



Project Summary

Determinants of Cancer and Cardiovascular Disease Mortality in Mining Counties of California

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PLAINTIFF'S EXHIBIT

CAP-344

The purpose of this research effort was to design an epidemiological study protocol to evaluate the influence of environmental asbestos exposure on mortality from lung cancer, mesothelioma, and cardiovascular disease in the asbestos mining areas of California. Mortality data (1968-1978) and emissions data (both anthropogenic) were reviewed in an effort to determine the most preferable study area. The area selected for future study was Western Calaveras and Tuolumne Counties which contain the Calaveras serpentine deposit. Selection criteria included suitable population base, sufficient number of deaths, evidence of elevated airborne and waterborne asbestos concentrations, and the existence of archives containing ambient air sampler filters for preceding years. A questionnaire was developed for obtaining information from next-of-kin of decedents in the study area though interviewing was not attempted. Next-of-kin interviews are expected to be a component of future studies. Necessary elements of quality assurance were identified and documented as part of protocol design.

This Project Summary was developed by EPA's Health Effects Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the

same title (see Project Report ordering information at back).

Introduction

This epidemiological study evaluates the hypothesis that asbestos-related health effects have been observed among populations not occupationally exposed. The study was divided into four conceptual tasks:

Epidemiological protocol design. In this segment, alternative study approaches were evaluated. The mortality data base, the sources, and the exposure to asbestos were considered.

Questionnaire development. In concert with protocol design and exposure findings, the primary data-gathering mechanism for obtaining subject information from survivors was drafted, pre-tested, revised, and submitted.

Source inventory and exposure characterization. All anthropogenic and natural emission sources of asbestos were delineated and quantified in each California study area. Existing occupational and ambient data were reviewed to establish inhalation and ingestion population exposure.

Quality assurance. Elements of quality assurance were to be identified and documented as part of the protocol design.

The initial components of this study were the source inventory and exposure characterization. A summary of the

principal findings are given here.

Two distinct California asbestos mining and milling areas were researched. One is associated with a serpentine deposit running through the junction of Fresno and San Benito Counties (herein referred to as the New Idria Deposit). The second is located throughout the western sections of Calaveras and Tuolumne Counties (the Calaveras Deposit). The preferable study area was determined to be that associated with the Calaveras Deposit. Selection criteria included greatest population base, evidence of elevated airborne and waterborne concentrations of asbestos, and the existence of archives of useful ambient air sampler filters dating back over seven years.

For the case of the New Idria Deposit, the mining areas are sufficiently remote to make it unlikely that any population center will be affected. One mill is located near a community and limited airborne asbestos measurements point to significant concentrations there at the time taken.

By contrast, the Calaveras Deposit area has a greater at-risk population as a result of mining and milling of asbestos and other minerals. In addition, airborne background ambient levels taken upwind or remote from known sources are elevated. No waterborne asbestos measurements were made specifically for the water distribution systems serving the Calaveras Deposit area; however, measurements on San Francisco Bay water district reservoirs located in western Calaveras and Tuolumne Counties show higher than average concentrations for those with supplies passing through serpentine formations. The oldest ambient data uncovered for the Calaveras Deposit area was reported in the California Department of Health Study of 1965-1967. Asbestos concentration was measured by dust sample collection through impingers. Quantification was by optical microscopy. Measured ambient levels (upwind at a large mine site, etc.) on two separate occasions ranged between 0.1 and 2 million particles per cubic foot of air. A federal study at about the same time of the area "Environmental Survey of Asbestos Mining and Milling in California" December, 1966, Public Health Service Division of Occupational Health, suggests the equivalence 10 total fibers/cc $\equiv$ 1 mppcf by impinger. In the cited ambient concentrations (from the NIOSH Recommended Asbestos Standards), the levels across the country are summar-

ized as generally $< 10 \text{ ng/m}^3$ with occasional peaks as high as 100 ng/m^3 (by electron microscopy). Using optical microscopy, ambient levels are generally less than 0.01 fibers $> 5 \mu\text{m/cc}$ with peak values as high as 0.03 fibers $> 5 \mu\text{m/cc}$. Use of the Public Health Service equivalence 6 fibers $> 5 \mu\text{m/cc} \equiv 1 \text{ mmpcf}$ by impinger yields the mine area ambient (upwind) concentration range 0.6-12 fibers/cc.* Further, use of the NIOSH suggested equivalent 20 fibers $> 5 \mu\text{m}$ in length (as determined by optical microscopy) per nanogram of asbestos yields the mine ambient range 12-240 ng/m^3 . Thus, the ambient levels detected at upwind locations in the vicinity of a Calaveras mine/mill are at the extreme high end of the surveyed range.

High volume air sampler filters from the Calaveras Deposit area population centers have been located in the California Air Resources Board archives dating back to the early 1970s. They can be utilized to quantify airborne asbestos concentration and they therefore approximate exposure data. Coupled with the water assay, they will establish the quantitative relationship among population centers in the serpentine area and the other areas of Calaveras and Tuolumne Counties. Also, they will provide the basis for stratifying the populations according to inhalation and ingestion exposure.

Based upon the source and exposure information available to this study, the potential study group was defined as those people who died in Calaveras and Tuolumne Counties during the last ten years. Approximately 4,300 people will be included. Exposure of the preliminarily identified group is expected to be significant; principally due to general ambient sources rather than a dominant single point source. Exposure may be differentiated among the group members between air and water, with either predominating in particular residential segments. This approach will permit investigation of the relative importance of different exposure routes and will facilitate interpretation of possible dose-effect relationships. Water distribution systems for the area through the last ten years were described.

*Note: The current NIOSH recommended standard is 0.1 fiber/cc for an 8-hour time-weighted average.

Conclusions

There are two principal areas of California in which asbestos mining and milling activities are conducted. This study investigated both areas and surveyed the anthropogenic and natural sources of asbestos emissions into the environment. The county areas which constitute both regions are principally rural; the cities generally contain less than 6,000 people. The only large cities in Calaveras, Fresno, Monterey, San Benito, and Tuolumne Counties are located apart from the serpentine areas. The coincidence of asbestos mining and milling with such less-urbanized county areas is a favorable factor; people in more populous urban centers are exposed to a number of toxic substances in their ambient environment.

Based upon the synthesis of published literature, a field survey, and the review of the limited asbestos monitoring information available, the study concluded that airborne and waterborne asbestos levels in particular areas of Calaveras and Tuolumne Counties may be elevated with respect to background. In the other principal serpentine area (San Benito, Fresno, Monterey), insufficient information is available to estimate exposure. In these latter areas, mining activities are relatively isolated from population areas. However, ore transport and milling are in the King City-San Lucas areas. Isolated airborne data taken in King City showed elevated concentrations; more extensive mill site data (provided by the mill management) appears somewhat lower. The single piece of waterborne assay information from the Coalinga vicinity is insufficiently documented to be definitive.

Upwind data taken at Calaveras asbestos during 1965-1967 range from 12-240 ng/m^3 extrapolated to electron microscope concentrations from optical microscopy counts of fibers greater than $5 \mu\text{m}$. Ambient concentrations across the country are generally below 10 ng/m^3 .

High volume air quality sampler filters were located in the archives of the California Air Resources Board for a number of sites in Calaveras and Tuolumne Counties. Samples of 24- and 48-hour duration date back to the early 1970s. These asbestos analyses are practical and may be utilized to provide an exposure mapping of the areas of interest.

Water distribution systems in Calaveras and Tuolumne Counties have been identified. Sources, routes, and

treatment differ throughout the area. No specific asbestos analyses of the water used for local supply was found. Based upon several available measurements of elevated asbestos content in serpentine deposit area reservoirs (which serve San Francisco Bay communities), water sampling and analysis should be performed for chrysotile asbestos.

Based upon available air and water data, elevated asbestos exposure to the general population may have occurred in areas of Calaveras and Tuolumne Counties.

Recommendations

Water sampling and air/water analysis should be conducted to define exposure to the population by place of residence. Parallel with that effort, information from the California death tape rolls can be initially extracted on an annual basis for both counties. These tapes can be processed according to cause of death (ICD system) with case and control groups extracted, and disease mortality rates compiled. The statistical adequacy of all cause-of-death categories of interest would then be determined. All diseases associated with occupational exposure to asbestos would be considered. In addition, all statistically adequate death category populations can be contrasted as a function of exposure. The product of this effort is the delineation of the range of correlation of mortality categories with exposure. This may suggest additional cause-of-death categories. These steps will be followed by the final study components which will include the detailed data gathering by survivor questionnaire and medical records and the comprehensive data analyses.

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John Acquavella is the EPA Project Officer (see below).

The complete report, entitled "Determinants of Cancer and Cardiovascular Disease Mortality in Asbestos Mining Counties of California," (Order No. PB 81-208 985; Cost: \$11.00, subject to change) will be available only from:

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