

APPENDIX B - PART I
Analytic Data File Sets
Single Facilities
Health and Mortality Studies

**CEDR Analytic
Data File Sets**

| Data File Set | Study Name | Brief Description† | Page |
|----------------------|---|---|-------------|
| FRC94A02 | Fernald Cohort Study | Mortality study of 4,014 white male uranium workers, 1951-1989 | B-5 |
| FRW83A01 | Fernald (NLO) Cohort Study, 1983 | Nonmalignant respiratory morbidity study of 4,101 uranium workers, 1952-1972 | B-9 |
| HFC78A01 | Hanford Cohort Study, 1989 | Mortality study of 35,869 workers at a plutonium production and research facility, 1945-1981 | B-11 |
| HFI89A01 | Hanford Cohort Study, 1993 | Mortality study of 37,012 workers at a plutonium production and research facility, 1945-1986 | B-15 |
| HFLCAA01 | Hanford Lung Cancer Study, 1990 | Case-control study of 86 white male lung cancer cases and 445 matched controls among workers at a plutonium production and research facility, 1965-1980 | B-19 |
| HFMCCA02 | Hanford Case-Control Study of Congenital Malformations, 1988 | Case-control study of 672 congenital malformation cases and 978 matched controls among births in two counties adjacent to a plutonium production and research facility, 1957-1980 | B-21 |
| * HFMPVA02 | Hanford Community-Based Study of Congenital Malformations, 1988 | Prevalence study of congenital malformations among births in two counties adjacent to a plutonium production and research facility, 1968-1980 | B-27 |
| HFS93A03 | Hanford Cohort Study, 1993 | Mortality study of 44,101 workers at a plutonium production and research facility, 1944-1986 | B-31 |
| LAFEMA01 | Los Alamos National Lab (LANL) Female Cohort Study, 1987 | Mortality study of 5,234 white female workers at LANL research facility, 1978-1981 | B-35 |
| * LAHSWA04 | LANL Study of Workers with High Exposures to Plutonium | Mortality study of 7,466 white male and female workers at LANL (241 with estimated deposition of 10 nanocuries or more of plutonium and 7,225 controls) | B-39 |
| LAMENA03 | LANL Cohort Study, 1962 & 1994 | Mortality study of 15,727 male workers at LANL, 1943-1990 | B-43 |
| LASUIA02 | LANL Female Suicide Study, 1988 | Case-control study of suicide among 136 female workers at LANL research facility, 1943-1978 | B-47 |
| LAUPUA01 | Follow-up of Manhattan Project Plutonium Workers, 1973, 1979, 1983, 1985, 1989 & 1991 | Study of 26 white male Manhattan Project workers exposed to plutonium-239 during 1944-1945 at LANL | B-49 |
| LND87A01 | Linde Uranium Worker Cohort Study, 1987 | Mortality study of 995 white male uranium workers, 1943-1979 | B-51 |
| MCD94A01 | Mallinckrodt Chemical Works Cohort Study | Mortality study of 2,542 white male workers in the Uranium Division, 1942-1988 | B-55 |
| MDEXTA02 | Mound Facility External Radiation Cohort Study, 1991 | Mortality study of 4,182 workers at a research and production facility, 1947-1980 | B-59 |
| MDPOLA03 | Mound Facility Polonium Exposure Cohort Study, 1991 | Mortality study of 4,402 white male workers at a research and production facility, 1944-1972 | B-63 |
| MDSMRA01 | Mound Facility Cohort Study—Preliminary SMRs, 1991 | Mortality study of 4,697 white male workers at Mound, 1942-1979 | B-67 |

† The numbers of workers in the brief description represent the number of workers in the study cohort. Data in the files may pertain to a larger number of workers.

* New or updated data file set that was not included in the previous CEDR catalog dated May 1995.

**CEDR Analytic
Data File Sets
(cont.)**

| Data File Set | Study Name | Brief Description† | Page |
|----------------------|---|--|-------------|
| ORK25A01 | Oak Ridge K-25 (ORGDP) Nickel Exposure Cohort Study, 1984 | Mortality study of 8,366 white male workers at a uranium enrichment facility, 1948-1977 | B-71 |
| ORK25A02 | Oak Ridge K-25 Cohort Study | Mortality study of 40,785 workers at a uranium enrichment facility, 1945-1990 | B-75 |
| * ORK25A03 | K-25 Centrifuge Worker Study, 1992 | One file for an interview study of 263 process workers and 271 other employees at the K25 Centrifuge facility conducted to determine the incidence rate of cancers and illness symptoms related to epoxy resin and solvent exposures | B-79 |
| ORMULA01 | Oak Ridge Facilities Welders Study, 1981 | Mortality study of 1,059 white male welders at uranium and research facilities, 1943-1974 | B-83 |
| ORMULA02 | Oak Ridge Facilities World War II Cohort Study, 1990 | Mortality study of 28,008 white male workers at uranium and research facilities during World War II, 1950-1979 | B-87 |
| ORMULA03 | Oak Ridge Facilities Study— Ill-defined Cause of Death, 1992 | Case-control mortality study of 1,216 uranium and research workers (608 with ill-defined causes of death and 608 matched controls), 1943-1982 | B-91 |
| ORMULA04 | Oak Ridge Three-Facility Welder Study | Mortality study of 1,211 white male welders employed at either ORNL, Y-12, or K-25 facilities at Oak Ridge Site, 1943-1989 | B-93 |
| ORMULA05 | Oak Ridge Three-Facility Cohort Study | Mortality study of 106,020 workers at either ORNL, Y-12, or K-25 facilities at Oak Ridge Site, 1943-1984 | B-97 |
| ORX10A01 | Oak Ridge National Laboratory (ORNL) Cohort Study, 1985 | Mortality study of 8,375 white males at ORNL research facility, 1943-1977 | B-101 |
| ORX10A02 | ORNL Cohort—Follow-up Study, 1991 & 1993 | Mortality update study on 8,318 white males at ORNL research facility, 1943-1984 | B-105 |
| ORX10A03 | ORNL Cancer Case-Control Study, 1983 | Cancer mortality study of 1,785 male workers at ORNL research facility, 1943-1977 | B-109 |
| * ORX10A04 | Analysis of Oak Ridge X-10 mortality study | Evaluation of cancer mortality in a cohort of 8,318 white male workers at the X10 facility, exposed to low-level radiation (ORX10A02). | B-113 |
| * ORX10A05 | Expanded ORNL cohort study. | One analytic file containing data for study of radiation-mortality association among an expanded cohort of 14,095 ORNL workers. | B-115 |
| ORY12A01 | Oak Ridge Y-12 Plant Cohort Study, 1988 | Mortality study of 6,781 white male workers at a research and development facility, 1947-1979 | B-117 |
| ORY12A02 | Oak Ridge Y-12 Plant Mercury Exposure Cohort Study, 1984 | Mortality study of 5,663 white male workers at a research and development facility, 1955-1978 | B-121 |
| ORY12A03 | Oak Ridge TEC Cohort Study, 1981 | Mortality study of 18,869 white male TEC workers at a uranium plant, 1943-1973 | B-125 |
| ORY12A04 | Oak Ridge TEC Phosgene Exposure Cohort Study, 1980 & 1985 | Mortality study of 106 male TEC workers highly exposed to phosgene at a uranium plant, 1943-1973 and 1943-1978 | B-129 |
| * ORY12A05 | Oak Ridge Y-12 Cohort Mortality Study, 1996. | Two files generated for a cohort mortality study, published in the American Journal of Industrial Medicine in 1996, of 7,664 workers at the uranium enrichment facility (Y-12) plant in Oak Ridge, Tennessee | B-133 |

† The numbers of workers in the brief description represent the number of workers in the study cohort. Data in the files may pertain to a larger number of workers.

* New or updated data file set that was not included in the previous CEDR catalog dated May 1995.

**CEDR Analytic
Data File Sets**

| Data File Set | Study Name | Brief Description† | Page |
|----------------------|--|---|-------------|
| PXSMRA01 | Pantex Weapons Facility Cohort Study, 1985 | Mortality study of 3,564 white male workers at the Pantex weapons facility, 1951-1978 | B-137 |
| RFANLA02 | Rocky Flats Cohort Study | Mortality study of 9,490 workers at a plutonium fabrication facility, 1951-1989. | B-141 |
| RFPLUA01 | Rocky Flats Cohort Study, 1987 | Mortality study of 5,413 white male workers at a plutonium fabrication facility, 1951-1979. | B-145 |
| SRC88A01 | Savannah River Site Cohort Study, 1988 | Mortality study of 9,860 white male Savannah River workers, 1952-1980. | B-149 |
| SRC94A02 | Savannah River Site Cohort Study | Mortality study of 9,860 white male Savannah River Workers, 1952-1986. | B-153 |
| ZARADA01 | Zia Cohort Study | Mortality study of 5,424 radiation-monitored Zia support services workers at LANL, 1946-1984. | B-157 |

† The numbers of workers in the brief description represent the number of workers in the study cohort. Data in the files may pertain to a larger number of workers.

* New or updated data file set that was not included in the previous CEDR catalog dated May 1995.

FERNALD

FRC94A02 Data File Set

Description

This analytic data file set consists of three files generated for a retrospective cohort mortality study of white males employed at the Feed Materials Production Center (FMPC) in Fernald, Ohio.

This study of white males employed between 1951 and 1989 had a total of 121,000 person-years of follow-up. Results for the combined cohort showed statistically significantly elevated standardized mortality ratios (SMRs) for all cancers combined (1.15) and prostate cancer (1.58). Investigating SMRs separately for salaried and nonsalaried workers, there were notable differences between the mortality patterns of the two groups. Salaried workers had a statistically significantly increased SMR only for stomach cancer (2.61), as contrasted with all cancers combined (1.21), lung cancer (1.26), and motor vehicle accidents (1.59) for nonsalaried workers. No deaths from bone sarcomas were found in either group. The healthy worker effect was evident in the statistically significant all-causes SMR of 0.71 for salaried workers. The corresponding SMR for nonsalaried workers was 0.95 with an upper confidence bound of 1.01. Dose-response relationships were found only for cumulative external dose and lung cancer and for cumulative internal dose and nonmalignant respiratory diseases.

The demographic and work history analytic file (DLC4014) contains a record, which includes vital status as of

January 1, 1990, for each of the 4,014 members of the cohort. The last Social Security Administration (SSA) submission for this population provided “alive” status as of January 1, 1985; the “alive” category is no longer obtainable from SSA. However, the National Death Index (NDI) provides a record of all deaths occurring since January 1, 1979. If not identified as deceased by SSA or NDI, individuals last known to be alive before January 1, 1979 were considered lost to follow-up on the last date known alive. Those known to be alive after January 1, 1979, were considered alive at the end of the study. There were 1,064 deaths from all causes, with death certificates available for 99% of these individuals. There are two exposure files. NLOEXTL contains annual deep doses in cGy (rads) from external radiation sources, and NLOINTL contains annual calculated lung doses in cGy from internal radiation sources.

The FMPC was involved in processing uranium ore concentrate and uranium of low-grade enrichment into fabricated uranium metal products and in the production of thorium metal. Operations began in late 1951 with 85% of the cohort being hired before 1960. Employment at the facility reached its peak in 1956 and slowly decreased until operations halted in July of 1989. In addition to radiation and thorium, potential exposures included kerosene, tributyl phosphate, and other solvents. ❖

FERNALD

FRC94A02 Data File Set

Contact

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| Number of Analytic Files: 3 | | |
|-----------------------------|---------------------|------------------------------|
| File Name | Number of Variables | Type of Data |
| DLC4014 | 12 | vital status; work history |
| NLOEXTL | 4 | annual deep doses |
| NLOINTL | 4 | annual calculated lung doses |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|----------|
| | Male | Female † |
| Infectious & Parasitic Diseases | 7 | |
| All Malignant Neoplasms | 141 | |
| Lip, Oral Cavity & Pharynx | 6 | |
| Digestive Organs & Peritoneum | 41 | |
| Respiratory System | 53 | |
| Bone & Connective Tissue | 1 | |
| Skin | 1 | |
| Breast | 0 | |
| Genitourinary System | 13 | |
| Brain/Central Nervous System (CNS) | 3 | |
| Other & Unspecified Sites, Except Brain/CNS | 8 | |
| Lymphatic/Hematopoietic | 15 | |
| All Benign Neoplasms | 1 | |
| All Neoplasms, Unspecified | 1 | |
| Endocrine, Nutritional & Metabolic Diseases | 13 | |
| Diseases of Blood & Blood-Forming Organs | 0 | |
| Mental Disorders | 2 | |
| Diseases of Nervous System & Sense Organs | 3 | |
| Diseases of Circulatory System | 300 | |
| Diseases of Respiratory System | 34 | |
| Diseases of Digestive System | 25 | |
| Diseases of Genitourinary System | 8 | |
| Complications of Pregnancy & Childbirth | 0 | |
| Diseases of Skin & Subcutaneous Tissue | 0 | |
| Diseases of Musculoskeletal System & Connective Tissue | 2 | |
| Congenital Anomalies | 0 | |
| Symptoms & Ill-Defined Conditions | 607 | |
| Accidents, Poisoning & Violence (External Causes) | 70 | |

| | | |
|--------------------------|-------|--|
| Deaths, With ICD Code | 1,214 | |
| Deaths, No ICD Code | 2 | |
| Total Deaths, All Causes | 1,216 | |

† No females were included in this study.

Variables for Analytic File
DLC4014

293 KB

| Name | Description |
|-----------------|---|
| id | identification number |
| birth | birth date |
| otherfac | number of facilities at which person worked |
| status | last known vital status |
| ldate | last date known |
| icd8 | underlying cause-of-death code |
| ca8 | ICD8 code for cancer cause of death |
| fhire | first hire at Fernald |
| lterm | last termination date at Fernald |
| fpay | first pay code |
| lpay | last pay code at Fernald |
| tdays | total number of days employed at Fernald |

Variables for Analytic File
NLOEXTL

905 KB

| Name | Description |
|--------------|------------------------------------|
| id | identification number |
| expyr | year of this exposure |
| deep | photon dose for exposure year |
| stat | flag indicating status of the dose |

Variables for Analytic File
NLOINTL

1.5 MB

| Name | Description |
|----------------|---|
| id | identification number |
| alngdos | calculated lung dose |
| expyr | year of this exposure |
| flag | flag indicating how dose was calculated |

FRC94A02

FERNALD

FRW83A01 Data File Set

Description

This analytic data file set consists of one file generated for a 1983 dissertation that involved a study of nonmalignant respiratory disease among white males at the Fernald Facility.

This cohort morbidity study investigated the relationship between exposure to uranium and the development of nonmalignant respiratory disease. Diagnosis was based upon physician diagnoses as recorded on medical insurance claims. An examination of these data, along with exposure associated with job title, suggested that exposure to uranium dust was the principal exposure at Fernald that contributed to the development of nonmalignant respiratory disease. No statistically significant association was demonstrated for non-radioactive chemical exposures.

The single analytic file (PRELIM09) in this data file set contains 13,196 records, with one or more records for each person. Data in the file include demographic, work history, radiation exposure (internal and external), and smoking history (on a

17.4% sample) data. A list of all chemicals used in the plant and indicators of exposure risk level also are provided. The study cohort was defined as 4,101 white males who were first hired at Fernald between January 1, 1952, and December 31, 1972, and who had at least 3 months of continued employment. Internal and external exposures were obtained through urine bioassay, film badges, and air sampling data. Smoking data were potentially available for workers employed on or after January 1, 1968.

The chemicals used in the processes at the facility, along with job title and plant area, were analyzed by plant experts to determine exposure risk classes. Four exposure risk classes ranging from none to heavy were developed. A similar scale that ranged from no exposure above background to regular exposure at low levels was developed for radiation exposures. ♦

FERNALD

FRW83A01 Data File Set

Citations

Wilson, J. 1983. An epidemiologic investigation of nonmalignant respiratory disease among workers at a uranium mill. Ph.D. diss., University of North Carolina, Chapel Hill.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|---|
| File Name | Number of Variables | Type of Data |
| PRELIM09 | 43 | demographic work history; radiation exposure index; smoking history |

Note: *Summary Death Tables do not apply to this data file set*

| Variables for Analytic File PRELIM09 2 MB | | |
|---|---|--|
| Name | Description | |
| id | identification number | orgbldg department code and building number |
| obnum | observation number in Oak Ridge tape | place physical location of workplace |
| hiredate | date of first hire into this job | finaltrm date of final termination at Fernald |
| jobtitle | job title | n_resp total number of respiratory events |
| jobdays | number of days in this particular job | n_acute total number of acute respiratory events |
| jobcode | numerical job grouping code | n_chron total number of chronic respiratory events |
| radcode | radiation exposure code | case indicates if person was case or control |
| tce | trichloroethylene exposure code | cei cumulative exposure index |
| tbp | tributyl phosphate exposure code | age age at first termination |
| cutfluid | cutting fluid exposure code in this job | acuteyr year of first acute respiratory diagnosis |
| kerosene | kerosene exposure code in this job | chronyr year of first diagnosis of chronic event |
| lime | lime exposure code in this job | respyr year of first respiratory event |
| nh4 | ammonia exposure code for this job | respage age at first respiratory event |
| carbon | carbon exposure code in this job | acuteage age at first acute respiratory event |
| hno3 | nitric acid exposure code in this job | chronage age at first chronic respiratory event |
| naoh | sodium hydroxide exposure code for job | vstat vital status |
| totjdays | total job days worked | icd8x 4-character ICD cause of death |
| firsthir | date of first hire at NLO | icd8 3-digit ICD code for cause of death |
| bdate | birth date | ca8x ICD code for cancer |
| hireage | age at first hire at Fernald | ldate last known date per vital status |
| wagesal | wage/salary code | error code indicating error in vital status |
| | | smkhist smoking history code |

HANFORD

HFC78A01 Data File Set

Description

This analytic data file set consists of three files generated for the cohort mortality study, published in *Health Physics* in 1989, of operations workers at the Hanford Site.

The study evaluated the relationship of occupational radiation exposure and mortality from several specific causes. The study showed that Hanford workers exhibited a strong healthy worker effect, having death rates substantially below those of the general U.S. population. Comparisons by level of exposure within the Hanford worker population provided no evidence of a positive correlation between exposure and mortality from all cancers combined or between exposure and mortality from leukemia.

The three analytic files in the HFC78A01 data file set, constructed using the IARC protocol, pertain to 44,101 Hanford workers initially employed at Hanford between 1944 and 1978. The first file (CEDR78_1) contains demographic, work history, and vital status data and indicators of internal depositions. Mortality data are provided for deaths occurring outside the state of Washington between 1944 and 1981, as well as for deaths occurring in Washington between 1944 and 1985. Internal deposition data include the radionuclide symbol and the year of first plutonium deposition. There is one record per individual. The second file (CEDR78_2) contains annual external whole-body doses that were compiled from external monitoring data for operations workers. These data include doses received while the worker was employed at other sites but, unlike another Hanford data file set (HF189A01), they do not include doses received while performing construction work at Hanford. There is one record for each year of exposure data for each of the 35,869 workers who were monitored. The third file (CEDR78_3)

contains additional data related to on-site exposure and cause of death. There is one record for each worker.

The discussions in the published paper focus on monitored workers of both sexes. Dose-response analyses (internal comparison) included 35,869 workers who were monitored for external radiation. Vital status was ascertained through December 31, 1981, the study end date. There were 4,846 deaths identified, and death certificates were obtained for 4,797 (99.0%) of these deaths. Comparisons with the U.S. general population included 42,291 white workers. There were 7,249 deaths identified, and death certificates were obtained for 7,155 (98.7%) of these deaths. Internal exposures were also examined.

Workers at the Hanford Site were involved in a variety of activities that resulted in their exposure to radiation, including reactor operations, chemical separation of reactor fuel to obtain plutonium, treatment and storage of hazardous waste, and biological and engineering research. Personal dosimeters (film or thermoluminescent) have been used since 1944. Also, bioassay programs to detect exposures to internally deposited radionuclides, primarily transuranics, were initiated in 1944. Dose estimates resulting from these monitoring programs appear in this analytic data file set. Annual whole-body doses to penetrating external radiation are presented in units of millisieverts. Quality factors of 10 for fast neutrons, 3 for slow neutrons, and 1 for photons and electrons were used in the conversion of exposure to dose. Internal exposure data were collected and evaluated for all individuals who worked in locations where there was a potential for exposure to radioactive material (transuranics). ♦

HANFORD

HFC78A01 Data File Set

Citations

Gilbert, E. S., G. R. Petersen, and J. A. Buchanan.
1989. Mortality of workers at the Hanford Site:
1945-1981. *Health Physics* 56:11-25.

Additional References

Gilbert, E. S., J. A. Buchanan, and N. A. Holter.
1992. *Description of the process used to create
1992 Hanford mortality study data base.*
PNL Technical Report No. PNL-8449.

| Number of Analytic Files: 3 | | |
|-----------------------------|---------------------|---|
| File Name | Number of Variables | Type of Data |
| CEDR78_1 | 19 | demographic work history; vital status; internal deposition |
| CEDR78_2 | 7 | annual external whole-body doses |
| CEDR78_3 | 15 | on-site exposure; cause of death |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|--------|
| | Male | Female |
| Infectious & Parasitic Diseases | 32 | 5 |
| All Malignant Neoplasms | 1,437 | 318 |
| Lip, Oral Cavity & Pharynx | 41 | 1 |
| Digestive Organs & Peritoneum | 405 | 73 |
| Respiratory System | 466 | 50 |
| Bone & Connective Tissue | 8 | 5 |
| Skin | 21 | 6 |
| Breast | 3 | 79 |
| Genitourinary System | 192 | 49 |
| Brain/Central Nervous System (CNS) | 42 | 9 |
| Other & Unspecified Sites, Except Brain/CNS | 120 | 19 |
| Lymphatic/Hematopoietic | 139 | 27 |
| All Benign Neoplasms | 5 | 2 |
| All Neoplasms, Unspecified | 7 | 1 |
| Endocrine, Nutritional & Metabolic Diseases | 124 | 27 |
| Diseases of Blood & Blood-Forming Organs | 10 | 5 |
| Mental Disorders | 44 | 7 |
| Diseases of Nervous System & Sense Organs | 59 | 16 |
| Diseases of Circulatory System | 3,497 | 367 |
| Diseases of Respiratory System | 440 | 52 |
| Diseases of Digestive System | 277 | 65 |
| Diseases of Genitourinary System | 74 | 7 |
| Complications of Pregnancy & Childbirth | 0 | 1 |
| Diseases of Skin & Subcutaneous Tissue | 1 | 1 |
| Diseases of Musculoskeletal System & Connective Tissue | 19 | 10 |
| Congenital Anomalies | 11 | 5 |
| Symptoms & Ill-Defined Conditions | 49 | 5 |
| Accidents, Poisoning & Violence (External Causes) | 685 | 115 |
| Deaths, With ICD Code | 6,771 | 1,009 |
| Deaths, No ICD Code | 335 | 68 |
| Total Deaths, All Causes | 7,106 | 1,077 |

Variables for Analytic File
CEDR78_1

3 MB

| Name | Description |
|-----------------|---|
| id | identification number |
| sex | sex of worker |
| birth | date of birth (century, year, month, day) |
| endstudy | ending date of study |
| vital | date of last vital status |
| hire | date of initial employment (year, month, day) |
| followup | date of follow-up start |
| final | date of final employment (year, month, day) |
| yfpudep | year of first plutonium deposition |
| yfpumon | year of first plutonium monitoring |
| yfudep | year of first uranium deposition |
| yfumon | year of first uranium monitoring |
| otypedep | other type of internal deposition |
| yfodep | year of first other type of deposition |
| soccat | socioeconomic category |
| icdcause | underlying cause of death |
| icdrevis | ICD revision number |
| numext | number of external dosimetry readings |
| dupind | duplicate indicator |

Variables for Analytic File
CEDR78_2

10 MB

| Name | Description |
|-----------------|--|
| id | identification number |
| sex | sex of worker |
| birth | date of birth (century, year, month, day) |
| yearext | year of external dosimetry |
| facility | facility |
| totalpen | total whole-body penetrating radiation dose, mSv |
| dupind | duplicate indicator |

Variables for Analytic File
CEDR78_3

2 MB

| Name | Description |
|-----------------|--|
| id | identification number |
| sex | sex of worker |
| birth | date of birth (century, year, month, day) |
| race | race of worker |
| pudep | amount of plutonium deposition |
| statedth | state of death code |
| overlapf | study overlap flag |
| ascause1 | first associated cancer cause of death |
| ascause2 | second associated cancer cause of death |
| ascause3 | third associated cancer cause of death |
| ascause4 | fourth associated cancer cause of death |
| ascause5 | fifth associated cancer cause of death |
| numonext | number of on-site external dosimetry readings |
| yrfstond | year of first on-site external dosimetry reading |
| dupind | duplicate indicator |

HF C78A01

HANFORD

HFI89A01 Data File Set

Description

This analytic data file set consists of three files for the updated study, published in *Health Physics* in 1993, of operations workers at the Hanford Site.

This study continues to examine the relationship between occupational radiation exposure among Hanford workers and mortality from specific causes. The files used for this paper have been updated and refined since the 1989 publication. The study showed that both male and female workers continue to exhibit a strong healthy worker effect, with death rates from most causes substantially below those of the general U.S. population. Comparisons by level of radiation exposure within the Hanford worker population provided little evidence of a positive correlation between cumulative radiation exposure and mortality from leukemia or from all other cancers combined.

The three analytic files in the HFI89A01 data file set, constructed using the IARC protocol, pertain to 44,156 Hanford operations workers initially employed at Hanford between 1944 and 1978. The first file (IARC89_1), with one record per individual, contains demographic, work history, vital status, external dosimetry, and internal deposition data. Mortality data are provided for deaths occurring outside Washington State between 1944 and 1986, and deaths occurring in Washington between 1944 and 1989, inclusive. Internal deposition data include the radionuclide symbol and the year of first plutonium deposition. The second file (IARC89_2), contains external exposure data for the years 1944 through 1989. The dosimetry data include doses received while performing construction work at Hanford as well as occupational doses received off-site at other facilities. There is one record for each year of exposure data for each of the

37,012 monitored workers. The third file (IARC89_3) contains additional data related to internal exposures, off-site exposures, and cause of death. There is one record for each worker.

Comparisons with the U.S. general population included a cohort of 42,070 white workers. There were 9,452 deaths identified, and death certificates were obtained for 9,285 (98.2%) of these deaths. Dose-response analyses included 32,643 workers (24,672 males and 7,971 females) who were monitored for external radiation and employed for at least 6 months between 1944 and 1985. Vital status was ascertained through 1986, the study end date. There were 6,286 deaths identified, and death certificates were obtained for 6,200 (98.6%) of these deaths. Both types of analyses included deaths through December 31, 1986.

Workers at the Hanford Site were involved in a variety of activities that resulted in their exposure to radiation, including reactor operations, chemical separation of reactor fuel to obtain plutonium, treatment and storage of hazardous waste, and biological and engineering research. Personal dosimeters (film or thermoluminescent) have been used since 1944. Bioassay programs to detect exposures to internally deposited radionuclides, primarily transuranics, also were initiated in 1944. Dose estimates resulting from these monitoring programs appear in this data file set. Annual whole-body doses to penetrating external radiation are presented in units of millisieverts. Quality factors of 10 for fast neutrons, 3 for slow neutrons, and 1 for photons and electrons were used in the conversion of exposure to dose. Internal exposure data were collected and evaluated for all individuals who worked in locations where there was a potential for intake of radioactive material (transuranics). ❖

HANFORD

HFI89A01 Data File Set

Citations

Gilbert, E. S., E. Omohundro, J. A. Buchanan, and N. A. Holter. 1993. Mortality of workers at the Hanford Site: 1945-1986. *Health Physics* 64:6.

Additional References

Gilbert, E. S., J. A. Buchanan, and N. A. Holter. 1992. *Description of the process used to create 1992 Hanford mortality study data base*. PNL Technical Report No. PNL-8449.

| Number of Analytic Files: 3 | | |
|-----------------------------|---------------------|--|
| File Name | Number of Variables | Type of Data |
| IARC89_1 | 30 | demographic work history; vital status; internal deposition date |
| IARC89_2 | 13 | external exposure |
| IARC89_3 | 32 | internal exposure; off-site exposure; cause of death |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|--------|
| | Male | Female |
| Infectious & Parasitic Diseases | 42 | 8 |
| All Malignant Neoplasms | 1,927 | 451 |
| Lip, Oral Cavity & Pharynx | 48 | 4 |
| Digestive Organs & Peritoneum | 515 | 92 |
| Respiratory System | 637 | 80 |
| Bone & Connective Tissue | 13 | 7 |
| Skin | 33 | 6 |
| Breast | 4 | 113 |
| Genitourinary System | 264 | 67 |
| Brain/Central Nervous System (CNS) | 55 | 13 |
| Other & Unspecified Sites, Except Brain/CNS | 156 | 26 |
| Lymphatic/Hematopoietic | 202 | 43 |
| All Benign Neoplasms | 6 | 4 |
| All Neoplasms, Unspecified | 9 | 2 |
| Endocrine, Nutritional & Metabolic Diseases | 165 | 32 |
| Diseases of Blood & Blood-Forming Organs | 13 | 5 |
| Mental Disorders | 53 | 10 |
| Diseases of Nervous System & Sense Organs | 88 | 21 |
| Diseases of Circulatory System | 4,330 | 510 |
| Diseases of Respiratory System | 609 | 98 |
| Diseases of Digestive System | 331 | 82 |
| Diseases of Genitourinary System | 92 | 11 |
| Complications of Pregnancy & Childbirth | 0 | 1 |
| Diseases of Skin & Subcutaneous Tissue | 3 | 3 |
| Diseases of Musculoskeletal System & Connective Tissue | 22 | 12 |
| Congenital Anomalies | 11 | 5 |
| Symptoms & Ill-Defined Conditions | 62 | 10 |
| Accidents, Poisoning & Violence (External Causes) | 778 | 133 |
| Deaths, With ICD Code | 8,541 | 1,398 |
| Deaths, No ICD Code | 224 | 101 |
| Total Deaths, All Causes | 8,765 | 1,499 |

Variables for Analytic File

IARC89_1

3 MB

| Name | Description |
|----------|--|
| id | identification number |
| sex | sex of worker |
| birthyr | year of birth |
| birthmo | month of birth |
| birthday | day of birth |
| endyr | ending year of study |
| endmo | ending month of study |
| endday | ending day of study |
| vitalyr | year of last vital status |
| vitalmo | month of last vital status |
| vitalday | day of last vital status |
| hireyr | year of initial employment |
| hiremo | month of initial employment |
| hireday | day of initial employment |
| followyr | year of follow-up start |
| followmo | month of follow-up start |
| followda | day of follow-up start |
| finalyr | year of final employment |
| finalmo | month of final employment |
| finalday | day of final employment |
| yfpudep | year of first plutonium deposition |
| yfpumon | year of first plutonium monitoring |
| yfudep | year of first uranium deposition |
| yfumon | year of first uranium monitoring |
| typedep | type of internal deposition |
| yfodep | year of first other type of deposition |

| | |
|----------|---------------------------------------|
| lgensoc | longest general social class |
| icdcause | underlying cause of death |
| icdrevis | ICD revision number |
| numext | number of external dosimetry readings |

Variables for Analytic File

IARC89_2

20 MB

| Name | Description |
|----------|--|
| id | identification number |
| sex | sex of worker |
| birthyr | year of birth |
| birthmo | month of birth |
| birthday | day of birth |
| yearext | year of external dosimetry |
| facility | facility |
| gam_xray | penetrating radiation dose, mSv |
| neutron | neutron radiation dose, mSv |
| tritium | tritium radiation dose, mSv |
| totalpen | total whole-body penetrating radiation dose, mSv |
| xray | x-ray dose, mSv |
| extrem | extremity dose, mSv |

Variables for Analytic File

IARC89_3

6 MB

| Name | Description |
|----------|---|
| id | identification number |
| sex | sex of worker |
| birthyr | year of birth |
| birthmo | month of birth |
| birthday | day of birth |
| race | race of worker |
| pudep | amount of plutonium deposition |
| otherdep | amount of deposition other than plutonium |
| srflag | strontium flag |
| statedth | state of death |
| overlapf | study overlap flag |
| ascause1 | first associated cancer cause of death |
| ascause2 | second associated cancer cause of death |
| ascause3 | third associated cancer cause of death |
| ascause4 | fourth associated cancer cause of death |
| ascause5 | fifth associated cancer cause of death |
| lastsoc | last social class |
| lgensoc | longest general social class |
| longsoc | longest social class |
| lngthemp | length of employment |
| yoffdos1 | year of first off-site dose |
| offdos1 | amount of first off-site dose |
| yoffdos2 | year of second off-site |

HF189A01

| | |
|-----------------|-----------------------------------|
| yoffdos3 | year of third off-site dose |
| offdos3 | amount of third off-site dose |
| yoffdos4 | year of fourth off-site dose |
| offdos4 | amount of fourth off-site dose |
| yoffdos5 | year of fifth off-site dose |
| offdos5 | amount of fifth off-site dose |
| yoffdos6 | year of sixth off-site dose |
| offdos6 | amount of sixth off-site dose |

HANFORD

HFLCAA01 Data File Set

Description

This analytic data file set consists of one analytic file generated for a lung cancer case-control study, published in *Health Physics* in 1990, of men employed at the Hanford Site.

The purpose of the study was to investigate the association between lung cancer risk and occupational radiation exposure with appropriate adjustment for tobacco use. Data were analyzed using methods that took into account both the case-cohort design and the changes over time in the quality of the tobacco use information that was collected. Tobacco use was not strongly related to the level of radiation exposure, and adjustment for tobacco use did not greatly modify results of analyses assessing the association between lung cancer risk and cumulative dose equivalent. With or without adjustment for tobacco use, the estimated risks per unit of cumulative dose equivalent were negative, but the 95% confidence intervals were wide and included values several times those estimated from populations with high levels of irradiation.

The single analytic file (HFLUNGCA) contains one record for each of the study years 1965 through 1980 (or year of death if earlier) for each of the workers qualifying as a lung cancer case or selected as a subcohort member from a stratified random sample of cohort members. White male operations workers who died of lung cancer qualified as cases if they were monitored for external radiation for at least 3 years and terminated employment on or after January 1, 1965. Questions about tobacco use became a routine part of the periodic medical examination in 1965. Termination in or after this year allowed most workers to have at least one examination during the study period. The criteria for cohort members was identical except for the diagnosis of lung cancer, although this did not exclude their selection. The lung cancer cases were stratified into year-of-birth groups in 5-year intervals. These intervals were used as strata for identifying eligible persons

for the subcohort. For each stratum, at least five times as many subcohort members as cases were randomly selected.

Eighty-six workers qualified as lung cancer cases. This resulted in the random selection of 445 subcohort members from a total of 5,445 eligible workers. Thirteen of those selected also qualified as lung cancer cases. One of the 86 cases and three of the 445 subcohort members were excluded from the analyses because their medical records could not be located. Vital status was ascertained through December 31, 1980, the study end date. Of the 442 subcohort members, 344 remained alive through the end of the study. Internal as well as external radiation exposures were examined.

Workers at the Hanford Site were involved in a variety of activities that resulted in their exposure to radiation, including reactor operations, chemical separation of reactor fuel to obtain plutonium, treatment and storage of hazardous waste, and biological and engineering research. Personal dosimeters (film or thermoluminescent) have been used since 1944. Annual whole-body doses to penetrating external radiation are presented in units of millisieverts. Quality factors of 10 for fast neutrons, 3 for slow neutrons, and 1 for photons and electrons were used in the conversion of exposure to dose. Bioassay programs to detect exposures to internally deposited radionuclides, primarily transuranics, were also initiated in 1944. The potential for inhalation of uranium in this study was evaluated by reviewing each worker's uranium bioassay records. It was assumed that the number of bioassay measurements provided a rough indication of potential for exposure. Bioassay programs for uranium were primarily concerned with monitoring for uptake by the kidney and did not directly provide indications of lung dose. ♦

HANFORD

HFLCAA01 Data File Set

Citations

Petersen, G. R., E. S. Gilbert, J. A. Buchanan, and R. G. Stevens. 1990. A case-cohort study of lung cancer, ionizing radiation, and tobacco smoking among males at the Hanford Site. *Health Physics* 58:3-11.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|--|
| File Name | Number of Variables | Type of Data |
| HFLUNGCA | 34 | smoking history; vital status; external exposure |

Note: *Summary Death Tables do not apply to this data file set*

| Variables for Analytic File HFLUNGCA | | 1 MB |
|--------------------------------------|---|------|
| Name | Description | |
| id | identification number | |
| yrfollup | year of follow-up | |
| yrremex | year of most recent medical exam | |
| yrfinmex | year of final medical exam | |
| yrbirth | year of birth | |
| yrbegtob | year began tobacco use | |
| yrquitob | year quit tobacco use | |
| amtobuse | amount of tobacco use | |
| tobestfl | tobacco estimation flag | |
| tobustat | tobacco use status | |
| tobustyp | tobacco use type | |
| yrreamt | year of refined amount of tobacco use | |
| reamttob | refined amount of tobacco use | |
| yrretobs | year of refined tobacco use status | |
| retobust | refined tobacco use status | |
| reyrquit | refined year quit tobacco use | |
| yrdeath | year of death | |
| caseflag | case flag | |
| cacoflag | case control flag | |
| yrfraexp | year of final radiation exposure | |
| cumraexp | cumulative radiation exposure | |
| craexp12 | cumulative radiation exposure lagged 2 years | |
| crexp10 | cumulative radiation exposure lagged 10 years | |
| nuby4451 | number of uranium bioassay years 1944-1951 | |
| nubm4451 | number of uranium bioassay measurements 1944-1951 | |
| nuby5264 | number of uranium bioassay years 1952-1964 | |
| nubm5264 | number of uranium bioassay measurements 1952-1964 | |
| nuby6575 | number of uranium bioassay years 1965-1975 | |
| nubm6575 | number of uranium bioassay measurements 1965-1975 | |
| fsyr2ubm | first year with 2+ uranium bioassay measurements | |
| lsyr2ubm | last year before 1965 with 2+ uranium bioassay measurements | |
| genjobca | general job category | |
| titlejob | title for job held longest | |
| bocjobca | Bureau of Census job category | |

HANFORD

HFMCCA02 Data File Set

Description

This analytic data file set consists of five analytic files used to support a case-control study of congenital malformations, published in the *American Journal of Epidemiology* in 1988, among births in two counties adjacent to the Hanford Site.

The purpose of the study was to investigate the association of parental occupational exposure to low-level external whole-body penetrating ionizing radiation and risk of congenital malformations in their offspring. Cases and controls were ascertained from births in two counties in southeastern Washington State, where the Hanford Site has been a major employer. Twelve specific malformation types were analyzed for evidence of association with employment of the parents at Hanford and with occupational exposure to ionizing radiation. Two defects, congenital dislocation of the hip and tracheoesophageal fistula, showed statistically significant associations with employment of the parents at Hanford, but not with parental radiation exposure. Neural tube defects showed a significant association with parental preconception exposure, on the basis of a small number of cases. Eleven other defects, including Down syndrome, for which an association with radiation was considered most likely, showed no evidence of such an association. When all malformations were analyzed as a group, there was no evidence of an association with employment of the parents at Hanford, but the relation of parental exposure to radiation before conception was in the positive direction. Given the number of statistical tests conducted, some or all of the observed positive correlations are likely to represent false positive findings. In view of strong contradictory evidence, based on no demonstrated effects in genetic studies of atomic bomb survivors in Hiroshima and Nagasaki, it is unlikely that these correlations result from a cause-and-effect association with parental radiation exposure.

The HFMCCA02 data file set is comprised of five analytic files with information on 672 malformation cases and 978 matched controls. The first file (MALCCA_1) contains demographic data for the parents and the reproductive history of the mother. The second file (MALCCA_2) contains birth data for the infant. The third file (MALCCA_3) contains malformation data for cases, and additional medical data for the infant and mother. If the parents worked at Hanford prior to the infant's date of birth, the fourth file (MALCCA_4) contains employment data, and the fifth file (MALCCA_5) contains radiation exposure data. There is one record in each file for each of the cases and controls.

A unique feature of this study was the linking of quantitative individual measurement of external radiation exposures of Hanford employees and the disease outcome, congenital malformations. The population at risk, from which cases and controls were ascertained, consists of live births and fetal deaths occurring in three local hospitals during 1957 through 1980, the study end date. Of the 672 cases, 146 fathers and 48 mothers were employed at Hanford prior to conception. Twenty-two mothers of cases were employed at Hanford during gestation. Of these cases, 125 fathers and 28 mothers had positive recorded doses prior to conception. Only one mother of a case received more than 1 millisievert (mSv) during gestation. Information on internal radionuclide depositions was also obtained. However, only one father of a case had evidence of a deposition, and it was determined to be less than 1% of the applicable maximum permissible body burden.

Radiation exposure data routinely collected at Hanford include the doses from external sources to the whole body, the skin of the whole body, and the extremities, for each employee

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HFMCCA02 Data File Set

· working with or near radiation sources. Because exposure to
· the gonads was the primary interest of this study, analyses
· were limited to consideration of exposure to external whole-
· body penetrating radiation. Dose estimates, presented in units
· of millisieverts, were obtained primarily from personal
· dosimeter measurements. A sievert is numerically equivalent
· to the absorbed dose in gray multiplied by a quality factor
· expressing the biological effectiveness of the radiation type.
· Factors of 10 for fast neutrons, 3 for slow neutrons, and 1 for
· photons were used to convert external exposure
· measurements to dose estimates. Workers who are
· considered at risk for internal depositions also undergo
· routine bioassays and in vivo tests to determine such
· radiation exposure. ♦♦

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HFMCCA02 Data File Set

Citations

Sever, L. E., E. S. Gilbert, N. A. Hessol and J. M. McIntyre. 1988. A case-control study of congenital malformations and occupational exposure to low-level ionizing radiation. *American Journal of Epidemiology* 127:226-42.

| Number of Analytic Files: 5 | | |
|-----------------------------|---------------------|------------------------------------|
| File Name | Number of Variables | Type of Data |
| MALCCA_1 | 29 | demographics; reproductive history |
| MALCCA_2 | 14 | infant birth data |
| MALCCA_3 | 26 | malformation data; medical data |
| MALCCA_4 | 15 | employment data |
| MALCCA_5 | 11 | radiation exposure |

Note: Summary Death Tables do not apply to this data file set

| Variables for Analytic File MALCCA_1 106 KB | |
|---|-------------------------------------|
| Name | Description |
| studynum | study number |
| filetype | file type |
| fathrace | father's race |
| fathage | father's age |
| fathbipl | father's birthplace |
| fatheduc | father's education |
| fathoccu | father's occupation |
| mothrace | mother's race |
| mothage | mother's age |
| mothbipl | mother's birthplace |
| motheduc | mother's education |
| mothoccu | mother's occupation |
| prencare | prenatal care |
| prenvist | prenatal visits |
| childalv | children alive |
| childdead | children dead |
| stillbth | stillbirths |
| spoabort | spontaneous abortions |
| indabort | induced abortions |
| ectopreg | ectopic pregnancies |
| gravidty | gravidity |
| parity | parity |
| lastlive | last live birth |
| lastterm | last terminated pregnancy |
| rephagre | reproductive history agreement |
| childabc | children alive (birth certificates) |
| childdbc | children dead (birth certificates) |

fetdeath fetal deaths (birth certificates)
cagravbc case gravidity (birth certificates)

| Variables for Analytic File MALCCA_2 | |
|---|--------------------------------------|
| Name | Description |
| plurality | plurality |
| studynum | study number |
| filetype | file type |
| infbirth | infant's birth date |
| hospital | hospital of birth |
| infansex | infant's sex |
| multiden | multiple birth infant identification |
| infbstat | infant's birth status |
| lastmens | last menstrual period |
| gestaage | gestational age |
| birthwgt | birth weight |
| headcirc | head circumference |
| apgscore1 | Apgar Score (1 minute postpartum) |
| apgscore5 | Apgar Score (5 minutes postpartum) |

66 KB

| Variables for Analytic File MALCCA_3 | |
|---|-------------------------------|
| Name | Description |
| studynum | study number |
| filetype | file type |
| casestat | case status |
| congm1 | congenital malformation #1 |
| congm2 | congenital malformation #2 |
| congm3 | congenital malformation #3 |
| congm4 | congenital malformation #4 |
| infestat | infant's death status |
| infdeath | infant's death date |
| infdeage | infant's death age (days) |
| autostat | autopsy status |
| dthcause1 | death cause #1 |
| dthcause2 | death cause #2 |
| dthcause3 | death cause #3 |
| pcomstat | pregnancy complication status |
| pregcom1 | pregnancy complication #1 |
| pregcom2 | pregnancy complication #2 |
| pillstat | pregnancy illness status |
| pregill1 | pregnancy illness #1 |
| pregill2 | pregnancy illness #2 |
| anestype | anesthesia type |
| delitype | delivery type |
| caesstat | caesarean status |
| infresta | infant's resuscitation status |

130 KB

dcomstat delivery complication status
delicomp delivery complication

| Variables for Analytic File MALCCA_4 | |
|---|--|
| Name | Description |
| studynum | study number |
| filetype | file type |
| hanfstat | Hanford status |
| fhanslmp | father's Hanford status prior to last menstrual period |
| foccdlmp | father's occupation on date of last menstrual period |
| focpchem | father's occupation with potential chemical exposure |
| focldlmp | father's occupation of longest duration |
| fhansges | father's Hanford status during gestation |
| foccgest | father's occupation during gestation |
| mhanslmp | mother's Hanford status prior to last menstrual period |
| moccdlmp | mother's occupation on date of last menstrual period |
| mocpchem | mother's occupation with potential chemical exposure |
| mocldlmp | mother's occupation of longest duration |
| mhansges | mother's Hanford status during gestation |
| moccgest | mother's occupation during gestation |

71 KB

Variables for Analytic File

MALCCA_5

82 KB

| Name | Description |
|-----------------|--|
| studynum | study number |
| filetype | file type |
| conceinf | conception date of infant |
| fcexpcon | father's cumulative exposure prior to conception |
| fexp3con | father's exposure in the 3-month period |
| soufdose | source of father's dosimetry data |
| findepst | father's internal deposition status |
| mcexpcon | mother's cumulative exposure prior to conception |
| mexpgest | mother's exposure in the gestation period |
| soumdose | source of mother's dosimetry data |
| mindepst | mother's internal deposition status |

HANFORD

HFMPVA02 Data File Set

Description

This analytic data file set consists of five analytic files that support a prevalence study, published in the *American Journal of Epidemiology* in 1988, of congenital malformations in two counties adjacent to the Hanford Site.

The purpose of this study was to investigate the prevalence of congenital malformations among births in two southeastern Washington State counties where the Hanford Nuclear Site is a major employer. Various agriculturally and chemically related activities take place in this area as well. The rates of specific malformations ascertained during the first year of life were compared with combined rates from the Birth Defects Monitoring Program (BDMP) for the states of Washington, Oregon, and Idaho. Among defects that would be expected to be comparably ascertained, a statistically significant elevated rate of neural tube defects was observed in the two counties, while rates of cleft lip were significantly lower. For congenital heart defects, pyloric stenosis, and Down syndrome (defects often not diagnosed during the newborn period), BDMP data did not offer appropriate comparisons. However, the rates of these defects did not appear to be elevated in relation to rates found in other relevant populations. When rates of neural tube defects were compared with populations other than those in the BDMP, the bicoounty rates were still considered elevated. The increased rate cannot be explained by employment of the parents at Hanford or by the impact of Hanford plant emissions on the local population.

The HFMPVA02 data file set is comprised of five analytic files with information on 454 malformation cases. The first file (MALPVA_1) contains demographic data for the parents and the reproductive history of the mother. The second file (MALPVA_2) contains birth data for the infant. The third file (MALPVA_3) contains malformation data and additional medical data for the infant and mother. If the parents worked at Hanford prior to the infant's date of birth, the fourth file (MALPVA_4) contains employment data,

and the fifth file (MALPVA_5) contains radiation exposure data. There is one record in each file for each of the cases.

The population at risk consists of 23,076 live births and 243 fetal deaths occurring in three of the bicoounty hospitals from the beginning of the study in 1968 through the end of the study in 1980. Thus, the denominator for prevalence rates is 23,319. A total of 454 malformation cases was identified, for a congenital malformation rate in the newborn population of 19.6 per 1,000 or about 2% of all births. For the bicoounty general public, a maximally exposed individual could not have received more than 10 millisieverts (mSv) from Hanford nuclear activities during 1957-1984. This is about one-third of the exposure received from natural background over the same period. At the time of this study, more than 65,000 individuals had been employed at Hanford since it began operations in 1944, and about 15,000 of these people were still employed there. On the basis of a companion case-control study (HFMPVA02), it is estimated that 23% of all infants born during the 1968-1980 study period would have one or more parents employed at Hanford, and about 6% of these infants would have a parent with cumulative Hanford ionizing radiation exposure exceeding 10 mSv.

Radiation exposure data routinely collected at Hanford include the doses from external sources to the whole body, the skin of the whole body, and the extremities for each employee working with or near radiation sources. Dose estimates, presented in units of millisieverts, were obtained primarily from personal dosimeter measurements. A sievert is numerically equivalent to the absorbed dose in gray multiplied by a quality factor expressing the biological effectiveness of the radiation type. Factors of 10 for fast neutrons, 3 for slow neutrons, and 1 for photons were used to convert external exposure measurements to dose estimates. Workers who are considered at risk for internal depositions also undergo routine bioassays and in vivo tests to determine such radiation exposure. ❖

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HFMPVA02 Data File Set

Citations

Sever, L. E., N. A. Hessel, E. S. Gilbert, and J. M. McIntyre. 1988. The prevalence at birth of congenital malformations in communities near the Hanford Site. *American Journal of Epidemiology* 127: 243- 54.

| Number of Analytic Files: 5 | | |
|-----------------------------|---------------------|------------------------------------|
| File Name | Number of Variables | Type of Data |
| MALPVA_1 | 29 | demographics; reproductive history |
| MALPVA_2 | 14 | infant birth data |
| MALPVA_3 | 26 | malformation data; medical data |
| MALPVA_4 | 15 | employment data |
| MALPVA_5 | 11 | radiation exposure |

Note: Summary Death Tables do not apply to this data file set

Variables for Analytic File MALPVA_1 29 KB

| Name | Description |
|-----------|-------------------------------------|
| studynum | study number |
| filetype | file type |
| fathrace | father's race |
| fathage | father's age |
| fathbipl | father's birthplace |
| fatheduc | father's education |
| fathoccu | father's occupation |
| mothrace | mother's race |
| mothage | mother's age |
| mothbipl | mother's birthplace |
| motheduc | mother's education |
| mothoccu | mother's occupation |
| prencare | prenatal care |
| prenvist | prenatal visits |
| childalv | children alive |
| childdead | children dead |
| stillbth | stillbirths |
| spoabort | spontaneous abortions |
| indabort | induced abortions |
| ectopreg | ectopic pregnancies |
| gravidty | gravidity |
| parity | parity |
| lastlive | last live birth |
| lastterm | last terminated pregnancy |
| rephagre | reproductive history agreement |
| childabc | children alive (birth certificates) |
| childdbc | children dead (birth certificates) |

fetdeath fetal deaths (birth certificates)
cagravbc case gravidity (birth certificates)

Variables for Analytic File
MALPVA_2
18 KB

| Name | Description |
|-----------|--------------------------------------|
| studynum | study number |
| filetype | file type |
| infbirth | infant's birth date |
| hospital | hospital of birth |
| infansex | infant's sex |
| plurality | plurality |
| multiden | multiple birth infant identification |
| infbstat | infant's birth status |
| lastmens | last menstrual period |
| gestaage | gestational age |
| birthwgt | birth weight |
| headcirc | head circumference |
| apgscore1 | Apgar Score (1 minute postpartum) |
| apgscore5 | Apgar Score (5 minutes postpartum) |

Variables for Analytic File
MALPVA_3
35 KB

| Name | Description |
|-----------|-------------------------------|
| studynum | study number |
| filetype | file type |
| casestat | case status |
| congmal1 | congenital malformation #1 |
| congmal2 | congenital malformation #2 |
| congmal3 | congenital malformation #3 |
| congmal4 | congenital malformation #4 |
| infdstat | infant's death status |
| infdeath | infant's death date |
| infdeage | infant's death age (days) |
| autostat | autopsy status |
| dthcause1 | death cause #1 |
| dthcause2 | death cause #2 |
| dthcause3 | death cause #3 |
| pcomstat | pregnancy complication status |
| pregcom1 | pregnancy complication #1 |
| pregcom2 | pregnancy complication #2 |
| pillstat | pregnancy illness status |
| pregill1 | pregnancy illness #1 |
| pregill2 | pregnancy illness #2 |
| anestype | anesthesia type |
| delitype | delivery type |
| caesstat | caesarean status |
| infresta | infant's resuscitation status |

dcomstat delivery complication status
delicompl delivery complication

Variables for Analytic File
MALPVA_4
20 KB

| Name | Description |
|----------|--|
| studynum | study number |
| filetype | file type |
| hanfstat | Hanford status |
| fhanslmp | father's Hanford status prior to last menstrual period |
| foccdlmp | father's occupation on date of last menstrual period |
| focpchem | father's occupation with potential chemical exposure |
| focldlmp | father's occupation of longest duration |
| fhansges | father's Hanford status during gestation |
| foccgest | father's occupation during gestation |
| mhanslmp | mother's Hanford status prior to last menstrual period |
| moccdlmp | mother's occupation on date of last menstrual period |
| mocpchem | mother's occupation with potential chemical exposure |
| mocldlmp | mother's occupation of longest duration |
| mhansges | mother's Hanford status during gestation |
| moccgest | mother's occupation during gestation |

HFMPVA02

Variables for Analytic File

MALPVA_5

23 KB

| Name | Description |
|-----------------|--|
| studynum | study number |
| filetype | file type |
| conceinf | conception date of infant |
| fcexpcon | father's cumulative exposure prior to conception |
| fexp3con | father's exposure in the 3-month period |
| soufdose | source of father's dosimetry data |
| findepst | father's internal deposition status |
| mcexpcon | mother's cumulative exposure prior to conception |
| mexpgest | mother's exposure in the gestation period |
| soumdose | source of mother's dosimetry data |
| mindepst | mother's internal deposition status |

HANFORD

HFS93A03 Data File Set

Description

This analytic data file set consists of two files constructed for another analysis, published in the *American Journal of Industrial Medicine* in 1993, of operations workers at the Hanford Site.

This study examines the relationship between low-level occupational radiation doses among Hanford workers and mortality from specific causes. The approach taken in this study makes new use of standard epidemiologic procedures and reveals evidence of increased cancer risk at low dose levels.

The reanalysis does not indicate that radiation is more likely to cause leukemia than solid tumors or that there is a reduced cancer effectiveness of radiation at low dose levels. However, the estimated proportion of radiogenic cancers was much higher for the 175 nonfatal cancers than for the 1,732 fatal cases.

There is one record in each of the two analytic files corresponding to each of the 44,101 workers. The cohort was restricted to individuals who worked at Hanford between 1944 and 1978. The follow-up period for this reanalysis runs from January 1944 through December 1986. The first file (HFS93A03_1) contains demographic data, off-site doses, internal exposure data, annual external doses, and vital status data. The

second file (HFS93A03_2) contains work history and internal exposure data. Due to the many job titles at Hanford, six job categories were established: professional, managerial, clerical, crafts, blue collar, other, and not specified. Data include the date on which a worker was first monitored (by urinalysis) for internal deposition as well as the dates on which the result was first greater than zero (i.e., measurable), the result was greater than the standard error, and the result was greater than twice the standard error. Results of in vivo counting include the years at which depositions of one, two, or three nuclides were detected. There were 9,443 deaths identified through the follow-up period of December 31, 1986.

Workers at Hanford were involved in a variety of activities resulting in exposure to radiation, including reactor operations, chemical separation processes, treatment and storage of hazardous waste, and biological and engineering research. Personal dosimeters were first used in 1944. The doses contained in the file are expressed in centirad. Internal exposure data were collected and evaluated for all individuals who worked in locations where there was a potential for intake of radioactive materials. ❖

HANFORD

HFS93A03 Data File Set

Citations

Kneale, G. W., and A. Stewart. 1993. Reanalysis of Hanford Data: 1944-1986 Deaths. *American Journal of Industrial Medicine* 23:371-389.

| Number of Analytic Files: 2 | | |
|-----------------------------|---------------------|--|
| File Name | Number of Variables | Type of Data |
| HFS93A03_1 | 50 | demographic; off-site doses; vital status; external exposure |
| HFS93A03_2 | 56 | work history; internal exposure |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|--------|
| | Male | Female |
| Infectious & Parasitic Diseases | 41 | 8 |
| All Malignant Neoplasms | 2,016 | 458 |
| Lip, Oral Cavity & Pharynx | 48 | 4 |
| Digestive Organs & Peritoneum | 511 | 92 |
| Respiratory System | 640 | 78 |
| Bone & Connective Tissue | 13 | 7 |
| Skin | 33 | 6 |
| Breast | 4 | 113 |
| Genitourinary System | 354 | 77 |
| Brain/Central Nervous System (CNS) | 55 | 12 |
| Other & Unspecified Sites, Except Brain/CNS | 157 | 26 |
| Lymphatic/Hematopoietic | 201 | 43 |
| All Benign Neoplasms | 6 | 4 |
| All Neoplasms, Unspecified | 9 | 2 |
| Endocrine, Nutritional & Metabolic Diseases | 165 | 32 |
| Diseases of Blood & Blood-Forming Organs | 13 | 5 |
| Mental Disorders | 53 | 10 |
| Diseases of Nervous System & Sense Organs | 89 | 21 |
| Diseases of Circulatory System | 4,335 | 511 |
| Diseases of Respiratory System | 611 | 98 |
| Diseases of Digestive System | 329 | 81 |
| Diseases of Genitourinary System | 0 | 0 |
| Complications of Pregnancy & Childbirth | 0 | 1 |
| Diseases of Skin & Subcutaneous Tissue | 3 | 2 |
| Diseases of Musculoskeletal System & Connective Tissue | 22 | 12 |
| Congenital Anomalies | 11 | 5 |
| Symptoms & Ill-Defined Conditions | 62 | 9 |
| Accidents, Poisoning & Violence (External Causes) | 777 | 131 |
| Deaths, With ICD Code | 8,542 | 1,390 |
| Deaths, No ICD Code | 233 | 104 |
| Total Deaths, All Causes | 8,775 | 1,494 |

Variables for Analytic File
HFS93A03_1

12 MB

| Name | Description |
|---------------|--------------------------------------|
| id | identification number |
| sex | sex of worker |
| race | race of worker |
| birthyr | birth year |
| hireyr | hire year |
| offdsyr | year of first off-site dose |
| offds1 | first off-site dose |
| nyroffds | number of years of off-site doses |
| pudepyr | year of first plutonium deposition |
| pudep | plutonium deposition |
| deathyr | death year |
| deathst | state of death |
| icd8und | cause of death (underlying) |
| icd8con | cause of death (contributory) |
| icd8con2 | cause of death (second contributory) |
| extdos44 : | external dose by year, 1944-1978 |
| extdos78 | |

Variables for Analytic File
HFS93A03_2

10 MB

| Name | Description |
|------------|-----------------------------|
| job44 : | job code by year, 1944-1978 |
| job78 | |
| termdef | definite termination |
| biolev1 | bioassay level one |
| biolev2 | bioassay level two |
| biolev3 | bioassay level three |
| biolev4 | bioassay level four |
| biolev5 | bioassay level five |
| vivolev1 | in vivo level one |
| vivolev2 | in vivo level two |
| vivolev3 | in vivo level three |
| vivolev4 | in vivo level four |
| vivolev5 | in vivo level five |
| vivolev6 | in vivo level six |
| vivolev7 | in vivo level seven |
| vivolev8 | in vivo level eight |
| vivolev9 | in vivo level nine |
| vivolev10 | in vivo level ten |
| vivolev11 | in vivo level eleven |
| vivolev12 | in vivo level twelve |
| vivolev13 | in vivo level thirteen |
| vivolev14 | in vivo level fourteen |
| vivolev15 | in vivo level fifteen |

HFS93A03

LOS ALAMOS

LAFEMA01 Data File Set

Description

The LAFEMA01 data file set contains one analytic file used in a mortality study of white female workers at Los Alamos National Laboratory (LANL), published as a doctoral dissertation in 1987.

The analysis sought to determine whether mortality among these workers differed significantly from the general population of females in the United States and whether the subgroup of this cohort that was exposed to radiation was at an increased risk of dying from cancer when compared with the unexposed group. The analysis focused on 6,573 white (those with race unknown were assumed to be white) females who were employed at LANL between 1943 and 1978, inclusive. Most analyses were further limited to the 5,234 white workers employed at least 6 months. The study found a standardized mortality ratio for suicide that was significantly elevated. Rate ratios for cancers of the ovary and pancreas were also significantly elevated for radiation-monitored members of the cohort. Due to the elevated risk of suicide, an elevated rate ratio for deaths due to all causes was also observed for the radiation workers in this cohort.

The single analytic file (LAFEFIL) contains data for 6,790 females of all races employed at LANL through December 31, 1978. Some later hires are included in the file but not in the analysis. External exposure data in the file consist of dates (given in decimalized notation) on which the worker was first monitored, first received a positive exposure, first accumulated 1 rem whole-body dose, first accumulated 5 rems whole-body dose, and first received 10 rems whole-body dose. Whole-body dose was defined as the sum of all tritium, neutron, and penetrating gamma readings. External

exposure readings were available through 1981. Data pertaining to internal plutonium exposure include isotope, dates (in decimalized notation) of first and last samples, and estimated body burdens (in units of both nCi and nCi-years) of plutonium. The latest date shown for either date of first and last sample was January 1, 1985. Estimated body burdens were calculated. The computer code PUQFUA was used to estimate plutonium body burdens incurred by workers through 1984. Demographic data were extracted from a number of sources, including LANL personnel and other records, and were computerized in 1982 and 1983 by the LANL Epidemiology Section.

Vital status was ascertained for 87% of the 6,790 females through December 31, 1981, the study end date. There were 430 deaths identified in this cohort.

LANL has been a center for research in nuclear physics and weapons development since the 1940s. Sources of occupational exposures include external radiation, primarily gamma, and potential internal deposition of plutonium-238 and plutonium-239. Film dosimeters were used for personnel monitoring until 1980, when they were replaced with thermoluminescent dosimeters. Formal bioassay programs to monitor for internal exposures were begun in 1945. Results of both types of monitoring programs reflect technological improvements and changes in concepts and models. ♦♦

LOS ALAMOS

LAFEMA01 Data File Set

Citations

Wiggs, L. D. 1987. Mortality among females employed by the Los Alamos National Laboratory: An epidemiologic investigation. Ph.D. diss., University of Oklahoma.

Additional References

Lawrence, J. N. P. 1962. PUQFUA, an IBM 704 code for computing plutonium body burdens. *Health Physics* 8:61-66.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|---|
| File Name | Number of Variables | Type of Data |
| LAFEFIL | 38 | vital status; external whole-body doses; demographic; plutonium body burden |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|--------|
| | Male † | Female |
| Infectious & Parasitic Diseases | | 7 |
| All Malignant Neoplasms | | 182 |
| Lip, Oral Cavity & Pharynx | | 3 |
| Digestive Organs & Peritoneum | | 30 |
| Respiratory System | | 29 |
| Bone & Connective Tissue | | 3 |
| Skin | | 5 |
| Breast | | 51 |
| Genitourinary System | | 32 |
| Brain/Central Nervous System (CNS) | | 7 |
| Other & Unspecified Sites, Except Brain/CNS | | 10 |
| Lymphatic/Hematopoietic | | 12 |
| All Benign Neoplasms | | 3 |
| All Neoplasms, Unspecified | | 1 |
| Endocrine, Nutritional & Metabolic Diseases | | 5 |
| Diseases of Blood & Blood-Forming Organs | | 0 |
| Mental Disorders | | 6 |
| Diseases of Nervous System & Sense Organs | | 4 |
| Diseases of Circulatory System | | 155 |
| Diseases of Respiratory System | | 36 |
| Diseases of Digestive System | | 32 |
| Diseases of Genitourinary System | | 5 |
| Complications of Pregnancy & Childbirth | | 4 |
| Diseases of Skin & Subcutaneous Tissue | | 1 |
| Diseases of Musculoskeletal System & Connective Tissue | | 3 |
| Congenital Anomalies | | 1 |
| Symptoms & Ill-Defined Conditions | | 6 |
| Accidents, Poisoning & Violence (External Causes) | | 60 |

| | | |
|--------------------------|--|-----|
| Deaths, With ICD Code | | 511 |
| Deaths, No ICD Code | | 25 |
| Total Deaths, All Causes | | 536 |

† No males were included in this study.

Variables for Analytic File

LAFEFILE

2 MB

| Name | Description |
|------|-------------|
|------|-------------|

| | |
|----------|---|
| radflag | identifies worker as radiation worker |
| id | identification number |
| sex | sex of worker |
| race | race of worker |
| educ | highest level of education |
| ssa82 | vital status from SSA as of 12/31/79 |
| vseos | vital status as of 12/31/81 |
| ethnic | ethnicity of the worker |
| fjt | first job title at LANL |
| ljt | last job title at LANL |
| bdate | date worker was born |
| hiredate | date of first hire at LANL |
| termdate | latest known termination date from LANL |
| dla | date worker was last known to be alive |
| dlwork | date last worked |
| duremp | duration of employment at LANL |
| ddate | date of death |
| icda | cause of death - ICDA 8th revision |
| monplu | plutonium monitored flag |
| isotope | isotope of plutonium measured |
| numsamp | number of bioassay samples for worker |

| | |
|----------|--|
| valsamp | number of valid bioassay readings |
| fsamdate | date of first bioassay reading |
| pposdate | date of first positive plutonium uptake |
| lsamdate | date of last bioassay reading |
| nciyrs | body burden (12/31/84) in nCi-years |
| ncils | body burden (nCi) at last sample date |
| nciyls | body burden (nCi-years) last sample date |
| prevbb | body burden (nCi) as of 12/31/83 |
| curbb | body burden (nCi) as of 12/31/84 |
| extmon | external monitoring flag |
| fsdext | date first monitored for external radiation |
| fpsext | date external radiation dose greater than 0 |
| d1ext | date external radiation dose reached 1 rem |
| d5ext | date external radiation dose reached 5 rems |
| d10ext | date external radiation dose reached 10 rems |
| cumext | cumulative whole-body dose external |
| ltdate | latest date employed during study |

LAFEMAO1

LOS ALAMOS

LAHSWA04 Data File Set

Description

This data file set contains one analytic file prepared for a mortality study of 241 workers exposed to plutonium.

This file was generated in 1993-1994 for a historical cohort analysis, for which a paper is in preparation, of 241 plutonium-exposed workers employed at Los Alamos National Laboratory (LANL), the Zia Company (Zia), or the Manhattan Project. Data for 7,225 controls from the Zia and LANL populations are also included. The analysis seeks to determine whether mortality among these workers differed significantly from the general population of males and females in the United States and whether the males were at an increased risk of dying from cancer than the group of unexposed 7,225 male controls selected from the LANL and Zia cohorts.

This file contains demographic and exposure data for 224 white males and 17 females who were employed at the Los Alamos site during World War II and who represent the most highly exposed group of plutonium workers at LANL as of December 31, 1974. Also included is information for 6,452 white male controls selected from the LANL cohort matching the 224 plutonium-exposed males on race, age, and hire date. There is also information for 773 male Hispanic controls selected from the radiation-monitored subgroup from the Zia cohort (the only Zia group with sufficient demographic information) to approximate the ratio of Hispanic to non-Hispanic males in the 241-member cohort as closely as possible in the controls. None of the males in the control population have significant deposits of plutonium. Demographic information was abstracted from personnel records available for hires through December 31, 1977, for the LANL and Manhattan Project workers and through December 31, 1978, for the Zia workers. These data were supplemented with information from death certificates. Employment histories have not been updated since December 31, 1977, for the LANL workers and December 31, 1978, for the Zia workers.

Death information for the controls was last obtained in 1992 with a submission to the National Death Index (NDI). NDI data submissions were available from 1979 through 1990. Pre-1979 death information was available from earlier submissions to the Social Security Administration. The 241-member cohort was actively traced in June of 1990, and vital status was ascertained for all members of the cohort. A study end date of June 1990 is assigned based on the death information provided by the NDI and the tracing effort for the 241 workers. Some deaths after the study end date are recorded, but death information is not complete.

The sources of occupational radiation exposures were external radiation, primarily gamma, and internal deposition of plutonium-238 and plutonium-239. Film dosimeters were normally used for personnel monitoring from 1944 through the end of 1979, when they were replaced with thermoluminescent dosimeters. Formal bioassay programs to monitor for internal exposures were begun in 1944. Both external and internal radiation exposure data are available for all controls and the 241-member cohort. These are given as three arrays representing annual exposures in centirem for the years 1943-1990 for plutonium-239, plutonium-238, and external ionizing radiation. For all plutonium-monitored workers, first sample dates for plutonium-239 and plutonium-238 are included. For some plutonium-monitored workers, insufficient data were available to allow an estimate of their plutonium deposition, or their deposition is known to be less than 0.3 nCi but cannot be determined exactly using available techniques. These workers are flagged but have no information available for their actual plutonium depositions. Values for external ionizing radiation are given as annual whole-body penetrating doses that are computed as the sum of penetrating gamma, tritium, and neutron components. ♦

LOS ALAMOS

LAHSWA04 Data File Set

Citations

Voelz, George L.M.D. "Health Considerations for Workers Exposed to Plutonium". *Occupational Medicine: State of the Art Reviews*. Oct-Dec 1991; p. 694.

Voelz, George L., Robert S. Grier, Louis H. Hempelmann. "A 37-Year Medical Follow-Up Of Manhattan Project Pu Workers", *Health Physics*, Vol. 48, No. 3 (March 1985), pp. 249-259.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|---|
| File Name | Number of Variables | Type of Data |
| LHSWFILE | 164 | demographic; external and internal exposure |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|--------|
| | Male | Female |
| Infectious & Parasitic Diseases | 30 | 0 |
| All Malignant Neoplasms | 601 | 2 |
| Lip, Oral Cavity & Pharynx | 14 | 0 |
| Digestive Organs & Peritoneum | 177 | 1 |
| Respiratory System | 171 | 0 |
| Bone & Connective Tissue | 8 | 0 |
| Skin | 17 | 0 |
| Breast | 1 | 0 |
| Genitourinary System | 80 | 0 |
| Brain/Central Nervous System (CNS) | 15 | 1 |
| Other & Unspecified Sites, Except Brain/CNS | 41 | 0 |
| Lymphatic/Hematopoietic | 77 | 0 |
| All Benign Neoplasms | 5 | 0 |
| All Neoplasms, Unspecified | 2 | 0 |
| Endocrine, Nutritional & Metabolic Diseases | 47 | 1 |
| Diseases of Blood & Blood-Forming Organs | 11 | 0 |
| Mental Disorders | 26 | 0 |
| Diseases of Nervous System & Sense Organs | 28 | 0 |
| Diseases of Circulatory System | 1,220 | 2 |
| Diseases of Respiratory System | 222 | 1 |
| Diseases of Digestive System | 151 | 1 |
| Diseases of Genitourinary System | 39 | 0 |
| Complications of Pregnancy & Childbirth | 0 | 0 |
| Diseases of Skin & Subcutaneous Tissue | 2 | 0 |
| Diseases of Musculoskeletal System & Connective Tissue | 6 | 0 |
| Congenital Anomalies | 2 | 0 |
| Symptoms & Ill-Defined Conditions | 33 | 0 |
| Accidents, Poisoning & Violence (External Causes) | 251 | 0 |
| Deaths, With ICD Code | 2,676 | 7 |
| Deaths, No ICD Code | 47 | 0 |
| Total Deaths, All Causes | 2,723 | 7 |

Variables for Analytic File

LHSWFILE

10 MB

| Name | Description |
|------|-------------|
|------|-------------|

| | |
|----------|--|
| id | identification number |
| bdate | birth date |
| hiredate | date of first hire at LANL |
| termdate | latest termination date as of 1977 or 1978 |
| ethnic | ethnicity |
| educ | highest level of education |
| sex | sex of worker |
| race | race of worker |
| pflag | plutonium flag |
| p9flg | monitored for plutonium-239 |
| fsd9 | first sample year for plutonium-239 |
| p9stat | status of readings for plutonium-239 |
| p8flg | monitored for plutonium-238 |
| fsd8 | first sample year for plutonium-238 |
| p8stat | status of readings for plutonium-238 |
| wflag | type of worker |
| ddate | date of death |
| icda | ICDA death code - 8th revision |
| extmon | external monitored flag |
| cumext | cumulative whole-body dose external |

| | |
|---------|--|
| ext43 | external radiation dose by year, 1943-1990 |
| ext90 | |
| p9ann43 | plutonium-239 dose by year, 1943-1990 |
| p9ann90 | |
| p8ann43 | plutonium-238 dose by year, 1943-1990 |
| p8ann90 | |

LAHSWAO4

LOS ALAMOS

LAMENA03 Data File Set

Description

This data file set contains one analytic file used in a mortality study of male workers at the Los Alamos National Laboratory (LANL).

This file was prepared for a historical cohort analysis of males at LANL in 1993. The analysis sought to determine whether mortality among these workers differed significantly from the general population of males in the United States and whether the subgroup of this cohort exposed to external ionizing radiation or plutonium exhibited an increased cancer death rate when compared with the unexposed group. Analyses focused on 15,727 white (unknown race assumed to be white) males whose birth date and hire date were available on their records and who were hired before January 1, 1978. No cause of death was elevated among the plutonium-exposed workers when compared with their unexposed co-workers. Significant dose-response relationships with whole-body dose from external ionizing radiation and tritium were observed for cancers of the brain/central nervous system, the esophagus, and Hodgkin's disease. A suggestive relationship was also observed for cancers of the kidney. An osteosarcoma was observed among the plutonium-monitored workers.

This file contains demographic and exposure data for 16,438 males of all races employed at LANL from 1943 through December 31, 1977. Of these, 324 are non-white, 14,981 are known to be white, and 1,133 have an unknown designation for race. Demographic information was abstracted from personnel records available for hires through December 31, 1977. These data were supplemented with information from death certificates and some later information from LANL.

Death information was last obtained in 1992 with a submission to the National Death Index (NDI). NDI data were available from 1979 through 1990. Pre-1979 death information was obtained through earlier submissions to the Social Security Administration and numerous other sources. A study end date of December 31, 1990, was assigned based on the death information provided by the NDI. Some information on deaths after the study end date are included, but all workers identified as dead after the study end date were treated as alive for purposes of the study. There are a total of 3,319 deaths in the file with 3,239 of them occurring on or before December 31, 1990.

The sources of occupational radiation exposures were external radiation, primarily gamma, and internal deposition of plutonium-238 and plutonium-239. Film dosimeters were normally used for personnel monitoring from 1944 through 1980, when they were replaced with thermoluminescent dosimeters. Formal bioassay programs to monitor for internal exposures were begun in 1944. External data consists of dates (given in decimalized notation) at which the worker was first monitored, first received a positive exposure, first received 1 rem whole-body dose, first received 5 rems whole-body dose, and first received 10 rems whole-body dose. Whole-body dose was defined as the sum of all tritium, neutron, and penetrating gamma readings. External readings were available through December 31, 1990. Plutonium data includes isotope type, first sample date (in decimalized notation), last sample date (decimalized), and estimated whole-body burdens (both nCi and nCi-years) as of December 31, 1984. ❖

LOS ALAMOS

LAMENA03 Data File Set

Citations

Lawrence, J. N. P. 1962. PUQFUA, an IBM 704 code for computing plutonium body burdens. *Health Physics* 8:61-66.

Wiggs, L. D., E. R. Johnson, C. A. Cox-DeVore, and G. L. Voelz. 1994. Mortality through 1990 among white male workers at the Los Alamos National Laboratory - considering exposures to plutonium and external ionizing radiation. *Health Physics* 67:577-588.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|---------------------------------------|
| File Name | Number of Variables | Type of Data |
| LAMEFILE | 80 | demographic; annual external exposure |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|----------|
| | Male | Female † |
| Infectious & Parasitic Diseases | 18 | |
| All Malignant Neoplasms | 372 | |
| Lip, Oral Cavity & Pharynx | 9 | |
| Digestive Organs & Peritoneum | 105 | |
| Respiratory System | 96 | |
| Bone & Connective Tissue | 4 | |
| Skin | 12 | |
| Breast | 0 | |
| Genitourinary System | 49 | |
| Brain/Central Nervous System (CNS) | 16 | |
| Other & Unspecified Sites, Except Brain/CNS | 24 | |
| Lymphatic/Hematopoietic | 57 | |
| All Benign Neoplasms | 5 | |
| All Neoplasms, Unspecified | 1 | |
| Endocrine, Nutritional & Metabolic Diseases | 31 | |
| Diseases of Blood & Blood-Forming Organs | 6 | |
| Mental Disorders | 15 | |
| Diseases of Nervous System & Sense Organs | 23 | |
| Diseases of Circulatory System | 702 | |
| Diseases of Respiratory System | 123 | |
| Diseases of Digestive System | 78 | |
| Diseases of Genitourinary System | 23 | |
| Complications of Pregnancy & Childbirth | 0 | |
| Diseases of Skin & Subcutaneous Tissue | 2 | |
| Diseases of Musculoskeletal System & Connective Tissue | 3 | |
| Congenital Anomalies | 1 | |
| Symptoms & Ill-Defined Conditions | 16 | |
| Accidents, Poisoning & Violence (External Causes) | 183 | |
| Deaths, With ICD Code | 1,602 | |
| Deaths, No ICD Code | 26 | |
| Total Deaths, All Causes | 1,628 | |

† No females were included in this study.

Variables for Analytic File
LAMEFILE

11 MB

| Name | Description |
|------|-------------|
|------|-------------|

| | |
|-----------------|---|
| id | identification number |
| bdate | birth date |
| sex | sex of worker |
| race | race of worker |
| educ | highest level of education |
| hiredate | date of first hire at LANL |
| termdate | latest known termination date from LANL |
| dla | date worker was last known to be alive |
| ddate | date of death |
| icda | IDCA death code - 8th revision |
| p29date | date exposed to 2 nCi plutonium-239 |
| p59date | date exposed to 5 nCi plutonium-239 |
| p109date | date exposed to 10 nCi plutonium-239 |
| p28date | date exposed to 2 nCi plutonium-238 |
| p58date | date exposed to 5 nCi plutonium-238 |
| p108date | date exposed to 10 nCi plutonium-238 |
| ethnic | ethnicity |
| monplu | plutonium monitored flag |
| nciyrs | body burden (12/31/84) in nCi-years |
| lsamdate | date of last bioassay reading |

| | |
|-----------------|---|
| curbb | body burden as of 12/31/84 in nCi |
| isotope | isotope of plutonium measured |
| fsamdate | date of first bioassay reading |
| extmon | external monitored flag |
| fsdext | date first monitored for external radiation |
| fpsext | date external radiation dose gt 0 |
| d1ext | date external radiation dose reached 1 rem |
| d5ext | date external radiation dose reached 5 rem |
| d10ext | date external radiation dose reached 10 rem |
| cumext | cumulative whole-body dose external |
| cvseos83 | current vital status as of 1983 |
| mil | military appointment flag |
| extrad43 | external radiation dose by year, 1943-1990 |
| extrad90 | |

LAMENNA03

LOS ALAMOS

LASUIA02 Data File Set

Description

This data file set contains one analytic file that was used in a study of deaths from suicide among female workers at Los Alamos National Laboratory (LANL) in 1988.

A nested case-control study was undertaken to identify characteristics distinguishing white females dying from suicide from white females dying from all other types of injuries and those dying from noninjury causes. Two separate analyses were presented: one contrasting the 19 suicide deaths and the 41 other injury deaths, the other contrasting the 19 suicide deaths and 76 noninjury deaths. External radiation monitoring status and job classification both showed an association with risk of suicide when suicide deaths were compared with noninjury deaths. An association was also found between suicide and external radiation monitoring status when comparing suicide with deaths from all other injuries. No significant associations were found between risk of suicide and duration of employment, plutonium monitoring status, or marital status. Education was controlled in most comparisons.

The single analytic file (LASUFILE) pertains to 136 white females employed at LANL. This number includes all suicide, all other injury deaths, and a 4:1 random sample of all other deaths. External monitoring data consist of dates (in decimalized notation) on which the worker was first monitored, first received a positive exposure, first received 1 rem cumulative whole-body dose, first received 5 rems cumulative whole-body dose, and first received 10 rems

cumulative whole-body dose. Whole-body dose was defined as the sum of all tritium, neutron, and penetrating gamma readings. External readings were available through December 31, 1981.

Only eight of the females in this file were monitored for plutonium. Internal exposure data consist of plutonium-239 body burdens that were calculated by the PUQFUA computer code, the official code used at LANL to estimate body burdens from bioassay data. The date of first positive uptake of plutonium was hand-abstracted from data valid through 1986. Plutonium monitoring data include isotope type; first sample date (in decimalized notation); last sample date (decimalized); and estimated whole-body burdens (both nCi and nCi-years) as of December 31, 1983, as of December 31, 1984, and as of the last sample date.

LANL has been a center for research in nuclear physics and weapons development since the 1940s. Sources of occupational exposures include external radiation, primarily gamma, and potential internal deposition of plutonium-238 and plutonium-239. Film dosimeters were normally used for personnel monitoring until 1980, when they were replaced with thermoluminescent dosimeters. Formal bioassay programs to monitor for internal exposures were begun in 1945. Results of both types of monitoring programs reflect technological improvements and changes in concepts and models. ♦

LOS ALAMOS

LASUIA02 Data File Set

Citations

Wiggs, L. D., C. A. Weber, and E. T. Lee. 1988. Suicide mortality among female nuclear industry workers. *Proceedings of the 116th Annual Meeting of the American Public Health Association* (Boston, MA):46.

Additional References

Lawrence, J. N. P. 1962. PUQFUA, an IBM 704 code for computing plutonium body burdens. *Health Physics* 8:61-66.

Wiggs, L. D. 1987. Mortality among females employed by the Los Alamos National Laboratory: an epidemiologic investigation, Ph.D. diss., University of Oklahoma.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|--|
| File Name | Number of Variables | Type of Data |
| LASUFILE | 45 | external whole-body dose; plutonium whole-body burden; demographic; vital status |

Note: Summary Death Tables do not apply to this data file set

| Variables for Analytic File LASUFILE | | |
|---|--|----------|
| | | 35 KB |
| Name | Description | |
| typeod | type of death | valsamp |
| radflag | identifies worker as radiation monitored | fsamdate |
| id | identification number | pposdate |
| sex | sex of worker | lsamdate |
| race | race of worker | nciyrs |
| educ | highest level of education | ncils |
| ssa82 | vital status from SSA as of 12/31/79 | nciyls |
| vseos | vital status as of 12/31/81 | prevbb |
| ethnic | ethnicity of the worker | curbb |
| fjt | first job title at LANL | extmon |
| ljt | last job title at LANL | fsdext |
| bdate | date worker was born | fpsext |
| hiredate | date of first hire at LANL | d1rem |
| termdate | latest known termination date from LANL microfiche | d5rem |
| dla | date worker was last known to be alive | d10rem |
| dlwork | date last worked | cumext |
| duremp | duration of employment at LANL | ltdate |
| ddate | date of death | dstate |
| icda | cause of death - ICDA 8th revision | mstatus |
| monplu | plutonium monitored flag | occdc |
| isotope | isotope of plutonium measured | autopsy |
| numsamp | number of bioassay samples for employee | labocc |
| | | dcocc |

LOS ALAMOS

LAUPUA01 Data File Set

Description

This data file set consists of a single analytic file containing data taken from personnel records of 26 white males who were employed by the Manhattan Project (Los Alamos, New Mexico, now Los Alamos National Laboratory) during World War II. These subjects were exposed to plutonium-239 from 1944 through 1945, during chemical and metallurgical research dealing with plutonium, as well as the fabrication of plutonium parts.

The plutonium work in 1944-1945 was done partly in chemical fume hoods, but some operations were performed in open rooms. Contamination of the work rooms with plutonium resulted from these operations. Inhalation of plutonium particles was the principal mode of exposure for this group of workers.

This file was developed for the fourth study in a series of studies documenting the health experience and possible effects of exposure for the 26 subjects. The selection of the 26 subjects was based on the history of individual job assignments, work

conditions, and the results of plutonium measurements in urine samples taken during that period.

The purpose of this study was to maintain long-term surveillance of this unique group of workers in order to estimate the plutonium deposition throughout their lifetimes and to maintain detailed medical records. The information can then be compared with existing plutonium dosimetry models, radiobiological information, and human epidemiologic studies of plutonium workers.

These plutonium-exposed workers have had medical examinations approximately every 5 years since 1952. This data file was developed for the 1986-1987 examination records, at which time four of the subjects had died. There have been three additional deaths since that time.

The information has been obtained from personnel records and from continued personal contact with each of the 26 study subjects. ❖

LOS ALAMOS

LAUPUA01 Data File Set

Citations

Hemplemann, L. H., W. H. Langham, C. R. Richmond, and G. L. Voelz. 1973. Manhattan Project plutonium workers: a 27-year follow-up study of selected cases. *Health Physics* 25:461-479.

Voelz, G. L., R. S. Grier, and L. H. Hemplemann. 1985. A 37-year follow-up of Manhattan Project plutonium workers. *Health Physics* 48:249-259.

Voelz, G. L., L. H. Hempelmann, J. N. P. Lawrence, and W. D. Moss. 1979. A 32-year medical follow-up of Manhattan Project plutonium workers. *Health Physics* 37:445-485.

Voelz, G. L., G. W. Wilkinson, J. W. Healy, J. F. McInroy, and G. L. Tietjen. 1983. Mortality study of Los Alamos workers with higher exposures to plutonium. *Proceedings of the 16th Midyear Topical Meeting of the Health Physics Society* NTIS report CONF-83010:318-327.

Voelz, G. L., A. P. Stevenson, and C. C. Stewart. 1989. Does plutonium intake in workers affect lymphocyte function? *Radiat. Prot. Dos.* 26:223-226.

Voelz, G. L., and J. N. P. Lawrence. 1991. A 42-year medical follow-up of Manhattan Project plutonium workers. *Health Physics* 61(2):181-190.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|--|
| File Name | Number of Variables | Type of Data |
| UPPU89 | 6 | work history; vital status; cause of death |

Note: *Summary Death Tables do not apply to this data file set*

Variables for Analytic File

UPPU89

1 KB

| Name | Description |
|----------|-----------------------|
| id | identification number |
| hiredate | date of hire |
| termdate | termination date |
| bdate | birth date |
| ddate | date of death |
| icd8 | cause of death |

LINDE

LND87A01 Data File Set

Description

This analytic data file set consists of one file generated for a cohort mortality study, published in the *Scandinavian Journal Work Environment Health* in 1987, of white males employed at the Linde Plant.

This retrospective cohort mortality study investigated the relationship between exposure to low-level ionizing radiation and subsequent health outcomes among workers at the Linde Plant. Two comparison groups were used in this analysis. The first group consisted of all U.S. white males; the second was the white male population of Erie and Niagara counties in New York State. Significantly increased standardized mortality ratios were observed for all causes of death, laryngeal cancer, all circulatory diseases, arteriosclerotic heart disease, all respiratory diseases, and pneumonia. No association was found with length of employment or with work in the most hazardous areas of the plant. The comparison with regional rates gave similar results.

The single analytic file (MOSTEXP) in this data file set consists of one record per person in the study cohort and contains demographic, work history, and vital status data as well as information concerning exposures to chemicals and uranium. Examples of these are exposures to uranium hexafluoride, nitric acid, and hydrofluoric acid.

The cohort was selected from a roster of all persons (1,551) employed at the Linde Plant, which was in operation from 1943 to 1949. All females, non-white males, males of unknown race, and people employed less than 30 days were excluded, leaving 995 white males in the study cohort. Vital status was ascertained for 94.3% of the cohort through December 31, 1979, the study

end date. There were 429 deaths identified, and death certificates were obtained for 406 (94.6%) of these deaths.

At the Linde Plant, Congo pitchblende and uranium from domestic mines were converted to uranium tetrafluoride. This process yielded intermediate products, including uranium oxide, uranium trioxide, and uranium dioxide. Compared to uranium tetrafluoride, these products are relatively insoluble. Workers were also potentially exposed to low levels of external radiation and to a wide variety of chemicals. The more hazardous chemicals included chlorine, hydrofluoric acid, lead sulfate, nickel, nitric acid and nitrogen oxides, silicon dioxide, sulfuric acid, uranium dust, and uranium hexafluoride. Generally, four types of measurements contained information useful in assessing radiation hazards. They were (1) air monitoring results for radon-222 and airborne uranium, (2) measurements of surface contamination, (3) urinalysis results, and (4) personnel film badge results. The first three types of measurements were used to assess the potential for internal radiation exposure for each job that existed at the plant. Three separate analyses were carried out using each type of data, and the results were combined to assign a given job to one of three exposure groups. These data also were used to estimate individual lung doses. The limited film badge data were used to evaluate the potential for exposure to external radiation. Each job at the plant was assigned to one of two categories, namely, jobs with mean weekly film badge results below the minimum detectable level and jobs with mean weekly film badge results above the minimum detectable level. ❖

LINDE

LND87A01 Data File Set

Citations

Dupree, E. A., D. L. Cragle, R. W. McLain, D. J. Crawford-Brown, and M. J. Teta. 1987. Mortality among workers at a uranium processing facility, the Linde Air Products Company Ceramics Plant, 1943-1949. *Scandinavian Journal Work Environmental Health* 13:100-107.

| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|---|
| File Name | Number of Variables | Type of Data |
| MOSTEXP | 37 | demographic; work history; vital status; chemical, external, and internal exposure levels |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|----------|
| | Male | Female † |
| Infectious & Parasitic Diseases | 5 | |
| All Malignant Neoplasms | 73 | |
| Lip, Oral Cavity & Pharynx | 2 | |
| Digestive Organs & Peritoneum | 26 | |
| Respiratory System | 26 | |
| Bone & Connective Tissue | 0 | |
| Skin | 0 | |
| Breast | 0 | |
| Genitourinary System | 7 | |
| Brain/Central Nervous System (CNS) | 2 | |
| Other & Unspecified Sites, Except Brain/CNS | 4 | |
| Lymphatic/Hematopoietic | 6 | |
| All Benign Neoplasms | 1 | |
| All Neoplasms, Unspecified | 1 | |
| Endocrine, Nutritional & Metabolic Diseases | 7 | |
| Diseases of Blood & Blood-Forming Organs | 0 | |
| Mental Disorders | 5 | |
| Diseases of Nervous System & Sense Organs | 1 | |
| Diseases of Circulatory System | 216 | |
| Diseases of Respiratory System | 29 | |
| Diseases of Digestive System | 18 | |
| Diseases of Genitourinary System | 3 | |
| Complications of Pregnancy & Childbirth | 0 | |
| Diseases of Skin & Subcutaneous Tissue | 0 | |
| Diseases of Musculoskeletal System & Connective Tissue | 2 | |
| Congenital Anomalies | 0 | |
| Symptoms & Ill-Defined Conditions | 3 | |
| Accidents, Poisoning & Violence (External Causes) | 25 | |
| Deaths, With ICD Code | 389 | |
| Deaths, No ICD Code | 24 | |
| Total Deaths, All Causes | 413 | |

† No females were included in this study.

Variables for Analytic File
MOSTEXP

201 KB

| Name | Description |
|------|-------------|
|------|-------------|

| | |
|-----------------|---|
| id | identification number |
| fhire | first hire into ceramics plant |
| lterm | last termination date |
| multihir | multiple hire/term at ceramics plant |
| vstat | vital status code |
| ldate | last known date alive |
| icd8x | ICD code for underlying cause of death |
| ca8x | underlying cancer cause of death |
| birth | birth date |
| icd8 | ICD code for underlying cause of death |
| totdays | total days employed at ceramics |
| days_unk | job days with exposure not assignable |
| er_lev | external radiation (ER) level at which most days were spent |
| er_days | job days at ER level |
| er_dt | date first at ER level |
| ir_lev | internal radiation (IR) level at which most days were spent |
| ir_days | job days spent at IR level |
| ir_dt | first date at IR level |
| ud_lev | uranium deposition (UD) level at which most days were spent |
| ud_days | job days spent at UD level |

| | |
|-----------------|--|
| ud_dt | first date at UD level |
| hn_lev | nitric acid (HN) level at which most days were spent |
| hn_days | job days spent at HN level |
| hn_dt | first date at HN level |
| hf_lev | hydrofluoric acid (HF) level at which most days were spent |
| hf_days | job days spent at HF level |
| hf_dt | first date at HF level |
| uf6_lev | uranium hexafluoride (HF6) level at which most days were spent |
| uf6_days | job days spent at HF6 level |
| uf6_dt | first date at HF6 level |
| h2s_lev | sulfuric acid (H2S) level at which most days were spent |
| h2s_days | job days spent at H2S level |
| h2s_dt | first date at H2S level |
| sio_lev | silicone dioxide (SIO) level at which most days were spent |
| sio_days | job days spent at SIO level |
| sio_dt | the first date at SIO level |
| icda | ICD code for underlying cause of death |

LND87A01

MALLINCKRODT

MCD94A01 Data File Set

Description

This analytic data file set consists of one file generated for a retrospective cohort mortality study of white males employed in the Uranium Division of Mallinckrodt Chemical Works (MCW) in Missouri.

The study cohort comprised 2,542 white males employed for at least 30 days from 1942 through plant shutdown in 1966. Excluded were 556 females, 43 nonwhite males, as well as those employed for less than 30 days or having “critical errors” in their data. Follow-up was through the end of 1988. The total person-years of follow-up was 79,600 with a median of 27.3 years. A typical worker was first employed in 1951 at 30 years of age and worked slightly more than 5.5 years. The all-causes SMR was 0.94 with 95% confidence interval 0.87 to 1.00. The elevation in the all-cancers SMR of 1.13 (0.99 to 1.28) resulted from increases in a variety of cancers, particularly in those of the digestive and respiratory systems and prostate and brain cancer.

The single analytic file (ELL2542) contains a record, which includes vital status as of January 1, 1989, for each member of the cohort. The last Social Security Administration (SSA) submission for this population provided “alive” status as of January 1, 1985; the “alive” category is no longer obtainable from SSA. However, the National Death Index (NDI) provides a record of all deaths occurring since January 1, 1979, and

Pension Benefit Information Incorporated (PBI) also identifies deceased individuals. If not identified as deceased by SSA, NDI, or PBI, individuals last known to be alive before January 1, 1979, were considered lost to follow-up on the last date known alive, while those known to be alive after January 1, 1979, were considered alive at the end of the study. There were 837 deaths from all causes with death certificates available for 98.2% of these individuals.

MCW was one of the oldest and largest uranium processing facilities in the United States, operating in St. Louis from 1942 to 1958 and in Weldon Spring, Missouri, from 1958 through 1966. From 1946 through 1955, pitchblend ore was used in the processing of uranium dioxide and uranium metal. This ore was a dry solid that dusted easily and was nearly 60% pure uranium, resulting in exposure levels that may have been nearly 200 times the contemporary maximum permissible concentration. Most of the uranium compounds present were relatively insoluble. Potential exposures included gamma (from radium), beta, and alpha radiation, thorium, and chemicals, including nitric and hydrofluoric acids. Each employee had a pre-employment and annual physical exam, with abnormal findings leading to a transfer to another division of MCW. Transferred workers remain in this study cohort with follow-up through 1988. ♦

MALLINCKRODT

MCD94A01 Data File Set

Contact

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| Number of Analytic Files: 1 | | |
|-----------------------------|---------------------|---------------------------|
| File Name | Number of Variables | Type of Data |
| ELL2542 | 20 | demographic; work history |

Summary Death Tables

| Cause of Death | No. of Deaths | |
|--|---------------|----------|
| | Male | Female † |
| Infectious & Parasitic Diseases | 9 | |
| All Malignant Neoplasms | 233 | |
| Lip, Oral Cavity & Pharynx | 7 | |
| Digestive Organs & Peritoneum | 57 | |
| Respiratory System | 86 | |
| Bone & Connective Tissue | 1 | |
| Skin | 3 | |
| Breast | 0 | |
| Genitourinary System | 30 | |
| Brain/Central Nervous System (CNS) | 10 | |
| Other & Unspecified Sites, Except Brain/CNS | 19 | |
| Lymphatic/Hematopoietic | 20 | |
| All Benign Neoplasms | 1 | |
| All Neoplasms, Unspecified | 1 | |
| Endocrine, Nutritional & Metabolic Diseases | 9 | |
| Diseases of Blood & Blood-Forming Organs | 0 | |
| Mental Disorders | 1 | |
| Diseases of Nervous System & Sense Organs | 10 | |
| Diseases of Circulatory System | 405 | |
| Diseases of Respiratory System | 41 | |
| Diseases of Digestive System | 43 | |
| Diseases of Genitourinary System | 12 | |
| Complications of Pregnancy & Childbirth | 0 | |
| Diseases of Skin & Subcutaneous Tissue | 3 | |
| Diseases of Musculoskeletal System & Connective Tissue | 0 | |
| Congenital Anomalies | 1 | |
| Symptoms & Ill-Defined Conditions | 17 | |
| Accidents, Poisoning & Violence (External Causes) | 64 | |

| | | |
|--------------------------|-----|--|
| Deaths, With ICD Code | 850 | |
| Deaths, No ICD Code | 16 | |
| Total Deaths, All Causes | 866 | |

† No females were included in this study.

Variables for Analytic File

ELL2542

221 KB

| Name | Description |
|-----------------|---|
| id | identification number |
| birth | birth date |
| hire | first hire date within Uranium Division of Mallinckrodt |
| term | last termination date within Uranium Division of Mallinckrodt |
| htpairs | number of hire/termination date pairs |
| totdays | total days employed |
| stldays | number of days employed at St. Louis |
| wsdays | number of days employed at Weldon Springs |
| pitchbld | exposure to pitchblend indicator |
| thorium | exposure to thorium indicator |
| uua | code for number of uranium urinalysis readings |
| fb | film badge data indicator |
| rem5 | indicator if person is in 5 rem study |
| mainpl | main plant site indicator |
| ldate | last date known |
| vstat | vital status |
| ucause | ICD8 code for underlying cause of death |
| cacause | ICD8 code for cancer cause of death |

brthrn breath radon monitoring indicator

doefac number of DOE facilities at which person worked

MCD94A01

