TABLE 5-14. ENERGY IMPACTS FOR HAP CONTROL FOR MODEL RECOVERY FURNACES

Model recovery furnaces	Control option	Incremental energy impacts, MWh/yr
NDCE/converted DCE		
RF-1/4/8	Packed-bed scrubber	988
RF-2/5/9	Packed-bed scrubber	1,770
RF-3/6	Packed-bed scrubber	2,570
RF-7	Packed-bed scrubber	593
Unconverted DCE		
RF-7	Packed-bed scrubber	625
RF-8	Packed-bed scrubber	1,040
RF-9	Packed-bed scrubber	1,870

(a) Baseline energy impacts are equal to zero. Packed-bed scrubber energy impacts = [0.00018 x model gas flow rate x 3 in. H2O pressure drop x 1 MWh/1,000 kWh x 8,424 hr/yr] + [0.746 kW/hp x liquid flow rate x 60 ft head x specific gravity H2O x hp/3,960 gal x 1/(70% pump motor effic.) x 1 MWh/1,000 kWh x 8,424 hr/yr].

TABLE 5-15a (METRIC). WASTEWATER IMPACTS FOR HCL CONTROL FOR MODEL RECOVERY FURNACES[a]

Model recovery furnaces	Control option	Incremental wastewater impacts, million L/yr
NDCE/converted DCE		
RF-1/4/8	Packed-bed scrubber	10
RF-2/5/9	Packed-bed scrubber	18
RF-3/6	Packed-bed scrubber	26
RF-7	Packed-bed scrubber	6.1
Unconverted DCE		
RF-7	Packed-bed scrubber	6.3
RF-8	Packed-bed scrubber	10
RF-9	Packed-bed scrubber	19

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-15b. See Table 5-15b for footnotes, which include calculations.

TABLE 5-15b (ENGLISH). WASTEWATER IMPACTS FOR HCL CONTROL FOR MODEL RECOVERY FURNACES[a]

Model recovery furnaces	Control option	Incremental wastewater impacts, million gal/yr
NDCE/converted DCE		
RF-1/4/8	Packed-bed scrubber	2.7
RF-2/5/9	Packed-bed scrubber	4.8
RF-3/6	Packed-bed scrubber	7.0
RF-7	Packed-bed scrubber	1.6
Unconverted DCE		
RF-7	Packed-bed scrubber	1.7
RF-8	Packed-bed scrubber	2.8
RF-9	Packed-bed scrubber	5.0

(a) Wastewater impacts are zero at baseline; therefore, control level and incremental wastewater impact numbers are the same. Control level wastewater impacts = wastewater flow rate (gpm) x 60 min/hr x 8,424 hr/yr.

TABLE 5-16a (METRIC). MODEL BLACK LIQUOR OXIDATION UNIT PARAMETERS AND EMISSION FACTORS[a]

Model BLO units	Equipment type	Black liquor firing rate, kg BLS/d	Equivalent pulp production rate		Vent gas flow rate, m3/sec	Vent gas temperature, degrees C	Moisture content, %	Baseline gaseous organic HAP's, kg/kg BLS	Control level gaseous organic HAP's, kg/kg BLS
			ADMUP/d	ADMBP/d					
BLO-1	2-stage, air sparging	400,000	270	230	4.2	54	35	2.03E-04	4.06E-06
BLO-2	2-stage, air sparging	700,000	450	380	8.5	54	35	2.03E-04	4.06E-06
BLO-3	2-stage, air sparging	1,200,000	820	680	12.7	54	35	2.03E-04	4.06E-06

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-16b.

TABLE 5-16b (ENGLISH). MODEL BLACK LIQUOR OXIDATION UNIT PARAMETERS AND EMISSION FACTORS

Model BLO units	Equipment type	Black liquor firing rate, lb BLS/d	Equivalent pulp production rate		Vent gas flow rate, acfm	Vent gas temperature, degrees F	Moisture content, %	Baseline gaseous organic HAP's, lb/lb BLS (a)	Control level gaseous organic HAP's, lb/lb BLS (a)
			ADTUP/d	ADTBP/d					
BLO-1	2-stage, air-sparging	900,000	300	250	8,900	130	35	2.03E-04	4.06E-06
BLO-2	2-stage, air-sparging	1,500,000	500	420	18,000	130	35	2.03E-04	4.06E-06
BLO-3	2-stage, air-sparging	2,700,000	900	750	26,900	130	35	2.03E-04	4.06E-06

(a) Gaseous organic HAP's include acetaldehyde, benzene, formaldehyde, methanol, methyl ethyl ketone, methyl isobutyl ketone, phenol, toluene, and xylenes. Methanol comprises 85 percent of the total. Assume 98 percent control with incineration of BLO vent gases.

TABLE 5-17a (METRIC). PRIMARY GASEOUS ORGANIC HAP EMISSIONS FOR MODEL BLACK LIQUOR OXIDATION UNITS[a]

Model BLO units	Baseline emissions, Mg/yr	Control option	Control level emissions, Mg/yr	Emission reductions, Mg/yr	Emission reductions, %
BLO-1	29	BLO vent gas control	0.6	29	98
BLO-2	48	BLO vent gas control	1.0	48	98
BLO-3	87	BLO vent gas control	1.7	86	98

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-17b. Refer to Table 5-17b for footnotes, which include calculations.

TABLE 5-17b (ENGLISH). PRIMARY GASEOUS ORGANIC HAP EMISSIONS FOR MODEL BLACK LIQUOR OXIDATION UNITS[a]

Model BLO units	Baseline emissions, ton/yr	Control option	Control level emissions, ton/yr	Emission reductions, ton/yr	Emission reductions, %
BLO-1	32	BLO vent gas control	0.6	31	98
BLO-2	53	BLO vent gas control	1.1	52	98
BLO-3	96	BLO vent gas control	1.9	94	98

(a) Gaseous organic HAP emissions (ton/yr) = emission factor (lb/lb BLS) x model BLS firing rate (lb BLS/d) x 351 d/yr x 1 ton/2,000 lb. Gaseous organic HAP's include acetaldehyde, benzene, formaldehyde, methyl ethyl ketone, methyl isobutyl ketone, phenol, toluene, and xylenes. Methanol comprises 85 percent of the total.

TABLE 5-18a (METRIC). SECONDARY EMISSIONS FOR MODEL BLACK LIQUOR OXIDATION UNITS[a]

Model BLO units	Control option	Incremental emissions, kg/yr			
		PM	SO2	NOx	CO
BLO-1	BLO vent gas control	400	9,710	776	1,470
BLO-2	BLO vent gas control	807	16,900	1,560	2,970
BLO-3	BLO vent gas control	1,210	29,200	2,340	4,440

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-18b. Refer to Table 5-18b for footnotes.

TABLE 5-18b (ENGLISH). SECONDARY EMISSIONS FOR MODEL BLACK LIQUOR OXIDATION UNITS[a]

Model BLO units	Control option	Incremental emissions, lb/yr			
		PM	SO2	NOx	CO
BLO-1	BLO vent gas control	883	21,400	1,710	3,240
BLO-2	BLO vent gas control	1,780	37,200	3,450	6,540
BLO-3	BLO vent gas control	2,670	64,300	5,160	9,780

(a) Secondary emissions are zero at baseline; therefore, control level and incremental secondary emission numbers are the same. Secondary emissions for PM, NOx, and CO were estimated based on energy and emission factors for PM, NOx, and CO. Secondary emissions for SO2 were estimated based on (1) energy requirements and the emission factor for SO2 and (2) 1.88 lb of SO2 generated for each lb of TRS combusted. Calculations for energy impacts are presented in Table 5-19. Emission factors = 0.15 lb PM/MM Btu; 0.73 lb SO2/MM Btu; 0.29 lb NOx/MM Btu; and 0.55 lb CO/MM Btu.

TABLE 5-19. ENERGY IMPACTS FOR MODEL BLACK LIQUOR OXIDATION UNITS

Model BLO units	Control option	Incremental energy impacts, MWh/yr
BLO-1	BLO vent gas control	1,720
BLO-2	BLO vent gas control	3,480
BLO-3	BLO vent gas control	5,210

(a) BLO control energy impacts = 503 hp x 0.746 kW/hp x 8,424 hr/yr x 1 MWh/1,000 kWh x model vent gas flow rate/16,327 acfm. The hp requirements and vent gas flow rate were provided by an individual mill that controls vent gas emissions.

TABLE 5-20a (METRIC). TOTAL REDUCED SULFUR COMPOUND EMISSIONS FOR MODEL BLACK LIQUOR OXIDATION UNITS[a]

Model BLO units	Baseline emissions, Mg/yr	Control option	Control level emissions, Mg/yr	Emission reduction, Mg/yr	Emission reduction, %
BLO-1	4.2	BLO vent gas control	0.08	4.1	98
BLO-2	7.0	BLO vent gas control	0.14	6.9	98
BLO-3	13	BLO vent gas control	0.25	12	98

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-20b. Refer to Table 5-20b for footnotes.

TABLE 5-20b (ENGLISH). TOTAL REDUCED SULFUR COMPOUND EMISSIONS FOR MODEL BLACK LIQUOR OXIDATION UNITS

Model BLO units	Baseline emissions, ton/yr (a)	Control option	Control level emissions, ton/yr (b)	Emission reduction, ton/yr	Emission reduction, % (b)
BLO-1	4.6	BLO vent gas control	0.09	4.6	98
BLO-2	7.7	BLO vent gas control	0.15	7.6	98
BLO-3	14	BLO vent gas control	0.28	14	98

(a) The baseline TRS emissions for BLO units are based on an average TRS emission factor of 0.10 lb/ADTP (assuming an average 3,400 lb BLS/ADT of bleached and unbleached pulp).
(b) The control level TRS emissions for BLO units are based on 98 percent TRS control.

TABLE 5-21a (METRIC). MODEL SMELT DISSOLVING TANK PARAMETERS AND PM EMISSION FACTORS[a]

Model SDT's	Baseline APCD	Control option APCD	Black liquor firing rate kg BLS/d	Equivalent pulp production rate, ADMUP/d	Equivalent pulp production rate, ADMBP/d	Stack gas flow rate, m3/sec	Scrubber inlet gas flow rate, m3/sec	Existing pressure drop, mm Hg	New pressure drop, mm Hg	Baseline PM, kg/Mg BLS	Control level PM, kg/Mg BLS: PM control-- 0.10 kg/Mg BLS	Control level PM, kg/Mg BLS: PM control-- 0.06 kg/Mg BLS
SDT-1	scrubber	scrubber	400,000	270	230	4.2	4.4	13	13	0.19	0.10	0.06
SDT-2	scrubber	scrubber	700,000	450	380	7.1	7.4	13	13	0.19	0.10	0.06
SDT-3	scrubber	scrubber	1,200,000	820	680	12.7	13.4	13	13	0.19	0.10	0.06
SDT-4	scrubber	scrubber	1,800,000	1,200	1,000	18.4	19.3	13	13	0.19	0.10	0.06
SDT-5	mist eliminator	scrubber	400,000	270	230	4.2	4.4	1.3	13	0.23	0.10	0.06
SDT-6	mist eliminator	scrubber	700,000	450	380	7.1	7.4	1.3	13	0.23	0.10	0.06
SDT-7	mist eliminator	scrubber	1,200,000	820	680	12.7	13.4	1.3	13	0.23	0.10	0.06

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-21b.

TABLE 5-21b (ENGLISH). MODEL SMELT DISSOLVING TANK PARAMETERS AND PM EMISSION FACTORS[a]

Model SDT's	Baseline APCD	Control option APCD	Black liquor firing rate lb BLS/d	Equivalent pulp production rate, ADTUP/d	Equivalent pulp production rate, ADTBP/d	Stack gas flow rate, acfm	Scrubber inlet gas flow rate, acfm	Existing pressure drop, in. H2O	New pressure drop, in. H2O	Baseline PM, lb/ton BLS	Control level PM, lb/ton BLS: PM control-- 0.2 lb/ton BLS	Control level PM, lb/ton BLS: PM control-- 0.12 lb/ton BLS
SDT-1	scrubber	scrubber	900,000	300	250	9,000	9,400	7	7	0.37	0.20	0.12
SDT-2	scrubber	scrubber	1,500,000	500	420	15,000	15,700	7	7	0.37	0.20	0.12
SDT-3	scrubber	scrubber	2,700,000	900	750	27,000	28,300	7	7	0.37	0.20	0.12
SDT-4	scrubber	scrubber	3,900,000	1,300	1,100	39,000	40,900	7	7	0.37	0.20	0.12
SDT-5	mist eliminator	scrubber	900,000	300	250	9,000	9,400	0.7	7	0.46	0.20	0.12
SDT-6	mist eliminator	scrubber	1,500,000	500	420	15,000	15,700	0.7	7	0.46	0.20	0.12
SDT-7	mist eliminator	scrubber	2,700,000	900	750	27,000	28,300	0.7	7	0.46	0.20	0.12

TABLE 5-22a (METRIC). PRIMARY PM AND PM HAP EMISSIONS FOR MODEL SMELT DISSOLVING TANKS[a]

Model SDT's	Baseline emissions, Mg/yr		Control option	Control level emissions, Mg/yr		Emission reduction, Mg/yr		Emission reduction, %
	PM	PM HAP's		PM	PM HAP's	PM	PM HAP's	
SDT-1	27	0.02	PM control--0.10 kg/Mg BLS (b)	14	0.009	12	0.007	46
			PM control--0.06 kg/Mg BLS (b)	8.6	0.005	18	0.01	68
SDT-2	44	0.03	PM control--0.10 kg/Mg BLS (b)	24	0.01	20	0.01	46
			PM control--0.06 kg/Mg BLS (b)	14	0.009	30	0.02	68
SDT-3	80	0.05	PM control--0.10 kg/Mg BLS (b)	43	0.03	37	0.02	46
			PM control--0.06 kg/Mg BLS (b)	26	0.02	54	0.03	68
SDT-4	115	0.07	PM control--0.10 kg/Mg BLS (b)	62	0.04	53	0.03	46
			PM control--0.06 kg/Mg BLS (b)	37	0.02	78	0.05	68
SDT-5	33	0.02	PM control--0.10 kg/Mg BLS (c)	14	0.009	19	0.01	57
			PM control--0.06 kg/Mg BLS (c)	8.6	0.005	24	0.01	74
SDT-6	55	0.03	PM control--0.10 kg/Mg BLS (c)	24	0.01	31	0.02	57
			PM control--0.06 kg/Mg BLS (c)	14	0.009	41	0.02	74
SDT-7	99	0.06	PM control--0.10 kg/Mg BLS (c)	43	0.03	56	0.03	57
			PM control--0.06 kg/Mg BLS (c)	26	0.02	73	0.04	74

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-22b. Refer to Table 5-22b for footnotes, which include calculations.
(b) PM control is replacement of existing scrubber with a new scrubber.
(c) PM control is replacement of existing mist eliminator with a new scrubber.

TABLE 5-22b (ENGLISH). PRIMARY PM AND PM HAP EMISSIONS FOR MODEL SMELT DISSOLVING TANKS[a]

Model SDT's	Baseline emissions, ton/yr		Control option	Control level emissions, ton/yr		Emission reduction, ton/yr		Emission reduction, %
	PM	PM HAP's		PM	PM HAP's	PM	PM HAP's	
SDT-1	29	0.02	PM control--0.20 lb/ton BLS (b)	16	0.009	13	0.008	46
			PM control--0.12 lb/ton BLS (b)	9.5	0.006	20	0.01	68
SDT-2	49	0.03	PM control--0.20 lb/ton BLS (b)	26	0.02	22	0.01	46
			PM control--0.12 lb/ton BLS (b)	16	0.009	33	0.02	68
SDT-3	88	0.05	PM control--0.20 lb/ton BLS (b)	47	0.03	40	0.02	46
			PM control--0.12 lb/ton BLS (b)	28	0.02	59	0.04	68
SDT-4	127	0.08	PM control--0.20 lb/ton BLS (b)	68	0.04	58	0.03	46
			PM control--0.12 lb/ton BLS (b)	41	0.02	86	0.05	68
SDT-5	36	0.02	PM control--0.20 lb/ton BLS (c)	16	0.009	21	0.01	57
			PM control--0.12 lb/ton BLS (c)	9.5	0.006	27	0.02	74
SDT-6	61	0.04	PM control--0.20 lb/ton BLS (c)	26	0.02	34	0.02	57
			PM control--0.12 lb/ton BLS (c)	16	0.009	45	0.03	74
SDT-7	109	0.07	PM control--0.20 lb/ton BLS (c)	47	0.03	62	0.04	57
			PM control--0.12 lb/ton BLS (c)	28	0.02	81	0.05	74

(a) PM emissions (ton/yr) = PM emission factor (lb PM/ton BLS) x BLS firing rate (lb BLS/d) x 1 ton BLS/2,000 lb BLS x 351 d/yr x 1 ton PM/2,000 lb PM. PM HAP emissions (ton/yr) = 0.06 percent of PM emissions.

(b) PM control is replacement of existing scrubber with a new scrubber.

(c) PM control is replacement of existing mist eliminator with a new scrubber.

TABLE 5-23a (METRIC). SECONDARY EMISSIONS FOR MODEL SMELT DISSOLVING TANKS[a]

Model SDT's	Baseline emissions, kg/yr				Control option	Incremental emissions, kg/yr			
	PM	SO2	NOx	CO		PM	SO2	NOx	CO
SDT-5	2.3	11	4.5	8.5	PM control (b)	21	102	40	76
SDT-6	3.9	19	7.5	14	PM control (b)	35	170	67	128
SDT-7	7.0	34	13	26	PM control (b)	63	306	121	230

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-23b. Refer to Table 5-23b for footnotes.
(b) Impacts were estimated based on replacement of existing mist eliminator with a new scrubber.

TABLE 5-23b (ENGLISH). SECONDARY EMISSIONS FOR MODEL SMELT DISSOLVING TANKS[a]

Model SDT's	Baseline emissions, lb/yr				Control option	Incremental emissions, lb/yr			
	PM	SO2	NOx	CO		PM	SO2	NOx	CO
SDT-5	5.1	25	9.9	19	PM control (b)	46	224	89	169
SDT-6	8.5	42	17	31	PM control (b)	77	374	149	282
SDT-7	15	75	30	56	PM control (b)	138	674	268	508

(a) Secondary emissions were estimated based on energy impacts and emission factors for PM, SO2, NOx, and CO. Calculations for energy impacts are presented in Table 5-24. Emission factors = 0.15 lb PM/MM Btu; 0.73 lb SO2/MM Btu; 0.29 lb NOx/MM Btu; and 0.55 lb CO/MM Btu.
(b) Impacts were estimated based on replacement of existing mist eliminator with a new scrubber.

TABLE 5-24. ENERGY REQUIREMENTS FOR MODEL SMELT DISSOLVING TANKS

Model SDT's	Baseline energy impacts, MWh/yr (a)	Control option	Control level energy impacts, MWh/yr (b)	Incremental energy impacts, MWh/yr (b)
SDT-5	10	PM control (c)	100	90
SDT-6	17	PM control (c)	167	150
SDT-7	30	PM control (c)	300	270

(a) Baseline mist eliminator energy impacts = 0.00018 x model inlet gas flow rate x 0.7 in. H2O pressure drop x 8,424 hr/yr x 1 MWh/1,000 kWh

(b) Incremental energy impacts = (control level scrubber energy impacts) - (baseline mist eliminator energy impacts). Control level scrubber energy impacts = 0.00018 x model inlet gas flow rate x 7 in. H2O pressure drop x 8,424 hr/yr x 1 MWh/1,000 kWh

(c) Impacts were estimated based on replacement of existing mist eliminator with a new scrubber.

TABLE 5-25a (METRIC). MODEL LIME KILN PARAMETERS AND PM CONCENTRATIONS[a]

Model lime kilns	Baseline APCD	Control level APCD	Lime production rate, Mg CaO/d	Equivalent pulp production rate ADMP/d	Gas flow rate, m3/sec		Temperature, degrees C		Moisture content, %	
					APCD inlet	APCD outlet	APCD inlet	APCD outlet	APCD inlet	APCD outlet
LK-1	scrubber	ESP	90	320	10	7.3	249	71	25	30
LK-2	scrubber	ESP	180	680	20	14	249	71	25	30
LK-3	scrubber	ESP	270	1,000	34	24	249	71	25	30
LK-4	ESP	ESP	90	320	10	10	249	249	25	25
LK-5	ESP	ESP	180	680	20	20	249	249	25	25
LK-6	ESP	ESP	270	1,000	34	34	249	249	25	25

Model lime kilns	Baseline pressure drop, mm Hg	ESP SCA, m2/(m3/sec)			Baseline PM, g/dscm	Control level PM, g/dscm	
		Baseline	PM control-- 0.15 g/dscm	PM control-- 0.023 g/dscm		PM control-- 0.15 g/dscm	PM control-- 0.023 g/dscm
LK-1	39	--	90	220	0.27	0.15	0.023
LK-2	39	--	90	220	0.27	0.15	0.023
LK-3	39	--	90	220	0.27	0.15	0.023
LK-4	--	90	90	220	0.15	0.15	0.023
LK-5	--	90	90	220	0.15	0.15	0.023
LK-6	--	90	90	220	0.15	0.15	0.023

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-25b.

TABLE 5-25b (ENGLISH). MODEL LIME KILN PARAMETERS AND PM CONCENTRATIONS[a]

Model lime kilns	Baseline APCD	Control level APCD	Lime production rate, ton CaO/d	Equivalent pulp production rate, ADTP/d	Gas flow rate, acfm		Temperature, degrees F		Moisture content, %	
					APCD inlet	APCD outlet	APCD inlet	APCD outlet	APCD inlet	APCD outlet
LK-1	scrubber	ESP	100	350	22,000	15,500	480	160	25	30
LK-2	scrubber	ESP	200	750	42,500	30,000	480	160	25	30
LK-3	scrubber	ESP	300	1,100	72,200	51,000	480	160	25	30
LK-4	ESP	ESP	100	350	22,000	22,000	480	480	25	25
LK-5	ESP	ESP	200	750	42,500	42,500	480	480	25	25
LK-6	ESP	ESP	300	1,100	72,200	72,200	480	480	25	25

Model lime kilns	Baseline pressure drop, in. H2O	ESP SCA, ft2/1,000 acfm			Baseline PM, gr/dscf	Control level PM, gr/dscf	
		Baseline	PM control-- 0.067 gr/dscf	PM control-- 0.01 gr/dscf		PM control-- 0.067 gr/dscf	PM control-- 0.01 gr/dscf
LK-1	21	--	460	1,120	0.12	0.067	0.01
LK-2	21	--	460	1,120	0.12	0.067	0.01
LK-3	21	--	460	1,120	0.12	0.067	0.01
LK-4	--	460	460	1,120	0.067	0.067	0.01
LK-5	--	460	460	1,120	0.067	0.067	0.01
LK-6	--	460	460	1,120	0.067	0.067	0.01

TABLE 5-26a (METRIC). PRIMARY PM AND PM HAP EMISSIONS FOR MODEL LIME KILNS[a]

Model lime kilns	Baseline emissions, Mg/yr		Control option	Control level emissions, Mg/yr		Emission reduction, Mg/yr		Emission reduction, %
	PM	PM HAP's		PM	PM HAP's	PM	PM HAP's	
LK-1	36	0.5	PM control--0.15 g/dscm (b)	20	0.3	16	0.2	44
			PM control--0.023 g/dscm (b)	3.0	0.04	33	0.5	92
LK-2	70	1.0	PM control--0.15 g/dscm (b)	39	0.6	31	0.4	44
			PM control--0.023 g/dscm (b)	5.9	0.08	65	0.9	92
LK-3	120	1.7	PM control--0.15 g/dscm (b)	67	0.9	53	0.7	44
			PM control--0.023 g/dscm (b)	10	0.1	110	1.5	92
LK-4	20	0.3	PM control--0.023 g/dscm (c)	3.0	0.04	17	0.2	85
LK-5	39	0.6	PM control--0.023 g/dscm (c)	5.9	0.08	33	0.5	85
LK-6	67	0.9	PM control--0.023 g/dscm (c)	10	0.1	57	0.8	85

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-26b. Refer to Table 5-26b for footnotes, which include calculations.

(b) PM control is replacement of existing scrubber with new ESP.

(c) PM control is upgrade of existing ESP.

TABLE 5-26b (ENGLISH). PRIMARY PM AND PM HAP EMISSIONS FOR MODEL LIME KILNS[a]

Model lime kilns	Baseline emissions, ton/yr		Control option	Control level emissions, ton/yr		Emission reduction, ton/yr		Emission reduction, %
	PM	PM HAP's		PM	PM HAP's	PM	PM HAP's	
LK-1	40	0.6	PM control--0.067 gr/dscf (b)	22	0.3	18	0.2	44
			PM control--0.01 gr/dscf (b)	3.3	0.05	37	0.5	92
LK-2	78	1.1	PM control--0.067 gr/dscf (b)	43	0.6	34	0.5	44
			PM control--0.01 gr/dscf (b)	6.5	0.09	71	1.0	92
LK-3	132	1.8	PM control--0.067 gr/dscf (b)	74	1.0	58	0.8	44
			PM control--0.01 gr/dscf (b)	11	0.2	121	1.7	92
LK-4	22	0.3	PM control--0.01 gr/dscf (c)	3.3	0.05	19	0.3	85
LK-5	43	0.6	PM control--0.01 gr/dscf (c)	6.5	0.09	37	0.5	85
LK-6	74	1.0	PM control--0.01 gr/dscf (c)	11	0.2	63	0.9	85

(a) PM emissions (ton/yr) = PM concentration (gr/dscf) x lb/7,000 gr x model inlet gas flow rate (acfm) x (528R/[model inlet temperature + 460F]) x (100% - model inlet %H2O)/100% x 60 min/hr x 8,424 hr/yr x 1 ton/2,000 lb. PM HAP emissions (ton/yr) = 1.4 percent of PM emissions.

(b) PM control is replacement of existing scrubber with new ESP.

(c) PM control is upgrade of existing ESP.

TABLE 5-27a (METRIC). SECONDARY EMISSIONS FOR MODEL LIME KILNS[a]

Model lime kilns	Baseline emissions, kg/yr				Control option	Incremental emissions, kg/yr			
	PM	SO2	NOx	CO		PM	SO2	NOx	CO
LK-1	163	794	315	599	PM control--0.15 g/dscm (b)	(116)	(567)	(225)	(429)
					PM control--0.023 g/dscm (b)	(61)	(299)	(118)	(226)
LK-2	314	1,530	608	1,150	PM control--0.15 g/dscm (b)	(225)	(1,090)	(435)	(826)
					PM control--0.023 g/dscm (b)	(118)	(576)	(229)	(431)
LK-3	535	2,600	1,030	1,960	PM control--0.15 g/dscm (b)	(383)	(1,860)	(739)	(1,400)
					PM control--0.023 g/dscm (b)	(202)	(980)	(390)	(739)
LK-4	46	225	90	170	PM control--0.023 g/dscm (c)	55	269	107	202
LK-5	89	435	173	328	PM control--0.023 g/dscm (c)	107	517	206	393
LK-6	152	739	294	558	PM control--0.023 g/dscm (c)	181	880	350	662

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-27b. Refer to Table 5-27b for footnotes.
(b) Impacts were estimated based on replacement of existing scrubber with a new ESP.
(c) Impacts were estimated based on upgrade of existing ESP.

TABLE 5-27b (ENGLISH). SECONDARY EMISSIONS FOR MODEL LIME KILNS[a]

Model lime kilns	Baseline emissions, lb/yr				Control option	Incremental emissions, lb/yr			
	PM	SO2	NOx	CO		PM	SO2	NOx	CO
LK-1	359	1,750	694	1,320	PM control--0.067 gr/dscf (b)	(257)	(1,250)	(496)	(946)
					PM control--0.01 gr/dscf (b)	(135)	(660)	(261)	(499)
LK-2	693	3,370	1,340	2,540	PM control--0.067 gr/dscf (b)	(496)	(2,410)	(959)	(1,820)
					PM control--0.01 gr/dscf (b)	(261)	(1,270)	(504)	(950)
LK-3	1,180	5,730	2,280	4,320	PM control--0.067 gr/dscf (b)	(845)	(4,100)	(1,630)	(3,090)
					PM control--0.01 gr/dscf (b)	(445)	(2,160)	(860)	(1,630)
LK-4	102	497	197	374	PM control--0.01 gr/dscf (c)	122	593	235	446
LK-5	197	960	381	723	PM control--0.01 gr/dscf (c)	235	1,140	455	867
LK-6	335	1,630	648	1,230	PM control--0.01 gr/dscf (c)	399	1,940	772	1,460

(a) Secondary emissions were estimated based on electricity requirements and emission factors for PM, SO2, NOx, and CO. Calculations for electricity requirements are presented in Table 5-28. Emission factors = 0.15 lb PM/MM Btu; 0.73 lb SO2/MM Btu; 0.29 lb NOx/MM Btu; and 0.55 lb CO/MM Btu.
Numbers in parentheses represent negative values, indicating that secondary emissions are reduced by that amount.
(b) Impacts were estimated based on replacement of existing scrubber with a new ESP.
(c) Impacts were estimated based on upgrade of existing ESP.

TABLE 5-28. ENERGY IMPACTS FOR MODEL LIME KILNS[a]

Model lime kilns	Baseline energy impacts, MWh/yr (b),(c)	Control option	Control level energy impacts, MWh/yr (c)	Incremental energy impacts, MWh/yr
LK-1	701	PM control--0.15 g/dscm (0.067 gr/dscf) (d)	199	(501)
		PM control--0.023 g/dscm (0.01 gr/dscf) (d)	437	(264)
LK-2	1,350	PM control--0.15 g/dscm (0.067 gr/dscf) (d)	385	(965)
		PM control--0.023 g/dscm (0.01 gr/dscf) (d)	844	(506)
LK-3	2,300	PM control--0.15 g/dscm (0.067 gr/dscf) (d)	654	(1,650)
		PM control--0.023 g/dscm (0.01 gr/dscf) (d)	1,430	(870)
LK-4	199	PM control--0.023 g/dscm (0.01 gr/dscf) (e)	437	238
LK-5	385	PM control--0.023 g/dscm (0.01 gr/dscf) (e)	844	459
LK-6	654	PM control--0.023 g/dscm (0.01 gr/dscf) (e)	1,430	776

(a) Numbers in parentheses represent negative values, indicating that energy impacts are reduced by that amount.

(b) Baseline scrubber energy impacts = 0.00018 x scrubber inlet gas flow rate x 21 in. H2O pressure drop x 8,424 hr/yr x 1 MWh/1,000 kWh

(c) Baseline and control level ESP energy impacts = [(0.00018 x ESP inlet gas flow rate x 1 in. H2O pressure drop) + (0.00194 x ESP inlet gas flow rate x ESP SCA)] x (8,424 hr/yr x 1 MWh/1,000 kWh)

(d) Impacts were estimated based on replacement of existing scrubber with a new ESP.

(e) Impacts were estimated based on upgrade of existing ESP.

TABLE 5-29a (METRIC). WASTEWATER IMPACTS FOR MODEL LIME KILNS[a]

Model lime kilns	Control option	Incremental wastewater impacts, million L/yr
LK-1	PM control (b)	(226)
LK-2	PM control (b)	(484)
LK-3	PM control (b)	(709)

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-29b. Refer to Table 5-29b for footnotes, which include calculations.
(b) Impacts were estimated based on replacement of the existing scrubber with a new ESP.

TABLE 5-29b (ENGLISH). WASTEWATER IMPACTS FOR MODEL LIME KILNS[a]

Model lime kilns	Control option	Incremental wastewater impacts, million gal/yr
LK-1	PM control (b)	(60)
LK-2	PM control (b)	(128)
LK-3	PM control (b)	(187)

(a) Control level wastewater impacts are zero. Therefore, incremental impacts are equal to baseline. Numbers in parentheses represent negative values, indicating that wastewater impacts are reduced by that amount. Wastewater impacts = 4,500 lb/ODTP x 0.9 ODTP/ADTP x ADTP/d x 351 d/yr x gal/8.345 lb
(b) Impacts were estimated based on replacement of the existing scrubber with a new ESP.

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