

TABLE 5-1a (METRIC). MODEL NDCE RECOVERY FURNACE PARAMETERS^a

Model recovery furnaces	Furnace type	Black liquor firing rate, kg BLS/d	Equivalent pulp production rate		Type of ESP system	Gas flow rate, m ³ /sec		Temperature, degrees C		Moisture content, %		ESP SCA, m ² /m ³ /sec		Wastewater flow rate, L/min
			ADMUP/d	ADMBP/d		ESP exit	Quench outlet	ESP exit	Quench outlet	ESP exit	Quench outlet	PM control-0.10 g/dscm	PM control-0.034 g/dscm	
RF-1a	NDCE	700,000	450	380	Dry	93.4	76	199	72	26	33	90	100	20.21
RF-1b	NDCE	700,000	450	380	Dry	93.4	76	199	72	26	33	100	100	20.21
RF-2a	NDCE	1,200,000	820	680	Dry	168	136	199	72	26	33	90	100	36.30
RF-2b	NDCE	1,200,000	820	680	Dry	168	136	199	72	26	33	100	100	36.30
RF-3a	NDCE	1,800,000	1,180	1,000	Dry	243	197	199	72	26	33	90	100	52.43
RF-3b	NDCE	1,800,000	1,180	1,000	Dry	243	197	199	72	26	33	100	100	52.43
RF-4a	NDCE	700,000	450	380	Wet	93.4	76	199	72	26	33	90	100	20.21
RF-4b	NDCE	700,000	450	380	Wet	93.4	76	199	72	26	33	100	100	20.21
RF-5a	NDCE	1,200,000	820	680	Wet	168	136	199	72	26	33	90	100	36.30
RF-5b	NDCE	1,200,000	820	680	Wet	168	136	199	72	26	33	100	100	36.30
RF-6a	NDCE	1,800,000	1,180	1,000	Wet	243	197	199	72	26	33	90	100	52.43
RF-6b	NDCE	1,800,000	1,180	1,000	Wet	243	197	199	72	26	33	100	100	52.43

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-1b.

TABLE 5-1b (ENGLISH). MODEL NDCE RECOVERY FURNACE PARAMETERS^a

Model recovery furnaces	Furnace type	Black liquor firing rate, lb BLS/d	Equivalent pulp production rate		Type of ESP system	Gas flow rate, acfm		Temperature, degrees F		Moisture content, %		ESP SCA, ft ² /1,000 acfm		Wastewater flow rate, gal/min	
			ADTUP/d	ADTBP/d		ESP exit	Quench outlet	ESP exit	Quench outlet	Baseline	PM controls-0.044 gr/dscf	PM controls-0.015 gr/dscf			
RF-1a	NDCE	1,500,000	500	420	dry	198,000	161,000	390	161	26	33	430	530	620	5.34
RF-1b	NDCE	1,500,000	500	420	dry	198,000	161,000	390	161	26	33	530	530	620	5.34
RF-2a	NDCE	2,700,000	900	750	dry	357,000	289,000	390	161	26	33	430	530	620	9.59
RF-2b	NDCE	2,700,000	900	750	dry	357,000	289,000	390	161	26	33	530	530	620	9.59
RF-3a	NDCE	3,900,000	1,300	1,100	dry	515,000	418,000	390	161	26	33	430	530	620	13.85
RF-3b	NDCE	3,900,000	1,300	1,100	dry	515,000	418,000	390	161	26	33	530	530	620	13.85
RF-4a	NDCE	1,500,000	500	420	wet	198,000	161,000	390	161	26	33	430	530	620	5.34
RF-4b	NDCE	1,500,000	500	420	wet	198,000	161,000	390	161	26	33	530	530	620	5.34
RF-5a	NDCE	2,700,000	900	750	wet	357,000	289,000	390	161	26	33	430	530	620	9.59
RF-5b	NDCE	2,700,000	900	750	wet	357,000	289,000	390	161	26	33	530	530	620	9.59
RF-6a	NDCE	3,900,000	1,300	1,100	wet	515,000	418,000	390	161	26	33	430	530	620	13.85
RF-6b	NDCE	3,900,000	1,300	1,100	wet	515,000	418,000	390	161	26	33	530	530	620	13.85

TABLE 5-2a (METRIC). MODEL DCE RECOVERY FURNACE PARAMETERS^a

Model recovery furnaces	Furnace type	Black liquor firing rate, kg BLS/d	Equivalent pulp production rate		Type of ESP system	Gas flow rate, m ³ /sec		Temperature, degrees C		Moisture content, %		ESP SCA, m ² /(m ³ /sec)		Wastewater flow rate, L/min
			ADMUP/d	ADMBP/d		ESP exit	Quench outlet	ESP exit	Quench outlet	ESP exit	Quench outlet	PM controls-0.10 g/dscm	PM controls-0.034 g/dscm	
RF-7a	DCE converted DCE	400,000	270	230	wet dry	ESP exit	48	160	ESP exit	32	Baseline	70	100	12.45
						Quench outlet	45	199	Quench outlet	26	PM controls-0.10 g/dscm	100	120	12.11
RF-7b	DCE converted DCE	400,000	270	230	wet dry	ESP exit	48	160	ESP exit	32	Baseline	90	100	12.45
						Quench outlet	45	199	Quench outlet	26	PM controls-0.10 g/dscm	100	120	12.11
RF-8a	DCE converted DCE	700,000	450	380	wet dry	ESP exit	80	160	ESP exit	32	Baseline	70	100	20.74
						Quench outlet	76	199	Quench outlet	26	PM controls-0.10 g/dscm	100	120	20.21
RF-8b	DCE converted DCE	700,000	450	380	wet dry	ESP exit	80	160	ESP exit	32	Baseline	90	100	20.74
						Quench outlet	76	199	Quench outlet	26	PM controls-0.10 g/dscm	100	120	20.21
RF-9a	DCE converted DCE	1,200,000	820	680	wet dry	ESP exit	144	160	ESP exit	32	Baseline	70	100	37.29
						Quench outlet	136	199	Quench outlet	26	PM controls-0.10 g/dscm	100	120	36.30
RF-9b	DCE converted DCE	1,200,000	820	680	wet dry	ESP exit	144	160	ESP exit	32	Baseline	90	100	37.29
						Quench outlet	136	199	Quench outlet	26	PM controls-0.10 g/dscm	100	120	36.30

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-2b.

TABLE 5-2b (ENGLISH). MODEL DCE RECOVERY FURNACE PARAMETERS^a

Model recovery furnaces	Furnace type	Black liquor firing rate, lb BLS/d	Equivalent pulp production rate		Type of ESP system	Temperature, degrees F		Moisture content, %		ESP SCA, ft ² /1,000 acfm		Wastewater flow rate, gal/min					
			ADTUP/d	ADTBP/d		ESP exit	Quench outlet	ESP exit	Quench outlet	Baseline	PM controls-0.044 gr/dscf	PM controls-0.015 gr/dscf					
RF-7a	DCE converted DCE	900,000	300	250	wet dry	ESP exit	320	ESP exit	32	Baseline	330	PM controls-0.044 gr/dscf	430	PM controls-0.015 gr/dscf	520	Wastewater flow rate, gal/min	3.29
						Quench outlet	390	Quench outlet	26	430	530	620	3.20				
RF-7b	DCE converted DCE	900,000	300	250	wet dry	ESP exit	320	ESP exit	32	Baseline	430	PM controls-0.044 gr/dscf	430	PM controls-0.015 gr/dscf	520	Wastewater flow rate, gal/min	3.29
						Quench outlet	390	Quench outlet	26	430	530	620	3.20				
RF-8a	DCE converted DCE	1,500,000	500	420	wet dry	ESP exit	320	ESP exit	32	Baseline	330	PM controls-0.044 gr/dscf	430	PM controls-0.015 gr/dscf	520	Wastewater flow rate, gal/min	5.48
						Quench outlet	390	Quench outlet	26	330	530	620	5.34				
RF-8b	DCE converted DCE	1,500,000	500	420	wet dry	ESP exit	320	ESP exit	32	Baseline	430	PM controls-0.044 gr/dscf	430	PM controls-0.015 gr/dscf	520	Wastewater flow rate, gal/min	5.48
						Quench outlet	390	Quench outlet	26	430	530	620	5.34				
RF-9a	DCE converted DCE	2,700,000	900	750	wet dry	ESP exit	320	ESP exit	32	Baseline	330	PM controls-0.044 gr/dscf	430	PM controls-0.015 gr/dscf	520	Wastewater flow rate, gal/min	9.85
						Quench outlet	390	Quench outlet	26	330	530	620	9.59				
RF-9b	DCE converted DCE	2,700,000	900	750	wet dry	ESP exit	320	ESP exit	32	Baseline	430	PM controls-0.044 gr/dscf	430	PM controls-0.015 gr/dscf	520	Wastewater flow rate, gal/min	9.85
						Quench outlet	390	Quench outlet	26	430	530	620	9.59				

TABLE 5-3a (METRIC). MODEL NDCE RECOVERY FURNACE CONCENTRATIONS AND EMISSION FACTORS^a

Model recovery furnace	Furnace type	Type of ESP system	Baseline PM, g/dscm	Control level PM, g/dscm		Baseline gaseous organic HAP's, kg/kg BLS	Control level gaseous organic HAP's, kg/kg BLS	Baseline acid gases, kg/kg BLS		Control level acid gases, kg/kg BLS	
				PM controls-- 0.10 g/dscm	PM controls-- 0.034 g/dscm			HCl	SO ₂	HCl	SO ₂
RF-1a	NDCE	dry	0.27	0.1	0.034	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-1b	NDCE	dry	0.1	0.1	0.034	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-2a	NDCE	dry	0.27	0.1	0.034	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-2b	NDCE	dry	0.1	0.1	0.034	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-3a	NDCE	dry	0.27	0.1	0.034	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-3b	NDCE	dry	0.1	0.1	0.034	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-4a	NDCE	wet	0.27	0.1	0.034	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-4b	NDCE	wet	0.1	0.1	0.034	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-5a	NDCE	wet	0.27	0.1	0.034	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-5b	NDCE	wet	0.1	0.1	0.034	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-6a	NDCE	wet	0.27	0.1	0.034	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-6b	NDCE	wet	0.1	0.1	0.034	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-3b. Refer to Table 5-3b for footnotes.

TABLE 5 - 3b (ENGLISH) . MODEL NDCE RECOVERY FURNACE CONCENTRATIONS AND EMISSION FACTORS

Model recovery furnace	Furnace type	Type of ESP system	Baseline PM, gr/dscf	Control level PM, gr/dscf		Baseline gaseous organic HAP's, lb/lb BLS (c)	Control level gaseous organic HAP's, lb/lb BLS (c)	Baseline acid gases, lb/lb BLS (d)		Control level acid gases, lb/lb BLS (e)	
				PM controls-- 0.044 gr/dscf	PM controls-- 0.015 gr/dscf			HCl	SO2	HCl	SO2
RF-1a	NDCE	dry	0.12	0.044	0.015	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-1b	NDCE	dry	0.044	0.044	0.015	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-2a	NDCE	dry	0.12	0.044	0.015	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-2b	NDCE	dry	0.044	0.044	0.015	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-3a	NDCE	dry	0.12	0.044	0.015	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-3b	NDCE	dry	0.044	0.044	0.015	3.67E-05	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-4a	NDCE	wet	0.12	0.044	0.015	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-4b	NDCE	wet	0.044	0.044	0.015	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-5a	NDCE	wet	0.12	0.044	0.015	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-5b	NDCE	wet	0.044	0.044	0.015	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-6a	NDCE	wet	0.12	0.044	0.015	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04
RF-6b	NDCE	wet	0.044	0.044	0.015	1.30E-04	3.67E-05	1.20E-04	1.24E-03	6.21E-05	6.18E-04

(a) For furnaces controlling PM emissions to the 0.044 gr/dscf, PM controls are an ESP upgrade or replacement.
 (b) For furnaces controlling PM emissions to 0.015 gr/dscf, PM controls are an ESP upgrade or replacement plus addition of a packed-bed scrubber.
 (c) The baseline emission factor for models RF-1 through RF-3 is the average emission factor for NDCE recovery furnaces with dry ESP systems. The baseline emission factor for models RF-4 through RF-6 is the average emission factor for NDCE recovery furnaces with wet ESP systems. The control level emission factor for models RF-1 through RF-6 is the average emission factor for NDCE recovery furnaces with dry ESP systems. Gaseous organic HAP's include acetaldehyde, benzene, formaldehyde, methanol, methyl ethyl ketone, methyl isobutyl ketone, phenol, toluene, and xylenes. Methanol comprises 39 percent of the uncontrolled emissions and 13 percent of the controlled emissions.
 (d) The baseline HCl emission factor is an average of HCl emission data from NDCE and DCE recovery furnaces. The baseline SO2 emission factor is from an average SO2 emission factor of 4.2 lb/ADTP for NDCE recovery furnaces, assuming 3,400 lb BLS/ADTP.
 (e) The control level HCl emission factor was derived from a guaranteed 5 ppm scrubber outlet concentration. The control level SO2 emission factor was derived assuming 50 percent control of SO2 emissions with a packed-bed scrubber.

TABLE 5-4a (METRIC). MODEL DCE RECOVERY FURNACE CONCENTRATIONS AND EMISSION FACTORS^a

Model recovery furnace	Furnace type	Type of ESP system	Baseline PM, g/dscm	Control level PM, g/dscm		Baseline gaseous organic HAP's, kg/kg BLS	Control level gaseous organic HAP's, kg/kg BLS	Baseline acid gases, kg/kg BLS		Control level acid gases, kg/kg BLS	
				PM controls-- 0.10 g/dscm	PM controls-- 0.034 g/dscm			HCl	SO2	HCl	SO2
RF-7a	DCE converted DCE	wet dry	0.18	0.1	0.034	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-7b	DCE converted DCE	wet dry	0.1	0.1	0.034	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-8a	DCE converted DCE	wet dry	0.18	0.1	0.034	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-8b	DCE converted DCE	wet dry	0.1	0.1	0.034	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-9a	DCE converted DCE	wet dry	0.18	0.1	0.034	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-9b	DCE converted DCE	wet dry	0.1	0.1	0.034	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-4b. Refer to Table 5-4b for footnotes.

TABLE 5-4b (ENGLISH). MODEL DCE RECOVERY FURNACE CONCENTRATIONS AND EMISSION FACTORS

Model recovery furnace	Furnace type	Type of ESP system	Baseline PM, gr/dscf	Control level PM, gr/dscf		Baseline gaseous organic HAP's, lb/lb BLS (c)	Control level gaseous organic HAP's, lb/lb BLS (c)	Baseline acid gases, lb/lb BLS (d)		Control level acid gases, lb/lb BLS (e)	
				PM controls-- 0.044 gr/dscf	PM controls-- 0.015 gr/dscf			HCl	SO2	HCl	SO2
RF-7a	DCE converted DCE	wet dry	0.08	0.044	0.015	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-7b	DCE converted DCE	wet dry	0.044	0.044	0.015	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-8a	DCE converted DCE	wet dry	0.08	0.044	0.015	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-8b	DCE converted DCE	wet dry	0.044	0.044	0.015	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-9a	DCE converted DCE	wet dry	0.08	0.044	0.015	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04
RF-9b	DCE converted DCE	wet dry	0.044	0.044	0.015	5.15E-04	3.67E-05	1.20E-04	1.03E-03	6.53E-05 6.21E-05	5.15E-04 6.18E-04

- (a) For furnaces controlling PM emissions to 0.044 gr/dscf, PM controls are an ESP upgrade or replacement.
- (b) For furnaces controlling PM emissions to 0.015 gr/dscf, PM controls are an ESP upgrade or replacement plus addition of a packed-bed scrubber.
- (c) The baseline emission factor is the sum of the average emission factors for DCE recovery furnaces and BLO units.
The control level emission factor is the average emission factor for NDCE recovery furnaces with dry ESP systems.
Gaseous organic HAP's include acetaldehyde, benzene, formaldehyde, methanol, methyl ethyl ketone, methyl isobutyl ketone, phenol, toluene, and xylenes. Methanol comprises 67 percent of the uncontrolled emissions and 13 percent of the controlled emissions.
- (d) The baseline HCl emission factor is an average of HCl emission data from NDCE and DCE recovery furnaces.
The baseline SO2 emission factor is from an average SO2 emission factor of 3.5 lb/ADTP for DCE recovery furnaces, assuming 3,400 lb BLS/ADTP.
- (e) The control level HCl emission factor was derived from a guaranteed 5 ppm scrubber outlet concentration.
The control level SO2 emission factor was derived assuming 50 percent control of SO2 emissions with a packed-bed scrubber.

TABLE 5-5a (METRIC). PRIMARY PM AND PM HAP EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	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	
NDCE								
RF-1a/4a	358	0.7	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	131 45	0.3 0.09	227 313	0.5 0.6	63 88
RF-1b/4b	131	0.3	PM controls--0.034 g/dscm (c)	45	0.09	86	0.2	66
RF-2a/5a	645	1.3	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	236 81	0.5 0.2	408 564	0.8 1.1	63 88
RF-2b/5b	236	0.5	PM controls--0.034 g/dscm (c)	81	0.2	156	0.3	66
RF-3a/6a	934	1.9	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	341 116	0.7 0.2	593 818	1.2 1.6	63 88
RF-3b/6b	341	0.7	PM controls--0.034 g/dscm (c)	116	0.2	225	0.4	66
DCE								
RF-7a	144	0.3	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	79 27	0.2 0.05	65 117	0.1 0.2	45 81
RF-7b	79	0.2	PM controls--0.034 g/dscm (c)	27	0.05	52	0.1	66
RF-8a	239	0.5	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	131 45	0.3 0.09	108 194	0.2 0.4	45 81
RF-8b	131	0.3	PM controls--0.034 g/dscm (c)	45	0.09	87	0.2	66
RF-9a	431	0.9	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	236 81	0.5 0.2	194 350	0.4 0.7	45 81
RF-9b	237	0.5	PM controls--0.034 g/dscm (c)	81	0.2	156	0.3	66

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

Refer to Table 5-5b for footnotes, which include calculations.

(b) PM controls are an ESP upgrade or replacement.

(c) PM controls are an ESP upgrade or replacement plus a packed-bed scrubber.

TABLE 5-5b (ENGLISH). PRIMARY PM AND PM HAP EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	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	
NDCE								
RF-1a/4a	394	0.8	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	145 49	0.3 0.1	250 345	0.5 0.7	63 88
RF-1b/4b	145	0.3	PM controls--0.015 gr/dscf (c)	49	0.1	95	0.2	66
RF-2a/5a	711	1.4	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	261 89	0.5 0.2	450 622	0.9 1.2	63 88
RF-2b/5b	261	0.5	PM controls--0.015 gr/dscf (c)	89	0.2	172	0.3	66
RF-3a/6a	1,030	2.1	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	376 128	0.8 0.3	654 902	1.3 1.8	63 88
RF-3b/6b	376	0.8	PM controls--0.015 gr/dscf (c)	128	0.3	248	0.5	66
DCE								
RF-7a	158	0.3	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	87 30	0.2 0.06	71 129	0.1 0.3	45 81
RF-7b	87	0.2	PM controls--0.015 gr/dscf (c)	30	0.06	57	0.1	66
RF-8a	263	0.5	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	145 49	0.3 0.1	119 214	0.2 0.4	45 81
RF-8b	145	0.3	PM controls--0.015 gr/dscf (c)	49	0.1	95	0.2	66
RF-9a	475	0.9	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	261 89	0.5 0.2	214 386	0.4 0.8	45 81
RF-9b	261	0.5	PM controls--0.015 gr/dscf (c)	89	0.2	172	0.3	66

(a) PM emissions (ton/yr) = PM concentration (gr/dscf) x lb/7,000 gr x model gas flow rate (acfm) x (528R/(model temperature + 460F)) x (100% - model %H₂O)/100% x 60 min/hr x 8,424 hr/yr x 1 ton/2,000 lb.
PM HAP emissions (ton/yr) = 0.2 percent of PM emissions.

(b) PM controls are an ESP upgrade or replacement.

(c) PM controls are an ESP upgrade or replacement plus a packed-bed scrubber.

TABLE 5-6a (METRIC). SECONDARY EMISSIONS FOR PM CONTROL FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, kg/yr				Control option	Incremental emissions, kg/yr			
	PM	SO ₂	NO _x	CO		PM	SO ₂	NO _x	CO
NDC									
RF-1a/4a	395	1,920	767	1,450	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	76 267	367 1,300	145 517	272 980
RF-1b/4b	472	2,290	912	1,720	PM controls--0.034 g/dscm (c)	191	934	372	708
RF-2a/5a	712	3,470	1,380	2,610	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	136 476	662 2,340	263 921	499 1,750
RF-2b/5b	848	4,130	1,640	3,110	PM controls--0.034 g/dscm (c)	340	1,670	658	1,250
RF-3a/6a	1,030	4,990	1,990	3,770	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	195 694	953 3,400	381 1,340	717 2,530
RF-3b/6b	1,220	5,940	2,370	4,490	PM controls--0.034 g/dscm (c)	499	2,450	962	1,810
DCE									
RF-7a	193	940	372	708	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	45 189	218 916	86 363	163 689
RF-7b	238	1,160	458	871	PM controls--0.034 g/dscm (c)	143	699	277	526
RF-8a	320	1,560	621	1,170	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	75 315	363 1,530	145 608	277 1,160
RF-8b	395	1,920	767	1,450	PM controls--0.034 g/dscm (c)	240	1,170	463	880
RF-9a	576	2,810	1,120	2,120	PM controls--0.10 g/dscm (b) PM controls--0.034 g/dscm (c)	136 567	658 2,770	263 1,090	494 2,070
RF-9b	712	3,470	1,380	2,610	PM controls--0.034 g/dscm (c)	431	2,110	830	1,580

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-6b. See Table 5-6b for footnotes.

(b) Impacts were estimated for ESP upgrade/replacement.

(c) Impacts were estimated for ESP upgrade plus packed-bed scrubber.

TABLE 5-6b (ENGLISH) . SECONDARY EMISSIONS FOR PM CONTROL FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, lb/yr				Control option	Incremental emissions, lb/yr			
	PM	SO ₂	NOx	CO		PM	SO ₂	NOx	CO
NDCE									
RF-1a/4a	872	4,240	1,690	3,200	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	168 588	810 2,870	320 1,140	600 2,160
RF-1b/4b	1,040	5,050	2,010	3,800	PM controls--0.015 gr/dscf (c)	420	2,060	820	1,560
RF-2a/5a	1,570	7,650	3,040	5,760	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	300 1,050	1,460 5,150	580 2,030	1,100 3,860
RF-2b/5b	1,870	9,110	3,620	6,860	PM controls--0.015 gr/dscf (c)	750	3,690	1,450	2,760
RF-3a/6a	2,270	11,000	4,380	8,320	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	430 1,530	2,100 7,500	840 2,960	1,580 5,580
RF-3b/6b	2,700	13,100	5,220	9,900	PM controls--0.015 gr/dscf (c)	1,100	5,400	2,120	4,000
DCE									
RF-7a	424	2,070	821	1,560	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	100 416	480 2,020	189 799	360 1,520
RF-7b	524	2,550	1,010	1,920	PM controls--0.015 gr/dscf (c)	316	1,540	610	1,160
RF-8a	706	3,440	1,370	2,590	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	166 694	800 3,380	320 1,340	610 2,550
RF-8b	872	4,240	1,690	3,200	PM controls--0.015 gr/dscf (c)	528	2,580	1,020	1,940
RF-9a	1,270	6,200	2,460	4,670	PM controls--0.044 gr/dscf (b) PM controls--0.015 gr/dscf (c)	300 1,250	1,450 6,100	580 2,410	1,090 4,570
RF-9b	1,570	7,650	3,040	5,760	PM controls--0.015 gr/dscf (c)	950	4,650	1,830	3,480

(a) Baseline and control level secondary emissions were estimated based on electricity requirements and emission factors. Calculations for energy impacts are presented in Table 5-7. The 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 for ESP upgrade/replacement.

(c) Impacts were estimated for ESP upgrade plus packed-bed scrubber.

TABLE 5-7. ENERGY IMPACTS FOR PM CONTROL FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline energy impacts, MWh/yr	Control option	Control level energy impacts, MWh/yr	Incremental energy impacts, MWh/yr (c)
NDCE				
RF-1a/4a	1,700	PM controls-0.10 g/dscm (0.044 gr/dscf) (b) PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	2,030 2,850	330 1,150
RF-1b/4b	2,030	PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	2,850	820
RF-2a/5a	3,070	PM controls-0.10 g/dscm (0.044 gr/dscf) (b) PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	3,650 5,120	580 2,050
RF-2b/5b	3,650	PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	5,120	1,470
RF-3a/6a	4,430	PM controls-0.10 g/dscm (0.044 gr/dscf) (b) PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	5,270 7,410	840 2,980
RF-3b/6b	5,270	PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	7,410	2,140
DCE				
RF-7a	829	PM controls-0.10 g/dscm (0.044 gr/dscf) (b) PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	1,020 1,640	191 811
RF-7b	1,020	PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	1,640	620
RF-8a	1,380	PM controls-0.10 g/dscm (0.044 gr/dscf) (b) PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	1,700 2,730	320 1,350
RF-8b	1,700	PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	2,730	1,030
RF-9a	2,490	PM controls-0.10 g/dscm (0.044 gr/dscf) (b) PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	3,070 4,920	580 2,430
RF-9b	3,070	PM controls-0.034 g/dscm (0.015 gr/dscf) (c)	4,920	1,850

- (a) Numbers in parentheses represent negative values, indicating that energy impacts are reduced by that amount.
 PM control energy impacts at baseline and at 0.044 gr/dscf = $[0.00018 \times \text{model gas flowrate} \times 1 \text{ in. H}_2\text{O pressure drop} \times 8,424 \text{ hr/yr} \times 1 \text{ MWh}/1,000 \text{ kWh}] + [0.00194 \times \text{model gas flow rate} \times \text{SCA} \times 8,424 \text{ hr/yr} \times 1 \text{ MWh}/1,000 \text{ kWh}]$.
 PM control energy impacts at 0.015 gr/dscf = $[0.00018 \times \text{model gas flow rate} \times 4 \text{ in. H}_2\text{O pressure drop} \times 8,424 \text{ hr/yr} \times 1 \text{ MWh}/1,000 \text{ kWh}] + [0.00194 \times \text{model gas flow rate} \times \text{SCA} \times 8,424 \text{ hr/yr} \times 1 \text{ MWh}/1,000 \text{ kWh}] + [0.746 \text{ kW/hp} \times \text{liquid flow rate} \times 60 \text{ ft head} \times \text{spec. grav. H}_2\text{O} \times 1/70\% \text{ pump motor effici.} \times 8,424 \text{ hr/yr} \times 1 \text{ MWh}/1,000 \text{ kWh}]$.
- (b) Impacts were estimated for ESP upgrade/replacement.
- (c) Impacts were estimated for ESP upgrade/replacement plus packed-bed scrubber.

TABLE 5-8a (METRIC). PRIMARY GASEOUS ORGANIC HAP EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, Mg/yr	Control option	Control level emissions, Mg/yr	Emission reduction, Mg/yr	Emission reduction, %
NDCE					
RF-4	31	Wet to dry ESP system conversion	8.8	22	72
RF-5	56	Wet to dry ESP system conversion	16	40	72
RF-6	81	Wet to dry ESP system conversion	23	58	72
DCE					
RF-7	74	Low-odor conversion	5.3	69	93
RF-8	123	Low-odor conversion	8.8	114	93
RF-9	221	Low-odor conversion	16	206	93

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-8b. Refer to Table 5-8b for footnotes, which include calculations.

TABLE 5-8b (ENGLISH). PRIMARY GASEOUS ORGANIC HAP EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, ton/yr	Control option	Control level emissions, ton/yr	Emission reduction, ton/yr	Emission reduction, %
NDCE					
RF-4	34	Wet to dry ESP system conversion	9.7	25	72
RF-5	62	Wet to dry ESP system conversion	17	44	72
RF-6	89	Wet to dry ESP system conversion	25	64	72
DCE					
RF-7	81	Low-odor conversion	5.8	76	93
RF-8	136	Low-odor conversion	9.7	126	93
RF-9	244	Low-odor conversion	17	227	93

(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, methanol, methyl ethyl ketone, methyl isobutyl ketone, phenol, toluene, and xylenes. Methanol comprises 49 percent of the emission reduction for models RF-4 through RF-6 and 70 percent of the emission reduction for models RF-7 through RF-9.

TABLE 5-9a (METRIC). TOTAL REDUCED SULFUR COMPOUND EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, Mg/yr	Control option	Control level emissions, Mg/yr	Emission reduction, Mg/yr	Emission reduction, %
NDCE					
RF-4	5.5	Wet to dry ESP system conversion	2.5	3.0	55
RF-5	9.9	Wet to dry ESP system conversion	4.5	5.4	55
RF-6	14	Wet to dry ESP system conversion	6.5	7.8	55
DCE					
RF-7	24	Low-odor conversion	1.5	22	94
RF-8	40	Low-odor conversion	2.5	37	94
RF-9	71	Low-odor conversion	4.5	67	94

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-9b. Refer to Table 5-9b for footnotes.

TABLE 5-9b (ENGLISH). TOTAL REDUCED SULFUR COMPOUND EMISSIONS FOR MODEL RECOVERY FURNACES

Model recovery furnaces	Baseline emissions, ton/yr (a)	Control option	Control level emissions, ton/yr (b)	Emission reduction, ton/yr (b)	Emission reduction, %
NDCE					
RF-4	6.0	Wet to dry ESP system conversion	2.7	3.3	55
RF-5	11	Wet to dry ESP system conversion	5.0	5.9	55
RF-6	16	Wet to dry ESP system conversion	7.1	8.6	55
DCE					
RF-7	26	Low-odor conversion	1.6	25	94
RF-8	44	Low-odor conversion	2.7	41	94
RF-9	79	Low-odor conversion	4.9	74	94

(a) Baseline TRS for models RF-4 through RF-6 is based on a 10 percent trimmed TRS mean of 2.2 ppm taken from TRS emission data for NDCE recovery furnaces assumed to be equipped with wet ESP systems. The baseline TRS for models RF-7 through RF-9 is based on a 10 percent trimmed mean of 12 ppm taken from TRS emission data for DCE recovery furnaces plus an average TRS emission factor of 0.10 lb/ADTP for BLO units (assuming 3,400 lb BLS/ADT of bleached and unbleached pulp).

(b) TRS emission reduction = (baseline TRS) - (control level TRS). Control level TRS for models RF-4 through RF-9 is based on a TRS concentration of 1 ppm taken from TRS emission data for an NDCE recovery furnace known to be equipped with a dry ESP system.

TABLE 5-10a (METRIC). SECONDARY EMISSIONS FOR LOW-ODOR CONVERSION FOR MODEL DCE RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, kg/yr			Control option	Incremental emissions, kg/yr				
	PM	SO ₂	NO _x		CO	PM	SO ₂	NO _x	CO
RF-7	567	2,770	1,100	2,090	Low-odor conversion (b)	(567)	(2,770)	(1,100)	(2,090)
RF-8	776	3,770	1,500	2,840	Low-odor conversion (b)	(776)	(3,770)	(1,500)	(2,840)
RF-9	1,100	5,350	2,130	4,050	Low-odor conversion (b)	(1,100)	(5,350)	(2,130)	(4,050)
RF-7a	193	939	372	708	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	90	440	177	331
RF-7b	238	1,160	458	871	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	45	222	91	168
RF-8a	320	1,560	621	1,170	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	151	730	290	549
RF-8b	395	1,920	767	1,450	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	76	367	145	272
RF-9a	576	2,810	1,120	2,120	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	272	1,320	526	993
RF-9b	712	3,470	1,380	2,610	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	612	2,980	1,180	2,250
						136	662	263	499
						476	2,320	921	1,750

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-10b. See Table 5-10b for footnotes.
 (b) Impacts were estimated based on removal of the BLO unit during the low-odor conversion.
 (c) Impacts were estimated for low-odor conversion ESP upgrade.
 (d) Impacts were estimated for low-odor conversion ESP upgrade plus packed-bed scrubber.

TABLE 5-10b (ENGLISH). SECONDARY EMISSIONS FOR LOW-ODOR CONVERSION FOR MODEL DCE RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, lb/yr				Control option	Incremental emissions, lb/yr			
	PM	SO ₂	NO _x	CO		PM	SO ₂	NO _x	CO
RF-7	1,250	6,110	2,430	4,600	Low-odor conversion (b)	(1,250)	(6,110)	(2,430)	(4,600)
RF-8	1,710	8,310	3,300	6,260	Low-odor conversion (b)	(1,710)	(8,310)	(3,300)	(6,260)
RF-9	2,430	11,800	4,700	8,920	Low-odor conversion (b)	(2,430)	(11,800)	(4,700)	(8,920)
RF-7a	424	2,070	821	1,560	PM controls--0.044 gr/dscf (c) PM controls--0.015 gr/dscf (d)	199	970	389	730
RF-7b	524	2,550	1,010	1,920	PM controls--0.044 gr/dscf (c) PM controls--0.015 gr/dscf (d)	452	2,200	869	1,650
RF-8a	706	3,440	1,370	2,590	PM controls--0.044 gr/dscf (c) PM controls--0.015 gr/dscf (d)	100	490	200	370
RF-8b	872	4,240	1,690	3,200	PM controls--0.044 gr/dscf (c) PM controls--0.015 gr/dscf (d)	353	1,720	680	1,290
RF-9a	1,270	6,200	2,460	4,670	PM controls--0.044 gr/dscf (c) PM controls--0.015 gr/dscf (d)	334	1,610	640	1,210
RF-9b	1,570	7,650	3,040	5,760	PM controls--0.044 gr/dscf (c) PM controls--0.015 gr/dscf (d)	754	3,670	1,460	2,770
						168	810	320	600
						588	2,870	1,140	2,160
						600	2,910	1,160	2,190
						1,350	6,570	2,610	4,950
						300	1,460	580	1,100
						1,050	5,120	2,030	3,860

(a) Baseline and control level secondary emissions were estimated based on electricity requirements and emission factors. Calculations for energy impacts are presented in Table 5-11b. The emission factors = 0.15 lb PM/MM Btu; 0.73 lb SO₂/MM Btu; 0.29 lb NO_x/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 removal of the BLO unit during the low-odor conversion.

(c) Impacts were estimated for low-odor conversion ESP upgrade.

(d) Impacts were estimated for low-odor conversion ESP upgrade plus packed-bed scrubber.

TABLE 5-11a: (METRIC). ENERGY IMPACTS FOR LOW-ODOR CONVERSION FOR MODEL DCE RECOVERY FURNACES

Model recovery furnaces	Baseline energy impacts		Control option	Control level energy impacts		Incremental energy impacts	
	Electricity, MWh/yr	Steam energy, MJ/yr		Electricity, MWh/yr	Steam energy, MJ/yr	Electricity, MWh/yr	Steam energy, MJ/yr
RF-7	2,450	1.32E+09	Low-odor conversion (b)	0	1.51E+09	(2,450)	1.97E+08
RF-8	3,330	2.19E+09	Low-odor conversion (b)	0	2.52E+09	(3,330)	3.28E+08
RF-9	4,750	3.95E+09	Low-odor conversion (b)	0	4.54E+09	(4,750)	5.91E+08
RF-7a	829	--	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	1,220 1,710	-- --	391 881	-- --
RF-7b	1,020	--	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	1,220 1,710	-- --	200 690	-- --
RF-8a	1,380	--	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	2,030 2,850	-- --	650 1,470	-- --
RF-8b	1,700	--	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	2,030 2,850	-- --	330 1,150	-- --
RF-9a	2,490	--	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	3,650 5,120	-- --	1,160 2,630	-- --
RF-9b	3,070	--	PM controls--0.10 g/dscm (c) PM controls--0.034 g/dscm (d)	3,650 5,120	-- --	580 2,050	-- --

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-11b. See Table 5-11b for footnotes, which include calculations.

(b) Electricity impacts based on BLO removal; steam energy impacts based on furnace conversion.

(c) Impacts were estimated for low-odor conversion ESP upgrade.

(d) Impacts were estimated for low-odor conversion ESP upgrade plus packed-bed scrubber.

TABLE 5-11b (ENGLISH). ENERGY IMPACTS FOR LOW-ODOR CONVERSION FOR MODEL DCE RECOVERY FURNACES^a

Model recovery furnaces	Baseline energy impacts		Control option	Control level energy impacts		Incremental energy impacts	
	Electricity, MWh/yr	Steam energy, MM Btu/yr		Electricity, MWh/yr (c),(e)	Steam energy, MM Btu/yr (f)	Electricity, MWh/yr	Steam energy, MM Btu/yr
RF-7	2,450	1.25E+06	Low-odor conversion (b)	0	1.44E+06	(2,450)	1.87E+05
RF-8	3,330	2.08E+06	Low-odor conversion (b)	0	2.39E+06	(3,330)	3.12E+05
RF-9	4,750	3.75E+06	Low-odor conversion (b)	0	4.31E+06	(4,750)	5.61E+05
RF-7a	829	-	PM controls-0.044 gr/dscf (c) PM controls-0.015 gr/dscf (d)	1,220 1,710	- -	391 881	- -
RF-7b	1,020	-	PM controls-0.044 gr/dscf (c) PM controls-0.015 gr/dscf (d)	1,220 1,710	- -	200 690	- -
RF-8a	1,380	-	PM controls-0.044 gr/dscf (c) PM controls-0.015 gr/dscf (d)	2,030 2,850	- -	650 1,470	- -
RF-8b	1,700	-	PM controls-0.044 gr/dscf (c) PM controls-0.015 gr/dscf (d)	2,030 2,850	- -	330 1,150	- -
RF-9a	2,490	-	PM controls-0.044 gr/dscf (c) PM controls-0.015 gr/dscf (d)	3,650 5,120	- -	1,160 2,630	- -
RF-9b	3,070	-	PM controls-0.044 gr/dscf (c) PM controls-0.015 gr/dscf (d)	3,650 5,120	- -	580 2,050	- -

(a) Numbers in parentheses represent negative values, indicating that energy impacts are reduced by that amount.
 Baseline BLO energy impacts = annual BLO operating cost x kWh/\$0.06 x 1 MWh/1,000 kWh. Control level impacts = 0.
 PM control energy impacts at baseline and at 0.044 gr/dscf = [0.00018 x model gas flow rate x 1 in. H2O pressure drop x 8,424 hr/yr x 1 MWh/1,000 kWh] + [0.00194 x model gas flow rate x SCA x 8,424 hr/yr x 1 MWh/1,000 kWh].
 PM control energy impacts at 0.015 gr/dscf = [0.00018 x model gas flow rate x 4 in. H2O pressure drop x 8,424 hr/yr x 1 MWh/1,000 kWh] + [0.00194 x model gas flow rate x SCA x 8,424 hr/yr x 1 MWh/1,000 kWh] + [0.746 kW/hp x liquid flow rate x 60 ft head x spec. grav. H2O x 1/70% pump motor effici. x 8,424 hr/yr x 1 MWh/1,000 kWh].
 Unconverted DCE recovery furnace steam energy impacts = steam energy production for DCE.
 Converted DCE recovery furnace steam energy = steam energy production for NDCE - concentrator steam requirements
 Steam energy production = 6,000 Btu/lb BLS x model BLS firing rate (lb BLS/d) x 351 d/yr x furnace thermal effci. (56% DCE, 66% NDCE) x 1/(85% power boiler thermal effci.)
 Concentrator steam requirements = steam flow (10,000 lb/hr) x [model BLS firing rate (lb BLS/d)/2.4 MM lb BLS/d] x change in enthalpy (1,331.5 Btu/lb-189.2 Btu/lb) x 8,424 hr/yr.
 (b) Electricity impacts based on BLO removal; steam energy impacts based on furnace conversion.
 (c) Impacts were estimated for low-odor conversion ESP upgrade.
 (d) Impacts were estimated for low-odor conversion ESP upgrade plus packed-bed scrubber.

TABLE 5-12a (METRIC). PRIMARY ACID GAS EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, Mg/yr		Control option	Control level emissions, Mg/yr		Emission reduction, Mg/yr		Emission reduction, %	
	Hydrochloric acid	Sulfur dioxide		Hydrochloric acid	Sulfur dioxide	Hydrochloric acid	Sulfur dioxide	Hydrochloric acid	Sulfur dioxide
NDCE/converted DCE									
RF-1/4	29	295	Packed-bed scrubber	15	148	14	148	48	50
RF-2/5	52	531	Packed-bed scrubber	27	266	25	266	48	50
RF-3/6	75	767	Packed-bed scrubber	39	384	36	384	48	50
RF-7	17	148	Packed-bed scrubber	8.9	89	8.3	89	48	40
RF-8	29	246	Packed-bed scrubber	15	148	14	98	48	40
RF-9	52	443	Packed-bed scrubber	27	266	25	177	48	40
Unconverted DCE									
RF-7	17	148	Packed-bed scrubber	9.4	74	7.8	74	46	50
RF-8	29	246	Packed-bed scrubber	16	123	13	123	46	50
RF-9	52	443	Packed-bed scrubber	28	221	24	221	46	50

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-12b. Refer to Table 5-12b for footnotes, which include calculations.

TABLE 5-12b (ENGLISH). PRIMARY ACID GAS EMISSIONS FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Baseline emissions, ton/yr		Control option	Control level emissions, ton/yr		Emission reduction, ton/yr		Emission reduction, %	
	Hydrochloric acid	Sulfur dioxide		Hydrochloric acid	Sulfur dioxide	Hydrochloric acid	Sulfur dioxide	Hydrochloric acid	Sulfur dioxide
NDCE/converted DCE									
RF-1/4	32	325	Packed-bed scrubber	16	163	15	163	48	50
RF-2/5	57	585	Packed-bed scrubber	29	293	27	293	48	50
RF-3/6	82	845	Packed-bed scrubber	43	423	40	423	48	50
RF-7	19	163	Packed-bed scrubber	9.8	98	9.1	65	48	40
RF-8	32	271	Packed-bed scrubber	16	163	15	108	48	40
RF-9	57	488	Packed-bed scrubber	29	293	27	195	48	40
Unconverted DCE									
RF-7	19	163	Packed-bed scrubber	10	81	8.6	81	46	50
RF-8	32	271	Packed-bed scrubber	17	135	14	135	46	50
RF-9	57	488	Packed-bed scrubber	31	244	26	244	46	50

(a) HCl/SO₂ 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.

TABLE 5-13a (METRIC). SECONDARY EMISSIONS FOR HCL CONTROL FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Control option	Incremental emissions, kg/yr			
		PM	SO2	NOx	CO
NDCE/converted DCE					
RF-1/4/8	Packed-bed scrubber	229	1,120	444	839
RF-2/5/9	Packed-bed scrubber	412	2,000	798	1,510
RF-3/6	Packed-bed scrubber	594	2,900	1,150	2,190
RF-7	Packed-bed scrubber	138	671	266	503
Unconverted DCE					
RF-7	Packed-bed scrubber	145	708	281	531
RF-8	Packed-bed scrubber	242	1,180	467	889
RF-9	Packed-bed scrubber	435	2,120	844	1,600

(a) Metric equivalents in this table were converted from the calculated English unit values given in Table 5-13b. See Table 5-13b for footnotes.

TABLE 5-13b (ENGLISH). SECONDARY EMISSIONS FOR HCL CONTROL FOR MODEL RECOVERY FURNACES^a

Model recovery furnaces	Control option	Incremental emissions, lb/yr			
		PM	SO ₂	NO _x	CO
NDCE/converted DCE					
RF-1/4/8	Packed-bed scrubber	506	2,460	978	1,850
RF-2/5/9	Packed-bed scrubber	908	4,420	1,760	3,330
RF-3/6	Packed-bed scrubber	1,310	6,390	2,540	4,820
RF-7	Packed-bed scrubber	304	1,480	587	1,110
Unconverted DCE					
RF-7	Packed-bed scrubber	320	1,560	619	1,170
RF-8	Packed-bed scrubber	533	2,600	1,030	1,960
RF-9	Packed-bed scrubber	960	4,670	1,860	3,520

(a) Secondary emissions are zero at baseline; therefore, control level and incremental secondary emission numbers are the same. The control level secondary emissions were estimated based on electricity requirements and emission factors. Calculations for energy impacts are presented in Table 5-14. The emission factors = 0.15 lb PM/MM Btu; 0.73 lb SO₂/MM Btu; 0.29 lb NO_x/MM Btu; and 0.55 lb CO/MM Btu.