger (Dowex-50), and eluting the adsorbed Pu with a $\geqq$ 4M HNO_3 eluant containing a holding reductant (sulfonic acid).

131. PROCESS FOR THE SEPARATION OF PLUTONIUM. British Pat. 897,261, May 23, 1962.

A process is outlined for separating radioactive elements from Pu in irradiated U. The process comprises forming an acid solution of the irradiated U with a pH of 2 or less, precipitating plutonous iodate, dissolving the precipitate in acid, oxidizing the Pu to the hexavalent state, and precipitating an insoluble iodate to leave a supernatant plutonyl iodate solution.

132. SEPARATION OF PLUTONIUM. British Pat. 902,741, Aug. 9, 1962.

A process is outlined for separating Pu, E.G., from irradiated U. The process involves the usual formation of a LaF_3 precipitate carrier under reducing conditions, except that the hydrogen ion concentration is adjusted to a value approaching neutrality to improve the characteristics of the precipitate.

133. IMPROVEMENTS IN OR RELATING TO PLUTONIUM EXTRACTION. British Pat. 945,184, Aug. 17, 1960.

A process is given for obtaining Pu >99.5% yield from dilute Pu solutions using a solution of tertiary amine in organic solvent. The Pu is removed from the scrubbed organic phase with H_3SO_4-HNO_3 or $HClO_4$. Several examples of this process are given using trilauryl amine.

134. A REPORT OF BIOASSAY PROCEDURES: A SUMMARY AND BIBLIOGRAPHY. W. A. Brobst. COO-213, Jan. 21, 1957.

Various procedures are given for the analysis of urine for radioactivity. Details are included for Pu, Th, and U.

135. ION EXCHANGE SPECTROGRAPHIC METHOD FOR DETERMINATION OF IMPURITIES IN URANIUM AND PLUTONIUM. J. K. Brody, J. P. Faris, R. F. Buchanan. Anal. Chem. 30, 1909-12 (1958).

An anion exchange procedure using hydrochloric acid is used to separate certain elements from U and Pu. Emission spectrophotometric studies are included.

136. THE DETERMINATION OF PLUTONIUM AS A MINOR CONSTITUENT IN ALLOYS WITH LEAD, TIN, AND BISMUTH. K. W. Brooke, D. H. Atkins, E. N. Jenkins. AERE-C/M-336, Dec 1957.

Pu was determined by counting the alpha sources prepared by evaporating small aliquots of solutions prepared from binary alloys of Pu with Pb, Sn, or Bi and of tertiary alloys of Pu and Bi with Pb or Sn.

137. DISCUSSION OF HANFORD α EXPERIMENT WITH PROFESSOR H. A. BETHE. H. Brooks. KAPL-M-HB-2, April 9, 1947.

A spontaneous fission count is believed to provide a method of Pu^{240} determination with no interference from Pu^{238}.

138. COLLECTED LABORATORY PROCEDURES FOR THE DETERMINATION OF RADIO ELEMENTS IN URINE. R. O. R. Brooks. AERE-AM-60, Aug 1960.

Working details of procedures for the determinations of Am, I, Pu, Po, Ra, and fission products are given.

139. A PRELIMINARY SURVEY OF RADIOACTIVE CONSTITUENTS IN RAIN WATER AT ORNL. W. A. Brooksbank, Jr., A. H. Emmons, J. W. Gast, S. A. Reynolds. ORNL-816, Dec. 4, 1950.

A method was developed for determining gross changes in air contamination levels of Ce, Sr, Ru, Zr, Pu, and U by radiometric analysis of rain water.

140. SUMMARY OF ANALYTICAL METHODS USED IN THE CHEMICAL PROCESSING PLANTS AT HANFORD. R. J. Brouns, R. A. Schneider. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 28, 436, United Nations, New York, 1958.

Pu concentrations are measured by alpha counting or ceric titration.

141. DETECTION OF AIRBORNE PLUTONIUM USING ALPHA ENERGY ANALYSIS TECHNIQUES. D. P. Brown. HW-78734, Sept 1963.

A sensitivity of 40 MPC-hr was obtained using alpha energy analysis techniques, where contribution from higher-energy Rn and thoron were compensated using electronic balancing circuitry. Gamma background levels of 2 mr/hr and beta particles level of 2.4 x 10^4 dpm did not adversely affect sensitivity or general operation.

142. THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART II. PLUTONIUM NITRIDE. F. Brown, H. M. Ockenden, G. A. Welch. J. Chem. Soc. 4196-4201 (Dec 1955).

Methods are given for producing the nitride by heating the metal or metal hydride in a nitrogen atmosphere. The compound is quite reactive and easily decomposed. Complete hydrolysis occurs at 80-90°C in moist air.

143. METHOD OF SEPARATING PLUTONIUM FROM CONTAMINANTS. H. S. Brown, O. F. Hill. U. S. Pat. 2,785,047, March 12, 1957.

The U is dissolved in nitric acid and a lanthanum fluoride precipitation made, the precipitate carrying the Pu and fluoride soluble fission products. The dried precipitate is treated with HF, and fission products which form relatively volatile fluorides are volatilized off. The residue is treated with anhydrous F at elevated temperatures, oxidizing the Pu, which is volatilized as higher fluoride.

144. PROCESS OF SEPARATION PLUTONIUM FROM URANIUM. H. S. Brown, O. F. Hill. U. S. Pat. 2,851,333, Sept. 9, 1958.

The method consists of forming a uranous hydroxide in the Pu-bearing precipitate at a pH of at least 5. The carrier precipitate is then dissolved in acid solution, and the pH is adjusted to about 2.5 causing precipitation of the uranous hydroxide but leaving the still soluble Pu values in solution.

145. METHOD OF SEPARATING PLUTONIUM. H. S. Brown, O. F. Hill. U. S. Pat. 2,822,239, Feb. 4, 1958.

This process may be carried out by treating a mixture of fluoride vapors comprising plutonium hexafluoride, converting it to a less volatile fluoride, and then recovering the less volatile fluoride from the vapor by condensation.

146. CHEMICAL TECHNOLOGY DIVISION, CHEMICAL DEVELOPMENT SECTION C PROGRESS REPORT FOR OCTOBER-DECEMBER 1961. K. B. Brown. ORNL-TM-107, Feb. 21, 1962.

In continued, batch-countercurrent testing with simulated Purex 1BP solution of the proposed chemical flowsheet for final-cycle Pu recovery by amine extraction, the extraction profile with the amine (TLA) concentration decreased from 0.3 to 0.15M, confirming the predicted extraction isotherm. The product solution contained 23 g Pu/l, and the stripped organic and the raffinate contained 0.001 and <0.002 g/liter, respectively.

147. THE DETERMINATION OF PLUTONIUM BY (ETHYLENE DINITRILO) TETRAACETIC ACID TITRATION. W. B. Brown, D. R. Rogers, E. A. Mershad, W. R. Amos. Anal. Chem. 35, 1000-2 (July 1963).

A Pu solution containing 8-40 mg of Pu is buffered to pH 2.5-3.0, heated to boiling, and titrated with EDTA to Cu-Pan end point. The indirect procedure is a continuation of direct method. NH_4F is added to demask the Pu-EDTA complex. The uncomplexed EDTA is titrated with standard copper solution to a PAN end point. The main error of direct method is less than ±0.1 mg, and the indirect method was less than ±0.2 mg.

148. X-RAY COUNTER FOR PLUTONIUM SOLUTIONS. G. H. Bruber. DP-734, July 1962.

Design features and operating characteristics are given for an instrument that can measure concentration of 0.0001 to 150 g of Pu^{239} per liter in nitric acid solution. Scintillation techniques are used to count the X-rays that originate from Pu^{239}.

149. SOLVENT EXTRACTION PROCESS FOR SEPARATING URANIUM AND PLUTONIUM FROM AQUEOUS ACIDIC SOLUTIONS OF NEUTRON IRRADIATED URANIUM. F. R. Bruce. U. S. Pat. 3,046,087, July 24, 1962.

A solvent extraction process was developed for separating actinide elements including Pu and U from fission products.

150. THE CONCENTRATION AND PURIFICATION OF URANIUM AND PLUTONIUM BY ION EXCHANGE. F. R. Bruce, J. M. Fletcher, H. H. Hyman, Eds. Progress in Nuclear Energy, Series III. Process Chemistry, Volume 2. Pergamon Press, New York, 1958.

Cation exchange is used to concentrate U^{233} or Pu products which are obtained from solvent-extracting processes. Losses of fissionable material are less than 0.01%.

151. CONFERENCE ON PLUTONIUM CHEMISTRY IN IN THE PUREX PROCESS AT ORNL. F. R. Bruce. CF-50-2-112, Jan. 18, 1950.

The Purex process and the research program on Pu chemistry at KAPL, ANL, and Hanford works are reviewed.

152. RAPID SIMULTANEOUS DETERMINATION OF Pu(IV) and Am(III) IN NITRIC ACID SOLUTION. T. Bruce. CRDC-805, Aug 1958.

Zr is added to the solution to be analyzed as a carrier for Pu and phenyl arsonic acid is added as a precipitant leaving Am in the supernatant. The Pu and Am are then determined by alpha counting. The precision obtained is about ±2%.

153. DETERMINATION OF PLUTONIUM IN BIOLOGICAL MATERIAL BY SOLVENT EXTRACTION WITH PRIMARY AMINES. F. W. Bruenger, B. J. Stover, D. R. Atherton. Anal. Chem. 35, 1671-3 (Oct 1963).

Concentrated urine or a sample of bone ash is made 1M H_2SO_4, and Pu is extracted with highly branched amines in xylene. Pu is then extracted from the organic phases with 8M HCl and alpha-counted.

154. STUDIES OF THE OXIDATION STATES OF Pu^{239} IN INJECTION SOLUTIONS. F. W. Bruenger, D. R. Atherton, B. J. Stover. In COO-225, Research in Radiobiology. Annual Report of Work in Progress on the Chronic Toxicity Program, March 31, 1962, pp. 62-72.

Combined precipitation and spectrophotometric methods for evaluating the oxidation states of Pu^{239} are described.

155. FLOWSHEET FOR SEPARATION OF PLUTONIUM FROM THORIUM AND URANIUM. L. E. Bruns. HW-67674, Dec. 7, 1960.

The process includes preparation of unusual Pu-containing materials for feed materials and solvent extraction with 20% TBP in CCl_4.

156. PROTOTYPE HOOD FOR DISSOLUTION OF PLUTONIUM SKULLS, PLUTONIUM METAL, AND FOR LEACHING OF INCINERATOR ASH. L. E. Bruns, C. W. Nilsen. HW-70084, June 28, 1961.

Two processes are discussed: ammonium bifluoride-plutonium(IV) oxide fusion, and recirculating continuous dissolver.

157. OXIDATION OF PLUTONIUM(III) BY SODIUM NITRITE. A. Brunstad. HW-51655, July 17, 1957.

The reaction velocity constant for the oxidation of Pu(III) by nitrite in HNO_3 solution containing ferrous sulfamate is given.

158. POLYMERIZATION AND PRECIPITATION OF PLUTONIUM(IV) IN NITRIC ACID. A. Brunstad. Ind. Eng. Chem. 51, 38-40 (Jan. 1, 1959).

The formation of colloidal Pu(IV) hydroxide from Pu(IV) nitrate solutions was determined as a function of acid and Pu concentration at several temperatures. Except for colloidal sols formed from solutions containing a few grams per liter, the acidities become too high for the Pu to remain as a stable colloid.

159. COULOMETRIC DETERMINATION OF PLUTONIUM AND URANIUM. A. Brunstad. In TID-7516 (Pt. 1), AEC Materials Management-Contractor Representatives Meeting, Washington, D.C., May 7-9, 1956, pp. 137-160.

The Pu sample is oxidized to Pu^{6+} and then reduced with electrolytically generated Fe^{++} ions. Precision and error of ±0.5% with 10-mg samples of Pu are obtainable.

160. REDUCTION AND STABILIZATION OF PLUTONIUM NITRATE IN CATION EXCHANGE FEED AND PRODUCT SOLUTIONS. A. Brunstad, R. C. Smith. HW-52796, Sept. 24, 1957.

In the concentration and purification of Pu by cation exchange, the fuel solution of Pu must be in the plus-three valence state, but the nitrate solution from the solvent extraction process contains mostly Pu^{+4} with small amounts of Pu^{+6}. The bisulfates met the requirements for speed and completeness of reduction.

161. DETERMINATION OF AMERICIUM IN PLUTONIUM BY GAMMA COUNTING. J. Bubernak, M. S. Lew, G. M. Matlack. Anal. Chem. 30, 1759-62 (1958).

The gamma specific acitivity of Am^{241}, a common impurity in reactor Pu is 30,000 times greater than that of Pu, when gamma rays above 30 keV are counted. This is the basis of a procedure for determining as little as 5 ppm of Am in Pu.

162. THE DETERMINATION OF BURNUP IN PLUTONIUM REACTOR FUELS. J. Bubernak, J. W. T. Meadows, M. Lew, G. M. Matlack. In TID-7629, Analytical Chemistry in Nuclear Reactor Technology. Fifth Conference, Gatlinburg, Tenn., Oct. 10-12, 1961, pp. 177-183.

Only a few fission products are suitable for use in the determination of burnup in Pu fuels by fission-product analysis when the history of the fuel is one of a long period of neutron exposure which was repeatedly interrupted, or characterized by a fluctuating power level, such as might be expected in prototype Pu-fueled power reactors. Sr^{90} analysis is chosen. The actual analytical procedure involves Sr separation based on nitrate, chromate, and oxalate precipitation to obtain radiochemically pure Sr fission product. After a suitable waiting period, Y^{90} is separated from the Sr by tributyl phosphate extraction. The Y^{90} is then used for the actual radioactive measurement, from which the number of atoms of Sr^{90} in the sample is calculated, and thence the percent burnup.

163. THE USE OF TETRAVALENT URANIUM AND HYDRAZINE AS PARTITIONING AGENTS IN SOLVENT EXTRACTION PROCESSES FOR PLUTONIUM AND URANIUM. J. S. Buckingham, C. A. Colvin, C. A. Goodall. HW-59283, Feb. 1, 1959.

A study of oxidation-reduction potentials of Pu and various reducing agents indicates that hydrazine, U^{+4}, and Fe^{+2} have the potential to reduce all valence states of Pu. Tetravalent U will reduce Pu to the trivalent state and hence can be separated from U by solvent extraction.

164. THE ANALYTICAL APPLICATION OF THE NITRIC ACID ANION EXCHANGE SYSTEM TO PLUTONIUM-FISSIUM AND PLUTONIUM-BINARY ALLOYS USED IN METALLURGICAL STUDIES. R. F. Buchanan, J. P. Faris, K. A. Orlandini, J. P. Hughes. In TID-7560, Papers Presented at the Reactor Fuel Measurement Techniques Symposium, held at Kellogg Center, Michigan State University, East Lansing, Mich., June 18-20, 1958, pp. 179-188.

The elution characteristics of over 60 elements as tracers were determined in nitric acid medium using Dowex 1 x 10 anion exchanger.

165. THE DETERMINATION OF NITROGEN, AMERICIUM, NEPTUNIUM AND URANIUM IN P.P.M. QUANTITIES IN PURE PLUTONIUM. R. F. Buchanan, J. P. Hughes, J. J. Hines, C. A. A. Bloomquist. Talanta 6, 173-84 (1960).

Nitrogen is determined by classical method in which it is converted to NH$_3$ in an NaOH solution and absorbed in an H$_3$BO$_3$ solution. Am content was calculated from difference in 5.5 MeV alpha activity before and after separation of Am from Pu. The Np is extracted from 1 2N HCl containing 0.1M hydroquinone and 0.1M KI to keep the Np in the quadravalent state and the Pu in the trivalent state. The U is determined by extraction with 30% TBP using ferrous sulfumate to reduce Pu to the inextractable Pu(III).

166. THE COLORIMETRIC DETERMINATION OF ZIRCONIUM IN PLUTONIUM-URANIUM-FISSIUM ALLOYS. R. F. Buchanan, J. P. Hughes, C. A. A. Bloomquist. Talanta 6, 100-104 (1960).

A sample containing 40-100 μg of Zr was separated from Pu in a 10N nitric acid solution by anion exchange. The alizarin red-S lake was formed in 0.1N nitric, and its absorbency measured at 520 mu.

167. ETHER EXTRACTION AS A PORTION OF SEPARATIONS PROCESS. R. S. Buffum, R. E. Clark, D. K. Duffey, G. F. Quinn, J. B. Tepe. CN-2492, Dec. 14, 1944.

Laboratory and semiworks investigation of a diethyl ether extraction method for separating U and Pu are reported.

168. THE MICRO VOLUMETRIC DETERMINATION OF URANIUM AND PLUTONIUM. J. L. Bunce. AERE-C/R-2407, May 1951.

A method is described for determining U or Pu by reduction with liquid zinc amalgam and subsequent titration of the reduced solution with standard ceric sulfate.

169. URANIUM AND PLUTONIUM EXTRACTION BY ORGANOPHOSPHORUS COMPOUNDS. L. L. Burger. J. Phys. Chem. 62, 590-3 (1958).

Organic phosphates, phosphonates, phosphinates, and phosphine oxides are compared as solvents for U and Pu nitrates.

170. SEPARATION OF NEPTUNIUM AND PLUTONIUM BY ANION EXCHANGE. G. A. Burney. DP-689, April 1962.

Pu(IV) and Np(IV) are absorbed on an anion exchange resin from an 8M nitrate solution. The column is washed with 8M HNO$_3$ to remove contaminants. Then the Pu is removed as Pu(III) by washing the column with HNO$_3$ containing ferrous sulfamate and hydrazine. Finally, the Np is eluted with dilute HNO$_3$.

171. THE DETERMINATION OF TOTAL PLUTONIUM IN THE PRESENCE OF ALUMINUM. R. E. Burns, G. B. Barton. HW-15944, Feb. 10, 1950.

Adoption of aluminum nitrate as a salting agent in the redox process necessitated that a method be available for determining Pu in the presence of Al. Pu is carried on lanthanum hydroxide-sodium diuranate precipitate which separates it from Al as well as from any dichromate present. A regular lanthanum fluoride procedure is used on the dissolved precipitate in 2M HCl.

172. CHEMICAL ENGINEERING DIVISION, SUMMARY REPORT FOR JULY-SEPTEMBER 1949.
L. Burris, Jr., comp. ANL-4372.

Redox process studies, Pu processing, and removal of Ru by ozonization are described.

173. REPROCESSING URANIUM DIOXIDE FUELS.
L. Burris, Jr., A. Schneider. U. S. Pat. 3,023,097, Feb. 27, 1962.

A method of selectively reducing plutonium oxides and the rare earth oxides, but not uranium oxides, is described which comprises placing the oxides in a molten solvent of Zn or Cd and then adding metallic U as a reducing agent.

174. A BATCH PROCESS FOR THE RECOVERY OF Am^{241} FROM KILOGRAM AMOUNTS OF PLUTONIUM. J. P. Butler, J. S. Merritt. CRC-661, Aug 1956.

By precipitating PuO_4 from solutions 1-2N in acid, the Am can be recovered in the supernatant in about 98% yield. The method has been used with 100-200 g batches of Pu, where the recovery has been 99.8%. The method has the further advantage that the Pu is decontaminated from most cations. The Am is further purified by precipitations and ion-exchange methods with a yield of 98.4%.

175. REVIEW OF THE JOINT AECL/KAPL STUDIES OF THE TRANSURANIUM ELEMENTS.
J. P. Butler, T. A. Eastwood, H. G. Jackson. KAPL-1781, July 2, 1957.

A review of the transuranium elements produced by long-term irradiation of Pu in the KAPL Materials Testing Reactor is presented. The data cover elements from Pu^{238} to Fm^{255}.

176. SURFACE ALPHA MONITORING AS A METHOD OF MEASURING PLUTONIUM FALLOUT.
R. E. Butler, H. M. Miller. WT-1513, Aug 1961.

Alpha survey meter readings obtained on smooth, hard surfaces were correlated by chemical analysis with Pu concentrations in the immediate area of a one-point detonation of a weapon containing Pu.

177. ALPHA COUNTER FOR THE DIRECT DETERMINATION OF PLUTONIUM IN SOLUTION.
J. T. Byrne, G. A. Rost. Anal. Chem. 33, 758-61 (1961).

An effective alpha counter is designed which is used directly on samples, eliminating any chemical or physical treatment. Details of design, operation, and limitations are presented.

178. MEASUREMENT OF THE Pu^{240} CONCENTRATION OF A PLUTONIUM SAMPLE BY THE SPONTANEOUS FISSION METHOD. R. Caizergues, C. C. d'Orval. CEA-1527, 1960.

The method consists of electroplating Pu on Fe plates. The spontaneous fission rate of the deposits is measured in a multiplate ionization chamber, and the Pu^{240} content is calculated from the known spontaneous fission half-life. Precautions taken to avoid spurious pulses and α pile-up are described.

179. VOLUMETRIC ASSAY METHOD FOR PLUTONIUM USING SPECTROPHOTOMETRIC END POINT DETECTION. C. E. Caldwell, L. F. Grill, R. G. Kurtz, F. J. Miner, N. E. Moody. Anal. Chem. 34, 346-348 (1962).

A titrimetric method for the assay of Pu metal permits use of large samples and involves a spectrophotometric determination of the end point. The standard deviation is ±0.07%. Ferroin is used as the indicator, and the titrant is ceric sulfate.

180. SEPARATION PROCESS FOR TRANSURANIC ELEMENT AND COMPOUNDS THEREOF.
M. Calvin. U. S. Pat. 2,856,418, Oct. 14, 1958.

Separation process depends on the use of chelating agents while keeping U in the hexavalent state and Pu in the tetravalent state in a 1N acid solution. The chelating agents used here comprise a group of compounds characterized as fluorinated beta diketones.

181. DETERMINATION OF PLUTONIUM IN URINE BY ANION EXCHANGE. E. E. Campbell, W. D. Moss. LADC-5922, 1963.

Pu is concentrated from urine by co-precipitation with alkaline earth phosphates. The precipitate is dissolved in 7.5M HNO_3 and passed through an anion exchange column for purification. The Pu is finally removed with HCl + HI and alpha-counted by conventional methods. The recovery of 1.6 d/m of Pu from one liter of urine is 86 ± 7.8%.

182. SELECTIVE REDUCTION OF PLUTONIUM(VI) TO PLUTONIUM(IV) IN A PLUTONIUM(IV-VI) NITRIC ACID SOLUTION. M. H. Campbell. HW-68003, Feb 1961.

The valence in Pu(IV-VI) is adjusted to IV by reduction with ferrous sulfamate. Nitric acid concentration must be 2-6M to avoid Pu disproportionation or sulfamate precipitation. Fe(II) sulfamate concentration is kept below 1.0M. It is not necessary to reduce to three and then oxidize to Pu(IV).

183. AN ANALYSIS FOR FREE NITRIC ACID AND TOTAL NITRATE ION IN URANYL NITRATE AND PLUTONIUM NITRATE SOLUTIONS USING A CATION EXCHANGE RESIN. M. H. Campbell, J. F. Adams. HW-76363, Feb. 6, 1963.

The determinations are made in a single operation using a caustic titration. The analysis time is less than one hour.

184. CONTROLLED POTENTIAL COULOMETER.
Engineering drawings set CAPE-905. See also HW-65919, July 1960.

The function and applicability of a controlled-potential coulometer are described.

185. THE EXTRACTION OF PLUTONIUM AT VARIOUS OXIDATION POTENTIALS. G. Carleson. Proc. 2nd Intern. Conf. Peaceful Uses of Atomic Energy, Geneva, 1958, 17, 111, United Nations, New York, 1958.

Distribution coefficients for Pu(III), Pu(IV), and Pu(VI) with 40% tributyl phosphate in kerosene from nitric acid solution containing, in some cases, small amounts of oxidizing or reducing agents were investigated. Means of obtaining the various valence states are discussed in addition to their stabilities. The mechanism of the extraction with TBP is also discussed.

186. VAPOR PRESSURES OF AMERICIUM TRIFLUORIDE AND PLUTONIUM TRIFLUORIDE, HEATS AND FREE ENERGIES OF SUBLIMATION. S. C. Carniglia, B. B. Cunningham. J. Am. Chem. Soc. 77, 1451-3 (1955).

Vapor pressures were measured in the range 1100-1300°K by the Knudsen method.

187. COULOMETRIC DETERMINATION OF PLUTONIUM. W. N. Carson, Jr., J. W. Vanderwater, H. S. Gile. Anal. Chem. 29, 1417-22 (1957).

A general chemical method for the determination of samples containing 3 γ to 10 mg Pu. It is subject to few interferences. The procedure consists of a coulometric titration based on the preliminary oxidation of the Pu(VI), followed by titration with electrolytically generated ferrous ion to Pu(IV).

188. INSTRUMENTATION FOR CRITICALITY PROTECTION OF CHEMICAL PLANTS. D. K. Cartwright, M. J. Todd. Nuclear Power 6, No. 66, 79-82 (Oct 1961).

The application of conventional radiation detectors for locating uranyl deposits and the accumulations of Pu in chemical plants are discussed. Experimental work in detecting and locating undue build-up of fissile material is described.

189. RADIOACTIVE METAL MOBILIZATION. A. Catsch. KFK-76. Also Federation Proc. 20: Suppl. No. 10, 206-19 (Sept 1961).

The potentialities, drawbacks, and limitations of ethylene-diamine-tetraacetic acid (EDTA) in the removal of radioactive metals are discussed.

190. NEW OBSERVATIONS ON THE X SPECTRA OF PLUTONIUM. Y. Cauchois, L. de Bersuder, I. Manescu. Compt. rend. 253, 1042-3 (1961).

As a continuation of preliminary works on the X spectra of Pu, the L absorption spectra were analyzed with the aid of autonomous samples consisting of thermally evaporated metallic Pu, protected against oxidation by Al deposits, plastic envelopes, and maintenance under Ar.

191. FLUORESCENT L SPECTRUM OF PLUTONIUM. Y. Cauchois, I. Manescu. Compt. rend. 242, 1433-6 (1956). Also AEC-tr-4200.

Observations previously made on the adsorption spectra and four emission lines of Pu using about 10 mg of PuO_2 were extended to about 20 new emissions.

192. THE L SPECTRUM OF PLUTONIUM. Y. Cauchois, I. Manescu, F. LeBerquier. Compt. rend. 239, 1780-2 (1954).

The absorption spectrum and X-ray fluorescence spectrum of Pu were observed and measured.

193. TOTAL PLUTONIUM ASSAY IN THE PRESENCE OF ALUMINUM BY $Ca(OH)_2$-LaF_3 CARRIER PRECIPITATIONS. M. Cefola, W. S. Andrus. KAPL-M-MC-2, Sept. 23, 1949.

It has been established in many laboratories that the LaF_3 method for total Pu in solutions containing Al gives incorrect results. The precipitation of $La(OH)_3$ with NaOH has the effect of separating Al from Pu by keeping the Al in solution. $SnCl_2$ was used as a reducing agent instead of $NH_2OH \cdot HCl$.

194. THE ROLE OF MICRO- AND ULTRAMICROCHEMISTRY IN THE ISOLATION OF THE FIRST TRANSURANIUM ELEMENT: PLUTONIUM. M. Cefola. Microchem. J. 2, 205-17 (1958).

To handle minute amounts of Pu, reactions are carried out in capillary or cones with volumes near one microliter. New compounds were prepared by techniques of Renedetti and Cefola.

195. PLUTONIUM HANDLING HAZARDS. T. S. Chapman. In Proceedings of the Seventh Hot Laboratories and Equipment Conference, Cleveland, Ohio, April 7-9, 1959, Engineers Joint Council, New York, 1959.

The philosophy and practices of protection from hazards accompanying Pu processing and fabrication are described. Hazards of fire and water are also discussed.

196. COMPLEXES OF PLUTONIUM(IV) WITH PHENYLARSONIC ACID DERIVATIVES. I.. 1-(O-ARSONOPHENYLAZO)-2-NAPTHOL-3:6-DISULPHONIC ACID. (THORONOL.) D. A. Charman, D. W. Ockenden. RDB(W)5246, July 4, 1955.

A 1:1 plutonium-thoronal complex is formed immediately over the pH range 0.95-1.35 in nitric acid. The molar absorbency indices for the complexes of Pu(III), (IV), and (VI) with thoronal are given. The behaviors of UO_2^{+2}, Fe^{+3}, Cr^{+3}, Al^{+3}, and La^{+3} are given. A quantitative method is proposed.

197. A STUDY OF THE ACCURACY AND PRECISION OF THE LANTHANUM FLUORIDE COPRECIPITATION METHOD FOR THE DETERMINATION OF PLUTONIUM. R. B. Chenley, G. J. Hunter, T. J. Webber. AERE-C/M-327, June 1958.

The accuracy and precision of the procedure used have been determined, and consideration has been given to the choice of a standard reference for the accuracy. The coefficient of variation of these determinations was 1.9%, which enables a correction to be made for the negative bias of the method with confidence.

198. SOLVENT EXTRACTION CHEMISTRY SYMPOSIUM. PART III. RECOVERY AND PURIFICATION OF PLUTONIUM BY TRILAURYLAMINE EXTRACTION. A. Chesne, G. Koehly, A. Bathellier. Nucl. Sci. Eng. 17, 557-65 (Dec 1963).

Trilauryl amine nitrate, diluted in dodecane, is considered as an extracting agent for Pu that has been purified by one or more TBP cycles. A study of stripping solutions is also emphasized. Radiolytic degradation of the solvent is discussed.

199. AQUEOUS REPROCESSING OF URANIUM BY AMINE EXTRACTION. A. Chesne. AEC-tr-5014. Translated from NP-9340 (Vol. III) (Sect. II) "Advanced Course on Fuel Elements for Water Cooled Reactors."

Solvent extraction of Pu by amines is discussed.

200. STUDIES ON THE OXIDES OF PLUTONIUM. T. D. Chikalla. HW-63574. Also in "Plutonium 1960," Cleaver-Hume Press, Ltd., London, 1961, pp. 455-485.

Melting-point studies and sinterability data on the isomorphous compounds AlO_2 and PuO_2 and their intermediate compositions were obtained.

201. EXTRACTION OF PLUTONIUM AND OTHER ELEMENTS WITH N-BENZOYLPHENYLHYDROXYLAMINE. M. K. Chmutova, O. M. Petrukhin, Y. A. Zolotov. Zh. Analit. Khim. 18, 588-95 (May 1963).

The extractant in chloroform can be used to separate Pu from U, and fission products from a 3M nitric acid solution. The extraction of Pu from HCl and H_2SO_4 solutions was also studied.

202. SPECIAL CHEMISTRY OF 94-ANALYTICAL CHEMICAL RESEARCH REPORT FOR THE MONTH ENDING JUNE 1, 1944. CK-1756, June 15, 1944.

The copper spark method for the analysis of Pu is used on production samples. Also included is an investigation of thorium nitrate titration for fluoride, the use of cupferron for extraction of light metals from Pu, and the Al morin fluorescence method for B.

203. ION EXCHANGE STUDIES OF THE ACTINIDE ELEMENTS. G. R. Choppin. J. Chem. Educ. 36, 462-5 (1959).

Ion exchange studies of the actinide elements are reviewed.

204. REMOVAL OF PLUTONIUM FROM LABORATORY WASTES. C. W. Christenson, M. B. Ettinger, G. C. Robeck, E. R. Hermann, K. C. Kohr, J. F. Newell. Ind. Eng. Chem. 43, 1509-16 (1951).

Efficiencies of several methods for removing Pu from laboratory wastes were tried. Coagulation with Fe and lime was the preferred method. Approximately 20 gal of sludge, resulting in three pounds of dry solids, were produced for each 1000 gal of waste.

205. PAPER CHROMATOGRAPHY OF TRANSURANIUM ELEMENTS. VARIATION IN R_F OF PLUTONIUM AND AMERICIUM IN THE n-BUTANOL-HCl SYSTEM. F. Clanet. J. Chromatog. 6, 85-9 (1961).

R_F values are tabulated for U(IV) and U(VI), Pu(III), Pu(IV), and Pu(VI), and Am(III) with eight concentrations of HCl(I-10M) in 1:1 mixtures with BuOH.

206. SPOT TESTS ON PAPER OF TRANSURANIUM ELEMENTS. CHARACTERIZATION OF DIFFERENT DEGREES OF OXIDATION OF NEPTUNIUM AND PLUTONIUM. F. Clanet. In "Analytical Chemistry 1962," Elsevier Publishing Company, Amsterdam, 1963, pp. 28-38.

The sensitivities and colors obtained with 36 organic and inorganic reagents on the different valence states of Np and Pu are reported.

207. ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORTS AND PUBLISHED LITERATURE ON THE ACTINIDE ELEMENTS. PART IV. PLUTONIUM. R. W. Clarke, comp. AERE-C/R-2472 (Part IV), April 1958.

208. ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORTS AND PUBLISHED LITERATURE ON THE ACTINIDE ELEMENTS. PART V. TRANS-PLUTONIUM ELEMENTS. R. W. Clarke, comp. AERE-C/R-2472 (Part V), March 1958.

209. THE ENCYCLOPEDIA OF SPECTROSCOPY. G. L. Clark, editor. Reinhold Pub. Corp., New York, 1960.

210. INSTRUMENTS FOR PLUTONIUM MONITORING. N. T. Clarke, N. Pearce. In "Nuclear Electronics. Vol. III." Vienna, International Atomic Energy Agency, 1962, pp. 403-427.

The Pu^{239}-in-air filter paper monitor (NLS. 280) has been developed for emergency application when levels of 50 MPC or more may be encountered.

211. NUCLEAR SAFETY AND CRITICALITY OF PLUTONIUM. E. D. Clayton, W. A. Reardon. HW-71666, Nov 1961.

The data and techniques that were used to evaluate the criticality problems in typical Pu processing plants are presented. Recommendations are made concerning the reliability of the data, and techniques of control are discussed.

212. CRITICAL MASS EXPERIMENTS WITH PLUTONIUM-NITRATE SOLUTIONS. E. D. Clayton, W. A. Reardon et al. In HW-72586, Physics Research Quarterly Report, Oct, Nov, Dec 1961. Jan. 31, 1962, pp. 54-65.

Critical mass experiments were continued with Pu concentrations ranging from 36.3 g/l at 3.3M HNO_3 with a 4-in. concrete reflector, to 238.0 g/l at 5.21M HNO_3 with a 1.0-in. paraffin reflector. A coefficient was derived relating the nitrate-ion concentration to the critical volume.

213. IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF PLUTONIUM. D. W. Clelland, W. W. Marshall, G. R. Evans. British Pat. 882,950, Nov. 22, 1961.

Plutonium nitrate and oxalic acid solutions are fed to a stirred vessel at 80°C to effect precipitation. The resulting slurry is passed by gravity flow to a cooler at 25°C and thence to a column having an upward flow feed of a washing mixture of oxalic and nitric acids. The precipitate settles to the bottom of the column, from which it may be continuously withdrawn through a valve.

214. CHEMICAL RESEARCH-CHEMISTRY OF 94 (PLUTONIUM). REPORT FOR MONTH ENDING JULY 15, 1943. CN-795.

The metallurgical separation of Pu from U metal was studied. The U was alloyed with Sn, and the Sn-U is converted to the hydride. The hydride is dissolved in acid and the Pu separated from this solution.

215. CHEMICAL RESEARCH - BASIC CHEMISTRY OF PLUTONIUM. REPORT FOR MONTH ENDING JUNE 1, 1944. CN-1702, June 26, 1946.

Progress is reported on measurements of Pu(III)-Pu(IV) oxidation potentials on solubilities of phosphates and oxalates in HCl or HNO_3, the coseparation of Pu with carriers, the crystal structures of the Pu(IV) phosphates and oxalates, the hydrolysis of Pu(III) and Pu(IV), the rate of oxidation of Pu(IV) by ceric nitrate and by dichromate in nitric acid.

216. CHEMICAL RESEARCH - BASIC CHEMISTRY OF PLUTONIUM. REPORT FOR MONTH ENDING SEPTEMBER 1, 1944. CN-2088, Sept. 1, 1944.

The nitrates, sulfates, chlorides, acetates, oxalates, and phosphates of Pu are discussed. The hydrolytic behavior of Pu and oxidation-reduction potentials are given.

217. AN IONIZATION CHAMBER FOR THE STUDY OF PLUTONIUM HEXAFLUORIDE. J. W. Codding, Jr. KAPL-1759, March 29, 1957.

Calibration data are presented for a metal-ceramic ionization chamber for use with PuF_6 and nonradioactive gases in the pressure range of 0.1 to 100 mm of Hg.

218. A REVIEW OF THE PHYSICAL METALLURGY OF PLUTONIUM. A. S. Coffinberry, M. B. Waldron. Prog. of Nuclear Energy 1, Series V, 354-410 (1956).

The development of Pu metallurgy is reviewed, and data on physical properties of Pu intermetallic compounds are presented.

219. THE ABSORPTION SPECTRA OF PLUTONIUM IONS IN PERCHLORIC ACID SOLUTIONS. D. Cohen. J. Inorg. Nucl. Chem. 18, 211-218 (1961).

The absorption spectra of the four ions of Pu have been measured in the region between 2000 and 12,500 Å in perchloric acid solutions.

220. ELECTROCHEMICAL STUDIES OF PLUTONIUM IONS IN PERCHLORIC ACID SOLUTION. D. Cohen. J. Inorg. Nucl. Chem. 18, 207-10 (1961).

A potentiostat was used to obtain current-voltage for the oxidation-reduction reactions of Pu ions and to prepare the four valence states of Pu in perchloric acid solutions.

221. AMINE EXTRACTION OF PLUTONIUM AND RELATED METALS. C. F. Coleman. In TID-7607. Plutonium Ion Exchange Processes. Proceedings of the US-UK Technical Exchange Meeting. Oak Ridge National Laboratory. April 25-27, 1960, pp. 64-73.

The effects of solution and solvent concentration and oxidation state of the Pu and Np on the distribution coefficients were investigated. Degradation of amines due to radiation or chemical effects was not serious due to solubility of degradation products in aqueous solution.

222. POLAROGRAPHY IN MOLTEN AMMONIUM FORMATE. E. L. Colichman. LRL-117, Anal. Chem. 27, 1559-62 (1955).

Molten anhydrous $HCOONH_4$ was investigated as a solvent for the polarographic behavior of salts. At the operating temperature of 125 ± 1°C, traces of H_2O and of dissolved O were readily removed by a stream of N. Diffusion currents were great enough to ensure adequate sensitivity. The useful reduction range was from ±0.1 to -0.9 V vs a Hg pool. The anhydrous salts were carefully prepared for this study, which covered eight compounds of U, three compounds of Pu (some U analogs), and 69 other compounds of metals, including Th and typical fission products (e.g., Zr and the rare earths). Brief tests of $CdCl_2$ and $CdCO_3$ solutions (at 0.001, 0.005, and 0.010M) suggested quantitative possibilities.

223. A CONTINUOUS MONITOR FOR AIRBORNE PLUTONIUM. D. C. Collins. DP-188, Nov 1956.

A Pu monitor is described that can operate for one week without attention. It can detect the maximum amount of Pu permissible in air within 10 min and greater amounts in 2 min.

224. A COLORIMETER FOR IN-LINE ANALYSIS OF URANIUM AND PLUTONIUM SOLUTIONS. D. W. Colvin. DP-461, March 1960.

The colorimeter described can be used for continuous analysis of U and Pu nitrate solutions. The combined noise and drift causes an error of ±1%, but other factors such as acidity, temperature, and turbidity can cause errors of 15-20%.

225. THE COORDINATION CHEMISTRY OF THE ACTINIDES. A. E. Comyns. Chem. Rev. 60, 115-46 (1960).

A comprehensive survey is presented of coordination compounds formed by Ac, Th, U, Pa, Np, and Pu with organic ligands, both in solid state and in solution.

226. OXIDATION POTENTIALS OF THE Pu(III)-Pu(IV) AND Fe(II)-Fe(III) COUPLES IN PERCHLORIC ACID SOLUTION-HEAT CONTENT AND ENTROPY CHANGES. R. E. Connick, W. H. McVey. J. Am. Chem. Soc. 73, 1798-1804 (April 1951).

A formal potential scheme for Pu(III)-Pu(IV), Pu(VI) oxidation states in 1M $HClO_4$ was derived. Entropy values for ions Pu^{+4} and PuO_2^{++} correspond very closely to those for the corresponding ions for U.

227. OXIDATION POTENTIAL OF THE Pu(III)-Pu(IV) COUPLE IN PERCHLORIC AND HYDROCHLORIC ACID. R. E. Connick, W. H. McVey. J. Am. Chem. Soc. 74, 1341 (1952).

The formal potential scheme in 1M HCl @ 25°C is

$$\underbrace{\mathrm{Pu(III)}\ -0.969\ \mathrm{Pu(IV)}\ -1.052\ \mathrm{Pu(VI)}}_{-1.024}$$

The anomaly of a more negative potential for the

Pu(III)-Pu(VI) couple in HCl than in $HClO_4$ is thought to arise from an error in the Pu(III)-Pu(IV)-Pu(VI) equilibrium constant caused by reduction of Pu(IV) to Pu(III) by products of alpha particles.

228. DISPROPORTIONATION EQUILIBRIA AND RATES IN HCl SOLUTIONS OF PLUTONIUM. R. E. Connick, W. H. McVey. J. Am. Chem. Soc. 75, 474 (1953).

Previous data given have been corrected for the effects of alpha particles. A fifth-power dependence on (H^+) was obtained for Pu(IV) in HCl. An assumption of small amounts of complexing of Pu(III) by chloride ion appears valid.

229. THE PEROXY COMPLEXES OF Pu(IV). R. E. Connick, W. H. McVey. J. Am. Chem. Soc. 71, 1534 (1949).

Two peroxy-complexes of Pu(IV) are identified. The equilibria were measured spectrophotometrically. One complex is brown, while the other is red.

230. MECHANISM OF DISPROPORTIONATION OF Pu(V). R. E. Connick. J. Am. Chem. Soc. 71, 1528 (1949).

The mechanism for disproportionation of Pu(V) into Pu(VI) and Pu(IV) or Pu(III) is expected to proceed by either of two possible mechanisms. The importance of the mechanism in the reduction of Pu(VI) is discussed.

231. THE REDUCTION OF Pu(VI) BY NITROUS ACID. R. E. Connick. BC-71, Sept. 1, 1946.

In nitric acid solutions, Pu(VI) is rapidly reduced to Pu(V) until an equilibrium between Pu(V), Pu(VI), HNO_2, and NO_3^- is established. The mechanism of reduction below this Pu^{+5} oxidation state is discussed. In sulfuric acid, the equilibrium is rapidly established with reduction below Pu^{+5} being faster than in HNO_3 solutions.

232. PROPERTIES OF REFRACTORY NUCLEAR MATERIALS. M. Comstock. TID-3906, Feb. 17, 1960.

A bibliography of the properties of the carbides, nitrides, oxides and silicides of U, Pu, and Th is presented.

233. SOME EXPERIMENTS ON THE POLAROGRAPHY OF PLUTONIUM(VI) IN COMPLEXING MEDIA. G. P. Cook, J. K. Foreman, E. F. Kemp. Anal. Chim. Acta 19, 174-9 (1958).

The dropping mercury electrode for reduction of any of valence states of Pu is precluded by the values of the revelant formal oxidation potentials, which are +0.9 V and above. Two general approaches are suggested: anodic polarography in noncomplexing media, or the use of complexing agents. Thus the potential is moved into the working region of the dropping mercury electrode.

234. THE DETERMINATION OF THE PLUTONIUM CONTENT OF URINE (PHOSPHATE METHOD). G. P. Cook, O. Jones. IGO-AM/W-68, Sept. 19, 1952.

A solution of calcium phosphate in nitric acid is added to the urine. Pu is coprecipitated on Ca and magnesium ammonium phosphates after addition of ammonia. The ignited precipitate is dissolved in acid, and the Pu along with added iron is extracted as cupferride with chloroform. The alpha activity is determined on a scintillation counter.

235. URANIUM ANALYSIS BY GAMMA ABSORPTIOMETRY. R. E. Connally, U. L. Upson, P. E. Brown, F. P. Brauer. HW-54438, May 20, 1958.

A nondestructive γ-absorptiometric method is presented. Pu and other solutions can be analyzed.

236. EUROCHEMIC ASSISTANCE: ANALYTICAL-ANSWERS TO SPECIFIC QUESTIONS. L. T. Corbin. CF-59-1-9 (Rev. 1), July 14, 1959.

The spectrochemical, carrier distillation, liquid-liquid extraction, and ion exchange of Pu are discussed.

237. VOLATILE OXIDES OF SOME IMPORTANT MATERIALS USED IN NUCLEAR TECHNOLOGY. E. Cordfunke. In "Thermodynamics of Nuclear Materials." Proceedings of an IAEA Symposium held in Vienna, May 21-25, 1962.

Attention is given to the formation of the volatile oxides of U and Pu.

238. DIRECT VOLUMETRIC DETERMINATION OF URANIUM AND PLUTONIUM IN NITRIC ACID MEDIUM. J. Corpel, F. Regnaud. In TID-7655. Proceedings of the Sixth Conference on Analytical Chemistry in Nuclear Reactor Technology held at Gatlinburg, Tenn., Oct. 9-11, 1962, pp. 240-246.

The element is reduced with Ti(III) solution in the presence of sulfamic acid and titrated with Ce(IV). The method is rapid and accurate.

239. TITRATION OF PLUTONIUM WITH Ce(IV). J. Corpel, F. Regnaud. Anal. Chim. Acta 27, 36-39 (1962).

A method is described for titrimetric determination of Fe, U, or Pu in nitric acid media. The element is reduced with Ti(III) solution in the presence of sulfamic acid, and titrated with Ce(IV) solution.

240. PROCESS OF OXIDIZING PLUTONIUM. C. D. Coryell. U. S. Pat. 2,901,315, Aug. 25, 1959.

The oxidation of Pu to the six valence state is described using argentic oxide.

241. A STUDY OF THE POLYMERIZATION, DEPOLYMERIZATION, AND PRECIPITATION OF TETRAVALENT PLUTONIUM AS FUNCTIONS OF TEMPERATURE AND ACIDITY BY SPECTROPHOTOMETRIC METHODS: PRELIMINARY REPORT. D. A. Costanzo, R. E. Biggers. ORNL-TM-585, July 1, 1963.

It is clearly indicated that under conditions studied, the colloidal polymer formation is formed by an increase in Pu concentration and temperature, or by a decrease in the acidity. The Pu(IV) colloidal polymer was also observed to precipitate in high concentrations of nitrate salts.

242. A TECHNIQUE FOR OBTAINING PARTICLE ACTIVITY AND SIZE DISTRIBUTIONS. M. Cowan, Jr. SCR-296, April 1961.

An autoradiographic technique is described for determining the frequency distribution of particles by the amount of radioactivity per particle. Autoradiographs are obtained for several different exposure times from a geometry which, discounting self-absorption, makes particle signatures visible after exposure times that are inversely proportional to particle activity.

243. THE CHELATE PROCESS. H. W. Crandall, T. E. Hicks. In TID-2504 (Del.), Nuclear Science and Technology, Volume 3, Issues 1-4, March-Dec 1953, pp. 157-173.

The Chelate Process was conceived to promote the recovery and purification of Pu from dilute aqueous solutions of irradiated-uranium fuels by solvent extraction with thenoyltrifluoroacetone (TTA) in an organic diluent. The basic chemistry, kinetics, extraction mechanisms, and experimental data of the systems studied are reviewed.

244. THE SOLVENT EXTRACTION OF Pu(IV) BY TRIFLUOROACETYLACETONE. H. W. Crandall, J. R. Thomas, J. C. Reid. CN-2657, Jan. 15, 1945.

Certain variables of the extraction step of the proposed solvent-extraction process using TFA have been investigated. It was observed that the extraction coefficient rose to a maximum, and then there was a decrease due to a change in TFA in a 2-minute period. After 15-20 minutes, a slow reduction of Pu(IV) to Pu(III) was observed. Reproducible values of the extraction coefficient were determined under a variety of conditions.

245. OXIDATION OF Pu(IV) TO Pu(VI) IN SOLUTIONS OF NITRIC ACID, ALUMINUM NITRATE, SODIUM NITRATE, AND URANYL NITRATE. I. H. Crocker. CRDC-697, May 1957.

This report describes the effects of temperature, Pu concentration, nitric acid concentration, and nitrate ion concentration on the oxidation of Pu(IV) to Pu(VI).

246. PAPER CHROMATOGRAPHIC ANALYSIS OF IRRADIATED URANIUM IN A HYDROFLUORIC ACID MEDIUM. C. E. Crouthamel, A. J. Fudge. J. Inorg. Nucl. Chem. 5, 240-4 (1958).

Cs^{137}, Ba^{137}, Ce^{141}, Nb^{95}, Nb^{97}, Zr^{95}, Zr^{97}, Te^{132}, Sr^{90}, Y^{90}, Mo^{99}, Tc^{99}, Np^{239}, Pu^{239}, Am^{241}, Pa^{233}, Th^{234}, Ru^{106}, and Rh^{106} were identified in paper chromatograms made from fluorides made from nitrate resulting from dissolution of irradiated U_3O_8 in HNO_3.

247. PLUTONIUM BEHAVIOR IN THE FLUORIDE VOLATILITY PROCESS. R. A. Cross, C. L. Whitmarsh. CF-59-9-5, Sept. 3, 1959.

An investigation of Pu behavior as the Pu(VI) fluoride in the Fluoride Volatility Process.

248. THE DETERMINATION OF CARBON IN PLUTONIUM METAL, ALLOYS, OXIDES, AND CARBIDES. D. Crossley, G. Phillips. AERE-R-3790, Sept 1961.

The C is converted to CO_2 by combustion at high temperature in a stream of oxygen, and the CO_2 evolved is measured either manometrically, by means of its pressure in a known volume, or gravimetrically, after absorption on soda asbestos.

249. A MANOMETRIC METHOD FOR THE DETERMINATION OF MACRO QUANTITIES OF CARBON IN PLUTONIUM AND URANIUM CARBIDES. D. Crossley, E. Foster. AERE-R-4359, May 1963.

A method is described that can theoretically be applied to the carbide of any actinide element. The carbon dioxide produced by combustion is measured by observing its pressure in a known volume at room temperature. At the 100-mg level of carbon dioxide, the precision is 0.3%.

250. THE ANALYSIS OF COMPLEX MIXTURES OF ELEMENTS RESULTING FROM THE IRRADIATION OF FISSILE MATERIALS. E. A. C. Crouch, G. B. Cook. J. Inorg. Nucl. Chem. 2, 223-8 (April 1956).

A scheme for the separation of complex mixture of mainly fission-product elements on the semimicro scale is described.

251. THE EVAPORATION OF PLUTONIUM FROM SMALL PIECES OF URANIUM REACTOR FUEL. D. Cubicciotti. NAA-SR-1057, Oct. 15, 1954.

The evaporation of Pu from U containing initially about 0.01% Pu has been measured at 1600 and 1680°C. The results show that the rate of evaporation follows the equation based on Raoult's Law.

252. THE VOLATILIZATION OF TRACER PLUTONIUM FROM MOLTEN URANIUM METAL. D. Cubicciotti. NAA-SR-242, April 30, 1953.

The rate of volatilization of Pu from molten U in vacuum has been studied at 1495, 1600, and 1680°C. The feasibility of large-scale recovery of Pu from U by volatilization is considered.

253. REPROCESSING OF FUEL AND BLANKET MATERIALS BY SOLVENT EXTRACTION. F. L. Culler, *et al.* Chem. Eng. Prog. 51, 450-60 (1955).

Chemical processing flowsheets involving separation of Pu from natural U, of enriched U from Al and other diluents and cladding materials, and separation of U^{233}, Pa, and Th, are reviewed.

254. THE PURIFICATION OF PLUTONIUM BY A THENOYLTRIFLUOROACETONE (TTA) PROCESS. J. G. Cuninghame, G. L. Miles. J. Appl. Chem. (London) 7, 72-81 (1957).

Pu must be extracted in the +4 state. The extraction and back extraction are slow. Reduction of Pu(IV) is fast but the reduction of Pu(VI) is slow. Data are also given for purification of Pu from U, Zr, Ru, Fe, and Cr.

255. THE SEPARATION OF PLUTONIUM BY EXTRACTION WITH THENOYLTRIFLUOROACETONE (TTA). J. G. Cuninghame, G. L. Miles. J. Inorg. & Nuclear Chem. 3, 54-63 (1956).

Distribution ratio data are given along with factors affecting them. Values have been calculated for the equilibrium constant of the solvent-extraction reaction for Pu^{+4}.

256. THE PURIFICATION OF PLUTONIUM BY A THENOYLTRIFLUOROACETONE (TTA) PROCESS. J. G. Cuninghame, G. L. Miles. J. Appl. Chem. (London) 7, 72-81 (Feb 1957).

The extraction of Pu by TTA in the presence of impurities is discussed and data are presented for the extraction of U, Zr, Ru, Fe, and Cr.

257. METHODS OF COATING WITH PLUTONIUM ACETYLACETONATE AND COATED PRODUCT. B. B. Cunningham, C. Smith, J. S. Dixon. U. S. Pat. 2,545,606, March 20, 1951.

The Pu compound is volatilized in a vacuum and condensed on the cooled article.

258. THE FIRST ISOLATION OF PLUTONIUM. B. B. Cunningham, L. B. Werner. J. Am. Chem. Soc. 71, 1521-1528 (1949).

The first isolation of pure Pu is described. Nuclear and chemical properties are discussed.

259. FLUORESCENCE SPECTRUM OF Pu^{3+} IN LaCl$_3$. B. B. Cunningham, D. M. Gruen, J. G. Conway, R. D. McLaughlin. J. Chem. Phys. 24, 1275 (1956).

The fluorescence spectrum was detected in a crystal of LaCl$_3$ containing approximately 0.1% Pu^{3+}. The fluorescence was self-excited at room temperature due to the radioactivity of Pu^{239}, but the self-excitation was much weaker than in the case of Am^{241}.

260. SEPARATION OF U(VI), Pu(VI) AND Pu(IV) FROM Zr AND Nb ON A COLUMN OF SILICA GEL. D. Cvjeticanin. JENER-57, Aug. 25, 1958.

The chromatographic method for the separation of U(VI), Pu(VI), and Pu(IV) from Zr^{95}-Nb^{95} on a silica-gel column is described. These elements can be separated from aqueous as well as from organic solutions. The method is based on the extraction of U and Pu nitrates with methyl isobutyl ketone containing HNO$_3$ in the presence of silica gel. Zr^{95}-Nb^{95} under the same conditions were retained by the silica gel.

261. SEPARATION OF U AND Pu FROM Zr, Nb, Ru, AND Cs ON A COLUMN OF MANGANESE DIOXIDE. D. Cvjeticanin, N. Cvjeticanin. JENER-54, April 11, 1958.

It was established that it is quantitatively possible to wash UO$_2^{+2}$ and PuO$_2^{+2}$ from a column of manganese dioxide with 0.1N HNO$_3$.

262. NONDESTRUCTIVE TESTING IN THE CONTROL OF NUCLEAR MATERIALS. R. W. McClung. CONF-80-4. Institute of Nuclear Materials Management Fourth Annual Meeting, Buffalo, N. Y., June 1963.

The capabilities and limitations of the self-emitted gamma and external radiation methods of measuring the fuel content of nuclear materials are reviewed.

263. THE DETERMINATION OF PLUTONIUM IN URINE BY DIRECT PHOSPHATE PRECIPITATION AND AUTORADIOGRAPHY. J. C. Dalton. PG-Report-284, 1962.

Development and use of a method for routine determination of Pu in urine are described. The quantitative electrodeposition of Pu is discussed and details are given of the technique for the autoradiographic determination of the Pu content of the sources prepared.

264. DENSITOMETRIC DETERMINATION OF IRON IN PLUTONIUM. J. L. Daniel. HW-23080, Dec. 20, 1951.

The visual method is said to be accurate within a factor of two. For increased accuracy, the densitometric method uses an internal standard and the densities of selected spectral lines of the standard and sample are determined. Co is used here as the internal standard. The standard deviation for 213 ppm Fe was about 17.7 ppm or ±8.3%.

265. IMPROVED SPECTROGRAPHIC ANALYSIS OF URANIUM AND PLUTONIUM BY THE CARRIER CONCENTRATION METHOD. J. L. Daniel. HW-25859, Oct. 7, 1952.

From film studies of the emission characteristics of impurities in U and Pu it was found that accuracy and precision could be improved by increasing the carrier concentration and using fixed arcing time for all samples.

266. THE BUILD-UP OF PLUTONIUM ISOTOPES BY IRRADIATION. W. G. Davey. AERE-R/M-118 (LMFS/P-12), March 1957.

The characteristics of a mixture of Pu isotopes formed after long neutron irradiations of Pu^{239} are estimated. The effects of various neutron spectra are considered, and general conclusions are drawn.

267. THE CHELATE PROCESS VI. PROCESS FLOW INVOLVING o-DICHLOROBENZENE AS THE SOLVENT FOR TTA. M. W. Davis, Jr., T. E. Hicks, T. Verneulen. UCRL-1032, Jan 1951.

Comparative studies of a series of halogenated solvents, as carriers for TTA (thenoyltrifluoroacetone) in the chelate process for Pu extraction, indicate that ortho-dichlorobenzene most nearly satisfies the requirements.

268. SEPARATION OF PLUTONIUM AND URANIUM FROM FISSION PRODUCTS. J. K. Dawson, A. E. Truswell. British Pat. 778,051, Nucl. Eng. 2, 494 (Nov 1957).

A simple method of separating Pu and/or U, especially from Ru and Rh, consists of treating the metal or compound with a gaseous fluorinating agent (hydrogen fluoride; chlorine trifluoride; bromidetrifluoride) in admixture with 2 to 10% of a gaseous oxidizing agent (air; oxygen).

269. SEPARATION OF FISSION PRODUCTS FROM URANIUM OR PLUTONIUM OBTAINED FROM ATOMIC REACTORS. J. K. Dawson, H. A. McKay. German Pat. 1,058,747, June 4, 1959.

An excess of U or Pu is allowed to react with a melt of alkali metal chloride (at 1200°) containing $PbCl_2$, until all $PbCl_2$ is reduced to metallic Pb. Then Mg or Al is added in small excess, so that metallic U or Pu is regenerated and can be separated from the melt.

270. ELECTRONIC STRUCTURE OF THE HEAVIEST ELEMENTS. J. K. Dawson. Nucleonics 10, No. 9, 39-45 (1952).

Magnetic susceptibility of Th, Pa, U, Np, Pu, Am, and Cm are reviewed. Electronic configurations are suggested. The property that determines the lowest level seems to be the number of unpaired electrons rather than the atomic number.

271. SOLUBILITIES OF SOME PLUTONIUM COMPOUNDS. J. K. Dawson. AERE-C/M-92, Nov 1950.

Approximate solubilities of Pu(IV) and Pu(VI) nitrates in butex and $Pu(CrO_4)_2$ in water and $(NH_4)_2CrO_4$ solutions are given.

272. THE SUBLIMATION TECHNIQUE FOR THE PREPARATION OF THIN FILMS OF PLUTONIUM. J. K. Dawson. AERE-C/R-861. Thin Films; a Symposium sponsored by the Chemistry Division, AERE, Harwell, March 14-15, 1951.

$Pu(NO_3)_4$ is pipetted onto a Ta filament. Ammonium salts are driven off at 1000°C with the collecting tray swung out of position. U, Pu, Am and Cm compounds were also tried.

273. THE FLUORIDE-HYDROXIDE CYCLE IN THE PURIFICATION OF PLUTONIUM. J. K. Dawson, R. Hurst. AERE-C/M-80 (Rev.), 1957.

Pu is purified by precipitating as $KPuF_5$ in a nitrocellulose tube by using 150 mg KF and 2 ml 48% H_2F_2.

274. THE THERMOGRAVIMETRY OF SOME PLUTONIUM COMPOUNDS. J. K. Dawson, R. M. Elliott. AERE-C/R-1207, June 8, 1953.

A SiO_2-spring balance was used for continuous weighing of 2- to 50-mg samples of Pu compounds during heating at a rate of temperature rise of about 3°/min or at constant temperature.

275. THE PREPARATION AND SOME PROPERTIES OF PLUTONIUM FLUORIDES. J. K. Dawson, R. M. Elliott, R. Hurst, A. E. Truswell. J. Chem. Soc. 558-64 (Feb 1954).

Pu fluorides are prepared by reaction of HF and PuO_2 or oxalate. Both tetra and trifluorides of Pu precipitated from aqueous solution are hydrated. Thermogravimetric errors are described for anhydrous fluorides and the precipitated fluorides. Data are also given for free energy of formation of plutonium tetrafluoride.

276. THE HYDRATED TETRAFLUORIDES OF URANIUM AND PLUTONIUM. J. K. Dawson, R. W. M. D'Eye, A. E. Truswell. J. Chem. Soc. (London), 3922-9 (Nov 1954).

Methods for formation have been investigated as well as the cell structures of the tetrafluorides of Pu and U.

277. ELECTRODEPOSITION OF PLUTONIUM, AMERICIUM, AND CERIUM. V. B. Dedov, V. N. Kosyakov. Proc. Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1955, 7, 369-73, United Nations, New York, 1956.

Work on deposition of hydrous oxide films of the transuranides is presented. Aqueous alkanol-acetone media used for lanthanide electrode positions were used.

278. RADIATION DAMAGE OF ALPHA ACTIVE SUBSTANCES. R. W. M. D'Eye, L. E. J. Roberts. AERE-C/M-306, March 19, 1957.

It is stated that alpha-active chemical compounds undergo radiation damage both by alpha radiation and by recoiling heavy atoms. This paper explores the possibility of using short-level alpha-active radioisotopes to investigate radiation damages, by their incorporation in isostructural inactive materials.

279. PLUTONIUM FLUORIDES. E. N. Deichman, I. V. Tananev. Radiokhimiya 4, 66-73 (1961).

Studies of plutonium tetrafluoride solubility in sodium fluoride solutions indicated the formation of two compounds: $NaPuF_5$ and Na_2PuF_6. It was also shown that the two compounds are not readily soluble in NaF solution.

280. PROPERTIES, TOLERANCE DOSES, AND DETERMINATION OF AEROSOLS HAVING α RADIOACTIVITY. G. Delibrias, J. Labeyrie. J. Phys. Radium 14, 407-18 (June 1953).

A radiometric method is used for determining aerosols by collecting the aerosols upon a filter. The α radiation is measured either by a proportional counter or by radioautography.

281. APPLICATIONS OF CONTROLLED POTENTIAL COULOMETRY. W. L. Delvin, L. R. Duncan. HW-SA-2635, May 25, 1962.

The broad capability of controlled potential coulometry is shown by reviewing analytical methods for radioactive and nonradioactive materials. Methods are given for the coulometric determination of Pu, U, Fe, Pb, nitrate, Au, Cd, Cu, Tl, and Np.

282. A DEMONSTRATION OF DETERMINING PLUTONIUM IN URANIUM BY CONTROLLED POTENTIAL COULOMETRY. W. L. Delvin, L. R. Duncan. HW-71435, Oct. 24, 1961.

The reliability of controlled potential coulometry for determining Pu in U is demonstrated.

283. MICROACTIVATION ANALYSIS FOR OXYGEN IN THE ACTINIDE METALS. A. C. Demildt. Anal. Chem. 35, 1228-30 (Aug 1963).

He^3 activation analysis was found ideal for oxygen determination. It is estimated that O can be determined in as low a concentration as 0.001% in a few micrograms of matrix material. Interference by bombarding or activation of other elements can be partly restricted by controlling the bombarding energy of the He^3 particles. This makes the method applicable to the analysis of fissionable actinides.

284. SOME INVESTIGATIONS ON PLUTONIUM METAL. E. Dempsey, A. E. Kay. J. Inst. Metals 86, 379-84 (1958).

The possibility of a Pu specimen disintegrating owing to the production, from radioactive decay, of He within its volume is discussed.

285. SOLUBILITY PRODUCT OF PLUTONIUM(IV) DIPHOSPHATE AND ITS SOLUBILITY IN CERTAIN ACIDS. R. G. Denotkina, A. I. Moskvin, V. B. Shevchenko. Zhur. Neorg. Khim. 5, 805-10 (April 1960).

The solubility of $Pu(HPO_4)_2 \cdot XH_2O$ was determined in $HClO_4$ and HNO_3 at constant ionic strength and variable acidity up to 2.0N hydrogen ion. The solubility product was found to be 2×10^{-28}. A comparison with Th and U shows that plutonium(IV) diphosphate is the least soluble as would be expected with the decrease in ionic radius in the series Th - Pu.

286. AUTOMATIC ANALYSIS IN NUCLEAR TECHNIQUES. P. Desneiges. Chim. Anal. No. 3, 120-6 (March 1960) and No. 4, 195-9 (April 1960).

The automatic equipment for the continous analysis of Pu and U in irradiated U after dissolution in HNO_3 and extraction is described. The sample solution is evaporated in a cup and alpha-counted.

287. A SURVEY METER FOR URANIUM AND PLUTONIUM. A. H. Dexter. DP-62, Nov 1954.

A meter is described that will distinguish between U and Pu contamination on the basis of the range of the alpha particles in air.

288. AN ION-EXCHANGE STUDY OF POSSIBLE HYBRIDIZED 5+ BONDING IN THE ACTINIDES. R. M. Diamond, K. Street, Jr., G. T. Seaborg. J. Am. Chem. Soc. 76, 1461 (1954).

The elution behavior of actinides and some rare earths with HCl on Dowex 50 cation resin is studied. These elutions indicate that in high HCl the actinides may form complex ions with chloride ion to a greater extent than the lanthanides.

289. BIBLIOGRAPHY OF PLUTONIUM AND ITS COMPOUNDS. J. Dirian, et al. CEA-796, Jan 1958.

Analysis and chemical properties are included.

290. METHOD OF PREPARING COMPLEXES OF PLUTONIUM WITH DIKETONES. J. S. Dixon, J. J. Katz, E. F. Orlemann. U. S. Pat. 2,989,556, June 20, 1961.

A method is presented for separating Pu from an aqueous alkaline solution by precipitating with a β diketone or extracting into a solution of β diketone in an organic water immiscible solvent.

291. PURIFICATION OF PLUTONIUM BY CATION EXCHANGER. Z. I. Dizdar, D. H. den Boer. J. Inorg. Nucl. Chem. 3, 323-5 (1956).

Pu^{+++}, further purifiable, was eluted from a Dowex 50 column by 1.5N HNO_3 or HCl with good separation from UO_2^{2+}, and $N_2H_5^+$.

292. DETECTION OF PLUTONIUM CONTAMINATION IN HUMANS BY THE AUTORADIOGRAPHIC METHOD. N. L. Dockum, E. J. Coleman, G. Vogt. HW-51754, 1957. See also Stain Technol. 33, 137-142 (1958).

An autoradiographic technique, which is more sensitive than chemical analyses and counting techniques, is described for detecting Pu contamination in human skin, fingernails, and sputum and in a pigskin biopsy sample.

293. THERMAL ANALYSIS OF PLUTONIUM. L. G. Doom, R. Kamm. LA-639, May 28, 1944.

The apparatus used for determination of thermal arrest in Pu was essentially a vacuum furnace with means of obtaining a fairly constant rate of temperature increase. A melting point of 627 ± 3°C was established.

294. PLUTONIUM RECOVERY FROM CONTAMINATED MATERIALS. E. Doud. HW-57288, Aug. 27, 1958 and HW-58610, Jan 1959.

Incineration of combustible material and leaching of noncombustible material are practical methods of recovering Pu from contaminated wastes. Estimated recovery efficiency is 90%.

295. RESEARCH IN RADIOBIOLOGY. T. F. Dougherty. COO-222, Sept. 30, 1960.

Toxicity studies of Ra, Pu, Th, and Sr are summarized. A report is given of the study of soft-tissue-tumor incidence in beagles with long-term internal, radionuclide burdens.

296. STABILITY OF HEXAVALENT PLUTONIUM IN AQUEOUS SOLUTIONS. L. E. Drabkina, A. D. Gel'man. Radiokhimiya 1, 136-40 (1959).

Pu^{+6} was found to be stable in 1N HNO_3 for one week or longer. Pu^{+6} is reduced to lower valence states by oxalates, particularly at lower acidities.

297. COULOMETRIC TITRATION OF PLUTONIUM. A. B. Dreeben. AECD-3887, Feb. 17, 1953.

In this method there is an electroreduction of Pu^{+6} to Pu^{+3} in a nitric acid-sulfanic acid solution. Exploratory experiments in the search for a coulometric titration of Pu^{+3} using electrolytically generated Ce^{+4} are also described.

298. PLUTONIUM SEPARATION METHOD. J. L. Dreher, S. G. Thompson. U. S. Pat. 2,819,143, Jan. 7, 1958.

An improved method is described for separating Pu from fission-product contaminants. The process consists of treating a cerium-group trifluoride-carrier precipitate containing reduced Pu with an acidic solution containing ceric ion, which causes the precipitate to be dissolved and oxidizes the Pu to the hexavalent state.

299. EXTRACTION OF PLUTONIUM(IV) BY DIBUTYLPHOSPHORIC ACID. P. H. Dreze, G. Duyckaerts (Liege University). EUR-436.f. 1963.

The different parameters affecting the extraction of nitrate solutions of Pu(IV) by organic dibutylphosphoric acid solutions in benzene was studied. A mechanism is proposed for the extraction.

300. THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART IV. CRYSTALLINE PLUTONIUM NITRATE. J. L. Drummond, G. A. Welch. J. Chem. Soc. 2565-7 (1956).

A gummy semicrystalline solid phase is formed when concentrated solutions of Pu^{4+} in 1 to 4M HNO_3 is evaporated, the composition of which is not known. It was found that concentrated solutions of Pu tetranitrate in acid will deposit well-formed crystals when allowed to evaporate.

301. A SEMI-MICRO THERMOBALANCE FOR PLUTONIUM COMPOUNDS. J. L. Drummond, H. Chapman. TRG-Report-466, Jan. 15, 1963.

A sensitive thermobalance was designed for the study of oxidation and reduction reactions of mixed U-Pu oxides and for gravimetric determinations of oxygen to metal ratios. Weighings are reproducible to ±0.02 mg at temperatures of 1300°C. With minor modifications, the balance can be used for carbides and nitrides.

302. SOME ASPECTS OF THE MEASUREMENT OF THE OXYGEN-TO METAL RATIO IN SOLID SOLUTIONS OF URANIUM AND PLUTONIUM DIOXIDES. J. L. Drummond, V. M. Sinclair. In TID-7655, Proceedings of the Sixth Conference on Analytical Chemistry in Nuclear Reactor Technology held at Gatlinburg, Tenn., Oct. 9-11, 1962, pp. 217-239.

Methods of measuring the stoichiometry of the oxide fuels include measurement of the carbon dioxide formed on reduction, the use of the hydrogen-oxygen redox cycles on a thermobalance, and the use of X-ray diffraction techniques.

303. THE GRAVIMETRIC DETERMINATION OF PLUTONIUM AS OXIDE AT 1250°C. J. L. Drummond. IGO-AM/W-64, Dec. 18, 1956.

The solution of the pure salt is fumed to dryness with H_2SO_4, and the $Pu(SO_4)_2$ is ignited at 1250°C to stoichiometric dioxide, which is not hygroscopic.

304. THE ABSORPTIOMETRIC DETERMINATION OF TOTAL PHOSPHORUS IN PLUTONIUM SOLUTIONS (REDUCED PHOSPHO-MOLYBDATE METHOD). J. L. Drummond, G. P. Cook. IGO-AM/W-181, 1958.

Any organic phosphate present is converted to phosphoric acid by digestion with hydrobromic acid. The P is extracted into an amyl alcohol/ethyl acetate mixture as the phospo-molybdate complex. Stannous chloride is added to reduce the P to the phospho-molybdate complex, where it is determined absorptiometrically. The concentration range is 0.02% and above with respect to Pu. The precision at 3σ criterion is ±30% based on 23 determinations at the 1.6-μg level by three operators.

305. THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART VII. PLUTONIUM CARBIDES. J. L. Drummond, B. J. McDonald, H. M. Ockenden, G. A. Welch. J. Chem. Soc. 4785-9 (1957).

Methods are given for producing PuC and the sesquicarbide Pu_2C_3. Both carbides are easily hydrolyzed by dilute acid and boiling water. Chemical and X-ray evidence for existence of higher carbides is shown - but this has not been definitely identified.

306. THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART VI. PLUTONIUM DIOXIDE. J. L. Drummond, G. A. Welch. J. Chem. Soc. 4781-5 (1957).

This paper gives method for preparing stoichiometric oxide and discusses the oxides formed by igniting plutonium salts. The suggested formula is $PuO_{2.00-2.09}$, depending on starting material and ignition temperature.

307. METHOD OF SEPARATING TETRAVALENT PLUTONIUM VALUES FROM CERIUM SUBGROUP RARE EARTH VALUES. R. B. Duffield, R. W. Stroughton. U. S. Pat. 2,872,287, Feb. 3, 1959.

This method is based on the insoluble carbonate complex of Pu(IV) and the insoluble carbonate complexes of the Ce group upon the addition of an alkali metal carbonate to a solution that has an adjusted pH of 5.5-7.5.

308. SULFIDE METHOD FOR PLUTONIUM SEPARATIONS. R. B. Duffield. U. S. Pat. 2,847,274, Aug. 12, 1958.

A process is described for recovering Pu from irradiated U solutions. Such solutions are first treated with a soluble sulfide causing precipitation of Pu and U sulfides, along with those impurities that form insoluble sulfides. The precipitate is then treated with carbonate ions, which will dissolve the U and Pu, leaving the fission-product sulfides unaffected. After separation from the residue, this solution may be treated by any of the usual methods, such as formation of a lanthanum fluoride precipitate, to effect separation of Pu from U.

309. DISSOLUTION OF PLUTONIUM CONTAINING CARRIER PRECIPITATE BY CARBONATE METATHESIS AND SEPARATION OF SULFIDE IMPURITIES THEREFROM BY SULFIDE PRECIPITATION. R. B. Duffield. U. S. Pat. 2,894,812, July 14, 1959.

The carrier lanthanum fluoride precipitate is dissolved in alkali metal carbonate, a soluble sulfide is added, and sulfide precipitate separated. An alkali metal hydroxide is added and the precipitate is separated.

310. KINETICS AND MECHANISMS FOR THE OXIDATION OF TRIVALENT PLUTONIUM BY NITROUS ACID. E. K. Dukes. J. Am. Chem. Soc. 82, 9-13 (Jan 1960).

The proposed mechanism for the oxidation of Pu(III) by nitrous acid involves N_2O_4 as an intermediate in HNO_3 and NO^{+4} as an intermediate in HCl or $HClO_4$. Studies were made with 10^{-5}-10^{-6} molar Pu, and the change in distribution coefficient of Pu into 30 v/o tributyl phosphate was used to follow the reaction. Rate expressions and activation energies are given.

311. THE HANDLING OF PLUTONIUM IN LABORATORIES: PRECAUTIONS. H. J. Dunster, E. J. Bennellick. Atomics 6, 312-20 (1955).

Laboratory facilities and procedures for handling Pu at levels up to 10 Curies are outlined. Glovebox operation and maintenance are discussed, and emergency measures are suggested.

312. ADVANCES IN NUCLEAR ENGINEERING. VOLUME I. J. R. Dunning, B. R. Prentice, Eds. Pergamon Press, New York, 1957.

Papers are presented on manufacture, production, recovery, and economics of nuclear fuels, spent-fuel processing, plant-containment concepts and design, plant components, waste disposal, protection and safety measures, and radiation processing.

313. COPRECIPITATIONS OF ACTINIDES WITH THE PEROXIDES OF OTHER ACTINIDES. G. A. Dupetit, A. H. W. Aten, Jr. Radiochim. Acta. 1, No. 1, 48 (Sept 1962).

The coprecipitation of tracer quantities of actinides with actinide peroxides were studied.

314. ELECTRON-PROBE MICROANALYSIS OF PLUTONIUM-BASE ALLOYS. M. Dupuy, G. Moreau, D. Calais. CEA-2292, 1963.

The alloys are prepared according to Scott's method, decontamination, deposition of a formvar film, and introduction in the microprobe. L and M emission spectra are determined by rotating a quartz crystal on the Rowland circle and recording X-ray intensity versus wave length. A 99 w/o Pu-Al alloy is used as the standard.

315. THE ABSORPTION OF PLUTONIUM BY ANION RESINS. R. W. Durham, R. Mills. CEI-62 (Rev.) Oct 1961.

Equilibrium experiments have shown Pu^{+4} to be absorbed from nitric acid onto an anion resin as a complex anion $Pu(NO_3)_6^{-2}$. The amount of absorption is dependent on the Pu and nitric acid concentrations in the equilibrium solution, with a maximum at 7N to 8N HNO_3.

316. CONCENTRATION AND PURIFICATION OF PLUTONIUM SOLUTIONS BY MEANS OF ION EXCHANGE COLUMNS. R. W. Durham, A. M. Aikin. CEI-55, Feb. 12, 1953.

The distribution of Pu^{+3}, UO_2^{+2}, and Fe^{+2} was studied on Dowex-50 from nitric acid solutions. U can be completely removed from Pu even when the initial concentration of U is very much greater than that of the Pu.

317. TABLE OF CONSISTENT NUCLEAR DATA FOR U^{233}, U^{235}, AND Pu^{239} FOR 2200 M/SEC. NEUTRONS. P. A. Egelstaff, K. W. Morton, J. E. Sanders. AERE-NP/R-2140, Dec 1955.

Data are presented for average number of neutrons emitted per fission; average number of neutrons emitted per neutron absorbed; absorption cross section; fission cross section; fission cross section and ratio $(6_2 - 6_f)/6_f = a$.

318. GAMMA MONITOR TO RAPIDLY ASSAY PLUTONIUM IN PROCESS WASTES. F. Elliott, G. W. Pearson. Nucleonics 21, No. 5, 78; 80-1 (May 1963).

A rapid nondestructive method that uses gamma spectroscopy to count this 0.4 MeV gamma emission from Pu^{239} is described. Response is linear up to 50 g, and a detection limit equivalent to 200 mg of Pu is readily achieved. Radiochemical assay shows the instrument to be accurate to ±30%.

319. THE HOMOGENEOUS DECOMPOSITION OF HYDROGEN PEROXIDE BY PLUTONIUM(IV). R. E. Elson. UCRL-6536, Sept. 11, 1961.

The homogeneous decomposition of H_2O_2 by HNO_3, and by HNO_3 solutions (>1M) containing Pu(IV); Pu(IV) and Pt; Pu(IV) with Cu(II) and Fe(III); and Pu(IV) with Pt, Cu(II), and Fe(III) as a function of temperature, is investigated.

320. MEASUREMENTS OF N FOR Pu^{239} SPECIMENS CONTAINING SOME Pu^{240} AND OF THE EFFECTIVE RESONANCE ABSORPTION INTEGRAL FOR Pu^{240}. B. G. Erozolimsky, I. E. Kutikov, Y. P. Dobrynin, M. I. Pevzner, L. S. Danelyan, S. S. Moskalev. J. Nucl. Eng. 4, No. 1, 86-90 (1957).

Values of n (average number of neutrons emitted per neutron captured) for Pu^{239} are given for specimens containing 0-16% Pu^{240}.

321. SEPARATION OF URANIUM, NEPTUNIUM, PLUTONIUM, AND AMERICIUM BY REVERSED PHASE PARTITION CHROMATOGRAPHY. H. Eschrich. KR-11, Nov 1961.

Reversed-phase partition chromatography was applied to the separation of U, Np, Pu, and Am, using TBP as the stationary phase, and nitric acid with and without reducing agents as the mobile phase.

322. USE OF PLUTONIUM AS FUEL IN NUCLEAR REACTORS. EURAEC-130, Quarterly Rep. No. 4, April-June 1961, Societé Belge pour l'Industrie Nucleáire, Brussels, July 1961.

First results on Pu oxalate solubility show a minimum value of 21.9 mg Pu/l. Continued work is reported on research to establish the various factors affecting PuO_2 dissolution and purification of Pu salts by ion exchangers. Other work showed that Pu concentrations up to 10^{-5} g do not impede the fluorimetric determination of U.

323. THE USE OF PLUTONIUM AS FUEL IN NUCLEAR REACTORS. EURAEC-176, Quarterly Rep. No. 5, July 1-Sept. 30, 1961, Societé Belge pour l'Industrie Nucleáire, Brussels, Oct 1961.

Preparation and dissolution of PuO_2 are discussed. Also, the choice of electrodes, effects of catalysers, and reagent addition rate in the potentiometric analysis of Pu are reviewed.

324. USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS. EURAEC-670, Quarterly Rep. No. 10, Jan. 1-March 31, 1963, Societé Belge pour l'Industrie Nucleáire, Brussels, May 1963.

The development of PuO_2, UO_2, and mixed PuO_2-UO_2 fuel elements is reviewed. Analytical methods are outlined along with separation methods - principally ion-exchange.

325. ANION EXCHANGE SEPARATION AND SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF RHODIUM IN PLUTONIUM-URANIUM FISSIUM ALLOYS.
H. B. Evans, C. A. A. Bloomquist, J. P. Hughes. Anal. Chem. 34, 1692-1695 (1962).

Microgram amounts of Rh are separated from the components of an EBR-II fuel alloy using Dowex 1 x 10 anion exchange resin. The Rh is determined spectrophotometrically as the red chloro complex.

326. RECOVERY OF NEPTUNIUM-237 FROM SPECIAL HANFORD WASTES. H. B. Evans, W. B. Seefeldt, H. H. Hyman. ANL-4442, March 27, 1950.

Np^{237} is recovered with moderate success from eight batches of special Hanford Pu waste. The procedure used the behavior of Np(IV) to form highly solvent soluble nitrate complexes under conditions where Pu(III) can be stabilized. Some preliminary work on an alternate-batch solvent-extraction process utilizing the solvent inextractability of Np(V) is also reported.

327. THE PILOT PLANT DENITRATION OF PUREX WASTES WITH FORMALDEHYDE. T. F. Evans. HW-58587, Feb. 23, 1959.

Studies of the reaction between HCHO and HNO_3 indicate that a major portion of the HNO_3 can be readily removed from an acid solution containing nitrates by adding HCHO, the HNO_3 being destroyed with the production of predominantly gaseous products (NO_2, NO, CO_2). The operational behavior, HCHO utilization efficiency, and safety considerations were studied.

328. TEST GROUP 57 RADIOCHEMISTRY. R. J. Everett, R. W. Drake. SCTM-369-59(51), March 1960.

Results of Pu and U analysis of samples taken in the field from the Nevada Test Site devising Operation Plumbob are presented. The chemistry of U and Pu, procedures involved, counting statistics, etc., are discussed.

329. PROCEDURE FOR THE DETERMINATION OF PLUTONIUM IN HUMAN URINE. L. B. Farabee. MonH-218, April 11, 1947.

A direct precipitation of bismuth phosphate is made from the urine. The precipitate is dissolved and a reprecipitation made. A regular LaF_3 is then made on dissolved precipitate, followed by dissolution, then an oxidation of organic matter, and a final LaF_3. The method yields 93.4 ± 2.4% and results in excellent separation from U.

330. PRECIPITATION OF PLUTONOUS PEROXIDE. B. F. Faris. U. S. Pat. 3,033,645, 1962.

Hydrogen peroxide is added to an aqueous solution, containing Pu values, which is maintained at about 20°C. The resulting plutonous peroxide-containing solution is then cooled to 0 to 10°C, maintained within this temperature range long enough to promote settling of the precipitate, and the plutonous peroxide and supernatant liquid are then separated.

331. IMPROVEMENT IN DECONTAMINATION OF AQUEOUS ACIDIC SOLUTIONS CONTAINING PLUTONIUM AND FISSION PRODUCTS.
B. F. Faris, H. K. Strassel. U. S. Pat. 2,990,241, June 27, 1961.

In bismuth phosphate carrier precipitations process for separation of Pu and fission products, cerous ions are added to solutions containing Pu^{+4} and mercuric ions to solutions of Pu^{+6} prior to precipitation.

332. METHOD OF FORMING PLUTONIUM-BEARING CARRIER PRECIPITATES AND WASHING SAME.
B. F. Faris. U. S. Pat. 2,875,022, Feb. 24, 1959.

The lanthanum fluoride carrier precipitate is intimately washed with a 4-10% solution of sodium hydrogen sulfate at 10-95°C for 30-180 minutes. This treatment will minimize the Pu losses in the supernatant from the peroxide precipitation.

333. PILOT PLANT FOR PLUTONIUM EXTRACTION AT CHATILLON. RESULTS OF OPERATION.
P. Faugeras, P. Regnaut. Energie Nucleaire 1, No. 3, 123-137 (1957).

Main headings are as follows: Generalities, Chemical Procedure (decanning, dissolution, solvent extraction-TBP, concentration of Pu, evaporation and storage of fission product), etc.

334. PRECIPITATION OF PLUTONIUM(IV) OXALATE.
J. F. Facer, Jr., K. M. Harmon. HW-31186 (Del.) March 30, 1954.

Conditions were determined for the precipitation of Pu(IV) oxalate from nitric acid solutions. The Pu oxalate process proved adaptable to use with several process solutions. Recommended procedures are described.

335. SEPARATION OF PLUTONIUM FROM URANIUM.
H. M. Feder, R. L. Nuttal. U. S. Pat. 2,917,382, Dec. 15, 1959.

A process is described for extracting Pu from irradiated powdered U metal by contacting it with molten Mg, which takes up the Pu and separates the molten Mg from the solid U.

336. AMMONIUM BISULFATE FUSION. APPLICATION TO TRACE ANALYSIS BY SPECTROCHEMICAL AND OTHER TECHNIQUES. C. Feldman.
Anal. Chem. 32, 1727-8 (1960).

Application of the fusion technique was made to Pu, UF_4, and Nb-rare-earth alloy analysis.

337. HOMOGENEOUS REACTOR CHEMICAL PROCESSING. D. E. Ferguson. CF-52-3-215, Quarterly Report for the period ending March 31, 1952. March 25, 1952.

The development of this reactor has been based on a Pu producer using UO_2SO_4 heavy-water solutions as fuel. The general approach has been to study the application of tributyl phosphate solvent extractions to this separation problem.

338. THE DETERMINATION OF FLUORIDE IN PLUTONIUM METAL BY THORIUM TITRATION.
W. S. Ferguson, D. M. Newell. HW-27400, May 4, 1954.

Before steam distillation of the fluoride, the bulk of the Pu is separated by precipitation of the sulfate. The fluoride in the distillate is titrated at a pH 3.2 with 0.001M thorium nitrate using chrome azurol-S indicator. Applied to samples containing 1-1.5 ppm, the recovery is 87%, and precision at 95% confidence is ±0.65 ppm.

339. THE QUANTITATIVE RECOVERY OF PLUTONIUM FROM LABORATORY RESIDUES. W. S. Ferguson. HW-27401, March 18, 1953.

Method is based on precipitation of Pu(IV) hydroxide, Pu(IV) iodate, and Pu 8-hydroxy quinolate. Partial destruction of organic matters with nitric acid and metathesis of chloride solutions to nitrate solutions are used singly and in combinations for the recovery procedures.

340. A METHOD FOR DETERMINING THE DIFFUSION COEFFICIENT OF AN ALPHA EMITTER IN A SOLID. L. P. Fernandez. DP-727, May 1962.

A method for determining the rate of diffusion of alpha-emitting nuclides in ion-exchange resins was used to study the rate of diffusion of the anions of Np(IV) and Pu(IV), which were absorbed from solutions of 8M HNO_3, in Dowex 1-x4 and Permutit SK anion-exchange resins.

341. PREPARATION OF HEXAVALENT PLUTONIUM AND ITS DETERMINATION IN THE PRESENCE OF TETRAVALENT PLUTONIUM. C. Ferradini, J. Corpel. CEA-791, Feb 1958.

Two methods were used to determine Pu(IV) and (VI); one method used spectrophotometry, the other used counting, after separation of the Pu(IV) in the form of fluoride in the presence of a carrier. Conditions are given for preparing pure Pu(VI) by anodic oxidation at a Pt electrode. The eventual reductions were studied.

342. PURIFICATION OF EXTRACTION SOLVENTS CONTAINING TRIALKYL PHOSPHATES AND USED IN SEPARATION OF URANIUM, THORIUM, AND PLUTONIUM. B. O. Field, E. S. Lane. British Pat. 941,791, Nov. 13, 1963.

Purification is by contacting the solvent with liquid organic amine (alkanolamines or alkylenediamines), which does not substantially extract the trialkyl phosphate from the solvent.

343. THE POSSIBLE USE OF PAPER CHROMATOGRAPHY AND RADIOACTIVE REAGENTS IN ULTRAMICRO INORGANIC ANALYSIS WITH SPECIAL REFERENCE TO URANIUM AND PLUTONIUM. R. M. Fink, K. F. Fink. UCLA-30, June 14, 1949.

344. SEPARATION OF PLUTONIUM FROM ELEMENTS HAVING AN ATOMIC NUMBER NOT LESS THAN 92. F. T. Fitch, D. S. Russell. U. S. Pat. 2,852,338, Sept. 16, 1958.

Triglycoldichloride performs more effectively as an extractant when certain organic compounds such as benzaldehyde, saturated aliphatic aldehydes containing at least two C atoms, and certain polyhydric phenols are present.

345. THE ETHYLENEDIAMINE TITRATION: APPLICATIONS. III. H. Flaschka, A. J. Bernard, Jr., W. C. Broad. Chemistry Analyst 47, 52-6 (1958).

Eighty references are reviewed; their application to Pu(III) is discussed.

346. AN X-RAY SPECTROMETRIC METHOD FOR DETERMINATION OF PLUTONIUM IN SOLUTION. D. S. Flikkema, R. V. Schablaske. ANL-5804, Nov 1957.

X-ray emission spectrometry can be extended to the determination of Pu in solution using K and L X-ray emission. The standard deviation of a single result is less than 1% for a sample weight of between 0.4 and 0.8 mg.

347. PREPARATION AND PROPERTIES OF PLUTONIUM HEXAFLUORIDE AND IDENTIFICATION OF PLUTONIUM(VI) OXYFLUORIDE. A. E. Florin, I. R. Tannenbaum, J. F. Lemons. J. Inorg. and Nucl. Chem. 2, 368-79 (July 1955).

A study of equilibrium $PuF_4 + F_2 \rightleftarrows PuF_6$ has resulted in values of 11.5 kcal/mol and 7.8 e.u. for ΔH and ΔS in the temperature range 167-308°C. The solid compound produced when PuF_6 is exposed to moist air was identified as PuO_2F_2. The vapor pressure, which corresponds closely to that of UF_6, has been measured from 0 to 63°C. The heat of sublimation was calculated to be 12.1 kcal/mol, and the melting point was 50.7°C.

348. FACTORS ESTABLISHING LIMITS FOR RELEASE OF EFFLUENTS FROM THE PLUTONIUM RECYCLE TEST REACTOR. R. F. Foster, G. E. Backman, N. G. Wittenbrock, J. M. Skarpelos. HW-SA-2475.

The principal factors that must be considered in establishing permissible release rates and how these factors influenced the selection of operational guides for the aqueous and gaseous effluents from the Plutonium Recycle Test Reactor are discussed.

349. THE CHEMICAL ANALYSIS OF TERNARY ALLOYS OF PLUTONIUM WITH URANIUM AND MOLYBDENUM. E. Foster, G. Phillips. AERE-R-3147, Feb 1960.

The Pu is separated from an acid solution of the alloy by absorption as the nitrate-complex on an anion exchange resin. The Mo and U are determined in the column effluent without further separation-U as the sulfate complex, and Mo as the thiocyanate complex using absorptiometric methods.

350. POLAROGRAPHIC METHOD OF STUDIES OF COMPLEX PLUTONIUM OXALATES. V. V. Fomin, S. P. Vorol'ev, M. A. Andreeva. Atomnaya Energiya 4, 57-62 (1958).

Polarographic studies were made of the composition and stability of tri- and tetra-valent Pu in oxalate solutions.

351. EXTRACTION OF PLUTONIUM(IV) WITH TRIBUTYL PHOSPHATE. V. V. Fomin, E. P. Maiorova, M. I. Krapivin, V. G. Yudina. In AEC-tr-4457, pp. 161-166. Translation of Zhur. Neorg. Khim. 3, No. 9, 2113-16 (1958).

Data are presented to show that the deviation of the distribution-coefficient logarithm of tetravalent Pu from linear variations with the logarithm of TBP, when all conditions are constant, is caused by the presence of inextractable Am.

352. DECOMPOSITION PLUTONIUM OXALATES BY INTRINSIC ACTION OF ITS OWN ALPHA RADIATION. V. V. Fomin, R. E. Kartushova, T. I. Rudenko. J. Nucl. Eng. 4, No. 2, 247-52 (1957).

The autodecomposition rates of Pu(III), (IV), and (VI) oxalates were studied in air and vacuum, light and dark, and varying temperatures. In the case of Pu(IV) and (VI) oxalates, the carbon monoxide formed promotes conversion to Pu(III) and (IV) carbonates and oxides, or oxyoxalate-carbonate mixtures.

353. THE TESTING OF A METHOD FOR DETERMINING PLUTONIUM BY α-COUNTING IN THE PRESENCE OF STRONG CONCENTRATIONS OF SALTS OR OF URANIUM. A. M. Fontaine, L. M. Baude-Melafosse, M. J. Cunq. CEA-1977, 1961.

It is possible to determine 10^{-3} μg of Pu in the presence of 1.7 mg of uranyl nitrate.

354. THE DISTRIBUTION OF PLUTONIUM TRACER BETWEEN METALS AND THEIR MOLTEN HALIDES. VI. DISTRIBUTION OF PLUTONIUM AND URANIUM TRACERS IN THE MAGNESIUM METAL-HALIDE SYSTEM. B. J. Fontana. CK-1529, Feb. 21, 1944.

Previous experiments in this series are described in CK-942 and CK-1359. The equilibrium constant, when equal to unity, indicates equal reducing power of the tracer element and metal couple, while values greater than one indicate the tracer element is more electropositive than the metal couple.

355. ACTIVATION ANALYSIS OF TRACE METALS IN SODIUM TRIPHOSPHATE - USE OF DOWEX A-1 FOR CHEMICAL SEPARATIONS. S. Forberg, S. Lundgren. Anal. Chem. 32, 1202-3 (1960).

The excellent selectivity of Dowex A-1 for cations was found useful in the activation detection of trace amounts of Cu and Ni in Na triphosphate. Samples of 0.5 g were irradiated to about 20 mc Na^{24} activity and then dissolved in 100 ml of H_2O, pH 5, to which had been added 5 mg each of the carriers, Mn^{2+}, Cu^{2+}, and Ni^{2+}. The solution was percolated through approximately 10 cm of Dowex A-1 in a small ion-exchange column. The induced Na^{24} and P^{32} activities, which cause interference with the weaker activities, were eluted first. Mn^{56} was displaced by a phthalate-buffered inactive Mn^{2+} solution to avoid interference with the Ni^{65} activity. No parameters seemed to be critical, and only moderate radiation precautions were necessary.

356. Ca EDTA AND THE EXCRETION OF PLUTONIUM. H. Foreman, T. T. Trujillo, O. Johnson, C. Finnegan. Proc. Soc. Exptl. Biol. Med. 89, 339-42 (1955).

In experiments with rats injected intravenously with quadrivalent Pu^{239} in sodium citrate solution, it was found Ca EDTA induced greater Pu excretion than did similarly administered Zr citrate.

357. PLUTONIUM ACCUMULATION FROM LONG-TERM OCCUPATIONAL EXPOSURE. H. Foreman, W. Moss, W. Langham. Health Phys. 2, 326-33 (May 1960).

Analysis of tissue aliquots of a Pu process operator who was exposed to Pu^{239}, largely via chromic low-level inhalation for approximately 6 out of 11.5 years, showed that he had accumulated a body burden of approximately 0.018 μc. Estimations from urine assay ranged from 0.019 to 0.034 μc. The highest Pu concentration was found in pulmonary lymph nodes, followed by liver, lungs, and bones.

358. THE EFFECT OF X-IRRADIATION ON THE ABSORPTION OF PLUTONIUM IN THE GASTROINTESTINAL TRACT. H. Foreman, J. Post, C. Finnegan. Radiation Research 7, 267-9 (Sept 1957).

It is stated that transuranics are poorly absorbed from the G. I. tract; this study concerns the physiological effects of transuranics in the G. I. tract when exposed to large external irradiation doses, for example under fall-out conditions.

359. CLINICAL EXPERIENCES WITH RADIOACTIVE MATERIALS. H. Foreman, W. Moss, B. C. Eustler. Am. J. Roentgenol. Radium Therapy Nuclear Med. 79, 1071-9 (1958).

Case reports are presented on one individual who received an internal dose of Am^{241}, on two individuals who accumulated Pu^{239} internally, and on two individuals who received a body burden of Po^{210}.

360. APPLICATIONS OF CONWAY DIFFUSION TECHNIQUE TO ANALYSIS OF RADIOACTIVE MATERIALS FOR IMPURITIES. J. K. Foreman. The Analyst 83, 251-252 (1958).

This technique, in which the trace element is liberated as a volatile compound, had several features that favor its use for the analysis of radioactive materials. Specific applications described were the determination of chemically combined N, Cl, and S in Pu.

361. THE DETERMINATION OF NICKEL IN PLUTONIUM METAL. J. K. Foreman, W. T. Appleton. WSL-R-44, Oct. 2, 1952.

The marked difference in ion-exchange potential between Pu^{+3} and divalent Ni in dilute hydrochloric acid was utilized to secure a complete separating of microgram quantities using cation resins. Selective elution of Ni was achieved using potassium cyanide.

362. THE NATURE AND STABILITY OF THE COMPLEX IONS FORMED BY TER-, QUADRI-, AND SEXA-VALENT PLUTONIUM IONS WITH ETHYLENEDIAMINETETRA-ACETIC ACID. PART I. pH TITRATIONS AND ION-EXCHANGE STUDIES. PART II. SPECTROPHOTOMETRIC STUDIES. J. K. Foreman, T. D. Smith. J. Chem. Soc. 1752-62 (April 1957).

Potentiometric pH titration and cation-exchange studies have shown 1:1 chelates with EDTA and Pu^{+3}, Pu^{+4}, and plutonyl ions. In the first two cases, complexes with ratio of 2:1 are also formed. The stability constants for the 1:1 complexes of the three ions have been determined by a cation-exchange technique; the values of log K are Pu^{+3} 18.12; Pu^{+4} 17.66; plutonyl 16.39.

363. DETERMINATION OF PLUTONIUM AND URANIUM IN SCRUP DISSOLVER SOLUTIONS.
R. W. Foster, J. H. Cooper. ORNL-1854,
July 14, 1955.

Methods for determining Pu and U in highly radioactive SCRUP dissolver solutions is presented. A combination of extraction and anion-exchange techniques were used for the separation of Pu and U. The final determination was made by potentiometric titration methods.

364. THE DETERMINATION OF THE OXIDATION STATES OF URANIUM, NEPTUNIUM AND PLUTONIUM IN AQUEOUS MEDIA. S. C. Foti, E. C. Freiling. USNRDL-TR-444, July 8, 1960.

The development, testing, and application of a chemical procedure for determining the distribution of U, Np, and Pu among their respective oxidation states at tracer concentrations are described. The separations are about 95% clean. Recommendations for future investigations are given.

365. PLUTONIUM DATA MANUAL. E. L. Francis.
IGR-161(RD/R), June 1, 1959.

The best available unclassified data on the physical, mechanical, and chemical properties of Pu and some of its alloys is presented. A list of references (37) cited is appended.

366. THE ELECTROMAGNETIC SEPARATION OF PLUTONIUM ISOTOPES: OPERATIONAL EXPERIENCE IN 1957. J. H. Freeman, K. J. Hill, M. L. Smith. AERE-R-3043, Aug 1959.

A brief description of the 90° sector electromagnetic separator includes the actual machine, source unit, collectors, and the associated electrical and other services. Separation experience and an analysis of machine and service failures and operator training problems are given.

367. METHOD FOR THE REDUCTION OF PLUTONIUM AND ITS APPLICATION IN SEPARATING PLUTONIUM FROM URANIUM. French Pat. 1,220,061, Jan 1960.

For separating Pu and U, a nitric acid solution of Pu(IV) and U(IV) ions in tributyl phosphate is extracted with an aqueous ascorbic acid solution; Pu(III) ions are transferred to the aqueous phase.

368. PROCESS FOR SEPARATING PLUTONIUM FROM URANIUM. French Pat. 1,200,807, July 6, 1959.

A partition-separation method is described in which a solution of U and Pu nitrate in an organic solvent is sent through a column containing a finely divided carrier which has adsorbed a second solvent that is substantially immiscible with the first one and preferentially dissolves the Pu compound. The U is washed out with the organic solvent containing 0.34M HNO_3, and the Pu is eluted with 1.15M HNO_3.

369. THE CHEMISTRY AND CRYSTAL CHEMISTRY OF HEAVY-ELEMENT COMPOUNDS. S. Fried, W. H. Zachariesen. Proc. Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1955, 7, 235-44, United Nations, New York, 1956.

The Ac(III), Th(IV), Pa(IV-V), U(IV,V,VI), Np(IV,V,VI), Pu(III,IV,V,VI), Am(III,V,VI), and Cm(III) oxidation states are stable in aqueous solutions, whereas the Th(II,III), Pa(II), U(III), Np(II), Pu(II), Am(II,IV), and Cm(IV) oxidation states exist only in solids. The U(III) and Np(III) states are hydrolytically stable in halide but not in chalcogenide compounds. The 5f states are stable in aqueous solution and in crystals, while the states possessing 6d nonbonding electrons dismulate in solution. The III, IV, V, VI, states form, respectively, actinide, thoride, protactinide, and uranide series. Oxides, fluorides, chlorides, bromides, iodides, oxyhalides, metals, sulfides, oxysulfides, and some hydrides, carbides, and nitrides of these elements are reviewed. The chemical similarities, valence, and ionic radii of the 4f and 5f elements are compared. The crystal chemistry of the VI, V, and II states is discussed, including bond lengths and bond strengths in $PbUO_2(NO_3)_3$, $K_3UO_2F_5$, $CaUO_2O_2$, $MgUO_2O_2$, UOO_2, $BaUO_2O_2$, $KPuO_2CO_3$, UO_2F_2, and KmO_2F_2, predicted radical radii, and predicted and observed interatomic distances for ThO, ThS, PaO, UO, US, NpO, PuO, PuS, and AmO, and predicted values for RaO, RaS, PaS, NpS, AmS, AcO, and AcS. The predicted and observed interatomic distances in Ac_2S_3, Pu_2S_3, Th_2S_3, U_2S_3, and Np_2S_3 and the actinide effect are discussed.

370. THE SEPARATION OF NEPTUNIUM FROM PLUTONIUM BY A VOLATILIZATION METHOD.
S. Fried. ANL-4224, Nov. 23, 1948.

The large difference in vapor pressures of Np and Pu at 450°C permits their separation (less than 10^{-6} mm for $PuCl_3$ and about 10^{-1} mm for $NpCl_4$) by fractional sublimation. Separations of the order of 3×10^3 have been obtained.

371. THE HIGH ALTITUDE SAMPLING PROGRAM. VOLUME I. HASP PURPOSE AND METHODS. J. P. Friend, H. W. Feely, P. W. Krey, J. Spar, A. Walton. DASA-1300 (Vol. 1), Aug. 31, 1961.

High-flying long-range aircraft were used to collect filter samples of stratospheric air, to altitudes of 70,000 ft, in a meridional sampling corridor. More than 300 analyses were made of each of the hazardous nuclides Cs^{137} and Pu.

372. CONCENTRATION OF PLUTONIUM BY PRECIPITATION OF THE IODATE FROM $La(NO_3)_3$ SOLUTIONS. B. A. Fries. CN-1881,
Aug. 11, 1944.

The La nitrates obtained from metathesis of LaF_3 are treated with SO_2, and the hydroxides of La and Pu are precipitated. $Pu(IO_3)_4$ is precipitated from a nitrate solution of the hydroxides with a solubility of less than 5 mg Pu per liter. The La is separated from the Pu(VI) as LaF_3. The Pu is then precipitated as K_2PuF_6.

373. THE POTENTIOMETRIC DETERMINATION OF PLUTONIUM. A. J. Fudge, A. J. Wood, M. F. Banham. AERE-R-3264, April 1960.

The method used, in the range of 1-10 mg, Pu with a precision of ±0.2%. The Pu in sulfate solution is reduced to the (III) state by adding chromous sulfate in 1M sulfuric acid. The excess chromous is air oxidized until a steady potential is observed from the Pu calomel electrodes. The Pu(III) is then oxidized with ceric sulfate delivered from an agla micrometer syringe burette. A procedure is described for separating Pu from interfering elements.

374. NONDESTRUCTIVE DETERMINATION OF PLUTONIUM-239 IN CERAMIC FUEL ELEMENT PELLETS BY GAMMA SPECTROMETRY. A. J. Fudge, G. Phillips, E. Foster. AERE-R-3838, Jan 1962.

An investigation of the gamma spectrum of pure Pu^{239} showed that the most energetic gamma ray at 384 keV enabled a technique to be established for its nondestructive analysis. The best precision obtained with this equipment indicated that a batch of seven 10% PuO_2 in UO_2 pellets were identical in composition within a variation of 0.3%.

375. PREPARATION OF THIN ELECTRODEPOSITS OF ACTINIDES FROM AQUEOUS SOLUTIONS OF (ETHYLENEDIAMINE) TETRAACETIC ACID. J. Fuger. Bull. Soc. Chim. Belges 71, 134-41 (1962).

For Pu deposits up to 300 $\mu g/cm^2$ were obtained, but with a limiting yield of 70%.

376. RELATIVE MEASUREMENT OF THE FISSION CROSS SECTION OF PLUTONIUM FOR SLOW NEUTRONS. M. Galula, B. Jacrot, F. Netter. Compt. rend. 239, 1128-30 (Nov. 3, 1954).

The variation in fission cross section of Pu with energy is determined for slow neutrons, giving a resonance near 0.3 eV, the half-width of resonance peaks being 0.04 eV.

377. SEPARATION OF URANIUM, PLUTONIUM AND FISSION PRODUCTS ON ZIRCONIUM PHOSPHATE. PART I. ADSORPTION EQUILIBRIA AND KINETICS. I. Gal, A. Ruvarac. Bull. Inst. Nuclear Sci. "Boris Kidrich" (Belgrade), 13, No. 1, 1-17 (April 1962).

The distribution coefficients of UO_2^{+2}, PuO_2^{+2}, Pu^{+3}, Pu^{+4}, Fe^{+3}, $Cs^{137\,+}$, $Sr^{90\,+2}$, $Zr^{95\,+4}$, $Nb^{95\,+5}$, Ru^{106}, and $Ce^{144\,+3}$ were determined in the system $Zr(PO_4)_2HNO_3$.

378. EXTRACTION OF PLUTONIUM BY FORMATION OF INSOLUBLE SALTS. M. Ganivet. HW-tr-53, June 29, 1960, a translation of CEA-1592.

Three methods were studied for converting Pu(IV) into insoluble salts, namely, the oxalic acid method, the 8-hydroxy quinoline method, and hydrogen peroxide. The yield from 8-hydroxy quinoline was best, and < 5 mg/liter remained in mother liquor.

379. METHOD OF OXIDIZING PLUTONIUM ION WITH BISMUTH ION. C. S. Garner. U.S. Pat. 2,917,362, Dec. 15, 1959.

A method is presented for oxidizing Pu from the tetravalent to the hexavalent state with bismuthate oxidizing agents.

380. RADIOASSAY OF URANIUM AND PLUTONIUM IN VEGETATION, SOIL AND WATER. E. L. Geiger. Health Phys. 1, 405-8 (1959).

The method is based on the extraction of U and Pu from 4-6N nitric acid in 50% n-tributyl phosphate in n-tetradecane diluent. Recovery is good enough to permit direct monitoring of the organic for alpha counting and pulse-height analysis.

381. ACUTE UPTAKE OF PLUTONIUM AND URANIUM FOLLOWING WOUND CONTAMINATION. E. L. Geiger, S. M. Sanders. Proc. Health Phys. Soc. 61-6 (1957).

Urinary excretion of Pu during a 487-day period after an acute uptake by wound contamination was followed by the analysis of 99 urine samples.

382. DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANT FOR OXALATE COMPLEXES OF Pu^{3+} COMPOUNDS BY ION EXCHANGE. A. D. Gelman, N. N. Matorina, A. I. Moskvin. AEC-tr-3306, a translation of Atomnaya Energ. 4, 52-6 (1958).

The complex formation of Pu^{+3} was investigated in oxalate solutions in the pH interval of 1.4-3.0. In the given pH range, the complex ions $[Pu(C_2O_4)_2]^-$ and $[Pu(HC_2O_4)_4]^-$ are formed. The instability constants are in satisfactory agreement with those of the corresponding complex ion obtained by the solubility method.

383. THE COMPOSITIONS AND DISSOCIATION CONSTANTS OF THE EDTA COMPLEXES OF Pu(III) AND Pu(V). A. D. Gelman, A. I. Moskvin. Atomnaya Energ. 7, 162 (1959).

The ion-exchange method was used in complexing Pu(V) with EDTA. The same method was also used in complexing Pu(III) with ethylenediamine tetraacetic acid in a solution of pH 1.2-3.4. The order of complexing may be expressed by the sequence Pu(IV) > Pu(III) > PuO_2^{+2} > PuO_2^{+}.

384. CONDITIONS FOR THE FORMATION AND STABILITY OF OXALATE COMPLEX COMPOUNDS OF Pu(III) IN AQUEOUS SOLUTIONS. A. D. Gelman, N. N. Matorina, A. J. Moskvin. Doklady Akad. Nauk SSSR 117, No. 1, 88-91 (1957).

385. COMPLEX COMPOUNDS OF TRANSURANIUM ELEMENTS. A. D. Gelman, A. I. Moskvin, L. M. Zaitsev, M. P. Mefodeva. Moscow, Publishing House of the Academy of Sciences, 224 pages, 1961.

The chemistry of Np and Pu complex formation in aqueous solutions, the synthesis and properties of complex compounds of tri-, tetra-, and hexavalent Pu, and the formation of transplutonium element complexes in solutions are discussed, as well as various methods of extracting and separating transuranium elements.

386. SPECTROSCOPIC STUDIES OF Pu^{+3} COMPLEX FORMATION AND STABILITY. A. D. Gelman, A. I. Moskvin. Atomnaya Energ. 3, No. 10, 314-16 (1957).

The complex formation of Pu^{+3} with $C_2O_4^{-2}$, $C_2O_3^{-2}$, and $C_6H_5O_7^{-3}$ ions as well as with Trylon B is proved by means of the spectrograph.

387. ISOTOPIC ANALYSIS OF PLUTONIUM BY OPTICAL SPECTROSCOPY UTILIZATION OF THE LINE λ = 6887.8 Å. S. Gerstenkorn. Spectrochim. Acta 18, 353-62 (1962).

The line λ = 6887.8 Å is favorable for isotopic analysis of samples formed with Pu^{239} and Pu^{240}.

388. ACTION OF HYDROGEN PEROXIDE ON TRIVALENT AND TETRAVALENT PLUTONIUM IN HYDROCHLORIC ACID SOLUTION. A. S. Ghosh Mazumder, P. V. Balakrishnan, R. N. Singh. UCRL-trans-938(L), a translation of Vijnana Parishad Anusandhan Patrika 4, 149-60 (1961).

The ratio of Pu(IV) to Pu(III) in this system depends on H and Cl ion concentrations and on the Pu concentrations. Studies are made using a microtitrimetric method for estimating Pu(III) and H_2O_2 in the presence of each other in HCl.

389. THE LANTHANUM FLUORIDE-POTASSIUM BROMATE METHOD OF ANALYSIS FOR PLUTONIUM(III,IV). J. R. Gilbreath. CN-3678, Nov. 6, 1946.

It is possible to obtain reliable values for Pu(III), (IV), and (VI) by using either potassium bromate or potassium dichromate as a holding oxidant.

390. THE APPLICATION OF SOME ION EXCHANGE THEORIES TO THE ADSORPTION OF TRACE ELEMENTS. H. S. Gile. HW-32461-TH, June 1955.

Breakthrough curves and distribution ratios were obtained for Pu^{+4}, Cs, Sr, and Ce as trace elements from a $UO_2(NO_3)_2$-HNO_3 matrix system onto Dowex-50 resin at several column lengths and flow rates.

391. APPARATUS FOR THE PREPARATION, ANALYSIS AND INVESTIGATION OF PLUTONIUM SOLUTIONS. D. E. Glanvik, D. W. Grant, G. L. Strachan. AERE-C/R-2188, Feb. 28, 1957.

The apparatus and glovebox employed in studies of thermal stability of Pu solutions are described. Some new techniques are also described for evaporation, an arrangement for use of burette in such a box, and method for spectrophotometric measurements at elevated temperatures.

392. A METHOD FOR THE PREPARATION OF THIN FILMS OF PLUTONIUM AND URANIUM. K. M. Glover, P. Borrell. J. Nuclear Eng. 1, 214-17 (Feb 1955).

In this technique, the Pu or U is dissolved in a cellulose lacquer. This lacquer is painted on the foils, or for fission counters, the foils are dipped into this solution.

393. THE IMPORTANCE OF SOLVENT EXTRACTION IN ATOMIC ENERGY. E. Glueckauf. Ind. Chim. Belge 23, 227-32 (1958).

The separation of U and Pu and their fission products, of Th and U and their fission products, of Hf and Zr, of Nb and Ta, and of the rare earths and Pa are discussed.

394. PROCESS FOR THE SEPARATION OF HEAVY METALS. J. W. Gofman, R. E. Connick, A. C. Wohl. U. S. Pat. 2,871,251, Jan. 27, 1959.

A method is presented for separating U and Pu from each other or together. The method is based on the fact that hexavalent Pu forms an insoluble complex precipitate with sodium acetate as does uranyl ion, while reduced Pu is not precipitated by sodium acetate.

395. OXALATE PROCESS FOR SEPARATING ELEMENT 94. J. D. Gofman. U.S. Pat. 2,867,640.

A process is presented for separating Pu from U by precipitating thorium oxalate under carefully controlled conditions of acidity and oxalate concentrations.

396. RESEARCH AND DEVELOPMENT PROGRAMS EXECUTED FOR THE DIVISION OF REACTOR DEVELOPMENT. QUARTERLY PROGRESS REPORT OCTOBER, NOVEMBER, DECEMBER 1961. S. Goldsmith, Ed. HW-73100, May 1, 1962.

Research and development on 17 programs are reported. These programs include studies on basic properties of Pu and U ceramic materials, Pu and U fuel-fabrication methods, physics, chemical processing of reactor fuels and radioactive waste materials development, radiation effects on materials, fuel-cycle analysis and advanced concepts, instrumentation, and nondestructive testing techniques.

397. REDUCTION OF SOME ELEMENTS BY AN OXIDATION POLYMER. A. V. Gordievskii, E. V. Renard. Zh. Prikl. Khim. 36, 264-72 (1963).

Fe^{3+}, U^{5+}, Cr^{6+}, Ag^{+}, and Pu^{4+} were reduced by means of a resorcinol-hydroquinone-HCHO (1:1:2) resin. The influence of acidity, concentration, and flow rate of the solution of the reducing ability of the resin was studied under dynamic conditions. The dynamic capacity of the resin decreases with increasing concentration of the reduced ions and with increasing flow rate. Other flow rates, concentrations, and the effects of each were given.

398. THE CRYSTAL STRUCTURES OF PuAs, PuTe, PuP AND PuOSe. A. E. Gorum. Acta Cryst. 10, 144 (1957).

PuAs, PuTe, and PuP are of the NaCl type, isostructural with the analogous U compounds. Some methods of preparation and the stabilities and calculated densities of these compounds are given.

399. TRIBUTYL PHOSPHATE PROCESSING OF Pu-Al ALLOY FUELS: PRELIMINARY INVESTIGATION. P. D. Goulden, R. W. Durham, V. Corriveau. CRDC-640(AECL-348), March 23, 1955.

The partition coefficients for $Pu(NO_3)_4$ between TBP and HNO_3 solutions of $Al(NO_3)_3$ were measured. The maximum coefficient for Pu was found in a system 0.45M $Al(NO_3)_3$ and 5M nitric acid. Better decontamination was obtained with 5% TBP if the organic phase was saturated with Pu.

400. A SIMPLE PREPARATION OF Pu(VI) SULFATE SOLUTIONS. D. W. Grant. J. Inorg. Nucl. Chem. 6, 69-71 (1958).

This paper investigated the possibility of complete oxidation of macro-concentrations of Pu(IV) by ozonization in the absence of catalysts. The quantitative oxidation by ozone may be limited to fairly dilute sulfuric acid solutions, owing to the reduction of Pu(VI) by water at high sulfuric acid concentrations.

401. THE HYDROLYTIC BEHAVIOR OF PLUTONIUM IONS IN SULFURIC ACID. D. W. Grant, D. E. Glanville. AERE-C/R-2155, May 1957.

A thermal reduction of Pu(VI) sulfate by water at elevated temperatures is reported. The solubility of Pu(III) sulfate and the hydrolysis of Pu(IV) sulfate at elevated temperatures are investigated with particular reference to possible use in a homogenous reactor.

402. STATE OF Pu^4 IN DILUTE NITRIC ACID SOLUTIONS. V. I. Grebenshchikova, Y. P. Davydov. AEC-tr-4830, a translation of Radiokhimiya 3, 155-64 (1961).

By several techniques (e.g., adsorption on glass surfaces, ultrafiltration, centrifugation, migration in an electric field), the following points were established: at 6.8×10^{-8} M, Pu^{4+} and pH 0-2.8, Pu^{4+} was present in solution as a true ion; at pH 2.8-7.5, as a pseudocolloid; at pH 7.5-12.0, as a true colloid.

403. ON THE STABILITY OF NITRATE AND CHLORIDE COMPLEXES OF PLUTONIUM(IV). I. Grenthe, B. Noren. Acta Chem. Scand. 14, 2216-29 (1960).

The complexes were studied using the cation-exchanger method of Fronaeus. The calculation method was extended to systems of the type M^{+4}-A^{-}, where the central ion, the first, second, and third complexes can be absorbed on the ion exchanger.

404. PLUTONIUM MONITOR FOR PUNCTURE WOUNDS. G. H. Gruber. DP-508, Dec 1960.

A scintillation counter with a noise level low enough to permit counting of X-rays emitted from Pu isotopes was developed for checking puncture wounds for Pu contamination. With this assembly, it is no longer necessary to cut out flesh samples.

405. MANUAL OF LOW-ACTIVITY ENVIRONMENTAL ANALYSIS. J. E. Guthrie, W. E. Grummitt. AECL-1745, May 1963.

A series of analytical schemes for the measurement of Ba^{140}, Sr^{89}, Sr^{90}, Cs^{137}, I^{131}, and Pu^{238} in various environmental materials is described.

406. SEPARATION OF THE VARIOUS OXIDATION STATES OF PLUTONIUM BY REVERSED-PHASE PARTITION CHROMATOGRAPHY. R. Gwozdz, S. Siekierski. Nukleonika 5, 671-6 (1960). See also NP-9695.

TBP was used as the stationary phase for the separation and determination of Pu^{+3}, Pu^{+4}, Pu^{+6}, and colloidal Pu. Elution was carried out with 0.3 to 1.0M HNO_3.

407. MEASUREMENT OF PLUTONIUM DECONTAMINATION. W. O. Haas. KAPL-M-WOH-2, Nov. 17, 1950.

The use of low-energy β^-, γ activity of Pu^{239} is suggested in the defining decontamination and in setting specifications. The Pu^{241} soft betas and the Pu^{239} soft electrons are absorbed by minimum amount of absorber used to prevent alpha counting. The Al absorption carrier corresponds to that of 1.5 MeV, β's but weak X-rays are absorbed by heavier metals.

408. A METHOD FOR THE SEPARATION OF PLUTONIUM FROM URANIUM. E. Haeffner, A. Hultgren. Nucl. Sci. Eng. 3, 471-81 (1958).

A chromatographic method with possibilities for use on a larger scale has been developed for the separation of Pu from U.

409. THE SEPARATION OF URANIUM AND PLUTONIUM ISOTOPES IN CHEMICAL EXCHANGE SYSTEMS. H. T. Hahn. HW-40810, May 16, 1955.

The theory and results of chemical exchange experiments for separation of Pu and U isotopes are presented. Solvent extraction systems were studied in both aqueous and organic media. Chemical exchange systems are proposed which could yield high separation factors.

410. INVESTIGATIONS ON THE ADSORPTION OF THE RADIOELEMENTS IN SOLUTION. I. ADSORPTION OF PLUTONIUM(IV) FROM A SULFURIC ACID MEDIUM. M. Haissinsky, Y. Laflamme. J. Chim. Phys. 55, 510-12 (1958).

The adsorption of quadrivalent Pu on glass and Pt from a H_2SO_4 solution is studied. With concentrations of the order of 10^{-5}M, the adsorption is reversible and decreases with increasing acidity of the solvent.

411. THE SPECTROPHOTOMETRIC ASSAY OF PLUTONIUM IN AQUEOUS SOLUTION. G. R. Hall, P. D. Herniman. AERE-C/R-975, April 1952.

A method is presented for the rapid assay of Pu by measuring the absorption due to the trivalent state at 603 mu. Pu concentrations can be obtained to ±1% in the presence of U, Fe, or other colorless impurities.

412. THE EFFECT OF OXYGEN ISOTOPES IN THE ANALYSIS OF PLUTONIUM ISOTOPES USING PLUTONIUM OXIDE ION BEAMS IN THE SOLID SOURCE MASS SPECTROMETER. G. R. Hall, G. H. Palmer. AERE-C/R-1150, March 11, 1953.

The effect of O_2 isotopes in the analyses of Pu isotopes using PuO_2^+ PuO^+ beams is discussed. Equations are given to permit correction of observed peak heights and calculation of isotopic abundances. For a sample containing 0.1% Pu^{241} and for peaks of mass 273, about 75% of the observed peak height is due to ions (Pu^{239} O^{16} O^{18}), (Pu^{239} O^{17} O^{17}), and (Pu^{240} O^{16} O^{17}).

413. SPECTROPHOTOMETRIC STUDIES OF PLUTONIUM IN NITRIC ACID SOLUTION. PART I. G. R. Hall, P. D. Herniman, A. J. Walter. AERE-C/R-712, May 1, 1951.

The preparation, stability, and adsorption spectra of Pu(III), Pu(IV), and Pu(VI) in nitric acid are discussed.

414. THE FLUORIDE-HYDROXIDE, PEROXIDE, AND IODATE CYCLES IN THE PURIFICATION OF PLUTONIUM. G. R. Hall, R. Hurst. AERE-C/M-88 (Rev.), 1957.

From a solution containing U and Fe in amount equal to Pu, and with some Cr in addition, 93% Pu was recovered in 98% yield by two successive $KPuF_5$ precipitations, and conversion to the hydroxide was thoroughly washed. The final purification (101± 3%) was made by the peroxide precipitation and then $Pu(IO_3)_4$ precipitation from 2N HNO_3.

415. THE ABSORPTION SPECTRA OF THE ACTINIDE ELEMENTS. G. R. Hall. Photoelec. Spectrometry Group Bull. No. 8, 180-7 (1955).

This paper describes the absorption spectra of U, Np, Pu, Am, and Cm, in solutions and in solids, and the application of these data in the study of solution kinetics and complex formation.

416. A CEMENT BASE FOR THE HOT FILAMENT MASS SPECTROMETER SOURCE. J. E. Hand. AECD-3419 (LADC-1210).

Sauereisen cement No. 1 paste was found to be satisfactory as a porous unglazed porcelain-like base upon which to deposit U and Pu sample material for satisfactory adherence to Ta ribbon filaments.

417. ION EXCHANGE SEPARATION AND COULOMETRIC TITRATION OF PLUTONIUM IN IRRADIATED FUEL ELEMENT SOLUTIONS. J. W. Handshuh. HW-66441.

Micro quantities of Pu were accurately titrated after anion-exchange separation from irradiated fuel element solutions.

418. DETERMINATION OF SULFIDE IN PLUTONIUM. Analytical Procedure for the Plutonium Metal Fabrication Process. XII. M. B. Lebveuf. HW-25005, July 25, 1952.

The sample is dissolved in hot hydrochloric acid to evolve hydrogen sulfide. The evolved gas is absorbed in dilute zinc acetate. The sulfide is then treated with a reagent composed of ferric chloride and p-aminodimethyl aniline in dilute hydrochloric acid to form methylene blue. The method has a sensivity of 25 ppm. Several factors affecting the reliability and precision of the method were studied.

419. PROCEEDINGS OF THE SYMPOSIUM ON THE PHYSICS OF FISSION, HELD AT CHALK RIVER, ONTARIO, MAY 14-18, 1956. G. C. Hanna, J. C. D. Milton, W. T. Sharp, N. M. Stevens, E. A. Taylor, Eds. CRP-642-A, July 1956.

Eighteen papers are included. Some background fission physics, fission probability and results, and theoretical viewpoints are presented.

420. HEALTH AND SAFETY IN HANDLING THE NEWER METALS. W. B. Harris. Am. J. Public Health 49, 1138 (Oct 1959).

Some hazards involved in handling Th, U, Zr, Ti, Be, and Pu are discussed.

421. TRIBUTYL PHOSPHATE PROCESSING OF PLUTONIUM-ALUMINUM ALLOY FUELS. R. G. Hart. CRDC-630, March 1957.

Partition coefficients pertaining to the processing of Pu/Al alloy fuels by TBP extraction were obtained, and McCabe-Thiele calculations were made to predict behavior under various conditions in a continuous system.

422. THE CHEMISTRY OF THE ANION EXCHANGE PROCESS FOR THE RECOVERY OF PLUTONIUM. R. G. Hart, J. A. Brothers, I. W. Allam. CRDC-818, Dec 1958.

This is a semitheoretical study of the chemistry of the anion-exchange process for the recovery of Pu. Equilibrium constants, exchange-height equations, and elution equations are given for several ion-exchange systems.

423. CHEMICAL AND ISOTOPIC ANALYSIS OF IRRADIATED URANIUM SLUGS FROM DEMOUNTABLE SLUG ROD. R. G. Hart, M. Lounsbury, C. B. Bigham, L. P. V. Corriveau, F. Girardi. CRRP-761 (Pt. B), Sept 1959.

U samples were irradiated to various levels in the NRX Reactor for studies of the variation of activity with neutron irradiation. Samples were analyzed for U, Pu, U isotopic, and Pu isotopic.

424. ANALYTICAL METHODS USED IN A STUDY OF REACTIVITY CHANGES WITH LONG IRRADIATIONS. R. G. Hart, C. B. Bigham, M. Lounsbury. Talanta 6, 94-9 (1960).

Pu was determined by four different methods: spectrophotometric, direct low-geometric alpha counting, isotopic dilution with highly irradiated Pu, and isotopic dilution with Pu^{238}.

425. THE SPECTROGRAPHIC ANALYSIS OF PLUTONIUM USING THE CARRIER DISTILLATION PRINCIPLE WITH SPECIAL REFERENCE TO THE ESTIMATION OF BORON. H. E. R. Hartley, R. Orrell. WSL-R-35, June 19, 1952.

The Pu charger contained three times its weight of U as a buffer. Gallium oxide was found to be superior to silver chloride as a carrier. Arc-excitation conditions with a 20-cm, source-slit distance were employed. B and other elements can be determined in Pu nitrate and chloride solutions by above method.

426. THE CHEMISTRY OF PLUTONIUM. B. G. Harvey, H. G. Heal, A. G. Maddock, E. L. Rowley. J. Chem. Soc. Part 2, 1010-1021 (1947).

Some chemical and electrochemical properties of Pu are surveyed. Oxidation and reduction reactions between different valence states have been investigated. The reactions of Pu ions with some common organic reagents are described.

427. RADIOMETRIC PLUTONIUM DETERMINATION IN THE PRESENCE OF LARGE URANIUM EXCESS IN THE ORGANIC PHASE OF THE PUREX PROCESS. S. Havelka, M. Beran. Collection Czech. Chem. Comm. 28, 1603-6 (1963).

The U/Pu is about 1:10^6. The Pu is re-extracted by means of Fe(II) amidosulfonate solution, oxidation by sodium nitrite, and further extraction in 0.5M TTA solution in xylene. A precision of ±3% was obtained.

428. ELECTROCHEMICAL STUDIES OF THE TWO REDUCED STATES OF PLUTONIUM. H. G. Heal. CI-84, June 13, 1945.

The existence of two fluoride-insoluble valency states of Pu was demonstrated electrochemically. Approximate values for the oxidation reduction potential of Pu(III)-Pu(IV) in 1N sulfuric, hydrochloric, and perchloric acids are given. A practical procedure for cathodic reduction of milligram amounts of the element is described.

429. H. I. CONTROL LABORATORY - ROUTINE CHEMICAL PROCEDURES. J. W. Healy, R. C. Thorbun, Z. E. Carey. HW-20136, July 15, 1951.

This laboratory manual covers many of the actinides and fission products.

430. THE ESTIMATION OF PLUTONIUM LUNG BURDEN BY URINE ANALYSIS. J. W. Healy. Am. Ind. Hyg. Assoc. Quarterly 18, No. 3, 261-6 (1957).

This paper describes an attempt to interpret Pu excretion results from a number of workers over several years on the basis that ingested Pu is transferred to the bloodstream at a given rate over a period of time.

431. CORRELATION OF ABSORPTION SPECTRA AND PARTITION DATA FOR PLUTONYL NITRATE IN AQUEOUS AND ORGANIC MEDIA. T. V. Healy, A. W. Gardner. J. Inorg. Nucl. Chem. 7, 245-56 (Oct 1958).

An examination of absorption spectra of plutonyl nitrate in dibutyl carbitol shows the presence of two species, the dinitrate and trinitrate. The latter is formed in either nitric and/or quarternary ammonium salts. The trinitrate has a much higher partition coefficient than the dinitrate in dibutyl carbitol from aqueous nitric acid or nitrates. This improvement in extraction obtained by raising the acidity is shown by correlation with absorption spectra to be directly related to the production of the trinitrate plutonyl species.

432. SOLVENT EXTRACTION OF Pu(VI) NITRATE FROM HNO_3 AND NH_4NO_3. T. V. Healy, A. W. Gardner. AERE-C/R-800, Feb. 15, 1952.

Partition coefficients for $Pu(NO_3)_4$ in the systems dibutyl-carbitol, aqueous nitric acid have been obtained over the range O-9N HNO_3, and also for dibutyl carbitol, HNO_3, NH_4NO_3 from O-2N HNO_3. Absorption spectra are given of the various complexes formed.

433. DEVELOPMENT OF A CATION EXCHANGE RESIN WITH SCINTILLATING PROPERTIES. A. H. Heimbuch. NYO-9138, April 1962.

A resin was synthesized which has the unique feature of possessing both ion-exchange and scintillating properties. Sr^{90}, Pu^{239}, and Po^{210} were counted with overall efficiencies of 50, 30, and 40%, respectively.

434. THE DISTRIBUTION OF Pu(VI) AND Pu(III) IN THENOYLTRIFLUOROACETONE-BENZENE-HNO_3 MIXTURES. D. L. Heisig, T. E. Hicks. UCRL-1664, Feb. 2, 1952.

The distribution coefficients have been measured as a function of TTA, hydrogen ion, and nitrate ion concentrations. The extraction constants for Pu(VI) and Pu(III) are 1.4 x 10^{-2} and 2 x 10^{-5}, respectively.

435. THE EXTRACTION MECHANISM OF PLUTONIUM(IV) TTA CHELATE IN SECBUTYLBENZENE-NITRIC ACID-URANYL NITRATE MIXTURES. D. L. Heisig, T. E. Hicks. UCRL-1169, July 30, 1952.

The rate of extraction in these systems is limited by the rate of transfer across the organic-aqueous boundary layer. The equilibrium extraction coefficients of Pu(IV) have been measured as a function of TTA, hydrogen ion, and uranyl nitrate concentration. The extraction of the chelate from the organic phase in the presence of reducing agents was also studied.

436. THE SEPARATION AND PURIFICATION OF MILLIGRAM QUANTITIES OF AMERICIUM. P. D. Herniman. AERE-C/R-1113, Jan. 26, 1953.

A method is described for separation and purification of Am from solutions containing large amounts of Fe, U, and Pu.

437. EVALUATION OF THE PENTAETHER AND CHELATE PROCESSES FOR THE CHEMICAL SEPARATION OF PLUTONIUM AND URANIUM. T. E. Hicks, H. W. Crandall. UCRL-912 (Del.), Sept. 18, 1950.

The pentaether process was designed to separate U, and the chelate process was designed to separate Pu. A discussion of the various combinations of processes for optimum separation is given.

438. IDENTIFICATION OF α-EMITTERS IN NORMAL BIOLOGICAL MATERIALS. C. R. Hill. Health Physics 8, 17-25 (Feb 1962).

Preliminary results of an α spectroscopy program being carried out on natural levels of α activity in humans and their environment are reported. Pu^{239} content in normal biological materials are included.

439. PROBABLE VOLATILIZATION OF PLUTONIUM DURING A FIRE. R. K. Hilliard. HW-71743, Dec. 1, 1961.

The available experimental information was evaluated and compared with theoretical volatilization rates in order to estimate the amount of Pu released to the atmosphere in a fire. It was determined that the probable maximum release of Pu is 0.08%.

440. WAVELENGTH AND INTENSITY MEASUREMENTS IN THE SPARK EXCITED SPECTRUM OF PLUTONIUM. J. Haaland. JENER-51, Aug 1957.

Wavelengths of some 400 Pu lines are given as measured with a Zeiss Abbe comparator with an estimated accuracy of ±0.01Å.

441. PRODUCTION OF TRANSURANIUM ELEMENTS IN A THERMONUCLEAR EXPLOSION-ANACOSTIA. R. W. Hoff, D. W. Dorn. UCRL-7314 (Rev. 1), May 8, 1963.

Radiochemical analysis of the debris from a low-yield thermonuclear device established the fact that elements at least through mass number A=246 were formed. A plot of mass number versus abundance can be fitted, assuming a single flux region of about 3 x 10^{24}.

442. THE REACTOR HANDBOOK, 1st Edition. J. F. Hogerton, R. C. Grass, Editors. VOL. 3. MATERIALS. SECTION I. GENERAL PROPERTIES. C. R. Tipton, Jr., Editor. AECD-3647, Feb 1955.

Functions of reactor materials are presented, after which the general properties of many materials and alloys that are used in the reactor are tested.

443. DETERMINATION OF SILICON BY DISTILLATION-COLORIMETRIC METHOD. B. D. Holt. Anal. Chem. 32, 124-8 (Jan 1960).

The Si is volatilized as the tetrafluoride from a perchloric acid solution in an all-Pt, uniformly heated still. The distillate is absorbed in a solution of boric and molybdic acids, in which the Mo blue color is developed. Results from the analysis of Pu, U alloys, steels, and phosphoric acid by this technique are presented.

444. RECOVERY OF PLUTONIUM FROM NEUTRON-IRRADIATED URANIUM. H. H. Hopkins, Jr. U. S. Pat. 2,951,740, Sept. 6, 1960.

The reduced Pu is separated from the neutron-irradiated U by extracting U in 0.3M HNO_3 with 30% TBP in aliphatic naphtha. The Pu in the aqueous phase is oxidized and then extracted with 30% TBP in naphtha containing 0.03M dibutyl phosphate.

445. THE RECOVERY OF URANIUM AND PLUTONIUM FROM SULFURIC ACID DECLADDING SOLUTIONS. D. E. Horner, C. F. Coleman. ORNL-2830, Nov. 25, 1959.

U and Pu were recovered from simulated, sulfuric acid, stainless-steel decladding solutions with several extractants including primary amines in hydrocarbon-alcohol diluent, N-benzyl secondary alkyl amines, and trialkyl phosphine oxide. Dialkyl phosphoric acid was promising for U(VI) alone.

446. LOW LEVEL PLUTONIUM-241 ANALYSIS BY LIQUID SCINTILLATION TECHNIQUES. D. L. Horrocks, M. H. Studier. Anal. Chem. 30, 1747-50 (1958).

The Pu^{241} particles are counted with a relatively high and easily reproduced efficiency of 37%. The very low limit of detection, 10^{-15} gram of Pu^{241}, and the ease of recovery of the Pu for further investigations gives this method added advantages over other methods of analysis.

447. THE ANALYSIS OF URINE SPECIMENS FOR URANIUM AND PLUTONIUM. J. L. Howarth, R. O. Mills. AFSWC-TN-61-8, Nov. 1, 1960.

Methods of analysis of urine for Pu and U were studied for the purpose of recommending the most suitable methods. Alpha proportional counting is recommended. The recommended extraction procedures are the bismuth phosphate-lanthanum fluoride coprecipitation technique for Pu and a di n-butyl orthophosphoric acid extraction or anion exchange for U.

448. FIBERGLASS REINFORCED PLASTIC GLOVEBOXES FOR PLUTONIUM ANALYTICAL RESEARCH. J. P. Hughes, A. G. Jastrab. "Proceeding of the Ninth Conference on Hot Laboratories and Equipment, Chicago, Illinois, Nov. 7-9, 1961," edited by Paul R. Fields, American Nuclear Society, Hinsdale, Ill., 1962.

An economical fiberglass reinforced plastic glovebox was designed for use in an analytical Pu laboratory to eliminate chemical corrosion, decrease decontamination time, and increase flexibility of operation.

449. GROUP SEPARATION OF THE ACTINIDES FROM THE LANTHANIDES BY ANION EXCHANGE. E. K. Hulet, R. G. Gutmacher, M. S. Coops. J. Inorg. Nucl. Chem. 17, 350-60 (1961).

The separation of the lanthanides from the tripositive actinides has been successfully accomplished by column elution with lithium chloride solutions 10M or stronger using a moderately cross-linked, strongly basic, anion-exchange resin at an elevated temperature. Fractionation of the actinide ions into the groups Pu, Am-Cm, Bk, and Cf-Es can be obtained during the same column elution.

450. THE DETERMINATION OF SUBMICROGRAM QUANTITIES OF PLUTONIUM-239. G. J. Hunter, R. B. Chenley. AERE-AM-19, July 1959.

Plutonium fluoride and lanthanum fluoride are coprecipitated and mounted on a stainless-steel disk for counting. The method has a negative bias of 2.5%.

451. CHEMICAL METHODS FOR ROUTINE BIOASSAY. J. B. Hursh. AECU-4024, Nov 1958.

Methods in routine use for the bioassay of materials of use in the U.S.A.E.C. biology programs are described. Selected methods are presented for Pu, Po, Ra, Th, U, and Sr.

452. THE DISPROPORTIONATION REACTIONS OF THE HEAVY ELEMENTS. A REVIEW. R. Hurst. Chem. Soc., Spec. Publ. No. 1, 55-63, discussion 71-4, 1954.

The rates and mechanisms of disproportionation in the following systems are considered: Pu(IV) in HCl, Pu(IV) in $HClO_4$, Pu(V) in HCl, and Pu(V) in HNO_3.

453. THE IDENTIFICATION OF BETA-EMITTING ISOTOPES BY LIQUID SCINTILLATION COUNTING. W. P. Hutchinson. AERE-R-3605, Oct 1960.

The average energy of a beta-emitting isotope, in micro-microcurie amounts may be measured at room temperature by systems described. The apparatus is useful for rapid, quantitative, routine analysis of beta emitters.

454. PLUTONIUM RECYCLE PROGRAM ANNUAL REPORT FOR FISCAL YEAR 1957. Hanford Atomic Products Operation. HW-52000, Sept. 20, 1957.

Progress in the development of chemical processes for Pu recovery from fuel elements is summarized.

455. PLUTONIUM ABSTRACTS. Hanford Atomic Products Operation. HW-68600-28, July 1, 1963, and HW-68600-32.

Abstracts of references are presented on new developments in Pu technology, including biology and medicine, chemistry, metallurgy and ceramics, physics, and health and safety.

456. PLUTONIUM ABSTRACTS. Hanford Atomic Products Operation. HW-68600-30, Vol. 3, No. 8, Sept. 1, 1963.

References on the study of Pu in biology, chemistry, metallurgy, ceramics, physics, and reactor technology for Feb 1962-Aug 1963 are presented. New developments in Pu technology are also covered.

457. PLUTONIUM ABSTRACTS. Hanford Atomic Products Operation. HW-68600-29, Vol. 3, No. 7, Aug. 1, 1963.

An annotated bibliography on Pu technology is presented. The references are listed under chemistry, health and safety, physics, metallurgy and reactor technology.

458. PHYSICS RESEARCH QUARTERLY REPORT, APRIL-JUNE 1962. Hanford Atomic Products Operation. HW-74190, July 16, 1962.

Monte Carlo calculations were made of the limiting critical concentration of Pu^{239} and U^{235} in aqueous solutions.

459. CERAMICS RESEARCH. Paper 1 in HW-76301. Ceramics Research and Development Operation Quarterly Report, January-March 1963. Hanford Atomic Products Operation.

Several ceramics were studied such as Pu-C, PuN, and oxides of Pu. Analytical methods used for the analysis of these compounds are also discussed.

460. CERAMICS RESEARCH AND DEVELOPMENT OPERATION QUARTERLY REPORT. Hanford Atomic Products Operation. HW-76302, April-June 1963.

Progress is reported for numerous projects in ceramics research, fuels development, and fuels testing and analysis.

461. ZIRCONIUM PHENYLARSONATE TRACER SCALE METHOD FOR THE DIFFERENTIATION OF Pu(III) AND Pu(IV) IN REDOX SOLUTIONS. C. H. Ice. HW-10277, June 30, 1948.

The procedure is based on the carrying of Pu(IV) with zirconium phenylarsonate. The average recovery was about 98% for 50-50 mixtures.

462. THE DETERMINATION OF THE PLUTONIUM CONTENT OF URINE (PHOSPHATE METHOD). G. P. Cook, O. Jones. IGO-AM/W-68, Jan. 9, 1957.

A nitric acid solution of calcium phosphate is added to urine to act as a Pu carrier when ammonia is added. The precipitate is ignited, dissolved, and precipitated as the cupferride and extracted with chloroform. After removal of solvent and organic matter, the alpha activity is measured with a scintillation counter. The limit of detection is about 2 μg per sample, applicable to 2×10^4 μg per sample.

463. THE ABSORPTIOMETRIC DETERMINATION OF CHROMIUM IN PLUTONIUM METAL (DIPHENYLCARBAZIDE METHOD). IGO-AM/W-104, Sept 1957.

A portion of the solution of the metal in HCl is treated with Br, which converts Pu to the tetravalent state. The Pu is complexed with an ethereal solution of cupferron and extracted with chloroform. Residual traces of organic are removed by wet ashing and trivalent Cr is oxidized to dichromate with ammonium persulfate. The colored complex is formed by adding an acid solution of diphenylcarbazide. The concentration range is 25-500 ppm. The limit of detection is 1 μg Cr.

464. THE ABSORPTIOMETRIC DETERMINATION OF IRON IN PLUTONIUM METAL (AA DIPYRIDYL METHOD). IGO-AM/W-105, Oct 1957.

A solution of metal in HCl is treated with hydroxyl amine hydrochloride to reduce Fe to the ferrous state. The reagent is added to acetate-buffered solution at pH 3-6. Separation from Pu is effected by using a sodium alkyl sulfonate reagent as a promoter. The absorption of the chloroform solution is measured to determine the Fe concentration.

465. THE ABSORPTIOMETRIC DETERMINATION OF SILICON IN PLUTONIUM METAL. IGO-AM/W-106, Oct 1957.

The sample is dissolved in hydrochloric acid. The silicomolybdate complex is reduced with ascorbic acid and extracted with butyl alcohol. The absorption is measured on a Spekker absorptiometer. The concentration range is 10-200 ppm. The limit of detection is 0.5 μg. Precision at the 1.7-μg level (3-sigma criterion) is ±36%.

466. THE DETERMINATION OF NITROGEN IN PLUTONIUM METALS. CONWAY DIFFUSION SEPARATION AND MICRO-TITRATION. IGO-AM/W-107, Jan 1958.

N is liberated as ammonia by the addition of strong NaOH to a chloride solution of metal. The ammonia diffuses into a known amount of sulfuric acid, and the excess acid is titrated with standard NaOH. The concentration range is 50-100 ppm. The limit of detection is 0.5 μg.

467. THE ABSORPTIOMETRIC DETERMINATION OF THORIUM IN PLUTONIUM METAL. IGO-AM/W-168, March 1958.

The metal is dissolved in 11M HCl and oxidized to the tetravalent state with hydrogen peroxide. The Pu is absorbed on an anion-exchange column, and the Th passes through. The Th is determined as the thoronol complex in acetone solution. The limit of detection is 2 μg. Precision is ±27% at the 99% level.

468. THE DETERMINATION OF CARBON IN PLUTONIUM METAL (MICRO-COMBUSTION AND ABSORPTION IN BARIUM HYDROXIDE). IGO-AM/W-170, March 1958.

Pu metal is ignited in a stream of oxygen. The C present is converted to carbon dioxide, which is absorbed in barium hydroxide. The amount of barium hydroxide removed by the carbon dioxide is determined by titration with standard hydrochloric acid. The suggested concentration range is 50 ppm, and the limit of detection is judged to be 10 μg. The precision is ±40% (30 criterion), based on 20 determinations at the 50-μg level by three operators.

469. THE ABSORPTIOMETRIC DETERMINATION OF GALLIUM IN PLUTONIUM METAL (8-HYDROXYQUINOLINE METHOD). IGO-AM/W-172, 1958.

Ga is extracted from 5.8M HCl in the presence of titanous ion into ether. A wash with HCl and titanous ion removes most of the ferrous ion. The ether is evaporated, and the residue is dissolved in HCl. The solution is buffered to pH 2.6-3.0 using phthalate-boric acid. Hydroxyl amine is added, and the gallium oxinate complex is then formed using 8-hydroxy-quinoline in chloroform. After adjustment to a definite volume, the Ga is determined absorptiometrically. The concentration range is 5 ppm and above. No commonly occurring cations interfere.

470. THE DETERMINATION OF CHLORINE IN PLUTONIUM METAL BY POTENTIOMETRIC TITRATION AFTER A DIFFUSION SEPARATION. IGO-AM/W-175, 1958.

About 0.1 gram of the sample is dissolved in dilute sulfuric acid. A permanganate sulfuric acid mixture is added, and chlorine separated by diffusion into dilute NaOH contained in the inner chamber of a Conway unit. Hydrogen peroxide is added to convert any hypochlorite to chloride which is determined by titration with silver nitrate. The end point is determined potentiometrically by using a silver-silver amalgam electrode system. All reagents should be chloride-free.

471. THE FLUORIMETRIC DETERMINATION OF URANIUM IN PLUTONIUM METAL. IGO-AM/W-177, June 1958.

U is determined on a hydrochloric acid solution of metal by measuring fluorescence produced by ultraviolet light. Quenching effects are allowed for by use of internal standard addition technique. The Pu transferred to Pt plate should not exceed 10 μg. The concentration range is 0.1% and above. The limit of detection is judged to be 0.01 μg U.

472. THE DETERMINATION OF BORON IN PLUTONIUM METAL. IGO-AM/W-179, July 3, 1958.

A sample is dissolved in HCl, and B is separated by distillation as methyl borate and collected in a mixed glycerol-NaOH reagent. Methanol is removed by evaporation, and B in ignited residue is determined absorptiometrically by using curcumin in the presence of o-chlorophenol, perchloric acid, and acetic anhydride. Precision is ±70% at the 3σ criterion at the 0.04-ppm level. The concentration range is 0.025 ppm and above. Bias is adjusted to be insignificant with the calibration procedure specified.

473. THE ABSORPTIOMETRIC DETERMINATION OF TOTAL PHOSPHORUS IN PLUTONIUM SOLUTIONS (REDUCED PHOSPHO-MOLYBDATE METHOD). IGO-AM/W-181, 1958.

Any organic phosphate in sample is converted to phosphoric acid by digestion with hydrobromic acid. The P is extracted into amyl alcohol/ethyl acetate mixture as the phosphomolybdate complex. The reduced phosphomolybdate complex is produced by stannous chloride. This is good for P in the range 0.02% with respect to Pu. Precision at the 3σ level (95%) lies between ±30% to true value.

474. ANALYTICAL CHEMISTRY OF IRRADIATED NUCLEAR FUEL PROCESSING. "Analytical Chemistry of Nuclear Materials." Vienna, International Atomic Energy Agency, 1963.

Analytical methods and techniques for control of irradiated nuclear fuel processing plants are reviewed critically.

475. ANALYTICAL METHOD FOR THE DETERMINATION OF ZIRCONIUM-95 IN PLUTONIUM PLANT SOLUTIONS. IGR-109(O/W).

After several purification steps, radiozirconium and carrier are extracted into TTA/benzene and eventually weighed as ZrO_2.

476. α-COUNTING OF PLUTONIUM ISOTOPES WITH LIQUID SCINTILLATORS. ELIMINATION OF ERRORS, DUE TO WALL ADSORPTION OF PLUTONIUM. H. Ihle, A. Murrenhoff, H. Aulich. JUL-127-PC, July 1963.

Tri n-octyl phosphine oxide (TOPO) was found to be a suitable nonquenching complexing agent for application to internal liquid scintillation of Pu by eliminating errors due to wall adsorption of hydrolized species of Pu. The scintillator technique is favorable for samples that do not lend themselves to counting-plate techniques due to high salt concentration or due to organic Pu solutions containing organic complexing agents of low volatility.

477. THE DETECTION OF AIRBORNE PLUTONIUM HAZARDS. P. Iredale, G. Hinder. AERE-R-3783, Jan 1962.

Two instruments are investigated, both of which make corrections for the activities of naturally occurring Rn and thoron and improve the threshold sensitivity of air-sampling monitors.

478. APPLICATION OF THE PACKED COLUMN TO THE REDOX PROCESS. E. R. Irish. HW-29967A, March 12, 1957.

The Redox process for the separation of Pu from U and fission products is described briefly. Emphasis is then on the performance characteristics of packed solvent extraction columns.

479. SYNERGIC EFFECTS IN THE SOLVENT EXTRACTION OF THE ACTINIDES. III. TETRAVALENT ACTINIDES. H. Irving, D. N. Edgington. J. Inorg. Nucl. Chem. 20, 321-34 (Dec 1961).

Th^{230}, Np^{237}, and Pu^{239} are used as tracers to study the solvent extraction of the tetravalent actinides from nitric acid into mixtures of TTA with TBP or TBPO in cyclohexane.

480. SYNERGIC EFFECTS IN THE SOLVENT EXTRACTION OF THE ACTINIDES. IV. TRIVALENT PLUTONIUM, AMERICIUM, AND EUROPIUM. H. Irving, D. N. Edgington. J. Inorg. Nucl. Chem. 21, 169-180 (Dec 1961).

Radioactive tracers are used to study the solvent extraction of Pu(III), Am(III), and Eu(III) from 0.01N HCl, .001N HNO_3, and an acetate buffer of pH 3.95, respectively, into mixtures of TTA and TBP in cyclohexane. The extraction coefficient has been found to be greater for such mixtures than for either component alone, and the extractable species has the composition $MX_3 \cdot 2$ TBP (where TTA=HX and M=Pu, Am, or Eu).

481. SYNERGIC EFFECTS IN THE SOLVENT EXTRACTION OF THE ACTINIDES. II. PLUTONIUM(VI) AND NEPTUNIUM(V). H. Irving, D. N. Edgington. J. Inorg. Nucl. Chem. 20, 314-320 (Dec 1961).

Pu^{239} and Np^{237} are used to study the solvent extraction of Pu(VI) and Np(V) from nitric acid into mixtures of 1,1,1-trifluoro-3-2-thenoylacetone (TTA) and tri-n-butyl phosphate (TBP) in cyclohexane. The extraction coefficient is found to be greater for such mixtures than for either component alone.

482. DISTRIBUTION OF NEPTUNIUM BETWEEN TBP AND SOME MINERAL ACIDS. T. Ishimori, E. Nakamura. Bull. Chem. Soc. Japan 32, 713-720 (1959).

Distribution of Np in various valence states was studied. Comparisons are made with some of the other actinides.

483. INORGANIC EXTRACTION STUDIES ON THE SYSTEM BETWEEN TRI-n-BUTYL PHOSPHATE AND HYDROCHLORIC ACID. T. Ishimori, K. Watanabe, E. Nakamura. Bull. Chem. Soc. Japan 33, 636-44 (1960).

484. SPECIFIC ACTIVITIES OF NUCLIDES, $z > 87$. N. M. Isaac, J. W. Wilkins. Argonne National Laboratory. ANL-6042, Sept 1959.

The specific activity of an isotope is expressed as the product of its decay constant and the number of atoms per unit weight.

485. SEPARATION OF TRANS-CURIUM ELEMENTS FROM LARGE QUANTITIES OF CURIUM BY LIQUID-LIQUID EXTRACTION. N. M. Isaac, J. W. Wilkins, P. R. Fields. J. Inorg. Nucl. Chem. 15, 151-7 (1960).

The procedure involves 12N HCl and 100% Bu_3PO_4. It was applied successfully to the separation of Cm and Cf from Pu.

486. EXTRACTION OF PLUTONIUM AND URANIUM FROM NUCLEAR FUEL. N. M. Isaac. Industrie Chim. Belge 22, 139-52 (1957).

Aqueous, nonaqueous, and high-temperature methods employed for the extraction of Pu from irradiated U are reviewed. The advantages and disadvantages of some of these processes are discussed and some flow sheets are presented.

487. ESTIMATED DENSITIES OF PLUTONIUM AND HYDROGEN FOR USE IN CRITICALITY CALCULATIONS. E. E. Jackson, E. Wait. AERE-M-802, Dec 1960.

This is a compilation of Pu and H densities in solid Pu compounds for which X-ray or optical crystallographic data were available.

488. DESIGN AND OPERATION FOR DIRECT-MAINTENANCE FUEL SEPARATION. H. K. Jackson, G. S. Sadowski. Nucleonics 13, No. 8, 22-5 (1955).

A radiochemical separation plant is described that can be built, operated, and maintained with standard industrial techniques. Solvent extraction flow sheets show steps in separating Pu, U, and fission products.

489. TWO SIMPLE BATCH LIQUID-LIQUID EXTRACTORS. N. Jackson. AERE-C/M-365, Dec 1958.

Two simple and cheap batch-extraction units have been developed for work with volumes of solution in the range of 20 ml. Units are suitable for work in α or α, $\beta\gamma$ boxes. By using tributyl phosphate with odorless kerosine, Pu was separated from Am contained in an $Al(NO_3)_3$-HNO_3 solution. The Am contained, after purification, 0.07% $Pu^{239,240}$, with a recovery of 95.5% of the original Am present. Th also was recovered from a Th/oxalate slurry.

490. INITIAL TWO-YEAR EXPERIENCE WITH THE SAVANNAH RIVER PLANT PLUTONIUM URINALYSIS PROCEDURE. W. R. Jacobsen. In ANL-6637, Proceedings of the Seventh Annual Meeting on Bio-Assay and Analytical Chemistry, Held October 12 and 13, 1961 at Argonne National Laboratory, pp. 33-42.

The method consists of wet-washing the urine, purification of Pu by anion exchange, elution with H_2SO_4, and electrodeposition in a nitrate medium on a stainless-steel disc that is autoradiographed on nuclear track emulsion plates, and the resulting tracks are magnified and counted by a microprojector.

491. ENUMERATION OF NUCLEAR PROCESSES INVOLVING THE SIMULTANEOUS EMISSION OF SEVERAL NEUTRONS. J. Jacquesson. J. Phys. 24, suppl. to No. 6, 112A-116A (June 1963).

This method allows the measurement of multiple processes as spontaneous or induced fissions, or (n, 2n) reactions in presence of single processes. The method is applied to the determination of Pu^{240} in samples of Pu. The accuracy, estimated by comparison with mass spectroscopy, is 0.5%.

492. THE ANION-EXCHANGE SEPARATION OF PLUTONIUM AND THORIUM. D. B. James, E. L. Christensen. TID-14598 (LADC-5191), 1961.

Pu(IV) and Th are separated quantitatively by using an anion-exchange resin and a solution 7-8M HCl. Th is not absorbed. Both Pu and Th are strongly sorbed from 7.5M HNO_3.

493. THE PROCESSING OF PLUTONIUM BY ION EXCHANGE. I. THE CONCENTRATION DEPENDENCE OF DISTRIBUTION COEFFICIENTS ON DOWEX 1X4 FROM 7M NITRIC ACID. D. B. James. LADC-5377, 1961.

An expression is derived and experimentally confirmed for the change in the volume-distribution coefficient for Pu(IV) on Dowex 1x4 from 7M HNO_3 with varying concentrations of Pu(IV) in the aqueous phase.

494. SEPARATION OF PLUTONIUM FROM LANTHANUM BY CHELATION-EXTRACTION. R. A. James, S. G. Thompson. U. S. Pat. 2,863,892.

Pu is separated from La in which the La/Pu is at least five by adding the ammonium salt of N-nitrosoaryhydroxyl amine at a pH of 3-3.2 and extracting the chelate of +3 Pu with an immiscible solvent such as chloroform.

495. IMPROVEMENTS IN OR RELATING TO METHODS OF RECOVERING PLUTONIUM. W. D. Jamrock, G. M. Phillips. British Pat. 910,443, Nov. 14, 1962.

A method is described for recovering Pu in solutions of high purity from solutions containing small amounts of U and fission products.

496. THE ANALYSIS OF URINE FOR TRACES OF AMERICIUM AND OTHER ALPHA EMITTERS. E. N. Jenkins, G. W. Sneddon. AERE-C/R-1399, Nov. 10, 1954.

The method used by Argonne National Laboratory for the analysis of alpha emitters in urine was used. This involves co-precipitation of these emitters with bismuth phosphate from a nitric acid solution of oxidized urine, resolution of the precipitate, and subsequent precipitation with minimum La fluoride, which is alpha-counted. A modification is suggested for the determination of Am.

497. THE EFFECT OF DISSOLVED AIR ON THE REDUCTION OF TRACER LEVEL PLUTONIUM(IV) BY URANIUM(IV). E. N. Jenkins. J. Inorg. Nucl. Chem. 13, 323-5 (1960).

In the use of uranous salt in HNO_3 to remove tracer Pu(IV) and (VI) from hexane with excess U(IV) present, oxygen partially reoxidizes Pu(III) to Pu(IV), lowering the percentage of Pu removed.

498. THE USE OF URANIUM(IV) AS A REAGENT IN THE AQUEOUS PROCESSING OF IRRADIATED URANIUM. E. N. Jenkins, R. J. W. Streeton. AERE-R-3158, Dec 1959.

The uranous ion must be stabilized against nitrite with sulfamic acid or hydrazine. The stability, solvent extraction, and reducing power of uranous solutions were investigated. Reactions with Pu are also presented.

499. USE OF SULFAMIC ACID FOR DISSOLVING PLUTONIUM. W. J. Jenkins. J. Inorg. Nucl. Chem. 25, 463-464 (1963). See also TID-16387.

Pu metal dissolves readily in sulfamic acid and sulfamic acid-nitric acid mixtures. Reaction in 1.7M sulfamic acid proceeds almost to complete exhaustion of the H ion if the solution temperature is maintained below 40°C.

500. SOME PHYSICAL PROPERTIES OF PLUTONIUM METAL. E. R. Jette. J. Chem. Phys. 23, 365-68 (Feb 1955).

Data are presented on allotropic modification, crystal structure, transformation temperatures, melting point, densities, expansion coefficients, electrical resistance, and magnetic susceptibility.

501. METHOD OF REDUCING PLUTONIUM COMPOUNDS. I. B. Johns. U. S. Pat. 2,837,402, June 3, 1958.

Valence is reduced by treating the aqueous solution of higher-valence Pu compounds with H in contact with an activated Pt catalyst.

502. SPECTROCHEMICAL DETERMINATION OF TRACE IMPURITIES IN PLUTONIUM NITRATE SOLUTIONS. A. J. Johnson, E. Vejvoda. Anal. Chem. 31, 1643-46 (1959).

A direct spectrographic method has been developed for determining trace amounts of impurities in Pu nitrate solutions; 500γ of Pu is evaporated onto 800γ of sodium fluoride, the electrode is excited by an alternating-current arc, and the spectrum is recorded on a photographic plate. The method is applicable for determining 34 elements.

503. ANALYSIS OF POTASSIUM AND SODIUM SOLUTIONS. PROBLEM ASSIGNMENT NO. CX3-4. DEVELOPMENT OF RADIOCHEMICAL ANALYTICAL PROCEDURES FOR PLUTONIUM. G. L. Johnson, D. E. Koshland, Jr., C. W. Smith. CN-2043, June 30, 1945.

Two relatively simple ways are described for modifying the standard La fluoride procedure in the presence of Na ion concentrations greater than 2M or K ion concentrations greater than 0.05M.

504. SODIUM FLUORIDE AS A SPECTROSCOPIC CARRIER FOR PLUTONIUM METAL ANALYSIS. A. J. Johnson, E. Vejvoda. RFP-143, April 20, 1959.

A pyroelectric carrier distillation method may be used to determine five elements previously determined by the cupferron extraction method. The PuO_2 is mixed with about 5% NaF. The spectrum is recorded on a photographic plate, and impurities are estimated by visual comparison.

505. THE FLUORINATION OF URANIUM FROM DRIED SOLIDS AND ITS APPLICATION TO THE FLUORIDE VOLATILITY PROCESS. C. E. Johnson, J. Fischer. Argonne National Laboratory. ANL-6117, Aug 1960.

A fluoride-volatility process utilizes aqueous dissolution of fuel and fluidized-bed drying and fluorination to recover U and Pu from irradiated fuels.

506. THE PREPARATION OF HIGH PURITY PLUTONIUM METAL. K. W. R. Johnson. J. Inorg. Nucl. Chem. 9, 200-3 (March 1959).

High-purity α-phase Pu metal was produced by a process which consisted of two successive peroxide precipitations, direct fluorination with HF, and reduction to metal with Ca and I "booster." Total impurities varied from 94 to 276 ppm.

507. A COMPARISON OF OPERATING CHARACTERISTICS OF A GRIDDED AIR-CHAMBER AND A METHANE PROPORTIONAL COUNTER FOR ROUTINE α COUNTING. K. D. B. Johnson. AERE-C/M-39, Oct. 5, 1949.

The α counting of Pu after LaF_3 precipitation is best performed on the methane proportional counter. The best operating conditions are discussed.

508. REACTIONS OF SULFUR TETRAFLUORIDE WITH OXIDES, OXYFLUORIDES, AND FLUORIDES OF URANIUM AND PLUTONIUM. C. E. Johnson, J. Fischer, M. J. Steindler. J. Am. Chem. Soc. 83, 1620-2 (1961).

Some qualitative and quantitative observations are presented concerning the reaction of sulfur tetrafluoride with oxides, oxyfluorides, and fluorides of U and Pu.

509. COATING WASTE MEASUREMENT. W. H. Johnson, R. A. Schneider, W. H. Zimmer. HW-SA-2726, Aug. 23, 1962.

The development and application of an indirect measurement method which uses a fission product, Cs^{137}, as an index of the SS material content of coating waste are described.

510. CURRENT EXPERIENCE AND THINKING ON THE PLUTONIUM RATIO METHOD OF RECEIPT MEASUREMENT. W. H. Johnson. In TID-7615; Proceedings of Annual Nuclear Materials Management Meeting, Denver, Colorado, June 15, 1961, pp. 65-77.

The ratio method for determining the receipt measurement of Pu is evaluated. Advantages of the ratio method, such as relative independence from sampling and waste uncertainties and cost, are presented.

511. PREPARATION AND PROPERTIES OF A PLUTONIUM CARBIDE. A BIBLIOGRAPHY. C. P. Johnston, F. D. Lonadier, J. A. Powers. MLM-1169, July 1963.

A total of 111 references from Nuclear Science Abstracts and Abstracts of Classified Reports are listed.

512. THORIN: AN INTERESTING CHROMOGENIC AGENT AND CHELATOCHROME INDICATOR. M. B. Johnston, A. J. Barnard, Jr., W. C. Broad. Rev. univ, ind. Santander 2, 137-46 (1960). Translated in NP-tr-602.

A literature search was made on the uses of Thorin as a chromogenic agent and chelatochrome indicator in the precipitation titration of sulfate, and in various EDTA titrations.

513. RECOVERY OF PuF_6 BY FLUORINATION OF FUSED FLUORIDE SALTS. R. L. Jolley, G. I. Cathers. ORNL-3298, Oct. 8, 1962.

Fused-salt fluorination tests at 600°C showed good recoveries for 2 ppm of Pu from 50-50 m/o $NaF-ZrF_4$ or from 31-24-45 m/o $LaF-NaF-ZrF_4$.

514. INFRARED SPECTRA AND STRUCTURE OF URANYL AND TRANSURANIUM(V) AND (VI) IONS IN AQUEOUS PERCHLORIC ACID SOLUTIONS. L. H. Jones, R. A. Penneman. J. Chem. Phys. 21, 542 (1953).

Infrared spectra of U, Pu, Np, and Am(VI) show these ions exist as symmetrical and linear or nearly linear XO_2^{++}. The spectra of Np(V) and Am(V) show that they are probably XO_2^{+} ions.

515. REACTOR FUELS AND MATERIALS DEVELOPMENT. PLUTONIUM RESEARCH JANUARY-MARCH 1963. L. V. Jones, L. J. Wittenberg. MLM-1156, May 29, 1963.

Solvent-extraction methods were used as an analytical technique for Ce-Cu-Pu alloys. Analysis of Fe-Pu alloys proved that Pu(III) o-phenanthroline complexes, if formed at all, do not interfere. Ce-Co-Pu and Ce-Ni-Pu systems were also studied.

516. THE ABSORPTIOMETRIC DETERMINATION OF ALUMINUM AS A MINOR CONSTITUENT IN PLUTONIUM-ALUMINUM ALLOYS. I. G. Jones, G. Phillips. AERE-R-2879, Jan 1960.

Pu is removed by ion exchange, and Al is determined absorptiometrically following its extraction as the 8-hydroxy quinoline complex. Fe, which interferes, is removed by extraction with 8-hydroxy quinoline, and any residual Pu is removed by complexing with H_2O_2, before the 8-hydroxy quinoline extraction.

517. A PROGRAM FOR PUBLICATION OF SELECTED MEASUREMENT METHODS FOR PLUTONIUM AND URANIUM IN THE NUCLEAR FUEL CYCLE. R. J. Jones. In TID-7660, AEC and Contractor Nuclear Materials Management Symposium, Oct. 3-5, 1962, pp. 101-107. And in TID-7629, Analytical Chemistry in Nuclear Reactor Technology. Fifth Conference, Gatlinburg, Tenn., Oct. 10-12, 1961, pp. 259-266.

Measurement methods for nuclear materials are discussed. General information and selected analytical procedures are to be published.

518. A STUDY OF PLUTONIUM TRIFLUORIDE PRECIPITATED FROM AQUEOUS SOLUTION. M. M. Jones. HW-30384, Dec. 28, 1953.

Because of its reproducible composition, Pu fluoride is recommended as a primary standard. When dried at room temperature, the H_2O content is 2.3 ± 0.3%, corresponding to $PuF_3 \cdot 0.40H_2O$. The material undergoes slow hydrolysis to oxide. Concentrations up to 15 g/liter of Pu in 2N HNO_3 are attainable. The PuO_2

formed by ignition of fluoride has some advantages over the fluoride as a Pu standard.

519. CALORIMETRIC DETERMINATION OF THE ENERGY PRODUCED BY 49 [Pu^{239}]. W. M. Jones, J. W. Stout. LA-347, Aug. 17, 1945.

The energy production of a 120-gram sphere of Pu^{239} was measured calorimetrically. When the power produced is combined with the energy per α particle, a value for the half-life is obtained.

520. ABSORPTION SPECTRA OF ACTINIDE COMPOUNDS. C. K. Jorgensen. Mol. Phys. 2, 96-108 (1959).

The ground state of all actinide ions with a charge of at least 3 contain only 5f electrons outside the emanation shells. The absorption spectra of U(IV) complexes and of PuF_6 suggest interelectron repulsion parameters of about 60% of those in the corresponding lanthanides, while the Lande factors are about twice as large. Variation with oxidation number in the isoelectron series, U(III), and Np(IV), Pu(III), and AmF_4, Am(III), and CmF_4 are discussed. Chemical properties of the actinides are discussed.

521. PERFORMANCE OF A PLUTONIUM REFLUX SOLVENT EXTRACTION SYSTEM. B. F. Judson. HW-49441A, March 27, 1957.

The refluxing technique is considered to give definite advantages as regards overall processing flexibility and reduction of the number of process steps required to attain Pu concentrations up to 100 g/liter.

522. REACTIONS OF PLUTONIUM IONS WITH ETHYLENEDIAMINE TETRAACETIC ACID. O. L. Kabanova, M. A. Danuschenkova, P. N. Paley. Anal. Chim. Acta 22, 66-75 (Jan 1960).

The behavior of Pu in a solution of the disodium salt of EDTA was investigated. At a pH of 3 to 5, Pu(VI) is reduced to Pu(V), and a one-to-one complex is formed. With excess reagent, a Pu(IV) complex is formed after some time.

523. OXIDATION REDUCTION POTENTIALS OF PLUTONIUM IN ACID SOLUTIONS WITH DIFFERENT IONIC FORCES. O. L. Kabanova, A. N. Palei. Zhur. Neorg. Khim. 5, 31-4 (1960). See also CEA-tr-R-1378.

The oxidation-reduction potential of the Pu(III)/Pu(IV) system in $HClO_4$ at 0.5 to 4M at 25° increases with the concentration of the perchloric acid. The oxidation-reduction potential of the system becomes more negative with the increase of chloride in solution of HCl (1 to 5M) and of HCl + KCl (1M HCl + 0.5 to 3.8M KCl).

524. ELECTRODEPOSITION OF PLUTONIUM FLUORIDE. M. Kahen. U. S. Pat. 2,758,963, Aug. 14, 1956.

The electrolyte is an aqueous solution of $PuO_2(NO_3)_2$ with large amounts of NaF. A Pt disc is made the cathode. When a current is passed, the plutonyl ions migrate to the cathode, where they are reduced and deposited as the insoluble fluorides.

525. METHOD OF IMPROVING THE CARRIER PRECIPITATION OF PLUTONIUM. H. J. Kamack, J. H. Balthis. U. S. Pat. 2,863,719.

Pu values can be recovered from acidic solutions by adding lead nitrate, hydrogen fluoride, lanthanum nitrate, and sulfuric acid. The lead sulfate improves the separation characteristics of lanthanum fluoride carrier precipitate.

526. REDOX MONTHLY REPORT FOR SEPTEMBER 1948. Knolls Atomic Power Laboratory. KAPL-M-REDOX-1, Sept. 27, 1948.

Progress is reported on heavy-element and fission-product chemistry, Redox solution conductivity, analytical methods for Redox, Pu valence states, and decontamination of Redox waste solutions.

527. REDOX GROUP MONTHLY REPORT FOR OCTOBER 1948. Knolls Atomic Power Laboratory. KAPL-M-REDOX-2, Oct. 26, 1948.

This is a monthly report on progress made in the Redox group in heavy-element, fission-product, and analytical chemistry.

528. REPORT OF THE NUCLEAR PHYSICS SECTION FOR DECEMBER 1954, JANUARY, FEBRUARY 1955. Knolls Atomic Power Laboratory. KAPL-1302.

Procedures for determining trace amounts of U and Pu in the atmosphere are briefly discussed.

529. REPORT OF THE PHYSICS SECTION FOR JUNE, JULY, AUGUST 1956. Knolls Atomic Power Laboratory. KAPL-1611 (Del.).

A mass spectrometric analysis of millimicrogram samples of Pu is shown.

530. SOME FEATURES OF THE DISTRIBUTION OF EXTRACTED MATERIALS IN THE WASHING PORTION OF THE EXTRACTION-WASHING APPARATUS. S. M. Karpacheva, E. P. Rodionov. At. Energ. (U.S.S.R.), 13, 486-91 (1962).

Simultaneous extraction of several substances by organic solvents from an aqueous solution may result in a competition between these substances if the extraction agent forms chemical compounds with them. The concentration distribution of the macroelements and the microelements was determined, and a formula was derived for determining approximately the required number of extraction and washing columns. For exact calculations, the change in the ratios of the various streams caused by the volume changes occurring during the process must be taken into account.

531. SUMMARY OF SOME NEW NUCLEAR DATA. P. R. Kasten. ORNL-2142, Aug. 21, 1956.

Results obtained by different investigators of nuclear constants of U^{233}, Pu^{239}, Pu^{241}, U^{235}, Pu^{240}, Pu^{238}, Pu^{242}, and Am^{243} are summarized.

532. HIGHER OXIDES OF ACTINIDE ELEMENTS. THE PREPARATION OF Np_3O_8. J. J. Katz, D. M. Gruen. J. Am. Chem. Soc. 71, 2106-2112 (1949).

An attempt to prepare higher oxides of Np, Pu, Am, and Pa was unsuccessful. Np_3O_8 is described.

533. THE CHEMISTRY OF THE ACTINIDE ELEMENTS. J. J. Katz, G. T. Seaborg. London, Methuen and Co., Ltd., 1957.

The actinide elements are treated thoroughly, including important literature citations up to 1956.

534. FLUORIDE VOLATILITY PROCESS FOR THE RECOVERY OF URANIUM. J. J. Katz, H. H. Hyman, I. Sheft. Canadian Pat. 648,942, 1962.

The process comprises dissolving the irradiated U in a halogen fluoride under such conditions that the volatile PuF_6 is not formed, and distilling off the volatile UF_6. The formation of PuF_6 is avoided by continuous removal of the Br_2 and the BrF products of the dissolution.

535. RELATIVE EFFECTIVENESS OF VARIOUS AGENTS FOR PREVENTING THE INTERNAL DEPOSITION OF PLUTONIUM IN THE RAT. J. Katz, M. H. Weeks, W. D. Oakley. Radiation Research 2, 166-70 (1955).

Administration of Zr citrate 30 minutes after Pu(IV) citrate was twice as effective as Ca di-Na ethylenediaminetetraacetate in preventing skeletal deposition of Pu.

536. EXTRACTION OF TETRA- AND HEXAVALENT ACTINIDES FROM HYDROCHLORIC ACID BY TRI-n-OCTYLAMINE IN XYLENE. W. K. Keder. J. Inorg. Nucl. Chem. 24, 561-70 (1962).

Distribution data for extraction of the tetra- and hexavalent actinides from hydrochloric acid by tri-n-octylamine (TOA) solutions are reported, and the spectra of the extracted complex ion species are shown. The hexachloro complexes of the tetravalent metals are found to extract.

537. ACTINIDE NITRATE SPECIES IN XYLENE SOLUTIONS OF TRI-n-OCTYLAMINE. W. E. Keder, J. L. Ryan, A. S. Wilson. J. Inorg. Nucl. Chem. 20, 131-9 (1961).

The ionic species of the tetra- and hexavalent actinides that are extracted from nitric acid by tri-n-octylamine-xylene solutions were identified as $M(NO_3)_6^{-2}$ and $MO_2(NO_3)_3^-$, respectively.

538. THE EXTRACTION OF ACTINIDE ELEMENTS FROM NITRIC ACID SOLUTIONS BY TRI-n-OCTYLAMINE. W. E. Keder, J. C. Sheppard, A. S. Wilson. J. Inorg. Nucl. Chem. 12, 327-35 (1960).

The extraction of six actinide elements from nitric acid solutions by tri-n-octylamine in xylene has been investigated, and the effects of acid and amine concentrations have been measured. The extraction of Np(IV) and Pu(IV) was found to be much greater than any of the other oxidation states studied.

539. ISOTOPIC EXCHANGE BETWEEN Pu(III) AND Pu(IV). T. K. Keenan. J. Am. Chem. Soc. 78, 2339 (May 20, 1956).

Studies were initiated on the exchange reaction between Pu^{+3} and Pu^{+4} in $HClO_4$ solutions at 0°C. The rate of exchange in 0.5 formal is approximated by the equation $R = k{:}\ (III)(IV)$, where $k' = 1.10 \pm 0.10 \times 10^4$ liter/mol/min.

540. RECOVERY OF PLUTONIUM FROM FLUORIDE SLAGS. N. J. Keen, H. A. Alwyn. British Pat. 865,699, Feb. 13, 1959.

The slag is dissolved in HNO_3 containing Al^{3+}, and the Pu is extracted with tributyl phosphate. Recovery is about 97%.

541. CONFINEMENT TECHNIQUES AND HANDLING OF PLUTONIUM IN RESEARCH LABORATORIES. A. R. Keene. In TID-7577, Symposium on Technical Methods in Health Physics, Risö, Denmark, May 25-28, 1959, pp. 83-101.

Confinement techniques depend on quantity and physical form. Other factors to be considered in safe handling include pyrophoricity of Pu, required ventilation, use of strippable coatings, and survey techniques.

542. SEPARATION OF THE ELEMENTS ACTINIUM TO AMERICIUM BY PAPER CHROMATOGRAPHY. C. Keller. J. Chromatog. 7, 535-51 (1962).

Alcohol-acid mixtures of various concentrations are used as eluents. Assay, autoradiographic, and colorimetric techniques are used to determine the position of the ions on the paper chromatograms.

543. ELECTRONIC CONTROLLED-POTENTIAL COULOMETRIC TITRATOR FOR PLUTONIUM ANALYSIS. M. T. Kelley, H. C. Jones, D. J. Fisher. Talanta 6, 185-8 (1960).

A stabilized, printed-circuit, operational-difference amplifier, combined with a transistor current amplifier, is used to control the potential of the electrode at which the desired reaction occurs. Part of the electrolysis current is integrated by a stabilized, printed-circuit, operational amplifier connected as a time integrator.

544. MICROANALYTICAL TECHNIQUES IN THE ANALYSIS OF HIGHLY RADIOACTIVE MATERIALS. M. T. Kelley. Microchem. J., Symp. Ser. 2, 939-57 (1962).

Microanalytical techniques are employed that can be adapted to remote control. Liquid samples of 5-7000 μl are measured with a servoactuated pipettor with a precision of 0.3%. Coulometry is suited to remote application for the detection of U, Cu, Ni, Pu, and Np. Polarography is useful for determining reducible ions. U in sub γ amounts is detected by extraction, followed by fluorimetry. Spectrophotometry, flame photometry, and emission spectroscopy are also used.

545. A PLUTONIUM MONITOR. D. A. Kelley, D. Taylor. In "Plutonium 1960," Cleaver-Hume Press Ltd., London, 1961, pp. 237-245.

A completely transistorized unit was developed which can detect the 17-keV X-rays emitted with 4% of the alphas from Pu^{239}; 0.02 μc was detected through 1 cm of raw beefsteak (to simulate human tissue) with a signal-to-noise ratio of 40 to 1.

546. HANDLING ALPHA-ACTIVE PYROPHORIC MATERIALS. L. Kelman, W. D. Wilkinson, A. B. Shuck, R. C. Goertz. Nucleonics 14 (3) 61-5; (4) 65-71; (5) 77-82 (1956).

Fabricating Pu (the most difficult to handle of these metals) is complicated by combustible fine particles and sometimes by intense gamma and beta activities. Hazard evaluation points to several handling methods. Useful knowledge is presented for analyst handling of pyrophoric Pu compounds.

547. SOLVENT EXTRACTION BEHAVIOUR OF PLUTONIUM CUPFERRATES. I. Pu(III) CUPFERRATE. D. M. Kemp. AERE-R-4119, July 1962.

The solvent extraction of Pu(III) cupferrate from 1M chloride and 0.15M perchlorate media was investigated. Pu(III) is oxidized by cupferron, even in the presence of reducing agents such as hydroxyl amine. Solubility products and extraction constants were calculated.

548. ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. VIII. THE CARRIER CONCENTRATION METHOD. L. F. Kendall. HW-25206, Aug. 15, 1952.

This method takes advantage of the difference in volatilities of the matrix oxide and the impurity oxides. The more refractory matrix (plutonium oxide) is not volatilized appreciably during exposure, while the impurities are carried into arc stream by means of the gallium oxide carrier.

549. THE STRIPPING OF URANIUM AND PLUTONIUM FROM DEGRADED TBP/OK. J. Kennedy. AERE-M-1064, Aug 1962.

Complete removal of Pu is effected with a reducing strip consisting of 0.01M uranous ion in 0.3M HNO_3.

550. NUCLEAR SAFETY IN PLUTONIUM METAL DISSOLUTION. N. Ketzlach. HW-55707 (Del.), April 11, 1958.

Experimental evidence as well as theoretical considerations are presented which indicate that a Pu metal-Pu solution system can be more reactive than either one alone.

551. EXTRACTION OF PLUTONIUM(IV) FROM NITRIC ACID SOLUTIONS BY OXYGEN CONTAINING AGENTS. V. A. Khalkin, P. N. Palei, A. A. Nemodruk. Radiokhimya 5, 215-22 (1963).

Studies of Pu(IV) extract from nitric acid solutions with ethers, ketones, acetates, and aldehydes showed that of the agents studied, diethyl ether is the most effective. With 5.0 and 3.4M nitric acid in aqueous and organic, respectively, at equilibrium, the distribution coefficient was 11.5.

552. OBTAINING OF SOLID LAYERS OF URANIUM, NEPTUNIUM, PLUTONIUM, AND AMERICIUM BY ELECTROLYTIC DEPOSITION. G. I. Khlebnikov, E. P. Dergunov. Atomnaya Energ. 4, 376-7 (1958). Translated in AEC-tr-3497.

A technique for preparing tough thin layers is presented. Conditions of electrolysis are described, as well as preparation of the electrolyte and treatment of the target.

553. DETERMINATION OF PLUTONIUM-239 BODY BURDEN USING GAMMA SPECTROMETRY WITH PROPORTIONAL COUNTERS. H. Kiefer, R. Maushart. In "Whole-Body Counting," International Atomic Energy Agency, Vienna, 1962, pp. 289-293.

The construction of a part-body monitor consisting of eight large-area proportional counters is described. The assembly has almost 4π geometry for samples of up to 40 cm in length and 11 cm in diameter. For in vivo measurements, the subject places his arm into the counter, while for urine analysis the liquid is measured without concentration in special plastic bottles.

554. ISOTOPIC EXCHANGE BETWEEN Pu(III) AND Pu(IV). T. K. Keenan. J. Phys. Chem. 61, 1117-20 (1957).

Rates of exchange between Pu(III) and Pu(IV) in aqueous perchlorate solutions are discussed. Separation techniques involving the use of TBP were developed for certain Pu concentrations.

555. THE REPROCESSING OF URANIUM-MOLYBDENUM NUCLEAR FUELS. T. Kikindai. Energie Nucl. 5, 372 (July-August 1963).

Processes and difficulties encountered in reprocessing U-Mo fuel for the recovery of Pu and U are reviewed. The low solubility of Mo in acid medium causes most of the difficulty.

556. ANALYSIS OF RADIOACTIVE FALLOUT OF THE ATOMIC-BOMB EXPLOSION ON BIKINI. K. Kimura. Radioisotopes 3, No. 1, 1-4, 1954.

The radioactive fallout was found to contain 55.2, 7.0, 11.8, and 26.0% of CaO, MgO, CO_2, and H_2O, respectively, the chief constituent being $Ca(OH)_2$. Al, Fe, and Si were also present. Its specific activity measured on April 23, 1954, was 0.37 mc/g. Radioactive nuclei identified by March 26 were Sr^{89}, Sr^{90}, Y^{90}, Y^{91}, Zr^{95}, Nb^{95m}, Nb^{95}, Ru^{103}, Ru^{106}, Rh^{106}, Te^{129m}, Te^{129}, Te^{132}, I^{131}, I^{132}, Ba^{140}, La^{140}, Ce^{141}, Ce^{144}, Pr^{143}, Pr^{144}, Nb^{147}, Pm^{147}, S^{35}, Ca^{45}, U^{237}, and Pu^{239}.

557. ISOLATION OF Pu^{239} FROM URANIUM OXIDE IRRADIATED IN JRR-1. K. Kimura. T. Ishimori, K. Naito, H. Umezawa, K. Watanabe. J. Atomic Energy Soc. Japan 2, 328-36 (June 1960).

Natural or depleted U targets were irradiated for 30-60 hr with 10^{14} n/sec·cm^2. After cooling for a few months, the Pu^{239} was isolated by TBP extraction and further purified by anion exchange.

558. ANALYSIS FOR Pu(III) AND Pu(IV) ON A TRACER SCALE. E. L. King. CN-2726, Dec. 1, 1944.

Niobium oxide, thorium pyrophosphate, and zirconium phenyl arsonate were found to carry Pu^{+4} to the extent of 90, 96, and 98%, respectively, in the presence of Pu^{+3}. Conditions are discussed. Where sulfate is necessary, one must guard against the rapid oxidation of Pu^{+3} by O_2 in the air. The use of zirconium phenyl arsonate has been investigated quite thoroughly.

559. A SPECTROPHOTOMETRIC DETERMINATION OF MULTIMICROGRAM AMOUNTS OF PLUTONIUM. G. L. King. LA-1197, Jan. 26, 1951.

The red Pu-alizarinsulfonate color is developed in solutions of pH of about three in the presence of a formic acid-sodium formate buffer, and the resulting absorption is measured at 530 mu. Analysis of solutions in the range of 25-150 μg gave a standard deviation of ±0.92% for determined Pu content.

560. TRANSURANIC ELEMENTS: ANALYTICAL CHEMISTRY. P. L. Kirk, C. J. Rodden. TID-5002, 1947.

Procedures and equipment for the determination of Pu under all conditions and in many mixtures are discussed in detail. The effect of other transuranic elements on analytical determinations is given.

561. A SELECTED LIST OF REFERENCES OF PLUTONIUM HAZARDS. PART II. A. W. Klement, Jr., Compiler. WASH-1002, Feb. 25, 1958.

A bibliography of 140 references to books, technical reports, and journal articles on the hazards of Pu is presented.

562. SPHERICAL AND CYLINDRICAL PLUTONIUM CRITICAL MASSES. F. A. Kloverstrom. UCRL-4957, Sept. 1957.

Experiments to determine critical masses of S-phase Pu cylinders of three diameters and two spherical Pu cores with cores are reported.

562A. SOLUBILITY OF EDTA IN AMMONIA AND HYDROCHLORIC ACID AND ITS REACTION WITH URANIUM(IV) AND PLUTONIUM(IV). A. E. Klygin, I. D. Smirnova, N. A. Nikolskaya. Zhur. Neorg. Khim. 4, 2766-71 (1959).

Since the solubility of H_4R has a minimum of 3.05×10^{-4} moles/liter at pH = 1.6, this is the optimum pH for preparing H_4R from its Na salt. The H_4R complexes increase in stability in the order $\mathrm{Th\,IV}^4 < \mathrm{U\ IV} < \mathrm{Pu\ IV}$.

563. SPECTROPHOTOMETRIC INVESTIGATION OF Pu(IV) COMPLEXING WITH ARSENAZO. A. E. Klygin, V. K. Pavlova. Zhur. Neorg. Khim. 6, 1050-4 (May 1961).

Spectrophotometric determination of Pu(IV) may be carried out in solutions of 10^{-4} mole of arsenazo and from 2 to 5 pH. Complex formation constants are also given.

564. ACTINIDE METAL PRODUCTION. J. B. Knighton. U. S. Pat. 3,109,731, Nov. 5, 1963.

The reduction of oxides with Mg metal in a metal chloride flux was studied for optimum conditions.

565. EXTRACTION OF URANIUM, PLUTONIUM, RUTHENIUM, AND ZIRCONIUM WITH TRI-ISO-OCTYLAMINE. W. Knoch. Z. Naturforsch., 16a, 525-7 (1961). Translated in AEC-tr-5197.

A correlation is made between partition coefficients, liquid concentration, and complex type in the solvent extraction of Pu, Ru, U, and Zr using tri-iso-octylamine.

566. SEPARATING PLUTONIUM FROM A METATHESIZED BISMUTH PHOSPHATE CARRIER. W. J. Knox, S. G. Thompson. U. S. Pat. 2,938,768, May 31, 1960.

The precipitate containing Bi and Pu was slurred with 0.1M HNO_3 and centrifuged. The Pu is found in the supernatant. Recovery is about 97%. The process is applicable to U and Np also.

567. SOME LIQUID PHASE DIFFUSION COEFFICIENTS OF URANIUM AND PLUTONIUM. W. Knoch. J. Chem. Eng. Data 9(1), 60-1 (1964).

Diffusion coefficients of Pu(IV) and U(VI) in HNO_3 solutions, and some actual solvent-extraction systems like Bu_3PO_4-kerosene and triisooctylamine-xylene, were detected. Activation energies for the U diffusion are calculated.

568. MICRODETERMINATION OF PLUTONIUM. C. W. Koch. National Nuclear Energy Series, Div. IV, Vol. 14B, Transuranium Elements, Pt. II, 1337-8, McGraw-Hill Book Co., Inc., New York, 1949.

Pu sulfate solutions, approximately 5 mg Pu/ml, are reduced to Pu^{3+} in a small Jones reductor and are titrated to Pu^{4+} with 0.0045M ceric sulfate and ferrous o-phen-anthroline as indicator. The reproducibility on 2.5-mg samples is ±0.25%.

569. ELECTRODEPOSITION OF THE ACTINIDE ELEMENTS. R. Ko. HW-41025, Jan. 23, 1956.

Th, U, Np, Pu, Am, and Cr have been deposited at metal cathodes by the electrolytic formation of base. The electrolysis has been made in various acid solutions containing ammonium formate. The presence of formate reduces the hydrogen ion formation at the anode and makes quantitative precipitation of metal hydroxides at the cathode possible.

570. ELECTRODEPOSITION OF THE ACTINIDE ELEMENTS. R. Ko. Nucleonics 15, No. 1, 72 (1957).

This paper concerns the preparation of thin films by electrodeposition methods. Experimental techniques are described for Th, U, Np, Pu, Am, and Cm.

571. ELECTROLYTIC OXIDATION OF PLUTONIUM. R. Ko. Anal. Chem. 28, 274 (Feb 1956).

Quantitative electrodeposition of Pu is described in which Pu(VI) is reduced cathodically in a KOH solution and deposited as $Pu(OH)_4$; the metal must be in the sexivalent state. Electrolytic oxidation is to +6 state. Applicability is to μg and mg quantities of Pu.

572. THE USE OF ANION EXCHANGE IN THE SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN PLUTONIUM. R. Ko. HW-57873, Oct. 20, 1958.

This analysis is for Al, Ca, Cr, Fe, Mg, Mn, Ni, and Zn in Pu by anion exchange and spectrographic analysis.

573. SPECTROCHEMICAL ANALYSIS OF HIGH PURITY PLUTONIUM FOR METAL IMPURITIES USING ANION EXCHANGE. R. Ko. HW-69199, April 11, 1961.

Pu was separated by adsorption of the nitrate complex on Dowex 1. The metal impurities were not absorbed. The residue from evaporation of the solution was analyzed by d-c arc excitation. Fe, Ni, Cr, Ca, and Mn were determined below 1 ppm. A coefficient of variation of ±14% at the 2-ppm level was estimated.

574. DETERMINATION OF ZIRCONIUM IN PLUTONIUM BY ION EXCHANGE AND SPECTROGRAPHY. R. Ko. Appl. Spectroscopy 13, 10-11 (1959).

The Pu is separated by retaining the Pu as a nitrate complex on Dowex-1 anion exchange resin. The effluent and wash containing the Zr was evaporated to a small volume and analyzed for Zr by graphite-spark excitation using Co as the internal standard. Concentrations as low as 20 ppm of Zr have been determined with a precision of ±17 (95% C.L.) for a single determination.

575. TRILAURYLAMINE EXTRACTION: SPECTROGRAPHIC DETERMINATION OF TANTALUM IN PLUTONIUM. R. Ko. HW-79738, Dec 1963.

Pu is dissolved in HCl and separated by trilaurylamine extraction from dissolved and undissolved Ta. HF is added to dissolve all the Ta. Using a Nb internal standard, the Ta is determined by graphite-spark spectrographic analysis. Relative standard deviation was ±7% for 50 ppm in 50 mg of Pu.

576. MICRODETERMINATION OF PLUTONIUM. C. W. Koch. National Nuclear Energy Series, Div. IV, Vol. 14B, Transuranium Elements, Part 2, 1337-8. McGraw-Hill Book Co., Inc., New York, 1949.

577. THE INFLUENCE OF THE MATRIX ON THE CARRIER DISTILLATION OF METALLIC IMPURITIES FROM PuO_2 AND U_3O_8. R. J. Kofoed, Jr. HW-54032, April 10, 1958.

The preparation of high-purity PuO_2 spectrographic standards is described and compared with standards based on U_3O_8.

578. SEPARATION OF TRANSURANIC ELEMENTS FROM RARE EARTH COMPOUNDS. T. P. Kohman. U. S. Pat. 3,009,767, Nov. 21, 1961.

A process is described for separating Np and Pu values from rare earths and alkaline earth fission products present on a solid, mixed, actinide carrier [Th or U(IV) oxalate, or fluoride-fission product carrier LaF_3, CeF_3, SrF_2, CaF_2, YF_3, La oxalate, cerous oxalate, Sr oxalate, Ca oxalate, or Y oxalate] by extraction of the actinides at elevated temperatures with a solution of ammonium fluorides and/or ammonium oxalate.

579. PREPARATION OF PLUTONIUM. M. Kolodney. U. S. Pat. 2,893,928, April 7, 1959.

A method is presented for electrodeposition of Pu from fused mixtures of Pu halides and halides of alkali metals at temperatures of 600-850°C in a nonoxidizing atmosphere. The higher temperature is used for the powder form. A refractory crucible of Ta is sometimes used as the cathode.

580. STRUCTURE AND THERMAL EXPANSION OF δ AND η PLUTONIUM. S. T. Konobeevskii, N. T. Chebotarev. Atomnaya Energ. 10, 50-7 (Jan 1961).

In all examined structures, thermal expansion anisotropy results from the weakening of four covalent bonds and irregular distributions in interatomic distances in crystalline lattices.

581. TRACER EXPERIMENTS ON THE SOLVENT EXTRACTION OF NEPTUNIUM AND PLUTONIUM. J. Kooi. JENER-Pub-11, 1956.

Three solvents were studied: diethyl ether, dibutyl carbitol, and methyl isobutyl ketone. The extractions were made from nitric acid solution.

582. AN IMPROVED METHOD FOR THE DETERMINATION OF TRACE QUANTITIES OF PLUTONIUM IN AQUEOUS MEDIA. I. METHOD AND PROCEDURE. J. Kooi, U. Hollstein. Health Phys. 8, 41-8 (Feb 1962).

Improvements were made on a recently published method for determining tracer amounts of Pu in aqueous media. Essentially, the method consists of a bismuth phosphate co-precipitation, and an extraction with cupferron as a complexing agent.

582A. AN IMPROVED METHOD FOR THE DETERMINATION OF TRACE QUANTITIES OF PLUTONIUM IN AQUEOUS MEDIA. II. INTERFERENCE OF IRON, CALCIUM, URANIUM, AND CHLORINE; APPLICATION TO SEA WATER AND URINE. U. Hollstein, A. H. M. Hoogma, J. Kooi. Health Phys. 8, 49-59 (Feb 1962).

The applicability of the method for determining Pu in aqueous media by solvent extraction with cupferron was extended. Modifications required for application of the method to urine and sea water are given.

583. SUPERFINE AND ISOTOPIC STRUCTURE IN THE SPECTRUM OF PLUTONIUM. L. A. Korostyliva. Optika i Spektroskopiya 14, 177-83 (1963). Translated in Opt. Spectry. (USSR), 14: 93-95 (Feb 1963).

Some 118 lines were measured in the 3900-6900 A region of the isotopic shift in a Pu^{239}-Pu^{240} mixture. Of these lines, 51 had only isotopic structure and 67 had both isotopic and hyperfine structure. The spectrum shifts were also given.

584. PROCEDURE FOR THE DETERMINATION OF PLUTONIUM IN URINE. M. E. Koshland, L. M. Brown, M. J. Cook, D. E. Koshland, Jr. MonN-92, May 21, 1946.

The procedure involves the direct precipitation of $CaCrO_4$ from urine, oxidation of the oxalate to dissolve the precipitate, a precipitation of $La(OH)_3$ to separate from Ca, and a final LaF_3 precipitation. The yield is about 92 ± 2.6%.

585. DEVELOPMENT OF RADIOCHEMICAL ANALYTICAL PROCEDURES FOR PLUTONIUM. II. RECOMMENDATIONS FOR A STANDARD PROCEDURE AND TESTS IN URANYL SOLUTIONS. D. E. Koshland, Jr. CN-2041, Jan. 8, 1945.

The development of procedures for the analysis of total Pu in solution and the percentage of Pu(VI) in solution are described.

586. SEPARATION OF TRANSURANIUM ELEMENTS BY SOLVENT EXTRACTION WITH ALKYLPHOSPHORIC ACIDS. V. N. Kosyakov, E. S. Gureev, G. N. Yakovlev. Transplutonium Element Symposium Held at Argonne National Laboratory, May 1963, CONF-72-2.

The alkylphosphoric acids were studied as extractants for transuranium elements of different valences. The mechanism of extraction has a cation-exchange nature, and these cations are affected differently by acid and extractant ion concentrations, as well as diluent nature and concentration of complexing anion in aqueous phase.

587. SQUARE-WAVE POLAROGRAPHY OF PLUTONIUM. K. Koyama. Anal. Chem. 32, 523-4 (1960).

Pu in concentrations below 10^{-5}M is easily determined in hydrochloric or nitric acid medium with a stationary Pt electrode. Half-wave potentials agree with accepted values. The method has higher sensitivity than conventional methods.

588. CHEMICAL ANALYSES OF PLUTONIUM AND PLUTONIUM ALLOYS: METHODS AND TECHNIQUES. R. Kraft, C. Wensrich, A. Langhorst, Jr. UCRL-6873, April 11, 1962.

References (355) are given to books, periodicals, and reports published from 1950 to July 1961.

589. SOLUTION CHEMISTRY OF PLUTONIUM. K. A. Kraus. In TID-7683, Plutonium Chemistry Symposium, Chicago, Illinois, Feb. 18, 1963, pp. 30-35.

Among the properties of Pu solution discussed are the carrier properties, disproportionation reactions, hydrolysis, solvent extraction, complexes, and ion-exchange properties.

590. STUDIES ON POLYMERIC Pu(IV); DEPOLYMERIZATION OF POLYMERIC Pu(IV) SOLUTIONS IN NITRIC ACID. K. A. Kraus. CN-3399, June 30, 1945.

It was noted that in general depolymerization follows a first-order law. General aspects of the spectrophotometric analysis of two-component systems are discussed.

591. CHEMISTRY OF AQUEOUS URANIUM(V) SOLUTIONS. I. ANALOGY WITH Np AND Pu(V). K. A. Kraus, F. Nelson, G. L. Johnson. J. Am. Chem. Soc. 71, 2510-2517 (1949).

Methods of preparation, acid-stability range-oxidation potentials, and diffusion coefficient of U(V) are given.

592. ABSORPTION OF NEGATIVELY CHARGED COMPLEXES BY CATION EXCHANGERS. K. A. Kraus, D. C. Michelson, F. Nelson. J. Am. Chem. Soc. 81, 3204 (1959).

Strong absorption of some negatively charged complexes by cation-exchange resins is demonstrated. The use of anionic complexes for separation on cation exchangers is illustrated.

593. HYDROLYTIC BEHAVIOR OF METAL IONS. I. THE ACID CONSTANTS OF URANIUM(IV) AND PLUTONIUM(IV). K. A. Kraus, F. Nelson. J. Am. Chem. Soc. 72, 3901-6 (1950).

The acid constant of Pu^{+4}($K_m = 0.025$, $\mu = 0.5$) was found to be almost identical with, though slightly smaller, than that of U^{+4}. The spectral data, the quantitative hydrolytic data, and the observation that the chloride complexes of U(IV) and Pu(IV) are weak, are confirmatory evidence of the hypothesis that these elements are members of a "rare-earth-like" series.

594. THE QUANTITATIVE SEPARATION OF PLUTONIUM FROM VARIOUS IONS BY ANION EXCHANGE. I. K. Kressin, G. R. Waterbury. Anal. Chem. 34, 1598-1601 (1962).

Pu is absorbed on Dowex 1 x 2 resin from 7.2M nitric acid, while other ions are washed from the column with the same acid. The Pu is eluted with 0.36M HCl-0.01M HF mixture. Recovery averaged 100%.

595. PROPERTIES OF NITRIC SOLUTIONS OF PLUTONYL. II. FORMATION OF PLUTONYL COMPLEXES IN NITRIC SOLUTIONS. M. E. Krevinskaya, V. D. Nikolskii, B. G. Pojarskii. Radiokhimiya 1, 554-61 (1959). Translated in CEA-tr-R-1514.

Plutonyl absorption spectra were studied as a function of nitric acid concentration to determine the composition of complexing anions.

596. PLUTONIUM IN MAN AND HIS ENVIRONMENT. P. W. Krey, D. Bogen, E. French. Nature 195, 263-5 (July 21, 1962).

Distribution in man and animals from fallout is described. Average ground-level air concentration on 0.14 dpm/100m^3 was collected in the spring of 1959 at Washington, D. C. Pu analyses were also made on human tissues from the New York metropolitan area, and on steer tissues and beef.

597. MASS SPECTROMETRIC DETERMINATION OF THE YIELD OF FISSION FRAGMENTS OF HEAVY NUCLEI AND PRODUCTS OF CERTAIN OTHER NUCLEAR REACTIONS. L. Krizhanskii. Tr. Tashkentsk. Konf. po Mirnomu Ispolz. At. Energii, Akad. Nauk Uz. SSR 1, 222-7 (1961). Translated in AEC-tr-6398, pp. 288-295.

Fragment formation from Pu^{239} fission is determined by using a PuO_2 mold exposed to neutron beam. After cooling and dissolution in HNO_3^+HF, radiochemical and mass spectrometric determinations were made.

598. BEHAVIOR OF ETHYLENEDIAMINETETRAACETIC ACID IN ACID SOLUTIONS AND REACTION WITH U(IV). I. VERIFICATION OF Pu(IV)-EDTA STABILITY CONSTANTS. N. N. Krot, N. P. Ermolaev, A. D. Gelman. Zh. Neorg. Khim. 7, 2054-60 (Sept 1962).

Spectrophotometric studies were made of U(VI) complexing in acid medium. The obtained data were used for varification of Pu(IV)-EDTA stability constants.

599. THE DEVELOPMENT OF CHELATING AGENTS FOR ENHANCING THE URINARY EXCRETION OF STRONTIUM. H. Kroll, K. Wunschel, T. Wolf. TID-14373, Annual Report, February 1, 1961-November 30, 1961.

Triethylenetriamine hexacetic acid (TTHA) was synthesized and tested for promoting Pu excretion in rats.

600. CRITICAL MASS STUDIES OF PLUTONIUM SOLUTIONS. F. E. Kruesi, J. O. Erkman, D. D. Lanning. HW-24514 (Del.), May 19, 1952.

Critical mass studies were made for a variety of sizes of spheres and cylinders. The effects of displacement of hydrogen and the addition of poisons were measured. The absorption cross section for Pu^{240} is 925 ± 200 barns, and the minimum critical mass of Pu^{239} in water is 510 grams at a concentration of 33 grams/liter.

601. ADVANCES IN ANALYTICAL CHEMISTRY OF U, Th, AND Pu. V. I. Kuznetsov, S. B. Savvin, V. A. Mikhailov. Uspekhi Khim. 29, 525-67 (1960).

The chemical methods for determining U, Th, and Pu are reviewed, and the analytical reactions with these elements are discussed.

602. COPRECIPITATION OF Pu(IV) WITH ORGANIC COPRECIPITANTS. V. I. Kuznetsov, T. G. Akimova. Atomnaya Energ. 8, 148-150 (1960). Translated in JPRS-5150.

603. THE EXTRACTION OF COLORED COMPLEXES FORMED BY REAGENTS OF THE ARSENAZO-THORON GROUP. V. I. Kuznetsov, S. B. Savvin. Doklady Akad. Nauk S.S.S.R. 140, 125-8 (1961).

The detection of U, Th, Pu, Al, and other elements by reagents of the arsenazo-thoron group by extraction and photometry is described. The method for detecting the above elements in dilute solutions by precipitation and subsequent extraction is also described.

604. A RECORDER FOR RADIOACTIVE AEROSOLS. J. Labeyrie, M. Pelle. J. Phys. Radium 14, 477-80 (July-August-September 1953).

This apparatus gives a continuous measure of the α, β^-, and γ radioactivity carried by the aerosols present in the air.

605. ABSORPTIOMETRY WITH POLYCHROMATIC X-RAYS. M. C. Lambert. HW-SA-1972, Sept. 1, 1960.

A description of the principles of absorptiometry with polychromatic X-rays and a short historical account of the instrumentation development are given. Typical applications of the method to the analysis of single and mixed solutes and to the analysis of metal alloys are described.

606. X-RAY PHOTOMETRIC ASSAY OF PLUTONIUM IN METAL CASTINGS. M. C. Lambert. HW-26499 (Del.), Dec. 12, 1952.

Aspects of the X-ray photometric method, such as sample size, concentration, high-precision measurement technique, correction for extraneous substances, and comparison of chemical and X-ray results, are presented.

607. QUARTERLY STATUS REPORT ON LAMPRE PROGRAM FOR PERIOD ENDING NOVEMBER 20, 1961. Los Alamos Scientific Lab., LAMS-2647, Dec 1961.

A process for reprocessing UC-PuC buttons was developed which comprises the following steps: dissolution in 13M HNO_3-0.05M HF, dilution, extraction of Pu and U into TBP, and selective stripping of Pu and U. A processing method was devised for recovery of U and Pu from Na paste blankets or paste cores.

608. QUARTERLY STATUS REPORT ON LAMPRE PROGRAM FOR PERIOD ENDING FEBRUARY 20, 1962. Los Alamos Scientific Lab., LAMS-2681, March 1962.

Results are presented of runs on the separation of Pu from fission products by volatilization and liquidation.

609. DETERMINATION OF PLUTONIUM IN HUMAN URINE. W. H. Langham. MDDC-1555.

An account is given of the collection, ashing, and analysis of a 24-hour urine sample for Pu.

610. PREPARATION OF HIGH PURITY NEPTUNIUM ON MULTIGRAM SCALE. P. M. Lantz, W. J. Martin, G. W. Parker. ORNL-2642, Jan. 22, 1959.

Np was recovered in high yield from a solution containing 60 times as much Th as Np, plus traces of U, Pu, and metal corrosion products.

611. A SENSITIVE CONTINUAL MONITOR FOR THE DETECTION OF AIRBORNE PLUTONIUM. A. C. Lapsley. DP-201, Feb 1957.

An air impactor is used to collect the Pu and to reject the background alpha activity in the air. The threshold for detection is between one-half and twice the maximum permissible biological concentration of Pu.

612. DETERMINATION OF URANIUM AND PLUTONIUM IN URANIUM-PLUTONIUM-FISSION ELEMENT ALLOYS. R. P. Larsen and C. A. Seils, Jr. Anal. Chem. 32, 1863-6 (1960).

A tributyl phosphate-hydrochloric acid extraction system was used to separate U and Pu from certain fission elements and from each other prior to X-ray spectrometric determination of the U and spectrophotometric determination of Pu as the nitrate complex. Coprecipitation of Pu(III) with lanthanum fluoride was also used to separate the Pu. The coefficient of variations for both Pu and U was better than 1%.

613. PLUTONIUM FROM SWEDISH REACTOR FUEL. A. Larsson. Tek. Tidskr. 93(28), 709-13 (1963).

The Pu in HNO_3 solution is extracted by Bu_3PO_4. The Pu(IV) is reduced to Pu(III) with Fe sulfamate and then re-extracted to the aqueous phase, which is freed from the fission products. The purification is continued so that a purifying factor of 2×10^6 for U and 2×10^8 for Pu is attained.

614. PREPARATION BY ELECTRO-SPRAYING OF THIN URANIUM, PLUTONIUM AND BORON SAMPLES FOR NEUTRON CROSS SECTION MEASUREMENTS IN 4π GEOMETRY. K. F. Lauer, V. Verdingh. Nucl. Instr. Methods 21, 161-166 (Jan 1963).

Preparation of thin films of U, B, and Pu by electrospraying is described. Samples with a diameter up to 5 cm may be prepared.

615. PuQFUA, AN IBM 704 CODE FOR COMPUTING PLUTONIUM BODY BURDENS. J. N. P. Lawrence. Health Phys. 8, 61-6 (1962).

PuQFUA is an IBM 704 Fortran program, written primarily for Pu^{239}, which calculates from urinalyses the Pu body burden in microcuries and the percentage of the maximum permissible body burden.

616. REACTOR FUEL PROCESSING. S. Lawroski, Ed. A Quarterly Technical Progress Review, Vol. 5, No. 1 (Jan 1962).

Included are sections concerned with commercial aspects of fuel processing, aqueous and nonaqueous processing, waste disposal, production of U, Th, Pu, and their compounds, and fuel processing safety.

617. SURVEY OF SEPARATION PROCESSES FOR IRRADIATED FUELS. S. Lawroski, H. H. Hyman. Progress in Nuclear Energy-Series 3: Process Chemistry, 43-53, McGraw-Hill Book Co., Inc., New York, 1956.

618. PLUTONIUM PEROXIDE PRECIPITATION. J. A. Leary, A. N. Morgan, W. J. Maraman. Ind. Eng. Chem. 51, 27-31 (1959).

Precipitation of the hexagonal structure of plutonium peroxide is an excellent concentration and purification step in Pu metal preparation. Formation of the undesirable cubic structure is avoided by proper control of process variables.

619. ANALYTICAL PROCEDURES FOR THE METAL FABRICATION PROCESS. X. DETERMINATION OF CARBON IN PLUTONIUM METAL BY A MICROCOMBUSTION METHOD. M. B. Leboeuf. HW-20212, Feb. 20, 1951.

This paper describes a microcombustion method originally developed for steel analysis, with refinements of the apparatus and method.

620. ANALYTICAL PROCEDURES FOR THE PLUTONIUM METAL FABRICATION PROCESS. XII. DETERMINATION OF SULFIDE IN PLUTONIUM. M. B. Leboeuf. HW-25005, July 25, 1952.

The metal is dissolved in hot HCl to evolve hydrogen sulfide. The gas is swept out by N and absorbed in dilute zinc acetate. The sulfide is then treated with a reagent composed of ferric chloride and p-ammodimethyl aniline in dilute hydrochloric acid to form methylene blue. The optical density of resultant solution is read at 668 mμ.

621. SEPARATION OF PLUTONIUM AND URANIUM BY SOLVENT EXTRACTION. M. Lefort (In French). Bull. Soc. Chem. France 3, 616-17 (March 1962).

A method is described which permits rapid yields higher than 80% of Pu traces from a large quantity of U. The extraction of Pu takes place in a mixture of tributyl phosphate and 1,1,1-trifluoro-3, 2-thenoyl acetone.

622. MECHANICAL CHARACTERISTICS AND PERFORMANCE OF LIQUID-LIQUID EXTRACTION COLUMNS (thesis). Hugh Roberts Lehman. UCRL-1558, Nov 1951.

Representative mass-transfer data for extraction of Pu(IV)-TTA chelate have been obtained in pulsed and packed columns of 1-in. diameter.

623. A NEW PROCEDURE FOR PLUTONIUM URINALYSIS. S. C. Leidt, S. M. Sanders, Jr. AECU-4414, July 1959.

Urine is evaporated and wet-ashed, and the Pu is separated from macroquantities of other inorganic ions by anion exchange and then electrodeposited on a stainless-steel disk. Recovery for the method is about 74% for a 0.88-d/m/1.5 liter spike. Time for analysis is about 2 days.

624. ABSORPTION SPECTRA OF CRYSTALS OF PLUTONIUM SALTS. A. M. Leontovich. Optika I Spektroskopiya 2(6), 695-703 (1957). Translated in AEC-tr-3716.

The absorption spectra of the crystals of some Pu salts at temperatures +20 to -170°C have been investigated. The spectra of the salts have a rather different intensity and structure, and greatly differ from the spectra of corresponding solutions.

625. DETERMINATION OF THE CONVERSION RATIO OF THE EXPERIMENTAL BREEDER REACTOR BY RADIOCHEMICAL METHODS. "PRODUCTION AND CONSUMPTION PATTERNS IN THE EBR." M. Levenson. Argonne National Laboratory. ANL-5095, Dec. 23, 1953.

An evaluation of breeding in the EBR by chemical methods is described. The method for determining Pu production and U consumption involved accurate measurement of neutron spectra, cross sections for fission and capture, and resulting values of α for U^{235} and Pu^{239}. A net conversion ratio of one was obtained. Of the total Pu produced, 63.9% occurred in the outer blanket, and 35.7% in the inner blanket.

626. PLUTONIUM - HALF-LIFE FOR β^- DECAY. C. A. Levine, A. Ghiorso, G. T. Seaborg. Phys. Rev. 77, 296 (1950).

Pu^{238} (half-life 90 years) can presumably be derived from U^{238} by a double β^- mechanism. The half-life of U^{238} for this reaction is 76×10^{18} years, and 2 neutrons are probably emitted.

627. THE OCCURRENCE OF PLUTONIUM IN NATURE. C. A. Levine, G. T. Seaborg. AECD-3043 (UCRL-1025), Nov. 29, 1950, and J. Am. Chem. Soc. 73, 3278-83 (1951).

Plutonium has been chemically separated from seven different ores. All Pu was Pu^{239}, probably formed by U^{238} capturing neutrons formed by (α, n) reaction on light elements in ores and cosmic rays. The lower concentration in some ores is due to neutron-absorbing impurities. Concentration varied from one part in 10^{11} to 10^{15} parts ore.

628. LITERATURE SURVEY OF DRY FLUORIDE METHODS FOR SEPARATING URANIUM, PLUTONIUM, AND FISSION PRODUCTS. R. E. Leuze. CF-50-5-113, May 11, 1950.

629. SEPARATION OF PLUTONIUM FROM IRRADIATED URANIUM, AND FRACTIONATION OF LONG-LIVED FISSION PRODUCTS BY ION EXCHANGE. R. O. Lingjaerde. JENER-48, April 1957.

Ru^{106}, Sr^{90}, Cs^{137} plus U are separated from Pu, Ce^{144}, and Pm^{147} on a cation-exchange resin, the Ce^{144} and Pm^{147} then being separated from Pu by use of an anion-exchange resin.

630. A 3-STAGED METHOD FOR THE RECOVERY OF PLUTONIUM FROM IRRADIATED FUELS. R. O. Lingjaerde. JENER-55, June 24, 1958.

The process involves three stages: (1) Extraction of U + Pu with TBP, (2) separation of Zr/Nb from the TBP phase on a silica-gel column, and (3) separating Pu from U (still in the TBP phase) on a Dowex-50 column.

631. HIGH LEVEL ALPHA AIR MONITOR. G. D. Linsey, R. A. Harvey. HW-49561, June 14, 1957.

This report describes a high-level alpha air monitor giving an alarm at 10,000 mpc of airborne Pu in 3 minutes or 1,000 mpc in 30 minutes.

632. SEPARATION OF PLUTONIUM FROM IRRADIATED URANIUM AND FRACTIONATION OF LONG-LIVED FISSION PRODUCTS BY ION EXCHANGE. R. O. Lingjaerde. JENER-48, April 1957.

The long-lived Ru^{106}, Sr^{80}, and Cs^{137} plus U are separated from Pu, Ce^{144}, and Pm^{147} on a cation-exchange resin. The latter two are removed from Pu on an anion-exchange resin.

633. SPECTROPHOTOMETRIC STUDIES OF PLUTONIUM(IV) COMPLEXING WITH NITRIC ACID SOLUTIONS. L. V. Lipis, B. G. Pozharskii, V. V. Fomin. Zhur. Strukt. Khim. 1, 135-44 (July-August 1960).

Pu(IV) complexing in nitric acid solution was studied. The composition of complex ions is described by the formula $[Pu(NO_3)_n(H_2O)_{8-n}]^{4-n}$, where n = 1 to 6.

634. ABSORPTION SPECTRA OF TRIVALENT PLUTONIUM HALIDES. L. V. Lipis, B. G. Pozharskii. Zhur. Neorg. Khim. 5, 2162-6 (Oct 1960).

The absorption spectra of trivalent plutonium chloride, fluoride, and bromide were studied at ~10,000 to 3400 A. Absorption spectra at -195.8 exhibited spallated lines in the crystalline field, forming a number of components (from 2 to 12) depending on the type of compound.

635. SPECTROPHOTOMETRIC STUDY OF THE FORMATION OF THE SULFATE COMPLEXES OF Pu(IV) IN NITRIC ACID SOLUTIONS. A. A. Lipovskii, N. B. Chernyavskaya. Zhur. Neorg. Khim. 4, 244-7, 1959.

The changes in absorption spectra of Pu(IV) in 1.5N HNO_3 were determined in relation to the K_2SO_4 concentration. The rapid changes in absorption bands indicate the greater stability of the SO_4 complexes.

636. PRODUCTS RESULTING FROM IRRADIATION OF URANIUM. J. E. Littlechild. Royal Inst. Chem. Journ. Vol. 81, pp. 433-45, 1957.

This is the text of a lecture covering irradiation of U, fission products produced, extraction and purification of Pu, treatment of depleted U, and disposal of highly active effluents.

637. TOTAL BODY GAMMA-RAY COUNTING OF PLUTONIUM-239. R. D. Lloyd, C. W. Mays, W. Fisher, R. Hintze. In COO-225, Research in Radiobiology, Annual Report of Work in Progress on the Chronic Toxicity Program, March 1962, pp. 76-83.

The infrequent gamma-rays produced in the radioactive decay of Pu^{239} have been used to assay the Pu content of living dogs. The γ-rays at 100 and 380 keV can be employed in the measurement of Pu^{239} in the skeleton.

638. REACTOR PHYSICS PRIMER. E. H. Lockwood. HW-51856, Nov. 15, 1957.

An introduction for the beginner to the fundamentals of nuclear physics is presented, dealing generally with the reactor physics aspects of the processes used at Hanford in the production of Pu.

639. SOME PHYSICAL PROPERTIES OF METALLIC PLUTONIUM. W. B. H. Lord. Nature 173, 534-5 (March 1954).

Transition temperatures, densities, and coefficients of thermal expansion of the five allotropic modifications of metallic Pu are given.

640. SOME PHYSICAL PROPERTIES OF PLUTONIUM. W. B. H. Lord. Met. Rev. 8, 277-310 (1963).

The main physical properties of Pu are reviewed, and some of the theoretical problems set by its behavior are outlined.

641. THE DEVELOPMENT OF HANDLING TECHNIQUES FOR THE STUDY OF PLUTONIUM METAL. W. B. H. Lord, M. B. Waldron. J. Inst. Metals 86, 385-92 (1958).

Metallurgical studies of Pu are complicated by its fissionable nature, its extreme radioactive toxicity, and its ready oxidation to form a fine powder. The relative merits of various handling arrangements are discussed.

642. THE ANALYSIS OF PLUTONIUM-241 IN URINE. J. J. D. Ludwick. HW-64170, March 23, 1960.

The method is based on the recovery of Pu from electrodeposited disc and subsequent extraction of the Pu from 1N HCl into a liquid scintillator containing dibutyl phosphate. Samples containing as little as 2.2×10^{-6} μc of Pu^{241} may be detected. This represents 3.5% of the maximum permissible dose 90 days after personnel exposure.

643. DEMONSTRATION AND MEASUREMENT OF Pu^{239} IN PLANTS. F. Ludwieg. Atompraxis 8, 57-8 (Feb 1962).

Detailed instructions are given for determining Pu^{239} in plant foods (as a result of fallout), and feedstuffs produced from them.

644. THE MEASUREMENT OF OXYGEN TO METAL RATIO IN SOLID SOLUTION OF URANIUM AND PLUTONIUM DIOXIDES. W. L. Lyon. GEAP-4271, May 31, 1963.

A survey was made of methods potentially useful for determination of oxygen-to-metal ratios in mixed oxides of U and Pu. A gravimetric method was selected, based upon an equilibrium weight at 700°C in dry hydrogen. It was shown to be capable of measurement of O/(Pu + U) ratios in 20% PuO_2-80% UO_2 pellets with a standard duration of ±0.001. This ratio can be of importance in the sintering process as well as in fabrication, thermal conductivity, degree of fission-gas retention during irradiation, plasticity, and other properties of mixed oxide fuel.

645. DISSOLUTION AND FUEL DEPLETION ANALYSIS OF PWR CORE 1 BLANKET RODS. D. MacDonald, G. C. Owens. In WAPD-BT-26, Bettis Technical Review, Reactor Technology, Sept 1962, pp. 63-70.

Eight blanket fuel rods removed during the second refueling of PWR core 1 were chemically dissolved and analyzed to determine the concentrations of U, Pu, and Cs^{137} and the isotopic composition of the U and Pu. The analytical methods used are described.

646. THE APPLICATION OF X-RAY FLUORESCENCE METHODS TO THE IN-LINE DETERMINATION OF URANIUM AND PLUTONIUM CONCENTRATIONS. K. J. H. Mackay, R. P. Thorne. DEG-Report-134, April 26, 1960.

X-ray generators and radioisotopes are compared as sources of fluorescent X-radiation. The relative merits of crystal spectrometry and electronic discrimination were considered in detail. It was concluded that radioactive sources and electronic discrimination offered the most promise in detecting U and Pu.

647. EXTRACTION OF PLUTONIUM BY HEXONE FROM AQUEOUS SOLUTIONS CONTAINING NITRIC ACID. D. R. MacKenzie. CRC-487 (AECL-1787), Dec. 4, 1951.

From neutral or slightly basic solutions, Pu^{4+} is not extracted, while Pu^{6+} is easily extracted.

648. EXTRACTION OF PLUTONIUM FROM AQUEOUS SOLUTION. A. G. Maddock, A. H. Booth. Nucl. Eng. 3, 360 (1958).

Pu can be extracted from an aqueous solution containing oxalate by treating the solution with cupferron to form a complex of Pu and cupferron, which is extracted with a water-immiscible organic solvent.

649. SEPARATION OF PLUTONIUM. A. G. Maddock, F. Smith. U. S. Pat. 2,901,313, Aug. 25, 1959.

A method for separating Pu from U and fission products is presented. A nitrate solution containing Pu(VI), U, and fission products is treated with a water-insoluble fluoride. The residual solution is treated with a reducing agent for Pu and an insoluble fluoride to absorb the Pu. Subsequently the absorbed Pu is treated with at least one of a group consisting of Al, ferric, or manganous nitrate.

650. A GAMMA ABSORPTIOMETER FOR LABORATORY ANALYSIS OF THE HEAVY ELEMENTS. W. L. Maddox, M. T. Kelley. Talanta 3, 172-6 (Dec 1959).

Construction of a simple gamma absorptiometer employing a small Am^{241} source for the determination of U or Pu in relatively pure solutions is described. The instrument yields a recorded voltage directly proportional to absorbance.

651. SEPARATION AND DETERMINATION OF PLUTONIUM IN URANIUM-FISSION PRODUCT MIXTURES. W. J. Maeck, G. L. Booman, M. E. Kussy, J. E. Rein. Anal. Chem. 32, 1874-6 (1960).

Pu is oxidized to +6 with permanganate and quantitatively extracted as a tetra alkyl ammonium trinitrate complex into methyl isobutyl ketone from an acid-deficient aluminum nitrate salting agent. Pu is stripped from organic phase and reduced to +3 with hydroxylamine-iron(II) mixture. It is then oxidized to +4 with nitrite and quantitatively extracted with thenoyltrifluoroacetone-xylene.

652. SPECTROPHOTOMETRIC EXTRACTION METHOD SPECIFIC FOR PLUTONIUM. W. J. Maeck, M. E. Kussy, G. L. Booman, J. E. Rein. Anal. Chem. 33, 998-1001 (1961).

Following Ag(II) oxidation, mg quantities of Pu(VI) as the tetrapropylamminium trinitrate complex are extracted quantitatively into methyl isobutyl ketone from an acid-deficient aluminum nitrate salting solution. Though U and Np are extracted also, their spectra are sufficiently discrete so that a direct absorbance measurement of the separated organic phase can be made for Pu in the presence of the other two actinides.

653. SIMULTANEOUS MASS SPECTROMETRIC DETERMINATION OF PLUTONIUM AND URANIUM BY THE ISOTOPE DILUTION TECHNIQUE: APPLICATION TO POWER REACTOR FUEL DISSOLVER SAMPLES. W. J. Maeck, M. E. Kussy, T. D. Morgan, J. E. Rein. In TID-7615, Proceedings of Annual Nuclear Materials Management Meeting, Denver, Colorado, June 15, 1961, pp. 78-89.

A rapid-separation method is described. It is based on a batch, liquid-liquid extraction system, which provides a U-Pu separated fraction free of fission products and diverse ions, including Am and Cm, and with a controllable U-to-Pu ratio so that both elements are determinable with a single loading of the filament.

654. SEPARATION OF NEPTUNIUM FROM PLUTONIUM, URANIUM, AND FISSION PRODUCTS. L. B. Magnusson. U. S. Pat. 2,830,066, April 8, 1958.

Np is extracted from an acidic aqueous solution of Np^{4+} by chelation with fluorinated -diketones, such as 3-(2-thenoyl)-1,1,1-trifluoroacetone. Separation of Np from Pu depends on reduction of Pu to the trivalent state by a reducing agent, such as aqueous SO_2 solution.

655. BERKELIUM AND CALIFORNIUM ISOTOPES PRODUCED IN NEUTRON IRRADIATION OF PLUTONIUM. L. B. Magnusson, M. H. Studier, P. R. Fields, C. M. Stevens, J. F. Mech, A. M. Friedman, H. Diamond, J. R. Huizenga. Phys. Rev. 96, 1576-82 (1954).

Cf isotopes of mass numbers 249, 250, 251, and 252 have been identified by mass-spectrometric analysis. The half-lives and alpha energies of the isotopes are given. The beta-particle energy of Bk^{249} is 80 ± 20 keV. The spontaneous fission half-lives of Cf^{250} and Cf^{252} is $1.5 \pm 0.5 \times 10^4$ and 66 ± 10 years, respectively. The neutron-capture cross sections (Materials Testing Reactor at Arco, Idaho) for Bk^{249}, Cf^{250}, Cf^{251}, and Cf^{252} are given.

656. PRODUCTION OF PLUTONIUM METAL. E. W. Mainland, D. A. Orth, E. L. Field, J. H. Radke. Ind. Eng. Chem. 53, 685-94 (1961).

The operation of the three final steps in the Purex process in producing Pu metal are summarized.

657. CRYSTAL CHEMISTRY OF SIMPLE COMPOUNDS OF URANIUM, THORIUM, PLUTONIUM AND NEPTUNIUM. E. S. MaKarov. Moscow, Izd-vo AN SSSR, 1958.

Published crystal data up to 1957 on the actinide elements, and simple compounds of these elements are compiled. The atomic radii of actinides in crystals are also considered.

658. DETERMINATION OF Am^{241} CONTENT IN PLUTONIUM BY SPECTROSCOPY OF α AND γ RAYS. J. Malj, H. Kurzwellova, R. Lenk, I. Peka. Collection Czeck. Chem. Commun. 251, 1383-90 (1960).

A method is described and results are given from a measurement of traces of Am^{241} in Pu. The work indicates a possibility of determining Am^{241} in a minimum quantity of 0.02% by alpha spectroscopy, and in quantities of 0.001% by gamma spectroscopy.

659. SEPARATION OF NEPTUNIUM AND PLUTONIUM CHLORIDES BY A FLOW DISTILLATION METHOD. J. G. Malm. ANL-4382, Oct. 19, 1949.

Np can be efficiently freed of Pu by forming and distilling the chloride in a stream of N and CCl_4 at 500-600°C. The Pu concentration in the product can be reduced to as little as 1 ppm.

660. PREPARATION OF FILMS FOR α-COUNTING. C. J. Mandleberg. In AERE-C/R-861, Thin Films; a Symposium Sponsored by the Chemistry Division, A.E.R.E., Harwell and Held at Buckland House, 14-15th March, 1951. F. Hudswell and C. J. Mandleberg, Eds., Feb. 15, 1952.

A solution containing Pu is placed on sulfonated polystyrene disks, and the ions are allowed to exchange. The liquid is then removed.

661. THE SOLUBILITY OF PuF_4 IN NITRIC ACID SOLUTIONS AND THE SOLUBILITY PRODUCT OF PuF_4. C. J. Mandleberg, K. E. Francis. AERE-C/R-865, Feb. 20, 1952.

The solubility of PuF_4 in nitric acid solutions in the range of 0-3.19M has been determined and the solubility product calculated.

662. CURIUM-244 AND CURIUM-245. W. M. Manning, M. H. Studier, H. Diamond, P. R. Fields. U. S. Pat. 2,859,095, Nov. 4, 1958.

The Cm isotopes produced by the neutron irradiation of Pu^{239} have been separated by ion exchange.

663. PLANT-SCALE CONCENTRATION OF Am AND Pu(III) USING TRIBUTYL PHOSPHATE. W. J. Maraman, A. J. Beaumont, R. S. Day, R. S. Winchester. LA-1699, Aug. 2, 1954.

Am^{+3} and Pu^{+3} have been recovered on a plant scale by extraction with tributyl phosphate from slag and crucible and other recovery solutions. Process losses were 0.03% Am and 0.01% Pu.

664. CALCIUM OXALATE CARRIER PRECIPITATION OF Pu. W. J. Maraman, A. J. Beaumont, E. L. Christensen, A. V. Hendrickson, J. A. Hermann, K. W. R. Johnson, L. J. Mullins, R. S. Winchester. LA-1692, Feb. 25, 1954.

A plant-scale procedure is described for concentrating Pu and Am in slag and crucible (metal-reduction residues) and other recovery solutions by a calcium oxalate carrier precipitation.

665. SOME EXPERIMENTS ON THE PRECIPITATION OF PLUTONIUM COMPOUNDS FROM TRIBUTYL PHOSPHATE SOLUTIONS. W. J. Maraman, L. J. Mullins. LA-2050, June 11, 1956.

The feasibility of precipitating Pu^{+4} compounds from 35% TBP in Gulf BT solution has been surveyed.

666. ANION EXCHANGE OF METAL COMPLEXES. XIII. THE ACTINIDE (III)-NITRATE SYSTEM. Y. Marcus, M. Givon. IA-783, Oct 1962, and J. Inorg. Nucl. Chem. 25, 1457-1463 (1963).

Distribution data were obtained for several actinides in lithium nitrate solutions and were found to be comparable to the lanthanide group, so that no group separation is possible; but within the actinide group an efficient separation of Am and Cm was found. Extraction behavior by long chain amines followed that of lanthanides, but in reverse atomic-number order.

667. INVESTIGATION OF THE COMPLEX FORMATION OF QUADRIVALENT PLUTONIUM WITH THE SULFATE ION BY A CATION-EXCHANGE METHOD. I. N. Marov, M. K. Chmutova. Zh. Neorg. Khim. 6, 2654-62 (1961).

668. THE SOLVENT EXTRACTION OF PLUTONIUM AND AMERICIUM BY TRI-n-OCTYLPHOSPHINE OXIDE. B. Martin, D. W. Ockenden, J. K. Foreman. J. Inorg. Nucl. Chem. 21, 96-107 (Dec 1961).

The extraction of Pu in three valency states (III, IV, and V) from HNO_3 and HCl of various strengths and the properties of the Pu(IV and VI) TOPO complexes extracted into the organic phase from nitric acid are described.

669. THE PLANT SEPARATION OF PLUTONIUM AT HANFORD. O. Martin. Atomkern Energie, 10, 494 (1957).

670. THE PREPARATION OF A SOLUTION OF PLUTONIUM(V) IN 0.2M HNO_3. T. L. Markin, H. A. C. McKay. J. Inorg. Nucl. Chem. 7, 298-299 (1958).

A solution containing Pu in the pentavalent state only has been prepared by mixing equal concentrations of Pu(III) and Pu(VI) in 0.2M HNO_3 in the presence of dibutyl phosphate in benzene.

671. TYPES OF ACIDIC ORGANOPHOSPHORUS EXTRACTANTS AND THEIR APPLICATIONS TO TRANSURANIC SEPARATIONS. G. W. Mason, D. F. Peppard. Nucl. Sci. Eng. 17, 247-51 (1963).

Certain applications of acidic organophosphorus extractants to transuranic separations are given. The mono-2-ethyl hexyl phosphoric acid in toluene versus HCl system was used in effecting mutual M(III), M(IV), and M(VI) separations. The extractant dependency approximates first power.

672. LIMITING CRITICAL CONCENTRATIONS FOR A PLUTONIUM NITRATE SOLUTION AND FOR A URANIUM-235 SOLUTION. R. H. Masterson, V. I. Meely, T. J. Powell. In HW-73116, Physics Research Quarterly Report, January-March 1962. April 16, 1962, pp. 108-120.

Experiments were conducted to determine the limiting concentration (the concentration for which K_{2D} = unity) of aqueous plutonium nitrate and uranyl fluoride solutions.

673. THE LIMITING CRITICAL CONCENTRATIONS FOR Pu^{239} AND U^{235} IN AQUEOUS SOLUTIONS. R. H. Masterson, J. D. White, T. J. Powell. HW-77089, March 27, 1963.

Measurements were made with $Pu(NO_3)_4$ and 93.15% enriched UO_2F_2 in the PCTR reactor. The value for Pu^{239} was 8.0 ± 0.3, and that for U^{235} was 12.05 ± 0.03 g/l.

674. PROCESS OF REDUCING PLUTONIUM TO TETRAVALENT (TRIVALENT) STATE. D. F. Mastick. U. S. Pat. 2,936,213, May 10, 1960.

The reduction of Pu(VI) and (IV) to the trivalent state in strong nitric acid can be accomplished with hydrogen peroxide. The trivalent state can be stabilized as a precipitate by including oxalate or fluoride ions in the solution. The process is adoptable to separate Pu from U and impurities by adjusting the sequence of insoluble anion additions and the hydrogen peroxide addition.

675. PROCESS FOR PURIFYING PLUTONIUM. D. F. Mastick, E. P. Wigner. U.S. Pat. 2,833,800, May 6, 1958.

An acidic aqueous solution of higher-valent Pu and hexavalent U is treated with a soluble iodide to obtain the Pu in the plus-three oxidation state while leaving the U in the hexavalent state, adding a soluble oxalate, such as oxalic acid, and separating the insoluble plus the Pu trioxalate from the solution.

676. ORNL METAL RECOVERY PLANT PROCESSING CLEMENTINE REACTOR FUEL ELEMENTS. J. L. Matherne. ORNL-1941 (Del.), Sept. 7, 1955.

The processing of Los Alamos Fast Breeder Reactor fuel elements to recover Pu and Am is described.

677. THE DETERMINATION OF THE SPECIFIC ACTIVITY OF PILE-PRODUCED PLUTONIUM BY MEASUREMENT OF Pu^{238} CONTENT. G. M. Matlack, R. K. Zeigler. In TID-7629, Analytical Chemistry in Nuclear Reactor Technology, Fifth Conference, Gatlinburg, Tennessee, October 10-12, 1961, pp. 185-192.

Control analyses by counting methods in Pu recovery plants require a knowledge of the specific activity of each batch of Pu processed. Because there is a linear relationship between Pu^{238} content and specific activity, it is possible to determine the specific activity by a method based on alpha pulse-height analysis for the Pu^{238}.

678. KINETICS OF REACTION BETWEEN PLUTONIUM(III) AND CHLORINE IN CHLORIDE SOLUTIONS. A. S. G. Mazumdar, K. P. R. Pisharody, R. N. Singh. J. Inorg. Nucl. Chem. 24, 1617-21 (1962).

Oxidation of Pu(III) to (IV) by Cl was shown to follow an apparently first-order rate law with respect to both the reactants, when other conditions are constant. The rate was independent of acidity, but markedly dependent on the chloride in concentration. This dependence has been shown to be due to a specific effect of chloride ions rather than to a general effect of anions or ionic strength.

679. HOMOGENEOUS REACTOR PROJECT QUARTERLY PROGRESS REPORT FOR PERIOD ENDING OCTOBER 31, 1955. H. F. McDuffie, V. K. Hill, Compilers. ORNL-2004 (Del.), Jan. 31, 1956.

The leaching of Pu from irradiated ThO_2 is discussed, as well as studies of Pu chemistry, including the adsorption of Pu on metals.

680. NONDESTRUCTIVE ASSAY OF NUCLEAR FUELS. Quarterly Report No. 1, August 15, 1963-November 15, 1963. W. J. McGonnagle. TID-19821, Nov. 22, 1963.

A research program is being conducted to determine the feasibility of using a modified Compton magnetic spectrometer for analyzing the U and Pu content of cold and irradiated nuclear fuels, and to devise methods and techniques for determining the special material content of scrap.

681. CHEMICAL AND PHYSICAL REACTIONS OF RADIOACTIVE LIQUID WASTES WITH SOILS. J. R. McHenry, D. W. Rhodes, P. P. Rowe. In TID-7517, Sanitary Engineering Aspects of the Atomic Energy Industry. A Seminar Sponsored by the AEC and the Public Health Service, Held at the Robert A. Taft Engineering Center, Cincinnati, Ohio, December 6-9, 1955, pp. 170-190.

A representative soil sample from the Hanford project consists of sand 86.7, silt 11.9, and clay 1.4%. Adsorption of Pu and Cs is least sensitive to pH.

682. DETECTION OF PLUTONIUM BY IRRADIATION IN THE PILE. H. A. C. McKay. AERE-C/M-23, 1957.

The discussion is based on half-lives and fission cross sections. The detection of Pu^{239} by neutron irradiation of the sample in the pile and subsequent measurement of activity depend on complete prior removal of U.

683. MIXER-SETTLER RUNS TO STUDY URANIUM(IV) AS A REDUCTANT IN URANIUM/PLUTONIUM SEPARATION. H. A. C. McKay, R. J. W Streeton, A. G. Wain. AERE-R-4381, Sept 1963.

The U(IV) was hydrazine-stabilized and was used for Pu-U separation in the TBP process. Partition coefficients were measured and information obtained on the kinetics of the U(IV)-Pu(IV) reaction.

684. THE VOLATILIZATION OF PLUTONIUM FROM NEUTRON IRRADIATED URANIUM. D. E. McKenzie. Can. J. Chem. 34, 515-22 (1956).

The volatilization of Pu from neutron-irradiated U was examined at 1540, 1650, and 1769°C. Experimental and calculated results indicate that Pu in neutron-irradiated U follows the ideal solution laws.

685. EXTRACTION OF PLUTONIUM FROM NEUTRON-IRRADIATED URANIUM BY MOLTEN SILVER. D. E. McKenzie. CRC-585 (AECL-787), Jan 1955.

Pu is extracted from molten U by molten Ag, and U is recycled to a nuclear reactor.

686. THE EXTRACTION OF PLUTONIUM FROM PLUTONIUM-ALUMINUM ALLOYS BY MOLTEN BISMUTH. D. E. McKenzie, J. E. Fletcher, T. Bruce. CRC-639 (AECL-314), April 1956.

An equal volume of bismuth extracts 78% of the Pu and 93% of the Am and the majority of the fission product Ce. From the distribution data given, a possible process is discussed.

687. THE ABSORPTION SPECTRUM OF PuF_3 (THESIS). R. D. McLaughlin. UCRL-2440, Dec 1953.

The absorption spectrum of PuF_3 was measured over the region 2500 to 9000 A.

688. SURVEY OF PLUTONIUM SPECTRUM DATA. J. R. McNally, Jr. ORNL-2154, 1956.

In this review, the spectral lines of Pu, as reported in 19 references, are tabulated in the 2426-7221 A regions.

689. A SURVEY OF PLUTONIUM SPECTRUM DATA. J. R. McNally, Jr. ORNL-2154 (Rev.), Aug. 10, 1960.

Some 9865 lines are listed, covering the wave-length range from 964 to 2426 A.

690. THE USE OF HIGH-SPEED COMPUTERS IN THE PREPARATION AND REPORTING OF ROUTINE RADIOCHEMICAL PLUTONIUM ANALYSES. P. McWilliams and G. M. Matlack. In TID-7629, Analytical Chemistry in Nuclear Reactor Technology, Fifth Conference, Gatlinburg, Tennessee, Oct. 10-12, 1961, pp. 193-208.

Three Fortran programs of considerable utility in calculation, preparation of final reports, and preparation of monthly summary reports were used successfully for more than a year on IBM-704 computers and associated equipment.

691. DETERMINATION OF RADIOACTIVE ZIRCONIUM IN FISSIONED PLUTONIUM. J. W T. Meadows, G. M. Matlack. Anal. Chem. 32, 1607-10 (1960).

Radioisotopes of Zr are determined by multiple precipitations of zirconium p-bromomandelate. Te, the only interfering fission product, is removed by precipitation of carrier Te with SO_2. This also serves to reduce Pu to Pu(III), which is not precipitated by the reagent. Four determinations may be made in 5 hours with a coefficient of variation of 2%.

692. RADIOCHEMICAL DETERMINATION OF RUTHENIUM BY SOLVENT EXTRACTION AND PREPARATION OF CARRIER-FREE RUTHENIUM ACTIVITY. J. W. T. Meadows, G. M. Matlack. Anal. Chem. 34, 89-91 (1962).

Essentially quantitative extraction of ruthenium tetroxide by carbon tetrachloride from aqueous solutions at pH 4 forms the basis for a method for determining fission product Ru in neutron-irradiated Pu.

693. FISSION PRODUCT ANALYSIS OF FAST REACTOR PLUTONIUM FUELS. J. W. T. Meadows, G. M. Matlack, G. B. Nelson. Talanta 6, 246-53 (1960).

From the results of a testing program in which classical analytical methods originally developed for U fuel alloys were used to determine fission products, it was shown that adequate decontamination from Pu and Am was not achieved. New and modified methods were developed for Zr, Nb, Ru, Rh, Ce, Nd, and Pr. Methods for 14 fission products were tested or devised for use in the analysis of Pu fuels.

694. X-RAY EMISSION ANALYSIS OF PLUTONIUM AND URANIUM COMPOUND MIXTURES. O. Menis, E. K. Halteman, E. E. Garcia. Anal. Chem. 35, 1049-52 (1963).

The characteristic lines of U and Pu with thorium as an internal standard were measured after fusion of the refractory mixtures with potassium pyrosulfate. A casting technique was developed. The relative standard deviation of the method is less than 0.4%.

695. NUCLEAR EFFECTS OBSERVED IN X-RAY SPECTRA. J. J. Merrill, J. W. M. DuMond. In Proceedings of the International Conference on Nuclear Structure, Kingston, Canada, August 29-September 3, 1960, Toronto, University of Toronto Press and Amsterdam, North Holland Publishing Co., 1960, pp. 637-639.

Measurements of L X-ray spectra of heavy elements W, Pt, Bi, Th, U, Np, Pu, and Am with a precision, two-crystal spectrometer are described. The increased width of some lines for high atomic number are explained.

696. PRECISION MEASUREMENT OF L X-RAY WAVELENGTHS AND LINE WIDTHS FOR $74 \leqq Z \leqq 95$ AND THEIR INTERPRETATION IN TERMS OF NUCLEAR PERTURBATIONS. J. J. Merrill, J. W. M. DuMond. Ann. Phys. (N.Y.), 14, 166-228 (1961).

Techniques for the precision measurement of L X-ray lines for U, Np, Pu, and Am using the two-crystal spectrometer are discussed. These data were used in computing the binding energies of the electrons for these atoms.

697. PRECIPITATION CONDITIONS FOR TRACE AMOUNTS OF PLUTONIUM WITH MANDELIC ACID AS PRECIPITATION REAGENT. E. Merz. Z. Anal. Chem. 166, 417-22 (1959).

Mandelic acid and its derivatives were found to be suitable precipitation reagents for Pu(III) and Pu(IV) from weak acid solution with Y carrier. Pu^{+4} is precipitated almost quantitatively from strong acid solutions with Zr carrier, while Pu(III) remains in solution. It is also possible to separate Pu(IV) from U in weakly acid solutions.

698. THE ANALYTICAL CHEMISTRY OF PLUTONIUM. C. F. Metz. Anal. Chem. 29, 1748-56 (Dec 1957).

This paper reviews the general chemistry of Pu and applications of its analytical chemistry. Pu may be separated from impurities by precipitation, ion exchange, and solvent extraction. It may be determined by potentiometric titration, spectrophotometric, and radiochemical methods.

699. ANALYTICAL CHEMICAL LABORATORIES FOR HANDLING OF PLUTONIUM. C. F. Metz. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 681, United Nations, New York, 1958.

The analytical laboratories at Los Alamos equipped with dry- and gloveboxes are described, and the philosophy of handling Pu is presented.

700. THE CHEMICAL ANALYSIS OF PLUTONIUM-RICH FAST REACTOR FUEL. C. F. Metz, G. M. Matlack, G. R. Waterbury. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva 1958, 28, 441, United Nations, New York, 1958.

Included are potentiometric methods for Pu assay, radiochemical methods for gamma-counting of Am in Pu, and methods of separating Pu for measurement by alpha-counting techniques.

701. ANALYTICAL LABORATORIES FOR THE HANDLING OF PLUTONIUM. C. F. Metz, G. R. Waterbury. Talanta 6, 149-153 (1960).

The safe handling of gram quantities of Pu in analytical procedures is discussed. The gloveboxes are so designed that all required analytical operations can be undertaken with safety to the analyst.

702. ABSORPTION SPECTRA OF PLUTONIUM AND IMPURITY IONS IN NITRIC ACID SOLUTION. M. N. Meyers. HW-44744, July 31, 1956.

Absorption spectra of Pu III, IV, VI, and Pu IV peroxy complex were made. The effects of various ions and reagents on extraction coefficients were observed and determined. Temperature had little effect on measurements. However, acidity caused peak shifting, as well as some changes in extinction coefficients.

703. TANDEM MAGNETIC ANALYZER MASS SPECTROMETER SYSTEMS. E. J. Michael, D. J. Marshall. Conf-74-16. From 11th Annual Conference on Mass Spectrometry and Allied Topics, San Francisco, May 1963.

Tandem mass spectrometer systems with 12-in. radius, 90° sector magnetic analyzers were built for the precise analysis of low-abundance isotopes of U and Pu.

704. THE EXTRACTION OF URANIUM AND PLUTONIUM CHLORIDES FROM FUSED SALT MEDIA. M. Mielcarski, M. Taube. Nukleonika 7, 595-7 (1962).

The salt phase contained the eutectic mixture of KCl-CuCl at molar ratio of 1:2 and one other chloride, Cs, UCl_6, $PuCl_6$ or $PuCl_3$. Diphenyl was used as diluent, along with tri-n-acetylamine, tributyl phosphate, or di-n-butyl phosphoric acid. The extraction of Pu was small, the distribution ratio of U being higher by one order of magnitude.

705. A GAMMA ABSORPTOMETER FOR THE IN-LINE DETERMINATION OF PLUTONIUM OR URANIUM. D. G. Miller, R. E. Connally. HW-36788, June 1, 1955.

This instrument utilizes Tm^{170} as the source of gamma photons, a stainless-steel container fitted with fluorothene windows as the sample cell, a lead-lined ionization chamber as the detector, and a modified Beckman micromicroammeter as the current-measuring system.

706. REDUCTION OF PLUTONIUM TO Pu^{+3} BY SODIUM DITHIONITE IN POTASSIUM CARBONATE. D. R. Miller, H. R. Hoekstra. U.S. Pat. 2,864,665.

Pu values are reduced in an alkaline aqueous medium to the trivalent state by means of sodium dithionite. A separation from normally associated contaminants is also made by performing a metathesis of the lanthanum fluoride carrier precipitate in the presence of 0.2M sodium dithionite.

707. THE QUANTITATIVE SEPARATION OF AMERICIUM FROM PLUTONIUM AND URANIUM. H. W. Miller. HW-22267, Oct. 15, 1951.

Ceric ion is used to oxidize Pu to the plutonyl ion. The addition of HF causes partial precipitation of ceric fluoride which carries the Am. Treatment of the supernatant with hydroxylamine results in reduction of Ce^{+4} and Pu(VI) and their precipitation and entrainment with the insoluble cerous fluoride.

708. AMERICIUM-241 AS A PHOTON SOURCE FOR THE GAMMA ABSORPTIOMETRIC TECHNIQUE. D. G. Miller. HW-39971, Nov. 17, 1955.

The use of Am^{241} as a photon source for determining U and Pu are discussed. The major disadvantage of Am^{241} is its low photon intensity. Other possible photon sources are discussed.

709. THE OXIDATION OF PLUTONIUM TO THE PLUTONYL STATE. H. W. Miller, R. J. Brouns. HW-17266, March 22, 1950.

An ozonization procedure was selected as the most satisfactory method. The plutonyl solution prepared in 2M HCl was stable with no appreciable reduction, in the absence of impurities, for 20 days. Moisture must be scrupulously excluded from the ozonator.

710. THE PREPARATION OF THIN FILMS OF PLUTONIUM BY ELECTRODEPOSITION. H. W. Miller, R. J. Brouns. HW-17265, March 22, 1950.

The method consists of electrolytic reduction of Pu(VI) to Pu(IV) in 1N KOH. The Pu(IV) precipitates as hydrous oxide on Pt cathode. Impurities that precipitate should be absent. Other factors that cause low yields are incomplete oxidation to Pu(VI) and low alkalinity. Yields of 95-99% were obtained for up to 7 μg of Pu for a 2-hr plating time at room temperature.

711. QUANTITATIVE ELECTRODEPOSITION OF PLUTONIUM. H. W. Miller, R. J. Brouns. Anal. Chem. 24, 536-8 (1952).

A procedure is presented for preparing thin, uniform, and adherent films of Pu on Pt disks. Quantitites of Pu, from tracer amounts to 9 mg, have been deposited completely from solution in 2 hours.

712. ANALYTICAL PROCEDURES OF THE INDUSTRIAL HYGIENE GROUP. M. F. Milligan, E. E. Campbell, B. C. Eutsler, J. McClelland, W. D. Moss. LA-1858 (2nd Ed.), Aug 1958.

A collection of analytical methods used by the Industrial Hygiene Group at the Los Alamos Scientific Laboratory is presented.

713. A BRIEF INVESTIGATION OF THE PARTITION OF PLUTONIUM AND URANIUM BY URANIUM PEROXIDE PRECIPITATION. G. F. Mills, H. B. Whetsel. K-1064, Sept. 25, 1953.

Experience has shown that, by proper attention to the conditions of precipitation, uranium peroxide could be obtained as a microcrystalline, rapid-settling, easily-filterable precipitate. The semiempirical approach was without success in removing Pu.

714. ANALYSIS IN REACTOR RESEARCH AT HARWELL. G. W. C. Milner. In TID-7568, Analytical Chemistry in Nuclear Reactor Technology. Part 1. Specific Applications of Diverse Methods of Chemical Analysis. Second Conference, Gatlinburg, Tennessee, September 29 through October 1, 1958, pp. 24-35.

This is an analysis of binary systems containing Pu with Al, Fe, or U over the composition range of 1 to 99%. Pu was removed by ion exchange; Pu^{+4} in 7M HNO_3 was retained on anion-exchange resin.

715. VOLUMETRIC DETERMINATION OF PLUTONIUM WITH ETHYLENEDIAMINE-TETRA-ACETIC ACID. G. W. C. Milner, J. L. Woodhead. Analyst 81, 427-429 (1956).

After Pu metal has been dissolved in hydrochloric acid, the procedure consists in adding an excess of a standard EDTA solution (0.01M) and then weak ammonium hydroxide to adjust the pH to a value of 2.5. The amount of EDTA in excess of that required to form a complex with the Pu completely is next determined by titrating with a standard thorium nitrate solution (0.01M) to the color change of a mixed indicator consisting of alizarin red S and methylene blue.

716. ELECTROCHEMICAL ANALYSIS IN ATOMIC ENERGY. G. W. C. Milner. In "Analytical Chemistry 1962," Elsevier Publishing Company, New York, 1963, pp. 255-262.

Development of electrochemical methods for the determination of Fe, Np, Pu, and U is reported. Methods for determining each element are discussed separately.

717. CONTROLLED-POTENTIAL COULOMETRY IN METALLURGICAL ANALYSIS. G. W. C. Milner, J. W. Edwards. AERE-R-3772, July 1961.

Principle and technique of the instrument are discussed and its suitability in metallurgical analysis was investigated. Its application to the determination of Pu is given.

718. PLUTONIUM NITRATE SHIPPING INVESTIGATION. F. J. Miner, J. T. Byrne. RFP-330, Sept. 3, 1963.

This report relates to the long history of assay differences between shipper-receiver, the program formulated by Rocky Flats, and the results obtained to date.

719. THE SEPARATION AND DETERMINATION OF ALUMINUM IN PLUTONIUM-ALUMINUM ALLOYS. F. J. Miner, R. P. DeGrazio, C. R. Forrey, Jr., T. C. Jones. Anal. Chim. Acta 22, 214-20 (1960).

Anion exchange was used for separation of Al in 1% Pu-Al alloys. The Al is then determined by using either a gravimetric or volumetric oxime method, or by complexometric titration using EDTA.

720. DICESIUM PLUTONIUM HEXACHLORIDE, A PROPOSED PRIMARY STANDARD FOR PLUTONIUM. F. J. Miner, R. P. DeGrazio, J. T. Byrne. Anal. Chem. 35, 1218-23 (1963).

The salt Cs_2PuCl_6 is suggested as a primary standard for Pu. It is easily prepared and stable, has a high equivalent weight, and is readily soluble in dilute acids.

721. PLUTONIUM FACILITY OPERATING PROCEDURES IN CMF-5. W. N. Miner, F. W. Schonfeld, Compilers. LAMS-2660, Nov. 1, 1961.

Safety regulations and operating procedures related to the various types of equipment used in the Plutonium Physical Metallurgy Group at LASL are described in detail.

722. ELECTRODEPOSITION OF ACTINIDE ELEMENTS AT TRACER CONCENTRATIONS. R. F. Mitchell. Anal. Chem. 32, 326-8 (1960).

The electrodeposition of the actinides from an electrolyte of ammonium chloride-hydrochloric acid is a rapid method for recovering trace concentrations in high yields.

723. ISOTOPIC POWER SOURCES - A COMPENDIUM. PROPERTY AND PROCESSES REVIEW. PART II. Martin Co. Nuclear Div., Baltimore. MND-P-2581-III (Pt. II), 1961.

A selective bibliography was compiled on the nuclear, physical, and chemical properties and separation processes of Pu, Am^{241}, and Cm. The source was Nuclear Science Abstracts, VOL. 1, through 14 (1948-1960).

724. A NUMBER OF REGULARITIES IN THE COMPLEXING OF PENTAVALENT ACTINIDES. A. I. Mockvin, I. Geletseanu, A. V. Iapitskii. Dokl. Akad. Nauk SSSR, 149, 611-4 (March 1963).

The pentavalent actinides do not complex readily and differ only slightly in complexing ability. The strength of the pentavalent actinides with various addends can be listed in the following order: EDTA > citric > oxalic > phosphoric > tartartic > acetic > lactic.

725. PHYSICAL-CHEMICAL PROPERTIES OF PLUTONIUM CUPFERRON. I. V. Moiseev, N. N. Borodina, V. T. Tsvetkova. Zh. Neorg. Khim. 6, 543-8 (March 1961).

It was noted that regardless of the Pu valence state, the resulting product is $Pu(C_6H_5N_2O_2)_4$. The extraction of Pu(IV) with cupferron from sulfuric acid solutions was also studied. The solubility of Pu(IV) cupferrate in sulfuric acid was also investigated.

726. DISTRIBUTION OF PLUTONIUM ON EXTRACTION WITH TRIBUTYL PHOSPHATE. II. TEMPERATURE INFLUENCE ON THE Pu(IV) DISTRIBUTION. E. I. Moisenko, A. M. Rosen. Radiokhimiya 2, 274-80 (1960).

Pu(IV) distribution between 20% solution of TBP in hydrogenated kerosene as organic phase, and 0.021-1.26M $UO_2(NO_3)_2$-U solution in 0.1-10.0N HNO_3 as aqueous phase, was studied at 20, 30, 50, and 70°C, using 200 mg/l Pu(IV).

727. THE LANTHANUM FLUORIDE COPRECIPITATION METHOD FOR THE DETERMINATION OF PLUTONIUM; THE EFFICIENCY OF PRECIPITATION OF THE LANTHANUM CARRIER AS FLUORIDE. R. G. Monk. AERE-C/R-2382, June 1950.

The efficiency of precipitation of LaF_3 in the coprecipitation method for determining Pu has been investigated using La^{140} as the tracer.

728. LONG CHAIN AMINES, VERSATILE ACID EXTRACTANTS. F. L. Moore. Anal. Chem. 29, 1660-2 (1957).

A new anionic liquid-liquid extraction technique is studied. Solutions of long-chain amines are shown to be excellent extractants for mineral acids, many organic acids, and complex metal acids. Extractions of some anionic complexes of Po, Pu, U, Zr, Hf, and Pr are demonstrated.

729. RADIOCHEMICAL DETERMINATION OF NEPTUNIUM-239 AND PLUTONIUM-239 IN HOMOGENEOUS REACTOR FUEL AND BLANKET SOLUTIONS. F. L. Moore. Anal. Chem. 30, 1368-9 (1958).

The radiochemical determination of Np^{239} and Pu^{239} in uranyl sulfate fuel and blanket solutions is based on the carrying of these two isotopes by lanthanum fluoride, followed by liquid-liquid extraction of the Np^{239} with 2-thenoyl trifluoroacetone-xylene.

730. A NEW ANIONIC SOLVENT EXTRACTION TECHNIQUE. F. L. Moore. ORNL-1314, July 17, 1952.

The extraction of acids with long chain amines is described. Tribenzylamine has possibilities of extracting certain anions from sulfuric acid. Methyldiactyl amine was tried with various metal anionic complexes.

731. LIQUID-LIQUID EXTRACTION OF Pu FROM HYDROCHLORIC ACID SOLUTION WITH TRI(ISO-OCTYL)-AMINE IN SEPARATION FROM THORIUM, AND FISSION PRODUCTS. F. L. Moore. Anal. Chem. 30, 908 (1958).

A new and rapid method for the liquid-liquid extraction of U and Pu from HCl solution is based on the use of tri(iso-octyl)amine dissolved in xylene or methyl isobutyl ketone. U and/or Pu are separated from Th, alkalies, alkaline earths, rare earths, Zr, Nb, Ru, and other elements that do not form anionic species under the conditions described.

732. LIQUID-LIQUID EXTRACTION OF URANIUM AND PLUTONIUM FROM ACETATE SOLUTION WITH TRIISOOCTYLAMINE. SEPARATION FROM THORIUM AND FISSION PRODUCTS. F. L. Moore. Anal. Chem. 32, 1075 (1960).

A new and rapid method for extracting U and/or Pu from acetate solution is based on the use of triisooctylamine in xylene or other organic solvents. Separation is made from Th, rare earth, alkali, and alkaline earths, Zr, Fe, Ru, Am, and other elements that do not form anionic species under the conditions described.

733. INVESTIGATIONS OF THE CHEMISTRY OF PLUTONIUM. PRELIMINARY STUDIES OF PLUTONIUM IN ALKALINE SOLUTIONS. G. E. Moore, J. R. Dem. CN-2216, May 2, 1945.

Absorption spectra of Pu(IV) and Pu(VI) in 45% K_2CO_3 indicate that both ions are complexed by CO_3^{-2}. In 45% K_2CO_3, Pu(VI) was reduced by SO_3^{-2}, Cu_2O, and H_2O_2 but not by NO_2^-. Pu(IV) was oxidized to Pu(VI) in 45% K_2CO_3 by Ag_2O, MnO_4^-, and ClO^-, but not with SeO_4^{-2}, Hg_2O, IO_3^-, H_2O_2, O_3, or oxygen. Spectral curves also indicate the complexing of Pu(IV) by both acetate and oxalate solutions.

734. A SOLVENT EXTRACTION METHOD FOR PLUTONIUM ANALYSIS. F. L. Moore, J. E. Hudgens, Jr. ORNL-153, Sept. 2, 1948.

The method is based on the extraction of Pu^{+4} with TTA in C_6H_6 and a re-extraction into aqueous HF solution. Pu activity is recovered free from radioactive and nonradioactive interferences.

735. SEPARATION AND DETERMINATION OF PLUTONIUM BY LIQUID-LIQUID EXTRACTION.
F. L. Moore, J. E. Hudgens, Jr. Anal. Chem. 29, 1767-70 (1957).

A rapid and quantitative radiochemical method for the separation and determination of Pu based on the liquid-liquid extraction of Pu(IV) with 0.5M 2-thenoyltrifluoroacetone in xylene. Pu tracer is recovered free from interferences, both radioactive and nonradioactive.

736. THE APPLICATION OF HIGHSPEED COMPUTERS TO THE LEAST-SQUARES TREATMENT OF KINETIC DATA. R. H. Moore, T. W. Newton. LADC-5488, 1961.

The examples considered are the least-squares determination of the activation parameters for the reaction between U(IV) and Pu(VI). A nonlinear least-squares program was used for the routine calculations of apparent second-order rate constants from spectrophotometric data.

737. ELECTRODEPOSITION OF PLUTONIUM.
F. L. Moore, G. W. Smith. Nucleonics 13, No. 4, 66-9 (April 1955).

A method is presented for depositing thin films of Pu for alpha standard or fission counting, using chiefly Pu^{+4}. The Pu is deposited from oxalate medium on plates as large as 100 cm^2 with film densities up to 0.13 mg/cm^2.

738. PLUTONIUM RECOVERY FROM NEUTRON-BOMBARDED URANIUM FUEL. R. H. Moore.
U. S. Pat. 2,029,130, April 10, 1962.

A process is presented for recovering Pu from neutron-bombarded U by dissolving the fuel in equimolar aluminum chloride-potassium chloride, heating the mass to above 700°C for decomposition of plutonium tetrachloride to the trichloride, and extracting the plutonium trichloride into a molten salt.

739. ION-EXCHANGE DECONTAMINATION OF ACIDIC WASTES CONTAINING PLUTONIUM. A. J. Mooradian. Canadian Pat. 609,461, Nov. 29, 1960.

Trace amounts of Pu in acidic waste solutions are reduced to a tolerable level by treating the solutions with a cation-exchange resin converted to the ferrous form.

740. IMPROVEMENTS IN OR RELATING TO METHODS OF SEPARATING PLUTONIUM. F. Morgan.
British Pat. 754,651, Aug. 8, 1956.

The rods are dissolved in HNO_3, and Zr and Nb are added to serve as carriers. A soluble phosphate is added which precipitates Pu, Zr, Bi, and Nb. These are treated with oxalic acid, and Zr and Nb are rendered soluble, leaving an insoluble residue of Pu and Bi. These may be separated by several methods.

741. METHOD OF SEPARATING PLUTONIUM.
F. Morgan. U.S. Pat. 2,799,554, July 16, 1957.
Canadian Pat. 541,091, May 21, 1957.

Irradiated U is dissolved in nitric acid, Bi and Zr carriers are added, and Pu, Zr, Bi, and Nb precipitated as phosphates by addition of a soluble phosphate. The Zr and Nb are dissolved with oxalic acid. Separation of Bi and Pu is effected by treatment with HCl and precipitating Bi with hydrogen sulfide.

742. METHOD OF SEPARATING PLUTONIUM.
F. Morgan. U.S. Pat. 2,799,555, July 16, 1957.

Irradiated U is dissolved in nitric acid, Bi and Zr nitrates are added as carriers, and Pu, Zr, Bi, and Nb are precipitated as phosphates by addition of a soluble phosphate. The precipitated phosphates are treated with oxalic acid leaving an insoluble residue of Bi and Pu oxalates. Further separation is done by converting the residue to chloride with HCl, and precipitating the Bi with hydrogen sulfide, and evaporating the Pu solution.

743. SOLUBILITY AND ION EXCHANGE METHODS FOR DETERMINING THE COMPLEX FORMATION OF PLUTONIUM AND AMERICIUM III IN AQUEOUS SOLUTIONS. A. I. Moskvin. Radiokhimiya 1, 430-4 (1959).

The ion-exchange method was used for tri- and pentavalent Pu complex formation in oxalate and EDTA solutions in the pH range of 1 to 5 using KCl-2 ammonium resin.

744. DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANTS OF OXALATE AND CARBONATE COMPLEXES OF PLUTONIUM IV.
A. I. Moskvin, A. D. Gelman. Zh. Neorg. Khim. 3, 962-74 (1958).

Determination was made of $Pu(C_2O_2)_2 \cdot 6H_2O$ solubility in various concentrations of ammonium oxalate solutions (0.001 to 0.35 mol/l) in the presence of 1.0 mole HNO_3, and $Pu(OH)_4$ solubility in various concentrations of K_2CO_3 aqueous solutions.

745. STUDY OF THE PHYSICO-CHEMICAL PROPERTIES OF AQUEOUS SOLUTIONS OF PLUTONIUM(IV) OXALATE AND DETERMINATION OF ITS SOLUBILITY PRODUCT. A. I. Moskvin,
A. D. Gelman. Russian Journ. of Inorg. Chem. 3, Nos. 4-6, 188 (1958).

The solubility of Pu(IV) oxalate in water, H_2SO_4, HNO_3, and $HClO_4$ is determined. It is also shown that oxalate solutions of Pu(IV) possess acidic properties.

746. DETERMINATION OF THE COMPOSITION AND INSTABILITY CONSTANTS OF OXALATE AND CARBONATE COMPLEXES OF PLUTONIUM(IV).
A. I. Moskvin, A. D. Gelman. Russian Journ. of Inorg. Chem. 3, Nos. 4-6, 198 (1958).

The relative tendency of Pu(III, IV, V, VI) to form complexes with anions of certain acids is discussed. The solubility of Pu(IV) hydroxide in aqueous K_2CO_3 is given. The composition of the oxalate complexes of Pu(IV) is defined, and their instability constants calculated.

747. HYDROLYTIC BEHAVIOR OF PLUTONYL IN AQUEOUS SOLUTIONS. A. I. Moskvin, V. P. Zaitseva. Radiokhimiya 4, 73-81 (1961).

The solubility of ammonium diplutonate in aqueous solutions at various pH was studied, and the absorption spectra of saturated plutonyl solutions were measured. The scheme of plutonyl hydrolysis in aqueous solutions at various pH is included.

748. GRAVIMETRIC DETERMINATION OF THE OXYGEN CONTENT OF URANIUM-PLUTONIUM MIXED OXIDES. Special Report No. 15. N. Mostin, G. Valentini. EURAEC-818, 1963.

A gravimetric method is described for determining the oxygen content in mixed oxides of Pu and U. Also discussed is the behavior of PuO_2 obtained from different salts. The lowest temperature needed to obtain PuO_2 of stoichiometric composition is 800°C for the heating conditions considered.

749. SEPARATIONS CHEMISTRY QUARTERLY PROGRESS REPORT FOR OCTOBER-DECEMBER 1953. E. E. Motta, D. W. Bareis, D. D. Cubicciotti. NAA-SR-943 (Rev.), March 26, 1954.

Work has continued on high-temperature methods for processing irradiated U fuel. With fused fluorides, 95% of the Pu was removed from a U sample; treatment of U with HCl gas removed almost all the Pu and many fission products. A small-scale distillation of Pu from U showed that Raoult's law is obeyed.

750. A PLANT RADIATION STUDY INTERIM REPORT NO.5. PART II. DATA ON GAMMA SHIELDING OF SPECIAL PLUTONIUM SAMPLES. H. A. Moulthrop. HW-61755, Oct. 22, 1959.

The effectiveness of Pb, Pb glass, steel, safety glass, and Plexiglas for shielding gamma radiation from Pu samples was evaluated.

751. REMOVAL OF IRON FROM PLUTONIUM SOLUTION BY BASIC ACETATE PRECIPITATION. L. J. Mullins. LA-1139, June 1, 1950.

The Pu is oxidized to PuO_2^{++} with $KMNO_4$, and the Fe is precipitated by the addition $NH_4C_2H_3O_2$. About 98% of the Pu may be separated from the Fe if the acetate is 1.9M. The carrying of PuO_2^{+2} by the Fe precipitate is primarily a function of acetate concentration. UO_2^{++} acts effectively as a hold-back carrier for Pu when it is present in tracer quantities. The effect is negligible for macro concentrations of Pu.

752. THE DETERMINATION OF FLUORIDE IN PLUTONIUM FLUORIDES. B. B. Murray. DP-247, Nov 1957.

Fluoride was distilled from samples in 12M H_2SO_4, and the distillate was then titrated to a visual end point with a standard solution of thorium nitrate.

753. ABSORPTION SPECTRA OF PLUTONIUM AND IMPURITY IONS IN NITRIC ACID SOLUTION. M. N. Myers. HW-44744, July 31, 1956.

The absorption spectra of Pu(III), (IV), and (VI) and the red Pu(IV) peroxy complex were determined in nitric acid solution. Many of the spectra for impurities found in process streams are also presented.

754. REDUCTION OF PLUTONIUM(VI) WITH HYDROGEN PEROXIDE. M. N. Myers. HW-44987, Aug. 17, 1956.

The kinetics of the reduction of Pu(VI) by H_2O_2 in nitric acid was studied. The effect of Fe, H_2O_2 concentration, acid concentration, and light on the reaction is reported.

755. SPECTROCHEMICAL ANALYSIS OF PLUTONIUM AND ITS COMPOUNDS. II. THE CUPFERRON PROCEDURE. N. H. Nachtreib, H. A. Potratz, O. R. Simi, S. Wexler, B. S. Wildi. LA-387 (Del.), Sept. 14, 1945.

A method is described whereby milligram samples of Fe, Sb, V, Ta, Ti, Nb, Zr, Sn, Bi, U, or Pu may be analyzed for parts per million of 39 impurity elements. The acid insoluble cupferride of one of the above elements is formed and extracted with chloroform. The aqueous solution containing the impurities is evaporated on Cu electrodes which are sparked to produce the impurity spectrum.

756. THE TRANSURANIUM ELEMENTS. RESEARCH PAPERS. Glenn T. Seaborg, J. J. Katz, W. M. Manning. National Nuclear Energy Series, Div. IV, 14B, Pt. 1, McGraw-Hill Book Co., Inc., New York, 1949.

757. PRODUCTION OF A SYNTHETIC INORGANIC CATION EXCHANGER AND ITS APPLICATION FOR SELECTIVE PLUTONIUM ISOLATION. D. Naumann. JPRS-11184, Translated from Z. Chem. 1, No. 8, 247-8 (1961).

Preparation of a cation exchanger composed of Zr and Si oxyhydrates is described. The exchanger is stabilized with phosphate and has good capacity, high acid resistance, and satisfactory reproducibility of exchange properties.

758. LABORATORY STUDY ON THE CHLORINATION REPROCESSING OF NEUTRON-IRRADIATED URANIUM FUELS. 4. PRODUCTION AND PROPERTIES OF ZIRCONIUM-PHOSPHATE-SILICATE EXCHANGE MATERIAL AND ITS APPLICATION FOR PLUTONIUM ISOLATION. D. Naumann. Kernenergie 6, 173-6 (April 1963).

For the separation of Pu from fission products, the inorganic exchanger Zr phosphate-silicate was used with good results.

759. SEMIANNUAL PROGRESS REPORT (ON CHEMISTRY) FOR THE PERIOD, JANUARY 1961-JULY 1961. New Brunswick Lab., AEC, N. J. NBL-177.

Preparation of dicesium plutonium hexachloride is reported, along with evaluation of its suitability as a primary standard for Pu. A procedure is described for Si separation from Pu using a cation-exchange procedure prior to spectrographic determination. Continuing development of methods for the spectrographic determination of trace impurities in Pu is described.

760. SEMIANNUAL PROGRESS REPORT (ON CHEMISTRY) FOR THE PERIOD JULY 1962 THROUGH DECEMBER 1962. New Brunswick Lab., AEC, N. J., NBL-195, Aug 1963.

The following topics are covered: separation of Pu from impurities prior to spectrographic analysis; the effect of acid concentration on manitol in the determination of B in Pu and U using cation exchange; the constant-current potentiometric titration of Pu with $K_2Cr_2O_7$. Pu was separated from U solutions by crystallization as $Pu(SO_4)_2$.

761. THE ANALYTICAL CHEMISTRY OF PLUTONIUM. D. Nebel. JPRS-11689. Translated from Chem. Tech., Leipzig, 13, 522-9 (Sept 1961).

Methods for separating Pu, including solvent extraction, ion exchange, and precipitation are reviewed. Techniques for Pu determination, e.g., by absorption or emission spectrophotometry, electrochemical methods, potentiometry, polarographic methods, complexometry, and radiometry, are discussed.

762. SIMPLE PREPARATION OF PLUTONIUM(IV) IN DILUTED $HClO_4$. E. Nebel, D. Nebel. Kernenergie 4, 15-18 (Jan 1961).

Electrolysis in 1.0 and 0.5M $HClO_4$ at controlled potential was found to be a convenient method for preparing Pu(IV). The Pu is first converted electrolytically to Pu(III).

763. POLAROGRAPHIC INVESTIGATIONS WITH PLUTONIUM. D. Nebel, K. Schwabe. NP-tr-981. Translation of Z. Physik. Chem. 220, (3/4), 240-54 (1962).

The Pu(III)-Pu(IV) potential in acetate medium was studied. A wash was observed at -0.2 V, but the reaction is irreversible. In dilute $HClO_4$, a wash for Pu(IV) was obtained at -1.0 V for Pu in the range of 10^{4}-10^{-5}M. This is probably due to reduction to Pu amalgam.

764. SPECTROPHOTOMETRIC INVESTIGATIONS OF Pu(IV) ACETATE COMPLEXES IN AQUEOUS SOLUTION. E. Nebel, K. Schwabe. Z. Physik. Chem. 224, (1/2), 29-50 (1963).

The complex formation of Pu(IV) in aqueous AcONa solutions was examined spectrophotometrically. The adsorption spectra of Pu(III), Pu(IV), and Pu(VI) in AcONa-$HClO_4$ solutions of different concentrations and pH are discussed.

765. THE SPECTROPHOTOMETRIC DETERMINATION OF MICROGRAM QUANTITIES OF MOLYBDENUM AND TUNGSTEN IN PLUTONIUM USING DITHIOL. G. B. Nelson, G. R. Waterbury. In TID-7629. Analytical Chemistry in Nuclear Reactor Technology, Fifth Conference, Gatlinburg, Tennessee, October 10-12, 1961, pp. 62-68.

The Mo(VI)-dithiol complex was extracted from 5 to 6M HCl, and the W(V)-dithiol complex from 9 to 11M HCl into pentylacetate.

766. OBSERVATIONS ON THE MICROSTRUCTURE OF PLUTONIUM. R. D. Nelson, H. R. Gardner. HW-67737, March 1961.

Photomicrographs are presented illustrating the various configurations of the Pu-Pu_6Fe eutectic and PuN, PuC, and Pu_4Mg as inclusions. The presence of 500-1500 ppm of Fe was found to inhibit microcracking.

767. STUDY OF THE REACTION OF PLUTONIUM(IV) WITH ARSENAZO III. A. A. Nemodruk, N. E. Kochetkova. Zh. Analit. Khim. 18, 333-8 (March 1963).

Two series of complexes are formed by the interaction of Pu(IV) and arsenazo III, depending on the concentration of nitric acid. Optimum conditions for photometric determination are also given. The molar extinction coefficient for the 1:3 complex is 136,000.

768. NEPTUNIUM SEPARATION FROM URANIUM, PLUTONIUM AND FISSION PRODUCTS: AN ANNOTATED BIBLIOGRAPHY. B. J. Newby. IDO-14459, Dec. 29, 1958.

769. PRELIMINARY REPORT ON THE X-RAY PHOTOMETRIC ANALYSIS OF PLUTONIUM IN CONCENTRATED NITRATE SOLUTIONS. D. M. Newell. HW-32710 (Del.), Jan. 17, 1955.

The method uses a highly concentrated solution of aluminum nitrate as a salting agent and an acidity of 1.5N HNO_3. The Pu is extracted with 30% tributyl phosphate. The organic layer is read in a glass cell with a 12-mm path length in the X-ray photometer. Interferences are U and La.

770. THE KINETICS OF THE REACTION BETWEEN PLUTONIUM(VI) AND URANIUM(IV). T. W. Newton. J. Phys. Chem. 63, 1493-97 (1959).

The kinetics were studied in perchloric media. The H ion dependence indicated that the reacting system passes consecutively through two activated complexes with nearly the same ΔF values.

771. CHLORIDE COMPLEX IONS OF Pu(VI). T. W. Newton, F. B. Baker. J. Phys. Chem. 61, 934-8 (July 1957).

At different wavelengths, the absorption was determined as a function of Cl- from 0- to 1.8M. Making the usual assumption, it was found that the data at any one wavelength were consistent with the formation of a single complex ion with a constant association quotient and constant absorptibility.

772. SEPARATION OF URANIUM, PLUTONIUM AND FISSION PRODUCTS. C. M. Nicholls, I. Wells, R. Spence. Canadian Pat. 613,891.

A solvent extraction method is presented for treating neutron-irradiated U to remove Pu and U. The irradiated U is dissolved in nitric acid, and Pu and U are extracted from 3N nitric acid and with dibutyl carbitol containing 1.8N nitric acid. The Pu is separated from the U in the organic phase by extraction with an aqueous nitrate salt solution containing a reducing agent.

773. SEPARATION OF URANIUM, PLUTONIUM AND FISSION PRODUCTS. C. M. Nicholls, I. Wells, R. Spence. U. S. Pat. 2,908,547, Oct. 13, 1959.

Irradiated U is dissolved in nitric acid to provide a solution about 3N in nitric acid. The fission products are extracted with dibutyl carbitol. The organic solvent phase is neutralized with ammonium hydroxide, and Pu is reduced to the +3 state with hydroxylamine. Treatment of the mixture with saturated NH_4NO_3 extracts the reduced Pu and leaves the U in the organic solvent.

774. THE BEHAVIOR OF REPRESENTATIVE FISSION PRODUCTS AND PLUTONIUM IN THE KAPL ELECTROREFINING PROCESS AND A REVIEW OF THE STATUS OF THE PROCESS. L. W. Niedrach, A. C. Glamm, G. R. Fountain. KAPL-1692, March 27, 1957.

The current status of electrorefining as a method for processing reactor fuels is reviewed, including an indication of the types of fuel for which such a process would be most suitable.

775. RADIOCHEMICAL DETERMINATION OF PLUTONIUM FOR RADIOLOGICAL PURPOSES.
J. M. Nielsen, T. M. Beasley. HW-SA-3337, 1963.

776. QUANTITATIVE SEPARATION OF AMERICIUM AND PLUTONIUM USING CUPFERRON.
J. P. Nigon, R. A. Penneman. LA-1079 (Del.), March 8, 1950.

Am and Pu are separated quantitatively by chloroform extraction of Pu cupferrate from HCl solution. This separation is successful from tracer concentrations up to gram quantities of Pu, and milligrams of Am.

777. ESTIMATING RADIOELEMENTS IN EXPOSED INDIVIDUALS. I. RADIOELEMENTS METABOLISM. II. RADIATION DOSAGE AND PERMISSIBLE LEVELS. III. BIOASSAY OPERATIONS AND PROCEDURES. Nucleonics 8, No. 2, 13-28; No. 3, 66-78; No. 4, 59-67 (1951).

The laboratory must be isolated from possible sources of contamination. Samples are usually ashed with HNO_3(c). Methods for concentration by ion exchange, electrodeposition, precipitation with carrier, and solvent extraction are given, as well as recommended procedures for bioassays.

778. DEVELOPMENT OF PLUTONIUM BEARING FUEL MATERIALS. Progress Report for Period July 1 through September 30, 1961. Nuclear Materials and Equipment Corp., NUMEC-P-80.

The simultaneous determination of Pu and U by differential spectrophotometry was studied.

779. DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Progress Report, July 1 through September 30, 1962. Nuclear Materials and Equipment Corp. NUMEC-P-102.

The preparation of UO_2-PuO fuel materials is described along with analytical chemistry procedures required for support of the fuel-cycle program.

780. DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Progress Report, January 1 through March 31, 1963. Nuclear Materials and Equipment Corp. NUMEC-P-104.

Methods of preparing PuO_2 are discussed. A study was initiated to assess the feasibility of using gamma spectrometry for rapid process determination of Pu in solutions that also contain U. Pu can be determined to within 1%, provided that the U concentration is known to better than 2 mg/ml.

781. COMPLEXES OF PLUTONIUM(IV) WITH PHENYLARSONIC ACID DERIVATIVES. PART II. 2-(o-ARSONOPHENYLAZO)-1:8-DIHYDROXY-3:6-NAPHTHALENEDISULPHONIC ACID (URANOL) AND OTHERS. D. W. Ockenden. IGO-R/W-2, Feb. 1, 1956.

A complex of tetravalent Pu and uranol is quantitatively and immediately formed over the pH range of 0.95-1.35. The behavior of other ions (e.g., UO_2^{++}, Fe^{+3}, Cr^{+3}, Al^{+3}, La^{+3}, and Th^{+4}) was studied. Unfortunately, because of a slight fading, this reagent is no better than thornol for the absorptiometric determination of Pu. Many other reagents of similar structure have been studied, but few show any appreciable reaction with Pu^{+4} even in the ultraviolet region.

782. THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART V. COLLOIDAL QUADRIVALENT PLUTONIUM.
D. W. Ockenden, G. A. Welch. J. Chem. Soc. 3358-63 (Sept 1956).

Colloidal or polymeric Pu^{+4} has been separated from the ionic species of Pu by ion exchange. The rate of formation, its stability in more concentrated solutions of HNO_3, and its absorption on certain surfaces have been studied. Its minimum and maximum molecular weights of the colloid have been calculated from diffusion experiments.

783. THE KINETICS OF THE REACTION BETWEEN Pu^{+3} AND PuO_2^{+2}. A. E. Ogard, S. W. Rabideau. J. Phys. Chem. 60, 812-13 (June 1956).

Spectrophotometric observations on kinetics of Pu^{+3} and PuO_2^{+2} are made.

784. REDUCTION OF PLUTONIUM VALUES IN AN ACIDIC AQUEOUS SOLUTION WITH FORMALDEHYDE. C. M. Olson. U.S. Pat. 2,890,098, June 9, 1959.

A method is given for reducing Pu to the tetravalent state and lowering the high acidity of dissolver solutions by using formaldehyde in the ratio of 0.375:1 to 1.5:1 as formaldehyde is to HNO_3. Pu is then removed by carrier precipitation using $BiPO_4$, or by ion exchange.

785. A CHEMICAL METHOD OF TREATING FISSIONABLE MATERIAL. C. M. Olson. U. S. Pat. 2,902,340, Sept. 1, 1959.

One step of a process for separating Pu from U and fission products is presented. A nitric acid solution is treated with formic acid to give Pu of a valence state not greater than +4 and to destroy nitric acid.

786. PREPARATION OF URANIUM(IV) NITRATE SOLUTIONS. R. S. Ondrejcin. DP-602, July 1961.

U^{4+} in HNO_3-hydrazine solution is proposed as a Pu reduction agent in solvent-extraction processes. UO_2^{2+} in 0.5M H_2SO_4 was reduced to U^{4+} in 21 minutes by a 50% excess of Zn. Reoxidation was not observed during standing 24 hours in the air at 25°C.

787. ANALYTICAL CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING JANUARY 10, 1951. Oak Ridge National Laboratory. ORNL-955 (Del.), March 28, 1951.

Work was continued on the automatic titration of U and Pu.

788. ANALYTICAL CHEMISTRY DIVISION QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 26, 1952. Oak Ridge National Laboratory. ORNL-1423 (Del.), March 4, 1953.

This report discusses Pu analysis by α counting, solvent extraction methods, and carrying of Pu by fluoride precipitates.

789. ANALYTICAL CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1957. Oak Ridge National Laboratory. ORNL-2453, Jan. 30, 1958.

Research and development continued with spectrophotometric studies of Pu in sulfate systems, and determination of Pu^{+3} and Pu^{+4} in PuF_3-PuF_4 mixtures in fused NaF-BeF_2.

790. ANALYTICAL CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1960. Oak Ridge National Laboratory. ORNL-3060, Feb. 15, 1961.

This report covers analytical instrumentation, ionic analyses, nuclear analyses, optical and electron microscopy, radiochemical analyses, spectrochemical and X-ray analyses, and reactor projects analytical chemistry.

791. SOLVENT EXTRACTION TECHNOLOGY. In ORNL-3314, Chemical Technology Division Annual Progress Report for Period Ending June 30, 1962. Oak Ridge National Laboratory, Sept. 21, 1962, pp. 96-115.

Chemical and physical performance of the chemical flowsheet developed for final-cycle Pu purification by tertiary amine-extraction was demonstrated in countercurrent runs with simulated feeds and with Purex plant solutions.

792. CURIUM PROCESSING. In ORNL-3452, Chemical Technology Division Annual Progress Report for Period Ending May 31, 1963. Oak Ridge National Laboratory, Sept. 20, 1963, pp. 134-143.

The recovery of 30 grams of Pu and 4 grams of transuranium elements from highly irradiated Pu-Al alloy rods was completed in a pilot-plant study of flowsheets featuring anion exchange separation methods.

793. PLUTONIUM ION EXCHANGE PROCESSES. Proceedings of the US-UK Technical Exchange Meeting, Oak Ridge National Laboratory, April 25-27, 1960. Oak Ridge National Laboratory, TID-7607.

Information on the process chemistry of Pu in both cation- and anion-exchange systems. Information is also presented on the use of amine extraction to replace ion exchange for Pu product purification.

794. ANALYSIS BY ALPHA SPECTROMETRY. C. C. d'Orval. CEA-1594, 1960.

The energies of alpha particles are separated by counting in a chamber with a grid, especially designed for the analysis of Pu. A resolution of 1.7% is normally obtained for Pu. Pu^{239}-Pu^{233} and Pu^{239}-Pu^{238} mixtures were analyzed.

795. SOME ANALYTICAL APPLICATIONS OF m-NITROBENZOIC ACID WITH PARTICULAR REFERENCE TO SEPARATION OF QUADRIVALENT ELEMENTS (PLUTONIUM) FROM RARE EARTHS (LANTHANIDES). G. H. Osborn. Analyst 73, 381-4 (1948).

Reference is made to paper by B. G. Harvey et al. (J. Chem. Soc., 1010, 1947), who used m-nitrobenzoic acid as a reagent for Pu. It was found that the quadrivalent ion was precipitated, but not the trivalent ion.

796. SUMMARY REPORT FOR APRIL-JUNE 1950. CHEMISTRY DIVISION, SECTION C-1. D. W. Osborne. ANL-4490 (Del.), July 27, 1950.

Data are given on the extraction of Am, Cm, and Pu in aqueous HCl-butyl phosphate ester systems.

797. SUMMARY REPORT FOR JANUARY-MARCH 1950. CHEMISTRY DIVISION, SECTION C-1. D. W. Osborne. Argonne National Laboratory, ANL-4469 (Del.), June 7, 1950.

This report concerns separation of Pu and Np, and an investigation of naturally occurring Pu for isotopes other than Pu^{239}.

798. SOLVENT EXTRACTION OF METALS BY ORGANOPHOSPHORUS COMPOUNDS. II. PARTICULAR EXTRACTION SYSTEMS. K. Oshima. Nippon Genshiryoku Gakkaishi 4, 166-74 (March 1962).

The systematic study on the basic mechanism of extraction for the systems of TEP-acids, TBP-U-acids, and TBP-metals-HNO_3 was carried out, and the factors affecting the extractability in these systems were discussed. Separation of Pu from U was by solvent extraction.

799. ANALYTICAL METHOD FOR IN-LINE PLUTONIUM ANALYSES. R. F. Overman. DP-619, Aug 1961.

Laboratory studies demonstrated the feasibility of a colorimetric method for the in-line analysis of Pu(IV) and Pu(III). Negligible interference was caused by normal variations in concentrations of nitric, nitrous, and ferric sulfate from the Purex Process solution.

800. ON THE REDUCTION OF PLUTONYL SULFATE BY α RADIATION. M. Pagès, C. Ferradini, M. Haissinskii. Compt. rend. 245, 1128-9 (1957). Also AEC-tr-3534.

The reduction of plutonyl sulfate by gamma radiation from radioactive Co stops at the (IV) valence state and varies linearly with the absorbed energy. The yield diminishes with the increase of sulfuric acid concentration.

801. RADIOLYSE DES SOLUTIONS AQUEUSES DE PLUTONIUM. M. Pagès. CEA-1420, 1960.

The effects of gamma rays on Pu aqueous solutions at various valence states in sulfuric, perchloric, nitric, and hydrochloric acids were studied. In sulfuric and perchloric acid solutions, radiolysis of water produces OH, H_2O_2, H, and H_2. H and H_2O_2 reduce Pu(VI), while

Pu(V) is oxidized by OH radicals. The reaction with H_2O_2 is slow. The effect of alpha particles is similar to the effect of H_2O_2. At low acidities, Pu(IV) peroxide seems to lead to polymer forms.

802. ACTION OF GAMMA AND ALPHA RAYS ON PLUTONIUM SOLUTIONS. M. Pagès and M. Haissinskii. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 29, 44, United Nations, New York, 1958.

The radiochemical reduction of PuO_2SO_4 in sulfuric acid solutions after irradiation with Co^{60} gamma rays was studied. The effect of SO_4^{-2} is greater than that of H^+ ions. Self-reduction by Pu alpha rays varies with SO_4^{-2} and H^+ ions.

803. ANALYTICAL CHEMISTRY OF THE ACTINIDES. P. I. Palei. Zhur. Anal. Khim. 12, 647-64 (1957).

An outline is presented of the properties and reactions used as a basis for the chemical methods of separating and determining the elements of the actinide group, mainly U, Th, Pu, Np, and Am.

804. COMPLEXOMETRIC DETERMINATION OF Pu(IV) WITH ARSENAZO INDICATOR. P. N. Palei, W. Chang. Zhur. Anal. Khim. 15, 598 (1960).

Pu(IV) is titrated with 0.1-0.005M solution of complexone(III) in acid media (0.1-0.2N HCl or HNO_3) using arsenazo(I) as an indicator. La^{+3}, UO_2^{+2}, Cr^{+3}, Pb^{+2}, and Ni^{+2} do not interfere. Fe^{+3} must not exceed 3-4% of the Pu content.

805. THE THERMAL-EMISSION ION SOURCE IN SOLID SOURCE MASS SPECTROMETRY. G. H. Palmer. J. Nuclear Energy 7, 1-12 (1958).

The advantages of solid techniques are illustrated by considering the analysis of submicrogram quantities of Pb, U, and Pu.

806. A METHOD FOR MONITORING ELECTRODEPOSITION OF ALPHA-RADIOACTIVE ISOTOPES. A. A. Panomarev, G. I. Khlebnikov, K. A. Gavrilov. Pribry i Tekh. Ekspt. No. 6, 58-60 (1960).

An improved method for observing deposition of α active substances on thin base layers is described. Optimum conditions for Pu deposition from a mixture of formic acid and ammonium formate are 150 ma/cm^2 current and an electrolyte concentration of about 0.25 mol.

807. DETERMINATION OF IRON IN PRODUCT SOLUTIONS. A. K. Parlour. CN-1656, July 12, 1944.

Data are presented on the analysis of Fe in Pu solutions using ortho-phenanthroline. Transmittance curves show no serious interference from Zr^{+4}, Ni^{++}, Cr^{++}, Bi^{+3}, La^{+3}, and Mn^{+2} in the concentrations usually found in process solutions.

808. THE CHEMICAL PROPERTIES OF PLUTONIUM IN WATER SOLUTION. A. Pasternak. Nukleonika 3, 53-68 (1958).

The oxidation states and various forms of Pu in aqueous solutions are discussed, as well as the hydrolysis, polymerization, formation of colloids, and polyanions.

809. COPRECIPITATION OF PLUTONIUM WITH ALIZARIN. A. Pasternak. Nukleonika 6, 113-26 (1961).

A comparison is made of the coprecipitation with alizarin of Pu(III), Pu(IV), Pu(VI), and Pu(IV) in the presence of complexing agents such as alizarin S, TTA, and EDTA.

810. MANUAL OF SPECIAL MATERIALS ANALYTICAL LABORATORY PROCEDURES. J. H. Patterson, H. B. Evans, C. M. Stevens, A. L. Harkness, J. Sedlet, J. P. Hughes, J. K. Brody, V. R. Wiederkehr, R. J. Ferretti. ANL-5410, March 1955.

Procedures are presented for Pu, U, and for many U alloys. Also, isotopic determination by mass spectrometry, balance testing, and analytical weight-calibration procedures are given.

811. COMPOSITION OF PLUTONIUM(IV) 8-HYDROXYQUINOLATE. R. L. Patton. National Nuclear Energy Series, Div. IV, 14B, Transuranium Elements, Pt. I, 853-54, McGraw-Hill Book Company, Inc., New York, 1949.

There are four moles of organic radical per mole of the Pu derivative of 8-hydroxyquinoline. Therefore, the coordination number of Pu(IV) in such compounds is 8.

812. THE DETERMINATION OF PLUTONIUM IN IRRADIATED URANIUM FUEL SOLUTIONS BY CONTROLLED POTENTIAL COULOMETRY. R. M. Peekema, F. A. Scott. HW-58491, Dec. 10, 1958.

Method has been used for Pu in the range of 0.05-50 grams per liter. The titration curves follow the Nerst equation exactly for ions that undergo reversible reactions. Few ions interfere or have complexes near the Pu(III)-Pu(IV) couple. At 20 grams per liter, the standard deviation is about ±0.05% with an accuracy better than 0.1%.

813. PROPERTIES OF CERAMIC FUEL MATERIALS. L. A. Pember. HW-78260 CH, June 29, 1963.

A chart presents in condensed form the physical, mechanical, and fabrication properties of U, Pu and Th borides, carbides, nitrides, oxides, phosphides, sulfides, and silicides.

814. THE PREPARATION OF UNIFORM FILMS FOR SPONTANEOUS FISSION COUNTING. L. P. Pepkowitz, E. L. Shirley. KAPL-181, Nov. 8, 1950.

Two methods are described for thin (0.3 mg/cm^2) adherent films. The glycerine-aerosol technique is applicable to U, Pu, and Np, whereas the second technique referred to as the "glycerol pool" has been used successfully for U only. The special merit of the glycerol pool is that U films can be deposited on extremely thin backing materials such as 0.1 mil Al.

815. APPLICABILITY OF CERTAIN ORGANO PHOSPHORUS EXTRACTANTS TO ENVIRONMENTAL AND BIOLOGICAL RADIOACTIVE SURVEYS. D. F. Peppard, G. W. Mason, C. M. Andresjasich. J. Inorg. Nucl. Chem. 25, 1175-1189 (1963).

The applicability of certain organo phosphorus extractants to environmental and biological radioactivity surveys has been demonstrated. Specifically, a solution of mono-2-ethyl hexyl phosphoric acid, H_2MEHP, in a hydrocarbon and/or chlorinated hydrocarbon diluent has been shown to extract radioactive Ce(III), Pm(III), Y(III), Am(III), Pu(III), Th(IV), Pu(IV), and U(VI) from acidified human urine with sufficiently high K values to permit basing a scheme of analysis for such radioelements upon liquid-liquid extraction.

816. SEPARATION OF PLUTONIUM. J. H. Peterson. Canadian Pat. 625,515, Aug. 15, 1961.

The bismuth phosphate method for precipitation of Pu from solutions of n-irradiated U is improved by adding a Bi solution in 10N HNO_3 to a solution of irradiated U in 5-10N HNO_3-0.1M in H_3PO_4. The use of these high HNO_3 concentrations greatly enhances the ease with which the precipitation can be filtered.

817. ALKYLPHOSPHONATES: DIPHOSPHONATES, AND PHOSPHINE OXIDES AS EXTRACTANTS. K. A. Petrov, V. B. Shevchenko, V. G. Timoshev, F. A. Maklyaev, A. V. Fokin, A. V. Rodionov, V. V. Balandina, A. V. El'kina, Z. I. Nagnibeda, A. A. Volkova. Zh. Neorg. Khim. 5, 498-502 (1960).

The distribution coefficients of U, Pu(IV), Zr^{95} + Nb^{95}, and Nb^{95} were obtained with Bu_3PO_4, various alkyl phosphonates, phosphine oxides, and diphosphonates.

818. THE DETERMINATION OF FREE ACID IN PLUTONIUM SOLUTIONS. J. L. Pflug, F. J. Miner. Anal. Chim. Acta 23, 362-7 (Oct 1960).

The determination of the free acid in Pu process solutions requires a method that will prevent interference from hydrolysis of the Pu ions. This procedure involves the formation of a soluble complex of the hydrolyzable ions and then the titration of the free acid in the presence of this complex. The complexing agent used is the citrate ion, and the end point is detected potentiometrically.

819. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN URANIUM PLANT SOLUTIONS. (LANTHANUM FLUORIDE CO-PRECIPITATION FROM AMMONIUM SULFATE SOLUTION.) United Kingdom Atomic Energy Authority. Production Group, Chemical Services Dept., Windscale, Sellafield, England. PGR-95(W), March 1960.

The U is complexed by the ammonium sulfate, and the precipitation of U fluoride is prevented. The Pu is determined by alpha counting using standard alpha-scintillation equipment.

820. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN REACTOR FUEL PROCESSING AND EFFLUENT PLANT SOLUTIONS. (RAPID LANTHANUM FLUORIDE CO-PRECIPITATION.) United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-199, 1961.

Pu is precipitated along with La fluoride. The precipitate is dispersed on a stainless-steel plate, and the alpha activity is measured using standard alpha-scintillation counting equipment.

821. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN THE FEED AND PRODUCT SOLUTIONS OF THE WINDSCALE PRIMARY SEPARATION PLANT (COMPLEXOMETRIC TITRATION). United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-210, 1961.

A sample solution is mixed with a solution of hyamine 1622 in benzene. Pu is extracted, and the bulk of fission products, Fe, Cr, and U are not extracted. The solvent is evaporated, and the Pu is complexed with EDTA. The excess is back-titrated with standard zinc chloride to a photometric end point.

822. THE DETERMINATION OF URANIUM IN PLUTONIUM METAL: PLUTONIUM COMPOUNDS AND NITRIC ACID OR HYDROCHLORIC ACID SOLUTIONS OF PLUTONIUM. (POLAROGRAPHIC METHOD.) United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-236, 1961.

An alternating-current polarographic method is described by which U is estimated in trivalent Pu solution in $HClO_4$ with a limit of detection of 1 μg of U in a concentration range of 10 to 200 ppm of U.

823. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN THE PRODUCT FROM THE PLUTONIUM PURIFICATION PLANT (DIFFERENTIAL SPECTROPHOTOMETRY). United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-297, 1962.

The Pu in the sample (5 mg of Pu/ml) is reduced to the trivalent state with hydroxylamine hydrochloride and the absorbancy is compared with that of a standard at 565 mu.

824. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN THE FEED AND PRODUCT SOLUTIONS OF THE PLUTONIUM PURIFICATION PLANT. (DIRECT RADIOMETRIC.) United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-300, 1962.

A sample is evaporated on a flat, stainless-steel counting tray and the α activity measured with a proportional counter. The precision at three times the standard deviation is 5.2%.

825. ANALYTICAL METHOD FOR THE DETERMINATION OF THE PLUTONIUM/URANIUM RATIO ON THE FEED SOLUTION OF THE WINDSCALE PRIMARY SEPARATION PLANT. (ISOTOPE DILUTION METHOD.) United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-340, 1962.

The Pu/U ratio was determined by the isotope dilution technique after using a mass spectrometer and adding U^{233} and Pu^{242} tracers in known amounts to the feed solution.

826. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN SOLUTIONS CONTAINING LARGE AMOUNTS OF IRON AND CHROMIUM. (LANTHANUM FLUORIDE COPRECIPITATION.) United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-372, 1962.

Pu is coprecipitated with lanthanum fluoride and spread on a stainless-steel plate for measurement of the alpha activity by scintillation methods.

827. ANALYTICAL METHOD FOR THE DETERMINATION OF PLUTONIUM IN REACTOR FUEL PROCESSING PLANT SOLUTIONS. (LANTHANUM FLUORIDE COPRECIPITATION.) United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-373, 1962.

Pu is coprecipitated with lanthanum fluoride, and the alpha activity is measured using standard alpha-scintillation counting equipment.

828. ANALYTICAL METHOD FOR THE TITRIMETRIC DETERMINATION OF PLUTONIUM (CHROMOUS REDUCTION - CERIC SULFATE TITRATION). United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-309, 1962.

Following the removal of nitric acid, Pu is reduced to the trivalent state with an excess of chromous chloride. The excess of chromous salt is oxidized with air, and the Pu is titrated to the tetravelent form with standard ceric sulfate. The end point is obtained potentiometrically. The precision (3 x sigma) is ±1.23%.

829. ANALYTICAL METHOD FOR THE ASSAY OF PLUTONIUM OXIDE (DIFFERENTIAL SPECTROPHOTOMETRY). United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-442, 1963.

A solution of the oxide is prepared in nitric acid, hydrochloric acid is added, and the relative absorbency of the solution is measured at 565 $m\mu$ against a Pu standard. The precision (3 times standard deviation) applied to metal samples is ±0.28%.

830. ANALYTICAL METHOD FOR THE DETERMINATION OF THE SPECIFIC SURFACE AREA OF PLUTONIUM OXIDE POWDER (B.E.T. METHOD). United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England. PG-Report-502, 1963.

The outgassed plutonium oxide sample is exposed to N gas at the temperature of liquid N until equilibrium is established between unabsorbed and adsorbed gas. The volume of N adsorbed when the entire surface is covered with a unimolecular layer is obtained using the Brunauer-Emmett-Teller equation.

831. PRECISE DETERMINATION OF PLUTONIUM BY DIFFERENTIAL SPECTROPHOTOMETRY. G. Phillips. Analyst 83, 75-9 (1958).

The sample is dissolved in HCl and maintained in the reduced state by the presence of hydroxylamine hydrochloride in the solution. The relative absorbency of the sample is then measured against that of an accurately known standard solution at 5650 Å. The precision was ±0.5% using milligram amounts of Pu.

832. THE DIFFERENTIAL SPECTROPHOTOMETRIC DETERMINATION OF PLUTONIUM IN ROUTINE USE. G. Phillips. AERE-M-678, May 1960.

Pu is detected by differential spectrophotometry at 565 mu by using the Pu(III) color in HCl solution. The method is applicable for 1.5-14.0 mg/ml.

833. THE CHEMICAL ANALYSIS OF TERNARY ALLOYS OF PLUTONIUM WITH COBALT AND CERIUM. G. Phillips, E. Foster. AERE-R-2878, May 1959.

Pu is separated as nitrate complex on anion-exchange resin. Co is determined in the effluent with nitroso-R-salt and Ce by titration with $KMNO_4$ in pyrophosphate solution to a photometric end point. The Pu is determined absorptiometrically after elution as Pu(III) with hydroxylamine hydrochloride.

834. THE REMOVAL OF PLUTONIUM BEFORE THE ANALYSIS OF MIXED FISSION PRODUCTS. G. Phillips, E. N. Jenkins. J. Inorg. Nucl. Chem. 4, 220-4 (1957).

Pu is removed quantitatively as the tetravalent nitrate complex on De-acedite FF resin. Of the nongaseous fission products, all except Zr and Nb were recovered in 98% or greater yield on washing the resin. A procedure is given for Zr and Nb.

835. THE CHEMICAL ANALYSIS OF TERNARY ALLOYS OF PLUTONIUM WITH MOLYBDENUM AND URANIUM. G. Phillips, J. Woodhead, E. N. Jenkins. Anal. Chim. Acta 19, 229-234 (1958).

Mo is extracted with α-benzoin oxime first, and then Pu and U are separated by means of anion exchange. The elements are analyzed spectrophotometrically.

836. THE VOLATILITY OF PLUTONIUM DIOXIDE. T. E. Phipps, G. W. Sears, O. C. Simpson. J. Chem. Phys. 18, 724-34 (1950).

837. AN INTERIM REPORT ON STUDIES OF THE THERMIONIC PROPERTIES OF SURFACES CONSISTING OF PLUTONIUM ATOMS ADSORBED ON OXYGENATED TUNGSTEN. T. E. Phipps, E. G. Rauh, O. C. Simpson. ANL-4654, Aug. 27, 1951.

An apparatus consisting of a hot-wire detector in the path of an atomic beam of Pu atoms is described. An attempt to ionize Pu atoms was no success, so the ionization potential of Pu is greater than 6.2 Volts.

838. VOLATILITY OF PLUTONIUM DIOXIDE.
T. E. Phipps, G. W. Sears, O. C. Simpson.
J. Chem. Phys. 18, 724-34 (1950).

The volatility of plutonium dioxide has been measured in the temperature range of 1320 to 1790°C by a modification of the Knudsen effusion method. The thermal reduction of the oxide was also reversed by heating the reduced oxide in a low-pressure atmosphere of O.

839. PREPARATION OF STANDARD PLUTONIUM SOLUTIONS FOR ALPHA COUNTING.
C. E. Pietri. In NBL-204, Semiannual Progress Report (On Chemistry) for the Period January 1963 through June 1963. Dec 1963.

Two methods, coulometric and gravimetric, are described for preparation of standard Pu solutions for alpha-counting following removal of Am^{241} by anion-exchange separation. The absolute maximum error associated with the volumetric method is within 0.4-0.5%, while that for the gravimetric procedure is within 0.1%. Calibrations of the alpha counter with a standard Pu solution gave an efficiency factor of 49.91 ± 0.57% at 95% confidence level.

840. SEPARATION AND DETERMINATION OF PLUTONIUM IN PLUTONIUM-URANIUM FUEL ELEMENTS. C. E. Pietri. NBL-189, Jan 1963.

Pu is separated from U by cation exchange. The refractory oxides are dissolved by refluxing in concentrated nitric acid and 6N HF acid solution. Both U and Pu are determined potentiometrically at constant current with potassium dichromate.

841. PLUTONIUM SULFATE TETRAHYDRATE, A PROPOSED PRIMARY ANALYTICAL STANDARD FOR PLUTONIUM. C. E. Pietri. Anal. Chem. 34, 1604-6 (Nov 1962).

Stoichiometric Pu sulfate tetrahydrate has been prepared by controlled crystallization from sulfuric acid. The formula was found to be $Pu(SO_4)_2 \cdot 4H_2O$. No significant changes were observed over 28 months. Changes in relative humidity below 75% had little effect on the material.

842. THE DETERMINATION OF PLUTONIUM BASED ON NATIONAL BUREAU OF STANDARDS POTASSIUM DICHROMATE. C. E. Pietri, J. A. Baglio. Talanta 6, 159-166 (1960).

The design and operation of the New Brunswick Laboratory's Pu analytical facility are described. Pu metal (99.96%) is determined by potentiometric titration using polarized gold electrodes. The average results were within 0.01% of the purity of the Pu.

843. POTENTIOMETRIC DETERMINATION OF PLUTONIUM WITH POTASSIUM DICHROMATE: VOLUMETRIC SAMPLING EVALUATION.
C. E. Pietri, A. W. Wenzel. In NBL-204, Semiannual Progress Report (On Chemistry) for the Period January 1963 through June 1963. Dec 1963.

The precision obtained for the Pu assay method using a volumetric sampling procedure on two standard solutions is ±0.08% compared to previous results of 0.01 to 0.04% for gravimetric sampling. A possible effect of the order of pipetting and order of analysis on the results of the Pu assay was noted.

844. CATION EXCHANGE SEPARATION AND SPECTROGRAPHIC DETERMINATION OF SOLUBLE SILICON IN PLUTONIUM. C. E. Pietri, A. W. Wenzel. Anal. Chem. 35, 209-11 (Feb 1963).

A cation-exchange separation from Pu is made prior to spectrographic determination. Boiler-cap electrodes, in conjunction with sodium carbonate buffer, double the sensitivity normally obtained without caps. The lower limit of detection is 1 ppm. Overall relative standard deviation was ±9%.

845. HAZARDS IN HANDLING PLUTONIUM.
K. C. Pillai, S. Somasundaram, P. R. Kamath.
AEET/HP/SM-2, July 1, 1958.

The nuclear and metabolic properties of Pu^{239} are described briefly. Maximum permissible levels of Pu^{239} in the body, air, water, surfaces, and soil are given. The design of laboratory facilities for handling Pu is discussed. Safe handling rules are given.

846. EFFECTS OF RADIATION ON THE VALENCE STATE OF PLUTONIUM IN PERCHLORIC ACID SOLUTIONS. N. I. Popov. Atomnaya Energ. 6, 71-73 (1959).

A graphic representation is given of the radio-induced changes in valence of Pu and U perchlorates.

847. EFFECT OF RADIATION ON THE VALENCE STATE OF PLUTONIUM IN NITRIC ACID SOLUTION. N. I. Popov, V. I. Medvedovskii, N. A. Bakh. Atomnaya Energ. 4, 154-60 (1958).

Pu solutions containing HNO_3, $NaNO_3$, $UO_2(NO_3)_2$, and $K_2Cr_2O_7$ in various concentrations and combinations were subjected to X-radiation. The rate of increase in oxidized Pu concentration always decreased with the absorption of energy. The initial oxidation yield decreased with an increase in $NaNO_3$ concentration. Irradiation of pure HNO_3 solutions of Pu showed that HNO_3 depressed the oxidation yield of Pu more efficiently than $NaNO_3$.

848. ELECTRODEPOSITION OF PLUTONIUM AT A MERCURY CATHODE. J. A. Porter. DP-388, June 1959.

Pu was electrodeposited at a Hg cathode from an ethanol solution using Ce(III) trichloride as a stand-in for Pu.

849. A SURVEY OF ORGANIC SOLVENTS FOR THE ELECTRODEPOSITION OF PLUTONIUM.
J. A. Porter. DP-389, July 1959.

Using Ce(III) as a stand-in for Pu, the solubility and conductivity were investigated in dimethyl sulfoxide. The system dimethyl sulfoxide-cerium chloride is the most promising for electrodeposition of Ce at the Hg cathode.

850. PROCESS FOR THE RECOVERY OF PLUTONIUM.
H. A. Potratz. U. S. Pat. 2,864,841, Dec. 16, 1958.

Pu is separated from U and fission products by contacting an acid solution containing uranyl and Pu(IV) with enough ammonium carbonate to form an alkaline solution. Cupferron is added to precipitate the Pu which is extracted with a water-immiscible organic solvent such as chloroform.

851. LONG-CHAIN QUATERNARY AMMONIUM SALTS IN SOLVENT EXTRACTION OF METAL IONS. (SEPARATION AND DETERMINATION.)

R. Powell. The Analyst 83, 252-3 (1958).

A 1% solution of a long-chain quaternary ammonium nitrate in benzene or chloroform was used to extract Pu^{+4} quantitatively. The most successful compound was the Rohm and Haas product, Hyamine 1622. Thoronol was also used as a reagent for quadrivalent Pu.

852. DECONTAMINATION OF WATER CONTAMINATED WITH PLUTONIUM.

M. Pressman, D. C. Lindsten. ERDL-1613-RR, Jan. 12, 1960.

By the use of standard processes of coagulation with ferric chloride and limestone, disinfection, and diatomate filtration, the Army Mobile Water Purification unit is capable of removing 72% of the Pu from contaminated tap water. The percentage can be increased to 99.9% by using a combination of other reagents.

853. FINAL TREATMENT OF PLUTONIUM AT THE END OF THE FONTENAY-AUX-ROSES PILOT PLANT.

I. Prevot, J. Corpel, P. Regnaut. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 96, United Nations, New York, 1958.

The method consists of three parts: (1) a new solvent-extraction scheme to improve decontamination; (2) an ion-exchange step; and (3) final precipitation as the trifluorides. A theoretical study which led to the treatment is discussed.

854. USE OF ION EXCHANGE RESINS FOR THE CONCENTRATION AND PURIFICATION OF URANIUM.

I. Prevot, P. Regnaut. Energie Nucleaire 1, 207-15 (1957).

During the Geneva Conference, the French process for the extraction of Pu from irradiated U was described.

855. A HIGH SENSITIVITY SCANNING COULOMETER WITH AUTOMATIC BACKGROUND CORRECTION AND PROPORTIONAL SCAN RATE TITRATION OF PLUTONIUM AND OTHER REDOX SPECIES.

R. C. Propst. Anal. Chem. 35, 958-63 (1963).

The scanning coulometer is a new electroanalytical instrument for recording coulomb-potential curves of reversible processes under nearly equilibrium conditions. Application of the instrument is described to the direct determination of Pu in irradiated nuclear fuel at the 2- to 5-μg level with a precision of 2.1%.

856. EQUILIBRIA AND REACTION RATES IN THE DISPROPORTIONATION OF Pu(IV).

S. W. Rabideau. J. Am. Chem. Soc. 75, 798 (1953).

The equilibrium constants and specific rate constants of Pu(IV) were measured as a function of H and Pu concentration in perchloric acid solutions. The equilibrium quotient for the disproportionation reactions was found to be directly dependent upon 4th power of H ion concentration, thus supporting the existence of plutonyl ion in these reactions. A weighted mean value of 0.0089 was determined for the Pu(IV) disproportionation-equilibrium quotient in $HClO_4$ solutions of unit ionic strength at 25°C.

857. THERMODYNAMIC FUNCTIONS AND FORMAL POTENTIALS OF THE PLUTONIUM(V)-(VI) COUPLE.

S. W. Rabideau. J. Am. Chem. Soc. 78, 2705-7 (1956).

The formal potentials of Pu couples in 1M $HClO_4$ at 25°C are:

$$Pu^{+3}\ \ \underline{-0.9819}\ \ Pu^{+4}\ \ \underline{-1.1721}\ \ PuO_2^{+}\ \ \underline{-0.9133}\ \ PuO_2^{2+}$$

$$\underbrace{Pu^{+4} \cdots PuO_2^{2+}}_{-1.0433}$$

$$\underbrace{Pu^{+3} \cdots PuO_2^{2+}}_{-1.0228}$$

858. THE KINETICS OF THE DISPROPORTIONATION OF PLUTONIUM(V).

S. W. Rabideau. J. Am. Chem. Soc. 79, 6350-3 (1957).

Studies were made in perchlorate solutions of unit ionic strength, in which PuO_2^+ was formed by plutonyl ion reduction with iodide ion. The rate of disproportionation of Pu(V) was found to be directly proportional to the H ion concentration, suggesting that the rate-determining step is probably $PuO_2^+ + Pu(O)\,OH^{++} \rightarrow PuO_2^{++} + Pu(O)\,OH^+$, with a calculated activation energy of 19.6 kcal. Disproportionation was also studied in heavy water with no evidence to support a H atom transfer mechanism. Pu(V) was obtained by spontaneous alpha reduction of the plutonyl ion.

859. THE HYDROLYSIS OF PLUTONIUM(IV).

S. W. Rabideau. J. Am. Chem. Soc. 79, 3675-7 (1957).

The hydrolysis quotient $(PuOH^{+++})(H^+)/(Pu^{+4})$ was determined in Li perchlorate-perchloric acid solution at a constant total molarity of 2 from measurements of the Pu(III)-Pu(IV) formal potential as a function of acidity, and the temperature dependence determined. Virtually identical Pu(III)-Pu(IV) formal potentials were obtained when Na perchlorate was substituted for Li perchlorate as added salt to maintain an ionic strength of 2.

860. RECENT ADVANCES IN THE BASIC CHEMISTRY OF PLUTONIUM, AMERICIUM, AND CURIUM.

S. W. Rabideau, L. B. Asprey, T. K. Keenan, T. W. Newton. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 28, 361, United Nations, New York, 1958.

The oxidation-reduction potentials of Pu in acid solutions were determined, enabling the estimation of equilibrium relationships among the aqueous Pu species from electromotive force, spectrophotometric, and kinetic data.

861. ALPHA-PARTICLE OXIDATION AND REDUCTION IN AQUEOUS PLUTONIUM SOLUTIONS.

S. W. Rabideau, M. J. Bradley, H. D. Cowan. LAMS-2236, June 1958.

The rate of change of mean oxidation number of Pu solutions in perchloric and hydrochloric acid solvents was studied. The hydrogen peroxide concentrations were found to depend on temperature in $HClO_4$ solutions. In hydrochloric acid, the hydrogen peroxide and rates of decrease of oxidation number are much lower. From chemical and gas analysis, it was concluded that the perchlorate ion is reduced to a chloride ion by alpha-particle radiation.

862. CHLORIDE COMPLEXING AND DISPROPORTIONATION OF Pu(IV) IN HYDROCHLORIC ACID. S. W. Rabideau, H. D. Cowan. J. Am. Chem. Soc. 77, 6145-8 (1955).

It has been shown from measurements of the formal potentials of the Pu^{+3}-Pu^{+4} couple in HCl-$HClO_4$ solutions that the complex in $PuCl^{3+}$ is formed. Equilibrium and rate measurements were made in HCl solutions at different temperatures of the reaction $3Pu^{+4} + 2H_2O \longleftrightarrow 2Pu^{+3} + PuO_2^{+2} + 4H^+$.

863. KINETICS OF OXIDATION-REDUCTION REACTIONS OF PLUTONIUM. THE REACTION BETWEEN PLUTONIUM(IV) AND TITANIUM(III) IN PERCHLORATE SOLUTION. S. W. Rabideau, R. J. Kline. J. Phys. Chem. 64, 193-6 (1960).

The kinetics of the reactions were studied by following the rate of disappearance of Pu(IV) spectrophotometrically at 4695A°. The effect of chloride ion on rate was negligible. The thermodynamic quantities were calculated to be $\Delta F = 15.0 \pm 0.1$ kcal/mol; $\Delta H = 16.7 \pm 0.72$ kcal/mole, and $\Delta S = \pm 5.9 \pm 2$ e.u.

864. THE KINETICS OF THE REACTION BETWEEN PLUTONIUM(IV) AND VANADIUM(III) IN PERCHLORATE SOLUTION. S. W. Rabideau, R. J. Kline. J. Inorg. Nucl. Chem. 14, 91-7 (1960).

The reaction rate was found to be first order with respect to each of the reactants and inversely proportional both to the first power and second power of the H ion concentration. The rate of reduction was unaffected by the added chloride ion.

865. THE POTENTIAL OF THE Pu(III)-Pu(IV) COUPLE AND THE EQUILIBRIUM CONSTANTS FOR SOME COMPLEX IONS OF Pu(IV). S. W. Rabideau, J. F. Lemons. J. Am. Chem. Soc. 73, 2895 (1951).

The formal potentials of Pu(III)-Pu(IV) versus H_2-H^+ couple in $HClO_4$ and HCl were found to be -0.9821 and -0.9703 ± 0.005 volts, respectively. A value of 3.1×10^{-2} was obtained for the hydrolysis constant of Pu(IV) at 25°C. The dissociation constants of Pu(IV) sulfate and Pu(IV) nitrate was obtained from the shift of cell potential to more positive values with the addition of the complexing agents.

866. OXYGEN EXCHANGE REACTIONS OF PLUTONIUM IONS IN SOLUTION. S. W. Rabideau, B. J. Masters. J. Phys. Chem. 67, 318-23 (1963).

An acceleration in the rate of exchange of solvent water oxygen with that of plutonyl ion is observed with lower valence states of Pu present. The upper limit of the specific rate constant for the PuO_2^+-H_2O reaction was established to be 6.4×10^{-5} sec in M $HClO_4$ at 23°C. The fluoride ion can labilize the plutonyl oxygen with respect to exchange.

867. DISSOLUTION OF HIGH-DENSITY UO_2, PuO_2 AND PuO_2/UO_2 PELLETS IN INORGANIC ACIDS. A. L. Uriarte, R. H. Rainey. Trans. Am. Nucl. Soc. 6, 410-11 (Nov 1963).

Rates of dissolution of various oxides of Pu and U in nitric acid and nitric acid containing 0.05M HF are given. The rate of dissolution of PuO_2 in 14M HNO_3 + 0.1M HF is 1.5 mg/min/cm^2.

868. THE MECHANISM OF CARRYING Pu(III) ON LANTHANUM FLUORIDE. D. L. Ralphs. HW-24115, April 15, 1952.

Pu separation from aqueous solution by precipitation with La fluoride, is discussed.

869. A COMPARISON OF ARSENIOUS OXIDE AND PLUTONIUM FOR THE STANDARDIZATION OF CERIC SULFATE. P. F. Raney. HW-74555, Aug. 6, 1962.

The results show that the Pu method has a significantly larger standard deviation than the As oxide method. Possible explanations of the irregular Pu results are given.

870. THE USE OF COINCIDENCE COUNTING TECHNIQUES FOR ANALYZING LOW LEVEL PLUTONIUM CONTAMINATION OF FILTERS. M. O. Rankin. HW-75092, Nov. 15, 1962.

An air filter measurement instrument, which uses coincidence-counting techniques, was developed to detect 1850 dpm of Pu in less than 2 minutes in the presence of 5000 dpm of natural Rn and thoron alpha activity. With this method, it is not necessary to wait for the natural alpha emitters to decay.

871. PYROHYDROLYTIC DETERMINATION OF FLUORIDE IN MILLIGRAM QUANTITIES OF PLUTONIUM FLUORIDES. G. S. Rao, M. S. Subramanian. Talanta 9, 947-8 (1962).

The pyrohydrolytic determination of fluoride using moist air is determined with a precision and accuracy of about 1% on the milligram scale.

872. THERMAL DECOMPOSITION OF PLUTONIUM OXALATES. G. S. Rao, M. S. Subramanian, G. A. Welch. J. Inorg. Nucl. Chem. 25, 1293-5 (1963).

Pu(III) oxalate precipitated from aqueous solution was found to crystallize with 10 molecules of water, and not 9 molecules as has been previously noted. On heating on the thermobalance in air, hydrates containing 9, 2, and 1 molecules of water of crystallization were obtained, while in an Ar atmosphere, the anhydrous oxalate was also formed.

873. ANALYSIS OF RADIATIONS FROM SPENT FUEL ELEMENTS USING A BENT-CRYSTAL SPECTROGRAPH. N. C. Rasmussen, M. D. Cohan. Trans. Am. Nucl. Soc. 5, 24 (June 1962).

Determination of Pu in irradiated fuel elements by gamma-excited X-ray spectra is described.

874. EXTRACTION OF PLUTONIUM. P. Regnaut. Energie Nucleaire 1, 196-206 (1957).

After a brief survey of the formation of Pu in piles, the difficulties of extracting it from irradiated U bars are reviewed. The different processes studied or used for the extraction are examined, and the advantages and inconveniences of each are indicated.

875. PYROPROCESSING FOR NUCLEAR FUELS. R. C. Reid, J. E. Vivian, D. Duffey. Nucleonics 14, No. 2, 22-5 (1956).

The advantages of pyroprocessing over conventional aqueous processing are discussed, and a suggested processing system is described. Pu can be extracted from irradiated U with molten Ag.

876. SIMULTANEOUSLY DETERMINING Pu AND U IN DISSOLVER SAMPLES. W. J. Maeck, M. T. Laug, M. E. Kussy, T. D. Morgan, J. E. Rein. Nucleonics 20, No. 5, 80; 82-4 (May 1962).

A rapid method for simultaneous separation of U and Pu based on a batch liquid-liquid extraction system is described to show that the elements may be determined simultaneously by multiple-filament mass-spectrometry in which ions measured are singly-charged metal ions.

877. SELECTED BIBLIOGRAPHY ON ANALYSIS OF CERTAIN RADIOACTIVE ELEMENTS IN BIOLOGICAL MATERIALS. D. Revinson. NYO-4702, Dec. 7, 1956.

The materials considered are Pu, Po, Ra, Rn, Th, U, fission products, I, Sr, and T.

878. SPECIAL RADIOISOTOPE METHODS. SECTION II. S. A. Reynolds. CF-48-10-219, Sept. 20, 1948.

Methods for Ba, Sr, Ce, Cs, Nb and the La group Y, Pu, Am, Cm, the rare earths, and Zr are given.

879. LARGE ISOTOPE SHIFTS IN THE PLUTONIUM SPECTRUM AND THEIR SUITABILITY FOR ISOTOPE ANALYSIS. E. W. T. Richards, A. Ridgely. AERE-R-3576, Dec 1960.

The Pu spectrum was photographed in the region 2950-5750A. It was found that the abundance of large shifts increased sharply with increasing wavelength. Two lists of lines suitable for isotope analysis were prepared: one below 5000A, and the other above.

880. FISSION CROSS-SECTIONS AS A FUNCTION OF NEUTRON ENERGY. II. PLUTONIUM-239 AND PLUTONIUM-241. R. Richmond, B. T. Price. J. Nucl. Energy 2, 177-86 (March 1956).

The measurements cover the neutron energy range of 0.007 to 700 eV. The fission cross-section of a mixture containing Pu^{241} has been compared with the fission cross-section of Pu^{239} over the neutron energy range 0.04-0.4 eV, and with the (u, a) cross-section of B^{10} over the range 0.2-70 eV.

881. ANALYTICAL CONTROL METHODS FOR PUREX. B. F. Rider, R. M. Nolin. KAPL-572 (Del.) April 27, 1951.

The methods used at KAPL for the analytical control of the Purex Process are presented as step-by-step procedures.

882. PLUTONIUM DATA MANUAL. E. L. Francis. IGR-161 (RDR), June 1, 1959.

The physical, mechanical, and chemical properties of Pu and some of its alloys are compiled.

883. PROCESS FOR THE RECOVERY OF PLUTONIUM. D. M. Ritter. U.S. Pat. 2,868,619.

This is a suggested improvement in the recovery process. The carrier precipitate is dissolved, Pu is oxidized to the hexavalent state, and a La fluoride precipitation is made. The fluoride ions are then complexed with a borate, and the Pu is then reduced and precipitated with bismuth phosphate.

884. REDUCTION IN Pu RECOVERY PROCESSES. D. M. Ritter, R. P. S. Black. U.S. Pat. 2,906,597, Sept. 29, 1959.

Oxalate ions are incorporated in the hexavalent Pu containing solutions prior to a step for precipitating La fluoride in the solution.

885. SEQUENTIAL SEPARATION OF SOME ACTINIDE ELEMENTS BY ANION EXCHANGE. F. P. Roberts, F. P. Brauer. HW-60552, June 1, 1959.

Two methods are presented for the sequential separation of the actinide elements. The first method separates Am, Pu, and Np. These elements are sequentially eluted from columns of Dowex 1 resin in that order by 8M HNO_3, 0.02M ferrous sulfamate in 4.5M HNO_3, and 0.001M ceric sulfate in 0.75M HNO_3. In the second method, Am, Th, Pu, and Np are sequentially eluted from columns of Dowex 1 resin in that order by 8M HNO_3, 12M HCl, 12M HCl + 0.1M NH_4I, and 4M HCl. Pa and U follow Am in both methods.

886. A METHOD FOR CLEANING AQUEOUS SOLUTIONS IN THE PLUTONIUM PURIFICATION AND RECOVERY PROCESSES FROM ORGANIC MATTER, BY TREATMENT WITH BENZENE IN A PACKED COLUMN. F. Roberts, W. D. Jones. RDB(W)-TN-21, March 18, 1952.

887. RECENT DEVELOPMENTS AND CURRENT PROBLEMS IN INORGANIC ANALYTICAL CHEMISTRY. C. J. Rodden. Anal. Chem. 31, 1940-5 (Dec 1959).

The analysis of nuclear materials is divided into major and minor constituents. Under major constituents are nuclear materials such as U, Th, and Pu, and alloys of these elements. The determination of minor constituents in fuels and moderators are considered under two categories - those constituents that are undesirable due to neutron absorption, and those that affect metallurgical properties.

888. POTENTIOMETRIC DETERMINATION OF PLUTONIUM. C. J. Rodden. In NBL-156, Semiannual Progress Report for the Period January 1959 through June 1959. Oct 1959.

Topics covered in this report include: a potentiometric determination of Pu using Bureau of Standards potassium dichromate; separation of μg quantities of Pu from laboratory waste; three methods for preparing BF_3 for mass spectrometer analysis.

889. GRAVIMETRIC DETERMINATION OF PLUTONIUM. C. J. Rodden. In NBL-165, Semiannual Progress Report for the Period January 1960 through June 1960. Jan 1961.

The behavior of Pu sulfate tetrahydrate, which has been proposed as a primary standard, is considered. A rapid method for sulfate in Pu solutions is given, where Pu is absorbed on a cation resin, and an acidimetric titration is made of the displaced H ion, which is equivalent to the sulfate content of the sample.

890. SURFACE DOSE FROM PLUTONIUM. W. C. Roesch. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 23, 339, United Nations, New York, 1958.

A theoretical study was made of the dose rate to be expected at the surface of a material of a high atomic number that is emitting gamma rays.

891. FEASIBILITY OF IN VIVO PLUTONIUM MEASUREMENTS. W. C. Roesch, J. W. Baum. HW-43370 (Del.), May 14, 1956.

It was shown that the detector proposed for the body monitor would detect 0.02 microcurie of Pu in the chest cavity.

892. DETECTION OF PLUTONIUM IN WOUNDS. W. C. Roesch, J. W. Baum. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 23, 142, United Nations, New York, 1958.

About 4% of the disintegrations of Pu are followed by emission of X-rays of about 17 keV. Thin RaI crystals are very efficient detectors of these rays (0.25 mm gives 95%) and have low backgrounds.

893. DETECTION OF PLUTONIUM IN VIVO BY WHOLE BODY COUNTING. W. C. Roesch, H. E. Palmer. HW-SA-2653, June 26, 1962.

This paper concerns Pu detected within depths of the body by counting X and gamma rays emitted from Pu and its daughter products. Proportional counters and thin crystal scintillation counters were employed.

894. ON THE EXISTENCE OF ELECTRONIC BANDS IN THE INFRARED SPECTRUM OF URANIUM(III) AND (IV); THEIR RELATION TO THE SPECTRUM OF PLUTONIUM. R. Rohmer, R. Freyman, A. Chenet, P. Rohmer. Compt. rend. 231, 347 (1950).

A table is given of the electronic bands in the near infrared spectrum of aqueous and organic solutions of some U salts. In view of the findings for U(VI), it is probable that the findings attributed to Pu(VI) should be re-examined.

895. PROCESS ENGINEERING PROBLEMS IN THE HANFORD SEPARATION PLANT. C. A. Rohrmann. Mech. Eng. 79, 634-8 (1957).

This paper describes standard processes for the separation of U, Pu, and fission products, including active waste treatment and disposal. The emphasis is on chemical engineering problems.

896. CHEMISTRY OF THE NUCLEAR REACTOR. M. A. Rollier. Chim. Ind. (Milan) 36, 454-63 (1954).

This is an address. The production of U, the materials used for reflectors, the decontamination and recovery of fission products, and the chemical separation of Pu are discussed.

897. SEPARATION OF PLUTONIUM FROM URANIUM BY EXTRACTION WITH SOLVENTS. M. A. Rollier. Gazz. Chim. Ital. 84, 649-57 (1954).

Pu present in the exhausted bars of U from a nuclear reactor can be recovered by double extraction with Et$_2$O.

898. ALPHA ENERGY MEASUREMENTS OF Pu^{239} CONTAINED IN DEPLETED U AFTER IRRADIATION IN A SUBCRITICAL ASSEMBLY. M. A. Rollier, V. Maxia, S. Meloni. Chim. Ind. (Milan), 44, 1121-6 (1962).

In the case of impoverished specimens, the alpha particles peak at 4.77 meV is greatly reduced, and the maximum at 4.58 meV is no longer distinguishable. The samples were prepared for counting by both evaporation and electrolytic deposition.

899. EXPERIMENTAL ATOMIC SCATTERING FACTORS AND ANOMALOUS DISPERSION CORRECTIONS FOR Th, U, AND Pu. R. B. Roof, Jr. Acta Cryst. 14, 934-40 (1961).

Experimental atomic scattering factors were determined for Th, U, and Pu with MoK$_\alpha$, CrK$_\alpha$, FeK$_\alpha$, and CrK$_\alpha$X radiations.

900. NUCLEAR MATERIALS CONTROL SYSTEM (NMCS). PHASE II. CONTINUOUS MONITORS FOR URANIUM AND PLUTONIUM IN A CHEMICAL PROCESSING PLANT. E. R. Rosal, W. E. Foster, C. C. Thomas, Jr., H. Ginsburg. WCAP-6031, Dec. 1, 1959.

901. ANALYSIS OF Pu(IV) POLYMER FOR CHLORIDE IONS. D. G. Rose. CN-2807, April 23, 1945.

Experiments were performed on the precipitate resulting from the addition of KOH to Pu^{+4} polymer for chloride ions. The precipitate washes were also examined for chloride ions. It was concluded that the polymer did not include chloride ions; that the chloride was brought down during the precipitation, and was at best on the surface of the polymer particles.

902. PROGRESS REPORT: PLUTONIUM REMOVAL, TUMOR INCIDENCE STUDIES. PART II. M. W. Rosenthal, J. F. Fried, A. Lindenbaum, J. Schubert. In ANL-6464, Biological and Medical Division Semiannual Report January through June 1961, November 1961, pp. 82-84.

Results are reported from studies on the effectiveness of treatment with diethlenetraminepentaacetic acid on mortality and tumor incidence in Pu-injected mice.

903. KINETICS OF BODY DISTRIBUTION OF PLUTONIUM AS INFLUENCED BY ZIRCONIUM. M. W. Rosenthal, J. Schubert. Radiation Research 6, 349-51 (1957).

It is stated that injection of Zr salts increases excretion and decreases skeleton deposition of injected Pu and other radioelements in animals. This appears to be due to the Zr exerting a carrier action. The radioelement combines with colloidal Zr in the blood by absorption, ion exchange, or coprecipitation, and the subsequent distribution and excretion pattern of the combined materials is primarily that of Zr. It is concluded that a single small injection of Zr almost immediately prevents any further transfer of Pu from the blood to the skeleton.

904. AN EVALUATION OF DATA ON NUCLEAR CARBIDES. F. A. Rough, W. Chubb. BMI-1441, May 31, 1960.

Data on properties, constitution, compatibility, radiation behavior, fabrication, preparation and storage of U, Th, and Pu carbides are reviewed.

905. NEW METHOD OF ANALYSIS BY X-RAY FLUORESCENCE, APPLICABLE TO SMALL SAMPLES. H. Roulet, J. Despujols. Compt. rend. 253, 641 (1961).

A sample is irradiated by nearly monochromatic X-ray beam with a wavelength somewhat shorter (λ_1) or longer (λ_2) than the absorption discontinuity of the element sought. The secondary radiation strikes the window of a Geiger counter. If I_1 and I_2 are the number of impulses corresponding to λ_1 and λ_2, than $I_1 - mI_2$ is a measure of the fluorescent radiation of the element sought. The constant is determined experimentally.

906. DISTRIBUTION OF PLUTONIUM IN SOLVENT EXTRACTION BY TRIBUTYLPHOSPHATE. A. M. Rozen, E. I. Moiseenko. Zhur. Neorg. Khim. 4, 1209-14 (May 1959).

Distribution coefficients of Pu(IV) and Pu(VI) during solvent extraction by 20% TBP in kerosene were measured with varying acid and U concentrations.

907. SOME EXPERIMENTS WITH IMPORTANT FISSION PRODUCTS. G. Rudstam. Atompraxis 6, 124-8 (1960).

Dibutyl carbitol, Et_2O, and Bu_3PO_4 were used to separate U and Pu from fission products in HNO_3 solutions containing a salting agent, such as NH_4NO_3, $Mg(NO_3)_2$, $NaNO_3$, or $Ca(NO_3)_2$.

908. SEPARATING TRANSPLUTONIUM ISOTOPES FROM IRRADIATED PLUTONIUM. W. Ruehle, Jr. Nucleonics 12, No. 11, 84-5 (Nov 1954).

A dry box in a modified cave was equipped with apparatus necessary for separating the transplutonium isotopes from irradiated Pu. Shielding and processing equipment are described.

909. THE QUANTITATIVE DETERMINATION OF PLUTONIUM IN BIOLOGICAL MATERIALS. PART III. THE ANALYSIS OF TISSUES. E. R. Russell. N-1536pn, June 12, 1946.

Several methods are described for ashing of the tissues preparatory to extraction of the Pu by solvent extraction procedures such as cupferron-chloroform, hexone, and TTA. All methods described, with the exception of the TTA method, are dependent upon a final precipitation of Pu by Ca fluoride.

910. ADSORPTION-BISMUTH PHOSPHATE METHOD FOR SEPARATION OF PLUTONIUM. E. R. Russell, A. W. Adamson, G. E. Boyd. U. S. Pat. 2,942,937, June 28, 1960.

A process is presented for separating Pu from U and fission products. Pu and U are absorbed by a cation-exchange resin, Pu is eluted from the adsorbent, and then after oxidation to the hexavalent state, the Pu is contacted with a Bi phosphate carrier precipitate.

911. PROCESS OF REMOVING PLUTONIUM VALUES FROM SOLUTION WITH GROUP IV-B METAL PHOSPHO-SILICATE COMPOSITIONS. E. R. Russell, A. W. Adamson, J. Schubert, G. E. Boyd. U. S. Pat. 2,811,416, Oct. 29, 1957.

These values can be removed from an aqueous solution by taking an aqueous solution containing a salt of Zr, Ti, Hf, or Th, adding an aqueous solution of silicate and phosphoric acid anions to the metal-salt solution, and separating, washing, and drying the precipitate that forms when the two solutions are mixed.

912. THE QUANTITATIVE DETERMINATION OF PLUTONIUM IN BIOLOGICAL MATERIALS. PART II. ANALYSIS OF STOOLS. E. R. Russell, C. Brown. AECD-4070, June 13, 1946.

Methods are described for determining Pu excretion rates. The most consistent results were obtained in the TTA and Bi phosphate procedures.

913. DISTRIBUTION AND EXCRETION OF PLUTONIUM. E. R. Russell, J. J. Nickson. National Nuclear Energy Series, Div. IV, Vol. 20, Industrial Medicine on the Plutonium Project, 256-263, McGraw-Hill Book Company, Inc., New York, 1951.

From studies on five persons accidentally exposed to Pu, a urinary excretion and fecal rate were determined. Principal sites of Pu deposition were determined.

914. CHEMISTRY OF PLUTONIUM IN ANION EXCHANGE APPLICATIONS. J. L. Ryan. In TID-7607, Plutonium Ion Exchange Processes. Proceedings of the US-UK Technical Exchange Meeting, Oak Ridge National Laboratory, April 25-27, 1960, pp. 2-20.

The effects of temperature, solution concentration, and U concentrations on the distribution coefficient of Pu between Dowex 1 x 4 and $Ca(NO_3)_2$ and HNO_3 solutions are shown graphically. The desorption rates with dilute HNO_3 solutions are also shown.

915. SPECIES INVOLVED IN THE ANION-EXCHANGE ABSORPTION OF QUADRIVALENT ACTINIDE NITRATES. J. L. Ryan. J. Phys. Chem. 64, 1375-85 (1960).

The species absorbing from nitric acid were $Pu(NO_3)_6^{-2}$, $Np(NO_3)_6^{-2}$, and $Th(NO_3)_6^{-2}$. The presence of maxima in exchange distributions are attributed to formation of $HM(NO_3)_6^{-}$ and $H_2M(NO_3)_6$ at high acidity.

916. CONCENTRATION AND FINAL PURIFICATION OF NEPTUNIUM BY ANION EXCHANGE.
J. L. Ryan. HW-59193 (Rev.), Sept. 3, 1959.

A method is given for the final purification of Np from Pu, U, and fission products, Th, and metallic impurities. Np(IV) is absorbed on anion-exchange resins from 6M HNO_3 containing ferrous sulfamate and hydrazine. A choice of resin is given, along with elution techniques.

917. ANION EXCHANGE AND NONAQUEOUS STUDIES OF THE ANIONIC NITRATE COMPLEXES OF THE HEXAVALENT ACTINIDES. J. L. Ryan. J. Phys. Chem. 65, 1099-1107 (1961).

Spectrophotometric studies were used to identify the species of hexavalent actinides that are absorbed by anion-exchange resins from nitrate solutions. The anion-exchange resins were found to absorb predominantly $MO_2(NO_3)_4^{-2}$. The formation constant in nitromethane is 4.7 ± 0.2.

918. RECOVERY AND PURIFICATION OF PLUTONIUM BY ANION EXCHANGE. J. L. Ryan, E. J. Wheelwright. Ind. Eng. Chem. 51, 60-5 (1959).

Plutonium can be absorbed from 7M HNO_3 on several commercially available anion-exchange resins. The degree of separation depends on the extent of the washing cycle with 7M HNO_3. Separation factors for U and fission products as high as 3 x 107 have been obtained in two cycles. Several resins show adequate resistance to chemical and radiation damage.

919. APPLICATION OF ANION EXCHANGE TO THE REPROCESSING OF PLUTONIUM. J. L. Ryan, E. J. Wheelwright. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 137, United Nations, New York, 1958.

It has been demonstrated that Pu(IV) can be absorbed from nitric acid solution by anion-exchange resins. By operating at an elevated temperature (50 to 60°C), and by proper choice of anion-exchange resins, the separation of Pu from irradiated U is made efficient.

920. SEPARATION OF METAL ACETYLACTONATES. J. Rydberg. Arkiv Kemi 9, 95-103 (1955).

The possibility of separating metals by extracting some of them as acetylacetonates from aqueous $NaClO_4$ solutions into chloroform, benzene, or methyl isobutyl ketone is discussed in the light of recent information about the complex formation between metals and acetylacetone.

921. TWO METHODS FOR THE ISOLATION OF TRACER AMOUNTS OF PLUTONIUM. J. Rydberg. Acta Chem. Scand. 9, No. 8, 1252-60 (1955).

A modified bismuth-phosphate-carrier method and a sulfide-precipitation method are outlined for the separation of trace amounts of Pu from irradiated U.

922. THE REDUCTION OF PLUTONIUM BY TETRAVALENT URANIUM. J. Rydberg. J. Inorg. Nucl. Chem. 5, 79-86 (1958).

The conditions for using U(IV) as a reducing agent for Pu in HNO_3 and other solutions have been investigated. It is shown that U(IV) quantitatively reduces Pu to Pu(III) within 5 min in 1M HNO_3. This fact has been used in liquid-liquid extractions for separating Pu from U.

923. STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXVII. THE DISTRIBUTION OF SOME ACTINIDES AND FISSION PRODUCTS BETWEEN METHYL ISOBUTYL KETONE AND AQUEOUS SOLUTIONS OF HNO_3 AND $Ca(NO_3)_2$. J. Rydberg, B. Bernstrom. Acta Chem. Scand. 11, No. 1, 86-97 (1957).

Distribution ratios of U(VI), Pu(VI), Pu(IV), Th(IV), La(III), Ca(II), and Na are given for system nitric acid, calcium nitrate, and hexone. Applications to the separation of U and Pu are given.

924. COMBINATION OF UNIT PROCESSES FOR ISOLATING PLUTONIUM. J. Rydberg, L. G. Sillen. Acta Chem. Scand. 9, No. 8, 1241-51 (1955).

The unit processes, reduction-oxidation, and separation that have been compiled from various laboratory and industrial methods used for the separation of Pu from irradiated U are discussed.

925. SPECTRAL ANALYSIS BY THE EVAPORATION METHOD-V. ANALYSIS OF PLUTONIUM BY THE METHOD OF EVAPORATION IN VACUUM. A. N. Saidel, N. I. Kaliteievsky, L. V. Lipis, V. M. Tarakanov. Optika i Spectroskopiya 3, No. 1, 16 (1957).

926. ION-EXCHANGE SEPARATION OF URANIUM, PLUTONIUM, THORIUM, AND NEPTUNIUM. N. Saito, T. Sekine. Dai-1-kai Genshiryoku Symposium Habunshu 1957, 506-9 (1957).

U, Pu, Th, and Np in HCl are separated by the use of an anion-exchange resin. When a HCl solution containing these elements is passed through the anion-exchanger column (Dowex-1, x-8), Th is found in the eluate, while U, Np, and Pu are eluted from the column with N HCl. SO_2 is passed through the effluent to reduce Pu and Np to Pu(III) and Np(IV), respectively. The solution is strongly acidified again with HCl (9N) and passed through the same column. Pu(III) is then found in the eluate. After Np(IV) is eluted from the column with 6N HCl, U is eluted with NHCl.

927. ELECTRODEPOSITION OF SMALL AMOUNTS OF URANIUM, NEPTUNIUM, AND PLUTONIUM. A. G. Samartseva. In AEC-tr-4497, Transactions of the All-Union Scientific Technical Conference on the Use of Radioactive and Stable Isotopes and Radiations in the National Economy and in Science, April 4-12, 1957. Isotopes and Radiation in Chemistry, 1958, pp. 400-410.

A method was developed for the quantitative electrodeposition of Th, U, Pu, and Am from solutions of HNO_3, H_2SO_4, HCl, $HClO_4$, and $H_2C_2O_4$, at 10M hydrogen ion concentration in the electrolytes.

928. SEPARATION OF TRACES OF URANIUM, NEPTUNIUM, PLUTONIUM AND AMERICIUM BY ELECTROLYSIS. A. G. Samartseva. Atomnaya Energ. 8, 324-9 (1960).

An electrolytic method is suggested for separating U, Np, Pu, and Am from acid solutions. The yield is independent of anion concentration but dependent on pH. The influence of Fe is eliminated by adding oxalate.

929. THE ADSORPTION OF QUADRIVALENT PLUTONIUM ON POLISHED PLATINUM SURFACE. A. G. Samartseva. Radiokhimiya 4(5), 526-31 (1962).

In the adsorption of Pu(IV) from nitrate solutions containing 4.1×10^{-9}M Pu^{239}, on polished Pt, the time needed to reach equilibrium was 1, 2-3, and 5-6 hr at pH 1.3, 2.1-2.7, and 7-8, respectively.

930. PRELIMINARY WORKING PROGRAM FOR THE DEVELOPMENT OF ANALYTICAL METHODS FOR THE EUROCHEMIC REPROCESSING PLANT, 1958. TECHNICAL REPORT 6. K. Samsahl. NP-7663, May 16, 1958.

This report describes instrumentation and the determination of Pu in irradiated fuels. Pu is suggested to be determined by the LaF_3 method, the TTA extraction method of direct α-counting.

931. DETERMINATION OF PLUTONIUM IN URINE. S. M. Sanders, Jr. DP-146, March 1956.

The procedure includes two bismuth phosphate coprecipitations, two lanthanum fluoride coprecipitations, a TTA solvent extraction, and electrodeposition, and a radioautographic determination.

932. A NEW PROCEDURE FOR PLUTONIUM URINALYSIS. S. M. Sanders, Jr., S. C. Leidt. Health Physics 6, 189-97 (Oct 1961).

In this method, anion exchange is used to separate Pu from other inorganic ions remaining after evaporation and oxidation of the urine. The quantity of Pu is then determined by counting α tracks in an autoradiograph of the metal disk upon which the Pu has been electrodeposited.

933. ELECTROCHROMATOGRAPHIC SEQUENCES. T. R. Sato, W. P. Norris, H. H. Strain. Anal. Chem 26, 267-71 (1954).

Solutions of mixtures were added to the center of 30 x 15-cm paper and 5-13 v/cm applied. In 0.1M I, U^{233}, Pu^{239}, and Th^{230} separated in said sequence.

934. RAPID METHOD FOR THE DETERMINATION OF PLUTONIUM IN RADIOACTIVE EFFLUENTS. J. Scheidhauer. Chim. Anal. 43, 462-4 (1961).

Pu was separated from other active constituents by coprecipitation with LaF_3, subsequent reduction to Pu(IV) and extraction with 2-thenoyl trifluoroacetone in xylene; the organic extract was evaporated to dryness and ashed before final determination of the α activity with a scintillation counter.

935. RAPID DETERMINATION OF PLUTONIUM IN RADIOACTIVE EFFLUENTS. J. Scheidhauer, L. Messainguiral. Chim. Anal. 43, 462-4 (1961).

The process stream to be analyzed has a low α-activity but high dissolved salts content. Pu is oxidized by $K_2Cr_2O_7$ to Pu^{4+}, the HF precipitate is removed, Pu^{4+} is reduced to Pu^{3+} with NH_2OH, and PuF_3 is coprecipitated with LaF_3. After dissolution in $NHNO_3$, Pu^{3+} is extracted into xylene with thenoyltrifluoroacetone. The Pu is extracted back into H_2O, the solution is evaporated, and the Pu activity is counted.

936. PLUTONIUM - ITS CHEMICAL AND PHYSICAL PROPERTIES. A. Schiffers. Chemiker Z. 86, 656-70 (1962).

Topics discussed are the preparation and occurrence of the metal, isotopes and alloys, chemical properties, and analytical chemistry. Principal compounds and their properties and preparation are tabulated.

937. SEPARATION METHODS FOR PLUTONIUM. A. Schiffer. Chemiker Z. 86, 845-51 (1962).

The methods and techniques used for the separation and preparation of Pu are summarized.

938. FLUORIDE COMPLEXING OF U(VI) AND Pu(IV) IN SOLUTIONS CONTAINING Al(III) AND Zr(IV). C. S. Schlea, J. T. Lowe. DP-842.

The relative amounts of fluoride complexing in solutions containing fluoride and the subject cations were measured to provide a method of calculating the concentrations of U(VI) and Pu(IV) fluoride complexes over a wide range of solution compositions. The information is useful in solvent-extraction processes that involve the recovery of Pu and U from fluoride solutions.

939. ON THE COPRECIPITATION OF TETRAPOSITIVE IONS WITH LANTHANUM FLUORIDE. K. Schlyter, L. G. Sillen. Acta Chem. Scand. 4, No. 8, 1323 (1950).

X-ray diffraction studies of the precipitates from Ce^{+4}, La^{+3}, and U^{+4}-La^{+3} lead to conclusions that Ce^{+4} and U^{+4} are actually contained in the LaF_3 lattice. An analogy - Pu^{+4} with a radius similar to Ce^{+4} and U^{+4} should act in the same way.

940. THE REPROCESSING OF IRRADIATED FUELS. Progress Report No. 1. J. Schmets. EURAEC-23, 1960.

A prototype thermobalance for Pu work was constructed and tested successfully.

941. DETERMINATION OF AMERICIUM. H. R. Schmidt. HW-25927, Oct. 15, 1952.

Am is determined by oxidizing Pu to the fluoride soluble plutonyl state and subsequently precipitating Am trifluoride with the Ce fluoride carrier.

942. MEASUREMENT OF THE NUCLEAR MATERIALS CONTENT OF NONPRODUCTION FUELS. R. A. Schneider. HW-60533, May 25, 1959.

Problems associated with the measurement of the nuclear materials content on nonproduction fuels are discussed. Measurements based on the bulk measurement of dissolver solution and on the Pu-to-U ratio method accepting the records of total U are performed.

943. ANALYTICAL EXTRACTION OF NEPTUNIUM USING TRI-ISO-OCTYLAMINE AND THENOYLTRIFLUOROACETONE. R. A. Schneider. Anal. Chem. 34, 522-5 (1962).

An analytical solvent-extraction method for separating Np from Pu, Am, Cm, U, Th, and fission products using TOA and TTA is described.

944. ANALYTICAL TECHNICAL MANUAL. R. A. Schneider, K. M. Harmon. HW-53368, Feb. 1, 1961.

The text covers alpha counting methods, emission spectrographic methods, X-ray absorptiometric determination of Pu and U, Np methods and extraction methods for Pu and Am; determination of Am^{241} by TBP-TTA extraction; and separation of Pu by solvent extraction with TTA.

945. STUDIES IN ION EXCHANGE ADSORPTION: EQUILIBRIUM WITH Pu(IV), FISSION, AND OTHER CATIONS. J. Schubert. CN-1873, Jan. 1, 1945.

The order of adsorption of several cations was studied using Amberlite IR-1. These studies were also used in the detection and study of colloids, and in a study of distribution coefficients.

946. PROGRESS REPORT: RADIOBIOCHEMISTRY. J. Schubert. In ANL-4401, Quarterly Report, November, December 1949 and January 1950, Biological and Medical Divisions, pp. 171-173.

Certain salts were found effective in the removal of Pu from the body. The rate of removal in the prevention of bone deposition is directly proportional to the amount of salt administered. Pu is taken up by a nearly irreversible physical absorption, while Sr is taken up by a chemical (ion) exchange. The metabolism of Pt has been found to be unaffected by either sodium citrate or zirconium citrate.

947. SEPARATION OF PLUTONIUM FROM AQUEOUS SOLUTIONS BY ION EXCHANGE. J. Schubert. U. S. Pat. 2,837,401, June 3, 1958.

A process is described for separating Pu from an aqueous solution of a Pu salt. The process comprises adding to the solution an acid of the group consisting of sulfuric acid, phosphoric acid, and oxalic acid, and mixtures thereof to provide an acid concentration between 0.001 and 1M, contacting the resultant solution with a synthetic organic anion-exchange resin, and separating the aqueous phase and the resin which contains the Pu.

948. RADIOELEMENT REMOVAL BY CHELATING AGENTS: APPLICATION OF MASS ACTION LAWS AND OTHER FACTORS. J. Schubert. Federation Proc. 20, Suppl. 10: 219-21 (1961).

A procedure is described for testing the effect of chelating agents on the removal of radioactive metals from mammals. The effectiveness of DTPA in the removal of Pu is discussed.

949. INTERNAL CONTAMINATION AND ITS TREATMENT. J. Schubert. In IXth International Congress of Radiology, Vol. 2, Georg Thieme Verlag, 1961, pp. 1251-7.

The action of chelating agents in hastening the elimination of radioelements deposited in the body is described.

950. STUDIES ON Pu(IV) SOLUTIONS IN THE PRESENCE AND ABSENCE OF CITRIC ACID. J. Schubert, D. Revinson. CH-3578, June 20, 1946.

The stability of Pu^{+4} and the complex formed with citric acid was studied over a wide pH range. Above a pH 2.6, Pu^{+4} underwent an abrupt change to a radiocolloidal behaving state.

951. CONTROL OF HEALTH HAZARDS IN HANDLING OF PLUTONIUM: RESULTS OF 14 YEARS EXPERIENCE. H. F. Schulte, D. D. Meyer. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 23, 206, United Nations, New York, 1958.

The health hazards involved, both external and internal radiation, are outlined and a brief historical review of the Los Alamos experience in developing methods of handling Pu safely is presented.

952. COULOMETRIC GENERATION AND BACK TITRATION OF INTERMEDIATE REAGENTS AT CONTROLLED POTENTIAL - APPLICATION TO DETERMINATION OF PLUTONIUM. W. D. Schults. Anal. Chem. 33, 15-8 (1961).

Coulometric reagents for secondary processes may be electrically generated and back-titrated at controlled electrode potential, rather than controlled electrolysis current. Advantages of technique and factors to be considered are mentioned. Its application to Pu(VI) and Fe(II) are discussed.

953. CRITICALITY MEASUREMENTS PERFORMED IN SITU. C. L. Schuske. RFP-245, 1961.

Low-level neutron-multiplication measurements made in situ are being used as an aid in arriving at safe, practical criticality limits for the design and operation of process equipment handling U^{235}, Pu^{239}, and U^{233}.

954. POTENTIOMETRIC INVESTIGATIONS ON PLUTONIUM. K. Schwabe, D. Nebel. Z. Physik. Chem. (Leipzig) 220, 339-54 (1962).

The complex formation between Pu^{+4} or Pu^{+3} and acetate ions was investigated. The complex constants were measured, and the Pu^{+4}/Pu^{+3} standard potential estimated.

955. NUCLEAR-TRACK TECHNIQUE FOR LOW-LEVEL Pu IN URINE. L. C. Schwendiman, J. W. Healy. Nucleonics 16, No. 6, 78, 80-82 (1958).

The method required evaporation of the urine sample, muffling, precipitation, and an extraction with thenoyltrifluoroacetone (TTA). The Pu is subsequently electrodeposited on a 7-mm-dia area, and the disc so prepared is held against a nuclear track emulsion for 168 hr.

956. A SENSITIVE ANALYTICAL METHOD FOR THE DETERMINATION OF VERY LOW LEVEL PLUTONIUM IN HUMANS. L. C. Schwendiman, J. W. Healy. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 23, 144, United Nations, New York, 1958.

A method was developed for determining extremely low levels of Pu in urine. This method involves sample evaporation, muffling, dissolution of salts, coprecipitation with lanthanum fluoride, and chelation with thenoyltrifluoroacetone to isolate the Pu.

957. ANALYSIS FOR PLUTONIUM BY CONTROLLED-POTENTIAL COULOMETRY. F. A. Scott, R. M. Peekema. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 28, 573, United Nations, New York, 1958.

Either Hg or Pt electrodes are used. The method is simple with a minimum of sample pretreatment and no chemical adjustment of valence state necessary.

958. ELECTRON-PROBE MICROANALYSIS OF RADIOACTIVE SAMPLES. QUANTITATIVE ANALYSIS OF THE PLUTONIUM-IRON SYSTEM. V. D. Scott, C. V. T. Ranzetta. J. Inst. Metals 90, 160-7 (1962).

Techniques suitable for the examination of radioactive specimens by electron-probe microanalysis are presented with illustrations and assessed. Quantitative results from a series of alloys containing Fe and the heavily-absorbing element Pu showed large differences between the measured Fe contents and the true values.

959. SEPARATING NEPTUNIUM FROM PLUTONIUM IN AQUEOUS INORGANIC SOLUTION. G. T. Seaborg. U.S. Pat. 3,005,680, Feb. 2, 1948.

Np is separated from Pu in aqueous solution by using the rapid oxidation of Np and the slow oxidation of Pu in solutions of the reduced ions. The solution of the reduced ions, as sulfates, is treated with alkali bromate at 15-25°C until substantially all the Np is oxidized. La^{3+} and F^- are added, and the Pu containing precipitate is separated. In an alternative method, the reduced ions are treated with an aqueous solution of 0.2M BrO_3^- and 0.2M Br.

960. THE TRANSURANIUM ELEMENTS: RESEARCH PAPERS. G. T. Seaborg, J. J. Katz, W. M. Manning, Editors. National Nuclear Energy Series, Div. IV, Vol. 14B, McGraw-Hill Book Company, Inc., New York, 1949.

961. EXTRACTION OF HEXAVALENT PLUTONIUM FROM AQUEOUS ACIDIC SOLUTION WITH ETHYL SULFIDE. G. T. Seaborg. U. S. Pat. 2,990,242, June 27, 1961.

A process is described for extracting Pu^{6+} from an aqueous ammonium nitrate-nitric acid solution with ethyl sulfide.

962. EXTRACTION OF TETRAVALENT PLUTONIUM VALUES FROM AQUEOUS ACID SOLUTIONS BY 2-ETHYLBUTOXY ETHANOL. G. T. Seaborg. U. S. Pat. 2,996,526, Aug. 13, 1961.

963. SEPARATION OF PLUTONIUM FROM URANIUM AND FISSION PRODUCTS BY SOLVENT EXTRACTION. G. T. Seaborg, W. J. Blaedel, M. T. Walling, Jr. U. S. Pat. 2,950,166, Aug. 23, 1960.

Differences in solubilities of oxidation states are used. Nitric acid and hexone media are considered.

964. THE ACTINIDE ELEMENTS. G. T. Seaborg, J. J. Katz, Editors. National Nuclear Energy Series, Div. IV, Vol. 14A, McGraw-Hill Book Company, Inc., New York, 1954.

965. SEARCH FOR ELEMENTS 94 AND 93 IN NATURE. PRESENCE OF 94^{239} IN PITCHBLENDE. G. T. Seaborg, M. L. Perlman. A-146, April 13, 1942.

An examination of a pitchblende concentrate indicated that no positive amount of either element could be conclusively detected.

966. SEARCH FOR ELEMENTS 94 AND 93 IN NATURE. PRESENCE OF 94^{239} IN PITCHBLENDE. G. T. Seaborg, M. L. Perlman. J. Am. Chem. Soc. 70, 1571-3 (1948).

A final fraction of 94 and 93 precipitated with rare-earth carrier is counted for fissions with slow and fast neutrons, and an upper limit of one part in 10^8 to 10^9 has been set for the amount of these elements in the sample. One part in 10^{14} is estimated as the amount of 94^{239} in the original pitchblende concentrate.

967. PEROXIDE PROCESS FOR SEPARATION OF RADIOACTIVE MATERIALS. G. T. Seaborg, I. Perlman. U. S. Pat. 2,852,336, Sept. 16, 1958.

A method is presented for separating Pu from hexavalent U by using Th as a carrier in the precipitation of the peroxide. The precipitation is done in a sulfate medium with the pH controlled between 2-3.

968. CONCENTRATION AND DECONTAMINATION OF SOLUTIONS CONTAINING PLUTONIUM VALUES BY BISMUTH PHOSPHATE CARRIER PRECIPITATION METHODS. G. T. Seaborg, S. G. Thompson. U. S. Pat. 2,950,168, Aug. 23, 1960.

A process is presented for recovering Pu from fission products by a series of oxidation-reduction cycles.

969. THE CHEMICAL PROPERTIES OF ELEMENTS 94 AND 93. G. T. Seaborg, A. C. Wahl. J. Am. Chem. Soc. 70, 1128 (1948).

This report describes the chemical experiments that were performed on elements 94 and 93 and the chemical properties that were deduced from these experiments.

970. SEPARATION OF PLUTONIUM FROM URANIUM AND FISSION PRODUCTS BY ADSORPTION. G. T. Seaborg, J. E. Willard. U.S. Pat. 2,819,144, Jan. 7, 1958.

This separation is accomplished by contacting the solutions containing Pu in the 3+ or 4+ oxidation states with diatomaceous earth which preferentially adsorbs the Pu present.

971. AMPEROMETRIC TITRATION OF PLUTONIUM(VI) WITH IRON(II). C. A. Seils, Jr., R. J. Meyer, R. P. Larsen. Anal. Chem. 35, 1673-5 (1963).

Pu is oxidized in a sulfate medium to Pu(VI) with argentic oxide. The excess oxidant is destroyed by heating, and the Pu is titrated with Fe(II). For 15-mg samples, precisions of ±0.6% relative standard deviation are obtainable. For 0.2-mg samples, the relative standard deviation is about 0.4%.

972. DISTRIBUTION OF PARTICLE SIZE FOUND IN BREATHING AIR AT HANFORD PLUTONIUM FABRICATION FACILITIES. J. M. Selby. HW-SA-2623, 1962.

Results from a study on the particle-size distribution found in a Hanford Pu fabrication facility are discussed.

973. SIZE ANALYSIS OF PARTICULATES FOUND IN AIR AT HANFORD PLUTONIUM FABRICATION FACILITIES. J. M Selbey. HW-SA-2713, Aug. 9, 1962.

The characteristics of radioactively-contaminated air at Hanford work locations were studied. One main objective in this study is to define the size of particular air contamination in Pu handling facilities.

974. THE SEPARATION OF FISSION PRODUCTS ON ION EXCHANGERS. K. E. Seyb, G. Herrmann. Z. Elektrochem. 64, 1065-72 (1960).

A scheme for separation of fission products having a half-life above 1 day, U, and neighboring elements is described. The separation is made by ion exchange coupled with distillation.

975. PREPARATION OF THIN UNIFORM FILMS OF PuO_2 SUITABLE FOR FISSION FRAGMENT COUNTING. J. Shaw, A. Whittaker, L. Polley, G. Wortley. WSL-R-39, Aug. 12, 1952.

Thin films of PuO_2 suitable for detection of Pu^{240} were prepared by dropping Pu salt solution onto the center of a spinning Pt dish and igniting (850°C) the Pu salt to the oxide. The spinning rate is important, and 1800 rpm was used with a 1.5-in.-dia dish.

976. PROCESS FOR EXTRACTING NEPTUNIUM AND PLUTONIUM FROM NITRIC ACID SOLUTIONS OF SAME CONTAINING URANYL NITRATE WITH A TERTIARY AMINE. J. C. Sheppard. U. S. Pat. 3,047,360, July 31, 1962.

A process of selectively extracting plutonium nitrate and neptunium nitrate with an organic solution of a tertiary amine, away from uranyl nitrate present in an aqueous solution in a maximum concentration of 1M is described.

977. THE EXTRACTION OF NEPTUNIUM(IV) AND PLUTONIUM(IV) FROM NITRIC ACID SOLUTION WITH TRI-n-OCTYL AMINE. J. C. Sheppard. HW-51958, Aug. 22, 1957.

The extraction behavior of Pu(IV) and Np(IV) was investigated and the utility of amine proven. This was expected in view of the behavior of the nitrates on anion-exchange resins. Tri-n-octyl extraction behavior amine acts essentially in an acid media as a liquid-exchange resin. The effect of acid concentration, reagent concentration, and other variables is discussed.

978. TTA EXTRACTION CURVES. E. Sheperd, W. W. Meinke. AECU-3879, Oct. 24, 1958.

Curves are given of pH values versus percent extraction by thenoyltrifluoroacetone in benzene for Ac, Br, Be, Ce, Ag, Eu, Gd, Hf, Ho, In, Fe, La, Pb, Nd, Np, Pu, Pr, Pm, Sm, Si, Tl, Tm, Th, U, V, and Y. Solvent partition in aqueous benzenethenoyltrifluoroacetone system is covered.

979. CARBIDE FUEL DEVELOPMENT. Phase III Report, September 15, 1960-September 15, 1961. W. Sheridan, A. Strasser. NDA-2162-5, Sept. 30, 1961.

A glovebox for high-temperature property measurements of PuC-UC was designed. A conceptual design of the facility for examining irradiated Pu was made.

980. TEMPERATURE EFFECTS ON URANYL NITRATE AND TETRAVALENT PLUTONIUM EXTRACTION BY MIXED SOLVENTS. V. B. Shevchenko, I. A. Fedorov, V. S. Smelov. Radiokhimiya 3, 256-60 (1961).

981. EFFECT OF TEMPERATURE ON THE EXTRACTION OF URANYL AND PLUTONIUM NITRATES AND OF NITRIC ACID BY TRIBUTYL PHOSPHATE. V. B. Schevchenko, I A. Fedorov, Y. P. Agureev. AEC-tr-4674.

The basic experimental data concerning the effect of temperature on the extraction of uranyl and plutonium nitrates and of nitric acid by tributyl phosphate solution in saturated, high-boiling hydrocarbons are presented.

982. EXTRACTION OF PLUTONIUM BY TRI-n-OCTYL AMINE FROM HYDROCHLORIC ACID SOLUTIONS. V. B. Shevchenko, V. S. Schmidt, E. A. Mezhov. Zhur. Neorg. Khim. 5, 1911-1913 (1960).

Apparently two moles of TOA · HCl are used in the extraction of Pu(IV). The extractant did not extract Pu(III) by this method.

983. BEHAVIOR OF PLUTONIUM DURING ITS EXTRACTION FROM SULFATE SOLUTIONS BY AMINES. I. EXTRACTION OF SULFURIC ACID AND PLUTONIUM(IV) SULFATE BY TRI-n-OCTYLAMINE (TOA). V. B. Shevchenko, Y. F. Zhdanov. Radiokhimiya 3, 676-84 (1961).

The extraction of Pu increases with increasing TOA concentration and changes irregularly with increasing H_2SO_4 concentration; this is attributed to the interference of the TOA bisulfate in the organic phase with the extraction of Pu. When Li_2SO_4 is added to the aqueous solution, extraction of Pu first increases and then decreases with increasing Li_2SO_4 concentration.

984. EXTRACTION OF Pu FROM SULFURIC ACIDS BY AMINES. I. EXTRACTION OF SULFURIC ACID AND PLUTONIUM(IV) SULFATE BY n-TRIOCTYLAMINE. V. B. Shevchenko, Y. F. Zhdanov. Radiokhimiya 3, 676-84 (1961).

The influence of trioctylamine concentration on Pu(IV) extraction from sulfuric acid and of the influence of sulfuric acid concentration on Pu(IV) distribution coefficients were analyzed.

985. CONTROLLED POTENTIAL COULOMETRIC TITRATION OF PLUTONIUM-APPLICATION TO PRFR SAMPLES. W. D. Shults. ORNL-2921, April 25, 1960.

The application of coulometric titration of Pu and its application to Power Reactor Fuel Reprocessing pilot plant samples are covered. Operating conditions and potential interferences are given.

986. ORNL PROCEDURES FOR CONTROLLED-POTENTIAL COULOMETRIC TITRATION OF PLUTONIUM. W. D. Shults. ORNL-TM-366, Sept. 14, 1962.

Six procedures, in stepwise form, that can be used for the determination of Pu in several forms by controlled-potential coulometric titration are presented.

987. COULOMETRIC GENERATION AND BACK TITRATION OF INTERMEDIATE REAGENTS AT CONTROLLED POTENTIAL. APPLICATION TO THE DETERMINATION OF PLUTONIUM. W. D. Shults. Anal. Chem. 33, 15-8 (1961).

The determination of Pu in the presence of Fe is described.

988. APPLICATIONS OF CONTROLLED-POTENTIAL COULOMETRY TO THE DETERMINATION OF PLUTONIUM. A REVIEW. W. D. Shults. Talanta 10, 833-49 (1963).

The techniques, procedures, and separations that were developed are described. The effects of some contaminants that are common to Pu-containing samples are also presented.

989. ON METHODS OF SEPARATION OF NEPTUNIUM FROM PLUTONIUM. I. K. Shevtsov, A. M. Vorobyev. In Proc. 1st Int. Conf. Peaceful Uses Atomic Energy, Geneva, 1955, 7, 304, United Nations, New York, 1956.

990. DI-2-AMYL 2-BUTYLPHOSPHONATE AS AN EXTRACTANT FOR THE RECOVERY OF URANIUM AND PLUTONIUM. T. H. Siddall, III. DP-548, Feb 1961.

Equilibrium data are presented for the extraction of U, nitric acid, and Pu(IV). Separation of Pu from nitric acid solutions is discussed.

991. EFFECTS OF STRUCTURE OF N, N-DISUBSTITUTED AMIDES ON THEIR EXTRACTION OF ACTINIDE AND ZIRCONIUM NITRATES AND OF NITRIC ACID. T. H. Siddall, III. J. Phys. Chem. 64, 1863-6 (1960).

Successive alkyl substitution on the α-carbon atom greatly decreases the extraction of quadrivalent actinides and of Zr, but only moderately decreases the extraction of hexavalent actinides and nitric acid.

992. RATIONALE FOR THE RECOVERY OF IRRADIATED URANIUM AND THORIUM BY SOLVENT EXTRACTION. T. H. Siddall, III. In Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 339, United Nations, New York, 1958.

The graphical and the iterative arithmetical methods of computing flowsheets for a solvent-extraction system are compared. These methods are applied to calculations of flowsheets for recovery of U and Th by the use of TBP. Compact algebraic expressions are derived and used to compute the stage-to-stage behavior and inventory of Pu, and the separation of Pu from UX_1, for a representative flowsheet. Batch equilibrium data for the extraction of U, Th, Pu, and Zr by dibutyl butylphosphonate and diamyl amylphosphonate are compared with similar data for TBP. Some phase diagrams are presented.

993. GENERAL REMARKS ON SYNERGIC EFFECTS IN THE EXTRACTION OF URANIUM AND PLUTONIUM COMPOUNDS. S. Siekierski, M. Taube. Nukleonika 6, 489-501 (1961).

Classification of extraction systems containing mixtures of two extracting agents is proposed.

994. THE SEPARATION OF PLUTONIUM FROM URANIUM AND FISSION PRODUCTS WITH ION EXCHANGE COLUMNS. T. Sikkeland. JENER-38.

Tetravalent Pu is quantitatively adsorbed from a U solution by passing the solution through a column of anion-exchange resin. The U and most of the fission products are eluted with 2M HCl and Pu and the remaining fission products with 5M HCl.

995. SOME ANALYTICAL METHODS USED IN CONNECTION WITH THE CHEMICAL SEPARATION OF PLUTONIUM. T. Sikkeland, J. Haaland. JENER-46, Dec. 19, 1956.

Analytical methods used in the chemical separation of Pu on a laboratory scale are presented. They include reactions for identification of element, analysis of chemical state, determination of concentrations, and analysis for impurities.

996. ANION EXCHANGE STUDIES OF PLUTONIUM. T. Sikkeland, J. Juul. JENER-44, Aug. 27, 1956.

This is a study of the absorption of Pu on Dowex-1 resin. Pu^{+3} is not absorbed at any HCl concentration. Pu^{+4} can be stabilized with $NaNO_2$. Pu^{+4} is absorbed at about 2.5M HCl but is unstable in 4-7M HCl range. PuO_2^{++} is absorbed. However, it is reduced to Pu^{+3}, and attempts to stabilize it with Cl_2 or $K_2Cr_2O_7$ were unsuccessful.

997. REDOX DIAGRAMS. L. G. Sillen. J. Chem. Educ. 29, 600-8 (1952).

Oxidation-reduction diagrams are given for the oxidation states of Cu, Fe, Tl, Ti, V, U, Np, and Pu, each at pH O. Graphic diagrams based on a single variable have served to simplify complicated equilibria (acid base, coordination complex, etc.) for oxidation-reduction systems or similar applications.

998. ELECTROLYTIC EXTRACTION OF MICRO-QUANTITIES OF URANIUM AND PLUTONIUM.
G. S. Sinitsyna, S. L. Fadeev, G. M. Sukhodolov.
Radiokhimiya 1, 295-9 (1959).

The influence of current density, acidity, and type of cathode material on the electrolytic precipitation of U and Pu was studied. Separations of Pu and U were studied. Separation of Pu and U were found to depend on pH of the precathode layer, regardless of pH of the initial solution.

999. THE PLANNING OF A SMALL PILOT PLANT FOR DEVELOPMENT WORK ON AQUEOUS REPROCESSING OF NUCLEAR FUELS.
T. U. Sjoeborg, E. Haeffner, A. Hultgren.
AE-122, Oct 1963.

U-Pu separation takes place on a column filled with silica gel pretreated with 0.03M Fe(II) and 0.8M hydrazine nitrate.

1000. ANALYTICAL APPLICATIONS OF THERMO-GRAVIMETRY. II. THERMOGRAVIMETRIC STUDY OF PLUTONIUM COMPOUNDS.
I. S. Sklyarenko, T. M. Chubukova. Zhur. Anal. Khim. 15, 706-10 (1960).

Plutonium 8-hydroxyquinolate, after drying at 230°C, can be used as a gravimetric form as well as $Pu(SO_4)_2$, plutonium iodate, and the anhydrous oxalate quadrivalent Pu.

1001. THE DETERMINATION OF SMALL AMOUNTS OF NEPTUNIUM IN PLUTONIUM METAL.
L. J. Slee, G. Phillips, E. N. Jenkins.
Analyst 84, 596-603 (1959).

Np in the range of 10-2000 ppm is separated from Pu metal by solvent extraction with 2-thenoyl trifluoroacetone and then determined on the square-wave polarograph. Np was found to range from 25-500 ppm with a precision of ±10 and ±2%, respectively.

1002. CRITICAL MASS CONTROL SPECIFICATION HOOD 9A. R. J. Sloat. HW-76553 (Rev.), May 31, 1963.

Pu concentration in oxalate slurries and filter cokes allowed to accumulate in volumes in excess of 4 liters should be limited to a maximum of 100 g of Pu/cc in process equipment. The critical mass of nonconfirmed Pu may exceed 7 kg for dry, unmoderated, Pu compounds.

1003. NUCLEAR EMULSION TECHNIQUE FOR DETERMINATION OF THE PLUTONIUM-240-PLUTONIUM-239 RATIO. E. N. Sloth, M. H. Studier. Anal. Chem. 30, 1751 (1958).

The Pu^{240}-Pu^{239} ratio has been determined in submicrogram quantities of Pu by using a nuclear emulsion technique. The method is based on the fact that 11% of the Pu^{239} α-particles have coincident electrons arising from the conversion of gamma rays, while 24% of the α-particles from Pu^{240} have coincident-conversion electrons.

1004. THE DETERMINATION OF PLUTONIUM IN URINE. A. A. Smales, L. Airey, G. N. Walton, R. O. R. Brooks. AERE-C/M-533, May 1950.

1005. A METHOD OF CLEANING PLUTONIUM METAL SAMPLES FOR ANALYSIS.
W. G. Smiley. LA-1349 (Del.), Feb. 2, 1953.

The electrolytic cleaning of Pu metal with ethylene glycol-phosphoric acid is not satisfactory for preparing samples for O_2 determination. A method of cleaning in 20% aqueous potassium carbonate is described. Electrolysis at 4.5 volts in a Ta cup is usually sufficient.

1006. A NEW MICRO COMBUSTION METHOD FOR CARBON IN PLUTONIUM. W. G. Smiley.
LA-1128, July 6, 1950.

The capillary-trap, resistance furnace for induction heating and use of O_2 at atmospheric pressure are the main alterations in a modified method for the determination of carbon in Pu.

1007. THE DETERMINATION OF OXYGEN IN PLUTONIUM BY THE CAPILLARY TRAP METHOD.
W. G. Smiley. LA-1350, Feb 1953.

The oxides in the sample react with carbon of a graphite crucible to form CO, which is swept out by a stream of Ar at atmospheric pressure. The CO is oxidized to CO_2, which is condensed in a capillary trap and measured with a capillary manometer.

1007a. SOLVENT EXTRACTION DATA FOR PLUTONIUM. A COMPILATION OF DATA IN THE LITERATURE. L. L. Smith. DP-700, Dec 1962.

This is a compilation of data in the literature. Extraction coefficients for the distribution of Pu(III), (IV), and (VI), in a large number of aqueous and organic systems are presented in tabular and graphic form.

1008. DETERMINATION OF CHROMIUM IN PLUTONIUM. M. E. Smith. AECD-4171, April 1955.

The Cr is oxidized to chromate in basic solution with H_2O_2. Excess peroxide is removed by heating. The Cr is then determined by measuring the absorbance of the chromate ion or by using diphenylcarbazide as a colorimetric reagent. As little as 10 ppm of Cr may be determined. Standard deviations of 1-7 relative % were obtained for Cr concentrations of 1%-40 ppm, respectively.

1009. THE DETERMINATION OF FREE ACID IN PLUTONIUM SOLUTIONS. M. E. Smith.
LA-1864, Jan 1955.

A method is presented for determining free acid in Pu solutions having an excess acidity greater than 0.2N. Hydrolytic behavior of Pu is prevented by precipitation with potassium iodate. The filtrate is titrated with a standard base using a potentiometric end point. If Pu(VI) is known to be absent, phenolphthalein may be used as an indicator.

1010. THE DETERMINATION OF VANADIUM IN THE PRESENCE OF PLUTONIUM.

M. E. Smith. LA-1285, Aug. 1, 1951.

This polarographic method does not require a separation from Pu. Both Pu and V in hydrochloric acid solutions are reduced with Zn and Zn amalgam. The height of the anodic wave produced by the oxidation of V(II) is proportional to the V concentration. Pu(III) does produce an interfering wave. Solutions with a V/Pu ratio as low as 6.4×10^{-4} may be analyzed with a reproducibility of 3.4% of the 95% level.

1011. THE POLAROGRAPHIC DETERMINATION OF TITANIUM IN PLUTONIUM SOLUTIONS.

M. E. Smith. LA-1345, Dec. 20, 1951.

A polarographic procedure for Ti in Pu of Ti/Pu as low as 0.128 has been devised.

1012. THE POLAROGRAPHIC DETERMINATION OF URANIUM IN THE PRESENCE OF PLUTONIUM.

M. E. Smith. LA-1249, May 25, 1951.

Using hydroxylamine hydrochloride as the supporting electrolyte, U was determined in the presence of Pu and Fe. Solutions with U/Pu weight ratio as low as 3.5×10^{-3} were analyzed with an error of 2%.

1013. SPECTROPHOTOMETRIC DETERMINATION OF SILICON IN PLUTONIUM.

M. E. Smith. TID-6071, 1957.

Pu is separated by precipitation of the insoluble Pu(III) fluoride, and silicon is determined spectrophotometrically by a procedure based on the formation of the silico-molybdic acid after its reduction with 1 amino-2-napthol-4-sulfonic acid to the blue complex. Al is used to complex fluoride. In the range of 25-100 ppm, the standard deviation varied from 10 to 5 relative %, respectively. Time for duplicate analyses is about 3 hours, and 0.004M $KMnO_4$ is used to oxidize any reducing impurities before adding $(NH_4)_6Mo_7O_{24}$ and adjusting pH for formation of silicomolybdic acid. Prepare plastic transfer pipet in order to always get same amount of fluoride. Measure at 825 mu. Pu(III), (IV), and (VI) forms insoluble compounds with molybdenum. As, P, Ge, Ni, Fe, and Cr interfere.

1014. SPECTROPHOTOMETRIC DETERMINATION OF RHODIUM AND PLATINUM IN PLUTONIUM.

M. E. Smith. Anal. Chem. 30, 912-3 (1958).

A simultaneous determination with no separation from Pu is necessary, but a correction must be applied for the absorbence of Pu(III) at the wavelengths used to determine the Rh and Pt. The range is 5 to 14 ppm of Rh and Pt.

1015. THE SPECTROPHOTOMETRIC DETERMINATION OF CERIUM IN PLUTONIUM.

M. E. Smith. LA-1995, Jan 1956.

A method is described for determining Ce in Pu alloys containing 3% cobalt. A separation of Ce is made by oxidizing Pu to (VI) with persulfate and precipitating Ce using LaF_3 as a carrier. The Ce is then converted to the sulfate, oxidized with persulfate, and the absorbence measured at 320 mu. In small amounts, Mo, Ta, Fe, Zr, Nd, and Ru do not interfere.

1016. PYROPHORICITY - A TECHNICAL MYSTERY UNDER VIGOROUS ATTACK.

R. B. Smith. Nucleonics 14, No. 12, 28-33 (1956).

The pyrophoricity of Pu, U, Th, Zr, and Hf are discussed. Some possible mechanisms of various fires and explosions are given.

1017. SAFETY REVIEW OF HANFORD LABORATORIES PILOT PLANT FACILITIES.

W. A. Snyder. HW-69587 (Rev.), Nov. 10, 1961.

The safeguards incorporated by design features and administrative controls in Hanford Laboratories and pilot plant facilities employed in handling fission products and Pu are discussed.

1018. ESTIMATION OF Pu BODY BURDENS ON THE BASIS OF URINALYSIS DATA.

W. S. Snyder. In ORNL-3189, Health Physics Division Annual Progress Report, for Period Ending July 31, 1961. Oct. 31, 1961, pp. 191-192.

A formula for estimating body burdens of Pu from urinary excretion data was derived and programmed on the IBM-709 computer.

1019. A CATHODIC SPUTTERING TECHNIQUE TO PRODUCE UNIFORM FOILS OF FISSILE MATERIAL.

H. E. Soisson, J. C. Sheffield. KAPL-903, April 20, 1953.

A technique is presented for producing thin adherent films of fissile material on thin Al foil. A uniformity within 1.5% for densities of 0.01-0.6 mg/cm^2 has been achieved for foils up to 50 cm^2. Methods for measuring the uniformity of the surface density and of the number of atoms of fissile material in a film are discussed.

1020. EXTRACTION OF ELECTROLYTES FROM NITRIC ACID SOLUTIONS BY NEUTRAL ORGANOPHOSPHORIC SOLVENTS. CALCULATION OF DISTRIBUTION CURVES.

A. S. Solovkin. AEC-tr-4671, 1960.

In connection with the study of the quantitative laws of the extraction of electrolytes by neutral organophosphoric solvents from nitric acid solutions, equations have been derived which allow the calculation of the distribution coefficients without previous determination of the activity coefficients of the extracting materials.

1021. SEPARATION PROCESS USING COMPLEXING AND ADSORPTION.

J. H. Spedding, J. A. Ayers. U. S. Pat. 2,837,548, June 3, 1958.

The method consists of forming a chelate complex compound with Pu ions in the solution by adding a derivative of 8-hydroxyquinoline (which derivative contains a sulfonic acid group), and adsorbing the remaining cations from the solution on a cation-exchange resin, while the complexed Pu remains in the solution.

1022. PLUTONIUM ALLOY AND METHOD OF SEPARATING IT FROM URANIUM.

F. H. Spedding, T. A. Butler. U. S. Pat. 2,778,730, Jan. 22, 1957.

A method is presented for recovering and concentrating Pu contained in large quantities of U. Sn is melted with the U-Pu mixture. Upon solidification, two phases are formed, one of U-Sn alloy carrying the bulk of the

Pu, and the other consisting essentially of metallic U. The U phase is selectively hydrided at 250°C. Final separation is made by sieving, flotation, or the like.

1023. CHEMICAL PROCESS DEVELOPMENT FOR THE WINDSCALE PLUTONIUM PLANT. R. Spence. J. Roy. Inst. Chem. 81, 357-68 (1957).

This is the text of a lecture presented at the Annual Conference of the Royal Institute of Chemistry, April 1957.

1024. EVALUATION OF ISOTOPIC CONTENT OF IRRADIATED NATURAL URANIUM DIOXIDE FUEL RODS FROM PWR CORE I. C. D. Sphar. WAPD-TM-265, Feb 1962.

During the first seed refueling of PWR Core I, selected natural uranium dioxide fuel elements were removed from the blanket region of the core and destructively analyzed for their U and Pu isotopic content.

1025. METHOD OF REMOVING CONTAMINATION FROM BISMUTH PHOSPHATE PRECIPITATES OF PLUTONIUM. G. W. Stahl. U. S. Pat. 2,867,500, Jan. 6, 1959.

When Pu in the tetravalent state is carried on bismuth phosphate, certain of the fission products are carried along. The improvement consists of washing the precipitate with an aqueous solution of ammonium hydrogen fluoride.

1026. DETERMINATION OF PLUTONIUM-URANIUM RATIO IN URANIUM PITCH ORE. I. E. Starik, A. P. Ratner, M. A. Pasvik, F. L. Ginzburg. AEC-tr-4820. Translation of Geokhimiya No. 2, 142-6 (1957).

It was found that the Pu-U ratio was $(2.0 \pm 0.3) \times 10^{-11}$. Two methods were developed for separating and purifying Pu.

1027. USE OF PHENYLARSONIC ACID TO SEPARATE NEPTUNIUM AND PLUTONIUM. I. E. Starik, A. P. Ratner, M. A. Pasvik, F. L. Ginzburg. NP-tr-741, 1959.

The Np as Np(IV) is coprecipitated with zirconium phenylarsonate using phenylarsonic acid as the precipitating agent. Under these conditions, Pu is reduced to +3, and quantitative separation may be obtained.

1028. SEPARATION OF PLUTONIUM FROM SOLUTION BY ADSORPTION ON ZIRCONIUM PYROPHOSPHATE. R. W. Stoughton. U. S. Pat. 2,970,035, Jan. 31, 1961.

Granular ZrP_2O_7 or $(ZrO)_2P_2O_7$ are used as adsorbents to separate Pu and fission products from $UO_2(NO_3)_2 \cdot 6H_2O$ solution.

1029. COMMENTS OF THE HANDLING OF PLUTONIUM. M. J. Steindler. ANL-6021, June 1959.

Facilities for Pu and a variety of safety equipment are covered.

1030. RADIATION PROBLEMS ASSOCIATED WITH THE HANDLING OF THE ACTINIDE ELEMENTS. M. J. Steindler. ANL-6540, April 1962.

The hazards connected with the handling of actinide elements are surveyed. Emphasis is placed on Th, U, Np, and Pu.

1031. PROCESS OF TREATING URANIUM HEXAFLUORIDE AND PLUTONIUM HEXAFLUORIDE MIXTURE WITH SULFUR TETRAFLUORIDE TO SEPARATE SAME. M. J. Steindler. U. S. Pat. 3,046,089, July 24, 1962.

A process was developed for separating uranium hexafluoride from plutonium hexafluoride by the selective reduction of the plutonium hexafluoride to the tetrafluoride with sulfur tetrafluoride at 50 to 120°C, cooling the mixture to -60 to -100°C, and volatilizing unreacted sulfur tetrafluoride and sulfur hexafluoride formed at that temperature. The uranium hexafluoride is volatized at room temperature away from the solid plutonium hexafluoride.

1032. AIR SAMPLING WITH THE ANNULAR IMPACTOR. D. C. Stevens. AERE-HP/M-110, Aug. 28, 1956.

The annular impactor is a highly selective sampling device for airborne dust particles produced in the course of operations of Pu laboratories. It enables one to count samples without delay for the decay of natural Rn daughter products.

1033. ABSORPTION SPECTRA OF LANTHANIDE AND ACTINIDE RARE EARTHS. II. TRANSITION PROBABILITIES FOR +3 IONS IN THE TWO SERIES. D. C. Stewart. ANL-4812, Feb. 1952.

Absorption curves for U^{+3}, Pu^{+3}, and Am^{+3} were determined in perchloric acid and measurements were extended into the ultraviolet region. Data were also given for calculated transition probabilities of the electron quantum states for Nd^{+3}, Pm^{+3}, Sm^{+3}, En^{+3}, U^{+3}, Np^{+3}, and Pu^{+3}.

1034. ALKYL PHOSPHORIC ACID EXTRACTIONS. D. C. Stewart, T. E. Hicks. UCRL-861, Aug. 9, 1950.

Organic solvent-extraction techniques were used to separate the mono- and di-alkyl substituted commercial phosphoric acid mixtures. Some preliminary experiments on separation of U^{233} and Pu^{239} were undertaken, and data presented.

1035. SAFETY CONSIDERATIONS FOR HANDLING PLUTONIUM, URANIUM, THORIUM, THE ALKALI METALS, ZIRCONIUM, TITANIUM, MAGNESIUM, AND CALCIUM. E. L. Stout. LA-2147, Sept. 4, 1957.

This report compiles from various sources, safety considerations for work with these special metals.

1036. SECOND ANNUAL CONFERENCE ON PLUTONIUM, RADIUM, AND MESOTHORIUM, SALT LAKE CITY, UTAH, June 17-19, 1954. C. N. Stover, Jr., Compiler. TID-7639.

Results are reviewed from studies on the long-term toxic effects of Pu, Ra, and MsTh in dogs. The use of chelating compounds for removing such isotopes from bone and the equilibrium constants resulting therefrom are also discussed.

1037. INDUSTRIAL ACTIVATION ANALYSIS. J. E Strain, G. W. Leddicotte. ISA, Proc. Natl. Anal. Instr. Symposium 8, 297-302 (1962).

This is an analysis of Pb, U, and Pu by gamma absorptimetry with an Am^{241} source.

1038. THE ATOMIC SPECTRUM OF PLUTONIUM. A. R. Striganov, L. A. Korostyleva. AEC-tr-2918. Translation of Optika I Specktroskopiya 1, 957-64 (1956).

1039. THE DETERMINATION OF AMERICIUM IN PLUTONIUM PRODUCT SOLUTIONS. A. Chetham-Strode, Jr. HW-25205, Aug. 15, 1952.

The cerium fluoride method for determining Am in the presence of Pu and U has been extended for application to plant streams of very high Pu-to-Am ratios. The precision of the modified method has been determined to be ±2.24% at the 99% limits.

1040. FORMAL OXIDATION POTENTIALS OF IRON, PLUTONIUM AND NEPTUNIUM DETERMINED WITH A CONTROLLED POTENTIAL COULOMETER. R. W. Stromatt, R. M. Peekema, F. A. Scott. HW-58212, Nov. 12, 1958.

This method was used to measure formal oxidation potentials of Fe, Pu, and Np in various acid solutions, with excellent agreement with reported values. The method is limited by the inability to measure the potential of irreversible couples. Complex formation constants were also estimated for Np(VI) sulfate, Np(IV) nitrate, and Np(IV) chloride.

1041. KINETICS OF THE REDUCTION OF NEPTUNIUM(VI) BY URANIUM(IV). J. C. Sullivan, A. J. Zielen, J. C. Hindman. J. Am. Chem. Soc. 82, 5288-92 (1960).

Kinetics of analogous reactions of the (IV) and (VI) states of U, Np, and Pu are discussed.

1042. ABSENCE OF LETHAL RADIATION EFFECTS FOLLOWING MASSIVE ORAL ADMINISTRATION OF PLUTONIUM. M. F. Sullivan, R. C. Thompson. Nature 180, 651-2 (1957).

It was concluded from experiments that alpha radiation originating from massive doses was largely ineffective in causing acute damage to intestinal mass, and it would appear that alpha emitters in the gastrointestinal tract may be ignored in calculating maximum permissible concentrations.

1043. ION-EXCHANGE STUDY OF THIOCYANATE COMPLEXES OF THE ACTINIDES AND LANTHANIDES. J. P. Surls, Jr., G. R. Choppin. J. Inorg. Nucl. Chem. 4, 62-73 (1957).

Their elution behavior from Dowex-1 anion exchange resin with ammonium thiocyanate is studied. The lanthanides and Yttrium eluted first. Neither series shows a simple elution sequence with atomic number. Using Dowex-50 resin, the actinides eluted in the usual sequence of decreasing atomic number. The actinides eluted sooner, indicating stronger complexing for ions of comparable ionic radius.

1044. PRECIPITATION METHOD OF SEPARATING PLUTONIUM FROM CONTAMINATING ELEMENTS. J. B. Sutton. U. S. Pat. 2,823,978, Feb. 18, 1958.

The process consists broadly in improving a method for recovering Pu from radioactive U fission products in aqueous solutions by decontamination steps, including by-product carrier precipitation comprising the step of introducing a preformed aqueous slurry of a hydroxide of a metal of group IV-B.

1045. REPROCESSING ANALYSIS. M. B. Svendsen. JENER-59, April 1959.

This involves the determination of Pu by methods used at JENER reprocessing plant. It covers determination by lanthanum fluoride method, direct counting, pulse analysis, TTA method, and oxidation states of Pu.

1046. FISSION PRODUCT DISTRIBUTION IN AN ADSORPTION EXTRACTION DECONTAMINATION CYCLE WITH AN ION EXCHANGER. J. A. Swartout, D. N. Hume. CN-1839, July 10, 1944.

The absorption-extraction process in which Pu and U are absorbed from 10% UNH solution by an ion exchanger are discussed. U is removed with 0.25M H_2SO_4, and Pu is removed with 1.25M $NaHSO_4$, and the residual fission-product activity is removed with 0.4% $H_2C_2O_4$.

1047. DETERMINING CONCENTRATION OF AIRBORNE PLUTONIUM DUST. G. W. C. Tait. Nucleonics 14, No. 1, 53-55 (1956).

An annular impactor is used for collecting dust which has a high sampling efficiency of about 90% for dusts generated by normal technical processes and a low efficiency of 10% for Rn-decay products. Determination is by alpha counting.

1048. PLUTONIUM. M. Taube. Nowa Tech. No. 16, 1958.

Chapters are included on Pu; its nuclear, chemical, and physiological effects are discussed. Also given are laboratory practices, chemical technology, and its role in the development of nuclear energy.

1049. THE INFLUENCE OF DILUENT POLARITY ON EXTRACTION OF PLUTONIUM COMPLEXES TO ORGANIC MEDIA. M. Taube. J. Inorg. Nucl. Chem. 12, 174-80 (1959).

Diluents such as carbon tetrachloride, chloroform, benzene, cyclohexane and n-heptane, bromoform, and dibrommethane were used with various organic agents singly and in mixtures. Evidence is presented for the importance of dipole moment of diluent in the extraction process in connection both with the structure of the organic phase and dipole-dipole interaction promoting solutions of the Pu-complex. Maxima were found to exist in the extraction of plutonium-tetra n-butyl ammonium nitrate in mixtures of polar diluent with ion-polar diluents and in particular with benzene.

1050. THE SYNERGETIC AND ANTAGONISTIC EFFECTS ON THE PLUTONIUM EXTRACTION SYSTEMS. M. Taube. PAN-270/V. Polish Academy of Sciences. Inst. of Nuclear Research, Sept 1961.

The synergetic and antagonistic effects of Pu(IV) and (VI) nitrate and sulfate liquid-liquid extraction were investigated for the following systems: monodecylphosphoric acid (DDPA) and tributylphosphate (TBP); thenoyltrifluoroacetone (TTA) and TBP; dinibutylphosphoric acid (DBP) and TBP; tri-n-octylamine (TOA) and TBP; and TOA and DBP.

1051. A SEMIMICRO VACUUM FUSION APPARATUS FOR THE DETERMINATION OF OXYGEN IN URANIUM AND PLUTONIUM CARBIDES. B. L. Taylor, H. A. Prior. AERE-R-4216, Feb 1963.

Details of a semimicro vacuum fusion apparatus are described. Details of measurement and accuracy of method are also described.

1052. THE ABSORPTIOMETRIC DETERMINATION OF NICKEL IN PLUTONIUM METAL (ALPHA FURIL DIOXIME). C. G. Taylor, R. Powell. IGO-AM-W-109, Feb 1958.

The Ni is determined absorptiometrically as the Ni(II) alpha furil dioxime complex after extraction with chloroform. Precision is ±12% at the 2-μg level based on 160 determinations. Concentration range is 10-2000 ppm.

1053. THE REMOVAL OF AMERICIUM AND PLUTONIUM FROM THE RAT BY CHELATING AGENTS. D. M. Taylor, F. D. Sowby. Phys. in Med. Biol. 7, 83-91 (July 1962).

The effect of treatment with several different chelating agents on the retention of Pu or Am has been studied in rats. Diethylenetriamine pentaacetic acid (DTPA) was found to be the most effective reagent for the removal of both Pu and Am.

1054. DETERMINATION OF GASES IN PLUTONIUM, URANIUM, AND ZIRCONIUM BY VACUUM FUSION. R. E. Taylor. Anal. Chem. Acta 21, 549-55 (1959).

A vacuum fusion method suitable for the analysis of gases in Pu, U, and Zr is presented. Gases are released by heating the metal in a vacuum at 1900°C in a metal bath contained in a graphite crucible. The gases evolved from each sample are collected in individual bulbs for later mass spectrographic analysis. The results for Pu samples analyzed by the Fe and Pt bath techniques are in satisfactory agreement. The apparatus and technique described provide a method whereby the gases present in five separate metallic samples may be collected in one melting operation of less than 2 hr duration.

1055. DETERMINATION OF GASES IN METALS BY GASOMETRIC METHODS. R. E. Taylor. HW-42663 (Rev.), May 1, 1956.

The design and operation of a high-vacuum system for the analysis of N_2, O_2, and H_2 in Pu, Zr, and U are described. Vacuum diffusion or vacuum extraction results for H_2 normally agree within 5 ppm, and O_2 values obtained are within 10%.

1056. CHEMISTRY AND METALLURGY OF PLUTONIUM. Tecknica 11, 223-4, Feb. 16 (1962).

The use of Pu in various alloys for nuclear reactors and related physical, chemical, and metallurgical properties is discussed.

1057. PROCESS OF SECURING PLUTONIUM IN NITRIC ACID SOLUTIONS IN ITS TRIVALENT OXIDATION STATE. J. R. Thomas. U. S. Pat. 2,849,277, Aug. 26, 1958.

It has been found that the addition of a stabilizing or holding reductant such as sulfamate prevents reoxidation of Pu. Ferrous ions are commonly used as the reducing agent.

1058. CONTROLLED-POTENTIAL COULOMETRIC ANALYSIS OF DISSOLVER SOLUTIONS OF VARIOUS REACTOR FUELS. P. F. Thomason, W. D. Shults, B. B. Hobbs, E. L. Blevins. In TID-7581, AEC and Contractor SS Materials Management Meeting, May 25-28, 1959 (Germantown, Maryland). pp. 182-9.

The results obtained for U determination in dissolver solutions are discussed. For controlled potential analysis, only two conditions are necessary for accurate determination. The first is to carry out the reaction so that only one reaction takes place; secondly, the total current for the electrolysis must be accurately integrated.

1059. ADSORPTION METHOD FOR SEPARATING METAL CATIONS. E. R. Tompkins, G. W. Parker. U. S. Pat. 2,877,093, March 10, 1959.

A solution containing U, Pu, and fission products can be separated and the fractions concentrated by ion-exchange techniques. Concentration is effected by passing the solutions through successively smaller columns each time eluting with a considerably smaller volume than that which contained the ions before adsorption.

1060. IONIC ANALYSES. P. F. Thompson, R. F. Biggers, J. M. Chilton. In ORNL-2453, Analytical Chemistry Division Annual Progress Report for Period Ending December 31, 1957. Jan. 30, 1958, pp. 1-7.

This report concerns spectrum of PuO_2^{+2} in sulfate media, autoreduction of PuO_2^{+2}, by-products of the alpha-particle radiolysis of water, and determination of Pu(III) and (IV) in PuF_3-PuF_4 mixtures contained in fused NaF-BeF_2.

1061. PROCEDURES FOR THE SEPARATION OF PRODUCTS RESULTING FROM BOMBARDMENT OF HEAVY ELEMENTS. R. Thompson. CC-3623, Sept. 23, 1946.

A discussion of problems encountered and methods used for separation of the actinides from bombarded heavy element targets is presented.

1062. PRECIPITATION METHOD FOR THE SEPARATION OF PLUTONIUM AND RARE EARTHS. S. G. Thompson. U. S. Pat. 2,934,402, April 26, 1960.

A method for purifying Pu is given. Tetravalent Pu is precipitated with thorium pyrophosphate, the Pu is oxidized to the hexavalent state, and then impurities are precipitated with thorium pyrophosphate.

1063. MAINTAINING PLUTONIUM IN A HIGHER STATE OF OXIDATION DURING PROCESSING. S. G. Thompson, D. R. Miller. U. S. Pat. 2,892,678, June 30, 1959.

Pu ions in an oxidation state ≤ 4 contained in an aqueous HNO_3 solution (2N to 8.5N) can be oxidized by either BiO_3^- or Ce^{+4} ions. The strong oxidizing agents should be present in an amount $>$ a stoichiometric equivalent of the reduced Pu present, and a stoichiometric amount of a H_2O soluble dichromate is needed as a relatively weaker oxidizing agent. The temperature must be maintained between 20 and 95°C for longer than 30 minutes.

1064. ARSENATE CARRIER PRECIPITATION METHOD OF SEPARATING PLUTONIUM FROM NEUTRON IRRADIATED URANIUM. S. G. Thompson, D. R. Miller, R. A. Jones. U. S. Pat. 2,989,367, June 20, 1961.

A process is described for precipitating Pu from an aqueous solution, either per se or with bismuth arsenate carrier, whereby a separation from U and fission products is accomplished.

1065. PHOSPHATE METHOD FOR SEPARATION OF RADIOACTIVE ELEMENTS. S. G. Thompson, G. T. Seaborg. U. S. Pat. 2,799,553, July 16, 1957.

The method is for separating Pu from U, certain fission products, and Np. The irradiated U is dissolved in nitric acid, and the uranyl nitrate concentration is adjusted to about 22%. Sulfuric acid is added for a total acidity of 0.85 to 1.24N. A soluble Bi compound is added to give a Bi ion concentration of 1 to 2.5 g/liter. Addition of a soluble phosphate then precipitates Bi phosphate, which carries down substantially all the Pu, leaving the bulk of the others in solution.

1066. MEASUREMENTS ON PHOENIX FUEL STANDARDS. T. B. Thornbury. HW-74796, Sept. 10, 1962.

The B and Pu contents of the poison standards for the Phoenix Fuel experiment were measured in the Physical Constants Testing Reactor. This demonstrates the use of the PCTR to measure the quantity of fissile material in a sample by varying the relative worths of the fast and thermal neutrons.

1067. PAPERS PRESENTED AT THE BELGIUM SYMPOSIUM ON CHEMICAL REPROCESSING, BRUSSELS, May 20-24, 1957. TID-7534, Books 1, 2, 3.

Included are papers on the conversion chemistry of plutonium nitrate and performance of a Pu reflux solvent extraction system.

1068. PLUTONIUM ION EXCHANGE PROCESSES. PROCEEDINGS OF THE US-UK TECHNICAL EXCHANGE MEETING, Oak Ridge National Laboratory, April 25-27, 1960. TID-7607.

The chemistry of Pu in both anion and cation applications are reviewed.

1069. CONCENTRATION AND PURIFICATION OF URANIUM, PLUTONIUM, AND NEPTUNIUM BY ION EXCHANGE IN NUCLEARLY SAFE EQUIPMENT. F. W. Tober. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 574, United Nations, New York, 1958.

The initial products from the processing of irradiated fuel elements are usually relatively dilute solutions of U, Pu, or Np, which must be concentrated and further purified. Ion exchange has proved to be a useful method for accomplishing these objectives.

1070. CONCENTRATION OF PLUTONIUM BY CATION EXCHANGE-STABILIZATION OF Pu(III) IN NITRIC ACID. F. W. Tober, E. R. Russel. DP-349, Feb 1959.

A study to define the effectiveness limits of sulfamic acid and to discover other better stabilizers for Pu(III) is described. Ascorbic and isoascorbic acids, used in conjunction with sulfonic acid, reduced Pu(IV) to stable Pu(III) in nitric acid.

1071. SAFETY REVIEW OF MANUFACTURING FACILITIES CHEMICAL PROCESSING DEPARTMENT. R. E. Tomlinson. HW-69586 (Rev.), June 23, 1962.

Safety procedures for the Redox and Purex solvent-extraction plants and the plant for processing Pu to metallic buttons and weapons components are presented.

1072. LIQUID SCINTILLATION COUNTING OF PLUTONIUM-239 FROM BIOLOGICAL SAMPLES. T. Y. Toribara, D. A. Morken, C. Predmore. UR-607, Jan. 23, 1962.

The conditions for measuring Pu^{239} activity from biological samples by liquid scintillation counting were determined. It was found that considerable quantities of Fe may be tolerated in the final counting solution if phosphoric acid is added to form a colorless complex.

1073. THE SEPARATION AND DETERMINATION OF PLUTONIUM IN DIVERSE BIOLOGICAL SAMPLES. T. Y. Toribara, C. Predmore, P. A. Hargrave. UR-606, Jan. 22, 1962.

The separation scheme for Pu is based on the absorption of an anionic form of tetravalent Pu in a strong hydrochloric acid solution by a strong-base anion-exchange resin. Final estimation was made by liquid scintillation counting.

1074. TERTIARY AMINE EXTRACTION AND PURIFICATION OF PLUTONIUM. M. D. Trentinian, A. Chesne. Translation of AEC-tr-5018, 1960.

Trilaurylamine diluted with dodecane was used in a study dealing with the extraction characteristics of Pu, U, and certain fission products in nitrate solutions and in various valence states.

1075. LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID BED FLUORIDE VOLATILITY PROCESSES. PART III. SEPARATION OF GASEOUS MIXTURES OF URANIUM HEXAFLUORIDE AND PLUTONIUM HEXAFLUORIDE BY THERMAL DECOMPOSITION. L. Trevorrow, J. Fischer, J. Riha. ANL-6762, Aug 1963.

Gaseous mixtures of the mixed fluorides were passed through Ni vessels packed with Ni wool at various temperatures from 150 to 300°C. About 99.5-99.9% of the Pu was removed. The solid product remaining in the vessels was plutonium tetrafluoride. The method is applicable to recovering fissile material from reactor fuels.

1076. A METHOD OF DETECTING PLUTONIUM BY GAMMA SPECTROGRAPHY AT 17 keV: APPLICATION OF MEASUREMENT OF RADIOACTIVE CONTAMINATION IN MAN. M. Trouble. AEC-tr-5251. Translated from Proceedings of the Symposium on Selected Topics in Radiation Dosimetry, held in Vienna, June 7-11, 1960, International Atomic Energy Agency, Vienna, pp. 237-41.

1077. THE PREPARATION OF SAMPLES FOR ALPHA COUNTING BY THE DIRECT EVAPORATION OF ORGANIC SOLUTIONS. D. G. Tuck. Anal. Chim. Acta 17, 271-4 (1957).

By heating the periphery of the tray, a suitable temperature gradient is maintained across the tray, giving smooth evaporation of the solvent to leave a deposit which is suitable for alpha counting.

1078. THE PROPERTIES OF INORGANIC COMPOUNDS IN ORGANIC SOLVENTS. I. THE HYDROLYSIS AND POLYMERIZATION OF QUADRIVALENT PLUTONIUM NITRATE SPECIES IN DIETHYLENE GLYCOL DIBUTYL ETHER. D. G. Tuck. J. Inorg. Nucl. Chem. 6, 252-6 (1958).

Color changes in weak acid solution of Pu(IV) nitrate in ethylene glycol dibutyl ether have been shown to be due to hydrolysis and subsequent formation of a polymeric form of Pu(IV), which shows many correspondences with the colloid formed in aqueous solutions.

1079. ISOTOPIC ANALYSIS OF PLUTONIUM AND URANIUM BY MASS SPECTROMETER. A. H. Turnbull, D. F. Dance. AERE-C/R-2776, Dec 1958.

The techniques, sensitivity, and accuracy of the method used for the isotopic analysis of U and Pu are discussed. A Metropolitan-Vickers Type M55 mass spectrometer was used.

1080. X-RAY FLUORESCENCE ANALYSIS OF PLUTONIUM. W. S. Turnley. Talanta 6, 189-95 (1960).

An X-ray fluorescence method using Y as an internal standard was developed for the quantitative determination of Pu. The range of the method is from 10 ppm to 100% Pu for solid samples, and from 5 to 250 g/liter for liquid samples. The method is applicable to almost all types of samples and is almost completely free from cationic and anionic inteferences.

1081. THE DETERMINATION OF LOCALIZED CONCENTRATION OF Pu^{239} IN BONE. J. A. Twente, W. S. S. Jee. Health Phys. 5, 142-8 (June 1961).

A microdensitometric technique of measuring localized concentrations of α-emitting radionuclides was used to determine the Pu^{239} in bone. The accuracy of the technique was verified by comparing the Pu^{239} content of a thoracic vertibral centrum determined microdensitometrically with the Pu^{239} content of an adjacent centrum measured radiochemically. The amount found microdensitometrically was 76% of that determined radiochemically.

1082. HAZARDS CONTROL QUARTERLY REPORT NO. 6, JULY-SEPTEMBER, 1961. Lawrence Radiation Laboratory, Livermore. UCRL-6658 (Rev.).

A solid-state, continuous, alpha air monitor is described with which it is possible to detect one maximum permissible concentration of Pu in less than 8 hr of sampling time.

1083. ANALYZING FOR LOW ENERGY GAMMA EMITTERS IN A RADIONUCLIDE MIXTURE. U. L. Upson, R. E. Connally, M. B. Leboeuf. Nucleonics 13, No. 4, 38-42 (1955).

Pu is measured in the presence of mixed fission products through its 100 keV. Gamma rays with a 2-mm NaI(Tl) crystal, and a stable single-channel pulse height analyzer are considered. The detection limit is 30 mg/l.

1084. SACLAY HOT CELLS ADVANCE PLUTONIUM FUEL PROGRAM. A. Valentin. Nucleonics 20, No. 7, 845 (1962).

Pu handling equipment associated with the Saclay hot-cell facility is described.

1085. THE OPTICAL SPECTRUM OF PLUTONIUM AND ITS HYPERFINE STRUCTURE. M. Van den Berg, P. F. Klinkenberg. Physica 20, 461-80 (1954).

The spectrum of Pu, excited in a hollow-cathode discharge, was observed in the region 2900-6400A with prism spectrographs.

1086. A COMPARISON OF TWO METHODS FOR THE SPECTROCHEMICAL ANALYSIS OF PLUTONIUM. H. H. Van Tuyl. HW-15846, Feb. 1, 1950.

Comparison of analyses of Pu by the carrier concentration and cupferron extraction-copper spark methods show diversities as high as a factor of 50. Analyses by direct copper spark and theoretical considerations all indicate the carrier-concentration method is more accurate than the cupferron method for all elements.

1087. SPECTROGRAPHIC ANALYSIS OF PLUTONIUM BY THE THENOYLTRIFLUOROACETONE EXTRACTION METHOD. H. H. Van Tuyl. HW-28530, June 29, 1953.

Impurities are separated from Pu solutions by means of TTA extractions.

1088. DISTRIBUTION OF FISSION PRODUCTS IN ETHER EXTRACTION PROCESS. V. M. Vdovenko. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 175, United Nations, New York, 1958.

The behavior of fission products in the extraction of U and Pu with diethyl ether and a mixture of dibutyl ether with carbon tetrachloride is described.

1089. SEPARATION OF URANIUM AND PLUTONIUM FROM FISSION PRODUCTS BY EXTRACTION WITH DIBUTYL ETHER. V. M. Vdovenko, M. P. Kovalskaia. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 329, United Nations, New York, 1958.

The results of studies on fission-products behavior in the extraction of Pu and U by diethyl ether and a mixture of dibutyl ether with carbon tetrachloride are presented. Zr and Ru were most difficult to separate.

1090. SPECTROPHOTOMETRIC STUDIES OF PLUTONYL NITRATE COMPLEXES IN ACETONE. V. M. Vdovenko, A. A. Lipovskii, M. G. Kuzina. Radiokhimiya 2, 301-6 (1960).

The composition of the complexes and their evolution were determined in acetone.

1091. PRINCIPLES OF VACUUM DISTILLATION OF METAL MIXTURES. J. E. Vivian. LRL-88, March 1954.

The principles of vacuum distillation, as applied to separation of mixtures of metals, have been critically reviewed.

1092. REMOVAL OF PLUTONIUM FROM URANIUM BY MOLTEN METAL EXTRACTION. A. F. Voight, R. G. Clark, J. G. Gonser, D. L. Haes, G. J. Lutz, K. L. Malaby. IS-470, May 1962.

The extraction of Pu from molten U with immiscible molten metals, Ag, La, and Ce, was investigated.

1093. LIQUID-METAL EXTRACTION FOR PROCESSING OF SPENT FUEL. A. F. Voight, A. H. Daane, E. H. Dewell, R. G. Clark, J. E. Gonser, J. F. Haefling, K. L. Malaby. A.I.Ch.E. Journ. 2, 169-73 (1956).

Pu and fission products can be removed from irradiated U by liquid-metal extraction by use of another metal immiscible with U. Metals studied have been Ag, Ce, and La. Pu removed by Ag is high, that removed by the rare-earth metals is moderate. In all cases, volatile elements, including Cs, Sr, and Ba, are removed. Rare earths are efficiently removed. Ru and Mo are largely unaffected. Experiments with synthetic fuels corresponding to long burnup periods show improved removal of most elements. Repeated batch extractions indicate that a continuous process separating the fuel into U, Pu, and fission product fractions could be developed.

1094. DETERMINATION OF PLUTONIUM AEROSOLS IN THE PRESENCE OF LARGE AMOUNTS OF URANIUM. A. M. Vorobev, V. P. Kuzmina. Gigiena i Sanit. 28(9), 54-5 (1963).

The aerosols are collected on a filter by aspiration, the filter destroyed with HNO_3 and H_2O_2, and the Pu separated from the U by extraction of the (IV) form with TTA in PhMe. Pu is extracted with HNO_3 from the PhMe and precipitated for counting by the $BiPO_4$ method.

1095. THE CORROSION BEHAVIOR OF PLUTONIUM AND URANIUM. J. T. Waber. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 6, 204, United Nations, New York, 1958.

The many similarities in the chemical reactivity of Pu and U were used to gain a deeper understanding of the mechanisms involved in the corrosion behavior of these metals and their alloys.

1096. THE CORROSION OF PLUTONIUM. J. T. Waber, E. S. Wright. LADC-3107. In The Metal Plutonium, The University of Chicago, Chicago, 1961, pp. 194-204.

The corrosion behavior of Pu in moist and dry air at temperatures up to 75°C and in pure oxygen at high temperatures was investigated.

1097. PROCESS FOR THE REDUCTION OF PLUTONIUM. R. Wagner. Canadian Pat. 626,591, Aug. 29, 1961.

Ascorbic acid is recommended as a fast reductant of Pu(IV), even in the presence of nitric acid. Its use is recommended for use in the TBP process where both U and Pu are extracted and Pu is back-extracted after reduction to Pu(III).

1098. PROCESS FOR SEPARATING PLUTONIUM FROM IMPURITIES. A. C. Wahl. U. S. Pat. 2,813,004, Nov. 12, 1957.

It has been found that if the Pu is reduced to its 3+ valence state, and the U present is left in its higher valence state, then the differences in solubility between certain salts (e.g., oxalates) of the trivalent Pu and the hexavalent U can be used to separate the metals.

1099. PROCESS OF SEPARATING PLUTONIUM VALUES BY ELECTRODEPOSITION. A. C. Wahl. U. S. Pat. 2,830,939, April 15, 1958.

The process consists of subjecting an aqueous 0.1 to 1.0N nitric acid solution containing Pu ions to electrolysis between inert metallic electrodes.

1100. THE PHYSICAL PROPERTIES AND ALLOYING BEHAVIOR OF PLUTONIUM METAL. M. B. Waldron. At. Nucl. Energy 8, 383-6 (1957).

The subject is reviewed under the following headings: toxicity, glovebox work, allotropes, expansion, other physical properties, and alloying behavior.

1101. THE FIRST ISOLATIONS OF THE TRANSURANIUM ELEMENTS - A HISTORICAL SURVEY.
J. C. Wallmann. J. Chem. Educ. 36, 340-3 (July 1959).

A short historical survey of Pu, Np, Am, C, Bk, and Cf is presented.

1102. ELECTROPHORETIC DEPOSITION OF PLUTONIUM. (A FEASIBILITY STUDY.)
K. A. Walsh. LA-2153, July 18, 1957.

Electrophoretic deposition of plutonium hydride from suspensions in n-butyl alcohol and other organic liquids was examined for its feasibility in the preparation of thin sections of Pu metal.

1103. STUDIES OF NUCLEAR DEBRIS IN PRECIPITATION. A. Walton, R. E. Fried. NYO-9530, Aug. 15, 1961.

A summary report was prepared from the studies of nuclear debris in precipitation at Westwood, New Jersey. Particular attention is given to descriptions of the methods of collection and the radiochemical procedures used for the assay of certain radionuclides, such as Sr^{90}, Sr^{89}, W^{185}, Ce^{144}, Ba^{140}, and Pu.

1104. THE USE OF TTA FOR THE ESTIMATION OF PLUTONIUM IN TRACER QUANTITIES.
G. N. Walton. AERE-C/M-37, Sept 1949.

Existing available information about TTA and its use is summarized. An analytical method is given for the tetravalent Pu extraction from the tri- and hexavalent states. Equilibria involved are given.

1105. THE COPRECIPITATION OF SMALL AMOUNTS OF PLUTONIUM ON LANTHANUM FLUORIDE IN THE PRESENCE OF URANIUM.
G. N. Walton, E. Furby, V. Owen.
AERE-C/R-2388, 1958.

The LaF_3 technique is unsuitable for Pu in the presence of U. The absorbed material cannot be washed off by repeated precipitation or washing. The absorption effect can be minimized by using the smallest amounts of precipitant, but not less than 50 μg of La should be used.

1106. THE QUENCHING ACTION OF PLUTONIUM AND IRON ON THE FLUORESCENCE OF URANIUM IN SODIUM FLUORIDE PHOSPHORS.
G. N. Walton, G. Hutton, J. A. W. Dalziel.
AERE-C/R-966, July 30, 1952.

The transmission of NaF to ultraviolet light at different wavelengths shows that NaF alone, or when containing Fe, has no absorption bonds. Fe does have strong quenching action, but Fe does not quench by light absorption. It is decided that the initially-excited states of U and not the metastable fluorescent are subject to quenching by Fe. Forster's theory is criticized in that it fails to predict self-quenching. The absence of detectable quenching in Pu compounds is discussed.

1107. THE POLAROGRAPHIC BEHAVIOR OF VARIOUS METAL IONS IN PLUTONIUM SOLUTIONS. C. G. Warren. LA-1843 (Del.), July 1953.

The reported procedures for the polarographic determination of U, V, and Ti in Pu were investigated to see if they could be used for other common metals in Pu. It was found that the procedure using hydroxyl amine to reduce Pu to the (III) oxidation state could be used to determine Bi, Pt, Rh, Cu, Sn, Pb, Tl, In, and Cd. The procedure using Zn and Zn amalgam in hydrochloric acid to reduce Pu to the (III) oxidation state is quite limited but might be used to determine Mo.

1108. TURBIDIMETRIC MICRODETERMINATION OF SULFATE IN PLUTONIUM SOLUTIONS.
H. D. Warren, A. Brunstad. HW-55349, March 14, 1958.

The method is based on the removal of Pu with a cation-exchange resin, followed by formation of a barium sulfate suspension and measurement of optical density of the suspension with a spectrophotometer. The method is used for 0.02-10M sulfate using a 50-microliter sample. Precision is ±3% for a single result expressed as the standard deviation. Pu present in five-fold molar excess does not interfere.

1109. SOLUBILITY OF PLUTONIUM(IV) SULFATE IN NITRIC ACID SOLUTIONS. H. D. Warren, A. Brunstad. HW-55357, March 14, 1958.

The solubility of Pu(IV) sulfate in 2, 4, and 6M nitric acid solutions was determined at 25°C, and in 6M HNO_3 at 55°C.

1110. PROCEEDINGS OF THE SECOND ANNUAL MEETING ON BIO-ASSAY AND ANALYTICAL CHEMISTRY, OCTOBER 11 AND 12, 1956.
WASH-736, Sept. 27, 1957.

Topics discussed included the toxicology of Pu.

1111. RADIOCHEMICAL DETERMINATION OF PLUTONIUM IN THE JN-1 IRRADIATED URANIUM.
K. Watanabe. J. At. Eng. Soc. Japan 3, 497-501 (July 1961).

An anion-exchange column was used to separate Pu from U and fission products using a 7N nitric acid solution. The Pu was eluted with hydroxylamine. The hydroxylamine was removed by passing the solution over a Dowex-50, cation-exchange resin.

1112. FINAL SAFETY EVALUATION OF PLUTONIUM PROCESSING TO BE PERFORMED IN THE HEAVY ELEMENT PROCESSING FACILITY.
J. Watcher. MND-P-2396, Sept 1960.

The potential hazards associated with the handling and processing of Pu^{238} and Pu^{239} were evaluated.

1113. THE DETERMINATION OF INDIUM IN INDIUM PLUTONIUM SOLUTIONS. G. R. Waterbury, LA-1189 (AECD-3845), Dec. 12, 1950.

In this procedure, the Pu is initially separated as the peroxide followed by the quantitative precipitation of indium diethyl dithiocarbamate from a slightly acidic solution. The suggested range is 5-50 mg of In per sample. Recoveries ranged from 99.4 to 100.5%, with an average precision of 2.3/1000 on known Pu-In solutions.

1114. MODIFIED SARGENT-MALMSTADT AUTOMATIC TITRATOR FOR REMOTE CONTROL USE WITH PLUTONIUM SOLUTIONS. G. R. Waterbury. Anal. Chem. 31, 1138 (1959).

Several modifications to adapt the commercially available, differential-potentiometric automatic titrator for use with Pu solutions, and to improve parts of it for specific purposes include replacing the gravity-flow buret with a motor-driven syringe buret, replacing the stirrer with a magnetic stirrer, rewiring the titrator for remote operation inside a Pu dry box or hood, and adding a microammeter to indicate potential changes.

1115. SEPARATION AND DETERMINATION OF MICROGRAM AMOUNTS OF MOLYBDENUM IN PLUTONIUM. G. R. Waterbury, C. E. Bricker. Anal. Chem. 29, 129-35 (1957).

Mo is extracted from HCl-HF solution with hexone and back-extracted with water. Fe is removed by precipitation with NaOH. The color is developed with chloranilic acid in 1-4M $HClO_4$ and measured at 350 mu. Sn, W, and Bi interfere. Recovery is about 99.8%, with a standard deviation of 1.6%.

1116. PRECISE DETERMINATION OF PLUTONIUM BY POTENTIOMETRIC TITRATION. G. R. Waterbury, C. F. Metz. Anal. Chem. 31, 1144 (1959).

Macro amounts of Pu are quantitatively oxidized with fuming perchloric acid, and Pu(VI) is reduced to Pu(IV) with a slight excess of standard Fe(II) solution, which is then titrated automatically with Ce(IV). Of 26 foreign metals investigated, Cr, Au, Mn, V, and Pt seriously interfered. The spectrophotometric titration of Pu is also discussed.

1117. THERMOGRAVIMETRIC BEHAVIOR OF PLUTONIUM METAL, NITRATE, SULFATE, AND OXALATE. G. R. Waterbury, R. M. Douglass, C. F. Metz. Anal. Chem. 33, 1018-23 (1961).

A thermo balance for analysis of Pu samples is described. The subject compounds were studied in the range of 20-1250°C, and oxides produced were examined microscopically and by X-ray powder diffraction. The final dioxides from all samples, except the nitrate, contained excess oxygen after 4 hours at 1250°C. Only the sulfate formed a stable, intermediate, anhydrous plutonium sulfate which might be used in the gravimetric determination of Pu.

1118. METHOD OF SEPARATING PLUTONIUM FROM LANTHANUM FLUORIDE CARRIER. G. W. Watt, R. H. Goeckermann. U. S. Pat. 2,838,371, June 10, 1958.

The method relates to the separating of Pu from La ions in an aqueous 0.5 to 2.5N nitric acid solution by treating the solution, at room temperature, with ammonium sulfite in an amount sufficient to reduce the hexavalent Pu present to a lower valence state, and then treating the solution with H_2O_2, thereby forming a tetravalent plutonium peroxide precipitate.

1120. THE DISTRIBUTION OF PLUTONIUM TRACER BETWEEN METALS AND THEIR MOLTEN HALIDES. III. FURTHER EXPERIMENTS IN THE URANIUM-URANIUM BROMIDE SYSTEM INCLUDING EXPERIMENTS WITH THORIUM TRACER. IV. THE MANGANESE-MANGANOUS CHLORIDE SYSTEM. V. THE CALCIUM-CALCIUM CHLORIDE SYSTEM. R. A. Webster. CK-1359, Feb. 1, 1944.

Additional studies on above systems indicate that Pu is more electropositive than U and Mn, and less electropositive than Ca.

1121. THE DISTRIBUTION OF PLUTONIUM TRACER BETWEEN METALS AND THEIR MOLTEN HALIDES. THE URANIUM-URANIUM BROMIDE SYSTEM. II. THE LEAD-LEAD CHLORIDE SYSTEM. R. A. Webster, B. J. Fontana. CK-942.

Studies were initiated on high-temperature oxidation-reduction relation of Pu in $U-UBr_3$ and $Pb-PtCl_2$ systems. Pu appears to be more electropositive than U or Pt.

1122. THE DETERMINATION OF PLUTONIUM BY MASS SPECTROMETRY USING A [242] PLUTONIUM TRACER. R. K. Webster, A. A. Smales, D. F. Dance, L. J. Slee. Anal. Chim. Acta 24, 371-380 (1961).

An isotopic dilution method is described for determining Pu in samples of irradiated U using a Pu^{242} tracer. An aliquot of tracer is added to the sample, and the mixture is treated to insure isotopic exchange; Pu is then separated by an ion-exchange procedure, and an isotopic analysis is made using an MS5 mass spectrometer.

1123. DETERMINATION OF PLUTONIUM IN NATURAL URANIUM FUEL ELEMENTS. R. K. Webster, D. F. Dance, L. J. Slee. Anal. Chim. Acta 24, 509-25 (1961).

A procedure is described for determining the (total Pu)/(total U) concentration ratio for a given solution by an isotopic dilution method. A possible application of the method would be its use for Pu accounting analyses in a chemical plant processing natural U fuel elements, an important feature being the near elimination of the effect for plant sampling errors.

1124. CRITICAL MASS STUDY FOR CYLINDRICAL GEOMETRY AS A FUNCTION OF RADIUS TO HEIGHT RATIO. R. A. Weir. LWS-24712, Jan. 20, 1953.

Results are presented of a study on the manner of variation of the critical mass of Pu and the peak-to-average power production ratio in a bare cylindrical reactor core. Results indicate that increasing the ratio of the critical radius to the critical height from 0.5 to 1.0 would entail a critical mass increase of 22%.

1125. RADIOCHEMICAL DETERMINATION OF PLUTONIUM IN URINE. H. V. Weiss, W. H. Shipman. Anal. Chem. 33, 37-9 (1961).

Pu was co-crystallized with potassium rhodizonate from urine. It is then purified from interfering substances by coprecipitation with La salts and ion exchange. Finally, the radio element was electrodeposited onto a Ta disk and alpha-counted. Average recovery was about 91.38 ± 5%, and the analysis time is about 5-6 hours.

1126. A PRELIMINARY DISCUSSION OF THE RATIO OF CAPTURE TO FISSION (PRELIMINARY DRAFTS). V. F. Weisskopf. NDA-Memo-15B-1, July 23, 1952.

Two methods for measuring α at energies higher than 500 eV are discussed. The first method consists of wrapping samples in shields of different thickness and composition and irradiating them in a reactor. A mass spectrometer is used to measure the amount of U^{236} and Pu^{240} produced. The second method involves measurement of larger coefficients for various samples in different reactors and different locations.

1127. THE DETERMINATION OF HEAVY METAL FLUORIDES BY PYROHYDROLYSIS. G. A. Welch, N. Parker. WSL-R-36, June 17, 1952.

A method for determining Th, U, and Pu fluorides by pyrohydrolysis at 1000°C in a current of steam is presented. The fluoride is determined by titration with standard alkali.

1128. A METHOD FOR THE RAPID DETECTION OF PLUTONIUM DUSTS IN AIR. G. M. Wells. RDB(W)TN-109, Oct 1953.

Air is drawn through a filter paper. The filter paper is ashed and treated with nitric acid. The tray in which the paper is ashed is then heated to 1200-1300°C to "boil off" all the natural activity leaving only the Pu, which may then be counted in the normal manner.

1129. SPECTROCHEMICAL DETERMINATION OF BORON IN PLUTONIUM AND URANIUM FOLLOWING CATION-EXCHANGE SEPARATION. A. W. Wenzel, C. E. Pietri. In NBL-204, Semiannual Progress Report (On Chemistry) for the Period January 1963 through June 1963. Dec 1963, pp. 71-73.

Mannitol was used to prevent volatilization losses of B during evaporative concentrations of the B-rich effluent. Zn was used as an internal standard. Results on B-spiked Pu and U solutions showed essentially quantitative recovery in the 3- to 30-ppm range.

1130. EMISSION SPECTROGRAPHIC ESTIMATION OF AMERICIUM IN PLUTONIUM. A. W. Wenzel, C. E. Pietri. In NBL-204, Semiannual Progress Report (On Chemistry) for the Period January 1963 through June 1963. Dec 1963, pp. 65-69.

The method is quantitative in the 10- to 120-ppm range and, estimates may be made in the rest of the 1- to about 200-ppm range. Greater sensitivity was obtained when standards were processed in 1N HNO_3 instead of 8N HNO_3.

1131. PURIFICATION OF PLUTONIUM SULFATE TETRAHYDRATE BY RECRYSTALLIZATION AND ION EXCHANGE. A. W. Wenzel, C. E. Pietri. Anal. Chem. 35, 1324 (1963).

An anion-exchange resin, Dowex-1 x 10 or AG1 is used. The impurities are washed from the column with 8N nitric acid, after which the Pu was eluted with 0.35N nitric acid and crystallized as the tetrahydrate.

1132. SEPARATION OF PLUTONIUM FROM AMERICIUM. L. B. Werner. U. S. Pat. (Appl.) 72,754, Official Gaz. 663, 1220, 1952.

Am is separated from contaminants in an aqueous solution by stirring with Pu-V carrier and centrifuging. After 40 hours, the Pu-V precipitate is centrifuged and washed with carbonate solution. A method for preparing the Pu-V carrier is given.

1133. METHODS OF CONCENTRATING FISSIONABLE MATERIAL. L. B. Werner, B. A. Fries, G. T. Seaborg. U. S. Pat. 2,776,185, Jan. 1, 1957.

The specification describes a process for concentrating dilute Pu solutions. It consists of alternately using La and Nb carrier precipitations and redissolving each precipitate in a substantially smaller volume of solvent than that from which it was precipitated.

1134. METAL RECOVERY PROCESS. L. B. Werner, O. F. Hill. U. S. Pat. 2,815,265, Dec. 3, 1957.

A process is presented for separating Pu from the niobium oxide which is frequently used as a carrier precipitate to separate the Pu from solutions of dissolved fuel elements.

1135. THE INVESTIGATION OF SOFT RADIATIONS FROM Pu^{239} AND U^{233} WITH A PROPORTIONAL COUNTER. D. West, J. K. Dawson, C. J. Mandleberg. AERE-N/R-902, April 28, 1952.

Pu^{239} emits the L X-radiation of U with an intensity of 4 ± 1 x 10^{-2} L X rays per particle. U^{233} emits the L X-radiation Th. Data are also given on gamma radiations from both Pu^{239} and U^{233}.

1136. SOLUBILITY DATA ON INORGANIC COMPOUNDS OF RARE EARTHS, PROTOACTINIUM, THORIUM, URANIUM, NEPTUNIUM, AND PLUTONIUM. S. Wexler. CL-1039, Nov. 5, 1943.

Data are given in tabular form.

1137. ANION EXCHANGE RECOVERY OF PLUTONIUM FROM THE HANFORD 234-5 BUILDING BUTTON LINE. TASK I. OXALATE FILTRATE. E. J. Wheelwright. HW-75309, Nov. 13, 1962.

The Pu lost to the Task I oxalate filtrate can be recovered by the nitric acid anion-exchange process.

1138. SPECIAL RESEARCH PROBLEMS. J. C. White, P. F. Thomason. In ORNL-3397, Analytical Chemistry Division Annual Progress Report for Period Ending December 31, 1962. Feb. 8, 1963, pp. 26-38.

Absorption studies of Pu were continued to determine the kinetics of polymerization and depolymerization of Pu^{+4} in nitrate solutions and to determine the properties of the polymer with respect to such parameters as acidity, temperature, and ionic concentration.

1139. DESIGN AND OPERATION OF THE HANFORD PLUTONIUM METALLURGY INSTALLATIONS. O. J. Wick, I. D. Thomas. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 531, United Nations, New York, 1958.

The philosophy of Pu handling on a large scale is described in detail.

1140. SOME CUMULATIVE YIELDS OF ISOTOPES FORMED IN THE THERMAL NEUTRON FISSION OF Pu^{239}. D. M. Wiles, J. A. Petruska, R. H. Tomlinson. Can. J. Chem. 34, 227-32 (1956).

The relative yields of Cs, Ce, Nd, and Sm produced by neutron fission of Pu^{239} have been determined with a mass spectrometer. Preliminary yield values of 16 isotopes of these elements have been assigned, along with four yields of Xe isotopes by means of isotope dilution techniques.

1141. DISSOLUTION OF A PLUTONIUM METAL BILLET IN NITRIC ACID. V. J. Wilkinson, J. A. Peacegood. RDB(W)/TN-77, June 1953.

A 240-gram billet of Pu metal was dissolved completely in one liter of 16N nitric acid to which 4 grams of HF were added. A solution rate of 0.2 grams/cm^2/hour was achieved.

1142. EXTRACTIVE AND PHYSICAL METALLURGY OF PLUTONIUM AND ITS ALLOYS INCLUDING A SPECIAL INTRODUCTION AND ANNOTATED BIBLIOGRAPHY. W. D. Wilkinson. Interscience Publishing Co., New York, 1960.

The extractive characteristics of Pu and impurities are given for the system tri-butyl phosphate from nitric acid solution.

1143. SOME FACILITIES FOR THE STUDY OF PLUTONIUM AND ITS ALLOYS. G. K. Williamson, D. M. Poole, J. A. C. Marples. J. Inst. Metals 85, 431-6 (1957).

Various types of gloveboxes for the safe handling of Pu and its alloys are described. Facilities are provided for alloy preparation, X-ray examination, heat treatment, and metallography.

1144. PLUTONIUM RECOVERY FROM CONTAMINATED MATERIALS, PROJECT CGC-813, 232-Z BUILDING, 200-W AREA. FINISHED PRODUCTS CHEMICAL TECHNOLOGY NEUTRON MONITORING INVESTIGATION. C. G. Wills. HW-70792. Aug. 23, 1961.

A discussion is given of the investigation of the neutron-monitoring characteristics for the determination of the extent of Pu accumulation in incinerators.

1145. TERTIARY AMINE EXTRACTION OF PLUTONIUM FROM NITRIC ACID SOLUTIONS. A. S. Wilson. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 348, United Nations, New York, 1958.

Data are presented to show the effect of pertinent variables on the extraction of Pu. The extraction of Pu(III) and (VI) is shown to be small. The data on the extraction of Pu(IV) by several amines are presented and discussed.

1146. PLUTONIUM CONTAMINATED INJURY CASE STUDY AND ASSOCIATED USE OF Na_4EDTA AS A DECONTAMINATING AGENT. R. H. Wilson, W. B. Silker. HW-66309, Aug. 3, 1960.

A description is given of the treatment of a puncture wound sustained by an employee with a sliver of Pu metal found to contain ~32.9 μc of Pu and weighing 0.497 mg.

1147. AQUEOUS RECOVERY OF PLUTONIUM FROM ALLOYS CONTAINING FISSION PRODUCT ELEMENTS. R. S. Winchester, W. J. Maraman. Proc. 2nd Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1958, 17, 168, United Nations, New York, 1958.

A survey of aqueous Pu recovery and purification methods as applied to Pu-rich reactor fuels is presented. These methods consist of precipitating plutonium fluoride, oxalate, and peroxide absorbing on anion-exchange resins, and solvent-extracting with tri-n-butyl phosphate.

1148. MAGNESIUM EXTRACTION PROCESS FOR PLUTONIUM SEPARATION FROM URANIUM. I. O. Winsch, L. Burris, Jr. Chem. Eng. Prog. 53, 237-42 (1957).

In the process described, molten Mg, which is immiscible with molten U, may be used to extract Pu from irradiated U. The Pu distributes between the Mg and U with a distribution coefficient of about 2 (weight basis) in favor of the Mg. The Pu is then separated from the Mg by volatilization of the latter.

1149. IMPROVED EQUIPMENT FOR POTENTIOMETRIC TITRATION PROCEDURE. E. N. Wise. LA-1176, Sept. 11, 1950.

An automatic titrator has been designed and constructed which is capable of handling homogeneous solutions of Pu with a precision of 0.7-0.9 part per thousand. The samples are converted to the sulfate and reduced to the +3 state with titanous sulfate. The titrator automatically added the sulfatoceric acid and accurately determined the ceric-titanous and then the ceric-plutonium end point.

1150. QUANTITATIVE ION-EXCHANGE SEPARATIONS FOR SEQUENTIAL RADIOCHEMICAL ANALYSIS. L. Wish. USNRDL-TR-185, Oct. 10, 1957.

A method for a rapid separation and determination of Np, Pu, U, Zr, Nb, and Mo isotopes in mixed fission products is evolved from Dowex-2 anion-exchange equilibrium data of these elements in HCl, HCl-HF, and HNO_3.

1151. QUANTITATIVE RADIOCHEMICAL ANALYSIS BY ION EXCHANGE. ANION EXCHANGE BEHAVIOR IN MIXED ACID SOLUTIONS AND DEVELOPMENT OF A SEQUENTIAL SEPARATION SCHEME. L. Wish. Anal. Chem. 31, 326-330 (1959).

Elution characteristics of Np, U, Pu, and Zr in HCl, HNO_3, and H_2SO_4 media with Dowex-2 anion-exchange resin were found. Pa has also be included. Np, Pa, and Pu were of about 99% purity after one column pass. The U was contained in a large proportion of Zr and had to be treated further.

1152. SEQUENTIAL ANALYSIS OF TRACER AMOUNTS OF Np, U, AND Pu IN FISSION-PRODUCT MIXTURES BY ANION EXCHANGE. L. Wish, M. Rowell. USNRDL-TR-117, Oct. 11, 1956.

Elution characteristics of Np, U, Pu, and Zr in HCl, HNO_3, and H_2SO_4 media with Dowex-2 anion resin were found. From these, a procedure for the sequential analysis of the three actinides in fission-product mixtures in HCl and HNO_3 has been developed. Pu was also included in this separation scheme. In most cases, the Np, Pa, and Pu were sufficiently decontaminated after one column for 99% purity. The U contained a large portion of the Zr and had to be treated further for a satisfactory separation. The yields were approximately 70-90%.

1153. REACTOR FUELS AND MATERIAL DEVELOPMENT PLUTONIUM RESEARCH, APRIL-JUNE 1963. L. J. Wittenberg. MLM-1162, June 30, 1963.

1154. THE CHELATE COMPOUNDS OF PLUTONIUM. F. J. Wolter. ISC-14, May 25, 1946.

The history of the Pu problem during the early days of the Manhatten Project is discussed. Also covered is the chemistry of the various oxidation states of Pu and the nature of chelate compounds.

1155. ELECTRODEPOSITION OF PLUTONIUM. F. J. Wolter. U. S. Pat. 2,805,985, Sept. 10, 1957.

A process of electrolytically recovering Pu from dilute aqueous solutions containing Pu ions comprises electrolyzing the solution at a current density of about 0.44 amp per sq cm in the presence of an acetate-sulfate buffer, while maintaining the pH of the solution at substantially 5 and using a stirred Hg cathode.

1156. PLUTONIUM COMPOUNDS AND PROCESS FOR THEIR PREPARATION. F. J. Wolter, H. C. Diehl, Jr. U. S. Pat. 2,819,280, Jan. 7, 1958.

This patent relates to certain new compounds of Pu, and to the utilization of these compounds to effect purification or separation of the Pu. The compounds are organic chelate compounds consisting of tetravalent Pu, together with a di-(salicylal) alkylene diamine.

1157. ANALYTICAL CHEMISTRY OF PLUTONIUM. (SUMMARY.) F. J. Woodman. The Analyst 84, 259-60 (1959).

This is a brief summary of a paper presented at the Scottish Section.

1158. THE DISPERSAL OF EFFLUENT IN THE SEA. J. Wright. Atomics 7, 274-9 (1956).

Experiments were made to determine the nature of processes leading to physical dispersion of radioactivity from the point of discharge in the sea.

1159. PROPERTIES OF FISSILE AND BREEDER METALS. J. C. Wright. Metal Treatment and Drop Forging 27, 375, (Sept 1960).

The properties and characteristics of the fissile and breeder metals and alloys of Pu, Th, and U are given.

1160. THE PRODUCTION OF REACTOR FUEL ELEMENTS. III. L. M. Wyatt. Nucl. Power 1, 125-9 (July 1956).

The physical properties of Pu metal are given. The difference between British and American fuel plate designs are noted. The method for developing the BEPO type can is explained.

1161. ELECTROMAGNETIC RESEARCH DIVISION PROGRESS REPORT JULY 1, 1950 TO OCTOBER 1, 1950. Oak Ridge National Laboratory, Y-12 Area. Y-676, Oct. 12, 1950.

With the installation of the assembly and the shielding, the 86-in. cyclotron is structurally complete. The separation of intermediate level U^{236} is nearing completion, and preliminary tests were made for the separation of Th, Bi, and Pu isotopes.

1162. THE PREPARATION OF THIN FILMS OF PLUTONIUM, AMERICIUM, AND CURIUM BY AN ELECTROLYTIC METHOD. G. N. Yakovlev, P. M. Chulkov, V. B. Dedov, V. N. Kosyakov, Y. P. Soboley. J. Nuclear Energy 5, No. 1, 159-61 (1957).

Methods were developed for the quantitative deposition of Pu, Am, and Cm on metallic surfaces. The elements were deposited as hydroxides from neutral and weakly acidic alcoholic solution of the chlorides.

1163. ARSENAZO(III) AND ITS USES. P. Yang. Hua Hsuch Tung Pao 9, 567, 568-71 (1963).

Zr and Pu can be determined with Arsenazo III.

1164. DETERMINATION OF PLUTONIUM BY TITRATION WITH CERIC SULFATE. P. Young. Anal. Chem. 24, 152-62 (1952).

Plutonium sulfate solutions are reduced to Pu(III) in a small Jones reductor, and titrated to Pu(IV) with ceric sulfate (0.0045N) with ferroin as indicator. The reproducibility on 2.5 mg of Pu was ±0.25%.

1165. CRYSTAL STRUCTURE OF SOME SULFIDES.
W. H. Zachariasen. Acta. Cryst. 2, 288, 1949.

A number of sulfides and oxysulfides of 5f elements and of Ce have crystal structures of NaCl type, Sb_2S_3 type, $PbCl_2$ type, and PbFCl type.

1166. THE STRUCTURE OF PLUTONIUM METAL.
W. H. Zachariasen. In TID-7683, Plutonium Chemistry Symposium, Chicago, Illinois, February 18, 1963, pp. 12-15.

The results of crystal structure studies of Pu metal are summarized. Structure data are given for all six phases, and metallic radius is discussed in relation to related elements and to the electron configuration.

1167. CHROMATOGRAPHIC SEPARATION OF MICROQUANTITIES OF Np AND Pu ON KU-1 AND KU-2 CATION RESINS. V. D. Zagrai, L. I. Sel'chenkov. Radiokhimiya 4, 181-4 (1962).

Separation of 98 ± 2% of Np and Pu was achieved using KU-1 and KU-2 cation resin (with $>10^3$ separation coefficient) with 0.02N hydrofluoric acid eluant.

1168. SPECTRAL ANALYSIS BY THE VAPORIZATION METHOD. V. ANALYSIS OF PLUTONIUM BY THE VAPORIZATION METHOD IN VACUUM.
A. N. Zaidel, N. I. Kaliteevskii, L. V. Lipis, V. M. Tarakanov. UCRL-Trans-766(L). Translated from Optika i Spektroskopiya 3, 16-20 (1957).

A technique was developed for applying the evaporation method to the spectral analysis of Pu.

1169. SOME ASPECTS OF SYNERGISM IN SOLVENT EXTRACTION. II. SOME DI-, TRI-, AND TETRAVALENT METAL IONS. M. Zangen.
J. Inorg. Nucl. Chem. 25, 1051-63 (1963).

Synergistic extraction of trivalent lanthanides and actinides, alkaline earths, and Th from hydrochloric solutions was studied using a combination of a monoacidic phosphonate ester (the chelating agent) with a neutral organophosphorus compound (the synergist) at varying concentrations in cyclohexane.

1170. THE SALICYLATES OF PLUTONIUM.
O. Y. Zvyagintsev, B. N. Sudarikov. NP-tr-312, (pp. 231-247).

The behavior of salts of Pu(III) and (IV) in solutions of salicylic and ammonium salicylate was studied. It was shown that the salicylate of Pu(III) and Pu(IV) can be titrated against solutions of ammonia or alkali.

1171. CHROMATOGRAPHIC SEPARATION OF Np FROM U, Pu AND FISSION PRODUCTS.
Y. A. Zolotov, D. Nishanov. Radiokhimiya 4, 241-4 (1962).

Np(V) is eluted from the cation column by 1M nitric acid ahead of U(VI) and other fission products.

1172. SPECTROCHEMICAL ANALYSIS OF PLUTONIUM. G. Zotov, C. A. Fowler. AECL-298, May 3, 1955.

A procedure is given for the spectrochemical analysis of Pu for impurity content. A sparking technique is used for excitation of the graphite electrodes. Oxygen atmosphere reduces the background due to C and cyanogen. Techniques for preparation of samples, standards, loading of electrodes, plate calibration, and internal standardization are described.

SUBJECT INDEX

x