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Technical Topics:

Research on Adverse Health Effects Related to the Rocky Flats Plant

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Introduction

This paper summarizes past research on health effects in workers and members of the public who may have been exposed to toxic materials from the Rocky Flats Plant. The Colorado Department of Health reviewed these studies before designing the State of Colorado's dose reconstruction project that began in 1990. The planning of future health effects research or epidemiologic studies would benefit from a similar review.

Epidemiologic studies that have been conducted to assess the health effects of toxic substances at the Rocky Flats Plant can be grouped in two major categories: (1) those that focus on members of the public who lived near the plant and (2) those that assess health problems in plant workers.

Exposures to contaminants may be substantially different for workers than for members of the public. Finding elevated rates of disease in workers does not necessarily mean that there will be increased risk of disease in the public. Conversely, finding increased disease rates in the public does not necessarily mean that workers have increased risk for disease.

The following summaries provide limited detail about previous studies of Rocky Flats workers and the public. Complete references are listed at the end of this paper for those who wish to read the original study findings.

Meanings of Terms

Dose Reconstruction: Research and analysis of historical data and information regarding contaminant releases from a facility and calculation of doses, or amounts of contaminants received by an exposed population group. This information is used to assess the risks of potential health effects related to past exposure to contaminants.

Epidemiology: The study of specific health effects or diseases and their distribution in a population group; the determination of potential causes of the observed health effects.

Risk Assessment: A study process involving identification of a source of toxic substances, evaluation of conditions under which a population group could have been exposed, analysis of the toxicity of the specific substances and calculation of increased risks of adverse health effects related to the exposure.

Statistical Analysis: Collection, organization and interpretation of data and the application of mathematical techniques to identify trends or characteristics in a population or study sample group.

Technical Topics: This series of papers explains the research design, methods and terminology used in the State of Colorado's health studies related to the Rocky Flats Plant. For information about this ongoing research to identify past contaminant releases from the plant and assess potential health risks, call the Colorado Department of Health at (303) 692-2640 or 692-2652.



Studies of Workers

Epidemiologic Studies

Health risks to workers have been evaluated through two types of research – epidemiologic studies and disease surveillance programs. Epidemiologists at the Los Alamos National Laboratories have been conducting an epidemiologic study of cancer death rates (mortality) in Rocky Flats workers since the 1970s.

Gregg Wilkinson and fellow researchers at the Los Alamos National Laboratories studied white males employed at Rocky Flats for at least two years between 1956 and 1980 and analyzed records of cancer deaths for this group. They divided the work force into two groups based on the amount of plutonium measured in urine tests. In the group with higher plutonium concentrations in urine, they found higher rates of death from all causes (combining cancer and non-cancer deaths) and also found higher rates of certain types of cancer.

Wilkinson's study also divided workers into two groups based on cumulative external radiation dose as measured by the film badges they wore to measure radiation. The group with the higher doses had higher rates of certain types of cancer. The results from both comparisons suggested a possible relation between exposure and observed health effects but were not conclusive, which might be attributed to the small number of workers in the study.

In 1990, William Brandom and co-researchers published results from a limited study of chromosome abnormalities in 18 plutonium workers at Rocky Flats. They divided this group according to cumulative doses from plutonium and found more chromosome aberrations for those with high doses. They found no differences between groups classified by exposures to chemicals.

Health Surveillance

The U. S. Department of Energy (DOE) currently supports a number of health surveillance studies at the Rocky Flats Plant. These differ from epidemiologic studies in that they are designed to detect early evidence of health problems in workers and do not use statistical analysis to answer research questions.

The Health Tracking and Recall Physical Exam Program is a surveillance program for former Rocky Flats workers whose documented radiation exposures were high compared with those for the rest of the work force. Participants receive periodic physical exams and tests for radionuclides in their bodies.

In addition, the DOE conducts an industry-wide surveillance program for workers exposed to the toxic metal beryllium, which was used in weapons production at Rocky Flats and other DOE facilities. The program is designed to identify and locate all exposed workers and to provide periodic examinations for berylliosis, a chronic lung disease.

Current Rocky Flats workers are also included in the Hanford Health Surveillance Program, which is administered by the Hanford Environmental Health Foundation and the University of Washington. The program gathers data on workers who miss more than five consecutive days of work, change jobs, develop cancer or terminate their jobs for health reasons.

Rocky Flats workers can also volunteer to participate in the U.S. Transuranium and Uranium Registries, operated by Washington State University. The registry staff arranges to conduct

autopsies on deceased nuclear workers exposed to plutonium and other isotopes. The data from autopsy analyses are used to conduct research on the health effects of radioactive chemicals in the body.

Studies of the Public

In 1981, Carl Johnson used cancer diagnosis data for 1969-1971 from the National Cancer Institute's Third National Cancer Survey to examine the relation between cancer rates and exposures to plutonium. Plutonium exposures were based on analysis of a group of soil samples collected from the region around Rocky Flats in 1970. The Johnson study found increases in many cancer types for persons in exposed areas, as compared with those for unexposed areas.

A feasibility study for an epidemiologic study of persons who lived near the plant was reported by Nancy Dreyer and co-workers in 1982. They assumed exposure to plutonium began in 1967 and concluded that, based on the environmental data they analyzed, exposures were not high enough to be evaluated with statistical analyses in an epidemiologic study.

In 1982, John Cobb and co-workers measured plutonium concentrations in autopsy samples from more than 500 persons who died in Colorado. They compared those who lived near Rocky Flats with those who lived far from the plant, and found a weak relation between plutonium concentrations in autopsy samples and distance from Rocky Flats. However, these researchers concluded that the evidence was not strong enough to link the elevated concentrations to emissions from Rocky Flats.

In 1987, Kenneth Crump and others replicated the study design used by Carl Johnson and re-evaluated cancer diagnosis data for 1969-1971 and for 1979-1981. Although they confirmed Johnson's findings, they could draw no conclusions about an association between plutonium concentrations in the soil and cancer rates after considering distance from the Denver metropolitan area. They also found no increase in cancer rates for all cancers combined, for radiation-sensitive cancers, or for cancers of the respiratory system in the region within ten miles of Rocky Flats for both study periods.

In 1990, researchers at the National Cancer Institute completed a study of cancer incidence and mortality around 62 nuclear facilities in the United States. This study compared cancer rates in counties near nuclear facilities including the Rocky Flats Plant with those for counties farther away. The results from this study show slight elevations for some cancers in some age groups, but these data are hard to interpret because of limited information about other cancer-related factors.

The previous studies of public health effects have certain limitations. In most cases, information on smoking habits and other cancer-related factors (called "confounders") were not taken into account, and data on public exposures to Rocky Flats contaminants were limited.

What Have We Learned? What Else Can We Study?

Epidemiologic studies of the Rocky Flats work force suggest elevated risks for workers, but these results are not definitive. Epidemiologists from the Colorado Department of Health have concluded that additional analyses might clarify risks to workers. They are beginning a new study of cancer incidence and mortality in Rocky Flats workers in collaboration with scientists at the University of Colorado Health Sciences Center and the National Institute of Occupational Safety and Health, which is part of the Centers for Disease Control and Prevention.

This worker health study began in the fall of 1993, and will last for five or more years. Researchers will expand the scope of previous studies as well as the number of years for which cancer data will be analyzed. They will study cancer incidence and mortality and relate these data to estimates of radiation and chemical exposure to the workers.

As described previously, epidemiologic studies of persons who lived near the Rocky Flats Plant have yielded conflicting results, mainly because data on exposures to toxic materials from the plant were not sufficient and/or other cancer-related factors were not considered. It is not yet clear whether additional epidemiologic studies of the public would provide clarification. Epidemiologists face two major problems:

- 1) It is difficult to determine who has been exposed to toxic materials from the Rocky Flats Plant and to what extent they have been exposed, and
- 2) There may not be sufficient numbers of individuals with enough exposure to produce results with scientific validity.

In other words, if a new epidemiologic study of the public is conducted and the results show a relation between exposures from Rocky Flats and cancer, it will be difficult to exclude the possibility that exposures to toxic materials from other sources or risk factors such as smoking caused the cancer increase. Likewise, if no increased cancer risks related to Rocky Flats exposures are identified, scientists will not be able to exclude the possibility that health effects might have occurred, but were not reported or available for statistical analyses.

Data from the State of Colorado's dose reconstruction project will determine whether or not past exposures to Rocky Flats contaminants were sufficient to result in possible health effects. This information will help determine the feasibility of additional epidemiologic studies and identify the population groups most likely to have been exposed to past Rocky Flats releases of hazardous materials.

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