AP42 Section:	9.10.1.2
Title:	Sugarbeet Processing Comments and letters from industry 1997

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INTEROFFICE MEMORANDUM

MIDWEST RESEARCH INSTITUTE

July 8, 1997

To: AP-42 Section 9.10.1.2, Sugarbeet Processing, Project File

From: Tom Lapp and Brian Shrager

Subject: National Emission Estimate

The recently published AP-42 Section 9.10.1.2, Sugarbeet Processing, includes emission factors for particulate matter (PM) emissions from pulp dryers, sugar granulators, and sugar coolers. Emission factors for volatile organic compounds (VOCs) are presented for pulp dryers, carbonation tanks, and thin juice evaporators. Factors for methane, nitrogen oxides (NO_x), sulfur dioxide (SO_2), carbon monoxide (CO), and carbon dioxide (CO_2) emissions are presented for pulp dryers. Existing pulp dryers are fueled with coal, natural gas, or fuel oil. To develop this national emission estimate, average PM emission factors were estimated based on available AP-42 data for the various fuel types. Average emission factors for VOC, methane, and the inorganic gases were calculated based on the available AP-42 data for the different fuel types. Emission factors for specific organic emissions were presented for carbonation tanks and thin juice evaporators based on a single source test. Since it could not be established that this source was typical of the industry, the factors for the specific compounds are summed and reported in this estimate as total VOC. All of these factors were used, in conjunction with sugarbeet and beet sugar production statistics, to estimate emissions at the county level and on a national basis.

In AP-42 Section 9.10.1.2, the units for the emission factors are:

pulp dryers = lb per ton of pressed wet pulp to the dryer
sugar granulators and sugar coolers = lb per ton of sugar output
first and second carbonation tanks = lb per 1,000 gallons of raw juice produced
first evaporator = lb per 1,000 gallons of thin juice produced.

The most readily available annual data for sugarbeets are quantity of beets harvested (produced) and quantity of refined beet sugar produced. Information presented in the reference document by McGinnis was used to modify each of the cited emission factors so that emissions can be estimated based on either tons of sugarbeets harvested or tons of sugar produced.[1] Because there is reported to be negligible weight loss during sugarbeet cleaning and handling and raw cossette production, the reported quantities of sugarbeets harvested (produced) are assumed to be equal to the quantities processed into raw cossettes.

After sugar extraction, the cossettes (termed wet pulp) are screened, pressed to remove water, treated with molasses, and sent to the dryers. The net weight of the pressed wet pulp to the dryers is about 26 percent of the weight of the raw cossettes before sugar extraction; raw cossette weight is equivalent to the quantity of beets processed. Therefore, 0.26 tons of pressed wet pulp are produced per ton of sugarbeets processed. Estimation of the production quantity of raw and thin juice in terms of tons of sugarbeets processed is more complex than the pressed wet pulp feed estimation. "Draft" is the ratio of the weight of diffusion juice drawn from the diffuser to the weight of the cossettes introduced, times 100.[1] Values for draft usually vary between 100 and 150; an average of 125 was assumed. The densities for raw and thin juice were calculated from equations and data tabulations presented in McGinnis. These calculated densities were combined with the average draft value to estimate the gallons of raw and thin juice produced per ton of sugarbeets processed. The calculated volume of raw juice is 240 gallons per ton of beets processed and the volume of thin juice is 270 gallons per ton of beets processed.

The estimated county and nationwide emissions were developed based on either the annual quantity of sugarbeets harvested or the annual beet sugar production quantity; both of these figures are available from either the U.S. Department of Agriculture (USDA) or the United States Beet Sugar Association.[2-3] For each sugarbeet processing plant, the location (city and state) and daily capacity were obtained from the U. S. Beet Sugar Association.[3] County identifications for each plant were obtained using an Atlas of the United States. The daily capacity of the 31 plants was summed and the percentage of the total daily capacity calculated for each plant. The total annual sugarbeets harvested and the total annual beet sugar production were prorated among the 31 processing plants according to their percentage of the total daily processing capacity. The 1995 total quantity of sugarbeets harvested was 28,117,980 tons; this figure was based on a yield of 19.8 tons per acre and $1{,}420.1 \times 10^3$ acres planted. As stated earlier, the annual quantity of sugarbeets processed is assumed to be equal to the total quantity of sugarbeets harvested. Refined sugar production was 3,689,000 tons; this figure was based on an average production of 5,196 lb per acre and $1{,}420.1 \times 10^3$ acres planted.[3] In Table 1, the location (state, city, county), 1995 daily processing capacity, percent of the total industry daily capacity, prorated volume of sugarbeets processed based on the 1995 sugarbeet harvest, and prorated volume of sugar produced based on 1995 total sugar production are presented for each processing plant.

Table 2 presents the estimated filterable and condensible particulate matter (PM) emissions for each processing plant. The PM emissions result from the pulp dryers, sugar granulators, and sugar coolers. The emission factors for these sources are shown in the footnotes to Table 2. To estimate these emissions, data are required for the tons of pressed wet pulp to the dryer and tons of refined sugar produced. The prorated volume of refined sugar production is provided in Table 1. Each ton of processed sugarbeets yields 0.26 tons of pressed wet pulp; the volume of sugarbeets processed in 1995 was given in Table 1.

Emissions of VOC are generated from pulp dryers, carbonation tanks, and the evaporator; these emisions are summarized in Table 3. The emission factors are shown in the footnotes to Table 3. Data are required for tons of pressed wet pulp, gallons of raw juice produced, and gallons of thin juice produced. Each ton of processed sugarbeets yields 0.26 tons of pressed wet pulp, 240 gallons of raw juice, and 270 gallons of thin juice. The VOC emissions for all three sources were summed and reported in Table 3.

Table 4 summarizes emissions of methane and selected inorganic gases from pulp dryers. The emission factors are shown in the footnotes to Table 4; the estimation method for pressed wet pulp production has been discussed.

The results of Tables 2, 3, and 4 are summarized in Table 5. On a national basis for 1995, estimated filterable PM emissions were 2,752 tons and total condensible PM emissions were 1,339 tons; total PM emissions were 4,091 tons. Total 1995 nationwide VOC and methane emissions were 418 and 102 tons, respectively. For the inorganic gases, the 1995 total emissions on a national basis were 2,303 tons for NO_x; 2,888 tons for SO_2; 3,655 tons for CO; and 1,164,834 tons for CO_2.

References

1. R.A. McGinnis, *Beet-Sugar Technology, Third Edition*, Beet Sugar Development Foundation, Fort Collins, CO, 1982.

2. *Sugar and Sweetner Yearbook,* U.S. Department of Agriculture, Economic Research Service, Washington, DC, June 1995.

3. *Directory of American Beet Sugar Companies,* United States Beet Sugar Association, Washington, DC, 1997.

TABLE 1. 1995 PRODUCTION ESTIMATES (BY CITY AND COUNTY) FOR SUGARBEET PROCESSING PLANTS

State	City	County	Daily capacity, tons of beets	Percent of total industry daily capacity	Refined sugar produced, tons*	Sugarbeets processed, tons*
Idaho	Mini-Cassia	Cassia	10,000	5.55	204,888	1,561,676
	Twin Falls	Twin Falls	6,200	3.44	127,030	968,239
	Nampa	Ada	11,800	6.55	241,767	1,842,778
Oregon	Nyssa	Malheur	9,000	5.00	184,399	1,405,509
California	Woodland	Yolo	3,600	2.00	73,760	562,203
	Tracy	San Joaquin	5,000	2.78	102,444	780,838
	Mendota	Madera	4,200	2.33	86,053	655,904
	Brawley	Imperial	8,200	4.55	168,008	1,280,574
Montana	Billings	Yellowstone	5,000	2.78	102,444	780,838
	Sidney	Richland	5,400	3.00	110,639	843,305
Wyoming	Lovell	Bighorn	3,000	1.67	61,466	468,503
	Worland	Washakie	3,600	2.00	73,760	562,203
	Torrington	Goshen	5,400	3.00	110,639	843,305
Colorado	Greeley	Weld	3,500	1.94	71,711	546,587
	Ft. Morgan	Morgan	5,000	2.78	102,444	780,838
Texas	Hereford	Deaf Smith	7,700	4.28	157,763	1,202,491
North Dakota	Drayton	Walsh	5,900	3.28	120,884	921,389
	Hillsboro	Trail	5,900	3.28	120,884	921,389
	Wahpeton	Richland	7,500	4.17	153,666	1,171,257
Minnesota	East Grand Forks	Polk	8,000	4.44	163,910	1,249,341
	Crookston	Polk	5,300	2.94	108,590	827,688
TOTAL FOR POLK COUNTY			13,300	7	272,500	2,077,029
	Moorhead	Clay	5,300	2.94	108,590	827,688
	Renville	Renville	10,000	5.55	204,888	1,561,676
Nebraska	Scottsbluff	Scotts Bluff	5,000	2.78	102,444	780,838
	Bayard	Morrill	3,000	1.67	61,466	468,503
Michigan	Bay City	Tuscola	8,000	4.44	163,910	1,249,341
	Caro	Tuscola	3,500	1.94	71,711	546,587
TOTAL FOR TUSCOLA COUNTY			11,500	6.39	235,621	1,795,928
	Carrollton	Saginaw	3,100	1.72	63,515	484,120
	Sebewaing	Huron	5,550	3.08	113,713	866,730
	Croswell	Sanilac	3,600	2.00	73,760	562,203
Ohio	Fremont	Sandusky**	3,800	2.11	77,857	593,437
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			180,050	100	3,689,000	28,117,980

*Prorated values based on total annual values obtained from References 2 and 3.
**Factory operations are suspended

Variables:

Total industry daily capacity, 1995:	180,050 tons	
Refined sugar produced, 1995:	3,689,000 tons	
Sugarbeets processed, 1995:	28,117,980 tons	assumed to equal beets harvested

TABLE 2. 1995 NATIONAL EMISSION ESTIMATE (BY CITY AND COUNTY) FOR PM FROM SUGARBEET PROCESSING

State	City	County	Refined sugar produced, tons*	Pressed wet pulp, tons*	PM emissions, tons Filterable	Condensible
Idaho	Mini-Cassia	Cassia	204,888	406,036	153	74
	Twin Falls	Twin Falls	127,030	251,742	95	46
	Nampa	Ada	241,767	479,122	180	88
Oregon	Nyssa	Malheur	184,399	365,432	138	67
California	Woodland	Yolo	73,760	146,173	55	27
	Tracy	San Joaquin	102,444	203,018	76	37
	Mendota	Madera	86,053	170,535	64	31
	Brawley	Imperial	168,008	332,949	125	61
Montana	Billings	Yellowstone	102,444	203,018	76	37
	Sidney	Richland	110,639	219,259	83	40
Wyoming	Lovell	Bighorn	61,466	121,811	46	22
	Worland	Washakie	73,760	146,173	55	27
	Torrington	Goshen	110,639	219,259	83	40
Colorado	Greeley	Weld	71,711	142,113	53	26
	Ft. Morgan	Morgan	102,444	203,018	76	37
Texas	Hereford	Deaf Smith	157,763	312,648	118	57
North Dakota	Drayton	Walsh	120,884	239,561	90	44
	Hillsboro	Trail	120,884	239,561	90	44
	Wahpeton	Richland	153,666	304,527	115	56
Minnesota	East Grand Forks	Polk	163,910	324,829	122	60
	Crookston	Polk	108,590	215,199	81	39
TOTAL FOR POLK COUNTY			272,500	540,028	203	99
	Moorhead	Clay	108,590	215,199	81	39
	Renville	Renville	204,888	406,036	153	74
Nebraska	Scottsbluff	Scotts Bluff	102,444	203,018	76	37
	Bayard	Morrill	61,466	121,811	46	22
Michigan	Bay City	Tuscola	163,910	324,829	122	60
	Caro	Tuscola	71,711	142,113	53	26
TOTAL FOR TUSCOLA COUNTY			235,621	466,941	176	86
	Carrollton	Saginaw	63,515	125,871	47	23
	Sebewaing	Huron	113,713	225,350	85	41
	Croswell	Sanilac	73,760	146,173	55	27
Ohio	Fremont	Sandusky**	77,857	154,294	58	28
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			3,689,000	7,310,675	2,752	1,339

*Prorated values based on data from Table 1.
**Factory operations are suspended

Variables:

Total industry daily cap., 1995:	180,050 tons	
Refined sugar produced, 1995:	3,689,000 tons	
Sugarbeets processed, 1995:	28,117,980 tons	assumed to equal beets harvested
Pressed wet pulp dried, 1995:	7,310,675 tons	0.26 x tons of beets processed

Filterable PM emission factors:

Pulp dryers:	0.67	lb/ton of pressed wet pulp (avg. of AP-42 factors for controlled coal-, gas, and oil-fired dryers)
Granulators:	0.064	lb/ton of sugar output
Coolers:	0.1	lb/ton of sugar output (avg. of AP-42 factors for controlled coolers)

Condensible PM emission factors:

Pulp dryers:	0.36	lb/ton of pressed wet pulp (avg. of AP-42 factors for coal- and oil-fired dryers, no data for gas-fired dryers)
Granulators:	0.0037	lb/ton of sugar output
Coolers:	0.0089	lb/ton of sugar output

TABLE 3. 1995 NATIONAL EMISSION ESTIMATE (BY CITY AND COUNTY) FOR VOC FROM SUGARBEET PROCESSING

State	City	County	Raw juice produced, 1000 gal	Thin juice produced, 1000 gal	Pressed wet pulp, tons	VOC emissions, tons
Idaho	Mini-Cassia	Cassia	374,802	421,653	406,036	23
	Twin Falls	Twin Falls	232,377	261,425	251,742	14
	Nampa	Ada	442,267	497,550	479,122	27
Oregon	Nyssa	Malheur	337,322	379,487	365,432	21
California	Woodland	Yolo	134,929	151,795	146,173	8
	Tracy	San Joaquin	187,401	210,826	203,018	12
	Mendota	Madera	157,417	177,094	170,535	10
	Brawley	Imperial	307,338	345,755	332,949	19
Montana	Billings	Yellowstone	187,401	210,826	203,018	12
	Sidney	Richland	202,393	227,692	219,259	13
Wyoming	Lovell	Bighorn	112,441	126,496	121,811	7
	Worland	Washakie	134,929	151,795	146,173	8
	Torrington	Goshen	202,393	227,692	219,259	13
Colorado	Greeley	Weld	131,181	147,578	142,113	8
	Ft. Morgan	Morgan	187,401	210,826	203,018	12
Texas	Hereford	Deaf Smith	288,598	324,672	312,648	18
North Dakota	Drayton	Walsh	221,133	248,775	239,561	14
	Hillsboro	Trail	221,133	248,775	239,561	14
	Wahpeton	Richland	281,102	316,239	304,527	17
Minnesota	East Grand Forks	Polk	299,842	337,322	324,829	19
	Crookston	Polk	198,645	223,476	215,199	12
TOTAL FOR POLK COUNTY			498,487	560,798	540,028	31
	Moorhead	Clay	198,645	223,476	215,199	12
	Renville	Renville	374,802	421,653	406,036	23
Nebraska	Scottsbluff	Scotts Bluff	187,401	210,826	203,018	12
	Bayard	Morrill	112,441	126,496	121,811	7
Michigan	Bay City	Tuscola	299,842	337,322	324,829	19
	Caro	Tuscola	131,181	147,578	142,113	8
TOTAL FOR TUSCOLA COUNTY			431,023	484,900	466,941	27
	Carrollton	Saginaw	116,189	130,712	125,871	7
	Sebewaing	Huron	208,015	234,017	225,350	13
	Croswell	Sanilac	134,929	151,795	146,173	8
Ohio	Fremont	Sandusky**	142,425	160,228	154,294	9
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			6,748,315	7,591,855	7,310,675	418

**Factory operations are suspended

VOC emission factors:

Pulp dryers:	0.11	lb/ton of pressed wet pulp (AP-42 factor for oil-fired dryers)
First and second carbonation tanks:	0.00473	lb/1000 gallons of raw juice produced (sum of speciated organics in Table 9.10.1.2-4)
First evaporator:	7.11E-05	lb/1000 gallons of thin juice produced (sum of speciated organics in Table 9.10.1.2-4)

TABLE 4. 1995 NATIONAL EMISSION ESTIMATE (BY CITY AND COUNTY) FOR CH_4, NO_x, SO_2, CO, AND CO_2 FROM SUGARBEET PROCESSING

State	City	County	Pressed wet pulp, tons	Methane emissions, tons	NOx emissions, tons	SO2 emissions, tons	CO emissions, tons	CO2 emissions, tons
Idaho	Mini-Cassia	Cassia	406,036	6	128	160	203	64,695
	Twin Falls	Twin Falls	251,742	4	79	99	126	40,111
	Nampa	Ada	479,122	7	151	189	240	76,340
Oregon	Nyssa	Malheur	365,432	5	115	144	183	58,226
California	Woodland	Yolo	146,173	2	46	58	73	23,290
	Tracy	San Joaquin	203,018	3	64	80	102	32,348
	Mendota	Madera	170,535	2	54	67	85	27,172
	Brawley	Imperial	332,949	5	105	132	166	53,050
Montana	Billings	Yellowstone	203,018	3	64	80	102	32,348
	Sidney	Richland	219,259	3	69	87	110	34,935
Wyoming	Lovell	Bighorn	121,811	2	38	48	61	19,409
	Worland	Washakie	146,173	2	46	58	73	23,290
	Torrington	Goshen	219,259	3	69	87	110	34,935
Colorado	Greeley	Weld	142,113	2	45	56	71	22,643
	Ft. Morgan	Morgan	203,018	3	64	80	102	32,348
Texas	Hereford	Deaf Smith	312,648	4	98	123	156	49,815
North Dakota	Drayton	Walsh	239,561	3	75	95	120	38,170
	Hillsboro	Trail	239,561	3	75	95	120	38,170
	Wahpeton	Richland	304,527	4	96	120	152	48,521
Minnesota	East Grand Forks	Polk	324,829	5	102	128	162	51,756
	Crookston	Polk	215,199	3	68	85	108	34,288
TOTAL FOR POLK COUNTY			540,028	8	170	213	270	86,044
	Moorhead	Clay	215,199	3	68	85	108	34,288
	Renville	Renville	406,036	6	128	160	203	64,695
Nebraska	Scottsbluff	Scotts Bluff	203,018	3	64	80	102	32,348
	Bayard	Morrill	121,811	2	38	48	61	19,409
Michigan	Bay City	Tuscola	324,829	5	102	128	162	51,756
	Caro	Tuscola	142,113	2	45	56	71	22,643
TOTAL FOR TUSCOLA COUNTY			466,941	7	147	184	233	74,399
	Carrollton	Saginaw	125,871	2	40	50	63	20,055
	Sebewaing	Huron	225,350	3	71	89	113	35,906
	Croswell	Sanilac	146,173	2	46	58	73	23,290
Ohio	Fremont	Sandusky**	154,294	2	49	61	77	24,584
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			7,310,675	102	2,303	2,888	3,655	1,164,834

**Factory operations are suspended

Pulp dryer emission factors:

Methane:	0.028 lb/ton of pressed wet pulp (AP-42 factor for oil-fired dryers, no data for coal- or gas-fired)
NOx:	0.63 lb/ton of pressed wet pulp (avg. of AP-42 factors for coal- & oil-fired dryers, no data for gas-fired)
SO2:	0.79 lb/ton of pressed wet pulp (AP-42 factor for coal-fired dryers, no data for gas-fired, oil-fired not used)
CO:	1.0 lb/ton of pressed wet pulp (AP-42 factor for oil-fired dryers, no data for gas-fired, coal-fired not used)
CO2:	319 lb/ton of pressed wet pulp (avg. of AP-42 factors for coal-, gas, and oil-fired dryers)

TABLE 5. SUMMARY OF 1995 NATIONAL EMISSION ESTIMATES (BY CITY AND COUNTY) FOR SUGARBEET PROCESSING

State	City	County	PM emissions, tons Filterable	PM emissions, tons Condensible	VOC emissions, tons	Methane emissions, tons	NOx emissions, tons	SO2 emissions, tons	CO emissions, tons	CO2 emissions, tons
Idaho	Mini-Cassia	Cassia	153	74	23	6	128	160	203	64,695
	Twin Falls	Twin Falls	95	46	14	4	79	99	126	40,111
	Nampa	Ada	180	88	27	7	151	189	240	76,340
Oregon	Nyssa	Malheur	138	67	21	5	115	144	183	58,225
California	Woodland	Yolo	55	27	8	2	46	58	73	23,290
	Tracy	San Joaquin	76	37	12	3	64	80	102	32,348
	Mendota	Madera	64	31	10	2	54	67	85	27,172
	Brawley	Imperial	125	61	19	5	105	132	166	53,050
Montana	Billings	Yellowstone	76	37	12	3	64	80	102	32,348
	Sidney	Richland	83	40	13	3	69	87	110	34,935
Wyoming	Lovell	Bighorn	46	22	7	2	38	48	61	19,409
	Worland	Washakie	55	27	8	2	46	58	73	23,290
	Torrington	Goshen	83	40	13	3	69	87	110	34,935
Colorado	Greeley	Weld	53	26	8	2	45	56	71	22,643
	Ft. Morgan	Morgan	76	37	12	3	64	80	102	32,348
Texas	Hereford	Deaf Smith	118	57	18	4	98	123	156	49,815
North Dakota	Drayton	Walsh	90	44	14	3	75	95	120	38,170
	Hillsboro	Trail	90	44	14	3	75	95	120	38,170
	Wahpeton	Richland	115	56	17	4	96	120	152	48,521
Minnesota	East Grand Forks	Polk	122	60	19	5	102	128	162	51,756
	Crookston	Polk	81	39	12	3	68	85	108	34,288
TOTAL FOR POLK COUNTY			203	99	31	8	170	213	270	86,044
	Moorhead	Clay	81	39	12	3	68	85	108	34,288
	Renville	Renville	153	74	23	6	128	160	203	64,695
Nebraska	Scottsbluff	Scotts Bluff	76	37	12	3	64	80	102	32,348
	Bayard	Morrill	46	22	7	2	38	48	61	19,409
Michigan	Bay City	Tuscola	122	60	19	5	102	128	162	51,756
	Caro	Tuscola	53	26	8	2	45	56	71	22,643
TOTAL FOR TUSCOLA COUNTY			176	86	27	7	147	184	233	74,399
	Carrollton	Saginaw	47	23	7	2	40	50	63	20,055
	Sebewaing	Huron	85	41	13	3	71	89	113	35,906
	Croswell	Sanilac	55	27	8	2	46	58	73	23,290
Ohio	Fremont	Sandusky**	58	28	9	2	49	61	77	24,584
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			2,752	1,339	418	102	2,303	2,888	3,655	1,164,834

**Factory operations are suspended

CONTACT REPORT--MRI Project No. 4603-01-03

From: Tom Lapp, Environmental Engineering Department

Date of Contact: February 8, 1996

Contacted by: Telephone

Company/Agency: Idaho Department of Health and Welfare
Division of Environmental Quality
1410 North Hilton
Boise, ID 83706-1255

Telephone Number: (208) 373-0502

Person(s) Contacted/Title(s)

Camile Ajaka

CONTACT SUMMARY:

Mr. Ajaka was contacted to determine if Amalgamated Sugar Company facility in Nampa, ID was still using formaldehyde solutions as a biocide in mixers, towers, and press water. A test report from the facility for the 1992 campaign stated that formaldehyde solutions were one of the biocides used. A telephone conversation with Western Sugar Company indicated that they did not think anyone was still using formaldehyde solutions. Mr. Ajaka stated that Amalgamated used formaldehyde in the 1992 campaign but subsequently changed to sodium bisulfite, which they are still using. The sodium bisulfite is causing equipment problems due to corrosion and Amalgamated has indicated to Mr. Ajaka that they may change back to formaldehyde but have not done so as yet.

As of February 1, 1996, no facility is currently using formaldehyde solutions as a biocide. However, this may change in the future.

Rec'd 2/12/96 TL

Memo

To: *Tom Lapp, MRI*
From: *Patricia R. Fuller-Pratt, Western Sugar*
Date: *February 6, 1996*
Re: *Emissions Information*

I was able to find some of the information that you wanted. The emissions report did not include a process description, and did not have any process data. Our particulate limit with the state is in lbs/hr regardless of the process feed rate so the State did not need the process data. I did have Scottsbluff personnel look up the process information. Average process feed to the drier was 33.99 tons of pulp per hour (816 tons per day) during the 1994-1995 campaign. Specific process feed rates were 873.3 tons on Dec. 13 and 429.4 tons on Dec. 14. We do not keep the records of the per hour rates after campaign has concluded. The amount was less than normal on the 14th because of beet slicing problems on the midnight shift. The drier was operating in a normal manner during the testing according to Scottsbluff personnel . Therefore, the 873.3 tons per day is probably the most representative; use 36.4 tons per hour feed rate.

Scottsbluff has one large rotary drum drier. Wet pulp is conveyed to the drier. A fan pulls hot air directly from the natural gas burner into the drier. Dry pulp is conveyed out of the drier. A fan pulls the exhaust air to two separate scrubbers. Each scrubber exhausts from a stack. The testing was performed at sampling ports in the stacks.

Table 4.1.21 is attached, as are the two tables that report field and laboratory data (4.1.12 and 4.1.13). The NO_x and SO_2 testing was performed only on the south scrubber stack. The particulate testing was performed on both stacks.

I also enclosed the granulator testing from October 1995. The testing was performed by Clean Air Engineering, and the report is more complete (I think it has all of the data that you need). Scottsbluff has two cooling granulators and two drying granulators. The upper granulator is the cooler and the lower is the drier. Sugar from the process is split into two streams. One stream goes to the South upper granulator to be cooled and then into the South lower granulator to be dried. The other stream goes to the North granulators. Each granulator has a scrubber and stack (4 total).

1995

Granulators
Emission Testing

RESULTS

Table 2-1:
Lower South Granulator Stack - Particulate

Run No. [1]		1	3	4	Average
Date (1995)		October 23	October 24	October 24	
Start Time (approx.)		14:35	10:31	12:56	
Stop Time (approx.)		16:00	11:07	14:12	
Process Conditions					
	Sugar throughput (cwt)	630.4	817.4	648.1	
Gas Conditions					
T_s	Temperature (°F)	101	99	102	**101**
B_{wo}	Moisture (volume %)	7.38	6.02	6.38	**6.59**
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	3,614	3,640	3,610	**3,621**
Q_{std}	Standard conditions (dscfm)	2,752	2,820	2,772	**2,781**
Front Half Particulate					
C	Concentration (gr/dscf)	0.0114	8.10E-03	0.0170	**0.0122**
E	Emission rate (lb/hr)	0.268	0.196	0.404	**0.289**
Back Half Organic Particulate					
C	Concentration (gr/dscf)	9.40E-04	6.89E-04	7.87E-04	**8.05E-04**
E	Emission rate (lb/hr)	0.0222	0.0167	0.0187	**0.0192**
Back Half Inorganic Particulate					
C	Concentration (gr/dscf)	2.20E-04	2.26E-04	2.45E-04	**2.30E-04**
E	Emission rate (lb/hr)	5.19E-03	5.46E-03	5.82E-03	**5.49E-03**
Total Particulate					
C	Concentration (gr/dscf)	0.0125	9.02E-03	0.0180	**0.0132**
E	Emission rate (lb/hr)	0.296	0.218	0.428	**0.314**

[1] Run 2 is not reported because the process was not running during the test.

RESULTS

Table 2-2:
Upper South Granulator Stack - Particulate

Run No. [1]		3	4	5	Average
Date (1995)		October 24	October 24	October 24	
Start Time (approx.)		10:30	12:50	14:51	
Stop Time (approx.)		11:49	14:06	16:09	
Process Conditions					
	Sugar throughput (cwt)	817.4	648.1	1040.1	
Gas Conditions					
T_s	Temperature (°F)	107	107	119	**111**
B_{wo}	Moisture (volume %)	8.03	8.02	12.77	**9.61**
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	4,006	4,018	3,915	**3,980**
Q_{std}	Standard conditions (dscfm)	2,995	3,007	2,723	**2,908**
Front Half Particulate					
C	Concentration (gr/dscf)	2.19E-03	1.31E-03	4.23E-03	**2.58E-03**
E	Emission rate (lb/hr)	0.0563	0.0339	0.0988	**0.0630**
Back Half Organic Particulate					
C	Concentration (gr/dscf)	4.24E-04	4.97E-04	1.06E-04	**3.43E-04**
E	Emission rate (lb/hr)	0.0109	0.0128	2.48E-03	**8.73E-03**
Back Half Inorganic Particulate					
C	Concentration (gr/dscf)	2.75E-04	4.82E-05	0.00	**1.08E-04**
E	Emission rate (lb/hr)	7.06E-03	1.24E-03	0.00	**2.77E-03**
Total Particulate					
C	Concentration (gr/dscf)	2.89E-03	1.86E-03	4.34E-03	**3.03E-03**
E	Emission rate (lb/hr)	0.0743	0.0479	0.1013	0.0745

[1] Run 1 is not reported because it did not meet EPA requirements for isokineticity.
Run 2 is not reported because the process was not running during the test.

RESULTS

Table 2-3: Upper North Granulator Stack - Particulate

Run No.		1	2	3	Average
Date (1995)		October 24	October 25	October 25	
Start Time (approx.)		17:42	08:05	10:26	
Stop Time (approx.)		19:08	09:29	11:50	
Process Conditions					
	Sugar throughput (cwt)	601.3	563.5	702.3	
Gas Conditions					
T_s	Temperature (°F)	109	113	119	**114**
B_{wo}	Moisture (volume %)	8.99	10.21	12.81	**10.67**
O_2	Oxygen (dry volume %)	20.9	20.9	20.9	**20.9**
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	**0.0**
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	4,289	4,181	4,181	**4,217**
Q_{std}	Standard conditions (dscfm)	3,160	3,023	2,903	**3,029**
Front Half Particulate					
C	Concentration (gr/dscf)	1.98E-03	1.73E-03	2.49E-03	**2.06E-03**
E	Emission rate (lb/hr)	0.0535	0.0448	0.0619	**0.0534**
Back Half Organic Particulate					
C	Concentration (gr/dscf)	6.43E-04	3.49E-04	1.99E-04	**3.97E-04**
E	Emission rate (lb/hr)	0.0174	9.03E-03	4.96E-03	**0.0105**
Back Half Inorganic Particulate					
C	Concentration (gr/dscf)	2.58E-04	1.10E-03	0.00	**4.52E-04**
E	Emission rate (lb/hr)	7.00E-03	0.0285	0.00	**0.0118**
Total Particulate					
C	Concentration (gr/dscf)	2.88E-03	3.18E-03	2.69E-03	**2.91E-03**
E	Emission rate (lb/hr)	0.0779	0.0823	0.0669	**0.0757**

RESULTS

Table 2-4:
Lower North Granulator Stack - Particulate

Run No.		1	2	3	Average
Date (1995)		October 24	October 25	October 25	
Start Time (approx.)		17:43	08:07	10:29	
Stop Time (approx.)		18:19	08:43	11:05	
Process Conditions					
	Sugar throughput (cwt)	601.3	563.5	702.3	622
Gas Conditions					
T_s	Temperature (°F)	104	103	99	102
B_{ws}	Moisture (volume %)	8.32	8.08	6.36	7.59
O_2	Oxygen (dry volume %)	21.0	21.0	21.0	21.0
CO_2	Carbon dioxide (dry volume %)	0.0	0.0	0.0	0.0
Volumetric Flow Rate					
Q_a	Actual conditions (acfm)	3,058	2,902	2,733	2,898
Q_{std}	Standard conditions (dscfm)	2,290	2,183	2,353	2,275
Front Half Particulate					
C	Concentration (gr/dscf)	4.40E-02	1.99E-02	1.56E-02	2.65E-02
E	Emission rate (lb/hr)	0.864	0.372	0.315	0.517
Back Half Organic Particulate					
C	Concentration (gr/dscf)	7.46E-04	6.40E-04	4.13E-04	5.99E-04
E	Emission rate (lb/hr)	0.0146	0.0120	8.32E-03	0.0116
Back Half Inorganic Particulate					
C	Concentration (gr/dscf)	6.92E-04	4.21E-04	3.77E-04	4.97E-04
E	Emission rate (lb/hr)	0.0136	7.88E-03	7.61E-03	9.69E-03
Total Particulate					
C	Concentration (gr/dscf)	0.0455	0.0209	0.0164	0.0276
E	Emission rate (lb/hr)	0.893	0.391	0.331	0.538

DESCRIPTION OF INSTALLATION

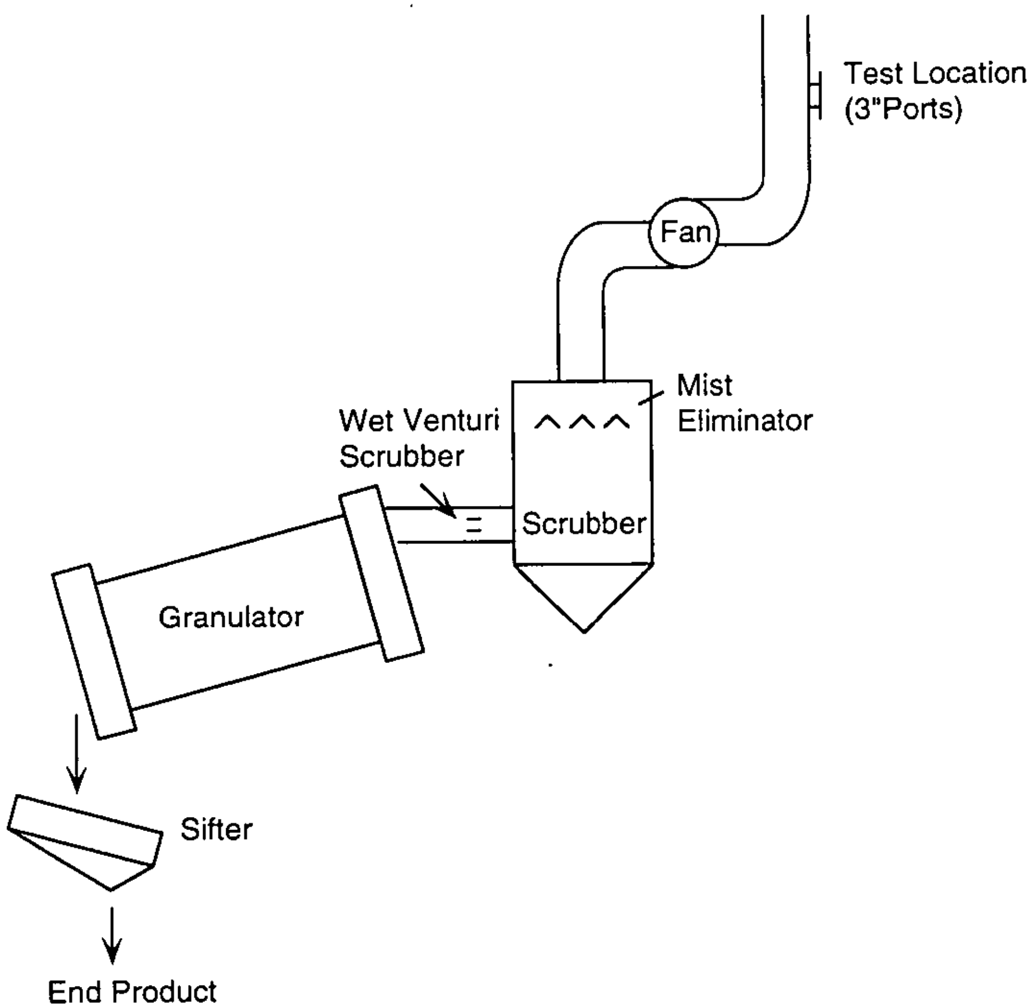


Figure 3-1: Granulator Process Schematic

METHODOLOGY

SAMPLING POINT DETERMINATION

Sampling point locations were determined according to EPA Method 1.

Table 4-2 outlines the sampling point configurations. Figure 4-1 and Figure 4-2 illustrate the sampling points and orientation of sampling ports for each of the sources tested in the program.

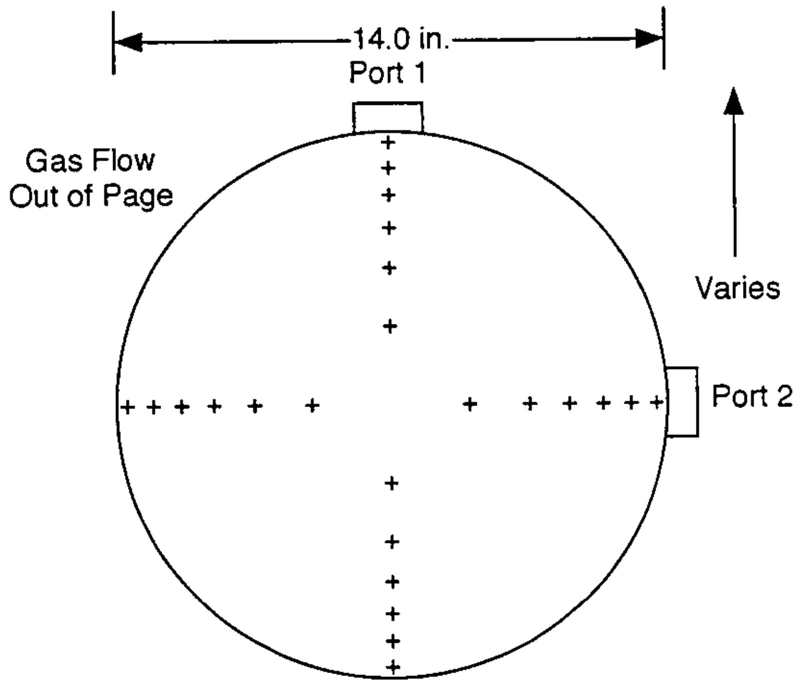
Table 4-2:
Sampling Points

Location	Constituent	Method	Ports	Points per Port	Minutes per Point	Total Minutes	Figure
Granulator Stacks	Particulate	5/202	2	12	3	72	4-1
Boiler Stack	Particulate	5/202	2	6	5	60	4-2
	CO, SO2, NO_x[1]	6C, 7E, 10	1	1	60	60	N/A

[1] Carbon Monoxide, Sulfur Dioxide, and Nitrogen Oxides was sampled from the approximate center of the duct. Sampling was simultaneous with the particulate testing.

METHODOLOGY

SAMPLING POINT DETERMINATION (CONTINUED)



Sampling Point	Port to Point Distance (in.)
1	0.5
2	0.9
3	1.7
4	2.5
5	3.5
6	5.0
7	9.0
8	10.5
9	11.5
10	12.3
11	13.1
12	13.5

Diameters to upstream disturbance: 4.5 Limit: 2.0
Diameters to downstream disturbance: >8.0 Limit: 0.5

Each of the 4 granulator stacks had the same diameter, the same upstream and downstrearm disturbance measuremetns, and the same port-to-point distances.
Port orientations varied from stack to stack (Ports rotated 90°).

Figure 4-1: Granulator Stacks Sampling Points (EPA Method 1)

Rec'd 5/17/95
TL

MICHIGAN SUGAR COMPANY

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300 Plaza North
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Telephone (517) 799-7300
FAX (517) 799-1836 Operations

JOSEPH FLYNN
Process Engineer

May 10, 1995

Mr. Dallas W. Safriet, Environmental Engineer
U.S. EPA
Emission Factor and Inventory Group (MD-14)
Research Triangle Park, North Carolina 27711

Mr. Safriet:

I am responding to the draft version of Section 9.10.1.2, Sugar Beets Processing, AP-42. I have marked the text errors with post-its and written in the corrections, these errors I find minor as compared to the actual AP-42 factors.

Draft Table 9.10.1.2-2 (English Units), Proposed SCC 3-02-016-XX Natural gas-fired pulp dryer with multiclone, the reference to Michigan Sugar Company's data neglects to mention the fact that fuel gas recirculation is used. The operation of Michigan Sugar Company Caro (Reference 23) control system involves the aspiration of the multiclone and reintroduction of these gasses into the combustion chamber. It is very important to note that the recirculation rate and method of recirculation greatly effect the amount of emissions especially the Particulate Matter.

Proposed SCC3-02-016-XX Fuel oil-fired pulp dryer with multiclone, the reference to Michigan Sugar Company's data and Great Lakes Sugar Company neglects to mention the fact that fuel gas aspiration is used in both of these systems. The aspiration systems are different, in the Michigan Sugar Company Carrollton system (Reference 24), the gasses are processed through a bag house then discharged to a stack, where the Great Lakes Sugar Company system (Reference 15), the aspirated gasses are reintroduce into the combustion chamber. It is very important to note that the recirculation rate and method of recirculation greatly effect the amount of emissions especially the Particulate Matter.

Draft Table 9.10.1.2-3 (Metric And English Units). Emission Factors for TOC, Methane, And Inorganic Pollutant Emissions From Sugarbeet Processing Operations, Fuel oil-fired pulp dryer has a CO factor, CO was detected at only one of our four facilities, and the amount of CO present is based on the type of fuel and firing equipment associated with the pulp dryer.

the only reference to a Michigan Sugar Co. test on fuel oil fired pulp dryers is for CO_2 emissions and only one of their tests was referenced (ref. 24)

Sincerely,

Joseph E. Flynn

Joseph E. Flynn

c: Mark Suhr
Thomas Schwartz

michigan Sugar Co.
text comments.

Emission Factor Documentation for AP-42
Section 9.10.1.2

SUGARBEET PROCESSING

Draft Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group

EPA Contract 68-D2-0159
Work Assignment No. II-03

MRI Project No. 4602-03

March 1995

Emission Factor Documentation for AP-42
Section 9.10.1.2

SUGARBEET PROCESSING

Draft Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group
Research Triangle Park, NC 27711

Attn: Mr. Dallas Safriet (MD-14)
Emission Factor and Inventory Group

EPA Contract 68-D2-0159
Work Assignment No. II-03

MRI Project No. 4602-03

March 1995

NOTICE

This document is a preliminary draft. It has not been formally released by the U. S. Environmental Protection Agency and should not at this stage be construed to represent Agency policy. It is being circulated for comments on its technical merit and policy implications.

2. INDUSTRY DESCRIPTION[1,2]

Sugarbeet processing is the production of sugar (sucrose) from sugarbeets. Byproducts of sugarbeet processing include pulp and molasses. Most of the molasses produced is processed further to remove the remaining sucrose. The pulp and most of the remaining molasses are mixed together, dried, and sold as livestock feed. The four-digit standard industrial classification (SIC) code for sugarbeet processing is 2063. The six-digit source classification code (SCC) for sugarbeet processing is 3-02-016; there are two eight-digit SCC's: 3-02-016-01 (dryers) and 3-02-016-99 (other not classified).

2.1 INDUSTRY CHARACTERIZATION[3]

In 1991, approximately 3,925,000 short tons of beet sugar were produced at 36 plants located in 14 States. Table 2-1 shows the number of sugarbeet processing plants by State. No new sugarbeet processing facilities have been built since the mid-1970's. In comparison to 1974, 20 fewer facilities are currently operating. However, the 36 facilities currently operating have been modified to produce more sugar more efficiently than the 56 facilities operating in 1974.

TABLE 2-1. SUGARBEET PROCESSING PLANTS BY STATE, 1991

State	Number of plants
California	8
Colorado	2
Idaho	3
Michigan	5
Minnesota	4
Montana	2
Nebraska	3
New Mexico[a]	
North Dakota	3
Ohio	1
Oregon	1
Texas	1
Wyoming	3
Washington[a]	

[a]State-produced small quantities of sugarbeets, but not sugarbeet processing plants are located in the State.

2.2 PROCESS DESCRIPTION[1,2,4,5]

Figures 2-1 and 2-2 are flow diagrams for a typical sugarbeet processing plant. Figure 2-1 shows the preprocessing operations and the livestock feed production operations, and Figure 2-2 shows the beet sugar production operations. Mechanically harvested sugarbeets are shipped to processing plants, where they are typically received by high-speed conveying and screening systems. The screening systems remove loose dirt from the beets and pinch the beet tops and leaves to facilitate separation from the beet roots. The conveyors transport the beets to storage areas and then to the final cleaning and trash removal operations that precede the processing operations. The beets are usually conveyed to the final cleaning phase using flumes, which use water to both move and clean the beets. Although most plants use flumes, some plants use dry conveyors in the final cleaning stage. The disadvantage of flume conveying is that some sugar leaches into the flume water from damaged surfaces of the beets. The flumes carry the beets to the beet feeder, which regulates the flow of beets through the system and prevents stoppages in the system. From the feeder, the flumes carry the beets through several cleaning devices which ... rs, sand separators,

r ... ing, the beets are

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2.2,
diffuser: horizontal: rotary
Towers

... on, juice purification,

e ... lasses. Descriptions

of

... d washed beets are

sli ... tinuous diffuser, in

wh ... the cossettes. The diffuser is usually slanted upwards and conveys the cossettes up the slope as water is introduced at the top of the diffuser and flows countercurrent to the cossettes. The water temperature in the diffuser is typically maintained between 50° and 80°C (122° and 176°F). This temperature is dependant on several factors, including the denaturization temperature of the cossettes, the thermal behavior of the beet cell wall, potential enzymatic reactions, bacterial activity, and pressability of the beet pulp. Formalin, a 40 percent solution of formaldehyde, is sometimes added to the diffuser water as a disinfectant. Sulfur dioxide and chlorine are also sometimes used as disinfectants. The sugar-enriched water that flows from the

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Nebraska	3
New Mexico[a]	
North Dakota	3
Ohio	1
Oregon	1
Texas	1
Wyoming	3
Washington[a]	

[a]State-produced small quantities of sugarbeets, but not sugarbeet processing plants are located in the State.

2.2 PROCESS DESCRIPTION[1,2,4,5]

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Sugarbeet processing operations comprise several steps, including diffusion, juice purification, evaporation, crystallization, dried-pulp manufacture, and sugar recovery from molasses. Descriptions of these operations are presented in the following paragraphs.

Prior to removal of the sucrose from the beet by diffusion, the cleaned and washed beets are sliced into long, thin strips, called cossettes. The cossettes are conveyed to a continuous diffuser, in which hot water is used to extract sucrose from the cossettes. The diffuser is usually slanted upwards and conveys the cossettes up the slope as water is introduced at the top of the diffuser and flows countercurrent to the cossettes. The water temperature in the diffuser is typically maintained between 50° and 80°C (122° and 176°F). This temperature is dependant on several factors, including the denaturization temperature of the cossettes, the thermal behavior of the beet cell wall, potential enzymatic reactions, bacterial activity, and pressability of the beet pulp. Formalin, a 40 percent solution of formaldehyde, is sometimes added to the diffuser water as a disinfectant. Sulfur dioxide and chlorine are also sometimes used as disinfectants. The sugar-enriched water that flows from the outlet of the diffuser is called raw juice and contains between 10 and 15 percent sugar. This raw juice proceeds to the juice purification operations. The processed cossettes, or pulp, leaving the diffuser are conveyed to the dried-pulp manufacture operations.

This is wrong. From screens to pre-limer, heated, main limer, then 1st carb.

In the juice purification stage, non-sucrose impurities in the raw juice are removed so that the pure sucrose can be crystallized. First, the juice passes through screens to remove any small cossette particles. Then the mixture is heated to 80° to 85°C (176° to 185°F) and proceeds to the first carbonation tank. In the first carbonation tank, milk of lime [$CA(OH)_2$] is added to the mixture to adsorb or adhere to the impurities in the mixture, and carbon dioxide (CO_2) gas is bubbled through the mixture to precipitate the lime as insoluble calcium carbonate crystals. Lime kilns are used to produce the CO_2 and lime used in carbonation; the lime is converted to milk of lime in a lime slaker. The small, insoluble crystals (produced during carbonation) settle out in a clarifier, after which the juice is again treated with CO_2 (in the second carbonation tank) to remove the remaining lime and impurities. The pH of the juice is lower during this second carbonation, causing large, easily filterable, calcium carbonate crystals to form. After filtration, a small amount of sulfur dioxide (SO_2) is added to the juice to inhibit reactions that lead to darkening of the juice. The SO_2 is produced by burning elemental sulfur in a sulfur stove or is purchased in liquid form. Following the addition of SO_2, the juice (known as thin juice) proceeds to the evaporators.

The evaporation process, which increases the sucrose concentration in the juice by removing water, is typically performed in a series of five evaporators. Steam from large boilers is used to heat the first evaporator, and the steam from the water evaporated in the first evaporator is used to heat the second evaporator. This transfer of heat continues through the five evaporators, and as the temperature decreases (due to heat loss) from evaporator to evaporator, the pressure inside each evaporator is also decreased, allowing the juice to boil at the lower temperatures provided in each subsequent evaporator. Some steam is released from the first three evaporators, and this steam is used as a heat source for various process heaters throughout the plant. After evaporation, the percentage of sucrose in the "thick juice" is 50-65 percent. Crystalline sugars, produced later in the process, are added to the juice and dissolved in the high melter. This mixture is then filtered, yielding a clear liquid known as standard liquor, which proceeds to the crystallization operation.

Sugar is crystallized by low-temperature pan boiling. The standard liquor is boiled in vacuum pans until it becomes supersaturated. To begin crystal formation, the liquor is either "shocked" using a small quantity of powdered sugar or is "seeded" by adding a mixture of finely milled sugar and isopropyl alcohol. The seed crystals are carefully grown through control of the vacuum, temperature, feed-liquor additions, and steam. When the crystals reach the desired size, the mixture of liquor and crystals, known as massecuite or fillmass, is discharged to the mixer. From the mixer, the massecuite is poured into high-speed centrifugals, in which the liquid is centrifuged into the outer shell, and the crystals are left in the inner centrifugal basket. The sugar crystals are then washed with pure hot water and are sent to the granulator, which is a rotary drum dryer, and then to the cooler. Some facilities refer to the granulator as the sugar dryer. The wash water, which contains a small quantity of sucrose, is pumped to the vacuum pans for processing. After cooling, the sugar is screened and then either packaged or stored in large bins for future packaging.

The Steffan Process is no longer in use.

The liquid that was separated from the sugar crystals in the centrifugals is called syrup. This syrup serves as feed liquor for the "second boiling" and is introduced back into the vacuum pans along with standard liquor and recycled wash water. The process is repeated once again, resulting in the production of molasses, ~~which can be further desugarized using the Steffan process~~. Molasses that is not desugarized can be used in the production of livestock feed (there are many more uses for molasses than this.

The Steffan process is used to recover some of the sugar remaining in molasses. The process involves the addition of lime to produce saccharate (sugar and lime compounds) precipitates, which are broken up by the addition of carbon dioxide gas, thus freeing the sugar and creating a calcium carbonate precipitate. The product of the Steffan process is called saccharate milk and is used as feed for the juice purification operations. Byproducts of the Steffan process include concentrated Steffan filtrate (CSF), which can be added to beet pulp prior to drying or can be used to produce monosodium glutamate. A relatively new process called deep molasses desugarization is used by some plants to remove additional sugar from molasses.

Wet pulp from the diffusion process is another product of sugarbeet processing. The pulp is first pressed, typically in ~~vertical~~ horizontal ~~single~~ double-screw presses, to reduce the moisture content from about 95 percent to about ~~80~~ 75 percent. The water removed by the presses is collected and used as diffusion water. After pressing, CSF or molasses is added to the pulp, which is then dried by hot air in a horizontal rotating drum known as a pulp dryer. The pulp dryer, which can be fired by oil, natural gas, or coal, typically provides entrance temperatures between 482° and 927°C (900° and 1700°F). As the pulp is dried, the gas temperature decreases and the pulp temperature increases. The exit runs (Runs 2 and 4) were conducted on the east stack, and the emission rates measured during Run 3 on the west stack were doubled to represent both stacks. Pertinent test data, process data, and emission factor calculations are provided in Appendix M.

4.2.14 Reference 14

This report documents a compliance test conducted at Holly Sugar Corporation in Santa Maria, California, on June 4-14, 1991. Three fuel oil-fired pulp dryers, each followed by two cyclones (and an air recirculation system), were tested for filterable PM, condensible inorganic PM, condensible organic PM, CO_2, SO_2, carbon monoxide (CO), nitrogen oxide (NO_x), total organic compounds (TOC), and methane emissions. One of two stacks on each dryer was tested, and emissions from each stack were multiplied by two to estimate the total emissions from each dryer. Also, a beet pulp cooler was tested for PM emissions, but all three test runs are invalid because the isokinetic ratios were all far below 90 percent. Particulate matter emissions were quantified using EPA Method 5 (including front- and back-half analyses). Continuous monitoring of CO_2, SO_2, CO, and NO_x emissions was conducted according to CARB Method 100, which appears to be similar to EPA-approved continuous monitoring methods for the same pollutants. Sulfur dioxide emissions were not detected during any test run. Total organic compound and methane emissions were quantified by drawing gas samples into tedlar bags and analyzing the samples with a flame ionization detector gas chromatograph (similar to EPA Methods 18 and 25A). The report presents concentrations of C1 through C6 hydrocarbons, and TOC concentrations were calculated on an "as carbon" basis by multiplying the individual C1 through C6 concentrations by the corresponding number of carbons (C1 concentration multiplied by 1, C2 concentration multiplied by 2, etc.) and summing the adjusted concentrations. The reported C1 concentrations were assumed to be entirely methane, and were used to determine methane emissions. Production rates are provided for each dryer, but data needed to convert the production rates to dryer feed rates are only provided for dryer No. 1. Because the reported production rates are the same for the three dryers, the average feed rate calculated for dryer No. 1 is assumed to equal the feed rate for dryers 2 and 3.

The data for dryer No. 1 are assigned a B rating because only one of two stacks from the dryer was tested. Otherwise, the test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. The data for dryers 2 and 3 are assigned a C rating because the dryer feed rates are estimated using the average feed rate for dryer No. 1 and only one of two stacks from each dryer was tested. Pertinent test data, process data, and emission factor calculations are provided in Appendix N.

4.2.15 Reference 15

Not Cooperative, Michigan Sugar Co.
owned by Company

This report documents a compliance test conducted at the Great Lakes Sugar Cooperative in Fremont, Ohio, on December 2, 1992. A fuel oil-fired pulp dryer, followed by a cyclone, was tested for filterable PM, CO_2, and SO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with a Fyrite gas analyzer), respectively. Sulfur dioxide emissions were measured using a modified EPA Method 8 test, which was a Method 8 analysis of the impingers from the Method 5 sampling train. Three test runs were conducted, but the first run was not valid because the isokinetic variation was not within the prescribed limits. Process data, including run-by-run wet beet pulp feed rates to the dryer, are included in the report.

The filterable PM and SO_2 data from this report are assigned a B rating because only two valid test runs were conducted. The test methodology appears to be sound, extensive process data are provided, and adequate detail is included in the report. The CO_2 data from this report are assigned a C rating because of the relative inaccuracy of Fyrite analyzers. Pertinent test data, process data, and emission factor calculations are provided in Appendix O.

4.2.16 Reference 16

This report documents a compliance test conducted at the American Crystal Sugar Company in East Grand Forks, Minnesota, on February 24, 1994. Three coal-fired pulp dryers (dryers A, B, and C), each controlled by multiclones, were tested for filterable PM, condensible organic PM, CO_2, and NO_x emissions. In addition, a cascade impactor was used to determine the particle size distribution during a single test run for pulp dryer B. Particulate matter, CO_2, and NO_x emissions were quantified using EPA Methods 5 (including front- and back-half analyses), 3 (with an Orsat gas analyzer), and 7, respectively. Three test runs were conducted for each pollutant and dryer, but only one valid NO_x test run was conducted on dryers B and C. The NO_x data for dryers B and C are not used for emission factor development. Process data, including hourly wet beet pulp feed rates to the dryer, are included in the report.

analyses) and 3 (with an Orsat gas analyzer), respectively. Because very small amounts (0.03 percent volume) of CO_2 were detected during all test runs, CO_2 emissions are assumed to be negligible. Three test runs were conducted, and process data, including run-by-run sugar cooler throughput rates (equivalent to sugar granulator output rates), are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix T.

4.2.21 Reference 22

This report documents a compliance test conducted at the American Crystal Sugar Company in Crookston, Minnesota, on February 22, 1993. The No.1 and No.2 pulp dryers, each controlled by multiclones and a stack filter system, were tested for filterable PM, condensible organic PM, and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 (including front- and back-half analyses) and 3 (with an Orsat gas analyzer), respectively. Five valid test runs were conducted on dryer No. 1, and nine valid runs were conducted on dryer No. 2. Process data, including run-by-run wet pulp feed rates to the dryers, are included in the report.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix U.

4.2.22 Reference 23

This report documents a compliance test conducted at the Michigan Sugar Company in Caro, Michigan, on December 14, 1989. A natural gas-fired pulp dryer, followed by multiclones, was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 17 and 3 (with an Orsat gas analyzer), respectively. Five test runs were conducted, but Runs 1 and 3 were not valid and were not used to determine the emissions from the dryer. Process data are included in the report, and run-by-run dryer feed rates were calculated using the process data.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix V.

4.2.23 Reference 24 If this aspiration is to A bag house. And the Aspiration Rate is related to the P.M. concentration

This report documents a compliance test conducted at the Michigan Sugar Company in Carrollton, Michigan, on November 14 and 16, 1989. A natural gas-fired pulp dryer, followed by multiclones, was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 17 and 3 (with an Orsat gas analyzer), respectively. Three test runs were conducted while the dryer operated at two different aspiration rates, but one run from each test was not valid because the isokinetic variation was not within the prescribed limits. The aspiration rate did not appear to affect PM or CO_2 emissions; therefore, data from the four valid test runs are averaged. Process data are included in the report, and run-by-run dryer feed rates were calculated using the process data.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix W.

4.2.24 Reference 25

This report documents a compliance test conducted at the Michigan Sugar Company in Croswell, Michigan, on November 19, 1990. A fuel oil-fired pulp dryer, followed by multiclones, was tested for filterable PM and CO_2 emissions. Particulate matter and CO_2 emissions were quantified using EPA Methods 5 and 3 (with an Orsat gas analyzer), respectively. Three test runs were conducted, process data are included in the report, and run-by-run dryer feed rates were calculated using the process data.

The data from this report are assigned an A rating. The test methodology appears to be sound, sufficient process data are provided, and adequate detail is included in the report. Pertinent test data, process data, and emission factor calculations are provided in Appendix X.

Draft Table 9.10.1.2-1 (cont.).

[a]Emission factor units are kg/Mg of pressed pulp feed to the dryer, unless noted. Factors represent uncontrolled emissions unless noted. SCC = Source Classification Code. ND = no data.
[b]Reference 17.
[c]References 7,16-17,19,21.
[d]References 16-17,19,21.
[e]References 3,13.
[f]Reference 13.
[g]Reference 3.
[h]References 22-23.
[j]References 8-12.
[k]References 11-12.
[m]References 4-6.
[n]References 4-6,14. Includes condensible organic PM data from dryers controlled by cyclones and dryers controlled by a dry scrubber and cyclone combination.
[p]Reference 14.
[q]References 15,24.
[r]Reference 20. Emission factor units are kg/Mg of sugar throughput.
[s]Reference 18. Emission factor units are kg/Mg of sugar throughput.

Draft Table 9.10.1.2-2 (English Units).
PARTICULATE MATTER EMISSION FACTORS FOR SUGARBEET PROCESSING OPERATIONS[a]

Source	Filterable PM				Condensible PM					
	PM	EMISSION FACTOR RATING	PM-10	EMISSION FACTOR RATING	Inorganic	EMISSION FACTOR RATING	Organic	EMISSION FACTOR RATING	Total	EMISSION FACTOR RATING
Coal-fired pulp dryer[b] (SCC 3-02-016-XX)	4.4	D	ND		ND		ND		ND	
Coal-fired pulp dryer with multiclone (SCC 3-02-016-XX)	0.66	B	ND		ND		0.084[d]	C	ND	
Coal-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	0.49	D	ND		0.050[f]	D	0.35[e]	D	0.40[g]	D
Natural gas-fired pulp dryer with multiclone[h] Gas/Coal (SCC 3-02-016-XX)	0.69	D	ND		ND		ND		ND	
Natural gas-fired pulp dryer with wet scrubber (SCC 3-02-016-XX)	0.16	D	ND		0.021[k]	D	ND		ND	
Fuel oil-fired pulp dryer with cyclone (SCC 3-02-016-XX)	1.4	C	ND		0.24[n]	C	0.076[m]	C	0.32[n]	C
Fuel oil-fired pulp dryer with dry scrubber and cyclone (SCC 3-02-016-XX)	1.1	D	0.83[p]	D	0.24[n]	C	ND		ND	
Fuel oil-fired pulp dryer with multiclone[q] (SCC 3-02-016-XX)	0.60	D	ND		ND		ND		ND	
Sugar cooler with mechanical centrifugal separator with water sprays[r] (SCC 3-02-016-XX)	0.13	D	ND		ND		0.0043	D	ND	
Sugar cooler with venturi scrubber[s] SCC 3-02-016-XX)	0.065	D	ND		0.0047	D	0.0042	D	0.0089	D
Sugar granulator with mechanical centrifugal separator with water sprays[r] (SCC 3-02-016-XX)	0.064	D	ND		ND		0.0037	D	ND	
Sugar conveying and sacking (SCC 3-02-016-XX)	ND		ND		ND		ND		ND	
Sulfur stove (SCC 3-02-016-XX)	ND		ND		ND		ND		ND	

AMERICAN CRYSTAL SUGAR COMPANY

FACSIMILE COVER LETTER

ENGINEERING/ENVIRONMENTAL DEPARTMENT

DATE: 3-14-95

TO: Brian Shrager

FIRM NAME: MRI

FAX NO:

FROM: Joel Smith

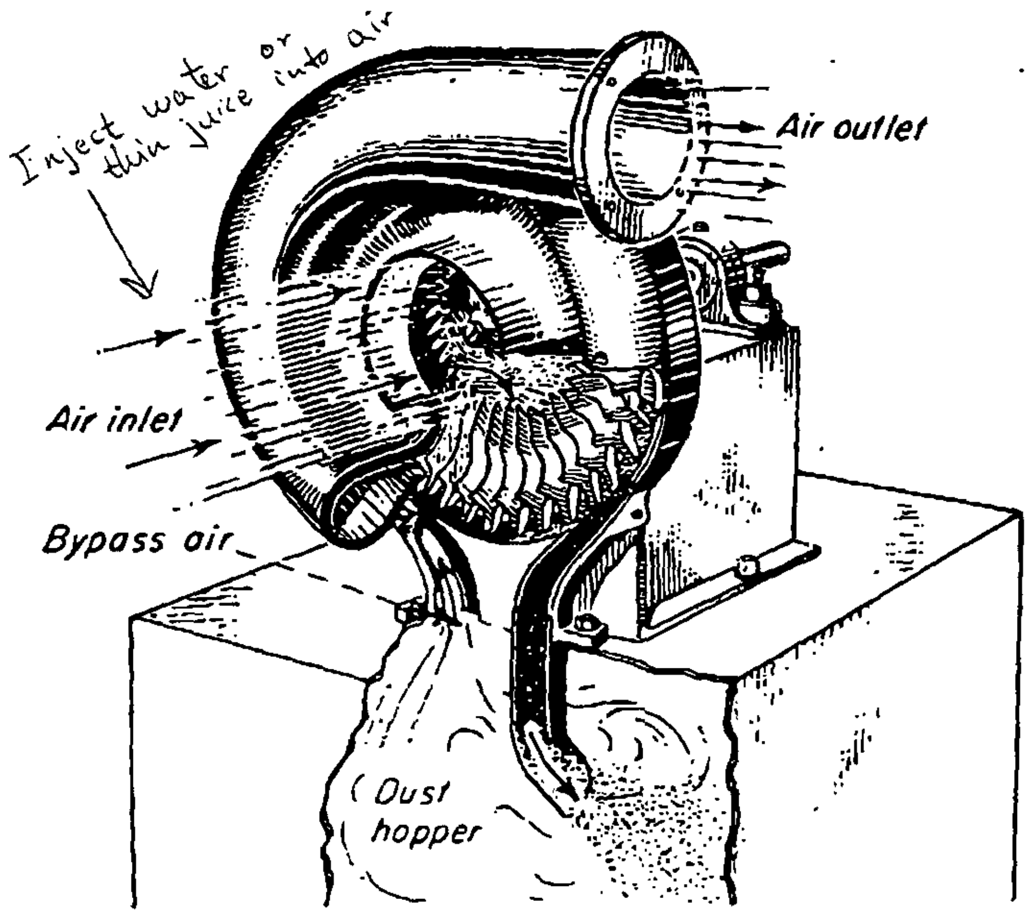
OUR FAX NO: (218) 236-4388

NUMBER OF PAGES (Including cover letter): 3

COMMENTS:

Description of Roto Clone made by American Air Filter Co. - mainly used to recapture product harged from an external power source to enhance collection. Depo-ition produced by Stefan flow can be significant when water vapor s condensing in a scrubber.

Despite numerous claims or speculations that wetting of dust par-icles by the scrubbing liquid plays a major role in the collection pro-ess, there is no unequivocal evidence that this is the case. The issue s whether wetting is an important factor in the adherence of a par-icle to a collecting droplet upon impact. From the body of general xperience, it can be inferred that wettable particles probably are iot collected much, if any, more readily than nonwettable particles f the same size. However, the available experimental techniques iave not been adequate to permit any direct test to resolve the ques-ion. Changing from a wettable to a nonwettable test aerosol or from ne scrubbing liquid to another is virtually certain to introduce other and possibly unknown) factors into the scrubbing process. The most



G. 20-113 Typical mechanical centrifugal separator. Type D Rotoclone utaway view). *(American Air Filter Co., Inc.)*

FACILITY DESCRIPTION

I. Overview

The permit authorizes continued operation of the sugar granulator and sugar cooler permitted for installation by permit number 29A-83-I-7. Compliance with the requirements of that permit was demonstrated by performance testing in 1983 and 1985.

Permit number 29A-83-I-7 underwent review according to Prevention of Significant Deterioration regulations including BACT (Best Available Control Technology) analysis. Permit number 29A-83-I-7 was issued in accordance with those regulations.

II. Emission Sources and Pollution Control Equipment

The emission sources and associated process equipment, air pollution control equipment and monitoring equipment at the emission facility described above include the following:

Source No. 1

Process Equipment -	Type:	Sugar granulator
	Mfr.:	Stearns Roger Co.
	Date of Installation:	1983
	Type:	Rotary drum
	Design Capacity:	40 tph
	Feed:	Wet sugar (1-2% moisture, by weight)
Control Equipment -	Type:	Roto-clone
	Mfr./Model:	American Filter Corp./27W
	Wheel Size:	27 inches (diameter)
	Operating Pressure Drop:	4.0 inches H_2O
	Water Application Rate:	7.4 gpm at 40 psig
	Design Collection Efficiency:	98%
	Power:	27 bhp
	Speed:	692 rpm
Monitoring Equipment -	Type:	Pressure Drop Gauge
Stack Parameters -	Height:	90.1 feet above grade
	Inside Exit Diameter:	2.25 feet
	Rated Exhaust Gas Flow:	15,000 acfm @ 130^{o}F and 2% moisture by volume; 13,150 dscfm
	Actual Exhaust Gas Flow:	11,000 acfm @ 115^{o}F (10,140 scfm)

Source No. 2

Process Equipment -	Type:	Sugar cooler
	Mfr.:	Stearns Roger Co.
	Date of Installation:	1983

Rec'd 5/3/95 TL

Western Sugar

April 13, 1995

The Western Sugar Company
1700 Broadway
Suite 1600
Denver, Colorado 80290
(303) 830-3939
Telecopier: (303) 830-3940

Mr. Dallas W. Safriet
Environmental Engineer
U.S. Environmental Protection Agency
Emission and Inventory Group (MD-14)
Research Triangle Park
North Carolina 27711

RE: Comments on Draft AP-42 Section on Sugar Beet Processing

Dear Mr. Safriet:

Thank you for sending the draft version of AP-42 Section 9.10.1.2 on Sugar Beet Processing for review. We reviewed the document and provide our comments in this letter.

The company that prepared this draft section obviously relied on the R.A. McGinnis book, *Beet Sugar Technology*. This book provides a good description of the process, but because it was published in 1982 it is outdated in a few areas. Some of our comments address changes in the beet sugar industry since 1982 and the remaining comments address other specific issues.

Comments:

1. Page 2-1. The table on industry characterization shows 36 plants including 8 in California. Since 1991, two of the plants in California have been shut down. In 1994, 34 beet sugar factories operated in the U.S.

2. Pages 2-2 and 9.10.1-4. The process description sections mentions that Formalin is sometimes added to the diffuser water as a disinfectant. Formalin and formaldehyde are typically no longer used in the beet sugar industry.

3. Pages 2-4, 2-6, 9.10.1-3, 9.10.1-5, 9.10.1-6 and Figure 9.10.1.2.2. The process description sections describe the Steffan process for recovering sugar from molasses in some detail and only mention a "relatively new process" of deep molasses desugarization in one sentence. In 1995, all but one of the beet sugar companies have built molasses desugarization facilities and eliminated the Steffan process. Molasses desugarization processes are all based upon ion exchange, although they are patented or proprietary and differ slightly from company to company. Typically a molasses desugarization facility is built at one factory to process molasses from several other factories.

4. Pages 2-5, 2-7, 9.10.1-4 and 9.10.1-6. The description of the process and emissions states that sulfur stoves are used to produce SO_2 and result in emissions. Very few beet sugar factories still use sulfur stoves. Most purchase SO_2 rather than produce it.

5. Pages 2-6 and 9.10.1-5 and Tables 9.10.1.2-1. The description of sugar granulators and coolers is somewhat inaccurate. Typically the sugar heaters (which are also called dryers) and coolers are collectively referred to as granulators. Sugar is heated and dried in the heaters and cooled in the coolers. In older granulators the heaters and coolers are separate pieces of equipment but nonetheless are collectively called granulators. Each piece of equipment exhausts separately. In the newer granulators, the heaters and coolers are essentially one piece of equipment (connected within one unit), although the heater and cooler parts typically still exhaust separately.

6. Pages 2-7 and 9.10.1-6. The potential emissions from lime kilns are not included because the authors (mistakenly) assume that lime kilns at sugar beet factories are similar to those in lime manufacturing and that emissions are described in AP-42 Section 11.15. Lime kiln emissions at sugar beet factories are not similar to lime manufacturing. At sugar beet factories, lime kilns are used to produce lime and CO_2 gas. The CO_2 gas is used in the carbonation system to remove impurities. Depending upon the type of lime kiln, frequently the entire lime kiln emission stream is drawn into the process. Therefore, other than when the kiln is first lit, the only emissions from many kilns (particularly gas-fired kilns) are from later in the process from the carbonation tanks not the lime kiln. The carbonation system essentially acts like a scrubber. Western Sugar has installed several of the new gas-fired lime kilns which did not require permitting by the states due to minimal emissions.

7. Pages 2-7 and 9.10.1-6. The authors note that emissions from carbonation tanks are primarily VOCs and may include CO_2 and combustion gases. Emissions from carbonation tanks are primarily water vapor. The other "pollutant" in the vapor emissions that has been of most concern in the past is ammonia, which is not discussed in the document. We report calculated ammonia emissions in annual EPCRA Form R reporting but have never performed emission testing. Ammonia emissions are in somewhat larger quantities than the very small emission factors reported in the document for VOCs.

8. Page 4-35 and Table 9.10.1.2-3. The section on sulfur dioxide emissions from pulp dryers states that control devices for beet pulp dryer emissions are not designed to control SO_2 emissions and therefore the emission factor can be used regardless of control device. Experience in testing Western Sugar coal-fired boilers that have wet venturi-type scrubbers indicates that wet scrubbers are typically about 50-70 percent efficient in scrubbing SO_2. Therefore it would seem that a coal-fired dryer controlled by a wet scrubber might also

Reference 19 in the AP-42 section is reference 20 in Section 4.

Ref. 19 in the AP-42 Section is not same as Ref 19 in Section 4 -- she is looking @ Ref. 19 in Section 4, which is for a sugar cooler.

achieve some SO_2 control. Note also that Draft Table 9.10.1.2-3 footnotes SO_2 coal-fired pulp dryer factors to References 7 and 19. Reference 19 is for a sugar cooler not a pulp dryer.

9. Emission Factors and Emission Reports. Many of the beet sugar companies are in the midst of submitting operating permit applications and have conducted additional emission testing or will do so over the next year. Western Sugar conducted additional testing this past year (and will do more in late 1995), although mostly on boilers. We have attached copies of 1994 testing reports for the pulp dryers at our Ft. Morgan, Colorado factory (note that because the source is grandfathered, only front half catch particulate testing is required) and parts of testing reports for Scottsbluff on pulp dryers. Sugar granulators (coolers and heaters) were tested at Scottsbluff but could not be appropriately tested due to velocity. They will be retested in late 1995.

   It would seem that it would be prudent to obtain these additional testing reports and revise this section before issuing it.

Please contact me if you have any questions about these comments.

Very truly yours,

Patricia R. Fuller-Pratt

Patricia R. Fuller-Pratt
Manager of Environmental Affairs

Enclosure

cc: B. Lindgren
T. Schwartz, BSDF

pfp\epa.sam

Rec'd 8/24/95 TL

Airotech, Inc.

Report sent 10/4/95 TL

Tom
would you please
send this guy
a copy

Thanks
Dallas

August 3, 1995

U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group
Research Triangle Park, N.C. 27711

ATTENTION: Mr. Dallas Safriet (MD -14)
Emission Factor and Inventory Group

SUBJECT: See Attached

The writer would like to obtain a copy of the subject report. Can you tell me where I can secure a copy for our review and files? The writer has worked with the beet sugar industry for the past 30 years, providing air pollution control equipment on their various emission sources.

Thanking you in advance.

Very truly yours,

Wallace I. Olson

Wallace I. Olson
Senior Product Engineer

dcb

BOYLE CENTER • 120 E. NINTH AVE. • HOMESTEAD, PA 15120-1600 • PHONE (412) 462-4404 • FAX (412) 462-8816
EQUIPMENT AND SERVICE FOR AIR POLLUTION CONTROL

Emission Factor Documentation for AP-42
Section 9.10.1.2

SUGARBEET PROCESSING

Draft Report

For U. S. Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factor and Inventory Group
Research Triangle Park, NC 27711

Attn: Mr. Dallas Safriet (MD-14)
Emission Factor and Inventory Group

EPA Contract 68-D2-0159
Work Assignment No. II-03

MRI Project No. 4602-03

March 1995

MRI

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

October 4, 1995

Mr. Wallace I. Olson
Airotech, Inc.
Boyle Center
120 East Ninth Avenue
Homestead, PA 15120-1600

Dear Mr. Olson:

As we discussed on the telephone this morning, I have enclosed a copy of the Draft Report of the background document and AP-42 section for Sugarbeet Processing. As we agreed, the Appendices containing excerpts of data from test reports have not been included to conserve copy costs. If you would require selected appendices, please contact me and we can arrange to obtain copies for you.

We will commence preparation of the Final Report for this section within 2 to 3 weeks, so receipt of any review comments from you within that timeframe would be appreciated. Please be advised that we have received review comments from beet sugar producers requesting modifications to portions of the process description. These modifications have not been reflected in this copy of the Draft Report. We will make all changes to the report at one time.

Thank you very much for your interest in this report and any review comments that you wish to submit. If you have any questions or comments, please contact me at your convenience at (919) 677-0249, ext. 5258.

Sincerely,

Thomas W. Lapp

Thomas W. Lapp
Principal Environment Scientist

Enclosure

Airotech, Inc.

October 11, 1995

Midwest Research Institute
Suite 350
401 Harbison Oaks Blvd.
Cary, N.C. 27513-2412

ATTENTION: Thomas W. Lapp
Principal Environmental Scientist

SUBJECT: Draft Report of
Emission Factor Documentation for AP-42
Section 9.10.1.2
MRI Project No. 4602-03

Thank you for forwarding me a copy of the subject draft report. During the past 25 years I've worked with many of the beet sugar companies and plants mentioned in the report to reduce their plant emissions and improve product recovery. Three emission applications were not mentioned in the report. These result from venting the following:

Beet Pulp Pelletizers
Pelletizer Coolers
Sugar Storage Silos

Except for a few misspellings the overall report was well prepared and informative.

Very truly yours,

Wallace I. Olson

Wallace I. Olson
Senior Product Engineer

dcb

AMERICAN CRYSTAL SUGAR COMPANY

Rec'd
8/24/94
TL

August 19, 1994

Tom Lapp
Midwest Research Institute
401 Harrison Oaks Blvd.
Suite 350
Carry, North Carolina 27513

Dear Mr. Lapp:

Enclosed is the information you requested regarding air emissions from our sugar beet factories. Please note that some of the test information provided were engineering tests. Air flow rates, air recycle rates, etc. were being changed to determine the effect on emissions. The state of Minnesota uses both front and back half catch to determine compliance.

If you have any questions regarding the data, please call me at (218) 236-4347.

Sincerely,

Joel Smith

Joel Smith
Manager, Environmental Affairs

cc: File

THE AMALGAMATED SUGAR COMPANY
P.O. BOX 87 • NAMPA, IDAHO 83653 • PHONE (208) 466-3541

September 7, 1994

Mr. Tom Lapp
MRI, Suite 350
401 Harrison Oaks Blvd.
Cary, NC 27513

RE: Particulate, Aldehyde, and Semi-Volatile Organic Compound (SVOC) Emission Testing Results

Dear Mr. Lapp:

In response to your request, attached is a summary of the report entitled "Particulate, Aldehyde, and Semi-Volatile Organic Compound (SVOC) Testing Report for the Pulp Dryer Stacks, 1st and 2nd Carbonation Tank Vents, and the Evaporator Heater Vents". The stack tests were approved by the Idaho Division of Environmental Quality. The stack tests were conducted during the 1992 beet processing campaign at The Amalgamated Sugar Company facility in Nampa, Idaho.

The stack testing results indicate that particulate emission concentrations varied from each pulp dryer. According to the stack testing results, the two scrubbers on the south pulp dryer had the lowest emissions, the two scrubbers on the center pulp dryer had the second lowest emissions, and the north pulp dryer had the highest emissions. One of the primary factors effecting particulate emissions is the design of the impingement type scrubbers. During the testing, the following were the differences in the design of the pulp dryer scrubbers:

1) South Pulp Dryer Scrubbers - Water spray system; highest impingement velocities of gases entering the scrubber; level controls on the scrubber water tub; pressure drop ~ 4 in. H_2O.

2) Center Pulp Dryer Scrubbers - No water sprays; lower impingement velocities than south pulp dryer scrubbers; level controls on the scrubber water tub; pressure drop ~ 4 in. H_2O.

3) North Pulp Dryer Scrubber - Water sprays; lower impingement velocities than south pulp dryer scrubbers; no automatic level controls; pressure drop ~ 2 in. H_2O.

Since completing these tests in 1992, the North Pulp Dryer Scrubber has been rebuilt and provides performance comparable to the South Pulp Dryer Scrubbers.

If you have any questions, feel free to contact either Edward G. Bulgin, Corporate Chief Engineer, or me at 208-466-3541.

Sincerely,

Dean C. DeLorey

Dean C. DeLorey
Corporate Environmental Engineer

Attachment

DCD:ce

cc: George Hobbs
John Lemke
Ed Bulgin

DD02SEP7

Rec'd
9/6/94 TL

Western Sugar

The Western Sugar Company
1700 Broadway
Suite 1600
Denver, Colorado 80290
(303) 830-3939
Telecopier: (303) 830-3940

September 1, 1994

Mr. Tom Lapp
Midwest Research Institute
Suite 350
301 Harrison Oaks Blvd.
Cary, NC 27513

RE: Emission Data, Beet Sugar Processing

Dear Mr. Lapp:

I have enclosed several emission testing reports for Western Sugar beet factories. Most of the emission testing that we have done has been on the boilers. However we have done some limited testing of the beet pulp dryers and pellet coolers; that data is enclosed. I did not necessarily separate out the boiler information from dryer information if it was in the same report so some of that data is also enclosed.

We will be testing dryers for particulates at one factory in about November of this year using Methods 201 and 202. At that same time we will also be testing the sugar granulators (both dryers and coolers) and the lime slaker. If you are interested, we can provide that data when it is available.

Please call me if you have questions.

Very truly yours,

Patricia R. Fuller-Pratt

Patricia R. Fuller-Pratt
Manager of Environmental Affairs

cc: B. Lindgren

pfp\lapp.sam

Reports Included

Billings MT
88-89
89-90
90-91
(subsequent tests have only been for SO_2

Scottsbluff NE
89-90 Dryers

Printed on Recycled Paper

Rec'd 10/28/94
TL

HOLLY SUGAR CORPORATION
A Subsidiary of Imperial Holly Corporation

October 25, 1994

Mr. Tom Lapp
Midwest Research Institute
Suite 350
401 Harrison Oaks Blvd.
Cary, NC 27513

RE: Beet Pulp Dryer Source Test Reports

Dear Mr. Lapp:

Enclosed are two source test reports for beet pulp driers at two Holly plants. The reports include tests of other facilities, so I have not tried to copy portions you might want. Please copy portions of these reports you want and return originals to me -- these are my only copies.

Let me know if you have any questions.

Sincerely,

Kenneth N. Bartle

Kenneth N. Bartle
Manager of Environmental Affairs

Returned copies to Mr. Bartle on November 4.
TL

called 11/29 - Bartle did receive the reports back.

ONE IMPERIAL SQUARE • P.O. Box 9 • SUGAR LAND, TEXAS 77487-0009
TELEPHONE 713/491-9181 • FAX 713/490-9879

MRI

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

November 4, 1994

Mr. Kenneth N. Bartle
Manager, Environmental Affairs
Holly Sugar Corporation
One Imperial Square
Sugar Land, Texas 77487-0009

RE: Beet Pulp Dryer Test Reports

Dear Mr. Bartle:

Enclosed are the source test reports for beet pulp dryers at two Holly plants that you sent to me on October 25. We have copied the portions of each report that are of interest to us for the preparation of the AP-42 emission factors.

I would like to take this opportunity to thank you very much for your cooperation, particularly for sending us your only copies of the reports. It might be of interest to you that we have received beet pulp dryer test reports from all of the beet sugar producers, except for one. This large number of test reports for beet pulp dryers should allow us to develop average emission factors that are very representative of the industry.

If you have any questions, please contact me at (919) 677-0249, ext. 5258. Also, if you wish to be a reviewer of the draft report, please contact me either by letter or telephone.

Sincerely,

Thomas W. Lapp

Thomas W. Lapp
Principal Environmental Scientist

Rec'd 8/5/94 TL

MICHIGAN SUGAR COMPANY

GENERAL OFFICES
4800 Fashion Square Boulevard
300 Plaza North
P. O. Box 1348
SAGINAW, MICHIGAN 48605
Telephone (517) 799-7300
FAX (517) 799-1836 Operations

JOSEPH FLYNN
Process Engineer

August 3, 1994

MR.THOMAS W. LAPP
MIDWEST RESEARCH INSTITUTE
401 HARRISON OAKS BLVD.
CRAY, NORTH CAROLINA 27513-2412

RE: AP-42 Food Processing Update

Dear Mr.Lapp:

I am enclosing the information you requested about the Michigan Sugar Company beet pulp driers that you spoke to our Mr. Mark Suhr about. I have included our operating reports for the dates of the test to help you with any correlation you are making. It is very important to note that because of varying Sugar Beet conditions, actual slice rate or as AP-42 states Sugar Beets Processed should not be used to estimate emissions; I believe the process weight rate or rather the actual amount entering the drier is a much better number to estimate the emissions.

Before you publish any of the information that we have supplied to you , we reserve the right to review this information and revoke your use of it.

If there is any further information that I can provide you with please contact me at (517)-799-7300.

Sincerely,

Joseph E. Flynn

Joseph E. Flynn

Minnesota Pollution Control Agency

November 28, 1994

Copies of test reports for AP-42 Section on Sugar Beet Processing

Mr. Tom Lapp
Midwest Research Institute
401 Harrison Oaks Boulevard
Suite 350
Cary, North Carolina 27513

REF # 95-255

Claim for reimbursement to the State of Minnesota for copying performed at/by the Minnesota Pollution Control Agency.		
Subject Matter: Photocopies made from MPCA's Air Quality Division Files.		
RE: Air Quality Division File #. Southern Mn. Beet Sugar Coop. 177 Pages @$ .20 per page	$35.40	
6.5% Minnesota State Tax	$ 2.30	
PAYMENT DUE THIS CLAIM		$37.70
Make checks payable to the Minnesota Pollution Control Agency and forward to the address given below.		

Steven Rewill
Authorized Signature

520 Lafayette Rd. N.; St. Paul, MN 55155-4194; (612) 296-6300 (voice); (612) 282-5332 (TTY)
Regional Offices: Duluth • Brainerd • Detroit Lakes • Marshall • Rochester
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MRI

Fax No.
(612) 297-7709

MIDWEST RESEARCH INSTITUTE
Suite 350
401 Harrison Oaks Boulevard
Cary, North Carolina 27513-2412
Telephone (919) 677-0249
FAX (919) 677-0065

October 26, 1994

Mr. Todd Biewen
Supervisor, Compliance Determination Unit
Air Quality Division
Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194

Dear Mr. Biewen:

Midwest Research Institute (MRI) is currently providing technical support to the U. S. Environmental Protection Agency, Emissions Inventory Branch, to revise and expand Chapter 9 (formerly Chapter 6) of the "Compilation of Air Pollutant Emissions Factors (AP-42)." The new Chapter 9 is entitled "Food and Agricultural." One of the new sections to be added to Chapter 9 is Section 9.10.1.2, Beet Sugar Processing. We have compiled emission test reports from several of the sugar beet producers and processors and would like to include test reports from the Southern Minnesota Beet Sugar Cooperative.

On Monday, I talked with Mr. Stuart Arkley of your unit and he stated that the unit has the following four reports from this cooperative:

Source	Test Date
1. Drum dryer cyclone	January 1988
2. Combined sugar dryer/cooler	November 1986
3. Dryer No. 2	December 1988
4. Lime kiln	December 1988

There are test reports from boilers but we have no interest in this source at the present time. MRI would like to request one copy of each of the four reports. According to Mr. Arkley, there is a copy charge of $0.20 per page for the reports, which MRI will pay from project funds. Alternatively, if you would be willing to ship the four reports to MRI, we can have them copied and then return the original reports to you.

If you have any questions, please call me at your convenience. My telephone number is (919) 677-0249, ext. 5258. Thank you very much for your assistance in this matter.

Sincerely,

Thomas W. Lapp

Thomas W. Lapp, Ph.D.
Principal Environmental Scientist

J:\DMS\460203\3505

CONTACT REPORT--MRI Project No. 4601-08

From: Brian Shrager, Environmental Engineering Department

Date of Contact: 11/18/93

Contacted by: Telephone

Company/Agency: American Society of Sugar Beet Technologists
90 Madison, Suite 208
Denver, CO 80206

Telephone Number: (303) 321-1520

Person(s) Contacted/Title(s)
Thomas K. Schwartz, Executive Vice President

CONTACT SUMMARY:

Mr. Schwartz was asked if he knew of any air emission test data that was available for sugarbeet processing plants. He stated that substantial amounts of data (from compliance tests) should be available from either the plants or the States in which plants are located.

American Sugar Alliance
1225 Eye St. NW, STE. 400
Washington, DC 20005
(202)457-1437
Vickie Myers, Executive Dir.

Was referred to:
Jim Johnson
U.S. Beet Sugar Association
1156 15th St. NW
Washington, DC 20005
(202) 296-4820

Mr. Johnson was not in. I was referred to Mr. Van Olsen, President of U.S. Beet Sugar Association. He was a very nice person and indicated he would like to review the report.

Information:

14 States where plants are located: Minnesota, North Dakota, Montana, Idaho, Washington (a few), California, New Mexico (a few), Texas, Colorado, Wyoming, Nebraska, Oregon, Ohio, Michigan.
The 1992-93 crop was excellent this year. There were ideal conditions and a huge crop.

Because it was a good and large crop, prices are down.

They have built no new factories in 18 years. In 1974 there were 56. There are only 36 now. -But they are making much more sugar now, more efficiently, and yield more sugar beets and the sugar beets have more sugar in them.

New Process in last 5 years: Desugarization

New process can now reprocess molasses to get more sugar that was previously left in there. Molasses still has sugar left in it after it is processed. This gets more sugar out. They run the molasses through and get more sugar. It is an expensive investment, "Deep Molasses Desugarization", but more efficient.

A sugar beet contains 2 1/2 - 3 or 4 pounds of water. It produces refined sugar, molasses, and pulp (pulp is dried and sold for cattle food).

They use more energy than any food processing industry but they are very efficient users of energy because energy costs are major costs to them.

* For any further questions, I recommend you call Mr. Olsen.

American Society of Sugar Beet Technologists
90 Madison, Ste. 208
Denver, CO 80206
(303)321-1520
Thomas K. Schwartz, Exec. V.Pres.

Mr. Schwartz is sending a copy of the Directory of Beet Sugar Companies, and a copy of "Beet Sugar Technology", 800 pages.

He says growth is fairly level.

New technology: Molasses Exhaustion

They produce, White Sugar, Molasses, and Beet Pulp. Molasses still has sugar in it after it is processed. Now molasses can be reprocessed to get more sugar out that previously was left in there.

Change in industry: It is same as 10 years ago. There are less plants, but they have increased the capacity of plants, and they are more efficient.

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INTEROFFICE MEMORANDUM

MIDWEST RESEARCH INSTITUTE

July 8, 1997

To: AP-42 Section 9.10.1.2, Sugarbeet Processing, Project File

From: Tom Lapp and Brian Shrager

Subject: National Emission Estimate

The recently published AP-42 Section 9.10.1.2, Sugarbeet Processing, includes emission factors for particulate matter (PM) emissions from pulp dryers, sugar granulators, and sugar coolers. Emission factors for volatile organic compounds (VOCs) are presented for pulp dryers, carbonation tanks, and thin juice evaporators. Factors for methane, nitrogen oxides (NO_x), sulfur dioxide (SO_2) , carbon monoxide (CO), and carbon dioxide (CO_2) emissions are presented for pulp dryers. Existing pulp dryers are fueled with coal, natural gas, or fuel oil. To develop this national emission estimate, average PM emission factors were estimated based on available AP-42 data for the various fuel types. Average emission factors for VOC, methane, and the inorganic gases were calculated based on the available AP-42 data for the different fuel types. Emission factors for specific organic emissions were presented for carbonation tanks and thin juice evaporators based on a single source test. Since it could not be established that this source was typical of the industry, the factors for the specific compounds are summed and reported in this estimate as total VOC. All of these factors were used, in conjunction with sugarbeet and beet sugar production statistics, to estimate emissions at the county level and on a national basis.

In AP-42 Section 9.10.1.2, the units for the emission factors are:

pulp dryers = lb per ton of pressed wet pulp to the dryer
sugar granulators and sugar coolers = lb per ton of sugar output
first and second carbonation tanks = lb per 1,000 gallons of raw juice produced
first evaporator = lb per 1,000 gallons of thin juice produced.

The most readily available annual data for sugarbeets are quantity of beets harvested (produced) and quantity of refined beet sugar produced. Information presented in the reference document by McGinnis was used to modify each of the cited emission factors so that emissions can be estimated based on either tons of sugarbeets harvested or tons of sugar produced.[1] Because there is reported to be negligible weight loss during sugarbeet cleaning and handling and raw cossette production, the reported quantities of sugarbeets harvested (produced) are assumed to be equal to the quantities processed into raw cossettes.

After sugar extraction, the cossettes (termed wet pulp) are screened, pressed to remove water, treated with molasses, and sent to the dryers. The net weight of the pressed wet pulp to the dryers is about 26 percent of the weight of the raw cossettes before sugar extraction; raw cossette weight is equivalent to the quantity of beets processed. Therefore, 0.26 tons of pressed wet pulp are produced per ton of sugarbeets processed. Estimation of the production quantity of raw and thin juice in terms of tons of sugarbeets processed is more complex than the pressed wet pulp feed estimation. "Draft" is the ratio of the weight of diffusion juice drawn from the diffuser to the weight of the cossettes introduced, times 100.[1] Values for draft usually vary between 100 and 150; an average of 125 was assumed. The densities for raw and thin juice were calculated from equations and data tabulations presented in McGinnis. These calculated densities were combined with the average draft value to estimate the gallons of raw and thin juice produced per ton of sugarbeets processed. The calculated volume of raw juice is 240 gallons per ton of beets processed and the volume of thin juice is 270 gallons per ton of beets processed.

The estimated county and nationwide emissions were developed based on either the annual quantity of sugarbeets harvested or the annual beet sugar production quantity; both of these figures are available from either the U.S. Department of Agriculture (USDA) or the United States Beet Sugar Association.[2-3] For each sugarbeet processing plant, the location (city and state) and daily capacity were obtained from the U. S. Beet Sugar Association.[3] County identifications for each plant were obtained using an Atlas of the United States. The daily capacity of the 31 plants was summed and the percentage of the total daily capacity calculated for each plant. The total annual sugarbeets harvested and the total annual beet sugar production were prorated among the 31 processing plants according to their percentage of the total daily processing capacity. The 1995 total quantity of sugarbeets harvested was 28,117,980 tons; this figure was based on a yield of 19.8 tons per acre and 1,420.1 x 10^3 acres planted. As stated earlier, the annual quantity of sugarbeets processed is assumed to be equal to the total quantity of sugarbeets harvested. Refined sugar production was 3,689,000 tons; this figure was based on an average production of 5,196 lb per acre and 1,420.1 x 10^3 acres planted.[3] In Table 1, the location (state, city, county), 1995 daily processing capacity, percent of the total industry daily capacity, prorated volume of sugarbeets processed based on the 1995 sugarbeet harvest, and prorated volume of sugar produced based on 1995 total sugar production are presented for each processing plant.

Table 2 presents the estimated filterable and condensible particulate matter (PM) emissions for each processing plant. The PM emissions result from the pulp dryers, sugar granulators, and sugar coolers. The emission factors for these sources are shown in the footnotes to Table 2. To estimate these emissions, data are required for the tons of pressed wet pulp to the dryer and tons of refined sugar produced. The prorated volume of refined sugar production is provided in Table 1. Each ton of processed sugarbeets yields 0.26 tons of pressed wet pulp; the volume of sugarbeets processed in 1995 was given in Table 1.

Emissions of VOC are generated from pulp dryers, carbonation tanks, and the evaporator; these emisions are summarized in Table 3. The emission factors are shown in the footnotes to Table 3. Data are required for tons of pressed wet pulp, gallons of raw juice produced, and gallons of thin juice produced. Each ton of processed sugarbeets yields 0.26 tons of pressed wet pulp, 240 gallons of raw juice, and 270 gallons of thin juice. The VOC emissions for all three sources were summed and reported in Table 3.

Table 4 summarizes emissions of methane and selected inorganic gases from pulp dryers. The emission factors are shown in the footnotes to Table 4; the estimation method for pressed wet pulp production has been discussed.

The results of Tables 2, 3, and 4 are summarized in Table 5. On a national basis for 1995, estimated filterable PM emissions were 2,752 tons and total condensible PM emissions were 1,339 tons; total PM emissions were 4,091 tons. Total 1995 nationwide VOC and methane emissions were 418 and 102 tons, respectively. For the inorganic gases, the 1995 total emissions on a national basis were 2,303 tons for NO_x; 2,888 tons for SO_2; 3,655 tons for CO; and 1,164,834 tons for CO_2.

References

1. R.A. McGinnis, *Beet-Sugar Technology, Third Edition*, Beet Sugar Development Foundation, Fort Collins, CO, 1982.

2. *Sugar and Sweetner Yearbook*, U.S. Department of Agriculture, Economic Research Service, Washington, DC, June 1995.

3. *Directory of American Beet Sugar Companies*, United States Beet Sugar Association, Washington, DC, 1997.

TABLE 1. 1995 PRODUCTION ESTIMATES (BY CITY AND COUNTY) FOR SUGARBEET PROCESSING PLANTS

State	City	County	Daily capacity, tons of beets	Percent of total industry daily capacity	Refined sugar produced, tons*	Sugarbeets processed, tons*
Idaho	Mini-Cassia	Cassia	10,000	5.55	204,888	1,561,676
	Twin Falls	Twin Falls	6,200	3.44	127,030	968,239
	Nampa	Ada	11,800	6.55	241,767	1,842,778
Oregon	Nyssa	Malheur	9,000	5.00	184,399	1,405,509
California	Woodland	Yolo	3,600	2.00	73,760	562,203
	Tracy	San Joaquin	5,000	2.78	102,444	780,838
	Mendota	Madera	4,200	2.33	86,053	655,904
	Brawley	Imperial	8,200	4.55	168,008	1,280,574
Montana	Billings	Yellowstone	5,000	2.78	102,444	780,838
	Sidney	Richland	5,400	3.00	110,639	843,305
Wyoming	Lovell	Bighorn	3,000	1.67	61,466	468,503
	Worland	Washakie	3,600	2.00	73,760	562,203
	Torrington	Goshen	5,400	3.00	110,639	843,305
Colorado	Greeley	Weld	3,500	1.94	71,711	546,587
	Ft. Morgan	Morgan	5,000	2.78	102,444	780,838
Texas	Hereford	Deaf Smith	7,700	4.28	157,763	1,202,491
North Dakota	Drayton	Walsh	5,900	3.28	120,884	921,389
	Hillsboro	Trail	5,900	3.28	120,884	921,389
	Wahpeton	Richland	7,500	4.17	153,666	1,171,257
Minnesota	East Grand Forks	Polk	8,000	4.44	163,910	1,249,341
	Crookston	Polk	5,300	2.94	108,590	827,688
TOTAL FOR POLK COUNTY			13,300	7	272,500	2,077,029
	Moorhead	Clay	5,300	2.94	108,590	827,688
	Renville	Renville	10,000	5.55	204,888	1,561,676
Nebraska	Scottsbluff	Scotts Bluff	5,000	2.78	102,444	780,838
	Bayard	Morrill	3,000	1.67	61,466	468,503
Michigan	Bay City	Tuscola	8,000	4.44	163,910	1,249,341
	Caro	Tuscola	3,500	1.94	71,711	546,587
TOTAL FOR TUSCOLA COUNTY			11,500	6.39	235,621	1,795,928
	Carrollton	Saginaw	3,100	1.72	63,515	484,120
	Sebewaing	Huron	5,550	3.08	113,713	866,730
	Croswell	Sanilac	3,600	2.00	73,760	562,203
Ohio	Fremont	Sandusky**	3,800	2.11	77,857	593,437
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			180,050	100	3,689,000	28,117,980

*Prorated values based on total annual values obtained from References 2 and 3.
**Factory operations are suspended

Variables:

Total industry daily capacity, 1995:	180,050 tons	
Refined sugar produced, 1995:	3,689,000 tons	
Sugarbeets processed, 1995:	28,117,980 tons	assumed to equal beets harvested

TABLE 2. 1995 NATIONAL EMISSION ESTIMATE (BY CITY AND COUNTY) FOR PM FROM SUGARBEET PROCESSING

State	City	County	Refined sugar produced, tons*	Pressed wet pulp, tons*	PM emissions, tons Filterable	PM emissions, tons Condensible
Idaho	Mini-Cassia	Cassia	204,888	406,036	153	74
	Twin Falls	Twin Falls	127,030	251,742	95	46
	Nampa	Ada	241,767	479,122	180	88
Oregon	Nyssa	Malheur	184,399	365,432	138	67
California	Woodland	Yolo	73,760	146,173	55	27
	Tracy	San Joaquin	102,444	203,018	76	37
	Mendota	Madera	86,053	170,535	64	31
	Brawley	Imperial	168,008	332,949	125	61
Montana	Billings	Yellowstone	102,444	203,018	76	37
	Sidney	Richland	110,639	219,259	83	40
Wyoming	Lovell	Bighorn	61,466	121,811	46	22
	Worland	Washakie	73,760	146,173	55	27
	Torrington	Goshen	110,639	219,259	83	40
Colorado	Greeley	Weld	71,711	142,113	53	26
	Ft. Morgan	Morgan	102,444	203,018	76	37
Texas	Hereford	Deaf Smith	157,763	312,648	118	57
North Dakota	Drayton	Walsh	120,884	239,561	90	44
	Hillsboro	Trail	120,884	239,561	90	44
	Wahpeton	Richland	153,666	304,527	115	56
Minnesota	East Grand Forks	Polk	163,910	324,829	122	60
	Crookston	Polk	108,590	215,199	81	39
TOTAL FOR POLK COUNTY			272,500	540,028	203	99
	Moorhead	Clay	108,590	215,199	81	39
	Renville	Renville	204,888	406,036	153	74
Nebraska	Scottsbluff	Scotts Bluff	102,444	203,018	76	37
	Bayard	Morrill	61,466	121,811	46	22
Michigan	Bay City	Tuscola	163,910	324,829	122	60
	Caro	Tuscola	71,711	142,113	53	26
TOTAL FOR TUSCOLA COUNTY			235,621	466,941	176	86
	Carrollton	Saginaw	63,515	125,871	47	23
	Sebewaing	Huron	113,713	225,350	85	41
	Croswell	Sanilac	73,760	146,173	55	27
Ohio	Fremont	Sandusky**	77,857	154,294	58	28
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			3,689,000	7,310,675	2,752	1,339

*Prorated values based on data from Table 1.
**Factory operations are suspended

Variables:

Total industry daily cap., 1995:	180,050	tons	
Refined sugar produced, 1995:	3,689,000	tons	
Sugarbeets processed, 1995:	28,117,980	tons	assumed to equal beets harvested
Pressed wet pulp dried, 1995:	7,310,675	tons	0.26 x tons of beets processed

Filterable PM emission factors:

Pulp dryers:	0.67	lb/ton of pressed wet pulp (avg. of AP-42 factors for controlled coal-, gas, and oil-fired dryers)
Granulators:	0.064	lb/ton of sugar output
Coolers:	0.1	lb/ton of sugar output (avg. of AP-42 factors for controlled coolers)

Condensible PM emission factors:

Pulp dryers:	0.36	lb/ton of pressed wet pulp (avg. of AP-42 factors for coal- and oil-fired dryers, no data for gas-fired dryers)
Granulators:	0.0037	lb/ton of sugar output
Coolers:	0.0089	lb/ton of sugar output

TABLE 3. 1995 NATIONAL EMISSION ESTIMATE (BY CITY AND COUNTY) FOR VOC FROM SUGARBEET PROCESSING

State	City	County	Raw juice produced, 1000 gal	Thin juice produced, 1000 gal	Pressed wet pulp, tons	VOC emissions, tons
Idaho	Mini-Cassia	Cassia	374,802	421,653	406,036	23
	Twin Falls	Twin Falls	232,377	261,425	251,742	14
	Nampa	Ada	442,267	497,550	479,122	27
Oregon	Nyssa	Malheur	337,322	379,487	365,432	21
California	Woodland	Yolo	134,929	151,795	146,173	8
	Tracy	San Joaquin	187,401	210,826	203,018	12
	Mendota	Madera	157,417	177,094	170,535	10
	Brawley	Imperial	307,338	345,755	332,949	19
Montana	Billings	Yellowstone	187,401	210,826	203,018	12
	Sidney	Richland	202,393	227,692	219,259	13
Wyoming	Lovell	Bighorn	112,441	126,496	121,811	7
	Worland	Washakie	134,929	151,795	146,173	8
	Torrington	Goshen	202,393	227,692	219,259	13
Colorado	Greeley	Weld	131,181	147,578	142,113	8
	Ft. Morgan	Morgan	187,401	210,826	203,018	12
Texas	Hereford	Deaf Smith	288,598	324,672	312,648	18
North Dakota	Drayton	Walsh	221,133	248,775	239,561	14
	Hillsboro	Trail	221,133	248,775	239,561	14
	Wahpeton	Richland	281,102	316,239	304,527	17
Minnesota	East Grand Forks	Polk	299,842	337,322	324,829	19
	Crookston	Polk	198,645	223,476	215,199	12
TOTAL FOR POLK COUNTY			498,487	560,798	540,028	31
	Moorhead	Clay	198,645	223,476	215,199	12
	Renville	Renville	374,802	421,653	406,036	23
Nebraska	Scottsbluff	Scotts Bluff	187,401	210,826	203,018	12
	Bayard	Morrill	112,441	126,496	121,811	7
Michigan	Bay City	Tuscola	299,842	337,322	324,829	19
	Caro	Tuscola	131,181	147,578	142,113	8
TOTAL FOR TUSCOLA COUNTY			431,023	484,900	466,941	27
	Carrollton	Saginaw	116,189	130,712	125,871	7
	Sebewaing	Huron	208,015	234,017	225,350	13
	Croswell	Sanilac	134,929	151,795	146,173	8
Ohio	Fremont	Sandusky**	142,425	160,228	154,294	9
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			6,748,315	7,591,855	7,310,675	418

**Factory operations are suspended

VOC emission factors:

Pulp dryers:	0.11	lb/ton of pressed wet pulp (AP-42 factor for oil-fired dryers)
First and second carbonation tanks:	0.00473	lb/1000 gallons of raw juice produced (sum of speciated organics in Table 9.10.1.2-4)
First evaporator:	7.11E-05	lb/1000 gallons of thin juice produced (sum of speciated organics in Table 9.10.1.2-4)

TABLE 4. 1995 NATIONAL EMISSION ESTIMATE (BY CITY AND COUNTY) FOR CH4, NOx, SO2, CO, AND CO2 FROM SUGARBEET PROCESSING

State	City	County	Pressed wet pulp, tons	Methane emissions, tons	NOx emissions, tons	SO2 emissions, tons	CO emissions, tons	CO2 emissions, tons
Idaho	Mini-Cassia	Cassia	406,036	6	128	160	203	64,695
	Twin Falls	Twin Falls	251,742	4	79	99	126	40,111
	Nampa	Ada	479,122	7	151	189	240	76,340
Oregon	Nyssa	Malheur	365,432	5	115	144	183	58,226
California	Woodland	Yolo	146,173	2	46	58	73	23,290
	Tracy	San Joaquin	203,018	3	64	80	102	32,348
	Mendota	Madera	170,535	2	54	67	85	27,172
	Brawley	Imperial	332,949	5	105	132	166	53,050
Montana	Billings	Yellowstone	203,018	3	64	80	102	32,348
	Sidney	Richland	219,259	3	69	87	110	34,935
Wyoming	Lovell	Bighorn	121,811	2	38	48	61	19,409
	Worland	Washakie	146,173	2	46	58	73	23,290
	Torrington	Goshen	219,259	3	69	87	110	34,935
Colorado	Greeley	Weld	142,113	2	45	56	71	22,643
	Ft. Morgan	Morgan	203,018	3	64	80	102	32,348
Texas	Hereford	Deaf Smith	312,648	4	98	123	156	49,815
North Dakota	Drayton	Walsh	239,561	3	75	95	120	38,170
	Hillsboro	Trail	239,561	3	75	95	120	38,170
	Wahpeton	Richland	304,527	4	96	120	152	48,521
Minnesota	East Grand Forks	Polk	324,829	5	102	128	162	51,756
	Crookston	Polk	215,199	3	68	85	108	34,288
TOTAL FOR POLK COUNTY			540,028	8	170	213	270	86,044
	Moorhead	Clay	215,199	3	68	85	108	34,288
	Renville	Renville	406,036	6	128	160	203	64,695
Nebraska	Scottsbluff	Scotts Bluff	203,018	3	64	80	102	32,348
	Bayard	Morrill	121,811	2	38	48	61	19,409
Michigan	Bay City	Tuscola	324,829	5	102	128	162	51,756
	Caro	Tuscola	142,113	2	45	56	71	22,643
TOTAL FOR TUSCOLA COUNTY			466,941	7	147	184	233	74,399
	Carrollton	Saginaw	125,871	2	40	50	63	20,055
	Sebewaing	Huron	225,350	3	71	89	113	35,906
	Croswell	Sanilac	146,173	2	46	58	73	23,290
Ohio	Fremont	Sandusky**	154,294	2	49	61	77	24,584
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			7,310,675	102	2,303	2,888	3,655	1,164,834

**Factory operations are suspended

<u>Pulp dryer emission factors:</u>

Methane:	0.028 lb/ton of pressed wet pulp (AP-42 factor for oil-fired dryers, no data for coal- or gas-fired)
NOx:	0.63 lb/ton of pressed wet pulp (avg. of AP-42 factors for coal- & oil-fired dryers, no data for gas-fired)
SO2:	0.79 lb/ton of pressed wet pulp (AP-42 factor for coal-fired dryers, no data for gas-fired, oil-fired not used)
CO:	1.0 lb/ton of pressed wet pulp (AP-42 factor for oil-fired dryers, no data for gas-fired, coal-fired not used)
CO2:	319 lb/ton of pressed wet pulp (avg. of AP-42 factors for coal-, gas, and oil-fired dryers)

TABLE 5. SUMMARY OF 1995 NATIONAL EMISSION ESTIMATES (BY CITY AND COUNTY) FOR SUGARBEET PROCESSING

State	City	County	PM emissions, tons Filterable	PM emissions, tons Condensible	VOC emissions, tons	Methane emissions, tons	NOx emissions, tons	SO2 emissions, tons	CO emissions, tons	CO2 emissions, tons
Idaho	Mini-Cassia	Cassia	153	74	23	6	128	160	203	64,695
	Twin Falls	Twin Falls	95	46	14	4	79	99	126	40,111
	Nampa	Ada	180	88	27	7	151	189	240	76,340
Oregon	Nyssa	Malheur	138	67	21	5	115	144	183	58,226
California	Woodland	Yolo	55	27	8	2	46	58	73	23,290
	Tracy	San Joaquin	76	37	12	3	64	80	102	32,348
	Mendota	Madera	64	31	10	2	54	67	85	27,172
	Brawley	Imperial	125	61	19	5	105	132	166	53,050
Montana	Billings	Yellowstone	76	37	12	3	64	80	102	32,348
	Sidney	Richland	83	40	13	3	69	87	110	34,935
Wyoming	Lovell	Bighorn	46	22	7	2	38	48	61	19,409
	Worland	Washakie	55	27	8	2	46	58	73	23,290
	Torrington	Goshen	83	40	13	3	69	87	110	34,935
Colorado	Greeley	Weld	53	26	8	2	45	56	71	22,643
	Ft. Morgan	Morgan	76	37	12	3	64	80	102	32,348
Texas	Hereford	Deaf Smith	118	57	18	4	98	123	156	49,815
North Dakota	Drayton	Walsh	90	44	14	3	75	95	120	38,170
	Hillsboro	Trail	90	44	14	3	75	95	120	38,170
	Wahpeton	Richland	115	56	17	4	96	120	152	48,521
Minnesota	East Grand Forks	Polk	122	60	19	5	102	128	162	51,756
	Crookston	Polk	81	39	12	3	68	85	108	34,288
TOTAL FOR POLK COUNTY			203	99	31	8	170	213	270	86,044
	Moorhead	Clay	81	39	12	3	68	85	108	34,288
	Renville	Renville	153	74	23	6	128	160	203	64,695
Nebraska	Scottsbluff	Scotts Bluff	76	37	12	3	64	80	102	32,348
	Bayard	Morrill	46	22	7	2	38	48	61	19,409
Michigan	Bay City	Tuscola	122	60	19	5	102	128	162	51,756
	Caro	Tuscola	53	26	8	2	45	56	71	22,643
TOTAL FOR TUSCOLA COUNTY			176	86	27	7	147	184	233	74,399
	Carrollton	Saginaw	47	23	7	2	40	50	63	20,055
	Sebewaing	Huron	85	41	13	3	71	89	113	35,906
	Croswell	Sanilac	55	27	8	2	46	58	73	23,290
Ohio	Fremont	Sandusky**	58	28	9	2	49	61	77	24,584
TOTALS FOR U.S. SUGARBEET PROCESSING PLANTS			2,752	1,339	418	102	2,303	2,888	3,655	1,164,834

**Factory operations are suspended