

TABLE 1
Generic Abrasive Summary
Phase 1
Average Results for Abrasive Type¹

Generic Abrasive Type	Number of Products	Cleaning Rate (ft ² /hour)	Consumption Rate (Lbs./ft ²)	Surface Profile (mils)	Number of Uses	Breakdown Rate (%)	Embedment (%)	Maximum Microhardness (Knoop)	Conductivity (microsiemens)
CG	1	33.00	10.99	2.72	1	51.36	2.1	185	112.0
CS	7	34.00	10.44	3.07	1	47.95	12.2	720	176.9
(CS range)		(28-42)	(9.05-12.35)	(2.67-3.72)		(38.41-54.71)	(3.6-25.3)	(611.0-720.0)	(23.8-833.3)
CSDS	2	37.00	11.42	3.28	1	52.73	7.5	760	221.2
(CSDS range)		(35-38)	(10.64-12.2)	(3.13-3.42)		(52.00-53.46)	(4.7-10.3)	(594.0-760.0)	(42.0-400.3)
N	2	41.00	14.17	3.56	1	52.55	14.3	984	91.5
(N range)		(35-47)	(12.50-15.83)	(3.25-3.87)		(51.2-53.90)	(1.2-27.3)	(545.0-984.0)	(36.3-146.7)
O	1	44.00	8.02	3.03	1	33.58	15.1	960	96.7
S	2	46.00	8.71	2.05	1	18.84	0.2	936	150.3
(S range)		(44-49)	(7.51-9.90)	(2.02-2.08)		(18.06-19.63)	(0.1-0.2)	(219.0-936.0)	(87.3-213.3)
SH	1	32.00	6.60	2.77	1	40.72	0.7	1182	63.3
SS	7	31.00	13.43	3.40	1	54.13	4.9	2469	147.0
(SS range)		(25-37)	(9.05-26.32)	(2.73-4.40)		(25.58-72.88)	(0.1-12.3)	(1267.0-2469.0)	(18.2-708.3)
SSDS	3	33.00	11.10	2.92	1	48.23	1.6	2008	61.7
(SSDS range)		(26-39)	(8.74-13.89)	(2.83-3.02)		(31.28-66.54)	(0.8-2.7)	(643.0-2008.0)	(25.0-99.3)
CP ²	4	52.00	17.82	3.49	2	54.49	21.5	769	108.6
(CP range)		(28.00-92.00)	(12.95-25.80)	(2.98-3.92)		(51.80-69.53)	(8.1-41.5)	(540.0-769.0)	(31.8-223.3)
CPDS ^c	1	35	15.09	3.44	2	64.91	19.2	656	39.8
G ²	7	44	9.46	3.03	2-3	53.61	5.6	1809	116.1
(G range)		(24.00-75.00)	(7.12-14.42)	(2.07-4.15)		(20.74-75.81)	(0.1-36.7)	(535.0-1809.0)	(9.0-586.7)
SG ²	2	35	24.94	3.13	25	5.22	2.8	823	61.9
(SG range)		(27.00-44.00)	(21.53-28.75)	(2.88-3.40)		(0.67-8.72)	(1.6-4.1)	(240.0-823.0)	(33.7-100.0)

Note 1 - There was a wide variation in performance between the products within a given generic class of abrasives. Specific products should be evaluated individually.

Note 2 - Values for the recyclable abrasives represent the average of the initial and final runs.

TABLE 2
Abrasive Cleaning Cost Summary

Phase 1

Abrasive No.	Generic Abrasive	Size Designation	Nozzle Size	Flow rate	Mat'l Cost	Disposal	Equipment	Labor	No. of	Cleaning Rate	Cleaning Cost
				(ton/hr.)	(\$/ton)	(\$/ton)	(\$/hr.)	(\$/hr.)	Uses	(sq ft/hr.)	(\$/sq ft)
CG-01	Crushed Glass	2040	1/4	0.180578	100.00	30	7.59	36.60	1	32.9	2.06
CS-01	Coal Slag	1240	1/4	0.160171	51.00	30	7.59	36.60	1	27.5	2.07
CS-02	Coal Slag	2043	1/4	0.150830	44.00	30	7.59	36.60	1	30.9	1.79
CS-03	Coal Slag	2040	1/4	0.209351	35.00	30	7.59	36.60	1	33.9	1.70
CS-04	Coal Slag	2049	1/4	0.160301	37.00	30	7.59	36.60	1	30.7	1.79
CS-05	Coal Slag	2040	1/4	0.183824	29.00	30	7.59	36.60	1	34.4	1.60
CS-06	Coal Slag	2040	1/4	0.188784	38.00	30	7.59	36.60	1	41.4	1.38
CS-07	Coal Slag	2040	1/4	0.190107	63.90	30	7.59	36.60	1	42.0	1.48
CS-AVG ¹	Coal Slag	2040	1/4	0.203502	38.00	30	7.59	36.60	1	39.0	1.49
CS-13 ²	Coal Slag	2040	3/8	0.376356	38.00	30	7.59	36.60	1	94.8	0.74
CS-14 ²	Coal Slag	2040	7/16	0.447513	38.00	30	7.59	36.60	1	114.6	0.65
CSDS-01	Coal Slag with Dust Suppressant	2040	1/4	0.188561	51.00	30	7.59	36.60	1	35.4	1.68
CSDS-02	Coal Slag with Dust Suppressant	1240	1/4	0.229241	61.00	30	7.59	36.60	1	37.6	1.73
N-01	Nickel Slag	2050	1/4	0.218050	41.00	30	7.59	36.60	1	34.9	1.71
N-02	Nickel Slag	2040	1/4	0.376712	57.56	30	7.59	36.60	1	47.6	1.62
O-01	Olivine	40	1/4	0.175638	70.00	30	7.59	36.60	1	43.8	1.41
S-01	Staurolite	XL	1/4	0.164216	121.50	30	7.59	36.60	1	43.7	1.58
S-02	Staurolite	Regular	1/4	0.241222	105.40	30	7.59	36.60	1	48.7	1.58
SH-01	Specular Hematite	#50	1/4	0.106529	130.00	30	7.59	36.60	1	32.3	1.90
SS-01	Silica Sand	20-30	1/4	0.175610	22.00	30	7.59	36.60	1	33.7	1.58
SS-02	Silica Sand	#1	1/4	0.324910	25.50	30	7.59	36.60	1	24.7	2.52
SS-03	Silica Sand	3	1/4	0.194342	35.05	30	7.59	36.60	1	34.2	1.66
SS-04	Silica Sand	2340	1/4	0.167593	13.00	30	7.59	36.60	1	37.0	1.39
SS-05	Silica Sand	JC 20	1/4	0.156658	22.25	30	7.59	36.60	1	30.4	1.72
SS-06	Silica Sand	16 x 40	1/4	0.198156	27.07	30	7.59	36.60	1	29.4	1.89
SS-07	Silica Sand	#16	1/4	0.173717	23.68	30	7.59	36.60	1	26.6	2.01
SSDS-01	Silica Sand with Dust Suppressant	20-30	1/4	0.185338	32.00	30	7.59	36.60	1	26.7	2.09
SSDS-02	Silica Sand with Dust Suppressant	2340	1/4	0.169396	23.00	30	7.59	36.60	1	38.8	1.37
SSDS-03	Silica Sand with Dust Suppressant	3.0	1/4	0.180971	45.05	30	7.59	36.60	1	33.9	1.70
CP-01	Copper Slag	16 x 50	1/4	0.593478	51.25	30	13.36	36.60	2	91.6	0.81
CP-02	Copper Slag	16/30	1/4	0.414990	84.50	30	13.36	36.60	2	54.0	1.37
CP-03	Copper Slag	16/30	1/4	0.665640	36.75	30	13.36	36.60	2	51.6	1.40
CP-04	Copper Slag	16/30	1/4	0.253054	30.00	30	13.36	36.60	2	32.7	1.76
CPDS-01	Copper Slag with Dust Suppressant	16/30	1/4	0.292986	76.00	30	13.36	36.60	2	40.3	1.62
G-01	Garnet	2050	1/4	0.145859	300.00	30	13.36	36.60	2	34.6	2.14
G-02	Garnet	#36	1/4	0.111088	243.00	30	13.36	36.60	2	31.2	2.09
G-03	Garnet	#40	1/4	0.125174	230.00	30	13.36	36.60	2	33.7	1.97
G-04	Garnet	#36	1/4	0.222490	200.00	30	13.36	36.60	3	57.8	1.16
G-05	Garnet	30 x 60	1/4	0.320245	200.00	30	13.36	36.60	3	66.7	1.12
G-06	Garnet	30/40	1/4	0.317610	210.00	30	13.36	36.60	2	75.0	1.17
G-07	Garnet	#36	1/4	0.231420	180.00	30	13.36	36.60	2	57.0	1.30
SG-01	Steel Grit	40, 50, 80 Blend	1/4	0.448500	460.00	30	13.36	36.60	25	31.2	1.88
SG-02	Steel Grit	40/50 Blend	1/4	0.482927	494.00	30	13.36	36.60	25	44.4	1.35

¹ -- Average of the process control checks with a single coal slag abrasive. The same abrasive was used for the additional runs using the larger nozzle orifice sizes.

² -- Two additional runs made with coal slag using the same equipment and operating restrictions, except that the nozzle was increased. Costs per square foot were reduced by more than one-half.

Table 3
Comparison of Airborne Concentrations to Bulk Concentrations - Arsenic
 NIOSH REL 2.0 micrograms/cubic meter Ceiling Limit
 OSHA PEL 10.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 µg/m ³	Fixed Station #2 µg/m ³	Fixed Station #3 µg/m ³	(OBZ) µg/m ³	µg/g
CG-01	ND	ND	ND	ND	ND
CS-01	ND	10.00	24.76	9.18	1.40
CS-02	ND	ND	10.41	ND	1.60
CS-03	ND	ND	ND	ND	0.68
CS-04	ND	ND	ND	ND	ND
CS-05	ND	ND	ND	ND	ND
CS-06	ND	2.09	3.31	2.08	ND
CS-07	ND	ND	29.13	4.38	2.10
CSDS-01	ND	ND	ND	ND	ND
CSDS-02	ND	ND	4.76	ND	0.80
N-01	ND	ND	ND	ND	ND
N-02	19.81	37.41	170.80	35.28	15.00
O-1	ND	ND	ND	ND	0.33
S-01	ND	ND	ND	ND	ND
S-02	ND	ND	ND	ND	ND
SH-01	ND	ND	ND	ND	ND
SS-01	ND	ND	ND	ND	ND
SS-02	ND	ND	ND	ND	ND
SS-03	ND	ND	ND	ND	ND
SS-04	ND	ND	ND	ND	ND
SS-05	ND	ND	ND	ND	0.71
SS-06	ND	2.07	6.92	ND	1.50
SS-07	ND	ND	ND	ND	ND
SSDS-01	ND	ND	ND	ND	ND
SSDS-02	ND	ND	ND	ND	ND
SSDS-03	ND	ND	ND	ND	ND
CP-1A	5.98	18.64	29.05	17.18	13.00
CP-2A	6.60	16.73	99.54	45.70	18.00
CP-3A	51.63	196.12	1116.86	889.90	160.00
CP-4A	90.65	440.16	24484.80	3693.07	410.00
CPDS-1A	9.53	11.55	107.37	ND	5.70
G-1A	ND	ND	ND	ND	ND
G-2A	ND	ND	ND	ND	0.55
G-3A	ND	ND	ND	ND	0.50
G-4A	ND	ND	ND	ND	ND
G-5A	ND	ND	ND	ND	ND
G-6A	ND	ND	ND	ND	ND
G-7A	ND	ND	2.09	ND	ND
SG-1A	ND	ND	9.96	35.07	27.00
SG-2A	17.49	12.11	17.83	41.41	31.00

ND represents results less than the limit of detection.

Table 4
Comparison of Airborne Concentrations to Bulk Concentrations - Beryllium
 NIOSH REL 0.50 micrograms/cubic meter
 OSHA PEL 2.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 $\mu\text{g}/\text{m}^3$	Fixed Station #2 $\mu\text{g}/\text{m}^3$	Fixed Station #3 $\mu\text{g}/\text{m}^3$	(OBZ) $\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{g}$
CG-01	ND	0.10	0.13	0.08	ND
CS-01	0.62	2.29	10.11	1.92	5.70
CS-02	0.75	2.93	14.37	3.54	3.70
CS-03	0.35	2.07	4.77	1.82	3.20
CS-04	0.19	0.96	2.69	1.05	0.33
CS-05	0.31	1.42	3.35	1.87	0.28
CS-06	1.13	2.93	3.73	1.12	0.58
CS-07	1.94	6.26	24.97	3.96	6.30
CSDS-01	0.35	2.29	7.48	4.37	0.78
CSDS-02	0.66	2.48	3.93	3.56	3.90
N-01	ND	ND	0.11	ND	0.05
N-02	0.17	0.35	1.73	0.50	0.28
O-1	ND	ND	0.08	0.12	ND
S-01	ND	ND	0.29	ND	0.01
S-02	ND	0.12	0.14	ND	ND
SH-01	ND	ND	0.44	ND	0.16
SS-01	ND	0.07	ND	0.10	ND
SS-02	ND	ND	ND	ND	ND
SS-03	ND	ND	ND	ND	ND
SS-04	0.08	0.29	0.36	0.21	0.03
SS-05	ND	0.13	0.27	0.18	0.06
SS-06	0.14	0.15	0.29	0.14	0.05
SS-07	0.12	0.14	0.29	0.09	0.07
SSDS-01	0.12	ND	ND	ND	ND
SSDS-02	ND	0.14	0.31	0.14	0.08
SSDS-03	ND	ND	ND	ND	ND
CP-1A	0.39	0.18	0.23	0.13	0.04
CP-2A	0.17	0.82	3.94	1.64	0.77
CP-3A	0.50	1.19	6.41	5.59	1.40
CP-4A	0.70	1.05	6.12	0.90	1.00
CPDS-1A	0.30	0.56	2.89	0.31	0.47
G-1A	ND	ND	0.07	ND	ND
G-2A	ND	0.14	0.25	0.12	0.06
G-3A	ND	0.07	0.09	ND	0.04
G-4A	0.20	0.52	1.27	0.52	0.05
G-5A	0.07	0.13	ND	0.10	0.07
G-6A	0.10	0.23	2.29	1.80	0.07
G-7A	ND	ND	ND	0.23	ND
SG-1A	ND	ND	ND	ND	ND
SG-2A	0.52	0.20	ND	0.35	ND

ND represents results less than the limit of detection.

Table 5
Comparison of Airborne Concentrations to Bulk Concentrations - Cadmium

NIOSH REL - Limit of Quantification (Lowest Feasible Concentration)
 OSHA PEL 5.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area Fixed Station #1	@ Operator Area Fixed Station #2	@ Exhaust Area Fixed Station #3	Operator 's Breathing Zone (OBZ)	Virgin Bulk Proportion
	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{g}$
CG-01	ND	ND	ND	ND	ND
CS-01	ND	ND	ND	0.25	ND
CS-02	ND	ND	ND	0.20	ND
CS-03	ND	ND	0.25	0.37	0.06
CS-04	ND	ND	ND	ND	ND
CS-05	ND	0.16	ND	1.35	ND
CS-06	0.56	ND	ND	ND	ND
CS-07	ND	0.25	1.21	2.71	ND
CSDS-01	ND	ND	ND	0.21	ND
CSDS-02	ND	ND	ND	ND	ND
N-01	ND	ND	ND	ND	ND
N-02	10.21	0.52	1.56	0.64	ND
O-1	ND	ND	ND	ND	ND
S-01	ND	ND	ND	0.23	ND
S-02	ND	ND	ND	ND	ND
SH-01	ND	ND	ND	0.25	ND
SS-01	ND	ND	ND	1.99	ND
SS-02	ND	ND	ND	ND	ND
SS-03	ND	ND	ND	ND	ND
SS-04	0.10	ND	0.14	ND	ND
SS-05	ND	ND	ND	0.12	ND
SS-06	ND	ND	0.13	0.13	ND
SS-07	ND	ND	0.17	ND	ND
SSDS-01	ND	0.23	ND	1.49	ND
SSDS-02	ND	ND	ND	ND	ND
SSDS-03	ND	ND	ND	ND	ND
CP-1A	0.27	0.79	2.49	0.78	0.48
CP-2A	ND	ND	0.10	0.15	ND
CP-3A	0.35	0.98	3.93	2.69	ND
CP-4A	2.06	16.14	71.41	13.13	8.30
CPDS-1A	ND	ND	ND	ND	ND
G-1A	ND	ND	ND	0.70	ND
G-2A	ND	ND	0.29	0.73	ND
G-3A	ND	0.14	0.48	1.65	ND
G-4A	ND	ND	0.45	0.19	ND
G-5A	ND	ND	ND	0.98	ND
G-6A	ND	0.25	0.44	2.69	ND
G-7A	ND	0.11	ND	0.59	ND
SG-1A	ND	ND	ND	0.56	ND
SG-2A	ND	ND	ND	ND	ND

ND represents results less than the limit of detection.

Table 6
Comparison of Airborne Concentrations to Bulk Concentrations - Chromium

NIOSH REL 500.0 micrograms/cubic meter

OSHA PEL 500.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 $\mu\text{g}/\text{m}^3$	Fixed Station #2 $\mu\text{g}/\text{m}^3$	Fixed Station #3 $\mu\text{g}/\text{m}^3$	(OBZ) $\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{g}$
CG-01	ND	16.67	22.69	12.63	ND
CS-01	11.74	35.42	129.98	31.30	55.00
CS-02	19.34	54.35	229.12	85.43	38.00
CS-03	10.72	43.49	136.87	37.27	37.00
CS-04	ND	17.16	39.35	20.58	ND
CS-05	ND	20.86	46.04	27.29	ND
CS-06	22.94	52.36	111.78	41.63	2.40
CS-07	32.95	81.32	332.92	72.98	7.70
CSDS-01	ND	43.74	118.36	60.33	4.60
CSDS-02	11.95	41.36	136.62	54.42	47.00
N-01	345.46	1772.31	7036.42	3688.52	400.00
N-02	138.89	270.21	1270.57	249.01	120.00
O-1	65.90	96.05	246.56	119.30	49.00
S-01	ND	ND	33.40	ND	3.20
S-02	ND	14.45	16.46	ND	2.10
SH-01	ND	ND	ND	ND	ND
SS-01	ND	ND	ND	ND	ND
SS-02	ND	ND	ND	ND	ND
SS-03	ND	ND	ND	ND	ND
SS-04	ND	12.56	14.64	10.91	2.70
SS-05	ND	12.79	24.94	18.04	3.70
SS-06	ND	13.05	ND	ND	2.80
SS-07	ND	ND	27.16	ND	ND
SSDS-01	ND	ND	10.72	ND	ND
SSDS-02	ND	ND	15.27	ND	2.80
SSDS-03	ND	ND	ND	ND	ND
CP-1A	12.99	70.42	130.73	48.18	7.60
CP-2A	20.01	52.28	290.34	105.94	46.00
CP-3A	10.95	22.95	101.34	93.13	17.00
CP-4A	105.07	419.20	2244.44	471.89	96.00
CPDS-1A	24.32	37.12	227.13	96.37	28.00
G-1A	ND	20.47	62.28	47.03	4.00
G-2A	ND	ND	11.61	ND	ND
G-3A	ND	27.02	25.18	ND	3.70
G-4A	18.07	16.95	98.62	1.40	ND
G-5A	ND	14.94	41.62	60.63	3.50
G-6A	24.95	108.70	205.99	43.49	3.00
G-7A	ND	13.27	31.29	12.77	ND
SG-1A	12.25	18.26	72.64	226.94	48.00
SG-2A	1008.44	939.46	1264.51	5175.98	1700.00

ND represents results less than the limit of detection.

Table 7
Comparison of Airborne Concentrations to Bulk Concentrations - Lead

NIOSH REL 100.0 micrograms/cubic meter
 OSHA PEL 50.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 $\mu\text{g}/\text{m}^3$	Fixed Station #2 $\mu\text{g}/\text{m}^3$	Fixed Station #3 $\mu\text{g}/\text{m}^3$	(OBZ) $\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{g}$
CG-01	3.91	15.00	26.82	13.87	6.30
CS-01	2.27	5.42	10.52	3.96	2.20
CS-02	ND	7.53	33.33	11.46	6.20
CS-03	ND	ND	11.41	4.97	3.00
CS-04	ND	ND	ND	ND	0.95
CS-05	ND	1.94	5.02	ND	0.53
CS-06	ND	2.51	4.35	2.29	0.63
CS-07	3.71	7.92	35.37	10.22	6.80
CSDS-01	ND	3.12	12.67	3.12	0.79
CSDS-02	ND	88.92	4.14	2.30	0.96
N-01	ND	ND	2.28	1.82	0.62
N-02	5.11	13.72	49.99	14.11	7.50
O-1	ND	2.00	ND	ND	0.49
S-01	ND	4.80	25.05	9.39	8.40
S-02	2.92	15.08	33.33	8.56	6.00
SH-01	ND	ND	ND	ND	0.30
SS-01	ND	3.76	4.76	4.14	0.89
SS-02	8.31	ND	10.35	ND	0.39
SS-03	ND	ND	ND	ND	0.33
SS-04	ND	3.35	5.23	3.09	0.47
SS-05	ND	2.31	4.36	5.94	0.62
SS-06	ND	1.89	3.98	1.71	0.64
SS-07	ND	4.16	7.73	3.09	0.20
SSDS-01	ND	ND	2.06	1.95	0.41
SSDS-02	ND	ND	4.95	ND	1.30
SSDS-03	ND	0.18	ND	ND	0.42
CP-1A	7.84	20.71	56.03	23.04	12.00
CP-2A	ND	ND	9.75	3.74	1.90
CP-3A	140.44	459.00	2275.08	1593.54	330.00
CP-4A	391.43	2515.20	120383.60	2462.04	810.00
CPDS-1A	9.32	ND	15.07	ND	1.30
G-1A	ND	ND	ND	ND	0.83
G-2A	ND	ND	8.71	ND	ND
G-3A	ND	ND	2.10	ND	0.36
G-4A	ND	3.31	7.19	3.11	1.00
G-5A	ND	ND	4.37	1.82	0.84
G-6A	2.04	7.73	13.32	7.04	2.40
G-7A	ND	ND	2.50	2.30	0.13
SG-1A	ND	ND	ND	ND	ND
SG-2A	5.15	4.38	8.91	28.99	9.20

ND represents results less than the limit of detection.

Table 8
Comparison of Airborne Concentrations to Bulk Concentrations - Manganese

NIOSH REL 1000.0 micrograms/cubic meter
 OSHA PEL 5000.0 micrograms/cubic meter Ceiling Limit

Abrasive Type	@ Make-up Air Area Fixed Station #1	@ Operator Area Fixed Station #2	@ Exhaust Area Fixed Station #3	Operator 's Breathing Zone (OBZ)	Virgin Bulk Proportion
	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/g
CG-01	13.39	93.75	101.09	82.80	0.66
CS-01	28.84	122.92	309.47	108.51	94.00
CS-02	27.04	106.61	270.78	131.28	36.00
CS-03	61.87	269.21	829.53	289.92	240.00
CS-04	37.03	169.53	352.04	181.15	14.00
CS-05	26.84	112.66	230.22	134.82	6.00
CS-06	64.64	186.39	538.19	143.63	6.30
CS-07	78.25	250.21	873.91	229.36	31.00
CSDS-01	31.15	172.88	456.81	201.79	12.00
CSDS-02	26.79	167.49	289.80	148.60	68.00
N-01	117.86	625.52	2483.44	1209.02	150.00
N-02	122.55	270.21	1083.11	249.01	97.00
O-1	247.12	584.67	1376.62	313.94	510.00
S-01	19.52	79.35	521.92	160.65	13.00
S-02	52.11	230.32	270.83	108.58	8.90
SH-01	15.87	73.13	248.76	47.84	42.00
SS-01	10.94	48.02	59.98	55.90	0.13
SS-02	11.43	52.14	47.60	59.65	0.61
SS-03	8.12	46.22	53.13	50.39	0.31
SS-04	37.65	272.08	355.65	267.55	88.00
SS-05	11.05	35.65	135.11	59.44	2.10
SS-06	20.33	78.74	4.61	62.72	16.00
SS-07	14.97	60.25	181.74	43.31	14.00
SSDS-01	10.09	54.35	92.80	80.71	2.00
SSDS-02	33.34	147.92	350.81	153.94	80.00
SSDS-03	7.48	31.78	61.70	41.44	0.38
CP-1A	35.06	126.35	290.52	131.97	17.00
CP-2A	701.47	2091.18	12650.35	4777.73	2200.00
CP-3A	202.40	792.82	2895.55	2690.40	590.00
CP-4A	142.15	628.80	3264.64	738.61	190.00
CPDS-1A	932.31	1629.20	11356.60	4305.93	1600.00
G-1A	68.56	271.57	871.91	674.71	31.00
G-2A	115.91	870.12	1285.24	457.95	55.00
G-3A	517.17	1309.50	5036.73	541.78	130.00
G-4A	2437.04	2274.14	17670.02	4775.75	100.00
G-5A	92.63	394.36	1394.38	2048.92	89.00
G-6A	561.33	2717.39	6034.12	1097.54	61.00
G-7A	226.95	539.20	1418.44	418.85	100.00
SG-1A	285.83	601.66	1992.53	3919.95	1200.00
SG-2A	4733.48	4801.67	7669.98	26915.11	8900.00

ND represents results less than the limit of detection.

Table 9
Comparison of Airborne Concentrations to Bulk Concentrations - Nickel

NIOSH REL 15.0 micrograms/cubic meter
 OSHA PEL 1000.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 µg/m ³	Fixed Station #2 µg/m ³	Fixed Station #3 µg/m ³	(OBZ) µg/m ³	µg/g
CG-01	ND	ND	ND	ND	ND
CS-01	ND	33.33	82.53	22.95	28.00
CS-02	10.82	33.44	160.38	56.26	25.00
CS-03	ND	33.13	134.80	33.13	44.00
CS-04	ND	19.67	22.78	12.56	5.00
CS-05	ND	22.95	33.49	25.98	2.80
CS-06	ND	161.26	53.82	20.19	ND
CS-07	17.50	60.47	353.72	54.21	20.00
CSDS-01	ND	45.82	83.06	31.20	2.90
CSDS-02	ND	24.81	66.24	31.39	22.00
N-01	89.41	396.16	2897.35	1311.48	660.00
N-02	612.75	1455.00	6040.41	1245.07	640.00
O-1	864.91	1754.02	4520.24	1025.53	1700.00
S-01	ND	ND	ND	ND	ND
S-02	ND	ND	ND	ND	ND
SH-01	ND	ND	ND	ND	ND
SS-01	ND	12.11	ND	ND	ND
SS-02	ND	14.81	ND	ND	ND
SS-03	ND	ND	ND	ND	ND
SS-04	ND	ND	16.32	ND	ND
SS-05	ND	ND	ND	ND	ND
SS-06	ND	ND	ND	ND	3.00
SS-07	ND	ND	15.25	ND	ND
SSDS-01	ND	ND	ND	ND	ND
SSDS-02	ND	ND	ND	ND	2.50
SSDS-03	ND	ND	ND	ND	ND
CP-1A	15.26	ND	13.07	ND	ND
CP-2A	ND	29.28	126.50	49.85	24.00
CP-3A	ND	ND	28.96	35.18	6.40
CP-4A	16.28	60.78	306.06	67.71	17.00
CPDS-1A	ND	37.12	115.63	96.37	20.00
G-1A	ND	ND	ND	ND	ND
G-2A	ND	ND	ND	ND	ND
G-3A	ND	ND	ND	ND	ND
G-4A	ND	12.82	34.93	11.84	5.70
G-5A	ND	ND	ND	ND	ND
G-6A	ND	20.90	22.89	18.64	4.60
G-7A	ND	55.99	ND	ND	ND
SG-1A	28.58	19.29	70.57	474.52	140.00
SG-2A	493.93	521.92	704.81	2691.51	980.00

ND represents results less than the limit of detection.

Table 10
Comparison of Airborne Concentrations to Bulk Concentrations - Respirable Quartz

NIOSH REL 0.05 milligrams/cubic meter
 OSHA PEL As Calculated $\left(PEL = \frac{10 \text{ mg} / \text{m}^3}{\% \text{ silica} + 2} \right)$

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator's Breathing Zone	Virgin Bulk Percentage
	Fixed Station #1 mg/m ³	Fixed Station #2 mg/m ³	Fixed Station #3 mg/m ³	(OBZ) mg/m ³	
CG-01	ND	ND	ND	ND	ND
CS-01	ND	ND	ND	ND	ND
CS-02	ND	ND	ND	ND	ND
CS-03	ND	ND	ND	ND	ND
CS-04	ND	ND	ND	ND	ND
CS-05	ND	ND	ND	ND	ND
CS-06	ND	ND	ND	ND	ND
CS-07	ND	ND	ND	ND	ND
CSDS-01	ND	ND	ND	ND	2.90
CSDS-02	ND	ND	ND	ND	ND
N-01	ND	ND	ND	ND	ND
N-02	ND	ND	ND	ND	ND
O-1	ND	ND	ND	ND	ND
S-01	ND	ND	ND	ND	1.00
S-02	ND	0.49	ND	ND	0.90
SH-01	ND	ND	ND	ND	ND
SS-01	6.34	19.96	33.75	13.49	81.00
SS-02	9.80	26.01	43.17	20.34	73.00
SS-03	2.43	11.07	3.89	2.93	75.00
SS-04	ND	12.98	3.19	7.54	55.00
SS-05	4.13	16.03	30.58	22.03	70.00
SS-06	5.16	10.10	17.02	12.03	39.00
SS-07	3.46	7.09	16.03	10.74	52.00
SSDS-01	5.61	21.09	30.58	17.05	79.00
SSDS-02	ND	4.18	4.38	3.42	42.00
SSDS-03	ND	2.10	ND	0.96	88.00
CP-1A	ND	ND	ND	ND	ND
CP-2A	ND	ND	ND	ND	ND
CP-3A	ND	ND	ND	ND	ND
CP-4A	ND	0.50	ND	0.74	ND
CPDS-1A	ND	ND	ND	ND	ND
G-1A	ND	ND	ND	ND	ND
G-2A	ND	0.49	0.49	0.50	4.40
G-3A	ND	0.98	0.98	6.83	ND
G-4A	ND	0.74	0.49	1.25	ND
G-5A	ND	ND	ND	ND	ND
G-6A	ND	ND	0.24	0.24	ND
G-7A	ND	ND	ND	ND	ND
SG-1A	ND	ND	ND	ND	ND
SG-2A	ND	ND	ND	ND	ND

ND represents results less than the limit of detection.

Table 11
Comparison of Airborne Concentrations to Bulk Concentrations - Silver

NIOSH REL 10.0 micrograms/cubic meter
 OSHA PEL 10.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area Fixed Station #1	@ Operator Area Fixed Station #2	@ Exhaust Area Fixed Station #3	Operator 's Breathing Zone (OBZ)	Virgin Bulk Proportion
	µg/m ³	µg/m ³	µg/m ³	µg/m ³	µg/g
CG-01	ND	ND	ND	ND	ND
CS-01	ND	ND	ND	ND	0.39
CS-02	ND	ND	ND	ND	ND
CS-03	ND	ND	ND	ND	0.62
CS-04	ND	ND	ND	ND	ND
CS-05	ND	ND	ND	ND	ND
CS-06	1.94	ND	ND	ND	ND
CS-07	ND	ND	ND	ND	ND
CSDS-01	ND	20.62	ND	ND	ND
CSDS-02	ND	ND	1.95	ND	0.41
N-01	ND	ND	ND	ND	ND
N-02	ND	ND	ND	ND	ND
O-1	ND	ND	ND	ND	ND
S-01	ND	ND	ND	ND	ND
S-02	ND	ND	ND	ND	ND
SH-01	ND	ND	ND	ND	0.44
SS-01	ND	ND	ND	ND	ND
SS-02	ND	ND	ND	ND	ND
SS-03	ND	ND	ND	ND	ND
SS-04	ND	ND	ND	ND	ND
SS-05	ND	ND	ND	ND	ND
SS-06	ND	ND	ND	ND	ND
SS-07	ND	ND	ND	ND	ND
SSDS-01	ND	ND	ND	1.78	0.47
SSDS-02	ND	ND	ND	ND	ND
SSDS-03	ND	ND	ND	ND	ND
CP-1A	ND	ND	ND	ND	ND
CP-2A	ND	2.93	13.69	4.78	0.98
CP-3A	3.51	7.72	17.79	14.49	2.30
CP-4A	ND	6.71	77.54	8.62	4.60
CPDS-1A	ND	2.68	4.75	ND	0.69
G-1A	ND	ND	ND	ND	ND
G-2A	ND	ND	ND	ND	ND
G-3A	ND	ND	ND	ND	ND
G-4A	ND	ND	ND	ND	ND
G-5A	ND	ND	ND	ND	ND
G-6A	ND	ND	ND	ND	ND
G-7A	ND	3.11	ND	ND	ND
SG-1A	ND	ND	ND	ND	ND
SG-2A	ND	ND	ND	ND	ND

ND represents results less than the limit of detection.

Table 12
Comparison of Airborne Concentrations to Bulk Concentrations - Titanium

NIOSH REL - Limit of Quantification (Lowest Feasible Concentration)
 OSHA PEL 15000.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 $\mu\text{g}/\text{m}^3$	Fixed Station #2 $\mu\text{g}/\text{m}^3$	Fixed Station #3 $\mu\text{g}/\text{m}^3$	(OBZ) $\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{g}$
CG-01	ND	8.96	9.49	9.73	ND
CS-01	391.35	1208.33	5364.14	1168.61	1800.00
CS-02	540.77	1421.40	6456.99	2292.14	940.00
CS-03	721.80	2899.15	10576.52	2899.15	2000.00
CS-04	370.29	1318.54	3313.32	1729.11	130.00
CS-05	173.41	688.50	1423.19	756.33	71.00
CS-06	813.18	2010.47	1718.07	1311.41	58.00
CS-07	1112.03	2293.58	11652.10	2293.58	150.00
CSDS-01	332.23	1687.15	4568.11	2288.33	140.00
CSDS-02	412.12	1468.16	5588.90	1967.35	1600.00
N-01	18.49	81.32	289.74	176.23	13.00
N-02	347.22	644.36	2707.77	560.28	150.00
O-1	ND	8.14	17.88	10.05	2.50
S-01	228.41	1023.18	3131.52	3338.20	190.00
S-02	958.73	3768.84	3541.67	1148.47	140.00
SH-01	7.73	13.37	41.46	12.06	7.40
SS-01	10.73	87.68	37.23	76.60	4.70
SS-02	22.85	95.93	76.57	84.33	4.50
SS-03	4.58	11.34	26.56	15.72	2.70
SS-04	54.38	397.66	564.85	349.87	82.00
SS-05	8.24	31.46	64.44	49.19	11.00
SS-06	56.92	142.98	5.03	77.36	38.00
SS-07	28.71	72.72	271.57	37.12	19.00
SSDS-01	8.85	39.72	61.87	53.81	7.40
SSDS-02	39.59	179.17	598.43	196.48	73.00
SSDS-03	ND	5.96	6.57	8.70	4.50
CP-1A	146.42	745.65	1535.59	607.46	120.00
CP-2A	577.68	1589.29	9746.99	3946.82	1200.00
CP-3A	392.40	1022.32	5170.63	4759.93	840.00
CP-4A	309.02	1383.36	7345.44	1497.74	280.00
CPDS-1A	790.43	1299.24	8878.79	3280.71	390.00
G-1A	66.49	192.19	311.40	306.69	15.00
G-2A	19.39	110.36	93.28	77.02	11.00
G-3A	16.96	64.44	100.73	27.09	8.80
G-4A	406.17	392.81	965.69	1100.50	28.00
G-5A	53.52	228.31	332.99	564.50	33.00
G-6A	228.69	1045.15	790.68	434.87	40.00
G-7A	226.94	497.72	1251.56	335.08	46.00
SG-1A	9.80	10.17	47.74	167.11	28.00
SG-2A	7.20	7.52	8.71	28.99	8.00

ND represents results less than the limit of detection.

Table 13
Comparison of Airborne Concentrations to Bulk Concentrations - Vanadium

NIOSH REL 50.0 micrograms/cubic meter Ceiling Limit
 OSHA PEL 500.0 micrograms/cubic meter Ceiling Limit

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin Bulk Proportion
	Fixed Station #1 $\mu\text{g}/\text{m}^3$	Fixed Station #2 $\mu\text{g}/\text{m}^3$	Fixed Station #3 $\mu\text{g}/\text{m}^3$	(OBZ) $\mu\text{g}/\text{m}^3$	$\mu\text{g}/\text{g}$
CG-01	ND	ND	ND	ND	ND
CS-01	14.42	41.67	189.81	45.91	67.00
CS-02	29.12	83.61	354.09	131.28	57.00
CS-03	22.69	99.40	352.55	95.26	100.00
CS-04	9.46	39.77	109.75	53.52	5.70
CS-05	13.01	50.07	119.30	65.77	4.40
CS-06	29.19	69.11	91.08	54.12	3.60
CS-07	61.78	154.30	665.83	141.78	14.00
CSDS-01	11.21	60.40	176.50	85.29	7.40
CSDS-02	12.16	49.63	190.44	62.79	57.00
N-01	3.66	20.43	76.57	38.93	4.20
N-02	16.75	31.18	152.05	29.05	13.00
O-1	ND	2.30	3.90	ND	0.55
S-01	2.28	6.26	22.96	10.64	3.60
S-02	2.50	11.52	14.58	5.43	1.90
SH-01	ND	ND	6.84	ND	2.00
SS-01	ND	ND	2.07	2.48	ND
SS-02	ND	3.75	4.14	4.52	0.32
SS-03	ND	ND	ND	ND	ND
SS-04	3.56	15.49	23.01	13.38	4.20
SS-05	5.02	15.94	35.34	22.55	6.00
SS-06	2.03	6.22	ND	2.93	2.10
SS-07	ND	1.95	7.52	ND	0.93
SSDS-01	ND	2.09	3.71	2.48	0.34
SSDS-02	ND	6.67	2042.92	7.49	4.50
SSDS-03	ND	ND	2.19	ND	ND
CP-1A	3.09	13.46	31.13	11.73	1.90
CP-2A	30.95	83.65	518.46	201.50	88.00
CP-3A	17.76	45.90	248.19	206.95	53.00
CP-4A	11.33	58.69	244.85	55.40	15.00
CPDS-1A	40.54	65.99	454.26	168.14	51.00
G-1A	1.83	11.07	39.44	26.58	2.70
G-2A	ND	4.24	6.43	4.58	1.60
G-3A	3.10	3.33	9.44	3.13	1.10
G-4A	8.12	9.30	53.42	15.57	0.81
G-5A	1.77	9.76	31.22	43.91	2.70
G-6A	15.59	73.16	120.68	35.20	4.10
G-7A	9.28	20.12	52.15	12.57	3.00
SG-1A	4.70	5.60	29.06	142.36	34.00
SG-2A	57.63	50.10	78.77	331.26	110.00

ND represents results less than the limit of detection.

Table 14
Comparison of Airborne Concentrations to Bulk Concentrations - Respirable Dust
 NIOSH REL - none
 OSHA PEL 5 milligrams/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone
	Fixed Station #1 mg/m ³	Fixed Station #2 mg/m ³	Fixed Station #3 mg/m ³	(OBZ) mg/m ³
CG-01	7.76	56.06	70.01	51.38
CS-01	6.85	27.43	31.46	14.14
CS-02	4.64	17.92	13.45	17.67
CS-03	5.62	23.17	23.31	16.59
CS-04	2.93	13.47	27.29	13.02
CS-05	2.70	32.39	14.14	8.23
CS-06	10.25	37.81	40.94	17.00
CS-07	1.22	14.29	6.80	5.40
CSDS-01	2.94	8.58	12.48	5.61
CSDS-02	1.46	10.23	7.12	5.54
N-01	3.43	8.25	23.18	29.07
N-02	1.48	ND	ND	16.51
O-1	6.64	43.33	42.90	39.99
S-01	3.95	24.15	68.31	15.26
S-02	1.72	26.98	34.63	11.79
SH-01	3.41	10.29	15.21	12.79
SS-01	6.34	21.18	45.98	13.49
SS-02	13.97	27.73	50.29	28.82
SS-03	2.68	15.25	3.89	3.91
SS-04	ND	54.61	10.55	30.63
SS-05	4.62	25.27	52.10	31.09
SS-06	16.21	33.49	63.17	45.55
SS-07	8.15	23.97	43.66	31.24
SSDS-01	5.61	24.03	30.58	22.57
SSDS-02	ND	10.08	13.63	9.53
SSDS-03	1.17	2.80	2.82	14.96
CP-1A	3.93	27.82	31.55	16.08
CP-1B	7.32	41.86	49.49	31.76
CP-2A	4.41	12.74	6.39	10.54
CP-2B	4.14	8.09	17.96	6.93
CP-3A	3.17	9.77	23.84	8.63
CP-3B	7.17	23.91	13.32	14.56
CP-4A	6.07	38.12	13.22	40.39
CP-4B	6.36	33.35	33.26	44.18
CPDS-1A	0.73	7.99	9.60	4.66
CPDS-1B	2.21	15.82	19.72	12.33
G-1A	0.98	6.62	9.02	4.62
G-1B	1.22	14.95	6.92	8.95
G-2A	2.90	7.57	13.93	8.82
G-2B	2.68	13.51	7.02	7.14
G-3A	2.71	17.38	14.17	39.25
G-4A	1.95	18.66	21.34	18.69
G-4B	3.42	32.59	6.06	48.02
G-5A	2.68	10.97	13.22	8.48
G-5B	1.96	24.50	45.20	22.88
G-6A	3.18	26.90	8.77	19.37
G-6B	6.76	12.53	32.22	15.86
G-7A	8.85	29.44	23.95	18.44
G-7B	9.46	47.70	ND	34.61
SG-1A	6.37	33.82	22.11	19.40
SG-1B	0.90	4.05	2.26	1.61
SG-2A	4.88	8.31	31.50	15.12
SG-2B	ND	1.72	0.73	2.64

ND represents results less than the limit of detection.

Table 15: Summary of Airborne Sample Results of Health-Related Elements by Generic Category of Abrasive
Note: Unless Otherwise Noted, All Minimum, Maximum, and Geometric Mean Values are in micrograms per cubic meter

Generic Abrasive	Number of Samples	Arsenic	Beryllium	Cadmium	Chromium	Lead	Manganese	Nickel	Respirable Quartz (mg/m ³)	Silver	Titanium	Vanadium
CG	4	2.06 - 2.085 2.070 0	0.031 - 0.126 0.075 3	0.05 - 0.05 0.050 0	5.15 - 22.69 12.524 3	3.91 - 26.82 12.153 4	13.39 - 101.1 56.930 4	5.15 - 5.21 5.174 0	0.12 - 0.122 0.122 0	0.83 - 0.835 0.829 0	2.06 - 9.73 6.425 3	0.825 - 0.835 0.829 0
CS	28	0.52 - 29.13 2.902 9	0.193 - 24.97 2.040 28	0.05 - 2.71 0.134 10	5.145 - 332.9 38.727 26	0.825 - 35.37 3.885 18	26.84 - 873.9 148.723 28	5.15 - 353.7 28.303 23	0.11 - 0.124 0.122 0	0.83 - 2.615 0.907 1	173.4 - 11652 1545.090 28	9.46 - 665.8 69.966 28
CSDS	8	2.06 - 4.76 2.304 1	0.353 - 7.475 2.227 8	0.07 - 0.21 0.083 1	5.19 - 136.6 39.525 7	0.825 - 88.92 4.044 6	26.79 - 456.8 132.656 8	5.15 - 83.06 25.221 6	0.12 - 0.126 0.123 0	0.83 - 20.62 1.379 2	332.2 - 5589 1580.726 8	11.21 - 190.4 54.116 8
N	8	2.03 - 170.8 9.728 4	0.031 - 1.729 0.142 5	0.04 - 10.21 0.246 4	138.9 - 7036 811.832 8	0.815 - 49.99 4.397 6	117.9 - 2483 459.200 8	89.4 - 6040 987.252 8	0.12 - 0.124 0.159 0	0.82 - 0.835 0.826 0	18.49 - 2708 267.299 8	3.66 - 152.1 29.100 8
O	4	0.515 - 2.095 1.037 0	0.003 - 0.121 0.028 2	0.04 - 0.05 0.045 0	65.9 - 246.6 116.812 4	0.82 - 2.095 1.631 1	247.1 - 1377 499.883 4	865 - 4520 1628.467 4	0.12 - 0.123 0.123 0	0.82 - 0.835 0.829 0	2.06 - 17.88 7.409 3	0.825 - 3.9 1.577 2
S	8	2.075 - 2.095 2.087 0	0.031 - 0.292 0.059 3	0.075 - 0.23 0.086 1	5.19 - 33.4 8.621 3	0.83 - 33.33 7.654 7	19.52 - 521.9 120.960 8	5.19 - 5.235 5.215 0	0.12 - 0.486 0.145 1	0.83 - 0.84 0.835 0	228.4 - 3769 1564.573 8	2.28 - 22.96 7.287 8
SH	4	2.075 - 2.09 2.084 0	0.031 - 0.435 0.060 1	0.075 - 0.25 0.101 1	5.18 - 5.225 5.206 0	2.075 - 2.09 2.084 0	15.87 - 248.8 60.964 4	5.18 - 5.225 5.206 0	0.12 - 0.128 0.124 0	0.83 - 0.835 0.832 0	7.73 - 41.46 15.077 4	0.83 - 6.84 1.411 1
SS	28	0.82 - 6.92 2.039 2	0.03 - 0.356 0.087 17	0.04 - 1.99 0.084 7	5.02 - 27.16 7.123 8	0.805 - 10.35 2.744 17	4.614 - 355.6 45.717 28	5.02 - 16.32 5.990 4	0.12 - 43.17 8.828 27	0.81 - 0.84 0.828 0	4.58 - 564.9 48.837 28	0.805 - 35.34 3.161 18
SSDS	12	1.985 - 2.09 2.050 0	0.03 - 0.31 0.056 4	0.06 - 1.49 0.099 2	4.965 - 15.27 5.964 2	0.18 - 4.95 1.263 4	7.478 - 350.8 54.351 12	4.97 - 5.225 5.126 0	0.12 - 30.58 2.633 9	0.8 - 1.78 0.875 1	2.02 - 598.4 30.591 11	0.795 - 2043 3.286 7
CP	32	5.98 - 24485 89.068 32	0.036 - 6.412 0.783 27	0.04 - 71.41 1.041 27	10.95 - 2244 82.231 32	0.825 - 1E+05 91.953 29	35.06 - 12650 652.694 32	5.16 - 306.1 19.227 21	0.12 - 0.735 0.145 3	0.83 - 77.54 3.463 20	146.4 - 9747 1240.066 32	3.09 - 518.5 45.347 32
CPDS	8	2.05 - 107.4 14.942 7	0.243 - 2.891 0.639 8	0.04 - 0.36 0.079 2	24.32 - 227.1 66.750 8	0.82 - 15.07 5.112 5	932.3 - 11357 2717.631 8	5.06 - 115.6 30.219 6	0.12 - 0.125 0.122 0	0.81 - 9.42 2.101 5	790.4 - 8879 2077.501 8	40.54 - 454.3 108.112 8
G	52	0.515 - 2.12 1.970 1	0.021 - 2.289 0.098 30	0.04 - 2.69 0.129 25	1.4 - 206 18.249 37	0.35 - 13.32 1.844 24	58 - 17670 829.383 52	5.08 - 55.99 7.399 14	0.12 - 6.826 0.228 17	0.81 - 3.11 0.852 1	10.25 - 1252 186.754 52	0.82 - 120.7 10.782 50
SG	16	0.96 - 187.7 10.714 12	0.031 - 0.515 0.051 3	0.04 - 1.77 0.085 2	9.61 - 8551 231.112 14	0.39 - 45.88 2.632 8	14.6 - 41710 1815.402 16	9.61 - 4380 196.008 14	0.12 - 0.269 0.144 0	0.82 - 15.24 1.645 1	2.075 - 167.1 13.873 13	1.535 - 479.7 31.177 15

Legend

Range Min. - Max. Values
<--- Geometric Mean
<--- Samples > Limit of Detection

TABLE 16
Generic Abrasive Summary
Phase 2
Results for Abrasive Type

Generic Abrasive Type	Cleaning Rate (FT²/Hour)	Consumption Rate (Lbs./FT²)	Average Surface Profile (mils)	Average Breakdown Rate X%	Embedment %
CS-06	144	7.2	4.2	58.82	16.6
N-01	104	9.2	4.1	57.69	2.7
S-02	140	8.1	3.9	29.41	1.6
SS-04	127	8.5	4.3	54.17	4.5
SSDS-03	146	8.8	4.0	41.03	1.8
CP-2A	102	8.5	4.4	65.82	11.0
G-3A	173	8.0	4.4	50.00	5.0
SG-2A	83	15.6	4.3	3.92	11.1

TABLE 17
Abrasive Cleaning Cost Summary
Non Hazardous Waste
Phase 2

Abrasive No.	Generic Abrasive	Size Designation	Nozzle Size	Flow Rate* (ton/hr.)	Avg. Mat'l Cost (\$/ton)	Disposal (\$/ton)	Equipment (\$/hr.)	Crew Labor** (\$/hr.)	No. of Uses	Cleaning Rate* (sq ft/hr.)	Cleaning Cost (\$/sq ft)
CS-06	Coal Slag	2040	7/16"	1.03248	42.56	30.00	23.78	100.74	1	287	0.69
N-01	Nickel Slag	2050	7/16"	0.94703	49.28	30.00	23.78	100.74	1	207	0.96
S-02	Staurolite	Regular	7/16"	1.13724	113.45	30.00	23.78	100.74	1	281	1.02
SS-04	Silica Sand	2340	7/16"	1.07738	24.08	30.00	23.78	100.74	1	254	0.72
SSDS-03	Silica Sand with Dust Suppressant	3	7/16"	1.28392	33.35	30.00	23.78	100.74	1	292	0.71
CP-2A	Copper Slag	16/30	7/16"	0.87040	50.63	30.00	32.43	100.74	2	205	0.82
G-3A	Garnet	#40	7/16"	1.38320	223.29	30.00	32.43	100.74	2	346	0.89
SG-2A	Steel Grit	40/50	7/16"	1.28700	477.00	30.00	40.13	100.74	100	165	0.89

* Field study results doubled to account for two (2) abrasive blast nozzles

** Abrasive blast cleaning crew consisting of two (2) nozzle operators and one (1) laborer

TABLE 18
Abrasive Cleaning Cost Summary
Hazardous Waste
Phase 2

Abrasive No.	Generic Abrasive	Size Designation	Nozzle Size	Flow Rate* (ton/hr.)	Disposal (\$/ton)	Avg. Mat'l Cost (\$/ton)	Equipment (\$/hr.)	Crew Labor** (\$/hr.)	No. of Uses	Cleaning Rate* (sq ft/hr.)	Cleaning Cost (\$/sq ft)
CS-06	Coal Slag	2040	7/16"	1.03248	184.00	42.56	23.78	100.74	1	287	1.25
N-01	Nickel Slag	2050	7/16"	0.94703	184.00	49.28	23.78	100.74	1	207	1.67
S-02	Staurolite	Regular	7/16"	1.13724	184.00	113.45	23.78	100.74	1	281	1.65
SS-04	Silica Sand	2340	7/16"	1.07738	184.00	24.08	23.78	100.74	1	254	1.37
SSDS-03	Silica Sand with Dust Suppressant	3	7/16"	1.28392	184.00	33.35	23.78	100.74	1	292	1.38
CP-2A	Copper Slag	16/30	7/16"	0.87040	184.00	50.63	32.43	100.74	2	205	1.15
G-3A	Garnet	#40	7/16"	1.38320	184.00	223.29	32.43	100.74	2	346	1.20
SG-2A	Steel Grit	40/50	7/16"	1.28700	184.00	477.00	40.13	100.74	100	165	0.91

* Field study results doubled to account for two (2) abrasive blast nozzles

** Abrasive blast cleaning crew consisting of two (2) nozzle operators and one (1) laborer

Table 19
Comparison of Airborne Concentrations to Bulk Concentrations - Arsenic

NIOSH REL 2.0 micrograms/cubic meter Ceiling Limit
 OSHA PEL 10.0 micrograms/cubic meter

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Arsenic	
Type	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	10.54	7.18	9.25	7.77	ND	<LOD 0.9
N	2.10	6.11	5.62	4.77	ND	<LOD 0.9
S	ND	1.45	1.43	ND	ND	<LOD 0.9
SS	ND	9.93	11.28	4.41	ND	<LOD 0.9
SSDS	4.20	5.99	7.94	7.36	ND	<LOD 0.9
CP	10.92	25.01	25.04	33.13	24.00	>LOQ 9.0
G	5.61	10.10	11.89	11.08	ND	<LOD 0.9
SG	8.35	6.83	24.83	185.82	48.00	>LOQ 9.0

ND represents results less than the limit of detection.

Table 20
Comparison of Airborne Concentrations to Bulk Concentrations - Beryllium

NIOSH REL 0.50 micrograms/cubic meter
 OSHA PEL 2.0 micrograms/cubic meter

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Beryllium	
Type	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	0.86	5.07	5.87	4.83	0.11	>LOQ 0.05
N	0.08	0.23	0.16	0.17	0.04	<LOQ 0.05
S	0.33	0.79	0.80	0.53	ND	<LOD 0.01
SS	ND	0.84	0.90	4.83	0.05	<LOQ 0.05
SSDS	ND	0.11	0.12	0.14	ND	<LOD 0.01
CP	0.38	0.88	0.83	1.24	0.90	>LOQ 0.1
G	0.39	0.42	0.64	0.62	0.02	<LOQ 0.05
SG	ND	ND	ND	ND	ND	<LOD 0.01

ND represents results less than the limit of detection.

Table 21
Comparison of Airborne Concentrations to Bulk Concentrations - Cadmium

NIOSH REL - Limit of Quantification (Lowest Feasible Concentration)
 OSHA PEL 5.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Cadmium	
	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	1.03	0.28	0.41	0.53	0.03	<LOQ 0.7
N	0.23	0.34	0.31	0.57	ND	<LOD 0.02
S	0.21	0.29	0.31	0.21	ND	<LOD 0.02
SS	0.07	0.30	0.32	0.19	0.03	<LOQ 0.7
SSDS	0.11	0.18	0.22	0.51	ND	<LOD 0.02
CP	0.12	0.27	0.33	3.73	0.03	<LOQ 0.7
G	0.69	1.12	1.51	1.29	0.05	<LOQ 0.7
SG	0.08	0.19	0.17	12.25	ND	<LOD 0.02

ND represents results less than the limit of detection.

Table 22
Comparison of Airborne Concentrations to Bulk Concentrations - Chromium

NIOSH REL 500.0 micrograms/cubic meter
 OSHA PEL 500.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Chromium	
	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	62.37	124.63	162.43	121.84	ND	<LOD 2.0
N	1931.15	5434.78	3593.89	4038.18	350.00	>LOQ 7.0
S	54.26	88.85	98.18	63.64	ND	<LOD 2.0
SS	ND	52.81	63.17	94.53	3.00	<LOQ 7.0
SSDS	14.69	42.81	46.81	42.90	ND	<LOD 2.0
CP	39.70	85.46	85.57	101.45	33.00	>LOQ 7.0
G	56.05	98.93	131.60	108.70	3.00	<LOQ 7.0
SG	334.09	310.64	1241.62	8576.33	1300.00	>LOQ 7.0

ND represents results less than the limit of detection.

Table 23
Comparison of Airborne Concentrations to Bulk Concentrations - Lead

NIOSH REL 100.0 micrograms/cubic meter
 OSHA PEL 50.0 micrograms/cubic meter

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Lead	
Type	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	12.04	9.93	11.73	11.76	ND	<LOD 0.7
N	5.04	8.38	7.41	7.16	ND	<LOD 0.7
S	31.30	57.86	53.18	34.90	2.50	>LOQ 2.0
SS	ND	11.62	14.21	7.56	ND	<LOD 0.7
SSDS	4.62	9.42	10.99	11.24	ND	<LOD 0.7
CP	3.18	8.75	7.51	10.14	3.20	>LOQ 2.0
G	5.19	8.63	11.67	10.26	ND	<LOD 0.7
SG	1.92	4.76	11.59	24.50	4.70	>LOQ 2.0

ND represents results less than the limit of detection.

Table 24
Comparison of Airborne Concentrations to Bulk Concentrations - Manganese

NIOSH REL 1000.0 micrograms/cubic meter
 OSHA PEL 5000.0 micrograms/cubic meter Ceiling Limit

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Manganese	
Type	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	903.23	633.71	834.69	651.21	2.80	> LOQ 0.1
N	881.61	2264.49	1752.02	1762.11	130.00	> LOQ 0.1
S	480.01	764.53	818.20	554.32	5.30	> LOQ 0.1
SS	64.52	802.70	947.48	441.14	110.00	> LOQ 0.1
SSDS	102.80	256.87	325.60	306.45	0.17	> LOQ 0.1
CP	1091.79	2501.25	2504.38	3312.63	1600.00	> LOQ 0.1
G	5812.99	9261.60	13584.65	11075.56	170.00	> LOQ 0.1
SG	1607.78	1594.60	6001.16	38797.68	7000.00	> LOQ 0.5

Table 25
Comparison of Airborne Concentrations to Bulk Concentrations - Nickel

NIOSH REL 15.0 micrograms/cubic meter
 OSHA PEL 1000.0 micrograms/cubic meter

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
	Fixed Station #1 mg/m ³	Fixed Station #2 mg/m ³	Fixed Station #3 mg/m ³	(OBZ) mg/m ³	Nickel	
					µg/g	Notes
CS	36.56	73.93	101.52	90.33	ND	< LOD 2.0
N	482.79	1539.86	988.32	1101.32	400.00	> LOQ 4.0
S	16.70	37.19	42.96	12.32	ND	< LOD 2.0
SS	10.75	35.91	36.09	46.21	ND	< LOD 2.0
SSDS	ND	23.55	22.39	16.34	ND	< LOD 2.0
CP	15.88	37.52	43.83	47.62	19.00	> LOQ 4.0
G	ND	25.26	29.72	18.46	ND	< LOD 2.0
SG	179.57	130.47	682.89	4696.56	680.00	> LOQ 4.0

ND represents results less than the limit of detection.

Table 26
Comparison of Airborne Concentrations to Bulk Concentrations - Respirable Quartz

NIOSH REL 0.05 milligrams/cubic meter
 OSHA PEL As Calculated

Abrasive Type	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
	Fixed Station #1 mg/m ³	Fixed Station #2 mg/m ³	Fixed Station #3 mg/m ³	(OBZ) mg/m ³	Respirable Quartz	
					%	Notes
CS	ND	ND	0.01	ND	ND	< LOD 0.80
N	ND	ND	ND	ND	ND	< LOD 0.80
S	0.04	0.11	0.00	0.09	1.60	< LOQ 2.00
SS	0.40	1.30	0.00	1.54	51.00	> LOQ 2.0
SSDS	0.37	0.87	1.15	1.00	71.00	> LOQ 2.0
CP	ND	ND	ND	ND	ND	< LOD 0.80
G	0.04	0.00	0.16	0.08	1.90	< LOQ 2.00
SG	ND	ND	ND	ND	ND	< LOD 0.80

ND represents results less than the limit of detection.

Table 27
Comparison of Airborne Concentrations to Bulk Concentrations - Silver

NIOSH REL 10.0 micrograms/cubic meter
 OSHA PEL 10.0 micrograms/cubic meter

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Silver	
Type	ng/m ³	ng/m ³	ng/m ³	ng/m ³	µg/g	Notes
CS	ND	ND	ND	ND	ND	< LOD 0.3
N	ND	ND	ND	ND	ND	< LOD 0.3
S	ND	ND	ND	ND	0.40	< LOQ 1.0
SS	ND	ND	ND	ND	ND	< LOD 0.3
SSDS	ND	ND	2.04	ND	ND	< LOD 0.3
CP	ND	ND	ND	ND	1.00	< LOQ 1.0
G	ND	ND	ND	ND	ND	< LOD 0.3
SG	ND	ND	ND	ND	ND	< LOD 3.0

ND represents results less than the limit of detection.

Table 28
Comparison of Airborne Concentrations to Bulk Concentrations - Titanium

NIOSH REL Limit of Quantification (Lowest Feasible Concentration)
 OSHA PEL 15000.0 micrograms/cubic meter

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator 's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Titanium	
Type	ng/m ³	ng/m ³	ng/m ³	ng/m ³	µg/g	Notes
CS	1010.75	1901.14	2932.68	1806.57	33.00	> LOQ 2.0
N	90.26	217.39	159.48	165.20	12.00	> LOQ 2.0
S	4591.37	5165.72	5113.73	4722.02	97.00	> LOQ 2.0
SS	103.23	992.82	1127.96	2730.86	67.00	> LOQ 2.0
SSDS	15.74	29.97	32.56	38.82	3.40	> LOQ 2.0
CP	635.22	1438.22	1460.89	2070.39	790.00	> LOQ 2.0
G	228.37	273.64	339.62	307.65	7.90	> LOQ 2.0
SG	6.26	22.78	19.04	81.68	7.50	> LOQ 2.0

Table 29
Comparison of Airborne Concentrations to Bulk Concentrations - Vanadium

NIOSH REL 50.0 micrograms/cubic meter Ceiling Limit
 OSHA PEL 500.0 micrograms/cubic meter Ceiling Limit

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator's Breathing Zone	Virgin (Pre Blast) Bulk	
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Vanadium	
Type	mg/m ³	mg/m ³	mg/m ³	mg/m ³	µg/g	Notes
CS	45.16	133.08	171.45	123.94	1.80	> LOQ 1.0
N	23.09	58.88	42.68	42.22	2.90	> LOQ 1.0
S	18.78	28.93	28.64	24.64	0.90	< LOQ 1.0
SS	4.30	46.47	51.89	109.23	6.90	> LOQ 1.0
SSDS	2.10	4.71	4.07	2.04	ND	< LOD 0.3
CP	39.70	83.38	87.65	122.15	58.00	> LOQ 1.0
G	14.53	20.63	25.47	22.56	0.70	< LOQ 1.0
SG	19.21	19.05	68.29	490.08	67.00	> LOQ 1.0

ND represents results less than the limit of detection.

Table 30
Comparison of Airborne Concentrations to Bulk Concentrations - Respirable Dust

NIOSH REL - none
 OSHA PEL 5 milligrams/cubic meter

	@ Make-up Air Area	@ Operator Area	@ Exhaust Area	Operator's Breathing Zone	Virgin (Pre Blast) Bulk
Abrasive	Fixed Station #1	Fixed Station #2	Fixed Station #3	(OBZ)	Respirable Dust
Type	mg/m ³	mg/m ³	mg/m ³	mg/m ³	
CS	32.95	6.92	167.17	110.89	NA
N	53.31	166.50	204.37	130.71	NA
S	63.32	184.60	201.08	125.67	NA
SS	55.24	192.96	252.60	165.04	NA
SSDS	23.09	60.61	71.85	50.81	NA
CP	29.25	133.18	90.15	58.35	NA
G	34.86	260.16	200.88	123.40	NA
SG	10.11	35.55	38.77	23.33	NA

NA = not applicable

Table 31: Summary of Airborne Sample Results of Health-Related Elements by Generic Category of Abrasive
Note: Unless otherwise noted, all Minimum, Maximum, and Geometric Mean Values are in micrograms per cubic meter

Generic Abrasive	Number of Samples	Arsenic	Beryllium	Cadmium	Chromium	Lead	Manganese	Nickel	Respirable Quartz (mg/m ³)	Silver	Titanium	Vanadium	
CS	4	7.182 - 10.54 8.588 4	0.86 - 5.87 3.334 4	0.275 - 1.032 0.496 4	62.37 - 162.4 111.369 4	9.93 - 12.04 11.332 4	633.7 - 903.2 746.851 4	36.6 - 101.5 70.559 4	0.12 - 0.25 0.148 1	0.84 - 0.9 0.861 0	1011 - 2933 1786.259 4	45.16 - 171.5 106.305 4	
N	4	2.099 - 6.114 4.306 4	0.08 - 0.23 0.150 4	0.231 - 0.569 0.344 4	1931 - 5435 3513.072 4	5.04 - 8.38 6.880 4	881.6 - 2264 1575.632 4	483 - 1540 948.446 4	0.12 - 0.125 0.123 0	0.74 - 0.905 0.842 0	90.26 - 217.4 150.787 4	23.09 - 58.88 39.562 4	
S	4	0.615 - 1.446 1.229 2	0.33 - 0.8 0.577 4	0.205 - 0.307 0.248 4	54.26 - 98.18 74.084 4	31.3 - 57.86 42.818 4	480 - 818.2 638.728 4	12.3 - 42.96 23.944 4	1.01 - 5.03 2.306 4	0.82 - 0.835 0.825 0	4591 - 5166 4891.980 4	18.78 - 28.93 24.884 4	<--- Range Min. - Max. Values
SS	4	0.645 - 11.28 4.225 3	0.108 - 4.83 0.792 3	0.065 - 0.316 0.185 4	5.375 - 94.53 36.082 3	1.075 - 14.21 6.052 3	64.52 - 947.5 383.573 4	10.8 - 46.21 28.326 4	9.91 - 50.52 27.959 4	0.84 - 0.9 0.861 0	103.2 - 2731 749.579 4	4.3 - 109.2 32.622 4	<--- Geometric Mean
SSDS	4	4.196 - 7.937 6.190 4	0.042 - 0.14 0.094 3	0.105 - 0.511 0.216 4	14.69 - 46.81 33.523 4	4.62 - 11.24 8.563 4	102.8 - 325.6 226.562 4	5.25 - 23.55 14.580 3	9.18 - 28.2 19.104 4	0.82 - 2.04 1.045 1	15.74 - 38.82 27.788 4	2.04 - 4.71 3.010 4	<--- Samples > Limit of Detection
CP	4	10.92 - 33.13 21.817 4	0.38 - 1.24 0.766 4	0.119 - 3.73 0.448 4	39.7 - 101.5 73.668 4	3.18 - 10.14 6.785 4	1092 - 3313 2181.686 4	15.9 - 47.62 33.394 4	0.12 - 0.124 0.123 0	0.8 - 0.835 0.824 0	635.2 - 2070 1289.302 4	39.7 - 122.2 77.157 4	
G	4	5.605 - 11.89 9.292 4	0.39 - 0.64 0.505 4	0.685 - 1.507 1.105 4	56.05 - 131.6 94.373 4	5.19 - 11.67 8.558 4	5813 - 13585 9486.913 4	5.19 - 29.72 16.376 3	0.87 - 7.28 2.600 4	0.82 - 0.85 0.835 0	228.4 - 339.6 284.261 4	14.53 - 25.47 20.372 4	
SG	4	6.834 - 185.8 22.654 4	0.041 - 0.042 0.041 0	0.084 - 12.25 0.426 4	310.6 - 8576 1025.304 4	1.92 - 24.5 7.137 4	1595 - 38798 4942.877 4	130 - 4697 523.563 4	0.12 - 0.123 0.123 0	0.82 - 0.835 0.827 0	6.26 - 81.68 21.701 4	19.05 - 490.1 59.158 4	

TABLE 32
Abrasive Summary
Phase 1/Phase 2 Comparison
Results for Abrasive Type

Generic Abrasive Type	Cleaning Rate (FT ² /Hour)		Consumption Rate (Lbs./FT ²)		Average Surface Profile (mils)		Average Breakdown Rate X%		Embedment %		Maximum Microhardness (Knoop)		Conductivity (microsiemens)	
	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field
CS-06	41	144	9.12	7.2	2.8	4.2	36.69	58.82	8.4	16.6	617	--	47.0	--
N-01	35	104	12.5	9.2	3.25	4.1	51.20	57.69	1.2	2.7	984	--	146.7	--
S-02	49	140	9.9	8.1	2.02	3.9	19.63	29.41	0.1	1.6	219	--	87.3	--
SS-04	37	127	9.05	8.5	2.80	4.3	46.38	54.17	2.9	4.5	1267	--	66.0	--
SSDS-03	34	146	10.67	8.8	2.92	4.0	31.28	41.03	1.2	1.8	643	--	25.0	--
CP-2A¹	40	102	16.3	8.5	3.68	4.4	52.16	65.82	17.0	11.0	662	--	31.8	--
G-3A¹	34	173	7.43	8.0	3.1	4.4	42.24	50.00	2.1	5.0	1285	--	9.0	--
SG-2A¹	39	83	21.53	15.6	3.08	4.3	7.86	3.92	4.1	11.1	240	--	33.7	--

¹ Values for recyclable abrasives represent the initial run only

TABLE 33
Abrasive Cleaning Cost Summary
Phase1 and Phase 2

Abrasive No.	Generic Abrasive	Number of Recycles	Laboratory (\$/sq ft)	Field (non-hazardous waste) (\$/sq ft)	Field (hazardous waste)
CS-06	Coal Slag	1	\$1.38	\$0.69	\$1.25
N-01	Nickel Slag	1	1.71	0.96	1.67
S-02	Staurolite	1	1.58	1.02	1.65
SS-04	Silica Sand	1	1.39	0.72	1.37
SSDS-03	Silica Sand with Dust Suppressant	1	1.70	0.71	1.38
CP-2	Copper Slag	2	1.37	0.82	1.15
G-3	Garnet	2	1.97	0.89	1.20
SG-2	Steel Grit	25*	1.35	0.89	0.91

* 100 used for field

Table 34
Comparison of Airborne Concentration of Health-Related Agents For Paired Abrasives
From the Laboratory (Phase 1) and Field (Phase 2) Studies
Unless noted, all results are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Phase 1 Abrasive	Arsenic			Beryllium			Cadmium		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS-06	0.52	3.31	1.65	1.12	3.73	1.93	0.05	0.56	0.09
N-01	2.03	2.09	2.06	0.03	0.11	0.04	0.04	0.04	0.04
S-02	2.09	2.1	2.09	0.03	0.14	0.06	0.08	0.08	0.08
SSDS-03	1.99	2.07	2.02	0.03	0.03	0.03	0.06	0.06	0.06
CP-2A	6.6	99.54	26.62	0.17	3.94	0.97	0.04	0.15	0.07
G-3A	2.07	2.1	2.08	0.03	0.09	0.05	0.04	1.65	0.26
SG-2A	12.11	41.41	19.89	0.03	0.52	0.18	0.05	0.05	0.05
SS-04	2.06	2.1	2.08	0.08	0.36	0.2	0.04	0.14	0.08
Phase 2 Abrasive	Arsenic			Beryllium			Cadmium		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS	7.18	10.54	8.59	0.86	5.87	3.33	0.28	1.03	0.5
N	2.1	6.11	4.31	0.08	0.23	0.15	0.23	0.57	0.34
S	0.62	1.45	1.23	0.33	0.8	0.58	0.21	0.31	0.25
SSDS	4.2	7.94	6.19	0.04	0.14	0.09	0.11	0.51	0.22
CP	10.92	33.13	21.82	0.38	1.24	0.77	0.12	3.73	0.45
G	5.61	11.89	9.29	0.39	0.64	0.5	0.69	1.51	1.1
SG	6.83	185.82	22.65	0.04	0.04	0.04	0.08	12.25	0.43
SS	0.65	11.28	4.22	0.11	4.83	0.79	0.07	0.32	0.18

Phase 1 Abrasive	Chromium			Lead			Manganese		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS-06	22.94	111.78	48.62	0.84	4.35	2.14	64.64	538.19	174.69
N-01	345.46	7036.42	1996.57	0.82	2.28	1.3	117.86	2483.44	685.92
S-02	5.21	16.46	8.97	2.92	33.33	10.59	52.11	270.83	137.06
SSDS-03	4.97	5.18	5.04	0.18	0.93	0.61	7.48	61.7	27.92
CP-2A	20.01	290.34	75.32	0.83	9.75	2.82	701.47	12650.35	3068.53
G-3A	5.17	27.02	11.64	0.83	2.1	1.08	517.17	5036.73	1165.94
SG-2A	939.46	5175.98	1578.01	4.38	28.99	8.74	4733.48	26915.11	8276.39
SS-04	5.23	14.64	10.12	0.84	5.23	2.59	37.65	355.65	176.69
Phase 2 Abrasive	Chromium			Lead			Manganese		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS	62.37	162.43	111.37	9.93	12.04	11.33	633.71	903.23	746.85
N	1931.15	5434.78	3513.07	5.04	8.38	6.88	881.61	2264.49	1575.63
S	54.26	98.18	74.08	31.3	57.86	42.82	480.01	818.2	638.73
SSDS	14.69	46.81	33.52	4.62	11.24	8.56	102.8	325.6	226.56
CP	39.7	101.45	73.67	3.18	10.14	6.78	1091.79	3312.63	2181.69
G	56.05	131.6	94.37	5.19	11.67	8.56	5812.99	13584.65	9486.91
SG	310.64	8576.33	1025.3	1.92	24.5	7.14	1594.6	38797.68	4942.88
SS	5.38	94.53	36.08	1.08	14.21	6.05	64.52	947.48	383.57

Table 34
Comparison of Airborne Concentration of Health-Related Agents For Paired Abrasives
From the Laboratory (Phase 1) and Field (Phase 2) Studies
Unless noted, all results are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Phase 1 Abrasive	Nickel			Respirable Quartz (mg/m^3)			Silver		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS-06	5.22	161.26	30.92	0.12	0.12	0.12	0.83	1.94	1.03
N-01	89.41	2897.35	605.7	0.12	0.12	0.12	0.82	0.84	0.82
S-02	5.21	5.24	5.22	0.12	0.49	0.17	0.84	0.84	0.84
SSDS-03	4.97	5.18	5.04	0.12	2.1	0.62	0.8	0.83	0.81
CP-2A	5.16	126.5	31.24	0.12	0.12	0.12	0.83	13.69	3.55
G-3A	5.17	5.25	5.2	0.12	6.83	0.95	0.83	0.84	0.83
SG-2A	493.93	2691.51	836.25	0.12	0.12	0.12	0.84	4.14	1.75
SS-04	5.15	16.32	6.92	0.12	12.98	2.49	0.83	0.84	0.83
Phase 2 Abrasive	Nickel			Respirable Quartz (mg/m^3)			Silver		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS	36.56	101.52	70.56	0.12	0.25	0.15	0.84	0.9	0.86
N	482.79	1539.86	948.45	0.12	0.12	0.12	0.74	0.91	0.84
S	12.32	42.96	23.94	1.01	5.03	2.31	0.82	0.84	0.82
SSDS	5.25	23.55	14.58	9.18	28.2	19.1	0.82	2.04	1.05
CP	15.88	47.62	33.39	0.12	0.12	0.12	0.8	0.84	0.82
G	5.19	29.72	16.38	0.87	7.28	2.6	0.82	0.85	0.83
SG	130.47	4696.56	523.56	0.12	0.12	0.12	0.82	0.84	0.83
SS	10.75	46.21	28.33	9.91	50.52	27.96	0.84	0.9	0.86

Phase 1 Abrasive	Titanium			Vanadium		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS-06	813.18	2010.47	1385.37	29.19	91.08	56.16
N-01	18.49	289.74	93.61	3.66	76.57	21.73
S-02	958.73	3768.84	1957.98	2.5	14.58	6.91
SSDS-03	2.02	8.7	5.12	0.8	2.19	1.04
CP-2A	577.68	9746.99	2437.82	30.95	518.46	128.24
G-3A	16.96	100.73	41.56	3.1	9.44	4.18
SG-2A	7.2	28.99	10.81	50.1	331.26	93.17
SS-04	54.38	564.85	255.68	3.56	23.01	11.41
Phase 2 Abrasive	Titanium			Vanadium		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CS	1010.75	2932.68	1786.26	45.16	171.45	106.31
N	90.26	217.39	150.79	23.09	58.88	39.56
S	4591.37	5165.72	4891.98	18.78	28.93	24.88
SSDS	15.74	38.82	27.79	2.04	4.71	3.01
CP	635.22	2070.39	1289.3	39.7	122.15	77.16
G	228.37	339.62	284.26	14.53	25.47	20.37
SG	6.26	81.68	21.7	19.05	490.08	59.16
SS	103.23	2730.86	749.58	4.3	109.23	32.62

Table 35
Concentration of Health-Related Agents in the Paired (Lab/Field) Virgin Bulk Abrasives
 Unless noted, all units are in micrograms per gram (µg/g) or parts per million (ppm).

Phase 1	Arsenic	Beryllium	Cadmium	Chromium	Lead	Manganese	Nickel	Respirable Quartz	Silver	Titanium	Vanadium
Abrasive	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result	Result
CS-06	ND	0.58	ND	2.40	0.63	6.30	ND	ND	ND	58.00	3.60
N-01	ND	0.05	ND	400.00	0.62	150.00	660.00	ND	ND	13.00	4.20
S-02	ND	ND	ND	2.10	6.00	8.90	ND	0.90	ND	140.00	1.90
SSDS-03	ND	ND	ND	ND	0.42	0.38	ND	88.00	ND	4.50	ND
CP-2A	18.00	0.77	ND	46.00	1.90	2200.00	24.00	ND	0.98	1200.00	88.00
G-3A	0.71	0.05	ND	3.70	0.82	130.00	ND	ND	ND	8.80	1.10
SG-2A	31.00	ND	ND	1700.00	9.20	8900.00	980.00	ND	ND	8.00	110.00
SS-04	0.66	0.08	ND	2.70	1.00	88.00	ND	55.00	ND	82.00	4.20
Phase 2											
CS	ND	0.11	0.03	ND	ND	2.80	ND	ND	ND	33.00	1.80
N	ND	0.04	ND	350.00	ND	130.00	400.00	ND	ND	12.00	2.90
S	ND	ND	ND	ND	2.50	5.30	ND	1.60	0.40	97.00	0.90
SSDS	ND	ND	ND	ND	ND	0.17	ND	71.00	ND	3.40	ND
CP	24	0.90	0.03	33.00	3.20	1600.00	19.00	ND	1.00	790.00	58.00
G	ND	0.02	0.05	3.00	ND	170.00	ND	1.90	ND	7.90	0.70
SG	48	ND	ND	1300.00	4.70	7000.00	680.00	ND	ND	7.50	67.00
SS	ND	0.05	0.03	3.00	ND	110.00	ND	51.00	ND	67.00	6.90

ND represents results less than the limit of detection.

Table 36
Airborne Concentrations of Health-Related Agents for Individual Abrasives and Generic Categories
Unless noted, all results are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Phase 1 Expendable Abrasive	Arsenic			Beryllium			Cadmium			Chromium		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CG-01	2.06	2.09	2.07	0.03	0.13	0.07	0.05	0.05	0.05	5.15	22.69	12.52
CS-01	2.06	24.76	8.27	0.62	10.11	2.29	0.07	0.25	0.1	11.74	129.98	36.06
CS-02	2.08	10.41	3.12	0.75	14.37	3.25	0.08	0.2	0.1	19.34	229.12	67.35
CS-03	2.06	2.08	2.07	0.35	4.77	1.59	0.07	0.37	0.15	10.72	136.87	39.27
CS-04	2.06	2.1	2.07	0.19	2.69	0.85	0.07	0.09	0.08	5.15	39.35	16.35
CS-05	2.07	3.29	2.33	0.31	3.35	1.29	0.05	1.35	0.15	5.16	46.04	19.18
CS-06	0.52	3.31	1.65	1.12	3.73	1.93	0.05	0.56	0.09	22.94	111.78	48.62
CS-07	1.03	29.13	4.07	1.94	24.97	5.88	0.05	2.71	0.45	32.95	332.92	89.83
CS-GM	0.52	29.13	2.9	0.19	24.97	2.04	0.05	2.71	0.13	5.15	332.92	38.73
N-01	2.03	2.09	2.06	0.03	0.11	0.04	0.04	0.04	0.04	345.46	7036.42	1996.57
N-02	19.81	170.8	45.97	0.17	1.73	0.48	0.52	10.21	1.52	138.89	1270.57	330.1
N-GM	2.03	170.8	9.73	0.03	1.73	0.14	0.04	10.21	0.25	138.89	7036.42	811.83
O-1	0.52	2.1	1.04	0.01	0.12	0.03	0.04	0.05	0.04	65.9	246.56	116.81
S-01	2.08	2.09	2.08	0.03	0.29	0.05	0.08	0.23	0.1	5.19	33.4	8.29
S-02	2.09	2.1	2.09	0.03	0.14	0.06	0.08	0.08	0.08	5.21	16.46	8.97
S-GM	2.08	2.1	2.09	0.03	0.29	0.06	0.08	0.23	0.09	5.19	33.4	8.62
SH-01	2.08	2.09	2.08	0.03	0.44	0.06	0.08	0.25	0.1	5.18	5.23	5.21
CP-1 A/B	5.98	75.35	17.84	0.04	2.26	0.24	0.27	3.77	0.88	12.99	235.46	55.58
CP-2 A/B	6.6	99.54	21.78	0.17	3.94	0.74	0.04	0.5	0.08	20.01	290.34	55.98
CP-3 A/B	51.63	1116.86	299.46	0.5	6.41	2.19	0.35	4.47	1.67	10.95	101.34	40.76
CP-4 A/B	79.56	24484.8	540.81	0.22	6.12	0.98	2.06	71.41	10.2	103.9	2244.44	360.52
CP-GM	5.98	24484.8	89.07	0.04	6.41	0.78	0.04	71.41	1.04	10.95	2244.44	82.23
G-1 A/B	2.05	2.11	2.08	0.03	0.07	0.04	0.06	1.04	0.2	5.18	93.32	26.56
G-2 A/B	2.05	2.12	2.08	0.03	0.25	0.07	0.04	0.73	0.11	5.13	13.7	6.5
G-3A	2.07	2.1	2.08	0.03	0.09	0.05	0.04	1.65	0.26	5.17	27.02	11.64
G-4 A/B	2.03	2.09	2.06	0.2	1.27	0.52	0.04	0.45	0.11	1.4	98.62	18.59
G-5 A/B	2.06	2.09	2.08	0.03	0.19	0.07	0.05	0.98	0.1	5.15	102.13	21.97
G-6 A/B	2.05	2.11	2.07	0.1	2.29	0.34	0.05	2.69	0.17	13.13	205.99	49.4
G-7 A/B	0.52	2.12	1.48	0.02	0.23	0.04	0.05	0.59	0.08	5.14	40.29	13.27
G-GM	0.52	2.12	1.97	0.02	2.29	0.1	0.04	2.69	0.13	1.4	205.99	18.25
SG-1 A/B	0.96	49.52	5.15	0.03	0.04	0.03	0.04	0.56	0.09	9.61	226.94	38.2
SG-2 A/B	8.09	187.7	22.31	0.03	0.52	0.08	0.05	1.77	0.08	311.2	8550.57	1398.3
SG-GM	0.96	187.7	10.71	0.03	0.52	0.05	0.04	1.77	0.09	9.61	8550.57	231.11
SS-01	2.07	2.09	2.07	0.03	0.1	0.05	0.07	1.99	0.16	5.16	5.22	5.18
SS-02	2.06	2.09	2.07	0.03	0.03	0.03	0.07	0.08	0.07	5.14	5.22	5.18
SS-03	2.02	2.1	2.06	0.03	0.05	0.04	0.07	0.09	0.08	5.04	5.25	5.15
SS-04	2.06	2.1	2.08	0.08	0.36	0.2	0.04	0.14	0.08	5.23	14.64	10.12
SS-05	2.01	2.1	2.06	0.03	0.27	0.12	0.04	0.12	0.06	5.02	24.94	13.04
SS-06	1.02	6.92	2.35	0.14	0.29	0.17	0.05	0.13	0.08	5.08	13.05	6.53
SS-07	0.82	2.09	1.65	0.09	0.29	0.14	0.06	0.17	0.09	5.13	27.16	7.81
SS-GM	0.82	6.92	2.04	0.03	0.36	0.09	0.04	1.99	0.08	5.02	27.16	7.81

Table 36
Airborne Concentrations of Health-Related Agents for Individual Abrasives and Generic Categories
Unless noted, all results are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Phase 1 Expendable Abrasive	Lead			Manganese			Nickel			Respirable Quartz (mg/m^3)		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CG-01	3.91	26.82	12.15	13.39	101.09	56.93	5.15	5.21	5.17	0.12	0.12	0.12
CS-01	2.27	10.52	4.76	28.84	309.47	104.45	5.15	82.53	23.88	0.11	0.12	0.12
CS-02	2.08	33.33	8.79	27.04	270.78	100.61	10.82	160.38	42.51	0.12	0.12	0.12
CS-03	2.06	11.41	3.94	61.87	829.53	251.57	5.16	134.8	29.55	0.12	0.12	0.12
CS-04	2.06	2.1	2.07	37.03	352.04	141.45	5.15	22.78	13.04	0.12	0.12	0.12
CS-05	0.83	5.02	1.8	26.84	230.22	98.43	5.16	33.49	17.92	0.12	0.12	0.12
CS-06	0.84	4.35	2.14	64.64	538.19	174.69	5.22	161.26	30.92	0.12	0.12	0.12
CS-07	3.71	35.37	10.15	78.25	873.91	250.29	17.5	353.72	67.12	0.12	0.12	0.12
CS-GM	0.83	35.37	3.89	26.84	873.91	148.72	5.15	353.72	28.3	0.11	0.12	0.12
N-01	0.82	2.28	1.3	117.86	2483.44	685.92	89.41	2897.35	605.7	0.12	0.12	0.12
N-02	5.11	49.99	14.91	122.55	1083.11	307.42	612.75	6040.41	1609.17	0.12	0.12	0.12
N-GM	0.82	49.99	4.4	117.86	2483.44	459.2	89.41	6040.41	987.25	0.12	0.12	0.12
O-1	0.82	2.1	1.63	247.12	1376.62	499.88	864.91	4520.24	1628.47	0.12	0.12	0.12
S-01	0.83	25.05	5.53	19.52	521.92	106.75	5.19	5.22	5.21	0.12	0.12	0.12
S-02	2.92	33.33	10.59	52.11	270.83	137.06	5.21	5.24	5.22	0.12	0.49	0.17
S-GM	0.83	33.33	7.65	19.52	521.92	120.96	5.19	5.24	5.21	0.12	0.49	0.15
SH-01	2.08	2.09	2.08	15.87	248.76	60.96	5.18	5.23	5.21	0.12	0.13	0.12
CP-1 A/B	7.84	87.12	23.11	35.06	447.38	132.17	5.18	21.22	8.37	0.12	0.14	0.13
CP-2 A/B	0.83	9.75	2.25	701.47	12650.35	2345.52	5.16	126.5	22.54	0.12	0.12	0.12
CP-3 A/B	140.44	2275.08	662.27	202.4	2895.55	1098.32	5.17	35.64	13.53	0.12	0.16	0.14
CP-4 A/B	391.43	120383.6	2078.56	139.86	3264.64	533.01	13.79	306.06	53.54	0.12	0.74	0.2
CP-GM	0.83	120383.6	91.95	35.06	12650.35	652.69	5.16	306.06	19.23	0.12	0.74	0.15
G-1 A/B	0.85	2.09	1.48	58	953.96	335.81	5.11	33.18	7.26	0.12	0.12	0.12
G-2 A/B	0.82	8.71	1.6	115.91	1806.1	551.88	5.13	5.31	5.21	0.12	1.21	0.45
G-3A	0.83	2.1	1.08	517.17	5036.73	1165.94	5.17	5.25	5.2	0.12	6.83	0.95
G-4 A/B	0.81	7.19	2.54	578.75	17670.02	4063.91	5.08	34.93	9.47	0.12	3.69	0.57
G-5 A/B	0.35	4.37	1.16	92.63	3334.72	673.52	5.15	5.23	5.2	0.12	0.12	0.12
G-6 A/B	0.82	13.32	5.06	145.61	6034.12	1201.31	5.13	22.89	13.33	0.12	0.24	0.15
G-7 A/B	0.82	2.97	1.46	168.45	1505.51	450.49	5.14	55.99	7.88	0.12	0.12	0.12
G-GM	0.35	13.32	1.84	58	17670.02	829.38	5.08	55.99	7.4	0.12	6.83	0.23
SG-1 A/B	0.82	1.54	1.14	14.6	3919.95	457.56	9.61	723.81	52.39	0.12	0.27	0.17
SG-2 A/B	0.39	45.88	6.07	1639	41710.12	7202.79	161.83	4379.56	733.34	0.12	0.12	0.12
SG-GM	0.39	45.88	2.63	14.6	41710.12	1815.4	9.61	4379.56	196.01	0.12	0.27	0.14
SS-01	0.83	4.76	2.8	10.94	59.98	36.43	5.16	12.11	6.39	6.34	33.75	15.49
SS-02	2.06	10.35	4.38	11.43	59.65	36.06	5.14	14.81	6.73	9.8	43.17	21.76
SS-03	2.02	2.1	2.06	8.12	53.13	31.66	5.04	5.25	5.15	2.43	11.07	4.19
SS-04	0.84	5.23	2.59	37.65	355.65	176.69	5.15	16.32	6.92	0.12	12.98	2.49
SS-05	0.81	5.94	2.63	11.05	135.11	42.17	5.02	5.25	5.15	4.13	30.58	14.54
SS-06	0.82	3.98	1.8	4.61	78.74	26.09	5.08	5.25	5.18	5.16	17.02	10.16
SS-07	2.05	7.73	3.78	14.97	181.74	51.62	5.13	15.25	6.76	3.46	16.03	8.06
SS-GM	0.81	10.35	2.74	4.61	355.65	247.2	5.02	16.32	5.99	0.12	43.17	7.88

Table 36
Airborne Concentrations of Health-Related Agents for Individual Abrasives and Generic Categories
Unless noted, all results are in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Phase 1 Expendable Abrasive	Silver			Titanium			Vanadium		
	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean	Minimum Result	Maximum Result	Geometric Mean
CG-01	0.83	0.84	0.83	2.06	9.73	6.43	0.83	0.84	0.83
CS-01	0.83	0.84	0.83	391.35	5364.14	1312.14	14.42	189.81	47.84
CS-02	0.83	0.84	0.83	540.77	6456.99	1836.54	29.12	354.09	103.14
CS-03	0.83	0.83	0.83	721.8	10576.52	2830.25	22.69	352.55	93.29
CS-04	0.83	2.62	1.1	370.29	3313.32	1293.24	9.46	109.75	38.56
CS-05	0.83	1.32	0.93	173.41	1423.19	598.74	13.01	119.3	47.55
CS-06	0.83	1.94	1.03	813.18	2010.47	1385.37	29.19	91.08	56.16
CS-07	0.83	0.84	0.83	1112.03	11652.1	2873.34	61.78	665.83	173.2
CS-GM	0.83	2.62	0.91	173.41	11652.1	1545.09	9.46	665.83	69.97
N-01	0.82	0.84	0.82	18.49	289.74	93.61	3.66	76.57	21.73
N-02	0.82	0.84	0.83	347.22	2707.77	763.29	16.75	152.05	38.97
N-GM	0.82	0.84	0.83	18.49	2707.77	267.3	3.66	152.05	29.1
O-1	0.82	0.84	0.83	2.06	17.88	7.41	0.83	3.9	1.58
S-01	0.83	0.84	0.83	228.41	3338.2	1250.21	2.28	22.96	7.68
S-02	0.84	0.84	0.84	958.73	3768.84	1957.98	2.5	14.58	6.91
S-GM	0.83	0.84	0.83	228.41	3768.84	1564.57	2.28	22.96	7.29
SH-01	0.83	0.84	0.83	7.73	41.46	15.08	0.83	6.84	1.41
CP-1 A/B	0.83	0.96	0.89	146.42	2825.52	644.47	3.09	58.87	12.71
CP-2 A/B	0.83	13.69	2.4	577.68	9746.99	1826.33	30.95	518.46	95.88
CP-3 A/B	3.51	17.82	9.3	392.4	5170.63	1816.62	17.76	248.19	82.11
CP-4 A/B	0.83	77.54	7.26	285.6	7345.44	1105.94	11.33	244.85	42.25
CP-GM	0.83	77.54	3.46	146.42	9746.99	1240.07	3.09	518.46	45.35
G-1 A/B	0.82	0.85	0.83	29	311.4	156.07	1.83	39.44	12.62
G-2 A/B	0.82	0.85	0.83	10.25	114.18	44.98	0.82	6.43	2.82
G-3A	0.83	0.84	0.83	16.96	100.73	41.56	3.1	9.44	4.18
G-4 A/B	0.81	0.84	0.82	115.75	1100.5	589.14	1.96	53.42	12.87
G-5 A/B	0.83	0.84	0.83	53.52	564.5	164.26	1.77	70.86	13.1
G-6 A/B	0.82	0.85	0.83	49.22	1045.15	373.62	4.31	120.68	29.32
G-7 A/B	0.82	3.11	0.98	160.23	1251.56	354.36	5.75	52.15	14.37
G-GM	0.81	3.11	0.85	10.25	1251.56	186.75	0.82	120.68	10.78
SG-1 A/B	0.82	15.24	1.83	3.85	167.11	20.76	1.54	142.36	12.08
SG-2 A/B	0.83	4.17	1.48	2.08	37.54	9.27	15.15	479.67	80.49
SG-GM	0.82	15.24	1.64	2.08	167.11	13.87	1.54	479.67	31.18
SS-01	0.83	0.84	0.83	10.73	87.68	40.47	0.83	2.48	1.37
SS-02	0.83	0.84	0.83	22.85	95.93	61.34	0.83	4.52	2.76
SS-03	0.81	0.84	0.82	4.58	26.56	12.14	0.81	2.6	1.09
SS-04	0.83	0.84	0.83	54.38	564.85	255.68	3.56	23.01	11.41
SS-05	0.81	0.84	0.82	8.24	64.44	30.11	5.02	35.34	15.89
SS-06	0.82	0.84	0.83	5.03	142.98	42.18	0.84	6.22	2.36
SS-07	0.82	0.84	0.83	28.71	271.57	67.73	0.82	7.52	1.77
SS-GM	0.81	0.84	0.83	4.58	564.85	48.84	0.81	35.34	3.16

Table 37
Fraction of Individual Abrasives Within a Generic Category With Geometric Mean Concentrations Greater Than the Geometric Mean for the Silica Sand Generic Category of Abrasives

Abrasive	Arsenic		Beryllium		Cadmium		Chromium		Lead		Manganese		Nickel		Quartz		Silver		Titanium		Vanadium			
	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field	Lab	Field		
CG	0/1	-			0/1	-			1/1	+			1/1	+			0/1	-			0/1	-		
CS	6/7	±	1/1	+	7/7	+	1/1	+	6/7	±	1/1	+	7/7	+	1/1	+	7/7	+	1/1	+	4/7	±	1/1	+
N	2/2	+	1/1	+	1/2	±	0/1	-	1/2	±	1/1	+	2/2	+	1/1	+	2/2	+	1/1	+	0/2	-	0/1	-
O	0/1	-			0/1	-			0/1	-			1/1	+			1/1	+			0/1	-		
S	0/2	-	0/1	-	0/2	-	0/1	-	1/2	±	1/1	+	2/2	+	1/1	+	2/2	+	1/1	+	0/2	-	0/1	-
SH	0/1	-			0/1	-			1/1	+			0/1	-			1/1	+			0/1	-		
CP	4/4	+	1/1	+	4/4	+	0/1	-	3/4	±	1/1	+	4/4	+	1/1	+	4/4	+	1/1	+	0/4	-	0/1	-
G	6/7	±	1/1	+	2/7	±	0/1	-	6/7	±	1/1	+	6/7	±	1/1	+	1/6	±	1/1	+	7/7	+	1/1	+
SG	2/2	+	1/1	+	0/2	-	0/1	-	1/2	±	1/1	+	2/2	+	1/1	+	2/2	+	1/1	+	0/2	-	0/1	-

(+) Plus sign means that all individual abrasives within a generic category had geometric mean concentrations of a health-related agent that were greater than the corresponding geometric mean for the generic category of silica sand.

(-) Minus sign means that all individual abrasives within a generic category had geometric mean concentrations of a health-related agent that were less than the corresponding geometric mean for the generic category of silica sand.

(±) Plus and minus signs mean that individual abrasives within a generic category had geometric mean concentrations of a health-related agent that were above the corresponding geometric mean for the generic category of silica sand, while other individual abrasives were below.



Reads: For the lab, 1 of 2 steel grit abrasives had geometric mean concentrations of lead greater than silica sand. For the field, 1 out of 1 steel grit abrasive tested had a geometric mean concentration of lead greater than silica sand.

(*) These abrasives mathematically showed geometric mean concentrations for the specified contaminant which were greater than silica sand (using the formula LOD/2 in the equation). However, these values were the result of calculations involving the limit of detection (LOD) for all non-detectable results. Silica sand had a lower geometric mean, however, it was based upon detectable concentrations of the contaminant. Therefore, each of these abrasives are shown on this table as being below silica sand since all of the actual measured concentrations were non-detectable.