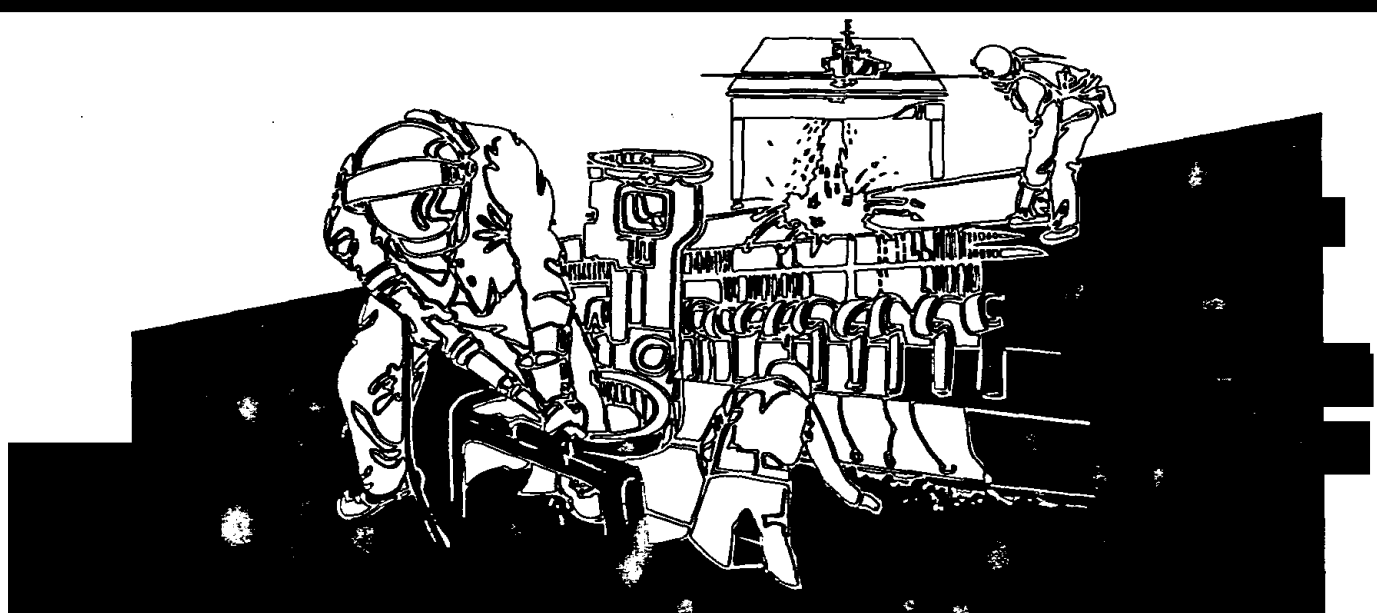
HEALTH HAZARD EVALUATION REPORT

HETA 91-360-2226
UNIVERSITY OF GEORGIA
ATHENS, GEORGIA



U.S. DEPARTMENT OF HEALTH AND HUMAN
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety
CDC
CENTERS FOR DISEASE CONTROL

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer and authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to federal, state, and local agencies; labor; industry; and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 91-360-2226
JUNE 1992
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I. SUMMARY

In August 1991, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from employees of the University of Georgia, Department of History, in Athens, Georgia. The employees were concerned about a suspected cancer cluster among faculty and students in the Department of History, which is located in LeConte Hall.

Based on a survey conducted by history department faculty and word-of-mouth information, 11 cancer cases were identified. Five cases occurred among the faculty, including one case each of Waldenstrom's macroglobulinemia, acute myelogenous leukemia, colon cancer, prostate cancer, and kidney cancer. Six cases occurred among former students. These included one case each of Waldenstrom's macroglobulinemia, breast cancer, leukemia, and brain cancer and two cases with an unspecified site.

At the request of the history department, the Public Safety Division (PSD) of the University of Georgia conducted numerous investigations of the building environment, including bioaerosol, chemical contaminant, and radiation assessments. Some concern was raised by the radiation results, which showed very low, but statistically significant, radiation counts above background in several rooms scattered throughout the building.

On March 3 and 4, 1992, NIOSH investigators toured LeConte Hall, obtained original building plans, and collected information about the history of research activities in the building. The investigators focused on determining whether research activities in LeConte Hall from 1940-1955 might have involved the use of long-lived radioactive materials. Based on a review of all environmental monitoring data collected by the PSD, the NIOSH investigators could not identify any chemical or physical agent other than radiation that would have been present in LeConte Hall and could have provided a plausible explanation for the occurrence of the various types of cancers reported. To validate previous results, the PSD and NIOSH investigators re-measured ionizing radiation in several areas in LeConte Hall.

In reviews of existing records (including lists of authorized radioisotope users, film badge records, waste disposal records, and past Atomic Energy Commission license approvals), doctoral dissertations and masters' theses, and annual department reports, NIOSH investigators found no evidence of the use of radioactive materials in LeConte Hall between 1940 and 1955.

Results of ionizing radiation measurements taken on March 3, 1992 indicated a background level of 150 counts per minute (cpm) on the sidewalk outside of LeConte Hall and 200-500 cpm at various locations inside the building. Differences between the measurements outside and inside the building and among the measurements inside the building can be attributed to naturally occurring radiation contained in building materials and the random variation of radiation levels within these materials.

NIOSH investigators compared the observed and expected number of cancer cases (all types) for history department faculty. Based on estimated cancer incidence rates in Georgia, a crude calculation indicates that 2.2 cases would be expected compared to 5 cases observed in a six-year period. The ratio of observed to expected cases is 2.3 (95% Confidence Interval [CI] 0.7, 5.4). The ratio of observed to expected cases is a measure of excess cancer; it is not considered statistically significant when, as in this instance, the 95% CI includes the value 1. Two cases of Waldenstrom's macroglobulinemia were reported, one in a faculty member and one in a former graduate student. Two cases of this rare disorder in a small group of people who shared a common environment is unusual.

Based on the lack of evidence of medically significant exposures to chemical or physical agents, it is unlikely that the cases of cancer can be attributed to the environment of LeConte Hall. Current levels of chemical contamination and naturally occurring radiation do not pose a human health hazard.

KEYWORDS: SIC 8221 (Colleges, universities, and professional schools), cancer, ionizing radiation.

II. INTRODUCTION

In August 1991, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation (HHE) from three employees of the University of Georgia, Department of History, in Athens, Georgia. The employees were concerned about a suspected cancer cluster among faculty and students in the Department of History, which is located in LeConte Hall. To respond to the request, NIOSH investigators received and evaluated medical and environmental information from the requestor and from the Public Safety Division (PSD) of the University of Georgia. NIOSH investigators also conducted a site visit on March 3-4, 1992.

III. BACKGROUND

LeConte Hall

Construction of LeConte Hall, a three-story building with 20 to 30 offices per floor, was completed in 1937. The primary occupants of LeConte Hall were the biology department (1937-1947), the geology department (1947-1955), the law and political science departments (1955-early 1960s), and the history department (1960 to present). Other departments, including nursing education and mathematics, offered courses in LeConte Hall during the 1940s and 1950s.

Cancer Concerns

Employees in the history department became concerned about cancer when a faculty member was diagnosed with leukemia in 1989. A suspected connection was made between this case and an earlier diagnosis of Waldenstrom's macroglobulinemia in a former faculty member. Both faculty had joined the department in 1965 and, beginning in the early 1970s, had adjoining offices on the first floor of the building (Rooms 116 and 118). In April 1989, concerned employees sent a letter inquiring about cancer occurrence to 150 former students on a history department mailing list. Concern was heightened when a second case of Waldenstrom's macroglobulinemia was reported by one of the 27 survey respondents.

Based on the student survey and word-of-mouth information, employees identified 11 cancer cases.* Five cases occurred among the faculty, including one case each of Waldenstrom's macroglobulinemia, acute

* In this investigation Waldenstrom's macroglobulinemia is considered as a type of cancer because of its similarity to some other cancers, such as chronic lymphocytic leukemia. In the international system for classifying diseases, however, Waldenstrom's macroglobulinemia is grouped with plasma cell disorders rather than neoplastic diseases.[1]

myelogenous leukemia, colon cancer, prostate cancer, and kidney cancer. The cases were diagnosed between 1986 and 1990. One case occurred in a 47-year-old male; the remaining cases occurred among men in their 60s. Four of the five cases were in faculty members who joined the history department between 1965 and 1967, and one case was in a person who joined in 1975. Six cases occurred among former students. These included one case each of Waldenstrom's macroglobulinemia, breast cancer, leukemia, and brain cancer, and two cases with an unspecified site. The students with cancer had been in the history department during the mid-1960s to the late 1980s for a period of one to five years.

Environmental Assessments

At the request of the history department, the PSD conducted numerous investigations of the building environment to determine whether carcinogens were present. The following investigations and their results were described in a report of the PSD issued on October 1, 1991.

- Bioaerosol investigation. Background levels of molds, yeasts, and bacteria were detected in LeConte Hall.

- Chemical contaminant investigation. Soil samples up to 200 centimeters (cm) from several locations around the building contained no detectable polychlorinated biphenyls (PCBs), but did have chlordane, a persistent pesticide commonly used for termite control, and malathion, a relatively short-lived, broad spectrum insecticide. According to the PSD report, air samples taken in several rooms and a tap water sample from one room contained no detectable levels of organic chemicals, air samples in the drain pipe in Room 118 indicated the presence of constituents of general cleaning compounds, and air samples in the floor drain in Room 111 contained aromatic hydrocarbons and ketones in concentrations within currently acceptable limits.

- Radiologic investigation. A building-wide radiation survey using a Geiger counter did not detect radiation levels above background. The results from wipe samples, however, indicated very low, but statistically significant, radiation counts above background in several rooms scattered throughout the building. The PSD report noted that radon measurements in the summer and winter were below levels for which the U.S. Environmental Protection Agency (EPA) recommends mitigation or further evaluation.[2] Radon levels are generally highest in the winter when windows and doors are kept closed.

IV. EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH investigators employ environmental evaluation criteria for assessment of chemical and physical agents. These criteria are intended to suggest levels of exposure to which

most workers may be exposed up to 10 hours/day, 40 hours/week for a working lifetime without experiencing adverse health effects. It is important to note, however, that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy). In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the levels established by the evaluation criteria. Evaluation criteria typically change over time as new information on the toxic effects of an agent become available.

A source of evaluation criteria for radiation exposure in the workplace is the Occupational Safety and Health Administration (OSHA).[3] Employers are legally required to meet the requirements of the OSHA standard. Under OSHA regulations, a worker can be exposed to 2.5 millirem per hour (mrem/hr) and not exceed the yearly exposure limit of 5 rem. A rem is one measure of the absorbed dose of ionizing radiation to body tissue. Another measure of absorbed dose in the Sievert. One sievert (Sv) is equal to 100 rem; one millisievert (mSv) is equal to 100 millirem (mrem). Expressed in units of mSv, the OSHA standard for workers is 50 mSv per year.

Radiation dose limits for the general public have been developed by the National Council on Radiation Protection and Measurements (NCRP). The general population limits are set lower than those for radiation workers. The NCRP currently recommends that individuals in the general public receive no more than 5 mSv in a single year.[4] It is estimated that a nonsmoking individual in the U.S. receives an average annual effective dose of 3.6 mSv.[5] Eighty-two percent of the total dose is due to naturally occurring radiation.[6] (The total dose to smokers is considerably higher due naturally occurring radioactive materials present in tobacco.)

V. METHODS

An opening conference on March 3, 1992 was attended by NIOSH investigators, faculty members of the history department, and representatives of the PSD. Following the conference, NIOSH investigators toured LeConte Hall, obtained original building plans, and collected information about the history of research activities in the building. The latter was derived from official University of Georgia records, including (a) records of the radiation safety office, (b) contents of appropriate doctoral dissertations and master theses held by the main university library and by individual departments, and (c) annual departmental reports. Each year, department heads are required to file annual reports, which include a list of faculty publications and presentations completed during an academic year.

The NIOSH investigators focused on determining whether research activities in LeConte Hall from 1940-1955 might have involved the use of any naturally or

artificially produced, long-lived radioactive materials. Based on a review of all environmental monitoring data collected by the PSD, the NIOSH investigators could not identify any chemical or physical agent, other than radioactive material would have been present in LeConte Hall and could have provided a plausible explanation for the occurrence of the various types of cancers reported. The 1940-1955 time period was chosen based on the following observations.

- The biology department, which occupied LeConte Hall prior to 1940, was not considered a likely user of radioactive materials in the late 1930s.

- The geology department, which occupied LeConte Hall after the biology department and remained until 1955, was more likely to have possessed natural radioactive materials for use either in its teaching or research programs.

- LeConte Hall was primarily a non-science academic building in the years between 1955 and 1959 when the history department established occupancy.

- The earliest year in which a history faculty member reported to have cancer joined the department was 1965.

As a further validation of previously reported ionizing radiation results, the PSD and NIOSH investigators re-measured several areas in LeConte Hall using the University of Georgia's calibrated Ludlum sodium iodide crystal/counter system. This instrument measures radiation in units of counts per minute, which can be converted to a dose unit (sievert or rem). Measurements were made around the floor-wall interface of each room selected, over all exposed pipes in the rooms, and on selected sections of floor tiles.

VI. RESULTS

NIOSH reviewed the information about cancer among staff and faculty, who generally spent more time in LeConte Hall than students. No cancer cases were identified among 14 staff members present between 1985 and 1990, the time period during which the reported cancer cases had been diagnosed. Five cancer cases (including one case of Waldenstrom's macroglobulinemia) were identified among 49 permanent faculty present between 1985 and 1990 (excluding two persons present for only one or two quarters in 1990). Based on estimated cancer incidence rates in Georgia, a crude calculation indicates that 2.2 cases would be expected in a six-year period in a group of this size with a similar age and gender distribution.** The ratio of

** Estimated rates are based on data from the Surveillance, Epidemiology and End Results Program, Division of Cancer Prevention and Control, National Cancer Institute and are made available through the Information Resources Management Office of the Centers for Disease Control.

observed to expected cases is 2.3 (95% Confidence Interval [CI] 0.7, 5.4). The ratio of observed to expected cases is a measure of excess cancer; it is not considered statistically significant when, as in this instance, the 95% CI includes the value 1.

At the radiation safety office of the University of Georgia, NIOSH investigators reviewed all existing records including lists of authorized radioisotope users, film badge records, waste disposal records, and past Atomic Energy Commission license approvals. No information about the use of radioactive materials at the University of Georgia before 1960 was found.

A search of the Dissertation Abstracts computerized database revealed that no doctoral dissertations in the areas of biology (zoology, bacteriology, botany), archaeology, or geology were written between 1940 and 1955. NIOSH investigators also conducted a manual search of approximately 450 masters' theses for this same time period and did not find any theses describing use of radioactive materials by departments located in LeConte Hall. No evidence of the use of radioactive materials was found among faculty presentations and publications listed in the annual reports for those departments occupying LeConte Hall from 1940 to 1955.

The background level of ionizing radiation taken on the sidewalk outside of LeConte Hall was 150 counts per minute. The level of ionizing radiation detected in rooms 116 and 118 ranged from 200 to 300 counts per minute (cpm). Readings in second floor rooms ranged from 250 to 400 cpm and in third floor rooms ranged from 400 to 500 cpm. No measured level exceeded 500 cpm anywhere in LeConte Hall.

VII. DISCUSSION AND CONCLUSIONS

Cancer is a group of diseases that share a common feature, the uncontrolled growth and spread of abnormal cells. Cancer is common in the United States. About one in three people will eventually develop cancer. One of every five deaths is from cancer. Among adults, cancer occurs more frequently among men than among women and the rate of occurrence increases with increasing age.[7]

Cancers often appear to occur in clusters. Cases that are close together in time or space (for example, a neighborhood or workplace) may have a common cause or may represent the coincidental occurrence of unrelated causes. The number of cases may seem high, particularly among the small group of people who have something in common with the cases, such as working in the same building. When a small number of cases occurs it usually is difficult to determine whether they have a common cause. This is especially true for cancer cases that occur among workers in non-industrial settings, where a biologically significant exposure may be difficult to identify.

In this investigation, the total number of cancer cases did not appear to be in excess. More importantly, all the reported cancer cases among faculty were of different types. Acute myelogenous leukemia and Waldenstrom's macroglobulinemia both affect blood-forming cells, but different cell types are involved in each.[8] Because most cancer-causing substances are known to cause only one or two different types of cancer, the pattern of cancers among the faculty are not suggestive of any specific cancer-causing agent.

Concern about the occurrence of two cases of Waldenstrom's macroglobulinemia in individuals with a connection to LeConte Hall is understandable. Waldenstrom's macroglobulinemia is a rare disorder that resembles the related diseases chronic lymphocytic leukemia and myeloma.[7] Although accurate estimates of the occurrence of Waldenstrom's macroglobulinemia are not available for the United States, data from the United Kingdom suggest that about one new case in a population of 200,000 will be detected each year.[9] Two cases in a small group of people who shared a common environment is unusual.

Little is known about the causes of Waldenstrom's macroglobulinemia. Its relationship to chemical exposures has not been evaluated adequately. One epidemiologic study has been conducted to determine whether suspected causes of related diseases affecting similar types of blood cells were also associated with Waldenstrom's macroglobulinemia. No association was found for a variety of occupational exposures, including those previously related to leukemia or lymphoma.[10] In one series of six cases of Waldenstrom's macroglobulinemia, three were in persons who had worked for long periods as shoe repairers.[8] One case has also been reported in a bird breeder.[11] It is unknown whether the exposures in these cases are causally related to Waldenstrom's macroglobulinemia.

Most cancers require a period of 10 to 30 years from time of first exposure to clinical detection. Because of this, it is important to look for evidence of past exposures to hazardous agents when considering potential causes. Although LeConte Hall housed science laboratories, information obtained by NIOSH investigators suggests that these laboratories were mainly used for undergraduate teaching. NIOSH investigators found no evidence of any research activity that would have produced hazardous agents that persisted through the time period prior to occupation of LeConte Hall by the history department.

Environmental assessments conducted by the PSD and radiation measurements made by NIOSH provide no evidence of current chemical or ionizing radiation levels of concern to human health. The highest level of ionizing radiation detected in LeConte Hall, 500 counts per minute, is equivalent to 2.5×10^{-4} mSv/hr. An individual exposed to this level of radiation for 40 hours per week and 50 weeks per year will have an annual exposure of 0.5 mSv per year, which is 100 times less than the current OSHA permissible exposure limit of 50 mSV per year for occupational

exposure and is only one-tenth of the NCRP recommended limit of 5 mSv per year for general population exposure.

Radiation levels outside the building are largely due to naturally occurring cosmic and terrestrial radiation. Differences between radiation measurements outside and inside buildings are not uncommon and can be attributed to natural radioactivity contained in building materials.[12] Differences within the building are likely to due to random variation in natural radiation levels and localized differences in the type and extent of building materials used, such as paints.

Based on the lack of evidence of medically significant exposures to chemical or physical agents, it is unlikely that the cases of cancer can be attributed to the environment of LeConte Hall. Current levels of chemical contamination and naturally occurring radiation do not pose a human health hazard.

VIII. REFERENCES

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IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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Copies of this report have been sent to:

1. University of Georgia, Public Safety Division
2. University of Georgia, Department of History
3. OSHA Region IV (Atlanta)
4. NIOSH

Copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

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