Brady (1998). Regarding the determination of reaction kinetics, the importance of surface area to volume ratios is described in Brady et al., 2004, and other references discussed in Chapter 1 and Chapter 6, and significant differences in crushed particle size distributions and effective surface areas were found among the lithologic units tested in this study. Standardizing the particle size distribution in each leaching column and humidity cell promotes control of that variable at the start of the weathering test, and facilitates the evaluation of surface area and related kinetic variables after weathering.

Table 3.3. Particle size distribution of reconstructed samples.

Sieve Size	Percent of Total Weight
+3/8 (9.52 mm)	-
3/8 - #4 (4.76 mm)	40
#4M - #10 (2.00 mm)	25
#10 - #16 (1.19 mm)	10
#16 - #35 (0.50 mm)	10
#35 - #60 (0.250 mm)	5
-#60 (0.250 mm)	10

<u>surface area effects on selected rock samples from 2002 and 2003 weathering tests:</u>
Laboratory 3 performed BET surface area measurements on three distinctly different lithologic units to evaluate the effects of weathering by particle size classes and by rock type characteristics. Table 3.4 shows the particle size distributions for the Brush Creek shale and Wadesville sandstone samples used in the 2002 weathering tests and the LRBT coal refuse sample used in the 2003 weathering tests at Laboratory 3.

For this study, the surface area of each fraction of sieved starting material was determined by BET (Brunauer et al., 1938; Yates, 1992) instrumentation using N_2 gas bulk adsorption. This method is a routine analytical approach to measure the accessible surface of the rock to gas molecules. Additional discussion of surface area measurements and their relationships to porosity and reaction kinetics are given by Brantley and Mellott (2002), Lasaga (1984, 1998) and Brady et al., (2004).

Surface areas were measured on the starting material sieve fractions, and at the completion of the testing, the resultant rock was again sieved and remeasured. The bulk surface areas for each column were determined for the post-leaching rock by taking the individual masses of the sieve fractions specified in the protocol above, multiplying each mass by the surface area (SA), and combining their fractional percent of the total as a weighted linear average.

$$A \times SA_{sieve1} + B \times SA_{sieve2} + C \times SA_{sieve3} = SA_{bulk}$$

Where: $A + B + C = 1$
A = fraction of total sieve 1 size
B = fraction of total sieve 2 size
C = fraction of total sieve 3 size