RAC Report No. 5-NMED-2002-FINAL

SUMMARY REPORT

Analysis of Exposure and Risks to the Public from Radionuclides and Chemicals Released by the Cerro Grande Fire at Los Alamos

June 12, 2002

Submitted to the New Mexico Environment Department
in Partial Fulfillment of Contract No. 01 667 5500 0001

"Setting the standard in environmental health"

Risk Assessment Corporation
417 Till Road, Neeses, SC 29107
Phone 803.536.4883 Fax 803.534.1995

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Contributing Authors

S. Shawn Mohler, Independent Consultant
Jill W. Aanenson, Scientific Consulting, Inc.
Helen A. Grogan, Cascade Scientific, Inc.
Lesley Hay Wilson, Ph.D., Sage Risk Solutions LLC
Patricia D. McGavran, Environmental Risk Assessment, Inc.
Kathleen R. Meyer, Ph.D., Keystone Scientific, Inc.
H. Justin Mohler, Bridger Scientific, Inc.
James R. Rocco, Sage Risk Solutions LLC
Arthur S. Rood, K-Spar, Inc.

Principal Investigator
John E. Till, Ph.D., ***Risk Assessment Corporation***

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CONTENTS

FIGURES

TABLES

INTRODUCTION

The Cerro Grande Fire burned about 45,000 acres (~180 km^2) in northern New Mexico in May 2000. It originated in the Bandelier National Monument on the evening of May 4, 2000, and spread east-northeast over the next 16 days consuming residential structures within the County of Los Alamos. The fire burned approximately 7500 acres (~30 km^2) within the Los Alamos National Laboratory (LANL) boundary, causing significant damage to structures and property on LANL land. Some of the areas that burned were known or suspected to be contaminated with radionuclides and chemicals.

At the request of the New Mexico Environment Department (NMED), the U.S. Department of Energy (DOE) provided funds for an independent study of public health risks from radionuclides and chemicals associated with the LANL facility released as a result of the fire. The NMED contracted with *Risk Assessment Corporation (RAC)* to estimate the potential increased health risk to people in the communities of northern New Mexico from these radionuclides and chemicals.

A team of national and international scientists, led by scientists from Colorado State University, conducted technical peer review of the work. The NMED provided opportunities for public input throughout the 18-month study period. In addition, *Risk Assessment Corporation* held three public meetings during the project to answer questions and talk about study findings.

This report summarizes information provided in more detail in the following final reports. For additional information regarding the study or the final reports, contact the NMED DOE Oversight Bureau in Santa Fe, New Mexico. The final reports, listed here, can be obtained from the NMED website (www.nmenv.state.nm.us/DOE_Oversight/RAC.htm).

- *Task 1.7: Estimated Risks from Releases to Air* (Rood et al. 2002)
- *Task 2.7: Estimated Risks from Releases to Surface Water* (Rocco et al. 2002)
- *Task 3: Calculating and Communicating Risks: Observations and Recommendations* (Mohler et al. 2002)

Overview of Study Results

The following sections provide a brief overview of the key results from each of the three tasks involved in the study.

Estimated Risks from Releases to Air

Our analysis indicated that exposure to LANL-derived chemicals and radionuclides released to the air during the Cerro Grande Fire did not result in a significant increase in health risk over the risk from the fire itself. The risk of cancer from exposure to radionuclides and carcinogenic (cancer-causing) metals in and on vegetation that burned was greater than that from radionuclides and chemicals released from contaminated sites at LANL. All cancer risks were below the U.S. Environmental Protection Agency (EPA) range of acceptable risks of 10^{-6} to 10^{-4} (1 to 100 chances in 1 million) (EPA 1991). Potential intakes of noncarcinogenic LANL-derived chemicals exceeded acceptable intakes established by the U.S.

The cancer incidence risk from breathing any LANL-derived chemical or radionuclide released to the air during the fire was less than 1 chance in 1 million.

EPA at some locations on LANL property. However, the estimated intakes are conservative and likely overestimate the actual risks that occurred. It is likely that the risks from exposure to particulate matter far outweigh the risks from LANL-derived radionuclides and chemicals and those released from natural vegetation during the fire.

While the modeling we developed is quite reliable, the estimates of the quantities of materials available for release to the air, the rate at which these materials were released to the air, and the risk associated with short-term exposure to some chemicals are less certain. Therefore, we made conservative (or cautious) assumptions to ensure we did not underestimate the risks.

Estimated Risks from Releases to Surface Water

Cancer risks from exposure to LANL-derived radionuclides and carcinogenic chemicals released to surface water as a result of the Cerro Grande Fire were within acceptable limits established by the U.S. EPA. Estimated intakes of noncarcinogenic LANL-derived chemicals were also less than acceptable limits established by the U.S. EPA. Of the *exposure scenarios* we considered, the estimated health risks were highest for the hypothetical resident living year round on the bank of the Rio Grande near the confluence of Water Canyon. The most important type of exposure in terms of risk was eating fish.

Exposure scenarios describe the lifestyle and activities of hypothetical people to estimate likely ranges of exposure and risks to them from radionuclides and chemicals.

Aside from an understanding of maximum potential risks, an important contribution from this work is the ability to look at the impact of individual contaminated areas of LANL, known as potential release sites, or other source areas on potential exposures. An individual potential release site can have a significant impact on the concentrations at a point of exposure, and there is a need for further and continuing investigations into the magnitude and extent of chemicals and radionuclides at the potential release sites. In addition, concentrations of chemicals and radionuclides in stream segments and reaches below the LANL facility can have a significant impact at the point of exposure, and thus there is also a need to characterize additional stream segments and reaches.

Calculating and Communicating Risks: Observations and Recommendations

We provided specific recommendations and observations to help agencies involved in the activities during and after the Cerro Grande Fire to improve the ability to calculate and communicate risks in the future. The recommendations were based in large part on our experiences during this project, focusing on general issues that impacted our ability to estimate potential risks or that appear to have affected the credibility of information provided to the public about risks during and following the fire. Our recommendations were intended to help understand and communicate potential risks to the public in the most effective, efficient, and defensible manner possible. The key to successfully implementing these recommendations will be to involve all stakeholders in developing and adopting new procedures for the future.

STUDY OBJECTIVES

The primary goal of the study was to analyze the immediate and longer-term impacts of the Cerro Grande Fire in terms of increased public exposures and potential risks from radionuclides and chemicals associated with the LANL facility that were released to air and surface water as a result of the fire. The study did not specifically address the risks associated with the burning of buildings and home sites in Los Alamos or the impact of the fire on groundwater in the future.

Our three major objectives were to

1. Estimate the increased exposure and associated risks to the public, emergency response personnel, and firefighters from transport of LANL-derived radionuclides and chemicals released as a result of the fire through the ***air pathway***. We also performed a preliminary evaluation of risks from naturally occurring radionuclides and metals released from burning of the forests around the LANL site.

Pathways are routes that radionuclides and chemicals can travel from the location of a release to human populations, such as through air or water.

2. Estimate the increased exposure and associated risks to the public from transport of LANL-derived radionuclides and chemicals released as a result of the fire through ***surface water pathways***. We also evaluated risks related to ash from burned areas around the LANL site.
3. Recommend steps that could be taken to improve communication of risks to the public for future emergency situations, based on the conclusions of our study, and recommendations for similar events in the future. An important goal of the study was to openly and accurately convey information about risks from the fire to the public, including the lessons learned regarding calculating and communicating risk.

STUDY AREAS

Before making any calculations, we first established the geographical areas of study for the air and surface water pathways (See Figure 1). The total extent of the study area for the air pathway was 37 × 35 mi (60 × 55 km). It encompassed approximately 815,000 acres (3300 km^2), and it included the cities of Santa Fe and Española, as well as Cochiti Lake. We also investigated potential exposures through the air pathway at locations outside the study area (such as Taos). Exposures at locations outside the study area were less than the maximum exposures calculated within the study area.

The surface water pathway study area encompassed approximately 182,000 acres (738 km^2). In relation to the LANL facility, the study area extended to the west to include the upper Pajarito Plateau watersheds for the canyons that cross the LANL facility, to the north to include the extent of the burned area in Santa Clara Canyon, to the east to include the Rio Grande, and to the south along the Rio Grande and downstream of Cochiti Dam.

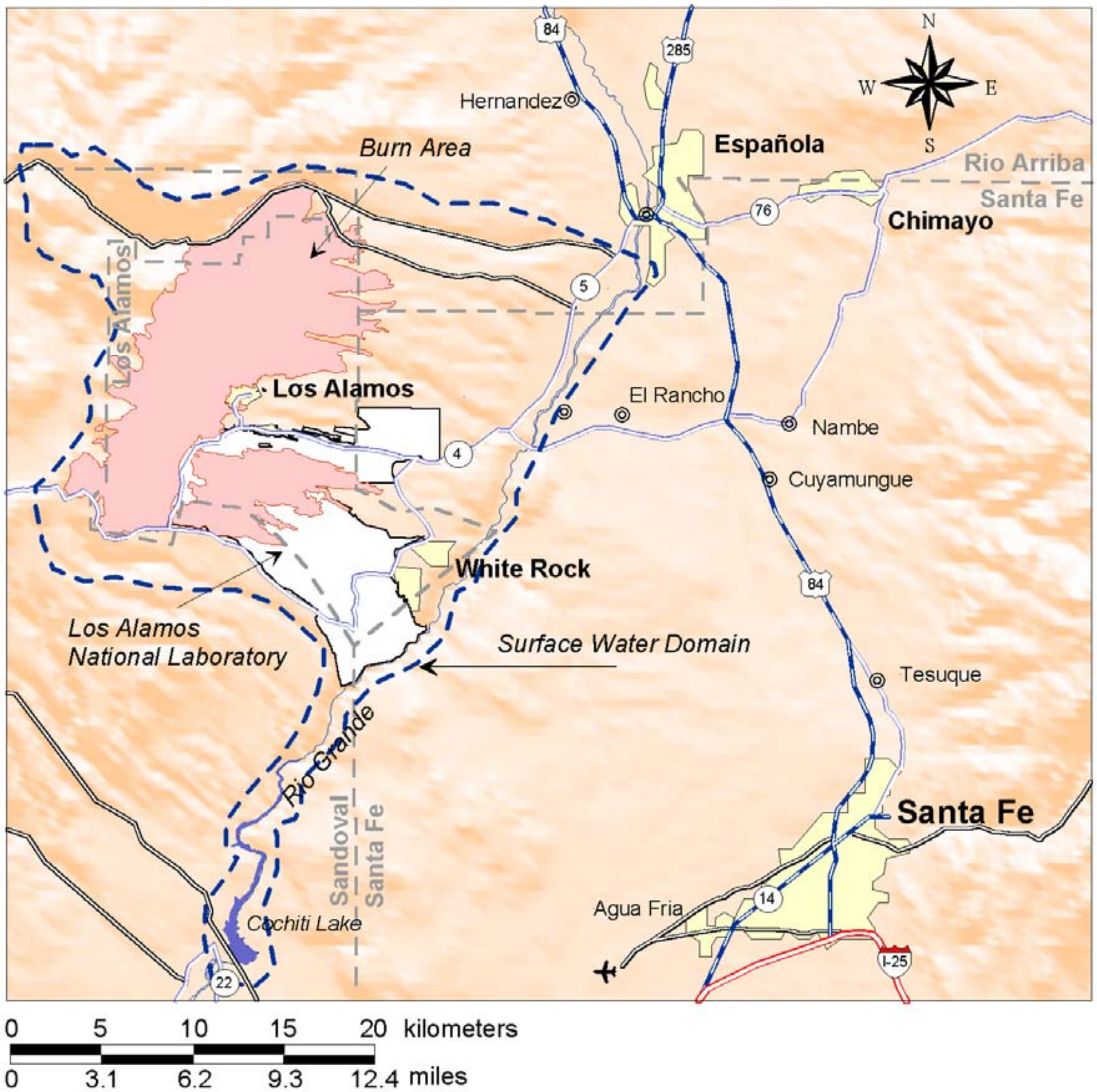

Figure 1. Study areas for analysis of releases to air and surface water from the Cerro Grande Fire. The total area shown was studied for the air pathway. The surface water study area (outlined in blue) was smaller and was restricted to watersheds that were impacted by the fire and the Rio Grande downstream to Cochiti Lake.

ESTIMATED RISKS FROM RELEASES TO AIR

Our primary focus for the air pathway was the analysis of radionuclides and chemicals derived from LANL operations that may have been released during the Cerro Grande Fire while the fire actively burned on LANL property. A secondary objective was to estimate the release of radionuclides and chemicals from the burning of natural vegetation both on and off LANL property. The sources of radionuclides and chemicals on natural vegetation included naturally occurring radionuclides and metals and worldwide fallout of radionuclides from atmospheric testing of nuclear weapons. Some radionuclides on natural vegetation are also attributed to the presence of LANL. To calculate the potential risks associated with these releases, we

- Evaluated the available air monitoring data and procedures
- Identified the sources and amounts of LANL-derived chemical and radionuclide on LANL lands that burned during the fire
- Estimated amounts of radionuclides and chemicals on all vegetation that burned during the Cerro Grande Fire
- Used computer modeling to estimate the release and transport of chemicals and radionuclides carried in the fire plume
- Identified representative individuals for defining exposure scenarios
- Estimated the resulting health risks and the associated uncertainties.

Available Monitoring Data

The data available to assess the concentrations of radionuclides and chemicals in the air during the Cerro Grande Fire included air and soil samples collected before, during, and after the fire; soil characterization data for contaminated sites at LANL that burned during the fire; meteorological data; and data for airborne contaminants measured in other fires.

When we started the project, we anticipated that the environmental air monitoring data would be complete enough to allow us to estimate *source terms* based on the measured concentrations in air combined with computer models that estimate how contaminants move in air. We believed these source terms would provide the basis to calculate the risks from the fire. However, the air monitoring data could not be used directly because not enough different locations were monitored, only a limited number of chemicals and radionuclides were measured, and the documentation for some of the data was incomplete. In addition, most of the concentrations measured were below the detection limits of the laboratory equipment used to analyze the samples.

A source term is the quantity of a chemical or radionuclide released from an area or event to an environmental media (air, water, or soil) over a certain period of time.

Screening and Source Term Calculation

Because the environmental monitoring data were less useful than originally anticipated, we used soil characterization data for potential release sites at LANL that burned during the fire as our main source of information available on radionuclides and chemicals that may have been released. We identified a large number of radionuclides and chemicals that were potentially

Risk estimates describe the probability that individuals exposed to a chemical or radionuclide will develop an adverse reaction, such as cancer.
The range of acceptable risks defined by the U.S. Environmental Protection Agency is from 1 to 100 chances in 1 million.

released during the fire, so we used a screening procedure to identify those that were most important in terms of health risk.

We developed conservative release estimates for the radionuclides and chemicals that were possibly released from LANL operations by using cautious assumptions to ensure that we did not underestimate risks. We then calculated cancer incidence *risk estimates* for radionuclides and carcinogenic chemicals and *hazard quotients* for noncarcinogenic chemicals. We removed contaminants from consideration that had a cancer incidence screening risk estimate of less than 1 chance in 100,000 or a screening hazard quotient of less than 1.

A hazard quotient is the ratio of the average daily intake of a contaminant per unit body weight to an acceptable reference value, established by the EPA.
A hazard quotient less than 1 indicates no adverse health effects.

Then, for these most important radionuclides and chemicals, we calculated source terms using available information on the quantities present at the contaminated sites and how they may have been released to the air during the Cerro Grande Fire. We used these source terms to estimate air concentrations.

Atmospheric Transport and Air Concentration Calculation

Calculating transport of radionuclides and chemicals released into the air during burning of the potential release sites first required an understanding of the behavior of the fire itself. During forest fires, combustion products in the form of particulate matter are emitted in large quantities. We used computer models to estimate the movement of combustion products common to all wildfires in the study area. Particulate matter less than 10 micrometers (*PM10)* was measured in air at a number of locations in the model domain. PM10 concentrations in air are commonly monitored, as this small particulate matter can be inhaled and cause adverse health effects. We compared the computer model-estimated concentrations of PM10 with the measured concentrations to confirm the computer model estimates and to better understand the uncertainty associated with the results.

PM10 is particulate matter less than 10 microns in diameter (roughly 1/2500th of an inch), and it is produced by all wildfires.

The process of calibrating the model to PM10 measurements involved (1) identifying the geographical area that was burned, (2) defining the time history of the fire, (3) estimating the amount of vegetation that burned, (4) estimating the amount of PM10 released by the burning vegetation and the heat generated during burning, and (5) modeling the transport in air of PM10 released by the fire. We accounted for contributions of PM10 from sources other than the fire in the calibration.

We then assumed the release and transport of radionuclides and chemicals from LANL sources to be proportional to the release and transport of PM10. The dispersion of PM10, therefore, served to trace or track particulate releases of radionuclides and chemicals. For volatile chemicals (chemicals that vaporize easily), carbon monoxide, which is also a forest fire combustion product, was used as a tracer.

We then calculated concentrations of radionuclides and chemicals identified as important through the screening process. In general, most predicted air concentrations were low. However, the predicted air concentrations and deposition amounts for the explosive compounds RDX, HMX, DNB, and TNT were relatively high. After the fire, however, explosive compounds were not detected in the limited soil sampling performed. The predicted deposition of these compounds would have been easily detected in soil, and this suggested that we overestimated the source terms for these compounds because of the cautious assumptions we made in our calculations.

Risk Estimates

We used four exposure scenarios to determine the risks to representative individuals from the LANL-derived radionuclides and chemicals released to the air during the fire; a resident adult, a firefighter, an emergency response worker, and a resident child. For each scenario we calculated cancer risk for radionuclides and carcinogenic chemicals, and hazard quotients for noncarcinogenic chemicals. We used the model-estimated concentrations at eight representative exposure locations, as well as the maximum predicted concentration in the study area. We calculated risks from naturally occurring radionuclides and chemicals on vegetation that burned during the Cerro Grande Fire for the adult resident scenario only. These risks would be associated with any forest fire and are not specific to LANL.

For LANL-derived chemicals and radionuclides, the maximum risk occurred within the active burned area and on LANL property. The maximum total *cancer incidence risk* from breathing any LANL-derived radionuclide released to the air during the fire was less than 1 chance in 10 million. In comparison, cancer incidence risks from breathing radionuclides released to the air from natural vegetation during the fire were estimated to be approximately 1 chance in 1 million. Cancer incidence risks from LANL-derived chemicals released during the fire were generally less than 1 chance in 1 million. The explosive compound RDX was a major contributor to this risk estimate, and we believe we overestimated the source term and risk for this compound. Cancer incidence risks from metals detected in natural vegetation and released during the fire were also approximately 1 chance in 1 million.

The total hazard quotient used to assess non-cancer health effects was generally less than or equal to 0.1 throughout the model domain for LANL-derived chemicals. Near areas where the fire burned, however, hazard quotients exceeded 1.0 and reached a maximum value of 2.0 for the resident adult scenario. This excursion above the acceptable level of 1 was limited to a small area within the LANL site near its western boundary. Most of the non-cancer risk was associated with the explosive compounds RDX, HMX, DNB, and TNT. As stated previously, we believe we overestimated the source terms for these compounds.

Hazard quotients indicated that intakes of LANL-derived noncarcinogenic chemicals released during the fire exceeding acceptable levels were limited to a small area of the LANL site.

A reference dose is an estimate of a daily exposure to the human population (including sensitive groups such as children) that is likely to be without a significant risk of negative health effects.

Hazard quotients for metals released during the fire from natural vegetation were less than 1.0 except for the metal manganese and, to a lesser extent, aluminum. However, the *reference doses* available to calculate the non-cancer health effects from these two metals were developed to evaluate chronic, or long-term, exposures, not short-term exposures such as those during the Cerro Grande Fire. They equated to air concentrations that were much lower than the occupational standards for these metals. We believe the use of these chronic reference doses resulted in the unrealistically high hazard quotients for these metals. Using a reference dose based on occupational standards resulted in a maximum hazard quotient of less than 1.

Concentrations of PM10 in the model domain exceeded U.S. EPA air quality standards for PM10 averaged over 24 hours at some locations in the study area and were sufficient to cause adverse health effects; however, we did not quantify the number or type of health effects resulting from PM10 exposure. We estimated that the deposition of radionuclides and chemicals from burned potential release sites would not be detectable in soil, with the exception of the explosive compounds RDX and HMX. We believe we overestimated the amount of these explosives released during the fire because soil sampling analyses did not detect these compounds in the soil even though the predicted concentrations were well above the detection limits of standard laboratory equipment. Exposure from the subsequent resuspension of the deposited radionuclides and chemicals was not calculated explicitly.

ESTIMATED RISKS FROM RELEASES TO SURFACE WATER

The Cerro Grande Fire destroyed vegetation and changed the surface soil, allowing greater quantities of storm water to flow through the canyons. This increased storm water flow can carry greater amounts of soil, sediment, and ash from the entire burned watershed, including some areas at LANL where chemicals and radioactive materials have been detected in soils. To estimate the potential increased exposure through the surface water pathway that occurred as a result of the fire and the associated risks, we

- Evaluated the available surface and storm water monitoring data
- Identified the sources and amounts of chemical and radionuclide releases
- Modeled the release and transport of radionuclides and chemicals in surface and storm water
- Identified representative individuals for defining exposure scenarios
- Estimated the associated health risks.

Monitoring Data Evaluation

We reviewed data on the concentrations of chemicals and radionuclides in water and sediments collected by LANL and the NMED before and after the fire. Because of the large number of measured chemicals and radionuclides, we developed a screening procedure to focus on those chemicals and radionuclides that were most likely to contribute to the health risk of those exposed directly or indirectly to surface water runoff from LANL.

Of the more than 250 chemicals and 75 radionuclides evaluated during this screening process, we identified 45 chemicals and radionuclides as most important in terms of the potential human health risk. We focused our evaluation of trends in the monitoring data on the human-made radionuclides in this list because there was a lack of post-fire monitoring data for many of the chemicals. Furthermore, for other chemicals, the results were below detection limits of the laboratory equipment used to analyze the samples so few conclusions could be drawn. As a result, we focused primarily on the radionuclides americium-241, cesium-137, strontium-90, plutonium-238, and plutonium-239,240 in surface water, storm water, and sediment. The monitoring data were useful for identifying apparent increases in concentration for some radionuclides and chemicals following the fire and also for identifying the possibility of LANL impact on measured concentrations.

Source Term Development

The most critical step in the risk estimation process is calculating the source term, or the amounts of chemicals and radionuclides in source areas available for movement into surface water. Our modeling approach for this step used measured concentrations of chemicals and radionuclides in soil or sediment, along with water runoff and sediment erosion yields. We then calculated downstream

Points of exposure are locations where an individual would likely come in contact with surface water, suspended sediments, or deposited sediments containing chemicals or radionuclides.

concentrations of chemicals and radionuclides at defined *points of exposure*, focusing on those that were most important in terms of potential health risk.

To identify the most important radionuclides and chemicals, we

- Calculated the average concentrations of chemicals and radionuclides across each source area and compared the highest average concentration to the U.S. EPA residential combined preliminary remediation goals for soil. Preliminary remediation goals are concentrations developed by the U.S. EPA for use as guidelines for evaluating and cleaning up contaminated sites, and they are calculated based on toxicity data and assumptions about exposure.
- Eliminated general water quality sampling results for which associated risks are not expected, and some other general categories of materials (like total petroleum hydrocarbons and lubricant range organics) for which information needed to calculate risk was not available in current regulatory guides
- Selected the chemicals and radionuclides that were also identified through the screening process used to evaluate the environmental monitoring data (described above), and if not already included, added chemicals or radionuclides that had significantly elevated concentrations in burned area ash
- Added chromium, mercury, RDX (a high explosive compound), and uranium because of either known public concern or high source area concentrations.

This process resulted in a final list of 37 chemicals and radionuclides for which we developed source term estimates.

Development of Scenarios and Points of Exposure

We designed four exposure scenarios to represent the different ways that individuals may be exposed to radionuclides and chemicals released to surface water. We developed the scenarios with caution so that a broad range of potential exposures would be represented. However, the hypothetical individuals described in the scenarios do not represent known individuals with these characteristics at these locations. Risks estimated for the hypothetical individuals in the scenarios would be greater than risks of other individuals who might be in the area for less time or under less exposed conditions.

The hypothetical individuals included (1) a local hunter, (2) a resident family (adult and child) living below Cochiti Lake, (3) a resident living below Water Canyon, and (4) a local fire cleanup worker at the LANL Site. The points of exposure for these individuals are shown in Figure 2, and the exposure pathways for the hypothetical individuals in each exposure scenario are shown in Table 1.

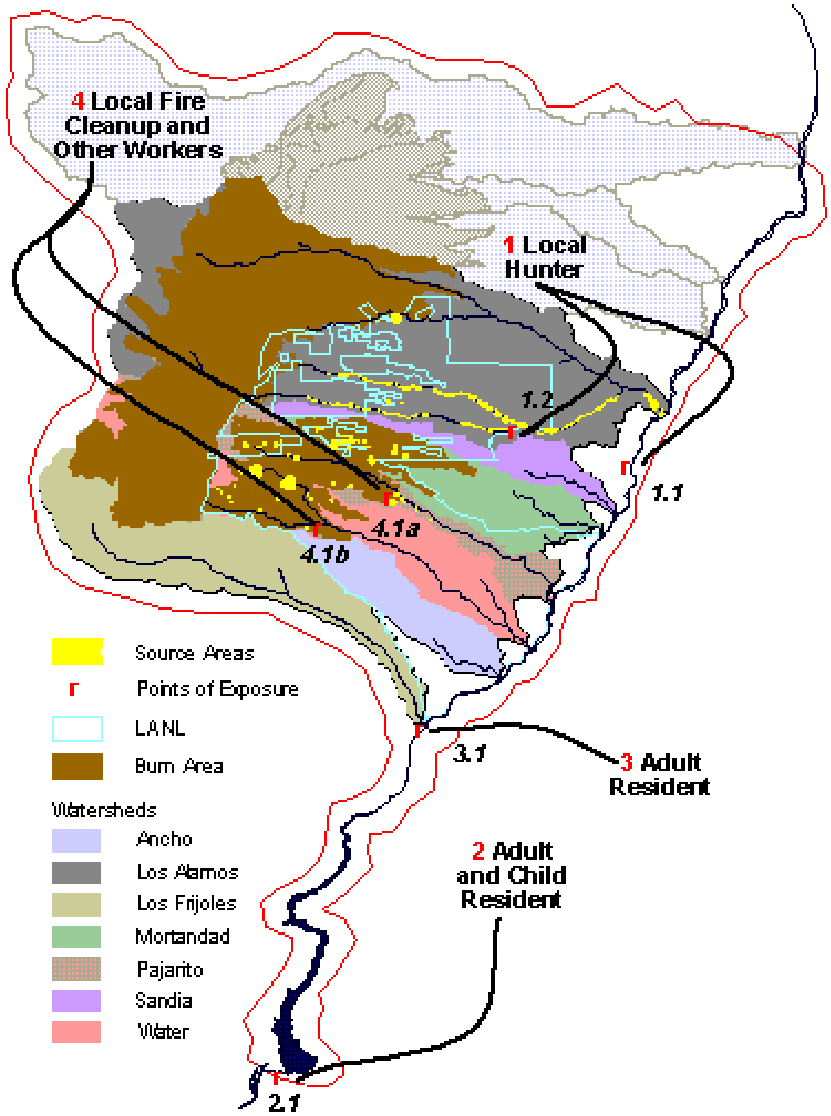

Figure 2. Points of exposure for the exposure scenarios used in the surface water pathway risk analysis of the Cerro Grande Fire.

Table 1: Exposure Scenarios for the Surface Water Pathway Risk Analysis

	Individuals in scenarios			
Surface water pathways	1	2	3	4
Drinking untreated water from the Rio Grande or Cochiti Lake	3	3	3	
Sediment exposure (ingestion, external exposure, and dermal contact)	3	3	3	3
Swimming or contact with water in Cochiti Lake and the Rio Grande (immersion and accidental ingestion)		3		
Eating fish from the Rio Grande and Cochiti Lake	3	3	3	
Eating garden produce irrigated with river water		3	3	
Eating beef from cattle using water from the river and Cochiti Lake		3	3	

Transport Modeling

Next, we estimated the concentration at the points of exposure for the 37 chemicals and radionuclides in storm water, surface water, and suspended and deposited sediments. To accomplish this, we

- Estimated the surface water flow within the watersheds and at outlets to the Rio Grande for storm events of various severities, all 6 hours in length (ranging from a 2-year to a 500-year design storm event).
- Developed estimates of suspended sediment concentrations before and after the fire based on an analysis of pre-fire and post-fire total suspended solids sampling data from the U.S. Geological Survey and LANL.
- Identified the watersheds contributing storm water flow to each point of exposure and the important source areas in the watershed.
- Estimated the maximum potential chemical mass and radionuclide activity that could be present at each point of exposure as a result of storm water flow across a source area.
- Identified background, or typical, storm water flow and suspended sediment concentration in the Rio Grande and in Cochiti Lake.
- Estimated distribution of the chemical mass and radionuclide activity in environmental media to estimate concentrations at each point of exposure.

The results of the transport modeling suggest that while the fire did impact the potential transport of chemicals and radionuclides, there was no consistent change in the resulting concentrations from pre-fire to post-fire. In other words, concentrations of chemicals and radionuclides measured in water after the fire differed by less than a factor of ten from concentrations measured before the fire. Concentrations of chemicals and radionuclides decreased as the point of exposure was moved further away from the source areas, resulting in higher concentrations within the canyons immediately below the LANL facility than in the Rio Grande and in Cochiti Lake.

Comparison to Measured Values

We compared predicted and measured concentrations of selected chemicals and radionuclides in surface water and sediment at each point of exposure. These comparisons suggest that our predicted concentrations are consistently greater than measured values (10 to 100 times greater) for americium-241, cesium-137, plutonium-238, and plutonium-239,240 in sediments. Predicted concentrations for the explosive RDX and polycyclic aromatic hydrocarbons are generally 10 to 1,000 times greater than measured concentrations. This over prediction supports the noted conservatism of both our source term development and transport calculations. The over prediction is generally greater for water than for sediment.

Comparisons between available measured concentrations and predicted concentrations suggest that our predictions were likely overestimated.

Risk Estimates

We presented risk estimates as cancer incidence risks for carcinogenic chemicals and radionuclides or as hazard quotients for noncarcinogens. We estimated the potential annual cancer risk from the Cerro Grande Fire burning on the LANL site to be less than 3 in one million from exposure to any LANL-derived chemical or radionuclide that may have been carried in the surface water and sediments to the Rio Grande and Cochiti Lake. If exposure to the same concentrations of LANL-derived chemicals or radioactive materials was assumed to continue for 7 years (the time it may take to return to pre-fire vegetation conditions in the area), then the potential cancer risk was greater at about 20 in 1 million. Estimated intakes of noncarcinogenic LANL-derived chemicals were less than acceptable intakes (a hazard quotient less than 1) established by the U.S. Environmental Protection Agency.

Cancer risks for LANL-derived radionuclides and chemicals were within the range of acceptable risks defined by the U.S. EPA.

Estimated intakes of noncarcinogenic LANL-derived chemicals were less than the U.S. EPA's acceptable intakes.

Of the different individuals considered in the hypothetical exposure scenarios, the health risks were highest for the hypothetical resident living year round on the bank of the Rio Grande near the confluence of Water Canyon. The type of exposure contributing most to the potential risk was eating fish. For this type of exposure, we assumed that the hypothetical individuals in the exposure scenarios consumed approximately 10 pounds of fish per year, all from the river or Cochiti Lake. However, the risks should be viewed as upper bound, or maximum, values because of the conservatism we assumed in estimating concentrations and in selecting lifestyle activities and values for the hypothetical individuals. The risks for all other types of exposure are lower than those for eating fish.

The hunter and firefighter, who were potentially exposed to higher concentrations in water and sediments, spent less time at those locations and had fewer types of exposures. Risk estimates and hazard quotients for the child and the adult at Cochiti Lake were generally similar. In general, risks for all pathways associated with the 500-year storm event were less than 10 times higher than the risks from the 2-year storm event, and the differences are likely to be within the range of uncertainty calculated.

CALCULATING AND COMMUNICATING RISKS: OBSERVATIONS AND RECOMMENDATIONS

A key element following the Cerro Grande Fire was to learn how available technical data was used to make rapid decisions and to communicate information about the potential risks to local residents and emergency response personnel. We made specific recommendations to improve the calculation and communication of risk from future emergency events that may be applicable to LANL and other sites. We examined two broad areas regarding lessons that can be learned to prepare for and be responsive to future emergencies: 1) calculating health risks and 2) communicating those risks to the public.

The following recommendations were based on our experiences and efforts during this project of independently assessing potential risks to the public as a result of the Cerro Grande Fire. Although these recommendations are directed at identifying areas where improvements or changes could be made, certain considerations may complicate their implementation. For example, while improved site characterization would greatly enhance our understanding of potential risks, public interests to “stop characterizing and start clean up” create conflicting pressures. As another example, a key to building trust and credibility involves ensuring that statements about risk are tied to valid and thoroughly analyzed data, but there is a competing desire by the public to have information provided immediately.

Recognizing these potentially conflicting concerns of State and federal officials and members of the public is critical to developing and adopting procedures that meet stakeholders’ needs as effectively as possible. There will always be limitations related to collecting, compiling, interpreting, and disseminating information. At the same time, identifying areas where changes could result in more efficient, timely, or comprehensive availability of data should be an ongoing process. It is important to strike a balance between responding to public wishes, working efficiently to calculate and communicate potential risks, and realizing practical limitations on what is possible to achieve. The key to successfully implementing these recommendations will be to involve all stakeholders in developing and adopting new procedures.

Recommendations for Calculating Health Risks

- Expand existing monitoring programs to establish a comprehensive program that addresses current and potential needs for both routine and emergency monitoring data collection.
- Characterize contaminated areas to determine the amount of chemicals and radionuclides that may be available for release, and rank the relative importance of those areas and the chemicals and radionuclides in terms of public health risk.
- Design and implement methods for monitoring and data compilation that are based on uses for the data that are collected. Determine the additional information needs to refine risk calculations, reduce and quantify uncertainties, and meet established goals (including regulatory requirements) so that an understanding of public risk, as well as minimization of the risk, is achieved efficiently and effectively.
- Define “background”, or typical, concentrations of chemicals and radionuclides throughout the site and surrounding area so that increases in contaminant concentrations in the future can be quickly identified.

- Collect data to understand typical short-term (e.g., hourly or daily) changes in air concentration, which can vary significantly with time of year or season. Collection times must be reported along with measured air concentrations.
- Maintain data collection and storage in a consistent and easily retrievable format so that preliminary risk results are timely, respond to public concerns, and can be easily understood by independent organizations.
- Link issues affecting the interpretation of data to the actual data. Design data collection to allow for rapid comparison of monitoring data to appropriate background values, protective standards, risk coefficients, or other relevant values.

Recommendations for Communicating Health Risks

- Give the primary responsibility of risk communication to an independent agency that works closely with the agencies involved in the emergency. When there is potential for public risk, the agency that the public views as responsible for the risk should not be the initial or primary source for communicating that risk to the public.
- Maintain a central point for issuing statements about health risk to avoid conflicting messages. Establish a way to reach agreement between agencies about statements that are issued. Develop a method to allow communication of other interpretations or opinions if complete agreement is not possible.
- Implement a well-coordinated and practiced emergency response plan that clearly identifies the responsibilities and capabilities of LANL, State and federal agencies, local communities, Pueblos, and other stakeholders with regard to understanding and communicating risks.
- Involve members of the local community in efforts to provide information about the emergency. Adopt a consistent method to provide appropriate perspective on the magnitude of measured concentrations.
- Base statements about immediate risks and potential future risks on available data only, and identify limitations, such as data gaps or uncertainties. Clearly identify the origin of the risk and the nature of the risk.
- Establish a method to allow environmental monitoring by groups, independent of State and federal agencies, to provide additional confidence in the results obtained by the site and regulatory agencies normally involved in data collection. Encourage constructive criticism by all stakeholders.
- Maintain a concerted effort to actively and effectively involve the local citizens in emergency and other planning. Continue to foster trust among all stakeholders.

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