AN UPDATE ON WATER RESOURCES FROM SPRINGS IN THE LOS ALAMOS AREA, NEW MEXICO

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A more complete and accurate understanding of the hydrologic conditions in the Los Alamos area is critical to the management and protection of water. Starting in the mid 1990s, the New Mexico Environment Department DOE Oversight Bureau (the Bureau) recognized that there was not an adequate characterization or inventory of local springs and surface-water resources in the Los Alamos area. This resulted in a need to revise the historic information regarding springs. Early investigations to document surficial water resources began in the late 1940s, when the town of Los Alamos grew to exceed its water demands that were met by spring-fed streams (Griggs and Hem, 1964). By 1952, the town’s water supply was converted to a modern system supplied by new production wells located in lower Los Alamos Canyon and Guaje Canyon. Although some early USGS reports such as Griggs and Hem (1964) provided water quality data, most more strongly emphasized geological investigations to identify and characterize specific water-bearing rock units. Additional work during the 1980s and 1990s by Los Alamos National Laboratory investigators such as Goff (1980) and others was more closely associated with geothermal investigations. In 1994, the Bureau undertook an effort to fill information gaps by locating new springs and characterizing them with respect to water quality. Furthermore, perennial surface-water flow from both newly discovered and previously identified springs was documented and monitored to determine changes in flow rates and stream conditions (e.g., length of flow) in response to wet and dry periods. The data include digitally corrected GPS location coordinates, estimated and measured flow rates, geologic discharge units, field parameters such as pH, specific conductance, in some cases major ions and trace elements; natural and anthropogenic radionuclides such as tritium and uranium, and the stable isotopes deuterium and oxygen-18. Data provided in this report were collected during the period of 1994 through 2004. This study resulted in the characterization of 89 previously undocumented perennial and ephemeral springs. The Bureau continues to monitor springs within the study area.

Most springs were geographically grouped into three major north-northeast trending regions. Region I is located at the western boundary of the study area and region III to the east (Fig. 1). The entire study area extended from Guaje Canyon to Frijoles Canyon, an area of about 365 square kilometers. The mountain block region (I) has springs discharging from perched saturation within the Sierra de Los Valles. Springs of the mountain front region (II) discharge within the Pajarito fault zone area of the eastern slope of the mountain block. It also includes some springs that discharge ephemerally from saturated canyon-bottom alluvium located in the Sierra de Los Valles and canyons that dissect the Pajarito Plateau. The White Rock Canyon region (III) along the Rio Grande contains springs discharging as perched lenses of intermediate saturation present between the regional aquifer and alluvial ground water and as the terminus point of the regional drinking-water aquifer.

The perennial springs in regions I and II discharge from volcanic rocks of the Tschicoma Formation (dacites) and Tshirege Member of the Bandelier Tuff. Flow rates for these springs range from less than 1 to about 380 liters per minute (lpm). The age of these springs are mostly modern (younger than 1943) with two springs showing sub-modern (older than 1943) with a small fraction of modern water (Longmire et al., in press). These waters tend to be Na-Ca-HCO_3 and Ca-Mg-Na-HCO_3 type waters with total dissolved solids ranging from approximately 40 to 250 mg/L, depending on the absence or presence of anthropogenic constituents. Ephemeral canyon-bottom alluvial springs that occur within Los Alamos National Laboratory property between regions II and III tend to be impacted by anthropogenic sources. The region III White Rock Canyon springs discharge from intermediate-depth perched zones and the regional aquifer within Pliocene basaltic units and sedimentary rocks of the Santa Fe Formation.

The Bureau focused additional resources on Region III springs along White Rock Canyon because they discharge from the upper saturated portion of the regional aquifer and intermediate aquifers beneath the Pajarito Plateau and Los Alamos National Laboratory. Springs within White Rock Canyon discharge predominantly from slump blocks of volcanic and sedimentary rock units. These springs exhibit mixed and sub-modern age water. Springs with mixed ages contain anthropogenic tritium (^3H) with apparent ages ranging from less than 1 year to about 54 years. Ground-water ages for the regional and intermediate aquifer springs range from 1449 - 9715 years and 2159 - 3786 years, respectively (Longmire et al., in press). These data are based on recently acquired radiocarbon data collected by the Bureau and ^3H/helium data collected from Los Alamos National Laboratory and the Bureau. Flow rates vary from less than 1 to about 920 lpm.

The chemistries for the White Rock Canyon springs tend to be Ca-Na-HCO_3 and Na-Ca-HCO_3 type water, and range from approximately 70 to 250 mg/L in total dissolved solids. Purtymun et al. (1980) segregated these springs into four distinct hydrochemical groups based on the sodium and calcium bicarbonate type, sulfate content and total dissolved solids. Bureau findings show that certain springs can also be grouped based on their sodium and/or calcium bicarbonate type and sulfate content. Chemical trends of these springs show that elevated concentrations of chloride, sulfate, nitrate, and perchlorate occur (notably at the Pajarito Canyon 4 Series springs) indicating an anthropogenic influence to some portion of the recharge waters. Dissolved silica increases to the south and dissolved strontium decreases to the south. Stable-isotope results for these springs suggest that the water is recharged from the central to western portion of the Pajarito Plateau (Blake et al., 1995; Longmire et al., in press).

In conclusion, these data are invaluable to investigators at Los Alamos National Laboratory for ground-water contaminant characterization and water-resource protection projects. It is our plan to expand this work further south through Bandelier National Monument to Bland Canyon.