

FINAL REPORT

Evaluation of Environmental Data for Historical Public Exposures Studies on Rocky Flats

Task 4: Evaluation of Environmental Data

Revision 1

August 1999

*Submitted to the Colorado Department of Public Health
and Environment, Disease Control and Environmental
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"Setting the standard in environmental health"



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EXECUTIVE SUMMARY

The Rocky Flats Environmental Technology Site is owned by the U.S. Department of Energy (DOE) and is currently contractor-operated by Kaiser-Hill Company. For most of its history, the site was called the Rocky Flats Plant (RFP) and was operated by Dow Chemical Company as a nuclear weapons research, development, and production complex. The RFP is located on approximately 2650 ha (6500 acres) of federal property, within a few miles of the cities of Arvada, Westminster, and Broomfield, Colorado, and 26 km (16 mi) northwest of downtown Denver, Colorado.

The Rocky Flats Historical Public Exposures Studies were undertaken to help the Colorado Department of Public Health and Environment evaluate the doses and potential health impacts to the public resulting from contaminant releases from the site to the environment during its years of operation. Phase I of the study was performed by ChemRisk (a division of McLaren/Hart, Environmental Engineering). In Phase I, ChemRisk conducted an extensive investigation of past operations and releases from the RFP. *Radiological Assessments Corporation (RAC)* was awarded the contract to conduct Phase II of the study, an in-depth investigation of the potential doses and risks to the public from historical releases from Rocky Flats.

The purpose of this report is to communicate RAC's findings about historical environmental monitoring around Rocky Flats to the Health Advisory Panel (HAP) for the Rocky Flats Public Exposures Studies, DOE and contractor personnel, the public, and scientific communities, and other interested persons. This report also has served as a reference document for environmental information used in other tasks of Phase II. Because of the historical emphasis of this work, the scope of the report extends up to 1990. In most cases, monitoring data from the earliest decades of operation (1950s, 1960s, and 1970s) received the most attention.

The historical environmental data evaluated were primarily the results of monitoring of the levels of contaminants in various environmental media like air, soil, water, sediment, or vegetation. Monitoring was conducted routinely by the RFP contractor as well as by independent agencies such as the Colorado Department of Public Health, the Health and Safety Laboratory of the Atomic Energy Commission, the U.S. Public Health Service, the U.S. Geological Survey, and the U.S. Environmental Protection Agency. Short-term research projects were also performed by these agencies, as well as universities and other organizations. Sources of information for environmental data included personal contacts and document repositories (including computer databases), both on and off the RFP site.

The principal radionuclides of concern for historical exposure of the public near Rocky Flats were isotopes of plutonium, ^{239}Pu and ^{240}Pu , which emit alpha particles and have long half-lives (24,065 and 6537 years, respectively). Also, tritium, which emits beta particles and has a half life of about 12 years, was released accidentally from the RFP on several occasions. The principal nonradioactive chemical of concern was carbon tetrachloride. Possible exposures and risks from beryllium, another nonradioactive contaminant of concern, received further evaluation in Phase II. RAC's environmental data evaluation focused on these materials. Environmental monitoring data for carbon tetrachloride and beryllium in the environment were very limited relative to the radioactive contaminants.

Phases I and II of this study identified the primary sources of past plutonium releases from the RFP. The source that resulted in the largest environmental contamination near the site was the 903 Area, where waste oil containing plutonium leaked from the stored barrels and contaminated the soil. Contamination was subsequently transported by wind, especially following removal of

the barrels and disturbance of the ground surface. The highest releases to air occurred during 1968–1969. Two other important sources of plutonium releases from the RFP were a major fire in 1957 and resuspension of remaining contaminated soil in the 1970s. Tritium was released accidentally from the RFP on several occasions when tritium-contaminated scrap material was processed. The tritium release of most concern to the public was in April 1973 when tritium was released to Walnut Creek, which flowed into the Great Western Reservoir at that time. Environmental data collected during these key events were of greatest interest for our evaluation. Thus, the primary time period of interest for our evaluation of historical data was before 1975.

We developed a framework for evaluating the utility of environmental data, which guided the progress of the work. This framework was based on a logic-diagram that required answering questions about when and where the contaminant was monitored and whether there was a measurable influence of Rocky Flats releases on environmental concentrations of the contaminant. The framework not only identified which data sets were likely to be useful (or not), but also how they could benefit the historical public exposures studies.

For key time periods and data sets, we made a concerted effort to locate the most original data sources available, like sample counting sheets, analytical data sheets, sample logbooks, and laboratory procedures associated with the environmental measurements. We were not successful in locating all the original documentation for all types of samples and time periods of interest.

Considerations of data quality arose only for the monitoring data that were identified as likely to be useful to the study. Questionable data quality did not automatically mean the data set would be rejected. We generally addressed data quality issues by attempting to quantify bias and uncertainty in the measurements. Because the sources of information about past releases were limited, data sets were not discounted without careful consideration. This approach is in contrast to current characterization work for future risk assessments, in which strict data usability criteria are applied.

Around 1970, there was a major break point in the environmental monitoring data record for Rocky Flats. After a major plutonium fire in a Rocky Flats building in May 1969, the routine monitoring by the RFP contractor was expanded to include soil, more sampling locations for other media, and analyses for specific contaminants like plutonium in addition to total alpha activity. Monitoring programs by other agencies also were instituted or expanded after 1970. The unfortunate but understandable result for our work was that the best quality environmental data were not from the time period of greatest interest. There were very few environmental measurements to support the assessment of one of the most important historical releases of plutonium, a fire in September 1957. Fortunately, the data to evaluate another major source, the 903 Area, were more numerous. Measurements in many different environmental media illustrate the timing of those releases, with the largest amounts being released in 1968 and 1969. The data also show the spatial extent of contamination from the 903 Area.

To interpret historical measurements of plutonium and related radioactive materials, an understanding of all sources of plutonium in the environment is needed. Two main sources of plutonium in the environment around the RFP are (1) accidental and routine releases from Rocky Flats operations and (2) widely distributed plutonium from the atmospheric testing of nuclear weapons, referred to as global fallout. In contrast to the timing of RFP plutonium releases, global fallout of plutonium was highest in the early 1960s. Long-term monitoring of plutonium in air and deposition in Denver and other cities was used to quantify the magnitude and time trend of fallout plutonium. The fallout contribution was subtracted from measured concentrations that

were compared to predictions from Rocky Flats releases. The integrated concentration of fallout plutonium in air was also used as a basis for risk comparison for the exposure from Rocky Flats releases.

The environmental data are not complete enough, either spatially or temporally, to be used directly to calculate the concentrations to which members of the public were exposed. Soil, sediment, air, and vegetation data were used to compare to predicted concentrations from our estimated releases of plutonium. These validation results are presented in the risk assessment reports of Phase II. Other data were not used quantitatively. Taken together, however, the environmental data present a fairly coherent picture that supports our overall understanding of past events resulting in environmental contamination around Rocky Flats.

There are seven main chapters of this report; each evaluates the monitoring data for air, deposition, vegetation, surface and drinking water, sediment, soil, and biological/miscellaneous media. Appendices contain detailed tables and figures. In addition, Chapter II of the report is an overview of our conclusions about what the environmental data tell us about past releases from Rocky Flats.

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