EVALUATING RISK TO AN UNDERGROUND FACILITY FROM A STROMBOLIAN ERUPTION

D. Krier, G. Heiken, G. Keating, and F. Perry, Earth and Environmental Sciences Division, Los Alamos National Laboratory, Los Alamos, NM 87545 USA

A factor in evaluating the natural risks to the proposed Yucca Mountain, Nevada, high-level nuclear waste repository is the low probability of intersection by an ascending basaltic dike and disruption by a resulting volcano. Should the dike(s) continue to rise and erupt, what percentage of the waste products transported during a Strombolian or violent Strombolian eruption would reach the surface? One approach to evaluating this problem is to understand Strombolian eruption phenomena, any associated hydrovolcanic phenomena, conduit formation, and to what depths the host rocks would be affected. To answer this question for a "Yucca Mountain volcano" we are evaluating the nearby 75,000 year old Lathrop Wells (LW) cone and eroded analog conduits.

Estimating the size and depth of a conduit underlying a scoria cone is truly difficult. Generic models exist for the plumbing, but every volcano is different, depending upon the physical properties of the host rock, magma composition, and presence or absence of an aquifer needed for hydrovolcanic interactions. The approaches used for conduit formation scenarios at Lathrop Wells cone include:

1. Examination of cone deposits and tephra fall blanket to determine the volume of material erupted magmatically as lava fountains or Strombolian bursts versus hydrovolcanic activity. At LW, there was hydrovolcanic activity early and possibly late in the cone history.
2. A study of lithic clasts within the cone and tephra fall to determine the volume of host rock excavated in formation of a conduit or crater. Lithics depths cannot be determined in that the underlying tuffs are fairly uniform to a depth of >300 m. Once the excavated volume has been estimated from lithic clast populations, the problem is the conduit shape—broad and shallow crater or a narrow, deep conduit? LW has been compared with other scoria cones where there are abundant lithic clasts, but measured clast populations in the LW cone range from 0.002-0.9%, not a significant component of the erupted material.
3. Eroded conduits below older scoria cones provide a general view of conduit diameters and depths below the ground surface. Analogues used in this study include Grants Ridge, NM, the Rio Puerco, NM, necks, and the Paiute Ridge complex, NV. Conduit width at Grants Ridge is 150 m; the Puerco necks range in maximum widths from 50 m to 600 m, with a mean equivalent diameter of about 200 m; and the Paiute Ridge conduit is ~200 m width.

Lithic clast studies and analogs supply useful information for estimating the size and properties of the conduit at Lathrop Wells. However, to specifically address the risk to the repository by conduit formation will require slant-core drilling below one or more of the nearby volcanoes in the Yucca Mountain region.