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Summary of Epidemiology Studies or Activities Involving Workers at the Savannah River Site or the Surrounding Public: An Update

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There have been numerous health studies or related activities over time that have involved workers at the Savannah River Site (SRS) or the surrounding public. While most of these epidemiology studies or activities have been performed by external agencies, it has proved useful to provide interested parties an overall summary of such activities. The first such summary was provided in an October 1998 report [1]. The 1998 summary was updated in a February 2000 report [2]. This report provides an update on the status or findings of epidemiology studies or activities involving SRS workers or the surrounding public, as an update to the previous summaries.

Although SRS health and safety officials provide information on site workers to various groups performing analytic epidemiological studies, they have not been directly involved in the performance of such studies in recent years. Therefore, the information herein may not be complete. Because of the interest in long-term health surveillance of SRS workers, however, site officials do closely follow the results of studies of pertinence to site workers or the public surrounding SRS. This summary is provided to familiarize interested parties with the various health studies that have been completed or are underway. Every attempt has been made to accurately summarize the findings or status of each of these activities, but in most cases the activities are conducted by others. Therefore, a list of principal contacts for each of the more recent activities is provided in Appendix I for those who wish more detail or further information about a given activity. Additionally, the National Institute for Occupational Safety and Health (NIOSH) periodically updates a website description of the status of NIOSH studies of Department of Energy (DOE) site workers.

There have been a large number of health studies of workers at DOE sites completed, and several more are in progress. Some of these studies have included workers from more than one DOE site. SRS workers have been or are included in several of these studies, and have been the primary subject of a few studies. In addition, the public around SRS has been included in several studies or activities related to public health.

Public Studies

U. S. Cancer Mortality Rates and Trends, 1950-1979, National Cancer Institute and the Environmental Protection Agency, March 1984. In this compilation of county and state statistics in the U. S., Aiken County and South Carolina had significantly more deaths from lung cancer than expected, and county rates were greater than the state rates from 1960 on. However, females in Aiken County and South Carolina did not experience more lung cancers than expected.

Mortality Trends in Counties Near the Savannah River Plant, 1949-1978, by Herbert I. Sauer and associates, July 1984. In response to the previous cancer findings, the Du Pont company funded this study to evaluate cancer rates in counties around SRS. No higher mortality rates for these or other cancers were found in counties adjacent to SRS compared with other counties farther from the site.

Cancer in Populations Living Near Nuclear Facilities, S. Jablon, etal, National Institute of Health, NIH Publication No. 90-874, Volumes 1,2 &3, 1990. This study found no evidence that living near a nuclear facility (it included SRS) caused excess childhood leukemia or other cancer deaths.

Savannah River Regional Health Information System, a DOE-funded effort by the Medical University of South Carolina (MUSC) to establish a cancer and birth defects registry in the counties around SRS, the counties adjacent to the Savannah River all the way to the coast, and the city of Savannah, GA. MUSC developed the registry, and with collaboration from Emory University for Georgia data, collected data in the registry for five years (1991 through 1995). MUSC has evaluated registry data and has issued a final report, available from MUSC. Some cancers were elevated for some groups, in particular cervical cancer in black females, and esophageal cancer in black males. Registry officials have stated there is no indication these cancers are related to SRS operations.

Savannah River Site Dose Reconstruction Project, being performed by the Centers for Disease Control and Prevention (CDC). This is the only known study involving the public around SRS that has had activity in the last few years. Phase I, which included identification, collection and review of

available and pertinent records, is complete. Phase II provided the determination of quantities of radionuclides and chemicals released from SRS. A draft report quantifying SRS releases over the years was released for review in early 1999 by Risk Assessment Corporation, which performed Phase I and II for CDC. For radionuclides, most quantities were comparable to quantities reported earlier by SRS. For Iodine-131, however, the report concludes that about 20 times higher quantities were released than previously reported, due to organic iodine compounds not detected in early SRS monitoring techniques and line losses. Plutonium releases were estimated to be about four times that previously reported, primarily due to line losses. A review panel established by the National Academy of Sciences was asked to review the report. A final report on Phase II is available from CDC.

Phase III, to prioritize radionuclides and chemicals for dose and/or risk analyses, is underway. Phase IV will provide dose and/or risk assessment for prioritized radionuclides and chemicals. CDC will then evaluate dose and risk data to determine whether further epidemiological studies of the public around SRS are needed.

SRS Worker Studies

Worker Cancer and Mortality Registries: The Du Pont Cancer Registry was begun in 1956, and the Du Pont Mortality File in 1957. The Cancer Registry included cancer cases identified among active employees, and the Mortality File included deaths among employees and pensioners. SRS Du Pont employees were included in these registries through March 1989. The Epidemiology Section of the Du Pont Medical Department periodically performed analyses and issued informal evaluations to the Medical Division or Du Pont management, to provide long-term health surveillance of Du Pont employees.

The following two reports were published formally, but did not address Savannah River employees separately:

Cancer Epidemiologic Surveillance in the Du Pont Company, Sidney Pell, etal, Journal of Occupational Medicine, Vol. 20, No. 11, November 1978.

Cancer Incidence and Mortality in the Du Pont Company: An Update, Maureen T. O&#65533;Berg, etal, Journal of Occupational Medicine, Vol. 29, No. 3, March 1987.

Other evaluations were reported internally by the Du Pont Medical Division. In 1976, the Du Pont Medical Division performed an internal statistical assessment of the Du Pont registries, which examined cancer incidence data from 1956 to 1974 on workers at each Du Pont plant, including SRS. This evaluation was the first assessment of the SRS work force specifically. Overall SRS cancer incidence rates for active employees were not higher than U. S. or corporate rates; lung cancer rates were slightly elevated for male exempt employees, but were slightly depressed for male non-exempt employees; and leukemia rates were slightly elevated among both male exempt and non-exempt employees. This study was shared with DOE predecessors, CDC, NIOSH, and ORAU. Site review of medical records for these workers indicated that 90 percent of workers who died of lung cancer were moderate to heavy smokers.

Radiation and Leukemia at Savannah River Plant, J. L. Chen, an unpublished report to the Du Pont Medical Division, August, 1980. He performed a case-control evaluation of leukemia among SRS employees, which showed no indication that risk of leukemia was related to prior occupational exposure to radiation.

1982 Update of SRS Health Statistics: Cancer incidence statistics for SRS Du Pont employees were updated by the Du Pont Medical Division to cover the period 1956-1980. No significant changes were noted from the 1976 data.

1983 Update of SRS Health Statistics: The Du Pont Medical Division performed an internal statistical evaluation of mortality among SRS active and pensioned Du Pont employees for the period 1957-1980, and found no statistically significant elevations in lung cancer or leukemia mortality.

1984 Update of SRS Health Statistics: The Du Pont Medical Division updated the SRS employee cancer incidence statistics to cover the period 1956-1983. Similar patterns to the 1976 evaluations were noted.

CDC Scientific Advisory Panel: At the request of DOE, following an intense period of criticism of primarily internal studies of SRS workers, CDC formed a Scientific Advisory Panel in 1983 to review available epidemiologic data on SRS workers and to make recommendations on needs for future studies. SRS officials cooperated fully with the Panel and the Du Pont cancer incidence and mortality statistics for SRS Du Pont employees were made available. The Du Pont Medical Director made presentations to the CDC Panel and to Congressional delegations. In those presentations, he noted that the Du Pont registries and the corporate statistical assessments of them were developed to enable Du Pont to perform long-term health surveillance of its plants and workers as part of a highly proactive corporate safety culture. They were never intended for use in formal, external publications. The Du Pont registries were quite unique within the industrial complex during the time they were established. The CDC Panel recommended further studies of SRS workers by independent epidemiology organizations.

Plutonium Workers: Data on SRS plutonium workers was supplied to epidemiologists at Los Alamos National Laboratory during the middle 1980's, who had planned to perform a study on plutonium workers from several DOE sites, as a follow-up to their earlier studies on Los Alamos and Rocky Flats Plant plutonium workers. This study was never formally initiated, due to the shift in emphasis for health studies to be performed by researchers independent of the DOE complex.

Mortality Among Workers at a Nuclear Fuels Production Facility, Donna L. Cragle, etal, American Journal of Industrial Medicine 14:379-401 (1988). Funded by DOE, Cragle and associates at ORAU performed this study during the 1986-87 period. It included white male workers at SRP between 1952 and 1974, and deaths through 1980 were included. This was the first analytical epidemiology study specifically of SRS workers by an external organization. The study only evaluated mortality rates for diseases, and did not include data on exposures to work place hazards such as radiation. While SRS workers exhibited the healthy worker effect (lower mortality rates for most diseases compared to the U. S. population), and there was no excess of total cancers, excess leukemia mortality was identified in some work groups.

Epidemiologic Study of a Possible Link Between Occupational Radiation Exposure and Respiratory Cancer, Prostate Cancer, and Leukemia in Savannah River Plant Employees, W. E. Fayerweather, R. M. Hall, and M. E. Karns, February 7, 1991 (Draft Westinghouse Savannah River Company report). This study was initiated 1986 and completed in 1990 by epidemiologists in the Du Pont Medical Division and a health physicist at SRS. It was a case-control study of incidence and mortality cases of lung cancer, prostate cancer, and leukemia among SRS Du Pont male employees during the period 1957-1987. Leukemia mortality was statistically significantly elevated in the higher exposed group of radiation workers. Further analysis of the leukemia mortality data indicated an increased mortality risk for chronic lymphocytic leukemia; all other types of leukemia showed no statistically significant association with radiation exposure (chronic lymphocytic leukemia has not been associated with radiation exposures in studies of populations with high radiation doses). In the analysis of the incidence cases of the three types of cancer studied, there was no increased incidence of prostate cancer, lung cancer, or leukemia for workers in the higher radiation exposure group. Although efforts were made during 1990 and 1991 to publish this report, it remains a draft (one author died, another separated from the company).

Memorandum of Understanding on Epidemiology Studies: In 1991, the Secretary of Energy and the Secretary of Health and Human Services signed a Memorandum of Understanding (MOU) establishing that DOE and its contractors would no longer perform analytical epidemiology studies of its sites. It was agreed that NIOSH would perform or oversee worker studies, and CDC/NCEH would perform or oversee studies of populations in the

vicinity of DOE sites. DOE, through its Office of Health Programs, continues to provide long-term health surveillance of current DOE site workers. The MOU remains in effect, and has been modified several times since 1991.

Mortality Among Workers at a Nuclear Fuels Production Facility: The Savannah River Site, 1952-1986, Donna L. Cragle and associates at ORISE, March 1995. ORISE was funded initially by DOE, then NIOSH assumed oversight for this study. This study was performed to follow up the earlier study with more years, and to perform a dose response on types of cancer that were in excess for the SRS population studied. It included the same worker population as the earlier ORAU study (1988), but included radiation exposure data, and included deaths through 1986. The data again indicated the healthy worker effect, with death rates for most diseases lower than that for the U. S. population. Again, total cancer deaths were not in excess. A statistically significant excess of leukemia was noted. The leukemia deaths exhibited a slightly positive response with exposure to external radiation dose.

A Study of Mortality and Morbidity Among Persons Occupationally Exposed to > 50 mSv in a Year: Phase I, Mortality through 1984, S. Fry, etal, Applied Occupational & Environmental Hygiene 11 (4): 334-343, 1996. This study included DOE site workers who had received 5 rem (50 mSv) or more in any given year, including those few SRS workers in that category. The overall mortality experience was consistent with a healthy worker effect.

Multiple Myeloma Among Workers Exposed to Ionizing Radiation and Other Physical and Chemical Agents, S. Wing, etal, University of North Carolina, performed this case-control study for NIOSH of workers at 4 DOE sites, including SRS. The study was started in July 1995 and completed in 1997, with a draft report to NIOSH. The results of the study were released in March 1998. The study found that although there was not a positive dose response for the entire population studied, workers over 45 had a positive dose response for multiple myeloma. There was no excess of multiple myeloma among SRS workers.

Health Surveillance of DOE Contractor Workers, an ongoing assessment by the DOE Office of Health Programs to regularly and systematically collect, analyze and interpret data on illnesses and injuries in the DOE contractor work force to protect and enhance the health and safety of workers. This effort began in October 1990, and regularly collects health, injury and exposure data on contractor employees who miss five days of work or more consecutively. The Office of Health Programs periodically evaluates these data and reports results to Site workers and officials, and makes reports available electronically.

Multiple-Site Case-Control Study of Leukemia and Ionizing Radiation, an ongoing study by NIOSH, which includes 5 DOE sites, including SRS, and one Navy site. This study will likely encompass 300 leukemia deaths and will be the largest such study of its kind. It was established to follow up on the positive dose response for leukemia reported in the 1995 ORISE study of SRS workers. The study started in July 1996. Data collection and evaluation is still in progress.

Exposure Assessment of Hazardous Waste/Clean-up Workers (Phase I), a multiple site study started August 1996 by NIOSH to catalog and describe the spectrum of site projects and worker populations involved in hazardous waste work, decommissioning and demolition work, and clean-up work. NIOSH performed initial work to assess whether records currently collected by DOE sites allow accurate identification of remediation workers and their exposure, work history, and medical information. This information was needed in order to evaluate any relationships between occupational exposures and health effects workers may experience. They found that:

1. Some remediation workers who have worked at DOE sites cannot be identified.
2. Accurate and complete exposure, work history, and medical records are not available for this population.

3. Individual workers cannot consistently be linked to their exposure and medical records.
4. At the present time the necessary information to conduct epidemiologic, exposure assessment, or hazard surveillance of remediation workers is not available.

DOE Former Building Trades Workers Medical Surveillance Program is conducted by the Center for the Protection of Worker's Rights and affiliates for the DOE Office of Health Programs. The purpose is to identify building trades workers who may have been exposed to radioactivity or chemicals during the Cold War to an extent such that health surveillance is warranted. The SRS study, entitled Augusta Building Trades Medical Screening Program, began in October 1997. Phase I, program design and worker notification, is completed, and Phase II, Year 4 (September 25, 2001 – September 24, 2002) is in progress. In this phase workers who have responded are interviewed, and medical screening provided those with higher potential for exposure. Preliminary screening test results indicate positive test responses for beryllium and asbestos exposures, and loss of hearing.

SRS Former Production Workers Medical Surveillance Program is conducted by the Medical University of South Carolina and the University of South Carolina for the DOE Office of Health Programs. The purpose is to identify production workers who may have been exposed to radioactivity or chemicals during the Cold War to an extent such that health surveillance is warranted. This study, parallel to the building trades worker study, began in 1997. Phase I, program design and worker notification, is completed, and Phase II, Year 3 is in progress. In this phase workers who have responded are interviewed, and medical screening provided those with higher potential for exposure. Over 643 medical evaluations had been completed at the end of Phase II, Year 2. No preliminary screening tests are yet available.

Mortality Among Female Nuclear Weapons Workers, a pooled cohort mortality study by the University of New York for NIOSH. This is the first pooled cohort mortality study of females working in the nuclear weapons complex. The focus is occupational exposure to ionizing radiation and chemicals, taking into account various socioeconomic and occupational factors. The study began in July 1996, and includes approximately 67,000 females workers at twelve DOE sites, including SRS.

In June 2000, researchers reported that, for most causes of death, including cancers related to ionizing radiation, fewer female workers died than would be expected based on the U. S. female population. At all of the sites, the number of deaths was either similar to or lower than expected (due to the healthy worker effect). More female workers than expected died from mental disorders, genito-urinary diseases, and ill-defined conditions. Analysis of female workers monitored for external radiation showed an increase in leukemia mortality among female workers who were more highly exposed to radiation. In addition, increases for all cancers combined, breast cancer, and hematologic cancers were found among female workers who were more highly exposed to external radiation.

For SRS female workers included in the study, the healthy worker effect was also evident. There was an increased relative risk of death from all cancers combined and from radiosensitive solid tumors with increasing dose. These slightly elevated relative risks have not been realized in other studies of SRS workers.

Mortality Among Chemical Laboratory Workers, an ongoing historical cohort mortality study by NIOSH of male and female chemical workers employed at Oak Ridge K-25 Plant, Oak Ridge National Laboratory, Oak Ridge Y-12 Plant, and SRS. The study, which started September 1998, will assess death rates for chemical workers at these facilities employed from the early 1940's through 1984, with deaths through 1995 included. This study is currently in the data collection phase.

Update of the 1995 ORISE Mortality Study, by the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) for DOE. In response to interest by the SRS Citizens Advisory Board in the results of the 1995 ORISE findings, CRESP began in 1997 to update that study, with additional

years of study (the 1995 study included deaths through 1986) and with additional numbers of workers, including females and minorities. Phase I, updating mortality statistics, is completed; preliminary mortality data indicates overall leukemia not in excess, but was during the 1960s; prostate cancer not elevated; two other cancers, not previously in excess, now are elevated skin cancer in white females (9 deaths) and breast cancer in males (3 deaths). This project is currently inactive.

Mult-Site Case-Control Study of Lung Cancer and External Ionizing Radiation, a case-control study of DOE contractor reactor workers and external radiation dose at four sites, including SRS, is being conducted by NIOSH. This study is still in the data collection phase.

Compensation Program for DOE Contractor Workers In July 1999 the DOE Secretary announced he was requesting Congress to fund a program to include DOE contractor workers in the federal worker's compensation program for beryllium disease. While DOE contractor workers are already eligible for state worker's compensation programs, the federal program offers additional compensation. Also in July 1999, the President directed the National Economic Council (NEC) to establish a panel to review health studies of DOE contractor workers and make recommendations on whether exposures to radiation, asbestos or other chemicals should be also included for these workers in the federal compensation program. That panel made their final report to the NEC in March 2000. Based on their recommendations, the DOE Secretary introduced legislation to Congress for a compensation program.

In October 2000 Congress enacted the Energy Employees Occupational Illness Compensation Program Act (EEOICPA) to provide a new entitlement program for workers who developed cancer and lung diseases as a result of exposure to radiation, beryllium or silica in the nuclear weapons complex. Under the legislation, several thousand workers (or their survivors) will be eligible to receive $150,000 plus prospective medical payments. The workers will also be able to apply for lost wage payments through state workers' compensation programs. The EEOICPA is conducted by the Department of Labor, but there is involvement by other agencies for some portions of the program. For instance, NIOSH performs dose reconstruction and probability of causation evaluations. Each case will be reviewed by a panel of occupational medicine physicians to determine whether or not the claimed illness is work related. To date, over 2,600 claims from SRS workers or survivors have been filed, most to both the federal and state programs.

For workers (or their survivors) who suffer from illnesses not covered under the EEOICPA, the DOE Office of Workers Advocacy has developed a program to facilitate processing of claims through the state workers' compensation programs.

References

1. Crase, K. W. and Singh, L. P., Epidemiology Studies or Activities Involving Workers at the Savannah River Site or the Surrounding Public, WSRC Report ESH-HPT-98-0505, October 5, 1998.
2. Crase, K. W. and Singh, L. P., Update on Epidemiology Studies or Activities Involving Workers at the Savannah River Site or the Surrounding Public, WSRC Report ESH-HPT-2000-00015, February 14, 2000.

Appendix I
Principal Contacts for Health Studies or Activities

- Savannah River Regional Health Information System
  - Dr. Dan Lackland, MUSC, 843-876-1140

- SRS Dose Reconstruction Project
  - Phil Green, CDC, 404-498-1717, or visit http://www.cdc.gov/nceh/radiation

- Health Surveillance of Current DOE Contractor Workers
  - Dr. Cliff Strader, DOE, 301-903-5799

- Leukemia Mortality Case-Control Study
  - Dr. Thurmond Wenzl, NIOSH, 513-841-4490

- Exposure Assessment of Hazardous Waste/Cleanup Workers
  - Dr. Steven Ahrenholz, NIOSH, 513-841-4400

- SRS Former Building Trades Workers Medical Surveillance Program
  - Dr. Knut Ringen, Center for Protection of Workers Rights, 202-962-8494

- SRS Former Production Workers Medical Surveillance Program
  - Dr. David Hoel, MUSC, 843-876-1109

- Mortality Among Female Nuclear Weapons Workers
  - Dr. Steven Ahrenholz, NIOSH, 513-841-4400

- Mortality Among Chemical Laboratory Workers
  - Dr. Cynthia Robinson, NIOSH, 513-841-4217

- SRS Mortality Study Update
  - Dr. Barry Friedlander, CRESP, 732-235-9605

- Lung Cancer Study
  - Sharon Silver, NIOSH, 513-841-4313

- General Information (related to health studies of DOE site workers)
  - Dr. Bonnie Richter, DOE Office of Health Programs, 301-903-4501, or visit http://www.eh.doe.gov/health

- General Information (related to NIOSH epidemiology studies of DOE site workers)
  - Dr. Steven Ahrenholz, NIOSH Health-Related Energy Research Branch, 513-841-4400

- Information on the Compensation Program for DOE Contractor Workers:
  - Department of Labor at 866-888-3322, or visit http://www.dol.gov
  - DOE Office of Worker Advocacy at 866-888-3322, or visit http://www.eh.doe.gov/advocacy