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New Mexico's Right to Know:
The Potential for Groundwater Contaminants from
Los Alamos National Laboratory to Reach the Rio Grande

A study by George Rice for Concerned Citizens for Nuclear Safety (CCNS)

Los Alamos National Laboratory (LANL) sits atop the Pajarito Plateau approximately 40 miles northwest of Santa Fe, New Mexico. The Pajarito Plateau consists of a series of east-west oriented canyons and mesas. It is bounded on the west by the Jemez Mountains and on the east by the Rio Grande.

Nuclear-related activities have been continuous at LANL since its development in 1943 as part of the Manhattan Project. These activities result in emissions of radionuclides and chemicals into the air, discharges of contaminated liquids into canyon systems and disposal of radioactive waste in canyons and on mesa tops above the Rio Grande.

Concerned Citizens for Nuclear Safety (CCNS) created the Rio Grande Watershed Initiative in 2002 in order to address concerns about LANL contamination potentially compromising the quality of the Rio Grande. As a result, CCNS organized two rafting trips along the Rio Grande from the Buckman Wellfield, which supplies the City of Santa Fe with 40% of its drinking water, to Cochiti Dam. Along the way, CCNS and technical experts collected samples of springwater and moss to be independently analyzed for radionuclides. The result of that sampling was released in October 2003 in the report *Early Warning: A Radioactive Rio Grande*. Please see www.nuclearactive.org/docs/RGWIindex.html for more information.

CCNS also enlisted the assistance of George Rice, a groundwater hydrologist with experience at Department of Energy sites nationwide, to analyze the potential for groundwater contamination from LANL to reach the Rio Grande. In *New Mexico's Right to Know: The Potential for Groundwater Contaminants from LANL to Reach the Rio Grande,* Rice addresses two questions:

- Is it possible for groundwater to transport contaminants from LANL to the Rio Grande during the 61 years that LANL has existed?
- If so, have contaminants from LANL reached the Rio Grande?

Rice finds that the answer to both of these questions is yes. In order to reach this conclusion, Rice addresses the following questions:

Have contaminants from LANL entered the groundwater? Rice cites groundwater monitoring data from both LANL and the New Mexico Environment Department in order to prove that contaminants from LANL have entered the groundwater in Pueblo Canyon, Los Alamos Canyon, Mortandad Canyon and at Technical Area 16. Monitoring data indicates that groundwater in these canyons is contaminated with radioactive tritium, high explosives and perchlorate, a hazardous, fast moving chemical.

Does groundwater under LANL flow toward the Rio Grande? Rice finds that groundwater generally flows along the hydraulic gradient. On the Pajarito Plateau, the hydraulic gradient slopes toward the Rio Grande. Therefore, groundwater from LANL flows toward the Rio Grande.

Is groundwater, and the contaminants it transports, able to travel from contaminated areas at LANL to the Rio Grande in 61 years or less? Rice uses Darcy's Law, which estimates flow through porous media, to determine that it is possible for groundwater to travel from LANL to the Rio Grande in fewer than 61 years. However, there are several parameters that determine how long it may take contaminants to reach the river. For example, the groundwater hydrology of the Pajarito Plateau is diverse and features many varied porosities that may effect groundwater flow rate.

Further, the movement of radionuclides and chemicals with groundwater is determined by the partition coefficient of each constituent. The partition coefficient is a parameter that controls the degree to which a contaminant will become attached to the solid materials through which it passes. For example, perchlorate, with a partition coefficient of zero, moves steadily with groundwater as it is less likely to become attached to solid materials as it travels. Conversely, plutonium has a high partition coefficient and moves at roughly 8% of groundwater speed.

Rice finds that although the travel time of contaminants varies, it is possible for contaminants from LANL to reach the Rio Grande in 61 years or less.

Have contaminants from LANL been found discharging to the Rio Grande? According to monitoring data, tritium has been detected in most of the springs emanating from beneath LANL that feed the Rio Grande. However, because tritium is also produced naturally in the upper atmosphere and is associated with aboveground nuclear weapons testing, it is uncertain that the tritium in the springs is derived from LANL contamination sources.

Perchlorate has been reported in samples from CCNS Spring, the Spring 3, 4 and 5 series, as well as many other springs that discharge into the Rio Grande. This perchlorate cannot necessarily be confirmed as derived from LANL because some of the samples were analyzed by a laboratory since proven to be disreputable. Also, there are several detections of perchlorate in northern New Mexico that cannot be associated with LANL. Nevertheless, perchlorate detected in Spring 4C can confidently be associated with LANL contamination.

Radionuclides have been detected in Springs 2, 4A, 5A, 6A and 9, as well as Sacred Spring, Sandia Spring and Ancho Spring. These radionuclides include americium-241, cesium-137, plutonium-238 and strontium-90. However, these detections are suspect because duplicate analyses of these findings could not confirm radionuclides in the springs. Therefore, this data is not a useful indicator of contamination derived from LANL in the springs.

Nevertheless, there are cases in which it is certain that contaminants from LANL are discharging from the springs that feed the Rio Grande. High explosives have been detected in Ancho Spring and Spring 6 and perchlorate in Springs 4 and 4C.

CCNS Recommendations

In view of the above, CCNS recommends that in order to protect the quality of the Rio Grande for its ten million downstream neighbors, LANL must perform clean up of contamination and waste sites that is supportive of clean surface and groundwater. Clean up must entail the removal of all waste buried atop the Pajarito Plateau and all potential future waste must be stored in hardened facilities aboveground.

LANL must develop strategies for managing buried hazardous and radioactive waste in order to protect not only the Rio Grande, but also the aquifer located beneath the Pajarito Plateau and the health and safety of those that rely on these water sources for drinking, agriculture and recreation.

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