Recommendation No. 102

November 16, 1999

Tritium Health Motion

Background

In 1995, the Board urged the Centers for Disease Control and Prevention (CDC) and National Institute of Occupational Safety and Health (NIOSH) to investigate the health impact of the releases of tritium on workers at the Savannah River Site (SRS) (see motion #7), but they refused. Since tritium is the largest source-term of radionuclides released from SRS, and those with the greatest exposure to tritium are workers at SRS, if the health of the workers is positive, it will provide assurance of the public's safety for tritium releases from SRS.

Instead, at the Board's request, the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) (Dan Wartenberg) investigated whether workers at SRS are more likely, on average, to die of certain cancers than the general public (conducted with a data sharing agreement with NIOSH).

One specific goal of the CRESP study was to reassess observations of two previous studies. In those studies (i.e., Cragle et al., 1988; 1995), investigators reported a significant excess in leukemia mortality during 1965-1969 and a marginally statistically significant exposure trend to account for response latency. The authors of the previous studies also suggested that the prostate cancer mortality data looked suspicious.

Compared to the earlier studies, the CRESP study has twice the number of workers in addition to nine more years of follow-up, producing three times the mortalities, which increases the confidence power of their findings. CRESP's analyses rely on mortality data only, using standardized mortality ratios (SMRs) for causes of death based on national and regional mortality rates (i.e., U.S. or Georgia and South Carolina). The use of the regional mortality rates adjusts for specific cancers that may be more common or rare in the region than in the entire U.S. These results, through 1995, do not address diagnoses, treatment, or access to health care; cancers with good survivorship (e.g., bladder cancer, breast cancer); they rely on death certificates which are often unreliable and not cross-validated; and they only address workers, a relatively healthier group. All of these factors may affect the results and conclusions.

CRESP conducted separate analyses for each gender and race.

Results of the CRESP Study for the SRS worker cohort:

1. Overall, CRESP found little change in SMRs for total mortality and total cancer mortality. SMRs for all four gender/race groups were statistically significantly depressed and showed a substantial healthy worker effect. Rates based on national mortality rates and regional mortality rates were comparable.
2. For leukemia mortality, in addition to the nine additional years of follow up, CRESP split all cases of chronic lymphocytic leukemia (CLL) into a separate category because there is no evidence that CLL is related to exposure to ionizing radiation. When the leukemias without CLL are compared to the regional mortality rates, no overall excess was found. There was an apparent excess among white males in the mid-1960s but the rates have decreased since then. The suggestion of an excess in the mid-1980s, which was reported in an earlier study, was not found. Rates in other gender/race groups were within expected bounds.
3. Prostate cancer, the other cancer noted in previous studies, was not in excess when compared to regional rates. When the mortality rates for African-American males were compared to national rates, a moderate increase was observed, but vanished when compared to regional mortality data because mortality rates for prostate cancer were higher in Georgia and South Carolina than the US (South Carolina ranked 6th and Georgia 9th in age-adjusted rate of prostate cancer mortality nationally for 1988-1992). The SRS worker population was no different from others in the region with respect to prostate cancer mortality. A screening program may be useful for early identification and treatment of incident cases and for surveillance data.
4. Skin cancer among white females was statistically significantly elevated. Based on 9 cases, the SMR showed a four-fold excess. However, review showed that these women were hired prior to

1956; 8 of the 9 worked less than 10 years and had not worked at SRS for at least 30 years at the time of death; and 6 of the 9 had held clerical jobs. There was little evidence to suggest that this excess was related to work at SRS. A screening program might be useful for early identification and treatment and for surveillance data.

5. An excess of male breast cancer mortality was observed among white male hourly workers. Based on 3 cases, the risk was greater than three-fold; the deaths were among workers hired prior to 1956 and occurred between 1986 and 1995; but the small number of cases means that it is premature to draw conclusions.
6. At the request of the Board, CRESP also evaluated links between leukemia mortality and exposure to tritium as a result of an excess reported in previous studies of SRS workers but that appears to no longer be present. To investigate, CRESP compared tritium exposures among those who died of leukemia and other workers of similar age, gender, race and employment history. Results showed that this study lacked sensitivity to detect an effect due to the relatively small number of leukemia deaths and the small proportion of workers exposed to tritium. Other problems encountered were incomplete exposure files, illegible microfiche records, and a limited number of computerized exposure records. With limited computerized tritium data (it exists on hard copy), analysis was possible only for workers who worked at SRS after 1978 (many of these workers began working at SRS in the early 1950s, and were still working there after 1978). Results do not support an association between tritium work and leukemia, although the results are limited.

When a study of a given worker population shows elevated mortality which has the potential to be related to work at that site, as was concluded in the original studies (e.g., Cragle et al., 1988 and 1995), that those workers deserve additional study of them specifically. With the Board's encouragement, CRESP did exactly that, while other Federal agencies were not willing to do so. We commend CRESP for completing this phase of the work.

Summary

This study provides reassurance of the health of the SRS worker population. Previously high rates of leukemia mortality have retreated to normal rates and concern for prostate cancer mortality appears unfounded based on the data. The excess of skin cancer among white females may warrant further study, but no evidence suggests a relationship with working at SRS; and the excess of breast cancer among white males may also warrant further study, but the cases are too few to draw conclusions.

Overall Benefits of Continuing the Study

1. A better understanding of the role of external radiation exposure on the overall mortality experience of workplace related risks from the association between exposure to external radiation and causes of death.
2. Better understanding of lifestyle factors on the mortality experience of workers.

Recommendation

The SRS CAB recommends that DOE should:

1. Continue to study the impacts of tritium on the health of workers at SRS; especially examine the work history of those having excess cancers and the associations with tritium exposures.
2. Include in this study work history, lifestyle behaviors, other exposures, and the impacts on health for workers at SRS.
3. While the elevated cancer findings are apparently not work-related, institute cancer education programs at SRS for cancers that appear elevated in order to alert workers at SRS about the findings in the study and to provide advice on prevention (i.e., avoiding excessive sunbathing; reducing fat in diets).
4. Re-institute the SRS database ended in 1989 in order to collect worker mortality and incidence data for all causes along with safeguards to protect individual confidentiality.

Reference List

1. Wartenberg et al. Report to Stakeholders on SRS Worker Mortality (Feb. 24, 1999; Oct. 28, 1999).
2. Cragle DL, McLain RW, Qualters JR, Hickey JLS, Wilkinson GS, Tankersley WG et al. Mortality among workers at a nuclear fuels production facility. American J Industrial Med. 1988; 14:379-401.
3. Cragle DL, Watkins JP, Robertson-Demers K. Mortality among workers at a nuclear fuels production facility: The Savannah River Site, 1952-1986. Manuscript 1995.
4. Cragle DL, Watkins JP, Robertson-Demers K. 1997. Mortality among workers at a nuclear fuels production facility: The Savannah River Site, 1952-1986.

5. Pickle LW, Mungiole M, Jones GK, White AA. Atlas of United States Mortality. Hyattsville, MD: National Center for Health Statistics, USHHS, 1996.

Closure Criteria

1. Evidence that the Tritium health study and lifestyle behaviors study will continue.
2. Reinstitution of the SRS mortality database.
3. Cancer education program initiated at SRS.

Agency Responses

Department of Energy-SR