Dust Monitoring of a Polypropylene Film Densification Process at a Small-Scale Plastics Facility

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DUST MONITORING OF A POLYPROPYLENE FILM DENSIFICATION PROCESS AT A SMALL-SCALE PLASTICS FACILITY

FINAL REPORT

Prepared for:

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Report No. PL-97-7

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EXECUTIVE SUMMARY

This study samples indoor dust levels generated by sortation and densification operations at a small-scale plastic recycling facility. Both respirable nuisance dust and total nuisance dust levels are observed as time-weighted averages on two typical production days during which polypropylene film is being densified. The goal of the study is to gather basic information regarding dust levels, in order to assist in the evaluation and selection of adequate dust control options. Testing is performed for informational purposes only, and the results are not statistically valid for the demonstration of compliance or noncompliance with any industrial standard.

For the purposes of this study, the polypropylene dust generated during the densification process is considered to be in the category of a nuisance dust, i.e., a dust that is generally innocuous and not recognized as the cause of serious pathological conditions. Because exposure to high concentrations of any dust, regardless of chemical toxicity level, can cause respiratory disruption, the United States Occupational Safety and Health Administration (OSHA), under the Code of Federal Regulations 29 CFR 1910.1000, regulates exposure to nuisance dust in the workplace. Allowable exposure is regulated via permissible exposure limits (PELs), or time-weighted averages (TWAs) that are not to be exceeded for an 8-hour workday within a 40-hour workweek. Regulatory exposure levels exist for both total nuisance dust and respirable nuisance dust. Federal regulations require that exposure to any regulated indoor air contaminant, including nuisance dust, not exceed the documented PELs. In addition, individual states have the ability to set PELs that are more restrictive than the federal regulations. Compliance with PELs can be achieved through administrative controls (operational training, employee rotation to reduce exposure, etc.) and/or engineering controls (site ventilation, use of respirators, etc).

While the results of this study cannot be used to determine compliance or noncompliance with PELs, the measurements provide estimates of the magnitude and distribution of dust levels in the facility. A preliminary review of available research indicates that human physiological responses to polypropylene fibers appear to be similar to other "inert" types of fibers and dusts. However, evidence is not available to preclude the potential for harmful effects, particularly regarding exposures to dust concentrations near or above PELs. In high concentrations, any nuisance dust

can cause respiratory disruptions by restricting respiratory airflow due to muscle stimulation or excess mucus production. Dust may also exacerbate existing chronic health conditions, such as emphysema and bronchitis. In general, it is advisable to keep the levels of any nuisance dust as low as is practical.[1]

In this study, four respirable nuisance dust samples and four total nuisance dust samples are collected during two typical processing days. Dust measurements are taken in the densification area, which exhibits the highest level of visible dust, and also in the sorting area, which exhibits a much lower level of visible dust. During the two tests, the densification process operates at 86% and 97% respectively of the rated production capacity of 1,000 pounds per hour.

Respirable dust level measurements in the densifier area, the sorting area, and the forklift operations area, range from 0.13 milligrams per cubic meter (mg/m^3) to 1.20 mg/m^3. For comparative purposes, the measured respirable dust values are well below the U.S. Occupational Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) PEL for respirable nuisance dust of 5 mg/m^3.

Total dust level measurements in the sorting area range from 0.22 mg/m^3 to 0.27 mg/m^3, and in the densifier area from 12.83 mg/m^3 to 18.20 mg/m^3. For comparative purposes, the measured total dust values in the sorting area are well below the OSHA PEL for total nuisance dust of 15 mg/m^3 and the WISHA PEL of 10 mg/m^3; however, the measured total dust values in the densifier area exceed the PEL. Higher total dust values in the densifier area indicate that the facility could benefit substantially from dust control measures targeted toward the densification equipment.

This study is not a statistical sampling, and thus the measurements are invalid for the determination of compliance or noncompliance with federally mandated or state-mandated PELs. However, test data provides information on the level, type, and location of dust in the work environment, and this information is useful for the evaluation of ventilation options.

[1] National Safety Council, pp 171-200.

The respirable nuisance dust measurements taken in all test areas are 76% to 97% lower than the WISHA PEL value. The total nuisance dust measurements in the sorting area are 97% to 98% lower than the WISHA PEL, while those in the densifier area are 28% to 82% higher.

Comparing respirable and total dust measurements, this facility's polypropylene film densification process generates more nonrespirable than respirable particles. These nonrespirable particles are also confined to the densifier equipment area, indicating that a localized ventilation solution, such as a vacuum hood system, may be sufficient to adequately reduce excess dust. If respirators are selected as a means of controlling dust exposure in Washington State, then the appropriate minimum requirements must be met. [2]

[2] General Occupational Health Standards, WAC 296-62-07109, Volume I, State of Washington, Department of Labor and Industries.

1.0 OBJECTIVES OF STUDY

The objective of this study is to gather basic information regarding dust levels, in order to assist in the evaluation and selection of adequate dust control options for a recycled polypropylene film densification process. The measurements are performed for informational purposes only, and the results are not statistically valid for the demonstration of compliance or noncompliance with federally regulated permissible exposure limits. Other potential indoor air contaminants are not considered during this study.

2.0 SAMPLING PLAN AND METHODOLOGY

2.1 CHOICE OF ANALYTES

This study monitors total nuisance dust and respirable nuisance dust generated by a recycled polypropylene plastic densification process. Total nuisance dust refers to the total amount of dust to which an employee is exposed, while respirable nuisance dust refers to the respirable fraction (or fraction of dust particles that are less than ten (10) microns in size).

Other potential indoor air contaminants are not addressed in this study. Research indicates that the high-temperature heating of plastics (i.e., above 200°C), such as heating that occurs during initial processing or incineration, can result in the release of various chemicals. These chemicals may include monomers, additives, plasticizers, or other thermal decomposition products. However, the temperature range of the polypropylene densification process under consideration in this study is much lower (80°C to 105°C), and potential chemical releases are not considered.

2.2 SAMPLING AND ANALYTICAL METHODOLOGY

All samples are collected using personal monitoring pumps and pre-weighed polyvinyl chloride filters, placed in preloaded cassettes. The pore size of the filters is five microns, in accordance with the applicable National Institute of Occupational Safety and Health (NIOSH) analytical methods. The filters are 152 microns thick, with a typical 99.94% aerosol retention. Aluminum cyclones, made by Mine Safety Appliances Co. (MSA), are used to restrict the particle size collected for the respirable dust samples.

The following analytical methods are used:

- Respirable nuisance dust: NIOSH 0600
- Total nuisance dust: NIOSH 0500

Both methods involve weighing the filters after samples are collected, and comparing with the pre-sample filter weights. Time-weighted-average results are calculated in the accredited testing laboratory using volume data (the volume of air pumped through the filter) from the test site.

The sampling plan for this study is loosely based on an initial sampling strategy known among industrial hygienists as an "exposure screening program", or “screening." The purpose of “screening” is to selectively obtain exposure estimates for "maximum-risk" workers.[3] In this study, of the eight employees in the processing area, the densifier operator appears to be subject to more visible dust exposure than any of the other seven employees.   These seven other employees appear to have a similarly reduced exposure to visible dust, when compared with the densifier operator. A true “screening” program (which requires a 90% probability that the sample contains at least one employee in addition to the "high-risk" employee, in the top 10% of the exposures for that group) would have required sampling six of the seven additional employees. Because the goal of this project is to obtain basic information to assist in the evaluation of dust control options, such a large sample size is not required.

American Society for Testing and Materials (ASTM) Standard D 4532-92 is used as a guideline for sampling respirable dust.[4] Although much of this method relates to laboratory procedures, the guidelines on sampling are followed to the maximum extent possible. Specifically, the pumps run for fifteen minutes before sampling, to stabilize the flow rate. Airflow through the cartridges is measured with a calibrated rotometer three to four times during the sampling events. A flow rate of 1.7 liters per minute is maintained as closely as possible. An attempt is made to keep the cyclones and filter cartridges within the prescribed worker's breathing zone of 300 millimeters

[3]Leidel and Busch. pp. 523-532.
[4]ASTM. pp. 309-313.

from the eyes. However, because the cyclone interferes with employee activities that involve repeated bending, the limits of this breathing zone may be slightly extended.

The testing procedures are designed to measure conditions over the duration of two sampling events. The sampling events occur on two different days, over a period of at least seven hours for each sample unit. When calculating the volume of air pumped through the filters, time spent at normal lunch or breaks is not subtracted. Full plant production capacity for polypropylene film densification at the test site is rated at 6,500 pounds in 6.5 hours, or 1,000 pounds per hour. The production capacity for the two sampling days is 858 pounds per hour (86% of capacity) and 973 pounds per hour (97% of capacity).

Two respirable nuisance dust samples and two total nuisance dust samples are collected in the densification area. One respirable nuisance dust sample and two total nuisance dust samples are collected in the sorting area. One respirable nuisance dust sample is collected from the forklift operator, whose responsibilities require transporting materials between the densification area and the sorting area.

During the sampling event, participating employees are instructed to maintain “normal” working conditions, since the testing goal is to sample “normal” conditions to the maximum extent possible. Observations are made periodically by the test director during the sampling event to ensure that the monitors are worn properly and that the instruments are functioning correctly. Observations are also made periodically by the facility supervisor to ensure that normal work conditions are being maintained by employees during the testing.

2.3 FACILITY DESCRIPTION

Eight employees typically work in the processing area during an eight hour day-shift. One employee operates the densifier; six employees work in the sorting area; and one employee operates a forklift that travels between the densifier and the sorting area. Based on visual inspection of the facility during a typical processing day, the densification area clearly generates the most significant portion of visible dust. Thus, the one employee manning the densification area is exposed to a higher level of visible dust than any of the other seven employees in the processing area. For the purposes of this study, data is collected during two work shifts on the densifier operator, during one work shift on the fork-lift operator, and during one work shift for an employee in the sorting area.

2.4 TESTING

Four respirable nuisance dust samples and four total nuisance dust samples are collected during two days. The densifier operator participates both days, wearing equipment to collect one respirable dust sample each day. One total dust sample is collected each day in the densifier work area, with the sampling equipment placed at a stationary location on the densifier loading platform. One total dust sample is collected each day from sampling equipment placed at a stationary location in the sorting area. One respirable dust sample is also collected from an employee in the sorting area, and one respirable dust sample is collected from the forklift operator.

Data collected during the sampling events is provided in Appendices A through C. *Appendix A: Field Sampling Data Sheets*, contains copies of the original data collection sheets. *Appendix B: Field Sampling Data/Chain of Custody Form Submitted to Laboratory*, contains summary data sheets submitted to the testing laboratory. *Appendix C: Sampling Data Calculation Spreadsheets,* consists of two spreadsheets (one spreadsheet contains the total air volume to which the sample filters were exposed, and the other spreadsheet contains incremental rotometer flow rates calculated from instrument calibration values).

3.0 SUMMARY OF RESULTS

Table 3-1 summarizes dust monitoring results for both days of testing. Laboratory reports of the analysis results are provided in *Appendix D: Laboratory Reports*. Analysis results provide average concentrations (in milligrams per cubic meter) of each contaminant, over the exposure period for each sampling participant or stationary sampling unit.

TABLE 3-1: Dust Monitoring Summary of Results

Work Area	Date	Sample Number	Contaminant	WA State PEL[5] (mg/m^3)	Result[6] (mg/m^3)	Sample Time (hrs:min)	Comments
Densifier	1/11/96	D-R-1	Respirable Dust	5	0.14	7:33	A[7]
	1/16/96	D-R-2	Respirable Dust	5	1.20	8:00	B[8]
	1/11/96	D-T-1	Total Dust	10	12.83	7:29	A
	1/16/96	D-T-2	Total Dust	10	18.20	8:11	B
Sorting Area	1/11/96	S-T-1	Total Dust	10	0.22	7:00	A
	1/16/96	S-T-2	Total Dust	10	0.27	7:49	B
	1/11/96	S-R-1	Respirable Dust	5	0.13	7:02	A
Forklift Driver	1/16/96	F-R-2	Respirable Dust	5	0.27	7:55	B

Respirable dust level measurements in the densifier area, the sorting area, and the forklift operations area range from 0.13 milligrams per cubic meter (mg/m^3) to 1.20 mg/m^3. The measured respirable dust values are well below the U.S. Occupational Safety and Health Administration (OSHA) PEL for respirable nuisance dust of 5 mg/m^3.

Total dust level measurements in the sorting area range from 0.22 mg/m^3 to 0.27 mg/m^3, and in the densifier area from 12.83 mg/m^3 to 18.20 mg/m^3. The measured total dust values in the sorting area are well below the OSHA PEL for total nuisance dust of 10 mg/m^3; however, the measured values in the densifier area are in excess of the OSHA PEL, indicating that the densifier area of the processing plant could benefit substantially from targeted dust control measures.

[5]For comparative purposes only. PEL = permissible exposure limit. This value is an eight-hour time-weighted average.
[6]Results are time-weighted averages, averaged out over the sample time (see "sample time" column).
[7]Comment A = 5,436 pounds of polypropylene film was processed by the densifier in five hours, twenty minutes of production time. Reportedly, full production capacity is 6,500 pounds in six hours, thirty minutes.
[8]Comment B = 4,734 pounds of polypropylene film was processed by the densifier in four hours, fifty-two minutes of production time.

4.0 DISCUSSION OF RESULTS

4.1 PERSPECTIVES REGARDING PERMISSIBLE EXPOSURE LIMITS (PELs) AND THRESHOLD LIMIT VALUES (TLVs)

Permissible exposure limits (PELs) are federal and state regulatory exposure limits for airborne contaminants "based on the best available information from industrial experience, from experimental human and animal studies, and, when possible, from a combination of the three. The basis on which the values are established may differ from substance to substance; protection against impairment of health may be a guiding factor from some, whereas reasonable freedom from irritation, narcosis, nuisance or other forms of stress may form the basis for others."[9] Permissible exposure limits are "intended for use in the practice of industrial hygiene"[10] and should be interpreted and applied using industrial hygiene principles.

The U.S. Occupational Safety and Health Administration (OSHA) federal regulations for nuisance dust are found in the Code of Federal Regulations 29 CFR 1910.1000. Individual states may have regulations that are more restrictive than the federal regulations. For instance, the Washington Industrial Safety and Health Act (WISHA), which is Washington State's safety and health plan administered by the State Department of Labor and Industries, requires a maximum PEL for total nuisance dust of 10 mg/m^3, versus the OSHA maximum of 15 mg/m^3. Both WISHA and OSHA require a maximum PEL for respirable nuisance dust of 5 mg/m^3.

Permissible exposure limits for most airborne contaminants have been derived by OSHA in part from threshold limit values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH). TLVs are recommended, nonregulatory exposure limits. PELs may be stricter or less strict than TLVs. Table 4-1 summarizes the PEL and TLV[11] values for nuisance dust that can be used for comparative purposes with respect to this study.

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[9] General Occupational Health Standards, WAC 296-62-07501(5), Volume I, State of Washington, Department of Labor and Industries.
[10] General Occupational Health Standards, WAC 296-62-07501(8), Volume I, State of Washington, Department of Labor and Industries.
[11] ACGIH. 1995. p. 29.

TABLE 4-1: PEL and TLV Values for Nuisance Dust

	ACGIH TLV	OSHA PEL (Federal)	WISHA PEL (WA State)
Total (Inhalable) Particulates Not Otherwise Classified (PNOC)	10 mg/m^3	15 mg/m^3	10 mg/m^3
Respirable PNOC	3 mg/m^3	5 mg/m^3	5 mg/m^3

While PELs and TLVs are good guideposts, strict adherence to designated levels does not guarantee a lack of problems associated with worker exposure to airborne contaminants. In general, the National Safety Council advises that it is prudent to keep the levels of any nuisance dust as low as is practical. Although not required by regulatory agencies, efforts to move beyond compliance are viewed as consistent with the proper practice of industrial hygiene.[12]

4.2 POTENTIAL HEALTH EFFECTS OF POLYPROPYLENE DUST

The human breathing apparatus normally has the capacity to handle a significant amount of dust.[13] The upper respiratory system has the ability to filter out particles larger than ten microns.[14] Preliminary research indicates that polypropylene fibers are not likely to pose a high risk of causing serious fibrosis conditions.[15] A search of the MEDLINE[16] database indicates that the fibrogenicity of inhaled polypropylene fiber has been observed to be considerably less than that of dusts that are typically associated with fibrosis conditions, such as asbestos or silicaasbestos or silica.[17] One study indicates that "no fibrosis was observed . . ." in a study of the effects of inhaled polypropylene fiber in rats, and that "minimal or mild increases in cellularity (referring to cellular response to the fibers) appeared to be reversible, especially at lower doses . . ."[18] This preliminary research does not preclude the potential for some harmful effects, especially regarding exposures to high concentrations. However, the documented responses to polypropylene fibers appear to be similar to other "inert" types of fibers and dusts.

This study samples nuisance dust levels generated by a recycled polypropylene densification process; other potential indoor air contaminants are not addressed. It should be noted, however,

[12]Powell, C. H. 1985. p. 368.
[13]Wright, G. W. p.289.
[14]Wright, G. W. p. 296.
[15]Hesterberg, T. W. et al. p. 358.
[16] MEDLINE is a compilation of references to approximately 3,600 biomedical journals, maintained by the U. S. National Library of Medicine.
[17]Cambelov'a, M. and Juck, A. p. 343.

that several studies have attempted to assess potential chemical exposures associated with heating plastics during initial processing, or during incineration. These processes operate at temperatures well in excess (processing at 175°C to 285°C; incineration at >285°C) of the densification process examined in this study, which operates at 80°C to 105°C. Thus, further research is necessary to determine if any potential chemical exposures may occur when polypropylene is subjected to temperatures under 110°C. If thermal decomposition products from polypropylene are suspected, passive organic vapor monitors can be used for simple testing. These monitors, comprised of badges containing charcoal, are easier to use than personal monitoring pumps.

4.3 ANALYSIS OF RESULTS

The measurements indicate, as expected, that dust concentrations near the densifier are more pronounced than conditions in the other areas of the facility. On average, total dust levels near the densifier are sixty times greater than total dust levels in the sorting area. Observations made during the testing with respect to dust generation are provided in *Appendix E: Sampling Event Observations Regarding Dust Generation*.

For this polypropylene film densification operation, the results also indicate a particle size distribution with more nonrespirable than respirable particles. The difference in size distribution is more pronounced in the immediate area of the densifier. In those samples, the weight of dust collected in the total dust samples exceeded the weight of the respirable dust samples by at least ten times. In the areas away from the densifier, no pattern of marked difference between respirable and total dust can be observed.

The highest result for respirable dust (1.2 mg/m^3), collected with sampling equipment worn by the densifier operator, is approximately 20% of the OSHA/WISHA PEL (5 mg/m^3), or 40% of the ACGIH TLV (3 mg/m^3). Other respirable dust samples, including the one other sample for the densifier operator, are all less than 10% of the ACGIH TLV. As a rule of thumb, most industrial hygienists recommend maintaining airborne contaminant levels, including nuisance dust, at less than 50% of the ACGIH TLV.

[18]Hesterberg, T. W. et al. p. 358.

The highest result for total dust (18.20 mg/m^3), collected in the densifier area, is approximately 21% above the OSHA PEL (15 mg/m^3), or 82% above the WISHA PEL/ACGIH TLV (10 mg/m^3). This indicates a potential problem with total dust level in the vicinity of the densifier.

The higher total dust values in the densifier area indicate that the facility could benefit substantially from dust control measures targeted toward the densification equipment. A localized ventilation solution, such as a vacuum hood system, may be sufficient to adequately reduce excess dust, as the test observations indicate that the nonrespirable particles are confined to the densifier equipment area. If respirators are used to reduce employee exposure to dust, then appropriate training measures must be adopted. *Appendix F: Respirator Training Requirements in Washington State* provides a useful summary. Any control equipment or technical measure utilized for the purpose of regulatory compliance with PELs must be approved for each particular use by a competent industrial hygienist or other technically qualified person.

5.0 CONCLUSIONS

This study is not a statistical sampling, and thus the measurements are invalid for the determination of compliance or noncompliance with federally mandated or state-mandated PELs. However, test data provides information on the level, type, and location of dust in the work environment, and this information is useful for the evaluation of ventilation options.

The respirable nuisance dust measurements taken in all test areas are 76% to 97% lower than the WISHA PEL value. The total nuisance dust measurements in the sorting area are 97% to 98% lower than the WISHA PEL, while those in the densifier area are 28% to 82% higher. Comparing respirable and total dust measurements, this facility's polypropylene film densification process generates more nonrespirable than respirable particles. These nonrespirable particles are also confined to the densifier equipment area, indicating that a localized ventilation solution, such as a vacuum hood system, may be sufficient to adequately reduce excess dust. If respirators are selected as a means of controlling dust exposure in Washington State, then the appropriate minimum requirements must be met.

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7.0 ACKNOWLEDGMENTS

CWC is a nonprofit organization providing recycling market development services to both businesses and governments, including tools and technologies to help manufacturers use recycled materials. CWC is the managing partner of the Recycling Technology Assistance Partnership (ReTAP) -- a program of the US Commerce Department's National Institute of Standards and Technology. The MEP is a growing nationwide network of extension services to help smaller US manufacturers improve their performance and become more competitive. ReTAP is also sponsored by the US Environmental Protection Agency.

Sampling and analytical methods were chosen by Erik Berg, Certified Hazardous Material Manager (CHMM), in cooperation with Certified Industrial Hygienists on the staff of Sentry Services (Industrial Hygiene Division). Sentry Services is an American Industrial Hygiene Association (AIHA) accredited laboratory.

APPENDIX A

Field Sampling Data Sheets

(Not included in this electronic document)

APPENDIX B

Field Sampling Data/Chain of Custody Forms Submitted to Laboratory

(Not included in this electronic file)

APPENDIX C

Sampling Data Calculation Spreadsheets

ALL-STAR PLASTICS RECYCLING
SAMPLING DATA CALCULATIONS

SAMPDAT.XLS

SAMPLE NO.	HRS: MIN	MINUTES	FLOW RATE (LPM)	VOLUME (L)
D-R-1	7:33	453	1.7	770
D-T-1	7:29	449	1.47	660
S-T-1	7:00	420	1.62	680
S-R-1	6:45	405	1.72	697
D-R-2	8:00	480	1.7	816
D-T-2	8:11	491	1.45	712
S-T-2	7:49	469	1.64	769
F-R-2	7:55	475	1.7	808

FLOW RATE CONVERSION TABLE (Based on Rotometer Calibration)

ROTOMETER READING	FLOW RATE (LPM)	ADDITIVE FACTOR
0	0.00	0.09175
0.1	0.09	
0.2	0.18	
0.3	0.28	
0.4	0.37	
0.5	0.46	
0.6	0.55	
0.7	0.64	
0.8	0.73	
0.9	0.83	
1	0.92	
1.1	1.01	
1.2	1.10	
1.3	1.19	
1.4	1.28	
1.5	1.38	
1.6	1.47	
1.7	1.56	
1.8	1.65	
1.9	1.74	
2	1.84	0.104
2.1	1.94	
2.2	2.04	
2.3	2.15	
2.4	2.25	
2.5	2.36	
2.6	2.46	
2.7	2.56	
2.8	2.67	
2.9	2.77	
3	2.88	
3.1		
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4		

APPENDIX D

Report of Analysis Results from Laboratory

Sentry Services
Industrial Hygiene Division

Industrial Hygiene Division
1800 North Point Drive
Stevens Point, WI 54481
800-443-9655
FAX 715-346-6330

LABORATORY REPORT

ERIK BERG
BERG ENVIRONMENTAL SERVICES
15525 SE 176TH STREET
RENTON WA 98058

PROJECT NUMBER: 96-040
DATE RECEIVED: 01/18/96
DATE ANALYZED: 01/24/96
DATE ISSUED: 01/24/96

CUSTOMER PURCHASE ORDER NUMBER: ____________

Sample Number	Contaminant	Laboratory Reference Number	Results	Analytical Method*
D-R-1	Respirable Nuisance Dust	279	0.14 mg/m³	GRAV NIOSH 0600
D-T-1	Total Nuisance Dust	280	12.83 mg/m³	NIOSH 0500
S-T-1	Total Nuisance Dust	281	0.22 mg/m³	
S-R-1	Respirable Nuisance Dust	282	0.13 mg/m³	
D-R-2	Respirable Nuisance Dust	283	1.20 mg/m³	
D-T-2	Total Nuisance Dust	284	18.20 mg/m³	
S-T-2	Total Nuisance Dust	285	0.27 mg/m³	
F-R-2	Respirable Nuisance Dust	286	0.27 mg/m³	
Blank 1	Resp. Dust (blank) Total Dust (blank)	287	<0.02 mg <0.02 mg	
Blank 2	Resp. Dust (blank) Total Dust (blank)	288	<0.02 mg <0.02 mg	

*See Current Fee Schedule

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APPENDIX E
Sampling Event Observations Regarding Dust Generation

Test measurements indicate dust concentrations near the densifier are more pronounced than conditions in the other areas of the facility. As indicated in the report *(Section 5.3 Analysis of Results)* total dust levels near the densifier are, on average, sixty (60) times greater than total dust levels in the sorting area. The following are observations made during the testing on 1/11/96 and 1/16/96 with respect to dust generation in the densifier area:

- Loading material into the densifier requires the periodic opening of a lid on the machine, which results in the periodic release of dust.
- The exit station below the densifier is uncovered; and as the densified material periodically exits the machine, dust is released.
- Small amounts of dust are generated as the densified material is transferred to totes.
- The dust collection “baghouse” area has a covered pallet-box that is not completely sealed, in order to allow steam to release from the densifier; however, this arrangement results in a significant amount of dust escaping from the pallet-box. It also appears that steam and dust may be escaping from the pump used to transfer dust to the pallet-box.
- Dust exits the machine from seams near the loading plate on top of the densifier.

These observations indicate that there is potential for the application of both administrative controls (such as operational modifications to the material input and output processes) and engineering controls (such as design modification of the “baghouse” area) to assist in reducing the amount of dust that is released into the facility.

APPENDIX F
RESPIRATOR TRAINING REQUIREMENTS
IN WASHINGTON STATE

Elements included in respirator training, as required by WAC 296-62-O7115(2)(c):

- The reasons for the need of respiratory protection.
- The nature, extent, and effects of respiratory hazards to which the person may be exposed.
- An explanation of why engineering controls are not being applied or are not adequate and of what effort is being made to reduce or eliminate the need for respirators.
- An explanation of why a particular type of respirator has been selected for a specific respiratory hazard.
- An explanation of the operation, and the capabilities and limitations, of the respirator selected.
- Instruction in inspecting, donning, checking the fit of, and wearing the respirator.
- An opportunity for each respirator wearer to handle the respirator, learn how to don and wear it properly, check its seals, wear it in a safe atmosphere, and wear it in a test atmosphere.
- An explanation of how maintenance and storage of the respirator is carried out.
- Instructions in how to recognize and cope with emergency situations
- Instructions as needed for special respirator use.
- Wearing instructions and training, including:

1. Donning, wearing, and removing the respirator.
2. Adjusting the respirator so that its respiratory-inlet covering is properly fitted on the wearer and so that the respirator causes a minimum of discomfort to the wearer.
3. Allowing the respirator wearer to wear the respirator in a safe atmosphere for an adequate period of time to ensure that the wearer is

familiar with the operational characteristics of the respirator.

4. Providing the respirator wearer an opportunity to wear the respirator in a test atmosphere to demonstrate that the respirator provides protection to the wearer. A test atmosphere is any atmosphere in which the wearer can carry out activities simulating work movements and respirator leakage or respirator malfunction can be detected by the wearer.