

PREFACE

The *Environmental Report 2002* is prepared for the U.S. Department of Energy (DOE), as required by DOE Order 5400.1 and DOE Order 231.1, by the Environmental Protection Department at Lawrence Livermore National Laboratory (LLNL). The results of LLNL's environmental monitoring and compliance efforts and an assessment of the impact of LLNL operations on the public and the environment are presented in this publication.

To increase the readability and usefulness of this document for our diverse readers, which include regulators, scientists and engineers, educators, the media, public interest groups, and interested citizens, this report is divided into two volumes: the main volume and the Data Supplement. The main volume describes LLNL's environmental impact and compliance activities and features descriptive and explanatory text, summary data tables, and plots showing data trends. The summary data include measures of the central tendency of the data (i.e., mean and median), their spread or variability, and their extreme values. The main volume contains the Executive Summary, the Compliance Summary, and other summary information, but it primarily features individual chapters on monitoring of air, sewage, surface water, groundwater, soil and sediment, vegetation and foodstuff, environmental radiation, as well as chapters on the subjects of groundwater remediation, radiological dose assessment, and quality assurance. Information on both the Livermore site and Site 300 is presented in each chapter. The main volume contains the information of interest to most of our

readers. The Data Supplement provides individual data points, where applicable, some summary data, and more detailed accounts of sample collection and analytical methods.

The primary methods of distribution of the *Environmental Report 2002* are electronic. The document will be physically distributed by compact disc (CD), and accessible on the Internet at the LLNL SAER homepage: <http://www.llnl.gov/saer>. Both the main volume and data supplement volume of each individual report can be viewed in its most up-to-date form. Environmental reports covering calendar years 1994 through 2002, and corrections to them, can be accessed at this same Internet address.

In the *Environmental Report 2002*, we continue our practice, begun with the 1991 report, of using *Système International* units. This is consistent with the federal law stated in the Metric Conversion Action of 1975 (15 United States Code 205a et seq.) and Presidential Executive Order 12770, Metric Usage in Federal government programs (July 25, 1991). To ease the transition for the reader, parallel units are provided in the Executive Summary and the first chapter. For ease of comparison to the environmental reports issued prior to 1991, dose values and many radiological measurements are presented in both metric and U.S. customary units throughout the report. Finally, a conversion table is provided in the Glossary under the heading of "metric units."

This document is the responsibility of LLNL's Operations and Regulatory Affairs Division of the Environmental Protection Department. Monitoring data were obtained through the combined efforts of the Operations and Regulatory Affairs Division, Environmental Restoration Division, the Chemistry and Materials Science Environmental Services Laboratories, and the Hazards Control Department. Special recognition is deserved for the dedication and professionalism of the technicians who carried out environmental and effluent monitoring—Gary A. Bear, Karl Brunckhorst, David J. Castro, Steven Hall, David Macedo, Renee Needens, Terrance W. Poole, Donald G. Ramsey, Sterling Sawyer, and Robert Williams—and to the data management personnel—Kimberly A. Swanson, Beth Schad, Hildy Kiefer, Suzanne Chamberlain, Della Burruss, Susan Lambaren, Nancy Montez, and Lisa Graves. Marla Carpenter provided secretarial support and collated and distributed drafts.

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Chapter Summaries

The chapter summaries demonstrate the breadth of the environmental activities at LLNL. There are 14 chapters in this report: 3 chapters provide general information about the LLNL sites, regulatory activities, and the structure of environmental programs at LLNL; 10 chapters provide environmental monitoring measurements and analyses; and 1 chapter describes the quality assurance program

and quality control activities that ensure the validity of the data. Brief descriptions of the contents of each of the individual chapters are presented here.

Chapter 1, Site Overview, describes the physical setting of the two LLNL sites. The description includes information about the topography, geology, and meteorology of the sites and clearly states the differences between them despite their proximity.

Chapter 2, Compliance Summary, summarizes information about LLNL's substantial compliance activities, including compliance with the major federal, state, and local environmental initiatives. The major topics covered are the Clean Air Act, the Clean Water Act and related state programs, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) the Resource Conservation and Recovery Act (RCRA) and state and local hazardous waste regulations, the National Environmental Policy Act and the California Environmental Quality Act, the Endangered Species Act, the National Historic Preservation Act, and the Antiquities Act.

Chapter 3, Environmental Program Information, describes the organization of LLNL's Environmental Protection Department and its divisions, giving the responsibilities of each organization for compliance and monitoring. This chapter also describes LLNL's activities and progress in waste minimization and pollution prevention.

Chapter 4, Air Effluent Monitoring, summarizes the facilities that have continuous air monitoring for their operations, including a summary of the results of the monitoring data collected for the sources.

Chapter 5, Ambient Air Monitoring, describes the purpose of the air particulate and tritium ambient air monitoring programs and provides analyses of

the measurements taken in calendar year 2002. The chapter provides dose estimates from exposure to radiological materials in the ambient air.

Chapter 6, Sewerable Water Monitoring, describes the extensive real-time and routine sampling efforts undertaken to characterize the radiological and nonradiological materials in the sewer effluent leaving the LLNL Livermore site.

Chapter 7, Surface Water Monitoring, is a compendium of data from many types of surface water and allowed discharges to surface water, including storm water runoff, rainwater, drinking water, the Livermore site Drainage Retention Basin, and cooling tower water. Monitoring of discharges occurring during maintenance of Arroyo Las Positas is also discussed.

Chapter 8, Groundwater Investigation and Remediation, summarizes CERCLA activities undertaken at the Livermore site and Site 300 during calendar year 2002. It contains many maps delineating the extent of contaminant transport in groundwater.

Chapter 9, Groundwater Monitoring, contains information about monitoring undertaken to confirm that no new additional sources of contamination of groundwater exist, and to demonstrate compliance with RCRA-permitted closure of disposal areas at Site 300.

Chapter 10, Soil and Sediment Monitoring, provides the data collected in the annual soils monitoring program, including plots of historic medians for contaminants of interest, such as plutonium and uranium.

Chapter 11, Vegetation and Foodstuff Monitoring, summarizes the data collected in the quarterly vegetation sampling and the annual sampling of local wines for tritium. The chapter provides dose estimates, including estimates for organically bound tritium, for exposures to vegetation and wine produced in the vicinity of LLNL.

Chapter 12, Environmental Radiation Monitoring, describes the direct environmental radiation measurements obtained for the Livermore site and Site 300. The measurement method and results are explained.

Chapter 13, Radiological Dose Assessment, discusses sources of potential emissions of radionuclides, principal public receptors, and dose modeling assumptions. The chapter presents the dose impacts of operations conducted in 2002. It also includes an intercomparison of modeled and monitored concentrations

Chapter 14, Quality Assurance, describes the extensive quality assurance program and quality control efforts that LLNL undertakes each year to ensure that samples are collected and handled properly. It also describes how data are reported and summarized in this report.