

## **Executive Summary**

Nuclear-related activities have been continuous in Los Alamos County (LAC) since the development of Los Alamos National Laboratory (LANL) in 1943. These activities result in emissions of radionuclides into the air, discharges of radioactive liquids into canyon systems and disposal of radioactive waste in canyons and on mesa tops above the Rio Grande. Prior to the passage of stricter environmental laws in the early 1970s, less stringent approaches to and enforcement of radioactive emissions, waste disposal and monitoring of employee exposures characterized LANL's early operations. The extent to which LAC residents and LANL employees have been exposed to ionizing radiation beyond background levels remains unclear.

LANL was the first site to develop atomic weapons. Yet a complete dose reconstruction study has not been conducted at LANL. In fact, it is the last major Department of Energy (DOE) site scheduled to undergo a dose reconstruction. A dose reconstruction is a study that estimates the amount of radioactivity and chemicals to which an individual may have been exposed based on the amounts of radioactivity and chemicals released by a facility.

Workers at other DOE sites have utilized these dose reconstruction studies to support their claims under the Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA). To their detriment, LANL retirees and workers do not have a dose reconstruction to rely on for their EEOICPA claims.

In early 1999, the National Center for Environmental Health of the Centers for Disease Control and Prevention (CDC) began the first phase of a possible five-phase project to determine historical radionuclide and chemical releases from LANL. The project is called the Los Alamos Historical Document Retrieval and Assessment Project (LAHDRA). However, security and access has been constrained due to the May 2000 Cerro Grande Fire, the Wen Ho Lee and missing property investigations and the events of September 11<sup>th</sup>. LANL has heightened security and imposed greater limits on access to information, thereby severely hampering the CDC's work.

Despite these obstacles, the CDC's work has been very fruitful. They have found that the soil surrounding LANL may contain as much as 100 times more plutonium than was previously estimated. Furthermore, they have uncovered documents indicating plutonium levels found in autopsies of LAC residents who never worked at LANL are higher than regional background levels.

In July 2003, CDC instructed its contractors to conclude the first half of the first phase of the LAHDRA. It is uncertain if or when the project will continue. If the LAHDRA ends, LAC

residents, LANL retirees and employees and those living in surrounding communities will never know the levels of radiation and chemicals to which they have been exposed.

Concerned Citizens for Nuclear Safety (CCNS) contracted with Bernd Franke, Catherine M. Richards, M.S., Steve Wing, Ph.D., and David Richardson, Ph.D. to investigate the following public health issues concerning LANL emissions:

- Historical and current emissions of radioactive materials from LANL operations into the air;
- Incidence and mortality rates for LAC residents for 24 types of cancer compared with state and national reference populations; and
- Occupational health studies of LANL employees exposed to radionuclides.

These studies focus on localized impacts at LANL and in LAC. LANL employees and LAC residents may receive the highest dose of radiation because of their proximity to the facility. Therefore, exposure of LANL employees and LAC residents may serve as an indicator of impacts to those living in the surrounding communities.

CCNS advocates preventing harm before it can happen. These reports serve as an early warning of harm to the public health and environment due to LANL operations. For example, as in dose reconstruction studies at other DOE sites, the source term estimate has been revised upwards. At LANL, the source term estimate has been doubled. Furthermore, there is increased incidence and mortality for certain cancers in LAC and the uncertainties and discriminatory nature associated with the existing LANL occupational health studies prevents full analyses of exposures. Therefore, CCNS believes that the LAHDRA project must continue in order that we may understand the source of the harm from LANL operations so that further harm may be prevented.

Based on the findings, conclusions and recommendations presented in these reports, CCNS strongly recommends that the CDC continue its LAHDRA work uninterrupted. We also strongly recommend that vulnerable populations, including children and the elderly, be included in the dose reconstruction. New Mexicans have the right to know the levels of radionuclides and chemicals to which they may have been exposed due to LANL operations. The LAHDRA and subsequent dose reconstruction project provide a vehicle for that knowledge and must continue uninterrupted.

This Executive Summary presents the findings, conclusions and recommendations resulting from these reviews and investigations.

**I: A Review of Historical and Current Emissions of Radioactive Materials from LANL, by Bernd Franke, Scientific Director, ifeu - Institut für Energie und Umweltforschung, Heidelberg, Germany**

Franke's investigation into historical and current emissions of radioactive materials resulting from LANL operations addresses many questions of public concern which include:

- How does currently available data on historical emissions from LANL compare with results from other DOE facilities?
- Is it reasonable to require a dose reconstruction of historical releases and an examination of subsequent health impacts?
- What conclusions can be drawn from the limited data on historical environmental monitoring?
- What issues with respect to current emissions of radioactive materials are still unresolved?

In responding to the first question, Franke utilizes data found in the February 2002 LAHDRA draft summary emissions report. Findings of the LAHDRA report include:

- The current release estimates for plutonium isotopes of 3.4 curies (Ci) are more than twice those previously estimated.
- The LANL historical plutonium emissions into the air of 3.4 Ci is about 20 times the amount of plutonium that was deposited onto the LANL site from atmospheric nuclear weapons tests, based on current estimates.
- Comparing the current LANL plutonium emission estimates with those of other DOE sites with dose reconstruction studies, the plutonium source term for LANL (3.4 Ci) is about twice that of releases from the Hanford site (1.78 Ci) and about seven times less than Rocky Flats releases (24.2 Ci).
- Comparing distances from the DOE facilities to homes and businesses, the LANL property is closer (< 1 mile) than either Hanford (15 miles) or Rocky Flats (5 miles).

In response to whether the requirement for a dose reconstruction study is reasonable, Franke demonstrates that an in-depth dose reconstruction is indeed necessary. LANL presents unique circumstances related to the lack of a final source term estimate; the existing estimate is 20 times the amount of plutonium fallout found on LANL property; and the proximity of residences and businesses to LANL facilities means that exposure is more immediate. Given that other radionuclides and toxic substances were released from LANL, there are significant uncertainties in estimating releases and subsequent exposures due to site-specific circumstances. Therefore, an in-depth dose reconstruction for LANL should be done.

Regarding the limited environmental monitoring data, Franke examines the ambient air monitoring data from the year 1972. While LANL's reported concentrations of plutonium-239/240 at most monitored on-site and off-site locations are in the expected range, the same cannot be said for the reported concentrations of plutonium-238. These exceed the expected concentrations at all locations by a factor between four and 20. The issue of plutonium-238 concentrations in ambient air at LANL is puzzling. A careful review of the quality of the air monitoring data for 1972, as well as for other years, is clearly warranted.

In response to the last question regarding current emissions, Franke generally agrees that in the year 2001, the radiation doses resulting from LANL operations were below the 10 millirem/year (mrem/yr) limit established by the Clean Air Act (CAA) 40 CFR 61, Subpart H regulation. Nevertheless, LANL was in substantive breach of its compliance obligations because of the lack of quality assurance of the data on radionuclide usage supplied by the facilities to the Meteorology and Air Quality Group.

In addition, Franke believes that one of the major problems with the Subpart H compliance definition is that the compliance limit of 10 mrem/yr effective dose equivalent only applies to a fixed location, such as a residence, school, business or office. There are many point sources in proximity to public access roads that allow travel by members of the public (sometimes called "transient receptors") to closely approach point sources, raising issues about whether these exposed receptors are covered by the compliance definition.

Many releases of radionuclide emissions are short-term and discontinuous. Short-term releases can also be expected from some of the unmonitored point sources, such as waste sites or during transportation of radioactive materials. Inhaling as few as 7.5 microcuries of plutonium would result in a dose that would be deemed noncompliant with the CAA regulations. It is uncertain whether LANL's ambient air monitoring system, AIRNET, is sensitive enough to detect such releases under certain conditions.

Franke concludes:

- The LANL historical plutonium emissions into the air of 3.4 Ci is about 20 times the amount of plutonium that was deposited onto the LANL site from atmospheric nuclear weapons tests, based on current estimates.
- The reported concentration of plutonium-238 in air in the vicinity of LANL in the year 1972 was between a factor four and 20 times higher than expected from other sources.
- The current information on historical emissions warrants a careful reconstruction of doses to members of the public, as well as an evaluation of the associated health risks.
- Visitors to the LANL site could receive an effective dose in excess of 10 mrem/yr from plutonium emissions under unfavourable circumstances (e.g., short-term emissions),

even though the emissions would be reported to be in formal compliance with 40 CFR 61, Subpart H of the CAA.

- The ability of LANL's ambient air monitoring system, AIRNET, to detect releases from unmonitored point or diffuse sources, such as waste sites, needs to be carefully analyzed.

## **II: An Investigation of Cancer Incidence and Mortality Rates in Los Alamos County and New Mexico 1970 – 1996, by Catherine M. Richards, M.S.**

This investigation is in response to community concerns about occurrences of specific types of cancer in LAC. Richards compared LAC cancer incidence and mortality rates to New Mexico cancer incidence and mortality rates, for all races, using data from the New Mexico Tumor Registry for the 27-year time period of 1970 through 1996.

The specific aims developed for this study were to:

- Compare LAC cancer incidence rates to incidence rates calculated for a New Mexico state reference population, for all races.
- Compare LAC cancer mortality rates to mortality rates for a New Mexico state reference population, for all races.
- Determine whether any of the LAC cancer incidence and mortality rates were significantly elevated in comparison to rates observed for the New Mexico state reference population.
- Begin to assess whether any of the significantly elevated cancer rates could be attributed to ionizing radiation exposures.
- Review existing literature on ionizing radiation exposure and health risks.

The incidence rates for 24 major types of cancers were investigated. Of these 24 types of cancers, seven were significantly elevated in LAC and include: breast, melanoma, non-Hodgkin's lymphoma, ovary, prostate, testicular (significant at the 90% confidence interval) and thyroid cancers. In addition to these seven cancers, the 1993 NMDOH report also found a moderate increased incidence rate for cancer of the brain and nervous system during the mid to late-1980s. All seven of the cancers mentioned above are cancers for which claims may be filed under the EEOICPA.

Of the seven cancers, breast, melanoma, ovarian, testicular and thyroid cancers were also elevated in LAC when compared with the U.S. Surveillance, Epidemiology, and End Results Program (U.S. SEER) site data for the time period of 1991 – 1995.

Based on a review of mortality data, compiled for 24 major types of cancer, cancer mortality rates that were significantly elevated in LAC when compared to the state reference population rates include breast cancer. When comparing the LAC mortality rate for breast cancer with that of the U.S. SEER sites for the time period 1991 – 1995, the LAC mortality rate was also elevated. Additionally, LAC mortality rates for melanoma and ovarian cancers were also elevated when compared with the U.S. SEER sites.

Significant elevations in cancer for LAC residents were determined by calculating the upper and lower confidence limits for each LAC rate at the 95% and 90% confidence intervals. If the lower confidence limit for a given LAC rate was greater than the New Mexico comparison rate, the elevation was considered significant. This methodology is the same as that used by the New Mexico Department of Health (NMDOH) in their report entitled *Los Alamos Cancer Rate Study Phase I: Cancer Incidence in Los Alamos County, 1970 – 1990*.

Study limitations include the small number of observations, population mobility, difficulty in establishing cause and effect relationships and socioeconomic status and ethnicity of LAC and New Mexico. However, this study serves as a tool that can be utilized for further analysis of cancer incidence and mortality in LAC.

Richards recommends:

- Reviewing cancer registry data to investigate the increases in LAC incidence rates, compared to the New Mexico state reference population, for cancers of the female breast (50% increase), melanoma (125%), non-Hodgkin's lymphoma (48%), ovary (45%), prostate (49%), testicular (82%) and thyroid (106%).
- Reviewing cancer registry data to investigate the elevated LAC mortality rates for breast (41%), melanoma (63%) and ovarian (27%) cancers when compared with the New Mexico state reference population and the U.S. population.
- Reviewing spatial and temporal trends of cancer rates by neighborhood unit and examining the proximity of cancer cases to pollution sources.
- Conducting case reviews to establish residential history, occupational history, family disease history, other behavioral risk factors and cancer etiology.
- Conducting dose reconstruction studies by accessing LANL documents to determine potential exposures for the community of LAC.

**III: A Review of Occupational Health Studies at Los Alamos National Laboratory,  
by Steve Wing, Ph.D., and David Richardson, Ph.D., with the Department of  
Epidemiology, School of Public Health, University of North Carolina**

Wing and Richardson provide a critical review of occupational health studies conducted at LANL. In the review, the authors discuss the weaknesses and strengths of the studies and their capacity to address health concerns of workers and the public. They consider which employees have been included or excluded from the occupational health studies. Building on this evaluation, the authors summarize the results of LANL worker studies. Next, they interpret the LANL studies in the context of studies of workers at other nuclear facilities and other types of research into the biological effects of ionizing radiation. They conclude with a discussion of the meaning of the studies for people with health concerns and make suggestions for protection of occupational and public health.

LANL has conducted three types of occupational health studies, which are exposure, medical follow-up, and epidemiological studies. The authors describe how workers may be exposed in the industrial setting; how internal and external exposure to radiation is measured, including autopsy studies of DOE workers; and how dose reconstructions may provide quantitative estimates of exposure. One medical follow-up study of LANL workers began in 1952. The significance of such studies is unclear because of the uncertainties associated with initial exposures, choice of workers, lack of a comparison group and the low statistical power for studies of diseases of interest, such as malignancies or genetic effects. Cohort and case control epidemiological studies have been conducted at LANL.

Cohort studies identify workers from a roster of employees and follow them through time to evaluate mortality or cancer incidence using vital records or tumor registry data. However, employed persons must be healthy enough to work and receive regular income, medical insurance and other benefits. As a result, they have generally lower disease rates that may increase through exposure to occupational hazards. Their disease rates are lower than the general population, which includes people who are too ill to work and lack the benefits of regular employment, in spite of their exposures. This phenomenon is sometimes called the "healthy worker effect." Cohort studies can also be used to conduct analyses of trends in disease rates with increasing occupation exposure, sometimes called dose response studies. A case control study evaluates a specific disease in relation to exposures of interest by choosing two groups of workers, one group of disease-free controls and the other of sick workers.

Wing and Richardson found that only employees of primary contractors have been included in occupational health studies at LANL. They have included only employees of the manager and operator of LANL, the University of California (UC), and the maintenance, construction and

support service workers, which are referred to as the “Zia employees.” Health studies have not been conducted of employees of other contractors or subcontractors. Furthermore, most of the occupational health studies at LANL have been limited to white Anglo UC employees. Studies of the Zia workforce, which include many Hispanics and Native Americans, have been much less complete than for the UC workforce. In one study, personnel records were available for 97% of the UC workers, but only 20% of the Zia workers, and urinalysis records were available for 39% of the UC workers, but only four percent of the Zia workers.

All types of occupational health studies have limitations in design and implementation. Exposure measurements for LANL workers are limited primarily to radiation hazards. In the case of internally deposited radionuclides, estimates of body burdens and internal doses are highly uncertain and do not take into account individual differences in metabolism and retention of radionuclides. Some of the studies lack adequate follow-up to detect diseases with long latency periods. Despite serious measurement problems and a lack of exposure data for many workers and time periods, excesses of certain cancers and dose response relationships for others have been observed among workers at LANL and other DOE facilities.

Wing and Richardson recommend that given the uncertainties associated with exposures and diseases, it is important that occupational and environmental exposures to hazardous agents be minimized and that workers and the general public be involved in decisionmaking about exposure standards and health related research.