



STATE OF MAINE
DEPARTMENT OF ENVIRONMENTAL PROTECTION



JANET T. MILLS
GOVERNOR

GERALD D. REID
COMMISSIONER

March 1, 2019

Michael Martunas
Dragon Products Company, LLC
PO Box 191
Thomaston, ME 04861

RE: Dragon Products Company LLC Application for Chapter 115 Minor Modification

Dear Mr. Martunas:

Your application for an air emission license has been received by the Department of Environmental Protection. The following application tracking number(s) have been assigned to this application: 579769. This application is expected to be addressed in license number A-326-77-12-A.

If you have any questions concerning your application, write or call Benjamin Goundie, the project manager for your application. Our main office number is (207) 287-7688. Prior to final issuance you will receive a copy of your draft air emission license for your review.

Your application has been accepted for processing. However, if materials that have been submitted are incomplete or additional materials are deemed necessary by the Department, processing of the application will be stopped until the required information has been submitted. This application was considered acceptable for processing on March 1, 2019.

Sincerely,

Jane Gilbert, P.E.
Bureau of Air Quality

Pc: Air Licensing File

AUGUSTA
17 STATE HOUSE STATION
AUGUSTA, MAINE 04333-0017
(207) 287-7688 FAX: (207) 287-7826
RAY BLDG., HOSPITAL ST.

BANGOR
106 HOGAN ROAD, SUITE 6
BANGOR, MAINE 04401
(207) 941-4570 FAX: (207) 941-4584

PORTLAND
312 CANCO ROAD
PORTLAND, MAINE 04103
(207) 822-6300 FAX: (207) 822-6303

PRESQUE ISLE
1235 CENTRAL DRIVE, SKYWAY PARK
PRESQUE ISLE, MAINE 04679-2094
(207) 764-0477 FAX: (207) 760-3143



Application Review Status

Form No.	A-L-0018
Effective Date	6/29/09
Revision No.	03
Last Revision Date	3/24/14
Page 1 of 1	

Draft Air License # (including type code: 70-71-75-77) # A-326-77-12-A

Facility Legal Name: Dragon Products Company, LLC

Project Manager: Benjamin Goundie

Application Tracking Number(s): 579769

Received on: 2/25/2019

App. Signed on: 2/22/2019

After the Fact

Jurisdiction: Dept. Board

Application Description: Minor mod to include recycled asphalt shingles, recycled post-consumer carpet and padding, and recycled plastics as alternative fuels.

This application has been reviewed and the status is:

Accepted as Complete on: 3/1/2019

Waiting on Additional Info as of:

Not Accepted on:

Hold as of:

(Written agreement is required to stop the clock.)

Technical Review was added in EFIS by the OAI with a due date of: 2/28/20

Please check all applicable boxes:

- Ch115 Major Modification (A)
- Ch115 Minor Modification (A)
- Ch115 Minor Revision (M)
- Ch115 New Major Source (N)
- Ch115 New Minor Source (N)
- Ch115 Renewal (R or N)
- Ch115 Transfer (T)
- Ch156 CO2 Budget Source (N)

- Tax Exemption (X)
- Part 70 502(B)(10) Change (A)
- Part 70 Admin Revision (A)
- Part 70 Initial License (A)
- Part 70 Minor Modification (A)
- Part 70 Renewal (R)
- Part 70 Significant Mod (A)
- Part 70 Transfer (T)

Proposed implementation date for changes (if provided by applicant): _____

Accepted letters sent on: _____

Not Accepted letter(s) sent on: _____

Name & Address to send Acceptance Letter to:

Michael Martunas
Dragon Products Company, LLC
P.O. Box 191
Thomaston, ME 04861

Please send a Copy to:

Additional Comments from the PM: _____



Certified Mail Receipt No. 7014 2120 0000 8201 5199

February 22, 2018

Mr. Benjamin Goundie
Maine Department of Environmental Protection
Bureau of Air Quality
17 State House Station
Augusta, Maine 04333

**Re: Dragon Products Company, LLC
Application for New Source Review Minor Modification
A-326-70-E-R/A**

Dear Mr. Goundie:

Dragon Products Company, LLC (Dragon) is submitting to the Maine Department of Environmental Protection (Department) an application for a new source review minor modification to include recycled asphalt shingles, recycled post-consumer carpet and carpet foam padding, recycled high density polyethylene (No. 2) plastics, and other recycled plastics (No.s 1, 2, 3, 4, 5, & 7) as acceptable materials for beneficial fuel substitution for the manufacture of portland cement. Dragon conducted successful trials of these materials from July 2018 through October 2018, pursuant to the trial description provided to the Department in a Letter of Intent submitted on May 21, 2018. A report summary of the trial is included with this submittal.

A copy of the application and supporting documentation has been filed at the Thomaston Town Office.

If you have any questions regarding Dragon's minor modification application or the alternative fuels trial results please contact me at (207)-593-0147.

Sincerely,

Michael Martunas
Environmental Manager
Dragon Products Company, LLC

c.c. Stephen P. Holt, P.E. (Dragon)
Thomaston Town Office



Form No.	A-L-0006
Effective Date	12/2005
Revision No.	10
Last Revision Date	2/1/16
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CHAPTER 115 AIR EMISSION LICENSE APPLICATION FORM

State of Maine
Department of Environmental Protection
Bureau of Air Quality
17 State House Station
Augusta, Maine 04333-0017
Phone: (207) 287-7688 Fax: (207) 287-7641

Section A: FACILITY INFORMATION

Owner or Operator (*Legal name as registered with the Secretary of State*):

Dragon Products Company, LLC

Facility Site Name: Dragon Products Company, LLC

Facility Site Address (*Physical, no post office boxes*): 107 New County Rd. (U.S. Rt. 1)

City/Town: Thomaston Zip Code: 04861 County: Knox

Facility Description: Cement Manufacturing

Application Description:

Dragon Products Company, LLC (Dragon) is submitting an application for a new source review minor modification to include recycled asphalt shingles, recycled post-consumer carpet and carpet foam padding, and recycled plastics (Nos 1, 2, 3, 4, 5, & 7) as acceptable materials for beneficial fuel substitution for the manufacture of portland cement. A report summary of the trial is included with this submittal.

Current License #: A- 326 - 70 - E - R/A

Check When Done:

All Sources

<input checked="" type="checkbox"/>	Application Completed
<input checked="" type="checkbox"/>	Copy Sent to Town (date sent: _____)
<input checked="" type="checkbox"/>	Public Notice Published paper name & date: Courier Gazette, 2/7/19
<input checked="" type="checkbox"/>	Enclosed Public Notice Tear Sheet
<input checked="" type="checkbox"/>	Signed Signatory Form (Section K)

Additional Requirements for New Sources

<input type="checkbox"/>	Schedule for construction or installation of equipment
<input type="checkbox"/>	Title, Right, or Interest (e.g. copy of deed or lease)
<input type="checkbox"/>	Check for Fee

Additional Requirements for New Major Sources and Major Modifications

<input type="checkbox"/>	Notify Abutting Landowners
--------------------------	----------------------------

For Department Use

Application #: A- _____ - _____ - _____ - _____

App Track #: _____

Chapter 115 Air Emission License Application
State of Maine DEP - Bureau of Air Quality

Facility Contact:

Name: Michael Martunas Title: Environmental Manager
Company: Dragon Products Company, LLC
Mailing Address: Dragon Products Company, LLC
P.O. Box 191
City/Town: Thomaston State: ME Zip Code: 04861
Phone: (207) 593-0147 Fax: (207) 593-0150
e-mail: mmartunas@elementia.com

Application Contact:

Name: Michael Martunas Title: Environmental Manager
Company: Dragon Products Company, LLC
Mailing Address: Dragon Products Company, LLC
P.O. Box 191
City/Town: Thomaston State: ME Zip Code: 04861
Phone: (207) 593-0147 Fax: (207) 593-0150
e-mail: mmartunas@elementia.com

Billing Contact:

Name: Deb Cyr Title: Accounting Manager
Company: Dragon Products Company, LLC
Mailing Address: Dragon Products Company, LLC
57 Atlantic Pl.
City/Town: South Portland State: ME Zip Code: 01406
Phone: (207) 553-7402 Fax: (207) 761-5694
e-mail: DebCyr@elementia.com

Chapter 115 Air Emission License Application
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Section B2: INTERNAL COMBUSTION ENGINES

(List equipment such as generators, diesel drive units, fire pumps, etc. Do not list wheeled mobile equipment such as loaders, backhoes, trucks, etc.)

Emission Unit ID	Serial Number	Maximum Design Heat Input Capacity (MMBtu/hr)	Maximum Output Capacity (kW or Hp)	Maximum Firing Rate	Fuel Type	% Sulfur	Date of Manf	Date of Installation	Portable	Stationary	Spark Ignition Engines Only			
											2-Stroke	4-Stroke	Rich Burn	Lean Burn
<i>Generator #1 (Example)</i>	<i>123ABC456 (Example)</i>	<i>5.0 MMBtu/hr (Example)</i>	<i>512 kW (Example)</i>	<i>35.7 gal/hr (Example)</i>	<i>Diesel (Example)</i>	<i>0.0015% (Example)</i>	<i>1984 (Example)</i>	<i>1990 (Example)</i>	X			X	X	
Not Applicable									<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
									<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Does your facility participate in a Demand Response program in which the generator(s) may be operated for more than 15 hours per calendar year?
 yes no

If yes, what units? _____

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Control Equipment for Fuel Burning Equipment

If applicable, indicate the types of required/operated add-on pollution control equipment, including baghouses, cyclones/multiclones, SCR, SNCR, etc.

Emission Unit	Type of Control	Pollutant Controlled	Control Efficiency
<i>Boiler #1 (Example)</i>	<i>Cyclone (Example)</i>	<i>PM (Example)</i>	<i>90% (Example)</i>
Not Applicable			

Monitors for Fuel Burning Equipment:

If applicable, indicate types of required/operated monitors, including Continuous Emission Monitors (CEM), Continuous Opacity Monitors (COM), parameter monitors for operational purposes, etc.

Emission Unit	Type of Monitor	Data Measured
<i>Boiler #1 (Example)</i>	<i>CEM (Example)</i>	<i>NO_x (Example)</i>
<i>Boiler #1 (Example)</i>	<i>Parameter – operational (Example)</i>	<i>Temperature (Example)</i>
U804	CEM	NO _x , SO ₂ , CO
U804	CEM	CO ₂
U804	CEM	HCl
U804	CEM	THC
U804	CEM	Hg
U804	CPMS	Particulate Matter

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Section C: INCINERATORS

	Incinerator Unit 1	Incinerator Unit 2
Incinerator Type (medical waste, municipal, etc.)	Not Applicable	
Waste Type		
Make (Shenandoah, Crawford, etc.)		
Model Number		
Date of Manufacture		
Date of Installation		
Number of Chambers		
Max. Initial Charge	lb	lb
Max. Design Combustion Rate	lb/hr	lb/hr
Heat Recovery? (Yes or No)		
Retention Time of Exhaust Gases	seconds	seconds
Automatic Feeder? (Yes or No)		
Temperature Range		
Primary	to °F	to °F
Secondary	to °F	to °F
Auxiliary Burner - Primary Chamber max. rating (MMBtu/hr)		
type of fuel used		
Auxiliary Burner - Secondary Chamber max. rating (MMBtu/hr)		
type of fuel used		
Annual Waste Combusted for ____ (yr)		
Pollution Control Equipment (if any)		
Stack Number		
Monitors (ie - temperature recorder)		

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 State of Maine DEP - Bureau of Air Quality

Section D: PROCESS EQUIPMENT

Emission Unit ID	Type of Equipment	Maximum Raw Material Process Rate (name and rate)	Maximum Finished Material Process Rate (name and rate)	Date of Manufacture	Date of Installation	Stack #	Control Device
<i>Kilns (Example)</i>	<i>Drying Kilns (Example)</i>	<i>N/A (Example)</i>	<i>25 MMBF/year (Example)</i>	<i>1990 (Example)</i>	<i>1990 (Example)</i>	<i>fugitive (Ex.)</i>	<i>none (Example)</i>
<i>PB#1 (Example)</i>	<i>Paint Booth (Example)</i>	<i>10 gal/hr (Example)</i>	<i>N/A (Example)</i>	<i>2001 (Example)</i>	<i>2001 (Example)</i>	<i>#4 (Ex.)</i>	<i>Paper Filters (Example)</i>
U804	Cement Kiln	1,274,690 tons/yr	766,500 tons/yr	1969	1969	1	Bag House & SNCR

Solvent Cleaners
 (Also known as Parts Washers and/or Solvent Degreasers)

Emission Unit ID	Capacity (gallons)	Solvent Used	Solvent % VOC
<i>Degreaser #1 (Example)</i>	<i>15 (Example)</i>	<i>Kerosene (Example)</i>	<i>100% (Example)</i>
Not Applicable			

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PROCESS EQUIPMENT (section D cont'd)

Chemical Usage

Note: Complete this section for any chemicals integral to your process, for example, a cementing process for outsoles, dyes, surface coating, printing, cleaning, etc. Attach additional pages or MSDS sheets as needed.

Process	Chemical substance used in process	Actual Usage (gal or lb for yr ____)	Hazardous chemical(s) in substance	Percent VOC ¹ (%)	Percent HAP ² (%)	Total VOC emitted (lb/year)	Total HAP emitted (lb/year)
Not Applicable							

¹ Volatile Organic Compounds

² Hazardous Air Pollutants

Describe method of record keeping (ie. monthly calculations from purchase records, flow monitors on solvent tanks, etc.)

Not Applicable

Describe methods used to calculate VOC/HAP emitted (ie – test results, if control equipment was taken into account; if conditions exist where solvents remain in the substrate rather than complete volatilization, etc.)

Not Applicable

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Section E: STACK DATA

Stack #	Height Above Ground (ft)	Inside Diameter (ft)	Exit Temperature °F	Exhaust Flow Rate (ft ³ /s) [indicate actual or standard]
1	404	7	<400	~160 KSCFM

Section F: ANNUAL FACILITY FUEL USE

Total Fuel Consumption by Month for: _____ (year)

Fuel type: _____

Fuel type: _____

Fuel type: _____

Avg % sulfur (oil) _____

Avg % sulfur (oil) _____

Avg % sulfur (oil) _____

Avg % moisture (wood) _____

Avg % moisture (wood) _____

Avg % moisture (wood) _____

(circle one: gal, tons, scf)

(circle one: gal, tons, scf)

(circle one: gal, tons, scf)

January _____
 February _____
 March _____
 April _____
 May _____
 June _____
 July _____
 August _____
 September _____
 October _____
 November _____
 December _____

Total _____

Proposed Annual Limit _____

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Section G: LIQUID ORGANIC MATERIAL STORAGE

Tank #	Not	Applicable				
Capacity (gallons)						
Materials Stored						
Reid Vapor Pressure (RVP)						
Annual Throughput						
Above or Below Ground?						
Tank Type (floating or fixed, riveted or bolted, etc.)						
Physical Description – year installed						
Physical Description – color						
Dimensions - height (ft)						
Dimensions - Diameter (ft)						
Construction Material						
Control Device						

Section H: MISCELLANEOUS

Note: Use this section to describe any equipment, activities, or other air emission sources that did not fit in any of the above categories. Include descriptions of the associated emissions. Attach additional pages if necessary.

Not Applicable.

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Section I: BPT/BACT AND OTHER ATTACHMENTS

BPT/BACT Analysis:

For a license renewal for existing equipment, the applicant is required to submit a Best Practical Treatment (BPT) analysis to the Department. A BPT analysis establishes what equipment or requirements are appropriate for control or reduction of emissions of regulated pollutants to the lowest possible level considering the existing state of technology, the effectiveness of available alternatives, and the economic feasibility.

For a new license or the addition of new equipment to an existing license, the applicant is required to submit a Best Available Control Technology (BACT) analysis. A BACT analysis is a top-down approach to selecting air emission controls. It is done on a case-by-case basis and develops emission limits based on the maximum degree of reduction for each pollutant emitted taking into account economic, environmental and energy impacts.

- I certify that, to the best of my knowledge, the control equipment, fuel limitations, and process constraints outlined in this application represent BPT / BACT for the equipment and processes listed.

OR

- I have attached a separate BPT / BACT analysis to this application.

Other Attachments:

Please list any other attachments included with this application.

Attachment #1 - Alternative Fuels Trial Summary Report

Attachment #2 - Public Notice of Intent

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Section J: APPLICABLE RULES

Please indicate any rules you believe may be applicable to your facility by checking the associated box.


Citation	Title
✓ 06-096 CMR 101	Visible Emissions
06-096 CMR 103	Fuel Burning Equipment Particulate Emission Standard
06-096 CMR 104	Incinerator Particulate Emission Standard
06-096 CMR 105	General Process Source particulate Emission Standard
06-096 CMR 106	Low Sulfur Fuel Regulation
06-096 CMR 111	Petroleum Liquid Storage Vapor Control
06-096 CMR 112	Bulk Terminal Petroleum Liquid Transfer Requirements
✓ 06-096 CMR 117	Source Surveillance
06-096 CMR 118	Gasoline Dispensing Facilities Vapor Control
06-096 CMR 121	Emission Limitations and Emission Testing of Resource Recovery Facilities
06-096 CMR 123	Paper Coating Regulation
06-096 CMR 124	Total Reduced Sulfur Control from Kraft Mills
06-096 CMR 125	Perchloroethylene Dry Cleaner Regulation
06-096 CMR 126	Capture Efficiency Test Procedures
06-096 CMR 129	Surface Coating Facilities
06-096 CMR 130	Solvent Degreasers
06-096 CMR 131	Cutback Asphalt and Emulsified Asphalt
06-096 CMR 132	Graphic Arts – Rotogravure and Flexography
06-096 CMR 133	Petroleum Liquids Transfer Vapor Recovery at Bulk Gasoline Plants
06-096 CMR 134	Reasonably Available Control Technology for Facilities That Emit Volatile Organic Compounds
✓ 06-096 CMR 137	Emission Statements
06-096 CMR 138	Reasonably Available Control Technology for Facilities That Emit Nitrogen Oxides
✓ 06-096 CMR 140	Part 70 Air Emission License Regulations
06-096 CMR 145	NOx Control Program
06-096 CMR 153	Mobile Equipment Repair and Refinishing
06-096 CMR 159	Control of Volatile Organic Compounds from Adhesives and Sealants
06-096 CMR 161	Graphic Arts – Offset Lithography and Letterpress Printing
✓ 40 CFR Part 60	New Source Performance Standards (NSPS) (please list Subpart(s): IIII)
✓ 40 CFR Part 63	National Emission Standards for Hazardous Air Pollutants (NESHAP) (please list Subpart(s): LLL)
Other (list)	
Other (list)	

Chapter 115 Air Emission License Application
State of Maine DEP - Bureau of Air Quality

Section K: SIGNATORY REQUIREMENT

Each application submitted to the Department must include the following certification signed by a Responsible Official*:

"I certify under penalty of law that, based on information and belief formed after reasonable inquiry, I believe the information included in the attached document is true, complete, and accurate."

 _____ Responsible Official Signature	<u>2/22/19</u> _____ Date
Martin Turecky	Plant Manager
_____ Responsible Official (Printed or Typed)	_____ Title

* A Responsible Official is defined by MEDEP Rule, Chapter 100 as:

- A. For a corporation: a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:
 - (1) The facilities employ more than 250 persons or have gross annual sales or expenditures exceeding \$25 million (in second quarter 1980 dollars); or
 - (2) The delegation of authority to such representatives is approved in advance by the permitting authority;
- B. For a partnership or sole proprietorship: a general partner or the proprietor, respectively;
- C. For a municipality, State, Federal, or other public agency: Either a principal executive officer or ranking elected official. For the purposes of this part, a principal executive officer of a Federal agency includes the chief executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., a Regional Administrator of EPA).

Alternative Fuel Trial Results

Recycled asphalt shingles
Recycled post-consumer carpet
Recycled post-consumer carpet foam padding
Recycled high-density polyethylene (HDPE) plastics (No. 2)
Recycled Plastics (RP) (No.'s 1, 3, 4, 5, and 7)

Dragon Products Company, LLC
February 2019

PURPOSE

Dragon Product Company, LLC (Dragon) is a manufacturer of portland cement, located in Thomaston, Maine. The cement making process begins with raw feedstock of calcium carbonate bearing rock and other materials including sand (silica) and iron. The calcium carbonate bearing rock is quarried from the onsite limestone quarry in Thomaston, Maine. The limestone is pulverized and mixed with sand and iron to make the raw feedstock. The raw feed is then introduced into the kiln system, where it is heated to near liquid phase in the rotary kiln then cooled quickly to produce clinker, the main ingredient in portland cement. Dragon currently uses petroleum coke (petcoke) as a primary fuel for the thermal energy required to heat the raw feed material. Dragon consumes approximately 10 tons per hour of petcoke in two (2) locations within the kiln system. Approximately five (5) tons per hour is consumed in the rotary kiln and an additional five (5) tons per hour is consumed in the calciner. Dragon is currently licensed (#S-02851-WV-X-N) to use tire chips (tire-derived fuel (TDF)) and recycled carpet material as alternative fuels, which are fired directly in the calciner.

On May 21, 2018, Dragon submitted a Letter of Intent to the Maine Department of Environmental Protection (Department) to conduct alternative fuels trials of the following materials:

1. Recycled asphalt shingles;
2. Recycled post-consumer carpet;
3. Recycled post-consumer carpet foam padding;
4. Recycled high-density polyethylene (HDPE) plastics (No. 2);
5. Recycled Plastics (RP) (No.'s 1, 3, 4, 5, and 7);
6. Recycled conveyor belt material;
7. Fiberform® graphite and carbon material;
8. Coal-tar pitch;
9. Coal-tar pitch coke; and
10. Earthlife® bio-solids.

The purpose of the trials was to fully evaluate the beneficial use and potential limitations of the materials as alternative fuels. Each proposed alternative fuel was trialed separately to evaluate material handling characteristics, impacts to air emission quality, and impacts to clinker chemistry.

The results of the trials indicate the following five (5) materials are acceptable as beneficial fuel substitutes under Dragon's current alternative fuel system:

1. Recycled Asphalt Shingles
2. Recycled post-consumer carpet
3. Recycled post-consumer carpet foam padding
4. Recycled high-density polyethylene (HDPE) plastics (No. 2)
5. Recycled Plastics (RP) (No.'s 1, 3, 4, 5, and 7)

The details of the successful trials are provided in the following sections. Clinker chemistry data and air emissions summaries are included as Attachments.

A separate report detailing the trial results for the materials deemed unsuccessful is included as Attachment No. 7.

TRIAL SUMMARIES

Section 1 – Recycled Asphalt Shingles

Dragon conducted a two-stage trial of the recycled asphalt shingles material to fully evaluate the process handling, clinker chemistry, and air emission impacts to the cement manufacturing process. The first stage of the trial examined the material handling of the product and the efficiency of introducing it into the kiln system, and the second stage of the trial examined clinker chemistry and air emission impacts. As detailed in Dragon's Letter of Intent, the recycled asphalt shingles are processed into flakes or chips by recycling companies prior to being transported to Dragon. The material was stored on site in the same manner and location as approved under Fuel Substitution License S-02851-WV-X-N and the facility's Alternative Fuel Operation's Manual. The material was introduced through the existing tire chip conveying system to the calciner. No modifications to the existing system were required to process the asphalt shingles material.

Dragon processed approximately 22 tons of recycled asphalt shingles. Dragon introduced the asphalt shingle material at a nominal feed rate of 2.4 tons per hour (tph) through the TDF feeder system. The first stage of the trial was approximately 9 hours in length. Strict adherence to air emissions quality and emissions limits were maintained during this stage of the trial.

During the first stage of the trial, Dragon monitored applicable process data to evaluate the thermal benefit of the recycled asphalt shingles, and determine potential impacts (if any) to process conditions while introducing the material into the calciner. The existing TDF conveying system processed the asphalt shingle material without incident and at the desired federate. Prior to entering the Calciner portion of the kiln system the material passes through a series of steel gates designed to reduce false air (i.e., ambient air) into the process and serve as a safety barrier in the event of a process shutdown. Due to the extreme temperatures of the Calciner the steel gates get very hot and Dragon observed some melting and buildup of the asphalt material on the gates. Periodic monitoring and cleaning of the gates will be required when processing asphalt shingles.

The second stage of the trial immediately followed the first, and Dragon processed an additional 22 tons at a feed rate of approximately 2.4 tons per hour. When combined with the first stage, the second stage of the trial processed a sufficient amount of the asphalt shingles to obtain valid air emissions and process data to adequately evaluate the

Alternative Fuels Trial Results

material. In addition, Dragon evaluated the clinker chemistry during the second stage of the trial to observe potential impacts.

Chemistry and Air Emission Results

Standards

Dragon's onsite Quality Control laboratory analyzed and evaluated any potential changes in clinker chemistry during the asphalt shingle trial. Results were compared to average non-trial clinker chemistry data collected in July 2018. A successful fuel trial results in no adverse impacts to air emissions quality, and clinker chemistry remains consistent with typical daily production quality.

Clinker Chemistry Quality

Laboratory results of the clinker produced during the trial proved to be within normal production specifications. Dragon observed no adverse impact to clinker chemistry quality as a result of combusting the asphalt shingles. A comparative chemical analysis of the clinker chemistry produced during the asphalt shingle trial compared to the average clinker chemistry for July 2018 is included in Attachment No. 1.

Air Emissions

Dragon continuously monitored air emissions during the asphalt shingle trial. Dragon currently operates a Continuous Emission Monitoring Systems (CEMS) for CO, CO₂, NO_x, SO_x, THC, HCl, and Hg to confirm that emissions do not exceed limits established in Dragon's current Title V air emission license (A-326-70-E-R/A). No adverse impacts to air emission quality were observed during the trial, and all emissions remained within licensed limits. Included in Attachment No. 2 is the emissions data collected during both stages of the asphalt shingle trial.

Conclusion

The two-stage trial of asphalt shingle material demonstrated the material is a viable fuel substitute in the manufacture of portland cement. Dragon has determined the trial of asphalt shingles to be successful based on the following:

- the material handling characteristics allowed for sufficient processing and introduction of the asphalt shingles into the process without modification of the existing system,
- no adverse impacts to air emission quality were observed, and
- no adverse impacts to clinker chemistry quality were observed.

Section 2 – Recycled Post-Consumer Carpet & Recycled Post-Consumer Foam Padding Trial

Dragon conducted a single stage trial of recycled post-consumer carpet and foam padding material to evaluate the process handling, clinker chemistry, and air emission impacts to the cement manufacturing process. The trial examined the material handling of the product and the efficiency of introducing it into the kiln system, and evaluated the clinker chemistry and air emission impacts. As detailed in Dragon's Letter of Intent, the recycled post-consumer carpet and foam padding was collected and processed by recycling companies prior to being transported to Dragon. The material was stored on site in the same manner and location as approved under Fuel Substitution License S-02851-WV-X-N and the facility's Alternative Fuel Operation's Manual.

Dragon processed approximately 11 tons of recycled post-consumer carpet and foam padding. Both materials were introduced into the kiln system through the existing shredding and conveying system as a single, co-mingled, stream. No modifications to the existing system were required to process the post-consumer carpet or foam padding material. Dragon introduced the carpet and foam padding material at an average feed rate of 0.25 – 0.50 tons per hour (tph). Strict adherence to air emissions quality and emissions limits were maintained during the trial.

Dragon's CEMS monitored CO, CO₂, NO_x, SO_x, THC, HCl, and Hg to ensure that emissions were not adversely impacted during the trial. Dragon also monitored applicable process data to evaluate the thermal benefit of the recycled post-consumer carpet and foam padding and observe potential impacts to process conditions.

Chemistry and Air Emission Results

Standards

Dragon's onsite Quality Control laboratory analyzed and evaluated any potential changes in clinker chemistry during the recycled carpet and foam padding trial. Results were compared to average non-trial clinker chemistry data collected in July 2018. The fuel trials would be deemed successful if no negative impacts to air emission quality are observed and clinker chemistry remains consistent with average daily production quality.

Clinker Chemistry Quality

Laboratory results of the clinker produced during this trial were within normal production specifications. No adverse impact to clinker chemistry quality as a result of combusting the post consumer carpet and foam padding was observed. A comparative chemical analysis of the clinker chemistry produced during the recycled carpet trial compared to the average clinker chemistry for July 2018 is included in Attachment No. 3.

Air Emissions

Dragon continuously monitored air emissions during the asphalt shingle trial. Dragon currently operates a CEMS for CO, CO₂, NO_x, SO_x, THC, HCl, and Hg to confirm that emissions do not exceed limits established in Dragon's current Title V air emission license (A-326-70-E-R/A). No adverse impacts to air emissions quality were observed during the trial, and all emissions remained within licensed limits. Included in Attachment No. 4 is the emissions data collected during the recycled carpet and foam padding trial.

Conclusions

The two-stage trial of the post consumer carpet and foam padding material demonstrated the materials are a viable fuel substitute in the manufacture of portland cement. Dragon has determined the trial of post consumer carpet and foam padding to be successful based on the following:

- the material handling characteristics allowed for sufficient processing and introduction of the post consumer carpet and foam padding into the process without modification of the existing system,
- no adverse impacts to air emission quality were observed, and
- no adverse impacts to clinker chemistry quality were observed.

Section 3 – Recycled High Density Polyethylene (HDPE) Plastics (No. 2) and Recycled Plastics (RP) (No. 1, 3, 4, 5 and 7) Trial

Dragon conducted a two-stage trial of recycled high-density polyethylene (HDPE) plastic and a second two-stage trial for recycled plastics (RP) (No.'s 1, 3, 4, 5, and 7) to fully evaluate the process handling, clinker chemistry, and air emission impacts to the cement manufacturing process. The first stage of each trial examined the material handling of the products and the efficiency of introducing them into the kiln system. The second stage of each trial examined clinker chemistry and air emission impacts. As detailed in Dragon's Letter of Intent, the recycled plastics are sourced from solid waste recycling facilities where it is sorted and compressed into bales before being transported to Dragon. The material was stored on site in the same manner and location as approved under Fuel Substitution License S-02851-WV-X-N and the facility's Alternative Fuel Operation's Manual. The materials were introduced into the kiln system through the existing shredding and conveying system to the calciner. No modifications to the existing system were required to process the HDPE and RP materials.

Dragon processed a total of approximately 29 tons of recycled plastics. Dragon introduced the plastics at an average feed rate of 0.5 tons per hour (tph) through the shredder system. Strict adherence to air emissions quality and emissions limits were maintained during this stage of the trial.

During the first stage of each trial, Dragon processed approximately 1.5 tons of plastics through the shredding and conveying system. As detailed in Dragon's Letter of Intent, the first stage of the trial was to determine if the existing shredding system could process the plastic materials. Dragon monitored the shredding and conveying system and determined no adverse impacts to the system occurred with either the HDPE or the RP materials. Dragon did observe a buildup or "bridging" of material in the shredder feed hopper during the RP trial. Periodic monitoring and cleaning of the shredder hopper will be required to ensure material feeds consistently into the shredder when processing RP material. In addition, a large piece of steel was inadvertently introduced into the shredder with the HDPE material. The shredder was shut down and the steel removed. Dragon will work with HDPE material suppliers to ensure proper screening of the material occurs to eliminate the introduction of improper materials.

The second stage of both trials occurred from October 15, 2018 until October 26, 2018, and Dragon processed approximately 13 tons of HDPE material and 16 tons of the RP material. A sufficient amount of both the HDPE and the RP materials were consumed to evaluate the impact on air emissions and process data and determine if any negative impacts to clinker chemistry occurred. Dragon also monitored applicable process data to evaluate the thermal benefit and determine potential impacts to process conditions when introducing the material into the calciner.

Chemistry and Air Emissions Results

Standards

Dragon's onsite Quality Control laboratory analyzed and evaluated any potential changes in clinker chemistry during the HDPE and RP trials. Results were compared to average non-trial clinker chemistry data collected in July 2018. A successful fuel trial results in no adverse impacts to air emission quality and clinker chemistry remains consistent with daily production quality.

Clinker Chemistry Quality

Laboratory results of the clinker produced during the trial proved to be within normal production specifications. No adverse impact to clinker chemistry quality as a result of combusting the HDPE and RP was observed. A comparative chemical analysis of the clinker chemistry produced during the HDPE and RP trials compared to the average clinker chemistry for July 2018 is included in Attachment No. 5.

Air Emissions

Dragon continuously monitored air emissions during the HDPE and RP trials. Dragon currently operates a CEMS for CO, CO₂, NO_x, SO_x, THC, HCl, and Hg to confirm that emissions do not exceed limits set forth by Dragon's current air emission license. No adverse impacts to air emissions quality were observed during the trial, and air emissions remained within licensed limits. Attachment No. 6 is the emissions data collected during both stages of the HDPE and RP trials.

Conclusions

The trials of the recycled materials (HDPE and RP) demonstrated the materials are a viable fuel substitute in the manufacture of portland cement. Dragon has determined the trial of recycled plastics to be a success based on the following:

- the material handling characteristics allowed for sufficient processing and introduction of the plastics into the process without modification of the existing system,
- no adverse impacts to air emission quality were observed, and
- no adverse impacts to clinker chemistry quality were observed.

TRIAL CONCLUSIONS

The alternative fuels trials of recycled asphalt shingles, recycled post-consumer carpet and foam padding, recycled HDPE (No. 2) plastics, and Recycled Plastics (No.'s 1, 3, 4, 5, and 7) demonstrated that the materials are viable fuel substitutes in the manufacture of cement. Based on the data contained in this report, Dragon confirms that the trials of

Alternative Fuels Trial Results

asphalt shingles, recycled post-consumer carpet and foam padding, recycled HDPE (No. 2) plastics, and Recycled Plastics (No.'s 1, 3, 4, 5, and 7) were successful. The evaluation of clinker chemistry and air emission quality during the trials confirms the materials pose no adverse impacts to production or air quality. Accordingly, Dragon is requesting the Department include recycled asphalt shingles, recycled post-consumer carpet and foam padding, recycled HDPE (No. 2) plastics, and Recycled Plastics (No.'s 1, 3, 4, 5, and 7) as acceptable and permissible fuels under Dragon's Fuel Substitution License S-02851-WV-X-N.

ATTACHMENT No. 1

Clinker Chemistry Analysis – Recycled Asphalt Shingles Trial

Dragon Products Company, LLC
Thomaston, Maine
Cement Laboratory

	Clinker Asphalt Shingle Trial Average		Clinker July 2018 Average	
	Average	StdDev	Average	StdDev
Si	21.27	0.31	21.42	0.34
Al	3.60	0.10	3.83	0.56
Fe	3.25	0.08	3.31	0.08
Ca	63.17	0.40	64.18	0.84
Mg	3.27	0.14	3.35	0.19
S	1.17	0.19	1.40	0.16
K	1.23	0.10	1.22	0.14
Na	0.35	0.01	0.32	0.03
P	0.05	0.01	0.05	0.01
Ti	0.26	0.01	0.24	0.02
Cl	----	----	0.01	0.01
LOI	0.15	0.00	0.76	2.18
Total	97.75	0.46	100.07	2.18
C3S	63.31	2.61	63.73	6.40
C2S	13.23	2.56	13.33	4.87
C3A	4.05	0.19	4.56	1.52
C4AF	9.88	0.24	10.06	0.25
S/R	3.11	0.08	3.02	0.20
Al/Fe	1.11	0.02	1.16	0.18
LSF	95.83	1.19	96.32	1.72
% Liq	21.70	0.47	22.48	1.76
AlkEq	1.16	0.08	1.13	0.10
Sulfur:Alkali	0.77	0.08	0.99	0.11
Wet Fr CaO	0.77	0.14	0.90	0.14

ATTACHMENT No. 2
Air Emission Quality – Recycled Asphalt Shingle Trial

Hour	07/12/2018						07/13/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	1.2	149.3	53.2	3.21	17.082	0	1.1	138.9	122.4	7.29	12.192	0
01:00	1.2	151	30.4	2.49	19.134	0	1	116.5	30.4	2.2	12.14	0
02:00	1.2	150.9	30.7	2.4	18.616	0	1	121.6	37.2	2.65	10.495	0
03:00	1.4	158.4	41.2	3.07	21.812	0	1	121.3	24	2.36	12.644	0
04:00	1.2	154.6	37.4	1.91	22.3	0	1.2	128.3	32.1	1.9	11.473	0
05:00	1.2	154.5	46.5	1.3	23.364	0	1	122.2	44.4	1.48	10.626	0
06:00	1.2	152.2	43.5	2.75	25.35	0	1	123	44.7	3.25	11.765	0
07:00	1.2	154.3	52.3	3.07	23.248	0	1	123.7	40.4	2.53	11.577	0
08:00	1.2	153.1	74.6	3.95	21.487	0	1	123.7	57	4.18	9.302	0
09:00	1.2	156	63.9	2.79	19.954	0	1.5	126.8	59.9	3.6	111.681	0
10:00	1.2	150.9	67.1	3.6	20.118	0	2	130.4	49.9	3.4	104.888	0
11:00	1.2	150.8	64.2	3.53	19.617	0	1.3	154.1	20.6	3	37.074	0
12:00	1.2	149	102.3	5.76	25.031	0	2.1	132.8	43.8	3.49	115.299	0
13:00	1.2	149.2	117.9	7.8	25.93	0	2.2	143.8	43.3	3.4	96.747	0
14:00	1.2	149.6	93.9	6.32	19.059	0	1.9	128.7	41.2	3.58	69.803	0
15:00	1.2	151.2	106	6.73	15.7	0	1	131.2	43.5	3.36	9.202	0
16:00	1.2	144.8	76.3	5.09	12.255	0	1.1	135.2	65.5	6.16	8.753	0
17:00	1.1	146.5	88.4	6.25	12.01	0	1	134.5	57.9	3.7	8.957	0
18:00	1.2	145.8	91.2	6.33	11.765	0	0.9	126.1	55.7	3.81	10.043	0
19:00	1.1	147.7	89.7	6.09	11.383	0	1.3	124.8	51.4	3.72	59.626	0
20:00	1.2	143.3	84.5	4.75	11.902	0	0.9	124.5	82.1	4.78	11.207	0
21:00	1.1	134.8	70.2	4.35	11.835	0	0.9	125.9	75.4	4.5	11.494	0
22:00	1.2	133.6	96.9	5.52	11.995	0	0.9	124.5	80.3	4.6	10.345	0
23:00	1	136.5	111.4	8.05	12.016	0	0.9	126.3	65.7	3.97	10.057	0

* - Highlighted cells indicate trial data

ATTACHMENT No. 3

Clinker Chemistry Analysis – Recycled Post-Consumer Carpet and Foam Padding Trial

Dragon Products Company, LLC
Thomaston, Maine
Cement Laboratory

	Clinker Carpet and Foam Padding Trial Average		Clinker July 2018 Average	
	Average	StdDev	Average	StdDev
Si	21.70	0.56	21.42	0.34
Al	3.76	0.22	3.83	0.56
Fe	3.20	0.15	3.31	0.08
Ca	64.48	0.35	64.18	0.84
Mg	3.30	0.33	3.35	0.19
S	1.50	0.11	1.40	0.16
K	1.31	0.12	1.22	0.14
Na	0.31	0.03	0.32	0.03
P	0.06	0.00	0.05	0.01
Ti	0.25	0.01	0.24	0.02
Cl	0.01	0.00	0.01	0.01
LOI	0.15	0.00	0.76	2.18
Total	100.01	0.04	100.07	2.18
C3S	63.49	5.74	63.73	6.40
C2S	14.31	5.86	13.33	4.87
C3A	4.56	0.71	4.56	1.52
C4AF	9.73	0.45	10.06	0.25
S/R	3.12	0.13	3.02	0.20
Al/Fe	1.18	0.10	1.16	0.18
LSF	95.92	2.68	96.32	1.72
% Liq	22.09	0.69	22.48	1.76
AlkEq	1.17	0.08	1.13	0.10
Sulfur:Alkali	1.00	0.08	0.99	0.11
Wet Fr CaO	1.00	0.38	0.90	0.14

ATTACHMENT No. 4
Air Emission Quality – Recycled Post-Consumer Carpet and Foam Padding Trial

Hour	08/08/2018						08/09/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	0	0	0	0.42	0	19.9123	0	54.2	73.3	3.88	12.422	0
01:00	0.9	256.2	14.9	1.75	88.417	11.14954	0	41.4	117.8	6.08	12.516	0
02:00	1.4	370.9	58.8	5.85	21.305	0	0	67.5	117.2	5.7	14.058	0
03:00	1.9	421.3	54.4	6.68	23.339	0	0	53.4	107.7	3.19	13.089	0
04:00	0.2	58	47.3	4.27	17.203	0	0	54.5	72.9	2.14	12.887	0
05:00	0	27.7	53.9	3.08	16.529	0	0	37.1	41.5	0.9	11.373	0
06:00	0	17.5	46.7	5.93	119.088	0	0	61.3	34.8	1.82	28.816	0
07:00	0	25.8	62.2	6.65	17.344	0	0.4	54.5	37.3	2.73	118.147	0
08:00	0	25	43.1	2.75	39.787	0	0.6	46.1	58.3	4.2	74.236	0
09:00	0	32.3	62.7	7	32.945	0.38949	11.2	152.3	168.7	11.12	20.31	0.95816
10:00	0	43.6	72.2	7.61	12.283	0	0.8	76.6	70.6	9.17	21.806	0
11:00	0	58.3	70.2	7.24	10.563	0	1.3	48	88.7	6.58	17.103	0
12:00	0	43.9	56.6	5.89	9.655	0	0.2	48.6	85	4.97	65.136	0
13:00	0	31	75.8	7.36	9.89	0	1.2	82.5	77.8	6.94	184.195	0
14:00	0	28.8	78.1	7.22	11.86	0	1.1	73.6	94.4	8.76	152	0
15:00	0	42.9	78.9	6.63	13.978	0	0.2	87.7	89.4	8.19	74.278	0
16:00	0	53.3	76.5	7.08	14.801	0	0	82.4	72	6.04	20.339	0
17:00	0	64.5	79.2	6.29	13.493	0	0	107	79.8	7.03	19.67	0
18:00	0	92.1	74.9	5.82	10.314	0	0	145.1	75.2	7.32	23.407	0
19:00	0	73.7	76.9	4.66	11.264	0	0.3	188.5	71.9	8.07	25.882	0
20:00	0	67.1	74.8	5.1	12.25	0	0.2	167.9	68.2	7.37	27.424	0
21:00	0	60.9	92.2	4.22	13.54	0	0.2	133.4	49	6.12	30.702	0
22:00	0	63.8	110.4	5.93	14.552	0	0.2	142.1	43	6.13	27.939	0
23:00	0	31.1	105.7	5.19	14.534	0	0.2	157.3	61.1	7.34	26.438	0

* - Highlighted cells indicate trial data

(Attachment No. 4 – cont.)
 Air Emission Quality – Recycled Post-Consumer Carpet and Foam Padding Trial

Hour	08/14/2018						08/15/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7% O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7% O2)
00:00	0	71.2	96.2	4.91	16.393	0	0	119	77.5	6.43	18.275	0
01:00	0	94.4	93.3	4.67	17.817	0	0	121.5	106.7	7.73	17.884	0
02:00	0	87.2	78.3	3.67	18.882	0	0	106.7	96.7	7.36	16.645	0
03:00	0	92.2	59.5	4.76	18.742	0	0	110	155.9	6.95	15.513	0
04:00	0	91.5	95.8	3.17	19.853	0	0	100.5	119	5.91	16.23	0
05:00	0	93.8	49.6	1.3	96.936	0.09961	0	97.3	84.9	2.87	17.06	0
06:00	0	77.6	81.9	3.72	111.52	0	0	102.4	94.1	6.99	23.147	0
07:00	0	49.9	108.2	4.7	106.821	0	0	109.7	121.5	7.78	23.444	0
08:00	0	73.6	123.4	9.38	14.199	0	0	112.8	88.5	6.72	24.314	0
09:00	0	77.3	88.4	4.44	17.291	0	0	128.4	129.5	9.4	24.254	0
10:00	0	89.1	98.3	5.76	18.599	0	0	110	92.6	7.19	26.52	0
11:00	0	60.1	249.2	9.96	16.22	0	0.7	118.2	108.1	7.94	111.067	0
12:00	12.4	181.3	8	1.79	117.143	0	0.2	73	93.7	7.99	114.691	0
13:00	11	542.1	113.1	12.6	106.947	0.15041	0.2	81.4	103.4	9.06	123.567	0
14:00	0	144.2	101	7.01	18.266	0	0	103	89.6	8.12	50.381	0
15:00	0	84.3	106.6	6.92	14.641	0	0	78.2	70.4	6.38	20.275	0
16:00	0	95.7	95.7	6.25	15.957	0	0	74.9	112.6	6.25	18.905	0
17:00	0	85	79.6	4.93	60.567	0	0	58.9	107.8	6.74	17.698	0
18:00	0.2	97.8	85.3	6.83	109.794	0	0	68.6	121.7	6.28	17.684	0
19:00	1.4	112.9	89.5	6.48	105.928	0	0	77.2	190.1	12.16	18.765	0
20:00	0.2	106.5	80	6.51	86.376	0	0	87.9	111.9	6.84	21.208	0
21:00	0	58.9	86.9	6.72	13.761	0	0	52.9	92.1	5.22	18.452	0
22:00	0	92.3	92.6	6.04	12.585	0	0	51.1	140.4	6.08	20.712	0
23:00	0	112.5	76.7	6.01	15.625	0	39.4	58.6	172.8	22.19	18.411	0

* - Highlighted cells indicate trial data

(Attachment No. 4 – cont.)
 Air Emission Quality – Recycled Post-Consumer Carpet and Foam Padding Trial

Hour	08/24/2018					
	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	0.4	150	63.7	1.76	17.912	0
01:00	0.4	154.4	70.3	2.68	18.17	0
02:00	0.4	151.8	74.5	2.12	18.323	0
03:00	1.5	185.2	112.8	4.07	24.356	0
04:00	0.9	215.1	79	2.44	24.613	0
05:00	0.4	151.5	93.9	1.4	19.459	0.10722
06:00	0.4	156.3	64.9	1.81	32.216	0
07:00	0.4	163.8	73.2	2.28	27.706	0
08:00	0.4	146.4	72.8	2.3	22.384	0
09:00	0.3	131.2	23	0.36	11.621	0
10:00	0.5	149.1	36.1	0.69	8.174	0
11:00	0.8	151.9	54.2	2.26	6.333	0
12:00	0.8	167.7	52.8	2.37	20.685	0
13:00	3.3	200.3	94.3	4.81	118.703	0
14:00	3.5	227.2	144	6.25	115.796	0
15:00	3.5	231.1	111.2	4.22	111.314	0
16:00	1	220.7	117.8	3.7	9.329	0
17:00	0.7	183.3	128.9	5.45	8.077	0
18:00	0.7	168.4	71.4	2.78	7.503	0
19:00	0.7	155.5	96	4.27	8.575	0
20:00	0.7	167	99.6	4.03	9.618	0
21:00	0.7	157.2	119.5	7.29	10.902	0
22:00	0.5	160.1	115.8	8.75	10.507	0
23:00	0.7	156.2	76.6	3.06	10.559	0

* - Highlighted cells indicate trial data

ATTACHMENT No. 5

Clinker Chemistry Analysis – Recycled High-Density Polyethylene (HDPE) Plastics
 (No.2) and Recycled Plastics (RP) (No.'s 1, 3, 4, 5 and 7)

Dragon Products Company, LLC
Thomaston, Maine
Cement Laboratory

	Clinker Recycled Plastics Trial Average	StdDev	Clinker July 2018 Average	StdDev
	Average		Average	
Si	21.35	0.32	21.42	0.34
Al	3.86	0.18	3.83	0.56
Fe	3.27	0.12	3.31	0.08
Ca	64.69	0.55	64.18	0.84
Mg	3.55	0.23	3.35	0.19
S	1.53	0.24	1.40	0.16
K	1.02	0.12	1.22	0.14
Na	0.29	0.03	0.32	0.03
P	0.05	0.01	0.05	0.01
Ti	0.22	0.02	0.24	0.02
Cl	0.01	0.00	0.01	0.01
LOI	0.15	0.02	0.76	2.18
Total	99.97	0.38	100.07	2.18
C3S	66.18	4.21	63.73	6.40
C2S	11.27	3.81	13.33	4.87
C3A	4.69	0.45	4.56	1.52
C4AF	9.94	0.37	10.06	0.25
S/R	3.00	0.12	3.02	0.20
Al/Fe	1.18	0.06	1.16	0.18
LSF	97.39	1.83	96.32	1.72
% Liq	22.23	0.72	22.48	1.76
AlkEq	0.96	0.09	1.13	0.10
Sulfur:Alkali	1.23	0.13	0.99	0.11
Wet Fr CaO	0.95	0.31	0.90	0.14

ATTACHMENT No. 6

Air Emission Quality – Recycled High-Density Polyethylene (HDPE) Plastics (No.2) and Recycled Plastics (RP) (No.'s 1, 3, 4, 5 and 7)

Hour	10/15/2018						10/16/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	1.7	162.4	23	2.64	6.375	0	10	142.3	36.9	1.67	10.932	0
01:00	1.3	143.9	10.4	2.13	7.714	0	35.5	114.1	47.3	3.95	144.631	1.79209
02:00	1.8	161.1	11.5	2.29	8.493	0	21.5	111.8	12.6	1.4	112.704	6.255
03:00	2.7	156.6	14.8	2.41	10.847	0	1.2	106	14.4	1.15	8.272	0
04:00	1.5	165.3	16	1.69	9.185	0	1.1	124	12.3	0.75	7.072	0
05:00	1.2	154.1	10.3	0.87	8.828	0	1.1	130.1	13.2	0.45	5.793	0
06:00	1.4	153	10.3	2.11	8.828	0.16794	1.3	140.1	15.4	0.84	6.72	0
07:00	1.5	148.8	14.4	2.08	8.545	0	1.4	134.3	17.9	0.95	7.227	0
08:00	1.7	147.8	13.3	2.06	8.499	0	3.3	133.1	36.4	1.01	7.848	0
09:00	1.6	149.1	11.4	2.14	10.818	0	3.1	131.5	34.4	0.88	8.82	0
10:00	1.4	146.3	13.3	2.15	10.43	0	1.9	131.9	38.1	0.73	8.005	0
11:00	1.7	151.6	18.6	2.13	11.598	0	2.6	130.6	35	0.44	7.925	0
12:00	2.1	153.4	29.6	2.63	9.536	0	2.9	138.4	44.9	0.73	9.814	0
13:00	2	156	49.7	3.24	9.278	0	2.4	132.5	62.3	0.86	10.559	0
14:00	2	149.8	10.2	0.96	9.278	0	2	142.6	55.1	0.87	10.794	0
15:00	1.9	153.9	13.6	0.91	7.959	0	2.3	138	106.2	3.85	11.7	0
16:00	2.1	172.9	17.5	1	7.809	0	2	149.8	58.5	0.71	10.662	0
17:00	2.6	167.7	19.4	1.03	6.801	0	1.7	133.1	62.7	0.73	10.741	0
18:00	3.9	168.6	16.5	0.91	9.332	0	1.8	147.8	49.5	0.58	11.816	0
19:00	3.8	172.3	18	1.07	9.068	0	2	147.8	61.6	0.73	13.772	0
20:00	3.4	163.5	11.3	0.75	9.079	0	1.8	154.5	48.5	0.58	12.716	0
21:00	3.5	148	16.6	0.91	8.978	0	1.7	149.4	45.7	0.58	16.564	0
22:00	3.1	165	16.8	0.91	8.933	0	2.1	170.2	39.3	0.58	21.368	0
23:00	4	161.7	20.7	0.74	7.843	0	2.6	165.7	37.7	0.58	18.37	0

* - Highlighted cells indicate trial data

(Attachment No. 6 – cont.)
 Air Emission Quality – Recycled High-Density Polyethylene (HDPE) Plastics (No.2) and
 Recycled Plastics (RP) (No.'s 1, 3, 4, 5 and 7)

Hour	10/17/2018						10/18/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	2.9	169.8	39.2	0.57	17.312	0	3	139.6	66.8	2.18	23.077	0
01:00	3.4	166.5	40.8	0.43	17.229	0	2.9	139.6	65.1	2.04	22.995	0
02:00	3.7	167.6	77.3	1.72	16.11	0	3	138.2	63.7	2.02	22.941	0
03:00	3.6	182	49.4	0.59	16.627	0	2.5	135.6	69.5	2.33	21.948	0
04:00	1.2	146.6	34.3	0.66	12.5	0	2.9	142.1	132.8	4.36	20.794	0
05:00	1.5	178.2	33.5	0.32	10.323	0	3.7	137.9	71	0.84	22.78	0
06:00	1.5	161.8	34.7	0.35	11.193	2.51617	3	139.1	64.9	1.87	21.612	0
07:00	2.8	159	46.5	0.61	10.407	0	10	111.4	50.4	2.92	95.297	0
08:00	4.3	172.7	56.1	0.74	10.345	0	30	123.2	17.7	2.97	201.395	2.97424
09:00	5.1	156.9	56.8	0.78	11.372	0	56.6	133.7	52.7	2.32	214.452	6.06432
10:00	3.7	159.2	164	11.04	13.785	0	59.1	156.9	49.3	1.83	181.054	5.87954
11:00	4	168.9	80.3	1.37	15.771	0	54.8	164.3	51.1	1.86	138.528	4.03887
12:00	4.6	161.1	64.9	1.04	15.771	0	12.5	153.4	67.6	2.68	36.518	1.00989
13:00	5.3	162.3	69.1	0.91	15.771	0	5.3	143.9	72.4	2.64	16.747	0
14:00	5.7	156.9	66.3	0.9	14.836	0	6	147.2	131.2	3.6	17.351	0
15:00	9.4	155	84.6	1.17	14.836	0	7.2	141.2	100.5	3.48	19.645	0
16:00	13	141.6	169.3	4.94	14.72	0	3.6	148.6	90.8	4.19	22.128	0
17:00	10.4	140.2	124.4	1.77	16.589	0	2	146.5	79.2	4.41	18.863	0
18:00	8.2	138.9	105.8	1.81	19.393	0	1.5	148.7	75.5	4.1	18.863	0
19:00	7.9	138.2	86.4	1.5	20.495	0	1.5	143.2	83.6	3.91	18.863	0
20:00	4.5	136.3	74.7	1.83	23.242	0	1.7	146.8	76.8	3.56	18.841	0
21:00	4.1	140.2	83.4	2.77	25.149	0	1.5	139.4	102.1	3.67	19.355	0
22:00	4	135.1	72	2.79	25.089	0	1.7	169.3	73.9	3.54	20.398	0
23:00	4.1	142.1	68.5	2.06	25.089	0	0.3	182	101.8	3.84	19.048	0

* - Highlighted cells indicate trial data

(Attachment No. 6 – cont.)

Air Emission Quality – Recycled High-Density Polyethylene (HDPE) Plastics (No.2) and
Recycled Plastics (RP) (No.’s 1, 3, 4, 5 and 7)

Hour	10/19/2018						10/20/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	0	0	0	4.61	0	0	0.9	135.3	30	2.62	9.959	0
01:00	0	0	0	3.66	0	0	1.1	144.5	31.3	3.02	11.892	0
02:00	0	0	0	3.66	0	0	1.1	144.9	35.7	3.11	12.766	0
03:00	0	0	0	10.32	0	0	1.1	142.6	43.1	3.08	11.503	0
04:00	0	0	0	0.77	0	0	1.1	147.2	37.1	2.35	13.29	0
05:00	0	0	0	0.25	0	7.40456	1.1	147.4	47.4	1.6	21.456	0
06:00	0	0	0	0.64	0	21.68947	1.1	144.5	37.1	3.44	26.024	0
07:00	30.7	80.7	4.3	0.82	920	20.77527	1	141.7	35.8	2.99	21.551	0
08:00	21.4	213.6	44.8	17.29	120	6.35279	3.6	144.5	38.5	3.09	49.805	0
09:00	14.8	161	63.7	10.33	122.686	0.61527	1.1	144.5	44.2	3.32	21.926	0
10:00	3.7	91.5	15.5	5.9	95.845	0	1.1	143.8	52.3	2.92	20.781	0
11:00	0.3	17	1	4.8	200	0	1.1	143.5	51.1	2.79	19.647	0
12:00	0	4.6	0.7	1.3	180	0	1.2	147.8	58.6	2.74	22.573	0
13:00	14.1	17.8	0	0.67	270	9.93314	1.5	153.4	57.5	2.64	19.27	0
14:00	0.8	240.7	0.9	1.89	209.091	15.97628	1.7	171.5	54.9	2.5	19.054	0
15:00	14	307.3	24.7	3.06	181.424	3.16838	1.4	167.8	23.9	2.7	19.502	0
16:00	22.7	148.2	52.9	3.83	183.462	1.41898	1.3	166.4	22.8	2.43	15.223	0
17:00	6.8	165.9	24.1	2.86	54.074	0.95293	6.1	157.9	55.2	6.94	15.006	0.27279
18:00	0.9	137.2	28.5	2.48	6.628	0	2.1	157.8	57.7	3.83	13.969	0
19:00	0.9	145.9	39.8	2.41	7.616	0	1.8	159.8	50	2.63	14.484	0
20:00	0.9	144.9	75.5	3.43	7.49	0	1.4	145.1	39.6	2.39	13.753	0
21:00	0.9	143.8	55.4	2.52	7.397	0	1.6	144.3	51.2	1.98	13.753	0
22:00	1.1	147.5	105.6	3.87	8.345	0	1.6	159.2	42.1	1.99	13.806	0
23:00	1.1	142.3	73.5	2.77	9.626	0	1.4	154.3	43.9	1.99	16	0

* - Highlighted cells indicate trial data

(Attachment No. 6 – cont.)
 Air Emission Quality – Recycled High-Density Polyethylene (HDPE) Plastics (No.2) and
 Recycled Plastics (RP) (No.'s 1, 3, 4, 5 and 7)

Hour	10/21/2018						10/22/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	1.6	157.2	35.8	2.01	17.165	0	2.3	107.4	18.5	1.91	14.744	0
01:00	2.1	161.4	49.9	1.98	17.076	0	5.8	111.3	22.9	1.92	17.519	0
02:00	3.8	159.2	55.9	2.09	19.565	0	10.8	117.9	36.3	1.84	19.697	0
03:00	2.4	127.5	63.7	3.39	17.062	0	17.7	119.9	31.5	1.8	22.911	0
04:00	1.6	144.3	26	1.51	13.872	0	13.5	132.6	25.2	1.52	24.282	0
05:00	1.7	137.6	27	1.02	11.887	0	13.3	124	32.5	0.92	22.747	0
06:00	1.4	134.8	23.3	2.12	13.373	0	66	134	34	2	220.588	1.43899
07:00	1.1	113.9	21.6	2.13	13.522	0	65.1	149.2	37.7	2.19	207.724	4.16299
08:00	1	115.1	23.8	2.3	12.596	0	5.7	124.7	62.5	2.2	11.628	0.13377
09:00	0.9	113.8	35.2	3.41	11.111	0	35	126.9	72.2	2.29	55.191	0
10:00	1.3	115.5	45.1	3.13	8.498	0	19.9	136.6	72.1	1.96	20.774	0
11:00	3.2	121.1	50.2	2.65	9.677	0	20.8	137.2	62.8	2.12	20.619	0
12:00	3.8	124.1	45.2	2.17	9.663	0	7.5	104.4	81.3	2.11	21.319	0
13:00	1.8	117.1	29.3	2.08	9.807	0	4.3	133.6	36.7	1.82	16.089	0
14:00	5.5	125.9	44.6	2	9.483	0	5.3	129.6	63.4	5.22	13.154	0.28055
15:00	15.4	120.8	60	2.24	10.379	0	5.5	132.8	55.7	2.31	13.856	0
16:00	17.3	126.8	60.4	2.26	11.31	0	4.2	140.1	55	2.43	16.387	0
17:00	3.7	110.2	57.8	3.7	11.315	0	5.1	141.9	57.1	2.36	17.526	0
18:00	2.1	107.6	52.8	3.83	8.682	0	5.6	141.9	53.4	2.21	17.526	0
19:00	9.8	103.3	55.9	3.15	8.64	0	6.8	146.1	49.4	2.17	19.974	0
20:00	19.1	111.8	67.8	2.12	10.143	0	10.8	140.8	62.4	2.17	26.82	0
21:00	2.5	106.4	21.7	1.85	11.52	0	9.6	149.9	78.3	2.07	21.855	0
22:00	2.2	115.6	28.5	2.08	13.102	0	9	153.3	71.3	2.07	20.839	0
23:00	1.4	108.9	12.9	1.87	13.826	0	7.7	172.4	72.9	2.09	21.527	0

* - Highlighted cells indicate trial data

(Attachment No. 6 – cont.)
Air Emission Quality – Recycled High-Density Polyethylene (HDPE) Plastics (No.2) and
Recycled Plastics (RP) (No.’s 1, 3, 4, 5 and 7)

Hour	10/23/2018						10/24/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	6.2	173	67.7	2.09	21.652	0	2.5	191.5	88.7	4.71	30.113	0.14303
01:00	4.9	157.4	61.5	2.09	21.652	0	9.3	141.2	88	3.03	87.768	0
02:00	5.3	161.8	47.6	2.05	22.609	0	31.4	157.3	80.9	2.7	297.332	0
03:00	5.2	152.9	49.7	1.93	25.802	0	36.5	157.6	82.1	2.7	241.89	0
04:00	5.4	167.6	63.7	1.73	25.802	0	33.6	154.3	104.4	3.34	187.245	0
05:00	6.7	157.3	67.9	1.02	26.683	0	9.4	220	53.2	1.68	55.703	0
06:00	26.2	184.4	72.8	2.09	27.702	0	1.4	133.2	50.8	3.99	14.939	0
07:00	9.3	154.2	92.3	2.05	30.617	0	1.1	132.1	55.5	3.29	17.131	0
08:00	14.6	158.3	143.3	2.24	28.642	0	1.1	134.7	63	3.25	18.254	0
09:00	24.5	148.9	166.2	2.22	28.571	0	1.1	137.4	132.6	3.56	18.444	0
10:00	21.7	158.4	131.4	2.27	31.197	0	1.3	142.8	170.6	5.74	18.408	0
11:00	20.8	155.2	125.6	2.38	31.923	0	1.2	138.8	165.9	3.4	19.083	0
12:00	14.7	148.1	100.8	2.56	29.988	0	1.4	138.7	132.9	3.68	18.08	0
13:00	9.8	147.3	105.9	2.39	25.03	0	1.1	131.8	55.1	4.2	17.928	0
14:00	9.4	149.6	128.7	2.57	29.075	0	1.2	131.9	55.7	4.43	17.928	0
15:00	19.8	141.2	177.4	2.91	77.643	0	1.1	133.2	44.7	3.79	17.096	0
16:00	2.6	162	166.8	3.29	25.998	0	1.2	127.1	44.3	3.51	17.517	0
17:00	2.4	160.2	210.3	3.38	28.053	0	1.2	130.2	57.2	3.51	16.757	0
18:00	2.6	160.9	200.4	3.5	27.251	0	19.7	135.5	91.5	3.69	152.918	0
19:00	1.9	151.7	152.8	3.48	29.975	0	27.5	141.6	144.8	4.49	148.755	0
20:00	1.6	157.6	144.3	3.2	28.589	0	10.8	109.9	34.4	4.66	142.966	0
21:00	1.9	144.8	113.9	2.99	30.175	0	6.4	108.6	26	4.37	133.904	0
22:00	7.7	159	65.5	2.91	74.333	0	3.6	96.1	17.1	3.24	126.519	0
23:00	2.3	167.1	60	2.77	31.512	0	3.2	98.6	19.1	3.27	131.734	0

* - Highlighted cells indicate trial data

(Attachment No. 6 – cont.)

Air Emission Quality – Recycled High-Density Polyethylene (HDPE) Plastics (No.2) and
 Recycled Plastics (RP) (No.'s 1, 3, 4, 5 and 7)

Hour	10/25/2018						10/26/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mm ton)	(PPMVD @7%O2)
00:00	1.2	96.6	16.2	3.61	52.399	0	1.5	194.9	71.9	7.57	12.651	0
01:00	0.6	96.9	14	4.24	7.143	0	1.7	196.7	93.3	7.97	13.368	0
02:00	0.6	102.2	22.5	5.29	6.431	0	1.2	152.3	68.7	7.79	13.595	0
03:00	0.8	104.2	25	6.36	9.164	0	1	127.6	30.3	7.78	15.53	0
04:00	0.8	104.3	15.6	4.04	7.878	0	0.9	103.7	36.4	4.96	15.75	0
05:00	0.8	102.5	17.3	2.21	7.878	0	5.8	125.9	41.7	3.59	57.305	0
06:00	0.6	103.7	18.4	5.97	9.164	2.11039	0.1	10.2	0.3	4.02	270	0.80474
07:00	0.8	104	30.8	1.53	10.078	0.27089	0	6.8	0.2	1.08	170	4.24187
08:00	0.9	107.2	79.8	7.87	10.847	0	0	4.8	0.4	1.4	170	9.38972
09:00	1.1	111.5	70.6	7.83	11.739	0	0	0	0	2.21	0	0.22753
10:00	1.3	110.6	130.1	9.61	12.899	0	0	0	0	7.02	0	0
11:00	1.3	129.2	132.2	9.77	12.813	0	0	0.5	0.3	6.95	150	0
12:00	1	101.1	141.1	10.17	12.69	0	0	0	0	38.85	0	0
13:00	0.8	85.5	119	10.47	13.793	0	0	0	0	5.84	0	0
14:00	1	116.2	94.4	8.89	13.793	0	0	0	0	1.99	0	0
15:00	0.8	93	84.5	8.14	13.755	0	0	0	0	1.2	0	5.39858
16:00	0.8	101.3	118	8.78	13.957	0	0	0	0	0.9	0	17.98824
17:00	1	118.7	52.4	8.65	14.069	0	0	0	0	0.74	0	14.66095
18:00	1.5	181.7	48.4	9.08	13.973	0	0	0	0	0.61	0	15.17523
19:00	1.5	192.9	53.5	9.5	13.477	0	0	0	0	0.74	0	14.98377
20:00	1.5	188.7	65.4	8.32	12.264	0	0.4	317.7	19.2	2.34	139.216	15.8514
21:00	1.8	217.3	61.7	7.76	13.351	0	18.5	394.2	67.8	6.54	211.084	3.82216
22:00	1.6	196.8	50.2	7.6	13.543	0	9.3	517.1	24.5	5.19	180.874	3.55723
23:00	2	244.7	77.1	7.71	13.193	0	8	590.7	37.5	7.36	81.043	1.14376

* - Highlighted cells indicate trial data

ATTACHMENT No.7

Alternative Fuel Trial Results

Recycled conveyor belt material
Earthlife® bio-solids
FiberForm® graphite and carbon material
Coal-tar pitch
Coal-tar pitch coke

Dragon Products Company, LLC
February 2019

PURPOSE

Dragon Product Company, LLC (Dragon) is a manufacturer of portland cement, located in Thomaston, Maine. The cement making process begins with raw feedstock of calcium carbonate bearing rock and other materials including sand (silica) and iron. The calcium carbonate bearing rock is quarried from the onsite limestone quarry in Thomaston, Maine. The limestone is pulverized and mixed with sand and iron to make the raw feedstock. The raw feed is then introduced into the kiln system, where it is heated to near liquid phase in the rotary kiln then cooled quickly to produce clinker, the main ingredient in portland cement. Dragon currently uses petroleum coke (petcoke) as a primary fuel for the thermal energy required to heat the raw feed material. Dragon consumes approximately 10 tons per hour of petcoke in two (2) locations within the kiln system. Approximately five (5) tons per hour is consumed in the rotary kiln and an additional five (5) tons per hour is consumed in the calciner. Dragon is currently licensed (#S-02851-WV-X-N) to use tire chips (tire-derived fuel (TDF)) and recycled carpet material as alternative fuels, which are fired directly in the calciner.

On May 21, 2018, Dragon submitted a Letter of Intent to the Maine Department of Environmental Protection (Department) to conduct alternative fuels trials of the following materials:

1. Recycled asphalt shingles;
2. Recycled post-consumer carpet;
3. Recycled post-consumer carpet foam padding;
4. Recycled high-density polyethylene (HDPE) plastics (No. 2);
5. Recycled Plastics (RP) (No.'s 1, 3, 4, 5, and 7);
6. Recycled conveyor belt material;
7. FiberForm® graphite and carbon material;
8. Coal-tar pitch;
9. Coal-tar pitch coke; and
10. Earthlife® bio-solids.

The purpose of the trials was to fully evaluate the beneficial use and potential limitations of the materials as alternative fuels. Each proposed alternative fuel was trialed separately to evaluate material handling characteristics, impacts to air emission quality, and impacts to clinker chemistry.

The results of the trials demonstrated the following two (2) materials are unacceptable as beneficial fuel substitutes under Dragon's current alternative fuel system:

1. Recycled Conveyor Belting
2. Earthlife® Bio-Solids

The evaluation of the recycled conveyor belt material and the Earthlife® bio-solids trials indicated these materials are not viable fuels using Dragon's current alternative fuels

Alternative Fuels Trial Results

handling systems. The details of the recycled conveyor belt material and bio-solids trials are provided in the following sections.

The trials of the FiberForm® graphite and carbon material, coal-tar pitch and coal-tar pitch coke were inconclusive. Dragon was not able to process the FiberForm® materials using the current alternative fuels handling system. However, Dragon believes the FiberForm® materials can be processed through the existing solid fuel handling system and used in conjunction with Dragon's primary fuel, petroleum coke. Dragon intends to submit an additional Notice of Intent to the Department to trial an alternative method of introducing the fuels into the process. In this report, the evaluation of the FiberForm® material as a viable alternative fuel is inconclusive, and additional trials are warranted.

TRIAL SUMMARIES

Section 1 – Recycled Conveyor Belt Material Trial

Dragon proposed a two-stage trial of the recycled conveyor belt material to fully evaluate the process handling, clinker chemistry, and air emission impacts to the cement manufacturing process. The first stage of the trial examined the material handling of the product and the efficiency of introducing it into the kiln system, and the second stage of the trial examined clinker chemistry and air emission impacts. As noted in Dragon's Letter of Intent, the recycled material was sourced from removed or replaced conveyor belts used in Dragon's manufacturing process. The material was stored on site in the same manner and location as approved under Fuel Substitution License S-02851-WV-X-N and the facility's Alternative Fuel Operation's Manual. The material was processed and introduced into the kiln system with the existing conveying and shredding system. No modifications to the existing system were necessary to process the recycled conveyor belt material. Dragon proposed to introduce the recycled conveyor belt material at a nominal feed rate.

The first stage of the trial was designed to evaluate the performance of Dragon's shredder and its ability to adequately process the conveyor belt material. Due to the durability and composition of the conveyor belt material, the shredder was unable to adequately process the belt. The belts caused the shredder system to bind, and the shredder failed to reduce the size of the material. Since the conveyor belt material could not be processed with the existing shredding system the trial was abandoned.

The first stage of the recycled conveyor belt trial was unsuccessful; therefore, Dragon did not conduct the second stage of the trial. Dragon processed less than 1 ton of recycled conveyor belt material. Dragon performed no further evaluation of the conveyor belt material.

Section 2 - Earthlife® Bio-Solids Trial

Dragon proposed a two-stage trial of the Earthlife® Bio-Solids material to evaluate the process handling, clinker chemistry, and air emission impacts to the cement

Alternative Fuels Trial Results

manufacturing process on July 30, 2018 and July 31, 2018. The first stage of the trial examined the material handling of the product and the efficiency of introducing it into the kiln system, and the second stage of the trial examined clinker chemistry and air emission impacts. As noted in Dragon's Letter of Intent, the bio-solids material is a heat-dried granulated material processed at New England Fertilizer Company's (NEFCO) plant prior to being transported to Dragon. The material was stored on site in the same manner and location as approved under Fuel Substitution License S-02851-WV-X-N and the facility's Alternative Fuel Operation's Manual. The material was processed and introduced into the kiln system with the existing tire chip conveying system. No modifications to the existing system were required to process the Earthlife® Bio-Solids material. Dragon introduced the bio-solids material at a nominal feed rate of 0.5 tons per hour (tph). Strict adherence to air emissions quality and emissions limits were maintained during this stage of the trial.

The first stage of the trial evaluated the processing of the Earthlife® Bio-Solids through Dragon's existing tire chip conveying system. Dragon monitored applicable process data to evaluate the potential impacts to process conditions while introducing the material into the calciner. The tire chip conveying system consists of a steel hopper equipped with a drag chain transport system that moves material from the hopper to the long conveyor belt that feeds material into the Calciner. Dragon determined that the size of the bio-solids pellets were too small to be effectively transported through the tire chip conveying system, resulting in material spillage at the drag chain ingress and egress points. In addition, buildup of the bio-solids material resulted in "bridging" in the hopper, preventing effective transportation onto the long conveyor.

Strict adherence to air emissions quality and emissions limits were maintained during this stage of the trial. The emissions results for the first stage of the Earthlife® Bio-Solids trial are provided in Attachment No. 1

Conclusions

The trial of Earthlife® Bio-Solids material demonstrated that the material cannot be utilized as a viable fuel substitute using Dragon's existing alternative fuels handling system. Dragon determined the trial of Earthlife® bio-solids to be unsuccessful based on the following;

- the material handling characteristics prevented sufficient transport of the material into the process; and
- an increase in mercury emissions raises concerns regarding the viability of the bio-solids material as a long term fuel source.

Section 3 - FiberForm® Graphite and Carbon, Coal-tar Pitch, and Coal-tar Pitch Coke

Dragon proposed a two-stage trial of the Fiberform®, coal-tar pitch and coal-tar pitch coke material to fully evaluate the process handling, clinker chemistry, and air emission impacts to the cement manufacturing process on August 31, 2018. The first stage of the trial examined the material handling of the product and the efficiency of introducing it into the kiln system, and the second stage of the trial proposed to examine clinker chemistry and air emission impacts. As noted in Dragon's Letter of Intent, the materials were sourced from Fiber Materials, Inc. (FMI) in Biddeford, Maine. The material was stored on site in the same manner and location as approved under Fuel Substitution License S-02851-WV-X-N and the facility's Alternative Fuel Operation's Manual. The material was processed and introduced into the kiln system with the existing conveying and shredding system.

The first stage of the trial was designed to evaluate the performance of Dragon's shredder and its ability to adequately process the FiberForm® material. Dragon's shredding system adequately processed the FiberForm® material; however the process created a nuisance dust issue at the exit transfer point from the shredder. Potentially combustible dust created by the shredder is a significant safety concern, so the trial was immediately abandoned.

The first stage of the FiberForm® trial was deemed unsuccessful using Dragon's current alternative fuels system. Dragon did not conduct the second stage of the trial. Dragon processed less than 0.25 tons of material. Therefore, analysis of the clinker chemistry and evaluation of the air emissions were not performed.

However, as noted in Dragon's Letter of Intent, the FiberForm® materials are good candidates for fuel substitution. Laboratory analysis indicates sufficient thermal energy (14,000 – 16,000 Btu/lb) and low ash content. Dragon believes the FiberForm® materials can be processed through the existing solid fuel handling system that currently processes petroleum coke. Additional analysis of the material's hardness is required to determine if the material can be sufficiently processed through the solid fuel milling system. If the FiberForm® materials are adequate for processing through the milling system, Dragon will submit an amended Letter of Intent to conduct a trial utilizing the solid fuel feed system to evaluate the use of this material as an alternative fuel.

FiberForm® Conclusions

The trial of Fiberform®, coal-tar pitch and coal-tar pitch coke materials demonstrated that the material cannot be utilized using Dragon's existing alternative fuels handling system. Dragon has determined the trial of these materials to be inconclusive, and intends to re-evaluate the material for introduction into the kiln process via an alternative method. Dragon will submit an amended Letter of Intent for additional trialing of these materials.

TRIAL CONCLUSIONS

The alternative fuels trials of recycled conveyor belting and Earthlife® Bio-Solids demonstrated that the materials cannot be utilized using Dragon's current alternative fuels handling systems. Based on the data contained in this report, Dragon confirms that the trials of recycled conveyor belting and Earthlife® Bio-Solids were unsuccessful. In addition, the trial of the FiberForm® materials was deemed inconclusive, and additional evaluation of the materials is warranted. FiberForm® If future modifications to Dragon's alternative fuels handling system provide the opportunity to adequately process these materials, Dragon may re-evaluate their use at the facility.

ATTACHMENT No. 1
Air Emission Quality – Stage 1 Earthlife ® Bio-Solids

Hour	07/30/2018						07/31/2018					
	SO2	NOX	CO	THC	Hg	HCL	SO2	NOX	CO	THC	Hg	HCL
	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mmton)	(PPM VD@7 %O2)	(PPH)	(PPH)	(PPH)	(PPMVD @7% O2)	(Lb/Mmton)	(PPM VD@7 %O2)
00:00	1.4	188	33.1	2.87	140	0	1.2	193.8	146.2	4.11	26.838	0
01:00	1.4	198	40.3	2.89	41.793	0	1.1	185.1	124.3	2.68	33.701	0
02:00	1	179.7	37.7	2.36	12.259	0	1.2	191.1	88.8	2.24	43.415	0
03:00	1.2	161.7	30.9	2.58	15.467	0	1.6	212.9	99.5	2.56	51.812	0
04:00	0.9	164.9	52.5	2.32	14.598	0	1.2	198.6	111.1	2.24	59.827	0
05:00	0.9	159.7	25.7	1.02	13.517	0	1.4	217.7	69.8	1.08	72.661	0
06:00	1	163.1	29.8	2.24	34.11	0	1.4	220.4	67.8	1.88	115.148	0
07:00	0.9	160.7	45.1	2.63	14.678	0	1.6	220.2	53.4	2.37	139.255	0
08:00	0.9	165.3	71.6	4.17	14.718	0	3.3	367.4	47.6	2.56	443.176	0
09:00	0.9	160.3	52.4	3.61	11.93	0	2.6	284.4	86.2	4.14	463.12	0
10:00	0.9	164	74.6	4.05	10.568	0	4.1	281.4	91.5	3.56	460.507	0
11:00	1.1	173.3	54.7	3.1	11.648	0	4.8	258.2	79.4	3.06	468.478	0
12:00	1.2	213.7	51.9	2.94	23.677	0	2.3	349.7	82.4	3.38	60.145	0
13:00	1.4	229.5	63.7	3.41	34.124	0	1.6	249.5	77.3	3.16	70.609	0
14:00	1.7	221	59.5	3.5	31.225	0	1.8	258.2	82.8	3.43	82.318	0
15:00	1.4	225.9	50.3	2.82	37.789	0	1.8	274.1	60.3	2.64	67.152	0
16:00	1.2	213	57.2	2.88	37.644	0	1.8	283.3	45.9	2.62	130.193	0
17:00	1.4	211.9	44	2.39	38.039	0	1.8	272.9	48.4	2.5	56.28	0
18:00	1.8	208.3	59.5	3.06	112.371	0	1.6	258.4	40.4	2.65	50.665	0
19:00	3	235	103.9	4.54	378.055	0	1.5	219.7	45.5	2.74	47.153	0
20:00	12.8	238.6	112.6	4.49	376.77	0	1.3	211.9	31.9	2.39	42.857	0
21:00	15.1	247.1	123.4	5.3	389.312	0	1.3	204.6	50.9	3.41	38.529	0
22:00	8.7	233.2	100.1	4.35	380.76	0	1.1	175.3	19.7	2.53	267.407	0
23:00	4.3	216.3	125.3	4.43	153.922	0	1.3	197.9	21.8	2.38	45.481	0

* - Highlighted cells indicate trial data