

## NSA/SDI NOTIFICATION

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**IODINE-129**

407925

VI05 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 321 61 30 SEPTEMBER 1975

14273 NSA 321061 REPORT HWL--1950(Pt.3)

RADIOMITIGES FROM NUCLEAR POWER REACTORS.

THOMAS, C.W. (BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH. (USA))  
FEB 1975. 22-24P.

+++

CAT. 4420 ENVIRONMENTAL AND EARTH SCIENCES	** RADIOACTIVE EFFLUENTS
AMERICIUM ISOTOPES	CARBON 14
CESIUM 135	COBALT 60
CURIUM ISOTOPES	ENVIRONMENT
FISSION PRODUCTS	FORECASTING
+ IODINE 129	IRON 55
MANGANESE 54	NICKEL 63
NIOBIUM 93	NUCLEAR INDUSTRY
NUCLEAR POWER PLANTS	PLUTONIUM 238
PLUTONIUM 239	RADIOACTIVE WASTES
RADIOACTIVITY	SAMARIUM 151
SELENIUM 79	TECHNETIUM 99
TIN 125	TRITIUM
ZIRCONIUM 95	

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1320  
9  
62

SDI EVALUATION SHEET

VIOS PEERS, RUTH DIS, WASHINGTON X4166 REV 8/30/71

VOL 32 ISS 6

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V109 PERKS, RUTH

*IODINE-129*

NSA/SOI NOTIFICATION

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V109 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 32(9) 19 NOVEMBER 1975

22286 NSA 32(9) JOURNAL

RADIATION HAZARD OF 75UP 1237I.  
MUSKALOV, YU.I.; VASILENKO, I.YA. GIG. SANIT., 2, 80-83, FEB 1975. (IN  
RUSSIAN)

\*\*\*

CAT. 4434 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
TRANSPORT \*\* ECOSYSTEMS AND FOOD CYCLES  
BIOSPHERE BUILTUP  
GLOBAL FALLOUT +IODINE 129  
RADIOECOLOGICAL CONCENTRATION RADIONUCLIDE MIGRATION  
REACTORS

NSA/DOJ EVALUATION SHEET

VLSB PERKS, RUIF OIS, WASHINGTON X416E REV 8/30/73

VOL 32 ISS 9

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22260 H S N \*\*\*\*\* M S N \*\*\*\*\* M S N

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V105 PERKS, RUTH

NSA/SDI NOTIFICATION

*IODINE - 129*

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DOCUMENTS. PLEASE FILL IN THE LAST PAGE OF THIS NOTIFICATION.

V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 32(2) 31 JULY 1975

03472 NSA 32(02) TRANSLATION BNWL-TR--139

PLANNED AND UNPLANNED RELEASES OF RADIOACTIVE FISSION PRODUCTS DURING  
REPROCESSING, FISSION-PRODUCT TREATMENT AND STORAGE- AN ATTEMPTED RISK  
ANALYSIS.

LASER, M.; BRUECHER, H.; MERZ, E.; WOLF, J. TRANSLATED FROM GERMAN MAR  
1975. 22P. DEP. NTIS \$4.25. ANNUAL CONVENTION OF THE RADIATION-  
PROTECTION ASSOCIATION, HELGOLAND, F.R. GERMANY, 23 SEP 1974

+++

CAT. 4422 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVE EFFLUENTS \*/\* SOIL  
DIFFUSION ENVIRONMENT  
FLOODS FUEL REPROCESSING PLANTS  
GASEOUS WASTES HUMAN POPULATIONS  
+IODINE 129 IODINE 131  
KRYPTON 85 LIQUID WASTES  
RADIATION HAZARDS RADIATION PROTECTION  
RADIOACTIVE WASTE MANAGEMENT RADIOACTIVE WASTE STORAGE  
RADIOACTIVITY STACK DISPOSAL  
SURFACE AIR TRITIUM  
UNDERGROUND

EVALUATION SHEET

V105 PERKS, RJTH

OIS, WASHINGTON

X4166

REV 8/30/73

VOL 32

ISS 2

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03472 4 S N

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V105 PERKS, RUTH

NSA/SDI NOTIFICATION

*IODINE - 129*

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V105 PERKS, RUTH                      OIS, WASHINGTON                      X4166                      REV 8/30/73                      1  
NSA 32( 4) 31 AUGUST 1975

08920                      NSA 32(04)                      REPORT                      BNWL-SA--5411

IODINE-129 IN AQUATIC ORGANISMS NEAR NUCLEAR FUELS PROCESSING PLANTS.  
WATSON, D.G. (BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH. (USA))  
APR 1975. 14P. DEP. NTIS \$4.00. 4. NATIONAL SYMPOSIUM ON RADIOECOLOGY,  
CORVALLIS, OREGON, USA, 12 MAY 1975

+++

CAT. 4434 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
TRANSPORT \*\* ECOSYSTEMS AND FOOD CYCLES

ALGAE	AQUATIC ECOSYSTEMS
CRUSTACEANS	DIFFUSION
ENVIRONMENT	FUEL REPROCESSING PLANTS
GEOGRAPHY	HAPD
+IODINE 129	PLANTS
RADIATION MONITORING	RADIOACTIVE WASTE DISPOSAL
RADIOACTIVE WASTE MANAGEMENT	RADIONUCLIDE KINETICS
RADIONUCLIDE MIGRATION	SEDIMENTS
SURFACE WATERS	VARIATIONS
WEST VALLEY PROCESSING PLANT	

NSA/SDI EVALUATION SHEET

V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/77

VOL 32 ISS 4

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NSA/SDI NOTIFICATION

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V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 33( 4) 29 FEBRUARY 1976

07287 NSA 33(04) BOOK / THESIS

ISOTOPIIC RATIOS OF IODINE AND OTHER RADIONUCLIDES AS NUCLEAR POWER  
POLLUTION INDICATORS.

ERAUER, F.P.; BALLOU, N.E. ISOTOPE RATIOS AS POLLUTANT SOURCE AND  
BEHAVIOUR INDICATORS. VIENNA, INTERNATIONAL ATOMIC ENERGY AGENCY, 1975.  
215-229P. SEE STI/PUB--382; CONF-741120--, SYMPOSIUM ON ISOTOPE  
RATIOS AS POLLUTANT SOURCE AND BEHAVIOR INDICATORS, VIENNA, AUSTRIA, 18  
NOV 1974

+++  
CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
TRANSPORT

- |                       |                        |
|-----------------------|------------------------|
| AIR                   | CESIUM 134             |
| CESIUM 137            | COBALT 58              |
| COBALT 60             | CONTAMINATION          |
| FOOD                  | IODINE 127             |
| +IODINE 129           | ISOTOPE RATIO          |
| NUCLEAR POWER PLANTS  | PLANTS                 |
| RADIOACTIVE EFFLUENTS | RADIONUCLIDE MIGRATION |

NSA/SDI EVALUATION SHEET

V105 PERKS, RUTH

OIS, WASHINGTON

X4166

REV 8/30/

VOL 33

ISS 4

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## NSA/SDI NOTIFICATION

IODINE - 129

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V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 31(11) 15 JUNE 1975

29604 NSA 31(11) REPORT COO--2450-1

IODINE-129- A STUDY OF ITS TRANSPORT IN THE ENVIRONMENT AND DISTRIBUTION  
IN BIOLOGICAL SYSTEMS. ANNUAL PROGRESS REPORT, JUNE 1, 1974--MAY 31,  
1975.

MANUEL, D.K.; NICHOLSON, L.M. (MISSOURI UNIV., ROLLA (USA). DEPT. OF  
CHEMISTRY) 1975. 35P. DEP. NTIS \$4.75.

+++  
CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ABSORPTION SPECTROSCOPY	ACTIVATION ANALYSIS
BIOLOGICAL MATERIALS	CALIBRATION STANDARDS
CHEMICAL ANALYSIS	CHEMICAL PREPARATION
COMBUSTION	DISTILLATION
DISTRIBUTION	IODINE
+IODINE 129	LABORATORY EQUIPMENT
NEUTRON REACTIONS	PLANT TISSUES
PLANTS	QUANTITATIVE CHEMICAL ANALYSIS
RADIONUCLIDE KINETICS	RADIONUCLIDE MIGRATION
SEPARATION PROCESSES	SOILS
TISSUE DISTRIBUTION	

29627 NSA 31(11) REPORT UCRL--76552

FRESHWATER ENVIRONMENT.  
HARRISON, F.L.; OPHEL, I.L. (CALIFORNIA UNIV., LIVERMORE (USA).  
LAWRENCE LIVERMORE LAB.) 24 FEB 1975. 11P. DEP. NTIS \$4.00. NATIONAL  
ACADEMY OF SCIENCES WORKSHOP, WASHINGTON, DISTRICT OF COLUMBIA, USA, 7  
JAN 1975

+++  
CAT. 4434 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT \*/\* ECOSYSTEMS AND FOOD CYCLES

AMERICIUM 241	ANIMALS
AQUATIC ECOSYSTEMS	BIOLOGICAL HALF-LIFE
BIOLOGICAL RADIATION EFFECTS	CARBON 14
CESIUM 137	CHRONIC IRRADIATION
DELAYED RADIATION EFFECTS	DIFFUSION

\* IODINE 129  
LAKES  
PLANTS  
PLUTONIUM 239  
PLUTONIUM 241  
RADIOECOLOGICAL CONCENTRATION  
RADIOISOTOPE MIGRATION  
SEDIMENTS  
TRITIUM  
WATER RESERVOIRS

IODINE 131  
METABOLISM  
PLUTONIUM 238  
PLUTONIUM 240  
RADIOACTIVITY  
RADIOISOTOPE KINETICS  
RIVERS  
STRONTIUM 90  
VARIATIONS

EVALUATION SHEET

V105 PERKS, RUTH

OIS, WASHINGTON

X4166

REV 8/30/73

VOL 31

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29627 M S N

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V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 31(12) 30 JUNE 1975

33114 NSA 31(12) REPORT ORNL--5016

## RADIONUCLIDE CYCLING AND EFFECTS.

DAHLMAN, R.C.; ANDERSON, S.H.; BRINKLEY, F.S. (OAK RIDGE NATIONAL LAB.,  
TENN. (USA)) MAR 1975. 81-93P.

+++

CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ADSORPTION

CHROMIUM

COBALT 60

COOLING TOWERS

ECOSYSTEMS

FORESTS

MAMMALS

PLANTS

RADIOECOLOGICAL CONCENTRATION

RADIONUCLIDE MIGRATION

TRITIUM

CESIUM 137

CLAYS

CONTAMINATION

DISTRIBUTION

FOOD CHAINS

+IODINE 129

MINERALS

RADIOACTIVE WASTES

RADIONUCLIDE KINETICS

SOILS

33141 NSA 31(12) REPORT BNWL--1950(P.T.2)

## TERRESTRIAL ECOLOGY.

(BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WASH. (USA)) DEC 1974.  
157-207P.

+++

CAT. 4434 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT \*/\* ECOSYSTEMS AND FOOD CYCLES

ALASKA

CERIUM 144

DEER

ESKIMOS

FORAGE

+IODINE 129

RADIATION MONITORING

RADIONUCLIDE MIGRATION

SOILS

BIRDS

CESIUM 137

EGGS

FOOD CHAINS

HARD

PLANTS

RADIONUCLIDE KINETICS

RADIUM 226

TERRESTRIAL ECOSYSTEMS

WILD ANIMALS

71PCCN1UM 95

WILD ANIMALS



EVALUATION SHEET

V105 PERKS, PUTH OIS, WASHINGTON X4166 REV 8/30/73

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V105 PERKS, RUTH

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V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 30(12) 30 DECEMBER 1974

32022 NSA 30(12) BOOK / THESIS

EMISSION OF RADIOACTIVE AEROSOLS FROM REPROCESSING PLANTS.  
LASER, M.; BEAUJEAN, H.; FILSS, P.; MERZ, E.; VYGEN, H. PHYSICAL  
BEHAVIOR OF RADIOACTIVE CONTAMINANTS IN THE ATMOSPHERE. VIENNA,  
INTERNATIONAL ATOMIC ENERGY AGENCY, 1974. 99-107P. SEE STI/PUB--354;  
CONF-731110--, SYMPOSIUM ON THE PHYSICAL BEHAVIOR OF RADIOACTIVE  
CONTAMINANTS IN THE ATMOSPHERE, VIENNA, AUSTRIA, 12 NOV 1973

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CAT. 4421 ENVIRONMENTAL AND EARTH SCIENCES /\* RADIOACTIVE EFFLUENTS /\*  
ATMOSPHERE  
AEROSOL WASTES  
GASEOUS WASTES  
IODINE 131  
RADIATION HAZARDS  
RADIOACTIVE WASTE PROCESSING  
TRITIUM  
FUEL REPROCESSING PLANTS  
+IODINE 129  
KRYPTON 85  
RADIOACTIVE AEROSOLS  
RADIOACTIVE WASTES

I-129

EVALUATION SHEET

V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/7

VOL 30 ISS 12

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32022 M S N \*\*\*\*\* M S N \*\*\*\*\* M S N

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V-2 11/100-1  
V105 PERKS, RUTH

NSA/SDI NOTIFICATION

I-129

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V105 PERKS, RUTH DIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 30(10) 30 NOVEMBER 1974

26785 NSA 30(10) JOURNAL

ENVIRONMENTAL RADIATION EFFECTS OF NUCLEAR FACILITIES IN NEW YORK STATE.  
TERPILAK, M.S.; JORGENSEN, B.L. (ENVIRONMENTAL PROTECTION AGENCY, NEW  
YORK) RADIAT. DATA REP., 15, 7, 375-400, JUL 1974.

+++  
CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ALPHA SOURCES	AQUATIC ECOSYSTEMS
ATMOSPHERIC PRECIPITATIONS	BARIUM 140
BETA SOURCES	BNL
CESIUM 134	CESIUM 137
COBALT 60	CONTAMINATION
DEER	DRINKING WATER
EARTH ATMOSPHERE	ENVIRONMENT
FISHES	GASEOUS WASTES
GINNA-1 REACTOR	GROUND WATER
HUDSON RIVER	HUMAN POPULATIONS
INDIAN POINT-1 REACTOR	INDIAN POINT-2 REACTOR
+ IODINE 129	IODINE 131
KRYPTON 85	LIQUID WASTES
MANGANESE 54	MILK
NEW YORK	NINE MILE POINT-1 REACTOR
NUCLEAR INDUSTRY	PLANTS
PLUTONIUM 238	PLUTONIUM 239
POTASSIUM 40	RADIATION DOSES
RADIATION MONITORING	RADIOACTIVE WASTES
RADIOACTIVITY	RADIOECOLOGICAL CONCENTRATION
RADIONUCLIDE KINETICS	RADIONUCLIDE MIGRATION
RUTHENIUM 106	SEDIMENTS
SOILS	STRONTIUM 89
STRONTIUM 90	SURFACE WATERS
TRITIUM	WEST VALLEY PROCESSING PLANT
ZINC 65	ZIRCONIUM 95

EVALUATION SHEET

V105 PERKS, RUTH

DIS, WASHINGTON

X4166

REV 8/30/73

VOL 30

ISS 10

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26785 M S N

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V105 PERKS, RUTH

IODINE - 129

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NSA 30(7) 15 OCTOBER 1974

18621 NSA 30(07) JOURNAL

ENVIRONMENTAL AND RADIOLOGICAL MONITORING AT THE NATIONAL REACTOR TESTING  
STATION DURING FY-1973 (JULY 1972--JUNE 1973).

MARKHAM, O.D. (ATOMIC ENERGY COMMISSION, IDAHO FALLS, ID) RADIAT. DATA  
REP., 15, 5, 227-246, MAY 1974.

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CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES /\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ALPHA SOURCES	ANTELOPES
BETA SOURCES	CERIUM 144
CESIUM 134	CESIUM 137
CORAL 60	ECCSYSTEMS
GROUND WATER	IODINE 127
+IODINE 129	IODINE 131
ISOTOPE RATIO	MILK
NRTS	PLUTONIUM 238
PLUTONIUM 239	RADIATION MONITORING
RADIOACTIVITY	RADIONUCLIDE KINETICS
RADIONUCLIDE MIGRATION	SOILS
STRONTIUM 90	SURFACE AIR
SURFACE WATERS	TRITIUM
UPTAKE	WHEAT

EVALUATION SHEET

V105 PEKKS, RUTH

OIS, WASHINGTON

X4166

REV 8/30/7

VOL 30

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V105 PERKS, RUTH

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V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 30(4) 31 AUGUST 1974

09498 NSA 30(04) REPORT NP--20037

PRODUCTION AND RELEASE OF RADIOIODINES BY NUCLEAR POWER PLANTS AND  
REPROCESSING PLANTS AND THE EXPECTED RADIOLOGICAL BURDEN TILL THE YEAR  
2000.

PORZ, F. (KARLSRUHE UNIV. (TH) (F.R. GERMANY). INST. FUER PHYSIKALISCHE  
GRUNDLAGEN DER REAKTORTECHNIK; KERNEFORSCHUNGSZENTRUM KARLSRUHE (F.R.  
GERMANY). INST. FUER NEUTRONENPHYSIK UND REAKTORTECHNIK) JUL 1973. 82P.  
(IN GERMAN) DEP. NTIS (US SALES ONLY) \$7.25.

+++

CAT. 4421 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVE EFFLUENTS \*\*  
ATMOSPHERE

FUEL REPROCESSING PLANTS  
IODINE 131  
IODINE 135  
RADIATION MONITORING

+IODINE 129  
IODINE 133  
NUCLEAR POWER PLANTS  
RADIOACTIVE WASTES

EVALUATION SHEET

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V105 PERKS, RUTH OIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 30( 2) 31 JULY 1974

03175 NSA 30(02) REPORT EPA--520-4-73-2

ENVIRONMENTAL RADIATION DOSE COMMITMENT- AN APPLICATION TO THE NUCLEAR  
POWER INDUSTRY.

(ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C. (USA). OFFICE OF  
RADIATION PROGRAMS) FEB 1974. 88P.

+++

CAT. 4434 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
TRANSPORT \*\* ECOSYSTEMS AND FOOD CYCLES

- |                        |                              |
|------------------------|------------------------------|
| ACTINIDES              | DIFFUSION                    |
| ENVIRONMENT            | FISSION PRODUCT RELEASE      |
| FOOD CHAINS            | HEALTH HAZARDS               |
| HUMAN POPULATIONS      | +IODINE 129                  |
| KRYPTON 85             | NUCLEAR POWER PLANTS         |
| RADIATION DOSES        | RADIATION HAZARDS            |
| RADIATION MONITORING   | RADIOACTIVE WASTE MANAGEMENT |
| RADIOACTIVITY          | RADIONUCLIDE KINETICS        |
| RADIONUCLIDE MIGRATION | TRITIUM                      |

EVALUATION SHEET

VI05 PERKS, RUTH

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V105 PERKS, RUTH DIS, WASHINGTON X4166 REV 8/30/73 1  
NSA 29(11) 15 JUNE 1974

26835 NSA 29(11) JOURNAL

IODINE-129 LEVELS IN MILK AND WATER NEAR A NUCLEAR FUEL REPROCESSING PLANT.

DALY, J.C.; GOODYEAR, S.; PAPERIELLO, C.J.; MATUSZEK, J.M. (NEW YORK  
STATE DEPT. OF HEALTH, ALBANY) HEALTH PHYS., 26, 4, 333-342, APR 1974.

+++

CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ADULTS	BIOSPHERE
DOSE COMMITMENTS	ENVIRONMENT
HEALTH HAZARDS	+IODINE 129
MILK	RADIATION MONITORING
RADIATION PROTECTION	RADIOACTIVE WASTES
RADIOACTIVITY	RADIOECOLOGICAL CONCENTRATION
RADIONUCLIDE MIGRATION	RECOMMENDATIONS
SURFACE WATERS	WEST VALLEY PROCESSING PLANT

EVALUATION SHEET

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VOL 29

ISS 11

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V105 VORESS, H.E. CIS, WASHINGTON  
NSA 29( 3) 30 APRIL 1974

REV 8/30/73 1

18319 NSA 29(08) REPORT JUL--997-RG

IODINE RELEASE FROM NUCLEAR POWER PLANTS AND REPROCESSING PLANTS AS WELL  
AS THE ESTIMATION OF THE CONTAMINATION OF THE ENVIRONMENT IN THE FUTURE.  
BONKA, H.; BRUSSERTMANN, K. (KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (F.R.  
GERMANY). INST. FUER REAKTORENTWICKLUNG) AUG 1973. 72P. (IN GERMAN)  
DEP. NTIS (U.S. SALES ONLY) \$5.75.

+++

CAT. 4421 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVE EFFLUENTS \*\*  
ATMOSPHERE

CONTAMINATION  
FUEL REPROCESSING PLANTS  
GERMAN FEDERAL REPUBLIC

+IODINE 129  
LIQUID WASTES  
NUCLEAR POWER PLANTS

ENVIRONMENT  
GASEOUS WASTES  
IODINE  
IODINE 131  
LMFBR TYPE REACTORS  
RADIOACTIVE WASTES

EVALUATION SHEET

V105 VGRESS, H.E.

DIS, WASHINGTON

REV 8/30/77

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V105 VORESS, H.E. OIS, WASHINGTON  
NSA 29( 5) 15 MARCH 1974

REV 8/30/73 1

10143 NSA 29(05) REPORT BNWL--1783

RADIOECOLOGY OF IODINE-129- AN INTERIM REPORT.  
SOLDAT, J.K.; BRAUER, F.P.; CLINE, J.F.; FAGER, J.E.; KLEPPER, B.;  
RICKARD, W.H.; VAUGHAN, B.E.; WATSON, D.G. (BATTELLE PACIFIC NORTHWEST  
LABS., RICHLAND, WASH. (USA)) SEP 1973. 8CP. DEP. NTIS \$5.45.

+++

CAT. 4434 ENVIRONMENTAL AND EARTH SCIENCES */* RADIOACTIVITY MONITORING AND	
TRANSPORT */* ECOSYSTEMS AND FOOD CYCLES	
AQUATIC ECOSYSTEMS	BIBLIOGRAPHIES
DIFFUSION	ECOSYSTEMS
FOOD CHAINS	GASEOUS WASTES
HUMAN POPULATIONS	+IODINE 129
LIQUID WASTES	MAN
NUCLEAR POWER PLANTS	RADIATION DOSES
RADIATION HAZARDS	RADIOACTIVE WASTES
RADIOECOLOGICAL CONCENTRATION	RADIOISOTOPE MIGRATION
TERRESTRIAL ECOSYSTEMS	THYROID
UPTAKE	

EVALUATION SHEET

VI05 VORESS, H.E.

OIS, WASHINGTON

REV 8/30/7

VOL 29

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VI05 VORESS, H.E. OIS, WASHINGTON  
NSA 29( 4) 28 FEBRUARY 1974

REV 8/30/73 1

07699 NSA 29(04) REPORT CCNF-721107--

FUTURE IMPLICATIONS OF SOME LONG-LIVED FISSION PRODUCT NUCLIDES DISCHARGED  
TO THE ENVIRONMENT IN FUEL REPROCESSING WASTES.

BRYANT, P.M.; JONES, J.A. (ORGANIZATION FOR ECONOMIC CO-OPERATION AND  
DEVELOPMENT, 75 - PARIS (FRANCE); INTERNATIONAL ATOMIC ENERGY AGENCY,  
VIENNA (AUSTRIA)) MAR 1973. 131-151P. SYMPOSIUM ON THE MANAGEMENT OF  
RADIOACTIVE WASTES FROM FUEL REPROCESSING, PARIS, FRANCE, 27 NOV 1972

+++

CAT. 4420 ENVIRONMENTAL AND EARTH SCIENCES	*/ * RADIOACTIVE EFFLUENTS
ENVIRONMENT	FUEL REPROCESSING PLANTS
GASEOUS WASTES	HUMAN POPULATIONS
+ IODINE 129	KRYPTON 85
NUCLEAR POWER PLANTS	RADIATION DOSES
RADIOACTIVE WASTE DISPOSAL	RADIOACTIVE WASTE PROCESSING
RADIOACTIVITY	TRITIUM

EVALUATION SHEET

V105 VORESS, H.E.

CIS, WASHINGTON

REV 8/30/7

VOL 29

ISS 4

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V105 VORFESS, H.E. OIS, WASHINGTON  
NSA 29(1) 15 JANUARY 1974

REV 8/30/73 1

00381 NSA 29(01) REPORT BNWL-SA--4723

PARTICULATE AND GASEOUS ATMOSPHERIC IODINE CONCENTRATIONS.  
BRAUFR, F.P.; RIECK, H.G. JR.; HOOPER, R.L. (BATTELLE PACIFIC NORTHWEST  
LABS., RICHLAND, WASH. (USA)) 24 AUG 1973. 20P. DFP. NTIS \$3.00.  
SYMPOSIUM ON THE PHYSICAL BEHAVIOR OF RADIOACTIVE CONTAINMENT IN THE  
ATMOSPHERE, VIENNA, AUSTRIA, 12 NOV 1973

+++  
CAT. 4431 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT \*/\* ATMOSPHERE  
ACTIVATION ANALYSIS AEROSOLS  
ALASKA BRAZIL  
GAMMA SPECTROSCOPY GASEOUS WASTES  
IODINE 127 +IODINE 129  
IODINE 131 MONTANA  
NEUTRON BEAMS NEUTRON REACTIONS  
RADIATION MONITORING RADIOACTIVE WASTES  
WASHINGTON

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V105 VORESS, H.E.

OIS, WASHINGTON

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VOL 29

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VI05 VORESS, H.F. PIS, WASHINGTON  
NSA 29( 3) 15 FEBRUARY 1974

REV 8/30/73 1

05099 NSA 29(03) REPORT BNWL-SA--4694

NATURAL IODINE AND IODINE-129 IN MAMMALIAN THYROIDS AND ENVIRONMENTAL  
SAMPLES TAKEN FROM LOCATIONS IN THE UNITED STATES.

BRAUER, F.P.; SOLDAT, J.K.; TENNY, H.; STREBIN, R.S. JR. (BATTELLE  
PACIFIC NORTHWEST LABS., RICHLAND, WASH. (USA)) 1973. 28P. DEP. NTIS \$  
3.50. SYMPOSIUM ON ENVIRONMENTAL SURVEILLANCE AROUND NUCLEAR  
INSTALLATION, WARSAW, POLAND, 5 NOV 1973

+++

CAT. 4430 ENVIRONMENTAL AND EARTH SCIENCES \*/\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ATMOSPHERIC PRECIPITATIONS  
EARTH ATMOSPHERE  
GRASS  
IODINE 127  
MAN  
MONITORING  
RADIATION MONITORING  
THYROID

CATTLE  
ENVIRONMENT  
IODINE  
+IODINE 129  
MILK  
RADIATION DOSES  
SWINE  
USA

EVALUATION SHEET

V105 VOPRESS, H.E. OIS, WASHINGTON

REV 8/30/77

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VI.5 VORESS, H.E. OIS, WASHINGTON  
NSA 28(10) 30 NOVEMBER 1973

REV 8/30/73 1

24472 NSA 28(10) REPORT DCKET-50201--143

WEST VALLEY REPROCESSING PLANT. QUARTERLY REPORT FOR APRIL 1, 1973--JUNE  
30, 1973.

(NUCLEAR FUEL SERVICES, INC., WEST VALLEY, N.Y.). 17 JUL 1973.  
9P. OFP. NFIS \$3.00.

+++

CAT. 443 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
TRANSPORT

ALPHA PARTICLES	BETA PARTICLES
CESIUM 137	GASEOUS WASTES
+ IODINE 129	IODINE 131
LIQUID WASTES	MILK
RADIATION MONITORING	RADIOACTIVE WASTE PROCESSING
RADIOACTIVE WASTES	RHODIUM 106
RUTHENIUM 106	STRONTIUM 90
TRITIUM	WEST VALLEY PROCESSING PLANT

EVALUATION SHEET

V1.5 VDRESS, H.E.

OIS, WASHINGTON

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VOL 28

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V105 VOPESS, H.F. CIS, WASHINGTON  
NSA 28( 3) 15 AUGUST 1972

BEG. 11/17/72

05533 NSA 28(03) JOURNAL

EXAMPLES OF WORKING LIMITS FOR DISCHARGES OF RADIONUCLIDES TO ATMOSPHERE.

BRYANT, P.M. (NATIONAL RADIOLOGICAL PROTECTION BOARD, HARWELL, ENG.  
). PP 101-110 OF DISPOSAL OF RADIOACTIVE WASTE. PARIS-  
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, 1972. (IN  
FRENCH AND ENGLISH). FROM MEETING ON DISPOSAL OF RADIOACTIVE WASTE,  
PARIS, FRANCE, 12 APR 1972, 14 APR 1972. SEE CONF-720453--.

+++

CAT. 4421 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVE EFFLUENTS \*\*  
ATMOSPHERE

AIR  
CRITICAL ORGANS  
EARTH ATMOSPHERE  
IODINE 131  
MAN  
RADIATION DOSES  
RADIOISOTOPES  
STACK DISPOSAL  
TRITIUM

CONTAMINATION  
DOSE LIMITS  
+IODINE 129  
KRYPTON 86  
MILK  
RADIOACTIVE WASTE DISPOSAL  
RADIONUCLIDE MIGRATION  
STRONTIUM 90  
WATER

05535 NSA 28(03) JOURNAL

HEALTH IMPLICATIONS OF THE DISPOSAL OF RADIOACTIVE WASTES AND WASTES FROM  
OTHER SOURCES.

SHALMON, E.-CHANTEUR, J. (WORLD HEALTH ORGANIZATION, GENEVA).  
PP 205-223 OF DISPOSAL OF RADIOACTIVE WASTE. PARIS- ORGANISATION FOR  
ECONOMIC CO-OPERATION AND DEVELOPMENT, 1972. (IN FRENCH AND ENGLISH)  
. FROM MEETING ON DISPOSAL OF RADIOACTIVE WASTE, PARIS, FRANCE, 12  
APR 1972, 14 APR 1972. SEE CONF-720453--.

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CAT. 4420 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVE EFFLUENTS

AIR POLLUTION  
GASEOUS WASTES  
KRYPTON 86  
LIQUID WASTES

BIOLOGICAL EFFECTS  
+IODINE 129  
LAND POLLUTION  
NONRADIOACTIVE WASTE DISPOSAL

POLLUTION REGULATIONS  
SOLID WASTES  
WATER POLLUTION  
PUBLIC HEALTH

RADIOACTIVE WASTE DISPOSAL  
TRITIUM  
WHO  
THERMAL EFFLUENTS

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V105 VORESS, H.F. CIS, WASHINGTON  
NSA 28(2) 31 JULY 1973

BEG. 11/17/72

02585 NSA 28(02) JOURNAL

EXTINCT LUNAR RADIOACTIVITIES- XENON FROM /SUP 244/PU AND /SUP 129/I IN  
APOLLO 14 BRECCIAS.

BEHRMANN, C.J.- DROZD, R.J.- HOHENBERG, C.M. (WASHINGTON UNIV., ST.  
LOUIS). EARTH PLANET. SCI. LETT.- 17- NO. 2, 446-455(JAN 1973).

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CAT. 4431 ENVIRONMENTAL AND EARTH SCIENCES \*\* RADIOACTIVITY MONITORING AND  
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PROGRAMS, WASHINGTON, D.C. (USA). FIELD OPERATIONS DIV.). OCT 1972.  
31P.

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**26442 PULSARS: OBSERVATIONS OF SPECTRA.** Goldstein, R. M. (California Inst. of Tech., Pasadena). Science, 161: 341-343 July 9, 1969.

Radio spectrograms of two of the recently discovered pulsating radio sources were obtained. The data provide the instantaneous spectrum and the time-frequency history of the signals over a bandwidth of 3 MHz. (auth)

**26443 STELLAR ROTATION.** Epps, Harland W. (Univ. of California, Los Angeles). Proc. Nat. Acad. Sci. U. S. 66: 51-54 May 1969.

A perturbation technique is described for approximating the internal structure of rotationally distorted stars. (M.O.J.)

**26444 COSMOLOGICAL RED-SHIFT LAW FOR RADIO GALAXIES AND QUASAR-STELLAR RADIO SOURCES.** Gomide, F. M. (Instituto Tecnológico de Aeronáutica, São José dos Campos, Spais). An. Acad. Brasil. Cienc., 36: 400-412 Dec. 31, 1967.

Certain objections are raised as to the validity of the evolutionary cosmological models on theoretical and observational grounds. The probable presence of obscuring intergalactic matter pointed out by Ewicky, suggests the utilization of radio magnitudes of optically identified radio sources to test the red shift-magnitude relation. In order to be more observational selection a comparison is proposed, with statistics of red shift-to-magnitude data for groups of objects with about the same red shifts, with magnitudes defined in the system of the brightest. For radio galaxies results seem to favor the static de Sitter world-model. The somewhat different result for quasars-stellar radio sources may be perhaps an indication that the red shifts of these objects are not entirely of cosmological origin. (auth)

**26445 PHASE INTEGRALS IN PULSATION THEORY OF VARIABLE STARS.** de Freitas Pacheco, J. A. (Instituto Tecnológico de Aeronáutica, São José dos Campos, Spais). An. Acad. Brasil. Cienc., 39: 413-419 Dec. 31, 1967.

A method of calculus of the pulsation constant  $Q$ , in the pulsation theory of variable stars, is discussed through the calculus of the system phase integrals. (auth)

**26446 THE DOPPLER EFFECT AND ITS DISPLACEMENT FROM THE PFD IN RATIONAL MECHANICS: APPLICATIONS AND EXPERIMENTAL VERIFICATIONS.** Loissac, Jean. Appl. Opt., 8: 1849-1850 July 1969. (In French)

Stars recede toward the red of the galaxy NGC 5668 for a beam of 21 cm.  $\lambda$  measured in radioastronomy with a frequency meter and  $\lambda'$  measured in optics with a spectrograph, not being equal, it follows that the speed of light from a galaxy  $\bar{r}$  is not equal to that of a galaxy  $c$  which is measured on Earth from a stationary source. The Doppler empirical formula cannot be explained in classical mechanisms since it is in contradiction with  $H$ . As for the theory of relativity  $\bar{r} = c$  from a point of view  $\bar{r} = c$ . If one considers the Universe represented as a 3-dimensional space (H), non-Euclidian, with Euclidian connection projected in a Riemannian four-dimension space (E), a certain universal time, like that of an astronomer, can be defined and its course calculated in relation to this time. It will necessarily be confounded with the atomic clock time, but  $\bar{r} = c$  and  $\bar{r}' = c$ : the Doppler formula is not accurate. However,  $\bar{r}$  and  $c$  as well as  $\bar{r}'$  and  $c$  are so close in all the experiments carried out on Earth, even when an artificial satellite is used, that the errors made in using the Doppler formula are clearly inferior to experimental errors. (auth)

**26447 PULSAR E EFFECT.** Douglas-Hamilton, D. H. (Harvard Coll. Observatory, Cambridge, Mass.). Nature (London), 218: 1035-6 June 15, 1968.

It has been suggested that a small orbiting companion of a neutron star might trigger pulses of radio emission, in a way analogous to the Io effect in Jupiter. A satellite of mass  $m < 10^{21}$  g was proposed, to avoid difficulties with gravitational radiation, orbiting at  $R = 10^8$  cm to give a period of the order observed in pulsars. This suggestion is discussed, and it is concluded that an alternative mechanism for pulsars appears to be excluded, unless briefly a suggestion of nonradiating states in free-fall motion is accepted. (UK)

**26448 METALS IN THE EARLY SOLAR SYSTEM.** Reynolds, J. (Univ. of California, Berkeley). Nature (London), 218: 1037-8 June 15, 1968.

Observations on the platinum-244/cobalt and iodine-129/antimony systems for ancient meteorites could confirm the suggestion that these two extinct radioactivities were synthesized by the same mechanism as the stable elements. (auth) (UK)

**26449 THE GRAVITATIONAL REDSHIFT OF QUASARS.** (UK)

D. (Univ. of Manchester, Jodrell Bank, Eng.). Nature (London), 218: 1036-8 June 15, 1968.

Observations at 11 cm were extended to the four known pulsars. Observations were made with the Mark 2 telescope at 2092 MHz in May 1968. Pulses were clearly detected from CP 0950 and 1133. Their arrival times agreed with those expected from comparison with observations at 408 MHz using established dispersion delays. For CP 0834 and 1919 only upper limits could be placed on 11 cm emission. Data are given for peak flux density and mean pulse energy, and results are discussed. (UK)

**26470 INTERSTELLAR MAGNETIC FIELD.** Roger, R. S. (Dominion Radio Astrophysical Observatory, Pentecost, CAN.). Nature (London), 218: 1036 June 15, 1968.

An upper limit of  $< 8 \times 10^{-7}$  gauss to the interstellar magnetic field in the direction of the pulsar CP 0950, derived from Faraday rotation measurements, has been reported (Smith, Nature 218: 1037 (1968)). This value, for a component directed towards the Earth, is much lower than previous estimates. It is also noted that the contribution to the total rotation from the Earth's ionosphere implied by this limit is considerably lower than would be expected for the local time of the observations. In the present communication it is suggested that the observations are compatible with an interstellar field component of about  $10^{-6}$  gauss, directed towards the source and with a larger rotation contribution from the ionosphere. It seems reasonable to conclude that the total rotation of +4 radians observed by Smith could be made up of +12 radians in the ionosphere and -8 radians in interstellar space. This interpretation is consistent with the observation that the total radiation was in the same sense as the ionospheric contribution, and implies an interstellar magnetic field four times larger than Smith's upper limit. (UK)

**26471 PRELIMINARY RESULTS OF PULSATING RADIO SOURCES.** Greenf, G.; Roth, G.; Vigotti, M. (Univ. of Bologna). Nature (London), 218: 1036-7 June 15, 1968.

A programme of observations of pulsars has been started at 408 MHz using the N-S arm of the Northern Cross radio telescope. The long transit time (4 min) in the antenna fan beam allows observation of hundreds of pulses at each transit, and the multi-beam arrangement enables rapid and precise determination of declination. Sources CP 0950, 1133 and 1919 have so far been observed, but not CP 0834. Values of  $\delta$  are tabulated. A significant difference was apparent between the behavior of CP 1919 and that of CP 1133 and 0950 with regard to the pulse height in a train of pulses. CP 1919 showed trains of pulses all having almost the same height, whereas the other two sources showed a succession of markedly different pulses. An attempt was made to find some sort of correlation between the peak values of the successive pulses of a given source. CP 1919 and 0950 gave no indication of significant deviation from a sequence of random values, but CP 1133 showed some sort of regular pattern, consisting of a fluctuation of the average pulse height with a period twice that of the pulse repetition. A preliminary value obtained for the ratio between the average peak value of "even" pulses and that of "odd" pulses was  $1.50 \pm 0.18$ . This modulation would support the concept of "something" oscillating both in the fundamental mode and in some higher order mode. (UK)

**26472 GRAVITATIONAL REDSHIFT AND QUASAR-STELLAR OBJECTS.** Hameen-Anttila, K. A. (Univ. of Oulu, Finland). Nature (London), 218: 1040-1 June 15, 1968.

The chief criticism of the gravitational interpretation of the red shift in the spectra of quasars is concerned with three aspects—high electron density, differential gravitational red shift, and the small thickness of the line-emitting layer. There are some phenomena suggesting that quasars are not at cosmological distances, and it is interesting to try to construct models in which difficulties imposed by gravitational red shift are avoided. The model studied by Greenstein and Schmidt (Astrophys. J. 140: 1 (1964)) is modified by assuming that quasars are relatively cool bodies having eruptive atmospheres, the eruptions rising radially from the surface and then falling back. If the surface temperature is sufficiently low the entire observed spectrum originates in the eruptive layer in which rapid ionization and gas ionization processes are taking place, each other give an impression of high electron temperature. The thickness of the emitting layer AR is then determined not by ionization and excitation but by the average height to which the eruptions are able to rise. It is assumed that gravitation is the main factor determining this height. An order-of-magnitude estimate for AR is obtained from the general relativistic equations of geodesics in Schwarzschild's solution. The gravitational line broadening is independent of the distance proportional to the square of the Doppler velocity. It is shown that the observed Doppler velocity is independent of the distance, and that the observed Doppler velocity is independent of the distance. (UK)

Jugnot, B. (Laboratoire d'Hygiène de la Ville, Paris); Decker, M.; Chou, L.; Burg, C. Vienna, International Atomic Energy Agency, 1965. Preprint SM-72/7, 14p. (In French). (CONF-660667-7). ORAU.

From Symposium for the Disposal of Radioactive Wastes into Sea, Ocean, and Surface Waters, Vienna.

Natural radioisotopes present in surface waters and those which have been added by human activities, such as fallout and wastes from scientific, industrial, and medical applications, are discussed. The radioisotopes are fixed in relatively large amounts on solid particles in suspension and on mud. The program of studies on the waters of the Seine basin and various French rivers has been supplemented by examination of mud collected over a certain period by means of special submerged tanks. This examination yielded representative data on the radioisotopes transported by the water during the sampling period (normally one month). The mud collected exhibited an activity considerably higher than that of the water, and is suitable for direct gamma spectrometry and various other analyses. The examinations carried out include: direct gamma spectrometry; drying and crushing; alpha, beta, and gamma measurements on the dried mud; and separation of the sand, clay, and organic matter fractions from the fresh mud. Investigations were also made of the fixation capacity of the mud and its various components, of radioisotopes of Cs, Sr, Co, Ru, P, and I and their significance in fallout or in scientific uses. The purifying role of mud is confirmed by the results of measurement of fixation capacities. Depending on their nature and chemical form radioisotopes may be only slightly fixed (iodine), or may be almost totally fixed (cesium). A large part of the activity transported by surface waters is thus eliminated by deposition of mud or by filtration plants. (auth)

43145 DISTRIBUTION OF  $^{137}\text{Cs}$  IN PLANKTON FROM OFSHORE WATERS OF WASHINGTON AND OREGON, 1961-1963. Lewis, Gary B.; Seymour, Allyn H. (Univ. of Washington, Seattle), 12p. (CONF-650654-2). ORAU, Omskin, AED-CONF-65-167-5.

From Ocean Science and Engineering Conference, Washington, D. C.

The distribution of  $^{137}\text{Cs}$  values for unsorted plankton caught in a No. 8 mesh net within 135 miles of the mouth of the Columbia River conforms to the general pattern of the horizontal distribution of Columbia River water. The principal source of  $^{137}\text{Cs}$  in this area are the Hanford nuclear reactors, 360 miles upstream from the river mouth. Analyses of 238 samples collected between January 1961 and December 1963 indicate significant seasonal, but not annual, changes and a close relationship between  $^{137}\text{Cs}$  in river water and plankton. Maximum  $^{137}\text{Cs}$  values for all seasons occurred near the Washington coast in the winter, in the spring the values increased off the river mouth and seaward, values for the southern offshore area reached a maximum in the summer, the autumn season was characterized by minimum values in all areas. The data were described by the geometric mean since the array of the  $^{137}\text{Cs}$  values approximated a log-normal distribution. Values ranged from zero to 1,300 picocuries of  $^{137}\text{Cs}$  per gram of dry plankton. (auth)

43146 THE ISOTOPES  $^{23}\text{Na}$  AND  $^{26}\text{Mg}$  IN THE ATMOSPHERE. Rowell, W. Heidelberg, Univ., 1964. 7p. \$2.00 Omskin, AED-Disc. 64-3006.

Isotopes  $^{23}\text{Na}$  produced by cosmic rays was detected in rain water samples. Average concentration in rain is 220 atoms/liter corresponding to a few percent of the tropospheric production. Results of determinative in rain 1962-64 are given. A large fraction of the activity is due to nuclear activities. (auth)

43147 EFFECTS OF DISTANCE FROM A TWO-DIMENSIONAL SOURCE OF NEUTRONS ON THE NEUTRON FLUX AND ON THE RATIO OF NEUTRON FLUX TO SOURCE STRENGTH. (Contract 44-11-7500-01-10000). Los Alamos Scientific Laboratory, Los Alamos, N.M., 1965. 10p. (CONF-650654-2).

level in the atmosphere, water, and rocks of the earth's crust. The height, latitude, and longitude dependences of the neutron intensity are reported. The formation of neutrons in the atmosphere under the effect of primary cosmic radiation (protons,  $\alpha$  particles, heavy nuclei) and secondary radiation (fast neutrons,  $\pi$  mesons,  $\mu$  mesons, photons, and electrons) was examined. The intensity of neutrons coming from the sun is evaluated. The regular and irregular variations of the natural neutron background are described. The rate of neutron formation in rocks of the earth crust as a consequence of the spontaneous fission of heavy nuclei by ( $\alpha, n$ ) reactions, the formation of neutrons at different depths under the effects of cosmic radiation, and the photoneutron reactions resulting from the fission of heavy nuclei are evaluated. The neutron spectrum in the atmosphere and in rocks of the earth's crust is described. (tr-auth)

## Site Survey and Selection

43148 RADIOMETRIC MEASUREMENTS IN SELECTED POINTS OF THE ISLAND OF UNIVERSARIA, NEAR GUANABARA. Meyer, Edgard; Ballarín, Maria. (Comissao Nacional de Energia Nuclear, Rio de Janeiro). An. Acad. Brasil. Cienc., 37: 209-19(1965). (In Spanish).

Radiometric measurements were made in 1963 and 1964 of the background, soil, vegetation, and air before the construction of the Argonaut reactor and of the startup of the reactor. The results obtained for the air activities are tabulated. (J.S.R.)

## Techniques and Equipment

Refer also to abstracts 43094 and 43163.

43149 (NP-16200) THE APPLICATION OF RADIOACTIVE TRACERS IN THE STUDY OF SAND MOVEMENTS IN RIVERS. Report No. 4 (Final). Vukmirovic, Vojislav (Institut za Vodoprivredu "Jarsolav Cerul," Belgrade (Yugoslavia)). Dec. 1965. IAEA Contract 207/RL/RB. 93p. Dep. na.

The development of a kinetic theory of bed material discharge to study sand movement in rivers is presented. The theory was applied to sand movement in the Velika Morava River, using  $^{137}\text{Cs}$  as a tracer. In the study, 96% of the sand did not move more than 8m downstream and the tracer penetrated to 14 cm in depth. (F.S.)

43150 (NYO-644-67) NUCLEAR CHEMISTRY AND GEOCHEMISTRY RESEARCH. Progress Report, 1965-1966. Kolman, Truman P. (Carnegie Inst. of Tech., Pittsburgh, Dept. of Chemistry). June 30, 1966. Contract AT(40-1)-644. 67p. Dep. na. CPSTI \$3.00 cy, \$0.75 ma.

Research activities in nuclear chemistry, nuclear geology, nuclear reaction studies, and instrumentation are summarized. Laboratories, instruments, and irradiation facilities used are described. Lists of publications published and in preparation are included. (F.S.)

43151 (VUP-3015) SEISMIC VELOCITY DETERMINATION AND DISTANCE MEASUREMENTS IN A SALT DOME. PROJECT DRIBBLE, SALT DOME EVENT. McLaun, V. R. (Telephos Industries, Inc., Pasadena, Calif. Earth Science Div.). Apr. 1965. 7p. Dep. na. CPSTI \$1.50 cy, \$0.75 ma.

The downhole hardware and recording system designed to record high frequency energy including both compression and shear wave arrivals with unprecedented resolution is described. The compressional (4616 m/sec) and shear wave (2630 m/sec) velocities determined between the air filled 1 1/4-in. dia uncased hole (Station 1-A) and mud filled 1 1/4-in. dia uncased hole separated by approximately 22.9 m in the depth interval 731 m to 762 m are reported by continuous and accurate to  $\pm 1\%$ . This occurrence is the first time a depth of 762 m was reached with the depth

TOP SECRET



**3617 SOURCES OF RADIOACTIVITY IN FOODS.** Alfred W. Klement, Jr. (Atomic Energy Commission, Washington, D. C.). Ohio Agr. Expt. Sta., Spec. Rept. Ser. No. 1, 4-8(1963).

Various sources of environmental radioactivity that may affect its accumulation in foods are discussed. Plant roots are one of the most important entry routes of radioactive materials into biological systems. With respect to agriculture radium is usually the most important of the naturally-occurring nuclides, with  $K^{40}$  likely being the most abundant natural radionuclide in agricultural soils. Cosmic particles reacting with stable elements in the atmosphere, and to a lesser extent in the soil, are responsible for addition of tritium and  $C^{14}$  to the food chain. Undoubtedly, the major source of current concern with regard to radioactivity in foods is debris from nuclear weapons tests. Of the radionuclides produced in nuclear weapons tests, most are short-lived and decay to unmeasurable amounts within the first few hours. Types of fallout generated by a nuclear detonation are relative to the yield of the explosion. Yields of less than 1 megaton primarily contaminate the Troposphere and produce tropospheric fallout. The principle radionuclides of interest in Tropospheric fallout are  $P^{32}$ ,  $Sr^{90}$ ,  $Ba-140$ , and  $Zn^{65}$ . Weapons with yields in excess of one megaton contaminate both Troposphere and Stratosphere. In the case of Stratospheric fallout, longer-lived nuclides such as  $Si^{36}$ ,  $Cs^{137}$ ,  $Cl^{36}$ , and  $Pu^{239}$  become important. Direct-cycle air-cooled reactors and reactor fuel processing plants are examples of industrial operations that release some radioactive debris to the atmosphere. Iodine-131 contamination of milk resulting from the Wind-scale incident is discussed. Basic methods of radioactive waste disposal are reviewed. (H.M.G.)

**3618 RADIOACTIVITY IN FOODS—POULTRY AND ANIMALS IN GENERAL.** Homer Patrick (West Virginia Univ., Morgantown, W. Va.). Ohio Agr. Expt. Sta., Spec. Rept. Ser. No. 1, 32-10(1963).

Fission products most commonly considered important in animal foods are  $Sr^{90}$ ,  $Sr^{90}$ ,  $Cs^{137}$ ,  $Ba^{140}$ , and  $P^{32}$ . The two most probable sources from which large amounts of  $Sr^{90}$  and  $Sr^{90}$  could be obtained are plant and animal products high in calcium. Radio-strontium isotopes, concentrated in the bones and egg shells of meat animals, may be removed prior to slaughter of the animal via feeding either a calcium-deficient diet or a highly calcium-rich diet. Due to confinement of radiostromium in food products primarily to bone and egg shell, the consumption hazard is small. However, cooking processes may result in a migration of these nuclides to edible portions. Cesium-137 enters the food chain via plant root absorption. The  $Cs^{137}$  entering a plant occupies the same molecular position as potassium in the fiber structure but does not react biochemically as a part of the enzyme system. Cesium concentrates in the soft tissues and muscles. Radioisotopes of iodine are predominately concentrated in the thyroid gland, some is excreted in milk. Iodine-129 and  $I^{131}$  are not a hazard in meat and eggs. Barium 137-140 is such a poorly absorbed element and so highly complexed in the gut that it probably will not become any great danger. Criteria are drawn for radioactivity determinations in meat and eggs, and basic recommendations are made for the establishment of estimating ratios. (H.M.G.)

**3619 STRONTIUM 90 IN U.S. WHEAT AND FLOUR.** Alfred W. Klement, Jr. (Atomic Energy Commission, Washington, D. C.). Ohio Agr. Expt. Sta., Spec. Rept. Ser. No. 1, 4-8(1963).

made by the Health and Safety Laboratories (HASL). Samples were obtained from Minnesota crops of 1956, 1957, and 1958. Wheat and milling products from the 1958 crops of nine additional states were obtained and analyzed for  $Sr^{90}$  and calcium. Previous experiments showed that strontium derived from the soil is taken up relatively poorly by the berry and tends to concentrate in the bran fraction.  $Sr^{90}/Ca$  ratios in U. S. wheat crops were determined for each year between 1958 and 1961. Patent flour was found to contain 10% of the  $Sr^{90}$  in wheat. The  $Sr^{90}/Ca$  ratio in the flour was about two-fifths that of the wheat. Specific activity ( $\mu C Sr^{90}/mg Sr$ ) measurements in bran layer fractions indicated that the mechanism of contamination was by direct deposition of the outermost tissues of the berry and then some translocations of the  $Sr^{90}$  to the inner tissues from which flour is made. From the HASL tri-city diet study it was deduced that from 10 to 20% of the total  $Sr^{90}$  was taken in at each of the cities.  $Sr^{90}/Ca$  ratio in the total diet was lower than that of wheat products. The significance of this finding for dietary control of  $Sr^{90}$  levels is indicated. (H.M.G.)

**3620 RADIOACTIVITY IN GRAINS.** Philip F. Gustafson (Argonne National Lab., Ill.). Ohio Agr. Expt. Sta., Spec. Rept. Ser. No. 1, 41-8(1963).

Various types of grains were analyzed for  $Cs^{137}$  and  $K^{40}$  by gamma spectrometry of bulk samples. Samples representing the major grain producing portions of the United States were obtained from the United States Department of Agriculture. The data presented show that the  $Cs^{137}$  and  $Sr^{90}$  contents of grain are strongly dependent upon the fallout deposition occurring during the growing season and to a lesser extent upon the accumulation of these radionuclides in the soil. Newly deposited fallout products have a 10-fold greater probability of entering the plant and being incorporated into the grain. Hence the importance of foliar uptake or other modes of entry into the plant exclusive of the root uptake is apparent. It is also of interest to note the relative low amounts of  $Cs^{137}$  and  $Sr^{90}$  present in corn as compared to other cereal products. (H.M.G.)

**3621 SURVEY OF RADIOACTIVITY IN FRUITS AND VEGETABLES.** Edwin P. Laug (Dept. of Health, Education, and Welfare, Washington, D. C.). Ohio Agr. Expt. Sta., Spec. Rept. Ser. No. 1, 56-7(1963).

Data are presented on  $Sr^{90}$  concentration per kilogram of fruit and vegetable raw product. The ordinary mechanical processes in the preparation of human food can be expected to reduce the intake of  $Sr^{90}$  materially. Furthermore, the concentrations per kilogram of any food must be evaluated in terms of the average daily amount eaten. When this is done the orientation offered by the Federal Radiation Council becomes very useful. (auth)

**3622 CURRENT RESEARCH ON RADIOACTIVE CONTAMINATION OF SOILS AND PLANTS.** Alfred W. Klement, Jr. (U. S. Atomic Energy Commission, Washington, D. C.). Ohio Agr. Expt. Sta., Spec. Rept. Ser. No. 1, 59-63(1963).

Research dealing with the interrelations of soils and plants that control the absorption of radionuclides by plants is reviewed. Descriptions are given of AEC-sponsored programs on radioactive contamination of plants and soils. (H.M.G.)

**3623 GUIDELINES FOR TOLERANCE LEVELS OF RADIONUCLIDES IN MAN.** Donald R. Chudak (U. S. Public Health Service, Washington, D. C.) and Gerald J.

**45937 RECOIL PROTONS IN LIVER AND KIDNEYS.** Majewski, C.; Wszolick, B.; Kukiel, E. (J. Strus Municipal Hospital, Poznan, Poland). *Pol. Med. J.*, 7: 1173-7 (1968).  
Translated from *Patol. Pol.*, 18: No. 4 (1967).

Recoil protons are recorded in nuclear emulsions when dehydrated homogenates of renal clear-cell carcinoma, Guerin epithelioma, and liver and kidneys of rats with implanted Guerin epithelioma were exposed. Recoil protons were formed as a result of elastic collision of fast neutrons with hydrogen atoms from nuclear emulsion. The described phenomena may play an important role in living organisms in which hydrogen is one of the fundamental elements. (auth)

**45938 RADIATION DOSAGE AND COMPLICATIONS IN CERVICAL CANCER THERAPY.** Peckham, Ben M.; Kline, Joyce C.; Schultz, Alwin E.; Cameron, John R.; Vermund, Halvor (Univ. of Wisconsin, Madison). *Amer. J. Obstet. Gynecol.*, 104: 485-94 (June 15, 1969).

Computerized dosimetry in 346 patients treated by a combination of intracavitary and supervoltage radiotherapy permitted a detailed analysis of dose delivered and an analysis of severe complications in relation to dose. The radiation delivered to the bladder, rectum, paracervical area, and the pelvic wall is described for a technique in which a calculated bladder and rectal tolerance was used as the limiting factor for total central dose. Rectovaginal and vesicovaginal fistulas occurred in only 1.4% of the patients, but other serious bowel and ureteral complications were seen in 6.4%. There were 16 severe bowel injuries (8 necrosis and/or perforation and 8 obstructive). In addition, there were 18 cases of proctitis and 16 of cystitis. Three other serious complications included 1 severe pelvic infection requiring exploration and 2 bone complications (necrosis of the femoral head and a traumatic subcapital fracture). Most injuries occurred in patients in a relatively early stage of disease. No significant correlation could be found between dose ranges in the bladder, rectum, or paracervical area and complications. However, there was a significantly greater number of bowel and ureteral complications in patients receiving 2 intracavitary applications compared with only 1. (BBB)

**45939 MEDICAL BASIC PRINCIPLES WHICH SERVE AS THE BASIS FOR THE BODY OF REGULATIONS CONCERNING IONIZING RADIATION.** LaFontaine, A. (Institut voor Hygiene en Epidemiologie, Brussels). *Bull. Belgicatom*, 12: 19-22 (May-June 1967). (In Flemish).

A radiobiological effect depends on the quantity of energy absorbed by living matter. Factors governing this include the spatial and temporal propagation of radiation in the organism, and the type of radiation and the kind of irradiated tissue. General characteristics of radiopathological effects are the variety of symptoms, general nonspecificity, and appearance as combined effects. There may be a very long latent period. Radiopathological effects are briefly described for the head, hematopoietic organs, legs, eye, and sex organs. Effects of total-body irradiation are described, with emphasis on the acute irradiation syndrome; irradiation of the fetus may produce congenital malformation. Genetic influences include dominant and recessive mutated genes. The relation between dose, effect, and radiation protection is described. The simplest chemical radioprotective agents, MEA and AET, are noted. Physicians are urged to acquire special knowledge of radiation problems. (BBB)

**45940 EFFICIENCY AND LIMITATIONS OF LASERS AS WEAPONS.** Meyer-Arendt, Jurgen R. (Pacific Univ., Forest Grove, Oreg.). *Amer. J. Optom.*, 45: 188-91 (Mar. 1968).

Biological effects of laser radiation, particularly in the eye, are reviewed and the use of lasers as military weapons is considered. Laser radiation entering the eye will be focused on the retina, increasing the energy density by at least 100 times. This energy is then absorbed primarily by the pigment in the retinal epithelium. Even at low irradiance the pigment epithelium becomes disorganized. In more severe cases the epithelium can virtually explode, forming vapor bubbles and causing severe hemorrhages surrounding the vaporized and destroyed tissue. Most of this is due to heat effects although pressure waves, ionization, and, perhaps, gaseous plasmas may also play a role. The typical lesion in the retina consists of 3 zones. In the center, pigment granules are severely disarranged and dislodged. Some black pigment may actually be ejected into the vitreous humor. A hemorrhage is often found in front of the retinal lesion. A marked decrease in certain enzyme activities may be found with even the slightest damage, and such lesions occur first at the hot spots of a laser beam, the regions of slightly higher energy density within a beam of non-uniform energy distribution. This explains why minimal lesions can be smaller than the actual diameter of the laser beam on the retina. In severe cases, the choroid is damaged as well. From the center, heat is dissipated by conduction and this produces a surrounding

zone of edema and coagulation. This zone, in turn, is surrounded by a region showing some orange discoloration and other disturbances in the normal pigment distribution. The threshold above which retinal lesions develop is  $0.072 \text{ J/cm}^2$  with a conventional ruby laser. (BBB)

**45941 A DRAMATIC CASE OF SPINO-CELLULAR EPITHELIOMA ON RADIODERMATITIS OF THE SCALP.** Vabreemersch, Fr.; Praaux, J.; Texier, M. *Bull. Soc. Fr. Dermatol. Syphiligr.*, 74: 203-2 (1967). (In French).

The case history of a woman, aged 38 yrs, with spino-cellular epithelioma on radiodermatitis of the scalp is reported. The woman had received an overexposure from radiotherapy resulting in acute radionecrosis of the scalp and ears. She was under treatment for 3 yrs, then after a lapse of 6 yrs she again needed treatment for vast infected ulcerations of the scalp. Seven yrs later, she was again under treatment for benign ulcerations and a spino-cellular epithelioma. Both times she refused to complete the course of treatment. Two yrs later, in 1967, she again was under treatment for occipital malignant tumor. Surgical treatment was planned, but the patient developed a massive occipital invasion that made the surgery impossible. The patient was put under a alleviation treatment and died in July 1967. (U.S.N.)

**45942 BONE CHANGES IN OCCUPATIONAL RADIODERMATITIS.** Kolar, J.; Vrabec, R.; Jirasek, L.; Bek, V.; Peskova, H. (Charles Univ., Prague). *Acta Chir. Plast.*, 10: 74-80 (1968).

Bone changes in 81 patients with occupational damage to the skin caused by radiation were evaluated and classified. Most patients were physicians and laboratory technicians working with various kinds of ionizing radiation, in most cases x-ray apparatus. All showed chronic radiation changes in the skin, i.e., atrophy, telangiectasia, fissures, erosion, ulceration, and hyperkeratosis. In more than 50% of the patients there were malignant changes. The bone changes induced by the direct effect of irradiation of the bone and secondarily by restriction of nutrition of bone due to damage to the vessels by radiation may be of concern in therapy, especially for plastic surgical operations. Investigation of the condition of the bone is considered an indispensable part of the preoperative examination in these patients. Bone injury is accompanied by osteoporosis, which is more marked at the ends of the tubular bones of the hand especially in the phalanges. Reconstruction of bone occurs first in the distal and medial phalanges, then in the basal ones and only in a considerably advanced stage at the ends of the metacarpals. The basic features of the rebuilding process are those of hypertrophic osteoporosis; the compact bone in the phalanges is usually thinned. Some of the trabeculae of the spongiosa are disordered and the remaining ones thickened. Changes in the joints are, as a rule, found only in cases with severe damage, i.e., in those with advanced atrophy, ulcerations, and hyperkeratoses of radiation origin. They appear as a slowly progressing eroding arthritis that, in patients after therapeutic irradiation, usually affects a single joint. In occupational injury to the hands interphalangeal joints are affected. In the radiographs, the first signs consist in marginal erosions on the edges of the articular surfaces that gradually become more extensive and finally show a picture of advanced eroding arthritis with destruction of the articular surface. (BBB)

**45943 MEDICAL CONSEQUENCES OF RADIOACTIVE POLLUTION.** Dunham, C. L. (Atomic Energy Commission, Washington, D. C.). *ADM (Rev. Assoc. Dent. Mex.)*, 24: 153-8 (Mar.-Apr. 1967). (In Spanish).

An assessment is made of the extent of distribution of radionuclides in the biosphere as a result of nuclear testing and increasing use of nuclear sources of power, as well as of the risks of contamination and of the known biological effects of radiation. Levels of  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$ ,  $^{14}\text{C}$ ,  $^{129}\text{I}$ , and  $^{239}\text{Pu}$  released by nuclear testing are discussed. Surface tests equivalent to 511 Mt of TNT released  $\sim 20 \text{ MCi}$  of  $^{90}\text{Sr}$  into the atmosphere. The carcinogenic potential of these radionuclides are considered. Tables are given which show the projected number of genetic defects and of leukemia and osteosarcoma expected from fallout radiation in the United States. It is suggested that man-made radiation levels are low compared with other environmental and medical sources of irradiation, and that the risks to future generations are very small. (BBB)

**45944 RESULTS OF RADIATION TREATMENT OF BLADDER CARCINOMA WITH ULTRAHARD X RADIATION FROM A 17-MeV BETATRON.** Vieten, H.; Guenther, D. (Univ., Duesseldorf). *Urologe*, 6: 83-7 (Mar.-Apr. 1967). (In German).

Complications of treatment of bladder carcinomas with high-voltage (17-MeV) betatron irradiation were discussed. The greatest danger of this type of irradiation was development of radlogenic cystitis due to extremely rapid disintegration of the tumor. This was particularly true in inoperable patients where irradiation was the only treatment feasible. In order to prolong

## CHEMISTRY

### General

Refer also to abstract 7533.

**6739** (NSP-12417) ON HOMOGENEOUS FLUIDIZATION. I. A KINETIC THEORY OF THE HOMOGENEOUS FLUIDIZED BED. II. THE AXIAL MIXING COEFFICIENT IN A HOMOGENEOUS FLUIDIZED BED. F. Ruckenstein (Academia R. P. R., Institutul de Fizică Atomică, Bucharest), [1962], 39p.

A kinetic theory of the homogeneous fluidized bed is developed which provides information on the mixing process as well as on the physical properties of the bed. The physical model of the fluidized bed is discussed. Energy dissipation in the motion of the solid particles and the dynamics of the motion are considered. Finally, the kinetic theory is used to point out a possible mechanism for axial mixing (diffusion) within the fluidizing agent and to derive equations for the axial mixing coefficient. (D.L.C.)

**6740** A NEW FORM OF THE PERIODIC SYSTEM OF THE ELEMENTS. Torolf Ternstroem (Kungl. Patent- & Registreringsverket, Stockholm), Svensk Kem. Tidskr., 75: 579-87(1962). (In Swedish)

A new form of the periodic system of the elements, based upon the Werner-Bohr and a horizontal Bohr-line system, is proposed. The vertical lines in the latter system were replaced by blocks and the right hand sloping lines raised to the right. The new system also includes a special line-system, a 6th-order period with neutrino, new group designations and a new C-group arrangement. (auth)

### Analytical Procedures

**6741** (AERE R-1469) THE DETERMINATION OF RADIUM-228 IN HARWELL EFFLUENT. W. M. Henry, B. A. Doreidge, and J. R. Weaver (United Kingdom Atomic Energy Authority, Research Group, Atomic Energy Research Establishment, Harwell, Berks, England), Dec. 1963, 23p.

Radium is recovered from an aliquot of effluent by coprecipitation with lead and barium sulfates. The precipitate is dissolved in an alkaline solution of ethylenediaminetetraacetic acid and the barium-radium sulfate is reprecipitated by careful adjustment of the acidity. Following methanesis to the carbonate and solution in dilute acid, the barium-radium solution is fed to a heated column of ion exchange resin. The radium is eluted free from barium carrier, with 0.1 M citric acid adjusted to pH 6 with ammonia. The cerium-228 daughter is permitted to grow in the radium fraction of the eluate before being extracted with 50% ethylhexyl hydrogen phosphate. The recovered activity is purified by further ion exchange separations and then determined. The analytical procedure is standardized against a solution of natural thorium containing a known amount of cerium-228. (auth)

**6742** (AEC-11624) DETERMINATION OF PICRIC ACID AND MONOTROPHENOLS IN ICPP PROCESS SOLUTIONS. Stanley S. Yamamura and John H. Sikes (Phillips Petroleum Co., Atomic Energy Div., Idaho Falls, Idaho), Dec. 1963, Contract AF(19-1)-205, 12p.

The determination of picric acid and the 2,4,6-trinitrophenols in the ICPP mixed effluent stream is described. The picric acid is determined by a colorimetric method using a diazotized

lect as an index of the hazard, has been determined with a precision of 3.1% relative standard deviation. The picric acid is extracted selectively from acidic medium into 2-ethyl-1-hexanol then measured photometrically as the yellow picrate ion at 353 m $\mu$ . Monotrophenols also are separated by extraction and measured photometrically at 412 m $\mu$ . In the presence of citrate at pH 5 to 6, the coextraction of nitrate, picric acid, and uranium(VI) is nil. (auth)

**6743** (AMS-2988) THE DIFFERENTIAL THERMAL ANALYSIS UNIT AT GROUP GMX-3. Stanley V. Dubiel, Jr. and John F. Baytos (Los Alamos Scientific Lab., N. Mex.), May 31, 1963, Contract W-7405-eng-36, 59p.

A custom-made instrument for differential thermal analysis (DTA) of explosive materials was designed and built for routine operations at Group GMX-3. This compact model is based on the prototype developed by R. N. Rogers, Group GMX-2, who adapted DTA to explosive materials. DTA thermograms are obtained with this apparatus on very small samples, which reduces the explosion hazard. The main feature of the apparatus is an expendable furnace assembly contained in a blast-shielded drawer. This drawer, the programmer, the thermocouple reference, the microvolt amplifier, and the X-Y recorder are assembled into a relay rack for ease of operation by the analyst. Calibration of the axes is described, and a simplified procedure is developed for the accurate recording of DTA thermograms on a preprinted chart. Irregularities caused by faulty components and manipulative technique are discussed, and recommended methods are given to remedy each situation. The appendices contain a formal procedure for the operation of this instrument with illustrations of the apparatus, schematic diagrams, graphs of temperature vs millivolt output, and typical DTA thermograms produced by this instrument. (auth)

**6744** (NBL-198) AN AUTOMATIC FUEL ELEMENT ENRICHMENT DIFFERENTIATOR (FEED) BASED ON GAMMA-RAY SPECTROMETRY. L. C. Nelson, Jr., S. J. Lorik, H. Bussell, and C. J. Zyskowski (New Brunswick Lab., AFC, N. J.), Aug. 1963, 11p.

An automatic fuel element enrichment differentiator (FEED) system was developed which utilizes a single-channel pulse height analyzer measuring the 0.184 Mev gamma ray of  $U^{235}$  to differentiate between fuel elements of 0.72 and 0.91 wt %  $U^{235}$ , and a relay-meter read-out to determine if the fuel element is within an acceptable range. The system can scan a fuel element in about 20 seconds and differentiate with an error of 0.66 fuel elements per hundred. (auth)

**6745** (NSC-88) SURVEY OF IODINE-129 CONCENTRATIONS IN THYROID TISSUES. Progress Report (Nuclear Science and Engineering Corp., Pittsburgh), Mar. 4, 1963, Contract AT(30-1)-3049, 19p.

Progress is reported in a survey of  $I^{129}$  concentrations in human and other mammalian thyroid tissue collected at times varying from 1930 to 1963. Neutron activation analysis, leading to the formation of  $I^{130}$ , was used to determine  $I^{129}$  concentrations. The experimental procedure is described in detail. Results are reported for 9 whole human thyroid glands and 4 samples of desiccated hog thyroid. Results include geographical variations and a comparison of the average  $I^{129}$  content from 1937 to 1962. (auth)

ated the conversion of MIT to DIT as well as coupling of DIT, and thus formation of thyroid hormones. Addition of TSH to the serum-containing medium improved organification of the  $^{125}\text{I}$  concentrated by the explant, which was reflected mainly in its increased incorporation into  $\text{T}_4$ . However, increased  $^{125}\text{I}$  utilization in thyroid glands of 17-17.5-day-old embryonic rats cannot be ascribed to TSH because the serum was prepared from the blood of rats that had been hypophysectomized 6 months previously. (auth)

**8754**  $^{125}\text{I}$ -UPTAKE IN CERVICAL MUCUS DURING THE MENSTRUAL CYCLE. Hilda E. Pariser, Alberto B. Houssay, Ana C. Zapata, Adela C. Valerga, and Jorge F. Cordero Funes (Centro de Endocrinología, Buenos Aires). Fertility Sterility, 15: 433-9 (Aug. 1964).

The glands of the uterine cervix concentrate  $^{125}\text{I}$  and it appears in the cervical mucus in high concentrations. Since cervical mucus undergoes cyclic changes during the human menstrual cycle, a comparison was made of  $^{125}\text{I}$  uptake by the cervical mucus during the estrogenic and progestational phases of the sexual cycle in normal women. Two  $^{125}\text{I}$  studies were made at 2-month intervals in 12 women. The first was performed between the 12th and 14th days of the cycle (first phase) and the second between the 25th and 27th days (second phase), by injecting intravenously  $100 \mu\text{C}^{125}\text{I}$ . Peripheral blood and cervical mucus were obtained at different intervals 20 to 135 min after the injection. The ratio, mg cervical mucus:  $\mu\text{l}$  plasma, called the mucus/plasma ratio (M/P) was calculated for every sample. Curves were obtained by plotting the M/P ratios, the 60-min sample being chosen to represent 100% value in each individual curve. The curve representing the first phase of the cycle increased rapidly during the two hr of the experiment, the 120-min value being 50% greater than the 60-min. The highest value in the second-phase curve was obtained after 60 min, it decreased slowly thereafter. Thus  $^{125}\text{I}$  uptake was greater in the progestational phase. This difference coincides with the change of other characteristics of the cervical mucus such as viscosity, osmotic pressure, transparency, rate of secretion, and chemical composition. To find out if the cervical glands are able to concentrate other ions, these experiments were repeated, using  $^{24}\text{Na}$ , in three normal women, but Na uptake by the cervical mucus could not be demonstrated. (BBB)

**8755** ON THE RETENTION OF CESIUM-137 IN PEOPLE. M. A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). Health Phys., 11: 21-2 (Jan. 1965).

Cesium-137 retention following four cases of accidental contamination was measured as a function of time in the Los Alamos human spectrometer and counter. Inhalation was the primary route in at least three of these exposures. A simple exponential function fits the data well, the biological half time averaging 128 days. (auth)

**8756** FATE OF THE KIDNEY RADIOISOTOPES IN THE HUMAN AND ESTIMATION OF THE RADIATION EXPOSURE. J. F. Colard, W. G. Verly, J. A. Henry, and R. R. Boulenger (CEN. Mol. Belg.). Health Phys., 11: 23-35 (Jan. 1965).

Fate of the iodine isotopes and resulting organ exposures were studied using a four-compartment model previously proposed to account for the metabolism of this element. Mathematical equations were established for this model from biological data accepted in the human. They were used to calculate the amounts of iodine  $^{131}\text{I}$  in the thyroid and in the remaining body as a function of time in case of a single or a chronic contamination; in the latter case three phases were considered: rise, equilibrium, and decrease after removal of the contaminating source. The importance of the daily stable iodine intake from the food was emphasized. Some of the theoretical results were checked by experiments on eight volunteers. Calculations were extended to the other radioiodine isotopes in order to determine the equivalent dose of the thyroid gland. (auth)

appears that some I.C.R.P. recommendations for maximum permissible body burden must be revised. (auth)

**8757** EXPERIMENTAL UPTAKE OF STRONTIUM-85 BY FRESH-WATER ORGANISMS. W. A. Brungs (Robert A. Taft Sanitary Engineering Center, Cincinnati). Health Phys., 11: 41-6 (Jan. 1965).

Factorial studies were conducted to determine the effects of variable concentrations of calcium, magnesium, sodium, and potassium on the uptake of dissolved strontium-85 by small bluegills, *Lepomis macrochirus*. The distribution of strontium-85 introduced to a pond containing macrofauna indigenous to the Midwest was also investigated. Of the four cations tested, only calcium was found to have a significant effect within the experimental range on the uptake of strontium-85 by small bluegills. Data from the pond uptake study indicate that after the 80-day experimental period only 25% of the strontium-85 remained in the dissolved phase. The total calculated activity in the experimental fauna never exceeded 0.5% of the amount added. The remaining radioactivity was associated with the substrate. The data also indicate that strontium-85 accumulation is related to age of the test organisms. (auth)

**8758** ABSORPTION OF STRONTIUM-90 IN MAN. Minoru Fujita (Japan Atomic Energy Research Inst., Tokyo). Health Phys., 11: 47-50 (Jan. 1965).

Analyses were performed with reference to the levels of  $^{90}\text{Sr}$  and stable calcium in diet and excreta of man. From the data obtained, the absorption of Sr was estimated. Four healthy volunteers received the same diet for 7 periods, each period consisting of five consecutive days, but, except for the periods examined the subjects consumed any food they liked. The given diet contained nearly 0.55 g of Ca per day. The daily intake of  $^{90}\text{Sr}$  ranged between 7 and 13  $\mu\text{C}$  according to the fallout levels in the diets. The absorption coefficient,  $f_1$ , per 5-day period of the four volunteers averaged about 0.38 with a large fluctuation of from 0.09 to 0.63. However, values of  $f_1$  over a considerable time around two periods ranged between 0.20 and 0.32, making a strong contrast with the range between 0.09 and 0.48 obtained for the same 5-day period. (P.C.H.)

**8759** FUNDAMENTAL STUDIES ON THE CONTAMINATION OF MILK BY RADIOACTIVE STRONTIUM SPECIALLY, ON THE MECHANISMS OF CONTAMINATION. Akira Yuyama. Iwate Daigaku Nogakubu Hokoku, 8: 49-80 (1962). (In Japanese)

The mechanism of milk contamination by radiostrontium was investigated by administering  $^{45}\text{Ca}$  and  $^{90}\text{Sr}$  to lactating goats. Metabolism changes in these animals were also observed. Experimental methods and results are discussed. (J.R.D.)

**8760** CHEMICAL MECHANISMS UNDERLYING THE BIOLOGICAL MECHANISMS OF THE AGING PROCESS. Johan Bjorksten and Fred Andrews (Bjorksten Research Foundation, Madison, Wis.). J. Am. Geriatr. Soc., 12: 827-31 (July 1964).

New data related to the chemical mechanism underlying the biological mechanism of somatic mutation as a factor in aging are discussed. It is noted that cell cross-linkage is the initial step in aging and ultimate destruction of the cell. (J.R.D.)

**8761** PLACENTAL TRANSFER OF  $\text{F}^{19}$  IN SHEEP. James W. Bowden, A. Stark Wolkoff, and Charles E. Flowers, Jr. (Univ. of North Carolina, Chapel Hill). J. Dental Res., 43: 878-83 (Sept.-Oct. 1964).

A surgical technique was employed on eight pregnant ewes to gain access to the maternal and fetal circulations with the lamb in utero. Injections of  $^{19}\text{F}$  (2 mC) were made into the animals in order to study various aspects of maternal-fetal  $^{19}\text{F}$  exchange. The data revealed that maternal plasma clearance of  $^{19}\text{F}$  is quite rapid and that fetal plasma levels are relatively low when compared to maternal levels. Uptake in fetal dental and skeletal tissues was rapid. Fetal incisor teeth yielded from 800 to 1500 counts per minute (cpm) and bone granules from 200 to 400 cpm.



# WASTE DISPOSAL AND PROCESSING

See also BIOLOGY AND MEDICINE - Biology

CHARACTERIZATION OF WASTE  
TREATMENT AND DISPOSAL

Refer also to abstract 2828.

**2828** TREATMENT OF WASTE WATER AT THE KALININURGE ATOMIC RESEARCH CENTER. PART I. KALININURGE, USSR. *Radiochim. Acta*, 1968, 10, 1-14.

The Karlsruhe Nuclear Research Center has been treating from 1962 domestic and industrial wastewater, mainly, and chemical wastes that may be quite different from secondary chemical wastes from chemical plants. The nature of the wastes and the manner in which they are collected are described. (Public Health Abstr.)

**2829** TREATMENT OF WASTE WATER AT THE KALININURGE ATOMIC RESEARCH CENTER. PART II. KALININURGE, USSR. *Radiochim. Acta*, 1968, 10, 15-24.

The description of conventional water works of Karlsruhe Atomic Research Center is given. The following methods are used singly or in combination: chemical precipitation (with lime, ferric chloride, and aluminum sulfate); ion exchange (especially after chemical precipitation); adsorption (activated carbon); ozonation; and other processes. Particular attention is given to the treatment of the effluent of the wastewater treatment plant. The operating temperature of the ion exchange is 10°C. The operating characteristics under these conditions are described. (Public Health Abstr.)

**2830** RADIOACTIVE WASTE MANAGEMENT AND ENVIRONMENTAL HAZARDOUS. (International Atomic

Energy Agency, Vienna, 1968, 10, 15-24, 25-34, 35-44.

Abstracts of papers presented at the International Conference on Environmental Hazards of Radioactive Wastes, Karlsruhe, 1968. The papers are arranged in sections dealing with the management of radioactive wastes, the disposal of radioactive wastes, the protection of the environment from radioactive wastes, and the management of radioactive wastes by other means. (I.A.E.A.)

**2831** THE REGULATIONS FOR UNRESTRICTED AERIAL, ALUMINUM, IN THE FEDERAL GOVERNMENT, CANADA. *Can. J. Chem.*, 1968, 46, 2811-2814.

As a result of new AEC standards for concentration of 57 in effluents to uncontrolled areas, a study was performed to define the limits of reactor operating conditions under which the maximum concentration (10% of its practical limit) of 57 in effluent can be verified without physical measurement. The quantity of 57 in a reactor during and following irradiation is shown for operating periods of 100 days, 1 year, and three years. Single bursts, continuous, periodic operation, and daily bursts for periods up to 7 years are also considered. Computations for quantities with long life can be demonstrated without physical measurements and that analysis of this nature may be applicable to other radionuclides. (I.A.E.A.)

## EARTH SCIENCES

## Geology

Refer also to abstracts 10444 and 10722.

**10443** (NYO-3234-1) <sup>129</sup>I AS A GEOCHEMICAL AND ECOLOGICAL TRACER. Progress Report, December 1, 1965-October 31, 1966. Kohman, Truman P.; Edwards, Raymond R. (Carnegie Inst. of Tech., Pittsburgh, Pa. Dept. of Chemistry), Nov. 30, 1966. Contract AT(30-1)-3624. 45p. Dep. mm. CFSTI \$3.00 cy, \$0.65 mn.

Studies were made to exploit the natural occurrence of the long-lived <sup>129</sup>I (half-life  $1.6 \times 10^7$  years) expected from spontaneous and induced fission of uranium and from cosmic-ray interactions with the atmosphere, meteorites, and similarly exposed materials, and the somewhat larger quantities introduced into the environment through atomic energy activities. A substantial number of samples of biological, mineral, and commercial iodine-bearing materials, including some collected or processed before 1945, have been acquired. Chemical procedures for pre-irradiation isolation of iodine and post-irradiation preparation for counting have been adapted to the analytical specimens of interest. Many of the specimens have been processed to varying extents. Conditions have been established for the use of an existing  $\gamma$ - $\gamma$  coincidence detector system for the assay of <sup>129</sup>I in relatively large ( $\sim$ gram) samples of iodine, and partially tested following four irradiations of natural and synthetic samples. Specifications have been formulated for a  $\beta$ - $\gamma$  coincidence system for the assay of <sup>129</sup>I in very small amounts in small ( $\sim$ mg) samples of iodine. (P.C.H.)

**10444** (ORNL-TM-1681) STUDY OF THE MOVEMENT OF RADIONUCLIDES THROUGH SATURATED POROUS MEDIA. Shaikh, M. U.; Jacobs, D. G.; Parker, F. L. (Oak Ridge National Lab., Tenn.), Jan. 1967. Contract W-7405-eng-26. 118p. Dep. mm. CFSTI \$3.00 cy, \$0.65 mn.

Theoretical solution of water flow has been obtained for an inverted five-spot system with the injection well located at the center of a square sandstone slab (6 feet by 6 feet by 6 inches) and four relief wells at the corners of a centered 3-foot square, oriented in the same direction as the edges of the slab. Equations for stream function, potential function, and the velocities in the block have been developed. From the distribution of velocities, in the radial flow and distorted flow, it has been shown that the flow pattern is unaffected by wells up to a distance of 6 inches from the injection well. Equipotential contours, streamlines, and the flow history of the system have been plotted by the computer. From the sorption data obtained from linear flow cores, the time required for the breakthrough of <sup>82</sup>Br and <sup>45</sup>Ca has been found to be 8.5 and 8.3 times that of water, respectively. Using different linear flow rates, coefficients of dispersion have been obtained using cores of sandstone. By combining the solution of the velocity distribution attributed to geometry with solution dispersion at various rates of linear flow, net solution breakthrough curves have been constructed. (F.S.)

**10445** SELECTION OF GRAZING LAND DISTRICTS ACCORDING TO THE RADIOACTIVITY OF UNDERGROUND WATERS OF UPPER CRETACEOUS PERIOD. Ergashev, S. E. Dokl. Akad. Nauk Uz. SSR, No. 7, 51-3(1966). (In Russian).

Uranium and radium content in underground waters was studied in the arctic basins in the Northwestern part of Middle Asia. Many holes drilled at 140 to 450 m in depth indicated the presence of a connected united Semnan-Turonian water-bearing complex. A schematic distribution of drinking water districts was established considering permissible uranium norms as  $5 \times 10^{-4}$  g/l. (U.V.J.)

**10446** RADIOACTIVE TRACING OF STORM RUNOFF ON A SMALL CATCHMENT. II. DISCUSSION OF RESULTS. Pilgrim, D. H. (Univ. of New South Wales, Kensington). J. Hydrol., 41: 306-34(1968).

The use of <sup>125</sup>Iu and <sup>51</sup>Cr for tracing storm runoff on a 96-acre natural catchment is described. Each activity-time record at the catchment outlet provided a hydrograph of outflow of the labeled drop of water. Consideration of these records enabled clarification of the concept of concentration time. Measured values of this time of travel from the point most remote from the catchment outlet were found to depend mainly on the discharge, and also on the duration of rainfall excess. Application of time of travel measurements to a number of hydrograph synthesis methods is discussed. The results also provide information on several aspects of the storm runoff process, including the effects of

linear analysis, an apparent partial area runoff production effect, and the distribution of initial loss. (BBB)

**10447** RADIOACTIVE TRACING OF STORM RUNOFF ON A SMALL CATCHMENT. I. EXPERIMENTAL TECHNIQUE. Pilgrim, D. H. (Univ. of New South Wales, Kensington). J. Hydrol., 41: 288-306(1968).

A method was developed whereby radiolabeled tracers were used for direct measurement of travel times of storm runoff on a 96-acre natural catchment. The primary objective was to measure the time of concentration, but the flow of water from various representative points on the catchment was also traced. The experimental technique and instrumentation are described. Several problems resulted from the impossibility of predicting heavy rain far in advance and from the field conditions prevailing during flood-producing rain. The methods used for overcoming these problems are outlined. Two radiolabeled tracers, <sup>125</sup>Iu and <sup>51</sup>Cr-EDTA, were used. The requirements and types of tracers are discussed, together with safety aspects of the project and the performance of the tracers. The performance of the <sup>51</sup>Cr-EDTA was most satisfactory. (BBB)

**10448** GEOPHYSICAL AND ISOTOPE GEOCHEMISTRY. Tilton, G. R.; Davis, G. L.; Hart, S. R.; Aldrich, L. T.; Stegler, R. H.; Gast, P. W. (Carnegie Institution, Washington, D. C.), Carnegie Inst. Wash., Pap. Geophys. Lab., No. 1440, 240-56 (Dec. 1964).

Theoretical and practical aspects of the use of U, Th, Pb, Sr, Rb, Ar, and K isotopes for determining ages of minerals and rocks are discussed. Also described is an investigation dealing with the isotopic composition of lead in feldspars and galenas of different ages which suggests a value for the age of the earth somewhat different from the currently quoted one of  $4.55 \times 10^9$  yr. This value is obtained by comparing the isotopic composition of some modern terrestrial lead with that of lead from the troilite phase of iron meteorites, taken to be primordial lead, i.e., the lead present in the earth when it was formed. A <sup>207</sup>Pb-<sup>206</sup>Pb age was calculated by assuming that the modern terrestrial lead has evolved from the meteoritic lead in a chemically closed system. The isotopic composition of lead from certain rocks cannot be fitted to a closed system growth curve for an earth that is  $4.55 \times 10^9$  yr old. Instead, it appears that the source of the leads has been enriched in uranium with respect to lead by chemical transport. Allowance for the failure of the closed system condition yields a min age of  $4.7 \times 10^9$  yr for the earth. Also considered are the isotopic composition of lead in volcanic rocks from the Mid-Atlantic Ridge and the dating of orogenic phases in the Central Alps with K-Ar ages for hornblende. (BBB)

**10449** CONCENTRATION OF <sup>226</sup>Ra AND ITS DAUGHTER PRODUCTS IN CERTAIN CZECHOSLOVAK MINES. Sevc, Josef; Cech, Jan. Prac. Lek., 18: 438-42(Dec. 1966). (In Czech).

The radiometric investigation was carried out in 22 coal and 12 ore mines from 1962 to 1965. The concentration of <sup>226</sup>Ra and its short-term daughter products were investigated; attention was also given to the level of the external gamma radiation. In 11 mines radon concentrations were found which were higher than 30.0 pCi/l and in 6 mines these concentrations were higher than 100 pCi/l. Concentrations of the other substances investigated, as well as the intensity of the external gamma radiation, were very low. According to the Ra concentrations found, a classification of the investigated Czechoslovak mines was proposed. Precautions in the individual groups were recommended, e.g., more intensive ventilation, in certain cases, use of the same technical and hygienic measures as those used in mines of radioactive grade ores. (auth)

**10450** CHEMICAL FRACTIONATION AND ITS RELATIONSHIP TO THE DISTRIBUTION OF THORIUM AND URANIUM IN A ZONED GRANITE BATHOLITH. Ragland, Paul C.; Billings, Gale K.; Adams, John A. S. (Rice Univ., Houston, Tex. Univ. of North Carolina, Chapel Hill). Geochim. Cosmochim. Acta, 31: 17-22(Jan. 1967).

Major element and radiometric analyses were performed on 19 samples from the Eucalyptus Rock batholith, Llano Uplift, Texas. The major element data are in agreement with earlier work that the batholith is not zoned in the classical manner, from more mafic rocks along the margins to more felsic in the core, but rather in a more complex fashion. Evidence is offered to suggest that the magma fractionated before and/or during emplacement rather than after. Anomalous high thorium and uranium values can be correlated with the presence of allanite and abundant sphene, whereas the decrease in uranium content with increasing fractionation may be a result of increasingly effective

A short review is given of the sources of the secondary particles and of the advantages and disadvantages of the activation by secondary reactions. A method was developed for the determination of  $^{14}\text{O}$  in hydrogen-containing substances by the secondary reaction  $^{14}\text{O}(n,p)^{13}\text{N}$  induced by recoil protons. The reaction chain  $^{14}\text{O}(n,p)^{13}\text{N}$ ,  $^{13}\text{N}(e^+)^{13}\text{C}$  was made the basis of a method of detection of lithium in a variety of substances and of detection of oxygen in metal-organic compounds, organic solvents, and monomers. It is also shown that the matrix-effect, which appears in activation analysis with secondary reactions, can be compensated in most cases by calculated factors containing the different ranges of the charged particles and the different atomic densities of sample and standard. (auth)

**12321 DETECTION OF BIOSPHERIC LEVELS OF  $^{137}\text{Cs}$  BY NEUTRON ACTIVATION ANALYSIS.** Ketsch, B.; Koch, R. C.; Levine, A. E. (Nuclear Science and Engineering Corp., Pittsburgh). pp 284-90 of Proceedings of 1968 International Conference on Modern Trends in Activation Analysis. College Station, Tex., Texas A and M Univ., 1968.

Since  $^{137}\text{Cs}$  is formed in atmospheric nuclear detonations, increases in its concentrations in environmental and biological matrices would be expected following world-wide deposition of debris from these detonations. Its concentrations in thyroid tissues and related commercial preparations were selected to serve as an index of the biospheric levels of  $^{137}\text{Cs}$ . An array of several hundred samples was studied. The general experimental method involved preirradiation purification of the iodine fraction of the sample as well as postirradiation radiochemical purification operations. A beta-gamma coincidence counter was used. Several significant modifications were incorporated in the detector-instrumentation system and in the experimental procedure, which resulted in increased analytical sensitivity and accuracy.  $^{137}\text{Cs}$  levels were determined in thyroid tissues from subjects spanning the entire age group (pediatric to geriatric). A statistically significant variation of the  $^{137}\text{Cs}/^{127}\text{I}$  ratio with age was observed in recently collected samples (1962 to 1964) from young subjects. The ratio was largest in pediatric tissues and decreased by about a factor of four with age through adolescence and early adulthood. In more advanced age groups the ratio was essentially constant about a mean value of  $(1.45 \pm 0.40) \times 10^{-3}$ . These samples were collected in Pittsburgh, Pennsylvania, and New York City. No significant geographical or temporal differences were observed. However, studies of biological material collected at various times since 1945 at various locations revealed a distinct temporal behavior for the  $^{137}\text{Cs}/^{127}\text{I}$  ratio. The samples collected from approximately 1949 to 1962 exhibited maximum values that exceeded current values by more than two orders of magnitude. The predicted value ( $10^{-4}$ ) for the preatomic era  $^{137}\text{Cs}/^{127}\text{I}$  ratio was not detected, but analysis of pre-1945 iodine-bearing chemical compounds established a value of  $\sim 3 \times 10^{-12}$  for the ratio. This value corresponds closely to the expected limit imposed on the method of analysis by multiple neutron capture in  $^{137}\text{I}$  during neutron activation. (auth)

**12322 NEW DEVELOPMENTS IN THE SYSTEMATIC ANALYSIS OF HIGH PURITY METALS AND ESPECIALLY OF ALUMINUM, COPPER AND ZIRCONIUM.** Albert, P.; Cuyppers, M.; Leebate, A.; Mignone, E. (Centre d'Etudes de Chimie Metallurgique, CNRS, Vitry, France). pp 310-16 of Proceedings of 1968 International Conference on Modern Trends in Activation Analysis. College Station, Tex., Texas A and M Univ., 1968.

The systematic analysis of copper was developed using separations by electrolysis under controlled potential. The determination of sulfur was performed by different methods, depending on the relative concentration of this element and the phosphorus content in the copper samples. A great number of analyses were performed by this method on samples, and the total impurity concentrations which were determined varied from 0.4 to 25 ppm. A method of systematic analysis of zirconium, based on the initial separations by ion exchange with an anion resin of the impurities in eight groups, was studied. The advantage of this method was that the sample can be dissolved in a hydrofluoric-nitric medium, avoiding the principal disadvantages of the use of hydrofluoric acid. The determination of sulfur and phosphorus are possible in the systematic analysis. The systematic analysis of aluminum was improved at different points. One of the results of the study of the analysis of copper was the development of a scheme of separations of the radioisotopes of the elements that sulfide precipitate in an acid medium. These separations are now used on a routine basis in the systematic analysis of aluminum, iron, and zirconium. (auth)

**12323 SIMPLE AND RAPID MAGNESIUM DETERMINATION IN BIOLOGICAL SAMPLES BY NEUTRON ACTIVATION ANALYSIS.** Kim, Chong K.; Metake, W. Wayne (Univ. of Michigan, Ann Arbor). pp 318-19 of Proceedings of 1968 International Conference on Modern Trends in Activation Analysis. College Station, Tex., Texas A and M Univ., 1968.

Activation analysis of magnesium using the 9.5-min  $^{24}\text{Mg}$  is described. The method can be successfully applied to any biological sample, giving good results within a few minutes. Samples analyzed included whole blood, drinking water, urine, and beef tissue. (auth)

**12324 USE OF NEUTRON ACTIVATION ANALYSIS TO DETERMINE BIOLOGICAL AVAILABILITY OF COPPER IN SOILS AND FOR NONDESTRUCTIVE ANALYSIS OF SOILS.** Kline, J. R.; Braz, S. S.; Gumberson, P. F.; East, R. H. (Argonne National Lab., Ill. Univ. of Minnesota, St. Paul). pp 319-23 of Proceedings of 1968 International Conference on Modern Trends in Activation Analysis. College Station, Tex., Texas A and M Univ., 1968.

Methods were developed for determination of various chemical fractions of copper in soil samples by a batch processing technique, which allows the collection of a reasonable body of information in relatively short time intervals. Information, which was obtained by application of these methods includes measurement of the kinetics and amounts of copper released from several soils. Other fractions of soil copper obtained include that which is contained in dilute acid soluble minerals and that which is contained in the very stable silicon structures of soils. In other observations of neutron irradiated soils little biological interest was found by observing the gamma spectra of chemically unaltered soils. The spectra did show a surprising degree of structural uniformity, however, which was not anticipated since the samples were originally taken from widely separated areas of Minnesota and from areas that differed in the geologic mode of deposition. The similarities of the spectra suggest certain limitations on the use of gamma spectra of neutron-irradiated soils for identification of soils or the tracing of specimens to their origin. (auth)

**12325 NEUTRON ACTIVATION ANALYSIS FOR PLUTONIUM MIXED IN SOIL.** Fuller, R. K. (Naval Radiological Defense Lab., San Francisco); O'Connor, J. D.; Lukens, H. R.; Fleishman, D. pp 324-6 of Proceedings of 1968 International Conference on Modern Trends in Activation Analysis. College Station, Tex., Texas A and M Univ., 1968.

A nondestructive, quantitative, analytical procedure was developed for determining plutonium mixed in soil. The method is entirely instrumental and can probably be used to analyze for plutonium in other materials. The procedure eliminates the need for chemical separations and for alpha counting. It also eliminates the need to know the age and composition of the original source of plutonium or to have a reference sample of it. The neutron activation procedure was developed to analyze for plutonium in samples of particulate fallout material deposited from dust clouds generated by high explosive, nonnuclear detonations of simulated nuclear weapons containing plutonium and depleted uranium (containing 0.2%  $^{235}\text{U}$ ). The samples were collected on horizontal, petri-dish-coated, 16 sq ft aluminum collectors located at ground level positions, downwind from the detonation. Samples consisted of particles of plutonium and depleted uranium from the device, mixed with desert soil, which itself had a background of natural uranium (containing 0.72%  $^{235}\text{U}$ ) but no plutonium. Essentially the method consisted of determining the intensity of the 105-keV photopeak of  $^{239}\text{Pu}$  and the 1.60-MeV photopeak of  $^{137}\text{La}$  in neutron-irradiated fallout samples, in calibration standards, and in pre-shot desert background soils. The major radioactive isotopes produced in the soil matrix of the fallout samples of neutron irradiation were 2.3-min  $^{24}\text{Al}$ , 8.7-min  $^{44}\text{Ca}$ , 2.88-hr  $^{54}\text{Mn}$  and 15-hr  $^{24}\text{Na}$ . Of these, only  $^{24}\text{Na}$  made a significant contribution to the gamma radiation rate at 5 to 6 days. After 6 days there was no significant gamma radiation from soil, except from a  $^{24}\text{Na}$  photopeak only at 1.37-MeV and 9.7-MeV; thus, it did not contribute significantly to the intensities of either the 105-keV or the 1.6-MeV photopeaks. (D.H.M.)

**12326 ELECTRON ACTIVATION ANALYSIS FOR THE DETERMINATION OF CARBON IN SUBMICROGRAM QUANTITIES OF VIRUS.** Kruger, Paul; Linstedt, K. D. (Stanford Univ., Calif.). pp 327-30 of Proceedings of 1968 International Conference on Modern Trends in Activation Analysis. College Station, Tex., Texas A and M Univ., 1968.

An analytical method is being developed for physical measurement of submicrogram virus samples to complement the usual means of electron microscopy and biological plaque counting. For this method, the Stanford University Mark II electron linear accelerator is used to produce a 36-MeV electron beam for irradiation of tobacco mosaic virus targets. The analysis involves the measurement of the mono-constituent, carbon, which determines the virus content. (auth)

**12327 ACTIVATION WITH PROTONS OR CHARGED PARTICLES FOR THE ANALYSIS OF NONMETALLIC ELEMENTS.** Engelmann, C.; Cabane, G. (CEM, Saclay, France). pp 331-6



## NUCLEAR SCIENCE ABSTRACTS

## CHEMISTRY

## Analytical Chemistry

Refer also to abstracts 25833, 25935, 26070, 26288, and 27527.

**25766** (AERE-M-1844) THE DETERMINATION OF  $^{235}\text{U}$  IN URINE BY LIQUID SCINTILLATION COUNTING. Sandals, F. J. (Atomic Energy Research Establishment, Harwell (England)). Mar. 1967. 15p. Dep. CPSTI. UK 1s. 9d.  
A rapid and sensitive method is described. A 10-ml sample of urine with added sulphate carrier is oxidized with Benedict's reagent and  $^{235}\text{U}$  precipitated as barium sulphate. An overall recovery of 95% is obtained, and the counting efficiency is 75% with a Packard Tricarb 3214 counter. The minimum level of detection corresponds to approximately 340 pCi/1400 ml of urine, which is lower than the investigation level by a factor of about  $10^4$ . (auth)

**25766** (AERE-R-5406) THE DETERMINATION OF RADIOIODINE IN HARWELL EFFLUENT. Loveridge, B. A.; Gordon, M. S. (Atomic Energy Research Establishment, Harwell (England)). Mar. 1967. 14p. Dep. CPSTI. UK 2s. 6d.  
Iodine carrier is added to the effluent and extracted together with the radioiodine into organic solvents after oxidation and reduction to ensure complete radiochemical exchange. The radioiodine is counted in a liquid scintillation coincidence counter, and the recovery of the carrier measured by photometry. Decontamination from other radioisotopes, including radiobromine, exceeds  $10^4$ . (auth)

**25767** (EUR-3161,(Vol.3)) ETUDE DES POSSIBILITES D'UTILISATION INDUSTRIELLE DE L'ANALYSE PAR ACTIVATION POUR LE DOSAGE DE L'OXYGENE ET EVENTUELLEMENT DE L'AZOTE ET DE L'HYDROGENE DANS LES ACIERS. PREMIERE PARTIE. RAPPORT BIBLIOGRAPHIQUE. (Investigations on the Industrial Application Possibilities of Activation Analysis for the Determination of Oxygen and Eventually of Nitrogen and Hydrogen in Steel. Part I. Bibliographical Report). Stoll, N.; Wagner, A.; Gossart, L. (Acieries Reunies de Burbach-Eich-Dudelange S. A., Luxembourg). Nov. 1966. 48p. (In French). Dep.

Various nonuclear methods used or being developed for the determination of oxygen, nitrogen, and hydrogen in steel are reviewed. The nuclear reactions that are best suited for the determination of these three elements are considered. The irradiation means suited for use on an industrial scale for the determination of these three elements are discussed and the methods for measuring the induced activity, the methods for neutron flux monitoring, and the sample transfer systems are described. The calibration methods are reviewed and the analytical performances of neutron activation analysis are discussed. It was concluded that among the three elements under consideration only the oxygen can be determined in steel on an industrial scale by activation. (auth)

**25768** (EUR-3161,(Vol.3)) ETUDE DES POSSIBILITES D'UTILISATION INDUSTRIELLE DE L'ANALYSE PAR ACTIVATION POUR LE DOSAGE DE L'OXYGENE ET EVENTUELLEMENT DE L'AZOTE ET DE L'HYDROGENE DANS LES ACIERS. DEUXIEME PARTIE. DESCRIPTION ET RESULTATS DES ESSAIS. (Investigations on the Industrial Application Possibilities of Activation Analysis for the Determination of Oxygen and Eventually of Nitrogen and Hydrogen in Steel. Part II. Description and Results of the Tests). Stoll, N.; Wagner, A.; Gossart, L.

(Acieries Reunies de Burbach-Eich-Dudelange S. A., Luxembourg). Nov. 1966. 69p. (In French). Dep.

Sampling, machining, and selecting the steel samples are discussed. The selection of the analytical methods and of the laboratories retained for the investigations along with the working program followed are described. The apparatus for the determination of oxygen and conditions for carrying out the tests are considered. All the results obtained during the tests are listed. (auth)

**25769** (EUR-3161,(Vol.3)) ETUDE DES POSSIBILITES D'UTILISATION INDUSTRIELLE DE L'ANALYSE PAR ACTIVATION POUR LE DOSAGE DE L'OXYGENE ET EVENTUELLEMENT DE L'AZOTE ET DE L'HYDROGENE DANS LES ACIERS. TROISIEME PARTIE. DISCUSSION DES ESSAIS ET CONCLUSIONS A TIRER DE L'ETUDE. (Investigations on the Industrial Application Possibilities of Activation Analysis for the Determination of Oxygen and Eventually of Nitrogen and Hydrogen in Steel. Part III. Discussion of the Tests and Conclusions to be Deduced From the Investigation). Stoll, N.; Wagner, A.; Gossart, L. (Acieries Reunies de Burbach-Eich-Dudelange S. A., Luxembourg). Nov. 1966. 29p. (In French). Dep.

The analytical results obtained and the advantages and disadvantages of neutron activation and of conventional equipment tested are considered. Installation costs for various neutron activation equipment are indicated and the cost price of one oxygen determination by neutron activation and by conventional means was calculated as a function of the number of determinations performed. It was concluded that neutron activation analysis is capable of determining the oxygen content in steel during production with rapidity and the accuracy necessary to enable the steel makers to choose the deoxidation means to be added as a function of this oxygen content. (auth)

**25770** (JAERI-1126) CHEMICAL ANALYSIS PROCEDURES FOR JPDR LABORATORY. Ishiwatari, Naomichi (Japan Atomic Energy Research Inst., Tokyo). Sept. 1966. 18p. (In Japanese). Dep.

The nuclear species and chemical compounds for which the improved procedures were applied at JPDR include the following: aluminum, boric acid, chloride, chromate, chromium, chromium-51, cobalt-58 and -60, copper, copper-64, dissolved oxygen, fluorine-18, iodine 131 through 135, iron, iron-59, manganese, manganese-54 and -56, molybdenum, molybdenum-99, nickel, silica, sodium-24, tungsten-187, turbidity and zinc-65. (auth)

**25771** (LA-DC-4807) SPECTROCHEMICAL DETERMINATION OF IMPURITIES IN HIGH-PURITY PLUTONIUM BY ANION-EXCHANGE SEPARATION AND GRAPHITE-SPARK EXCITATION. Murphy, James F.; Phelps, Robert T. (Los Alamos Scientific Lab., N. Mex.). (1964). Contract W-7408-eng-36. 37p. (CONF-670518-2). Dep. CPSTI.  
From 15th Annual Mid-American Symposium on Spectroscopy, Chicago, Ill.

Limits of detection with respect to those obtained by routine spectrochemical methods were improved and a greater number of elements (29) were determined in high-purity Pu by an anion exchange-spectrochemical method. In the method developed, Pu(IV) is adsorbed from 7.5 M HNO<sub>3</sub> onto Bio-Rad 1 x 7 resin and the non-adsorbed elements washed from the resin column with HNO<sub>3</sub> of the same molarity. After adding indium internal standard and gallium matrix, the solutions containing the impurity elements are evaporated on the ends of graphite electrodes

**42762** (CONF-670542-1) TRANSURANUM ELEMENTS AS BYPRODUCTS OF NUCLEAR FUEL REPROCESSING. Overbeck, W. P. (Du Pont de Nemours & Co., Alton, S. C. Savannah River Lab.). May 1967. Contract AT(07-3)-1. 16p. Dep. CFSTI.

From Conference on Nuclear Power Fuel Reprocessing: Technology and Economics, Augusta, Ga.

The transuranium isotopes of principal interest are  $^{239}\text{Pu}$ ,  $^{240}\text{Pu}$ , and  $^{241}\text{Pu}$ . Substantial quantities of these isotopes can be obtained as by products of the nuclear power industry if the necessary recovery facilities are provided. These quantities can be considerably enhanced through recycling of uranium and plutonium fuels. Within the next 10 years, large-scale production of  $^{239}\text{Pu}$  and  $^{240}\text{Pu}$  could be achieved. If an adequate market can be developed, production of these transuranium isotopes could result in significant long-term savings in the cost of nuclear power. (auth)

**42763** (JUL-77-RB) RADIOAKTIVE MARKIERUNGEN IM ELEKTROENMIKROSKOP. (Radioactive Labeling in the Electron Microscope). Riedel, G. (Kernforschungsanlage, Juelich (West Germany), Institut fuer Reaktorbauelemente). June 1966. 29p. (In German). Dep.

Three articles on radioactive labeling in the electron microscope are compiled. Preparation of an aerosol labeled with a radiotracer for use in the electron microscope is described. A means for electron-microscopic differentiation of emulsions of diverse origins exposed to  $\alpha$  and  $\beta$  irradiation is reported. Improvement of the resolution of radioactive labeling by stereoscopic picture taking in the electron microscope is described and illustrated by stereoscopic pictures. (J.S.R.)

**42764** (NYO-844-71) NUCLEAR CHEMISTRY AND GEO-CHEMISTRY RESEARCH. CARNEGIE INSTITUTE OF TECHNOLOGY, 1966-1967. Progress Report. (Carnegie Inst. of Tech., Pittsburgh, Pa., Dept. of Chemistry). June 30, 1967. Contract AT(30-1)-844; AT(30-1)-3624. 74p. Dep. CFSTI.

Research progress is reported on: Mossbauer spectroscopy of Fe in coal, terrestrial occurrence and distribution of  $^{137}\text{Cs}$ ,  $\mu$ -induced nuclear reactions in natural materials, activation analysis of iron meteorites, isotopic composition of thallium in meteorites, plans for radiogenic isotope studies of lunar materials, expectation levels of  $^{137}\text{Cs}$  in meteorites, search for radioactivity of  $^{40}\text{Ca}$ , counting systems, and cylindrical anticoincidence guard counter. (M.C.G.)

**42765** (ORO-2418-3) INFRARED SPECTRA OF PLASTICS AND ELASTOMERS AFTER NUCLEAR IRRADIATION. Annual Progress Report. Sears, W. C. (Georgia Univ., Athens, Dept. of Physics). Sept. 12, 1967. Contract AT(40-1)-2418. 13p. Dep. CFSTI.

Since molar absorptivity for the trans-vinylene band in trans-1,4-polybutadiene was found to change with temperature, a study of it has begun to determine applicable absorptivities for analyzing irradiated polymers whose spectra have been measured at elevated temperatures to eliminate crystallinity. It has been found that molar absorptivity drops sharply at 46°C in changing from crystalline modification I to II. There is a possibility that this transition temperature will shift to 78°C after being cooled from above 78°C or to melt at 145°C to room temperature. Applicable trans-vinylene absorptivities for analyzing irradiated Neoprenes may be evaluated from the Neoprene polymers themselves or from values obtained from trans-1,4-polybutadiene. A study is also in progress on the effects of gamma rays on poly-2-vinylpyridine and a 75/25 copolymer of 1,3-butadiene and 2-methyl-5-vinylpyridine. (auth)

**42766** (NP-1565) WOOD-PLASTIC COMPOSITE. WPC. Miettinen, J. K. Translated from Kem. Teollisuus, 23: 1084-8(1966). Sp. Dep. CFSTI. JCL \$1.10 fr, \$0.80 mf.

Studies were made of the production of wood-plastic combinations by impregnating wood blocks with monomers and irradiating them. Bending strength of the wood was increased, shearing strength increased, and water absorption decreased. Dimensional changes in the wood were greatly reduced. Uses of the wood-plastic combinations are discussed. (M.C.G.)

**42767** THE RADIATION CHEMISTRY OF CYCLIC DIENES. II. THE RADIOLYSIS OF 1,4-CYCLOHEXADIENE IN THE GAS PHASE. Nakagawa, Tsunehiko; Takamuku, Setsuo; Sakurai, Hiroshi (Osaka Univ.). Bull. Chem. Soc. Jap., 40: 2081-8 (Sept. 1967).

The  $\gamma$  radiolysis of 1,4-cyclohexadiene vapor was investigated at room temperature. The gaseous products were hydrogen, acetylene, and 1,3-butadiene. Benzene, cyclohexene, 1,3-cyclohexadiene, and 1,2-cyclohexene were identified as the low volatile liquid products. The yield of each product was almost independent of the dose (0.87 to 0.91 mole/mole), while it was remarkably dependent on the

gas pressure (0 to 56 mm Hg). The G-values of hydrogen, the  $\text{C}_2 + \text{C}_3$  gas fraction, benzene, and cyclohexene were 1.95, 1.25, 28.5, and 14.0, respectively at 42 mm Hg. The large yields of benzene and cyclohexene may be explained in terms of a chain mechanism. The pressure dependence of these products was very similar in both the Hg-sensitized photolysis and the  $\gamma$  radiolysis of this diene vapor. The presence of the long-lifetime intermediates was as expected. The experiments with nitric oxide added as a radical scavenger suggest that the main path of hydrogen formation is the radical process. (auth)

**42768** RADIOLYSIS OF  $\text{Co}^{III}$ -EDTA IN AQUEOUS SOLUTION; THE YIELDS OF HYDROGEN AND HYDROGEN PEROXIDE IN 0.8N SULFURIC ACID. Matsumura, Niro (Tokyo Univ.); Shinohara, Nobuyoshi; Nishikawa, Masaru; Takizawa, Masao. Bull. Chem. Soc. Jap., 40: 2042-7(Sept. 1967).

The hydrogen and hydrogen peroxide produced in the radiolysis of  $\text{Co}^{III}$ -EDTA ( $\text{Co}^{III}\text{Y}^-$ ) in 0.8 N sulfuric acid were measured. The yields of hydrogen and hydrogen peroxide were found to be  $G_0(\text{H}_2) = 0.4$  and  $G_0(\text{H}_2\text{O}_2) = 2.5$  for the aerated system,  $G_0(\text{H}_2) = 3.2$  and  $G_0(\text{H}_2\text{O}_2) = 0$  for the deaerated system were  $G_0$  denotes the yield at the infinite solute concentration. The decomposition mechanism proposed previously was discussed in detail on the basis of the observed  $G_0(\text{H}_2)$  and  $G_0(\text{H}_2\text{O}_2)$  and of the effect of chloride ion on the decomposition yield  $G_0(\text{Co}^{III}\text{Y}^-)$ . A similar experiment was carried out for EDTA alone and the decomposition mechanism is discussed. (auth)

**42769** ION-MOLECULE REACTIONS IN THE RADIOLYSIS OF ORGANIC LIQUIDS. Ward, James A.; Hamill, William H. (Univ. of Notre Dame, Ind.). J. Amer. Chem. Soc., 89: 5116-20(Sept. 27, 1967).

Conventional carbonium ion reaction mechanisms provide a basis for measuring yields of carbonium ions in suitable radiolytic systems, e.g., hydrocarbon-alcohol liquid mixtures. Small yields of products expected from carbonium ions were found: anisole from benzene-methanol; cyclohexyl ethyl ether from cyclohexane-ethanol; t-butyl ethyl ether from neopentane-ethanol; ethyl acetate from acetone-ethanol, all at ca. 20°C. Complicating ion-molecular processes may include proton transfer from  $\text{C}_2\text{H}_5^+$  and  $\text{t-C}_4\text{H}_9^+$  to  $\text{C}_2\text{H}_5\text{OH}$  as well as competition between  $\text{RH}^+ + \text{R}^+ + \text{H}$  and  $\text{RH}^+ + \text{R}^+\text{OH} \rightarrow \text{R} + \text{R}^+\text{OH}_2^+$ . There is evidence for proton transfer from  $\text{C}_2\text{H}_5^+$  to ethanol, but not from neo- $\text{C}_4\text{H}_9^+$ . The structure of the parent molecule had a marked effect on yields with G(carbonium ion) ranging from ~0.03 for benzene to greater than 1.2 for neopentane. (auth)

**42770** POSITRON ANNIHILATION IN RADIATION-INDUCED SOLID-STATE POLYMERIZATION. Ogata, Atsushi; Tabata, Yoneho; Hamaguchi, Hiroshi (Tokyo Univ.). Bull. Chem. Soc. Jap., 40: 2205(Sept. 1967).

Positron annihilation in the gamma-radiolysis-induced, solid-state polymerization of acetaldehyde was studied. It was found that the positron lifetime spectrum was affected by both lattice deformation due to polymerization and accumulation of active species with irradiation. It is believed that the variation of positron lifetime spectra can give useful information about the mechanism of solid-state polymerization. (J.G.B.)

**42771** GRAFT-COPOLYMERIZATION OF N-VINYLPHTHALIMIDE TO POLYETHYLENE BY  $\gamma$ -RAY RADIATION. Murata, Kenichi (Government Industrial Research Inst., Osaka). Bull. Chem. Soc. Jap., 40: 2187-9(Sept. 1967).

The  $\gamma$  radiolysis-induced graft polymerization of N-vinylphthalimide to polyethylene was studied. The grafted film was reacted with n-propylamine at room temperature, and the process of the reaction traced by infrared spectra. Results of dyeing the grafted film as well as the amine-treated film with direct, acid, basic, and dispersed dyes are reported. The amine-treated films were dyed more easily than the original copolymer. (J.G.B.)

**42772** HYDROGEN ISOTOPE EFFECTS IN THE RADIOLYSIS OF WATER. Vukmiric, Zorka B. (Boris Kidric Inst. of Nuclear Sciences, Belgrade). Israel J. Chem., 5: 75-87(May-June 1967).

The tritium fractionation between water and radicals formed in the radiolysis of dilute solutions of monomeric methyl methacrylate in  $\text{H}_2\text{O}$ -HTO and  $\text{D}_2\text{O}$ -DFO mixtures was studied. A parallel determination of the tritium content in molecular hydrogen was performed. Also, the isotopic composition of the initial molecular hydrogen was measured in the concentration range 10 to 90 mole %  $\text{D}_2\text{O}$  of  $\text{H}_2\text{O}$ -HDO- $\text{D}_2\text{O}$  mixtures. Hydrogen atoms, hydroxyl radicals, and molecular hydrogen produced in the radiolysis of these solvents were found to be depleted in heavier hydrogen isotopes. The isotope effects on the composition of hydrogen atoms are discussed in terms of the rate isotope effects in proton transfer. The isotope effects on the composition of hydroxyl radicals are close to

were done with a ZnS (Ag) crystal and a silicon surface-barrier detector, respectively. Six different Pb samples were analyzed, ranging from very old Pb with a negligible  $^{210}\text{Pb}$  content to recently manufactured lead containing up to 8100 disintegrations/hr/g Pb. It was also found that 3 superfluous ligands were bound to the Pb-copferin complex. (BBB)

**28740 DETERMINATION OF FISSION PRODUCTS BY A RADIOCHEMICAL PROCEDURE.** Corns, Rita (Rijkswaarschappelijk, Chem., Belg.). Meded. Wiss. Chem. Ver., 301: 6-17 (Jan.-Feb. 1968). (In Flemish).

An analytical technique was developed to determine long-lived  $\gamma$ -emitting fission products of U. It consists of a sodium bisulfate melt of the fission product solution or the U fuel, followed by liquid-liquid extractions. Then the isotopes are counted with a standardized 3 x 3 in. NaI crystal. The total  $\gamma$  spectrum of the original fission product solution, determined with a NaI crystal or a Ge(Li) detector, is also analyzed mathematically by mixed  $\gamma$  spectrometry. From a brief positron irradiation of the fission product solution the concentrations of both  $^{137}\text{I}$  and  $^{137}\text{Cs}$  are determined. The absolute amount of fission products related to the U concentration allows the calculation of the percent atomic burnup, the irradiation time, cooling period, flux of the reactor, and original degree of enrichment of the U. (BBB)

**28741 DETECTION LIMIT FOR SILVER BY ENERGY- DISPERSION X-RAY ANALYSIS USING RADIOISOTOPES.** Burkhart, P. G. (Bureau of Mines, College Park, Md.). Int. J. Appl. Radiat. Isotop., 20: 353-63 (May 1969).

The purpose of the study described was to determine the sensitivity for silver in silica using radioisotopic x-ray sources, electronic discrimination with a single-channel analyzer, and scintillation detectors. The sensitivity for silver was determined as a function of excitation energy. Using monoenergetic K-spectra x-ray sources of  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$ , and  $^{226}\text{Ra}$ , a normalized detection limit ranging from 21 to 13 ppm was obtained for 100-sec counting intervals. With an auxiliary  $^{226}\text{Ra}$  source a detection limit of 15 ppm silver was measured. The effect on the detection limit of heavy metals common to silver ores was also investigated. A detection limit of 25 ppm or less was still obtained when 5% concentrations were present in the silica matrix provided x-ray interferences with the Ag K $\alpha$  radiation did not exist. The need for accurate background measurements for analysis in the parts-per-million range is emphasized. The sensitivities found indicate that a portable radioisotopic x-ray analyzer could be designed for low-grade silver ores. (auth) (UK)

**28742 ANALYSIS OF ATMOSPHERIC CONCENTRATIONS OF RbA, RbB, AND RbC BY ALPHA SPECTROSCOPY.** Martz, Dowell E.; Holleran, Dan F.; McCurdy, David E.; Schlager, Keith J. (Colorado State Univ., Fort Collins). Health Phys., 17: 131-8 (July 1969).

A new method is presented for determining the airborne concentrations of  $^{210}\text{Po}$ ,  $^{210}\text{Pb}$  and  $^{210}\text{Bi}$  in atmospheres contaminated with  $^{210}\text{Rn}$ . The method employs alpha spectroscopy to measure the count rates of  $^{210}\text{Po}$  and  $^{210}\text{Pb}$  present on a membrane filter sample at two post-sampling times. The individual air concentrations and the statistical variances associated with each may then be calculated from the equations given. Theoretical and experimental comparisons are presented which indicate the improved accuracy of the spectroscopic method over methods previously available. (auth) (UK)

#### Activation Procedures

Refer also to abstract 28937.

**28743 (KURRI-TR-37) APPLICATION OF ACTIVATION ANALYSIS TO BIOLOGICAL SAMPLES.** Shigemitsu, Tsunenobu; Iwata, Shiro (Kyoto Univ. (Japan). Research Reactor Inst.). Jpn. Jpn. (In Japanese). Dep.

Japan has lagged in the field of activation analysis partly because of the lack of facilities in the past. There is great need to train people in the application of activation analysis in medical and biological areas. A special committee on activation analysis was created by KURRI (Kyoto University Reactor Institute) in April 1966 to define problem areas and to provide researchers with pertinent information concerning the application of activation analysis to medicine and biology. The subjects covered include: preparation of biological samples for trace analysis by activation; pretreatment of biological materials; pretreatment procedures; sample collection and preparation; standards to be used in the activation analysis of biological materials; irradiation techniques; chemical separation techniques involved in the trace analysis of biological materials; quantitative analysis by gamma spectrometry; and applications of activation analysis; applications of activation

analysis to medicine; sensitivity obtainable with the JRR-3 for activation analysis. (TTT)

**28744 (NYO-3834-3) TERRESTRIAL OCCURRENCE AND DISTRIBUTION OF  $^{129}\text{I}$ .** Edwards, Raymond R. (Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemistry). [1967]. Contract AT(40-1)-3834. 30p. Dep. OSTI.

The occurrence of the long-lived  $^{129}\text{I}$  (half-life  $1.6 \times 10^7$  years) in natural materials, expected from spontaneous and induced fission of uranium, and from cosmic-ray interaction with the atmosphere, meteorites, and similarly exposed materials, and the somewhat larger quantities introduced into the environment through atomic energy activities was explored. This was feasible because of the extreme sensitivity of activation analysis as a means of detection and assay of this nuclide. Development of the assay technique, and their application to the study of iodine (in geochemistry, ecology, and geochronology) are discussed. Measurement of the  $^{129}\text{I}$  activation product in iodine obtained from Pleistocene ( $<13$  My) brines and from Chilean nalcite indicated a ratio of  $^{129}\text{I}/^{127}\text{I} \approx 5 \times 10^{-12}$  for these geologically young materials, in essential agreement with hypothetical estimates. A sample of iodine from a much older ( $>200$  My) brine gave the anticipated negative result. A large number of additional biological and mineral specimens were prepared for the activation analysis. (auth)

**28745 (THAI-ABC-17) NEUTRON ACTIVATION ANALYSIS OF GOLD IN TEAK (TECTONA GRANDIS).** (Office of Atomic Energy for Peace, Bangkok (Thailand)). 1968. 4p. Dep.

The amount of gold in teak was determined by using a neutron activation technique. The neutron flux utilized was of the order of  $10^{16}$  n/cm $^2$ /sec. The spectrum of the energy peak of gold was identified using a gamma-multichannel pulse height analyzer. The sensitivity for gold was approximately  $10^{-1}$  g. In teak Na, As, Cu, Mn, and La were interfering elements in the energy region from 0.4 to 0.8 MeV. Nondestructive analysis was not possible and radiochemical separation was essential. The gold content of teak was  $0.58 \pm 0.0037$  ppm. (auth)

**28746 (THAI-ABC-23) DETERMINATION OF MANGANESE, COPPER, ZINC, IRON, AND MOLYBDENUM IN ANIMAL BLOOD SAMPLE BY NEUTRON ACTIVATION ANALYSIS.** Chamrirkasarn, Darakarat (Office of Atomic Energy for Peace, Bangkok (Thailand)). 1969. 5p. Dep.

The technique of neutron activation analysis was applied to determination of Mn, Cu, Zn, Fe, and Mo in animal blood samples as supplied by IAEA for intercomparison purposes. One gram of the sample was found to contain  $0.3786 \pm 0.0019$   $\mu\text{g}$  Mn,  $1.4146 \pm 0.0025$   $\mu\text{g}$  Cu,  $16.5713 \pm 0.0607$   $\mu\text{g}$  Zn,  $2.7025 \pm 0.0448$   $\mu\text{g}$  Fe, and  $0.0305 \pm 0.0013$   $\mu\text{g}$  Mo. (auth)

**28747 NEUTRON ACTIVATION ANALYSIS OF ALMOST ANY OLD THING.** Gordus, Adon A. (Univ. of Michigan, Ann Arbor). Contract AT(11-1)-912. Chemistry, 41: 8-15 (May 1968). (OO-912-12).

The use of neutron activation analysis for determining elements in minerals, coins, and paint pigments is discussed. Results were of use in determining the source of obsidian used by the Hopewell Indians, the average silver content in medieval Islamic coins, and the authenticity of a painting. (D.H.M.)

**28748 INSTRUMENTAL ANALYSIS OF NEUTRON IRRADIATED SOILS.** Kline, J. R.; Brar, S. S. (Argonne National Lab., Ill.). Soil Sci. Soc. Amer., Proc., 33: 254-8 (Mar.-Apr. 1969).

Soils from a worldwide collection were analyzed by gamma spectrometry, after thermal neutron activation, to identify and measure trace elements in soils which can be studied by this technique, and to determine whether gamma spectra of soils can be used to identify specimens of soil and trace them to their geographical origin. Samples of 100-mg size were irradiated for either 5 or 10 min in the Argonne CP-5 reactor at a thermal neutron flux of  $2 \times 10^{13}$  n/cm $^2$ /sec. Gamma spectrometry of activated samples was delayed until 4 days after irradiation because of high levels of  $^{24}\text{Na}$  which obscured the longer-lived nuclides. Therefore, nuclides with half-lives shorter than 15 hours were not measured. Long-lived nuclides, which could be observed after 4 days of delay are  $^{139}\text{La}$ ,  $^{51}\text{Cr}$ ,  $^{59}\text{Fe}$ ,  $^{51}\text{Cr}$ ,  $^{60}\text{Co}$ ,  $^{152}\text{Eu}$ ,  $^{154}\text{Eu}$ ,  $^{152}\text{Sm}$ ,  $^{154}\text{Sm}$ , and  $^{137}\text{Cs}$ . Quantitative determinations were easily made by nondestructive methods for La, Sc, Fe, Co, Eu, and Sm. Amounts of Fe were correlated with amounts of Fe, Co, and Eu in soils of highly diverse origin. Similar correlations were not obtained with La. Elemental ratios which sometimes resulted in similar gamma spectra for soils of dissimilar origin. These spectra, therefore, raised doubts as to whether they could be used without other supporting evidence to identify soil specimens or trace them to their place of origin when the analysis is done with NaI crystals and 400-channel analyzers. (auth)

of antipodal objects and the characteristic parameters of the Universe are deduced. Comparison with observations yields: 1) in the case of elliptical space the hypothesis of the existence of antipodal objects is not in contradiction to Einstein-Friedman cosmology ( $\Lambda = 0$ ); 2) at present the direct verification of this hypothesis by means of both redshifts seems to be impossible. (auth)

**51353 ORIGINS OF GALAXIES.** Omnes, R. (Laboratoire de Physique Theorique et Hautes Energies, Orsay, France). *Nature (London)*, 223: 1349-50 (Sept. 27, 1969).

It was suggested that, if mesons are bound states of nucleon-antinucleon pairs there might be a spatial separation of matter and antimatter in the black-body radiation above a critical temperature of about 350 MeV, leading to the production of separate condensations of matter and antimatter. The evolution of such condensations during the cooling down of the Universe is discussed, together with consequences for galaxy and quasar formation. Differences between the hadronic and leptonic era and the radiation era are described. When the radiation period ends gravitation becomes important and the amplification pressure precipitates the gravitational isolation of condensations into galaxies. A galaxy may have a smaller nucleus of antimatter trapped within it during this process, and this forms the basis for the model of quasars. (UK)

**51354 CHARGED SHELLS OF IDEAL FLUID AND THE GRAVITATIONAL COLLAPSE.** Kuchner, Karol. *Časopis Mat. Fyz. Prag.*, 15: 2, Friedrich-Schiller-Univ., Jena, Math.-Naturwiss. Reihe, 17: 185-9 (1969).

The remark that the final collapse of a body could possibly be prevented by a relatively small amount of charge is studied theoretically. The model is an infinitely thin spherical shell from homogeneous charged ideal fluid the particles of which interact by pressure only in the directions tangential to the shell. This shell would represent the hyper-surface of discontinuity in the gravitational and electromagnetic fields. A set of boundary conditions for the gravitational and electromagnetic fields on the charged shell is derived. Equations of motion of the shell are then formulated. The boundary conditions are applied to the homogeneous charged spherical shells, and the equations of motion are integrated to yield the law of conservation of energy, which is the initial point for analysis of the equilibrium state and the collapse of the shells. It is concluded that no charge however high it may be, can stop the gravitational collapse of the shell below the upper Schwarzschild radius. (USSR)

**51355 MEASURING THE RATE OF NUCLEOSYNTHESIS WITH A GAMMA-RAY DETECTOR.** Clayton, Donald D. *Ann. of the New York Acad. Sci.*, 162: 1-12 (1969).

The gamma rays emitted when  $^{60}\text{Fe}$  decays to  $^{60}\text{Co}$  are shown to provide a photon flux which is a significant fraction of the diffuse background near 1 MeV. Successful measurement of the line profiles can reveal both the present and past rates of nucleosynthesis in the Universe. (auth)

**51356 GENERAL FORM OF THE EINSTEIN EQUATIONS FOR A BIANCHI TYPE IX UNIVERSE.** Ryan, Michael P., Jr. (Univ. of Maryland, College Park). *J. Math. Phys. (N. Y.)*, 10: 124-8 (Sept. 1969).

The Einstein equations for a general Bianchi type IX universe are presented in a form suitable for numerical solution. As an example, the complete equations for a cosmology with a pure fluid stress tensor  $T_{\alpha\beta} = \rho u_{\alpha} u_{\beta} + P(\delta_{\alpha\beta} + u_{\alpha} u_{\beta})$  are also given. (auth)

**51357 BIANCHI TYPE-I COSMOLOGICAL MODELS.** Jacobs, Kenneth Charles. Pasadena, Calif., California Inst. of Tech., 1969. 255p.

Thesis.  
A brief review of observations of cosmological interest and a sketch of the "standard" spatially homogeneous and isotropic cosmological models of the Universe that are currently in vogue are given. Following this introduction anisotropic cosmologies and cosmological models of Bianchi Type I are investigated in detail. The primary goal is to understand the consequences of expansion anisotropies in the general relativistic, hot big-bang theory of cosmology. The Einstein field equations with vanishing cosmological constant, and Maxwell's equations, are used to study the temporal evolution of anisotropic Bianchi Type I cosmologies. These cosmologies are spatially homogeneous, but anisotropic; and they have no rotation. Only cosmologies with the flat, diagonal, Bianchi Type I metric  $ds^2 = dt^2 - A^2(dx^2 + B^2(dy^2 + C^2 dz^2))$  are considered. (ISS) (Diss. Abstr. Int., B)

**51358 NANOISOTOPIES AND THE HISTORY OF NUCLEOSYNTHESIS IN THE GALAXY.** Hohenberg, C. M. (Univ. of California, Berkeley). *Science*, 166: 212-15 (Oct. 10, 1969).

Nearly all of the heavier elements seem to have been assembled by successive neutron captures occurring in two distinct processes: the s (slow) process refers to neutron capture at a rate which is slow compared to the intervening beta decay; the r (rapid) process refers to neutron capture at a rate which is rapid compared to the beta decay process. It is becoming increasingly apparent that simple models for galactic r-process nucleosynthesis are inadequate. Modern astronomical observations, which indicate that the bulk of r-process synthesis may have occurred early in the life of the galaxy, cannot be ignored. Recent data on the fossil-genic xenon in whiteclite from the St. Severin meteorite also place stringent conditions on permissible models for element synthesis. It appears that neither sudden nor continuous models for element-formation are consistent with isotopic data now available. A more complex model is proposed for the synthesis of solar system material in which the r-process is allowed to occur in three distinct modes: a "prompt" synthesis early in the history of the Galaxy, a "continuous" synthesis whereby r-process products are continuously added to the galactic mix, and a "fast-ignite" synthesis which enriches the solar nebula with r-process material shortly before the formation of the solar system. Calculations based on the present abundances of uranium-235, uranium-238, and thorium-232 and the measured abundances of iodine-129 and plutonium-244 present when meteorites began to retain xenon indicate that the galactic age is between 4.9 and 9.9 billion years, with the initial "prompt" synthesis accounting for 81 to 99% of the total r-process material ever produced, the "fast-ignite" synthesis contributing between 11 and 19%, and 9 to 2% occurring in the continuous mode. The time interval between the isolation of the solar nebula from the galactic r-process and the onset of xenon retention in meteorites lies between 176 and 179 million years. (auth)

#### Planetary Phenomena

**51359 CONSEQUENCES OF VERY SMALL PLANETARY MAGNETIC MOMENTS.** McCormac, R. M.; Evans, J. E. Lockheed Palo Alto Research Lab., Palo Alto, Calif. *Nature (London)*, 222: 1765 (Sept. 20, 1969).

Consideration is given to possible changes in the atmosphere of the Earth and the planets as a result of the decay of the magnetic dipole moment during reversals of the magnetic field. Mariner V observations showed that Venus now has a nearly very near zero dipole moment, so that its atmosphere may show features which can be explained by erosion and modification by the solar wind. Consideration of the erosion of a planetary atmosphere by the solar wind when the dipole moment is near zero suggests that little or no  $\text{H}^+$  should be observed for Venus or Mars above the ionosphere, that enhancement of the cosmic radiation on the Earth cannot occur to any extent, and that the solar radiant energy might increase in certain regions of the Earth's atmosphere. Outside the bow shock on the sunward side of the magnetopause the solar wind will rapidly sweep away all ions formed inside the magnetosphere there will be no solar-wind erosion. As the strength of a planet's magnetic field decreases, the magnetopause moves toward the planet's surface, but at present the Earth's magnetopause is well outside its atmosphere. The maximum value of the dipole moment of Venus is too small to stop the solar wind off the planet's surface. During a reversal of the Earth's magnetic field the solar wind should compress the Earth's ionosphere to the same atmospheric pressure as for Venus, and the Earth's atmosphere above 100 to 120 km would be above the inner edge of the magnetopause. The ionosphere of Mars should also be compressed to about 50-km altitude. According to the dipole moment reversal curves the dipole moment may be small enough for the solar wind to erode the Earth's atmosphere for about one solar cycle, and the great variability in solar activity from one solar cycle to another means that effects on the Earth's atmosphere may be very different from one reversal to another. An ion loss of the order of  $10^{24}$  g/cm<sup>2</sup> during the solar cycle is calculated, and most of the  $\text{O}^+$  would be effectively removed from the Earth's atmosphere. No significant increase in cosmic radiation would occur. There might be removal of some of the neutral atmosphere, and some possible mechanisms for coupling the solar wind to the neutral atmosphere are discussed. The loss of  $10^{24}$  g/cm<sup>2</sup> of ions on a solar cycle may significantly alter the penetration and absorption of solar uv radiation, resulting in a modification of the constituents, chemistry, temperature, albedo, scale height and motion of the atmosphere. It may be easier to explain the structure of the atmosphere of Venus if the ions produced above 170 to 200 km are removed by the solar wind. Atomic oxygen below the Venus magnetopause would be photoionized and lost to the solar wind. A similar argument could explain the failure to observe atomic oxygen in the atmosphere of Mars. (UK)

9424 (DOCKET-50201-23) [WEST VALLEY REPROCESSING PLANT]. Environmental Report No. 4, January-June 1969. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 8 May 1969. 12p. Dep. CFSTI.

9425 (DOCKET-50201-24) [WEST VALLEY REPROCESSING PLANT]. Environmental Report No. 5, July-December 1969. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 8 May 1969. 20p. Dep. CFSTI.

9426 (DOCKET-50201-25) [WEST VALLEY REPROCESSING PLANT]. Environmental Report No. 6, January-June 1969. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 1 Dec 1969. 12p. Dep. CFSTI.

9427 (EUR-4401) ZETA POTENTIAL CONTROL APPLIED TO THE TREATMENT OF RADIOACTIVE EFFLUENT. Gillot-Stokink, A. J.; Lopes Cardoso, R. (European Atomic Energy Community, Ispra (Italy), Joint Nuclear Research Center). 3 Sep 1969. 46p. Dep. CFSTI (U. S. Sales Only).

Studies were carried out to improve working conditions in the decontamination plant for radioactive effluent at Ispra. This plant operates by a screening-flocculation process. The generally applied but unprecise "beaker tests" used for sedimentation control were completed by precise measurements of the surface charge or zeta potential of the radioactive sludge suspensions. This allowed the exact choice of appropriate reagents and dose rates for optimum flocculation in the case of each type of effluent to be treated. Zeta potential measurements were performed with a commercialized device called "Zeta-meter," comprising a Riddick-type electrophoresis cell. The use of a cationic polyacrylate flocculant, such as the Purific C 31 of Dow Chemicals, gave very satisfying results. Its application in the decontamination plant produced excellent and stable settling conditions, which resulted in doubling the previously obtained process rates. (auth)

9428 (EURAE-2086) REPROCESSING OF IRRADIATED FUELS. Final Report. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)). 8 Apr 1969. Contracts 006-65-7-RCIB; 916-65-1-RAFE. 116p. (EUR-4009). Dep. CFSTI.

Work performed under United States-Euratom Joint Research and Development Program.

Highlights from basic and conceptual studies and cold and hot technology experiments are presented. The reaction mechanism of  $\text{ClF}_3$  and  $\text{ClF}$  with  $\text{UO}_2$ - $\text{PuO}_2$  mixtures was investigated as a function of temperature and gas and fuel composition. The decreasing sphere model can be applied to the  $\text{ClF}_3$  reaction, which also takes place at high speed even with (U-Pu) $\text{O}_2$  solid solutions. The monofluoride (ClF) on the contrary can be considered as a selective fluorinating agent for  $\text{U}_3\text{O}_8$  but its lower reactivity requires much higher reaction temperatures (450°C). Cold technology problems on chemical decladding of stainless steel canned  $\text{UO}_2$  fuel using  $\text{HF} + \text{O}$  are briefly mentioned. Results from the volatilization of  $\text{UF}_4$  in fluidized packed-bed reactors are listed. The reaction rates and efficiencies in large columns of various fluorinating gases ( $\text{ClF}_3$ ,  $\text{ClF}$ ,  $\text{F}_2$ ,  $\text{HF} + \text{O}$ ) are discussed and compared.  $\text{UF}_4$  volatilization rates with  $\text{ClF}_3$  on  $\text{UO}_2$ - $\text{PuO}_2$  pellets, are discussed along with simultaneous removal of Pu either by volatilization of  $\text{PuF}_4$  with  $\text{F}_2$  or by elutriation of Pu containing fines. Conceptual design work was devoted essentially to the study of mechanical decontamination. (auth) (EURATOM)

9429 (IN-1314) CHEMICAL TECHNOLOGY BRANCH ANNUAL REPORT, FISCAL YEAR 1969. Bower, J. R. (ed.). (Idaho Nuclear Corp., Idaho Falls). Oct 1969. Contract AT-(0-1)-1230. 103p. Dep. CFSTI.

Research progress is reported on performance of ICPP fuel recovery processes, fluidized-bed denitration of ICPP product, graphite fuel reprocessing, electrolytic dissolution process for ER-II fuel, zirconium oxide fuel process, operating experience in the Idaho Waste Calcining Facility, storage of solid waste, calcination using in-bed combustion of fuel for heating, waste management studies, LOFT assistance program, and other reactor technology support programs. (M.C.G.)

9430 (IN-1320) URANIUM RECOVERY FROM ALUMINUM ALLOYED FUEL. ICPP RUN NO. 25. Baudouin, C. L.; Matulis, A. J. (Idaho Nuclear Corp., Idaho Falls). Oct 1969. Contract AT-(0-1)-1230. 33p. Dep. CFSTI.

About 677 kg of highly enriched uranium were recovered from aluminum alloyed fuels during Run No. 25 at the Idaho Chemical Processing Plant. Overall product recovery was greater than 95.80 percent and all product easily met required specifications. The feasibility of recovering uranium at ICPP was again demonstrated by recovering 98% of the neptunium in the second cycle raffinate generated during the campaign. Process modifications to the extraction system to allow for the recovery of neptunium and

as a result of the experience gained on the run, other modifications are currently being considered at the ICPP. (auth)

9431 (FRS-4989) PROSPECTS FOR TREATING WATER FROM NUCLEAR ELECTRIC POWER STATIONS WITH PULVERIZED IONITES. Martyssow, O. I.; Subbotina, N. P.; Kopylov, A. S. Translated from At. Energi. (USSR); 31: 8-16(1969). 8p. CFSTI.

An abstract of this paper, prepared from the original language, appeared as NSA 18: 40634.

9432 (KFK-904) DETERMINATION OF IN-PROCESS INVENTORY IN A REPROCESSING PLANT BY MEANS OF ISOTOPE ANALYSIS. Winter, H.; Avenhaus, R.; Gupta, D.; Kalz, F.; Kraemer, R. (Kernforschungsanstalt, Karlsruhe (West Germany), Institut fuer Angewandte Radiophysik). Jul 1969. 66p. Dep. CFSTI (U. S. Sales Only).

A method of independent determination of in-process inventory in a reprocessing plant is discussed. The method is based on measurement of different fission isotope concentrations in the input and output batches of a reprocessing plant. Topics covered include: principle of process inventory determination by isotope analyses, analysis of a typical reprocessing plant, simulation of a reprocessing plant in an analog computer, statistical statements about a diversion in the case of inventory determinations by tracer methods, and differences in isotopic composition of fuel from one reactor. (M.C.G.)

9433 (LIB-Trans-234) D<sub>2</sub>O SUPPLY BY THE HYDROGEN-AMMONIA TWO-TEMPERATURE PROCESS. Becker, E. W.; Lange, G.; Schindevoite, U. Translated by Peter J. F. Newton (Australian Atomic Energy Commission Research Establishment, Lucas Heights), from Atomwirts. Atomtech.; 14: 297-30(1969). 14p. Dep. CFSTI (U. S. Sales Only).

An abstract of this paper, prepared from the original language, appeared as NSA 23: 26247.

9434 (NYO-4057-1) SEPARATION OF KRYPTON AND XENON FROM REACTOR ATMOSPHERES BY SELECTIVE PERMEATION. Progress Report, January 1-December 31, 1969. Stern, S. A. (Syracuse Univ., N. Y. Dept. of Chemical Engineering and Metallurgy). Contract AT(90-1)-4057. 23p. Dep. CFSTI.

Studies are being made to develop an efficient process for removing rare gas fission products from nuclear reactor atmospheres by selective permeation through nonporous polymeric membranes. The potential value of anisotropic (cellulose acetate) membranes for the removal of Kr and Xe fission products is being investigated. (M.C.G.)

9435 (ORNL-TM-2412(P1.4)) DESIGN CONSIDERATIONS OF REACTOR CONTAINMENT SPRAY SYSTEMS. PART IV. CALCULATION OF IODINE-WATER PARTITION COEFFICIENTS. Parry, L. F. (Oak Ridge National Lab., Tenn.). Jan 1970. Contract W-7400-eng-29. 56p. Dep. CFSTI.

Procedures for calculating the partition coefficient of iodine between water and air from solubility, vapor pressure, and hydrolysis equilibrium data are described. Results are presented in tabular form covering the pH range 5.0 to 9.5, the temperature range 25 to 150°C, and dissolved iodine concentrations ranging from saturated solutions down to  $10^{-6}$  mole/liter. (auth)

9436 (ORNL-TM-2792) THORIUM FUEL CYCLE DEVELOPMENT PROGRESS REPORT NO. 5, DECEMBER 1969. (Oak Ridge National Lab., Tenn.). Jan 1970. Contract W-7400-eng-36. 16p. Dep. CFSTI.

Research and development are reported on head-end reprocessing, refabrication, materials irradiation, and  $^{232}\text{Th}$  reprocessing. (M.C.G.)

9437 (ORNL-TM-3046) THORIUM FUEL CYCLE DEVELOPMENT PROGRESS REPORT NO. 6, JANUARY 1970. (Oak Ridge National Lab., Tenn.). Contract W-7400-eng-38. 20p. Dep. CFSTI.

Research and development are reported on head-end reprocessing, refabrication, materials irradiation, and  $^{232}\text{Th}$  reprocessing. (M.C.G.)

9438 (ORNL-10-1881) PROCEDURE FOR PRELIMINARY DECONTAMINATION OF NUCLEAR FUELS TO BE PROCESSED. Balke, Werner; Vogt, Robert. Translated by R. Gregg McField (Oak Ridge National Lab., Tenn.), from German Patent 1,184,903. 4p. Dep. CFSTI.

An abstract of this paper, prepared from the original language, appeared as NSA 18: 20064.

9439 (FRF-1416) PREPARATION OF HIGHLY PURE NEPTUNIUM OXIDE. Comar, William V.; Procter, Stephen G.



6.03 alpha disintegration per second per square centimeter. The presence of polonium-210 in amounts that are close to equilibrium indicates a continuous turnover rate of lunar material at this site of less than 0.1 micrometer per year. The lack of such a deposit at two other lunar sites suggests lower local concentrations of uranium there. (auth)

**21815** DISCUSSION PAPER: RECOVERY OF DEUTERIUM IN THE ATMOSPHERE OF JUPITER. Hinchley, R. B.; Reid, R. C.; Glaser, P. E. (Arthur D. Little, Inc., Cambridge, Mass.). *Ann. N. Y. Acad. Sci.*; 163: 854-8(4 Sep 1969).

A serious logistic problem in long space flights is the necessity to carry a round-trip fuel supply or to obtain fuel either at the terminus or at an intermediate stop. Spacecraft in the future will probably be nuclear-powered and, hopefully, of a fusion-reaction type. If the fusion type were realized, it would be imperative to provide and store deuterium. Several possibilities for obtaining deuterium in the atmosphere of one of the gas-giant planets, such as Jupiter, are explored. Most "Earth" methods for preparing deuterium in a reasonably pure state are rejected as being unsuitable for application in space. To obtain deuterium from hydrogen present in the atmosphere of Jupiter, some method must be found to collect, liquefy, and separate the hydrogen and deuterium. Deuterium is probably present at a higher concentration than on Earth, and values as high as 700 to 800 ppm have been suggested. One proposal is to orbit a vehicle in the stratosphere and collect the hydrogen (deuterium)-helium mixture by a ram action. The hydrogen would be liquefied and rectified to produce deuterium. Also considered is location of the deuterium separation plant on one of Jupiter's moons, or on Saturn. The Galilean satellites of Jupiter would appear to be logical locations for large separation plants provided their atmospheres are found to be suitable. The concept of refueling a fusion device on Jupiter or some other gas giant does not appear to be impossible (unless subsequent studies show no hydrogen to be present). (RRB)

**21816** NONEQUILIBRIUM RADIATION FROM PLANETARY ATMOSPHERES. Thompson, Samuel Lee. Lexington, Ky.; Univ. of Kentucky (1966). 105p.

Thesis.

A possible solution to the problem of "measured" atmospheric temperatures of Jupiter too high to be in equilibrium with the incident solar radiation is studied. It is demonstrated that another interpretation of the measurements of the 8 to 14- $\mu$  emission is possible. The high radiation "temperature" is thus explicable by a cascade process of the molecules in Jupiter's atmosphere wherein a high energy photon is received from the Sun and reradiated as smaller quanta. It is also found that a possible explanation of the enhanced emission from the shadows of Jupiter's satellites is possible using the same idea. Nonequilibrium radiation and collisional deactivation processes in gases are studied. (TSS) (Diss. Abstr.)

**21817** PROCEEDINGS OF THE LUNAR SCIENCE CONFERENCE HELD AT HOUSTON, TEXAS, FROM 5 TO 8 JANUARY. Science; 167: 447-793(30 Jan 1970). (CONF-700106).

Results of the first systematic studies of the Apollo 11 samples by more than 500 scientists from nine countries are compiled. In all, 144 papers were submitted; separate abstracts were prepared for 50. (W. D. M.)

For abstracts of individual papers see: 20706-20711, 20711-20724, 20730-20739, and 21518-21547.

**21818** AGE OF THE MOON: AN ISOTOPIC STUDY OF URANIUM-THORIUM-LEAD SYSTEMATICS OF LUNAR SAMPLES. Tatsumoto, Mitsuonobu; Rosholt, John N. Geological Survey, Denver. Science; 167: 461-3(30 Jan 1970).

From Apollo 11 Lunar Science Conference, Houston, Tex. See CONF-700106.

Concentrations of U, Th, and Pb in Apollo 11 samples studied are low (U, 0.16 to 0.87; Th, 0.53 to 3.4; Pb, 0.29 to 1.7, in ppm) but the extremely radiogenic lead in samples allows radiometric dating. The fine dust and the breccia have a concordant age of 4.56 billion years on the basis of  $^{206}\text{Pb}/^{238}\text{U}$ ,  $^{207}\text{Pb}/^{235}\text{U}$ ,  $^{206}\text{Pb}/^{232}\text{Th}$ , and  $^{207}\text{Pb}/^{232}\text{Th}$  ratios. This age is comparable with the age of meteorites and with the age generally accepted for the Earth. Six crystalline and vesicular samples are distinctly younger than the dust and breccia. The  $^{235}\text{U}/^{238}\text{U}$  ratio is the same as that in Earth rocks, and  $^{235}\text{U}$  is in radioactive equilibrium with parent  $^{238}\text{U}$ . (auth)

**21819** AGES, IRRADIATION HISTORY, AND CHEMICAL COMPOSITION OF LUNAR ROCKS FROM THE SEA OF TRANQUILITY. Albee, A. L.; Burnett, D. S.; Chodos, A. A.; Eugliar, O. J.; Finkbe, J. C.; Panastassidou, D. A.; Podosek, F. A.; Russ, H. G.; Price, Sam, R. G.; Tera, F.; Wasserburg, G. J. (California Inst. of Tech., Pasadena). Science; 167: 463-6(30 Jan 1970).

From Apollo 11 Lunar Science Conference, Houston, Tex. See CONF-700106.

The  $^{40}\text{Ar}/^{39}\text{Ar}$  internal isochrons for five rocks yield an age of  $3.68 \pm 0.66 \times 10^9$  years which presumably dates the formation of the Sea of Tranquility. Potassium-argon ages are consistent with this result. The soil has a model age of  $4.5 \times 10^7$  years, which is best regarded as the time of initial differentiation of the lunar crust. A peculiar rock fragment from the soil gave a model age of  $4.44 \times 10^7$  years. Relative abundances of alkalis do not suggest differential volatilization. The irradiation history of lunar rocks is inferred from isotopic measurements of gadolinium, vanadium, and cosmogenic rare gases. Spallation xenon spectra exhibit a high and variable  $^{136}\text{Xe}/^{138}\text{Xe}$  ratio. No evidence for  $^{37}\text{Ar}$  was found. The isotopic composition of solar-wind xenon is distinct from that of the atmosphere and of the average for carbonaceous chondrites, but the krypton composition appears similar to average carbonaceous chondrite krypton. (auth)

**21820**  $^{40}\text{Ar}/^{39}\text{Ar}$  DATING OF LUNAR ROCK SAMPLES. Turner, Grenville (Univ. of Sheffield, Eng.). Science; 167: 466-8(30 Jan 1970).

From Apollo 11 Lunar Science Conference, Houston, Tex. See CONF-700106.

Seven crystalline rock samples returned by Apollo 11 were analyzed in detail by means of the  $^{40}\text{Ar}/^{39}\text{Ar}$  dating technique. The extent of radiogenic argon loss in these samples ranges from 7 to  $\geq 48\%$ . Potassium-argon ages, corrected for the effects of this loss, cluster relatively closely around the value of  $3.7 \times 10^9$  years. Most of the volcanism associated with the formation of the Mare Tranquillitatis presumably occurred around  $3.7 \times 10^9$  years ago. A major cause of the escape of gas from lunar rock is probably the impact event which ejected the rock from its place of origin to its place of discovery. Upper limits for the times at which these impact events occurred have been estimated. (auth)

**21821** URANIUM-THORIUM-LEAD ISOTOPE RELATIONS IN LUNAR MATERIALS. Silver, Leon T. (California Inst. of Tech., Pasadena). Science; 167: 468-71(30 Jan 1970).

From Apollo 11 Lunar Science Conference, Houston, Tex. See CONF-700106.

The lead isotopic compositions and uranium, thorium, and lead concentrations were measured on six samples of material from the Sea of Tranquility. The leads are moderately to very radiogenic; the initial lead concentrations are very low; the uranium and thorium levels are 0.26 to 0.88 and 0.87 to 3.35 parts per million, respectively. The Th/U ratios cluster about a 3.6 value. Apparent ages calculated for four rocks are  $4.1$  to  $4.2 \times 10^9$  years. Dust and breccia yield apparent ages of  $4.60$  to  $4.83 \times 10^9$  years. The uranium-lead ages are concordant, or nearly so, in all cases. The lunar surface is an ancient region with an extended record of events in the early history of the solar system. The discrepancy between the rock ages and dust ages poses a fundamental question about rock genesis on the Moon. (auth)

**21822** RUBIDIUM-STRONTIUM, URANIUM, AND THORIUM-LEAD DATING OF LUNAR MATERIAL. Gopalan, K.; Kaushal, S.; Lee-Hu, C.; Wetherill, G. W. (Univ. of California, Los Angeles). Science; 167: 471-3(30 Jan 1970).

From Apollo 11 Lunar Science Conference, Houston, Tex. See CONF-700106.

Rubidium and strontium concentrations and strontium isotopic compositions were measured on whole rock samples and density fractions of microgabbro. Density fractions on two rocks define isochrons of 3400 and 4500 million years with large uncertainties owing to low enrichment of radiogenic strontium. Lead from fine surface material is highly radiogenic. An age of 4750 million years was calculated from the ratio of  $^{87}\text{Rb}/^{86}\text{Rb}$ . The concentrations of uranium, thorium, and lead isotopes are consistent with the evolution of lead in a 4700-million-year-old closed system characterized by the ratios of uranium to lead and of thorium to lead in this surface material. (auth)

**21823** RUBIDIUM-STRONTIUM RELATIONS IN TRANQUILITY BASE SAMPLES. Hurley, P. M.; Plinson, W. H. Jr. (Massachusetts Inst. of Tech., Cambridge). Science; 167: 473-4(30 Jan 1970).

From Apollo 11 Lunar Science Conference, Houston, Tex. See CONF-700106.

Preliminary total rock analyses disclosed a greatly different Rb depletion between two groups of these igneous rocks, and ratios of  $^{87}\text{Rb}/^{86}\text{Rb}$  indicate that the Rb depletion in these materials must have occurred during or shortly after the accretion of the terrestrial planets. (auth)

**21824** RUBIDIUM-STRONTIUM AGE AND ELEMENTAL, AND ISOTOPIC ABUNDANCES OF SOME TRACE ELEMENTS IN LUNAR SAMPLES. Murthy, V. Rama (Univ. of Minnesota, Minneapolis); Schmitt, R. A.; Ray, P. Science; 167: 476-9(30 Jan 1970).

## PHYSICS (GENERAL)

## Astrophysics and Cosmology

**23544** EXPLORATION OF THE UNIVERSE. SECOND EDITION. Abell, George. New York: Holt, Rinehart, and Winston (1969). 733p.

This book is designed for a one- or two-semester course as an introduction to astronomy and astrophysics. No special training in science or mathematics is required for an understanding of the text. The book is liberally illustrated in black and white and some color. (W.D.M.)

## Cosmic Ray Exposure Ages

**23547** DATING OF METEORITES BY THE HIGH-TEMPERATURE RELEASE OF IODINE-CORRELATED  $^{129}\text{Xe}$ . Podosek, F. A. (Univ. of California, Berkeley). Geochim. Cosmochim. Acta; 34: 341-65(Mar 1970).

Correlations between the amounts of  $^{129}\text{Xe}$  and  $^{136}\text{Xe}$  released in stepwise heating of neutron-irradiated meteorites were used to determine the initial ratio  $^{129}\text{I}/^{136}\text{I}$  and hence a relative formation time for the various samples. The formation times in millions of years (relative to the L4 chondrite Bjurböle) of nine specimens are as follows:  $3.9 \pm 0.7$  for Karoonda (C4 chondrite);  $3.1 \pm 0.6$  and  $10.5 \pm 0.7$  for the matrix and chondrules, respectively, of Chainpur (LL3);  $7.5 \pm 1.0$  for St. Severin (LL6);  $3.9 \pm 2.9$  and  $2.3 \pm 1.0$  for the matrix and chondrules, respectively, of Allegan (H5);  $3.6 \pm 0.7$  for Peña Blanca Spring and  $20.8 \pm 9.5$  for Bishopville (subrites);  $3.8 \pm 0.7$  for a silicate inclusion of the iron meteorite El Taco (Campo del Cielo). No assumptions were made about the amount of  $^{129}\text{Xe}$  in the trapped gas. The correlations for previously published data were also recalculated in the same way, with no assumptions about trapped  $^{129}\text{Xe}$ . For a group of chondrites previously reported to be isochronous with a mean simultaneity of 2.5 million years, the recalculation confirms this mean simultaneity, but significant differences in formation times are resolved. An iodine-xenon age of  $53 \pm 9$  million years (after Bjurböle) was obtained from unpublished data for the achondrite Lafayette. The reliability of iodine-xenon ages of individual meteorites is considered; in particular, the ages of Bishopville and Lafayette are less reliable than those of most other meteorites studied, especially in view of the anomalous ages reported. The relevance of iodine-xenon dating to theories of nucleosynthesis, early solar system chronology, and theories of meteorite parent-body formation is discussed. (auth) (UK)

## Stars

Refer also to abstracts 23762, 23976, 24435, and 24516.

**23548** (NYO-3962-2) ANNUAL PROGRESS REPORT ON NUCLEAR PHYSICS AND NUCLEOSYNTHESIS. [Cameron, A. G. W.] (Yeshiva Univ., New York. Belfer Graduate School of Science). (17 Mar 1970). Contract AT(30-1)-3962. 11p. Dep. CFSTI.

A brief summary is given on the work carried out in the areas of neutron-star matter, neutron-rich nuclei, the URCA process in white dwarfs, and the nuclear mass formula. (W.D.M.)

**23549** LIGHT VARIATION OF FOUR MAGNETIC VARIABLE STARS. van Genderen, A. M. (Leiden Observatory). Astron. Astrophys., Suppl. Ser.; 1: 123-7(Feb 1970).

Photoelectric observations of the magnetic variable stars HD 8441, 21 Per,  $\epsilon$  Cas, and HD 25 354 are detailed. The first three stars were observed with a red filter only, the fourth one was also observed in UVB. (auth)

**23550** PHOTOELECTRIC OBSERVATIONS OF 32 CYGNI. Johansen, Karen T.; Rudkjöbing, J.; Gyldenkerne, K. (Univ. of Copenhagen Observatory, Brorfelds, Denmark). Astron. Astrophys., Suppl. Ser.; 1: 149-64(Feb 1970).

The long-period eclipsing binary 32 Cyg was observed at Copenhagen University Observatory in Brorfelds during the 1959, 1962, and 1965 eclipses. The observations were made with UVB standard filters and several narrow-band filters, and the combined light curve is discussed. A comparison is made with results obtained by other observers. At least the 1965 eclipse appears to be total. The atmospheric nature of the eclipse is demonstrated by the fact that at a certain phase outside totality the atmospheric fraction of the B-star radiation depends on the spectral region of observation. (auth)

**23551** PHOTOELECTRIC OBSERVATIONS OF EARLY A STARS. Johansen, Karen T.; Gyldenkerne, K. (Univ. of Copenhagen Observatory, Brorfelds, Denmark). Astron. Astrophys., Suppl. Ser.; 1: 165-88(Feb 1970).

Photoelectric observations of the  $\beta$  index and of indices similar to those of the Strömgren uvby system were made for 437 field stars and for a number of stars in the Coma Berenices, Praesepe, NGC 6633, and NGC 1682 clusters. Of the field stars, 377 are A0-A2 stars north of declination  $-8^\circ$  with  $V \leq 6.0$ ; in the clusters mostly A stars were observed. The night-to-night correction method is described and the transformation of the observed indices to the uvby and  $\beta$  standard systems is discussed in detail. (auth)

**23552** CATALOGUE OF PROPER MOTIONS FOR 437 A STARS. Olsen, H. J. Fogh (Univ. of Copenhagen Observatory, Brorfelds, Denmark). Astron. Astrophys., Suppl. Ser.; 1: 189-97(Feb 1970).

Proper motions and radial velocities are given for 437 A stars observed photoelectrically by Johansen and Gyldenkerne. Most of the proper motions are improved GC motions transformed to the FK4 system. (auth)

**23553** NARROW-BAND PHOTOMETRY OF LATE-TYPE STARS. Haegkvist, L.; Oja, T. (Uppsala Astronomical Observatory). Astron. Astrophys., Suppl. Ser.; 1: 199-232(Feb 1970).

The distribution of stars in the direction perpendicular to the galactic plane is investigated. It is limited to late-type stars, which are studied by means of interference filters; the break at the G band and the cyanogen absorption are measured. The catalog includes all late-type stars brighter than  $V = 5$  north of declination  $-10^\circ$  and those brighter than  $V = 6$  north of galactic latitude  $+60^\circ$ . The relation between the two-dimensional classification established for the G and K stars and the MK classification is studied. It is shown that the giants and the dwarfs are well separated from each other and that the separation can be made complete if the criteria are complemented by the B-V color. It is also found that the M giants can be classified quite accurately by means of the same criteria. The connection between the spectrophotometric criteria and the intrinsic colors in the UVB system is investigated, and it is found that different relations hold for the dwarfs and the giants. The mean errors of typical B-V color excesses derived from the criteria and B-V are about  $\pm 0.02$  for the dwarfs and  $\pm 0.03$  to  $\pm 0.05$  for the giants. The absolute magnitudes of the late-type giants are discussed and a relation between the mean absolute magnitude in a volume of space and the spectrophotometric criteria is derived from astrometric data only (trigonometric parallaxes and proper motions in combination with radial velocities). The dispersion of the absolute magnitudes is about  $\pm 0.8$ . (auth)

**23554** CASE B OF MASS EXCHANGE IN SYSTEMS  $4 + 3.2M_{\odot}$  AND  $4 + 1.6M_{\odot}$ . Harmannec, Petr (Astronomical Inst., Ondřejov, Czech.). Astrophys. Space Sci.; 6: 497-503(Mar 1970).

Two examples of case B of mass exchange are computed to estimate the effect of basic initial parameters on the course and the results of mass exchange. It seems that the resulting mass of the original primary is independent of the initial mass ratio, the resulting orbital period is independent of initial mass of the primary, and surface hydrogen content is independent of both of these parameters. (auth)

**23555** ONE EXAMPLE OF MASS EXCHANGE IN CASE AB IN SYSTEM  $5M_{\odot} + 4M_{\odot}$ . Horn, J. (Astronomical Inst., Ondřejov, Czech.). Astrophys. Space Sci.; 6: 492-6(Mar 1970).

Evolution of a binary system with masses of  $5M_{\odot}$  and  $4M_{\odot}$ , respectively, and with orbital period of 1.41 days is studied by means of nonstationary model calculations under assumptions of conservation of total mass and total orbital angular momentum of the system. As a result of mass exchange between the components a binary with masses of 3.46 and  $0.54 M_{\odot}$  is obtained. Physical parameters of the final product indicate possible connection with shell stars. It is also pointed out that the new secondary component can become rotationally unstable soon after the end of mass exchange. (auth)

**23556** DEVELOPMENT OF A COCCON STAR. Davidson, Kris (Cornell Univ., Ithaca, N. Y.). Astrophys. Space Sci.; 6: 423-35(Mar 1970).

A newly formed massive star is likely to be surrounded by dense gas and dust as it approaches the main sequence. Radiation pressure must push some of the inner material outward before

thermal flux in the central zone of the beam of  $1.25 \times 10^6$  n. cm<sup>-2</sup> sec<sup>-1</sup> and for a fast neutron flux of  $2.25 \times 10^4$  n. cm<sup>-2</sup> sec<sup>-1</sup>, was found to be: (a) dose due to the reaction <sup>14</sup>N(n,p)<sup>14</sup>C: 175 mrad/min; (b) dose due to capture gammas: 180 mrad/min; (c) dose due to direct gamma radiation: 8 mrad/min; (d) dose due to fast neutrons: 55 mrad/min. (France)

**31962** (CEA-R-3994) DOSE ABSORBED IN BIOLOGICAL TISSUE IRRADIATED BY FAST MONOENERGETIC NEUTRONS. Sklaventis, Helene; Devillers, Christian (Commissariat à l'Énergie Atomique, Fontenay-aux-Roses (France), Centre d'Études Nucleaires). Apr 1970. 37p. (In French). Dep. CPSTI (U. S. Sales Only).

The dose absorbed in an irradiated biological tissue equivalent medium is calculated with a view to carry out radioactivation quantitative analysis with fast monoenergetic and unidirectional neutrons. The results are compared to those of a similar American work at energies of 10, 2, and 0.5 MeV. The method is then applied to neutrons of 14.75 and 3.6 MeV. (France)

**31963** (CISE-N-128) EXPOSURE OF CHILDREN OF 10 YEARS OF AGE TO IONIZING RADIATION. Bazzano, E.; Ghislandi, E. (Centro Informazioni Studi Esperienze, Milan (Italy)). Sep 1969. 14p. (In Italian). (CONF-690929-1). Dep. CPSTI (U. S. Sales Only).

From 15th National Congress of the Italian Association for Health Physics and Protection against Radiation, Cagliari, Italy.

The particular aspects of the exposure of 10-year old minors to ionizing radiation both from professional activity and from study and training were considered. After a discussion of the motives for which both the Euratom Standards and the laws of many countries (of which Italy is one) prohibit the professional exposure of such persons, the problems of students, especially those in nuclear engineering schools, who participate in exercises with radiation sources and in periods of practical instruction at nuclear installations, are examined. The criteria that can be followed to establish the dose limits to which these students can be exposed are examined from the viewpoint of a rigorous radio-protection. (fr-auth)

**31964** (DOCKET-50201-26) WEST VALLEY REPROCESSING PLANT. Environmental Radioactivity in New York State, 1968. (New York State Dept. of Health, Albany). 14 Jul 1969. 34p. Dep. CPSTI.

**31965** (NP-18121) ANNUAL REPORT TO THE DIRECTOR-GENERAL FOR THE YEAR ENDED 30th JUNE 1969. (Commonwealth X-Ray and Radium Lab., Melbourne (Australia)). 1969. 42p. Dep. CPSTI (U. S. Sales Only).

The historical and present-day responsibilities of the Laboratory are discussed and the developments during the year are reported. Progress is outlined in the fields of national standards of activity of radionuclides and of exposure to x and γ radiation, radiation dosimetry, diagnostic radiology, radium, radon, radioisotopes, radiochemistry and low-level measurements, whole-body monitor, radiological protection, and film-badge service. Appendixes provide information on statistical data for radiochemistry and low-level measurements, radioisotopes, radon, and radium, as well as the procedures for procurement of radioisotopes for medical research in Australia. (C.O.)

**31966** METHODS OF COMPUTER CALCULATION OF DOSE DISTRIBUTIONS IN TELETHERAPY. Cunningham, J. R. (Ontario Cancer Inst., Toronto). pp 19-24 of Role of Computers in Radiotherapy. Vienna, International Atomic Energy Agency, 1967.

From Panel on the Role of Computers in Radiotherapy, Vienna, Austria. See STI/PUB-203; CONF-670736.

Dose distribution computations have been carried out for many years both for purposes of on-line production of data to be used directly for patients and to produce atlases and analyses of data. In this work, the computer has not merely done more quickly what can be done with a slide rule or a desk calculator, but has made possible the inclusion of such factors as, for example, three-dimensional representations and allowances for tissue inhomogeneities. The central problem is always the determination of the dose at any point in an absorbing and scattering medium for a single beam. Multiple-beam distributions are combinations of single beams. The single beam has been represented by digitized isodose data, or by empirical generating functions, or by use of decrement lines, or by separation of scattered and primary radiation. There has been little program interchange among workers in this field; each worker has followed his own methods, the type of program used being frequently determined by available computer facilities. It appears to be likely that the greatest need is for information on the relative merits of the various calculations, extent of tumor, and the relative merits of the various methods of beam distri-

tribution. It is likely that the computer can assist in dealing with all these points. (40 references.) (auth)

**31967** COMPUTER DOSIMETRY FOR INTERSTITIAL AND INTRACAVITARY IMPLANTATIONS. A SURVEY. Stevill, Marilyn (Anderson Hospital and Tumor Inst., Houston, Tex.); Shalek, R. J.; Peterson, Mary. pp 25-35 of Role of Computers in Radiotherapy. Vienna, International Atomic Energy Agency, 1967.

From Panel on the Role of Computers in Radiotherapy, Vienna, Austria. See STI/PUB-203; CONF-670736.

Fourteen digital computer techniques for the dosimetric evaluation of interstitial and intracavitary applications of sealed radioactive sources are reviewed; eleven of these programs were designed for routine calculation of dose distribution in individual patients and three programs are special-purpose. The techniques used for routine computations are compared in terms of method of obtaining input data, types of sources considered, method of calculation, and form of output data. The similarity between these methods reveals a fundamental agreement among workers concerning the basic approach to the problem. The principal differences appear in the form of output data, but these largely reflect the hardware capabilities available at various institutions. Five figures illustrate some forms of output data in use at present. (37 references.) (auth)

**31968** COMPUTER CALCULATION OF DOSE DISTRIBUTIONS IN <sup>60</sup>Co TELETHERAPY. Houdak, P. (Oncological Inst., Prague); Hron, M. pp 39-45 of Role of Computers in Radiotherapy. Vienna, International Atomic Energy Agency, 1967.

From Panel on the Role of Computers in Radiotherapy, Vienna, Austria. See STI/PUB-203; CONF-670736.

The use of Sterling's non-linear equation for the calculation of two- and three-dimensional dose distribution is briefly described. The role of the sigma constant, a function of penumbra width, as it affects the construction of a <sup>60</sup>Co unit is discussed. Dose distributions as calculated with a Gier computer are presented. (40 references.) (auth)

**31969** AN IMPROVED MODEL FOR RECTANGULAR <sup>60</sup>Co GAMMA RADIATION BEAMS IN UNIT-DENSITY MEDIA. Van de Geijn, J. (Ziekenhuis van des H. Johannes de Do, The Hague). pp 47-51 of Role of Computers in Radiotherapy. Vienna, International Atomic Energy Agency, 1967.

From Panel on the Role of Computers in Radiotherapy, Vienna, Austria. See STI/PUB-203; CONF-670736.

A point-source model for rectangular <sup>60</sup>Co beam γ dose distribution in a water-equivalent medium proved to be sufficiently accurate for clinical purposes. The principal shortcomings of this model occurred in the region of the beam penumbra near the surface of the medium. A description is given of a relatively simple improvement of the model. It is based on an analysis of the geometry of the source, collimator walls, aperture, and patient (or phantom). The new model provides a reasonably accurate quantitative description of the behavior of decrement lines, based on computer calculations of dose distribution. (C.H.)

**31970** BEHAVIOUR OF ZONAL INTEGRAL DOSE IN HIGH-ENERGY MOVING-FIELD TELETHERAPY. Van de Geijn, J. (Ziekenhuis van des H. Johannes de Do, The Hague). pp 53-66 of Role of Computers in Radiotherapy. Vienna, International Atomic Energy Agency, 1967.

From Panel on the Role of Computers in Radiotherapy, Vienna, Austria. See STI/PUB-203; CONF-670736.

Some initial results are reported on the use of two parameters which may be useful in judging the relative quality of treatment plans and the relative merits of high-energy radiation machines used for moving-field γ therapy. These two parameters are zonal integral dose and zonal surface area. These concepts are based on a comparison of the dose to the target volume with the dose to a certain critical region surrounding it, using computer calculations. Attention is limited to a few moving-field techniques, where the target volume is defined by the 80% isodose surface. In the tissue surrounding the target volume, the 60 to 70% and 70 to 80% regions were investigated. Some results are given on the effect of field size and other factors for four different teletherapy machines: three <sup>60</sup>Co units and one linear accelerator. Performances of these machines are compared. (C.H.)

**31971** PROGRESS IN OPTIMIZATION BY SCORE FUNCTIONS. Hope, C. S. (Western Regional Hospital Board, Glasgow); Laurie, J.; Orr, J. S.; Haines, K. E. pp 67-9 of Role of Computers in Radiotherapy. Vienna, International Atomic Energy Agency, 1967.

From Panel on the Role of Computers in Radiotherapy, Vienna, Austria. See STI/PUB-203; CONF-670736.

France; *Ann. Astrophys.*, 39: 729-34 (July-Aug. 1967). (In French.)

A series of radiometric experiments on millimetric waves was carried out in order to determine the absorption by the ionospheric atmosphere and the brightness temperature of the solar disk at 5.65-mm wave length. The radiometric device used was composed of a radiometer and an antenna of the Cassegrain type. The measurement procedures used are outlined. The first measurement gave for the total vertical attenuation at 53 GHz a mean value of 4 dB and a brightness temperature of approximately 7,600°K. (J.R.R.)

4975 <sup>244</sup>Pu IN THE EARLY SOLAR SYSTEM AND CONCORDANT PLUTONIUM/XENON AND IODINE/XENON DECAY INTERVALS OF ACHONDRITES. Babu, D. D.; Kurda, P. K. (Univ. of Arkansas, Fayetteville). *Nature* (London), 216: 643-6 (Nov. 4, 1967).

Concordant plutonium/xenon and iodine/xenon decay intervals have been obtained for a dozen meteoritic, mostly achondritic, Plutonium-244 and iodine-129 abundances in the early solar system suggest that these extinct nuclides were synthesized in the galactic nucleosynthesis process, which lasted several billion years. (auth)

4976 EVIDENCE OF CONTINUUM EMISSION FROM JUPITER AT 18 Mc. Barrow, C. H.; Williams, J. R. (Florida State Univ., Tallahassee). *Nature* (London), 216: 483-3 (Nov. 4, 1967).

It was reported earlier that almost continuous "bursty" radiation from Jupiter could be detected at low frequencies if an aerial-receiver system of sufficient sensitivity was available. A marked increase in emission probability at 18.3 Mc was also found using the large array at Clark Lake Radio Observatory. Evidence is presented in this communication of a related effect at 18 Mc observed on several occasions during the 1966-67 apparition of Jupiter; this refers to a relatively steady emission, sometimes appearing as a background to the more usual "bursty" type of emission. The observations were made with an interferometer consisting of two identical broadband arrays, each consisting of four whole-wave dipoles, on an E-W baseline of 16 wavelengths. The event characteristics are tabulated. A total of 17 events out of 43 observed during the period November 5, 1966 to March 4, 1967 contained evidence of continuum emission. That this effect was not observed on every occasion presumably indicates that the continuum emission is either not a frequent occurrence at 18 Mc, or that it is always present but usually of too low intensity to be recorded. (UK)

4977 CASE OF THE VANISHED CORRELATION IN STATISTICS OF QUASI-STELLAR OBJECTS. Gamov, G. (Univ. of Colorado, Boulder). *Nature* (London), 216: 461-2 (Nov. 4, 1967).

The result of the studies by Longair and Sobouev (*Nature* 215: 919 (1967)) concerning the possible correlation between optical and radio intensities and red shifts in quasars are discussed. These authors found that correlation disappeared when the effects of relativistic time dilation were eliminated. An explanation of this disappearance is offered, based on absorption by galaxies. The observed Doppler effect in the absorption lines will correspond not to the recession velocity of the source, but to that of an intervening galaxy. (UK)

4978 SPECTRA OF SOME BLUE OBJECTS IN HIGH GALACTIC LATITUDES. Dihal, E. A.; Zaitov, V. F. (Astronomical Inst., Moscow). *Sov. Astron. AJ* (Engl. Transl.), 11: 230-3 (Sept.-Oct. 1967).

A search was made for extragalactic objects among blue stars in high galactic latitudes. Spectra of Tonantzitlan objects 256, 259, 261, 262, 264, 266, 788, 811, 812, and 817 were obtained with an image tube and a grating spectrograph at the Cassegrain focus of the 123-cm reflector. Except for Ton 256, none of the objects exhibits emission lines. A spectrophotometric study was made of the quasi-stellar galaxy Ton 256, discovered by Sandage. The physical parameters of the gaseous envelope are derived from the forbidden-line intensities. The situation is found to be similar to the phenomena observed in Seyfert galaxy nuclei, but on a larger scale. (auth)

4979 POSSIBLE POLARIZATION OF BREMSSTRAHLUNG X RADIATION FROM SOLAR FLARES. Kopylov, A. A.; Leonovich, M. A. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio Wave Propagation, Moscow). *Dokl. Akad. Nauk SSSR*, 173: 391-4 (Mar. 11, 1967). (In Russian.)

An examination is presented of the method of analyzing the polarization of hard solar-flare x radiation in order to determine the radiation generation mechanism involved (bremsstrahlung, synchrotron, Compton). Specifically, Dolan's (*Astr. Phys. J.*, 79:

127 (1965)) conclusion that the detected linear polarization signal is other than the radiation is synchrotron radiation or, if the angular distribution of radiating electrons is anisotropic, that it is bremsstrahlung radiation, is examined. The second possibility namely, bremsstrahlung, is analyzed in greater detail (especially as the generation of sharply anisotropic accelerated electron beams would be most probable in the case of solar flares). Bremsstrahlung polarization properties are analyzed both for the case of a parallel electron beam as well as the case where the electrons are captured in the magnetic field and an angular velocity distribution is established. It is concluded that if the energy spectrum of electrons accelerated in a flare extends into the non-relativistic region, the bremsstrahlung will significantly exceed both the Compton and synchrotron radiation. The degree to which x radiation will be linearly polarized depends on the frequency. For best results in determining the radiation mechanism in polarization observations, it is recommended that the observations be conducted in at least two photon energy regions which are relatively distant from each other in terms of the energy spectrum. (ATD)

5000 ON THE NATURE OF THE INFRARED NEBULA IN ORION. Hartmann, William K. (Univ. of Arizona, Tucson). *Astrophys. J.*, 149: L87-90 (Sept. 1967).

A recently discovered infrared nebula in Orion is interpreted as a proto-cluster with 1 to 10<sup>3</sup> massive stars imbedded in an opaque dust cloud. Collapse is about to be or has been reversed, and lifetimes of such objects in the observed states are expected to run 2 to 10<sup>4</sup> years. (auth)

5001 NEGATIVE RESULTS IN A SEARCH FOR RADIO EMISSION FROM INFRARED AND T TAURI STARS. Comella, J. (Cornell Univ., Ithaca, Puerto Rico). *Astrophys. J.*, 149: L81-3 (Sept. 1967).

Negative results were obtained in a search for radio emission from the following infrared and T Tauri stars: two objects in Cygnus and Taurus, T Tau, RY Tau, and E Mon. The 1950.0 coordinates, frequencies of observation, and numbers of observations at each frequency for each are tabulated. All the observations were made with the Arecibo 1000-ft telescope and Dicke-switched radiometers. (W.D.M.)

5002 INFRARED RADIATION FROM UPSILON SAGITTARI. Lee, Thomas A.; Nariai, Kyoji (Univ. of Arizona, Tucson; Tokyo Astronomical Observatory, Mitaka). *Astrophys. J.*, 149: L93-5 (Sept. 1967).

Infrared photometry of  $\epsilon$  Sgr was undertaken with the hope that it would reveal the nature of the secondary component. Mean magnitude and colors from three UVRI observations and three JHKL observations are given along with a comparison of the colors of  $\epsilon$  Sgr with those of standard stars. (W.D.M.)

5003 INFRARED OBSERVATIONS OF THE PLANE NEBULA NGC 7027. Gillett, F. C. (Univ. of California, San Diego); Low, P. J.; Sista, W. A. *Astrophys. J.*, 149: L97-100 (Sept. 1967).

Observations of NGC 7027 were made in May and June 1967 at the Catalina observing station in an attempt to detect an infrared line of  $\text{C}^{++}$  at  $\lambda = 10.53 \mu$ . As a result of the observations there was some indication of the detection of the predicted line. However it was discovered that there was a measurable continuum flux from NGC 7027 in the wavelength range from 7.5 to 14  $\mu$  that compared in value with the strength of stellar radiation from  $\alpha$  Lyr (AO) at about 9  $\mu$ . (W.D.M.)

5004 OBSERVATIONS OF HZ 29. Wampler, E. Joseph (Univ. of California, Santa Cruz). *Astrophys. J.*, 149: L101-3 (Sept. 1967).

Burbidge, Burbidge, and Hoyle (1967) have argued that HZ 29 considered by Greenstein and Matthews (1967) to be a white dwarf with a helium spectrum, may be a radio-quiet, quasi-stellar object. Recently Smak (1967) has reported that the magnitude of HZ 29 is variable with a period of 18 min and an amplitude of 0.33 mag. In an effort to obtain additional data, photoelectric scans of HZ 29 were obtained using the Lick prime-focus scanner at the 120-in telescope. (W.D.M.)

5005 PHYSICAL CONDITIONS IN SCO X-1. Tucker, W. H. (Cornell Univ., Ithaca, N. Y.). *Astrophys. J.*, 149: L105-9 (Sept. 1967).

Some restrictions on the parameters characterizing Sco X-1 are discussed, and a model for Sco X-1 and other x-ray sources is suggested. The basic assumptions are: (1) the x-ray flux observed in the 2- to 30-keV range is due to bremsstrahlung from an optically thin plasma with a temperature  $T = 5 \times 10^6$  K, and (2) the gas has the cosmic abundances given by Aller (1961). (W.D.M.)



function of reactor operation time, both during operation and after shutdown, is described and the results presented graphically. (I.C.L.)

**6447 STANDARIZATION OF RADIOISOTOPES AT AEST.**  
Ozga, U. C.; Srivastava, P. K.; Mitra, S. C.; Mehta, N. P. S.; Dhangra, K. C. Atomic Energy Establishment, Trombay, India, pp 434-47 of Proceedings of the All India Symposium on Radioactivity and Metrology of Radioisotopes, Bombay, March 14-18, 1964. Bombay, Atomic Energy Establishment Translation, 1964. 20 p. CONF-64041.

The standardization of radioactive standards at the Atomic Energy Establishment Trombay (AEST) is described. The different steps involved in standardization and considerations in the choice of the original radioactive solution together with a comparative study of the various counting methods are discussed. (auth)

## Materials Testing

*Refer also to abstract 6672.*

**6448 (LA-2675-84) APPARATUS FOR INVESTIGATING THE BEHAVIOR OF METALS AND ALLOYS UNDER THE EFFECT OF TEMPERATURES.** Seitzman, G. V. A.; Dickenson, G. S. Translated by Helen J. Chick and James M. Dickenson. (Los Alamos Scientific Lab., N. Mex.), from *Progress Mat. Sci.*, March 1963, 1: No. 5, 84-101(18). 12p. Dep. C1771. PCL \$1.00 h., \$0.80 mf.

To study the temperature dependences of the behavior of metals and alloys over a temperature range from 20 to 300°C, a special apparatus for high-temperature irradiation was designed and built. This apparatus is a high-temperature irradiation chamber in which irradiation by an indium-110 source is accomplished with an angle of 130° between opposite faces and unilateral flattening of control samples. (N.O.G.)

**6449 IMPROVEMENTS IN OR RELATING TO METHODS OF INSPECTING WIRE.** Sayers, Joan Francis. (to United Kingdom Atomic Energy Authority). British Patent 1,699,301, Nov. 29, 1967. Filed Jan. 14, 1966.

An improved method for inspecting drawn wire for metallic projections is described. Wire is passed axially through a hollow metal cylinder with a potential difference maintained between the wire and the cylinder. The wire is illuminated by a light source for the purpose of detecting any metallic projections. The light source is connected to a circuit which is sufficient for a corona discharge in the presence of a projection. A method is described for controlling the corona discharge. (P.S.)

## Protective Structures

*Refer also to abstract 7340.*

**6450 (NP-1718) NUMERICAL ANALYSIS OF PLANE STRUCTURE-MEDIUM INTERACTION IN ELASTIC-PERFECTLY PLASTIC MEDIA.** Civil Engineering Studies Structural Research Series No. 307. Chang, G. C.; Ang, A. H. S. Illinois Univ., Urbana, June 1966. 167p.

An analytical method is developed for determining the effects of stress and strain in the neighborhood of a lined tunnel or tunnel-like cylindrical cavity embedded in an elastic or elastoplastic perfectly plastic half-space while engulfed by a blast wave traveling in a direction perpendicular to the axis of the tunnel. Data were obtained on the transmission of blast waves through the soil cover. In addition to variations in material properties, the effects of depth of burial, partial loading on the surface of the half space, and the effects of the presence of a lining are investigated. A computer program written in FORTRAN for an IBM-7094. The data obtained are useful in the design of underground protective structures. (P.S.)

**6451 RADIATION LEAK TESTS ON THE JOINTS OF A STRUCTURE.** Tsumi, Tetsuo; Aoki, Eizo. (Tokai University, Muroran Heavy Ind. Co., Ltd., Japan). *Chemistry Ind. Japan*, 19: No. 8, 26-31(Pub. 1967). (In Japanese).

Experimental investigations were made on radiation leaks through the joints of a structure, and the results of the tests are described. The tests were carried out with a <sup>60</sup>Co source of 100 Ci with gamma-ray energy 1.32 MeV on non-irradiated and irradiated joints of lead and lead with iron lining. The results show that the radiation leak through the joints of a structure composed with a slight swarming, in the scale of joints studied, there is no need to consider rigorously the problem of swarming. Values of radiation leaks and their spatial distributions agree relatively well with those calculated on the basis of the diffusion theory. It is necessary to make systematic experiments and theoretical analyses by varying the shape of the radiation source, the energy of the shielding material and the radiation itself. (USA of Japan)

## Radioactive Material Handling

*Refer also to abstracts 6311 and 6312.*

**6452 DECONTAMINATION OF PRODUCTS FROM CHEMO-NUCLEAR REACTIONS.** Zepflich, Charles. *Franklin Inst.*, New York, Researcher Polytechnic Inst., 1966. 12pp. Thesis.

Investigations have been carried out to determine the extent of contamination and methods of decontamination of products from chemonuclear reactions. The products examined in this study were sodium cyanide, sodium cyanide, sodium cyanide, and sodium cyanide. The work was divided into three phases: decontamination of the 5% of the fusion fragments that escape the glass fibers and investigation of several specific techniques to elucidate their behavior relative to the bulk activity; examination of several methods for decontamination of carbonaceous polymer; alternative precipitation-dissolution techniques for the decontamination of sodium cyanide; and the decontamination of sodium cyanide by evaporation. Evaporation of <sup>137</sup>Cs from sodium cyanide gave decontamination factors of 10<sup>3</sup> to 10<sup>4</sup> at boil-up-rates of 300 to 400 lbs/hr-°F. It had been indicated that one could only expect values of 10<sup>2</sup> for the evaporator alone at such rates whereas 5 x 10<sup>4</sup> was obtained in this work. Additional experiments with mixtures of fusion products indicated 1, Xc, and possibly Tc were volatile under the conditions used. Decontamination factors of 10<sup>3</sup> to 10<sup>4</sup> were obtained for Xc and Tc. In addition to 1 and Xc were present while absorption and gamma spectrometric analysis showed we were dealing with a weak beta emitter that gave off only a small amount of gamma rays at 0.070, 0.095, and 0.335 MeV. Identification was not possible because of the small amount of activity present. (Diseer. Abstr.)

**6453 DEVICE FOR DISCHARGING A RADIOACTIVE WASTE GAS.** Yamaguchi, Masami. (to Tokyo Shibura Elec. Co., Ltd.). Japanese Patent 1946-20760, Dec. 3, 1964. Filed Oct. 25, 1963. A device is described for disposal of radioactive waste gas after several stages of dilution. The gas is discharged in small amounts, with the discharge rate adjustable, which leads to a reduction in the economy. It consists of a device for absorbing the waste gas in a carbon tetrachloride solution; a device for heat-condensing the resulting solution to release the radioactive gas; a device for again absorbing the released gas in a carbon tetrachloride solution; a waste discharge device, in which a small amount of the waste-gas contained solution is taken in and heated to condense it and release the radioactive gas, and finally the released gas is discharged to the atmosphere after dilution with air to below the level of the maximum permissible concentration. The device is also provided. (USA of Japan)

inhalation exposure to  $^{222}\text{Rn}$  and daughter products from the accumulated  $^{210}\text{Pb}$  body burden are given. The effect of the violation of the assumption that there was no significant  $^{210}\text{Pb}$  contributions from sources other than  $^{222}\text{Rn}$  daughters on the model, and the results are considered. (UK)

**8681** DERIVATION OF WORKING LIMITS FOR CONTINUOUS RELEASE RATES OF  $^{125}\text{I}$  TO ATMOSPHERE. Bryant, Pamela M. (United Kingdom Atomic Energy Authority, Harwell, Eng.). *Health Phys.*; 19: 611-16(Nov 1970).

Working limits for continuous release rates of  $^{125}\text{I}$  to atmosphere are derived by the specific activity method and, with appropriate modification, by the direct foliar contamination method used for  $^{131}\text{I}$  involving the grass-cow-milk-infant critical pathway. Limitations of the methods are discussed. It is concluded that derived working limits calculated by the specific activity method are appropriate for design purposes in connection with planned continuous release rates of  $^{125}\text{I}$ . As an illustrative example, the derived working limit is 270 mCi/day for a chimney of effective height 60 m, assumed to be the only source of  $^{125}\text{I}$  in the area and situated at 400 to 500 m from the nearest pasture. In some environmental situations, e.g., near the sea, the derived working limit might be up to ten times greater than this due to a high average stable iodine ( $^{127}\text{I}$ ) concentration in the atmosphere. (auth) (UK)

**8682** DOSIMETRY OF PROTON RADIATION FIELDS IN SPACE WITH NUCLEAR EMULSIONS. Schaefer, H. J. (Naval Aerospace Medical Inst., Pensacola, Fla.); Sullivan, J. J.; Richmond, R. G. *Health Phys.*; 19: 663-70(Nov 1970).

The bulk of the astronauts' radiation exposure in space is due to trapped protons in the South Atlantic Anomaly or, on a deep space mission, in the radiation belt itself. The energy spectrum of the proton flux in both cases is a broad continuum from zero to several hundred MeV, with low energy protons and protons ending in tissue carrying a substantial fraction of the total dose. As demonstrated with the emulsion data of the Earth-orbital mission Apollo VII, a method using grain counting of tracks traversing the emulsion combined with a count of those ending in it (zero energy) provides sustained accuracy over the entire energy range. Within certain limits, the counts of ending protons at various locations in the space vehicle are proportional to the corresponding total doses. Highly structured directional patterns that are generally characteristic for the low energy particles were analyzed in detail from the unmanned Apollo VI mission during which a total proton dose of 1.56 rad was observed within the vehicle. The fact that low energy protons with their comparatively high LET contribute substantially to the total dose is reflected in large microdosimetric fluctuations of the absorbed energy in tissue, with Bragg peaks of ending tracks occurring only in a few percent of the total cell population even at dose levels of 50 to 100 rad. (auth) (UK)

**8683** COMPUTER CALCULATION OF RADIATION ATTENUATION AROUND A MEDICAL CURIETRON-TYPE RADIOACTIVE PROBE. Costa, A.; Dutreix, Andree (Institut Gustave Roussy, Villejuif, France). *J. Biol. Med. Nucl.*; 5: No. 20, 22-6(May-Jun 1970). (In French).

The Curitherapy Service of the Gustave Roussy Institute uses an apparatus commercialized under the name Curietron, by the A.G.S. Company. This unit allows permanent storage of miniaturized  $^{137}\text{Cs}$  sources and their automatic transfer by remote control in a radium holder. The design of the Curietron and the choice of  $^{137}\text{Cs}$  comply with the IAEA rules on the safety and protection of hospital staff. A programme of dose calculation for a computer, in FORTRAN IV, was established to determine the form of the isodose around a rectilinear probe, taking into account the presence of metal bearings between the grains of  $^{137}\text{Cs}$ . (France)

**8684** COMPUTER DOSIMETRY OF THE RADIOIRIDIUM CASTINGS. Sinistrero, G.; Ragni, G.; Benedetto, A. (Turin Univ.). *J. Radiol. Electrol. Med. Nucl.*; 51: 399-402(Jun-Jul 1970). (In French).

The castings used were 0.5 and 1 cm thick and rectangular shaped; the isodoses were studied in two planes: a plane parallel to the longest side and a plane parallel to the shortest side. Percentage depth dose and isodose curves were calculated at quarter millimeter intervals; along each isodose curve values were calculated every millimeter. It appeared that under such conditions the superficial dose tended to be small. It was thus possible to use spheres of higher activities (between 2 and 3 mCi/sphere). The wires were first used for the castings and then for implantations when their activities had decreased. These castings were used to treat basal cell epitheliomas, which were not very thick but were very extensive (more than 4 cm in diameter), intermediate metaplastic epitheliomas, and also a few different types

squamous cell epitheliomas located in regions with curved or irregular surfaces covering bony or cartilaginous planes (falx nasi, auricle, etc.). (France)

**8685** DOSE AND LET DISTRIBUTIONS IN SMALL-ANIMAL SIZED CYLINDERS FOR A FISSION NEUTRON SPECTRUM. Willhoit, Donald G.; Jones, Troyce D. (Oak Ridge National Lab., Tenn.). *Radiat. Res.*; 44: 263-72(Nov 1970).

Monte Carlo sampling techniques were used to produce neutron histories in tissue geometries corresponding in size to the mouse, rat, and guinea pig. Dose and LET distributions were evaluated for 60,000 to 80,000 normally incident neutrons having an energy distribution corresponding to that of the Health Physics Research Reactor (HPRR) spectrum. For these geometries, 99% of the dose delivered by recoil nuclei was from elastic scattering with H, O, C, and N. The dose averaged over the volume of each animal was 94, 84, and 78% of kerma for tissue for free space ( $2.2 \times 10^{-7}$  erg  $\text{g}^{-1}$  neutron $^{-1}$   $\text{cm}^2$ ) for the mouse, rat, and guinea pig, respectively. For these geometries, unilateral exposure results in maximum to minimum dose ratios greater than 1.30, which according to the ICRU recommendations are classified as nonuniform irradiation condition. These data indicate that rotation of the animals in the field would result in a uniform (variation less than 15%) irradiation condition. The distribution of dose as a function of LET was not markedly dependent on depth in the animal geometries. The dose median LET was estimated to be about 50 keV/ $\mu$  for these geometries for the HPRR neutron spectrum. (auth)

**8686** GAMMA-RAY DOSE DISTRIBUTIONS IN EXTERNALLY IRRADIATED CYLINDERS. Hubbard, Lincoln B. (Oak Ridge National Lab., Tenn. Knoxville Coll., Tenn.). *Radiat. Res.*; 44: 4-12 (Oct 1970).

An approximate model was presented for the irradiation of uniform cylinders by external, broad-beam  $\gamma$  rays. In the model, the point doses for unilateral and bilateral irradiations were simple expressions of elementary functions. The range from maximum to minimum dose values was shown to be about half as great for bilateral irradiation as compared with unilateral irradiation. Thus, if the unilateral irradiation was considered nonuniform, then the bilateral irradiation was at best moderately uniform. The dose distributions for unilateral and bilateral irradiations have very different properties. These distributions were discussed, and their effects on experimental design were noted. The surface average, volume average, and midline dose were compared for these irradiations. (auth)

**8687** TECHNIQUES FOR MEASURING GAMMA RADIOACTIVITY IN THE HUMAN BODY. Clemente, Gianfelice (CNEN, Rome). *G. Fis. Sanit. Prot. Radiaz.*; 12: 200-13(Jul-Sep 1968). (In Italian). (RT PROF-(69)6).

All the principal geometries used for external scintillation detector measurements of  $\gamma$  activity in the human body were examined critically. For all geometries the principal advantages and disadvantages were analyzed as a function of the type of measurement made. Applications of partial-body and whole-body scanning and other external measurements for radiation protection programs and medical studies are considered. The best working conditions are outlined. (tr-auth)

### Radiation Protection

Refer also to abstracts 8755, 8793, and 9540.

**8688** (SZS-6/70) METHODS OF APPLICATION OF GAMMA EMITTERS IN CONTACT THERAPY WITH REGARD TO RADIATION PROTECTION. THE NEED FOR MEASURING THE RADIATION BURDEN OF THE BLADDER AND RECTUM WITH THE "GAMMA METER" IN GYNECOLOGICAL CONTACT THERAPY TO AVOID RADIATION DAMAGE. METHODS OF APPLICATION OF GAMMA EMITTERS, ESPECIALLY RADIO-GOLD-SEEDS IN CONTACT THERAPY WITH SPECIAL REGARD TO RADIATION PROTECTION. THE SITUATION AND THE TENDENCY OF CONTACT THERAPY IN THE TREATMENT OF GYNECOLOGIC CARCINOMAS. Moebius, W.; Glaser, F. H.; Dietze, R.; Grossmann, H. (Staatliches Zentralfür Strahlenschutz, Berlin (East Germany)). Mar 1970. 35p. (In German). Dep. NTS (U. S. Sales Only).

Separate abstracts were prepared for the four sections of this report. (E.R.B.)

For abstracts of individual sections see: 8679, 8689, 8729, and 8739.

**8689** (SZS-6/70, pp 19-27) METHODS OF APPLICATION OF GAMMA EMITTERS, ESPECIALLY RADIO-GOLD-SEEDS IN CONTACT THERAPY WITH SPECIAL REGARD TO RADIATION PROTECTION.

**29171** POLYMERIC CHROMIUM(III) COMPLEXES RESULTING FROM THE NEUTRON IRRADIATION OF CRYSTALLINE POTASSIUM CHROMATE. II. EFFECT OF PERIOD OF IRRADIATION ON THE SPECIFIC ACTIVITY AND DECOMPOSITION OF THE MANNER IN WHICH MONO- AND POLYNUCLEAR RECOIL PRODUCTS ARE FORMED. Guetlich, P.; Froelich, K.; Odar, S. (Technische Hochschule, Darmstadt, Ger.). *J. Inorg. Nucl. Chem.* 33: 621-9 (Mar 1971). (In German).

The  $^{51}\text{Cr}$  activity distribution and the specific activity of the various mono- and polynuclear recoil products of chromium(III) produced by thermal neutron capture in crystalline  $\text{K}_2\text{CrO}_4$  were investigated as a function of neutron dose. For all neutron doses under investigation the highest enrichment factors for  $^{51}\text{Cr}$  were observed in the fraction of the (presumably) trimeric complex. The enrichment factors for all cationic fractions decreased with increasing neutron dose. A mechanism for the formation of the mono- and polynuclear recoil products as a consequence of the  $(\alpha, \gamma)$  reaction in crystalline  $\text{K}_2\text{CrO}_4$  is discussed. (auth) (UK)

## Radiochemistry

Refer also to abstract 29169

**29172** THERMAL ANALYSIS OF PROMETHIUM OXALATE. McNeilly, C. E.; Roberts, F. P. (Battelle-Memorial Inst., Richland, Wash.). Contract AT(45-1)-1830. pp 727-38 of *Thermal Analysis*, Vol. 2. /Schwenker, Robert F. Jr. (ed.). New York; Academic Press, Inc. (1969).

From second international conference on thermal analysis; Worcester, Mass. (18 Aug 1968). See CONF-680851.

Differential thermal analysis (DTA) and thermogravimetric analysis (TGA) were used to study the decomposition of promethium oxalate. TGA results were quite similar to those for samarium oxalate, as expected; however, the DTA results were almost entirely different, with respect to both types and temperatures of reaction. The starting material was shown by TGA to correspond to the formula  $\text{Pm}_2(\text{C}_2\text{O}_4)_3 \cdot 3 \text{H}_2\text{O}$ . Differential thermal analysis, performed over a one-month period, showed a marked change taking place in the material, presumably due to radiolytic decay of  $^{147}\text{Pm}$  to  $^{147}\text{Sm} + \beta$ . Radiation damage due to the beta particles results in the formation of a material with the apparent formula  $\text{Pm}_2\text{O}_2\text{CO}_3 \cdot 3 \text{H}_2\text{O}$  as determined by TGA. (auth)

**29173** CERTIFICATES OF RADIOACTIVITY STANDARDS. Garfinkel, S. B.; Baerg, A. P.; Zigman, P. E. Washington, D. C.; National Academy of Sciences, National Research Council (1966). 11p. Available from National Academy of Sciences, National Research Council, Washington, D. C.

Features of a suitably informative and precise certificate for radioactivity standards are described. Information that should be on the certificate includes: parent nuclide, reference time and date, activity per gram of solution, daughter activity, chemical composition of solution, method of standardization, listing of known radioactive impurities, type of irradiation, chemical and isotopic composition of the target, method and date of chemical purification, estimates of errors in standardization, composition of the stated overall uncertainty, possible systematic errors, and decay characteristics. (M.C.G.)

**29174** USERS' GUIDES FOR RADIOACTIVITY STANDARDS. Kahn, B.; Choppin, G. R.; Taylor, J. G. V. Washington, D. C.; National Academy of Sciences, National Research Council (1967). 43p. Available from National Academy of Sciences, National Research Council, Washington, D. C.

Short guides to chemical and counting problems for common standards are given. The guides are prepared separately for these elements: Na, Mg, P, S, Cl, K, Ca, Cr, Fe, Co, Zn, Ga, As, Br, Kr, Sr, Y, Zr, Nb, Ru, Rh, Ag, Sn, Sb, Te, I, Cs, Ba, rare earths, Au, Hg, Tl, Po, Rn, Ra, Th, U, Np, and Am. (M.C.G.)

## Separation Processes

Refer also to abstracts 28979, 28999-29001, 29014, 29074, 29075, 29165, 29317, 29393, and 29413.

**29175** (BARC-509) SYNTHESIS OF PHYLLITIC MINERALS: THEIR UTILISATION IN RADIOACTIVE WASTE TREATMENT. II. FROM MIXED GELS OF SILICA AND ALUMINA IN PRESENCE OF MAGNESIUM ACETATE AND SODIUM ACETATE. Brat, Satya; Balu, K. (Bhabha Atomic Research Centre, Bombay (India)). 1970. 23p. Dep. NTIS (U. S. Sales Only).

Syntheses of phyllitic silicate minerals were carried out using silica gel and mixed gels of silica and alumina in the presence of magnesium acetate and sodium acetate at atmospheric pressure

and at a temperature of approximately 100°C. The products obtained were subjected to x-ray evaluations and found to be of an interstratified group of the non-saponifiable family. The suitability of the synthetic products for the decontamination of radioactive wastes with  $\text{CaCl}_2 + ^{137}\text{Cs}$  was studied and the products obtained with the initial ingredients  $\text{SiO}_2/\text{Al}_2\text{O}_3$  molecular ratio varying between 2.2 to 2.9 were found to be quite suitable for removal of radioactive cesium from liquid wastes. With the increase in initial ingredients  $\text{SiO}_2/\text{Al}_2\text{O}_3$  molecular ratio beyond 2.9, a decrease in sorption capacity for the removal of cesium ion was observed. (auth)

**29176** (BARC-516) RECOVERY OF PROMETHIUM FROM FISSION PRODUCT WASTE. PART III. USE OF MANGANESE DIOXIDE COLUMN ADSORPTION FOLLOWED BY ANION EXCHANGE ELUTION. Shukla, J. P.; Chandrasekharan, E. S.; Rangan, K. (Bhabha Atomic Research Centre, Bombay (India)). 1970. 17p. Dep. NTIS (U. S. Sales Only).

Experiments were carried out to evolve a simple procedure for recovery of  $^{147}\text{Pm}$  from nuclear fuel reprocessing wastes. Preliminary purification of Pm from associated fission products is readily accomplished by a  $\text{MnO}_2$  column. Final purification of the Pm fraction from other rare earth constituents was achieved by an anion exchanger using 20% 7M  $\text{HNO}_3$ -80%  $\text{CH}_3\text{OH}$  (%) mixture as the eluant. (auth)

**29177** (CEA-R-4090) SEPARATION AND RECOVERY OF PERMANENT GASES BY PREPARATIVE CHROMATOGRAPHY. Dupuis, Marie-Claire; Lutz, Michel; Massimino, Daniel (Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France), Centre d'Etudes). Jan 1971. 23p. (In French). Dep. NTIS (U. S. Sales Only).

The study and manufacture of a preparative gas chromatograph for the separation and quantitative recovery of the components of a given gas mixture are described. The factors influencing the separation and purity of each component prepared in this way are demonstrated and may be chosen without restriction as a function of the various gas mixtures to be treated. The main applications of the process are: treatment of an Ar mixture containing Kr and Xe traces, treatment of Ar contaminated by tritium, and purification of carbon dioxide labeled with  $^{14}\text{C}$ . (auth)

**29178** (CEA-R-4102) TOTAL ELEMENTARY SEPARATION OF RARE EARTHS ON CATION EXCHANGE RESINS. Gusmini, Simone; Dubuquoy, Claude (Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France), Centre d'Etudes). Jan 1971. 25p. (In French). Dep. NTIS (U. S. Sales Only).

Total separation of the rare earths with carrier on a cation resin column was investigated by elution with ammonium lactate and  $\alpha$ -hydroxyisobutyrate. The experimental conditions applicable as a function of the analytical needs and time limits were defined. A lactate concentration gradient is more suitable for fission product rare earths, while a better separation of the yttrium group is obtained with a simultaneous pH and  $\alpha$ -hydroxyisobutyrate concentration gradient. The whole rare earth group and yttrium can be treated with  $\alpha$ -hydroxyisobutyrate. Technical difficulties involved in the elution that condition the quality of the separation are mentioned. The chemical separation and purification of the rare earth group is discussed. (auth)

**29179** (DOCKET-50201-69) WEST VALLEY REPROCESSING PLANT. Environmental Report No. 9, July-December 1970. (Nuclear Fuel Services, Inc., West Valley, N. Y.). Mar 1971. 12p. Dep. NTIS.

Gross radioactivity and concentrations of  $^{90}\text{Sr}$ , T,  $^{131}\text{I}$  in samples of air, fallout, milk, water, and silt were measured. Airborne particulate activity continued to be less than pre-operational levels. Data are given in graphs. (M.C.G.)

**29180** (DOCKET-50201-70) WEST VALLEY REPROCESSING PLANT. Quarterly Report, January 1-March 31, 1971. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 20 Apr 1971. 9p. Dep. NTIS.

Reports on environmental monitoring, low-level liquid effluents, stack effluents, and surveillance tests are reported. Data are given on amounts of gross  $\alpha$ , gross  $\beta$ , tritium,  $^{90}\text{Sr}$ ,  $^{129}\text{I}$ ,  $^{131}\text{I}$ , and  $^{85}\text{Kr}$ . (M.C.G.)

**29181** (GEPP-85) PRODUCTION OF BULK QUANTITIES OF ULTRAPURE ERBIUM. Parsons, N. H. (General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.). 10 Mar 1971. Contract AT(29-2)-656. 19p. Dep. NTIS.

A vacuum distillation operation is described for the reprocessing of erbium. This distillation method is capable of increasing the purity of commercially available erbium up to 99.96 wt % by mass spectrographic analysis. (auth)



**13068** CHEMICAL CONSEQUENCES OF THE NUCLEAR REACTIONS  $^{58}\text{Fe}(n,\gamma)^{59}\text{Fe}$  AND  $^{57}\text{Co}(\text{EC})^{57}\text{Fe}$  IN SOLUBLE PRUSSIAN BLUE. Fenger, J. (Cambridge Univ., Eng.); Maddock, A. G.; Sektorska, K. E. J. Chem. Soc., A; No. 19, 3255-61(1970).

$\text{KFe}(\text{Fe}(\text{CN})_6)_3 \cdot \text{H}_2\text{O}$  was prepared with  $^{58}\text{Fe}$  in either the cation or the complex, and both samples were neutron-irradiated and analyzed for free and complexed  $^{59}\text{Fe}$ . Parallel experiments were performed on  $\text{K}_4[\text{Fe}(\text{CN})_6]_3 \cdot 3\text{H}_2\text{O}$ . In Prussian Blue the retention in the hexacyano-complex is ca. 5% and can be increased only slightly by annealing, whereas it is ca. 20% in the simple hexacyanide and increases to 30% on annealing. It is suggested that the low retention in Prussian Blue is due to competition between recoil  $^{59}\text{Fe}$  and inactive  $\text{Fe}^{3+}$  for re-formation of the complex. Moessbauer experiments were performed on  $\text{KFe}(\text{Fe}(\text{CN})_6)_3 \cdot \text{H}_2\text{O}$  doped with  $^{57}\text{Co}$  as cation or in the complex. The spectra showed that  $^{57}\text{Fe}$  formed by the  $^{57}\text{Co}(\text{EC})^{57}\text{Fe}$  process in the cationic  $^{57}\text{Co}$  does not enter the complex.  $^{57}\text{Fe}$  formed from  $^{57}\text{Co}(\text{CN})_6^-$  however appears principally in a different complex species, probably losing a  $\text{CN}^-$  ligand to form a pentacyanide. (auth) (UK)

**13069** DIRECT LABELLING REACTIONS OF RECOILING  $^{35}\text{S}$  AND  $^{32}\text{P}$  ATOMS. Turcanu, C. N. (Inst. for Atomic Physics, Bucharest). Radiochim. Radioanal. Lett.; 5: 287-91(31 Dec 1970).

Direct labeling reactions of carrier-free  $^{35}\text{S}$  and  $^{32}\text{P}$  formed in anhydrous  $\text{AlCl}_3$  and  $\text{FeCl}_3$  by (n, p) and (n,  $\alpha$ ) nuclear reactions, respectively, with  $\text{S}_2\text{Cl}_2$ ,  $\text{SCl}_2$ ,  $\text{SOCl}_2$ ,  $\text{SO}_2\text{Cl}_2$ ,  $\text{PSCl}_3$ ,  $\text{POCl}_3$ , and  $\text{PCl}_3$ , were studied. The radiosphulphur and the radiophosphorus atoms present in  $\text{AlCl}_3$  and  $\text{FeCl}_3$  targets show some differences in these reactions. The study presents a new labeling method for some chlorine-sulfur compounds. (auth)

**13070** CHEMICAL BEHAVIOR OF HOT ATOMS OF  $^{14}\text{C}$  AND  $^{15}\text{N}$  IN SEVERAL SOLID INORGANIC COMPOUNDS. I. METALLIC NITRIDES. Kuhry, J. G. (Centre de Recherches Nucleaires, Strasbourg). Radiochim. Acta; 14: 122-6(Nov 1970). (In French).

$^{14}\text{C}$  produced by  $^{14}\text{N}(n,p)$  is found in metallic nitrides as carbide  $^{14}\text{CMe}$ , cyanide  $^{14}\text{CN}^-$ , cyanamide  $^{14}\text{CN}_2^-$ , and isocyanide  $\text{O}^{14}\text{CN}^-$ . The last two species result from secondary processes activated by the radiation flux involving  $^{14}\text{CN}^-$ . The carbide and the cyanide are created in replacement collisions of  $^{14}\text{C}$  with nitrogen and metal atoms, but these forms become stabilized only after long irradiation times. The chemical forms of  $^{15}\text{N}$  formed in the  $^{14}\text{N}(n,2n)$  process in the nitrides are  $^{15}\text{NMe}$ (nitride) and  $^{15}\text{NN}$ (molecular nitrogen). The behaviour of  $^{15}\text{N}$  suggests a low recoil energy of the hot atom. (auth)

**13071** CHEMICAL FORMS OF  $^{37}\text{S}$  RESULTING FROM NEUTRON IRRADIATION OF  $\text{LiCl}$  IN SOLUTION IN METHANOL. Meyer, J. P. (Centre de Recherches Nucleaires, Strasbourg). Radiochim. Acta; 14: 154-6(Nov 1970). (In French).

The chemical forms of  $^{37}\text{S}$  produced by the  $^{37}\text{Cl}(n,p)$  reaction in methanolic solutions of lithium chloride were determined. 60% of the activity was found as monoatomic neutral sulfur, the residual activity being distributed among sulfate (16%), sulfite (10%), and sulfide (14%). In the presence of water, the sulfur atoms are oxidized to sulfate. The formation of  $\text{S}^+$  ions leading to sulfate and of another species giving sulfate in aqueous solution and sulfite with a reducing agent are considered. (auth)

**13072** CHEMICAL BEHAVIOR OF HOT ATOMS OF  $^{14}\text{C}$  AND  $^{15}\text{N}$  IN SEVERAL SOLID INORGANIC COMPOUNDS. II. ALKALI CYANIDES. Kuhry, J. G. (Centre de Recherches Nucleaires, Strasbourg). Radiochim. Acta; 14: 127-30(Nov 1970). (In French).

The chemical forms of  $^{15}\text{N}$  in sodium and potassium cyanides are cyanide  $\text{C}^{15}\text{N}^-$ , cyanamide  $^{15}\text{NCN}^-$ , and molecular nitrogen  $^{15}\text{NN}$ . These compounds result from reactions of  $^{15}\text{N}$  with the fragments of CN ligands and from an addition process on  $\text{CN}^-$ . The pile irradiation of the cyanides yields the following  $^{14}\text{C}$  compounds:  $\text{CN}^-$ ,  $\text{CC}$ , elementary C, and  $\text{CN}_2$ . The formation of these species is explained by similar processes and by secondary thermal activated reactions with radiolytic decomposition products of the targets. (auth)

## Radiochemistry

Refer also to abstracts 13068 and 13374.

**13073** COULOMB FRAGMENTATION FOLLOWING THE DECAY OF  $^{131}\text{I}$ . Langhoff, H. (Franklin Inst., Swarthmore, Pa.). Phys. Rev., A; 3: 1-5(Jan 1971).

The fragmentation of several diatomic iodine compounds as a consequence of  $\beta^-$  decay was investigated. Information about the velocity spectra of the  $^{131}\text{Xe}$  fragments was obtained by analyzing the profiles of their  $\gamma$  lines using the nuclear resonance fluores-

cence technique. Experimental cross sections for resonance fluorescence obtained with gaseous  $^{131}\text{I}$  sources were in satisfactory agreement with predictions using a simple model for the fragmentation process. (auth)

**13074** NUCLEAR GAMMA-RESONANCE STUDY OF PRODUCTS OF  $\beta$ -DECAY OF  $^{121}\text{mSn}$ . Lebedev, R. A.; Babeshkin, A. M.; Nesmeyanov, An. N.; Popov, E. A. Vestn. Mosk. Univ., Ser. II. Khim.; 11: 627-8(Sep-Oct 1970). (In Russian).

The products of  $\beta$  decay of  $^{121}\text{mSn}$  in solid inorganic tin compounds have been studied by nuclear gamma-resonance. Conclusions concerning the state of electron shells of daughter antimony atoms were drawn from the isomeric shifts. (auth)

**13075** ON THE MECHANISM OF FORMATION OF ANOMALOUS CHARGE STATES OF IRON AFTER  $^{57}\text{Co}$  ELECTRON CAPTURE IN  $\text{Co}$  COMPLEXES. Friedt, J. M.; Baggio-Saitovitch, E.; Danon, J. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro). Chem. Phys. Lett.; 7: 603-5(15 Dec 1970).

The Moessbauer absorption spectra of ferric acetylacetonate irradiated with electrons, are similar to the emission spectra after electron capture in  $^{57}\text{Co}$ -labeled  $\text{Co}(\text{AcAc})_3$ . This result indicates that an autoradiolysis mechanism is responsible in molecular compounds for the stabilization of the anomalous iron charge states. (auth)

## Separation Processes

Refer also to abstracts 12923, 12933-12935, 12947, 12999, 13039, 13043, 13625, and 13626.

**13076** (AECL-2503) REVIEW OF HEAVY WATER PRODUCTION PROCESSES. Rae, H. K. (Atomic Energy of Canada Ltd., Chalk River (Ontario)). Aug 1969. 21p. (CONF-651019-1; CRL-91). Dep. NTIS (U. S. Sales Only). AECL \$1.00.

From 15th Canadian Chemical Engineering Conference, Quebec City, Canada.

The rapid growth of Canadian heavy-water-power-reactor capacity has renewed interest in  $\text{D}_2\text{O}$  production. The economic source for large quantities of  $\text{D}_2\text{O}$  today is considered to be water. Processes include hydrogen distillation (where pure hydrogen streams are available for stripping) and several chemical exchange reactions. Chemical exchange of deuterium and hydrogen between two compounds leads to the preferential accumulation of the deuterium in one. Choosing a gas and a liquid, efficient countercurrent multistage operation is possible giving large enrichment factors in a single tower. To obtain reflux the deuterium transfer must be reversed outside the tower using chemical conversion or another exchange tower operating at a higher temperature. Chemical exchange between water and hydrogen sulfide has been used at the USAEC Savannah River plant for 16 years and is the process chosen for the three large heavy water plants being built in Canada. Ammonia-hydrogen exchange and amine-hydrogen exchange are other processes. (auth)

**13077** (ANL-7755) CHEMICAL ENGINEERING DIVISION FUEL CYCLE TECHNOLOGY QUARTERLY REPORT, JULY-SEPTEMBER 1970. Webster, D. S.; Jonke, A. A.; Bernstein, G. J.; Levitz, N. M.; Pierce, R. D.; Steindler, M. J.; Vogel, R. C. (Argonne National Lab., Ill.). Oct 1970. Contract W-31-109-eng-38. 55p. Dep. NTIS.

Work has been done during the period July through September, 1970 on fuel cycle technology projects in the following areas: (1) development of a head-end process for LMFBR fuels, consisting of removal of stainless steel cladding in a zinc bath and subsequent reduction of the fuel oxide to metal, (2) laboratory-scale and pilot-scale work to develop a fluid-bed process for the conversion of uranium nitrate and plutonium nitrate solutions to an oxide form suitable for the fabrication of fuel shapes for LMFBR fuel, (3) development of x-ray fluorescence spectrometry as an in-line analytical method for determining the Pu/U ratio of oxide fuels during fabrication, and (4) development of a centrifugal contractor of small diameter and large length-to-diameter ratio for the plutonium isolation steps in the solvent extraction of LMFBR fuels. (auth)

**13078** (DOCKET-50201-60) WEST VALLEY REPROCESSING PLANT. License No. CSF-1. Technical Specifications Change No. 13. (Division of Materials [and] Licensing (AEC), Washington, D. C.). 26 Jan 1971. 11p. Dep. NTIS.

Revision to Section 5.1 of the Technical Specifications (Effluent and Environmental Monitoring) is presented. It was concluded that the change does not present significant safety hazards considerations. (M.C.G.)

**13079** (DOCKET-50201-61) WEST VALLEY REPROCESSING PLANT. Quarterly Report, October 1-December 31, 1970.

(Nuclear Fuel Services, Inc., West Valley, N. Y.). 21 Jan 1971. 3p. Dep. NTIS.

Environmental monitoring, low level liquid effluents, stack effluents, and periodic testing are reported. (M.C.G.)

13080 (DOCKET-50201-62) WEST VALLEY REPROCESSING PLANT. Environmental Sample Data. (Division of Materials and Licensing (AEC), Washington, D. C.). 31 Aug 1970. 122p. Dep. NTIS.

Data on radiation monitoring for the first three quarters of 1969 are presented. Data for grass  $\alpha$ ,  $\beta$ , and  $\gamma$  in plants, soils, Bummilk Creek, Cattaraugus Creek, drinking water, and hold-up and burial lagoons are given. Tritium data are given for drinking water and tritium and  $^{90}\text{Sr}$  data are included for the creeks and lagoons. (M.C.G.)

13081 (NP-18577) INVESTIGATION OF REPROCESSING INPUT MEASUREMENT USING TRACER TECHNIQUE. Bokelung, H. (European Company for the Chemical Processing of Irradiated Fuels, Mol (Belgium)). Oct 1970. 31p. (ETR-266). Dep. NTIS (U. S. Sales Only).

The quantities of uranium and/or plutonium fed into a reprocessing plant are currently found by multiplying the dissolver solution batch size (volume or weight) by the concentrations of these elements as found by analyses of samples taken from the batch. An independent verification of the volume measurement using tracer techniques is proposed. The basic concept is that of isotope dilution mass spectrometry applied to the dissolver solution into which, at the outset, a known amount of  $^7\text{Li}$  is mixed as tracer. Samples of the solution are spiked with  $^6\text{Li}$ ,  $^{23}\text{U}$ , and  $^{240}\text{Pu}$  for mass spectrometry. The measured ratio  $^6\text{Li}/^7\text{Li}$  verifies the batch size (volume or weight), whereas the concentration ratios  $^6\text{Li}/\text{U}$  and  $^6\text{Li}/\text{Pu}$  give the quantities of these fissile materials, (kg), in the batch. The solution of the  $^6\text{Li}$  spike is calibrated against a dilution of the  $^7\text{Li}$  solution used to trace the dissolver solution; the batch size can thus be found merely as a ratio of two  $^6\text{Li}/^7\text{Li}$  ratios, thereby circumventing the complicated absolute standardization of the  $^6\text{Li}$  additive. The assets of the Li concept are discussed in terms of process compatibility, analytical sensitivity, precision, and price. The chemical separation of Li from the dissolver solution prior to its determination by mass spectrometry is described. Results on simulated input solutions show the capability of the system under laboratory conditions to be about 0.3% relative standard deviation. (auth)

13082 (RLC-2225-T-11-1) DYNAMICS OF SOLVENT EXTRACTION SYSTEMS. III. Progress Report No. 3, October 1, 1969-September 30, 1970. Baab, Albert L.; Garbd, Kermit L. (Washington Univ., Seattle, Dept. of Nuclear Engineering). Oct 1970. Contract AT(45-1)-2225. 83p. Dep. NTIS.

Controlled cycling operation of a pulsed, sieve-plate extraction column was studied. The significance of design variables and operating variables on extraction efficiency and column throughput was established. Random variations in organic phase holdup were measured and analyzed. A computer model was developed for describing typical dynamic operation of extraction systems. (M.C.G.)

13083 (WHAN-FR-33) APPLICATION OF AQUEOUS TECHNOLOGY TO LMFBR SEPARATIONS PROCESSES. PROGRAM PLAN FOR TASK T-2: FUEL DISSOLUTION CHARACTERISTICS. Lerch, R. E. (WADCO Corp., Richland, Wash.). Dec 1970. Contract AT(45-1)-2170. 38p. Dep. NTIS.

A development program for investigating the effects of fuel fabrication variables and irradiation history on the dissolution characteristics of LMFBR fuels in nitric acid is outlined. Studies will include measurements on the dissolubility and dissolution rate of various unirradiated and irradiated mixed plutonium-uranium oxides in nitric acid. An effort will be made to establish how dissolubility and dissolution properties vary with composition, fabrication, and conditions of breeder reactor exposure. Methods for predicting dissolubility and dissolution behavior of unirradiated and irradiated mixed oxide fuels from fabrication and irradiation parameters will be developed. Initial experiments were made to determine feasibility of the studies and to establish fractionation variables to be considered. (J.G.B.)

13084 ION EXCHANGE PROPERTIES OF CRYSTALLINE ZIRCONIUM PHOSPHATE. Harvie, Sylvia J.; Nancoilas, George H. (State Univ. of New York, Buffalo). J. Inorg. Nucl. Chem.; 32: 3923-37 (Dec 1970).

Equilibrium and kinetic studies were made at 25°C of the exchange of cesium, sodium, potassium, calcium, and strontium ions on crystalline zirconium phosphate. The results are consistent with the existence of several distinct crystalline phases of the metal forms. As was found for the semicrystalline material, the properties of crystalline zirconium phosphate are to

some extent dependent on the method of preparation of the particular form. (auth) (UK)

13085 CONTRIBUTION TO THE ELEMENTARY INTEGRATION OF NONLINEAR TRANSPORT EQUATIONS IN ISOTOPE SEPARATION. PART I. Zieger, K. (Institut fuer Stabile Isotope, Leipzig). Isotopenpraxis; 6: 316-18 (Sep 1970). (In German).

A large class of isotope separation procedures can be described uniformly by Cohen's transport equations. In the simplest case a system of two first order partial differential equations of the hyperbolic type exist. This nonlinear system is reduced by a suitable substitution to a linear differential equation of second order. Then problem formulations are confined, for which not only the differential equation but also the boundary and initial conditions are linear after the reduction. (auth)

13086 INVESTIGATION OF SPONTANEOUS SILVER PRECIPITATION ON POWDERY PLATINUM IN NITRIC SOLUTIONS. Toth, G.; Fueszy, E. (Inst. for Isotope, Budapest). Isotopenpraxis; 6: 307-9 (Sep 1970). (In German).

It was found that silver ions precipitate on hydrogenated platinum powder, while with nitric acid concentration between 5 and 0.001 N the maximum precipitated quantity does not come up to the value equaling the monomolecular layer. Though the values obtained through measuring with regard to the dependence of the precipitation upon concentration formally seem to cover the Langmuir equation, the values determined by means of this equation showed some dependence on pH values, and did not correspond with the BET surface. Spontaneous silver precipitation on platinum powder can be used for the separation of radioactive silver isotopes. (auth)

13087 ASSAINISSEMENT ET DECHETS RADIOACTIFS. (Antipollution and Radioactive Wastes). Rodier, Jean; Vernhes, Claude. Paris: Dunod (1970). 127p.

The dangers connected with radioactive wastes and their administrative consequences are examined. Radioactive wastes and their different treatments are classified and their conditioning and final disposal discussed. The cost of administrating radioactive wastes is estimated. (France)

13088 CHEMICAL SEPARATION OF RUTHERFORDIUM. Silva, R.; Harris, J.; Nurmia, M.; Eskola, K.; Ghiorsio, A. (Lawrence Radiation Lab., Berkeley, Calif.). Inorg. Nucl. Chem. Lett.; 6: 871-7 (Dec 1970).

Element 104 is expected to fall into group IVB, i.e., to be eka-hafnium. It is predicted to have a valence and ionic radius similar to Zr and Hf and to exhibit similar chemical properties. Previous studies with actinide elements showed that cation exchange columns using chelating agents as eluants could provide rapid chemical separations on one atom at a time and yield sources suitable for alpha energy analysis. These methods were developed further in order to test the above predictions. The behavior of the activity assigned to element 104 with mass 261 was found to be entirely different from trivalent and divalent actinide elements but similar to Hf and Zr as predicted. (UK)

13089 POTENTIAL CHLORIDE ELECTROLYTES FOR RECOVERING THE METALS Ti, Zr, AND Hf BY FUSED SALT ELECTROLYSIS. Flengas, S. N.; Pint, P. (Univ. of Toronto). Can. Met. Quart.; 8: 151-66 (Apr-Jun 1969).

The properties of potential electrolytes for recovery of Ti, Zr, and Hf by a fused salt electrolytic process employing solutions of  $\text{TiCl}_4$ ,  $\text{ZrCl}_4$ , and  $\text{HfCl}_4$  in alkali and alkaline earth chloride melts are discussed in terms of thermal stability. Pressure-temperature relationships for these systems are analyzed, and methods for calculating activities of complex ionic species in solution are presented. (auth) (Canada)

13090 PROCEDURE FOR RECOVERY OF FISSILE MATERIALS IN CHEMICAL DECLADDING SOLUTIONS. Faugeras, Pierre; Kikindai, Tivadar (to Commissariat a l'Energie Atomique). French Patent 1,586,431. 12 Jan 1970. Filed 20 Aug 1968. (In French).

A decladding solution, obtained from the dilute nitric acid attack of metal cladding, is subjected to a selective crystallization of the salts present in order to eliminate the crystals of cladding metal nitrate, the soluble nitrates of fissile materials being left in solution. The solution collected, after elimination of the crystals, is sent to the unit where the rods of fissile material are dissolved after decladding. (auth) (France)

13091 ION-EXCHANGE SELECTIVITY OF THE SYNTHETIC ZEOLITE LINDE A IN ANHYDROUS AND MIXED MEDIA. Barrett, R. B.; Marinsky, J. A. (State Univ. of New York, Buffalo). Contract AT(30-1)-2269. J. Phys. Chem.; 75: 85-9 (7 Jan 1971).

The selectivity coefficients for the ion exchange of cesium with

## EARTH SCIENCES

## Geology and Hydrology

Refer also to abstracts 39773 and 39774.

596 (TID-25724) DISTRIBUTION OF RADIONUCLIDES IN BOTTOM SEDIMENTS OF THE COLUMBIA RIVER ESTUARY. Bbell, D. W.; Glenn, J. L. (Geological Survey, Portland, Oregon Resources Div.). 1971. 136p. Dep. NTIS.

A study was made of the distribution of radionuclides, produced primarily by the neutron activation of naturally occurring stable elements and chemical additives in nuclear reactor coolant water, in the bottom sediments of the Columbia River estuary. In situ gamma radiation varies over a seventyfold range and generally correlates with the total concentration of individually measured radionuclides in surficial samples. The most abundant radionuclides measured in samples from the estuary are  $^{51}\text{Cr}$ ,  $^{65}\text{Zn}$ ,  $^{86}\text{Sr}$ ,  $^{106}\text{Ru}$ ,  $^{54}\text{Mn}$ ,  $^{60}\text{Co}$ , and  $^{95}\text{Zr}$ - $^{95}\text{Nb}$ . Concentrations of  $^{51}\text{Cr}$ ,  $^{65}\text{Zn}$  in surficial sediment are approximately 6.2 and 2.2 times, respectively, greater than the concentration of naturally-occurring  $^{40}\text{K}$ , which averages about 14 picocuries per gram of silt; the other measured radionuclides are substantially less abundant. The total amount of measured radioactivity (excluding  $^{40}\text{K}$ ) in the sediment column beneath the bed surface ranges from about 0.05 to 15 microcuries per square foot. (D.H.M.)

597 (UCRL-51014) MICROSCOPIC EXAMINATION OF DEFORMED AND LABORATORY-DEFORMED WAGON WHEEL ROCKS. Borg, I. Y. (California Univ., Livermore, Lawrence Radiation Lab.). 28 Jan 1971. Contract W-7405-eng-48. 15p. p. NTIS.

The mineralogic makeup of shales, siltstones, and wackes (medium-grained sands); grain size; modal analyses; and number of grain contacts per quartz or chert grain are given for core samples taken from the gas-bearing horizon of Wagon Wheel Hole No. 1 in Pinedale Wyoming. In contrast to rock at comparable horizons at the Gasbuggy site near Farmington, New Mexico, they contain more  $\text{SiO}_2$  and calcite, fewer rock fragments, and less clay. Wagon Wheel wackes are coarser grained, and their particles are more angular. They have more than twice as many grain contacts per grain, or potential sites of local stress concentration per unit volume, which suggests that failure is more likely to be associated with microfracturing than in the case of Gasbuggy rock. Wagon Wheel wackes deformed in one-dimensional strain tests and triaxial experiments were examined microscopically. No microfracturing was detected in the samples deformed in one-dimensional tests where the mean stress ranged up to 5.87 kbar. In axial tests at mean pressures up to 9.61 kbar, brittle failure is characterized by the development of single shear faults surrounded by highly localized zones of fracturing; transitional failure is associated with broad zones of shear failure and pervasive microfracturing of the whole specimen; and ductile failure is characterized by the demolition of all mechanically strong components of rock and subsequent cataclastic flow (intercrystalline movement and rotation). Plasticity of the individual minerals (intracrystalline slip and twinning) contributes very little to the overall ductility of the deformed specimens. (auth)

598 EFFECT OF LIMING OF SOIL ON THE DIFFUSION COEFFICIENT OF  $^{86}\text{Sr}$ . Prokhorov, V. M.; Frid, A. S.; Ryzhinski, M. (Agrophysical Inst., Leningrad). Agrokhimiya: 7: No. 2, 1970. (In Russian).

Samples of soil from the Leningrad area were acidified with  $\text{HCl}$ , washed with distilled water, and treated with various ratios of  $\text{CaO}$ . It was found that with amounts of  $\text{CaO}$  up to 80% of the hydrolytic acidity the coefficient of diffusion of  $^{86}\text{Sr}$  decreased by a factor of 5. For  $\text{CaO}$  doses greater than 90% of the hydrolytic acidity the  $^{86}\text{Sr}$  coefficient increased. (tr-auth)

599 INFLUENCE OF TEMPERATURE DURING THE THERMAL IRRADIATION PERIOD ON THE SUBSEQUENT THERMOLUMINESCENCE OF SOILS AND  $\text{LiF}$  AND  $\text{CaF}_2$  DOSIMETERS. Shita, H.; Hamilton, M. (Univ. of California, Los Angeles). Abstract AT(04-1)-Gen-12. Soil Sci.: 111: No. 6, 393-8 (Jun 71).

The influence of temperature ( $0^\circ$  to  $70^\circ\text{C}$ ) during the exposure of soils and  $\text{LiF}$  (TLD-100) and  $\text{CaF}_2$  (TLD-200) dosimeters to  $^{60}\text{Co}$  gamma radiation on the thermoluminescence of these materials was examined. The thermoluminescence of these materials was affected by their temperature during irradiation. The effect of temperature during irradiation was eliminated in the soils by using a pre-readout, post-irradiation heating regimen of  $100^\circ\text{C}$

for 20 min or by allowing the thermoluminescent decay to progress for an appropriate length of time. For the two soils examined, this time was about 58 and 168 hrs. The pre-readout post-irradiation heating regimen ( $100^\circ\text{C}$  for 10 min) sometimes used for TLD-100 and TLD-200 dosimeters did not eliminate the effect of temperature during irradiation. (auth)

39600 AERIAL RADIOLOGICAL SURVEYING OF NUCLEAR FACILITIES: STATUS THROUGH 1970. Burson, Z. G.; Doyle, J. F.; Fritzsche, A. E. (EG and G, Inc., Las Vegas, Nev.). Trans. Amer. Nucl. Soc.: 14: No. 1, 65 (Jun 1971).

From 17th Annual Meeting of the American Nuclear Society; Boston, Mass. (13 Jun 1971). See CONF-710606.

39601 RECONNAISSANCE STUDY OF URANIUM IN THE SOUTH PLATTE RIVER, COLORADO. Boberg, Walter W. (Conoco Uranium Exploration, Casper, Wyo.); Runnells, Donald D. Econ. Geol.: 66: 435-50 (May 1971).

The South Platte River in Colorado drains areas of crystalline and sedimentary rocks. The water is a sodium-calcium-sulfate-chloride type throughout its length of flow in Colorado. The concentration of uranium in the water of the South Platte during the winter of 1969 to 1970 ranged from 5 ppB to 67 ppB, making it anomalously rich in uranium in comparison with most other rivers of the world. The concentration of uranium increases downstream, in contrast to the decrease in uranium concentration observed in other rivers that drain areas with known deposits of uranium. The South Platte contains a higher concentration of uranium than either the Colorado or North Platte rivers, despite the fact that the latter two rivers drain ore-producing areas of the United States. It is likely that most of the uranium in the South Platte is contributed by uraniumiferous coal seams in the Cretaceous Laramie Formation and by uranium-rich black shales in the Cretaceous Pierre Formation. The possibility that undiscovered deposits of uranium ore are present in the drainage basin of the South Platte cannot be excluded, but no major deposits are known. Use of the parameter "incremental areal uranium-load" permits certain portions of the drainage basin to be recognized as contributors of anomalously large amounts of uranium to the river. In the headwaters of the South Platte the incremental areal uranium-load is a low  $0.00018 \text{ kg U/day/km}^2$ , whereas for the increment of drainage between Weldona and Balzac, Colorado, the incremental areal uranium-load is  $0.016 \text{ kg U/day/km}^2$ . This parameter may be useful for hydrogeochemical prospecting for uranium ore in other areas. The concentration of uranium in the interstitial water of the alluvium in cutoff meanders varies seasonally, but there is no clear-cut evidence for precipitation of uranium minerals. Measurements of Eh, pH, and total vanadium in interstitial waters indicate that neither uraninite, coffinite, nor carnotite is stable. (auth)

39602  $^{210}\text{PoO}_2$  MOVEMENT IN A MOUNTAIN WATERSHED SOIL. Hansen, W. R. (Colorado State Univ., Fort Collins); Watters, R. L.; Yaney, N. D. Health Phys.: 20: 425-9 (Apr 1971).

Uniform contamination of a Rocky Mountain watershed with  $^{210}\text{PoO}_2$  from a SNAP generator would find the major contamination retained by the soil. A simulated snow-melt run-off experiment was conducted with a mountain Podzol soil from the Fraser Alpine Area, Colorado.  $^{210}\text{PoO}_2$  was applied to the litter layer as a point source one meter from water collection vessels at the base of a 30% slope. Cores from the soil on which one mean annual rainfall (18.6 in.) of ice was melted indicated both vertical and horizontal movement of  $^{210}\text{PoO}_2$  into the soil. The run-off water collected at the base of the slope at the bottom of the litter layer and A<sub>2</sub> horizon indicated only  $10^{-1}$  of the original activity moved through these soil horizons. Data from soil cores were used to predict the movement of a uniform deposition of  $^{210}\text{PoO}_2$  to a stream. The equations derived indicate only the first 50 cm bordering a stream contribute significant contamination to the water. (auth) (UK)

## Meteorology

Refer also to abstracts 39600 and 39851.

39603 (BRH/NERHL-70-3) INVESTIGATION OF AIRBORNE RADIOACTIVE EFFLUENT FROM AN OPERATING NUCLEAR FUEL REPROCESSING PLANT. Cochran, J. A.; Smith, D. G.; Magno, P. J.; Shleten, B. (Bureau of Radiological Health, Win-

chester, Mass. Northeastern Radiological Health Lab.), Jan 1970, 46p. NTIS.

Studies carried out at an operating nuclear fuel reprocessing plant for the purposes of characterizing the stack effluent, measuring the environmental levels of activity due to component of stack release, and evaluating instrumentation and methodology used to sample both at the stack and in the environment are described. Four field sampling stations, located in the vicinity of the plant perimeter, and a stack sampler simultaneously monitored  $^{85}\text{Kr}$ ,  $^{133}\text{I}$ , and  $^3\text{H}$  (gaseous and water vapor) during two dissolution cycles. Particulates were monitored at the stack and one field station. Measurements are presented and discussed in terms of emission level versus specific plant operations, primarily the dissolution cycle. In addition, observed and theoretical dilution factors are compared and, based on meteorological considerations, show reasonable correlation. The instrumentation used includes thin-window Geiger-Mueller detectors and flow-through ionization chambers for  $^{85}\text{Kr}$ ; bubblers, traps, and grab samplers for  $^3\text{H}$ ; and resin traps for  $^{133}\text{I}$ . Choice of methodology and instrumentation is discussed with emphasis placed on a system usable in determining dose to a population in the plant vicinity. (auth)

**39604 AIR SAMPLING.** pp 411-77 of Applied Radiation Protection and Control. Vol. 1. /Fitzgerald, J. J. New York; Gordon and Breach, Science Publishers, Inc. (1969).

The basic objectives of air sampling are: to evaluate airborne hazards; to determine ventilation requirements; to determine respiratory protection needs; and to establish safe handling procedures. Air sampling for both nonradioactive and radioactive contaminants is discussed in detail with reference to the following aspects: criteria for effective air sampling; selection of equipment and methods; effects of sample flow velocity and of filter media on collection efficiencies; design and operation of specific sampling devices; and methods for evaluating air sampling data. (L.C.L.)

**39605 RADIOACTIVITY IN FLY ASH FROM A COAL BURNING POWER PLANT.** Goldstein, N. P.; Sun, K. H.; Gonzalez, J. L. (Westinghouse Electric Corp., Pittsburgh). Trans. Amer. Nucl. Soc., 14: No. 1, 66-7 (Jun 1971).

From 17th Annual Meeting of the American Nuclear Society; Boston, Mass. (13 Jun 1971). See CONF-710606.

**39606 SNOW WATER EQUIVALENT PREDICTION BY MEASURING NATURAL GAMMA ATTENUATION FROM AIRCRAFT.** Fritzsche, A. E.; Burson, Z. G. (EG and G, Inc., Las Vegas, Nev.). Trans. Amer. Nucl. Soc., 14: No. 1, 67-8 (Jun 1971).

From 17th Annual Meeting of the American Nuclear Society; Boston, Mass. (13 Jun 1971). See CONF-710606.

**39607 SOME ATMOSPHERIC EFFECTS OF ENERGY PRODUCTION AND USE.** Greenfield, S. M. (Environmental Protection Agency, Rockville, Md.). Trans. Amer. Nucl. Soc., 14: No. 1, 74 (Jun 1971).

From 17th Annual Meeting of the American Nuclear Society; Boston, Mass. (13 Jun 1971). See CONF-710606.

**39608 EVALUATION OF THE RISK TO THE POPULATION FROM RADIOACTIVE DISCHARGES TO THE ATMOSPHERE BY THE C.C.R. AT ISPRÁ OF THE BASIS OF LOCAL METEOROLOGICAL DATA.** Gaglione, P.; Gandino, C.; Markovina, A. (CCR-EURATOM, Ispra, Italy). Minerva Fisiconucl., 13: 204-14 (Jul-Sep 1969). (In Italian). (CONF-680535-22).

From fourteenth national conference of the Italian Association for Health Physics and Protection from Radiation; Formia, Italy (29 May 1969).

The calculation of atmospheric diffusion of radioactive gaseous discharges, using the current diffusion models, is seriously affected by the complex morphology of Ispra site. As no experimental tests are as yet possible the problem was studied by a computation which, although based upon the Gaussian distribution model and the vertical standard deviations proposed by Gifford, makes use principally of the local micrometeorological parameters subdivided, for each wind direction, into the different stability categories. The calculation, averaged over a period of one year, was performed both for flat ground and taking into account its real configuration. The results obtained for the doses to population following the C.C.R. discharges, lie far below the dose limits; therefore the proposed method may satisfy the requirements of the Center installations safety reports. (auth)

**39609 FISSION PRODUCTS IN THE ATMOSPHERIC PRECIPITATION IN DEBRECEN, HUNGARY, DURING 1968 AND 1969.** Szalay, A.; Csongor, E. (Inst. of Nuclear Research, Debrecen, Hungary). Acta Phys. Acad. Sci. Hung., 29: No. 4, 407-13 (1970).

Observations concerning the beta activity of fission products in atmospheric precipitation were continued during 1968 and 1969. The annual sum of beta activity in these two years was double and triple that in 1967, respectively. Some samples demonstrated exceedingly high specific activity in the summer of 1969. In these samples it was possible to localize alpha-active hot particles by means of cellulose nitrate detector foil. (auth)

## Mineralogy and Exploration

Refer also to abstract 39443.

**39610 (EM-IC-8476) RARE-EARTH ELEMENTS, YTTRIUM, AND THORIUM.** A Materials Survey. Parker, John G.; Baroch, Charles T.; Adams, John W. (Bureau of Mines, Washington, D. C.). 1971, 82p. GPO \$1.00.

A survey of rare earth elements, yttrium, and thorium is presented that summarizes the demand-supply position in the United States and includes information on properties, resources, industry structure, production, consumption, trade, strategic factors, technology, and pertinent history. (D.H.M.)

**39611 (CU-1936-87) RESEARCH ON THE NATURAL OCCURRENCE OF URANIUM AND RELATED STUDIES.** Final Report. Kerr, Paul P. (Columbia Univ., New York). (nd. Contract AT(30-1)-1936. 28p. Dep. NTIS.

A study of the natural occurrence of uranium on the Colorado Plateau including deposits at Marysvale, Utah; Temple Mountain, Utah; Kane Creek, Utah; Laguna, New Mexico; Cameron, Arizona; and Orphan Pipe, Arizona is presented. (D.H.M.)

## Oceanography

**39612 (UCRL-Trans-10535) DRIFT OF RADIOACTIVE MATERIALS CONTAINED IN LOW-LEVEL RADIOACTIVE EFFLUENTS DISCHARGED INTO COASTAL WATERS.** Sakagishi, S. Translated by H. Nakagawa for Univ. of California Lawrence Radiation Lab., Livermore, from Genshiryoku Kogyo, 13: 32-5 (Sep 1966). 17p. Dep. NTIS.

An investigation is presented that considers how the radioactive materials contained in waste water from an atomic power station, or a reprocessing plant for atomic fuel are diluted through diffusion in the sea after discharge, for instance, into coastal waters. (auth)

**39613 OCEAN USE PLANNING.** Rice, T. R. (Center for Estuarine and Menhaden Research, Beaufort, N. C.). Trans. Amer. Nucl. Soc., 14: No. 1, 74-5 (Jun 1971).

From 17th Annual Meeting of the American Nuclear Society; Boston, Mass. (13 Jun 1971). See CONF-710606.

**39614 URANIUM CONTENT OF MID-OCEANIC BASALTS.** Aumento, P. (Dalhousie Univ., Halifax, Can.). Earth Planet. Sci. Lett., 11: No. 2, 90-4 (May 1971).

Tholeiitic basalts from the mid-Atlantic Ridge at 45°N may have extruded with an original total uranium content between 0.18 and 0.30 ppm U. Deep-sea weathering increases the uranium concentration of most basalts at the rate of at least 1 ppm per 10 Myr equivalent to 1 ppm for every 2% sea water absorbed. (auth)

**39615 VOLCANOGENIC URANIUM, VANADIUM, AND IRON IN INDIAN OCEAN SEDIMENTS.** Bostrom, Kurt; Fisher, David E. (Univ. of Miami, Fla.). Earth Planet. Sci. Lett., 11: No. 2, 95-8 (May 1971).

About one hundred U, V, and Fe analyses of Indian Ocean sediments indicate that enrichments of U and V occur in hemipelagic sediments close to the continents, probably associated with biogen constituents. The highest concentration, however, of U, V, and Fe occurs in active ridge sediments, suggesting that submarine volcanism is an important source of these elements. (auth)

**39616 RAPID BETA GAMMA COINCIDENCE TECHNIQUE FOR DETERMINATION OF NATURAL RADIONUCLIDES IN MARINE DEPOSITS.** Bhandari, N.; Bhat, S. G.; Krishnaswamy, S.; Lal, D. (Tata Inst. of Fundamental Research, Bombay). Earth Planet. Sci. Lett., 11: No. 2, 121-6 (May 1971).

A nondestructive and specific counting technique employing beta and gamma detectors in coincidence is described. The application of the present system rests on the fact that several daughter nuclides of  $^{230}\text{Th}$  and  $^{232}\text{Th}$  exhibit a favorable  $\beta-\gamma$  decay allowing their high sensitivity assay. It is experimentally demonstrated that the activities from the radionuclides  $^{214}\text{Pb}$ ,  $^{214}\text{Bi}$  ( $^{230}\text{U}$  series) and  $^{228}\text{Ac}$ ,  $^{208}\text{Tl}$  ( $^{232}\text{Th}$  series) can be unambiguously identified and

assuming the wind velocity is a linear function of the height. Six equations were obtained for determining the relative concentration of the particles on the earth's surface. A GIER computer was used for the numerical calculations for the low yield explosions that produced clouds in the troposphere and for the distances covered by the local fallout. Curves of the size-distribution of the particles for several distances and explosion yield are presented. Significant differences in the particle size distribution for different explosion yields were found. (auth)

48859 (FRNC-TR-40) RADON AND AEROSOL DIFFUSION IN THE TROPOSPHERE. Bir6t, Andre (Toulouse Univ. (France)). 1971. 169p. (In French). Dep. NTIS (U. S. Sales Only). Thesis.

The way in which the naturally radioactive gas, radon, is used to study atmospheric physics, in particular, tropospheric exchanges, is discussed. Two complementary approaches to the problem are considered: a theoretical analysis of models based upon a numerical solution of the classical diffusion equation and in situ experimental work. Models corresponding to diverse conditions are presented e.g., geometry of the source and diffusivity and vertical wind profiles. (auth) (France)

48660 (IITRI-C-6105-14) SCAVENGING STUDY OF SNOW AND ICE CRYSTALS. Final Report. Sood, Sudesh K. (IIT Research Inst., Chicago, Ill.). 10 Feb 1971. Contract AT(11-1)-578. 72p. Dep. NTIS.

Scavenging efficiency of naturally precipitating snow and ice crystals was determined for submicron polystyrene latex and sodium chloride aerosols. The effect of crystal habit, dimensions, and particle size on scavenging efficiency was established. Experimental results show the scavenging efficiency to be a function of both the crystal and particle diameter. In addition, data on SO<sub>2</sub> scavenging by snow and ice crystals is also included. Experimental work on capture of aerosol particles by growing ice crystals was also initiated. Experimental data obtained so far show that the number of particles captured by a growing ice crystal is proportional to the mass of the crystal. (auth)

48661 (IITRI-C-6105-16) SCAVENGING STUDY OF SNOW AND ICE CRYSTALS. Quarterly Progress Report, May 1, 1971-July 31, 1971. Sood, Sudesh K. (IIT Research Inst., Chicago, Ill.). Aug 1971. Contract AT(11-1)-578. 24p. Dep. NTIS.

Experimental work on aerosol generation was resumed during this report period. A vaporization-condensation aerosol generator has been assembled and a number of fluorescent materials have been examined to determine the feasibility of using fluorescent aerosols during snow scavenging experiments. (auth)

48662 (LCA/MS-RAE-3/641) EXPERIMENTS IN CORRELATING THE RADIOACTIVITY OF THE AIR AND PRECIPITATIONS AT GROUND LEVEL WITH VARIOUS METEOROLOGICAL PARAMETERS. Klentzel, J. M.; Cambon, P. (Laboratoire Central de l'Armement, Arrouel (France)). Jan 1971. 67p. (In French). Dep. NTIS (U. S. Sales Only).

Radioactivity measurements taken over a three year period in the Paris area are considered. The experiments demonstrate the influence of certain factors, such as the origin of the air masses, the nature of the cloud layers, and the frequency of precipitation. No correlation between the results obtained and the height of the tropopause was found. (auth) (France)

48663 (SRC-344-12) WEST VALLEY REPROCESSING PLANT, PART I. Quarterly Report, January 1, 1971-March 31, 1971. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 20 Apr 1971. 8p. Dep. NTIS.

During the report period, three analyses were performed on milk from the NFS farm. The <sup>131</sup>I concentrations determined in the milk were all below  $5 \times 10^{-4}$   $\mu$ Ci/ml. Thirty-five samples were obtained from the perimeter monitoring stations and analyzed for alpha and beta activity. The alpha activities were all below  $1.15 \times 10^{-14}$   $\mu$ Ci/cc. The beta activity ranged from  $5.49 \times 10^{-15}$   $\mu$ Ci/ml to  $7.09 \times 10^{-15}$   $\mu$ Ci/ml with an overall average of  $3.13 \times 10^{-15}$   $\mu$ Ci/ml. The amounts of radioactivity discharged from the plant lagoons during this period and their relationship to the maximum permissible concentration (MPC) in the Cattaraugus Creek are tabulated. Effluent data not previously available are also presented. The amount of particulate radioactivity discharged via the plant stack and relationships of <sup>85</sup>Kr and <sup>131</sup>I to their release limits in technical specifications are shown tabularly. Data are also included on surveillance of facilities and equipment including filters. (J.R.D.)

48664 (UCRL-78270) PRODUCTION OF TRITIUM BY NUCLEAR WEAPONS. Mistel, John A. (California Univ., Liver-

more, Lawrence Radiation Lab.). 30 Jun 1971. 12p. (CONF-710809-3). Dep. NTIS.

From Tritium symposium; Las Vegas, Nev. (30 Aug 1971).

The effects of nuclear weapons tests on the current world tritium inventory can be summarized as follows: the contribution from fission weapons is negligible, whether they were tested in the atmosphere or underground; the contribution from the thermonuclear tests that were conducted in the atmosphere is large. The present inventory is approximately 45 times the natural background as a result of weapons testing and, even in the absence of further atmospheric tests, will be a significant (>10%) perturbation on the natural background for about 100 yr; and the underground testing of thermonuclear weapons has not contributed significantly to the atmospheric burden, even when the containment has been imperfect. (auth)

48665 (WASH-1183) SUMMARY INFORMATION ON ACCIDENTAL RELEASES OF RADIOACTIVE EFFLUENT TO THE ATMOSPHERE FROM UNDERGROUND NUCLEAR DETONATIONS DESIGNED FOR CONTAINMENT, AUGUST 5, 1963-JUNE 30, 1971. Allen, Robert E. (Division of Operational Safety (AEC), Washington, D. C.). Jun 1971. 28p. GPO \$0.35.

Information concerning the 17 nuclear tests that inadvertently released sufficient radioactivity to the atmosphere to be detected by ground monitors or ground monitoring equipment off the testing site is presented, including depth of burial, quantity of radioactivity released to the atmosphere; types of radionuclides identified in the release; the highest air concentrations detected in the offsite area; the highest gamma exposure levels detected in the offsite area; the highest levels of radioiodine detected in milk; and the thyroid dose where sufficient radioiodine was detected that could lead to a measurable thyroid dose. (D.H.M.)

48666 PHYSICAL CLIMATOLOGY OF AMCHITKA ISLAND, ALASKA. Armstrong, Robert H. (Environmental Science Services Administration, Las Vegas, Nev.). Contract SF-54-351. Bioscience; 21: No. 12, 607-9 (15 Jun 1971).

From twenty-first annual AIBS meeting; Bloomington, Ind. (26 Aug 1970). See CONF-700843.

Climatological statistics based on data from the vicinity of the airfield at the low-level southeast end of the island are presented. However, these statistics only approximate conditions for the relatively mountainous areas of the island. (P.C.H.)

48667 <sup>12</sup>C/<sup>13</sup>C RATIO AS AN INDICATOR OF AIR POLLUTION. Atkins, Patrick R. (Univ. of Texas, Austin). Isotop. Radiat. Technol.; 8: No. 4, 381-5 (Summer 1971).

The stable isotopes of several atmospheric constituents possibly can be used as natural tracers of pollutants and as indicators of general levels of pollution. A recent preliminary study is described in which CO<sub>2</sub> samples were collected by freeze-out and precipitation procedures and the <sup>12</sup>C/<sup>13</sup>C ratios of the samples were determined. The results indicate that the <sup>12</sup>C/<sup>13</sup>C ratio in atmospheric CO<sub>2</sub> can provide useful information about the degree—and perhaps the sources—of pollution that affects a given area. Freeze-out sampling is less convenient but more reliable, and probably more accurate, than precipitation. With some technique development and with calibration against freeze-out results, the precipitation procedure may prove to be usable. (auth)

## Mineralogy and Exploration

48668 (JUL-755-PA-RG) URANIUM: SUPPLY AND DEMAND. ANALYSIS AND PROGNOSIS. Dietrich, Guenther; Schwarz, Helmuth; Voss, Alfred (Kernforschungsanlage, Juelich (West Germany). Institut fuer Reaktorentwicklung). Apr 1971. 36p. (In German). Dep. NTIS (U. S. Sales Only).

Present world reserves of uranium, their exploration, and special aspects in regard to supply for West Germany are discussed. The most important uranium deposits are discussed as well as possibilities of their enlargement through prospecting. Growth of ore processing capacity is outlined. Based on the projected use of uranium, the theoretical point of exhaustion is calculated. For West Germany, nuclear energy applications are projected with respect to both power production and process heat. It is concluded that reduction of known uranium reserves encourages prospecting through which, thus far, new deposits were discovered. Therefore, limitation of uranium supply should not present a serious concern. (H.B.G.)

48669 URANIUM CONTENT AND ABUNDANCE IN DEEP-ZONE ROCKS OF THE EARTH CRUST AND UPPER MANTLE. Borzina, I. G.; Lutts, B. G.; Alkmov, A. P. Izv. Akad. Nauk SSSR, Ser. Geol.; No. 1, 14-24 (Jan 1971). (In Russian).

Results are given for the determination of the uranium content,

relationship in the low dose region. In barley it was shown that irradiation during meiosis caused a considerably higher induction of waxy mutants than during subsequent developmental stages. Furthermore, the amount of mutants was shown to be dependent on the height of tiller at irradiation and on the spikelet position within the spike. In maize a pronounced difference in mutation rate of the pollen grains from individual plants fixed on five consecutive days was observed. This constitutes a complication for the determination of the dose-effect relationship. This complication was circumvented by constructing one dose-effect relationship for the maximum mutation rate of each plant, as well as one dose-effect relationship for the average mutation of five fixing days. Regardless of the way in which the dose-effect relationship was computed it was shown to be linear. The entire investigation comprised the analysis of more than 40 million pollen grains composing more than 30,000 pollen samples. (auth)

**55191 INDUCED TRANSLOCATIONS IN VICIA FABA L.** Sjöedin, Jan (Swedish Seed Association, Svalöf, Sweden). *Hereditas*; 58: No. 1, 1-34(1971).

A total of 198 translocations have been induced in *Vicia faba* L. with ionizing radiations and chemical mutagens. The ionizing radiations were about five times more effective in inducing translocations as compared with the chemical mutagens. In all, 109 translocations were analysed. These studies revealed that the translocation break points are not randomly distributed over the chromosomes but within individual chromosomes. Chromosomes 1, 2, and 5 displayed a significantly lower aberration frequency than the other three chromosomes. Quadrivalents in translocation heterozygotes were mostly characterized by a mixture of rings and chains. The average pollen fertility was 56 percent. Gametes and zygotes of translocation homozygotes were fully viable except in six translocation lines, in which they were semi-lethal. Vegetative growth was slightly depressed compared with the parental variety *Primus*; but the seed yield was reduced by 25 percent. No differences between extreme translocations and others were detected as regards plant vigour. In the F<sub>2</sub> offspring of crosses between translocations involving the same two chromosomes, the translocations behaved differently when compared with barley and *Zea mays* translocations—i.e., quadrivalents occurred in a much higher frequency in *Vicia faba*. Only when the breaks were in the same arm in both chromosomes, and then in rather close proximity, were six bivalents formed. (auth)

**55192 DYNAMICS OF MITOTIC ABERRATIONS INDUCED IN THE WHITE RAT BY A SINGLE DOSE OF 800 R.** Anastasiu, Gh.; Cilievlci, O. *Arch. Roum. Pathol. Exp. Microbiol.*; 29: No. 1-2, 81-9(1970).

With a view to studying cell division in the femur bone marrow, white Wistar rats were exposed to a single dose of 800 R. The study involved determination of the mitotic index, mitotic and chromosomal aberrations and a 60-day observation period of the cariotype, at various time intervals. A single 800 R dose inhibited cell division, led to aberrant mitoses and multiple chromosomal aberrations such as: ruptures, translocations, agglutinations, and polyploidy. Starting with the 15th day, however, the natural restoring mechanisms interfered, tending to bring the mitotic index in the normal range, to eliminate aberrant mitoses and chromosomal aberrations. (Rom. Sci. Abstr.)

## Health Physics and Safety

Refer also to abstracts 54937-54962, 54964, 54966, 54967, 55157, and 57103.

**55193 HEALTH PHYSICS ASPECTS OF NUCLEAR FACILITY SITING. VOLUME III.** Proceedings of the Fifth Annual Health Physics Society Midyear Topical Symposium, Idaho Falls, Idaho, November 8-6, 1970. Voilleque, Paul G.; Baldwin, Burton R. (comps.). Idaho Falls, Idaho; Burton R. Baldwin, Publications Chairman (1971). 256p. (CONF-701106-(Vol.3)).

Seventeen articles are included; separate abstracts were prepared for 15. One article on reasons for differences in calculated estimates of the cloud dose was previously included in NSA as 25: 8668. The remaining article on basic data on heat dissipation downstream for large heat sources was not in scope for NSA. (P.C.H.)

For abstracts of individual papers see: 54547, 54796, 54797, 55125, 55182, 55188, 55201, 55202, 55241, 55242, 55253, 55254, 55347, 56081, and 57131.

## Radioactive Contamination and Decontamination

Refer also to abstracts 54545, 54753, 54751, 54781, 54923, 54926, 54933, 55117, 55118, 55149, 55151, 55154, and 56582.

**55194 (70-CNA-641) BIOLOGICAL SIGNIFICANCE OF RADIOACTIVE RELEASES TO THE ENVIRONMENT.** Marko, A. M. (Atomic Energy of Canada Ltd., Chalk River (Ontario)), 1970, 12p. (CONF-700564-12). Dep. NTIS (U. S. Sales Only).

From tenth annual international conference of the Canadian Nuclear Association; Toronto, Canada (24 May 1970).

The biological significance of radioactive releases to the environment by the nuclear industry is discussed. The past record of the industry is mentioned and the significance of natural radioactivity and biological concentration processes in the human food chain is estimated. Radioactive releases from Canadian reactors are summarized. (E.R.B.)

**55195 (CONF-710401-, pp 352-64) APPROACH TO PLUTONIUM SURFACE CONTAMINATION LEVELS.** Healy, John W. (Los Alamos Scientific Lab., N. Mex.). 15 Apr 1971.

From Rocky Flats symposium on safety in plutonium handling facilities; Golden, Colo. (13 Apr 1971).

A very brief summary of one attempt to obtain surface contamination levels as based on possible radiation doses to people is presented. The models used are crude and require refinement both in detail and in study of the individual factors involved. They do however indicate the possibility of more refined study of the possible impact of contamination and they open the door to consideration of very valuable studies of an applied health physics nature which will greatly expand understanding of the possible problems of control. In particular, it is emphasized that the numerical values obtained should be used only as guides to the professional in investigating particular cases and in establishing limits of sensitivity for routine monitoring. The prospect for deriving general contamination limits for use in release of materials and equipment seems discouraging at the moment because of the lack of definition of the many places these materials can go, the uses to which they are put, and the quantities so moved. It is possible, however, that detailed study of these factors, along with the transfer coefficients, could lead to acceptable models for many situations which could lead to the development of acceptable standards. (auth)

**55196 (LA-4558) SURFACE CONTAMINATION: DECISION LEVELS.** Healy, J. W. (Los Alamos Scientific Lab., N. Mex.). Sep 1971. Contract W-7405-eng-36. 115p. Dep. NTIS.

Levels of contamination are derived for over 180 isotopes for the skin and clothing of workers and individuals in the general public as based on the National Council on Radiation Protection and Measurements (NCRP) recommendations on dose limitation. These levels consider the dose to the skin, the possible inhalation or ingestion of the deposited material, and possible absorption through the skin. Estimates of the levels for transfer to the home are based on these mechanisms plus direct external radiation and resuspension using plausible transfer coefficients. The relation of these transfer levels to transfers to other areas is discussed. Readings on several of the more common types of instruments used to measure surface contamination are then derived. Appendices to provide background data on specific subjects include Appendix A, The Skin; Appendix B, Beta Dose to The Skin; and Appendix C, Resuspension. All derived values for the decision levels for individual isotopes are given in Appendix D. (auth)

**55197 DETERMINATION OF <sup>239</sup>Pu AND ENRICHED URANIUM IN THE URINE IN THEIR COMBINED PRESENCE.** Golutvina, M. M.; Stepanov, A. P.; Sadikova, N. M.; Blinov, A. P. *Med. Radiol.*; 16: No. 9, 46-9(Sep 1971). (In Russian).

A method based on the destruction of tests by boiling with nitric acid and hydrogen peroxide, and concentration of isotopes by precipitation and subsequent extraction with precipitates of bismuth phosphate (<sup>239</sup>Pu) and lanthan fluoride (enriched uranium) is proposed. In conclusion, mixing of precipitates with a fluorescent compound and measurement of their radioactivity in a layer of hard scintillator are done. The efficacy of registration of alpha-particles comprises 90 to 95%. (auth)

**55198 MISUSE OF THRESHOLD LIMIT VALUES.** Major, G. (Univ. of Sydney). *Health Phys.*; 21: No. 4, 611(Oct 1971).

It is pointed out that Cohen misused the concept of Threshold Limit Values in his recent publication (*Health Phys.* 19: 637(1970)). It is hoped that intended users of this concept would read the preface of the American Conference of Governmental Industrial Hygienists in which it is stated "that these limits are intended for use in the practice of industrial hygiene" and may not be used for "the establishment of standards for radionuclides in a natural gas supply". (UK)

**55199 PUBLIC HEALTH ASPECTS OF <sup>129</sup>I FROM THE NUCLEAR POWER INDUSTRY.** Russell, John L. (Public Health Service, Rockville, Md.); Hahn, Paul B. pp 241-51 of *Health Physics Aspects of Nuclear Facility Siting. Vol. I.* /Voilleque,

Paul G. (comp.). Idaho Falls, Idaho; Burton R. Baldwin, Publications Chairman (1971).

From fifth annual midyear topical symposium on health physics aspects of nuclear facility siting; Idaho Falls, Idaho (3 Nov 1970).

The production of  $^{129}\text{I}$  in nuclear power reactors and its subsequent environmental releases during fuel reprocessing represent a potential long-term public health problem. Because of its extremely long half-life, any discharged  $^{129}\text{I}$  is essentially a permanent contaminant in the biosphere, where it will eventually be found as a fraction of total iodine within a locality and possibly worldwide. This potential problem, its possible geographical scope, and the projected impact on population exposure are discussed along with data from measurements at nuclear power reactors and a fuel reprocessing plant. A concentration of 0.86%  $^{129}\text{I}$  in total iodine produces the dose limit recommended by the FRC for a suitable sample of an exposed population. The quantity of  $^{129}\text{I}$  discharged from operating power reactors was estimated from measurements of  $^{131}\text{I}$  discharges by calculating a  $^{129}\text{I}/^{131}\text{I}$  build-up ratio. This analysis showed the  $^{129}\text{I}$  discharge from operating power reactors was negligible. Measurements at a fuel reprocessing plant indicated that approximately 10% of the total  $^{129}\text{I}$  inventory in spent fuel was discharged from the stack during the batch dissolution process. The liquid discharge concentrations were about 2% of the total  $^{129}\text{I}$  inventory. Iodine-129 levels in deer thyroids taken in the reprocessing plant locality were about 40% of levels of FRC guidance for human thyroids. (auth)

**55200** RECAPITULATION OF EFFLUENT RELEASES AND RELATED CHANGES IN BACKGROUND RADIATION LEVELS AT BROOKHAVEN NATIONAL LABORATORY, AND SOME COMPARISONS WITH THOSE ASSOCIATED WITH NUCLEAR POWER REACTOR PLANTS. Hull, Andrew P. (Brookhaven National Lab., Upton, N. Y.). pp 342-60 of Health Physics Aspects of Nuclear Facility Siting. Vol. II. /Voilleque, Paul G. (comp.). Idaho Falls, Idaho; Burton R. Baldwin, Publications Chairman (1971).

From fifth annual midyear topical symposium on health physics aspects of nuclear facility siting; Idaho Falls, Idaho (3 Nov 1970).

Laboratory operations at Brookhaven since its establishment in 1949 have included the routine release to the environment of gaseous, halogen, air particulate, and  $^3\text{H}$  radioactivity in reactor air effluents and of beta-gamma emitters and  $^3\text{H}$  in low-level liquid wastes in amounts comparable to current releases from power reactors. Past and current surveillance data at BNL were evaluated for short and long-term changes in radiation levels attributable to these operations. The relation between the large amounts ( $4.5 \times 10^6$  Ci/yr) of  $^{40}\text{Ar}$  emitted from the 100m BGRR stack and observed downwind radiation levels is indicated and is used to estimate the ground level doses from the smaller amounts of fission gases emitted from power reactors. The data examined for cumulative deposition of long-lived air effluent nuclides include continuous measurements of external background radiation levels, both on and off site, and measurements of gamma-emitters in soil and vegetation and of  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  in milk from close-in and more distant farms. The data examined for the accumulation or uptake of radionuclides contained in liquid effluents include the concentrations and amounts of activity discharged into and released from a sanitary waste treatment facility, average concentrations in water samples from downstream and remote locations, current concentrations of radionuclides in the stream sediments and vegetation, and the current concentrations in samples of water from eleven widely separated on-site supply wells. On the basis of these data, it is concluded that few changes in background should be apparent, even after long-term operation of nuclear power reactors. (auth)

**55201** DETERMINATION OF THE MAXIMUM PERMISSIBLE BODY BURDENS USING THE METHODS OF THE MEDICAL INTERNAL RADIATION DOSE (MIRD) COMMITTEE OF THE SOCIETY OF NUCLEAR MEDICINE. Schadt, Warren W. (Radiological Health Div., Washington, D. C.); Battist, Lewis. pp 590-9 of Health Physics Aspects of Nuclear Facility Siting. Vol. III. /Voilleque, Paul G. (comp.). Idaho Falls, Idaho; Burton R. Baldwin, Publications Chairman (1971).

From fifth annual midyear topical symposium on health physics aspects of nuclear facility siting; Idaho Falls, Idaho (3 Nov 1970).

Maximum permissible body burdens, "q," for 31 radionuclides were calculated using the methods of the Medical Internal Radiation Dose (MIRD) Committee of the Society of Nuclear Medicine in combination with the methods and biological data of ICRP Publication 2. For 24 of these radionuclides, the ICRP method is conservative by a factor ranging from 1.0 for  $^{32}\text{P}$  in bone to 2.7 for  $^{52}\text{Mn}$  in the pancreas. Seven of the isotopes considered showed a decrease in the MIRD value of "q." These radionuclides and their ratios of the MIRD "q" to the ICRP "q" are listed. These ratios are dependent upon the decay scheme data and the methods used to determine the energy absorbed in the critical organ per unit

energy emitted by the source (absorbed fraction). The dependence of the ratio on decay scheme data is eliminated by using the MIRD decay scheme data in the ICRP formulation. The revised ratios, "Q," is then a function only of the absorbed fraction. The values of "Q" are also shown. Except for  $^{113}\text{Sn}$  in bone, the ratios for all radionuclides indicate that the ICRP results are conservative by a factor ranging from approximately 1 to 2. (auth)

**55202** ESTIMATION OF THE RELATIVE INHALATION HAZARD OF REACTOR INVENTORY RADIONUCLIDES. Raabe, Otto G. (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). Contract AT(29-1)-1013. pp 619-33 of Health Physics Aspects of Nuclear Facility Siting. Vol. III. /Voilleque, Paul G. (comp.). Idaho Falls, Idaho; Burton R. Baldwin, Publications Chairman (1971).

From fifth annual midyear topical symposium on health physics aspects of nuclear facility siting; Idaho Falls, Idaho (3 Nov 1970).

The relative hazard in a nuclear reactor accident from inhalation of radioactive aerosols and vapors was considered on the basis of a model of the inventory of radionuclides in a uranium fueled reactor for 1 yr and 5 yrs of sustained operation. The use of plutonium fuel is also discussed. This approach involves estimation of the relative probabilities of accidental release and the relative probabilities of the production of airborne material of soluble or insoluble forms with respect to lung clearance. With the latest information on the distribution and excretion of both soluble and insoluble forms of the radionuclides, the biological solubility probabilities are used to calculate the relative doses of radiation to various organs after inhalation exposure. The inventory model, release probabilities, solubility probabilities, and organ dose calculations are then combined to provide the relative organ dose estimates and relative hazard estimates of the reactor inventory nuclides. (auth)

### Dosimetry and Monitoring

Refer also to abstracts 54784, 54789, 54987, 55002, 55006, 55032, and 55152.

**55203** (CEA-N-1449) HEALTH PHYSICS DEPARTMENT PROGRESS REPORT FROM THE NEUTRON WORKING GROUP, MARCH 1969-DECEMBER 1970. (Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France), Centre d'Etudes Nucleaires). Jun 1971. 96p. (In French). Dep. NTIS (U. S. Sales Only).

The current program of the Health Physics department DPS (Department de la Protection Sanitaire) on the problems raised by the exposure of the human body to mixed radiations (neutrons, gamma radiation) is discussed. The dosimetric studies, which were largely carried out in collaboration with other services within the working group (CRAC) of the DPSR, concern the evaluation of internal doses, sodium activation within the body, and sulfur activation of the hair, nails, and clothes. Radiological studies were made on the formation of dicentric chromosomes in lymphocytes following in vitro exposure of human blood, the hematological evolution, LD 50 (30 days), weight loss and the pathology of delayed mortality in rats, and the excretion of urinary amino acids and electrolytes in rats. (France)

**55204** (CONF-710401-, pp 267-79) IN-RESIDENCE HEALTH AND SAFETY SUPPORT IN A PLUTONIUM FACILITY. Morse, J. L.; Marshall, A. L.; Celoni, A. M. (California Univ., Livermore, Lawrence Radiation Lab.). 14 Apr 1971.

From Rocky Flats symposium on safety in plutonium handling facilities; Golden, Colo. (13 Apr 1971).

Health and Safety Technicians (monitors) provide in-residence safety services to the metallurgical research and engineering effort of the plutonium facility at the Lawrence Radiation Laboratory, Livermore. The qualifications of these technicians and typical services rendered by them to the facility scientific personnel, such as, contamination control, waste recovery, monitoring of air sampling equipment, frequent smear and swipe samples, radiation surveys, equipment calibration, out-processing of liquid and solid wastes to control fire and criticality hazard, etc., are described. (auth)

**55205** (NYO-2740-8) ANNUAL REPORT ON RESEARCH PROJECT. (Columbia Univ., New York, Radiological Research Lab.). 1 Jul 1971. Contract AT(30-1)-2740. 259p. Dep. NTIS.

Separate abstracts were prepared for the three sections presented. (W.H.K.)

For abstracts of individual sections see: 55002, 55206, and 55207.

**55206** (NYO-2740-8, pp 147-219) BIOPHYSICS. (Columbia Univ., New York, Radiological Research Lab.).

# PHYSICS (GENERAL)

## Astrophysics and Cosmology

Refer also to abstract 4189.

5034 (OR0-3236-72) NUCLEAR AND COSMOCHEMISTRY. Annual Progress Report. (Arkansas Univ., Fayetteville, Dept. of Chemistry). 31 Jul 1971. Contract AT(40-1)-3235. 25p. Doc. NTIS.

Brief summaries of research on origin and age of the elements, nuclear spectroscopy, fusion fuels, and instrumentation are presented. A list of papers published or in press is appended. (U.S.)

### Cosmic Ray Exposure Ages

Refer also to abstract 6228.

5035 MASS SPECTROSCOPIC RESEARCHES IN NUCLEAR PHYSICS AND ISOTOPE COSMOLOGY. Hintenberger, H. (Max-Planck-Institut fuer Chemie, Mainz). pp 3-25 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

Mass-spectroscopic researches that should improve the knowledge on the existence and properties of nuclides, as well as on nuclear reactions, are reviewed. Mass-spectroscopic investigations are summarized that should yield new information on the composition and history of terrestrial matter and the evolution of matter in the solar system and in the Universe. (W.D.M.)

5036 XENON PROBLEMS IN METEORITES: A REVIEW. Reynolds, J. H. (Univ. of California, Berkeley). pp 594-607 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

Several distinct xenon components that have been identified in meteorites are discussed, starting with components that are understood and proceeding to components about which speculation only is possible. Attention is focused upon the more-recent results, and no attempt is made to comprehensively discuss the extensive literature in the field. (W.D.M.)

5037 INDUCED NONVOLATILE NUCLIDES IN METEORITES. Shima, Masako (Tokyo Univ.). pp 608-20 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

The concentration of cosmic-ray-produced stable nuclides of Cr, V, Ti, Ca, and Fe and two long-lived nuclides,  $^{90}\text{K}$  and  $^{53}\text{Mn}$ , were determined in iron meteorites. The cosmic-ray-produced  $^{90}\text{K}$  in the metallic phase of chondrites was also detected after it was purified by a fractional dissolution method. All the above elements were simultaneously extracted from iron meteorites by a wet chemical method. The contamination level of K, Ca, Ti, and V was of an order of 0.1, 0.1, 0.03, and 0.01 ppm respectively. The mass spectrometry of each element was performed by a surface ionization solid source mass spectrometer. (W.D.M.)

5038 DISTRIBUTION OF SOME STABLE AND LONG-LIVED NUCLIDES PRODUCED BY COSMIC RAYS IN THE IRON METEORITE GRABT. Inamura, M.; Shima, Masako; Honda, M. (Tokyo Univ.). pp 617-51 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

Most of the studies on depth effect of the cosmic-ray-produced nuclides in iron meteorites have been made with Fe, Ni, and Ar. However, the data on the distribution of the nuclides with a mass number near that of the target, such as Ti, V, Cr, and Mn, are much more helpful in estimating the preatmospheric size and erosion rate of the meteorite in space. The results on the distribution of the cosmogenic nuclides of K, Ca, Ti, V, Cr, and Mn in the Grant meteorite are described. (W.D.M.)

5039 STUDY OF HELIUM ISOTOPIC ABUNDANCE IN THE SAMPLES WITH SMALL HELIUM CONTENT. Alimova,

I. A.; Mamyrin, B. A.; Gartmanov, V. N.; Boltenkov, B. S. (Ioffe Inst. of Physics and Tech., Leningrad). pp 652-3 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

A very brief description is given of helium isotope analysis of air, meteorites, cosmic dust, aluminum, and mineral samples. (W.D.M.)

5040 MASS SPECTROGRAPHIC DETERMINATION OF TRACE ELEMENTS IN METEORITES. Hintenberger, H.; Berghof, W. (Max-Planck-Institut fuer Chemie, Mainz). pp 657-65 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

The rare earth elements as well as the heavy elements Re, Os, Ir, Pt, Au, Tl, Pb, Bi, Th, and U were determined by spark source mass spectroscopy in the olivine-hypersthene chondrites Holbrook and Mocs and in the enstatite chondrite Abee. The rare earth elements were also measured in silicate inclusions of the iron meteorite El Taco. Compared to the rare earths in ordinary chondrites a strong depletion of europium was found in the El Taco inclusions. (auth)

5041 STABLE CARBON-ISOTOPE RATIOS IN METEORITIC ORGANIC MATTER. Flory, D. A. (Manned Spacecraft Center, Houston, Tex.). pp 692-9 of Recent Developments in Mass Spectroscopy. /Ogata, Koreichi (ed.). Baltimore; University Park Press (1970).

From Recent developments in mass spectroscopy conference; Kyoto, Japan (8 Sep 1969).

The measurement of stable carbon-isotope ratios of genuinely indigenous carbon-containing matter can shed new light on the admixture theory versus the successive-metamorphism theory of carbonaceous chondrite evolution. Successive metamorphism would result in isotope fractionation by preferential vaporization as the total carbon content decreases by the volatilization of organic carbon and would tend to produce material with only slight differences (about one percent) in isotopic composition for all carbon-containing phases. However, an admixture would retain any isotopic content variations in discrete phases and would show no correlation between isotopic composition and carbon content. For this report, carbon-isotope composition data were obtained for the total carbon present, the inorganic carbon fraction, the carbonate carbon fraction, and the insoluble organic carbon fraction. The extractable organic carbon fraction was not considered. Investigations conducted to determine the nature of the extractable organic carbon fraction concluded that the source is terrestrial contamination. The results of a recent study of the stable carbon-isotope composition of the soluble organic carbon in several carbonaceous chondrite meteorites carried out in the University of Houston biophysical science laboratories are also consistent with the conclusion of a terrestrial contamination source. (auth)

5042 EXTINCT  $^{129}\text{I}$ ,  $^{244}\text{Pu}$ , AND SUPERHEAVY ELEMENTS IN THE EARLY HISTORY OF THE SOLAR SYSTEM. York, Derek (Univ. of Toronto). Comments Earth Sci., Geophys.; 2: No. 1, 14-21 (Jun-Jul 1971).

A brief review is given on the existence of the extinct isotopes  $^{129}\text{I}$  and  $^{244}\text{Pu}$  and their implications for an understanding of the early solar system. 30 references. (W.D.M.)

### Stars

Refer also to abstracts 5198, 5204, 5344, and 5482.

5043 LITHIUM ISOTOPE RATIO IN F AND G FIELD STARS. Cohen, Judith Gamora. Pasadena, Calif.; California Inst. of Tech. (1971). 220p. University Microfilms Order No. 71-27,095.

Thesis.

Theoretical profiles of the resonance line of Li I were computed using an absorption coefficient (sum of each of the four components) and a model stellar atmosphere. These profiles were used to verify the lithium abundances derived by previous investigators with various approximations. A study of the feasibility of measuring the lithium isotope ratio with high-dispersion photographic spectra was made, with negative results. Profiles were obtained of  $\lambda 6708 \text{ \AA}$  of Li I,  $\lambda 6717 \text{ \AA}$  of Ca I, and sometimes  $\lambda 6710.3 \text{ \AA}$  of



# PHYSICS (GENERAL)

## Astrophysics and Cosmology

### Cosmic Ray Exposure Ages

**9934** RUBIDIUM-STRONTIUM STUDIES ON BLACK HYPERSTHENE CHONDRITES: EFFECTS OF SHOCK AND REHEATING. Gopdan, K. (Univ. of California, Los Angeles); Welherth, G. W. J. *Geophys. Res.*, 76: No. 35, 8434-35 (10 Dec 1971).

Whole-rock Rb-Sr data were measured for 15 hypersthene chondrites, including 10 black chondrites. The latter appeared to have been the most heavily shocked and reheated. Several density fractions for two of the black chondrites, Orvino and Farmington, were separated, and Rb-Sr analyses were performed. Whole-rock data for observed black hypersthene falls contained (within experimental error) to the 1.5 to 1.6  $\times 10^9$ -year isochron defined by other chondrites. Although black "finds" plotted uniformly to the left of the isochron, this behavior was also shown by unshocked finds. Therefore the total-rock data did not reveal any significant shock or reheating effects. The density separates, particularly those of Orvino, departed significantly from the 1.5-b.y. isochron. Although their  $^{87}\text{Rb}/^{86}\text{Sr}$  ratios varied from 0.5 to 1.1, their  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios were the same as that of the total meteorite to within 0.002. This similarity resulted in a nearly horizontal distribution of points on a Sr evolution diagram. To a lesser extent, data from Farmington also showed the same effect. It was concluded that this behavior is due to partial homogenization of the Sr isotopes within these two meteorites very recently in their history. The scatter in the data precluded any precise determination of the time of the event. (auth)

**9935** HIGH-ANGULAR-RESOLUTION ASTROPHYSICAL OBSERVATIONS FROM SPACE. De Jager, C. (Astronomical Inst., Utrecht). *Earth Extraterr. Sci.*, 1: No. 8, 243-50 (Nov 1971).

The symposium held at Seattle in June 1971 was convened to review and compare present-day possibilities of high angular resolution observations of the celestial bodies, from the ground, from balloons, and from space; and to have a preview of future projects, both the agreed ones and those still in the planning stage. (W.D.M.)

**9936** XENON RECORD OF EXTINGUISHED RADIOACTIVITIES IN THE EARTH. Boulos, Mervet S.; Manuel, Oliver K. (Univ. of Missouri, Rolla). *Science*, 174: No. 4016, 1334-6 (24 Dec 1971).

Analyses of xenon from well gas rich in carbon dioxide reveal a large excess of radiogenic xenon-129 from the decay of extinct iodine-129. Smaller excesses observed in the heavy xenon isotopes are from fission. These results place narrow limits on any age difference between the Earth and the oldest meteorites. The occurrence of excess radiogenic xenon-129 in well gas also suggests that any quantitative degassing of existing solid materials to form the atmosphere must have been limited to a very early period of the Earth's history, approximately the first  $10^7$  years. Alternatively, this observation is consistent with a model of the Earth's continuous, but still incomplete, degassing since its time of formation. (auth)

**9937** ISOTOPIC COMPOSITION OF TRAPPED HELIUM AND NEON IN CARBONACEOUS CHONDRITES. Srinivasan, B.; Manuel, O. K. (Univ. of Missouri, Rolla). *Earth Planet. Sci. Lett.*, 12: No. 3, 282-6 (Nov 1971).

The covariance observed in the isotopic composition of primordial He, Ne, and Ar in carbonaceous chondrites can be explained on the basis of simple mass-dependent fractionation. (auth)

**9938** Xe AND Kr ANALYSES OF SILICATE INCLUSIONS FROM IRON METEORITES. Bogard, D. D.; Huneke, J. C.; Bennett, D. S.; Wasserburg, G. J. (California Inst. of Tech., Pasadena). *Geochim. Cosmochim. Acta*, 35: No. 12, 1231-54 (Dec 1971).

The Xe and Kr contents of silicate inclusions from the iron meteorites Copiapo, Four Corners, Linwood, Pine River, Weckerroo Station, and Woodbine ( $^{136}\text{Xe} = 2$  to  $10$ ,  $^{84}\text{Kr} = 3$  to  $103 \times 10^6$  atoms/g,  $^{86}\text{Kr}/^{136}\text{Xe} = 2$ ) are comparable to chondritic values. The isotopic compositions show trapped gas of both chondritic composition (dominant in Pine River) and atmospheric composition (dominant in Linwood). Large spallation effects ( $^{81}\text{Kr} = 1 \times 10^7$ ,  $^{136}\text{Xe} = 2 \times 10^6$  atoms/g) occur in Weckerroo Station and Four Corners. The spallation Xe and Kr spectra in Weckerroo differ from those reported for stone meteorites. A re-analysis

of literature data shows that systematic variations also exist among stone meteorite spallation spectra which can be qualitatively understood in terms of target element abundance and shielding variations. Very large neutron capture effects on Br and I occur in several meteorites ( $^{82}\text{Kr}/^{81}\text{Kr} = 100/2/3 \times 10^6$  atoms/g in Linwood). The  $^{81}\text{Kr}/^{86}\text{Kr} = 2.5$  ratios from neutron capture on Br for Linwood and Copiapo are distinct from that found in stone meteorites. All samples have pronounced  $^{136}\text{Xe}$  excesses (3 to  $50 \times 10^6$  atoms/g) which apparently indicate differences in formation times from chondrites of less than about  $10^7$  yr; however, the presence of trapped  $^{136}\text{Xe}$  in silicates which were enclosed in molten Fe-Ni and cooled slowly prove that they were not entirely outgassed; thus, some of the  $^{136}\text{Xe}$  excess may also be trapped. No discernible fission Xe was observed. (auth)

**9939** PRODUCTION RATE OF  $^{26}\text{Al}$  FROM TARGET ELEMENTS IN THE BRUDERHEIM CHONDRITE. Cressy, Philip J. Jr. (Goddard Space Flight Center, Greenbelt, Md.). *Geochim. Cosmochim. Acta*, 35: No. 12, 1283-96 (Dec 1971).

An 849-g specimen of the Bruderheim chondrite was subjected to magnetic and heavy-liquid mineral separation procedures, resulting in a number of chemically distinct samples. These samples were analyzed for cosmogenic  $^{26}\text{Al}$  by nondestructive gamma-gamma coincidence counting. The observed  $^{26}\text{Al}$  specific activities were correlated with the chemical composition of potential target elements by a weighted least-squares fitting technique. The calculated  $^{26}\text{Al}$  production rates, in dpm per kilogram of target element, are: Al,  $1130 \pm 190$ ; Si,  $245 \pm 31$ ; S,  $133 \pm 11$ ; Mg,  $28 \pm 30$ . Production rates from Ca and Ni + Fe were estimated to be 24 and 2.2 dpm/kg, respectively, from spallation systematics. Most meteorite classes show a distribution of  $^{26}\text{Al}/^{27}\text{Al}$ , primarily between 0.80 and 1.10 (excluding short-exposure-age effects). The only exception is the eucrites. The five eucrites with the highest relative  $^{26}\text{Al}$  activities have only  $0.77 \pm 0.93$  of their respective calculated activities. Two Apollo 12 samples, from mean depths of 15 to 20 cm, have approximately 0.78 of the  $^{26}\text{Al}$  activities calculated for their chemical compositions. A depletion in  $^{26}\text{Al}$  in lunar samples shielded from solar radiation is in accord with a reduced cosmic-ray flux near the Earth's orbit, relative to that experience by most meteorites. The  $^{26}\text{Al}$  depletion in the eucrites suggests that they spent a greater proportion of their orbital periods near 1 AU than have most meteorites. The similarity in relative  $^{26}\text{Al}$  contents of the lunar samples and the eucrites may not be a coincidence. (auth)

### Stars

Refer also to abstracts 9069, 10186, 10600, and 11014.

**9940** STELLAR EVOLUTION AND VARIABLE STARS. Penny, A. J.; Powell, A. L. T. (Royal Greenwich Observatory, Hailsham, Eng.). *Earth Extraterr. Sci.*, 1: No. 8, 229-41 (Nov 1971).

Summaries of the lectures given at the NATO Advanced Study Institute on Stellar Evolution and Variable Stars held at Ofir, Portugal in 1970 are given. (auth)

**9941** POPULATION OF HELIUM TRIPLET STATES IN GASEOUS NEBULAE. Drake, G. W. F. (Univ. of Windsor, Ont.); Robbins, R. R. *Astrophys. J.*, 171: No. 1, 55-61 (1 Jan 1972).

Several authors have found that in planetary nebulae the population of helium atoms in the metastable  $1s2s\ ^3S$  state calculated by balancing the theoretical rates of formation and destruction is one or two orders of magnitude greater than that deduced from measured intensity ratios. The problem was reexamined, using updated atomic data and including additional triplet-depopulation mechanisms. Out of 11 objects studied, nine showed reasonable agreement between the two methods of deriving the triplet populations. It was found that in some cases depopulation of the  $2\ ^3S$  state via the  $2\ ^3P_1 - 1\ ^1S_0$  transition may be significant. The remaining discrepancies are no longer sufficient to require extinction of  $10.830\ \text{\AA}$  photons upon dust grains, as has previously been suggested. A comparison of the present results with radiative-transfer calculations suggests that the data may be interpreted in terms of a "space filling" factor describing the degree of nebular condensation. (auth)

**9942** UNUSUAL ABSORPTION FEATURE IN THE FAR-ULTRAVIOLET SPECTRUM OF EARLY-TYPE SUPERGIANTS. Guderhill, A. B.; Leckrone, D. S.; West, D. K. (Goddard Space

# ENVIRONMENTAL AND EARTH SCIENCES

## Minerals and Ores

Refer also to abstract 18490.

**17689** (ORNL-TM-3563) AVAILABILITY OF NATURAL RESOURCES FOR MOLTEN-SALT BREEDER REACTORS. Bell, M. J. (Oak Ridge National Lab., Tenn.). 11 Nov 1971. 26p. Dep. NTIS.

An investigation has been made of the availability of, and the anticipated demand for, materials of importance to the MSBR program. Materials considered included the constituents of Hastelloy-N, coolant salt, fuel salt, and materials required for construction and operation of the processing plant. It was found that the world reserves of beryllium, fluorine, and bismuth are being rapidly depleted by non-MSBR uses, and that these reserves can be expected to be exhausted by the turn of the century. Ample resources of beryllium and fluorine are available to sustain a large MSBR industry, but development of an improved mining technology will be required to make their recovery economical. Ore from which thorium is recoverable for  $^{235}\text{U}$  will be available into the middle of the twenty-first century. MSBR demands for all materials, with the possible exception of bismuth used in modified Hastelloy-N, comprise only a small fraction of the predicted world primary demand for these minerals. The fuel cycle cost was found to be relatively insensitive to the price of raw materials; an increase in the cost of enriched  $^{235}\text{U}$  to ten times its present level, or an increase in the price of thorium or Hastelloy-N to three times their present levels, would increase the fuel cycle cost by 0.1 mol/kWh, each.

**17690** URANIUM IN AUSTRALIA'S NORTHERN TERRITORY. Com. Nat. Energ. Nucl. Sci. (Aust.) 17: No. 19, 64-68 (1971). (In Italian).

A review of the latest uranium deposits discovered in Australia's important uranium province of the Northern Territory is presented. (auth)

**17691** URANIUM CONTENT OF THE OCEANIC UPPER MANTLE. Aumento, F.; Hyndman, R. D. (Dalhousie Univ., Halifax, Nova Scotia). Earth Planet. Sci. Lett. 12: No. 1, 373-84 (Dec 1971).

Fission track determinations of both the whole rock contents and the distribution of uranium in individual phases were made on twenty serpentinized ultramafic rocks from the Mid-Atlantic Ridge at 45°N (Hudson Fracture zone) and 23°N (Gibbs Fracture Zone). The rocks are thought to represent uppermost oceanic upper mantle material. Whole rock uranium concentrations, varying from 0.13 to 0.70 ppm, both before and after the subsequent effects of metasomatism (serpentinization, amphibolization and sodification) from their concentrations in the original fresh rocks. Radiochemicals reveal that, unlike continental mantle (granite), most of the uranium is homogeneously distributed in primary olivines (1 ppm), and to a lesser extent in primary orthopyroxenes. Primary olivine is relatively depleted in uranium (0.01 ppm), as is primary chrome spinel (0.01 ppm). Extrapolation to pre-metasomatic conditions suggests that at the time of crystallization these ultramafic rocks had concentrations of at least 1 to 10 ppm uranium, up to an order of magnitude greater than expected. These concentrations suggest that the ultramafic rocks are unlikely to be directly genetically related to the serpentine, talc, and talcophiles containing 0.25 ppm uranium, but are probably primary ultramafic material from which there has been no previous episode of basalt extrusion. These uranium concentrations suggest that the oceanic upper mantle (plate) has quite high radioactive heat production in contrast to low heat production in the continental upper mantle. The equality of oceanic and continental heat flows is explained by the data, since the total heat produced in an oceanic plate is estimated to be about equal to that of the continental crust. One can construct a model that has an isothermal, low velocity (crustal melt) layer at a shallower depth under the oceans than under the continents and that has the same heat flux from below the oceanic and shield plates. Lateral convective heat transfer in the low velocity layer is not required, although radioactive heat production of the oceanic plate can explain the high heat flows measured behind trenches with downgoing slabs. (auth)

## Radioactive Effluents

Refer also to abstracts 17697, 17714, 18407, 19896, and 19811.

**17692** (DOCKET-50201-107) WEST VALLEY REPROCESSING PLANT. Quarterly Report, October 1-December 31, 1971. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 31 Jan 1972. 9p. Dep. NTIS.

Information is presented on analysis of milk from the NFS farm, the radioactivity discharged from the plant lagoons, the particulate radioactivity discharged via the plant stack and surveillance tests. (M.C.G.)

**17693** (WASH-1512(Dr.)) ROVER FUELS PROCESSING FACILITY. National Reactor Testing Station, Idaho. Environmental Statement. (Atomic Energy Commission, Washington, D. C.). Jan 1972. 146p. Dep. NTIS.

The project proposed would consist of modifying a small portion of the existing Idaho Chemical Processing Plant (ICPP) to store and subsequently reclaim useable uranium from the Rover fuels. It would be located at the National Reactor Testing Station (NRTS), which is situated on a plain in Southeastern Idaho and consists of a flat area covered primarily with sagebrush and grass. The principal wildlife residing in this area consists of antelope, coyotes, rabbits, and small rodents. Rover fuel is stored at the Nuclear Rocket Development Station (NRDS) in Nevada and contains about 2600 kg of highly enriched uranium (93%  $^{235}\text{U}$ ) that is not being utilized in its present form. The proposed operation would recover uranium worth \$26 million for reuse at an estimated cost of \$4.5 million. Upgrading of the containment of the radionuclides in the fuel by storage at a single facility designed specifically to handle radioactive material is considered. Environmental costs associated with this project will be the temporary use of less than one acre of restricted land within the boundaries of NRTS for an indefinite period of time and the release of small quantities of radioactive fission products in concentrations several orders of magnitude below current discharge guidelines. Nonradioactive chemicals will be released to the environment in concentrations less than 0.1% of federal and state regulations. The facility will be designed to minimize the quantities of radioactive and nonradioactive discharges released. The anticipated benefits were assessed and balanced against the environmental and economic costs, and available alternatives considered. (M.C.G.)

## Radioactivity Transport and Monitoring

Refer also to abstracts 17310, 17356, 17757, 17836, and 18107.

**17694** (COO-3462-4) URANIUM GEOCHEMISTRY IN CARBONATES USING THE FISSION TRACK METHOD. Technical Progress Report. Miller, Donald S.; Friedman, Gerald M. (Rensselaer Polytechnic Inst., Troy, N. Y.). Jan 1972. Contract AT(41-1)-3462. 12p. Dep. NTIS.

**17695** RESULTS OF A FOLLOWUP RADIATION SURVEY ON COLOR TELEVISION SETS, SUFFOLK COUNTY, NEW YORK. Becker, Seymour (Suffolk County Dept. of Health, Smithtown, N. Y.). Radiol. Health Data Rep.; 12: No. 9, 457-8 (Sep 1971).

The U. S. Public Health Service's regulatory standard required that television receivers manufactured after January 15, 1970, produce no radiation exceeding an exposure rate of 0.5 mR/h at 5 cm from any point on the external surface of the receiver. Results of a survey of color television sets manufactured after the effective date of the Public Health Service standard show improvement in the reduction of radiation emission. Those color television sets manufactured before the effective date of the standard that are being serviced by the factory-trained television servicemen reveal no levels of x-radiation emissions above natural background emissions. With the cooperation of the independent television serviceman and the individual color television set owner, it appears that the x-radiation problem in color television receivers will be eliminated. (auth)

**17696** NUCLEAR METHODS IN METEOROLOGY AND HYDROLOGY. Kruger, Paul (Stanford Univ., Calif.). pp 113-26 of Nuclear Methods in Environmental Research. (Vogt, James R. (ed.). Columbia, Mo.; Univ. of Missouri (1971).

From Meeting on nuclear methods in environmental research; Columbia, Mo. (23 Aug 1971).

The spectrum of nuclear techniques has been employed in essentially the entire spectrum of geofluid circulations on earth.

This volume covers the mineralogy and petrology of the samples. A paper by A. N. Kovalyov on the Luna 16 sample is also included. (W.D.M.)

**18625** PROCEEDINGS OF THE SECOND LUNAR SCIENCE CONFERENCE, HOUSTON, TEXAS, JANUARY 11-13, 1971. VOLUME 2. CHEMICAL AND ISOTOPE ANALYSES. ORGANIC CHEMISTRY. (Levinson, A. A. (ed.). *Geochimica et Cosmochimica Acta*, Supplement 2. Cambridge, Mass.; Massachusetts Institute of Technology Press (1971). 257 p., \$25.00. (CONF-710102-(V61,2)).

This volume contains the papers dealing with chemical analysis, isotopic analysis, and organic chemistry of the Apollo 11 and 12 samples. (W.D.M.)

**18626** PROCEEDINGS OF THE SECOND LUNAR SCIENCE CONFERENCE, HOUSTON, TEXAS, JANUARY 11-13, 1971. VOLUME 2. PHYSICAL PROPERTIES. SURVEYOR III. (Levinson, A. A. (ed.). *Geochimica et Cosmochimica Acta*, Supplement 2. Cambridge, Mass.; Massachusetts Institute of Technology Press (1971). 875 p., \$25.00. (CONF-710102-(V61,3)).

This volume contains the papers dealing with the physical properties of Apollo 11 and 12 samples and eleven papers on materials from the Surveyor III craft. (W.D.M.)

**18627** AGE OF A LUNAR ANORTHOSITE. Huson, Liaquat; Schaeffer, Oliver A.; Suttler, John F. (State Univ. of New York, Stony Brook). *Science*; 175: No. 4020, 428-30 (28 Jan 1972).

The crystallization age of an Apollo 15 anorthosite rock, 15415,9, returned from the lunar highlands was measured to be  $4.09 \pm 0.19 \times 10^9$  years. The primitive lunar crust must have been formed in the first 300 to 400  $\times 10^6$  years. The results give some evidence to the hypothesis that the primitive lunar surface was molten and large-scale fractional crystallization occurred in the early history of the Moon. (auth)

**18628** APOLLO 15 LUNAR SAMPLES: A PRELIMINARY DESCRIPTION. *Science*; 175: No. 4020, 363-75 (28 Jan 1972).

Samples returned from the Apollo 15 site consist of mare basalts and breccias with a variety of primary igneous rocks. The mare basalts are from at least two different lava flows. The bulk chemical compositions and textures of these rocks confirm the previous conclusion that the lunar maria consist of a series of extensive volcanic rocks that are rich in iron and poor in sodium. The breccias contain abundant clasts of anorthosite fragments along with clasts of basaltic rocks much richer in plagioclase than the mare basalts. These two rock types also occur as common components in soil samples from this site. The rocks and soils from both the front and mare region exhibit a variety of shock characteristics that can best be attributed to ray material from the crater of Imbrius or Autaeus. (auth)

**18629** GEOLOGIC SETTING OF THE APOLLO 15 SAMPLES. *Science*; 175: No. 4020, 397-412 (28 Jan 1972).

The samples and photographs returned from the Apollo 15 site show that Hadley Delta is largely underlain by breccias whose clasts are mainly fragments of coarse-grained feldspathic rocks and nonmare-type basalt. Conspicuous sets of lineaments, visible in surface and orbital photographs of Mount Hadley and Hadley Delta, may represent systematic lava flow or fracture sets. The mare surface, with regolith about 3 meters thick, is underlain by two mare basalt types, at least one of which has extensive lateral continuity and is exposed in the upper wall of Hadley Rille. Gradual erosional recession at the edges and filling of the interior of the rille by talus has contributed to the present cross-sectional profile. (auth)

**18630** CHEMISTRY, GEOCHRONOLOGY, AND PETROGENESIS OF LUNAR SAMPLE 15555. (Chappell, B. W.; Compton, W.; Green, D. H.; Ware, N. G. (Australian National Univ., Canberra). *Science*; 175: No. 4020, 415-16 (28 Jan 1972).

Lunar sample 15555 is a mare-type basalt generally similar in chemical composition to the Apollo 12 basalt 8. Sample 15555 is older than any Apollo 12 basalt but younger than the Apollo 14 basalt 8 analyzed thus far. (auth)

**18631**  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  DATING OF APOLLO SAMPLE 15555. Alexander, E. C. Jr.; Davis, P. K.; Lewis, R. N. (Univ. of California, Berkeley). *Science*; 175: No. 4020, 417-19 (28 Jan 1972).

An age of  $3.33 \pm 0.05 \times 10^9$  years was obtained for Apollo 15 sample 15555 by  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  dating. The age of rock 15555, a basalt from the rim of Hadley Rille, establishes an upper limit to the age of the rille. The basalt flows filling the Hadley Rille between the Imbrium basin postdate the formation of the basin as measured by the Apollo 11 samples of the Fra Mauro formation by at least 200  $\times 10^6$  years. Therefore, the mare basalts

cannot be simple impact melts but rather must result from homogeneous activity on the Moon. (auth)

**18632** RUBIDIUM-STRONTIUM AND POTASSIUM-ARGON AGE OF LUNAR SAMPLE 15555. (Rada, Muelly, J.; Evensen, N. M.; John, Bor-ming; and others) (Univ. of Minnesota, Minneapolis). *Science*; 175: No. 4020, 419-21 (28 Jan 1972).

The lunar mare basalt 15555 from the edge of Hadley Rille was dated at  $3.7 \pm 0.7$  years by both rubidium-strontium and potassium-argon techniques. Age and trace element abundances closely resemble those of the Apollo 11 mare basalt. Data from lunar basalt 15555 thus far indicate that they cannot be derived by simple fractionation from a homogeneous magma. (auth)

**18633** KRYPTON RECORD IN THE LARGEST APOLLO 15 ROCK. (Marti, K.; Lightner, B. D. (Univ. of California, San Diego, La Jolla). *Science*; 175: No. 4020, 421-423 (Jan 1972).

The spallation krypton data from rock chip 15555,23 indicate a well-shielded location during most of the time during which the rock was exposed to cosmic rays. A krypton krypton exposure age of  $1.1 \times 10^9$  years is calculated, and the gas retention ages are estimated. No evidence for the presence of products from  $^{24}\text{Pu}$  or  $^{24}\text{Am}$  was found. (auth)

**18634** GAS-RETENTION AND COSMIC-RAY EXPOSURE AGES OF LUNAR ROCK 15555. (Podosak, P. A.; Huneke, J. C.; Wasserburg, G. J. (California Inst. of Tech., Pasadena). *Science*; 175: No. 4020, 423-5 (28 Jan 1972).

The last lava flow in the Hadley Rille area of Mare Imbrium, as inferred from an  $^{40}\text{Ar}$ - $^{39}\text{Ar}$  experiment on a plagioclase separate from the lunar basalt 15555, occurred  $3.31 \pm 0.03 \times 10^9$  years ago. An  $^{39}\text{Ar}$ - $^{39}\text{Ar}$  experiment on a whole rock sample shows significant loss of radiogenic  $^{39}\text{Ar}$  and yields a well-defined, high-temperature plateau indicating a lower age of  $3.22 \pm 0.04 \times 10^9$  years. A cosmic-ray exposure age of  $99 \pm 10 \times 10^6$  years is determined from the ratio of spallogenic  $^{39}\text{Ar}$  to calcium. (auth)

**18635** GEOCHEMISTRY OF APOLLO 15 BASALT 15555 AND SOIL 15531. (Schnetzler, C. C.; Philpotts, John A.; Nava, David F.; Schuhmann, Shuford; Thomas, Herman H. (Goldard Space Flight Center, Greenbelt, Md.). *Science*; 175: No. 4020, 426-8 (28 Jan 1972).

Major and trace element concentrations were determined by atomic absorption spectrophotometry, colorimetry, and isotope dilution in Apollo 15 mare basalt 15555 from the Hadley Rille area; trace element concentrations were also determined in plagioclase and pyroxene separated from basalt 15555 and in soil 15531 from the same area. (W.D.M.)

**18636** MINERALOGIC AND PETROLOGIC STUDY OF LUNAR ANORTHOSITE SLIDE 15415,18. (Hargraves, R. B.; Hollister, L. S. (Princeton Univ., N. J.). *Science*; 175: No. 4020, 430-2 (28 Jan 1972).

The anorthosite slide 15415,18 contains 88% subhedral plagioclase (97 mole % anorthite), two pyroxenes: diopside and its (49% wollastonite, 39% enstatite, 16% ferrosilite) with subsidiary (10%) lamellae and grains of hypersthene (2.5% wollastonite, 3% enstatite, 39.5% ferrosilite), and traces of ilmenite. The pyroxene occurs interstitial to, and as small grains enclosed within plagioclase. The textures and compositions of the phases appear compatible with an origin by concentration and a lamellar growth of plagioclase from a gabbroic anorthosite (or hyperaluminous) magma in a "plutonic" environment. (auth)

**18637** LUNAR ANORTHOSITE 15415: TEXTURE, MINERALOGY, AND METAMORPHIC HISTORY. (James, Odette E. (Geological Survey, Washington, D. C.). *Science*; 175: No. 4020, 432-6 (28 Jan 1972).

Lunar anorthosite 15415 consists almost entirely of anorthite (homogeneous anorthite 96.6 mole %), with accessory diopside and traces of hypersthene, ilmenite, and a silica mineral. The rock has had a complex metamorphic history. The texture reflects at least two episodes of shearing (followed by intense and partial recrystallization, respectively), one episode of cataclastic deformation, and one or more episodes of shattering and fragmentation. (auth)

**18638** APOLLO 15 GEOCHEMICAL X-RAY FLUORESCENCE EXPERIMENT: PRELIMINARY REPORT. (Adler, I. (Goldard Space Flight Center, Greenbelt, Md.); Trombka, J.; Gerard, J.; and others). *Science*; 175: No. 4020, 436-8 (28 Jan 1972).

Although only part of the information from the x-ray fluorescence geochemical experiment has been analyzed, it is clear that the experiment was highly successful. The present report contains preliminary data among and possibly within the mare and highlands regions. When viewed in the light of the lunar highlands rocks

A gradual fall in the extent of contamination of most of the food products with  $^{90}\text{Sr}$  and  $^{137}\text{Cs}$  was noted in the period from 1967 to 1969. The rate of fall of contamination of bread, fish, potatoes, and meat with  $^{137}\text{Cs}$  was much more significant than that of contamination with  $^{90}\text{Sr}$ . In 1969, in comparison with that in 1967, the intake of  $^{90}\text{Sr}$  by the population of the Soviet Union decreased by 50% and that of  $^{137}\text{Cs}$  by almost 60%. The level of intake of  $^{90}\text{Sr}$  by the population in 1969 amounted to about 6% and that of  $^{137}\text{Cs}$  to 1.2% of the permissible intake of these isotopes according to the 1969 standard of radiation safety. (auth)

23182 CONSIDERATION OF STABLE IODINE IN THE ENVIRONMENT IN THE EVALUATION OF MAXIMUM PERMISSIBLE CONCENTRATIONS FOR  $^{129}\text{I}$ . Tadmor, Jacob (Soreq Nuclear Research Centre, Yafne, Israel. Tel-Aviv Univ., Israel). Radiol. Health Data Rep.; 12: No. 12, 611-14(Dec 1971).

An increase in the content of  $^{129}\text{I}$  in the atmosphere due to release from nuclear fuel reprocessing plants is predicted, based on projected figures for the expansion of the nuclear industry to the year 2000. It is pointed out that stable iodine is also released from nuclear fuel reprocessing plants. Consideration of the relationship between the concentration of stable and radioactive isotopes in an equilibrated environment revealed that the maximum permissible concentration (MPC) values for  $^{129}\text{I}$  might need revision. A test computation was performed on the MPC of  $^{129}\text{I}$  in atmosphere and the corresponding maximum permissible burden in the human thyroid, taking into consideration the ratio between the mass concentration of the radioactive and total isotopes. Data on the half-time equilibrium for  $^{129}\text{I}$  via different food chain pathways to various human tissues were used in the computation. It was concluded that, based on the MPC value of  $6 \times 10^{-11} \text{ Ci/m}^3$  for the nonoccupational population, the  $^{129}\text{I}$  burden of the human thyroid in the year 2000 could reach a level about 14-fold higher than the maximum permissible burden. (C.H.)

23183 BONDS OF METHYLENE BLUE TO ERYTHROCYTES OF URANIUM MINERS. Nosek, J. (Inst. of National Health in Uranium Industry, Příbram, Czech.). Cas. Lek. Cesk.; 110: No. 14, 313-16(2 Apr 1971). (In Czech).

A study is presented on the progressive decoloring of methylene blue by the suspension of erythrocytes, carried out on uranium miners. The results of this and of two preceding studies show a different content of pyridinenedindinucleotides in the erythrocytes of uranium miners, as compared with controls. The reason is assumed to be the contamination of erythrocytes by uranium. (NSA of Czech)

23184 BODY BURDENS OF  $^{137}\text{Cs}$  AND  $^{40}\text{K}$  IN THE JAPANESE POPULATION. Katsumuma, Haruo; Yoshizawa, Yasuo (Tokyo Univ.). Nippon Igaku Hoshasen Gakkai Zasshi; 31: No. 1, 1-6 (Apr 1971).

About 2000 Japanese were sampled for this study. Body burdens of  $^{137}\text{Cs}$  and  $^{40}\text{K}$  in the Japanese population were measured with a whole-body counter. Sex and age of the subjects, ranging in age from 6 to 87 years, were evenly distributed. The survey took 2 yrs to complete. The decreasing rate of body burdens of  $^{137}\text{Cs}$  during the 2 yrs was taken into account, and the necessary correction was made. Number of subjects showed in tables by age and sex. The potassium concentration was recorded as grams of potassium per kilogram of lean body mass (LBM). The body burdens of  $^{137}\text{Cs}$  were expressed as radioactivities per kilogram of body weight per gram of potassium. From the values obtained in this study, the genetically significant doses delivered by body burdens of  $^{137}\text{Cs}$  and  $^{40}\text{K}$  to the Japanese population were calculated as  $20.61 \pm 0.50 \text{ mRem/yr}$  and  $0.49 \pm 0.05 \text{ mRem/yr}$  respectively (the values of August 1967 were used for the calculation of the dose). (Japan)

23185 ABSORPTION AND RETENTION OF COBALT IN MAN BY WHOLE-BODY COUNTING. Smith, T.; Edmonds, C. J.; Barnaby, C. F. (University Coll., London). Health Phys.; 22: No. 4, 359-67(Apr 1972).

Retention of  $^{60}\text{Co}$  given intravenously or orally as  $^{60}\text{CoCl}_2$  to human subjects was measured by whole-body counting for periods of up to 1018 days. Intravenous  $^{60}\text{Co}$  was retained for long periods, as much as 9 to 16% of the dose being eliminated only with a biological half-life of about 2 yr. The absorption of orally administered  $^{60}\text{CoCl}_2$  depended on several factors, especially on the amount of stable cobalt given. Only 5% or less of a trace dose (containing less than  $1 \mu\text{g Co}$ ) was absorbed but this increased to more than 20% when larger quantities of stable cobalt (1.2 mg) were given. The absorbed fraction of an oral dose was apparently retained by the whole body in a similar way to  $^{60}\text{Co}$  given intravenously. Results of serial counts over the liver using a collimated NaI detector, indicated that  $^{60}\text{Co}$  was concentrated in this organ in excess of the average whole-body concentration even in subjects mea-

sured after 1000 days. The results indicated that the amount of  $^{60}\text{Co}$  present in the liver was, on average, about one fifth of the total body content. (auth)

## Animals

Refer also to abstracts 2279 and 2303.

23186 (AEC-46-7209) MARINE RADIOECOLOGY. Baki-Karpiy, G. G. (ed.). Translation of Morskaya Radioekologiya, Kiev, Izdatel'stvo Naukova Dumka, 1970. 335p. Dep. NTIS.

Research techniques, many of which are applicable in various branches of marine biology and oceanography, are described. Results are reported from studies on the dynamics and nature of exchange of radioactive and chemical substances between hydrobiota and the environment; the distribution of radionuclides in organisms of marine fauna, and the radiosensitivity of mitosis in fish embryos. Composite data on the radioecology of seas and oceans are presented. Emphasis is placed on the transport of  $^{90}\text{Sr}$  in water and organisms of the Black and Red Seas, and the content of  $^{90}\text{Sr}$  in fish in the Atlantic and Indian Oceans. (368 references) (C.H.)

23187 (CEA-R-1266) GAMMA-RAY SPECTROMETRY EXPERIMENTS WITH LARGE FARM ANIMALS. Dubron, Francois; Remy, Jacques; Grillon, Gerard; Tricaud, Yves; Nizza, Pierre (Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires). Nov 1971. 103p. (In French). Dep. NTIS (U. S. Sales Only).

A survey was made of the various types of whole-body radiation monitors for large farm animals reported in the literature. Monitoring facilities developed for sheep, swine, and cattle are described from the point of view of radiation detection, containment of the animals, and phantoms used for calibration. The problems of radionuclide distribution in the body were carefully studied in order to try and show the changes that would affect the counting geometry. Some examples given include: iodine metabolism in dairy cattle, assessment in the fetuses and body burdens following the administration of  $^{131}\text{I}$ ; rate of transit of an ingested insoluble compound ( $^{232}\text{RaSO}_4$ ); and the determination of the site of uptake of radionuclides ( $^{137}\text{Cs}$  and  $^{134}\text{Cs}$ ) by the interpretation of the scanning data. (auth)

23188 (EUC-4741) MOVEMENT OF CERTAIN ISOTOPES IN ANIMALS AND MAN. Annual Report, 1970. (Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires). 1971. 36p. (In French). Dep. NTIS (U. S. Sales Only). EUR FF 6.65.

Investigations on the metabolism of lanthanides and actinides following inhalation or intramuscular injection were carried out in rats. Differences were noticed between  $^{239}\text{Pu}$  and  $^{241}\text{Pu}$  distribution in tissues. The metabolism of  $^{239}\text{Pu}$  was similar to that of  $^{241}\text{Pu}$ . Several lanthanides and actinides of valence 3 and 4 were compared both for alveolar clearance and removal from bone. The results obtained with actinides of a higher valence were gathered to show the similarities and differences of distribution as compared with actinides of valence 3 or 4. Further progress was made in studies on alveolar clearance and the kinetics obtained in various experimental conditions were analyzed. (auth)

23189 (RLO-1750-55)  $^{65}\text{Zn}$  IN BENTHIC INVERTEBRATES OFF THE OREGON COAST. Carey, Andrew G. Jr. (Oregon State Univ., Corvallis, Dept. of Oceanography). (1970). 27p. Dep. NTIS.

Radioecological studies of benthic invertebrate fauna off central and northern Oregon demonstrate that  $^{65}\text{Zn}$  entering the Northeast Pacific Ocean via the Columbia River is concentrated by the sublittoral, bathyal, and abyssal fauna. The  $^{65}\text{Zn}$  (pCi/g ash-free dry wt) and specific activity ( $\mu\text{Ci } ^{65}\text{Zn/g Zn}$ ) in the fauna decreases fairly regularly with distance from the river and markedly with depth within the first 400 m. The major route of the isotope to the fauna appears to be through the food web. The radioecology of the benthic organisms differs from that of the pelagic fauna. (auth)

23190 (RLO-1750-61) SEASONAL AND AREAL DISTRIBUTIONS OF RADIONUCLIDES IN THE BIOTA OF THE COLUMBIA RIVER ESTUARY. Renfro, William C.; Forster, William O.; Osterberg, Charles (Oregon State Univ., Corvallis. Dept. of Oceanography). (1969). 42p. Dep. NTIS.

In the Columbia River Estuary  $^{65}\text{Zn}$  was present during 1964 to 1968 in measurable amounts in all organisms. Because of the ease with which it could be measured and because of the biological importance of zinc,  $^{65}\text{Zn}$  was studied most intensively. Other radionuclides measured at least once in the biota were  $^{137}\text{Cs}$ ,  $^{134}\text{Cs}$ ,

Nuclear, Madrid). *Energ. Nucl. (Madrid)*; 15: No. 73, 431-4 (Sep-Oct 1971). (In Spanish).

As a result of a series of systematic radioactive prospections in the Iberian Cordillera, important radioactive discoveries were located. The geology of the Sorian zone is described. The preliminary geological surveys indicate anomalies which can reflect a possible uranium deposit to the south of these anomalies. (J.S.R.)

## Radioactive Effluents

Refer also to abstracts 26027, 27413, 27419, 27480-27482, 27493, 27507, 27514, 27515, 27520, and 27522.

**25556** (DOCKET-50268-26) MIDWEST FUEL RECOVERY PLANT. Draft Detailed Statement on Environmental Considerations Related to Proposed Operation. (Division of Radiological and Environmental Protection (AEC), Washington, D. C.). Mar 1972. 86p. Dep. NTIS.

Environmental considerations related to the proposed issuance of an operating license for the Midwest Fuel Recovery Plant are discussed. The site, plant, environmental impact of site preparation and plant construction, environmental impact of plant operation, probable adverse effects, short-term uses and long-term productivity, commitments of resources, alternatives to proposed action and cost-benefit analysis of their environmental effects are considered. (M.C.G.)

**25557** PERMISSIBLE ACTIVITY DISCHARGE INTO RECEIVING WATERS THROUGH RADIOACTIVE WASTE WATER FROM NUCLEAR POWER PLANTS. Brunner, P. G. *Wasser Boden*; No. 4, 124-6(1971). (In German).

Details are given of the future consumption of electric energy and of the future installed electric power from nuclear power plants. Based thereon, the permissible radioactivity discharge per 100 MWe into waters is determined to be 1.5 Ci/a, except T, for a total power of nuclear power plants of 100,000 MWe. Considering the capacity of decontamination plants the permissible activity discharge per 100 MWe can be provisionally established to be 1 Ci/a. (INIS)

## Radioactivity Transport and Monitoring

Refer also to abstracts 25501 and 25508.

**25558** (DOCKET-50201-112) WEST VALLEY REPROCESSING PLANT. Environmental Report No. 11, 2nd Half, 1971. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 29 Feb 1972. 30p. Dep. NTIS.

Over 2000 separate analyses of air, water, milk, fish, deer, and silt were performed in the 6 months period. Discharges of  $^{90}\text{Sr}$  from the lagoon system decreased by a factor of 3 compared with the first half of 1971 and by a factor of 9 compared to 1970.  $^{137}\text{Cs}$  discharges decreased by a factor of 5 compared with the first half of 1971.  $^{131}\text{I}$ , tritium, and  $^{85}\text{Kr}$  were monitored in stack effluent. Data are presented in tables. (M.C.G.)

**25559** (EGG-1183-1522) ENVIRONMENTAL RADIATION SURVEYS AND SNOW MASS PREDICTIONS FROM AIRCRAFT. Technical Report No. L-1034. Deal, L. J.; Doyle, J. F.; Burson, Z. C.; Fritzsche, A. E. (EG and G, Inc., Las Vegas, Nev.). 25 Jun 1971. 23p. (CONF-710540-1). Dep. NTIS.

From seventh international symposium on remote sensing of environment; Ann Arbor, Mich. (17 May 1971).

An aerial radiation detection and tracking system is described and its use in recording radiation levels from isotopes in air, on the ground, or in the soil is discussed. Information is included on instrumentation and radioisotope detectability. Experiments and field tests are described to illustrate the capabilities of the system. (J.R.D.)

**25560** (JPRS-55430) TRANSLATIONS ON EASTERN EUROPE. Scientific Affairs No. 230. Translation of articles on Eastern Europe. 26p. NTIS.

Four papers are included in the translation. One paper is in the scope of NSA and is concerned with calculation of the relative concentration and mass of fallout particles in nuclear explosion clouds. (J.R.D.)

**25561** (LA-4371) ENVIRONMENTAL MONITORING IN THE VICINITY OF THE LOS ALAMOS SCIENTIFIC LABORATORY, JANUARY THROUGH JUNE 1971. Herceg, Joseph E. (comp.)

(Los Alamos Scientific Lab., N. Mex.). Jan 1972. Contract W-7405-eng-36. 44p. Dep. NTIS.

A description is given of the environmental monitoring program in effect at the University of California Los Alamos Scientific Laboratory during the first half of calendar year 1971. Results of programs designed to monitor radiation levels in the Laboratory environs, including the atmosphere, local surface and ground waters, sediments and soils are presented. These measurements are used to make estimates of the dose commitments due to plutonium and tritium concentrations in air. The boundaries of the Laboratory site, the programs associated with various Laboratory technical areas, geologic, climatologic, and economic characteristics of the Los Alamos area, and laboratory procedures used for the analysis of samples are described. (auth)

**25562** (PEL-214) CHANGE IN CONCENTRATION OF TRITIUM IN WATER DURING EVAPORATION AND THE POSSIBILITY OF USING IT TO DETERMINE EVAPORATION FROM WATER, SOIL, AND PLANT SURFACES. van der Westhuizen, M.; Smith, Mavis J. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Sep 1971. 15p. Dep. NTIS (U.S. Sales Only).

The change in tritium concentration of open water surfaces during evaporation is discussed and experiments to test the evaporation formula of Craig and Gordon are described. The first few experiments were done to determine the unknown constant and the subsequent experiments were then used to test the formula as such. The agreement between measured and calculated values was good, as indicated by the correlation coefficients which were better than 0.95. The change in tritium concentration in the different soil layers during evaporation from the soil surface is discussed and the theory of Zimmerman et al is given. Two experiments were done and in both cases the calculated values were lower than the measured values. The possible changes in the tritium concentration in plants are discussed. Four experiments were done in which the tritium concentration in the water, soil, roots and leaves were determined. The concentration in the leaves was lower than that in the added water, and it seems that the ratio of the concentration in the leaves to that in the water is linearly related to the measured evaporation rate. The application of this method for determining evaporation from large water, soil and plant surfaces is somewhat impracticable at the present stage. With more research, it should be possible to determine the evaporation from a tree or a group of trees using this method. A thorough study of this method will throw light on the mechanism of evaporation from water, soil and plant surfaces. (auth)

**25563** (RL0-2225-T-25-3) SEDIMENT TRANSPORT ON THE CONTINENTAL SHELF OFF OF WASHINGTON AND OREGON IN LIGHT OF RECENT CURRENT MEASUREMENTS. Smith, J. Dunagan; Hopkins, T. S. (Washington Univ., Seattle, Dept. of Oceanography, Atomic Energy Commission, Athens (Greece)). 1971. Contract AT(45-1)-2225. 63p. Dep. NTIS.

Prolonged series of direct current measurements on the central and outer parts of continental shelves are rare, yet an understanding of the detailed flow regime in this area is of considerable geological importance. Due to the lack of this data in the oceanographic literature, especially in regard to the temporally variable near-bottom velocity field, a direct current measurement program began at the University of Washington during summer 1967. Initial emphasis was placed upon obtaining a time series of at least a two-year duration at a single location. Data were obtained with current meters located 3 m above the seabed in 50 and 80 m water. Results indicate that significant sediment transport occurs only during storms and the near bottom currents were found to have a fairly large offshore component. Calculations based on the current measurements and on analyses of sediment samples taken from the experimental site show that bed load transport of sediment is important only insofar as it affects the boundary geometry, whereas, suspended load transport of sediment is extremely important. Although no completely satisfactory suspended sediment transport theory is available, estimates indicate that a typical winter storm with current speeds up to 60 cm/s transports on the order of 5 m<sup>3</sup>/h/m of shelf length; a storm with speeds of up to 70 cm/s transports about 15 m<sup>3</sup>/h/m of sediment off of the continental shelf and into deeper water. Such calculations suggest that a severe storm occurring every few years might have more geological significance than a number of less severe storms. Some funneling of the transported material into local submarine canyons is likely but insufficient data are available to document this hypothesis. (auth)

**25564** (SWRHL-81-r) OFF-SITE SURVEILLANCE ACTIVITIES OF THE SOUTHWESTERN RADIOLOGICAL HEALTH LABORATORY FROM JANUARY THROUGH JUNE 1968. (Western Environmental Research Lab., Las Vegas, Nev.). Jan 1972. 107p. Dep. NTIS.

**31001** EKSPERIMENTAL'NOE ISSLEDOVANIJE MINERALO-OPRAZOVANIYA. (Experimental Investigation of Mineral Formation). Nasedkin, V. V. (ed.). Moscow; Izdatel'stvo Nauka (1971). 436p.

A separate abstract was prepared for each of two chapters selected for inclusion in NSA. (J.R.D.)

For abstracts of individual chapters see: 31105 and 31106.

**31002** DISEQUILIBRIUM STUDIES IN  $^{232}\text{Th}/^{230}\text{Th}$  ACTIVITY RATIO IN SOME SEDIMENT SAMPLES OF INDIA. Joshi, L. U.; Ganguly, S. K. (Bhabha Atomic Research Centre, Trombay, India). pp 137-43 of Proceedings of the Chemistry Symposium, 1970, Vol. II. Bombay; Dept. of Atomic Energy (1970).

From Chemistry symposium; Madras, India (25 Nov 1970). See CONF-701148-(Vol.2).

A geochemical study of sediment samples is being carried out by EDTA leaching at pH 3.0 in order to investigate the surface phenomena and distribution of natural thorium in backwater sediments. Unusually high values of  $^{232}\text{Th}/^{230}\text{Th}$  activity ratios have been found in the deposits of the sediments in the Indian coastal region of Bombay and Kerala Belt. The ratio was approximately 1.75 in the Bombay Harbor region and 1.5 at the coastal region of Kerala. The variations in the ratio of  $^{232}\text{Th}/^{230}\text{Th}$  is most likely due to leaching of  $^{226}\text{Ra}$  by seawater resulting in depletion of  $^{226}\text{Th}$  in the  $^{232}\text{Th}$  decay chain. (auth)

**31003** U/He AGES AS INDICATORS OF EXCESS ARGON IN DEEP SEA BASALTS. Fisher, David E. (Univ. of Miami, Fla.). Earth Planet. Sci. Lett.; 14: No. 2, 255-8 (Mar 1972).

U/He ages of deep sea basalts which show unequivocal evidence of excess Ar are generally higher than the corresponding K/Ar ages, suggesting that this result is diagnostic of the presence of excess rare gases. Concordant U/He and K/Ar ages are indicative of the validity of such ages. U/He ages lower than the corresponding K/Ar ages are not informative. (auth)

**31004** RARE EARTH CONTENTS IN CARBONATITES. Loubet, Michel; Bernat, Michel; Javey, Marc; Allegre, Claude J. (Univ., Paris). Earth Planet. Sci. Lett.; 14: No. 2, 226-32 (Mar 1972).

Mass spectrometric measurements of rare-earth elements were made by isotope dilution in several carbonatites. The results show a great enrichment of total rare earth content and a large fractionation between heavy and light rare earths. The patterns observed permit an easy distinction between limestones and carbonatites. This result suggests that in the carbonatite process the gas phase might play an important role. (auth)

## Radioactive Effluents

Refer also to abstracts 30917, 32866, 32872, 32882, and 32897.

**31005** OCEANOGRAPHY RESEARCH: SOME NEW PHYSICAL, CHEMICAL, AND RADIOLOGICAL STUDIES IN OCEANOGRAPHY. Walden, H.; Weichart, G.; Kautsky, H. (Deutsches Hydrographisches Institut, Hamburg). Naturwissenschaften; 59: No. 1, 12-22 (Jan 1972). (In German).

Some special German investigations of physical, chemical and radiological aspects of oceanography are described. The physical contributions deal with a cruise of the Meteor research vessel in the Icelandic region, the upwelling phenomenon, the relationship between large-scale meteorological and oceanographic processes, and ocean-wave research. As regards marine chemistry, information is given on new developments in instruments which perform continuous and automatic analyses with some practical applications. The radiological contribution concerns the oceanographic problems connected with the disposal of packaged low-level radioactive wastes. (auth)

**31006** EXPANSION OF THE POWER GENERATION SYSTEM. Kroms, Anton. Elektrizitätswirtschaft; 70: No. 20, 591-600 (1971). (In German).

The power generation system is influenced by an unprecedented increase of power demand. The demand has reached such proportions that not only are the availability and costs of the primary energy carriers of importance, but also the requirements for protection of the environment are important. Most power plants use fossil fuels such as coal, oil, and natural gas as sources for the energy production. Electric power plants have become the largest consumer of coal. In the past few years difficulties arose with the use of coal. They are primarily caused by the new requirements concerning environmental protection. The use of sulfur-containing coal has been coupled with the demand to install desulfurization systems which are costly and not yet sufficiently developed. This fact has brought coal in close competition with nuclear power. Despite this, however, it is forecast that the coal consumption by

power plants will further rise until the turn of the century, when it will begin to go down. (Air Pollut. Contr. Assn. Abstr.)

## Radioactivity Transport and Monitoring

Refer also to abstracts 31105 and 31106.

**31007** WERK-45 (D) ENVIRONMENTAL ASPECTS OF  $^{131}\text{I}$ . Koenig, L. A. (Kernforschungsanstalt, Karlsruhe (West Germany)). Jan 1972. 7p. (In German). Dep. NTIS (U. S. Sales Only).

The  $^{131}\text{I}$  burden in the environment is studied. It was found that environmental contamination by this radionuclide is due almost exclusively to the release from processing plants, while the release from reactors was immeasurably small under normal operation (1 nCi/g). It is recommended that environmental monitoring for  $^{131}\text{I}$  be started now, although the  $^{131}\text{I}$  level is in general still far below the limit of the permissible burden factor.

**31008** (PEL-116) ENVIRONMENTAL RADIOACTIVITY AT THE NATIONAL NUCLEAR RESEARCH CENTRE, PELINDABA. Report for the Year 1970. van As, D.; Vleggar, Constance M. (Atomic Energy Board, Pelindaba, Pretoria (South Africa)). Sep 1971. 21p. Dep. NTIS (U. S. Sales Only).

A revised environmental survey program, with the emphasis on monitoring of the critical paths of exposure of the general public, was introduced during the period. Results of determinations of both gross radioactivity and of individual nuclides in samples of fish and water (which are critical materials for liquid effluent releases) from the Hartbeespoort Dam and from the Crocodile River, are given and discussed. Results of gamma-spectrometric and  $^{87}\text{Sr}$  analyses of milk, which is the critical material for releases to the atmosphere, are presented. Results of similar investigations of the composition of effluent releases, which are performed in order to be able to detect possible other critical nuclides, are given. Levels of deposited inorganic activity from nuclear bomb tests are reported. (auth)

**31009** RADIOACTIVE SUBSTANCES IN THE BIOLOGICAL ENVIRONMENT. Huber, Otto (Univ., Fribourg, Switzerland). Preventivmedizin; 15: No. 3, 189-95 (1970). (In German).

Extensive  $\gamma$ -spectroscopic measurements of the radioactive concentrations of the total biological environment (air, water, milk, bones, body burden, fallout) of Switzerland were made from 1962 to 69;  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$ , and  $^3\text{H}$  data are given for 1966. The  $\gamma$  activities determined are considerably less than the maximum permissible concentrations. (Euratom)

## Atmosphere

Refer also to abstracts 30655, 30711, 31067, 31368, and 31381.

**31010** (CLA-R-4280) PRACTICAL AND GENERAL METHOD OF CALCULATION FOR FORECASTING POLLUTION CARRIED BY THE ATMOSPHERE. Doury, Andre (Commissariat à l'Énergie Atomique, Bruyères-le-Châtel (France), Centre d'Études), Feb 1972. 37p. (In French). Dep. NTIS (U. S. Sales Only).

An automatic, convenient, and economic method is proposed for solving most of the problems concerning the transport of pollution by the atmosphere. The method was developed from a synthesis of a large quantity of specialized work. The fundamental physical principles are simple and logical and the model can be continuously improved and adapted to fit the experimental conditions; this can be accomplished by a simple adjustment of the values of a small number of parameters without modifying the form of the model. A unique analytical solution, valid for an instantaneous elementary source (not necessarily a point source), is used to obtain results for any type of source within confidence limits compatible with the measurement methods. The types of meteorological conditions which must be considered have been reduced to a necessary minimum, which is probably sufficient for current applications. All the operations (pollution forecast, improvements to the model, etc.) can be treated after an operational time delay by a computer having a passive storage. (auth)

**31011** (HAST-EM-71-15) DETERMINATION OF THE WORKING LEVEL OF RADON DAUGHTERS BY THE MODIFIED ESPOSITA-METHOD. Thomas, Ross W. (New York Operations Office (AEC), N. Y. Health and Safety Lab.). Jul 1971. 11p. Dep. NTIS.

Equations are presented for calculation of working levels for 5 and 10 min sampling times, together with equations for calculating the standard deviation of the measurement.

# ENVIRONMENTAL AND EARTH SCIENCES

## Minerals and Ores

**38400** (CEA-CONF-1979) DEVELOPMENT AND PROSPECTS FOR GEOCHEMICAL PROSPECTING OF URANIFEROUS STRATA. Grimbart, A. (Commissariat à l'Énergie Atomique, Fontenay-aux-Roses (France), Centre d'Études Nucleaires), [ed.], 3p. (In French). (CONF-710456-1), Dep. NTIS 40, S. Sales Only.

From third international symposium on geochemical prospecting, Toronto, Canada (Apr 1971).

French studies in the area of geochemical prospecting of uranium deposits are reviewed. The different geochemical prospecting techniques both in the average and the local region are discussed. The techniques are applied to the analysis of waters and the alluvium of rocks and soils. The studies made on the content of U, Th, Ra, Ra<sup>226</sup> and <sup>210</sup>Pb in these media are mentioned. The problems relating to the dispersion of these elements are considered. Numerous subjects of research in order to promote the knowledge and possibilities of geochemical prospecting are suggested. (auth)

**38401** EVOLUTIONARY MODEL FOR LEAD ISOTOPES IN CONFORMABLE ORES AND IN OCEAN VOLCANICS. Russell, R. D. (Univ. of British Columbia, Vancouver), *Rev. Geophys. Space Phys.* 10: No. 2, 529-49 (May 1972).

Recently, absolute isotopic ratios have been published for lead standards. This makes possible for the first time a meaningful comparison of published isotopic ratios of lead from conformable ores with those from oceanic volcanics. These analyses of material of stable isotopic patterns that may be of earthwide significance. A preliminary study has been made of the adjusted ratios of 206Pb conformable ores and 206Pb oceanic volcanic rock leads. Each group shows a recognizable pattern such that leads from one regime cannot be obtained by any simple mixture of leads from the other. One widely recognized difference between the patterns is the considerably higher ratio of 206Pb/207Pb for the more radiogenic samples of similar age. The nature of a heterogeneous source. The contrasts clearly within each group are for either isotopic ratios are much more complex than the mean age. Another characteristic is the presence of equal lead to thorium, or the significant enrichment of <sup>210</sup>Pb in the oceanic volcanic leads. It is shown that the characteristic patterns can be reproduced as a model in which uranium, thorium and lead are transported from the source to the site of deposition. The transport of uranium and thorium must occur much more rapidly than for lead, and for all elements transport must be sufficient to allow the uranium and thorium to be in a time scale shorter than the age of the ore. The close relation of patterns in the lead and additional transport of lead to the site of deposition. Two forms of transport are considered, in each, the time varying concentrations of <sup>210</sup>Pb upon an isotopic value exponentially with time. Model A, in which the transport of uranium and thorium is very rapid, provides the best fit to the beginning of differentiation at a time  $t_0$ . Model B, in which the transport of uranium and thorium is exponentially related to time, corresponds to a differentiation time of  $2.2 \times 10^{10}$  years. There seem to be a strong case for the latter of the model used. It is suggested that lead isotope measurements might be used to identify characteristic isotopic patterns in low mineralization ores as the result of isotopic patterns. (auth) (53 references)

**38402** URANIUM EXPLORATION IN ITALY: RESULTS ACHIEVED AND PROSPECTS. Mironpergner, Maria. *Com. Naz. Energ. Nucl., Notiz.* 15: No. 4, 35-39 (Apr 1972). (In Italian).

The uranium exploration activities conducted in Italy from the early fifties to the present, as well as the prospect of such activities for the coming years, are reviewed. (auth)

**38403** NUCLEAR ENERGY IN THE AFRICAN COUNTRIES. Cassi, A. P.; Perilli, M. J.; Sansone, M. M. *Com. Naz. Energ. Nucl., Notiz.* 15: No. 4, 41-58 (Apr 1972). (In Italian).

The status of nuclear energy in the African countries is reviewed. At present only the UAR and South Africa have sizeable national nuclear programs, and a few more countries possess research centers and operating research reactors. A very different picture is that of uranium supplies, since deposits of this mineral have been worked since the early years of the atomic age. (auth)

**38404** RADIOMETRIC EVIDENCE FOR THE RAPID GROWTH RATE OF SHALLOW-WATER, CONTINENTAL MARGIN MANGA-

NESE NODULES. Ku, T. L. (Univ. of Southern California, Los Angeles); Glasby, G. P. *Geochim. Cosmochim. Acta* 35: No. 6, 599-703 (Jun 1972).

Radio-element concentrations in two shallow-water, continental margin ferromanganese nodules from the Jervis Inlet, British Columbia, and Loch Fyne, Scotland, were found to be markedly different from those found in deep sea manganese nodules. Compared with their deep sea counterparts, the shallow-water concretions showed: (1) higher uranium (10 to 20 ppm) and much lower thorium (2 to 5 ppm) contents; (2) very low <sup>230</sup>Th and <sup>234</sup>Pa activities, such that these nuclides are depleted, rather than enriched, with respect to the amounts which are supported by the uranium present; and (3) two or more orders of magnitude higher growth rate. The higher growth rates, together with the data on Mn/Fe ratios and trace element contents, conform with, though do not prove, the concept of an in-situ source of manganese for nodule accretion in shallow marine environments. (auth)

**38405** THORIUM DISTRIBUTION IN A GRANITE STOCK NEAR BULL CANYON, LEMHI COUNTY, IDAHO. Staats, Mortimer H.; Bunker, Carl M.; Bush, Caries A. (Geological Survey, Denver), U. S., Geol. Surv., Prof. Pap., No. 800-B, 51-6 (1972).

A granite stock underlying an area of about 1.3 square miles occurs on the west side of the Beaverhead Mountains near Bull Canyon, Idaho. This granite body, which is of probable Silurian age, has intruded both the upper Precambrian Belt Supergroup and the Ordovician Kinnikinnick Quartzite. The granite consists principally of perthite and quartz with minor amounts of plagioclase, magnetite, biotite, zircon, apatite, rutile, monazite, and allanite. The average thorium content of 16 representative samples from various parts of the stock is 1.5 ppm. A radio-metric map of the granite stock indicates that the most radioactive area occurs along an arcuate ridge near the east edge of the stock. The most radioactive parts of this area are in widely scattered zones along fractures and in small irregular areas. In these abnormally radioactive areas, which may contain in excess of 100 ppm Th, the principal thorium mineral is thorite, which occurs as tiny crystals along fractures. Late-stage post-magmatic fluids are believed to have altered the original granite and deposited the thorite along favorable zones. (auth)

## Radioactive Effluents

Refer also to abstracts 38375, 39296, 40313, 40327, 40330, 40339, 40341, 40374, 40367, and 40380.

**38406** (CONF-720522-4) ENVIRONMENTAL PROTECTION DURING FUEL PROCESSING. Yarbro, O. O.; Nichols, J. P.; Unger, W. E. (Oak Ridge National Lab., Tenn.), 1972, 11p. Dep. NTIS.

From seventy-second national meeting of the American Institute of Chemical Engineers; St. Louis, MO. (21 May 1972).

The trend toward tightened restrictions on the radioactivity of effluents from nuclear facilities is evident. Recent revisions to 10 CFR, part 50, of the Federal Register reduced the permissible discharge limits from reactors, by approximately a factor of 100 and part 20 was revised to require discharges to be reduced "as far below the limits specified in this part as practicable." In response to these requirements for improved effluent control, methods for removing the volatile fission products are under development. Efficient methods for controlling tritium, krypton-xenon, and iodine in fuel reprocessing plants were demonstrated on a laboratory and small engineering scale. Full-scale demonstrations have not been carried out as yet and many scale-up questions as well as the engineering problems associated with an actual plant application are yet to be answered. An off-gas flow sheet for volatile fission product control is included. (M.C.G.)

**38407** (DOCKET-408102-6) HIGHLAND URANIUM MILL. Draft Detailed Statement on Environmental Considerations, etc., Comments and Questions. (Humble Oil and Refining Co., Houston, Tex., Minerals Dept.), 12 Jun 1972. 2p. Dep. NTIS.

**38408** (LA-tr-72-17) ANALYSIS OF THE PROBLEMS OF PROTECTION POSED BY FLUORINE AND FLUORINATED COMPOUNDS. Bittel, R.; Voubert, W. (Commissariat à l'Énergie Atomique, Fontenay-aux-Roses (France), Centre d'Études Nucleaires). Translated for Los Alamos Scientific Lab., N. Mex., from report CEA-Bib-200, 51p. Dep. NTIS.

Possible origins of a release of fluorine to the environment.

# PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Refer also to abstract 41682.

## Cosmic Radiation

Refer also to abstracts 41747, 41753-41760, 41771-41773, 41789-41797, 41832, 41836, 41853, 41912, and 41915.

**41526** CHEMICAL COMPOSITION OF COSMIC RAYS. II. Aller, Lawrence H. (Univ. of California, Los Angeles). *Sky Telescope*; 43: No. 6, 362-3 (Jun 1972).

Solar cosmic radiation is discussed and the origin of primary cosmic radiation is considered. (W D M.)

**41527** ISOTOPIC COMPOSITION AND ELEMENTAL ABUNDANCE OF GALLIUM IN METEORITES AND IN TERRESTRIAL SAMPLES. De Laeter, J. R. (Western Australian Inst. of Tech., South Bentley). *Geochim. Cosmochim. Acta*; 36: No. 7, 735-43 (Jul 1972).

The isotopic composition of gallium in six iron meteorites and a terrestrial standard were measured using a solid-source mass spectrometer. Isotopic abundances of meteoritic and terrestrial gallium agree to within 0.11%. The concentration of gallium in 21 iron and 5 stone meteorites and in 13 standard rocks was determined using the method of isotope dilution. In general, the agreement between this work and other published data is excellent. (auth)

**41528** SURVEY OF THE ISOTOPIC AND ELEMENTAL ABUNDANCE OF ZINC. Rosman, K. J. R. (Univ. of Western Australia, Perth). *Geochim. Cosmochim. Acta*; 36: No. 7, 501-14 (Jul 1972).

A mass spectrometric technique applicable to the study of high ionization potential elements was used to investigate the possibility of natural processes producing variations in the isotopic composition of zinc. No significant variations were detected in the samples studied. The isotopic abundances of the mass 64, 66, 67, 68, and 70 isotopes in terrestrial zinc were estimated to be  $48.6 \pm 0.1$ ,  $27.90 \pm 0.08$ ,  $4.10 \pm 0.03$ ,  $1.8 \pm 0.2$ , and  $0.62 \pm 0.01\%$  respectively. Zinc concentrations were determined in 14 stone, 1 stony-iron, and 20 iron meteorites and in a large number of terrestrial samples using isotope dilution and atomic absorption methods. The range of concentrations found in stone meteorites and terrestrial rocks is similar to that previously reported, but for the iron meteorites a slightly wider concentration range was observed (0.02 to 50 ppm). (auth)

**41529** GAS RETENTION CHRONOLOGY OF PETERSBURG AND OTHER METEORITES. Pospisek, F. A. (California Inst. of Tech., Pasadena). *Geochim. Cosmochim. Acta*; 36: No. 7, 755-72 (Jul 1972).

Argon and xenon data are presented for a thermal release study on a neutron-irradiated sample of the eucrite meteorite Petersburg. Xenon spallation corrections are made by the method of correlation systematics, and the relationship of lunar systematics to the systematics derived for the Angritoso Reis meteorite is discussed. Correlation systematics are also used in reevaluation of neutron-activation xenon data for other meteorites in which spallation effects are prominent. Petersburg has no excess  $^{222}\text{Xe}$  attributable to in situ decay of  $^{235}\text{U}$  and a  $^{238}\text{Pu}/^{238}\text{U}$  ratio corresponding to onset of xenon retention  $146 \pm 14$  million years after the chondrite St. Severin. The argon data show substantial loss of radiogenic  $^{40}\text{Ar}$  and do not define a  $^{40}\text{Ar}/^{39}\text{Ar}$  plateau, establishing a lower limit K-Ar age of  $4.35 \times 10^7$  yr, relative to an assumed age of  $4.60 \times 10^7$  yr for St. Severin. Comparison with strontium data for other eucrites and the chondrite Guareña suggests an interval of 220 million years between fractionation from a rubidium-rich reservoir and the final cooling of Petersburg. The rubidium-rich achondrite Lafayette has no detectable decay products of either  $^{235}\text{U}$  or  $^{238}\text{U}$ , indicating a gas-retention formation time at least 350 million years after St. Severin. The current best value of the  $^{238}\text{Pu}/^{238}\text{U}$  ratio in the chondrite St. Severin at the time of its formation is  $0.0154 \pm 0.0014$ , 21% higher than previously reported. (auth)

**41530** COSMOGENIC  $^{26}\text{Al}$  AND  $^{22}\text{Na}$  IN A LUNAR REGOLITH RECOVERED BY LUNA-16. Vinogradov, A. P.; Lavrukha, A. K.; Gorin, V. D.; Ustinova, G. K. (Inst. of Geochemistry and Analytical Chemistry, Moscow). *Dokl. Akad. Nauk SSSR*; 202: No. 2, 437-40 (11 Jun 1972).

Samples of rock from four large areas on the visible side of the moon, upon analysis in laboratories on earth, proved to represent

two types, at least: breccia and regolith. The depth distribution in these samples of  $^{22}\text{Na}$  and  $^{26}\text{Al}$  was determined, and a comparison was made and is discussed. Extrapolating to the moment of sampling by Luna-16 yielded the following values for average activity in disintegrations/min · kg of sample: for  $^{26}\text{Al}$ , 61; for  $^{22}\text{Na}$ , 47. (K.S.W.)

**41531** ABSOLUTE VERTICAL COSMIC-RAY MUON INTENSITY AT SEA LEVEL. Ashton, F.; Taji, K.; Wolfendale, A. W. (Durham Univ., Eng.). *Nuovo Cim.*; 9B: No. 2, 344-50 (11 Jun 1972).

The absolute vertical intensity of muons with momentum above 0.88 GeV/c at sea level was measured and found to be  $(8.22 \pm 0.10) \cdot 10^{-3} \text{ cm}^{-2} \text{ sr}^{-1} \text{ s}^{-1}$ . This value was close to what would be expected from recent determinations by Altkofer et al. and was significantly higher than the normalization value for a number of years. By using other absolute measurements in this region of momentum, the integral and differential muon intensities at the standard momentum of 1 GeV/c were found to be  $(7.53 \pm 0.40) \cdot 10^{-3} \text{ cm}^{-2} \text{ sr}^{-1} \text{ s}^{-1}$  and  $(3.18 \pm 0.17) \cdot 10^{-3} \text{ cm}^{-2} \text{ sr}^{-1} \text{ s}^{-1} (\text{GeV}^{-1})$ , respectively. (auth)

**41532** ELECTRON PARAMAGNETIC RESONANCE OF RADIATION DAMAGE IN A LUNAR ROCK. Tsay, F.; Chan, S. I.; Manatt, S. L. (California Inst. of Tech., Pasadena). *Nature (London) Phys. Sci.*; 237: No. 77, 121-2 (19 Jun 1972).

Evidence is reported for radiation induced EPR signals in an Apollo lunar rock sample. The results indicate that radiation damage was less extensive than expected; this was in agreement with thermoluminescence measurements. The presence of both electron and hole traps was clearly shown, the EPR technique appears to be more effective than high-temperature thermoluminescence in detecting trapped electrons and holes with high activation energies. (UK)

**41533** LOW FREQUENCY RADIO EMISSION FROM EXTENSIVE AIR SHOWERS. Allan, H. R. (Imperial Coll. of Science and Tech., London). *Nature (London)*; 273: No. 5355, 384-5 (16 Jun 1972).

It is stated that the observed radio emission from extensive air showers at frequencies between 30 and 100 MHz is in good agreement with theory, but at lower frequencies the situation is much less satisfactory. Theory predicts that the field strength per unit bandwidth should rise smoothly from zero towards the observed values at 30 to 100 MHz, but the experimental values between 2 and 5 MHz are about 100 times larger. Calculations intended to set a generous upper limit to this field strength are presented, based on the least controversial elements of the theory. (UK)

**41534** ACTIVATION ANALYSIS DETERMINATION OF 40 ELEMENTS IN LUNAR MATERIAL. Brunfelt, A. O. (Univ. of Oslo); Steinness, E. *Dan. Kemi*; 53: No. 4, 49-52; 55 (1972). (In Norwegian).

A neutron-activation scheme for analysis of lunar material is described. It is possible to determine up to 42 elements on the basis of about 400 mg of material. The method is also applicable to other types of geological material, e.g., meteorites or core samples from deep sea basins. The scheme was tested with the standard rock basalt BCR-1 from the US Geological Survey. (B.P.) (Denmark)

**41535** DEPENDENCE OF THE COEFFICIENT OF INELASTICITY ON THE ENERGY OF THE NUCLEON. Akimov, V. V.; Grigorov, N. L.; Kozlov, V. D. *Izv. Akad. Nauk SSSR, Ser. Fiz.*; 35: No. 10, 2040-3 (Oct 1971). (In Russian).

The calculation of the nucleon flux at the atmospheric depth  $1000 \text{ g} \cdot \text{cm}^{-2}$  in the hypothesis that the primary spectrum of protons, the spectrum of all particles, and the increase of the inelastic cross section of interaction with increase of energy from experimental data obtained by the satellite "Proton" does not agree with other experimental data. It is sufficient to assume a dependence of the coefficient of inelasticity on the energy of the nucleon. (tr-auth)

**41536** GAMMA SPECTRA OBTAINED WITH A MULTILAYER X-RAY CAMERA AT A DEPTH OF  $700 \text{ g} \cdot \text{cm}^{-2}$ . Amineva, T. P.; Varkovitskaya, A. Ya.; Dubrovina, S. A.; (and others). *Izv. Akad. Nauk SSSR, Ser. Fiz.*; 35: No. 10, 2049-53 (Oct 1971). (In Russian).

A multilayer x-ray camera was used to obtain the spectrum of  $\gamma$  quanta by both the impulse and calorimetric methods simul-



solutions in the presence of methanol and ethanol is compared. (auth)

**45390** ADSORPTION OF POLYVALENT ELEMENTS ON SILICA GEL. III. ISOLATION OF PROTACTINIUM BY ADSORPTION ON SILICA GEL FROM THE SOLUTIONS OF HCl and H<sub>2</sub>SO<sub>4</sub>. Calotka, R. (Nuclear Research Inst., Rez, Czech.). Collect. Czech. Chem. Commun.; 37: No. 5, 1684-9 (May 1972).

The sorption of trace amounts of protactinium on silica gel was studied under dynamic conditions together with the desorption effectiveness of various aqueous and aqueous-organic solutions. The possibility to separate protactinium, zirconium, hafnium, and niobium in the hydrochloric or sulfuric acid solutions was proved experimentally. Protactinium was also separated from the activated thorium salts and from the uranium ore. The mixture of 30% of 11.5M-HCl and 70% of 2-propanol or 10M-H<sub>2</sub>SO<sub>4</sub> can be used for the elution of protactinium adsorbed on the column of silica gel. (auth)

**45391** ADSORPTION OF POLYVALENT ELEMENTS ON SILICA GEL. IV. SEPARATION OF THE TETRAVALENT AND PENTAVALENT PROTACTINIUM. Calotka, R.; Knobloch, V. (Nuclear Research Inst., Rez, Czech.). Collect. Czech. Chem. Commun.; 37: No. 5, 1690-2 (May 1972).

The possibility of the tetravalent and pentavalent protactinium sorption on silica gel was studied and it was found that in the presence of hydrochloric and sulfuric acids the protactinium adsorbed on the silica gel column is reduced and washed out by chromium(II) solutions whereas the nonreduced fraction of protactinium remains adsorbed on the column. The method was tested with trace amounts of the <sup>231</sup>Pa nucleus; it was found that under similar conditions the elution of neptunium from silica gel proceeds only partly. (auth)

### Radioisotope Production

Refer also to abstracts 45371 and 45399.

**45392** (N 72-15068) CYCLOTRON PRODUCTION OF <sup>123</sup>I; AN EVALUATION OF THE NUCLEAR REACTIONS WHICH PRODUCE THIS ISOTOPE. Sood, Vincent J.; Scholz, Kenneth J.; Blue, James W.; Wellman, Henry N. (National Aeronautics and Space Administration, Cleveland, Ohio, Lewis Research Center). Oct 1970. 45p. (NASA-TM-X-67394; HRH DMRE-70-46). NTIS.

Various nuclear reactions are described by which <sup>123</sup>I, a low radiation dose radiopharmaceutical, can be cyclotron produced. Methods of directly producing <sup>123</sup>I and those that indirectly produce the radionuclide through the beta decay of its natural precursor, <sup>123</sup>Xe, it is impossible to separate the radionuclide contaminants that occur in a direct method. Thus, it is preferable to produce pure <sup>123</sup>I from <sup>123</sup>Xe, which is easily separated from the radiocesium. Among the characteristics of <sup>123</sup>I is the capability of measuring the patient dose in a thyroid uptake measurement to a very small percentage of <sup>123</sup>I delivered by the more common <sup>131</sup>I. (auth) (STAR)

**45393** CONVERSION OF CALIFORNIA M-4-HYDROXYISOBUTYRATE TO ONDINE WITH CARBOXYLIC ACID RESIN. Charbon, R. M.; Hale, W. H. Jr. (E. I. du Pont de Nemours and Co., Alker, S. C.). Radiochem. Radioanal. Lett. Lett. No. 6, 339-41 (15 Jul 1972).

A method was developed to recover <sup>125</sup>I<sup>-</sup> from ion exchange product solutions and prepare <sup>125</sup>I<sup>-</sup>CF<sub>3</sub>CO<sub>2</sub>. The procedure was demonstrated with <sup>125</sup>I<sup>-</sup>CF<sub>3</sub>CO<sub>2</sub> and bulk neptunium standard; an ammonium oxalate-sulfate-Nd<sup>3+</sup> solution was adjusted to pH 4, Nd<sup>3+</sup>-CF<sub>3</sub>CO<sub>2</sub> was sorbed on carboxylic acid resin, and the oxide was prepared by calcination at 600°C. (auth)

**45394** PRODUCTION OF CARRIER-FREE <sup>213</sup>Bi BY THE  $\alpha$ -PARTICLE BOMBARDMENT OF NATURAL CHROMIUM. Akiba, Eumamasa (Hiroaki, Univ. Yamaguchi, Yonoh, Aomori, Yamaguchi, Fukuoka, Nagasaki, Murakami, Niigata, Nippon Kasei, Kanagi, No. 5, 968 (3 May 1972)). (In Japanese).

For the production of <sup>213</sup>Bi by the  $\alpha$ - and <sup>214</sup>Pb-particle reactions on natural chromium, their excitation curves and thick-target yields were measured. Various conditions in the production procedure, especially the chemical separation of <sup>213</sup>Bi, as in a hydrochloric acid solution of the bombarded target after the removal of <sup>214</sup>Pb were examined. A stack of thin chromium plates was bombarded by a beam of  $\alpha$ - or <sup>214</sup>Pb-particles (0.14-MeV maximum energy), and the manganese ion <sup>213</sup>Mn<sup>2+</sup> was measured non-destructively after the chemical separation. The excitation curve of the  $\alpha$ -reaction shows a maximum of 40 mb near 10 MeV energy, and that of the <sup>214</sup>Pb-reaction, a maximum of 8 mb near 18 MeV. The thick-target yields for 10-MeV incident energy are 3.4  $\mu$ Ci/mA and 1.3  $\mu$ Ci/mA for the  $\alpha$ -reaction and the <sup>214</sup>Pb-reaction, respectively. The  $\alpha$ -reaction thus proved to give a higher

yield of <sup>213</sup>Bi than the other possible reactions. The bombarded chromium target was dissolved in a hydrochloric acid solution (6N) from which the <sup>214</sup>Pb was removed by an extraction method. The remaining solution was saturated with pure HCl gas by bubbling it through the solution, from which almost all the nonradioactive chromium and other active contaminants were removed by an anion exchange method. The manganese solution thus obtained was evaporated to dryness, and the <sup>213</sup>Mn-free residue was dissolved in 50 ml of 10 mol/l H<sub>2</sub>SO<sub>4</sub> together with 2g of KIO<sub>4</sub>. Then the Mn was distilled out as Mn<sub>2</sub>O<sub>3</sub> from the resulting solution into a trap containing a small amount of dilute HCl solution plus H<sub>2</sub>O<sub>2</sub>. To maintain the solution at 10 mol/l of sulfuric acid concentration and 166°C, which is the optimum condition for distillation, azeotropic nitric acid vapor (120.5°C) was added gradually to the boiling solution. The <sup>213</sup>Mn was obtained in a carrier-free state. The chemical yields over all the chemical procedure proved to be >90% with a sufficient radiochemical purity. (auth)

**45395** PRODUCTION OF CARRIER-FREE <sup>197m</sup>,<sup>197g</sup>Hg WITH A CYCLOTRON. Wilkness, P. E.; Beach, L. A.; Marlow, K. W. (Naval Research Lab., Washington, D. C.). Radiochim. Acta; 17: No. 2, 110-13 (Jul 1972).

The practical aspects of the production of carrier-free mercury in a cyclotron by proton bombardment of a gold target are discussed. A liquid nitrogen cooled target assembly and the radiochemical procedure for the recovery of carrier-free mercury from the gold target are described. Gamma spectra obtained with a Ge(Li) detector and a Si(Li) detector are shown. Experimental yield determinations for <sup>197m</sup>,<sup>197g</sup>Hg are compared with theoretical calculations. (auth)

**45396** UTILIZATION OF RESEARCH REACTORS FOR RADIOISOTOPE PRODUCTION. Rahman, M. Matur (Pakistan Inst. of Nuclear Science and Tech., Rawalpindi). Nucleus (Karachi); 8: No. 1, 23-32 (1971).

The radioisotope production facility at the Pakistan Institute of Nuclear Science and Technology (PINSTECH) is described. It is suggested that efforts should be directed towards the establishment of methods for the selection of target materials and the determination of chemical processes for production. Besides, some basic research on nuclear reactions and the chemical effects of nuclear transformation is also vital for radioisotope production, to say nothing of the guaranteeing of high radiochemical purity for the products, procedures of activation analysis of target materials, etc. (auth)

### Reactor Fuel Reprocessing

Refer also to abstracts 45398 and 45300.

**45397** (CONF-720903-9) CONTINUOUS OR SEMICONTINUOUS LEACHER FOR LEACHING SOLUBLE CORE MATERIAL FROM SHEARED SPENT NUCLEAR FUEL TUBES. Odom, C. H. (Oak Ridge National Lab., Tenn.). 1972. 32p. Dep. NTIS.

From twentieth remote systems technology conference; Idaho Falls, ID. (17 Sep 1972).

The effective dissolution of sheared liquid-metal fast breeder reactor fuels is considered. Concepts and models representative of current approaches to the continuous or semicontinuous dissolution of these fuels were developed to assess the magnitude of the difficulties to be encountered in controlling the flow, residence time, agitation, and transfer of the sheared material through such a device. The performance of many of the models developed was successfully demonstrated, but the model of the compartmented rotary drum continuous leacher with sloped transfer ducts is representative of the most effective and straightforward design required to meet all of the performance requirements. (auth)

**45398** (DOCKET-50201-125) WEST VALLEY REPROCESSING PLANT. Quarterly Report for April 1, 1972-June 30, 1972, Part I. (Nuclear Fuel Services, Inc., West Valley, N. Y.). 14 p. Jul 1972. Sp. Dep. NTIS.

Environmental samples were analyzed for <sup>234</sup>Pa alpha activity, and beta activity. Total discharges in liquid and gaseous effluents are given for gross  $\alpha$ , gross  $\beta$ , tritium, <sup>90</sup>Sr, <sup>137</sup>Cs, <sup>85</sup>Kr, and <sup>131</sup>I. Surveillance tests and filter replacements are listed. (M.C.G.)

**45399** (DOCKET-50201-126) WEST VALLEY REPROCESSING PLANT. Technical Specifications, Request for Approval of Revisions. (Nuclear Fuel Services, Inc., Rockville, Md.). 19 Jul 1972. 48p. Dep. NTIS.

Revisions are requested for technical specifications for: form of materials, extractant concentration, plutonium ion exchange operation, caustic concentration in carbon steel waste storage tanks, solid radioactive waste removal, evaporator steam pressure, respiratory protection equipment, process instrumentation, high