HEHF 25

UNITED STATES TRANSURANIUM REGISTRY

705661

ANNUAL REPORT
OCTOBER 1, 1976 TO OCTOBER 1, 1977

TO DOE DIVISION OF
BIOMEDICAL AND ENVIRONMENTAL RESEARCH

REPOSITORY DOE-FORRESTAL
COLLECTION MARKEY FILES
BOX No. 4 of 6
FOLDER 2.14 TRANSURANIUM REGISTRY #1 FEB 5, 1976

HANFORD ENVIRONMENTAL
HEALTH FOUNDATION

1009553

HEHF 25

UNITED STATES TRANSURANIUM REGISTRY
ANNUAL REPORT OCTOBER 1, 1976 TO OCTOBER 1, 1977
TO DOE DIVISION OF BIOMEDICAL
AND ENVIRONMENTAL RESEARCH

by

B. D. Breitenstein, Jr., M.D., Carlos E. Newton, Jr. and
W. D. Norwood, M.D.

HANFORD ENVIRONMENTAL HEALTH FOUNDATION
Richland, Washington 99352

JANUARY 1978

Prepared for the U. S. Department of Energy under
Contract AT(45-1)-1837

1009554

U. S. TRANSURANIUM REGISTRY
ANNUAL REPORT

	Page
Summary	2
Introduction	3
Purpose and Scope of Registry	3
Registry Management	3
U. S. Transuranium Registry Statistical Data	4
Contractor and Licensee Activities	4
Education and Information Activities	8
USTR Data System	11
Research on Autopsy Problems	11
Advisory Committee Activities	12
U. S. Transuranium Registry Autopsy Case Reports	14
Appendices	57

1009555

SUMMARY

The U. S. Transuranium Registry (USTR) serves as a center for the acquisition and recording of the latest and most precise information of the transuranic elements in man and their effects on man. To date 14,386 U. S. transuranium workers have been tabulated, authority for 972 autopsies obtained, and 72 U. S. autopsies granted.

Department of Energy contractor and National Regulatory Commission licensee activities at participating sites are discussed. A significant increase in participation from the Savannah River plant has been received during the past year.

Three British scientists visited the USTR in 1977.

USTR educational and informational activities were again extensive and varied.

Research at Battelle Northwest on bone marrow separation from bone to determine plutonium concentration and study at Georgia Institute of Technology of microscopic deposition of plutonium in bone were assisted by the USTR.

A meeting of the USTR Advisory Committee was held in June 1977 in Richland, Washington.

1009556

INTRODUCTION

This report covers activities of the U. S. Transuranium Registry (USTR) for the period October 1, 1976 to October 1, 1977.

PURPOSE AND SCOPE OF REGISTRY

The primary purpose of the Registry is to serve as a center for the acquisition and recording of the latest and most precise information on the metabolism of the transuranic elements in man and their effects on man. This is being done with the cooperation of participating Department of Energy and Nuclear Regulatory Commission contractor and licensee nuclear facilities by:

- Initiating and supporting programs to identify, interview, secure medical, health physics and autopsy releases, and obtaining tissue samples at autopsy.
- Establishing contact with terminated employees to obtain participation in the Registry program.
- Overseeing processing of autopsy tissues by analytical laboratories.
- Compiling and analyzing medical and health physics data on autopsy cases for application or reconciliation with *in vivo* models.
- Establishing a base to provide input to epidemiology mortality studies.

REGISTRY MANAGEMENT

Bryce D. Breitenstein, Jr., M.D. is Director of the Registry, spending half-time in this activity. C. E. Newton continues part-time as Associate Director and W. D. Norwood, M.D. continues his affiliation with the Registry as a consultant, working on a limited basis.

The Los Alamos Scientific Laboratory is directing a U. S. plutonium worker health study which is affiliated with the Registry, with George Voelz, M.D. and Louis Hempelmann, M.D. serving as principal investigators. A separate advisory committee assists them in the study design and interpretation of findings.

Battelle Northwest (BNW), the University of Utah Radiobiology Laboratory and Argonne National Laboratory work with the Registry, especially in

1009557

the field of biology, so that animal results may be correlated with the human studies. Battelle health physicists are also working with the Registry in the use of autopsy data in developing models to best approximate the metabolism of plutonium in the human body.

U. S. TRANSURANIUM REGISTRY STATISTICAL DATA

Tables I and II indicate the number of transuranium workers identified, health physics and medical releases obtained, autopsy premissions secured, autopsies completed and autopsy reports completed for 1977 and 1976.

It will be noted that 361 additional transuranium workers were identified among the contractors, with most of these coming from Rocky Flats, Hanford and Savannah River. Two (2) additional transuranium workers were identified among the licensees. Oak Ridge has identified only 14 workers as having an estimated deposition of a few percent but have still not identified a larger number of workers who would be classified as transuranium workers in accordance with the Registry definition. The total number of transuranium workers identified to date is 14,386.

To date, 4,744 health physics and medical releases have been obtained. Most of these are from Hanford and Rocky Flats with Savannah River rapidly increasing since they have agreed to completely participate in the Registry program.

There have been 985 authorities for autopsy signed, 120 this calendar year, largely due to the Savannah River effort. Exxon Nuclear secured 8 of the 13 authorities for autopsy secured to date from the licensee group.

Eight autopsies were secured during the reporting year, 6 by Rocky Flats and 2 by Hanford. Reports have been completed on 75 of the 87 autopsies performed as part of the Registry program, of which 14 were received from a foreign source.

CONTRACTOR AND LICENSEE ACTIVITIES

Hanford

The large increase in identified Hanford transuranium workers from 2332 to 7079 resulted from a study identifying transuranium workers at Hanford who left employment prior to 1958. Autopsy authorizations have been obtained from 535 present and former Hanford employees, and 24 autopsies have been performed to date.

1009559

U. S. TRANSURANIUM REGISTRY - TABLE I

1977

Contractors	Transuranium Workers Identified			Health Physics and Medical Releases			Authority for Autopsy			Autopsies Obtained			Autopsy Reports Complete		
	Mo. Sep.	CY to Date	Total to Date	Mo. Sep.	CY to Date	Total to Date	Mo. Sep.	CY to Date	Total to Date	Mo. Sep.	CY to Date	Total to Date	Mo. Sep.	CY to Date	Total to Date
Hanford	0	113	7,079	0	89	2,244	1	8	535	0	2	24	0	1	17
Rocky Flats	4	141	2,129	4	136	1,960	0	20	209	0	6	42	0	0	40
Los Alamos	0	1	3,025	0	1	258	0	1	126	0	0	4	0	0	2
Savannah River	10	105	1,683	19	165	167	20	90	92	0	0	0	0	0	0
Mound	0	1	334	0	1	9	0	1	10	0	0	1	0	0	1
Oak Ridge	0	0	14	0	0	0	0	0	0	0	0	1	0	0	1
Subtotal	14	361	14,264	23	392	4,638	21	120	972	0	8	72	0	1	61
Licensees															
Richland Energy Lab	0	0	13	0	0	9	0	0	2	0	0	1	0	0	0
Exxon Nuclear	0	2	47	0	3	35	0	0	8	0	0	0	0	0	0
Babcock & Wilcox	0	0	61	0	0	61	0	0	2	0	0	0	0	0	0
Nuclear Fuel Services, Inc.	0	0	1	0	0	1	0	0	1	0	0	0	0	0	0
U.S. Total	14	363	14,386	23	395	4,744	21	120	985	0	8	73	0	1	61
Foreign	0	0	14	0	0	0	0	0	0	0	0	14	0	0	14
Combined Total	14	363	14,400	23	395	4,744	21	120	985	0	8	87	0	1	75

TABLE II

U. S. TRANSURANIUM REGISTRY

1976

Contractors	Transuranium Workers Identified			Health Physics and Medical Releases			Authority for Autopsy			Autopsies Obtained			Autopsy Reports Complete		
	Mo. Sep	CY to Date	Total to Date	Mo. Sep	CY to Date	Total to Date	Mo. Sep	CY to Date	Total to Date	Mo. Sep	CY to Date	Total to Date	Mo. Sep	CY to Date	Total to Date
Hanford	0	14	2332	0	12	2146	0	1	525	2	7	22	0	2	10
Rocky Flats	19	141	1913	19	139	1750	0	5	177	0	2	36	0	0	30
Los Alamos	0	0	3024	0	0	257	0	0	127	0	0	4	0	1	2
Savannah River	9	9	1576	0	0	0	0	0	0	0	0	0	0	0	0
Mound	0	0	333	0	0	8	0	0	9	0	0	1	0	0	1
Oak Ridge	13	13	14	0	0	0	0	0	0	0	0	1	0	0	1
Subtotal	41	177	9192	19	151	4161	0	6	838	2	9	64	0	3	44
Licensees															
Richland Energy Lab	0	0	13	0	0	9	0	0	2	0	1	1	0	0	0
Exxon Nuclear	0	1	42	0	1	32	0	1	8	0	0	0	0	0	0
Babcock & Wilcox	0	61	61	0	61	61	0	2	2	0	0	0	0	0	0
Nuclear Fuel Services, Inc.	0	1	1	0	1	1	0	1	1	0	0	0	0	0	0
Total	41	240	9309	19	214	4264	0	10	851	2	10	65	0	3	44

1009560

BNW, with the cooperation of several other laboratories, conducted an interlaboratory comparison to determine the reliability of results from analytical procedures for three levels of plutonium concentrations. Special emphasis was placed upon laboratories processing USTR autopsy samples. The work was presented at the Twenty-Third Annual Conference on Bioassay, Environmental and Analytical Chemistry, September 15 and 16, 1977, Jackson Lake Lodge, Moran, Wyoming. The data is published in BNWL-SA-6467 document "Plutoniun Analysis in Spiked Bovine Tissues - An Interlaboratory Study," V. W. Thomas, Jr., August 10, 1977.

Rocky Flats

Dr. B. D. Breitenstein visited Rocky Flats for a general discussion of their participation in the USTR activities. Rocky Flats continues to have a very active program, with 141 additional transuranium workers identified during the year. Six autopsies were performed, bringing the total to 42, with 40 reports completed.

Los Alamos

Autopsy reports were completed on two Los Alamos cases during the report period. As a result of discussions with Drs. George Voelz and J. F. McInroy of LASL, an arrangement was reached for the Registry to receive information on 30 autopsies completed on transuranium workers at LASL prior to USTR participation. Major efforts were directed toward an epidemiological study of plutonium workers, which is affiliated with the Registry.

Savannah River

One hundred sixty-five (165) health physics and medical releases were secured and 90 authorities for autopsy signed. To date, 1683 employees have been identified as transuranium workers.

Mound Laboratory

Dr. B. D. Breitenstein visited Mound to discuss present participation in the Registry and encourage greater participation. No additional transuranium workers were identified at Mound.

Oak Ridge

Following Dr. Breitenstein's visit to Oak Ridge, agreement was reached that Dr. T. A. Lincoln would contact for Registry participation currently employed or terminated ORNL transuranic workers with estimated body depositions of any transuranic elements equal to or exceeding 25% of the permissible limit.

Argonne National Laboratory

Dr. B. D. Breitenstein visited Argonne twice to encourage participation in the Registry and to supply information.

Battelle Memorial Institute

Dr. Breitenstein visited Battelle Columbus to supply information to the Medical Director, Robert L. Levitin, M.D., and others. It is anticipated that they will begin participation in the USTR program in the near future.

LICENSEES

Mr. Idecker of Nuclear Fuel Services, Inc., Erwin, Tennessee plant, was asked to supply the Registry with a list of their transuranium workers.

WHOLE BODY AUTOPSY CONSENTS

Four consents for whole body donation have been secured from USTR registrants. One of the consenting registrants has a plutonium deposition estimated to be several times greater than the maximum permissible body burden.

EDUCATION AND INFORMATION ACTIVITIES

Annual Letter

The annual letter to autopsy registrants (Appendix 1) was mailed to 882 transuranium workers who had authorized autopsy as of the time of the mailing.

Communications - U. S. Government

Annual Report for October 1, 1975 to October 1, 1976 was sent to DOE and to the USTR mailing list.

In response to inquiry, Dr. W. W. H. Weyzen of DBER, DOE Headquarters, was advised that of the first 50 Registry autopsy cases only 9 had authorized autopsy prior to death.

Dr. Weyzen was given information by telephone on cost of developing records of all U. S. plutonium accidents.

Bryce Breitenstein, M.D. and Carlos Newton met with Dr. Weyzen on February 1, 1977 in Washington, D. C. to discuss USTR activities.

Mr. C. T. Fitz, Office of Chief Counsel, DOE-RL, requested and received for review copies of all USTR forms.

Information on all USTR annual reports was supplied to Wayne Lei, Energy Programs Division, DOE-RL.

Scientific Meetings Attended and Plant Visits

Dr. Breitenstein attended the Advisory Committee meeting of the Study of Health Effects of Nuclear Industry Workers at Los Alamos Scientific Laboratory on October 28-29, 1976. The Study is affiliated with the USTR. The USTR program at LASL was also discussed.

Dr. Breitenstein and Mr. Newton attended a Health Physics Society meeting in Seattle, Washington where a paper on the state of the art of bone marrow transplantation was presented by Donall Thomas, M.D.

Carlos Newton held a meeting in Richland September 21, 1977, to discuss procurement and preparation of autopsy samples for the USTR, the role of prosector, designation and identification of samples secured at autopsy, sample weights, abnormalities, shipping and storage. The meeting was attended by health physics representatives from Rocky Flats, Los Alamos and Battelle Northwest.

Registry representatives visited Argonne National Laboratory, Rocky Flats, Oak Ridge, Battelle Memorial Institute and Mound Laboratory to exchange information and promote participation in the USTR program.

Analysis of Registry Data by Sidney Wolfe, M.D.

A request was received from a citizen of Sweden for an explanation of Dr. Sidney Wolfe's analysis of findings reported in "U. S. Transuranium Registry Study of Thirty Autopsies," W. D. Norwood and C. E. Newton, Jr., Health Physics, Vol. 28, June 1975, pp. 669-675. The Registry response cited a letter to the Editor of American Medical News, July 19, 1976 and "An Autopsy Study of Cancer Patients," The Journal of the American Medical Association, Vol. 221, No. 13, September 25, 1972, indicating the inappropriateness of the Registry material for the statistical use as applied by

Dr. Wolfe. This issue was discussed at length in the last USTR annual report.

Other Communications

A letter was sent to the USTR mailing list requesting discussion on the need to do effective separation and assay of bone marrow and marrow-free bone and autoradiography of bone.

Requested information was furnished the Los Alamos Scientific Laboratory for inclusion in the revised protocol for the Study of Plutonium Workers.

A requested update was provided John Abbotts, Public Interest Research Group, on USTR autopsy data provided in October 1976.

A suggested procedure for processing of whole bodies was furnished the Savannah River Plant at the request of Dr. George Poda.

Additional information on USTR autopsy cases was sent to Mr. J. A. Reissland, National Radiological Protection Board, Harwell Didcot, Oxfordshire, U.K.

Information on health and safety problems of concern to the public in the operation of commercial nuclear reactors was supplied to Dr. Richard Sutter, Director of the Sutter Occupational Health Clinic, St. Louis, Missouri.

In response to a request from Dr. J. L. Weeks, Director, Health and Safety Division, Whiteshell Nuclear Research Establishment of Atomic Energy of Canada Limited, Dr. Norwood furnished information on a 1973 insurance case in which he served as consultant. The case involved a soft tissue sarcoma, allegedly caused by handling a box housing a carboy containing a plutonium solution, which was leaking.

Visits from Other Projects

Dr. N. Scott, Chief of Medical Services, A.E.R.E., Harwell, U.K., visited the USTR as part of an informational tour and discussions with other agencies.

Dr. G. W. Dolphin and Mr. J. A. Reissland from the National Radiological Protection Board, Harwell, England, met with Carlos Newton, Dr. B. D. Breitenstein and representatives from Battelle Northwest to discuss the USTR autopsy program.

News Media Requests for Information

Mr. Fred Gillies of the Denver Post requested detailed information on

USTR Rocky Flats autopsy cases, including general findings on plutonium or toxic materials and incidence of bone sarcoma. He was supplied with the USTR annual report for the period October 1, 1975 to October 1, 1976 and supplementary information on Rocky Flats autopsy cases from that report period to the time of his request. Mr. E. A. Putzier of the Rocky Flats Plant was informed of Mr. Gillies' request and the USTR response. A copy of the resulting article is attached as Appendix 2.

Dr. Breitenstein responded to questions posed by Jini Dalen of the Tri-City Herald on health effects in relation to occupational radiation exposure levels for external and internal radiation.

USTR DATA SYSTEM

A meeting was held with Mr. M. E. Nordberg of Boeing Computer Services, Inc. preliminary for implementation of the employee record data portion of the USTR data system. It is anticipated that this system will be operational in early 1978.

RESEARCH ON AUTOPSY PROBLEMS

Two items of major interest to the Registry are (1) separation of bone marrow from bone and determination of their activity, and (2) determination of the microscopic deposition of plutonium in bone as an aid in determining the distribution factor to be used in determining the effectiveness of the alpha radiation in producing bone sarcoma in humans.

Mr. Iral Nelson of BNW was contacted regarding methods of separating bone marrow from bone. Using a method of washing out the bone marrow, and applying a tracer to determine effectiveness, he reported that the results were disappointing. Discussions have been held with his successor, Dr. Fred T. Cross, and with Dr. Wm. Bair regarding further investigation. It would be desirable to make the best estimate of Pu in total bone before the marrow Pu content is determined.

At his request, bone specimens from two USTR autopsy cases were sent to Dr. K. Z. Morgan, Georgia Institute of Technology for experimental work aimed at developing a technique for determining microscopic deposition of plutonium in bones.

ADVISORY COMMITTEE ACTIVITIES

In discussions with Dr. W. W. H. Weyzen of DBER, it was decided to discontinue the present USTR Advisory Committee and restructure the membership in line with the need to expand and develop new areas of involvement. This decision was carried out by letter to the previous Advisory Committee membership. A proposed agenda was prepared for a meeting of the Advisory Committee on June 15 and 16, 1977 in Richland. The membership of the newly appointed committee is as follows:

J. H. Sterner, M.D., Chairman
Dr. R. D. Evans, Vice Chairman
C. C. Lushbaugh, M.D.
Dr. C. W. Mays
Mr. H. M. Parker
Dr. John Poston
Dr. Donovan J. Thompson
George L. Voelz, M.D.

Recommendations were made by the Committee as follows:

1. The Committee noted that the basic charter of the Transuranium Registry included the responsibility for epidemiological studies and that Los Alamos also has a charter to conduct epidemiological studies in relation to the transuranic workers. Accordingly, it was recommended that both organizations define the scope of their programs, specify the kinds of collected information required and specifically note what collaboration between the two programs should and will develop. The Committee recommended that Drs. Voelz and Breitenstein pursue the resolution of these matters and report to the Committee their findings so this matter may be considered in more detail.

2. The Committee recommended that the use of a single laboratory to analyze the transuranium Registry autopsy samples be avoided and that a minimum of two laboratories be used. Two main considerations were the technical aspects involving laboratory intercalibrations and the avoidance of sociopolitical opponents criticizing single laboratory bias. It was emphasized that assuring low-level detection ability of transuranic elements at the designated laboratories was essential. Battelle Northwest, LASL and Rocky Flats were considered the best choices at this time.

1009566

3. The Committee recommended that histopathological slides be systematically collected for all future cases, and that a concerted effort be made to obtain histopathological slides on past autopsy cases. These slides are to be reviewed by at least two independent pathologists when received by the Registry, and kept on file.

4. It was recommended that all USTR forms be reviewed, revised if needed, and submitted to DOE for approval. In particular, the Committee noted that the current "Authorization for Release of Medical and Radiation Exposure Information" was quite wide in scope and may need to be more specific. Included in these concerns of the Committee were the effects of the Privacy Act on the solicitation of such information, as well as the need for a critical legal review of the "Authority for Autopsy" form.

5. It was recommended that the Registry consider maintaining duplicate records at widely separated storage facilities to reduce the risk of loss of data.

6. The matter of following up on separated transuranic employees was noted to relate back to the specific identification of such employees, and the Committee made no recommendations on this. It did recommend, however, that Drs. Voelz and Breitenstein consider this matter and present their findings and recommendations to the Committee for their subsequent advice.

7. The Committee made very strong recommendations regarding the necessity to obtain samples of bone and bone marrow, in particular the femur. Their recommendation was that the femur samples involving full-cross sections (napkin ring) be sought vigorously. The current studies regarding bone marrow separation were encouraged and a specific recommendation was made for the Registry to take a close look at the ethylenediamine extraction method of separation of bone and bone marrow, which has been successful in radium cases.

8. The Committee recognized the number of complications involved in the interpretation and extrapolation of data from the laboratory analyses of autopsy samples to that of the whole body and the subsequent correlation of the data with the health physics *in vivo* determinations.

To assist the Committee in making recommendations on this subject, it appointed Drs. Poston (Chairman) and Mays to investigate and report their findings. Mr. Newton of the USTR staff will work closely with them.

9. The matter regarding the establishment of a transuranic accident and analysis center was noted to be contained in the original charter of the Transuranium Registry and also inherently contained in the epidemiological study being conducted by Dr. Voelz. In addition, Oak Ridge Associated Universities, through Dr. Lushbaugh's staff, is compiling some transuranic accident data. This matter, the Committee noted, needs clarification for better assignment of responsibility. Discussions between Drs. Lushbaugh, Voelz and Breitenstein are needed, with their recommendations to the Committee.

10. The Committee recommended that the Registry continue to seek analyses of autopsy samples for both the transuranic elements and uranium where both depositions may have occurred. It recommended that the Registry not undertake the task of including in their activities a separate registry for uranium (metal) workers at this time. This is not because such an activity would be improper or foreign to the interests of the Registry, but rather that funds are already inadequate for some more vital efforts with the transuranium elements.

U. S. TRANSURANIUM AUTOPSY CASE REPORTS

The Following is a summary of completed USTR autopsy cases. Detailed data for these cases is available on request (Appendix 3). Many of these cases have been published in previous USTR annual reports.

Causes of death have been listed, but because of the biased selection process these cases together do not necessarily reflect the incidence of any disease in the total population of transuranic workers. Many of the cases have become USTR autopsy cases because of interest by survivors or attending physicians as to the nature of the disease process present. There is no evidence at this time that the diagnosed cause of death is either related or unrelated to the transuranic concentrations found in the autopsy tissues. The epidemiology study of plutonium workers at the Los Alamos

Scientific Laboratory is addressing the disease incidence issue in plutonium workers.

The number of years worked in the nuclear industry is an attempt to give an estimate of the potential occupational transuranic exposure, but in many cases the actual exposure to transuranics may be less.

There are instances of incomplete information in the summary. This represents either unknown or undetermined data. Missing information continues to be sought and as identified will be added.

It is the USTR intent to provide anonymity for its cases while attempting to obtain and provide as much detail as possible.

For those who are not familiar with occupational exposure limits for plutonium and americium, the allowable lifetime systemic burden for occupationally exposed plutonium workers is 40 nanocuries and for americium exposures is 50 nanocuries. These levels were established because no adverse human health effects would be expected at these levels.

The americium cases presented also are plutonium cases and the same case number has been assigned to them.

The term "chronic exposure" means that no specific acute exposure has been identified. Specific injuries and inhalations are identified when known and other therapy is also noted.

The analytical laboratories have processed, depending upon how the autopsy samples were obtained, some lung specimens separately from the identifiable tracheobronchial and pulmonary lymph nodes and in other cases have included these nodes with the lung tissue analysis. In practically all cases it is reasonably certain that at least some tracheobronchial and pulmonary lymph nodes have been processed with lung tissue. For this reason chest burdens are reported which include lung and lymphatic tissue. Results on only lung tissue have seldom been available. Data, however, on separated and separately analyzed lymphatic tissue continue to be sought and collected.

To determine the entire amount in an organ the total wet weight was used if this weight was at least as great as that of standard man (ICRP 23). If not, standard man weights were used for organ and total body burden extrapolations. In those cases where a reasonable number of representative samples were obtained, i.e., lung, nodes, bone, liver, muscle, kidney and

spleen, the lowest concentration was used to estimate the burden in unsampled organs, for example brain, skin and fat.

Study of the autopsy data shows that the systemic burdens of occupationally exposed plutonium workers estimated by urinalysis is greater than the systemic burdens estimated from extrapolation of the values obtained in tissues at autopsy.

About two-thirds of the cases showed plutonium tissue concentrations at background or "fallout" concentrations. The other one-third showed less systemic tissue plutonium than was predicted by health physics estimates antemortem.

The chest burden is conventionally considered separate from the systemic burden. The chest burden added to the systemic burden gives the total body burden as presented in the tables. It is important to note the conservatism of the antemortem health physics systemic burden estimates; however, when in vivo chest depositions have been estimated during life the trend is to estimate lower values than the values extrapolated from autopsy data.

An ad hoc committee of the USTR Advisory Committee composed of Drs. John Poston, Chairman, and C. W. Mays, assisted by Carlos E. Newton, will be meeting in early 1978 to evaluate and recommend refinements in the interpretation and extrapolation of data from the laboratory analyses of the autopsy samples and correlation of the data with health physics in vivo determinations.

U. S. PLUTONIUM AUTOPSY CASES

Case Number:	1
Age:	55
Sex:	M
Years Employed in Nuclear Industry:	25
Year of Death:	1970
Cause of Death:	Myocardial infarction due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	11.3
Autopsy Estimated Systemic Burden - nCi:	2.38
Chest Burden - nCi:	2.42×10^{-1}
Total Body Burden - nCi:	2.62
Organ of Highest Concentration - nCi/g:	TBLN* and Pulmonary Nodes (2.46×10^{-2})
Organ of Lowest Concentration - nCi/g:	Heart (neg.)
Comments:	Smoked 1 pkg cigarettes for years. Numerous acute inhalations 1952-63. Chronic inhalation and unexcised wound 1969.

Case Number:	2
Age:	80
Sex:	M
Years Employed in Nuclear Industry:	9
Year of Death:	1970
Cause of Death:	Cerebral stroke due to arteriosclerosis
Pre-Death Estimated Systemic Burden - nCi:	1.35
Autopsy Estimated Systemic Burden - nCi:	3.72×10^{-1}
Chest Burden - nCi:	1.44×10^{-3}
Total Body Burden - nCi:	3.74×10^{-1}
Organ of Highest Concentration - nCi/g:	Liver (1.71×10^{-4})
Organ of Lowest Concentration - nCi/g:	Brain, heart (neg.)
Comments:	Nonsmoker. Chronic inhalation 1953 (high routine sample)

*Tracheobronchial lymph nodes

Case Number:	3
Age:	64
Sex:	M
Years Employed in Nuclear Industry:	26
Year of Death:	1971
Cause of Death:	Myocardial infarction due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	5.85×10^{-2}
Chest Burden - nCi:	1.15×10^{-3}
Total Body Burden - nCi:	5.96×10^{-2}
Organ of Highest Concentration - nCi/g:	Bone (5.84×10^{-6})
Organ of Lowest Concentration - nCi/g:	Liver (3.41×10^{-8})
Comments:	Nonsmoker. Chronic inhalation exposures.

Case Number:	4
Age:	66
Sex:	M
Years Employed in Nuclear Industry:	24
Year of Death:	1971
Cause of Death:	Suicide - gunshot wound to head
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	2.35×10^{-1}
Chest Burden - nCi:	2.01×10^{-2}
Total Body Burden - nCi:	2.55×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (1.76×10^{-4})
Organ of Lowest Concentration - nCi/g:	Kidney (7.66×10^{-7})
Comments:	Nonsmoker. Chronic inhalation.

1009572

Case Number:	5
Age:	67
Sex:	M
Years Employed in Nuclear Industry:	29
Year of Death:	1972
Cause of Death:	Bronchogenic carcinoma
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.87×10^{-1}
Chest Burden - nCi:	3.15×10^{-2}
Total Body Burden - nCi:	2.18×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN and Pul. Node (2.34×10^{-3})
Organ of Lowest Concentration - nCi/g:	Muscle (2.25×10^{-7})
Comments:	Smoked cigarettes until 1967; started snuff. Tumors in both lungs at autopsy. One tumor sample essentially negative, other 3.92×10^{-4} nCi total. Acute inhalation from 5 contamination events.

Case Number:	6
Age:	72
Sex:	M
Years Employed in Nuclear Industry:	12
Year of Death:	1972
Cause of Death:	Myocardial infarction due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	1.4
Autopsy Estimated Systemic Burden - nCi:	3.17×10^{-2}
Chest Burden - nCi:	1.29×10^{-3}
Total Body Burden - nCi:	3.30×10^{-2}
Organ of Highest Concentration - nCi/g:	TBLN (1.13×10^{-5})
Organ of Lowest Concentration - nCi/g:	Muscle(2.79×10^{-7}
Comments:	Nonsmoker. Chronic inhalation and skin absorption.

1009573

Case Number:	7
Age:	66
Sex:	M
Years Employed in Nuclear Industry:	25
Year of Death:	1972
Cause of Death:	Arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	36
Autopsy Estimated Systemic Burden - nCi:	21.2
Chest Burden - nCi:	2.57×10^{-1}
Total Body Burden - nCi:	21.4
Organ of Highest Concentration - nCi/g:	Liver (6.31×10^{-3})
Organ of Lowest Concentration - nCi/g:	Fat (3.51×10^{-6})
Comments:	No smoking information. Chronic inhalation.

Case Number:	8
Age:	62
Sex:	M
Years Employed in Nuclear Industry:	17
Year of Death:	1973
Cause of Death:	Bronchogenic carcinoma
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	8.73×10^{-4}
Chest Burden - nCi:	1.13×10^{-3}
Total Body Burden - nCi:	2.00×10^{-3}
Organ of Highest Concentration - nCi/g:	Pancreas (6.31×10^{-6})
Organ of Lowest Concentration - nCi/g:	Bone, nodes, testicle, liver, trachea (neg.)
Comments:	Pipe smoker. Chronic inhalation.

1009574

Case Number:	9
Age:	59
Sex:	M
Years Employed in Nuclear Industry:	29
Year of Death:	1973
Cause of Death:	Chronic obstructive lung disease
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	5.14×10^{-2}
Chest Burden - nCi:	8.73×10^{-3}
Total Body Burden - nCi:	6.01×10^{-2}
Organ of Highest Concentration - nCi/g:	Liver (1.85×10^{-5})
Organ of Lowest Concentration - nCi/g:	Spleen (5.5×10^{-7})
Comments:	Smoked cigarettes until 1964. Chronic inhalation.

Case Number:	10
Age:	58
Sex:	M
Years Employed in Nuclear Industry:	11
Year of Death:	1973
Cause of Death:	Amyotrophic lateral sclerosis
Pre-Death Estimated Systemic Burden - nCi:	10
Autopsy Estimated Systemic Burden - nCi:	10.8
Chest Burden - nCi:	8.67×10^{-2}
Total Body Burden - nCi:	10.7
Organ of Highest Concentration - nCi/g:	Liver (4.12×10^{-3})
Organ of Lowest Concentration - nCi/g:	Heart (1.13×10^{-5})
Comments:	No smoking information. Chronic inhalation.

1009575

Case Number:	11
Age:	63
Sex:	M
Years Employed in Nuclear Industry:	28
Year of Death:	1974
Cause of Death:	Bronchogenic carcinoma
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	2.44×10^{-1}
Chest Burden - nCi:	1.73×10^{-2}
Total Body Burden - nCi:	2.61×10^{-1}
Organ of Highest Concentration - nCi/g:	Liver (5.68×10^{-5})
Organ of Lowest Concentration - nCi/g:	Kidney with metastases (3.68×10^{-6})
Comments:	Smoked 1 pkg. cigarettes per day until 1973. Rt. lung portion with tumor 4.06×10^{-4} nCi total.

Case Number:	12
Age:	65
Sex:	M
Years Employed in Nuclear Industry:	28
Year of Death:	1974
Cause of Death:	Myocardial infarction due to hypertensive cardiovascular disease
Pre-Death Estimated Systemic Burden - nCi:	9.0
Autopsy Estimated Systemic Burden - nCi:	3.43
Chest Burden - nCi:	4.59×10^{-2}
Total Body Burden - nCi:	3.48
Organ of Highest Concentration - nCi/g:	Liver (1.10×10^{-3})
Organ of Lowest Concentration - nCi/g:	Fat (7.70×10^{-7})
Comments:	Smoked greater than 1 package of cigarettes per day. Four wounds 1960, 61, 62, 62 all excised - acute inhalation 1966 est. 2.6 nCi insoluble in lung. Last 1972 chest measured negative. IV DTPA therapy given at time of each wound.

1009576

Case Number:	14
Age:	63
Sex:	M
Years Employed in Nuclear Industry:	28
Year of Death:	1974
Cause of Death:	Arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	8.84×10^{-2}
Chest Burden - nCi:	5.63×10^{-3}
Total Body Burden - nCi:	9.41×10^{-2}
Organ of Highest Concentration - nCi/g:	TBLN (5.5×10^{-5})
Organ of Lowest Concentration - nCi/g:	Muscle (Neg.)
Comments:	Smoked cigarettes until 1964. Chronic inhalation.

Case Number:	15
Age:	58
Sex:	M
Years Employed in Nuclear Industry:	21
Year of Death:	1975
Cause of Death:	Carcinoma of the stomach with metastases
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.22×10^{-2}
Chest Burden - nCi:	4.90×10^{-4}
Total Body Burden - nCi:	1.27×10^{-2}
Organ of Highest Concentration - nCi/g:	Stomach Tumor (2.2×10^{-5})
Organ of Lowest Concentration - nCi/g:	Kidney (Neg.)
Comments:	Smoked 1-1/2 pkgs. cigarettes for 34 years. No known intake. Tumor in esophagus 4.41×10^{-5} nCi total

1009577

Case Number:	17
Age:	59
Sex:	M
Years Employed in Nuclear Industry:	20
Year of Death:	1976
Cause of Death:	Acute myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	negative
Autopsy Estimated Systemic Burden - nCi:	1.07×10^{-2}
Chest Burden - nCi:	4.92×10^{-4}
Total Body Burden - nCi:	1.12×10^{-2}
Organ of Highest Concentration - nCi/g:	Liver (2.30×10^{-6})
Organ of Lowest Concentration - nCi/g:	Kidney (1.80×10^{-8})
Comments:	Pipe smoker for 20 years to 1970. Urinalyses 1952 - 1965 negative.

Case Number:	18
Age:	64
Sex:	M
Years Employed in Nuclear Industry:	32
Year of Death:	1976
Cause of Death:	Acute myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	2.0 (may change)
Autopsy Estimated Systemic Burden - nCi:	1.17
Chest Burden - nCi:	1.60
Total Body Burden - nCi:	2.77
Organ of Highest Concentration - nCi/g:	TBLN (3.01×10^{-2})
Organ of Lowest Concentration - nCi/g:	Kidney (4.01×10^{-6})
Comments:	Cigarette smoker - stopped 1956. Acute inhalation 1962, 65 and 70

1009578

Case Number:	23
Age:	58
Sex:	M
Years Employed in Nuclear Industry:	9
Year of Death:	1967
Cause of Death:	Acute myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	5.4
Autopsy Estimated Systemic Burden - nCi:	7.39×10^{-1}
Chest Burden - nCi:	1.06×10^{-1}
Total Body Burden - nCi:	8.45×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (6.13×10^{-4})
Organ of Lowest Concentration - nCi/g:	Kidney, spleen (negative)
Comments:	Acute and chronic inhalation.

Case Number:	24
Age:	50
Sex:	M
Years Employed in Nuclear Industry:	2.5
Year of Death:	1968
Cause of Death:	Anterior myocardial infarction due to Arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	8.10×10^{-3}
Chest Burden - nCi:	6.17×10^{-3}
Total Body Burden - nCi:	1.43×10^{-2}
Organ of Highest Concentration - nCi/g:	Lung (6.17×10^{-6})
Organ of Lowest Concentration - nCi/g:	Liver, kidney (negative)
Comments:	Chronic inhalation

1009579

Case Number:	25
Age:	50
Sex:	M
Years Employed in Nuclear Industry:	6
Year of Death:	1969
Cause of Death:	Acute myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	0.8
Autopsy Estimated Systemic Burden - nCi:	1.13×10^{-1}
Chest Burden - nCi:	1.43×10^{-1}
Total Body Burden - nCi:	2.56×10^{-1}
Organ of Highest Concentration - nCi/g:	Lung (1.39×10^{-4})
Organ of Lowest Concentration - nCi/g:	Kidney (9.42×10^{-7})
Comments:	Chronic inhalation

Case Number:	26
Age:	40
Sex:	M
Years Employed in Nuclear Industry:	8
Year of Death:	1970
Cause of Death:	Methanol poisoning
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	9.96×10^{-2}
Chest Burden - nCi:	Not sampled
Total Body Burden - nCi:	Estimate <1
Organ of Highest Concentration - nCi/g:	Spleen (2.71×10^{-4})
Organ of Lowest Concentration - nCi/g:	Bone - sternum (negative)
Comments:	Chronic inhalation. Predeath chest slightly positive.

Case Number:	27
Age:	55
Sex:	M
Years Employed in Nuclear Industry:	5
Year of Death:	1970
Cause of Death:	Brain tumor (astrocytoma)
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	3.46×10^{-2}
Chest Burden - nCi:	6.63×10^{-2}
Total Body Burden - nCi:	1.01×10^{-1}
Organ of Highest Concentration - nCi/g:	Lung (6.54×10^{-5})
Organ of Lowest Concentration - nCi/g:	Bone - sternum (negative)
Comments:	Chronic inhalation

Case Number:	28
Age:	63
Sex:	M
Years Employed in Nuclear Industry:	13
Year of Death:	1970
Cause of Death:	Metastatic carcinoma of bladder
Pre-Death Estimated Systemic Burden - nCi:	1.2
Autopsy Estimated Systemic Burden - nCi:	1.63
Chest Burden - nCi:	44.1
Total Body Burden - nCi:	45.8
Organ of Highest Concentration - nCi/g:	Lung (4.41×10^{-2})
Organ of Lowest Concentration - nCi/g:	Heart (9.01×10^{-6})
Comments:	Acute inhalation. Chest predeath estimate 39.6 nCi.

1009581

Case Number:	29
Age:	28
Sex:	M
Years Employed in Nuclear Industry:	12
Year of Death:	1970
Cause of Death:	Suicide - gunshot wound of head
Pre-Death Estimated Systemic Burden - nCi:	<1.2
Autopsy Estimated Systemic Burden - nCi:	2.87×10^{-1}
Chest Burden - nCi:	1.22
Total Body Burden - nCi:	1.50
Organ of Highest Concentration - nCi/g:	TBLN (7.46×10^{-3})
Organ of Lowest Concentration - nCi/g:	Sternum (3.63×10^{-6})
Comments:	Chronic inhalation.

Case Number:	30
Age:	47
Sex:	M
Years Employed in Nuclear Industry:	18
Year of Death:	1970
Cause of Death:	Carcinoma of stomach
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.22×10^{-1}
Chest Burden - nCi:	6.41×10^{-2}
Total Body Burden - nCi:	1.86×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (8.05×10^{-5})
Organ of Lowest Concentration - nCi/g:	Kidney (1.49×10^{-6})
Comments:	Chronic inhalation.

1009582

Case Number:	31
Age:	59
Sex:	M
Years Employed in Nuclear Industry:	15
Year of Death:	1970
Cause of Death:	Complications of heart surgery for treatment of rheumatic heart disease
Pre-Death Estimated Systemic Burden - nCi:	216*
Autopsy Estimated Systemic Burden - nCi:	9.90
Chest Burden - nCi:	2.60
Total Body Burden - nCi:	12.5
Organ of Highest Concentration - nCi/g:	Liver (4.21×10^{-3})
Organ of Lowest Concentration - nCi/g:	Bone (5.85×10^{-5})
Comments:	Acute and chronic inhalation. *Wound 5 yrs old. Predeath estimate at 370 nCi. Wound site not obtained at autopsy. Predeath chest - positive. No value assigned.

Case Number:	32
Age:	63
Sex:	M
Years Employed in Nuclear Industry:	10
Year of Death:	1971
Cause of Death:	Chronic lymphatic leukemia
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	2.95×10^{-1}
Chest Burden - nCi:	1.93×10^{-2}
Total Body Burden - nCi:	3.14×10^{-1}
Organ of Highest Concentration - nCi/g:	Lung (1.88×10^{-5})
Organ of Lowest Concentration - nCi/g:	Bone (4.21×10^{-6})
Comments:	Acute and chronic inhalation

Case Number:	33
Age:	49
Sex:	M
Years Employed in Nuclear Industry:	11
Year of Death:	1971
Cause of Death:	Suicide - gunshot wound to head. Cerebral hemorrhage.
Pre-Death Estimated Systemic Burden - nCi:	2.2
Autopsy Estimated Systemic Burden - nCi:	6.60×10^{-1}
Chest Burden - nCi:	7.65×10^{-1}
Total Body Burden - nCi:	1.42
Organ of Highest Concentration - nCi/g:	Axillary lymph nodes (4.12×10^{-3})
Organ of Lowest Concentration - nCi/g:	Heart (4.55×10^{-6})
Comments:	Chronic inhalation. Three wound excisions with remaining estimates 6961-0.008 ug, 1962-0.08 ug, 1963-<0.003 ug.

Case Number:	34
Age:	49
Sex:	M
Years Employed in Nuclear Industry:	6
Year of Death:	1971
Cause of Death:	Myocardial infarction due to arterio-sclerotic heart disease with multiple pulmonary emboli.
Pre-Death Estimated Systemic Burden - nCi:	2.6
Autopsy Estimated Systemic Burden - nCi:	3.33×10^{-1}
Chest Burden - nCi:	4.12
Total Body Burden - nCi:	4.45
Organ of Highest Concentration - nCi/g:	Lung (2.61×10^{-3})
Organ of Lowest Concentration - nCi/g:	Muscle (4.15×10^{-6})
Comments:	Acute and chronic inhalation.

1009584

Case Number:	35
Age:	65
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1971
Cause of Death:	Acute lymphoblastic leukemia
Pre-Death Estimated Systemic Burden - nCi:	0.2
Autopsy Estimated Systemic Burden - nCi:	7.01×10^{-2}
Chest Burden - nCi:	1.14×10^{-3}
Total Body Burden - nCi:	7.12×10^{-2}
Organ of Highest Concentration - nCi/g:	Spleen (2.26×10^{-5})
Organ of Lowest Concentration - nCi/g:	Liver (4.99×10^{-9})
Comments:	Chronic inhalation.

Case Number:	36
Age:	69
Sex:	M
Years Employed in Nuclear Industry:	9
Year of Death:	1971
Cause of Death:	Myocardial infarction due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	<1.2
Autopsy Estimated Systemic Burden - nCi:	1.03
Chest Burden - nCi:	19.8
Total Body Burden - nCi:	20.9
Organ of Highest Concentration - nCi/g:	Pul. nodes (3.29×10^{-2})
Organ of Lowest Concentration - nCi/g:	Fat, heart, trachea (negative)
Comments:	*In vivo* chest deposition estimated 17.6 nCi; total body approximately 18 nCi.

Case Number:	37
Age:	63
Sex:	M
Years Employed in Nuclear Industry:	27
Year of Death:	1971
Cause of Death:	Dissecting aneurysm of the aorta
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.04×10^{-1}
Chest Burden - nCi:	3.49×10^{-2}
Total Body Burden - nCi:	1.38×10^{-1}
Organ of Highest Concentration - nCi/g:	Liver (4.70×10^{-5})
Organ of Lowest Concentration - nCi/g:	Sternum (1.61×10^{-6})
Comments:	No known intake.

Case Number:	38
Age:	55
Sex:	M
Years Employed in Nuclear Industry:	16
Year of Death:	1972
Cause of Death:	Metastatic adenocarcinoma of bronchus and lung
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.31×10^{-2}
Chest Burden - nCi:	9.01×10^{-4}
Total Body Burden - nCi:	1.40×10^{-2}
Organ of Highest Concentration - nCi/g:	Pul. nodes (5.98×10^{-5})
Organ of Lowest Concentration - nCi/g:	Heart, lung, brain (negative)
Comments:	1/2 pkg. cigarettes per day to 1970.

Case Number:	39
Age:	25
Sex:	M
Years Employed in Nuclear Industry:	1
Year of Death:	1972
Cause of Death:	Shock and exposure due to fall in the mountains
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	2.12×10^{-2}
Chest Burden - nCi:	1.21×10^{-1}
Total Body Burden - nCi:	1.42×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (3.64×10^{-4})
Organ of Lowest Concentration - nCi/g:	Thyroid (negative)
Comments:	

Case Number:	40
Age:	60
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1972
Cause of Death:	Acute myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.04×10^{-2}
Chest Burden - nCi:	4.02×10^{-2}
Total Body Burden - nCi:	5.06×10^{-2}
Organ of Highest Concentration - nCi/g:	Pul. nodes (3.86×10^{-4})
Organ of Lowest Concentration - nCi/g:	Heart, spleen, bone (negative)
Comments:	

Case Number:	41
Age:	49
Sex:	M
Years Employed in Nuclear Industry:	15
Year of Death:	1972
Cause of Death:	Metastatic melanoma - primary site undetermined
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	Negative
Chest Burden - nCi:	1.46×10^{-2}
Total Body Burden - nCi:	1.46×10^{-2}
Organ of Highest Concentration - nCi/g:	Lung (1.23×10^{-5})
Organ of Lowest Concentration - nCi/g:	Bone, kidney, spleen, thyroid and fat (negative)
Comments:	Liver not analyzed.

Case Number:	42
Age:	53
Sex:	M
Years Employed in Nuclear Industry:	15
Year of Death:	1971
Cause of Death:	Cirrhosis of liver
Pre-Death Estimated Systemic Burden - nCi:	7.6
Autopsy Estimated Systemic Burden - nCi:	1.37
Chest Burden - nCi:	8.68
Total Body Burden - nCi:	10.0
Organ of Highest Concentration - nCi/g:	Pul. nodes (8.04×10^{-2})
Organ of Lowest Concentration - nCi/g:	Larynx-trachea (4.32×10^{-7})
Comments:	1-1/2 pkg cigarettes for 30 years.

Case Number:	. 43
Age:	. 60
Sex:	. M
Years Employed in Nuclear Industry:	. Not known
Year of Death:	. 1972
Cause of Death:	. Myocardial infarction with ventricular wall rupture due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	. Negative
Autopsy Estimated Systemic Burden - nCi:	. 8.11×10^{-3}
Chest Burden - nCi:	. 9.65×10^{-3}
Total Body Burden - nCi:	. 1.78×10^{-2}
Organ of Highest Concentration - nCi/g:	. Thyroid (8.83×10^{-5})
Organ of Lowest Concentration - nCi/g:	. Heart (negative)
Comments:	. Chronic inhalation.

Case Number:	. 44
Age:	. 46
Sex:	. M
Years Employed in Nuclear Industry:	. 9
Year of Death:	. 1972
Cause of Death:	. Adenocarcinoma of kidney with metastases.
Pre-Death Estimated Systemic Burden - nCi:	. Negative
Autopsy Estimated Systemic Burden - nCi:	. 1.48×10^{-1}
Chest Burden - nCi:	. 2.13×10^{-1}
Total Body Burden - nCi:	. 3.61×10^{-1}
Organ of Highest Concentration - nCi/g:	. Pul. nodes (2.37×10^{-1})
Organ of Lowest Concentration - nCi/g:	. Kidney (7.83×10^{-7})
Comments:	. Chronic inhalation.

1009589

Case Number:	45
Age:	51
Sex:	M
Years Employed in Nuclear Industry:	2
Year of Death:	1972
Cause of Death:	Head injury due to automobile accident
Pre-Death Estimated Systemic Burden - nCi:	1.24
Autopsy Estimated Systemic Burden - nCi:	3.57×10^{-1}
Chest Burden - nCi:	7.64×10^{-1}
Total Body Burden - nCi:	1.21
Organ of Highest Concentration - nCi/g:	Lung (7.59×10^{-4})
Organ of Lowest Concentration - nCi/g:	Heart (negative)
Comments:	Chronic inhalation.

Case Number:	46
Age:	55
Sex:	M
Years Employed in Nuclear Industry:	17
Year of Death:	1972
Cause of Death:	Ruptured myocardium from myocardial infarction due to arteriosclerotic heart disease.
Pre-Death Estimated Systemic Burden - nCi:	3.2
Autopsy Estimated Systemic Burden - nCi:	2.05×10^{-1}
Chest Burden - nCi:	1.64×10^{-2}
Total Body Burden - nCi:	2.21×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (5.07×10^{-4})
Organ of Lowest Concentration - nCi/g:	Spleen (negative)
Comments:	

Case Number:	47
Age:	55
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1972
Cause of Death:	Massive left cerebral infarction associated with squamous cell carcinoma of the tongue
Pre-Death Estimated Systemic Burden - nCi:	3.6
Autopsy Estimated Systemic Burden - nCi:	8.56×10^{-2}
Chest Burden - nCi:	2.56×10^{-2}
Total Body Burden - nCi:	1.11×10^{-1}
Organ of Highest Concentration - nCi/g:	Adrenals (5.45×10^{-5})
Organ of Lowest Concentration - nCi/g:	Kidney (8.52×10^{-7})
Comments:	Wound unexcised.

Case Number:	48
Age:	56
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1973
Cause of Death:	Myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	9.2
Autopsy Estimated Systemic Burden - nCi:	3.05
Chest Burden - nCi:	3.75
Total Body Burden - nCi:	6.80
Organ of Highest Concentration - nCi/g:	TBLN (1.87×10^{-2})
Organ of Lowest Concentration - nCi/g:	Fat (2.29×10^{-6})
Comments:	Also Am-241 deposition.

1009591

Case Number:	49
Age:	50
Sex:	M
Years Employed in Nuclear Industry:	12
Year of Death:	1973
Cause of Death:	Astrocytoma of brain
Pre-Death Estimated Systemic Burden - nCi:	0.88
Autopsy Estimated Systemic Burden - nCi:	7.85×10^{-2}
Chest Burden - nCi:	2.97×10^{-1}
Total Body Burden - nCi:	3.75×10^{-1}
Organ of Highest Concentration - nCi/g:	Pul. nodes (1.33×10^{-3})
Organ of Lowest Concentration - nCi/g:	Rib (4.19×10^{-7})
Comments:	Also Am-241 deposition.

Case Number:	50
Age:	38
Sex:	M
Years Employed in Nuclear Industry:	12
Year of Death:	1973
Cause of Death:	Myocardial infarction due to arterio-sclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	<0.4
Autopsy Estimated Systemic Burden - nCi:	9.77×10^{-2}
Chest Burden - nCi:	2.71×10^{-2}
Total Body Burden - nCi:	1.25×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (3.11×10^{-4})
Organ of Lowest Concentration - nCi/g:	Kidney (1.38×10^{-7})
Comments:	Chronic inhalation

Case Number:	51
Age:	55
Sex:	M
Years Employed in Nuclear Industry:	8
Year of Death:	1973
Cause of Death:	Head injury due to automobile accident
Pre-Death Estimated Systemic Burden - nCi:	3.12
Autopsy Estimated Systemic Burden - nCi:	8.14×10^{-1}
Chest Burden - nCi:	6.25×10^{-1}
Total Body Burden - nCi:	1.44
Organ of Highest Concentration - nCi/g:	Pul. nodes (1.09×10^{-3})
Organ of Lowest Concentration - nCi/g:	Heart (2.27×10^{-6})
Comments:	Also Am-241 deposition.

Case Number:	52
Age:	52
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1974
Cause of Death:	Cerebral stroke due to cerebrovascular malformation
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.99×10^{-3}
Chest Burden - nCi:	4.64×10^{-3}
Total Body Burden - nCi:	6.63×10^{-3}
Organ of Highest Concentration - nCi/g:	Lung (3.68×10^{-6})
Organ of Lowest Concentration - nCi/g:	Spleen (5.09×10^{-7})
Comments:	Also Am-241 deposition.

Case Number:	53
Age:	44
Sex:	M
Years Employed in Nuclear Industry:	9
Year of Death:	1975
Cause of Death:	Head injury due to automobile accident
Pre-Death Estimated Systemic Burden - nCi:	0.56
Autopsy Estimated Systemic Burden - nCi:	4.08×10^{-2}
Chest Burden - nCi:	1.25×10^{-1}
Total Body Burden - nCi:	1.66×10^{-1}
Organ of Highest Concentration - nCi/g:	Pul. nodes (2.85×10^{-4})
Organ of Lowest Concentration - nCi/g:	Brain (negative)
Comments:	

Case Number:	54
Age:	51
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1975
Cause of Death:	Carcinoma of the ampulla of Vater
Pre-Death Estimated Systemic Burden - nCi:	0.008
Autopsy Estimated Systemic Burden - nCi:	5.28×10^{-2}
Chest Burden - nCi:	1.12×10^{-2}
Total Body Burden - nCi:	6.39×10^{-2}
Organ of Highest Concentration - nCi/g:	TBLN (8.66×10^{-5})
Organ of Lowest Concentration - nCi/g:	Trachea (negative)
Comments:	

Case Number:	55
Age:	57
Sex:	M
Years Employed in Nuclear Industry:	8
Year of Death:	1975
Cause of Death:	Metastatic squamous cell carcinoma - primary site in larynx and esophagus
Pre-Death Estimated Systemic Burden - nCi:	0.03
Autopsy Estimated Systemic Burden - nCi:	1.79×10^{-1}
Chest Burden - nCi:	1.30×10^{-1}
Total Body Burden - nCi:	3.09×10^{-1}
Organ of Highest Concentration - nCi/g:	Pul. nodes (2.94×10^{-4})
Organ of Lowest Concentration - nCi/g:	Heart (6.87×10^{-7})
Comments:	Skin absorption exposures 1967 and 1968.

Case Number:	56
Age:	57
Sex:	M
Years Employed in Nuclear Industry:	18
Year of Death:	1975
Cause of Death:	Suicide - gunshot wound of head. Known carcinoma of the colon
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.66×10^{-2}
Chest Burden - nCi:	1.54×10^{-2}
Total Body Burden - nCi:	3.19×10^{-2}
Organ of Highest Concentration - nCi/g:	Lung (9.27×10^{-6})
Organ of Lowest Concentration - nCi/g:	Liver (negative)
Comments:	

Case Number:	57
Age:	48
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1976
Cause of Death:	Acute renal failure secondary to Kimmelstiel-Wilson syndrome due to diabetes mellitus
Pre-Death Estimated Systemic Burden - nCi:	0.013
Autopsy Estimated Systemic Burden - nCi:	2.85×10^{-2}
Chest Burden - nCi:	2.51×10^{-2}
Total Body Burden - nCi:	5.36×10^{-2}
Organ of Highest Concentration - nCi/g:	TBLN (4.42×10^{-5})
Organ of Lowest Concentration - nCi/g:	Brain (9.25×10^{-8})
Comments:	

Case Number:	58
Age:	60
Sex:	M
Years Employed in Nuclear Industry:	2-2½
Year of Death:	1976
Cause of Death:	Metastatic carcinoma of prostate, bronchopneumonia
Pre-Death Estimated Systemic Burden - nCi:	<0.4
Autopsy Estimated Systemic Burden - nCi:	7.70×10^{-1}
Chest Burden - nCi:	4.51×10^{-1}
Total Body Burden - nCi:	1.22
Organ of Highest Concentration - nCi/g:	TBLN (1.12×10^{-3})
Organ of Lowest Concentration - nCi/g:	Kidney (1.69×10^{-6})
Comments:	Two minor acute inhalations - urines negative.

UNITED STATES TRANSURANIUM REGISTRY

U. S. Transuranium Registry Annual Report 10/1/76 to 10/1/77 Errata Sheet

P. 43 Case 59; Pre-Death Estimated Systemic Burden - nCi
3.3 should read 33.

1009597

Case Number:	59
Age:	46
Sex:	M
Years Employed in Nuclear Industry:	25
Year of Death:	1973
Cause of Death:	Head and chest injuries due to automobile accident
Pre-Death Estimated Systemic Burden - nCi:	3.3*
Autopsy Estimated Systemic Burden - nCi:	8.50
Chest Burden - nCi:	36.1
Total Body Burden - nCi:	44.6 (w/o wound residual)
Organ of Highest Concentration - nCi/g:	TBLN (9.23×10^{-2})
Organ of Lowest Concentration - nCi/g:	Fat (1.64×10^{-6})
Comments:	Acute and chronic inhalations. *Wounds 1969 4 nCi remaining and 1970 0.8 nCi remaining after excision. 1-2 pkg cigarettes since 1945.

Case Number:	62
Age:	60
Sex:	M
Years Employed in Nuclear Industry:	28
Year of Death:	1972
Cause of Death:	Aircraft accident
Pre-Death Estimated Systemic Burden - nCi:	7.8
Autopsy Estimated Systemic Burden - nCi:	8.11×10^{-1}
Chest Burden - nCi:	2.86×10^{-1}
Total Body Burden - nCi:	1.10
Organ of Highest Concentration - nCi/g:	TBLN (4.66×10^{-3})
Organ of Lowest Concentration - nCi/g:	Thyroid, muscle (negative)
Comments:	Pipe smoker. Chronic inhalation 1968-1972.

Case Number:	63
Age:	60
Sex:	M
Years Employed in Nuclear Industry:	15
Year of Death:	1972
Cause of Death:	Undifferentiated carcinoma - primary site undetermined
Pre-Death Estimated Systemic Burden - nCi:	80
Autopsy Estimated Systemic Burden - nCi:	13.6
Chest Burden - nCi:	28.3
Total Body Burden - nCi:	41.9
Organ of Highest Concentration - nCi/g:	TBLN
Organ of Lowest Concentration - nCi/g:	Muscle, diaphragm (1.04×10^{-4})
Comments:	Nonsmoker. Chronic inhalation. Two lung tumor samples containing 5.50×10^{-4} and 1.23×10^{-1} nCi.

Case Number:	64
Age:	53
Sex:	M
Years Employed in Nuclear Industry:	12
Year of Death:	1972
Cause of Death:	Bronchogenic carcinoma
Pre-Death Estimated Systemic Burden - nCi:	22.0
Autopsy Estimated Systemic Burden - nCi:	7.01
Chest Burden - nCi:	7.58×10^{-1}
Total Body Burden - nCi:	7.77
Organ of Highest Concentration - nCi/g:	Liver (2.33×10^{-3})
Organ of Lowest Concentration - nCi/g:	Fat (7.0×10^{-6}
Comments:	Smoked 1-1½ pkg cigarettes per day for 34 yrs. Stopped 1970. Chronic inhalation.

1009599

Case Number:	81
Age:	60
Sex:	M
Years Employed in Nuclear Industry:	27
Year of Death:	1977
Cause of Death:	Recurrent carcinoma of lung
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.60×10^{-2}
Chest Burden - nCi:	5.25×10^{-3}
Total Body Burden - nCi:	2.13×10^{-2}
Organ of Highest Concentration - nCi/g:	Esoph. lymph node (1.38×10^{-4})
Organ of Lowest Concentration - nCi/g:	Heart, muscle, esophagus (negative)
Comments:	2-3 pkgs cigarettes per day for 40 years. Stopped in 1970.

Case Number:	83
Age:	62
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1977
Cause of Death:	Metastatic adenocarcinoma of lung
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.68×10^{-2}
Chest Burden - nCi:	3.91×10^{-4}
Total Body Burden - nCi:	1.72×10^{-2}
Organ of Highest Concentration - nCi/g:	TBLN (3.53×10^{-6})
Organ of Lowest Concentration - nCi/g:	Spleen, heart (negative)
Comments:	

Case Number:	84
Age:	54
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1977
Cause of Death:	Pleural mesothelioma with cardiac metastasis
Pre-Death Estimated Systemic Burden - nCi:	No data
Autopsy Estimated Systemic Burden - nCi:	1.33×10^{-2}
Chest Burden - nCi:	9.56×10^{-4}
Total Body Burden - nCi:	1.43×10^{-2}
Organ of Highest Concentration - nCi/g:	TBLN (3.75×10^{-6})
Organ of Lowest Concentration - nCi/g:	Hepatic lymph nodes, rib (negative)
Comments:	

Case Number:	86
Age:	
Sex:	M
Years Employed in Nuclear Industry:	
Year of Death:	1976
Cause of Death:	
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	7.91×10^{-4}
Chest Burden - nCi:	9.01×10^{-5}
Total Body Burden - nCi:	8.81×10^{-4}
Organ of Highest Concentration - nCi/g:	Gonad (6.80×10^{-7})
Organ of Lowest Concentration - nCi/g:	Bone, kidney, rib tissue, lymph nodes (neg.)
Comments:	

Case Number:	.	87
Age:	.	65
Sex:	.	M
Years Employed in Nuclear Industry:	.	
Year of Death:	.	1976
Cause of Death:	.	Acute myocardial infarction with cardiac rupture due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	.	Negative
Autopsy Estimated Systemic Burden - nCi:	.	5.99×10^{-1}
Chest Burden - nCi:	.	4.54×10^{-1}
Total Body Burden - nCi:	.	1.05
Organ of Highest Concentration - nCi/g:	.	Pul. nodes (2.53×10^{-3})
Organ of Lowest Concentration - nCi/g:	.	Muscle (5.46×10^{-7})
Comments:	.	

Case Number:	65
Age:	38
Sex:	Not known
Years Employed in Nuclear Industry:	18
Year of Death:	1974
Cause of Death:	Car crash
Pre-Death Estimated Systemic Burden - nCi:	Negative
Autopsy Estimated Systemic Burden - nCi:	1.65×10^{-1}
Chest Burden - nCi:	1.19×10^{-1}
Total Body Burden - nCi:	2.84×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (1.35×10^{-3})
Organ of Lowest Concentration - nCi/g:	Bone (4.65×10^{-6})
Comments:	

Case Number:	66
Age:	60
Sex:	Not known
Years Employed in Nuclear Industry:	11 (11 years as Pu worker)
Year of Death:	1963
Cause of Death:	Coronary thrombosis
Pre-Death Estimated Systemic Burden - nCi:	< 2
Autopsy Estimated Systemic Burden - nCi:	2.72×10^{-1}
Chest Burden - nCi:	5.80×10^{-2}
Total Body Burden - nCi:	3.30×10^{-1}
Organ of Highest Concentration - nCi/g:	Liver, lung (5.61×10^{-5})
Organ of Lowest Concentration - nCi/g:	Mediastimum (1.67×10^{-5})
Comments:	

Case Number:	67
Age:	46
Sex:	Not known
Years Employed in Nuclear Industry:	23 (9 years as Pu worker)
Year of Death:	1974
Cause of Death:	Coronary thrombosis
Pre-Death Estimated Systemic Burden - nCi:	8
Autopsy Estimated Systemic Burden - nCi:	2.43
Chest Burden - nCi:	1.92
Total Body Burden - nCi:	4.35
Organ of Highest Concentration - nCi/g:	TBLN (3.39×10^{-2})
Organ of Lowest Concentration - nCi/g:	Kidney (1.27×10^{-5})
Comments:	

Case Number:	68
Age:	50
Sex:	Not known
Years Employed in Nuclear Industry:	23 (20 years as a Pu worker)
Year of Death:	1973
Cause of Death:	Coronary thrombosis
Pre-Death Estimated Systemic Burden - nCi:	12
Autopsy Estimated Systemic Burden - nCi:	3.20
Chest Burden - nCi:	5.47
Total Body Burden - nCi:	8.67
Organ of Highest Concentration - nCi/g:	TBLN (8.92×10^{-2})
Organ of Lowest Concentration - nCi/g:	Connective tissue (5.88×10^{-6})
Comments: 1009604	

Case Number:	69
Age:	50
Sex:	Not known
Years Employed in Nuclear Industry:	19 (18 years a Pu worker)
Year of Death:	1973
Cause of Death:	Cerebral tumor
Pre-Death Estimated Systemic Burden - nCi:	16
Autopsy Estimated Systemic Burden - nCi:	4.38
Chest Burden - nCi:	6.95×10^{-1}
Total Body Burden - nCi:	5.08
Organ of Highest Concentration - nCi/g:	Liver (1.26×10^{-3})
Organ of Lowest Concentration - nCi/g:	Spleen (8.71×10^{-5})
Comments:	

Case Number:	70
Age:	62
Sex:	Not known
Years Employed in Nuclear Industry:	22 (5 years as a Pu worker)
Year of Death:	1974
Cause of Death:	Bronchopneumonia
Pre-Death Estimated Systemic Burden - nCi:	<2
Autopsy Estimated Systemic Burden - nCi:	6.56×10^{-1}
Chest Burden - nCi:	1.90×10^{-1}
Total Body Burden - nCi:	8.46×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (2.50×10^{-3})
Organ of Lowest Concentration - nCi/g:	Kidney (1.94×10^{-6})
Comments:	

Case Number:	71
Age:	60
Sex:	Not known
Years Employed in Nuclear Industry:	12 (4 years as Pu worker)
Year of Death:	1964
Cause of Death:	Bronchitis
Pre-Death Estimated Systemic Burden - nCi:	12
Autopsy Estimated Systemic Burden - nCi:	6.31×10^{-1}
Chest Burden - nCi:	7.30×10^{-1}
Total Body Burden - nCi:	1.36
Organ of Highest Concentration - nCi/g:	Lung (7.24×10^{-4})
Organ of Lowest Concentration - nCi/g:	Kidney (8.06×10^{-6})
Comments:	

Case Number:	72
Age:	55
Sex:	Not known
Years Employed in Nuclear Industry:	20 (9 years as Pu worker)
Year of Death:	1971
Cause of Death:	Coronary thrombosis
Pre-Death Estimated Systemic Burden - nCi:	4
Autopsy Estimated Systemic Burden - nCi:	2.59
Chest Burden - nCi:	1.33
Total Body Burden - nCi:	3.92
Organ of Highest Concentration - nCi/g:	TBLN (1.25×10^{-3})
Organ of Lowest Concentration - nCi/g:	Kidney (1.78×10^{-5})
Comments:	

Case Number:	73
Age:	48
Sex:	Not known
Years Employed in Nuclear Industry:	20 (1 year as Pu worker)
Year of Death:	1973
Cause of Death:	Fractured skull
Pre-Death Estimated Systemic Burden - nCi:	20
Autopsy Estimated Systemic Burden - nCi:	2.40
Chest Burden - nCi:	4.12×10^{-1}
Total Body Burden - nCi:	2.81
Organ of Highest Concentration - nCi/g:	TBLN (4.45×10^{-3})
Organ of Lowest Concentration - nCi/g:	Connective tissue (4.32×10^{-6})
Comments:	

Case Number:	74
Age:	36
Sex:	Not known
Years Employed in Nuclear Industry:	13 (7 years as Pu worker)
Year of Death:	1971
Cause of Death:	Acute leukemia
Pre-Death Estimated Systemic Burden - nCi:	16
Autopsy Estimated Systemic Burden - nCi:	2.86
Chest Burden - nCi:	2.98
Total Body Burden - nCi:	5.84
Organ of Highest Concentration - nCi/g:	Lung (1.30×10^{-2})
Organ of Lowest Concentration - nCi/g:	Bone (1.13×10^{-4})
Comments:	

Case Number:	75
Age:	49
Sex:	Not known
Years Employed in Nuclear Industry:	23 (15 years as Pu worker)
Year of Death:	1975
Cause of Death:	Chronic myeloid leukemia
Pre-Death Estimated Systemic Burden - nCi:	4
Autopsy Estimated Systemic Burden - nCi:	3.85×10^{-1}
Chest Burden - nCi:	2.09×10^{-1}
Total Body Burden - nCi:	5.94×10^{-1}
Organ of Highest Concentration - nCi/g:	TBLN (1.78×10^{-4})
Organ of Lowest Concentration - nCi/g:	Kidney (1.86×10^{-6})
Comments:	

Case Number:	76
Age:	35
Sex:	Not known
Years Employed in Nuclear Industry:	8 (1 year as Pu worker)
Year of Death:	1962
Cause of Death:	Fractured skull
Pre-Death Estimated Systemic Burden - nCi:	<2
Autopsy Estimated Systemic Burden - nCi:	1.81×10^{-1}
Chest Burden - nCi:	1.44
Total Body Burden - nCi:	3.25
Organ of Highest Concentration - nCi/g:	Lung (1.44×10^{-3})
Organ of Lowest Concentration - nCi/g:	Bone (9.00×10^{-5})
Comments:	

1009608

Case Number:	. 77
Age:	. 54
Sex:	. Not known
Years Employed in Nuclear Industry:	. 18 (15 years as Pu worker)
Year of Death:	. 1969
Cause of Death:	. Coronary thrombosis
Pre-Death Estimated Systemic Burden - nCi:	. <2
Autopsy Estimated Systemic Burden - nCi:	. 5.87×10^{-1}
Chest Burden - nCi:	. 5.97×10^{-1}
Total Body Burden - nCi:	. 1.18
Organ of Highest Concentration - nCi/g:	. Lung (5.94×10^{-4})
Organ of Lowest Concentration - nCi/g:	. Mediastinum (4.29×10^{-5})
Comments:	.

Case Number:	. 78
Age:	. 54
Sex:	. Not known
Years Employed in Nuclear Industry:	. 20 (11 years a Pu worker)
Year of Death:	. 1973
Cause of Death:	. Coronary thrombosis
Pre-Death Estimated Systemic Burden - nCi:	. <2
Autopsy Estimated Systemic Burden - nCi:	. 2.12×10^{-1}
Chest Burden - nCi:	. 1.13×10^{-1}
Total Body Burden - nCi:	. 3.25×10^{-1}
Organ of Highest Concentration - nCi/g:	. TBLN (6.10×10^{-4})
Organ of Lowest Concentration - nCi/g:	. Mediastinum (1.53×10^{-6})
Comments:	.

1009609

Case Number:	. 51
Age:	. 55
Sex:	. M
Years Employed in Nuclear Industry:	. 8
Year of Death:	. 1973
Cause of Death:	. Head injury due to automobile accident
Pre-Death Estimated Systemic Burden - nCi:	. No estimate
Autopsy Estimated Systemic Burden - nCi:	. 1.74×10^{-1}
Chest Burden - nCi:	. 1.66×10^{-1}
Total Body Burden - nCi:	. 3.39×10^{-1}
Organ of Highest Concentration - nCi/g:	. Lung (1.06×10^{-4})
Organ of Lowest Concentration - nCi/g:	. Kidney (2.17×10^{-6})
Comments:	. Also plutonium deposition

Case Number:	. 52
Age:	. 52
Sex:	. M
Years Employed in Nuclear Industry:	. Not known
Year of Death:	. 1974
Cause of Death:	. Cerebral stroke due to cerebrovascular malformation
Pre-Death Estimated Systemic Burden - nCi:	. No estimate
Autopsy Estimated Systemic Burden - nCi:	. 3.15×10^{-4}
Chest Burden - nCi:	. Negative
Total Body Burden - nCi:	. 3.15×10^{-4}
Organ of Highest Concentration - nCi/g:	. Heart (1.05×10^{-7})
Organ of Lowest Concentration - nCi/g:	. Lung, chest nodes, bone, trachea & esoph. (neg.)
Comments:	. Also plutonium deposition.

1009610

Case Number:	48
Age:	56
Sex:	M
Years Employed in Nuclear Industry:	Not known
Year of Death:	1973
Cause of Death:	Myocardial infarction due to arteriosclerotic heart disease
Pre-Death Estimated Systemic Burden - nCi:	Unknown
Autopsy Estimated Systemic Burden - nCi:	1.69
Chest Burden - nCi:	4.59×10^{-1}
Total Body Burden - nCi:	2.15
Organ of Highest Concentration - nCi/g:	Pul. nodes (9.03×10^{-3})
Organ of Lowest Concentration - nCi/g:	Spleen (2.37×10^{-7})
Comments:	Also plutonium deposition

Case Number:	49
Age:	50
Sex:	M
Years Employed in Nuclear Industry:	12
Year of Death:	1973
Cause of Death:	Astrocytoma of brain
Pre-Death Estimated Systemic Burden - nCi:	No estimate
Autopsy Estimated Systemic Burden - nCi:	1.82×10^{-1}
Chest Burden - nCi:	1.07×10^{-1}
Total Body Burden - nCi:	2.89×10^{-1}
Organ of Highest Concentration - nCi/g:	Lung (1.02×10^{-4})
Organ of Lowest Concentration - nCi/g:	Trachea (1.42×10^{-6})
Comments:	Also plutonium deposition

1009611

THE UNITED STATES TRANSURANIUM REGISTRY

April 1, 1977

ANNUAL LETTER TO AUTOPSY REGISTRANTS

Each year the U. S. Transuranium Registry sends you a letter similar to this one to serve several purposes. The most important is to update our records on the current locations of our participants. If you have moved, please complete and mail back the enclosed change of address card. Also enclosed is another Registry card which should be signed and carried with you if you have misplaced or damaged your original one.

I was named USTR Director in July 1976, succeeding W. D. Norwood, M.D., who was largely responsible for founding and developing the Registry. Dr. Norwood will continue as a USTR consultant.

We have been able to identify 14,056 transuranium workers in the United States. Los Alamos Scientific Laboratory is beginning a health study of plutonium workers. This is an affiliate program of the U. S. Transuranium Registry.

There are now 860 registrants in the USTR autopsy program. Our study is continuing and expanding as the use of plutonium also expands and the increase in the number of participants in the Registry continues. It is your continued participation and cooperation in the Registry that makes our program possible and therefore will make it possible to more fully understand the distribution, retention and the very long-time effects of plutonium in the human body. The Registry appreciates your participation in this vital program. If you have questions regarding our program or your participation in it, please write to me.

Sincerely,

Bryce D. Breitenstein

Bryce D. Breitenstein, Jr., M.D.
Director

1009612

P. O. BOX 100 RICHLAND, WASHINGTON 99352

Operated for the U. S. Atomic Energy Commission by the Hanford Environmental Health Foundation

DENVER POST August 14, 1977

PLUTONIUM PERIL?

Flats Cancer Deaths Spotlighted in Study

By FRED GILLIES
Denver Post Staff Writer

An autopsy study of 49 U.S. plutonium workers reveals cancer was the primary cause of death for more than one-third, including 13 who worked at the Rocky Flats nuclear weapons plant.

But federal researchers conducting the study point out that it is "heavily biased" toward cancer, with known and suspected cancer cases intentionally included in the study.

The families of plutonium workers who were known to have or suspected of having cancer were eager to have those workers included in the study, according to Dr. Bryce D. Breitenstein Jr., who heads it.

AND THE STUDY ALSO is heavily weighted with data about deceased Rocky Flats employes who worked with or were exposed to radioactive plutonium at the plant northwest of Denver. Those employes account for nearly 70 per cent of the 49 autopsies that have been completed or partially completed in the study conducted by the U.S. Transuranium Registry in Richland, Wash.

Because the study is neavily biased toward cancer and includes only a small fraction of the nation's 20,000 plutonium workers, no conclusions can yet be drawn as to plutonium's possible role in the cancer deaths, Breitenstein said

"There is no strong evidence of any excess of cancer among plutonium workers," he said. "But we've not really looked hard enough."

Such a searching look at plutonium workers is being taken in another federal study at the Los Alamos, N.M., Scientific Laboratory, Breitenstein noted.

HOWEVER, HE POINTED OUT it is known that large doses of plutonium have caused cancer in experiments with animals. And that laboratory finding was the "main reason" that the registry began its autopsy study early in 1969, he said.

In that study, to date, Breitenstein said, the following incidence of cancer has been found among the 49 plutonium workers autopsied:

—13 cancer deaths among 34 Rocky Flats employes.

—Three cancer deaths among 11 employes at the Hanford Plant in Richland, Wash.

—The cancer death of one employe of Mound Laboratories, Miamisburg, Ohio.

NO CANCER DEATHS were found in autopsy studies of two former employes of the Los Alamos Scientific Laboratory and one former employe of the Oak Ridge, Tenn., National Laboratory.

Among the 13 Rocky Flats employes who died of cancer, Breitenstein said, two died of leukemia, two of brain cancer, two of lung cancer, and one each of cancer of the bladder, abdomen, kidney, skin, colon, esophagus and prostate gland.

Lung cancer was the cause of death of the three Hanford employes.

And cancer "originating at an undetermined site" caused the death of a former Mound Laboratories employe, Breitenstein said.

"There is no unusual kind of tumor present" in those 17 cancer deaths—including the five lung tumors, Breitenstein said.

IF BONE CANCER OR a large number of lung cancers had been found in the autopsy study, those findings would have raised the researchers' suspicions, Breitenstein said. Both of thoe types of cancer have been caused by plutonium in experiments with animals, he noted.

The autopsy study, he said, is seeking to determine where plutonium is deposited in the body of plutonium workers and to compare the amount of plutonium estimated to have been deposited in living plutonium workers with the amount of plutonium found at autopsy.

In the registry's study, "we have discovered that they slightly overestimated the amount of plutonium in the body of the plutonium worker while he was on the job and somewhat underestimated the amount of plutonium in the workers' lungs," Breitenstein said. "If we knew every plutonium worker who died and knew the number of cancer deaths among that whole group, then we could make a statement about cancer risk.

"The main thing is to get these people to allow us to examine their tissues after death."

OF THE 70 AUTOPSIES that the Transuranium Registry is investigating, 39 are from Rocky Flats, 25 from Hanford, four from Los Alamos and one each from Mound and Oak Ridge.

Thirty of the Rocky Flats autopsies have been completed. Four which haven't been completed show cancer as the cause of death, and five other autopsies haven't been completed.

Autopsy tissues of the plutonium workers, Breitenstein said, are analyzed in the laboratories at Rocky Flats and the other four facilities, all of which are operated under the direction of the U.S. Energy Research and Development Administration.

Data obtained recently by The Denver Post from Rockwell International Corp. officials at the Rocky Flats plant showed that 56 active and former employes have died of cancer since the plant began operations nearly 25 years ago.

Those cancer deaths won't be analyzed until early next year to determine how they compare with national and Colorado cancer-death rates, a plant spokesman has indicated.