

Table A1.1
Person Years by Age Group and Calendar Year for Plant #1

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-79		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
20-24	Person Years At Risk	24.3 29	34.5 39	0.0 0	1.1 4	18.4 21	0.0 0	78.4 88	
25-29	Person Years At Risk	520.2 301	717.5 366	148.9 94	23.0 28	380.1 193	111.7 79	1901.5 764	
30-34	Person Years At Risk	1045.6 524	1971.1 818	1097.6 464	237.7 143	433.6 219	485.2 227	5270.8 1462	
35-39	Person Years At Risk	1067.7 514	2180.3 926	2297.3 872	1216.7 511	458.2 242	289.0 163	7509.2 1840	
40-44	Person Years At Risk	1043.6 484	1861.4 779	2304.2 944	2367.3 902	1347.0 555	368.7 215	9292.2 2122	
45-49	Person Years At Risk	1163.8 537	1670.6 705	1935.2 786	2313.0 954	2397.5 904	939.7 515	10419.7 2435	
50-54	Person Years At Risk	956.8 483	1673.3 671	1696.7 690	1889.3 772	2243.4 936	1470.8 756	9930.4 2429	
55-59	Person Years At Risk	852.2 379	1275.1 555	1615.3 638	1559.2 647	1796.5 731	1205.1 674	8303.5 2067	
60-64	Person Years At Risk	570.1 281	1010.6 402	1162.3 508	1421.2 571	1414.4 591	909.2 498	6487.9 1641	
65-69	Person Years At Risk	244.3 118	635.2 268	851.6 350	945.2 414	1157.7 478	681.8 383	4513.9 1127	
70-74	Person Years At Risk	10.3 6	209.3 98	483.5 214	617.6 270	714.5 320	531.4 284	2566.5 703	
75-79	Person Years At Risk	0.0 0	10.7 6	145.0 72	307.8 138	407.5 183	293.0 162	1164.1 346	
80-84	Person Years At Risk	3.3 1	0.0 0	6.7 4	76.6 41	151.2 80	127.0 86	364.8 142	
85+	Person Years At Risk	0.6 1	5.0 1	4.4 1	1.1 2	25.1 15	35.6 25	71.8 32	
TOTAL	Person Years At Risk	7502.8 2160	13254.7 2985	13748.9 2895	12976.8 2809	12945.1 2877	7448.3 2576	67876.6 3620	

PLAINTIFF'S
EXHIBIT
AL-1689

Table A1.2
Person Years by Age Group and Calendar Year for Plant #2

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
20-24	Person Years At Risk	7.8 12	7.7 12	0.0 0	0.8 1	3.6 5	0.0 0	19.9 28	
25-29	Person Years At Risk	126.2 101	216.6 106	34.6 24	4.5 5	76.0 52	29.0 16	486.8 210	
30-34	Person Years At Risk	297.3 164	548.1 228	292.3 128	58.2 38	133.0 75	138.8 66	1467.7 415	
35-39	Person Years At Risk	423.9 203	651.0 270	585.5 236	319.1 142	145.2 91	113.8 65	2258.5 589	
40-44	Person Years At Risk	414.6 198	677.1 271	687.5 267	610.4 245	365.4 170	140.3 76	2895.1 672	
45-49	Person Years At Risk	318.9 143	566.6 235	683.1 270	687.8 275	638.3 254	252.2 143	3146.9 712	
50-54	Person Years At Risk	272.5 122	407.7 171	553.8 224	644.2 257	660.8 268	382.5 210	2921.6 702	
55-59	Person Years At Risk	222.0 100	339.0 138	385.9 161	523.0 209	589.3 242	354.7 194	2414.0 591	
60-64	Person Years At Risk	168.6 70	259.7 108	295.5 125	350.7 147	472.6 196	331.2 170	1878.4 466	
65-69	Person Years At Risk	51.0 27	175.4 66	227.6 95	252.6 108	273.0 123	216.6 127	1196.2 321	
70-74	Person Years At Risk	6.6 2	44.1 23	149.7 54	192.3 92	202.1 88	111.9 71	706.7 184	
75-79	Person Years At Risk	0.0 0	6.8 2	31.2 19	102.5 44	146.1 58	84.7 49	371.3 105	
80-84	Person Years At Risk	0.0 0	0.0 0	5.0 1	18.3 11	56.7 28	39.6 30	119.5 48	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	5.0 1	9.1 8	14.0 7	28.1 11	
TOTAL	Person Years At Risk	2309.5 705	3899.6 847	3931.7 817	3769.4 809	3791.3 869	2209.3 765	19910.8 1043	

Table A1.3

Person Years by Age Group and Calendar Year for Plant #4

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
20-24	Person Years At Risk	10.3 10	9.0 7	3.3 9	3.9 8	0.1 1	0.0 0	0.0 0	26.7 31
25-29	Person Years At Risk	148.4 88	104.7 78	229.8 140	180.9 142	256.4 139	35.2 26	955.5 414	
30-34	Person Years At Risk	317.8 156	397.2 170	495.9 249	634.1 276	675.8 302	360.7 179	2881.4 774	
35-39	Person Years At Risk	381.8 198	601.4 261	654.5 290	727.8 326	900.7 356	445.1 265	3711.3 988	
40-44	Person Years At Risk	381.7 188	674.4 287	851.3 335	783.8 335	854.7 369	610.2 295	4156.1 1015	
45-49	Person Years At Risk	260.5 139	606.2 256	770.4 326	913.8 352	858.9 358	483.3 280	3893.1 957	
50-54	Person Years At Risk	189.2 95	416.9 171	649.3 253	744.9 313	920.0 350	524.1 286	3444.4 811	
55-59	Person Years At Risk	131.0 63	264.9 109	412.4 168	604.2 238	673.8 290	524.4 269	2610.6 651	
60-64	Person Years At Risk	78.5 43	183.2 70	245.6 103	372.5 152	522.0 209	321.2 189	1723.0 443	
65-69	Person Years At Risk	12.6 11	87.5 42	146.1 60	198.6 83	305.2 130	259.4 134	1009.6 269	
70-74	Person Years At Risk	3.8 1	13.4 11	63.9 31	103.6 45	174.7 69	132.0 80	491.3 141	
75-79	Person Years At Risk	0.0 0	3.8 1	9.5 8	49.8 22	78.8 37	79.9 39	221.9 66	
80-84	Person Years At Risk	0.0 0	0.0 0	3.8 1	3.8 6	27.8 15	22.3 14	57.8 22	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	2.0 2	6.1 3	8.1 3	
TOTAL	Person Years At Risk	1915.7 598	3362.6 864	4536.0 1065	5321.7 1237	6250.9 1384	3803.8 1293	25190.7 1543	

Table A1.4

Person Years by Age Group and Calendar Year for Plant #5

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
20-24	Person Years At Risk	0.0 0	1.9 5	7.3 12	11.9 28	34.9 40	0.0 0	56.0 76	
25-29	Person Years At Risk	0.0 0	473.8 343	571.5 363	381.0 227	531.5 247	129.2 87	2087.1 845	
30-34	Person Years At Risk	0.0 0	858.9 596	2004.3 814	1309.2 589	903.5 422	544.9 263	5620.8 1544	
35-39	Person Years At Risk	7.1 2	830.7 559	2294.6 937	2355.0 924	1631.9 685	644.6 362	7763.9 1903	
40-44	Person Years At Risk	0.5 2	582.8 392	1939.3 819	2552.3 1021	2476.4 952	1107.7 597	8659.1 2057	
45-49	Person Years At Risk	0.0 0	305.8 216	1327.6 526	2063.0 847	2575.0 1030	1538.6 804	7810.0 1895	
50-54	Person Years At Risk	0.0 0	56.9 41	497.2 235	1314.6 523	2062.3 831	1513.8 803	5444.8 1384	
55-59	Person Years At Risk	0.0 0	9.8 7	89.9 47	493.7 235	1264.6 505	1065.3 585	2923.3 840	
60-64	Person Years At Risk	0.0 0	0.0 0	13.8 6	84.5 45	447.8 212	615.0 320	1161.1 373	
65-69	Person Years At Risk	0.0 0	0.0 0	0.0 0	13.8 6	63.2 38	148.9 91	225.8 101	
70-74	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	11.4 6	21.7 14	33.1 15	
75-79	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	1.6 2	1.6 2	
80-84	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
TOTAL	Person Years At Risk	7.6 2	3120.6 1527	8745.5 2016	10579.1 2319	12002.6 2563	7331.3 2475	41786.7 2670	

Table A1.5
Person Years by Age Group and Calendar Year for Plant #6

Age Group		Time-Period										TOTAL
		50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	90+	95+	
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
20-24	Person Years At Risk	0.0 0	3.3 8	2.5 3	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	5.8 8	5.8 8	5.8 8
25-29	Person Years At Risk	3.5 2	51.6 63	95.9 58	4.6 9	39.2 22	8.9 8	203.6 104	203.6 104	203.6 104	203.6 104	203.6 104
30-34	Person Years At Risk	14.8 7	110.1 119	428.2 165	148.3 79	78.2 37	61.3 27	841.0 240	841.0 240	841.0 240	841.0 240	841.0 240
35-39	Person Years At Risk	13.9 8	149.2 138	494.6 217	468.7 176	184.4 90	51.8 32	1362.5 352	1362.5 352	1362.5 352	1362.5 352	1362.5 352
40-44	Person Years At Risk	7.8 5	134.6 147	611.5 236	515.6 225	479.7 179	139.5 82	1888.8 463	1888.8 463	1888.8 463	1888.8 463	1888.8 463
45-49	Person Years At Risk	3.7 3	91.1 97	537.4 202	631.8 243	514.6 225	313.0 159	2091.5 506	2091.5 506	2091.5 506	2091.5 506	2091.5 506
50-54	Person Years At Risk	0.0 0	27.9 39	277.9 112	528.6 199	613.0 232	301.3 176	1748.6 420	1748.6 420	1748.6 420	1748.6 420	1748.6 420
55-59	Person Years At Risk	0.0 0	14.0 12	74.4 43	257.8 106	503.7 190	366.2 192	1216.1 313	1216.1 313	1216.1 313	1216.1 313	1216.1 313
60-64	Person Years At Risk	0.0 0	1.1 1	29.5 13	66.6 40	231.0 98	255.0 138	583.1 182	583.1 182	583.1 182	583.1 182	583.1 182
65-69	Person Years At Risk	0.0 0	0.0 0	4.8 1	27.3 12	57.2 36	97.0 53	186.3 69	186.3 69	186.3 69	186.3 69	186.3 69
70-74	Person Years At Risk	0.0 0	0.0 0	0.0 0	1.2 1	27.1 11	22.9 14	51.1 15	51.1 15	51.1 15	51.1 15	51.1 15
75-79	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	9.8 5	9.8 5	9.8 5	9.8 5	9.8 5	9.8 5
80-84	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
TOTAL	Person Years At Risk	43.7 14	582.8 501	2554.7 540	2650.5 560	2727.9 573	1626.7 548	10188.3 618	10188.3 618	10188.3 618	10188.3 618	10188.3 618

Table A1.6
Person Years by Age Group and Calendar Year for Plant #7

Age Group		Time-Period						
		50-54	55-59	60-64	65-69	70-74	75-77	TOTAL
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
20-24	Person Years At Risk	10.2 12	16.2 18	0.4 2	0.0 0	4.2 9	0.0 0	30.9 36
25-29	Person Years At Risk	111.0 75	291.2 141	90.8 58	6.1 9	133.3 64	29.1 24	661.6 250
30-34	Person Years At Risk	202.0 123	661.3 288	426.8 177	136.9 76	153.5 81	162.2 76	1742.6 509
35-39	Person Years At Risk	277.6 150	824.0 369	841.2 316	471.0 189	243.5 125	114.4 77	2771.6 705
40-44	Person Years At Risk	265.3 153	818.5 353	981.3 398	860.3 321	517.4 216	221.5 122	3664.2 859
45-49	Person Years At Risk	232.3 130	712.0 309	931.3 373	969.6 394	848.8 320	337.3 187	4031.4 925
50-54	Person Years At Risk	86.4 54	449.7 183	763.1 307	908.4 365	943.8 381	532.2 269	3683.8 836
55-59	Person Years At Risk	37.9 19	140.7 65	441.3 182	720.5 293	869.9 348	543.1 292	2753.5 663
60-64	Person Years At Risk	21.8 9	54.9 24	142.8 65	401.5 171	671.3 272	468.0 247	1760.3 453
65-69	Person Years At Risk	3.0 2	27.1 9	54.2 24	132.1 61	374.9 153	333.6 185	924.9 260
70-74	Person Years At Risk	0.0 0	3.0 2	27.1 9	51.8 23	116.9 57	155.2 93	354.2 120
75-79	Person Years At Risk	0.0 0	0.0 0	3.1 2	20.4 8	36.3 17	44.8 28	104.6 38
80-84	Person Years At Risk	0.0 0	0.0 0	0.0 0	3.0 2	17.5 6	13.2 9	33.8 12
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	2.8 2	4.5 2	7.3 3
TOTAL	Person Years At Risk	1247.7 480	3998.6 948	4703.5 974	4681.7 974	4934.0 1068	2959.1 1007	22524.5 1144

Table A1.7

Person Years by Age Group and Calendar Year for Plant #8

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	1.9 2	7.9 3	0.4 1	0.0 0	0.0 0	10.2 3	
20-24	Person Years At Risk	0.0 0	15.3 17	7.7 12	21.1 23	20.0 27	0.6 2	64.8 61	
25-29	Person Years At Risk	5.8 5	161.6 157	307.4 159	129.9 135	467.9 203	97.2 66	1169.8 454	
30-34	Person Years At Risk	26.8 14	329.9 247	951.5 358	502.5 256	649.7 293	466.1 223	2926.5 793	
35-39	Person Years At Risk	26.7 10	293.7 216	970.2 398	1047.7 395	719.6 329	429.9 240	3487.7 886	
40-44	Person Years At Risk	27.8 12	237.8 175	760.5 330	1046.7 423	1125.5 420	494.0 268	3692.4 893	
45-49	Person Years At Risk	19.2 10	211.4 142	656.3 260	806.3 343	1074.5 427	689.9 357	3457.6 858	
50-54	Person Years At Risk	3.0 2	101.6 66	407.6 173	663.5 254	796.9 343	613.7 316	2586.4 644	
55-59	Person Years At Risk	3.1 1	15.4 10	160.2 66	383.6 166	632.9 246	435.4 238	1630.6 419	
60-64	Person Years At Risk	0.0 0	3.1 1	15.4 10	150.7 60	346.2 152	333.5 172	849.0 239	
65-69	Person Years At Risk	0.0 0	0.0 0	3.1 1	14.2 9	129.7 56	166.4 90	313.5 104	
70-74	Person Years At Risk	0.0 0	0.0 0	0.0 0	3.1 1	12.6 8	49.7 32	65.4 33	
75-79	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	3.1 1	2.2 3	5.3 3	
80-84	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	1.1 1	1.1 1	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
TOTAL	Person Years At Risk	112.3 35	1371.9 746	4247.9 924	4769.7 1112	5978.8 1311	3179.8 1268	23247.4 1351	

Table A1.8

Person Years by Age Group and Calendar Year for Plant #10

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
20-24	Person Years At Risk	0.0 0	5.4 11	3.2 4	1.4 1	0.0 0	0.0 0	10.0 15	
25-29	Person Years At Risk	0.9 1	226.8 157	135.5 90	17.0 15	29.2 21	9.1 7	418.4 199	
30-34	Person Years At Risk	5.9 3	543.0 340	857.3 332	172.1 103	94.7 49	63.5 33	1736.4 492	
35-39	Person Years At Risk	2.8 2	467.4 296	1213.5 469	858.4 333	199.5 115	84.7 45	2826.3 684	
40-44	Person Years At Risk	6.1 2	320.2 199	954.4 382	1215.7 465	857.1 336	157.7 106	3511.1 782	
45-49	Person Years At Risk	1.9 1	121.8 87	612.9 240	947.0 381	1179.5 462	616.8 309	3479.9 789	
50-54	Person Years At Risk	0.0 0	27.3 20	213.8 96	600.2 232	910.9 369	678.9 372	2431.1 628	
55-59	Person Years At Risk	0.0 0	12.9 8	45.8 24	204.4 91	579.7 226	480.4 264	1323.2 370	
60-64	Person Years At Risk	0.0 0	0.0 0	19.0 8	36.7 21	187.6 88	278.2 159	521.4 185	
65-69	Person Years At Risk	0.0 0	0.0 0	0.0 0	14.8 6	34.0 16	60.8 36	109.6 42	
70-74	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	13.3 6	16.8 9	30.1 10	
75-79	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	2.0 2	2.0 2	
80-84	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
TOTAL	Person Years At Risk	17.5 6	1724.8 792	4055.3 838	4067.7 837	4085.5 872	2448.8 830	14399.4 923	

Table A1.9
Person Years by Age Group and Calendar Year for Plant #12

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	
20-24	Person Years At Risk	28.3 25	21.4 33	5.6 7	9.8 17	4.0 7	0.0 0	69.0 73	
25-29	Person Years At Risk	194.5 124	420.9 232	271.0 158	135.1 123	280.5 115	12.7 17	1314.8 488	
30-34	Person Years At Risk	298.0 178	823.2 369	872.9 350	563.5 276	510.3 229	259.5 120	3327.4 869	
35-39	Person Years At Risk	338.8 194	896.3 416	1163.6 459	1084.8 443	809.6 350	346.7 193	4639.8 1150	
40-44	Person Years At Risk	306.4 182	833.5 374	1104.9 488	1273.9 518	1237.0 473	561.9 300	5397.5 1275	
45-49	Person Years At Risk	270.2 150	708.6 321	1053.9 433	1288.8 532	1354.8 542	763.5 398	5439.7 1337	
50-54	Person Years At Risk	190.1 116	557.8 241	871.9 351	1101.0 456	1336.5 538	841.3 435	4898.6 1174	
55-59	Person Years At Risk	120.2 62	332.2 151	577.6 246	859.4 347	1067.8 430	727.3 405	3684.5 934	
60-64	Person Years At Risk	61.6 31	175.7 74	313.2 142	519.4 223	777.5 315	581.2 307	2428.6 625	
65-69	Person Years At Risk	26.1 12	70.1 30	162.6 66	257.8 118	450.4 193	408.1 209	1375.0 373	
70-74	Person Years At Risk	9.3 4	30.8 13	61.3 28	117.5 51	194.0 95	193.4 117	606.4 191	
75-79	Person Years At Risk	0.0 0	11.0 4	22.6 12	37.2 17	79.9 33	53.1 37	203.9 69	
80-84	Person Years At Risk	0.0 0	0.0 0	8.1 4	11.5 7	31.6 16	23.4 14	74.7 26	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 4	11.5 6	19.5 6	
TOTAL	Person Years At Risk	1843.6 705	4881.5 1267	6569.1 1429	7259.7 1683	8141.9 1704	4783.8 1617	33479.7 1883	

Table A1.10

Person Years by Age Group and Calendar Year for Plant #13

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	4.1 1	0.0 0	0.0 0	0.0 0	4.1 1	
20-24	Person Years At Risk	0.0 0	15.3 17	5.4 3	9.9 11	15.1 20	1.0 3	46.7 47	
25-29	Person Years At Risk	3.7 4	126.0 99	155.8 70	70.1 61	276.9 144	105.3 59	737.8 290	
30-34	Person Years At Risk	27.0 14	233.8 146	511.1 198	247.9 136	476.4 216	348.6 167	1846.8 522	
35-39	Person Years At Risk	35.4 13	218.1 139	589.4 250	602.3 236	449.7 218	335.5 179	2230.4 602	
40-44	Person Years At Risk	13.7 8	219.6 128	539.7 232	644.5 271	694.3 275	334.1 164	2445.9 595	
45-49	Person Years At Risk	8.6 4	143.1 89	455.0 182	590.1 250	719.3 312	458.8 230	2375.0 595	
50-54	Person Years At Risk	1.2 1	78.6 50	328.3 130	477.5 188	616.9 261	431.3 230	1933.9 487	
55-59	Person Years At Risk	0.0 0	43.0 25	169.1 74	339.4 129	471.5 184	328.7 187	1351.7 348	
60-64	Person Years At Risk	3.9 1	9.4 8	71.1 28	166.6 74	322.5 125	246.6 134	820.1 220	
65-69	Person Years At Risk	0.0 0	4.5 2	11.1 8	61.8 24	145.0 67	153.1 81	375.5 113	
70-74	Person Years At Risk	0.0 0	0.0 0	4.5 2	8.8 7	57.4 22	62.9 34	133.6 41	
75-79	Person Years At Risk	0.0 0	0.0 0	0.0 0	4.5 2	7.2 6	16.7 10	28.3 13	
80-84	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	4.5 2	4.0 2	8.5 2	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	2.0 1	2.0 1	
TOTAL	Person Years At Risk	93.5 27	1093.4 463	2844.6 612	3223.4 741	4256.7 990	2828.7 953	14340.3 1024	

Table A1.11

Person Years by Age Group and Calendar Year for Plant #14

Age Group		Time-Period										TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77					
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0				
20-24	Person Years At Risk	16.0 22	10.0 13	0.9 2	3.9 4	8.4 14	0.0 0	0.0 0	39.3 49			
25-29	Person Years At Risk	153.2 96	240.4 127	90.3 51	52.3 48	146.8 85	53.7 27	736.7 293				
30-34	Person Years At Risk	308.1 170	579.1 253	447.2 183	202.6 103	306.2 137	191.8 103	2035.1 554				
35-39	Person Years At Risk	511.8 251	705.2 307	717.0 289	501.7 213	332.0 148	220.2 120	2987.9 786				
40-44	Person Years At Risk	544.7 247	953.6 385	806.4 334	734.4 304	577.5 243	237.0 131	3853.6 911				
45-49	Person Years At Risk	297.6 163	836.8 333	1058.3 403	829.1 346	800.7 332	416.1 215	4238.6 980				
50-54	Person Years At Risk	296.3 136	498.5 237	889.6 346	1057.3 402	871.2 364	485.9 276	4098.7 969				
55-59	Person Years At Risk	189.1 86	422.4 166	522.5 236	851.2 340	1054.8 400	520.5 289	3560.5 847				
60-64	Person Years At Risk	131.8 63	253.7 99	406.9 160	478.2 214	801.5 327	629.7 325	2701.7 674				
65-69	Person Years At Risk	47.9 24	142.8 63	214.3 90	348.3 136	409.5 189	370.4 206	1533.5 423				
70-74	Person Years At Risk	2.4 1	49.0 21	132.3 55	175.1 74	304.5 118	186.1 113	849.4 222				
75-79	Person Years At Risk	0.0 0	2.4 1	38.3 19	91.4 41	129.0 55	122.1 75	383.2 122				
80-84	Person Years At Risk	0.0 0	0.0 0	2.4 1	26.8 14	51.9 25	38.3 28	119.4 45				
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	2.4 1	12.7 7	18.5 10	33.6 11				
TOTAL	Person Years At Risk	2499.0 763	4694.0 1074	5326.3 1107	5354.7 1174	5806.9 1281	3490.5 1197	27171.3 1443				

Table A1.12

Person Years by Age Group and Calendar Year for Plant #15

Age Group		Time-Period							TOTAL
		50-54	55-59	60-64	65-69	70-74	75-77		
<20	Person Years At Risk	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0	0.0 0
20-24	Person Years At Risk	5.3 9	9.8 9	5.5 2	6.5 7	16.7 19	2.6 6	46.5 43	
25-29	Person Years At Risk	34.4 32	161.4 83	48.5 32	50.2 32	188.6 117	123.5 67	606.5 231	
30-34	Person Years At Risk	27.3 26	248.6 117	297.8 112	104.2 58	269.2 148	283.5 140	1230.4 357	
35-39	Person Years At Risk	60.1 43	219.3 111	366.8 152	323.4 124	191.0 112	237.1 124	1397.7 385	
40-44	Person Years At Risk	82.2 54	295.6 129	333.4 140	389.1 159	367.7 155	146.9 88	1615.0 402	
45-49	Person Years At Risk	49.2 38	257.2 119	383.2 153	357.3 144	449.0 189	284.0 146	1779.9 433	
50-54	Person Years At Risk	38.2 26	176.1 84	337.1 134	383.4 154	392.6 161	274.3 154	1601.7 407	
55-59	Person Years At Risk	16.8 15	109.8 44	207.8 85	337.0 131	397.8 166	250.8 130	1320.1 315	
60-64	Person Years At Risk	10.5 7	43.8 20	112.3 44	197.4 81	320.5 129	234.4 125	919.0 230	
65-69	Person Years At Risk	4.0 3	23.6 11	41.2 20	101.9 41	172.6 73	147.5 90	490.9 148	
70-74	Person Years At Risk	1.3 1	12.0 6	19.2 10	31.2 17	77.9 36	75.4 38	217.0 67	
75-79	Person Years At Risk	0.0 0	4.1 1	10.6 5	11.1 5	26.4 13	36.0 18	88.3 25	
80-84	Person Years At Risk	0.0 0	0.0 0	4.1 1	6.2 3	2.4 2	3.6 6	16.4 9	
85+	Person Years At Risk	0.0 0	0.0 0	0.0 0	4.1 1	0.3 1	0.0 0	4.4 1	
TOTAL	Person Years At Risk	329.4 192	1561.3 420	2167.7 456	2303.1 499	2872.7 741	2099.6 712	11333.7 780	

Appendix II-A
Methods Used in Obtaining Exposure Data

Estimation of employee exposures in Plants Nos. 1, 2, 3, 8, 9, 13, and 14 were based on air and biological sampling and extrapolation. It was the judgment of the industrial hygienist that smelting plants could be meaningfully delineated into three environmentally different periods designated as early, prehooding, and contemporary operation. This was based on both objective and subjective evaluations by the hygienist who has made such evaluations from the late 1940's to the present.

Estimations of exposures that occurred prior to this time were made possible by extrapolation of more recent objective findings, in accord with detailed plant histories that were kept for all of the plants. The plant historians faithfully recorded all pertinent (and many irrelevant) events that took place in their plants from their beginnings. Comments on environmental conditions and technological and engineering changes recorded in the finest detail were important elements of these histories. Because of this, it is believed that even the earliest estimates are valid to within at least an order of magnitude.

The designated year in which a plant went from one environmental period to another (i.e., from early to prehooding or to contemporary operation) was based on the years during which engineering changes took place that would significantly improve the working environment. Such changes did not take place at the same time in all smelters. This explains why the cut-off dates differ from plant to plant. Depending upon the age of the plant and the environmental improvements that took place, a plant could have gone through one, two, or three environmentally different periods. The rationale for the exposure values assigned to smelting plant employees working during each of the environmentally different periods is given below.

CONTEMPORARY

This period includes the time following installation of pot hoods to the cut-off year of the mortality study. Except for the effects of wear and tear on equipment, minor variations in work practice and environmentally insignificant engineering or technology changes, exposures throughout this period could be expected to be relatively constant.

Potroom Exposures

Pot Tender. All values for this classification are based on actual measurement with the exception of some sulfur dioxide values. In these instances, the exposures found

in the other plants (all quite consistent) were assigned where values were missing.

Anode. The same comments relating to pot tender apply here.

Crane Operator. Some values were derived from actual measurement; others were extrapolated values determined either from other plant data or from urinary fluoride measurements.

Other Job Classes. All of these are extrapolations based on urinary fluoride data and estimations of the relative exposures of these employees with respect to those whose exposures have been measured.

Carbon Plant Exposures

All Job Classes. Exposure values are based on actual measurements.

PREHOODING

At the beginning of this period, the plant histories showed that a considerable number of changes took place in the plants that would have a considerable impact on environmental conditions

(e.g., new equipment, improved technology, installation of exhaust systems, etc.). This period was terminated when hoods were installed on the pots.

Potroom Exposures

Pot Tender, Anode and Crane Operators. During this period, a considerable amount of area sampling was done for fluoride evaluations. Knowledge of the time spent in various areas of the potroom made it possible to estimate some employee exposures. Urinary fluoride data made it possible to rank order fluoride exposures to all job classes. The estimated values were consistent with exposures measured by an industrial hygiene survey performed in one smelter in 1946 by a state Department of Health.

Total particulates were estimated from the fluoride results. Sulfur dioxide exposures were estimated to be higher than those that would be found in hooded potrooms. The health department survey confirmed this and established the level of these exposures.

Since the principal source of coal tar pitch volatiles, even during the prehooding period, was the carbon plant, it is reasoned that the CTPV exposures should not be significantly different than those measured in the contemporary period.

Other Job Classes. Exposures to other job classes are based on extrapolation from the values determined for pot tender, anode and crane operator, together with more recent air sampling and urinary fluoride data that provide a rank ordering of exposures according to job class.

Carbon Plant Exposures

All Job Classes. All exposure values are based on professional judgment. Subjective evaluations recorded in plant histories indicate that dust concentrations increase as one goes backward in time. Results of dust measurements made during this period by the particle count method confirmed this.

Where environmental improvements were made, they almost always were concerned with dust control. Little attention was paid to the volatiles emitted from the pitch. From this one would assume that, although one might expect somewhat higher coal tar pitch exposures as one goes back in time (because of generally poorer environmental controls), there would be a definite limit to the maximum exposures to CTPV. One would have to remove few controls before there were no controls, mixing was a batch process with a limited capacity of the mixing vessels, and the maximum temperature of the mix was essentially constant through time. On the other hand, since the sources of dust were infinite, there appeared to be no limit to the amount of dust that could be generated.

Pneumatic tools were common throughout this period so that one would expect benzene soluble values to be higher than those for PPOM (i.e., because of oil in the compressed air).

During this period, there undoubtedly were significant exposures to pitch dust, which obviously would increase benzene soluble, PPOM, and B(a)P values. We have no way of estimating the magnitude of these exposures. On the other hand, by virtue of the manner of their generation, these dusts should contain much less respirable material than that which would be found in the particulates originating from heated pitch.

EARLY OPERATION

Potroom Exposures

Very little quantitative data is available for this period. Exposure estimates are based on professional judgment and the plant histories. Fluoride exposures are anticipated to be about the same as those estimated to exist in a plant of very early technology (and in which area measurements were made) where pots were small and ventilation was generally poorer. No significant exposures to CTPV are expected since there were no sources of pitch in the potroom.

Carbon Plant Exposures

These values also are derived from professional judgment and plant histories. One would have expected that benzene soluble and CTFV would generally coincide since there was more hand labor (i.e., fewer pneumatic assists) and the only source of benzene soluble material would be the pitch.

For Plant 5, estimates of prior exposure were developed by utilizing:

- (1) Industrial engineering studies which documented work practices and labor-saving devices, from start-up to present. As the plant was modernized, the worker efforts decreased.

- (2) Control of emissions - that is, the capture of fumes improved, as documented by daily empirical measurements of a "smoke index" by plant personnel.

- (3) Worker opinion - that is, workers and supervisors who were employed during start-up provided opinions regarding conditions of smoke and difficulty of work.

For Plant 12, the industrial hygiene program began in 1972, and results are based upon averages during this period. In 1975, re-cycled scrubber ore was introduced and exposures increased significantly. Data presented in previous years are simply estimates by the industrial hygienist who integrated historical engineering changes, feedback from plant personnel, and his best judgment.

In Plants 4, 6, 7, 10, and 15, exposure measurements for the period between 1973 and 1977 reflect results of routine industrial hygiene studies. Since 1978, however, sampling studies in these plants have followed the recommended strategy of Leidel, Busch, and Lynch in their "Occupational Exposure Sampling Strategy Manual." Utilizing this approach, a large enough sample size was collected for each job category to yield a ninety percent (90%) probability that at least one individual in each group had an exposure level in the highest ten percent (10%).

In order to arrive at estimates of prior exposure levels, two factors were considered for all jobs, in Plants 4, 6, 7, 10, and 15:

- (1) The time an employee was exposed at the worksite in an 8-hour shift. Prior to 1960, estimates of actual time worked were provided on a plant by plant basis. After 1960, industrial engineering time studies were used to determine actual time worked.

- (2) The effect of engineering controls, i.e., enclosing pots during the period 1941 to 1977.

Plants 4 and 15 have been divided into their respective north and south plants. While such a breakdown would not be included in the employee personnel records, all employees working at Plant 4 prior to 1959, and Plant 15 prior to 1968, would have been considered south plant employees.

In arriving at a multiplier to ascertain the effect of pot enclosure for Plant 4 (north and south plants) Coal Tar Pitch Volatiles (Benzene solubles) data were used from special studies undertaken in early 1973. At that time the north and south plants of Plant 4 were partially enclosed. These data, collected in 1973 for the north and south plants, were then compared to data collected in 1976 and 1978, after the pots had been fully enclosed. The ratio of exposure levels (fully enclosed divided by partially enclosed) produced an enclosure factor which reflects the effects of fully enclosing a pot. As can be seen from Table 2, Plant 4 (south plant) was partially enclosed from 1957 to 1973. Consequently, a 3.7 enclosure factor was obtained and used for this entire period. Although there are no data to calculate an enclosure factor for the open pot (1941 - 1957), plant history records indicate a substantial reduction in visual pot emissions, with the partial enclosure of the pot. As a result, an enclosure factor of 4.5 (estimated) was decided upon for the open pot. See Appendix B, for example of enclosure factor calculations.

Utilizing the estimate of actual time worked in an 8-hour day and the enclosure factor, appropriate multipliers were developed for Plants 4, 6, 7, 10, and 15 (See Table 2). For example: Plant 4, south plant: 1957 to 1961 (partial enclosure) - The estimated work time is 6 hours, and an enclosure factor of 3.7 was developed for that time period. Given that 4.5 hours is the actual time worked

today, the multiplier is calculated by the product of the enclosure factor (3.7) and the estimated time worked (6 hours), divided by the actual time worked today (4.5). See Appendix C, for exposure estimate calculations. It should be noted that, for Plants 6, 7, and 10, an enclosure factor was not utilized, since the control technology used at those plants has remained the same since start-up. Therefore, in Plants 6, 7, and 10, the final multiplier only reflects the longer hours worked during the earlier time period.

In addition, a special sampling study was carried out at Plants 6 (Soderberg) and 7 (prebake), to determine the relative exposures for maintenance and casting workers. Those data were utilized to estimate the exposure of similar employees at all other facilities covered by the study.