

Note: This material is related to a section in AP42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the file number, the AP42 chapter and then the section. The file name "rel01_c01s02.pdf" would mean the file relates to AP42 chapter 1 section 2. The document may be out of date and related to a previous version of the section. The document has been saved for archival and historical purposes. The primary source should always be checked. If current related information is available, it will be posted on the AP42 webpage with the current version of the section.

AP42 Section:	11.22
Title:	<i>Comments and correspondence for 1995</i>

FAX TRANSMISSION

TO: Ron Myers, EFIG
FROM: Rick Marinshaw, MRI
DATE: July 27, 1995

RECEIVING FAX NUMBER: 541-0684

SENDING FAX NUMBER: 919-677-0065

THIS FAX CONSISTS OF 2 PAGES (INCLUDING THIS PAGE)

As I mentioned in the voicemail message I just left for you, the STIRS data base includes five test reports on diatomite processing sources. The following page lists the information on those reports. We do not have copies of the reports. Do you want us to finalize the section as is or wait until we can get the test reports and incorporate the test data into the section? As it stands now, the section does not include any emission factors. Also, the test summary that we do have in our files is for a diatomite kiln being fired with waste oil. Do you want us to do anything with that data? Finally, we came across another test report for frit. Should we try to incorporate that report into the section now or hold it for a later revision? Please let me or Brian know.

Thanks.

STIRS DATABASE PRINTOUT

Scan number	Facility name	SCC	Agency	Test date	City	Sta	Zip	Process
1112SB23/2	Celite Corp.	305xxxxx	SB	06-Aug-92	Lompac		93436	Diatomaceous earth calcining
1116SB04	Celite Corp.	305xxxxx	SB	25-Nov-92	Lompac		93436	Diatomaceous earth calcining
1112SB15	Grefco, Inc.	305xxxxx	SB	17-May-90	Torrance		90509	Diatomaceous earth - rotary dryer
1112SB11	Grefco, Inc.	305xxxxx	SB	24-Nov-92	Torrance		90509	Diatomaceous earth - rotary dryer
1116SB02	Grefco, Inc.	305xxxxx	SB	22-Feb-93	Lompac			Diatomaceous earth dryer



UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

810 7th St., NW.

Washington, DC 20241-0001

DIVISION OF MINERAL COMMODITIES

Branch of Industrial Minerals — fax number (202) 501-3751

FACSIMILE TRANSMISSION COVER SHEET

Date: 4/27/93FAX No: 719 541-0684Number of pages (including cover sheet) 8TO: Ronald Myers, EPA (Name and company)FROM: Lawrence Davis 202 501-9386 (Name and telephone number)

MESSAGE:

I reviewed your Draft AP-42 Section 8.29 on diatomite and have no comments. It looks OK to me.

In response to your question on emissions, the only data I've seen is in an old report (1958) by the U.S. Public Health Service. Attached are the title page + table of contents.

Pneumoconiosis
IN
**DIATOMITE MINING
AND PROCESSING**

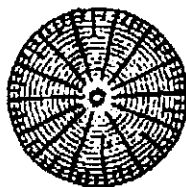
W. Clark Cooper, M. D.
Medical Director

Lewis J. Cralley, Ph. D.
Scientist Director

With the Assistance of

W. H. Clark, M. D., and B. R. Hubbard, M. S., California State Department of Public Health; D. J. Hurley, M. D., Nevada State Department of Health; and R. R. Sullivan, M. D., Oregon State Board of Health

Prepared under Direction of
W. M. Gafafer, D. Sc., Technical Adviser



U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of State Services
Division of Special Health Services
Occupational Health Program

Public Health Service Publication No. 601

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1958

For sale by the Superintendent of Documents, U. S. Government Printing Office
Washington 25, D. C. • Price 50 cents

Contents

	Page
FOREWORD.....	iii
FIELD STUDY PERSONNEL.....	iv
ACKNOWLEDGMENTS.....	v
PHOTOGRAPHS AND FIGURES.....	ix
TABLES.....	x
ABSTRACT.....	xiii
NATURE AND SCOPE OF STUDY.....	1
DIATOMS: DESCRIPTION AND DISTRIBUTION.....	5
REVIEW OF LITERATURE.....	7
Epidemiologic Studies.....	7
Pulmonary Pathology in Man.....	10
Pulmonary Function Studies.....	11
Studies in Lower Animals.....	12
Chemical and Physical Studies on Diatomite.....	14
THE DIATOMITE-PROCESSING INDUSTRY.....	15
Description of Operations.....	15
Quarrying.....	15
Material Treatment.....	15
Packing.....	17
Shipping.....	17
Maintenance.....	17
Sources of Airborne Dust.....	17
Nature of Product.....	18
Specific Operations.....	18
Quarrying.....	18
Material treatment.....	18
Packing.....	19
Shipping.....	19
Work Habits.....	19
Dust Load of Ambient Air.....	19
Condition of Operating Equipment.....	20
ENVIRONMENTAL STUDIES.....	21
Atmospheric Sampling Methods.....	22
Standard and Midget Impinger.....	22
Electrostatic Precipitator and High-Volume Sampler.....	23
Membrane Filter.....	23
	vii

ENVIRONMENTAL STUDIES—Continued	Page
Chemical and Physical Methods.....	25
Analytical Methods.....	25
Particle Size Determination.....	25
Dust Counting Procedure.....	25
Results of Environmental Studies.....	26
Composition of Crude Diatomite.....	26
Quartz in Parent Material, Settled Dust, and Airborne Dust.....	27
Cristobalite in Parent Material, Settled Dust, and Airborne Dust.....	27
Cristobalite in Different Size Fractions of Parent Materials.....	30
Particle Size Distribution.....	30
Atmospheric Dust Concentrations.....	39
Dust Control Program.....	41
Control of Dust at Source of Dispersion.....	42
Routine Dust Evaluation.....	42
Improved Housekeeping and Maintenance.....	42
Personal Respiratory Protection.....	42
Comparison of Initial and Followup Studies.....	43
MEDICAL STUDIES.....	62
Personnel and Facilities.....	62
Procedures.....	63
History and Physical Examinations.....	63
Chest Roentgenograms.....	63
Laboratory Examinations.....	63
Intradermal Tests.....	63
Pulmonary Function Tests.....	64
General Characteristics of Workers Examined.....	64
Sex, Race, Age, and Duration of Employment.....	64
Occupation.....	66
Pulmonary Findings.....	67
Classification of Roentgenographic Abnormalities.....	67
Film Interpretations.....	70
Films Interpreted as Abnormal.....	72
Chest Films as Related to Duration and Type of Exposure.....	74
Roentgenographic Changes and Age.....	77
Chest Films of Workers Exposed to Fresh Water Diatomite.....	77
Case Histories.....	78
Results of Intradermal Tests.....	80
Other Studies for Tuberculosis.....	82

Contents

ix

MEDICAL STUDIES—Continued

Pulmonary Findings—Continued	Page
Physical Signs and Chest Film Interpretations.....	83
Respiratory Symptoms and Ventilatory Function.....	83
Followup Observations.....	85
SUMMARY AND CONCLUSIONS.....	87
Environmental Findings.....	87
Medical Findings.....	88
RECOMMENDATIONS.....	90
Dust Control.....	90
Labeling.....	90
Medical Program.....	91
REFERENCES.....	92

Photographs and Figures

FRONTISPIECE. A panel of an exhibit prepared and shown by Occupational Health Program, Public Health Service.

FIGURE 1. Typical flow diagram.....	16
FIGURE 2. X-ray diffraction patterns of diatomite products.....	26
FIGURE 3. High quality, salt water, crude diatomite.....	81
FIGURE 4. High quality, fresh water, crude diatomite.....	82
FIGURE 5. Milled salt water natural diatomite (main product).....	33
FIGURE 6. Milled salt water natural diatomite (baghouse product).....	34
FIGURE 7. Flux-calcined milled salt water diatomite (main product).....	35
FIGURE 8. Flux-calcined milled salt water diatomite (baghouse product).....	36
FIGURE 9. Milled natural salt water diatomite.....	37
FIGURE 10. Milled flux-calcined salt water diatomite.....	38
FIGURE 11. Particle-size distribution of airborne dust by product category.....	39
FIGURE 12. Percent of samples showing indicated dust concentrations in million particles per cubic foot of air determined in the 5 plants during initial study of 1953-54, in the followup study of 1954-55, and in routine plant studies during 1956.....	44
FIGURE 13. Quarry truck-loading operation.....	46
FIGURE 14. Ventilating unit in truck cab showing replaceable air filter.....	47
FIGURE 15. Operator of carryalls in quarry wears an air supplied hood provided with clean air.....	48
FIGURE 16. Packing station.....	49

x

Contents

	Page
FIGURE 17. Product packing operation illustrating the use of local exhaust ventilation.....	50
FIGURE 18. Product packing station.....	51
FIGURE 19. Conveyor from packers to palletizing pit.....	52
FIGURE 20. Palletizing press.....	53
FIGURE 21. Personnel blowoff booth.....	54
FIGURE 22. Blowoff booth. Used for cleaning diatomite dust from equipment with compressed air.....	55
FIGURE 23. Dust collection system showing completely enclosed baghouses.....	56
FIGURE 24. Dust collection system showing cyclone collectors and completely enclosed baghouses.....	57
FIGURE 25. Processing area showing rotary kilns and classification equipment.....	58
FIGURE 26. Mill cleanup showing central vacuum system standpipes.....	59
FIGURE 27. Mobile vacuum cleaning unit for warehouse floor cleanup.....	60
FIGURE 28. Unit loading of boxcar.....	61
FIGURE 29. Chest film interpreted as consistent with advanced pneumoconiosis with coalescence. Classified LN_1C_1	69
FIGURE 30. Chest film interpreted as consistent with advanced pneumoconiosis with coalescence bilaterally. Classified LN_1C_1	70
FIGURE 31. Chest film interpreted as consistent with advanced coalescent pneumoconiosis, with distortion of intrathoracic structure and basal emphysema. Classified LN_1C_1	71
FIGURE 32. Chest film interpreted as consistent with advanced pneumoconiosis, with coalescent densities in both upper lung fields. Classified LN_1C_1	72
FIGURE 33. Chest film interpretations classified according to type and duration of exposure.....	75

Tables

TABLE 1. Percent composition by dry weight of crude diatomite according to source.....	27
TABLE 2. Percent by weight of quartz in parent material, settled dust, and airborne dust according to product, 5 plants combined.....	27
TABLE 3. Percent by weight of cristobalite in parent material, settled dust, and airborne dust according to product, 5 plants combined.....	28

Contents

xi

Page

TABLE 4. Percent by weight of cristobalite in different size fractions of product.....	30
TABLE 5. Particle size of airborne dust according to product, 5 plants combined.....	33
TABLE 6. Atmospheric dust concentrations by product and operation, 1953-54, 5 plants combined.....	40
TABLE 7. Summary of dust concentrations according to product during initial study, 1953-54, followup study, 1954-55, and routine plant studies, 1956, 5 plants combined.....	43
TABLE 8. Age distribution of 785 diatomite workers examined in 1953-54.....	65
TABLE 9. Age distribution of 785 diatomite workers examined in 1953-54, and of workers in other industries studied by the Public Health Service.....	65
TABLE 10. Distribution by years employed in diatomite industry of 785 workers examined in 1953-54.....	65
TABLE 11. Occupational distribution of 785 diatomite workers as of 1953-54.....	66
TABLE 12. Comparison of results of interpretations of chest films of workers in the diatomite industry, taken during 1953-54, by study group.....	73
TABLE 13. Interpretations of chest films of 738 workers examined in 1953-54 by duration of employment in the diatomite industry, workers with history of other dust exposures excluded.....	74
TABLE 14. Interpretations of chest films of 738 diatomite workers examined in 1953-54 by type and duration of exposure, workers with history of other dust exposures excluded.....	76
TABLE 15. Interpretations of chest films of 738 diatomite workers examined in 1953-54 by age, workers with history of other dust exposures excluded.....	78
TABLE 16. Positive reactions to intradermal tests with tuberculin, histoplasmin, and coccidioidin in relation to interpretations of chest films of 741 diatomite workers examined in 1953-54.....	81
TABLE 17. Summary of chest films of diatomite workers interpreted as showing progression between initial study in 1953-54 and followup in 1955-56, based on 375 workers who continued at their employment.....	86

Rick,

Roy recently gave me a copy of your AP-42 section 8.29 to use as a guide or template for sections I'm writing in Chapter 8.

I realized the Diatomite process is one I performed a series of tests at for CARS a couple (or more) years ago. The objective of our study was to characterize the contribution of organic & metallic pollutants from ^{facilities} using waste oil as fuel. ~~in different processes~~ We attribute the bulk of chlorinated species to chlorinated compounds in the fuel. Other organics & metals could be from the fuel or from the raw materials. We only have limited constituent data from the fuel (supplied by the facility).

If we have this contract later, perhaps this will be of use.

MARCH



MIDWEST RESEARCH INSTITUTE

Suite 350

401 Harrison Oaks Boulevard

Cary, North Carolina 27513-2412

Telephone (919) 677-0249

FAX (919) 677-0065

Date: April 6, 1993

Subject: Background Information for Proposed AP-42 Section 8.29,
Diatomite Processing
Review and Update Remaining Sections of Chapter 8
(Mineral Products Industry) of AP-42
EPA Contract 68-D2-0159, Work Assignment 012
MRI Project 3612

From: Richard Marinshaw

To: Ron Myers
EPA/EIB/EFMS (MD-14)
U. S. Environmental Protection Agency
Research Triangle Park, NC 27711

I. INTRODUCTION

This memorandum presents the background information that was used to develop the proposed AP-42 Section 8.29 on diatomite processing. A description of the industry is presented first. A process description followed by a discussion of emissions and controls are then presented. Finally, the reference list is provided. The draft AP-42 section is provided as the attachment.

II. INDUSTRY DESCRIPTION¹⁻³

Diatomite is a chalky, sedimentary rock consisting mainly of an accumulation of skeletons formed by diatoms, which are single-celled microscopic aquatic plants. The skeletons are essentially amorphous hydrated or opaline silica but occasionally include some alumina. The Standard Industrial Classification (SIC) code for diatomite mining is 1499 (miscellaneous nonmetallic minerals, except fuels), and the SIC code for diatomite processing is 3295 (minerals and earths, ground or otherwise treated). The six-digit Source Classification Code (SCC) for diatomite processing is 3-05-026.

The unique physical properties of diatomite derive from the size, shape, and structure of individual diatom skeletons and the packing characteristics of a mass of the particles. Diatoms range in diameter from about 10 micrometers (μm) (4×10^{-4} inch [in.]) to over 500 μm (0.02 in.) and generally have a spiny structure with intricately pitted surfaces. Contact between

MRI REPORT

Assessment of Combustion Sources That Emit Polychlorinated Dioxins and Furans, Polycyclic Aromatic Hydrocarbons, and Other Toxic Compounds

Final Report

**For California Air Resources Board
Research Division**

**ARB Agreement No. A832-124
MRI Project No. 9420-M**

January 31, 1992

4.2 RECYCLED WASTE OIL FACILITIES

4.2.1 Site A

4.2.1.1 Process Description

Site A produces high purity filtration materials from diatomaceous earth. A surface mine located on property adjacent to the plant supplies raw material for the process. The facility uses diesel fuel to fire its dryers and kiln. The use of recycled waste oil as a fuel had been discontinued just prior to conducting sampling for this test program. However, the facility graciously offered to use recycled waste oil as a fuel during the test program.

This facility operates on a schedule of 10 days of operation followed by 4 days of maintenance. The facility operates three 8-hr shifts per day during manufacturing periods and one shift during maintenance periods. This schedule is kept throughout the year.

Wet diatomaceous earth is introduced to an oil-fired dryer which heats the diatomaceous earth to remove all moisture. The dried earth is air-separated, and material of designated mesh size for the specific product line is directed to the waste oil-fired rotary kiln. Processed materials from the kiln are air-separated by size and weight, and then are directed to the shipping department where they are packaged in 50-lb bags. Outsized materials are directed to the combustion gas baghouse. A schematic of Site A is included as Figure 4-1.

Combustion gases from the rotary kiln and particulate separation of the dried diatomaceous earth are directed to an eight cell fabric filter baghouse. The exhaust was sampled from an 8-ft high, 17-in x 24.5-in rectangular vertical stack located on top of the baghouse with the top of the stack 36 ft from the ground. Gases entering the baghouse are at approximately +200°F, and never greater than 250°F. Materials captured in the baghouse are recycled back through the process.

4.2.1.2 Sampling

Test program samples were collected before the entrance to the baghouse and from one of the exit stacks of the eight-cell baghouse. Operating conditions for Site A are presented in Table 4-2. Inlet samples were collected between the induced draft (i.d.) fan and the baghouse. The inlet sample location was in a curved duct section directly above and after the fan. This location was not consistent with sampling procedures specified by ARB Method 1, but there was no alternative location. The exit stack of Baghouse Cell No. 1 was the outlet sample location. This site was an acceptable sampling location based on ARB Method 1.

TABLE 4-2. SITE A - PROCESS OPERATING CONDITIONS

Parameter	Units	Run 1	Run 2	Run 3
Waste oil feed rate to kiln	gal/min	2.5	2.4	2.5
Waste oil feed rate to furnace	gal/min	1.5	1.8	1.9
Kiln temperature	°F	1,581	1,492	1,625
Combustion air flowrate	ft ³ /min	5,100	4,900	5,300
Process feed rate	tons/hr	7.25	7.00	6.75
Baghouse temperature	°F	207	220	224
Baghouse pressure drop	inWC	3.1	3.4	3.8

Sampling at Site A was conducted at the beginning of a 10-day operation schedule. During Run 1 and part of Run 2, the facility was having minor start-up problems. The main problem was the temperature of the rotary kiln. The kiln temperature fluctuated enough that product from the kiln was of a size less uniform than usual. This caused some clogging of the air separation systems. When clogging occurred, an access door to the product exit tubes was opened and excess material was removed. This was an infrequent occurrence, and only once was the upset enough to cause a disruption in sampling. All other problems were considered minor enough that sampling was continued on the premise that these were normal occurrences which produced normal emissions.

Sampling at the inlet to and outlet from the baghouse was performed by a combination of ARB Methods 428 and 429. This combination of methods was approved by CARB before this test program began. Basically, the difference is in the recovery of the sample from the trains and how the sample was split for analysis. Analytical deviations are presented in Appendix A. Sampling Methods 428 and 429 were combined into one train. The trains were washed using acetone, then methylene chloride, and then toluene to recover samples. This was the only sample recovery method deviation. Metal samples were collected using ARB Method 436.

The inlet sampling train experienced a severe sample loading problem on the filter which resulted in a sampling method deviation. Particulate matter loading in the gas stream to the baghouse was so concentrated that the particulate filter became clogged to the point that an excessive vacuum built up in the sampling system. The vacuum was so great that isokinetic sampling could not be maintained, and sampling was halted. All three tests conducted at Site A experienced this problem. Sample times ranged from 36 to 60 min for the three tests. Samples that were collected are representative of conditions in the duct for those time periods. The volume of material collected was so great that no analytical minimum volume limit was exceeded. This problem is typical of inlet sampling, i.e., prior to air pollution control devices. No other sampling deviations occurred.

4.2.1.3 Analysis Results—Site A

Data on inlet and outlet measurements of moisture content, duct/stack temperature, and velocity are provided in Table 4-3. The average flow rates, measured by the trains, identified by run number and location are also given. These rates were used to calculate PCDDs and PCDFs, PAHs, and metals emissions. It should be emphasized that the stack sampled was the No. 1 cell of an eight-cell baghouse.

TABLE 4-3. SITE A - INLET AND OUTLET SUMMARY DATA

	Sampling time (min)	Gas volume sampled (dscm)	Moisture content (% vol)	Average stack temp (C)	Stack velocity (m/sec)	Stack flow rate (dscm/min)
<u>Run 1</u>						
MM-Inlet	60	1.118	11.8	97	25.2	1,268
SV-Inlet	42	0.656	17.5	100	24.4	1,138
MM-Outlet	180	2.705	13.3	89	19.0	200
SV-Outlet	180	3.623	13.7	89	17.9	188
<u>Run 2</u>						
MM-Inlet	36	0.649	15.0	105	26.1	1,230
SV-Inlet	36	0.609	17.9	105	26.3	1,197
MM-Outlet	180	2.444	16.5	91	17.8	178
SV-Outlet	180	4.169	11.1	91	18.8	201
<u>Run 3</u>						
MM-Inlet	36	0.649	15.2	104	25.8	1,223
SV-Inlet	36	0.599	15.9	104	26.1	1,223
MM-Outlet	180	2.421	13.9	94	18.8	193
SV-Outlet	180	3.763	13.7	94	16.2	167

MM = Multiple metals sampling train, ie. method 436 train.

SV = Semivolatile sampling train, ie. combined method 428 and 429 train.

Note: Outlet samples were collected from the stack of number 1 cell of an 8-cell baghouse.

The emissions calculated are only from this one stack.

Dioxin and Furan Emissions. Table 4-4 presents the dioxin and furan results by homologs, while Table 4-5 presents the 2,3,7,8-substituted data. In conjunction with the gas sample volumes, the concentrations and emission rates of dioxins and furans in the stack gas were calculated and are provided in these tables.

In Table 4-6, using ARB's 2,3,7,8-TCDD/TCDF toxic equivalency factors, each 2,3,7,8-substituted TCDD/TCDF congener was converted to its 2,3,7,8-TCDD/TCDF equivalent, and the total 2,3,7,8-TCDD/TCDF equivalent concentration and emission rate were determined.

Polycyclic Aromatic Hydrocarbon Emissions. Table 4-7 presents the concentrations found for 17 PAHs and their calculated emission rates.

Metals Emissions. Table 4-8 presents the concentrations and emission rates for the 12 metals of interest.

Continuous Emission Measurements. During the semivolatile and metals emission sampling, continuous measurements were conducted at the inlet and outlet locations for CO, SO₂, NO_x, O₂, and CO₂. Summary data for those measurements are presented in Table 4-9. Computer-generated graphs of the real-time measurements are included in Appendix B.

Additional Information. Although it was not a requirement of the survey, analysis results of the waste oil were obtained from the facility in order to provide some perspective on the waste fuel composition. Analysis summary is provided in Appendix C.

4.2.2 Site B

4.2.2.1 Process Description

Site B produces magnesium oxide which is used in the manufacturing of refractory firebrick and related materials. Ore is excavated from nearby mines and processed in high-temperature reducing kilns to form magnesium oxide. Recycled waste oil is used to fire the rotary kilns.

Raw magnesium ore is combined with water and mixed in a pug mill prior to introduction to the oil-fired kiln. The material is in a wet paste form when it enters the kiln. Processed material falls out the exit end of the kiln into cooling trays and then onto a belt which conveys it to a storage bin. A schematic of Site B is included as Figure 4-2.

TABLE 4-4. SITE A - DIOXIN/FURAN RESULTS FOR MM5-SV SAMPLES

Analyte	Blank Inlet	Blank Outlet	Run 1		Run 2		Run 3	
			Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Sample volume (dscm)			0.656	3.623	0.609	4.169	0.599	3.763
Stack flow rate (dscm/m)			1,138	188	1,197	201	1,223	167
Concentration CO ₂ (%)			1.8	2.2	3.2	2.3	3.4	2.3
Dioxins (pg)								
TCDD		564	302	409	320	355	354	283
PeCDD		270	241	330	243	103	194	54.1
HxCDD		281	338	769	312	271	336	116
HpCDD		181	249	495	272	235	181	135
OCDD		715	324	483	391	283	295	238
Total (pg)		2,011	1,454	2,486	1,538	1,247	1,360	826
Total (ng/dscm)	3.24 ^a	0.522 ^a	2.22	0.686	2.53	0.299	2.27	0.220
Total (ng/dscm @ 12% CO ₂)	13.9	2.76	14.8	3.74	9.47	1.56	8.01	1.15
Total (lb/hr)	5.08E-07	1.28E-08	3.34E-07	1.71E-08	4.00E-07	7.95E-09	3.67E-07	4.85E-09
Furans (pg)								
TCDF		2,110	6,540	3,460	3,900	1,560	1,880	1,260
PeCDF		1,800	559	1,040	888	653	492	421
HxCDF		431	411	966	314	335	144	187
HpCDF		69.8	192	612	204	184	127	95.4
OCDF		58.4	61.1	130	50.3	2.93 ^a	2.9 ^a	37.2
Total (pg)		4,469	7,783	6,208	5,356	2,735	2,646	2,001
Total (ng/dscm)	7.19 ^a	1.16 ^a	11.8	1.71	8.80	0.656	4.42	0.532
Total (ng/dscm @ 12% CO ₂)	30.8	6.14	78.9	9.35	33.0	3.42	15.6	2.77
Total (lb/hr)	1.13E-06	2.84E-08	1.78E-06	4.26E-08	1.39E-06	1.74E-08	7.15E-07	1.17E-08
Total Dioxins and Furans								
Conc. (ng/dscm @ 12% CO ₂)	44.7	8.91	93.7	13.1	42.5	4.98	23.6	3.92
Emission rate (lb/hr)	1.64E-06	4.12E-08	2.12E-06	5.97E-08	1.79E-06	2.54E-08	1.08E-06	1.66E-08
Surrogate recovery (%)								
13C-2,3,7,8-TCDF		106	97	101	121	100	109	125
13C-2,3,7,8-TCDD		103	97	96	111	97	92	124
13C-1,2,3,7,8-PeCDF		100	113	110	117	94	93	124
13C-1,2,3,7,8-PeCDD		97	102	100	119	95	97	129
13C-1,2,3,4,7,8-HxCDF		128	139	149	142	120	129	152
13C-1,2,3,6,7,8-HxCDD		114	105	98	114	108	101	127
13C-1,2,3,4,6,7,8-HpCDF		114	141	128	145	124	122	152
13C-1,2,3,4,6,7,8-HpCDD		98	118	125	120	121	127	162
13C-12-OCDD		98	101	117	118	111	118	144
37Cl-2,3,7,8-TCDD ^c		95	94	98	94	93	94	92
13C-2,3,4,7,8-PeCDF ^a		94	90	93	95	95	97	99
13C-1,2,3,6,7,8-HxCDF ^a		77	71	71	75	81	72	75
13C-1,2,3,4,7,8-HxCDD ^a		93	91	108	101	96	103	101
13C-1,2,3,4,7,8,9-HpCDF ^a		85	94	93	86	88	91	99

a. None detected. value shown is the detection limit. "Totals" calculated using half the detection limit.

b. Blank train "emissions" calculated using average flow rates from each location.

c. Field surrogates spiked into XAD prior to sample collection.

Note: Outlet samples were collected from the stack of number 1 cell of an 8-cell baghouse. The emissions calculated are only from this one stack.

TABLE 4-7. SITE A - PAHs EMISSIONS RESULTS FOR MM5-SV SAMPLES

	Run 1		Run 2		Run 3		Blank Inlet	Blank Outlet
	Inlet	Outlet	Inlet	Outlet	Inlet	Outlet		
Sample volume (dscm)	0.656	3.623	0.609	4.169	0.599	3.763		
Stack flow rate (dscm/m)	1138	188	1197	201	1223	167		
Concentration CO ₂ (%)	1.8	2.2	3.2	2.3	3.4	2.3		
PAHs (ug)								
Naphthalene	173	457	149	446	241	555		20.5
Acenaphthylene	14.3	61	18.9	53.5	15.7	70.7		0.1 a
Acenaphthene	5.61	28.9	8.62	27.9	9.03	35.4		0.102
Fluorene	17.5	66.1	22.4	62.3	23.5	77.2		0.278
Phenanthrene	22.2	59.7	27.7	50.4	31.2	66.3		0.342
Anthracene	25.6	70.9	2.03	4.16	4.38	7.94		0.381
Fluoranthene	3.49	3.65	4.48	2.65	7.05	7.52		0.173
Pyrene	3.49	2.97	4.11	2.53	6.32	6.67		0.179
Retene	0.1 a	0.389	0.538	0.272	0.664	0.63		0.1 a
Benz(a)anthracene	1.7	0.218	1.96	0.216	2.74	0.23		0.175
Chrysene	1.65	0.306	1.89	0.268	2.69	0.161		0.172
Benzo(b)fluoranthene	0.352	0.164	0.544	0.1 a	0.84	0.1 a		0.1 a
Benzo(k)fluoranthene	0.352	0.164	0.508	0.1 a	0.679	0.1 a		0.1 a
Benzo(a)pyrene	0.45	0.381	0.497	0.245	0.769	0.256		0.229
Indeno(1,2,3-cd)pyrene	0.1 a	0.1 a	0.187	0.1 a	0.305	0.1 a		0.1 a
Dibenz(a,h)anthracene	0.1 a	0.1 a	0.1 a	0.1 a	0.1	0.1 a		0.1 a
Benzo(ghi)perylene	0.473	0.1 a	1.18	0.1 a	1.01	0.1 a		0.1 a
Total PAHs (ug)	270	752	245	651	348	829	23.2	23.2
Total PAHs (ug/dscm)	412	208	402	156	581	220	37.4	6.03
Total PAHs (ug/dscm @ 12%)	2,749	1,132	1,506	815	2,050	1,149	160	31.9
Total PAHs (lb/hr)	0.0621	0.00516	0.0636	0.00415	0.0940	0.00486	0.00587	0.000148
FIELD SURROGATES RECOVERY								
D10-1-Methylnaphthalene	55%	70%	73%	60%	38%	66%		56%
D12-Perylene	72%	80%	91%	91%	86%	86%		96%
LAB SURROGATES RECOVERY								
D8-Naphthalene	34%	42%	51%	27%	8%	37%		29%
D10-Acenaphthene	69%	70%	77%	69%	66%	71%		72%
D10-Fluorene	77%	75%	82%	76%	77%	78%		80%
D10-Phenanthrene	84%	88%	89%	92%	88%	95%		85%
D10-Anthracene	79%	81%	83%	85%	79%	82%		83%
D10-Fluoranthene	87%	86%	88%	94%	86%	95%		86%
D10-Pyrene	86%	92%	87%	93%	85%	95%		89%
D12-Benz(a)anthracene	72%	91%	90%	97%	88%	98%		90%
D12-Chrysene	76%	94%	90%	98%	90%	100%		92%
D12-Benzo(a)pyrene	69%	88%	94%	96%	88%	96%		98%

Note: Outlet samples were collected from the stack of number 1-cell of an 8-cell baghouse. The emissions calculated are only from this one stack.

(a): Values shown are the detection limits which were calculated as 2.5 times the baseline noise level.

TABLE 4-8. SITE A - ANALYSIS RESULTS FOR MM5-MM (METALS) TRAIN

	Ag	As	Ba	Cd	Cr	Cu	Hg	Mn	Ni	Pb	Se	Zn
Run 1												
<u>Inlet</u>												
Rinse and filter, ug	243	<181	1153	<15.7	554	<38.2	<1.29	246	94.7	1,349	795	1,855
Nitric acid Impingers, ug	<1.63	<8.29	3.94	1.48	12.1	<1.54	<1.08	24.9	4.48	6.12	3.00	33.1
KMnO4 Impingers, ug	NA	NA	NA	NA	NA	NA	2.38	NA	NA	NA	NA	NA
Total, ug	243	<189	1,157	<17.2	568	<39.7	<4.75	271	99.1	1,355	798	1,888
Concentration, ug/dscm	217	<169	1,035	<15.4	507	<35.5	<4.25	242	88.7	1,212	714	1,510
Emissions, lb/hr	0.0365	<0.0284	0.174	<0.00258	0.0850	<0.00598	<0.000713	0.0406	0.0149	0.203	0.120	0.253
<u>Outlet</u>												
Rinse and filter, ug	<1.24	37.8	2.50	52.9	16.7	15.1	0.120	16.0	95.0	56.5	65.1	<6.29
Nitric acid Impingers, ug	<8.29	<8.29	2.14	4.60	29.6	<1.54	<1.21	124.88	6.24	9.69	27.1	41.8
KMnO4 Impingers, ug	NA	NA	NA	NA	NA	NA	1.71	NA	NA	NA	NA	NA
Total, ug	0	37.8	4.64	57.5	48.3	15.1	<3.04	12,504	100.2	66.2	92.2	<48.1
Concentration, ug/dscm	0	14.0	1.72	21.3	17.1	5.59	<1.12	4,622	37.0	24.5	34.1	<17.8
Emissions, lb/hr	0	0.000370	0.0000454	0.000562	0.000000	0.000148	<0.0000297	0.122	0.000880	0.000647	0.000902	<0.000471
Run 2												
<u>Inlet</u>												
Rinse and filter, ug	122	<163	1151	21.6	527	<34.2	<1.21	257	137	1329	825	1886
Nitric acid Impingers, ug	<1.63	<8.29	2.16	6.98	3.76	3.02	<0.918	26.5	2.84	6.73	<2.24	48.5
KMnO4 Impingers, ug	NA	NA	NA	NA	NA	NA	<0.612	NA	NA	NA	NA	NA
Total, ug	122	<171	1,163	28.5	531	<37.2	<2.74	283	140	1,338	825	1,733
Concentration, ug/dscm	188	<263	1,776	44.0	818	<57.4	<1.01	436	216	2,059	1,272	2,670
Emissions, lb/hr	0.0306	<0.0429	0.000716	0.00716	0.133	<0.00933	<0.0000267	0.0709	0.0351	0.335	0.207	0.434
<u>Outlet</u>												
Rinse and filter, ug	33.3	95.6	2.04	43.5	<1.32	32.6	0.168	13.1	58.1	42.3	55.3	<62.9
Nitric acid Impingers, ug	<1.63	<8.29	1.50	3.68	3.22	6.31	<1.53	31.6	11.7	15.3	5.94	111
KMnO4 Impingers, ug	NA	NA	NA	NA	NA	NA	0.531	NA	NA	NA	NA	NA
Total, ug	33.3	95.6	3.54	47.20	<4.54	38.9	<2.23	329	69.8	57.6	61.2	<174
Concentration, ug/dscm	13.6	39.1	1.45	19.31	<1.86	15.9	<0.912	135	28.5	23.6	25.1	<71.2
Emissions, lb/hr	0.000321	0.000921	0.0000341	0.000455	<0.0000437	0.000375	<0.0000215	0.00317	0.000872	0.000555	0.000590	<0.00168
Run 3												
<u>Inlet</u>												
Rinse and filter, ug	145	<157	1162	29.0	563	<33.1	2.91	265	138	1467	814	2788
Nitric acid Impingers, ug	<1.63	<8.29	1.05	1.18	2.70	<1.54	<0.966	13.8	7.25	3.47	<2.24	10.1
KMnO4 Impingers, ug	NA	NA	NA	NA	NA	NA	<0.482	NA	NA	NA	NA	NA
Total, ug	145	<165	1,163	30.2	565	<34.6	<4.36	279	145	1,470	814	2,789
Concentration, ug/dscm	224	<254	1,793	46.5	871	<53.3	<6.71	429	224	2,265	1,255	4,312
Emissions, lb/hr	0.0362	<0.0411	0.0290	0.00752	0.141	<0.00982	<0.00109	0.0694	0.0363	0.368	0.203	0.688
<u>Outlet</u>												
Rinse and filter, ug	<1.23	33.3	2.68	12.5	<1.32	9.13	0.0862	4.55	91.4	55.2	45.4	<6.29
Nitric acid Impingers, ug	2.49	<8.29	1.63	3.69	71.0	<1.54	<1.89	533.33	3.47	21.7	95.1	24.1
KMnO4 Impingers, ug	NA	NA	NA	NA	NA	<0.202	<0.202	NA	NA	NA	NA	NA
Total, ug	<3.72	<41.6	4.51	16.4	71.0	<10.7	<2.28	53.337	94.9	76.9	111	<30.4
Concentration, ug/dscm	<1.54	<17.2	1.66	6.78	29.3	<4.42	<0.941	22.031	39.2	31.8	45.6	<12.6
Emissions, lb/hr	<0.0000392	<0.000438	0.0000476	0.000173	0.000748	<0.000113	<0.0000240	0.562	0.00100	0.000811	0.00117	<0.000322
Blank train												
Rinse and filter, ug	<1.24	29.0	1.29	7.43	<1.32	1.96	0.0838	0.842	86.3	55.0	21.6	<6.29
Impingers 1-6, ug	<1.63	<8.29	0.371	0.332	1.02	<1.54	<0.259	12.1	<0.542	2.14	<2.24	11.0
Total, ug	<2.87	<37.3	1.66	7.76	<2.34	<3.50	<0.343	12.9	86.3	57.1	<23.8	<17.3

NA = Not applicable.

Note: The outlet samples were collected from the stack of cell-1 of an 8-cell baghouse. The emissions calculated are only from this one stack.

TABLE 4-9. SITE A -- CONTINUOUS EMISSION MEASUREMENTS

Run	Inlet		12% CO ₂							
			O ₂	CO ₂	CO	SO ₂	NO _x	CO	SO ₂	NO _x
Run 1	Inlet	Avg	19.0	1.8	196.1	3.3	30.5	1421.6	21.3	197.4
		Max	20.4	2.6	216.7	3.9	35.0	2798.6	29.1	271.5
		Min	.0	.8	169.0	2.7	27.0	956.4	17.0	147.6
	Outlet	Avg	17.9	2.2	173.9	32.1	19.3	959.1	171.0	106.2
		Max	19.6	2.8	200.5	136.8	22.0	1244.1	608.0	119.4
		Min	16.3	1.7	150.1	14.8	15.6	724.7	87.5	75.6
	Inlet	Avg	17.3	3.2	247.3	5.1	27.0	947.1	20.1	103.2
		Max	18.2	3.8	282.0	9.4	32.0	1656.3	59.0	169.5
		Min	16.5	1.8	216.7	.4	24.0	724.4	1.4	83.9
Run 2	Inlet	Avg	17.3	3.2	247.3	5.1	27.0	947.1	20.1	103.2
		Max	18.2	3.8	282.0	9.4	32.0	1656.3	59.0	169.5
		Min	16.5	1.8	216.7	.4	24.0	724.4	1.4	83.9
	Outlet	Avg	20.8	2.3	198.2	62.3	21.1	1025.8	311.8	109.3
		Max	21.4	3.0	234.4	166.5	25.3	1256.5	688.2	130.9
		Min	19.5	1.9	167.5	21.2	19.1	788.2	120.0	88.4
	Inlet	Avg	17.1	3.4	269.0	9.1	25.0	965.5	32.7	90.0
		Max	17.6	4.5	332.4	22.9	27.0	1590.1	78.0	113.2
		Min	16.0	2.1	223.6	3.8	11.0	728.9	11.9	57.8
Run 3	Inlet	Avg	17.1	3.4	269.0	9.1	25.0	965.5	32.7	90.0
		Max	17.6	4.5	332.4	22.9	27.0	1590.1	78.0	113.2
		Min	16.0	2.1	223.6	3.8	11.0	728.9	11.9	57.8
	Outlet	Avg	20.1	2.3	226.7	55.7	22.0	1185.6	271.5	115.3
		Max	22.6	3.1	279.9	252.7	24.1	1503.2	981.4	132.4
		Min	17.4	1.9	184.1	20.4	15.3	851.8	118.8	76.5

SITE A: WASTE OIL COMPOSITION (Obtained from Facility)

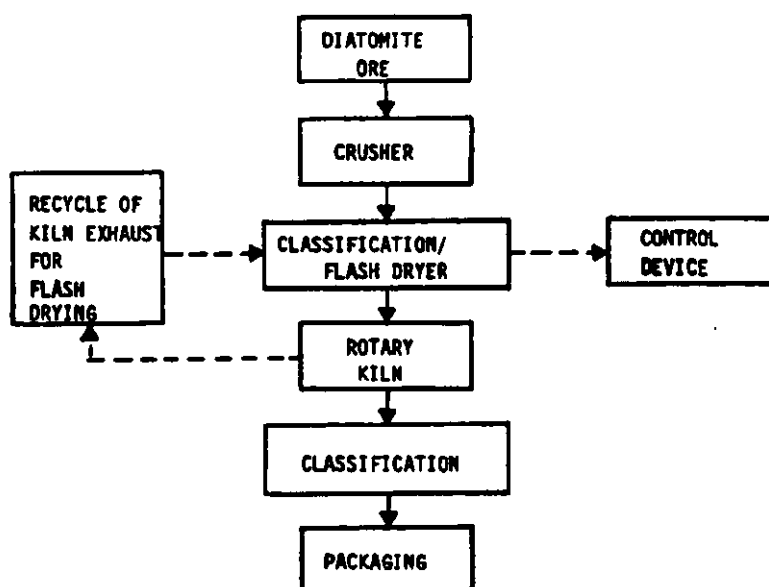
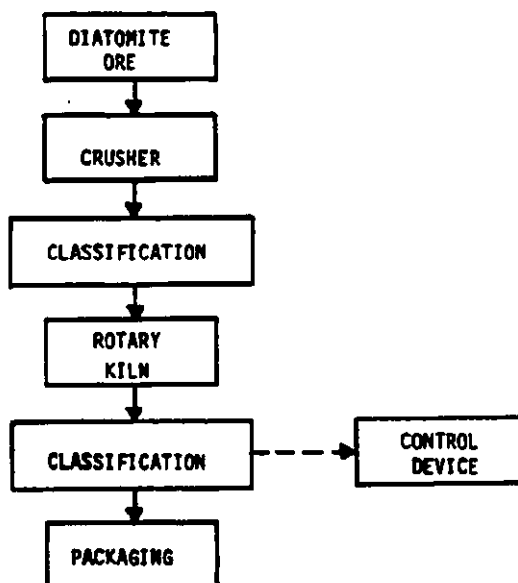
<u>Analyte</u>	<u>Concentration (ppm)*</u>
As	0.2
Cd	0.2 -2
Cr	0.5 - 2
Pb	1.5 - 25

* Data provided by plant for waste oil analysis conducted during February - April 1990.

SITE B: WASTE OIL COMPOSITION (Obtained from Facility)

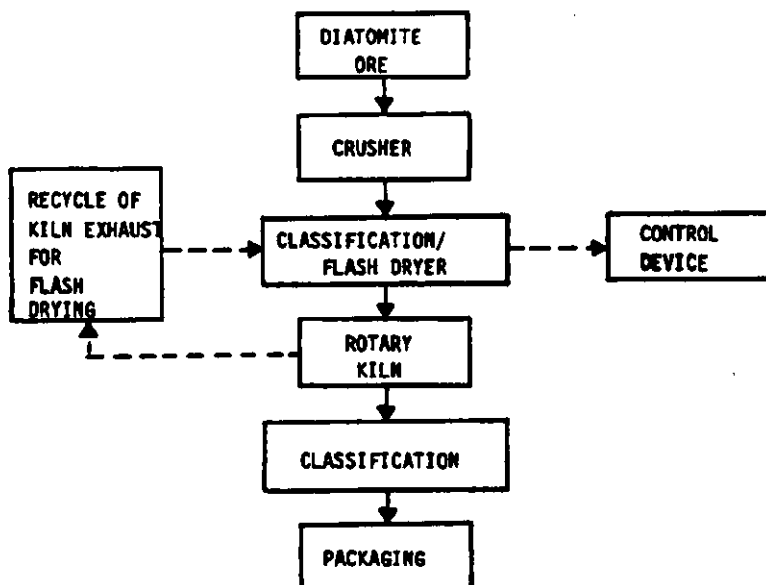
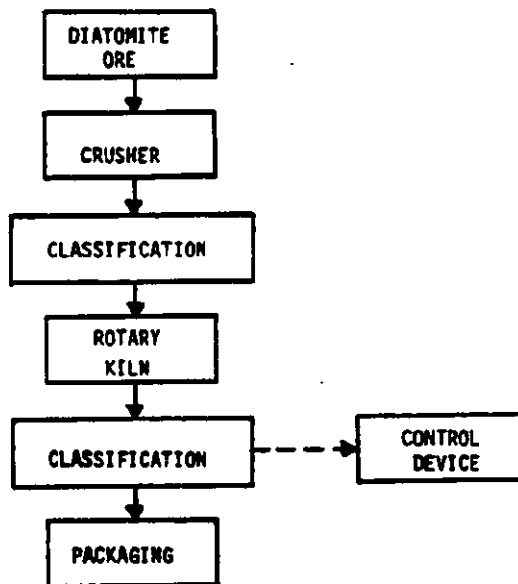
<u>Analyte</u>	<u>Result (mg/Kg)*</u>	<u>Reporting Limit (mg/Kg)</u>	<u>EPA Method</u>
Antimony	ND	2.5	6010
Arsenic	ND	1.3	6010
Barium	0.90	0.25	6010
Beryllium	ND	0.35	6010
Cadmium	ND	0.25	6010
Chromium (total)	0.26	0.25	6010
Cobalt	ND	0.25	6010
Copper	5.7	0.5	6010
Lead	4.7	1.3	7420
Mercury	ND	0.1	7471
Molybdenum	2.3	0.25	6010
Nickel	6.8	0.25	6010
Selenium	ND	1.3	6010
Silver	ND	0.5	6010
Thallium	ND	2.5	6010
Vanadium	11	0.5	6010
Zinc	73	0.25	6010

* Data provided by plant for waste oil analysis on sample submitted on 9/5/90.



————→ PROCESS FLOW

- - - - -> AIRFLOW



→ PROCESS FLOW

- - - - -> AIRFLOW