alkalinity, acidity, and sulfate. Samples also were filtered and analyzed for dissolved calcium, sulfate, acidity, alkalinity, iron, and manganese using EPA-approved methods. Data results of the analyses are included in Appendix D of this report.

The original type of humidity cell apparatus, used in the 2002 weathering tests, was constructed from rectangular plastic food storage containers with airtight lids. This approach was consistent with the project goals of requiring low cost materials and minimal apparatus construction. However, the humidity cells yielded consistently lower concentrations of key analytes reflecting less aggressive weathering than the leaching columns. A reason for this difference between humidity cells and leaching columns, particularly for carbonate minerals, may be the large amount of air space above the rock sample in the rectangular cells. As some humidity cell tests reported in the literature use a cylindrical apparatus resembling a short leaching column (e.g. White et al., 1994), the shape and dimensions of the humidity cells used in the 2003 weathering tests were made equivalent to the leaching columns.

Standardized Particle Size Distribution and Surface Area Measurements

The reconstruction of the particle size distribution following the crushing of each rock sample was included in the methods because variations in particle size distribution of the same lithologic unit can occur due to differences in crushing equipment, and the particle size distribution may vary significantly by rock type as shown in Table 3.2.

Table 3.2. Particle size distribution (by percent total weight) of as prepared rock samples.

	Limestone				Shale					Coal Refuse				
Lab	**1**	**2**	Mean	SD	**1**	**2**	**3**	Mean	SD	**1**	**2**	**3**	Mean	SD
***Sieve Size**														
+3/8	0.1	0.0	0	0.1	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0	0	0.0
3/8-#4	40.2	41.9	41	1.2	22.5	23.7	28.8	25	3.4	46.1	49.3	54.0	50	4.0
#4-#10	25.3	26.5	26	0.8	32.6	32.1	33.4	33	0.6	27.8	23.1	23.5	25	2.6
#10-#16	12.1	9.7	11	1.7	16.4	12.8	8.1	12	4.2	10.6	9.5	7.1	9	1.8
#16-#35	8.2	10.2	9	1.4	10.8	15.7	12.2	13	2.5	6.4	9.3	8.0	8	1.4
-30+#60							10.5					5.3		
#35-#60	5.1	3.8	5	0.9	6.8	4.9			1.3	3.7	3.2			0.3
-#60	9.1	8.0	8	0.8	10.8	10.9	7		2.2	5.3	5.7	2.2		1.9

*US sieve # or equivalent mesh size; SD represents standard deviation

Since the particle size distribution of the crushed rock sample is largely an artifact of the crushing process, rather than a natural systems process (like the particle size distribution of a soil or an unconsolidated sedimentary deposit), it was determined that the standardized particle size distribution, shown in Table 3.3 would promote operational consistency of the weathering test procedures and facilitate better control in determining reaction kinetics. Regarding operational consistency of the method, large amounts of fine particles within specific zones of the leaching columns were found to impede uniform fluid flow and/or gas flow in this study, and similar problems with fines are described in Bradham and Caruccio (1990, 1995) and Hornberger and