MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

MISSOURI AIR CONSERVATION COMMISSION

PERMIT TO CONSTRUCT

Under the authority of RSMo 643 and the Federal Clean Air Act the applicant is authorized to construct the air contaminant source(s) described below, in accordance with the laws, rules and conditions as set forth herein.

Permit Number: 112017-010 Project Number: 2017-07-054

Installation Number: 095-0298

Parent Company: Parker Hannifin

Parent Company Address: 6035 Parkland Blvd, Cleveland, OH 44124

Installation Name: CLARCOR Industrial Air

Installation Address: 417 SE Thompson Dr., Lee's Summit, MO 64082

Location Information: Jackson County, S17, T47N, R31W

Application for Authority to Construct was made for:
Four isopropyl alcohol coating lines, five plasma treatment lines, and associated equipment. This review was conducted in accordance with Section (6), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required.*

☐ Standard Conditions (on reverse) are applicable to this permit.

☑ Standard Conditions (on reverse) and Special Conditions are applicable to this permit.

David Little

Prepared by
David Little, PE
Environmental Engineer III
New Source Review Unit

Lyna L Moore

Director or Designee
Department of Natural Resources

NOV 21 2017

Effective Date

STANDARD CONDITIONS:

Permission to construct may be revoked if you fail to begin construction or modification within two years from the effective date of this permit. Permittee should notify the Enforcement and Compliance Section of the Air Pollution Control Program if construction or modification is not started within two years after the effective date of this permit, or if construction or modification is suspended for one year or more.

You will be in violation of 10 CSR 10-6.060 if you fail to adhere to the specifications and conditions listed in your application, this permit and the project review. In the event that there is a discrepancy between the permit application and this permit, the conditions of this permit shall take precedence. Specifically, all air contaminant control devices shall be operated and maintained as specified in the application, associated plans and specifications.

You must notify the Enforcement and Compliance Section of the Department's Air Pollution Control Program of the anticipated date of start up of this (these) air contaminant source(s). The information must be made available within 30 days of actual startup. Also, you must notify the Department's regional office responsible for the area within which you are located within 15 days after the actual start up of this (these) air contaminant source(s).

A copy of the permit application and this permit and permit review shall be kept at the installation address and shall be made available to Department's personnel upon request.

You may appeal this permit or any of the listed special conditions to the Administrative Hearing Commission (AHC), P.O. Box 1557, Jefferson City, MO 65102, as provided in RSMo 643.075.6 and 621.250.3. If you choose to appeal, you must file a petition with the AHC within 30 days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed. If it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC.

If you choose not to appeal, this certificate, the project review and your application and associated correspondence constitutes your permit to construct. The permit allows you to construct and operate your air contaminant source(s), but in no way relieves you of your obligation to comply with all applicable provisions of the Missouri Air Conservation Law, regulations of the Missouri Department of Natural Resources and other applicable federal, state and local laws and ordinances.

The Air Pollution Control Program invites your questions regarding this air pollution permit. Please contact the Construction Permit Unit using the contact information below.

Contact Information:
Missouri Department of Natural Resources
Air Pollution Control Program
P.O. Box 176
Jefferson City, MO 65102-0176
(573) 751-4817

The regional office information can be found at the following website:
http://dnr.mo.gov/regions/

SPECIAL CONDITIONS:
The permittee is authorized to construct and operate subject to the following special conditions:

The special conditions listed in this permit were included based on the authority granted the Missouri Air Pollution Control Program by the Missouri Air Conservation Law (specifically 643.075) and by the Missouri Rules listed in Title 10, Division 10 of the Code of State Regulations (specifically 10 CSR 10-6.060). For specific details regarding conditions, see 10 CSR 10-6.060 paragraph (12)(A)10. "Conditions required by permitting authority."

CLARCOR Industrial Air
Jackson County, S17, T47N, R31W

1. Capture Device Requirement – Isopropyl Alcohol (IPA) Lines
   A. CLARCOR Industrial Air shall capture emissions from the dip tanks (4 per IPA line) of the IPA coating lines (4 coating lines EU-06, EU-07, EU-08, EU-09) using respective partial enclosures and exhaust fans.
   B. Each partial enclosure shall consist of a roof with side curtains/walls extending almost to the floor, and a minimum opening for product entry. Each exhaust fan shall draw from inside the enclosure.
   C. Negative pressure shall be demonstrated at the enclosures' openings using a visual indicator such as an air velocity meter, streamers, smoke, powder puff, or other method preapproved by the Air Pollution Control Program.
   D. CLARCOR Industrial Air shall record the negative pressure demonstration method and indication of negative pressure status at at-least one location per each partial enclosure at least once every 24 hours of operation. Each 24 hour period without operation shall be indicated.
   E. CLARCOR Industrial Air shall capture emissions from the drying ovens of the IPA coating lines (EP-0U, EU-07, EU-08, EU-09) using totally enclosed drying ovens, except minimal openings for product entry.

2. Control Device Requirement – IPA Lines Catalytic Oxidizers
   A. CLARCOR Industrial Air shall control emissions from the IPA lines using catalytic oxidizers (catox) as indicated in Table 1.

Table 1: IPA Lines and Catox

IPA dip tanks and drying ovens	Regenerative thermal oxidizer
DL-1 (EU-06)	Catox 1 (EP-10)
DL-2 (EU-07)	
DL-3 (EU-08)	Catox 2 (EP-11)
DL-4 (EU-09)	

   B. The catoxs shall be operated and maintained in accordance with the manufacturer's specifications. Each catox shall be equipped with a combustion zone temperature gauge and outlet hydrocarbon concentration gauge. The gauges shall be located such that Department of Natural Resources' employees may easily observe them.

SPECIAL CONDITIONS:
The permittee is authorized to construct and operate subject to the following special conditions:

C. CLARCOR Industrial Air shall continuously monitor and record the combustion zone temperature and outlet hydrocarbon concentration at each catox. The combustion zone temperature and outlet hydrocarbon concentration shall be maintained within the design conditions specified by the manufacturer's performance warranty.

D. CLARCOR Industrial Air shall replace the catox catalyst within the design conditions specified by the manufacturer's performance warranty.

E. CLARCOR Industrial Air shall maintain a copy of each catox manufacturer's performance warranty on site.

F. CLARCOR Industrial Air shall maintain an operating and maintenance log for each catox which shall include the following:
1) Incidents of malfunction, with impact on emissions, duration of event, probable cause, and corrective actions; and
2) Maintenance activities, with inspection schedule, repair actions, and replacements, etc.
3) Dates of all above.

3. Control Device Requirement – Plasma Lines Scrubbers

A. CLARCOR Industrial Air shall control emissions from the plasma lines using wet venturi scrubbers as indicated in Table 2.

Table 2: Plasma Lines and Scrubbers

Plasma line	Scrubber
Plasma line Z-3 (EU-12)	Scrubber 1 (EP-17)
Plasma line Z-4 (EU-13)	
Plasma line Z-5 (EU-14)	Scrubber 2 (EP-18)
Plasma line Z-6 (EU-15)	
Plasma line Z-7 (EU-16)	

B. The scrubbers shall be operated and maintained in accordance with the manufacturer's specifications. Each scrubber shall be equipped with a gauge for fluid circulation rate and a gauge for air pressure drop. The gauges shall be located such that Department of Natural Resources' employees may easily observe them.

C. CLARCOR Industrial Air shall monitor and record the fluid circulation rate, air pressure drop, and fluid pH at each scrubber at least once every 24 hour period. Each 24 hour period without operation shall be indicated. The fluid circulation rate, pressure drop, and pH shall be maintained within the design conditions specified by the manufacturer's performance warranty. pH may be monitored using litmus strips.

SPECIAL CONDITIONS:
The permittee is authorized to construct and operate subject to the following special conditions:

D. CLARCOR Industrial Air shall maintain a copy of each scrubber manufacturer's performance warranty on site.

E. CLARCOR Industrial Air shall maintain an operating and maintenance log for the scrubbers which shall include the following:
   1) Incidents of malfunction, with impact on emissions, duration of event, probable cause, and corrective actions; and
   2) Maintenance activities, with inspection schedule, repair actions, and replacements, etc.
   3) Dates of all above.

4. Fuel Requirement – Natural Gas
All burners in the following table shall be fired exclusively with pipeline natural gas as defined in 40 CFR 72.2. CLARCOR Industrial Air shall demonstrate compliance using fuel SDS. All records shall be kept on site.

Table 3: Units Fired with Natural Gas

Emission Unit	Description
EU-06	IPA line drying oven DL-1
EU-07	IPA line drying oven DL-2
EU-08	IPA line drying oven DL-3
EU-09	IPA line drying oven DL-4
EP-21	Pellet melter
EP-20	Burn off oven
EP-10	Catox1
EP-11	Catox2

5. Operational Requirement - Burn Off Oven (EP-20)
   A. CLARCOR Industrial Air shall exclusively use the burn off oven to remove plastics/residue from tools/metal parts.

   B. No PVC or chlorinated materials shall be introduced into the oven.

   C. The burn off oven shall be operated with an afterburner/secondary combustion chamber. A temperature of at least 1,400 degrees Fahrenheit shall be maintained in the secondary combustion chamber.

   D. The burn off oven shall be operated with a digital gauge that continuously indicates the temperature in the secondary combustion chamber. The temperature shall be recorded at least twice per batch cycle while operating. The batch cycle start and stop times shall be recorded. The times that the temperature is recorded shall be indicated.

SPECIAL CONDITIONS:
The permittee is authorized to construct and operate subject to the following special conditions:

6. Operational Requirement – VOC Materials
CLARCOR Industrial Air shall keep the VOC containing materials in closed containers whenever the materials are not in use. CLARCOR Industrial Air shall provide and maintain suitable, easily read, permanent markings on all VOC material containers used with this equipment.

7. Record Keeping and Reporting Requirements
   A. CLARCOR Industrial Air shall maintain all records required by this permit for not less than five years and shall make them available immediately to any Missouri Department of Natural Resources' personnel upon request. These records shall include SDS for all materials used.

   B. CLARCOR Industrial Air shall report to the Air Pollution Control Program's Compliance/Enforcement Section, by mail at P.O. Box 176, Jefferson City, MO 65102 or by email at aircompliancereporting@dnr.mo.gov, no later than 10 days after the end of the month during which any record required by this permit shows an exceedance of a condition imposed by this permit.

REVIEW OF APPLICATION FOR AUTHORITY TO CONSTRUCT AND OPERATE
SECTION (6) REVIEW
Project Number: 2017-07-054
Installation ID Number: 095-0298
Permit Number: 112017-010

Installation Address:
CLARCOR Industrial Air
417 SE Thompson Dr
Lee's Summit, MO 64082

Parent Company:
Parker Hannifin
6035 Parkland Blvd
Cleveland, OH 44124

Jackson County, S17, T47N, R31W

REVIEW SUMMARY

- CLARCOR Industrial Air has applied for authority to install four isopropyl alcohol coating lines, five plasma treatment lines, and associated equipment.
- The application was deemed complete on August 4, 2017.
- HAP emissions are expected from plastic extrusion, plasma treatment, and natural gas combustion, but in amounts below respective SMALs.
- None of the NSPS apply to the project emission units.
- None of the NESHAPs apply to the project emission units.
- None of the MACTs apply to the project emission units.
- Two catalytic oxidizers for four IPA lines and two scrubbers for five plasma treatment lines are being used to control the IPA and HF emissions.
- This review was conducted in accordance with Section (6) of Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required.* The project VOC PTE is above the de minimis level but below major.
- This installation is located in Jackson County, part of which is a nonattainment area for the 2010 SO_2 standard. This installation is located outside of that area.
- This installation is not on the List of Named Installations found in 10 CSR 10-6.020(3)(B), Table 2. The installation's major source level is 250 tons per year and fugitive emissions are not counted toward major source applicability.
- Ambient air quality modeling was not performed for this review. No model is readily available which can accurately predict ambient ozone concentrations caused by this

installation's VOC emissions.

- Emission testing is not required as a part of this permit.

- Submittal of an intermediate operating permit application is required within 90 days of IPA line startup. Alternatively, submittal of a part 70 operating permit application is required within 12 months of IPA line startup. The applicant indicated equipment installation may be conducted in phases spanning several months. Therefore, the 90 day period and 12 month period commence after the IPA lines are operated, as these emission units contribute the majority of the project VOC emissions which puts the installation-wide VOC potential emissions above 100 tpy, necessitating the intermediate or part 70 operating permit.

- Approval of this permit is recommended with special conditions.

INSTALLATION DESCRIPTION

The installation manufactures expanded polytetrafluoroethylene (ePTFE) and nanofibers for use in a number of products including filters and the health care industry. The existing installation is a minor source of VOC for NSR permits and a basic source of VOC for operating permits. The following NSR (construction) permits have been issued to CLARCOR Industrial Air from the Air Pollution Control Program.

Table 4: Construction Permit History

Permit Number	Description
012004-009	ePTFE manufacturing
102014-003	Coating line, cure oven, thermal oxidizer
112016-003	Forcespinning unit to produce nanofibers
112016-003A	Nanofiber plasma treatment

PROJECT DESCRIPTION

Under this application, the installation proposes to install a polypropylene extruder and blown fiber former, burn off oven, IPA mixing tanks, IPA coating lines and drying ovens to treat the blown polypropylene mat, plasma treatment units, and control devices consisting of catalytic oxidizers and scrubbers. This application is combined with previous projects to create one project as summarized in Table 5.

Under this application, the installation will receive polypropylene pellets in Gaylords. The pellets will be fed into the extruder, melted, and blown to form filter mat material. The melt-blown process MHDR is 900 pounds per 24 hours of production. The melter is natural gas fired at a maximum of 1.5 MMBtu/hr input. The burn off oven cleans the machine parts of plastic scrap. It is rated at 0.26 MMBtu/hr input of natural gas. The blown fiber is its own inherent control device because as the fibers are blown and collected they form a mat, and collection of the fibers is necessary to make a salable product. Blown fiber is wound onto rolls and sent to the IPA lines.

Four IPA lines are proposed, each consisting of four dedicated dip tanks and a dedicated drying oven. The first tank contains a 60/40 IPA/water solution. The subsequent tanks begin with water but naturally change to increasing IPA concentrations due to carryover. The last tank is maintained at 10% or less IPA. Each drying oven is fired with natural gas at a maximum of 1 MMBtu/hr input. The ovens are completely enclosed except for product entry and exit. The tanks are surrounded by a roof and curtains. Emissions are routed to one of two catalytic oxidizers. Each catox is fired with natural gas. One is rated at 2 MMBtu/hr input; the other at 1.7 MMBtu/hr input. Dried mat is wound onto rolls and shipped offsite or made into filters onsite using glues that don't contain VOC.

IPA will be received to an outside storage tank and piped inside to totes for mixing. This new system will also provide IPA for existing unrelated processes. The existing processes will not see a potential increase as a result of the new IPA storage/mixing method.

Five plasma treatment lines will be installed. Plasma is used to modify the surface of filter material fibers. Each line consists of a single treatment unit. The units will be loaded with filter rolls, vacuum purged, filled with hexafluoropropylene gas, treated, vacuum purged, and unloaded. The gas MHDR is 1.439 lbs/hr per unit. The plasma results in hydrogen fluoride emissions which are sent to one of two scrubbers.

Table 5: Project Emission Units

Emission Unit	Emission Unit Description	Emission Point	Control Device
EP-19	Polypropylene (PPE) pellet unloading into melter		N/A
EP-21	PPE melting: material emissions and fuel combustion		N/A
EP-22	PPE blowing/fiber forming		Inherent fiber forming
EP-20	Burn-off oven		Integral afterburner
EU-06	IPA coating line DL-1: 4 tanks and drying oven	EP-10	Catox1
EU-07	IPA coating line DL-2: 4 tanks and drying oven		
EU-08	IPA coating line DL-3: 4 tanks and drying oven	EP-11	Catox2
EU-09	IPA coating line DL-4: 4 tanks and drying oven		
EU-12	Plasma treatment line Z-3	EP-17	Scrubber 1
EU-13	Plasma treatment line Z-4		
EU-14	Plasma treatment line Z-5	EP-18	Scrubber 2
EU-15	Plasma treatment line Z-6		
EU-16	Plasma treatment line Z-7		
EP-23	8,700 gal IPA storage tank		N/A
EP-24	350 gal tote for 60% IPA, 40% water mixing		N/A
EP-25	350 gal tote for 60% IPA, 40% water use		N/A
EP-26	350 gal tote for IPA/water return from IPA coating lines		N/A
EP-27	Existing paved haul roads		N/A
Previous Projects Combined with 2017-07-054 as One Project			
EP-04	Nanofiber forcespinning unit		N/A
EP-05	Nanofiber plasma treatment unit		Scrubbers preinstalled on unit but not federally enforceable

N/A = not applicable

EMISSIONS/CONTROLS EVALUATION

Emission factor references are provided at the end of this permit. Emission calculations are provided in the attached Excel document.

PM, PM_{10}, and $PM_{2.5}$ filterable emission factors for pellet handling were obtained from project 2009-07-026, 1 lb/ton. Melting emission factors were obtained from an AWMA document. Melting emissions include PM, PM_{10}, $PM_{2.5}$, VOC, CO, and HAPs. These are in addition to the natural gas fired melter emissions.

PM, PM_{10}, and $PM_{2.5}$ filterable emission factors for fiber forming originated from the permit application's mass balance of 0.0001 lb/lb blown equating to 99.99% control. This would be HEPA level control, without a HEPA being installed. Therefore, this review conservatively changed the control to 99.5%, for an emission factor of 0.005 lb/lb or 10 lb/ton blown. 99.5% was obtained from the permits section default PM and PM_{10} filterable control for a baghouse. The control is inherent to the fiber forming operation, therefore no special condition is required.

The IPA lines' emission factors were obtained from stack testing conducted on the same lines installed in another state. Those lines are being relocated to this installation for this project. The catox inlet value of 18.33 lb/hr for one line was reduced by a conservative 95% to obtain the stack emissions. Stack testing showed 96.5% control minimum. Fugitive emissions were calculated using the catox inlet value, with an assumed 95% capture efficiency. Potential fugitive IPA is 0.965 lb/hr per line. Potential IPA usage/loss rate for this project is approximately 19.30 lb/hr per line.

Plasma treatment results in hydrogen fluoride emissions, represented by a stack test. The controlled emission rate is 0.0006 lb/hr of hydrogen fluoride per unit. There are no fugitive emissions.

Natural gas combustion emissions were calculated using the EPA document AP-42, *Compilation of Air Pollutant Emission Factors*, Fifth Edition, Chapter 1.4 Natural Gas Combustion, July 1998.

IPA storage and mixing tank emissions were calculated using the EPA program TANKS 4.09d.

Haul road emissions for receiving and shipping were calculated using AP-42, Chapter 13.2.1 Paved Roads, January 2011.

The following table provides an emissions summary for this project. Existing potential emissions were obtained from operating permit project 2017-06-010, which includes projects 2016-08-028 (permit 112016-003) and 2017-01-037 (permit 112016-003A). Existing actual emissions were obtained from the installation's 2016 EIQ. Potential emissions of the project represent the potential of the IPA lines and plasma lines, summed with projects 2016-08-028 and 2017-01-037, as these three are one project for

construction permit purposes. The new installation conditioned potential is the sum of the existing potential plus just the new emission units in this project 2017-07-054.

Table 6: Emissions Summary (tpy)

Pollutant	Regulatory *De Minimis* Levels and SMAL	Existing Potential Emissions	Existing Actual Emissions	Potential Emissions of the Project	New Installation Conditioned Potential
PM	25.0	N/D	N/D	1.14	N/D
PM_{10}	15.0	1.01	1.1E-03	1.37	2.33
$PM_{2.5}$	10.0	0.64	1.1E-03	1.36	1.96
SO_2	40.0	0.07	1E-04	0.05	0.09
NOx	40.0	7.87	0.02	4.06	11.93
VOC	40.0	92.81	32.20	45.03	126.18
CO	100.0	6.64	0.01	3.47	10.07
Fluorides excluding HF	3.0	N/D	N/D	6.7E-05	N/D
GHG (CO_2e)	N/A	<<75,000	N/D	4,903.65	N/D
GHG (mass)	N/A	N/D	N/D	4,874.87	N/D
Combined HAPs	25.0	1.18	3.5E-03	1.13	1.28
Dimethyl formamide	1.0	N/D	3.5E-03	< 1	N/D
Formaldehyde	2.0	N/D	N/D	6.2E-03	N/D
Acrolein	0.04	N/D	N/D	1.3E-04	N/D
Acetaldehyde	9.0	N/D	N/D	2.6E-03	N/D
Proprionaldehyde	5.0	N/D	N/D	2.6E-04	N/D
Hydrogen fluoride (HF)	0.1	N/D	N/D	4.5E-02	N/D
Benzene	2.0	N/D	N/D	1.0E-04	N/D
Hexane	10.0	N/D	N/D	7.3E-02	N/D

N/A = Not Applicable; N/D = Not Determined
Other individual HAPs are potentially emitted, each below the respective SMAL.

APPLICABLE REQUIREMENTS

CLARCOR Industrial Air shall comply with the following applicable requirements. The Missouri Air Conservation Laws and Regulations should be consulted for specific record keeping, monitoring, and reporting requirements. Compliance with these emission standards, based on information submitted in the application, has been verified at the time this application was approved. For a complete list of applicable requirements for your installation, please consult your operating permit.

GENERAL REQUIREMENTS

- *Operating Permits*, 10 CSR 10-6.065
- *Start-Up, Shutdown, and Malfunction Conditions,* 10 CSR 10-6.050

- *Submission of Emission Data, Emission Fees and Process Information,* 10 CSR 10-6.110
    - Per 10 CSR 10-6.110(4)(B)2.B(II) and (4)(B)2.C(II) a full EIQ is required for the first full calendar year the equipment (or modifications) approved by this permit are in operation.

- *Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin*, 10 CSR 10-6.170

- *Restriction of Emission of Visible Air Contaminants*, 10 CSR 10-6.220

- *Restriction of Emission of Odors*, 10 CSR 10-6.165

SPECIFIC REQUIREMENTS

- 10 CSR 10-2.215 *Control of Emissions from Solvent Cleanup Operations* does not apply. If the IPA coating lines are interpreted for purposes of this rule to be solvent cleanup, then the rule does not apply to any stationary source at which cleaning solvent VOCs are emitted at less than 500 pounds per day. The potential controlled VOC emissions plus fugitives from the combined four IPA coating lines are 180.6 pounds per day. 180.6 is less than 500, therefore the rule does not apply.

- 10 CSR 10-2.230 *Control of Emissions From Industrial Surface Coating Operations* applies to the four IPA coating lines. The permit application refers to the lines as *coating* lines, and the process meets the definition of *coating* in 10 CSR 10-6.020(2)(C)31. The combined uncontrolled VOC PTE exceeds the rule's applicability of 2.7 tpy. However, the coated substrate is non-woven polypropylene that does not meet the definition of any substrate in 10 CSR 10-2.230(4), including not meeting the definition of fabric. Fabric coating is defined in 10 CSR 10-6.020(2)(F)1. as being applied to a textile substrate. Textile is not defined in the CSR but has a general definition as being woven, knitted, or felted. This substrate is not woven, knitted, or felted, therefore it is not a textile, and not a fabric for the purposes of this rule. Therefore, there is no applicable VOC emission limit within the rule.

STAFF RECOMMENDATION

On the basis of this review conducted in accordance with Section (6), Missouri State Rule 10 CSR 10-6.060, *Construction Permits Required*, it is recommended that this permit be granted with special conditions.

PERMIT DOCUMENTS

The following documents are incorporated by reference into this permit:

- The Application for Authority to Construct form, dated June 29, 2017, received July 18, 2017, designating Parker Hannifin as the owner and operator of the installation.
- The Application for Authority to Construct form, dated June 29, 2017, received August 4, 2017, designating Parker Hannifin as the owner and operator of the installation.

The following documents are permit references:

- 2017-07-054.xlsx
- 2017-07-054 draft 1.pdf
- 2017-07-054 draft 1 comments.pdf
- 2017-07-054 draft 2.pdf
- U.S. EPA document, AP-42 Compilation of Air Emission Factors, Fifth Edition, Volume 1.
- U.S. EPA software, TANKS version 4.09d
- *Development of Emission Factors for Polypropylene Processing.* Journal of the Air & Waste Management Association. Volume 49. January 1999.
- *Volatile Emissions During Thermoplastics Processing - A Review.* Advances in Polymer Technology, Vol 14 No. 1, 1995.

APPENDIX A

Abbreviations and Acronyms

% .....percent
°F .....degrees Fahrenheit
acfm.....actual cubic feet per minute
BACT.....Best Available Control Technology
BMPs.....Best Management Practices
Btu.....British thermal unit
CAM .....Compliance Assurance Monitoring
CAS.....Chemical Abstracts Service
CEMS .....Continuous Emission Monitor System
CFR.....Code of Federal Regulations
CO .....carbon monoxide
CO_2.....carbon dioxide
CO_2e.....carbon dioxide equivalent
COMS.....Continuous Opacity Monitoring System
CSR.....Code of State Regulations
dscf.....dry standard cubic feet
EIQ.....Emission Inventory Questionnaire
EP.....Emission Point
EPA.....Environmental Protection Agency
EU .....Emission Unit
fps.....feet per second
ft.....feet
GACT .....Generally Available Control Technology
GHG.....Greenhouse Gas
gpm .....gallons per minute
gr.....grains
GWP .....Global Warming Potential
HAP.....Hazardous Air Pollutant
hr.....hour
hp .....horsepower
lb.....pound
lbs/hr.....pounds per hour
MACT.....Maximum Achievable Control Technology
$\mu g/m^3$.....micrograms per cubic meter
m/s.....meters per second
Mgal .....1,000 gallons
MW .....megawatt
MHDR.....maximum hourly design rate
MMBtu ....Million British thermal units
MMCF .....million cubic feet
MSDS .....Material Safety Data Sheet
NAAQS ....National Ambient Air Quality Standards
NESHAPs National Emissions Standards for Hazardous Air Pollutants
NO_x.....nitrogen oxides
NSPS .....New Source Performance Standards
NSR.....New Source Review
PM.....particulate matter
$PM_{2.5}$.....particulate matter less than 2.5 microns in aerodynamic diameter
PM_{10} .....particulate matter less than 10 microns in aerodynamic diameter
ppm .....parts per million
PSD.....Prevention of Significant Deterioration
PTE .....potential to emit
RACT.....Reasonable Available Control Technology
RAL.....Risk Assessment Level
SCC .....Source Classification Code
scfm .....standard cubic feet per minute
SDS.....Safety Data Sheet
SIC.....Standard Industrial Classification
SIP.....State Implementation Plan
SMAL.....Screening Model Action Levels
SO_x.....sulfur oxides
SO_2.....sulfur dioxide
SSM.....Startup, Shutdown & Malfunction
tph .....tons per hour
tpy.....tons per year
VMT.....vehicle miles traveled
VOC .....Volatile Organic Compound

Installation: Clarcor, Lee's Summit
ID: 095-0298
Calculation Date: 9/26/2017
Project Description: **Polypropylene / IPA lines**

receive polypropylene pellets in gaylords, melt-blown on site using natural gas 1.5mmbtu.
MHDR PPE pellets 900 pounds per day, for 162,000 square ft /day blown. Has a separate 260,000 btu natural gas burn off oven.
4 new lines (EU-06 to EU-09) to coat continuous rolls of porous, non-woven polypropylene material with IPA/water mixture
DL-2 and DL-3 to catox1. DL-4 and DL-5 to catox2.
2 new catalytic oxidizers, natural gas with catalyst bed
monitors for inlet temp, outlet temp, hydrocarbon conc.
each line to have open top tank of 60/40 ipa/water, and 3 water rinse tanks
two of the 60/40 tanks will be 50 gal, two will be 75 gal
the solution is drawn out of the PPE by extraction rollers prior to leaving 1st tank area
secondary containment at each of the 4 solution tanks will be dedicated recessed floor pits, with vapors exhausted to catox
coated, washed material will enter a dedicated drying oven (100,000 btu each), exhausted to catox
existing process 232 IPA storage and mixing to be removed and replaced with combined system for 4 lines and process 232
1 new 8,700 gal IPA tank
300ft2 mixing room
once mixed delivery to each line via closed piping

Plasma / Z lines

five lines (EU-12 to EU-16) using hexafluorpropene gas as the plasma agent (results in hydrogen fluoride HAP emissions)
plasma units are sealed, vacuum purged, routed to 2 scrubbers
Z-3, Z-4, Z-5 to scrubber 1 (EP-17). Z-6 and Z-7 to scrubber 2 (EP-18).

PTE (tpy)

Pollutant	Melt/Blown	IPA Lines	Plasma Z-Lines	Storage Tanks, Pumping	Natural Gas Combustion	Haul Roads	Sum of 2017-07-054	prior project 2017-01-037	Combined Project	De minimis / SMAL (tpy)	combined project > demin or SMAL?	Installation PTE from 2017-06-010	New Installation PTE
PM	1.01				0.08	0.0090	1.10	0.044612148	1.14	25		n/d	#VALUE!
PM10	1.01				0.31	0.0018	1.32	0.044612148	1.37	15		1.01	2.33
PM2.5	1.01				0.31	0.0004	1.32	0.044612148	1.36	10		0.64	1.96
SO2					0.02		0.02	0.025608366	0.05	40		0.07	0.09
NOx					4.06		4.06		4.06	40		7.87	11.93
VOC	0.13	32.97		0.0475436	0.22		33.37	11.65673638	45.03	40	YES	92.81	126.18
CO	0.02				3.41		3.43	0.038238736	3.47	100		6.64	10.07
Fluorides excluding HF								6.72075E-05	6.7E-05	3		n/d	#VALUE!
GHG mass					4,874.87		4874.87		4874.87	0		n/d	#VALUE!
GHG CO2e					4,903.65		4903.65		4903.65	75000		n/d	#VALUE!
Combined HAPs	0.00612817		0.01314		0.08		0.10	1.031429107	1.13	25		1.18	1.28
DMF								<1	1	1	prior limited	n/d	#VALUE!
formaldehyde	0.00313718				3.05E-03		6.2E-03	1.24505E-05	6.2E-03	2		n/d	#VALUE!
acrolein	0.00013304						1.3E-04	1.6825E-07	1.3E-04	0.04		n/d	#VALUE!
acetaldehyde	0.00259515						2.6E-03	7.73952E-06	2.6E-03	9		n/d	#VALUE!
proprionaldehyde	0.0002628						2.6E-04	8.41252E-07	2.6E-04	5		n/d	#VALUE!
HF			0.01314				1.3E-02	0.031391105	4.5E-02	0.1		n/d	#VALUE!
benzene					8.53E-05		8.5E-05	1.68019E-05	1.0E-04	2		n/d	#VALUE!
hexane					0.07		0.07		7.3E-02	10		n/d	#VALUE!

Emission Unit	Emission Point	Description	Material	MHDR true	MHDR Bottlenecked (tph)	Pollutant	Emission Factor (lb/ton)	Emission Factor Source	Available Emissions (lb/hr)	Control Device	Capture Efficiency	Control Efficiency	PTE (lb/hr)	PTE (tpy)
	EP-19	polypropylene pellet unloading, gaylords into melter		N/D	0.01875	PM	1		0.01875	none	n/a	n/a	0.01875	0.08
						PM10	1		0.01875				0.01875	0.08
						PM2.5	1	see below	0.01875				0.01875	0.08

factor obtained from project 2009-07-026. Close to SCC 3-01-018-11 Storage 0.8 lb/ton.

Emission Unit	Emission Point	Description	Material	MHDR true	MHDR (tph)	Pollutant	Emission Factor (lb/ton)	Emission Factor Source	Available Emissions (lb/hr)	Control Device	Capture Efficiency	Control Efficiency	PTE (lb/hr)	PTE (tpy)
	EP-21	polypropylene pellet melting		N/D	0.01875	PM	1.306		0.0244875	none	n/a	n/a	0.0244875	0.11
						PM10	1.306		0.0244875				0.0244875	0.11
		mhdr 900 lbs per 24 hour production				PM2.5	1.306		0.0244875				0.0244875	0.11
						VOC	1.638		0.0307125				0.0307125	0.13
						CO	0.2		0.00375				0.00375	0.02
						Combined HAPs	0.07462		0.0013991				0.0013991	0.0061
						formaldehyde	0.0382		0.0007163				0.0007163	0.0031
						acrolein	0.00162		3.038E-05				3.038E-05	0.0001
						acetaldehyde	0.0316		0.0005925				0.0005925	0.0026
						propionaldehyde	0.0032	see below	0.00006				0.00006	0.0003

	ug / gram	lb /MM lb	lb/ton
pm	653	653	1.306
thc as voc	819	819	1.638
formaldehyde	19.1	19.1	0.0382
acrolein	0.81	0.81	0.00162
acetaldehyde	15.8	15.8	0.0316
propionaldehyde	1.6	1.6	0.0032
CO		100	0.2

PM, VOC, HAP factors from "Development of Emission Factors for Polypropylene Processing" AWMA 1999, Table 5. Assumed Test Run 3 at 605 degrees F for conservative worst case.
Carbon monoxide factor from "Volatile Emissions During Thermoplastics Processing - A Review, Advances in Polymer Technology", Vol 14 No. 1, 1995.

Emission Unit	Emission Point	Description	Material	MHDR true	MHDR (tph)	Pollutant	Emission Factor (lb/ton)	Emission Factor Source	Available Emissions (lb/hr)	Control Device	Capture Efficiency	Control Efficiency	PTE (lb/hr)	PTE (tpy)
	EP-22	polypropylene blowing, fiber forming		N/D	0.01875	PM	10		0.1875				0.1875	0.82
						PM10	10		0.1875				0.1875	0.82
						PM2.5	10	see below	0.1875	controlled emission factor			0.1875	0.82

Applicant claimed PM emission factor of 0.0001 lb/lb poly. This equates to 99.99% control. Conservatively 99.5% was chosen instead, equates to 0.005 lb/lb emission factor, 0.5% loss.
Same factor as project 2016-08-028.

Drying Line 2

Emission Unit	Emission Point	Description	Material	MHDR true	MHDR Bottlenecked (tph)	Pollutant	Emission Factor (lb/ton)	Emission Factor Source	New Jersey tested RTO inlet per line (lb/hr), highest of any test	Control Device	Capture Efficiency, 100% because tested value already in the catox inlet	Control Efficiency	PTE (lb/hr)	PTE (tpy)
DL-1	catox1	stack portion, 50 gallon open top dip tank and 3 rinse tanks	60% IPA by volume in dip tank, down to 10% in last rinse tank	n/d		IPA - VOC			18.333333	catox1	100%	95%	0.9166667	4.015

95% control efficiency should be conservative, as testing from New Jersey for these units showed 96.71% and 97.10% DRE.
catox combustion emissions included on separate tab

Emission Unit	Emission Point	Description	Material	MHDR true	MHDR Bottlenecked (tph)	Pollutant	Emission Factor (lb/ton)	Emission Factor Source	Available Emissions (lb/hr)	Control Device	Capture Efficiency	Control Efficiency	Fugitive PTE (lb/hr)	Fugitive PTE (tpy)
DL-1	fugitive	stack portion, 50 gallon open top dip tank and 3 rinse tanks	60% IPA by volume in dip tank, down to 10% in last rinse tank			IPA - VOC			19.298246		95%		0.9649123	4.23

95% capture efficiency estimated, enclosure using hanging plastic strips
available emissions backcalculated from stack test uncontrolled emissions

Available emissions are what would emit from tank prior to considering capture/control.

Drying Line Number	Stack VOC PTE (tpy)	Fugitive VOC PTE (tpy)	Total (tpy)
DL-1 EU06 to catox1 EP10	4.015	4.23	8.24
DL-2 EU07 to catox1 EP10	4.015	4.23	8.24
DL-3 EU08 to catox2 EP11	4.015	4.23	8.24
DL-4 EU09 to catox2 EP11	4.015	4.23	8.24
			32.97 all 4 lines

per IPA line			
line speed	29.7	linear ft/min	
max fabric width	60	inches	
line speed	148.5	ft2 / min	
max dry fabric weight	36	gram / m2	
max wet fabric weight	96	gram / m2	
liquid net weight	60	gram / m2	how much it can soak up or how much is released, 100% emitted?
liquid net weight	0.0122893	lb / ft2	
liquid rate	1.8249561	lb/min	
IPA volume	60%		
water volume	40%		
IPA density	6.56358	lb/gal	
water density	8.34	lb/gal	
liquid density	7.274148	lb/gal	
liquid rate	0.2508825	gal/min	how much it can soak up or how much is released 100% emitted?
IPA rate	0.9880122	lb/min	
IPA rate	0.0296404	tph	doesn't match application. Not needed since stack test used to calculate PTE.

Emission Unit	Emission Point	Description	Material	MHDR true	MHDR Bottlenecked (lb/hr)	Pollutant	Emission Factor (lb/ton)	Emission Factor Source	Available Emissions (lb/hr)	Control Device	Capture Efficiency	Control Efficiency	PTE (lb/hr)	PTE (tpy)
Z-3	EP-17	vacuum plasma treatment of filter substrate	hexafluoropropylene gas		1.439	hydrogen fluoride				scrubber 1			0.0006	0.002628
						HF controlled emission rate obtained from application citing 4/2/2007 stack test								
Z-4	EP-17	vacuum plasma treatment of filter substrate	hexafluoropropylene gas		1.439	hydrogen fluoride				scrubber 1			0.0006	0.002628
Z-5	EP-18	vacuum plasma treatment of filter substrate	hexafluoropropylene gas		1.439	hydrogen fluoride				scrubber 2			0.0006	0.002628
Z-6	EP-18	vacuum plasma treatment of filter substrate	hexafluoropropylene gas		1.439	hydrogen fluoride				scrubber 2			0.0006	0.002628
Z-7	EP-18	vacuum plasma treatment of filter substrate	hexafluoropropylene gas		1.439	hydrogen fluoride				scrubber 2			0.0006	0.002628
													total tpy	
													0.01314	

scrubber 1	scrubber 2
Z-3 EU12	Z-5 EU14
Z-4 EU13	Z-6 EU15
	Z-7 EU16

per plasma unit

HFP usage	[redacted].8	cc/min	this has to be the vapor cc/min for calculation to work, not liquid cc
HFP vapor density	[redacted]5.18	kg/m3	otherwise need to use the liquid density, not vapor
HFP usage	4.144E-05	kg/min	
HFP usage	0.0054815	lb/hr	
HFP consumed to roll	97%		sds gas density (lb/ft3) converted to kg/m3
HF emissions to scrubber inlet	0.0001644	lb/hr	0.3981 [redacted]6.3767831

can't follow the application's calcs, not necessary as there was a stack test and no fugitives.
application says hydrogen fluoride PTE is 7.196 lb/yr

Emission Unit	Emission Point	Description	MHDR (MMBtu/hr input)	Combined MHDR (MMBtu/hr input)	MHDR (MMcf/hr)
	EU-06	IPA line drying oven	1.0	9.46	0.00927
	EU-07	IPA line drying oven	1.0		
	EU-08	IPA line drying oven	1.0		
	EU-09	IPA line drying oven	1.0		
	EP-21	pellet melter	1.5		
	EP-20	burn off oven	0.260		
	EP-10	catox1	2		
	EP-11	catox2	1.7		

Natural Gas HHV (Btu/cf)
1,020

	SO2 (lb/mmcf)	grains sulfur per	scf	grs/cf
AP-42	0.6	2000	1,000,000	0.002
40 CFR 72.2	1.5	0.5	100	0.005
site specific	#VALUE!	fill in	fill in	#VALUE!

Turbine natural gas emission factor obtained from AP-42 Table 3.1-2a (0.94*S lb/MMBtu), 40 CFR 72.2 "pipeline natural gas" definition of 0.5 grains or less of total sulfur per 100 SCF (S = 1.62E-03), natural gas density of 0.044 lb/CF, and HHV of 1,020 Btu/CF. The result is 1.56 lb/MMCF. However all natural gas combustion types should have the same emission factor regardless of the type as long as there is good combustion. SO_2 is based upon fuel sulfur content. AP-42 Table 1.4-2 says based on 2,000 grains per MMCF, and to convert based upon ratio of concentrations (0.005 gr/cf / 0.002 gr/cf). The 0.6 factor becomes 1.5. So, 1.5 lb/MMCF was selected.

	Pollutant	CAS	HAP?	Emission Factor (lb / mmcf)	Emission Factor Source (SCC)	Available Pollutant (lb/hr)	Control Device	PTE (lb/hr)	PTE (tpy)
	PM filterable			1.9	1-02-006-02 industrial boiler, natural gas, 10-100MMBtu and 1-02-006-03 < 10MMBtu	0.0176	none	0.0176	0.08
	PM10			7.6		0.0705	none	0.0705	0.31
	PM2.5			7.6		0.0705	none	0.0705	0.31
	SO2			0.6		0.0056	none	0.0056	0.02
	NOx			100		0.9275	none	0.9275	4.06
	VOC			5.5		0.0510	none	0.0510	0.22
	CO			84		0.7791	none	0.7791	3.41
	Combined HAPs			1.888		0.0175	none	0.0175	0.08
	POM aggregate group			6.98E-04		6.48E-06	none	6.48E-06	2.84E-05
pom	2-Methylnaphthalene	91-57-6	y	2.40E-05		2.23E-07	none	2.23E-07	9.75E-07
pom	3-Methylchloranthrene	56-49-5	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
pom	7,12-Dimethylbenzanthracene	57-97-6	y	1.60E-05		1.48E-07	none	1.48E-07	6.50E-07
pom	Acenaphthene	83-32-9	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
pom	Acenaphthylene	203-96-8	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
pom	Anthracene	120-12-7	y	2.40E-06		2.23E-08	none	2.23E-08	9.75E-08
pom	Benzanthracene	56-55-3	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
	Benzene	71-43-2	y	2.10E-03		1.95E-05	none	1.95E-05	8.53E-05
pom	Benzo(a)pyrene	50-32-8	y	1.20E-06		1.11E-08	none	1.11E-08	4.87E-08
pom	Benzo(b)fluoranthene	205-99-2	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
pom	Benzo(g,h,i)perylene	191-24-2	y	1.20E-06		1.11E-08	none	1.11E-08	4.87E-08
pom	Benzo(k)fluoranthene	205-82-3	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
	Butane	106-97-8		2.10E+00		1.95E-02	none	1.95E-02	8.53E-02
pom	Chrysene	218-01-9	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
pom	Dibenzo(a,h)anthracene	53-70-3	y	1.20E-06		1.11E-08	none	1.11E-08	4.87E-08
	Dichlorobenzene	25321-22-6	y	1.20E-03		1.11E-05	none	1.11E-05	4.87E-05
	Ethane	74-84-0		3.10E+00		2.88E-02	none	2.88E-02	1.26E-01
pom	Fluoranthene	206-44-0	y	3.00E-06		2.78E-08	none	2.78E-08	1.22E-07
pom	Fluorene	86-73-7	y	2.80E-06		2.60E-08	none	2.60E-08	1.14E-07
	Formaldehyde	50-00-0	y	7.50E-02		6.96E-04	none	6.96E-04	3.05E-03
	Hexane	110-54-3	y	1.80E+00		1.67E-02	none	0.0167	0.07
pom	Indeno(1,2,3-cd)pyrene	193-39-5	y	1.80E-06		1.67E-08	none	1.67E-08	7.31E-08
pom	Naphthalene	91-20-3	y	6.10E-04		5.66E-06	none	5.66E-06	2.48E-05
	Pentane	109-66-0		2.60E+00		2.41E-02	none	2.41E-02	1.06E-01
pom	Phenanathrene	85-01-8	y	1.70E-05		1.58E-07	none	1.58E-07	6.91E-07
	Propane	74-98-6		1.60E+00		1.48E-02	none	1.48E-02	6.50E-02
pom	Pyrene	129-00-0	y	5.00E-06		4.64E-08	none	4.64E-08	2.03E-07
	Toluene	108-88-3	y	3.40E-03		3.15E-05	none	3.15E-05	1.38E-04
	Arsenic	7440-38-2	y	2.00E-04		1.85E-06	none	1.85E-06	8.12E-06
	Barium	7440-39-3		4.40E-03		4.08E-05	none	4.08E-05	1.79E-04
	Beryllium	7440-41-7	y	1.20E-05		1.11E-07	none	1.11E-07	4.87E-07
	Cadmium	7440-43-9	y	1.10E-03		1.02E-05	none	1.02E-05	4.47E-05
	Chromium	7440-47-3	y	1.40E-03		1.30E-05	none	1.30E-05	5.69E-05
	Cobalt	7440-48-4	y	8.40E-05		7.79E-07	none	7.79E-07	3.41E-06
	Copper	7440-50-8		8.50E-04		7.88E-06	none	7.88E-06	3.45E-05
	Manganese	7439-96-5	y	3.80E-04		3.52E-06	none	3.52E-06	1.54E-05
	Mercury	7439-97-6	y	2.60E-04		2.41E-06	none	2.41E-06	1.06E-05
	Molybdenum	7439-98-7		1.10E-03		1.02E-05	none	1.02E-05	4.47E-05
	Nickel	7440-02-0	y	2.10E-03		1.95E-05	none	1.95E-05	8.53E-05
	Selenium	7782-49-2	y	2.40E-05		2.23E-07	none	2.23E-07	9.75E-07
	Vanadium	7440-62-2		2.30E-03		2.13E-05	none	2.13E-05	9.34E-05
	Zinc	7440-66-6		2.90E-02		2.69E-04	none	2.69E-04	1.18E-03
	CO2			120,000		1112.94	none	1112.941	4,874.68
	Methane			2.3		0.0213	none	0.0213	0.09
	N2O			2.2		0.0204	none	0.0204	0.09
	GHG (mass)								4,874.87
	GHG (CO2e)								4,903.65

100yr GWP 40 CFR 98 Table A-1, Jan 1 2014

CO2	1
CH4	25
N2O	298

Natural gas HHV of 1,020 Btu/cf cited from AP-42 Section 1.4, July 1998.
Dichlorobenzene group CAS 25321-22-6 conservatively assumed as 100% 1,4-dichlorobenzene CAS 106-46-7.

see below	2 new 5,000 gal above ground tanks, vented	
EP-24	350 gal tote	60/40 mix tank
EP-25	350 gal tote	60/40 holding tank
EP-26	350 gal tote	return water from drying lines, contains the IPA being rinsed out of the PPE substrate

IPA tank MHDR is sum of tested RTO inlet (lb/hr) and calculated fugitives from the lines

RTO inlet VOC (lb/hr)	IPA fugitive (lb/hr)	total IPA lost (lb/hr)	IPA density (lb/gal)	total IPA lost (gal/hr)	number of lines	total IPA usage rate (gal/hr)	total IPA usage rate (gal/yr)	one 5,000 gal tank (turnovers/ yr)	one 350 gal tank (turnovers/ yr pure IPA)
18.33333333	19.298246	37.631579	6.56358	5.7333923	4	22.933569	200898.07	40.179613	573.99447
per line	per line	per line		per line					

This 19.30 is not the fugitive. It is the total available prior to considering capture/control. Therefore the 18.33 should be deleted, and the total IPA lost is only 19.30, not 37.63.
Assume resulting PTE is 19.30/37.63 of the values listed below, for tanks total 0.048 tpy not 0.093 tpy.

run TANKS program for one 5,000 gal tank at the total IPA usage rate
run TANKS program for one 350 gal tote at 100% IPA with turnovers per year to match total usage, double it for having two totes.

TANKS losses (lb/yr)

5,000 gal tank	130.68
350 gal	27.37
350 gal	27.37

total VOC (tpy)	0.09271	0.0475436
	incorrect	correct

draft 1 comments received 9/25/2017. instead of two 5,000 gal tanks there will be one 8,700 gal tank (EP-23). I decided to not redo calcs.

Natural gas already counted. Do we have emission factors for burn off ovens? Use crematory, msw incinerator?

make	model	model number
Pollution Control Products Co.	Controlled Pyrolysis	SCTR6 4160

no burn off oven emission factors could be found, AP-42, webfire, vendor website
Nebraska says less HAPs than MSW incinerator
several states have permit exemptions, others general permits
traditional APCP practice has been to count just the fuel combustion emissions with no PVC or chlorinated material allowed

Activity	MHDR (tons/hr)	MHDR (trips/hr)	Truck Types box truck	type	type	type	We*	Wf*
pellet receiving	0.0188	0.004	100%				10	15
IPA, HFP receiving	0.5	0.100	100%				10	15
product shipping	0.0188	0.004	100%				10	15
title		0.000					0	0
title		0.000					0	0
title		0.000					0	0
title		0.000					0	0
title		0.000					0	0
title		0.000					0	0

Truck Type	We (tons)	Wf (tons)
box truck	10	15
type		
type		
type		

truck type row must sum to 100% per each activity
only one activity per row

IPA receiving based on worst case of how much the fiber can soak up
HFP receiving based on application
IPA and HFP summed, rounded way up to 0.5 tph

Road Segment ID	1	2	3	4	5	6	7	8
D one way (feet)	200							
D one way (miles)	0.038							
pellet receiving	3							
IPA, HFP receiving	3							
product shipping	3							

Activitie

1=empty
2=full
3=both

pellet receiving	0.436	0.000	0.000	0.000	0.000	0.000	0.000	0.000
IPA, HFP receiving	11.628	0.000	0.000	0.000	0.000	0.000	0.000	0.000
product shipping	0.436	0.000	0.000	0.000	0.000	0.000	0.000	0.000
W	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Surface	Paved	Unpaved	Unpaved	Unpaved	Unpaved	Unpaved	Unpaved	Unpaved

W

E(PM2.5) (lbs/VMT):	0.01334							
E(PM10) (lbs/VMT):	0.05435							
E(PM30) (lbs/VMT):	0.27176							
Eext(PM2.5) (lbs/VMT):	0.01243							
Eext(PM10) (lbs/VMT):	0.05063							
Eext(PM30) (lbs/VMT):	0.25314							
pellet receiving	0.000284	0	0	0	0	0	0	0
IPA, HFP receiving	0.007576	0	0	0	0	0	0	0
product shipping	0.000284	0	0	0	0	0	0	0
MHDR (VMT/hr)	0.008144	0	0	0	0	0	0	0

MHDR'

PTE PM2.5 (lb/hr) w/ rain	0.000101	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
PTE PM10 (lb/hr) w/ rain	0.000412	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
PTE PM30 (lb/hr) w/ rain	0.002062	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
PTE PM2.5 (tons/yr) w/ rain	0.000443	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
PTE PM10 (tons/yr) w/ rain	0.001806	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!
PTE PM30 (tons/yr) w/ rain	0.00903	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!	#VALUE!

PTE (lb/hr)

PTE (tons/yr)

0.009	PM
0.0018	PM10
0.0004	PM2.5

There is no added control % for cleaning paved roads, but the sL decreases.
sL of 2.0 g/m2 is assumed for light industry (except more fugitive materials such as grain, aggregate, coal, etc may have higher sL).
sL lower than 2.0 can be used with a permit limit, cleaning, and testing required.
unpaved control for "BMP" is 90%, 90%, 74%. For undocumented watering is 50%, 50%, 41.1%. PM, PM10, PM2.5 respectively.

rates to modeling 24 hr max throughput (lb/hr)

paved	w/o rain
paved with control	reduced sL, w/o rain
unpaved	w/o rain
unpaved with control	controlled w/o rain

rates to modeling annual throughput (lb/hr)

paved	with rain
paved with control	reduced sL, w/o rain
unpaved	with rain
unpaved with control	controlled w/o rain

tpy rates to permit PTE annual throughput

paved	with rain
paved with control	reduced sL, w/o rain
unpaved	with rain
unpaved with control	controlled w/o rain

to portion out an activity in order to add to a composite emission factor:
apply this equation to each segment that the activity travels on and sum the results: MHDR' / MHDR(VMT/hr) x PTE(lb/hr)
then divide by that activity's MHDR (tph) to get lb/ton emission factor

Haul Road/Haul Truck/Material Hauled Information								
Haul Road ID No.:	1	2	3	4	5	6	7	8
W (tons)	12.50	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
sL (g/m^2):	2	2	2	2	2	2	2	2
P:	100	100	100	100	100	100	100	100
N:	365	365	365	365	365	365	365	365
Haul Roads - Max Hourly VMT Rate and Emission Factor Calculations								
$E(PM_{2.5})$(lbs/VMT):	0.0133	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$E(PM_{10})$(lbs/VMT):	0.0544	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$E(PM_{30})$ (lbs/VMT):	0.2718	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$Eext(PM_{2.5})$(lbs/VMT):	0.0124	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$Eext(PM_{10})$(lbs/VMT):	0.0506	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
$Eext(PM_{30})$ (lbs/VMT):	0.2531	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

E = k(sL)^0.91 * (W)^1.02 where:
E = particulate emission factor (having units matching the units of k)
k = particle size multiplier for particle size range and units of interest
sL = road surface silt loading (grams per square meter) (g/m^2)
W = average weight (tons) of the vehicles traveling the road

Table 13.2.1-1 PARTICLE SIZE MULTIPLIERS FOR PAVED ROAD EQUATION

Size range	k (lb/VMT)
PM2.5	0.00054
PM10	0.0022
PM15	0.0027
PM30	0.011

Eext = [k(sL)^0.91 * (W)^1.02](1-P/(4N)) where:
k, sL, W and S are as defined above and
Eext = annual average emission factor in the same units as k
P = number of "wet" days with at least 0.01 inch of precipitation during the averaging period
N = number of days in the averaging period (365 for annual)

The equations retain the quality rating of A (D for PM2.5), if applied within the range of source
Silt loading:

0.03-400 g/m^2

0.04-570 grains/square foot (ft^2)

Mean vehicle weight:

1.8-38 megagrams (Mg)

2.0-42 tons

Mean vehicle speed:

1-88 kilometers per bour (kph)

1-55 miles per hour (mph)

The upper 95% confidence levels of equation 1 for PM10 is best described with equations using
E95% = k(sL)^1.14 * (W)^1.19

E95%($PM_{2.5}$)(lbs/VMT):	0.0240	0.0000	0.0000	0.0000	0.0000	0.0000
E95%(PM_{10})(lbs/VMT):	0.0979	0.0000	0.0000	0.0000	0.0000	0.0000

Haul Road/Haul Truck/Material Hauled Information									
Haul Road ID No.:		1	2	3	4	5	6	7	8
	W (tons):	12.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	s (%):								
	P (days):	105	105	105	105	105	105	105	105
E(PM2.5) (lbs/VMT):									
E(PM10) (lbs/VMT):									
E(PM30) (lbs/VMT):									
Eext(PM2.5) (lbs/VMT):									
Eext(PM10) (lbs/VMT):									
Eext(PM30) (lbs/VMT):									

E = k (s/12)^a * (W/3)^b where:
E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)

Constants for Equation

	Constant		
Particle Size	k(lb/VMT)	a	b
PM2.5	0.15	0.9	0.45
PM10	1.5	0.9	0.45
PM30	4.9	0.7	0.45

Eext = E[(365-P)/365] where E is defined above and:
Eext = annual size-specific emission factor extrapolated for natural mitigation (lb/VMT)
P = number of days in a year with at least 0.01 inch of precipitation

TANKS 4.0 ReportTANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification
User Identification:clarcor 5000
City:
State:
Company:
Type of Tank:Vertical Fixed Roof Tank
Description:

Tank Dimensions
Shell Height (ft):13.30
Diameter (ft):8.00
Liquid Height (ft) :13.30
Avg. Liquid Height (ft):6.60
Volume (gallons):5,000.98
Turnovers:40.17
Net Throughput(gal/yr):200,889.17
Is Tank Heated (y/n):N

Paint Characteristics
Shell Color/Shade:White/White
Shell ConditionGood
Roof Color/Shade:White/White
Roof Condition:Good

Roof Characteristics
Type:Dome
Height (ft)0.00
Radius (ft) (Dome Roof)8.00

Breather Vent Settings
Vacuum Settings (psig):-0.03
Pressure Settings (psig)0.03

Meterological Data used in Emissions Calculations: Kansas City, Missouri
(Avg Atmospheric Pressure = 14.27 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

clarcor 5000 - Vertical Fixed Roof Tank

Daily Liquid Surf.
Temperature (deg F)Liquid
Bulk
Temp Vapor Pressure (psia)Vapor
Mol. Liquid
Mass Vapor
Mass Mol. Basis for Vapor Pressure
Mixture/ComponentMonthAvg.Min.Max.(deg F) Avg.Min.Max.Weight. Fract.
Fract. Weight Calculations

Isopropyl alcoholAll55.4550.2560.6553.64 0.40590.33340.491860.0900
60.09 Option 2: A=8.1177, B=1580.92, C=219.61

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

clarcor 5000 - Vertical Fixed Roof Tank

Annual Emission Calcaulations

Standing Losses (lb):24.1021
Vapor Space Volume (cu ft):364.3606
Vapor Density (lb/cu ft):0.0044
Vapor Space Expansion Factor:0.0475
Vented Vapor Saturation Factor:0.8651

Tank Vapor Space Volume:
Vapor Space Volume (cu ft):364.3606
Tank Diameter (ft):8.0000
Vapor Space Outage (ft):7.2487
Tank Shell Height (ft):13.3000
Average Liquid Height (ft):6.6000
Roof Outage (ft):0.5487

Roof Outage (Dome Roof)
Roof Outage (ft):0.5487
Dome Radius (ft):8.0000
Shell Radius (ft):4.0000

Vapor Density
Vapor Density (lb/cu ft):0.0044
Vapor Molecular Weight (lb/lb-mole):60.0900
Vapor Pressure at Daily Average Liquid
Surface Temperature (psia):0.4059
Daily Avg. Liquid Surface Temp. (deg. R):515.1202
Daily Average Ambient Temp. (deg. F):53.6167
Ideal Gas Constant R
(psia cuft / (lb-mol-deg R)):10.731
Liquid Bulk Temperature (deg. R):513.3067
Tank Paint Solar Absorptance (Shell):0.1700
Tank Paint Solar Absorptance (Roof):0.1700
Daily Total Solar Insulation
Factor (Btu/sqft day):1,356.9109

Vapor Space Expansion Factor
Vapor Space Expansion Factor:0.0475
Daily Vapor Temperature Range (deg. R):20.7989
Daily Vapor Pressure Range (psia):0.1584
Breather Vent Press. Setting Range(psia):0.0600
Vapor Pressure at Daily Average Liquid
Surface Temperature (psia):0.4059
Vapor Pressure at Daily Minimum Liquid
Surface Temperature (psia):0.3334
Vapor Pressure at Daily Maximum Liquid
Surface Temperature (psia):0.4918
Daily Avg. Liquid Surface Temp. (deg R):515.1202
Daily Min. Liquid Surface Temp. (deg R):509.9205
Daily Max. Liquid Surface Temp. (deg R):520.3199
Daily Ambient Temp. Range (deg. R):19.9167

Vented Vapor Saturation Factor
Vented Vapor Saturation Factor:0.8651
Vapor Pressure at Daily Average Liquid:
Surface Temperature (psia):0.4059
Vapor Space Outage (ft):7.2487

Working Losses (lb):106.5797
Vapor Molecular Weight (lb/lb-mole):60.0900
Vapor Pressure at Daily Average Liquid
Surface Temperature (psia):0.4059
Annual Net Throughput (gal/yr.):200,889.1700
Annual Turnovers:40.1700
Turnover Factor:0.9135
Maximum Liquid Volume (gal):5,000.9751
Maximum Liquid Height (ft):13.3000
Tank Diameter (ft):8.0000
Working Loss Product Factor:1.0000

Total Losses (lb):130.6817

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual
clarcor 5000 - Vertical Fixed Roof Tank

Components	Losses(lbs) Working Loss	Breathing Loss	Total Emissions
Isopropyl alcohol	106.58	24.10	130.68

TANKS 4.0 ReportTANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification
User Identification:350 clarcor mix
City:
State:
Company:
Type of Tank:Vertical Fixed Roof Tank
Description:

Tank Dimensions
Shell Height (ft):5.00
Diameter (ft):3.45
Liquid Height (ft) :5.00
Avg. Liquid Height (ft):2.50
Volume (gallons):349.65
Turnovers:574.00
Net Throughput(gal/yr):200,698.06
Is Tank Heated (y/n):N

Paint Characteristics
Shell Color/Shade:White/White
Shell ConditionGood
Roof Color/Shade:White/White
Roof Condition:Good

Roof Characteristics
Type:Dome
Height (ft)0.00
Radius (ft) (Dome Roof)3.45

Breather Vent Settings
Vacuum Settings (psig):-0.03
Pressure Settings (psig)0.03

Meterological Data used in Emissions Calculations: Kansas City, Missouri
(Avg Atmospheric Pressure = 14.27 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

350 clarcor mix - Vertical Fixed Roof Tank

Daily Liquid Surf.
Temperature (deg F)Liquid
Bulk
Temp Vapor Pressure (psia)Vapor
Mol. Liquid
Mass Vapor
Mass Mol. Basis for Vapor Pressure
Mixture/ComponentMonthAvg.Min.Max.(deg F) Avg.Min.Max.Weight. Fract.
Fract. Weight Calculations

Isopropyl alcoholAll55.4550.2560.6553.64 0.40590.33340.491860.0900
60.09 Option 2: A=8.1177, B=1580.92, C=219.61

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

350 clarcor mix - Vertical Fixed Roof Tank

Annual Emission Calcaulations

Standing Losses (lb):1.8474
Vapor Space Volume (cu ft):25.5826
Vapor Density (lb/cu ft):0.0044
Vapor Space Expansion Factor:0.0475
Vented Vapor Saturation Factor:0.9444

Tank Vapor Space Volume:
Vapor Space Volume (cu ft):25.5826
Tank Diameter (ft):3.4500
Vapor Space Outage (ft):2.7366
Tank Shell Height (ft):5.0000
Average Liquid Height (ft):2.5000
Roof Outage (ft):0.2366

Roof Outage (Dome Roof)
Roof Outage (ft):0.2366
Dome Radius (ft):3.4500
Shell Radius (ft):1.7250

Vapor Density
Vapor Density (lb/cu ft):0.0044
Vapor Molecular Weight (lb/lb-mole):60.0900
Vapor Pressure at Daily Average Liquid
Surface Temperature (psia):0.4059
Daily Avg. Liquid Surface Temp. (deg. R):515.1202
Daily Average Ambient Temp. (deg. F):53.6167
Ideal Gas Constant R
(psia cuft / (lb-mol-deg R)):10.731
Liquid Bulk Temperature (deg. R):513.3067
Tank Paint Solar Absorptance (Shell):0.1700
Tank Paint Solar Absorptance (Roof):0.1700
Daily Total Solar Insulation
Factor (Btu/sqft day):1,356.9109

Vapor Space Expansion Factor
Vapor Space Expansion Factor:0.0475
Daily Vapor Temperature Range (deg. R):20.7989
Daily Vapor Pressure Range (psia):0.1584
Breather Vent Press. Setting Range(psia):0.0600
Vapor Pressure at Daily Average Liquid
Surface Temperature (psia):0.4059
Vapor Pressure at Daily Minimum Liquid
Surface Temperature (psia):0.3334
Vapor Pressure at Daily Maximum Liquid
Surface Temperature (psia):0.4918
Daily Avg. Liquid Surface Temp. (deg R):515.1202
Daily Min. Liquid Surface Temp. (deg R):509.9205
Daily Max. Liquid Surface Temp. (deg R):520.3199
Daily Ambient Temp. Range (deg. R):19.9167

Vented Vapor Saturation Factor
Vented Vapor Saturation Factor:0.9444
Vapor Pressure at Daily Average Liquid:
Surface Temperature (psia):0.4059
Vapor Space Outage (ft):2.7366

Working Losses (lb):25.5190
Vapor Molecular Weight (lb/lb-mole):60.0900
Vapor Pressure at Daily Average Liquid
Surface Temperature (psia):0.4059
Annual Net Throughput (gal/yr.):200,698.0553
Annual Turnovers:574.0000
Turnover Factor:0.2189
Maximum Liquid Volume (gal):349.6482
Maximum Liquid Height (ft):5.0000
Tank Diameter (ft):3.4500
Working Loss Product Factor:1.0000

Total Losses (lb):27.3664

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual
350 clarcor mix - Vertical Fixed Roof Tank

Components	Losses(lbs) Working Loss	Breathing Loss	Total Emissions
Isopropyl alcohol	25.52	1.85	27.37

Missouri Department of dnr.mo.gov
NATURAL RESOURCES
Eric R. Greitens, Governor Carol S. Comer, Director

NOV 2 1 2017

Ms. Kathy French
Director EHS
CLARCOR Industrial Air
417 SE Thompson Dr
Lee's Summit, MO 64082

RE: New Source Review Permit - Project Number: 2017-07-054

Dear Ms. French:

Enclosed with this letter is your permit to construct. Please study it carefully and refer to Appendix A for a list of common abbreviations and acronyms used in the permit. Also, note the special conditions on the accompanying pages. The document entitled, "Review of Application for Authority to Construct," is part of the permit and should be kept with this permit in your files. Operation in accordance with these conditions, your new source review permit application and with your operating permit is necessary for continued compliance. The reverse side of your permit certificate has important information concerning standard permit conditions and your rights and obligations under the laws and regulations of the State of Missouri.

This permit may include requirements with which you may not be familiar. If you would like the department to meet with you to discuss how to understand and satisfy the requirements contained in this permit, an appointment referred to as a Compliance Assistance Visit (CAV) can be set up with you. To request a CAV, please contact your local regional office or fill out an online request. The regional office contact information can be found at the following website: http://dnr.mo.gov/regions/. The online CAV request can be found at http://dnr.mo.gov/cav/compliance.htm.

If you were adversely affected by this permit decision, you may be entitled to pursue an appeal before the administrative hearing commission pursuant to Sections 621.250 and 643.075.6 RSMo. To appeal, you must file a petition with the administrative hearing commission within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the administrative hearing commission, whose contact information is: Administrative Hearing Commission, United States Post Office Building, 131 West High Street, Third Floor, P.O. Box 1557, Jefferson City, Missouri 65102, phone: 573-751-2422, fax: 573-751-5018, website: www.oa.mo.gov/ahc.

If you have any questions regarding this permit, please do not hesitate to contact David Little, at the Department of Natural Resources' Air Pollution Control Program, P.O. Box 176, Jefferson City, MO 65102 or at (573) 751-4817. Thank you for your attention to this matter.

Sincerely,

AIR POLLUTION CONTROL PROGRAM

Susan Heckenkamp
New Source Review Unit Chief

SH:dlj

Enclosures

c: Kansas City Regional Office
PAMS File: 2017-07-054

Permit Number: 112017-010