Attachment A

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 1-
General Project Description

Appendix 1-K
Agency Correspondence

January 2019

Mountain Valley, LLC
MVP Southgate Project
Appendix 1-K
Agency Correspondence
11/6/2018-1/15/2019

Name	Type of Stakeholder	Business	Business Title	State	Inquiry Date[1]	Type of Contact	Inquiry Comments	Contact Date[2]	Type of Contact	Contact Comments
Troy Andersen	Federal Agencies	U.S. Fish and Wildlife Service (USFWS), Virginia Field Office	Endangered Species/Conservation Planning Assistance Supervisor	VA				11/6/2018	Email	Provided link to FERC application filed in 11/6/18 and provided updated project KMZ.
David Bailey	Federal Agencies	U.S. Army Corps of Engineers (USACE), Wilmington District	Project Manager	NC				12/3/2018	Email	MVP Southgate Project NC Joint Permit Application
								12/7/2018	Email	MVP Southgate Permit Application
								12/28/2018	Email	Request for Additional Information Alamance and Rockingham Counties
								1/14/2019	Phone Call	Discussed RAI response.
John Ellis	Federal Agencies	U.S. Fish and Wildlife Service (USFWS), NC	Biologist	NC				11/6/2018	Email	Provided link to FERC application filed in 11/6/18 and provided updated project KMZ.
								12/17/2018	Phone Call	Discussed 2018 plant report and RTE compliance for state species of concern.
Jennifer Frye	Federal Agencies	U.S. Army Corps of Engineers (USACE), Norfolk District	Western Section Chief	VA				11/28/2018	Phone Call	Quick update on the Project.
Todd Miller	Federal Agencies	U.S. Army Corps of Engineers (USACE), Norfolk District	Southern Section Chief	VA				12/21/2018	Email	Review of JPA
								1/14/2019	Phone Call	Left a voicemail to discuss RAI.
Dale Suiter	Federal Agencies	U.S. Fish and Wildlife Service (USFWS), NC	Biologist	NC				12/12/2018	Phone Call	ESI contacted Dale Suiter to discuss Schweinit'z Sunflower.
Steven Vanderploeg	Federal Agencies	U.S. Army Corps of Engineers (USACE), Norfolk District	Environmental Scientist	VA				1/9/2019	Meeting	Site visit in the field with biologists to review wetland and waterbody delineations. No meeting notes distributed.
Ernie Aschenbach	VA Agencies	VA Department of Game and Inland Fisheries (VDGIF)	Environmental Services Biologist	VA	11/15/2018	Email	VDGIF provided comments about avian resources and collation discussions in Draft Resource Report 3.	—	—	—
								11/6/2018	Email	Provided link to FERC application filed in 11/6/18 and provided updated project KMZ.
								11/15/2018	Email	VDGIF Comments pertaining to avian resources.
								12/11/2018	Email	MVP left voice mail and sent a follow up email about pending VDGIF comments on the Project.
								1/23/2019	Letter	MVP Response to VDGIF Comments to Resource Report 3.
—	VA Agencies	VA Department of Environmental Quality (VA DEQ)	Receipts Control	VA				12/11/2018	Letter	MVP sent a letter to VA DEQ regarding the Air Permit Application Fee.
Jerome Brooks	VA Agencies	VA Department of Environmental Quality (VA DEQ)	Office of Water Compliance	VA				11/6/2018	Email	MVP Southgate Project Update.
								1/14/2019	Phone Call	Left a voicemail to discuss DEQ comments filed on the docket.
Jason Bulluck	VA Agencies	VA Department of Conservation and Recreation (VDCR)	Environmental Manager II	VA				11/6/2018	Email	Provided link to FERC application filed in 11/6/18 and provided updated project KMZ.
Melanie Davenport	VA Agencies	VA Department of Environmental Quality (VA DEQ), Water Division	Water Permitting Division Director	VA				11/6/2018	Email	Notification regarding formal Application requesting certification of public convenience and necessity from the FERC.
Mike Johnson	VA Agencies	Virginia Marine Resources Commission (VMRC)	Habitat Management	VA				12/3/2018	Email	MVP Southgate #18-1892
Rene Hypes	VA Agencies	VA Department of Conservation and Recreation (VDCR), DNH	Environmental Manager I	VA				11/6/2018	Email	Provided link to FERC application filed in 11/6/18 and provided updated project KMZ.
Michael Kiss	VA Agencies	VA Department of Environmental Quality (VA DEQ) - Central Office, Office of Air Quality Assessments	Manager	VA				12/6/2018	Email	MVP received the Southgate Modeling Protocol Comments from VA DEQ.
Benjamin Leach	VA Agencies	VA Department of Environmental Quality (VA DEQ)	Erosion & Sediment Control & Stormwater Management	VA				11/6/2018	Email	MVP Southgate Project Update.
Jaime Robb	VA Agencies	Virginia Department of Environmental Quality	Office of Stormwater Management	VA				11/6/2018	Email	MVP Southgate Project Update.
Anita Walthall	VA Agencies	VA Department of Environmental Quality (VA DEQ)	Air Permit Writer Senior	VA				12/5/2018	Email	MVP received the initial letter of determination (ILOD) for the Lambert Station Application.
								12/14/2018	Letter	Lambert Compressor Station - Minor New Source Article 6 Air Permit Application.

Mountain Valley, LLC
MVP Southgate Project
Appendix 1-K
Agency Correspondence
11/6/2018-1/15/2019

Name	Type of Stakeholder	Business	Business Title	State	Inquiry Date[1]	Type of Contact	Inquiry Comments	Contact Date[2]	Type of Contact	Contact Comments
Joseph Weber	VA Agencies	VA Department of Conservation and Recreation (VDCR)	Natural Heritage Information Manager	VA				11/6/2018	Email	MVP provided a link for the FERC application filed in 11/6/18 and provided updated project KMZ to VDCR.
								12/11/2018	Phone Call	MVP contacted VDCR about forest fragmentation analysis is proceeding and confirm the current project shapefiles were received.
Julia Wellman	VA Agencies	VA Department of Environmental Quality (VA DEQ)	Environmental Impact Review Coordinator	VA	11/8/2018	Phone Call	Inquiry regarding Lambert Compressor Station.	—	—	—
								11/9/2018	Phone Call	MVP followed up with VA DEQ to confirm constructing the Lambert Compressor Station.
								11/16/2018	Email	MVP emailed VA DEQ to confirm Resource Report 9 was received.
Corey Anen	NC Agencies	NC Department of Environmental Quality (NC DEQ), DEMLR	Environmental Engineer	NC				11/6/2018	Email	MVP Southgate Project Update.
Rosei Blewitt	NC Agencies	NC State Historic Preservation Office (NCSHPO)	Staff Archaeologist	NC				11/9/2018	Email	Email to agency regarding an identified site.
Renee Gledhill-Earley	NC Agencies	NC State Historic Preservation Office (NCSHPO)	Environmental Review Coordinator	NC				12/20/2018	Letter	MVP received a letter in response to "Construct Interstate Pipeline".
Matt Gantt	NC Agencies	NC Department of Environmental Quality (NC DEQ), Land Resources	Regional Environmental Engineer	NC				11/6/2018	Email	MVP Southgate Project Update.
								11/20/2018	Email	MVP follow up to voicemail about E&S plans.
Karen Higgins	NC Agencies	NC Department of Environmental Quality (NC DEQ)	Water Resources Supervisor	NC				11/19/2018	Phone Call	Left a voicemail requesting a call back to discuss the upcoming 401 Application.
								11/20/2018	Phone Call	Discussion on Jordan Buffer Rules.
								11/27/2018	Phone Call	Left a voicemail.
								11/30/2018	Other	Receipt from NCDEQ - DWR of JPA
								12/10/2018	Phone Call	Discuss Jordan Watershed Buffer Rules and 401 process.
								1/10/2019	Letter	Letter sent to M. Raffenberg by the NCDEQ-Water Quality Program for a request for additional information.
								1/14/2019	Phone Call	Left a voicemail to set up project meeting.
Sue Homewood	NC Agencies	NC Department of Environmental Quality (NC DEQ), Water Resources, Water Quality Regional Operations Section	Sr. Environmental Scientist	NC				12/10/2018	Phone Call	Discussion on Jordan Watershed Buffer Rules and 401 process.
								12/10/2018	Email	Discussion on variance crossings with MVP and Sue Homewood.
								1/2/2019	Email	Discussion on variance crossings with MVP and Sue Homewood.
Robert Key	NC State Government	Haw River Planning Board and Town Council	Director of Inspections	NC				1/9/2019	Phone Call	Left voicemail regarding floodplain permitting within Haw River.
Shannon Leonard	NC Agencies	NC Department of Environmental Quality (NC DEQ), Land Resources	Regional Engineering Associate	NC				11/6/2018	Email	MVP Southgate Project Update.
Annette Lucas	NC Agencies	NC Department of Environmental Quality (NC DEQ), DEMLR	PE Stormwater Program Supervisor	NC				11/6/2018	Email	MVP Southgate Project Update.
								12/4/2018	Email	Stormwater Permitting Figure.
Sushma Masemore	NC Agencies	NC Department of Environmental Quality (NC DEQ), Air Quality	Deputy Assistant Secretary	NC				11/27/2018	Phone Call	Left a voicemail to discuss Air Permit Application.
John Mintz	NC Agencies	NC Historic Preservation Office	Archaeologist	NC				1/14/2019	Phone Call	Called office to arrange a site visit.
								1/15/2019	Phone Call	Call to discuss the submission of site treatment plans.
								1/15/2019	Email	Email with the set up of site visit.
Bridget Munger	NC Agencies	NC Department of Environmental Quality (NC DEQ)	Deputy Secretary	NC				11/26/2018	Email	MVP emailed a draft form letter to send to landowners for survey activities for review.
Nathan Page	Local Government	City of Graham	Planning Director	NC				1/9/2019	Phone Call	Left voicemail regarding floodplain permitting within Graham, NC.
Sarah M. Rice	NC Agencies	NC Department of Environmental Quality (NC DEQ), Waste Management	NC DEQ Title VI and EJ Coordinator	NC				11/27/2018	Email	MVP Southgate Follow-up Discussion.
Donna Setliff	NC State Government	City of Reidsville	Community Development Manager	NC				1/9/2019	Phone Call	Left voicemail regarding floodplain permitting within Reidsville, NC.
Renee Shearin	NC Agencies	NC State Historic Preservation Office (NCSHPO)	Environmental Review Technician	NC				12/21/2018	Email	Email response from agency with comments on the Phase I Report.

Mountain Valley, LLC
MVP Southgate Project
Appendix 1-K
Agency Correspondence
11/6/2018-1/15/2019

Name	Type of Stakeholder	Business	Business Title	State	Inquiry Date[1]	Type of Contact	Inquiry Comments	Contact Date[2]	Type of Contact	Contact Comments
Vann Stancil	NC Agencies	NC Wildlife Resources Commission (NCWRC)	Special Project Coordinator	NC				11/6/2018	Email	Provided link to FERC application filed in 11/6/18 and provided updated project KMZ.
								11/19/2018	Email	Vann Stancil responded to Nov 2, 2018 inquiry about time of year restrictions (TOYR); considering the proposed crossing methods and anticipated best management practices, NCWRC will not ask for any TOYRs for in-water work.
								1/4/2019	Phone Call	MVP and NCWRC discussed crayfish surveys; Vann wanted to speak with Brena Jones before advising MVP on best path forward.
								1/23/2019	Letter	MVP Response to VDGIF Comments to Resource Report 3.
Toby Vinson	NC Agencies	NC Department of Environmental Quality (NC DEQ), Division of Energy, Mineral and Land Resources	Director	NC				11/6/2018	Email	MVP Southgate Project Update.
Sue White	NC Agencies	NC Department of Environmental Quality (NC-DEQ)	Engineer	NC				1/3/2019	Email	Discussion between MVP and Sue White about the Stony Creek Reservoir.
Wenonah G. Haire	Tribes	Catawba Indian Nation	Tribal Historic Preservation Officer	SC				12/21/2018	Phone Call	Contacted MVP to request project address.
Edwina Butler-Wolfe	Tribes	Absentee-Shawnee Tribe of Oklahoma	Governor	OK				11/6/2018	Letter	MVP Southgate Natural Gas Pipeline in Pittsylvania County, VA and Alamance County, NC.

1, 2 Inquiries are tracked as communications from agencies. Contacts are tracked as communications to agencies.

Federal Correspondence

Ferry, Lori M

From: Stahl, Megan D. <IMCEAEX-_O=EXCHANGELABS_OU=EXCHANGE+20ADMINISTRATIVE+20GROUP+20+28FYDIBOHF23SPDLT+29_CN=RECIPIENTS_CN=20AAD7C76DE6480B86AE6E09EEFCB324-STAHL+2C+20MEGA@namprd20.prod.outlook.com>
Sent: Tuesday, November 6, 2018 4:09 PM
To: John_Ellis@fws.gov; Troy Andersen; Stancil, Vann F; Ernst Aschenbach; rr ProjectReview (DGIF); Hypes, Rene'; Bulluck, Jason; Weber Joseph xpg48711
Cc: Miller, Alex; Stephanie Frazier
Subject: MVP Southgate Project Update
Attachments: News Release - MVPSG Application Filing (Final).pdf; MVP_Southgate_FERC Filing Route_11.6.2018.kmz

Good evening,

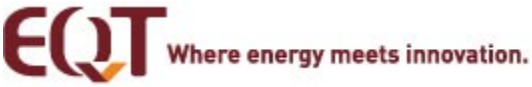
On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated kmz file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Please also feel free to forward this email to others within your agency that would be interested in this information.

Thank you,
Megan

Megan Stahl
Permitting Supervisor
625 Liberty Avenue, Suite 1700
Pittsburgh, PA 15222
T 412-553-7783
C 412-737-2587



www.eqt.com

From: Patti, Heather
Sent: Monday, December 03, 2018 4:08:16 PM
To: 'Bailey, David E CIV USARMY CESAW (US)' <David.E.Bailey2@usace.army.mil>
Cc: 'Miller, Alex' <Alex.Miller@nexteraenergy.com>; Walker, Lisa <LWalker@trcsolutions.com>; Zimmer, John <JZimmer@trcsolutions.com>
Subject: RE: MVP Southgate Project NC Joint Permit Application

You're welcome - we have been seeing that the ARMDEC site has been down so we went the FTP route. Please let

us know if you have any problems with any of the files. Thanks Dave!

Heather

-----Original Message-----
From: Bailey, David E CIV USARMY CESAW (US) <David.E.Bailey2@usace.army.mil>
Sent: Monday, December 3, 2018 1:54 PM
To: Patti, Heather <HPatti@trcsolutions.com>
Subject: RE: MVP Southgate Project NC Joint Permit Application 10-4. Thanks Patti.

David E. Bailey, PWS
Regulatory Project Manager US Army Corps of Engineers
CE-SAW-RG-R
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
Phone: (919) 554-4884, Ext. 30.
Fax: (919) 562-0421
Email: David.E.Bailey2@usace.army.mil

We would appreciate your feedback on how we are performing our duties. Our automated Customer Service Survey is located at: https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fcorpsmapu.usace.army.mil%2Fcm_apex%2Ff%3Fp%3D136%3A4%3A0&data=02%7C01%7CHPatti%40trcsolutions.com%7C94f6690f55984826efda08d65950b188%7C543eaf7b7e0d4076a34d1fc8cc20e5bb%7C0%7C0%7C636794600705265129&sdata=mPXJg1tGIwQsdvVmcLSBOYz5HiRiLT%2BQX8RB64oHM2g%3D&reserved=0

Thank you for taking the time to visit this site and complete the survey.

-----Original Message-----
From: Patti, Heather [mailto:HPatti@trcsolutions.com]
Sent: Friday, November 30, 2018 7:00 PM
To: Bailey, David E CIV USARMY CESAW (US) <David.E.Bailey2@usace.army.mil>; Higgins, Karen <karen.higgins@ncdenr.gov>; Homewood, Sue <sue.homewood@ncdenr.gov>
Cc: Walker, Lisa <LWalker@trcsolutions.com>; Zimmer, John <JZimmer@trcsolutions.com>; Miller, Alex <Alex.Miller@nexteraenergy.com>; Faul, Travis <Travis.Faul@nexteraenergy.com>
Subject: [Non-DoD Source] MVP Southgate Project NC Joint Permit Application

Hi all,

Please find attached an electronic copy of the MVP Southgate Project Joint Permit Application.

Some of the appendices are large, so we have uploaded them to an FTP site, for you to download.

This is the link to the FTP site:

Blockedhttps://trcextranet.trcsolutions.com/sites/CS-KM2/MVPSouthgateNC/SitePages/Home.aspx#InplviewHash184274f3-6dc6-4d65-b963-3823a065d750=Paged%3DTRUE-p_SortBehavior%3D0-p_Modified%3D20181129%252019%253a16%253a55-p_ID%3D3-PageFirstRow%3D16

Please let me know if you have any trouble logging in or downloading the files.

Have a good weekend,

Heather Patti, PWS
Senior Ecologist

5540 Centerview Drive, Suite 100, Raleigh, NC 27606

T: 919-256-6236 | F: 919-838-9661 | C: 262-623-1079

LinkedIn <Blockedhttp://www.linkedin.com/company/trc-companies-inc> | Twitter <Blockedhttp://twitter.com/TRC_Companies> | Blog <Blockedhttp://blog.trcsolutions.com/> | Flickr <Blockedhttp://www.flickr.com/photos/trcsolutions/> | Blockedwww.trcsolutions.com <Blockedhttp://www.trcsolutions.com/>

From: Bailey, David E CIV USARMY CESAW (US) <David.E.Bailey2@usace.army.mil>
Sent: Friday, December 7, 2018 7:47 AM
To: Walker, Lisa <LWalker@trcsolutions.com>
Cc: Patti, Heather <HPatti@trcsolutions.com>
Subject: RE: MVP Southgate Permit Application

Got it. Thanks.

David E. Bailey, PWS
Regulatory Project Manager
US Army Corps of Engineers
CE-SAW-RG-R
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
Phone: (919) 554-4884, Ext. 30.
Fax: (919) 562-0421
Email: David.E.Bailey2@usace.army.mil

-----Original Message-----
From: Walker, Lisa [mailto:LWalker@trcsolutions.com]
Sent: Thursday, December 6, 2018 4:22 PM
To: Bailey, David E CIV USARMY CESAW (US) <David.E.Bailey2@usace.army.mil>
Cc: Patti, Heather <HPatti@trcsolutions.com>
Subject: [Non-DoD Source] MVP Southgate Permit Application

Hi David,

You should have access to the Joint Permit Application site.

Here's the link.

Blockedhttps://trcextranet.trcsolutions.com/sites/CS-KM2/MVPSouthgateNC/SitePages/Home.aspx

Please let me know if you have any issues logging in or downloading/opening the files.

Thanks,

Lisa R. Walker
Senior Project Manager/Scientist

912 Lotus Lane South,

Jacksonville, FL

Cell: 904-716-7429

LinkedIn <Blockedhttp://www.linkedin.com/company/trc-companies-inc> |

Twitter <Blockedhttp://twitter.com/TRC_Companies> | Blog

<Blockedhttp://www.trcsolutions.com/resources-and-news> |

Blockedwww.trcsolutions.com <Blockedhttp://www.trcsolutions.com/> TRC Our

Values Are: Safety : Quality : Integrity

Creativity : Accountability : Teamwork : Passion

Hamberg, Alexis

From: Miller, Alex
Sent: Friday, December 21, 2018 1:51 PM
To: Hamberg, Alexis
Subject: FW: MVP Southgate Additional Information Request

-----Original Message-----
From: Raffenberg, Matthew
Sent: Friday, December 21, 2018 1:46 PM
To: Miller, Todd M CIV USARMY CENAO (US) <Todd.M.Miller@usace.army.mil>
Cc: Bailey, David E CIV USARMY CESAW (US) <David.E.Bailey2@usace.army.mil>; Amanda Mardiney <Amanda.Mardiney@ferc.gov>; Allen Jacks <allen.jacks@cardno.com>; Miller, Alex <Alex.Miller@nexteraenergy.com>
Subject: RE: MVP Southgate Additional Information Request

Todd,

Good to see your note. Thanks for the comments. We will review and get back with you after you return. Have a great holiday.

Thanks,

Matt

-----Original Message-----
From: Miller, Todd M CIV USARMY CENAO (US) <Todd.M.Miller@usace.army.mil>
Sent: Friday, December 21, 2018 2:41 PM
To: Raffenberg, Matthew <Matthew.Raffenberg@fpl.com>
Cc: Bailey, David E CIV USARMY CESAW (US) <David.E.Bailey2@usace.army.mil>; Amanda Mardiney <Amanda.Mardiney@ferc.gov>; Allen Jacks <allen.jacks@cardno.com>; Miller, Alex <Alex.Miller@nexteraenergy.com>
Subject: MVP Southgate Additional Information Request

CAUTION - EXTERNAL EMAIL

Mr. Raffenberg,

Comments for your JPA submittal. I am out until the 7th of January, but please contact me if you have any questions.

Todd Miller
Western Virginia Regulatory Section
U.S. Army Corps of Engineers
9100 Arboretum Pkwy, Ste 235
Richmond, Virginia 23236

(804) 323-3782 Richmond Office

todd.m.miller@usace.army.mil

DEPARTMENT OF THE ARMY
US ARMY CORPS OF ENGINEERS
NORFOLK DISTRICT
FORT NORFOLK
803 FRONT STREET
NORFOLK VA 23510-1096

Reply to
Attention of

December 21, 2018

Western Virginia Regulatory Section
NAO-2018-1574

Mountain Valley Pipeline, LLC
C/O Matthew Raffenberg
700 Universe Blvd
Juno Beach, FL 33408

Dear Mr. Raffenberg:

This is in reference to your Joint Permit Application (JPA) requesting to perform certain work in jurisdictional waters of the U.S. pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and Section 10 of the Rivers and Harbors act of 1899 (33 U.S.C. 403) to construct a natural gas pipeline along a corridor from the Pittsylvania County, Virginia to the North Carolina border.

Our permit process strives to balance benefits that may be expected to accrue from your proposal against its foreseeable detriments. Our decision reflects the national concern for both protecting and utilizing important resources such as those affected by your proposed project. However, prior to permit issuance, we must determine that the impacts have been avoided to the maximum extent practicable, that the remaining unavoidable impacts are minimized, and that a mitigation plan is developed that compensates for any remaining unavoidable impacts to functions and values of waters of the United States.

To continue the review of this project additional information will be needed. Please provide the following:

1. Provide the Final EIS from the Federal Energy Regulatory Commission (FERC) to complete your submittal.
2. A completed jurisdictional determination will be necessary prior to any permit review.
3. Prior to any permit issuance a Section 7 of the Endanger Species Act review must be completed. As FERC is the lead federal agency in this project provide the final action for the ESA review.
4. Prior to any permit issuance a Section 106 of the Historic Preservation Act review must be completed. As FERC is the lead federal agency in this project provide their final decision for the Section 106 review.
5. For application review to continue it will be necessary to have a final project map and calculation for all unavoidable impacts to aquatic resources regulated by the U.S. Army Corps of Engineers (USACE), Norfolk District.

6. After total impacts to aquatic resources that are regulated by USACE have been calculated provide a compensatory mitigation plan to compensate for all unavoidable impacts.

If the additional information is not received within 30 days we will assume you no longer wish to pursue this project and it will be withdrawn. Please direct any questions to contact Mr. Todd M. Miller in the Richmond Field Office at 9100 Arboretum Parkway, Suite 235, Richmond, Virginia 23236, (804) 323-3782.

Sincerely,

Todd Miller
Western Section
Norfolk District Regulatory Branch

CC;

David Bailey, Wilmington District, U.S. Army Corps of Engineers
Amanda Mardiney, Federal Energy Regulatory Commission
Allen Jacks, Cardno
Alex V. Miller, Nextera energy

From: Bailey, David E CIV USARMY CESAW (US)
To: Raffenberg, Matthew <Matthew.Raffenberg@fpl.com>; Patti, Heather <HPatti@trcsolutions.com>
Cc: Gibby, Jean B CIV USARMY CESAW (US) <Jean.B.Gibby@usace.army.mil>; McLendon, C S CIV USARMY CESAW (US) <Scott.C.McLendon@usace.army.mil>; Wicker, Henry M Jr CIV USARMY CESAW (US) <Henry.M.Wicker.JR@usace.army.mil>; Miller, Todd M CIV USARMY CENAO (US) <Todd.M.Miller@usace.army.mil>; 'Higgins, Karen'<karen.higgins@ncdenr.gov>; Homewood, Sue <sue.homewood@ncdenr.gov>; Miller, Alex <Alex.Miller@nexteraenergy.com>; Faul, Travis <Travis.Faul@nexteraenergy.com>; Amanda Mardiney <Amanda.Mardiney@ferc.gov>; Ellis, John <john_ellis@fws.gov>; Gledhill-earley, Renee <renee.gledhill-earley@ncdcr.gov>
Subject: Request for Additional Information; Mountain Valley Pipeline-Southgate, Alamance and Rockingham Counties; SAW-2018-00887
Date: Friday, December 28, 2018 1:38 PM
Attachments: 2018-00887 Request for Additional Information.pdf

All,

Thank you for your PCN and attached information, dated and received (via email) 11/30/2018, for the above referenced project. I have reviewed the information and need clarification before proceeding with verifying the use of Nationwide Permit 12 (https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fsaw-reg.usace.army.mil%2FNWP2017%2F2017NWP12.pdf&data=02%7C01%7CHPatti%40trcsolutions.com%7C542b8a76b31c4fed50da08d66cf3a5d9%7C543eaf7b7e0d4076a34d1fc8cc20e5bb%7C0%7C1%7C636816191582856522&sdata=cCqIJqz191xy2RZMSQP8RdOmuQqKrTYZM2h47YFfThY%3D&reserved=0). Please see the attached document and submit the requested information within 30 days, otherwise we may deny verification of the use of the Nationwide Permit or consider your application withdrawn and close the file.

Please let me know if you have any questions. Sincerely,

Dave Bailey

David E. Bailey, PWS
Regulatory Project Manager
US Army Corps of Engineers
CE-SAW-RG-R
3331 Heritage Trade Drive, Suite 105
Wake Forest, North Carolina 27587
Phone: (919) 554-4884, Ext. 30.
Fax: (919) 562-0421
Email: David.E.Bailey2@usace.army.mil

We would appreciate your feedback on how we are performing our duties. Our automated Customer Service Survey is located at: https://na01.safelinks.protection.outlook.com/?url=http%3A%2F%2Fcorpsmapu.usace.army.mil%2Fcm_apex%2Ff%3Fp%3D136%3A4%3A0&data=02%7C01%7CHPatti%40trcsolutions.com%7C542b8a76b31c4fed50da08d66cf3a5d9%7C543eaf7b7e0d4076a34d1fc8cc20e5bb%7C0%7C1%7C636816191582856522&sdata=k1BVoGW9WCIUC1YHWMamfE7lqIOS4c8kYwgLChDbY%2Fg%3D&reserved=0

Thank you for taking the time to visit this site and complete the survey.

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2018-00887** County: **Alamance/Rockingham** U.S.G.S. Quad: **multiple**

INCOMPLETE APPLICATION

Applicant: **NextEra Energy, Inc.**
Attn: **Matthew Raffenberg**
Address: **700 Universe Boulevard**
Juno Beach, FL 33408

Agent: **TRC Environmental Corporation**
Attn: Heather Patti
Address: **5540 Centerview Drive, Suite 100**
Raleigh, NC 27606

Location/Description of Proposed Activity: **The project area includes a 100-foot wide corridor, approximately 47 miles long, extending from the Virginia/North Carolina border near Ruffin, Rockingham County (36.541389°N, -79.632645°W), southeast to Graham, Alamance County (36.045480°N, -79.365252°W), North Carolina.**

The North Carolina portions of the proposed project, known as Mountain Valley Pipeline – Southgate (MVP Southgate), would construct a 24-inch natural gas pipeline, originating at the southern terminus of the Virginia portion of MVP Southgate (milepost [MP] 26.1), extending southwest approximately 4.3 miles to a proposed delivery interconnect (T-15 Dan River Interconnect) at MP 30.4. From the interconnect, the project would involve construction of a 16-inch natural gas pipeline running southeast to its delivery terminus (T-21 Haw River Interconnect) located at MP 73.1, approximately 2.5 miles southeast of Graham, North Carolina. The facility would generally require a 100-foot wide construction right-of-way (limit of disturbance) during construction consisting of a 50-foot permanent right-of-way and 50 feet of temporary workspace. The proposed project would involve temporary impacts to wetlands, streams, and open waters for installation of the pipeline, permanent impacts from the conversion of forested wetlands to herbaceous wetlands within the pipeline permanent maintenance corridor, and permanent and temporary impacts to wetlands and streams from the construction of access roads to facilitate construction and long term maintenance.

Approximately 26 miles of MVP Southgate would occur in Virginia and are not evaluated by the Wilmington District. MVP Southgate would receive gas from the Mountain Valley Pipeline mainline in Pittsylvania County, Virginia.

Type of Permit Applied For (check one): IP ☐ **NWP** ☒ GP ☐
Applicable law: **Section 404 of the Clean Water Act** ☒; Section 10, Rivers and Harbor Act ☐

YOUR APPLICATION IS INCOMPLETE AND CANNOT BE PROCESSED UNTIL THE FOLLOWING INFORMATION IS RECEIVED (CHECK ALL THAT APPLY):

☐ Your application form has not been completed and/or signed (see remarks)

☒ **Under the conditions of the Nationwide Permit, mitigation is required for your project. The mitigation proposal submitted with your application is insufficient. (see remarks.)**

☐ Your application did not include a statement explaining how avoidance and minimization for losses of waters of the U.S. were achieved on the project site. (see remarks)

☒ **Your submitted project plans or maps were insufficient, too large, or not legible (see remarks).**

☐ Your application did not include a delineation of affected special aquatic sites, including wetlands, vegetated shallows, and riffle and pool complexes as required.

☐ You must submit a copy of your application to the NC Wildlife Resources Commission (WRC) since your proposed work is in a designated trout water county (see remarks section below for the address of your WRC representative)

☒ **Other (see remarks below).**

****Please reference your PCN, plans, and other attachments submitted via email on 11/30/2018.**

REMARKS:

1. While the U.S. Army Corps of Engineers, Wilmington District, Raleigh Regulatory Field Office (Corps) has verified the delineation of potential waters of the US within a majority of the proposed pipeline route in North Carolina, there are still sections of the route that have not been delineated or the delineation has not been verified. In addition, it is our understanding that there may still be some re-routing of sections of the pipeline. Pending submittal of additional delineations, the Corps may choose to field-verify the delineation for these areas in order to determine not only the extent of the jurisdictional impacts, but also the functional quality of the resources, upon which to determine appropriate compensatory mitigation requirements. (see PCN Section B.4b.)

2. Changes to the wetland/stream delineation based on the Corps field-review are not all displayed on Appendix K 2-lh. For example, WB-C18-19 is shown as a pond, but was determined to primarily be a wetland, with a small component of surface water in its western extent. Also, S-C18-18 was determined to not be potentially jurisdictional. Review all delineation maps and plan sheets to ensure that the field-approved delineation is shown, and update all acreages/linear feet and impact proposals accordingly.

Further, it is possible that our office will not agree with some of your forested vs. non-forested wetland designation (e.g. W-A18-22-PEM, etc.). However, these distinctions will be made following the completion of field delineations, field verifications (if necessary), and re-submittal of your PCN and attachments.

3. The permit application appendices are missing the alignment sheets for the Alamance County section of the proposed project (i.e. Appendix B; Sheets PA-ALNC-H-650-01 through ALNC-H-650-21).

4. Appendices K 2-lg, 2-li, and 2-lk appear to be the same file on the project website. Further, the permit application package appears to be missing Figure 4 (Wetland & Waterway Delineation Maps) Sheets 1-103. Please ensure that the project webpage includes the complete and correct documentation.

5. Please provide detailed plan and profile views for all proposed permanent fills of wetlands, streams, and other waters, including culvert sizes and lengths, overlaid on the approved delineation.

6. Although no rip rap is currently proposed in wetland or stream areas, reference was made to decisions on rip rap needs being made during construction. Please note that the Corps Wilmington District considers rip rap to be a permanent impact (though not necessarily a permanent loss). As such, any rip rap proposed would need to be included in the PCN/application as a permanent impact and authorized prior to construction.

7. Based on the Rockingham County alignment sheets (Appendix B), additional avoidance and minimization of stream and wetland impacts could be achieved. Please review and update all project plan sheets based on the following comments. If additional avoidance and minimization is not practicable in these circumstances, please provide documentation to that effect:

a. The pipeline would presumably be constructed under roadways via conventional bore methods. As such, wetland and stream resources located next to roadways (e.g. W-B18-99/S-B18-99, W-B18-78/S-B18-74, etc.) could be avoided by extending conventional bores slightly beyond roadways. Costs for extending bores already planned should be considerably less than mobilizing for entirely new bores.

b. Several streams are proposed to be trenched through along their channel length rather than near-perpendicular (e.g. S-A18-140, S-A18-143, S-A18-147, etc.). Several hundred linear feet of stream disturbance could be avoided by slight redesigns in pipe centerline.

c. The pipe centerline is proposed to trench through several stream confluences (e.g. S-C18-38/S-C18-53, etc.). Prolonged stream disturbance would be expected in these locations due to inherent stream bank instability at stream confluences, difficulty in reconstructing intersecting stream banks in their original location, and lack of woody vegetation along stream banks due to long term maintenance. Slight redesigns in pipe centerline could avoid these issues.

8. On Appendix M (Section 404/401 Permit Application Proposed Pipeline Route and Impacts) Sheets 1-108, please add the 2018 aerial photo as a background, faded to still allow project details to show clearly. Within the wetland and stream areas, also add shading or hatching to show temporary construction impacts, permanent wetland conversion impacts, and permanent wetland/stream fill impacts. Also clearly note acreages/linear feet of each impact type at each crossing. Provide zoom-ins of crossing locations if necessary to show details.

Note that these impacts/details could also be shown on Appendix B plans if the two sets of plans should prove redundant.

9. Given the numerous proposed crossings of wetlands, streams, and open waters, please provide the itemized proposed impact information in digital format to facilitate efficient processing. Once additional delineations and any required field verification are complete and you plan to submit the updated PCN and attachments, please contact David Bailey for the latest ORM upload sheets, as the upload sheets are frequently revised.

Further, our office is under the impression that all of the delineated wetlands would be classified as either Headwater Forest, Bottomland Hardwood Forest, Floodplain Pool, or Non-Tidal Freshwater Marsh types based on the North Carolina Wetland Assessment Method (NCWAM). As such, for mitigation purposes, the appropriate Wetland Group/Credit Classification would be Riparian non-Riverine or Riparian Riverine. If applicable, please identify any delineated wetlands that you would classify instead as Basin Wetland, Seep, or any other NCWAM type that would better fit the Non-Riparian Wetland Group/Credit Classification.

10. Your current proposal is to acquire compensatory mitigation through private mitigation banks. We recommend that you also consider contingencies such as acquiring compensatory mitigation through the North Carolina Division of Mitigation Services (NCDMS) in the event that there are not enough appropriate private mitigation bank credits available. Further, provide letters from private Mitigation Banks and/or NCDMS stating that they are willing to provide the appropriate type and amount of compensatory mitigation credits required for this project. Note that a complete compensatory mitigation plan, including the letters referenced above, is required by our office for review and approval prior to verifying the use of NWP 12. (see PCN Sections D.2 and D.3.)

Further, although our office typically requires compensatory mitigation for permanent conversion of forested wetlands to another wetland type at a 1:1 ratio, compensatory mitigation for permanent fill of wetlands (see Access Road PA-RO-113A at MP 41.8) is typically required at a 2:1 ratio. Please update section 4.1.2 of your project narrative, as well as your related compliance statement on pages N-2-7 and N-2-8 of your application documents.

11. We are aware that the FERC (Lead Federal Agency) is preparing an Environmental Impact Statement which addresses the requirements of Section 106 of the National Historic Preservation Act (NHPA) and Section 7 of the Endangered Species Act (ESA).

a. Their final opinion on whether the proposed activity may affect properties listed, or eligible for listing, in the National Register of Historic Places is needed before the use of a Nationwide Permit can be verified for this project. Please provide documentation showing compliance with Section 106 of the NHPA. (see PCN Sections F.7)

b. Their final opinion on whether or not the project "may affect" a listed species or critical habitat is needed before the use of a Nationwide Permit can be verified for this project. Please provide documentation showing compliance with Section 7 of the ESA. (see PCN Sections F.8)

**Note that, due to the large volume of information submitted and reviewed for the project described in your PCN and attachments, items in addition to those listed above may be identified by our office upon submittal of any revised information.

Please submit the above information within 30 days of receipt of this Notification (via e-mail if preferred) or we may consider your application withdrawn and close the file. Please contact David Bailey at* (919) 554-4884 X 30 *or* David.E.Bailey2@usace.army.mil *if you have any questions.

Date: **December 28, 2018**

Corps Regulatory Official: _____

David E. Bailey

Corps Regulatory Field Office Address: **USACE Raleigh Regulatory Field Office, 3331 Heritage Trade Drive, Suite 105, Wake Forest, NC 27587**

Copy furnished (electronic):
Scott McLendon (Corps-SAW), Henry Wicker (Corps-SAW), Jean Gibby (Corps-SAW), Todd Miller (Corps-NAO), Karen Higgins (NCDWR), Sue Homewood (NCDWR), Alex Miller (NextEra), Travis Faul (NextEra), Amanda Mardiney (FERC), John Ellis (USFWS), Renee Gledhill-Early (NCSHPO)

Virginia Correspondence

Hamberg, Alexis

From: Chalmers, Cory M. <CChalmers@equitransmidstream.com>
Sent: Thursday, January 17, 2019 8:38 AM
To: Hamberg, Alexis; Ferry, Lori M
Subject: FW: MVP Southgate Project Update
Attachments: News Release - MVPSG Application Filing (Final).pdf; MVP_Southgate_FERC Filing Route_11.6.2018.kmz

Jaime Robb	VA Agencies	Virginia Department of Environmental Quality	Office of Stormwater Management	VA			

From: Chalmers, Cory M.
Sent: Wednesday, November 07, 2018 10:34 AM
To: Annie Willoughby <awilloughby@mdmcorp.com>
Subject: FW: MVP Southgate Project Update

From: Chalmers, Cory M.
Sent: Tuesday, November 06, 2018 9:54 PM
To: 'Jaime.Robb@deq.virginia.gov' <Jaime.Robb@deq.virginia.gov>
Subject: MVP Southgate Project Update

Hello Jaime,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated KMZ file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Best,
Cory

Cory Chalmers • Environmental Coordinator
120 Professional Place, Bridgeport, WV 26330
Direct: 304.848.0061 • Mobile: 304.627.8173
cchalmers@eqt.com

From:	Miller, Alex
To:	melanie.davenport@deq.virginia.gov
Cc:	james.golden@deq.virginia.gov; dave.davis@deq.virginia.gov; Justin Curtis; Raffenberg, Matthew
Subject:	MVP Southgate Project Update
Date:	Tuesday, November 06, 2018 5:10:27 PM
Attachments:	News Release - MVPSG Application Filing (Final).pdf MVP_Southgate_FERC Filing Route_11.6.2018.kmz

Hello Ms. Davenport,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application this afternoon requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated kmz file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Cordially,

Alex

Alex V. Miller
Environmental Permitting Lead
on behalf of Mountain Valley Pipeline, LLC
713-374-1599

Hamberg, Alexis

From: Chalmers, Cory M. <CChalmers@equitransmidstream.com>
Sent: Thursday, January 17, 2019 8:39 AM
To: Hamberg, Alexis; Ferry, Lori M
Subject: FW: MVP Southgate Project Update
Attachments: News Release - MVPSG Application Filing (Final).pdf; MVP_Southgate_FERC Filing Route_11.6.2018.kmz

CAUTION - EXTERNAL EMAIL

Jerome Brooks	VA Agencies	VA Department of Environmental Quality (VA DEQ)	Office of Water Compliance	VA			

From: Chalmers, Cory M.
Sent: Wednesday, November 07, 2018 10:34 AM
To: Annie Willoughby <awilloughby@mdmcorp.com>
Subject: FW: MVP Southgate Project Update

From: Chalmers, Cory M.
Sent: Tuesday, November 06, 2018 9:57 PM
To: Jerome Brooks (Jerome.Brooks@deq.virginia.gov) <Jerome.Brooks@deq.virginia.gov>
Subject: MVP Southgate Project Update

Hello Jerome,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated KMZ file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Best,
Cory

Cory Chalmers • Environmental Coordinator
120 Professional Place, Bridgeport, WV 26330
Direct: 304.848.0061 • Mobile: 304.627.8173
cchalmers@eqt.com

From:	Ernst Aschenbach
To:	Stahl, Megan D.; ProjectReview (DGIF); Sergio.Harding@dgif.virginia.gov
Subject:	[EXTERNAL] ESSLog 39178; Southgate follow up information & DGIF comments pertaining to avian resources
Date:	Thursday, November 15, 2018 4:14:51 PM
Attachments:	image001.png
Importance:	High

We have reviewed the MVP Southgate Project Draft Resource Report 3 (Fish, Wildlife and Vegetation). The final design, identifying what proportion of the alignment will be contained within existing right of way and sections of the alignment outside the existing right of way, is not currently available. Based on the existing preliminary information, we have the following comments pertaining to avian resources:

- **Avoiding impacts to bald eagles and heron rookeries:** According to our VAFWIS records, there is a bald eagle nest known from within approximately 8 miles of the north end of the project, within Pittsylvania County, VA. This raises the possibility of other nests within the county, where the project is located. In order to avoid impacts to nesting bald eagles, we recommend the proponent adhere to our Virginia Bald Eagle Guide for Landowners: https://www.dgif.virginia.gov/wp-content/uploads/virginia-bald-eagle-guidelines-for-landowners.pdf. In order to inform the need for such adherence, we recommend an aerial survey for bald eagle nests within 0.5 miles of the project during winter months during leaf-off of deciduous trees. The presence of any bald eagles should also be noted. If an empty bald eagle nest is documented, we recommend a follow-up survey later in the season to determine the status of the nest as active or inactive – this survey should take place prior to work proceeding in the area, and the surveys and any results should be coordinated with and communicated to DGIF. Concurrent with the bald eagle surveys and within the same survey footprint, we recommend that the proponent note all heron rookeries, so as to avoid impacts to any rookeries within 0.5 miles of the project, as outlined on p. 23 (3-16) of the Resource Report.
- **Collocation:** We support efforts collocating the alignment **within** an existing utility easement to the greatest extent practicable, to avoid and minimize land- and vegetation clearing for new right of way.
- **Alignment along existing utility easement:** While we prefer collocation **within** an existing utility right of way, we support efforts to minimize creation of new edge habitat and reduce forest fragmentation by locating some sections of the alignment adjacent to and adjoining existing utility easement, when necessary. However, as per your e-mail below and information provided in a separate Resource Report, we also understand that linear segments of the project totaling 5.6 miles will not be collocated with existing utility easements. We have insufficient information to evaluate what proportion of vegetation clearing along these 5.6 miles will take place within forested habitat, which would result in forest fragmentation and the creation of new edge habitat. Impacts resulting from such vegetation clearing are addressed on page 24 (3-17) of the Resource Report; the major project impact to forest-nesting birds is identified as habitat loss. We submit as an additional consideration that the creation of open corridors within forested habitat exposes forest-nesting birds to increased nest predation pressure from both mammalian and avian predators (including jays, crows, and grackles) and to brood parasitism by brown-headed

cowbirds. These in turn impact avian reproductive output, and could result in long-term impacts to avian populations within these newly-created corridors.

- **Tree and vegetation clearing:** We support clearing of trees and vegetation, during winter months, outside the nesting period as proposed. See the Time of Year Restrictions for general guidance: https://www.dgif.virginia.gov/wp-content/uploads/VDGIF-Time-of-Year-Restrictions-Table.pdf
  If tree removal becomes necessary, we also recommend adherence to our standard tree removal – T&E bat guidance protective of T&E bats known from the region: https://www.dgif.virginia.gov/environmental-programs/environmental-services-section/

Thank you for the opportunity to review this project and provide preliminary comments pertaining to avian resources. Guidance pertaining to other resources under DGIF purview were provided under separate cover. Please call if you have questions.

Ernie Aschenbach
Environmental Services Biologist
P 804.367.2733
Email: Ernie.Aschenbach@dgif.virginia.gov
Virginia Department of Game & Inland Fisheries
CONSERVE. CONNECT. PROTECT.
A 7870 Villa Park Drive, P.O. Box 90778, Henrico, VA 23228-0778
www.dgif.virginia.gov

From: Stahl, Megan D.
Sent: Thursday, September 27, 2018 4:18 PM
To: 'Ernst Aschenbach' <ernie.aschenbach@dgif.virginia.gov>; rr ProjectReview (DGIF) <projectreview@dgif.virginia.gov>
Cc: Miller, Alex <Alex.Miller@nexteraenergy.com>; Stephanie Frazier <SFrazier@envsi.com>
Subject: RE: [EXTERNAL] RE: Southgate follow up information

Ernie,

As explained in Section 1.3.1 of Resource Report 1, where the proposed pipeline is collocated (i.e. located parallel to and adjacent with existing utility corridors, trails, and roads) the permanent right-of-way is located immediately adjacent to or partially within the existing right-of-way of the pipeline or electric transmission utility wherever feasible. The Project is proposing to use up to 25 feet of temporary workspace within the adjacent utility rights-of-way where possible; however final design and use of workspace within these areas is dependent on successful negotiation with the easement owner(s).

In collocated areas land clearing will be minimized. You are correct that it could result in additional land clearing activity outside of the existing utility right-of-way; however, it would be clearing of edge habitat. Of the project areas that will need to be cleared, we are working to calculate the

acreage of edge habitat versus interior forest habitat. We will provide that information to you as soon as possible.

Please let me know if you have any other questions.

Thank you,
Megan

From: Ernst Aschenbach <ernie.aschenbach@dgif.virginia.gov>
Sent: Thursday, September 27, 2018 3:16 PM
To: Stahl, Megan D. <MStahl@eqt.com>; rr ProjectReview (DGIF) <projectreview@dgif.virginia.gov>; Aschenbach, Ernie (DGIF) <Ernie.Aschenbach@dgif.virginia.gov>
Cc: Miller, Alex <Alex.Miller@nexteraenergy.com>; Stephanie Frazier <SFrazier@envsi.com>
Subject: [EXTERNAL] RE: Southgate follow up information

Will you please clarify –

Directly abutting an already cleared right of way could be interpreted as- and sounds like adjacent to, but OUTSIDE existing, previously cleared right-of-way. This could result in additional land-clearing activity, outside existing utility right or way. In this case, it would be helpful to know where and the acreage.

We need to know what proportion is directly WITHIN existing, previously cleared right-of-way.

Thanks.

Ernie Aschenbach
Environmental Services Biologist
P 804.367.2733
Email: Ernie.Aschenbach@dgif.virginia.gov
Virginia Department of Game & Inland Fisheries
CONSERVE. CONNECT. PROTECT.
A 7870 Villa Park Drive, P.O. Box 90778, Henrico, VA 23228-0778
www.dgif.virginia.gov

From: Stahl, Megan D. <MStahl@eqt.com>
Sent: Thursday, September 27, 2018 2:45 PM
To: Aschenbach, Ernst <ernie.aschenbach@dgif.virginia.gov>; Projectreview@dgif.virginia.gov
Cc: Miller, Alex <Alex.Miller@nexteraenergy.com>; Stephanie Frazier <SFrazier@envsi.com>
Subject: Southgate follow up information

Ernie,
Thank you for your time on the phone on Tuesday. I really appreciate your feedback on the Southgate project.

In response to your question about collocation of the project, I am providing the following information for areas where the proposed ROW is collocated (meaning directly abutting an already cleared right-of-way):
Virginia - 79% (20.87-miles of the 26.25-miles)
North Carolina - 40% (18.94-miles of the 47.25-miles)
Overall - 54% (39.81-miles of the 73.50-miles)

Also, I confirmed that there are no HDDs currently proposed for the Virginia portion of the project.

I look forward to your response to our project review request.
Thanks,
Megan

Megan Stahl
Permitting Supervisor
625 Liberty Avenue, Suite 1700
Pittsburgh, PA 15222
T 412-553-7783
C 412-737-2587

From:	Walthall, Anita
To:	CBaker@eqt.com
Cc:	Miller, Alex; Ryan, Kristin; Ometz, Darin
Subject:	MVP - Lambert Station Application
Date:	Wednesday, December 05, 2018 4:13:27 PM
Attachments:	21652_ILOD.pdf Form 7_fee pages.pdf

Good afternoon,

Please see the attached initial letter of determination (ILOD) for your application dated November 5, 2018. An orginial copy of the letter will follow via postal mail.

Thank you,
Anita

_____

Anita L. Walthall
Air Permit Writer
Department of Environmental Quality
Blue Ridge Regional Office
3019 Peters Creek Rd
Roanoke, VA 24019
(540)562-6769

www.deq.virginia.gov

COMMONWEALTH of VIRGINIA

Matthew J. Strickler
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
Blue Ridge Regional Office
3019 Peters Creek Road, Roanoke, Virginia 24019
(540) 562-6700; Fax (540) 562-6725
www.deq.virginia.gov

David K. Paylor
Director

Robert J. Weld
Regional Director

December 5, 2018

Mr. Clifford W. Baker
Senior VP of Midstream Filed Operations
Mountain Valley Pipeline, LLC
625 Liberty Ave., Suite 1700
Pittsburgh, PA 15222

Location: Pittsylvania County
Registration No.: 21652

Dear Mr. Baker:

This letter acknowledges receipt of your permit application dated November 5, 2018 to construct and operate a natural gas compressor station (Lambert Compressor Station) located at milepost 0.0 near Chatham, Virginia. The Department of Environmental Quality (DEQ) Blue Ridge Regional Office staff has completed its initial review of your application. Based on that review, the proposed request has been determined to be subject to the permitting requirements of Chapter 80, Article 6 of the Virginia Regulations for the Control and Abatement of Air Pollution. Please note, however, that this determination is subject to change upon further review.

Based upon this initial review, the application does not contain sufficient information to begin the application review process. Additional information will be needed before the application may be considered complete:

- A Local Governing Body Certification Form signed by the authorized local official, certifying that the proposed facility is consistent with local ordinances pursuant to Chapter 22 (§§15.1-2200 et seq.) of Title 15.2 of the Code of Virginia (see page 3 of the application form. This form must be submitted to DEQ before a permit can be issued.

- A permit application fee of $3,000.00 is required in order to further review this permit application. Applications will not be considered complete if the proper fee is not paid and will not be processed until full payment is received. Please send the attached fee form and a check (or money order) payable to "Treasurer of Virginia" to:

  Department of Environmental Quality
  Receipts Control
  P.O. Box 1104
  Richmond, VA 23218

A copy of the completed fee form should be submitted to the Department of Environmental Quality (DEQ) Blue Ridge Regional Office.

-

In order to further clarify your application, please respond to the following questions:

- Please confirm the vendor provided uncontrolled NOx emission rate for the Solar Taurus 70 and Mars 100 turbine is 15 ppmvd and not 9 ppmvd.
- What practice(s) will be performed to minimize excessive emission from turbines operating at temperatures less than 0 °F?
- For pre-combustion control technology, will high-efficiency filtration on the inlet air of the combustion turbines be used to minimize the entrainment of particulate matter into the turbine's exhaust streams? If no, please explain why not.
- Will an emergency generator be used during events of power interruption? If so, please address the number of annual hours of operation and BACT for this process.
- What are the estimated number of turnovers per year for the condensate storage tanks and associated criteria/HAP emissions for this process?
- What measure(s) will be taken to minimize emissions from venting during ESD testing? For example, will the emissions be capped or double valves used (or equivalent) during venting operations?
- Compare the project's potential hexane emissions from combined blowdown operations to the exemption levels found in 9VAC 5-60-300 C for hexane.
- Provide data to support hexane mass percent equal to 0.04% in natural gas.

It is important that you provide the required information above so that the engineering staff can complete the review of your application. Please submit the requested information by December 19, 2019 **with a document certification form**. If the requested information is not received by the due date, your permit application may be withdrawn from consideration by the Department and returned to you. An extension may be granted if requested in writing before the end of that period.

If a later analysis of the permit application indicates that additional information is required to support your application, such information will be requested at that time.

You are reminded that modification of a facility subject to the permitting requirements in Chapter 80 of the Virginia Regulations for the Control and Abatement of Air Pollution, without the appropriate new source review permit, can result in enforcement action.

If you have any questions or require assistance, please contact me at: anita.walthall@deq.virginia.gov or call (540) 562-6769.

Sincerely,

Anita Walthall
Environmental Specialist II

cc: file
Alex Miller, NextEra Energy, Inc. (alex.miller@nexteraenergy.com)
Kristin Ryan, EQM Midstream Partners, LP (krRyan@eqt.com)
Darin Ometz, TRC (dometz@trcsolutions.com)

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY – 2018 AIR PERMIT APPLICATION FEES

Air permit applications are subject to a fee. The fee does not apply to administrative amendments or true minor sources. Applications will be considered incomplete if the proper fee is not paid and will not be processed until full payment is received. Air permit application fees are not refundable.

Fees are adjusted January 1 of each calendar year. THIS FORM IS VALID JANUARY 1, 2018 TO DECEMBER 31, 2018.

Send this form and a check (or money order) payable to "Treasurer of Virginia" to:
Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, VA 23218

Send a copy of this form with the permit application to:
The DEQ Regional Office

Please retain a copy for your records. Any questions should be directed to the DEQ regional office to which the application will be submitted. **Unsure of your fee? Contact the Regional Air Permit Manager.**

COMPANY NAME:		**FIN:**	
COMPANY REPRESENTATIVE:		**REG. NO.**	
MAILING ADDRESS:			
BUSINESS PHONE:		**FAX:**	
FACILITY NAME:			
PHYSICAL LOCATION:			

PERMIT ACTIVITY	APPLICATION FEE AMOUNT	CHECK ONE
Sources subject to Title V permitting requirements:		
• Major NSR permit (Articles 7, 8, 9)	$63,000	
• Major NSR permit amendment (Articles 7, 8, 9)*	$10,000	
• State major permit (Article 6)	$25,000	
• Title V permit (Articles 1, 3)	$35,000	
• Title V permit renewal (Articles 1, 3)	$15,000	
• Title V permit modification (Articles 1, 3)	$4,000	
• Minor NSR permit (Article 6)	$5,000	
• Minor NSR amendment (Article 6)*	$2,500	
• State operating permit (Article 5)	$10,000	
• State operating permit amendment (Article 5)*	$4,000	
Sources subject to Synthetic Minor permitting requirements:		
• Minor NSR permit (Article 6)	$3,000	
• Minor NSR amendment (Article 6)*	$1,000	
• State operating permit (Article 5)	$5,000	
• State operating permit amendment (Article 5)*	$2,500	
***FEES DO NOT APPLY TO ADMINISTRATIVE AMENDMENTS AIR PERMIT APPLICATION FEES ARE NOT REFUNDABLE**		

DEQ OFFICE TO WHICH PERMIT APPLICATION WILL BE SUBMITTED (check one)

☐ SWRO/Abingdon	☐ NRO/Woodbridge	☐ PRO/Richmond	**FOR DEQ USE ONLY** **Date:** _____ **DC #:** _____
☐ VRO/Harrisonburg	☐ BRRO/Roanoke	☐ TRO/Virginia Beach	**Reg. No.:** _____

APPLICATION FEE FORM DEFINITIONS:

Administrative amendment – An administrative change to a permit issued pursuant to Article 1 (9 VAC 5-80-50 et seq.), Article 3 (9 VAC 5-80-360 et seq.), Article 5 (9 VAC 5-80-800 et seq.), Article 6 (9 VAC 5-80-1100 et seq.), Article 7 (9 VAC 5-80-1400 et seq.), Article 8 (9 VAC 5-80-1605 et seq.), or Article 9 (9 VAC 5-80-2000 et seq.) of 9 VAC 5 Chapter 80. Administrative amendments include, but are not limited to, the following:

- Corrections of typographical or any other error, defect or irregularity which does not substantially affect the permit,
- Identification of a change in the name, address, or phone number of any person identified in the permit, or of a similar minor administrative change at the source,
- Change in ownership or operational control of a source where the board determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the board.

Major new source review permit (Major NSR permit) – A permit issued pursuant to Article 7 (9 VAC 5-80-1400 et seq.), Article 8 (9 VAC 5-80-1605 et seq.), or Article 9 (9 VAC 5-80-2000 et seq.) of 9 VAC 5 Chapter 80. For purposes of fees, the Major NSR permit also includes applications for projects that are major modifications.

- An Article 7 permit is a preconstruction review permit (case-by-case Maximum Achievable Control Technology (MACT) determination) for the construction or reconstruction of any stationary source or emission unit that has the potential to emit, considering controls, 10 tons per year or more of any individual hazardous air pollutant (HAP) or 25 tons per year or more of any combination of HAPs and EPA has not promulgated a MACT standard or delisted the source category.
- An Article 8 permit is for a source (1) with the potential to emit over 250 tons per year of a single criteria pollutant OR (2) is in one of the listed source categories under 9 VAC 5-80-1615 and has the potential to emit over 100 tons per year of any criteria pollutant OR (3) with the potential to emit over 100,000 tons per year of CO_2 equivalent (CO_2e) (9 VAC 5-85 Part III). PSD permits are issued in areas that are in attainment of the National Ambient Air Quality Standards.
- An Article 9 permit is a preconstruction review permit for areas that are in nonattainment with a National Ambient Air Quality Standard (NAAQS). Nonattainment permits are required by any major new source that is being constructed in a nonattainment area and is major for the pollutant for which the area is in nonattainment. Nonattainment permitting requirements may also be triggered if an existing minor source makes a modification that results in the facility being major for the pollutant for which the area is in nonattainment. A major source is any source with potential to emit over 250 tons per year of a single criteria pollutant or is in one of the listed source categories under 9 VAC 5-80-2010 and the potential to emit over 100 tons per year of any criteria pollutant. However, if any area is in nonattainment for a specific pollutant, the major source threshold may be lower for that pollutant. For example, sources locating in the Northern Virginia Ozone Nonattainment Area which are part of the Ozone Transport Region would be a major source if they have the potential to emit more than 100 tons per year of NO_X and/or 50 tons per year of VOC regardless of source category. Nonattainment permits do not require an air quality analysis but require a source to control to the Lowest Achievable Emission Rate (LAER) and to obtain offsets.

Major NSR permit amendment – A change to a permit issued pursuant to Article 7 (9 VAC 5-80-1400 et seq.), Article 8 (9 VAC 5-80-1605 et seq.), or Article 9 (9 VAC 5-80-2000 et seq.) of 9 VAC 5 Chapter 80. Only minor amendments and significant amendments are included in this category.

Minor new source review permit (Minor NSR permit) – A permit to construct and operate issued under

Article 6 (9 VAC 5-80-1100 et seq.) of 9 VAC 5 Chapter 80. Minor NSR permits are 1) categorically required; or 2) issued to sources whose uncontrolled emission rate for a regulated criteria pollutant is above exemption thresholds and permitting allowables are below Title V thresholds, and/or 3) issued to sources whose potential to emit for a toxic pollutant is above state toxic exemption thresholds and permitting allowables are below Title V thresholds. The minor NSR permit can be used to establish synthetic minor limits for avoidance of state major, PSD and/or Title V permits. For purposes of fees, the Minor NSR permit also includes exemption applications and applications for projects at existing sources.

Minor NSR amendment - A change to a permit issued pursuant to Article 6 (9 VAC 5-80-1100 et seq.) of 9 VAC 5 Chapter 80. Only minor amendments and significant amendments are included in this category.

Sources subject to Synthetic Minor permitting requirements - Stationary sources whose potential to emit exceeds the Title V threshold (100 tons per year of a criteria pollutant, 10/25 tpy of HAPs, and/or 100,000 tpy CO_2e) but have taken federally enforceable limits, either through a state operating permit or a minor NSR permit, to avoid Title V permit applicability.

Sources subject to Title V permitting requirements – Stationary sources that have a potential to emit above the Title V thresholds or are otherwise applicable to the Title V permitting program.

State major permit – A permit to construct and operate issued under Article 6 (9 VAC 5-80-1100 et seq.) of 9 VAC 5 Chapter 80. State major permits are for facilities that have an allowable emission rate of more than 100 tons per year, but less than 250 tons per year, of any criteria pollutant and are not listed in the 28 categories under "major stationary source" as defined in 9 VAC 5-80-1615.

State operating permit (SOP) – A permit issued under Article 5 (9 VAC 5-80-800 et seq.) of 9 VAC 5 Chapter 80. SOPs are most often used by stationary sources to establish federally enforceable limits on potential to emit to avoid major New Source Review permitting (PSD and Nonattainment permits), Title V permitting, and/or major source MACT applicability. SOPs can also be used to combine multiple permits from a stationary source into one permit or to implement emissions trading requirements. The State Air Pollution Control Board, at its discretion, may also issue SOPs to cap the emissions of a stationary source or emissions unit causing or contributing to a violation of any air quality standard or to establish a source-specific emission standard or other requirement necessary to implement the federal Clean Air Act or the Virginia Air Pollution Control Law.

SOP permit amendment - A change to a permit issued pursuant to Article 5 (9 VAC 5-80-800 et seq.) of 9 VAC 5 Chapter 80. Only minor amendments and significant amendments are included in this category.

Title V permit – A federal operating permit issued pursuant to Article 1 (9 VAC 5-80-50 et seq.) or Article 3 (9 VAC 5-80-360 et seq.) of 9 VAC 5 Chapter 80. Facilities which (1) have the potential to emit of air pollutants above the major source thresholds, listed in 9 VAC 5-80-60 OR (2) are area sources of hazardous air pollutants, not explicitly exempted by EPA OR (3) have the potential to emit over 100,000 tons per year of CO_2 equivalent (CO_2e) (9 VAC 5-85 Part III), are required to obtain a Title V permit. For purposes of fees, the Title V permit also includes Acid Rain (Article 3) permit applications.

Title V permit modification - A change to a permit issued pursuant to Article 1 (9 VAC 5-80-50 et seq.) or Article 3 (9 VAC 5-80-360 et seq.) of 9 VAC 5 Chapter 80. Only minor modifications and significant modifications are included in this category.

Title V permit renewal – A renewal of a Title V permit pursuant to Article 1 (9 VAC 5-80-50 et seq.) of 9 VAC 5 Chapter 80. Title V permits are renewed every 5 years and a renewal application must be submitted to the regional office no sooner than 18 months and no later than 6 months prior to expiration of the Title V permit. For purposes of fees, the Title V permit renewal also includes Acid Rain (Article 3) permit renewal applications.

True minor source – A source that does not have the physical or operational capacity to emit major amounts (even if the source owner and regulatory agency disregard any enforceable limits). For further information, click here.

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

Via certified mail/return receipt requested

Virginia Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, Virginia 23218

December 11, 2018

Re: MVP Southgate Project – Lambert Compressor Station
Air Permit Application Fee
Air Permit Registration No. 21652

Dear Receipts Control,

Mountain Valley Pipeline, LLC ("Mountain Valley") filed the Article 6 Air Permit Application for the new Lambert Compressor Station on November 8, 2018. Enclosed is a copy of the Air Permit Application Form 7 that Mountain Valley is submitting to the Virginia Department of Environmental Quality (VADEQ) Blue Ridge Regional Office. Also enclosed is a check made payable to the "Treasurer of Virginia" for $3,000 in accordance with the permit fee requirements of a minor New Source Review (NSR) permit.

If you have any questions or comments regarding the information provided in the attached form, please do not to hesitate to contact me 713-204-3729 or via email at alex.miller@nexteraenergy.com or Christina Akly (561-691-7065; christina.akly@nee.com).

Regards,

Alex Miller
MVP Southgate Environmental Permitting Lead

Enclosures: Copy of VADEQ Form 7
Permit Application Fee

CC: Kristin Ryan, EQM Midstream Partners, LP
Darin Ometz, TRC

Attachment A
VADEQ Form 7

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY – 2018 AIR PERMIT APPLICATION FEES

Air permit applications are subject to a fee. The fee does not apply to administrative amendments or true minor sources. Applications will be considered incomplete if the proper fee is not paid and will not be processed until full payment is received. Air permit application fees are not refundable.

Fees are adjusted January 1 of each calendar year. THIS FORM IS VALID JANUARY 1, 2018 TO DECEMBER 31, 2018.

Send this form and a check (or money order) payable to "Treasurer of Virginia" to:

Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, VA 23218

Send a copy of this form with the permit application to:
The DEQ Regional Office

Please retain a copy for your records. Any questions should be directed to the DEQ regional office to which the application will be submitted. **Unsure of your fee? Contact the Regional Air Permit Manager.**

COMPANY NAME:	**Mountain Valley Pipeline, LLC**	**FIN:**	
COMPANY REPRESENTATIVE:	**Clifford Baker**	**REG. NO.**	**21652**
MAILING ADDRESS:	**625 Liberty Avenue, Suite 1700 Pittsburgh, PA 15222**		
BUSINESS PHONE:	**412-395-3654**	**FAX:**	
FACILITY NAME:	**Lambert Compressor Station**		
PHYSICAL LOCATION:	**Chatham, VA**		

PERMIT ACTIVITY	APPLICATION FEE AMOUNT	CHECK ONE
Sources subject to Title V permitting requirements:		
• Major NSR permit (Articles 7, 8, 9)	$63,000	
• Major NSR permit amendment (Articles 7, 8, 9)*	$10,000	
• State major permit (Article 6)	$25,000	
• Title V permit (Articles 1, 3)	$35,000	
• Title V permit renewal (Articles 1, 3)	$15,000	
• Title V permit modification (Articles 1, 3)	$4,000	
• Minor NSR permit (Article 6)	$5,000	
• Minor NSR amendment (Article 6)*	$2,500	
• State operating permit (Article 5)	$10,000	
• State operating permit amendment (Article 5)*	$4,000	
Sources subject to Synthetic Minor permitting requirements:		
• Minor NSR permit (Article 6)	$3,000	X
• Minor NSR amendment (Article 6)*	$1,000	
• State operating permit (Article 5)	$5,000	
• State operating permit amendment (Article 5)*	$2,500	
***FEES DO NOT APPLY TO ADMINISTRATIVE AMENDMENTS AIR PERMIT APPLICATION FEES ARE NOT REFUNDABLE**		

DEQ OFFICE TO WHICH PERMIT APPLICATION WILL BE SUBMITTED (check one)

☐ **SWRO/Abingdon**	☐ **NRO/Woodbridge**	☐ **PRO/Richmond**
☐ **VRO/Harrisonburg**	X **BRRO/Roanoke**	☐ **TRO/Virginia Beach**

FOR DEQ USE ONLY
Date: _____
DC #: _____
Reg. No.: _____

Attachment B
Application Fee Check

MVP SOUTHGATE

TRC

21 Griffin Road North
Windsor, CT 06095

1154903

Citizens Bank
CONNECTICUT
51-7011/2111

CHECK DATE
December 10, 2018

PAY Three Thousand and 00/100 Dollars

AMOUNT
$ 3,000.00

PAY TO THE ORDER OF
TO Treasurer Of Virginia
Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, VA 23218

By _____ MP
VOID AFTER 90 DAYS AUTHORIZED SIGNATURE

Security Check features included. Details on back.

⑈1154903⑈ ⑆211170114⑆ 223203710⑆4⑈

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

Ms. Anita Walthall
Environmental Specialist II
Virginia DEQ – Blue Ridge Regional Office
3019 Peters Creek Road
Roanoke, VA 24019

December 14, 2018

Re: MVP Southgate Project – Lambert Compressor Station
Minor New Source Article 6 Air Permit Application
Response to December 5, 2018 Initial Letter of Determination

Dear Ms. Walthall,

Mountain Valley Pipeline, LLC ("Mountain Valley") filed the Article 6 Air Permit Application for the new Lambert Compressor Station on November 8, 2018. The purpose of this letter is to respond to your initial Letter of Determination dated December 5, 2018.

Attachment A includes the local governing body certification form that was provided to the Pittsylvania County officials on November 6, 2018 and Mountain Valley is anticipating a response prior to December 21, 2018 (the 45-day statutory time period). Mountain Valley understands that the local government officials are required to respond in writing within 45 days of receipt of the certification form or the certification requirement will be deemed as met.

Mountain Valley has submitted the permit application fee check in the amount of $3,000 to cover the application fee for this Project (copy included in Attachment B).

Mountain Valley understands that the VADEQ has requested additional information to clarify the application. Responses to these questions are provided in Attachment C. A signed document certification form is provided in Attachment D.

We look forward to working with you and your staff on this project. If you have any questions or comments regarding the information provided in the attached responses, or need additional information, please do not to hesitate to contact me 713-204-3729 or via email at alex.miller@nexteraenergy.com or Christina Akly (561-691-7065; christina.akly@nee.com).

Regards,

Alex Miller
MVP Southgate Environmental Permitting Lead

Enclosures

CC: Mike Kiss, VADEQ – Central Office
Tamera Thompson, VADEQ – Central Office
Christina Akly, MVP Southgate
Kristin Ryan, EQM Midstream Partners, LP
Darin Ometz, TRC

Attachment A
Local Governing Body Certification Form

MVP SOUTHGATE

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

Ms. Karen Hayes
Deputy Director
Community Development
Pittsylvania County
P.O. Drawer D
Chatham, Virginia 24531

November 6, 2018

Re: MVP Southgate Project – Lambert Compressor Station
VADEQ Local Certification Form

Dear Ms. Hayes,

Mountain Valley Pipeline, LLC ("Mountain Valley") is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project ("Project"). The Project will be located in Pittsylvania County, Virginia and Rockingham and Alamance, North Carolina. Mountain Valley proposes to construct approximately a 0.4-mile-long 24-inch-diameter pipeline (H-605) and 73 miles of 24- and 16-inch-diameter natural gas pipeline (H-650) to provide timely, cost-effective access to new natural gas supplies to meet the growing needs of natural gas users in the southeastern United States.

In addition to the pipeline, Mountain Valley proposes to construct and operate a new compressor station (Lambert Compressor Station) near the beginning of the pipeline at milepost 0.0. As part of the Southgate Project and in order to boost pressures on Mountain Valley's transmission pipeline system, Mountain Valley is proposing to construct and operate one Solar Taurus 70 compressor turbine (11,792 hp) and one Solar Mars 100 compressor turbine (17,123 hp) at the Lambert Compressor Station.

Mountain Valley is currently coordinating with the Virginia Department of Environmental Quality (VADEQ) to obtain a minor New Source Review (NSR) air permit in order to construct and operate the new compressor station. The VADEQ air permit application requires a Pittsylvania County representative certify that the facility location and operation are consistent with applicable local ordinances. Attached is the VADEQ Local Governing Body Certification form for your review and signature. In addition to the certification form, enclosed is a site map and proposed plot plan.

Upon your approval, please provide a signed copy of the certification form to: Mr. Paul Jenkins, Air Permitting Manager, VADEQ Blue Ridge Regional Office, 3019 Peters Creek Road, Roanoke, Virginia 24019. An electronic copy for Mountain Valley's records can be sent to my email address below.

If you have any questions or comments regarding the attached certification form, or need additional information for the Project, please do not hesitate to contact me at 412-400-6887 or via email at KrRyan@eqt.com.

Regards,

Kristin Ryan
Engineer III

Enclosures

LOCAL GOVERNING BODY CERTIFICATION FORM

Facility Name: Lambert Compressor Station	Registration Number:
Applicant's Name: Mountain Valley Pipeline, LLC	Name of Contact Person at the site: Kristin Ryan
Applicant's Mailing address: 2200 Energy Drive, Canonsburg, PA 15317	Contact Person Telephone Number: 412-400-6887
Facility location (also attach map): Chatham, Pittsylvania County, Virginia (See Figures 2-1 and 2-2 of Application)	
Facility type, and list of activities to be conducted: Natural Gas Compressor Station for MVP Southgate pipeline.	

The applicant is in the process of completing an application for an air pollution control permit from the Virginia Department of Environmental Quality. In accordance with § 10.1-1321.1. Title 10.1, Code of Virginia (1950), as amended, before such a permit application can be considered complete, the applicant must obtain a certification from the governing body of the county, city or town in which the facility is to be located that the location and operation of the facility are consistent with all applicable ordinances adopted pursuant to Chapter 22 (§§ 15.2-2200 et seq.) of Title 15.2. The undersigned requests that an authorized representative of the local governing body sign the certification below.

Applicant's signature:	Date: 10/31/2018

The undersigned local government representative certifies to the consistency of the proposed location and operation of the facility described above with all applicable local ordinances adopted pursuant to Chapter 22 (§§15.2-2200 et seq.) of Title 15.2. of the Code of Virginia (1950) as amended, as follows:

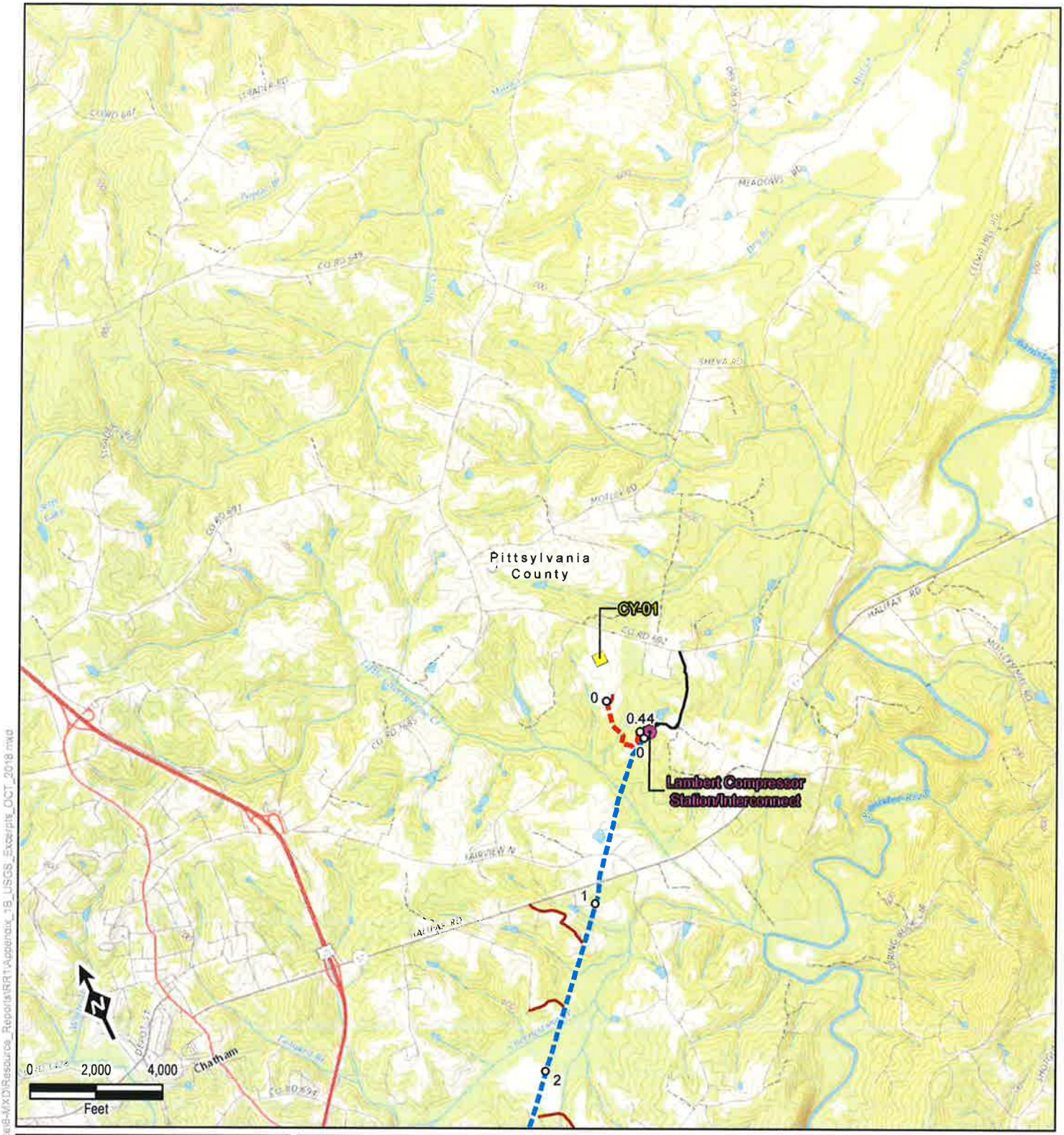
(**Check one block**)

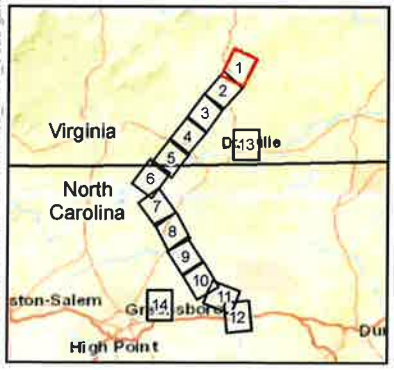
☐ The proposed facility is **fully consistent** with all applicable local ordinances.

☐ The proposed facility is **inconsistent** with applicable local ordinances; see attached information.

Signature of authorized local government representative:	Date:
Type or print name:	Title:
County, city or town:	

[THE LOCAL GOVERNMENT REPRESENTATIVE SHOULD FORWARD THE SIGNED CERTIFICATION TO THE APPROPRIATE DEQ REGIONAL OFFICE AND SEND A COPY TO THE APPLICANT.]





Legend

- Mileposts
- Compressor Station
- Contract Yard
- Meter Station
- Valve Site
- Permanent Access Road
- Temporary Access Road
- H-605 Pipeline
- H-650 Pipeline
- County Boundary
- State Boundary

Data Sources: ESRI, USGS, TRC, EQT

1 inch = 4,000 feet
When Printed 8.5x11

Mountain Valley PIPELINE, LLC

Appendix 1-B

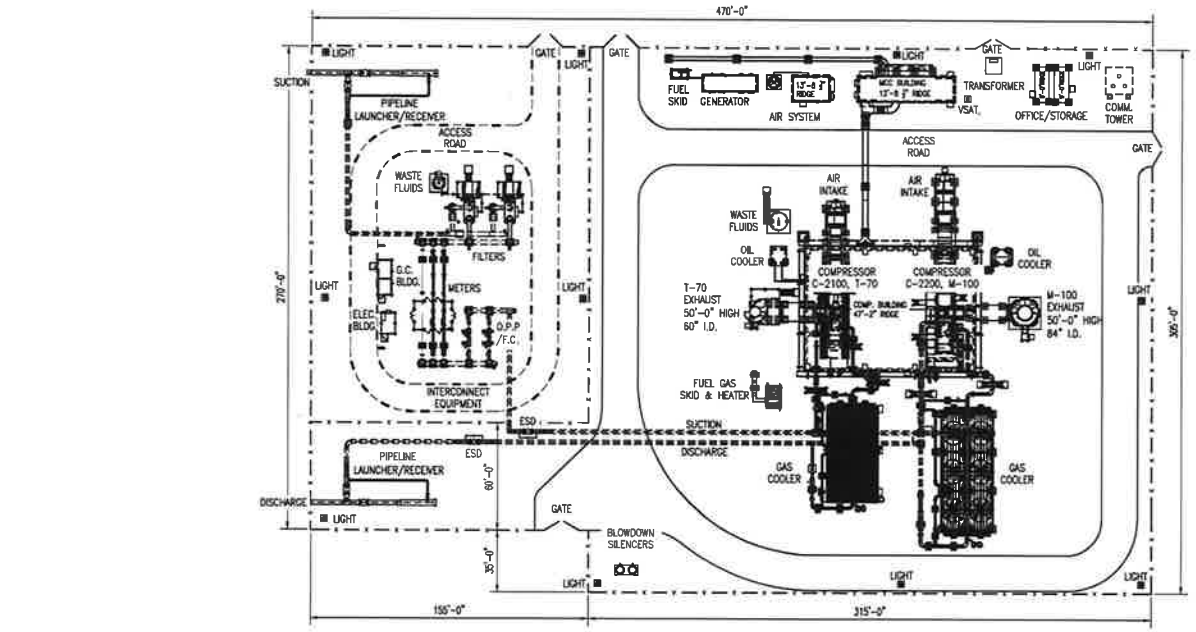
USGS Quadrangle Excerpts

Sheet 1 of 14

TRC

600 Willowbrook Ln
West Chester, PA 19382
October 2018

S:\1_PROJECTS\NEXTERA-302423_MVP_Southgate\8-MXD\Resource_Reports\RR1\Appendix_1B_USGS_Excerpts_OCT_2018.mxd



REFERENCE DRAWINGS		NO.	DATE	REVISION	BY	CHK	APPD	NO.	DATE	REVISION	BY	CHK	APPD
DRAWING NUMBER	DRAWING TITLE	P	8-14-2018	PRELIMINARY									
		P	10-08-2018	PRELIMINARY									
		P	10-10-2018	PRELIMINARY									

TO THE BEST OF MY KNOWLEDGE, ALL COMPONENTS OF THIS DRAWING ARE DESIGNED IN ACCORDANCE WITH APPLICABLE GUIDELINES AND SPECIFICATIONS

DOUG MACE — MECHANICAL DESIGN ENGINEER — 8-14-2018 DATE

/ — ELECTRICAL DESIGN ENGINEER — / DATE

NOTE: ANY CHANGES TO THE DESIGN SHOWN ON THIS DRAWING MUST BE APPROVED BY THE DESIGN ENGINEER.

Mountain Valley Pipeline, LLC

PROJECT ID: ######

DRAWING SCALE: 1/32" = 1'-0"

DRAWING TITLE: LAMBERT COMPRESSOR STATION MECHANICAL PIPING PLOT PLAN

FACILITY	STATE	IDENTIFICATION	SERIES	SHEET	REVISION
C	V	LAM	1100	01	P

Plotted by: Mark.Dang on October 10, 2018 - 2:43 PM

File Path: C:\Working\PROJECTS\SOUTHGATE\PLOT PLAN\Lambert CS 10-10-2018 DEVLDWG

Attachment B
Copy of Application Fee

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

Via certified mail/return receipt requested

Virginia Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, Virginia 23218

December 11, 2018

Re: MVP Southgate Project – Lambert Compressor Station
Air Permit Application Fee
Air Permit Registration No. 21652

Dear Receipts Control,

Mountain Valley Pipeline, LLC ("Mountain Valley") filed the Article 6 Air Permit Application for the new Lambert Compressor Station on November 8, 2018. Enclosed is a copy of the Air Permit Application Form 7 that Mountain Valley is submitting to the Virginia Department of Environmental Quality (VADEQ) Blue Ridge Regional Office. Also enclosed is a check made payable to the "Treasurer of Virginia" for $3,000 in accordance with the permit fee requirements of a minor New Source Review (NSR) permit.

If you have any questions or comments regarding the information provided in the attached form, please do not to hesitate to contact me 713-204-3729 or via email at alex.miller@nexteraenergy.com or Christina Akly (561-691-7065; christina.akly@nee.com).

Regards,

Alex Miller
MVP Southgate Environmental Permitting Lead

Enclosures: Copy of VADEQ Form 7
Permit Application Fee

CC: Kristin Ryan, EQM Midstream Partners, LP
Darin Ometz, TRC

Attachment A
VADEQ Form 7

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY – 2018 AIR PERMIT APPLICATION FEES

Air permit applications are subject to a fee. The fee does not apply to administrative amendments or true minor sources. Applications will be considered incomplete if the proper fee is not paid and will not be processed until full payment is received. Air permit application fees are not refundable.

Fees are adjusted January 1 of each calendar year. THIS FORM IS VALID JANUARY 1, 2018 TO DECEMBER 31, 2018.

Send this form and a check (or money order) payable to "Treasurer of Virginia" to:

Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, VA 23218

Send a copy of this form with the permit application to:
The DEQ Regional Office

Please retain a copy for your records. Any questions should be directed to the DEQ regional office to which the application will be submitted. **Unsure of your fee? Contact the Regional Air Permit Manager.**

COMPANY NAME:	**Mountain Valley Pipeline, LLC**	**FIN:**	
COMPANY REPRESENTATIVE:	**Clifford Baker**	**REG. NO.**	**21652**
MAILING ADDRESS:	**625 Liberty Avenue, Suite 1700 Pittsburgh, PA 15222**		
BUSINESS PHONE:	**412-395-3654**	**FAX:**	
FACILITY NAME:	**Lambert Compressor Station**		
PHYSICAL LOCATION:	**Chatham, VA**		

PERMIT ACTIVITY	APPLICATION FEE AMOUNT	CHECK ONE
Sources subject to Title V permitting requirements:		
• Major NSR permit (Articles 7, 8, 9)	$63,000	
• Major NSR permit amendment (Articles 7, 8, 9)*	$10,000	
• State major permit (Article 6)	$25,000	
• Title V permit (Articles 1, 3)	$35,000	
• Title V permit renewal (Articles 1, 3)	$15,000	
• Title V permit modification (Articles 1, 3)	$4,000	
• Minor NSR permit (Article 6)	$5,000	
• Minor NSR amendment (Article 6)*	$2,500	
• State operating permit (Article 5)	$10,000	
• State operating permit amendment (Article 5)*	$4,000	
Sources subject to Synthetic Minor permitting requirements:		
• Minor NSR permit (Article 6)	$3,000	X
• Minor NSR amendment (Article 6)*	$1,000	
• State operating permit (Article 5)	$5,000	
• State operating permit amendment (Article 5)*	$2,500	
***FEES DO NOT APPLY TO ADMINISTRATIVE AMENDMENTS AIR PERMIT APPLICATION FEES ARE NOT REFUNDABLE**		

DEQ OFFICE TO WHICH PERMIT APPLICATION WILL BE SUBMITTED (check one)

☐ **SWRO/Abingdon**	☐ **NRO/Woodbridge**	☐ **PRO/Richmond**
☐ **VRO/Harrisonburg**	X **BRRO/Roanoke**	☐ **TRO/Virginia Beach**

FOR DEQ USE ONLY
Date: _____
DC #: _____
Reg. No.: _____

Attachment B
Application Fee Check

MVP SOUTHGATE

TRC

21 Griffin Road North
Windsor, CT 06095

1154903

Citizens Bank
CONNECTICUT
51-7011/2111

CHECK DATE
December 10, 2018

PAY Three Thousand and 00/100 Dollars

AMOUNT
$ 3,000.00

PAY TO THE ORDER OF
TO Treasurer Of Virginia
Department of Environmental Quality
Receipts Control
P.O. Box 1104
Richmond, VA 23218

By _____ MP
VOID AFTER 90 DAYS AUTHORIZED SIGNATURE

Security Check features included. Details on back.

⑈1154903⑈ ⑆211170114⑆ 223203710⑆4⑈

Attachment C
Responses to VADEQ Questions

MVP SOUTHGATE

Number	VADEQ Question	Response
1	Please confirm the vendor provided uncontrolled NOx emission rate for the Solar Taurus 70 and Mars 100 turbine is 15 ppmvd and not 9 ppmvd.	As provided in the vendor performance data in Appendix B of the Air Permit Application, the uncontrolled NOx emission rate for the Solar Taurus 70 and Mars 100 turbines at the Lambert Station is 15 ppmvd.
2	What practice(s) will be performed to minimize excessive emission from turbines operating at temperatures less than 0 °F?	The combustion turbines will be equipped with pilot active control logic. At temperatures below 0 °F, the turbine is controlled to increase pilot fuel to increase flame stability. Note that the combustion turbines are expected to operate at temperatures below 0 °F for less than 14 hours per year.
3	For pre-combustion control technology, will high-efficiency filtration on the inlet air of the combustion turbines be used to minimize the entrainment of particulate matter into the turbine's exhaust streams? If no, please explain why not.	The combustion turbines will be equipped with self-cleaning inlet air filters to reduce the entrainment of particulate matter into the turbine and to reduce the PM exhaust emissions.
4	Will an emergency generator be used during events of power interruption? If so, please address the number of annual hours of operation and BACT for this process.	An emergency generator is not included in the Lambert Station design. The microturbines are the primary source of power to the Station and utility power will be utilized as secondary backup.
5	What are the estimated number of turnovers per year for the condensate storage tanks and associated criteria/HAP emissions for this process?	There are an estimated 12.5 turnovers per year for the condensate storage tanks as provided in Table B-9. The associated air pollutant emissions from the condensate tanks are provided in Table B-9 and include the turnover emissions. The estimated number of turnovers is conservative and accounts for upset conditions upstream of the Facility.
6	What measure(s) will be taken to minimize emissions from venting during ESD testing? For example, will the emissions be capped or double valves used (or equivalent) during venting operations?	In order to ensure a proper ESD test, the test will be performed in a natural state without additional valves such that only the ESD blowdown valve will be used during the test. Block valves will not be included in the Station design. The annual potential emissions of VOC from an ESD test are less than 0.5% of the total VOCs and less than 0.1% of the total CO2e for the facility, as shown in Tables B-1 and B-8.
7	Compare the project's potential hexane emissions from combined blowdown operations to the exemption levels found in 9VAC 5-60-300 C for hexane.	The potential hexane emissions from blowdown operations are provided in Appendix B-4. The potential combined hexane emission rate from all of the blowdown events is 0.024 tons per year. The maximum short-term hexane emission rate during a planned maintenance or operational activity is 1.2 lb/hr, assuming the entire blowdown occurs in 1-hour. The exemption levels for hexane emissions in 9VAC 6-60-300 are 11.616 lb/hr and 25.52 tons per year. Thus, the short-term and annual hexane emissions from the blowdowns at the Lambert Station are well below the exemption levels.

Number	VADEQ Question	Response
8	Provide data to support hexane mass percent equal to 0.04% in natural gas.	The attached gas sample provides representative expected gas composition data for the Lambert Compressor Station. The composition of hexane in the natural gas is 0.008 mole percent and 0.04 mass percent as shown in Table B-8.

Midstream TEG Dehydration Data Sheet

Project: **Lambert Compressor Station** **Rev 0: 10 Oct 2018**

Gas Sample:

Design / Operating Conditions			
Ambient Temperature Range:		-20 F to 100 F	
Site Elevation above Sea Level:		660 ft	
Site Address:		Transco Ln, Chatham, VA 24531	
Site Coordinates:	36.8269°, -79.3414°	**County**:	
Media:	Natural Gas	S.G.	.62
Gas Composition:		See Analysis	
EQT Project Engineer	Doug Mace	Email:	dmace@eqt.com

GAS PROPERTIES			
COMPONENT	**MOLE %**		
NITROGEN	0.396		**BTU/SCF (DRY)**
CARBON DIOXIDE	0.165		1097.6
OXYGEN	0.000		
METHANE	87.823		**BTU/SCF (SAT)**
ETHANE	11.303		1078.9
PROPANE	0.280		
ISO-BUTANE	0.009		**IDEAL GRAVITY**
N-BUTANE	0.010		.6152
ISO-PENTANE	0.003		
N-PENTANE	0.003		**REAL GRAVITY**
HEXANES (PLUS)	0.008		.6164
TOTAL	100		

Attachment D
VADEQ Document Certification Form

MVP SOUTHGATE

AIR PERMIT APPLICATION
CHECK ALL PAGES ATTACHED AND LIST ALL ATTACHED DOCUMENTS

1 Local Government Certification Form, Page 3
1 Application Fee Form, Pages 4-6
1 Document Certification Form, Page 7
___ General Information, Pages 8-9
___ Fuel Burning Equipment, Page 10
___ Stationary Internal Combustion Engines, Page 11
___ Incinerators, Page 12
___ Processing, Page 13
___ Inks, Coatings, Stains, and Adhesives, Page 14
___ VOC/Petroleum Storage Tanks, Pages 15-16
___ Loading Rack and Oil-Water Separators, Page 17
___ Fumigation Operations, Page 18
___ Air Pollution Control and Monitoring Equipment, Page 19
___ Air Pollution Control/Supplemental Information, Page 20
___ Stack Parameters and Fuel Data, Page 21
___ Proposed Permit Limits for Criteria Pollutants, Page 22
___ Proposed Permit Limits for Toxic Pollutants/HAPs, Page 23
___ Proposed Permit Limits for Other Reg. Pollutants, Page 24
___ Proposed Permit Limits for GHGs on Mass Basis, Page 25
___ Proposed Permit Limits for GHGs on CO_2e Basis, Page 26
___ BAE for Criteria Pollutants, Page 27
___ BAE for GHGs on Mass Basis, Page 28
___ BAE for GHGs on CO_2e Basis, Page 29
___ Operating Periods, Page 30

___ ATTACHED DOCUMENTS:
___ Map of Site Location
___ Facility Site Plan
___ Process Flow Diagram/Schematic
___ MSDS or CPDS Sheets
___ Estimated Emission Calculations
___ Stack Tests
___ Air Modeling Data
___ Confidential Information (see Instructions)
___ BACT Analysis

Check added form sheets above; also indicate the number of copies of each form in blank provided.

DOCUMENT CERTIFICATION FORM

I certify under penalty of law that this document and all attachments [as noted above] were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering and evaluating the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I certify that I understand that the existence of a permit under [Article 6 of the Regulations] does not shield the source from potential enforcement of any regulation of the board governing the major NSR program and does not relieve the source of the responsibility to comply with any applicable provision of the major NSR regulations.

SIGNATURE: Clifford Baker DATE: 12-12-18

NAME: Clifford Baker REGISTRATION NO: 21652

TITLE: Senior VP of Midstream Field Operations COMPANY: Mountain Valley Pipeline, LLC

PHONE: 412-395-3654 ADDRESS: 625 Liberty Ave, Suite 1700

EMAIL: cbaker@equitransmidstream.com Pittsburgh, PA 15222

References: Virginia Regulations for the Control and Abatement of Air Pollution (Regulations), 9 VAC 5-20-230B and 9 VAC 5-80-1140E.

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

January 23, 2019

Via Federal Express

Ernie Aschenbach
Environmental Services Biologist
Research Coordinator
Virginia Department of Game & Inland Fisheries
Habitat Conservation
7870 Villa Park Drive
P.O. Box 90778
Henrico, VA 23228-077

RE: MVP Southgate Project Response to Comments issued November 15, 2018

Mr. Aschenbach;

Thank you for providing comments on the MVP Southgate Project, August 22, 2018, Draft Resource Report 3 – Fish, Wildlife, & Vegetation. This letter responds to comments regarding avian resources issued by Virginia Department of Game & Inland Fisheries on November 15, 2018, as follows:

Avoiding impacts to bald eagles and heron rookeries: According to our VAFWIS records, there is a bald eagle nest known from within approximately 8 miles of the north end of the project, within Pittsylvania County, VA. This raises the possibility of other nests within the county, where the project is located. In order to avoid impacts to nesting bald eagles, we recommend the proponent adhere to our Virginia Bald Eagle Guide for Landowners: https://www.dgif.virginia.gov/wp-content/uploads/virginia-bald-eagle-guidelines-for-landowners.pdf. In order to inform the need for such adherence, we recommend an aerial survey for bald eagle nests within 0.5 miles of the project during winter months during leaf-off of deciduous trees. The presence of any bald eagles should also be noted. If an empty bald eagle nest is documented, we recommend a follow-up survey later in the season to determine the status of the nest as active or inactive – this survey should take place prior to work proceeding in the area, and the surveys and any results should be coordinated with and communicated to DGIF. Concurrent with the bald eagle surveys and within the same survey footprint, we recommend that the proponent note all heron rookeries, so as to avoid impacts to any rookeries within 0.5 miles of the project, as outlined on p. 23 (3-16) of the Resource Report.

As discussed in Final Resource Report 3 – Section 3.3.3.1, filed on November 6, 2018, MVP Southgate will adhere to the Virginia Bald Eagle Guidelines for Landowners. Aerial surveys will be conducted prior to construction to identify rookeries and active and inactive bald eagle nests, with resurvey of empty eagle nests later in the season.

Collocation: We support efforts collocating the alignment within an existing utility easement to the greatest extent practicable, to avoid and minimize land- and vegetation clearing for new right of way.

Comment noted.

Alignment along existing utility easement: While we prefer collocation within an existing utility right of way, we support efforts to minimize creation of new edge habitat and reduce forest fragmentation by

locating some sections of the alignment adjacent to and adjoining existing utility easement, when necessary. However, as per your e-mail below and information provided in a separate Resource Report, we also understand that linear segments of the project totaling 5.6 miles will not be collocated with existing utility easements. We have insufficient information to evaluate what proportion of vegetation clearing along these 5.6 miles will take place within forested habitat, which would result in forest fragmentation and the creation of new edge habitat. Impacts resulting from such vegetation clearing are addressed on page 24 (3-17) of the Resource Report; the major project impact to forest-nesting birds is identified as habitat loss. We submit as an additional consideration that the creation of open corridors within forested habitat exposes forest-nesting birds to increased nest predation pressure from both mammalian and avian predators (including jays, crows, and grackles) and to brood parasitism by brown-headed cowbirds. These in turn impact avian reproductive output, and could result in long-term impacts to avian populations within these newly-created corridors.

As discussed in the Final Resource Report 3 - Section 3.3.4, filed on November 6, 2018, the Project was routed to avoid interior forest and minimize potential effects of fragmentation to the extent practicable by avoiding large tracts of forest and collocating the pipeline alignment with existing facilities. To limit potential fragmentation, where feasible, the proposed route is collocated with other linear features (e.g., existing ROW). In total, approximately 54 percent (39.81 mi of 73.50 mi) of the proposed route is collocated (VA – 79% [20.87 mi of 26.25 mi]; NC – 40% [18.94 mi of 47.25 mi]).

The Southgate Project avoids impacts to high quality forested areas (Ecological Core Areas from VDCR's Virginia Natural Landscape Assessment - C1 – Outstanding; C2 – Very High; C3 – High). These areas exhibit the highest ecological value for wildlife and other natural resources in Virginia. A total of 19.5 acres and 39.2 acres of moderate (C4) and general (C5) quality forest habitat, respectively, is expected to be crossed by the Project. A total of approximately 5.1 acres and 9.6 acres of moderate and general quality forest habitat, respectively, will be maintained as non-forest habitat for the operation and maintenance of pipeline facilities. The high degree of collocation, coupled with avoidance of high quality forested habitats, limits impacts associated with habitat fragmentation to the extent practicable.

Tree and vegetation clearing: We support clearing of trees and vegetation, during winter months, outside the nesting period as proposed. See the Time of Year Restrictions for general guidance:
https://www.dgif.virginia.gov/wp-content/uploads/VDGIF-Time-of-Year-Restrictions-Table.pdf
If tree removal becomes necessary, we also recommend adherence to our standard tree removal – T&E bat guidance protective of T&E bats known from the region: https://www.dgif.virginia.gov/environmental-programs/environmental-services-section/

Comments noted.

For additional information, please do not hesitate to contact me.

Sincerely,

Megan Stahl
Permitting Coordinator
MVP Southgate

North Carolina Correspondence

From: Homewood, Sue [mailto:sue.homewood@ncdenr.gov]
Sent: Thursday, January 3, 2019 8:22 AM
To: Kevin Martin <kmartin@sandec.com>
Cc: Higgins, Karen <karen.higgins@ncdenr.gov>
Subject: RE: [External] variance exhibits for variance

Hello Kevin,

We agree.

Thanks,

Sue Homewood
Division of Water Resources, Winston Salem Regional Office
Department of Environmental Quality

336 776 9693 office
336 813 1863 mobile
Sue.Homewood@ncdenr.gov

450 W. Hanes Mill Rd, Suite 300
Winston Salem NC 27105

From: Kevin Martin <kmartin@sandec.com>
Sent: Wednesday, January 2, 2019 3:48 PM
To: Homewood, Sue <sue.homewood@ncdenr.gov>; Higgins, Karen <karen.higgins@ncdenr.gov>
Subject: [External] variance exhibits for variance

Do you all agree that for the variance MVP Southgate, only the crossings that require a variance should be submitted for the variance package (not all the others)? If all are shown I am afraid it will cause confusion. They will show all crossings on an overall map that individually indicates the ones that are before the EMC for a variance. thanks

Kevin C. Martin
Principal
Soil & Environmental Consultants, PA
North Quarter Office Park

8412 Falls of Neuse Road, Suite 104
Raleigh, NC 27615
(919) 846-5900 Office Phone
(919) 846-9467 Fax
(919) 270-7941 Mobile
kmartin@sandec.com
Visit us at SandEC.com!

Hamberg, Alexis

From: Chalmers, Cory M. <CChalmers@equitransmidstream.com>
Sent: Thursday, January 17, 2019 8:36 AM
To: Ferry, Lori M; Hamberg, Alexis
Subject: FW: MVP Southgate Project Update
Attachments: News Release - MVPSG Application Filing (Final).pdf; MVP_Southgate_FERC Filing Route_11.6.2018.kmz

CAUTION - EXTERNAL EMAIL

Corey Anen	NC Agencies	NC Department of Environmental Quality (NC DEQ), DEMLR	Environmental Engineer	NC			

From: Chalmers, Cory M.
Sent: Wednesday, November 07, 2018 10:34 AM
To: Annie Willoughby <awilloughby@mdmcorp.com>
Subject: FW: MVP Southgate Project Update

From: Chalmers, Cory M.
Sent: Tuesday, November 06, 2018 10:08 PM
To: 'corey.anen@ncdenr.gov' <corey.anen@ncdenr.gov>
Subject: MVP Southgate Project Update

Hello Corey,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated KMZ file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Best,
Cory

Cory Chalmers • Environmental Coordinator
120 Professional Place, Bridgeport, WV 26330
Direct: 304.848.0061 • Mobile: 304.627.8173
cchalmers@eqt.com

Hamberg, Alexis

From: Chalmers, Cory M. <CChalmers@equitransmidstream.com>
Sent: Thursday, January 17, 2019 8:39 AM
To: Hamberg, Alexis; Ferry, Lori M
Subject: FW: MVP Southgate Project Update
Attachments: News Release - MVPSG Application Filing (Final).pdf; MVP_Southgate_FERC Filing Route_11.6.2018.kmz

CAUTION - EXTERNAL EMAIL

Toby Vinson	NC Agencies	NC Department of Environmental Quality (NC DEQ), Division of Energy, Mineral and Land Resources	Director	NC			

From: Chalmers, Cory M.
Sent: Wednesday, November 07, 2018 10:34 AM
To: Annie Willoughby <awilloughby@mdmcorp.com>
Subject: FW: MVP Southgate Project Update

From: Chalmers, Cory M.
Sent: Tuesday, November 06, 2018 10:12 PM
To: 'toby.vinson@ncdenr.gov' <toby.vinson@ncdenr.gov>
Subject: MVP Southgate Project Update

Hello Toby,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated KMZ file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Best,
Cory

Cory Chalmers • Environmental Coordinator
120 Professional Place, Bridgeport, WV 26330
Direct: 304.848.0061 • Mobile: 304.627.8173
cchalmers@eqt.com

Hamberg, Alexis

From: Chalmers, Cory M. <CChalmers@equitransmidstream.com>
Sent: Thursday, January 17, 2019 8:37 AM
To: Hamberg, Alexis; Ferry, Lori M
Subject: FW: MVP Southgate Project Update
Attachments: News Release - MVPSG Application Filing (Final).pdf; MVP_Southgate_FERC Filing Route_11.6.2018.kmz

CAUTION - EXTERNAL EMAIL

Annette Lucas	NC Agencies	NC Department of Environmental Quality (NC DEQ), DEMLR	PE Stormwater Program Supervisor	NC	

From: Chalmers, Cory M.
Sent: Wednesday, November 07, 2018 10:34 AM
To: Annie Willoughby <awilloughby@mdmcorp.com>
Subject: FW: MVP Southgate Project Update

From: Chalmers, Cory M.
Sent: Tuesday, November 06, 2018 10:07 PM
To: 'annette.lucas@ncdenr.gov' <annette.lucas@ncdenr.gov>
Subject: MVP Southgate Project Update

Hello Annette,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated KMZ file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Best,
Cory

Cory Chalmers • Environmental Coordinator
120 Professional Place, Bridgeport, WV 26330
Direct: 304.848.0061 • Mobile: 304.627.8173
cchalmers@eqt.com

Hamberg, Alexis

From: Chalmers, Cory M. <CChalmers@equitransmidstream.com>
Sent: Thursday, January 17, 2019 8:34 AM
To: Hamberg, Alexis; Ferry, Lori M
Subject: FW: MVP Southgate Project Update
Attachments: MVP_Southgate_FERC Filing Route_11.6.2018.kmz; News Release - MVPSG Application Filing (Final).pdf

CAUTION - EXTERNAL EMAIL

Matt Gantt	NC Agencies	NC Department of Environmental Quality (NC DEQ), Land Resources	Regional Environmental Engineer	NC		

From: Chalmers, Cory M.
Sent: Wednesday, November 07, 2018 10:34 AM
To: Annie Willoughby <awilloughby@mdmcorp.com>
Subject: FW: MVP Southgate Project Update

From: Chalmers, Cory M.
Sent: Tuesday, November 06, 2018 10:09 PM
To: 'matt.gantt@ncdenr.gov' <matt.gantt@ncdenr.gov>
Subject: MVP Southgate Project Update

Hello Matt,

On behalf of the MVP Southgate project team, I am reaching out to notify you that we filed our formal Application today requesting certification of public convenience and necessity from the Federal Energy Regulatory Commission. We will continue to update our company webpage throughout the process with pertinent FERC filings. The entire Application can be found on our docket (CP19-14-000) in the FERC's eLibrary.

Attached you will find the public news release and an updated KMZ file of the MVP Southgate Project workspace that was used for the Application. MVP Southgate will continue to update stakeholders throughout the FERC process. Please feel free to reach out to me with any questions or concerns.

Best,

Cory

Cory Chalmers • Environmental Coordinator
120 Professional Place, Bridgeport, WV 26330
Direct: 304.848.0061 • Mobile: 304.627.8173
cchalmers@eqt.com

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

December 20, 2018

Tracy L. Millis tmillis@trcsolutions.com
TRC Environmental Corporation
50101 Governors Drive, Suite 250
Chapel Hill, NC 27517

Re: MVP Southgate Project, Construct Interstate Pipeline, Rockingham and Alamance Counties, ER 18-1041

Dear Mr. Millis:

Thank you for your November 6, 2018, letter transmitting the draft report for the above-referenced undertaking. We have reviewed the report and offer the following comments.

We concur that the following properties are unassessed for listing in the National Register of Historic Places and concur with the site boundaries:

31AM414, 31RK44, 31RK217, 31RK222, 31RK235, 31RK239, 31RK247, 31RK216, 31RK216, 31RK228, 31RK234, 31RK236, and 31RK237 have the potential to contain data that would provide information pertinent to prehistoric research questions.

31RK221, 31RK229, and 31RK230 have the potential to contain data that would provide information pertinent to historic research questions.

31RK244 and 31AM435 were determined not eligible within the area of disturbance, but we concur that they are unassessed outside of that boundary.

31RK238 and 31RK240 were determined not eligible within the area of disturbance but require further work due to possible deep deposits. We consider these sites unassessed.

We concur that the following properties are not eligible for the National Register for the reasons outlined in the report:

Sites 31AM415-428, 31AM432-424, 31AM436-437, 31RK218-220, 31RK223-227, 31RK231-233, 31RK241-242, 31RK245-246, 31RK248-249, and 31RK253-257 do not have the potential to contain information pertinent to prehistoric or historic research questions.

Sites 31AM346, 31AM347, 31RK129, 31RK181, and 31RK189 were not relocated within the project corridor.

Sites 31RK216, 31RK228, 31RK236, and 31RK237 are historic cemeteries that are ineligible for the National Register but will be avoided by the project.

We need additional information before we can concur with your determination for the following properties:

Sites 31RK234 and 31RK243 are described as ineligible in the report, but unassessed on the site forms submitted. Based on the submitted information, we agree that 31RK234 is unassessed and should be described as such in the report. We require further information on site 31RK243. The site form states that it may be unassessed due to historic artifacts but does not list or describe these artifacts.

Attached for your use are items that need to be corrected in the final report.

The above comments are made pursuant to Section 106 and 110 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-814-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona M. Bartos

Attachment – corrections

cc: Alex Miller, MVP Southgate, LLC, alex.miller@nexteraenergy.com
Paul Webb, TRC Environmental Corporation, pwebb@trcsolutions.com

North Carolina Office of State Archaeology
Archaeological Investigation Standards and Guidelines, 2017
Corrections for Final Report for ER 18-1041

Please add the information listed below to the final report, described in the guidelines for Phase I Identification Survey Reports, pages 21-27

a. Management Summary

2. Relevant legislation and SHPO environmental review number
5. Description of factors limiting the intensity or coverage of the survey

b. Introduction

3. SHPO environmental review number
7. Principal investigator and crew member names, including Archaeological Technicians

c. Environmental Setting

2. Map of project boundaries showing recent aerial imagery at a scale of 1:24,000 or less
3. Types of current and historic land use within the project area, including estimates of the acreage within each current land use type

d. Archaeological and Cultural Background

Correction for page 40 – "tannerys" should be "tanneries"

f. Results

1. Field survey time, specifically how many person-days in the field were necessary to cover the project area using the techniques described

- On page 136, Site 31RK249 needs a picture of a representative shovel test
- On page 120, please add a note clarifying that "RK1531" refers to an architectural resource, not an archaeological one. Please do the same on page 240, "AM1516."
- On page 57, the paragraph describing Segment 45 refers to the area as Segment 41. On page 136, Segment 57 is referred to as Segment 56.
- For segments without any positive shovel tests that had a newly recorded site, please be explicit in the description that the site was located by surface collection (e.g. Segment 9 and Segment 6).
- On page 261: "including 14 with historic components, 42 with prehistoric components, and **s** with historic and prehistoric components"; **s** should be five
- The NCOSA has stopped designating anything an "isolated find." We are treating any discovery of artifact(s) as an archaeological site. In the future, please include all the information requested for sites when describing isolated finds (including shovel test pictures, representative site pictures, etc.)
- Site 31AM413 is labeled on a map in Appendix 1 (sheet 41 of 54), but not described in the report. Will this be included in an Addendum report?

ROY COOPER
Governor
MICHAEL S. REGAN
Secretary
LINDA CULPEPPER
Director

NORTH CAROLINA
Environmental Quality

January 10, 2019

DWR # 20181638
Rockingham & Alamance Counties

Mountain Valley LLC
Attn: Matthew Raffenberg
700 Universe Boulevard
Juno Beach FL 33408

Subject: **REQUEST FOR ADDITIONAL INFORMATION**
Mountain Valley Pipeline – Southgate (MVP Southgate)

Dear Mr. Raffenberg:

On November 30, 2018, the Division of Water Resources – Water Quality Programs (Division) received your application dated November 30, 2018, requesting a 401 Individual Water Quality Certification and Buffer Authorization from the Division for your project. The Division has determined that your application is incomplete and cannot be processed. **The application is on-hold until all of the following information is received**:

1. Please provide the Division with a copy of your response to the US Army Corps of Engineers request for more information dated December 28, 2018. [15A NCAC 02H .0502(c)]

2. The application documentation notes that the pipeline construction sequence includes clearing and grubbing of the project right away. Clarify the linear schedule for clearing and grubbing. For instance, will the entire linear length be cleared and grubbed, including all wetland and buffer areas prior to initiation of the next phase of construction? What means and/or measures will be taken to ensure protection of waters of the state and protected riparian areas for the maximum time feasible? [15A NCAC 02H .0506(f) and (g)]

3. Section 4.4 of the Project Description notes that Impact Avoidance and Minimization Measures include "Cutting trees to grade, and only removing stumps from directly over the trench, or where safety dictate otherwise..." This statement appears to contradict Section 2.4.2 and Figure 2 which describe Typical Pipeline Construction Sequence as complete clearing and grading of the entire project corridor. Please clarify. [15A NCAC 02H .0506(f) and (g)]

For the portion of the project within the Jordan Lake watershed [15A NCAC 02B .0267]:

4. Provide route maps that show the proposed route and all impact areas overlaid onto the published county soil survey maps and USGS Topo maps. Please also clearly identify any streams that were determined to be "not present in the field" by DWR staff and therefore not subject to the Jordan Buffer Riparian Buffer Rules.

5. Provide a table that indicates which stream features are subject to the Jordan Lake Riparian Buffer Rules in accordance with the maps and site visit determinations noted in Item #3 above.

6. Modify Table 4.3 to indicate which stream impacts are being included in the Buffer Authorization request and which stream impacts will be requested under a major variance to be submitted separately.

7. All impacts from access roads should be accounted for as Road Impacts, or Temporary Road Impacts under the Table of Uses. Please clearly identify these on Table 4.3 (or other impact table) and calculate mitigation accordingly.

8. Provide impact maps with hatching or shading to clearly identify areas proposed (and calculated) as temporary impacts and areas proposed to be within a permanent maintenance corridor. Please provide impact drawings at a greater scale to clearly show details as necessary.

9. Provide mitigation acceptance/commitment letters from private Mitigation Banks and/or DMS to meet the Jordan Lake buffer mitigation requirements. The mitigation plan must comply with 15A NCAC 02B .0295 and G.S. 143-214.20.

10. Provide a description of Jordan Lake Riparian Buffer restoration within Section 2.5 of the Project Description.

11. Provide a description of the proposed permanent operation and maintenance plan for areas subject to the Jordan Lake Buffer Rules within Section 2.8 of the Project Description.

Please note that due to the large volume of information submitted and the significant amount of information being requested in this letter, the Division has not completed its review and additional requests for more information may be necessary.

Pursuant to Title 15A NCAC 02H .0502(e) and Title 15A NCAC 02B .0267, the applicant shall furnish all of the above requested information for the proper consideration of the application. Please respond in writing within 30 calendar days of receipt of this letter by:

- Sending one (1) copy of all of the above requested information to the 401 & Buffer Permitting Branch, 1617 Mail Service Center, Raleigh, NC 27699-1617,
- Sending one (1) copy of all of the above requested information to Sue Homewood, 450 West Hanes Mill Road, Suite 300, Winston-Salem, NC 27105, **and**
- Submitting all of the above requested information through this link: https://edocs.deq.nc.gov/Forms/Supplemental-Information-Form (note the DWR# requested on the link is referenced above).

If all of the requested information is not received within 30 calendar days of receipt of this letter, the Division will be unable to approve the application and it will be returned. The return of this project will necessitate reapplication to the Division for approval, including a complete application package and the appropriate fee.

Please be aware that you have no authorization under the Water Quality Certification Rules or Jordan Lake Buffer Rules for this activity and any work done within waters of the state or protected riparian buffers may be a violation of North Carolina General Statutes and Administrative Code.

Contact Sue Homewood at 336-776-9693 or Sue.Homewood@ncdenr.gov if you have any questions or concerns.

Sincerely,

Karen Higgins

Karen Higgins, Supervisor
401 & Buffer Permitting Branch

cc: Heather Patti, TRC Environmental Corporation (via email)
David Bailey, USACE Raleigh Regulatory Field Office (via email)
Olivia Munzer, NCWRC (via email)
DWR WSRO 401 files
DWR 401 & Buffer Permitting Unit

Filename: 20181638MVPSouthgate(RockinghamAlamance)_401_IC_HOLD

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

January 23, 2019

Via Federal Express

Vann Stancil
Research Coordinator
North Carolina Wildlife Resource Commission
Habitat Conservation
1721 Mail Service Center
Raleigh, NC 27699-1721

RE: MVP Southgate Project Response to Comments issued November 2, 2018

Mr. Stancil;

Thank you for providing comments on the MVP Southgate Project, August 22, 2018, Draft Resource Report 3 – Fish, Wildlife, & Vegetation. This letter responds to the comments issued by North Carolina Wildlife Resource Commission on November 2, 2018, as follows:

Page 3-3. Virginia has closer to 210 freshwater fish species (Jenkins and Burkhead 1993). Numbers of fish species for Virginia and North Carolina should be limited to freshwater fish.

This statement was revised in the Final Resource Report 3 – Section 3.2.2, filed on November 6, 2018.

Page 3-5. 3.2.2.5. The report states that impacts to recreational fisheries will be minor and temporary. Although no impacts are anticipated, the wording in this part of the statement seems too assured.

This statement was revised in the Final Resource Report 3 – Section 3.2.2.4, filed on November 6, 2018, to state "Any impacts on recreational fisheries associated with construction of Southgate Project facilities are expected to be minor and temporary; therefore, no permanent impacts are anticipated on recreational fisheries from the Project."

Page 3-7 bullet 2. Banks should be stabilized and sediment barriers installed as soon as possible, but at least within 24 hours.

The Project will stabilize waterbody banks and install sediment barriers as soon as possible, but at least within 24 hours of completing in-stream construction activities. Sediment barriers will be left in place until the site has been stabilized with perennial vegetation.

Page 3-7 bullet 7. Any herbicides used near water should be approved for aquatic use.

As discussed in the Final Resource Report 2 - Section 2.4.4.1, filed on November 6, 2018, no herbicides or pesticides will be used in or within 100 feet of a wetland or waterbody, unless specified by a federal or state agency.

Page 3-7 bullets 8 & 9. If surface waters are considered for source water, water withdrawal sources, withdrawal rates, and best management practices need to be described in detail.

Treatment of groundwater and surface water BMPs associated with hydrostatic testing are described in the Final Resource Report 3 - Section 3.2.4.4, filed on November 6, 2018.

Page 3-12 3.3.3.1 Migratory Bird Species of Concern. The report states NCNHP's online database and other online resources were accessed to identify birds with conservation concerns with the potential to occur near the project. The lack of records at or near the Project, or even in Rockingham and Alamance counties, does not imply or confirm the absence of a species. An on-site survey is the only definitive means to determine if the species is likely to occur at or near the Project.

The refined list of Project-specific Migratory Birds Species of Concern (MBSC) represents those species of concern that are known to occur and nest in and/or near the Project Area. Review of reputable inventory databases along with review of habitats found near the Project was used to identify species known or thought to occur near the Project. In addition to NCNHP's online database, the Project evaluated comments provided by NCWRC on August 10, 2018; data collected by the Carolina Bird Club, eBird's online mapping tool, National Land Cover Database (2011), Project-specific habitat data, and review of readily available sources regarding forest cover to understand potential presence of species and habitats near the Project.

Two of the main goals of identifying Project-specific MBSC are to 1) evaluate potential impacts to suitable habitat, and 2) identify strategies to avoid and minimize impacts on Project-specific MBSC and their associated habitats. The list of Project-specific MBSC presented in Resource Report 3, Table 3.3-3 require and occupy a variety of land cover types that also support habitat of species removed from the list; for example, grasshopper sparrow (a Project-specific MBSC), and Henslow's sparrow (a species that was considered but ultimately not included as a Project-specific MBSC), both use grassland habitats. The discussion of impacts to land cover in Resource Report 3, Section 3.3.3.2 addresses the overall potential impact to land cover types that support the full list of species considered for designation as Project-specific MBSC. In addition, species removed from the list have nesting seasons that overlap with nesting seasons for Project-specific MBSC listed in Resource Report 3, Table 3.3-4. Conservation measures proposed for Project-specific MBSC in Resource Report 3, Section 3.3.3.3 filed in November 6, 2018, would also provide benefits to the full suite of species listed in Table 3.3-3.

See Attachment 1 for revised Tables 3.3-3 and 3.3-4.

Page 3-12 3.3.3.1 Migratory Bird Species of Concern. The NC WAP is an additional resource to identify sensitive bird species that may be affected by the Project. The NC WAP also evaluates the threats to each species (i.e., transportation and service corridors, and human intrusions and disturbance).

The NC WAP was reviewed and resulted in the identification of additional species that potentially occur in and/or near the Project Area. Tables 3.3-3 and 3.3-4 were revised to reflect these changes, and are included as Attachment 1. Results of the NC WAP review suggest least bittern (*Ixobrychus exilis*) and yellow-crowned night heron (*Nyctanassa violacea*) should be included as a Project-specific MBSC due to potential for the species to nest in the geographic region. This increases the number of Project-specific MBSC from 12 to 14 species.

The NC WAP identifies 15 species of concern that are known or believed to occur in the geographic region of the Project (i.e., Piedmont). It should be noted that yellow-crowned night-heron will be considered a Project-specific MBSC due to potential to nest in the geographic region of the Project. This coupled with NCWRC's concern for heron rookies warrants the species inclusion. Eight of these were previously evaluated as Project-specific MBSC. Many species listed in the NC WAP do not occur in the geographic region of the Project and, therefore, were excluded from the Project-specific MBSC. For example, red knot (*Calidris canutus*) and piping plover (*Charadrius melodus*) occur along the Atlantic Coast (species not included in table 3.3-3). Some species may occur in the region during other times of year (i.e., migration; winter) but nest in other portions of North Carolina, such as golden-winged warbler (*Vermivora chrysoptera*), northern saw-whet owl (*Aegolius acadicus*), and brown creeper (*Certhia americana*) that nest in the higher elevation portions of the state.

The NC WAP was also reviewed to evaluate risks associated with proposed activities to each species. Table 3.3-3 was revised to summarize these risks (see Attachment 1).

Page 3-15 3.3.3.3 Proposed Conservation Measures. We also recommend avoiding routine ROW maintenance and other activities during the nesting season (April 1 to August 31).

As discussed in the Final Resource Report 3 - Section 3.2.4.1, filed on November 6, 2018, the Project will adopt the FERC's "Plan and Procedures", which prohibits routine vegetation mowing or clearing during the migratory bird nesting season between April 15 and August 1.

Page 3.-16 Wildlife Impacts and Mitigation. The report mentions that excavated trenches left open during the project construction can risk wildlife being trapped or experience bodily injury. We recommend sweeps of trenches to clear wildlife at least once each morning prior to construction.

To allow trapped wildlife egress from open trenches, the Final Resource Report 3 - Section 3.3.4 filed on November 6, 2018, was revised to include a discussion of wildlife escape ramps.

Page 3.-17 Wildlife Impacts and Mitigation. The report cites the North Carolina Forest Services Forest Action Plan (NCFS, 2010) for the acres of forested land in the Piedmont. The Forest Action Plan data is primarily from 2007 datasets. North Carolina is among the top ten fastest growing states with the most development in the Piedmont; therefore, the data from 10 years ago is obsolete. Furthermore, working forests are referred to forestland managed for renewable supply of wood for lumber, energy and paper industry. Artificially planted timberland comprises 18%, or approximately 3.2 million acres of all timberland in the Coastal Plain and Piedmont, and loblolly pine covers close to 80% of all plantation acreage (McConnell et al., 2016). Replacing native stands with even-aged pine plantations results in decreased habitat value for forest species that rely on diverse forest composition and structure. In 2002, less than 1% of both hardwood and pine trees in the Piedmont measured greater than 19 inches and shorter rotation forestry limits the creation of old-growth forest dynamics required by some Species of Greatest Conservation Need (SGCN) species.

Comment noted.

Page 3.-18 Wildlife Impacts and Mitigation. Although the ROW will provide a travel corridor for many wildlife species, we are still concerned about the impacts on habitat fragmentation and degradation. Anthropogenic impacts that create habitat fragmentation, loss, and degradation are some of the most important threats to populations of SGCN. For example, the Kentucky warbler is susceptible to brood parasitism in fragmented landscapes.

As discussed in the Final Resource Report 3 - Section 3.3.4, filed on November 6, 2018, the Project has avoided impacts to interior forest and therefore minimized potential effects of fragmentation to the extent practicable through routing to avoid large tracts of forest and collocating the pipeline alignment with existing facilities. As a result, in North Carolina, approximately 10.9 percent (43.1 acres) of the forest impacted for the construction of the pipeline right-of-way is considered interior forest and approximately 11.2 percent (17.2 acres) of the forest impacted for the continued operation and maintenance of the pipeline facilities is considered interior forest. Therefore, the majority of the impacts proposed are along forest edges and will not greatly alter the current wildlife usage of the area.

Page 3-20 Evergreen Forest. The last part of the sentence referencing spruce-fir forests is not accurate. That community represents higher elevation areas within NC, and it is not found near the MVP Southgate Project in our state.

This statement was revised in the Final Resource Report 3 – Section 3.4.2.2, filed on November 6, 2018 to exclude the presence of spruce-fir forests within the Project area.

Page 3-22 3.3.4. We question if kudzu should be included in this list of commonly observed invasive species.

The Final Resource Report 3 filed on November 6, 2018 addresses only the most commonly observed non-native or invasive plant species.

Page 3-26 Federal Species of Concern. On line 8, the sentence starting with "These species…" should be reworded to clarify if it is referring to only bat species or to bats and mussels.

The Final Resource Report 3 filed on November 6, 2018 was revised to refer to bat species.

Page 3-26 Federal Species of Concern. On line 10, although the USFWS has purview over federal listed species, we recommend including state agencies in consultations regarding field surveys for mussels and other species.

The MVP Southgate Project continues to coordinate with state and federal agencies regarding surveys of federally protected species. This statement was revised in the Final Resource Report 3 – Section 3.5.1, filed on November 6, 2018 to state: "Additionally, the Project continues consultation with the USFWS, as well as state agencies, to determine the appropriate level of effort recommended for field surveys for mussel species."

Page 3-26 James Spinymussel. While adult James Spinymussels may reach 3 inches in length, not all individuals will be that size.

The Final Resource Report 3 – Section 3.5.1.1, filed on November 6, 2018, clarified this by restating as follows, "Adults can reach three inches in length and have an orange foot and mantle".

Page 3-26 James Spinymussel. There are records for James Spinymussel in the Dan River. To say that the waterbody is potentially inhabited by the James Spinymussel is erroneous. This could be reworded to indicate that the Dan River at the crossing location is potentially inhabited by the James Spinymussel.

The Final Resource Report 3 filed on November 6, 2018 states, "In North Carolina, consultation with the USFWS and NCWRC indicated the James spinymussel may inhabit the Dan River at the Project crossing location."

Page 3-27 James Spinymussel. Additional avoidance and minimization efforts should be discussed to reduce impacts to James Spinymussel. If the species is detected during surveys, altering the route and changing the crossing method would avoid impacts to habitat occupied by the species.

Additional avoidance and minimization efforts will be identified, as applicable, following the completion of mussel surveys planned for spring 2019.

Page 3-27 Roanoke Logperch. The relatively recent discovery of the species in the Dan / Mayo river basin should be discussed also.

The Final Resource Report 3 document filed on November 6, 2018 states, "…In Rockingham County, the logperch is known to occur in the Dan River, Mayo River, Smith River, and Big Beaver Island Creek (NCWRC, 2018)."

Page 3-27 Roanoke Logperch. Avoidance and minimization efforts, such as using horizontal directional drilling or boring for crossings should be discussed here. These crossing methods are the primary means to reduce impacts to the species and its habitats.

As discussed in the Final Resource Report 3 - Section 3.5.1.1, filed on November 6, 2018, the Project proposes to employ the HDD method to construct the pipeline at the Dan River crossing and conventional bore for Cascade Creek and Wolf Island Creek crossings. Due to the implementation of HDD and conventional bore at these locations, no impacts to Roanoke logperch are anticipated.

Page 3-32. 3.5.2.2. The North Carolina Wildlife Action Plan (WAP) should be mentioned here since the WAP for Virginia was discussed and included in Table 3.5-1.

This comment is addressed in the Final Resource Report 3, Section 3.5.2.2 and Table 3.5-1, filed on November 6, 2018.

Table 3.5-1. The MVP Southgate Project is located outside the range of some of the bat species listed in this table, such as Florida yellow bat; therefore, some species should be deleted. Northern long-eared bat is listed as state threatened, and tricolored and little brown bats are SR in NC.

Refer to Attachment X-1 for a revised Table 3.5.-1.

For additional information, please do not hesitate to contact me.

Sincerely,

Megan Stahl
Permitting Coordinator
MVP Southgate

Attachment 1:
- Table 3.3-3
- Table 3.3-4
- Table 3.5-1

ATTACHMENT 1
TABLES

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
American woodcock	*Scolopax minor*	ACJV; VaFWIS (IIa)	Pittsylvania; Rockingham; Alamance	Low	Low	11	49	Yes	Conservation status and known documented records near Project warrant species inclusion.
bald eagle	*Haliaeetus leucocephalus*	IPaC; BGEPA; BCR 29; NCWAP	none	Low	Low	32	277	Yes	Species is included due to BGEPA. *No documented nests or concentration areas near Project (accessed online mapping tools on July 18, 2018).
brown-headed nuthatch	*Sitta pusilla*	BCR 29; ACJV	Rockingham; Alamance	Low	Low	214	733	Yes	Conservation status and known documented records near Project warrant species inclusion.
eastern whip-poor-will	*Antrostomus vociferus*	IPaC; BCR 29; ACJV	Pittsylvania	Low	Low	4	37	Yes	Conservation status and known documented records near Project warrant species inclusion.
grasshopper sparrow	*Ammodramm us savannarum*	ACJV; NCNHP	Pittsylvania; Rockingham; Alamance	Medium	Low	180	241	Yes	Conservation status in NC and known documented records near Project warrant species inclusion.
Kentucky warbler	*Geothlypis formosa*	IPaC; BCR 29; ACJV	none	Low	Low	3	9	Yes	Conservation status and known documented records near Project warrant species inclusion.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
least bittern	*Ixobrychus exilis*	NCWAP	-	None	Low	-	-	Yes	Species may nest in geographic range.
northern bobwhite	*Colinus virginiana*	ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	67	98	Yes	Conservation status and known documented records near Project warrant species inclusion.
prairie warbler	*Setophaga discolor*	IPaC; BCR 29; ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	30	113	Yes	Conservation status and known documented records near Project warrant species inclusion.
prothonotary warbler	*Protonotaria citrea*	IPaC; ACJV (Moderate)	Rockingham; Alamance	Low	Low	34	102	Yes	Conservation status and known documented records near Project warrant species inclusion.
red-headed woodpecker	*Melanerpes erythrocephalus*	IPaC; ACJV (Moderate)	Rockingham; Alamance	Low	Low	55	208	Yes	Conservation status and known documented records near Project warrant species inclusion.
willow flycatcher	*Empidonax trailii*	NCNHP	Rockingham	None	Unknown	5	8	Yes	Conservation status in NC and records near Project warrant inclusion.
wood thrush	*Hylocichla mustelina*	IPaC; BCR 29; ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	-	-	Yes	Conservation status and known documented records near Project warrant species inclusion.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
yellow-crowned night-heron	*Nyctanassa violacea*	VaFWIS	none	Low	Low	0	0	Yes	While VaFWIS identified species, the Wildlife and Environmental Review Map Service (WERMS) did not reveal any known records of the species. No documented occurrences near Project via eBird.Species may nest in region.
American black duck	*Anas rubripes*	ACJV; VaFWIS (IIa)	none	Low	Low	8	20	No	No records of nesting near Project.
Bachman's sparrow	*Peucaea aestivalis*	BCR 29; NCWAP	none	Low	Low	0	0	No	No records of species near Project.
Bewick's wren	*Thryomanes bewickii*	BCR 29	none	n/a	n/a	0	0	No	No records of species near Project.
black rail	*Laterallus jamaicensis*	BCR 29; ACJV; NCWAP	none	Low	None	0	0	No	No records of species near Project.
blue-winged warbler	*Vermivora cyanoptera*	IPaC; BCR 29	none	Low	Low	1	8	No	Species nests farther to west in mountainous region. No documented occurrences (eBird) during nesting season (May to August).

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
brown creeper	*Certhia americana*	NCWAP	-	Low	Low	-	-	No	Species nests in higher elevations
cerulean warbler	*Setophaga cerulea*	IPaC; BCR 29; VaFWIS (IIa); NCWAP	none	Low	Low	1	1	No	Species nests farther to west in mountainous region. Rare nesting to east in NC. No documented occurrences (eBird) during nesting season (May to August).
chimney swift	*Chaetura pelagica*	ACJV	Pittsylvania; Rockingham; Alamance	None	Low	628	1,027	No	Species nests primarily in chimneys. Project impacts are unlikely to affect species.
field sparrow	*Spizella pusilla*	ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	330	600	No	While the species is considered a 'High' priority bird by the ACJV in BCR 29, its decline is likely associated with conversion of open/early successional habitat to other land cover types. Construction of the Project will result in an increase sin suitable land cover types for nesting.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
golden-winged warbler	*Vermivora chrysoptera*	NCWAP	-	Low	Low	-	-	No	Nests in higher elevation portions.
Henslow's sparrow	*Ammodramm us henslowii*	BCR 29; NCWAP	none	Low	Low	0	0	No	No known nesting records near Project. State databases did not reveal records of species near Project.
king rail	*Rallus elegens*	ACJV; VaFWIS	none	Low	Low	0	0	No	VaFWIS identified species; however, the Wildlife and Environmental Review Map Service (WERMS) did not identify known records of the species. No documented occurrences near Project via eBird.
little blue heron	*Egretta caerulea*	NCWAP	-	Low	Low	-	-	No	Concern associated with rookeries Species does not nest in region.
loggerhead shrike	*Lanius ludovicianus*	BCR 29; VaFWIS; NCNHP; NCWAP	Former breeder in Rockingham and Alamance	low	Low	1	2	No	No records during nesting season. Conservation status and positive results from reviews of state databases.
northern saw-whet	*Aegolius acadicus*	NCWAP	-	Unknown	Low	-	-	No	Species nests at higher elevations.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
peregrine falcon	*Falco peregrinus*	BCR 29; NCWAP	none	Low	Medium	5	6	No	No known nesting records near Project. State databases did not reveal records of species near Project.
red-cockaded woodpecker	*Picoides borealis*	ACJV; NCWAP	none	Low	Medium	0	0	No	Species does not occur in region.
ruffed grouse	*Bonasa umbellus*	ACJV	none	Low	Low	0	0	No	Species occurs farther to west in mountainous region. No documented occurrences (eBird).
rusty blackbird	*Euphagus carolinus*	IPaC; BCR 29	n/a	Low	Low	11	38	No	Species does not nest in region.
sedge wren	*Cistothorus platensis*	BCR 29	none	Low	None	0	0	No	No known records near Project.
short-eared owl	*Asio flammeus*	BCR 29	n/a	Low	Low	0	2	No	Species does not nest in region.
snowy egret	*Egretta thula*	NCWAP	-	Low	Low	-	-	No	Concern associated with rookeries However, species does not nest in region.
Swainson's warbler	*Limnothlypis swainsonii*	BCR 29	none	Low	Low	0	0	No	No known records near Project.
tricolored heron	*Egretta tricolor*	NCWAP	-	Low	Low	-	-	No	Concern associated with rookeries. Species does not nest in region.
upland sandpiper	*Bartramia longicauda*	ACJV	none	Low	Low	0	0	No	No known records near Project.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
vesper sparrow	*Pooecetes gramineus*	NCWAP	-	Low	Low	-	-	No	Species nests in higher elevation portions of NC

NOTES
a/ IPaC = Unofficial list from United States Fish and Wildlife Service's Information for Planning and Consultation (IPaC) system; note that no species is included as a Project-specific MBSC based solely on unofficial IPaC results; BCR 29 =Included as 2008 Bird of Conservation Concern for Bird Conservation Region 29 (Piedmont); ACJV = Considered a 'Highest' or 'High' priority species in Atlantic Coast Joint Venture's 2014 Piedmont BCR 29 Implementation Plan. Two species (i.e., prothonotary warbler and red-headed woodpecker) with 'Moderate' priority status were included; Sources: http://acjv.org/documents/piedmont-2014.pdf; VaFWIS = Virginia Fish and Wildlife Information Service. Includes Species of Greatest Conservation Need ranked as tier I or II with positive results for records; NCNHP = North Carolina Natural Heritage Program's database; BGEPA = Bald and Golden Eagle Protection Act; NCWAP = State endangered, state threatened, and state species of concern included in North Carolina Wildlife Action Plan (2015).
b/ VA Source: Includes species with breeding status of 'Confirmed' and 'Probable' in the First Virginia Breeding Bird Atlas Survey (1985-1989); Second Virginia Breeding Bird Atlas currently in progress. NC Source: Birds of North Carolina: their Distribution and Abundance, http://ncbirds.carolinabirdclub.org/index.html
c/ Refers to Threat Metric 9.04 which evaluates potential risk associated with development and presence of transportation and service corridors and associated impacts (e.g., habitat fragmentation; susceptibility to nest predation). Source: North Carolina Wildlife Action Plan 2015.
d/ Refers to Threat Metric 9.06 which evaluates potential risk associated with human intrusions and disturbance (e.g., construction; human presence).Source: North Carolina Wildlife Action Plan 2015.
e/ eBird's online mapping tool was accessed on July 31, 2018 to identify records of potential MBSC from January 1, 1998 to May 31, 2018. Results in a submitted list that include species of interest, and should not be interpreted as number of individuals observed.
f/ MBSC – Migratory Bird Species of Concern

Table 3.3-4 [REVISED]

Preferred Nesting Habitat and Primary Nesting Season of Project-specific Migratory Bird Species

Species		Preferred Nesting Habitat	Primary Nesting Season
Common	**Scientific**		
American woodcock	*Scolopax minor*	Habitat consists of young forests and abandoned farmland mixed with forested land. Generally considered an edge species.	Apr. 1 to Aug. 31
bald eagle	*Haliaeetus leucocephalus*	Nests in trees among forests adjacent to large water bodies	Jan. 1 to Aug. 31
brown-headed nuthatch	*Sitta pusilla*	Mature and open longleaf pine stands; at least locally common in open loblolly, shortleaf, and pond pine stands, less so in Virginia pine. In the Piedmont, birds favor thinned or more open pine stands, such as in residential areas, golf courses, margins of lakes and ponds, and edges.	Apr 15 to Aug. 15
eastern whip-poor-will	*Antrostomus vociferus*	Forests and woodlands; no nest built, eggs laid on flat ground.	May 1 to Aug. 15
grasshopper sparrow	*Ammodrammus savannarum*	Fallow fields, pastures, hayfields, grasslands, and other areas dominated by graminoid vegetation.	May 15 to Aug. 15
Kentucky warbler	*Geothlypis formosa*	Prefers deep shaded woods with dense, humid thickets, bottomlands near creeks and rivers, ravines in upland deciduous woods, and edges of swamps; nests on ground or within a few inches of it	May 1 to Aug. 15
least bittern	*Ixobrychus exilis*	Nests in freshwater and brackish marshes with dense stands of emergent vegetation; primarily nests in Coastal Plain, but also known from eastern counties in Piedmont	15 May - 15 August
northern bobwhite	*Colinus virginiana*	Fallow fields, pastures, hayfields, grasslands, and other areas dominated by graminoid vegetation	Apr 15 to Aug. 31
prairie warbler	*Setophaga discolor*	Shrubby pastures, low pines; nest usually in a tree (such as pine, cedar, sweet-gum, oak), 1-45' above the ground	May 1 to Jul 31
prothonotary warbler	*Protonotaria citrea*	Wooded swamps, wetlands, river bottom hardwoods; Nest site usually 5-10' up (sometimes 3-30' up), above standing water in hole in tree or stump.	May 15 to Jul 31
red-headed woodpecker	*Melanerpes erythrocephalus*	Groves, farm country, orchards, shade trees in towns, large scattered trees; nests in tree cavities	May 10 to Sep. 10

Table 3.3-4 [REVISED]

Preferred Nesting Habitat and Primary Nesting Season of Project-specific Migratory Bird Species

Species		Preferred Nesting Habitat	Primary Nesting Season
Common	**Scientific**		
wood thrush	*Hylocichla mustelina*	Mainly deciduous woodlands; nest placed in vertical fork of tree (usually deciduous) or saddled on horizontal branch, usually about 10-15' above the ground, sometimes lower, rarely as high as 50'.	May 1 to Aug.31
willow flycatcher	*Empidonax traillii*	Open country, mainly in wide valleys with streamside thickets and corridors of trees adjacent to fields; marshes with shrubs and small trees	June 1 to Aug. 15
yellow-crowned night-heron	*Nyctanassa violacea*	Nests in small colonies in swamps and forested uplands near bodies of water; species known to occur in near residential areas	April 1 to July 31

Table 3.5-1 [REVISED]

Federally- and State-Listed Fish, Plant, and Wildlife Species with the Potential to Occur Along the MVP Southgate Project Route

Common Name	Scientific Name	Status			Survey Locations and Status
		Federal a/	VA b/	NC c/	
Arthropods					
Carolina ladle crayfish	*Cambarus davidi*			SR	The Project continues to consult with NRWRC to determine the need for survey. No surveys are expected to be required in Virginia.
Greensboro burrowing crayfish	*Cambarus catagius*			SC, SGCN	
Amphibians					
Four-toed salamander	*Hemidactylium scutatum*			SC, SGCN	The Project is evaluating potential suitable habitat and continues to coordinate with NCWRC. No surveys are expected to be required in Virginia.
Mole salamander	*Ambystoma talpoideum*		W(II)	SC, SGCN	
Fish					
Cape Fear shiner	*Notropis mekistocholas*	E d/		E, SGCN d/	Targeted surveys are not required e/
Riverweed darter	*Etheostoma podostemone*			SC	
Roanoke logperch	*Percina rex*	E	E	E, SGCN	
Mammals					
Eastern big-eared bat	*Corynorhinus rafinesquii macrotis*	SC d/	E d/	SC, SGCN d/	See Appendix 3-A of this Resource Report for the approved Bat Survey Study Plan and comprehensive Bat Survey Report.
Eastern red bat	*Lasiurus borealis*		W(IV)		
Eastern small-footed bat	*Myotis leibii*	SC d/	W(I) d/	SC, SGCN d/	
Northern yellow bat	*Lasiurus intermedius*			SC, SGCN d/	
Gray bat	*Myotis grisescens*	E d/	E d/	E, SGCN d/	
Hoary bat	*Lasiurus cinereus*		W(IV)		
Indiana bat	*Myotis sodalis*	E d/	E d/	E, SGCN d/	
Little brown bat	*Myotis lucifugus*		E d/	SR, SGCN	
Northern long-eared bat	*Myotis septentrionalis*	T	T	T, SGCN	
Rafinesque's big-eared bat	*Corynorhinus rafinesquii rafinesqui*	SC d/	E d/	T, SGCN d/	
Silver-haired bat	*Lasionycteris noctivagans*		W(IV)		
Southeastern bat	*Myotis austroriparius*	SC d/	W(I) d/	SC, SGCN d/	
Tri-colored bat	*Perimyotis subflavus*		E	SR, SGCN	

Table 3.5-1 [REVISED]

Federally- and State-Listed Fish, Plant, and Wildlife Species with the Potential to Occur Along the MVP Southgate Project Route

Common Name	Scientific Name	Status			Survey Locations and Status
		Federal a/	VA b/	NC c/	
Virginia big-eared bat	*Corynorhinus townsendii virginianus*	E[d/]	E[d/]	E, SGCN[d/]	
Mussels					
Atlantic pigtoe	*Fusconaia masoni*	PT	T	E, SGCN[d/]	Surveys are planned for April-May 2019.
Eastern creekshell	*Villosa delumbis*			SR, SGCN	
Eastern lampmussel	*Lampsilis radiata*			T, SGCN	
Green floater	*Lasmigona subviridis*	SC	T	E, SGCN	
James spinymussel	*Parvaspina collina*	E	E[d/]	E, SGCN	
Savannah lilliput	*Toxolasma pullus*			E, SGCN[d/]	
Yellow lampmussel	*Lampsilis cariosa*	SC	W(II)	E, SGCN	
Yellow lance	*Elliptio lanceolata*	T[d/]		E, SGCN[d/]	
Plants					
American bluehearts	*Buchnera americana*		R		Assumed present, no survey planned.
Cliff stonecrop	*Sedum glaucophyllum*			SR	No survey requested or planned.
Downy phlox	*Phlox pilosa*		R		Assumed present, no survey planned
Piedmont Barbara's-button	*Marshallia obovate var. obovate*		R		Assumed present, no survey planned.
Small whorled pogonia	*Isotria medeoloides*	T	E[d/]	T	No individuals observed during 2018 surveys; see Appendix 3A for survey results. Summer 2019 survey planned. No surveys are required in Virginia.
Smooth coneflower	*Echinacea laevigata*	E	T[d/]	E	No individuals observed during 2018 surveys; see Appendix 3A for survey results. Summer 2019 survey planned. No surveys are required in Virginia.

a/ Federal Status. E = Listed Endangered; T = Listed Threatened; PT = Proposed Threatened; SC = Species of Concern, a list maintained by USFWS Raleigh Field Office

b/ Virginia Status. E = Listed Endangered; T = Listed Threatened; R = Rare, including both Critically Imperiled and Imperiled state ranking; W (I) = Wildlife Action Plan, Tier I; W (II) = Wildlife Action Plan, Tier I; W (III) = Wildlife Action Plan, Tier III; W (IV) = Wildlife Action Plan, Tier IV

c/ North Carolina Status. E = Listed Endangered; T = Listed Threatened; SC = Species of Special Concern; SR = Significantly Rare; SGCN = Species of Greatest Conservation Need as listed in the Wildlife Action Plan

d/ Species not known to occur within the Project area.

e/ Per written comments issued by North Carolina Wildlife Resource Commission on Aug 10, 2018; and per phone conversation between Virginia Department of Game and Inland Fisheries and MVP Southgate on Sep 17, 2018.

Sources: Townsend, 2018; Roble, 2016; NCNHP, 2016; NCNHP, 2017; VDGIF, 2015; and NCWRC, 2015

Native American Correspondence

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

November 6, 2018

Edwina Butler-Wolfe, Governor
Absentee-Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper Drive
Shawnee, Oklahoma 74801

Subject: MVP Southgate Natural Gas Pipeline in Pittsylvania County, VA and Alamance County, NC

Dear Governor Butler-Wolfe:

Mountain Valley Pipeline, LLC, is in the process of developing the MVP Southgate project. As proposed, MVP Southgate extends 73 miles and will transport natural gas from Pittsylvania County, Virginia to new delivery points in Rockingham and Alamance Counties, North Carolina.

Today, MVP Southgate filed its application on the Federal Energy Regulatory Commission (FERC) Docket for the proposed project (MVP Southgate FERC Docket number is PF18-4-000). The filing will initiate the FERC regulatory review process.

Considering the regulatory responsibility of FERC, a federal agency, the proposed project will require review under both Section 106 of the National Historic Preservation Act (NHPA) and the National Environmental Policy Act (NEPA). FERC will produce an Environmental Impact Statement (EIS) as part of its review process and initiate Section 106 consultation.

MVP Southgate does not intend for any discussions between the Tribe and MVP Southgate to take the place of any official Section 106 consultation that has or will be conducted. Rather, our communication is consistent with our policy to reach out to Tribes with interest in the area of our projects and provide the latest information and gather feedback on the proposed project. If you have an interest in meeting with me and the project developer so that we can answer any questions, provide you additional information, and / or discuss any concerns you may have about the project location, please let me know.

For your convenience, please use the links below to view the historic and current information on the project.

FERC eLibrary: https://www.ferc.gov/docs-filing/elibrary.asp

MVP Southgate News & Info: http://www.mvpsouthgate.com/news-info/

Again, as it is MVP Southgate's policy to reach out to Tribes that have an interest in the area of the project, I wanted to provide you this information and offer an opportunity to meet over the next few months. If you would like additional information or to schedule a meeting at your offices to discuss the project, please let me know. I can be reached at (561) 691-2820 or via e-mail at Agnes.Ramsey@nee.com .

Regards,

Agnes S. Ramsey
Project Manager – Tribal Relations

Attachment B

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 3 –
Fish, Wildlife and Vegetation

Tables

January 2019

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
American woodcock	*Scolopax minor*	ACJV; VaFWIS (IIa)	Pittsylvania; Rockingham; Alamance	Low	Low	11	49	Yes	Conservation status and known documented records near Project warrant species inclusion.
bald eagle	*Haliaeetus leucocephalus*	IPaC; BGEPA; BCR 29; NCWAP	none	Low	Low	32	277	Yes	Species is included due to BGEPA. *No documented nests or concentration areas near Project (accessed online mapping tools on July 18, 2018).
brown-headed nuthatch	*Sitta pusilla*	BCR 29; ACJV	Rockingham; Alamance	Low	Low	214	733	Yes	Conservation status and known documented records near Project warrant species inclusion.
eastern whip-poor-will	*Antrostomus vociferus*	IPaC; BCR 29; ACJV	Pittsylvania	Low	Low	4	37	Yes	Conservation status and known documented records near Project warrant species inclusion.
grasshopper sparrow	*Ammodramm us savannarum*	ACJV; NCNHP	Pittsylvania; Rockingham; Alamance	Medium	Low	180	241	Yes	Conservation status in NC and known documented records near Project warrant species inclusion.
Kentucky warbler	*Geothlypis formosa*	IPaC; BCR 29; ACJV	none	Low	Low	3	9	Yes	Conservation status and known documented records near Project warrant species inclusion.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
least bittern	*Ixobrychus exilis*	NCWAP	-	None	Low	-	-	Yes	Species may nest in geographic range.
northern bobwhite	*Colinus virginiana*	ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	67	98	Yes	Conservation status and known documented records near Project warrant species inclusion.
prairie warbler	*Setophaga discolor*	IPaC; BCR 29; ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	30	113	Yes	Conservation status and known documented records near Project warrant species inclusion.
prothonotary warbler	*Protonotaria citrea*	IPaC; ACJV (Moderate)	Rockingham; Alamance	Low	Low	34	102	Yes	Conservation status and known documented records near Project warrant species inclusion.
red-headed woodpecker	*Melanerpes erythrocephalus*	IPaC; ACJV (Moderate)	Rockingham; Alamance	Low	Low	55	208	Yes	Conservation status and known documented records near Project warrant species inclusion.
willow flycatcher	*Empidonax trailii*	NCNHP	Rockingham	None	Unknown	5	8	Yes	Conservation status in NC and records near Project warrant inclusion.
wood thrush	*Hylocichla mustelina*	IPaC; BCR 29; ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	-	-	Yes	Conservation status and known documented records near Project warrant species inclusion.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
yellow-crowned night-heron	*Nyctanassa violacea*	VaFWIS	none	Low	Low	0	0	Yes	While VaFWIS identified species, the Wildlife and Environmental Review Map Service (WERMS) did not reveal any known records of the species. No documented occurrences near Project via eBird.Species may nest in region.
American black duck	*Anas rubripes*	ACJV; VaFWIS (IIa)	none	Low	Low	8	20	No	No records of nesting near Project.
Bachman's sparrow	*Peucaea aestivalis*	BCR 29; NCWAP	none	Low	Low	0	0	No	No records of species near Project.
Bewick's wren	*Thryomanes bewickii*	BCR 29	none	n/a	n/a	0	0	No	No records of species near Project.
black rail	*Laterallus jamaicensis*	BCR 29; ACJV; NCWAP	none	Low	None	0	0	No	No records of species near Project.
blue-winged warbler	*Vermivora cyanoptera*	IPaC; BCR 29	none	Low	Low	1	8	No	Species nests farther to west in mountainous region. No documented occurrences (eBird) during nesting season (May to August).

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
brown creeper	*Certhia americana*	NCWAP	-	Low	Low	-	-	No	Species nests in higher elevations
cerulean warbler	*Setophaga cerulea*	IPaC; BCR 29; VaFWIS (IIa); NCWAP	none	Low	Low	1	1	No	Species nests farther to west in mountainous region. Rare nesting to east in NC. No documented occurrences (eBird) during nesting season (May to August).
chimney swift	*Chaetura pelagica*	ACJV	Pittsylvania; Rockingham; Alamance	None	Low	628	1,027	No	Species nests primarily in chimneys. Project impacts are unlikely to affect species.
field sparrow	*Spizella pusilla*	ACJV	Pittsylvania; Rockingham; Alamance	Low	Low	330	600	No	While the species is considered a 'High' priority bird by the ACJV in BCR 29, its decline is likely associated with conversion of open/early successional habitat to other land cover types. Construction of the Project will result in an increase sin suitable land cover types for nesting.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
golden-winged warbler	*Vermivora chrysoptera*	NCWAP	-	Low	Low	-	-	No	Nests in higher elevation portions.
Henslow's sparrow	*Ammodramm us henslowii*	BCR 29; NCWAP	none	Low	Low	0	0	No	No known nesting records near Project. State databases did not reveal records of species near Project.
king rail	*Rallus elegens*	ACJV; VaFWIS	none	Low	Low	0	0	No	VaFWIS identified species; however, the Wildlife and Environmental Review Map Service (WERMS) did not identify known records of the species. No documented occurrences near Project via eBird.
little blue heron	*Egretta caerulea*	NCWAP	-	Low	Low	-	-	No	Concern associated with rookeries Species does not nest in region.
loggerhead shrike	*Lanius ludovicianus*	BCR 29; VaFWIS; NCNHP; NCWAP	Former breeder in Rockingham and Alamance	low	Low	1	2	No	No records during nesting season. Conservation status and positive results from reviews of state databases.
northern saw-whet	*Aegolius acadicus*	NCWAP	-	Unknown	Low	-	-	No	Species nests at higher elevations.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
peregrine falcon	*Falco peregrinus*	BCR 29; NCWAP	none	Low	Medium	5	6	No	No known nesting records near Project. State databases did not reveal records of species near Project.
red-cockaded woodpecker	*Picoides borealis*	ACJV; NCWAP	none	Low	Medium	0	0	No	Species does not occur in region.
ruffed grouse	*Bonasa umbellus*	ACJV	none	Low	Low	0	0	No	Species occurs farther to west in mountainous region. No documented occurrences (eBird).
rusty blackbird	*Euphagus carolinus*	IPaC; BCR 29	n/a	Low	Low	11	38	No	Species does not nest in region.
sedge wren	*Cistothorus platensis*	BCR 29	none	Low	None	0	0	No	No known records near Project.
short-eared owl	*Asio flammeus*	BCR 29	n/a	Low	Low	0	2	No	Species does not nest in region.
snowy egret	*Egretta thula*	NCWAP	-	Low	Low	-	-	No	Concern associated with rookeries However, species does not nest in region.
Swainson's warbler	*Limnothlypis swainsonii*	BCR 29	none	Low	Low	0	0	No	No known records near Project.
tricolored heron	*Egretta tricolor*	NCWAP	-	Low	Low	-	-	No	Concern associated with rookeries. Species does not nest in region.
upland sandpiper	*Bartramia longicauda*	ACJV	none	Low	Low	0	0	No	No known records near Project.

Table 3.3-3 [REVISED]

Project Migratory Bird Species of Concern

Common Name	*Scientific Name*	Source a/	Project County b/	Risk from transportation & travel corridors c/	Risk from human intrusions & disturbance d/	eBird Occurrence e/		MBSC f/	Rationale
						Within 5 mi	Within 10 mi		
vesper sparrow	*Pooecetes gramineus*	NCWAP	-	Low	Low	-	-	No	Species nests in higher elevation portions of NC

NOTES
a/ IPaC = Unofficial list from United States Fish and Wildlife Service's Information for Planning and Consultation (IPaC) system; note that no species is included as a Project-specific MBSC based solely on unofficial IPaC results; BCR 29 =Included as 2008 Bird of Conservation Concern for Bird Conservation Region 29 (Piedmont); ACJV = Considered a 'Highest' or 'High' priority species in Atlantic Coast Joint Venture's 2014 Piedmont BCR 29 Implementation Plan. Two species (i.e., prothonotary warbler and red-headed woodpecker) with 'Moderate' priority status were included; Sources: http://acjv.org/documents/piedmont-2014.pdf; VaFWIS = Virginia Fish and Wildlife Information Service. Includes Species of Greatest Conservation Need ranked as tier I or II with positive results for records; NCNHP = North Carolina Natural Heritage Program's database; BGEPA = Bald and Golden Eagle Protection Act; NCWAP = State endangered, state threatened, and state species of concern included in North Carolina Wildlife Action Plan (2015).
b/ VA Source: Includes species with breeding status of 'Confirmed' and 'Probable' in the First Virginia Breeding Bird Atlas Survey (1985-1989); Second Virginia Breeding Bird Atlas currently in progress. NC Source: Birds of North Carolina: their Distribution and Abundance, http://ncbirds.carolinabirdclub.org/index.html
c/ Refers to Threat Metric 9.04 which evaluates potential risk associated with development and presence of transportation and service corridors and associated impacts (e.g., habitat fragmentation; susceptibility to nest predation). Source: North Carolina Wildlife Action Plan 2015.
d/ Refers to Threat Metric 9.06 which evaluates potential risk associated with human intrusions and disturbance (e.g., construction; human presence).Source: North Carolina Wildlife Action Plan 2015.
e/ eBird's online mapping tool was accessed on July 31, 2018 to identify records of potential MBSC from January 1, 1998 to May 31, 2018. Results in a submitted list that include species of interest, and should not be interpreted as number of individuals observed.
f/ MBSC – Migratory Bird Species of Concern

Table 3.3-4 [REVISED]

Preferred Nesting Habitat and Primary Nesting Season of Project-specific Migratory Bird Species

Species		Preferred Nesting Habitat	Primary Nesting Season
Common	**Scientific**		
American woodcock	*Scolopax minor*	Habitat consists of young forests and abandoned farmland mixed with forested land. Generally considered an edge species.	Apr. 1 to Aug. 31
bald eagle	*Haliaeetus leucocephalus*	Nests in trees among forests adjacent to large water bodies	Jan. 1 to Aug. 31
brown-headed nuthatch	*Sitta pusilla*	Mature and open longleaf pine stands; at least locally common in open loblolly, shortleaf, and pond pine stands, less so in Virginia pine. In the Piedmont, birds favor thinned or more open pine stands, such as in residential areas, golf courses, margins of lakes and ponds, and edges.	Apr 15 to Aug. 15
eastern whip-poor-will	*Antrostomus vociferus*	Forests and woodlands; no nest built, eggs laid on flat ground.	May 1 to Aug. 15
grasshopper sparrow	*Ammodrammus savannarum*	Fallow fields, pastures, hayfields, grasslands, and other areas dominated by graminoid vegetation.	May 15 to Aug. 15
Kentucky warbler	*Geothlypis formosa*	Prefers deep shaded woods with dense, humid thickets, bottomlands near creeks and rivers, ravines in upland deciduous woods, and edges of swamps; nests on ground or within a few inches of it	May 1 to Aug. 15
least bittern	*Ixobrychus exilis*	Nests in freshwater and brackish marshes with dense stands of emergent vegetation; primarily nests in Coastal Plain, but also known from eastern counties in Piedmont	15 May - 15 August
northern bobwhite	*Colinus virginiana*	Fallow fields, pastures, hayfields, grasslands, and other areas dominated by graminoid vegetation	Apr 15 to Aug. 31
prairie warbler	*Setophaga discolor*	Shrubby pastures, low pines; nest usually in a tree (such as pine, cedar, sweet-gum, oak), 1-45' above the ground	May 1 to Jul 31
prothonotary warbler	*Protonotaria citrea*	Wooded swamps, wetlands, river bottom hardwoods; Nest site usually 5-10' up (sometimes 3-30' up), above standing water in hole in tree or stump.	May 15 to Jul 31
red-headed woodpecker	*Melanerpes erythrocephalus*	Groves, farm country, orchards, shade trees in towns, large scattered trees; nests in tree cavities	May 10 to Sep. 10

Table 3.3-4 [REVISED]

Preferred Nesting Habitat and Primary Nesting Season of Project-specific Migratory Bird Species

Species		Preferred Nesting Habitat	Primary Nesting Season
Common	**Scientific**		
wood thrush	*Hylocichla mustelina*	Mainly deciduous woodlands; nest placed in vertical fork of tree (usually deciduous) or saddled on horizontal branch, usually about 10-15' above the ground, sometimes lower, rarely as high as 50'.	May 1 to Aug.31
willow flycatcher	*Empidonax traillii*	Open country, mainly in wide valleys with streamside thickets and corridors of trees adjacent to fields; marshes with shrubs and small trees	June 1 to Aug. 15
yellow-crowned night-heron	*Nyctanassa violacea*	Nests in small colonies in swamps and forested uplands near bodies of water; species known to occur in near residential areas	April 1 to July 31

Table 3.5-1 [REVISED]

Federally- and State-Listed Fish, Plant, and Wildlife Species with the Potential to Occur Along the MVP Southgate Project Route

Common Name	Scientific Name	Status			Survey Locations and Status
		Federal a/	VA b/	NC c/	
Arthropods					
Carolina ladle crayfish	*Cambarus davidi*			SR	The Project continues to consult with NRWRC to determine the need for survey. No surveys are expected to be required in Virginia.
Greensboro burrowing crayfish	*Cambarus catagius*			SC, SGCN	
Amphibians					
Four-toed salamander	*Hemidactylium scutatum*			SC, SGCN	The Project is evaluating potential suitable habitat and continues to coordinate with NCWRC. No surveys are expected to be required in Virginia.
Mole salamander	*Ambystoma talpoideum*		W(II)	SC, SGCN	
Fish					
Cape Fear shiner	*Notropis mekistocholas*	E d/		E, SGCN d/	Targeted surveys are not required e/
Riverweed darter	*Etheostoma podostemone*			SC	
Roanoke logperch	*Percina rex*	E	E	E, SGCN	
Mammals					
Eastern big-eared bat	*Corynorhinus rafinesquii macrotis*	SC d/	E d/	SC, SGCN d/	See Appendix 3-A of this Resource Report for the approved Bat Survey Study Plan and comprehensive Bat Survey Report.
Eastern red bat	*Lasiurus borealis*		W(IV)		
Eastern small-footed bat	*Myotis leibii*	SC d/	W(I) d/	SC, SGCN d/	
Northern yellow bat	*Lasiurus intermedius*			SC, SGCN d/	
Gray bat	*Myotis grisescens*	E d/	E d/	E, SGCN d/	
Hoary bat	*Lasiurus cinereus*		W(IV)		
Indiana bat	*Myotis sodalis*	E d/	E d/	E, SGCN d/	
Little brown bat	*Myotis lucifugus*		E d/	SR, SGCN	
Northern long-eared bat	*Myotis septentrionalis*	T	T	T, SGCN	
Rafinesque's big-eared bat	*Corynorhinus rafinesquii rafinesqui*	SC d/	E d/	T, SGCN d/	
Silver-haired bat	*Lasionycteris noctivagans*		W(IV)		
Southeastern bat	*Myotis austroriparius*	SC d/	W(I) d/	SC, SGCN d/	
Tri-colored bat	*Perimyotis subflavus*		E	SR, SGCN	

Table 3.5-1 [REVISED]

Federally- and State-Listed Fish, Plant, and Wildlife Species with the Potential to Occur Along the MVP Southgate Project Route

Common Name	Scientific Name	Status			Survey Locations and Status
		Federal a/	VA b/	NC c/	
Virginia big-eared bat	*Corynorhinus townsendii virginianus*	E[d/]	E[d/]	E, SGCN[d/]	
Mussels					
Atlantic pigtoe	*Fusconaia masoni*	PT	T	E, SGCN[d/]	Surveys are planned for April-May 2019.
Eastern creekshell	*Villosa delumbis*			SR, SGCN	
Eastern lampmussel	*Lampsilis radiata*			T, SGCN	
Green floater	*Lasmigona subviridis*	SC	T	E, SGCN	
James spinymussel	*Parvaspina collina*	E	E[d/]	E, SGCN	
Savannah lilliput	*Toxolasma pullus*			E, SGCN[d/]	
Yellow lampmussel	*Lampsilis cariosa*	SC	W(II)	E, SGCN	
Yellow lance	*Elliptio lanceolata*	T[d/]		E, SGCN[d/]	
Plants					
American bluehearts	*Buchnera americana*		R		Assumed present, no survey planned.
Cliff stonecrop	*Sedum glaucophyllum*			SR	No survey requested or planned.
Downy phlox	*Phlox pilosa*		R		Assumed present, no survey planned
Piedmont Barbara's-button	*Marshallia obovate var. obovate*		R		Assumed present, no survey planned.
Small whorled pogonia	*Isotria medeoloides*	T	E[d/]	T	No individuals observed during 2018 surveys; see Appendix 3A for survey results. Summer 2019 survey planned. No surveys are required in Virginia.
Smooth coneflower	*Echinacea laevigata*	E	T[d/]	E	No individuals observed during 2018 surveys; see Appendix 3A for survey results. Summer 2019 survey planned. No surveys are required in Virginia.

a/ Federal Status. E = Listed Endangered; T = Listed Threatened; PT = Proposed Threatened; SC = Species of Concern, a list maintained by USFWS Raleigh Field Office

b/ Virginia Status. E = Listed Endangered; T = Listed Threatened; R = Rare, including both Critically Imperiled and Imperiled state ranking; W (I) = Wildlife Action Plan, Tier I; W (II) = Wildlife Action Plan, Tier I; W (III) = Wildlife Action Plan, Tier III; W (IV) = Wildlife Action Plan, Tier IV

c/ North Carolina Status. E = Listed Endangered; T = Listed Threatened; SC = Species of Special Concern; SR = Significantly Rare; SGCN = Species of Greatest Conservation Need as listed in the Wildlife Action Plan

d/ Species not known to occur within the Project area.

e/ Per written comments issued by North Carolina Wildlife Resource Commission on Aug 10, 2018; and per phone conversation between Virginia Department of Game and Inland Fisheries and MVP Southgate on Sep 17, 2018.

Sources: Townsend, 2018; Roble, 2016; NCNHP, 2016; NCNHP, 2017; VDGIF, 2015; and NCWRC, 2015

Attachment C

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 3 –
Fish, Wildlife, and Vegetation

Appendix 3-A

Agency-Approved Survey Plans and Survey Reports
[Privileged Information-
Provided Under Separate Cover]

January 2019

Attachment D

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 3 –
Fish, Wildlife and Vegetation

Appendix 3-B

Exotic and Invasive Plant Species Control Plan

January 2019

MVP Southgate Project

Exotic and Invasive Plant Species Control Plan

January 2019

Mountain Valley Pipeline, LLC ("Mountain Valley") developed an upland exotic and invasive plant species control plan for the MVP Southgate ("Project"). Invasive species are defined in Federal Executive Order ("EO") 13112(1999), as "an alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health". The intent of EO 13112 is to "prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause", and directs federal agencies to prevent, detect, respond to, monitor, and research invasive species. The purpose of this plan is to identify potential undesirable vegetation associated with the Project and outline methods to prevent recruitment and spread of exotic and invasive species.

Searches for terrestrial invasive plants along the right-of-way were directed to species with a high likelihood of occurring in the geographical region. Species search lists were populated with information available through the Virginia Department of Conservation and Recreation and the North Carolina Native Plant Society (Table 1). Species identified in Table 1 are considered moderately or highly invasive.

Table 1

Non-native Invasive Plant Species With Potential to Occur Along the Project Route.

Scientific Name	Common Name	Growth Form
Virginia Species - High Rank Category[a]		
Ailanthus altissima	Tree of Heaven[b]	Tree
Alliaria petiolata	Garlic mustard[b]	Herb
Ampelopsis brevipedunculata	Porcelain berry[b]	Shrub
Celastrus orbiculatu	Oriental bittersweet[b]	Vine
Centaurea stoebe ssp. *Micranthos*	Spotted knapweed[b]	Herb
Cirsium arvense	Canada thistle	Herb
Dioscorea polystachya	Cinnamon vine	Vine
Elaeagnus umbellata	Autumn olive[b]	Tree
Euonymus alatus	Winged euonymus	Shrub
Ficaria verna	Lesser celandine	Herb
Hydrilla verticillata	Hydrilla	Herb, aquatic
Iris pseudacorus	Yellow flag	Herb
Lespedeza cuneata	Chinese lespedeza[b]	Herb
Ligustrum sinense	Chinese privet[b]	Shrub
Lonicera japonica	Japanese honeysuckle[b]	Vine
Lonicera maackii	Amur honeysuckle[b]	Shrub
Lonicera morrowii	Morrow's honeysuckle	Shrub
Lythrum salicaria	Purple loosestrife	Herb
Microstegium vimineum	Japanese stiltgrass[b]	Grass
Murdannia keisak	Marsh dewflower[b]	Herb
Myriophyllum aquaticum	Parrot feather	Herb, aquatic
Myriophyllum spicatum	Eurasian milfoil	Herb, aquatic
Persicaria perfoliate	Mile a minute[b]	Vine
Phragmites australis ssp. australis	Common reed	Herb, aquatic
Pueraria montana var. lobata	Kudzu[b]	Vine
Reynoutria japonica	Japanese knotweed	Herb
Rosa multiflora	Multiflora rose[b]	Vine/shrub
Rubus phoenicolasius	Rubus	Vine/shrub
Sorghum halepense	Johnson grass[b]	Grass
Urtica dioica	Stinging European nettle	Herb

Table 1

Non-native Invasive Plant Species With Potential to Occur Along the Project Route.

Scientific Name	Common Name	Growth Form
Virginia Species - Medium Rank Category[a]		
Acer platanoides	Norway maple	Tree
Agrostis capillaris	Colonial bent grass	Grass
Akebia quinata	Five leaf Akebia	Vine
Albizia julibrissin	Mimosa[b]	Tree
Arthraxon hispidus var. *hispidus*	Joint head grass[b]	Grass
Berberis thunbergii	Japanese barberry	Shrub
Cirsium vulgare	Bull thistle[b]	Herb
Dipsacus fullonum	Wild teasel	Herb
Egeria densa	Brazilian waterweed	Herb, aquatic
Euonymus fortunei	Winter creeper	Vine
Glechoma hederacea	Gill-over-the-ground	Vine
Hedera helix	English ivy[b]	Vine
Holcus lanatus	Common velvet grass	Grass
Ligustrum obtusifolium var. *obtusifolium*	Border privet[b]	Shrub
Lonicera tatarica	Tartarian honeysuckle	Shrub
Lysimachia nummularia	Moneywort[b]	Herb
Miscanthus sinensis	Chinese silvergrass	Grass
Najas minor	Brittle naiad	Herb
Paulownia tomentosa	Royal paulowina[b]	Tree
Persicaria longiseta	Long-bristled smartweed[b]	Herb
Phyllostachys aurea	Golden bamboo	Grass
Poa compressa	Flat-stemmed bluegrass	Grass
Poa trivialis	Rough bluegrass	Grass
Pyrus calleryana	Callery pear[b]	Tree
Rhodotypos scandens	Jetbead	Shrub
Rumex acetosella	Sheep sorrel[b]	Herb
Spiraea japonica	Japanese spiraea	Herb
Stellaria media	Common chickweed	Herb
Veronica hederifolia	Ivy-leaved speedwell	Herb
Viburnum dilatatum	Linden arrow wood[b]	Shrub
Wisteria sinensis	Chinese wisteria[b]	Vine
North Carolina - Severe Threat Ranking[a]		
Ailanthus altissima	Tree of Heaven[b]	Tree
Albizia julibrissin	Mimosa[b]	Tree
Alliaria petiolata	Garlic mustard[b]	Herb
Celastrus orbiculatus	Asian bittersweet[b]	Vine
Elaeagnus umbellata	Autumn olive[b]	Tree
Hedera helix	English ivy[b]	Vine
Hydrilla verticillata	Hydrilla	Herb, aquatic
Lespedeza bicolor	Bicolor lespedeza	Shrub
Lespedeza cuneata	Sericea lespedeza[b]	Herb
Ligustrum sinense	Chinese privet[b]	Shrub
Lonicera fragrantissima	Fragrant honeysuckle[b]	Vine
Lonicera japonica	Japanese honeysuckle[b]	Vine
Microstegium vimineum	Japanese stilt grass[b]	Grass
Murdannia keisak	Asian spiderwort[b]	Herb

Table 1

Non-native Invasive Plant Species With Potential to Occur Along the Project Route.

Scientific Name	Common Name	Growth Form
Myriophyllum aquaticum	Parrotfeather	Herb, aquatic
Paulownia tomentosa	Princess tree[b]	Tree
Persicaria perfoliata (Polygonum perfoliatum L.)	Mile-a-minute vine	Vine
Phragmites australis (Cav.) Trin. ssp. *australis*	Common reed	Grass, aquatic
Pyrus calleryana	Bradford pear[b]	Tree
Reynoutria japonica (Polygonum cuspidatum)	Japanese knotweed	Herb
Pueraria montana	Kudzu[b]	Vine
Rosa multiflora	Multiflora rose[b]	Vine/shrub
Wisteria sinensis	Chinese wisteria[b]	Vine

[a] In Virginia, Invasiveness ranks reflect the level of threat to forests and other natural communities and native species. Ranks used on the list are high, medium, and low. High Species pose a significant threat, Medium Species pose a moderate threat. In North Carolina, Rank 1 – Severe Threat plants are exotic plant species that have invasive characteristics and spread readily into native plant communities, displacing native vegetation.

[b] Species observed during survey.

Sources: The Project used the Virginia Invasive Plant Species List and the North Carolina Invasive Plant Council List (Virginia Invasive Species Working Group, 2012; VDCR-DNH, 2018; and North Carolina Invasive Plant Council, 2016).

Crews recorded observations of exotic and invasive species concurrent with other field surveys. To ensure adequate survey coverage, the Project right-of-way was divided into 1,000-foot long blocks and where survey permission was granted, at least one observation of exotic and invasive species was made within each block and along each access road.

Limited weed-free areas were identified in the Project. Two or more adjacent blocks that lacked exotic and invasive species were considered weed-free; single isolated weed-free blocks surrounded by blocks with exotic and invasive species were not considered weed-free. Table 2 lists weed-free areas.

Exotic and invasive species were observed throughout the Project in both states. In Virginia, observations were completed in 133 blocks and partially completed in 27 blocks out of a total 193 blocks. At least one exotic or invasive species was present in 99% of surveyed and partially surveyed blocks (n=158). From blocks with exotic and invasive species, the most commonly observed species included: Japanese honeysuckle (87%); Chinese lespedeza (84%), Japanese stilt-grass (67%); Chinese privet (41%); tree of heaven (35%); multiflora rose (30%); spotted knapweed (27%); and Johnson grass (25%).

In North Carolina, observations were completed in 214 blocks and partially completed in 52 blocks out of a total 338 blocks. At least one exotic or invasive species was present in 80% of surveyed and partially surveyed blocks (n=266). From blocks with exotic and invasive species, the most commonly observed species includes: Japanese honeysuckle (54%); Japanese stilt-grass (54%); multiflora rose (34%); Chinese privet (25%), and tree of heaven (20%).

Table 1

Areas Lacking Invasive Species

County/State	Station Start	Station End
Rockingham, NC	31.2[a]	31.40 [a]
Rockingham, NC	37.30	37.48 [a]
Rockingham, NC	43.70[a]	43.90 [a]
Rockingham, NC	47.48 [a]	47.67
Alamance, NC	64.00 [a]	67.50[b]

[a] Weed-free block is adjacent unsurveyed block; status as weed-free could be revised pending survey of adjacent blocks.

[b] Area associated with re-route, surveys pending

Prior to construction, unsurveyed and partially surveyed blocks will be assessed for presence of exotic and invasive species, and Table 2 will be updated to reflect applicable changes.

Potential Invasive Plant Species Introduction Associated with Pipeline Construction

Excavation for pipeline placement exposes the topsoil surface to potential entrance of exotic, noxious, and/or invasive plant species. This can occur either by physical transport onto the exposed soil site by way of equipment, machinery, or vehicles, through windborne dissemination of seeds of exotic or invasive species from the surrounding area, or by introduction of seeds or plant parts contained in mulch or straw bales.

To avoid and minimize potential for introduction of these seeds to the Project corridor, the Project will apply three management strategies to control exotic, noxious, and invasive plant species, including: avoidance of exotic and invasive species found in organic materials brought onsite; monitoring and selective treatment of exotic or invasive species encountered during or following construction; and using seed mixes that include native species whenever possible.

1. Introduction of invasive species from organic materials brought onsite will be avoided during construction, temporary stabilization, and final reclamation through use of weed-free mulch, including straw, hay, wood fiber hydromulch, erosion control fabric, or a functional equivalent.

2. The Project will monitor the ROW during and post-construction to allow for early detection of exotic or invasive species infestations or outbreaks. If species or colonies of exotic or invasive species are found in numbers substantially greater than those existing nearby in off-ROW locations, the Project will conduct selective spot eradications of those species. Eradication measures could include hand cutting unless requested by a state or federal management agency to use herbicides to achieve effective removal of these species. Herbicide types will be determined based on the species requiring control, and all herbicides will be applied by applicators appropriately licensed or certified by the state where the work is conducted.

3. Seed mixes used during restoration will include native species within the seed mix. The Project will implement the restoration measures contained in the FERC *Upland Erosion Control, Revegetation and Maintenance Plan* ("FERC Plan") and *Wetland and Waterbody Construction and Mitigation Procedures* ("FERC Procedures"). In accordance with the FERC Plan, the Project will monitor all areas disturbed by Project construction to determine the post-construction revegetative

success for a minimum of two growing seasons following construction, or until revegetation is successful.

In addition to the three strategies described above, the following control measures will be used to further minimize introduction and/or spread of these species:

- Adhere to erosion control measures in the FERC Plan and Procedures to ensure that sediment movement and associated movement of non-native seeds into newly disturbed soils is minimized.
- Prior to mobilization into the Project area, contractors thoroughly clean all construction equipment to limit potential for spread of noxious weeds, insects, or other soil-borne pests.
- During construction, the environmental inspector (EI) will ensure all contractors clean the tracks, tires, and blades of equipment by hand or compressed air to remove any excess soil prior to movement of equipment out of known weed or soil-borne pest infested areas.
- Use construction techniques along the pipeline route that minimize the duration of bare soil exposure thus, minimizing the opportunity for exotic species to become established.
- In areas along the pipeline identified as containing exotic and invasive species, the topsoil from the full width of the construction ROW is stripped and stored separately from other, less contaminated topsoil and subsoil. Where topsoil segregation is required, identify the topsoil layer as outlined in the FERC Plan. EIs will identify and mark these areas prior to grading activities.
- Reseed all disturbed areas promptly after final grading, weather and soil conditions permitting, and in consideration of written recommendations from the local soil conservation authorities. Prompt reseeding ensures bare soil is not available for recruitment of exotic or invasive species. Seeding is not required in active agriculture lands unless requested by the landowner.
- As described in the FERC Plan, apply mulch (consisting of weed-free straw or hay or other erosion-control materials) if final grading and installation of permanent erosion control measures are not completed within 20 days after the trench is backfilled or seeding cannot be completed properly due to scheduling outside of recommended seeding dates.
- Do not move mowing and maintenance equipment from an area where invasive species have been encountered during operation of the Project unless the equipment is cleaned prior to moving.

At Project mobilization, contractors shall thoroughly clean all construction equipment prior to initial arrival at contractor yards and staging areas. This includes all equipment traveling along ROWs. Equipment includes all earth-moving vehicles, mechanized felling equipment, spreaders, track hoes, timber mats, straps, and any other heavy equipment capable of carrying mud and debris. Cleaning of tracks, heavy equipment tires, and blades is recommended. Cleaning shall remove excess soil and material. Upon arrival of equipment onsite, inspections are completed by the Contractor and an EI to verify equipment is free of soil and debris when it arrives onsite.

In addition to thorough cleaning prior to entering each spread, terrestrial equipment must be cleaned through the use of hand tools and/or pressurized air prior to entering areas lacking invasive species populations (Table 2). Information in Table 2 may be revised to include additional areas.

The EI will maintain a log documenting inspections of all equipment. Visual markers with date and time noted will be used to identify cleaned and inspected equipment. General requirements for equipment

cleaning while on Project are summarized in Table 3.

Table 2

Requirements of Equipment Cleaning

Item	Terrestrial Equipment Cleaning
Approved Equipment	Hand tools, high pressure air.
Inspection	Completed by Contractor and EI
Frequency	Prior to entering a new Spread; and prior to entering areas lacking invasive species, identified in Table 2.

References

North Carolina Invasive Plant Council. 2016. Available online at: www.nc-ipc.weebly.com Accessed on July 16, 2018.

USDA (United States Department of Agriculture). 2015. Natural Resources Conservation Service. Invasive and Noxious Weeds. http://plants.usda.gov/java/noxiousDriver. Accessed October 6, 2015. VDCR-DNH (Virginia Department of Conservation and Recreation, Division of Natural Heritage). 2018.

Virginia Invasive Plant Species List. Available online at: http://www.dcr.virginia.gov/natural_heritage/invsppdflist.shtml. Accessed September 25, 2018.

Virginia Invasive Species Working Group. 2012. Natural Heritage Technical Document 12-13. Richmond, VA. 55 pages.

Attachment E

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 5 – Socioeconomics

Appendix 5-A

Economic Benefits of the MVP Southgate Project in Virginia and North Carolina

January 2019

JANUARY 2019

FTI CONSULTING

ECONOMIC BENEFITS OF THE MVP SOUTHGATE PROJECT IN VIRGINIA AND NORTH CAROLINA

EXPERTS WITH IMPACT™

DISCLAIMER

The analysis and findings expressed herein are those of the author(s) and not necessarily the views of FTI Consulting, Inc., its management, its subsidiaries, its affiliates, or its other professionals.

Principal Authors:

Ken Ditzel

Scott Nystrom

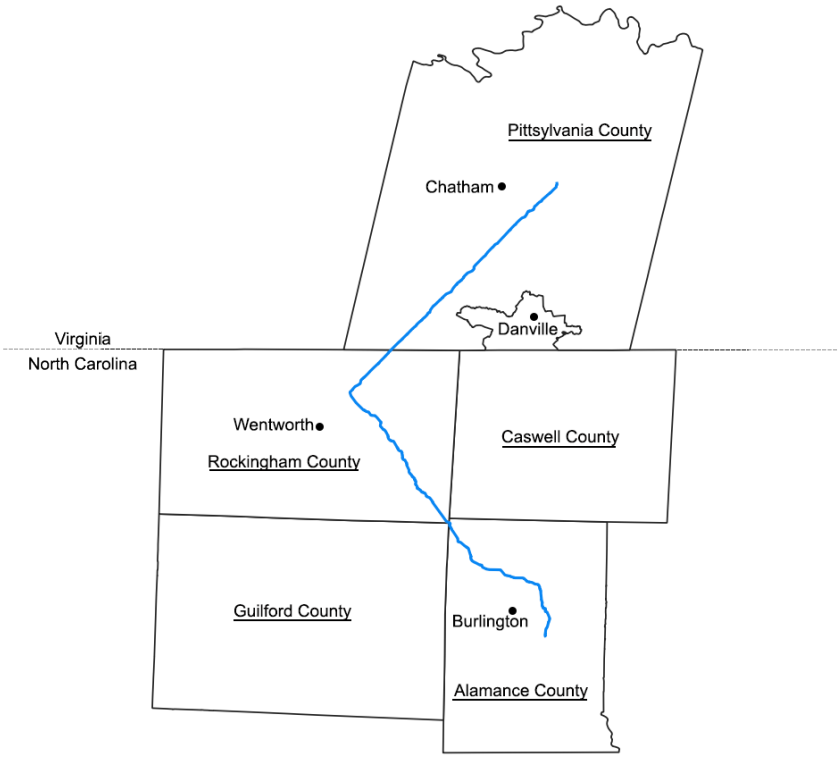
Katie O'Hare

Table of Contents

Executive Summary

Mountain Valley Pipeline, LLC ("Mountain Valley") retained FTI Consulting ("FTI") to examine the potential economic benefits of the MVP Southgate project to the states of Virginia and North Carolina through which the project would traverse. The MVP Southgate project is a natural gas pipeline system that would span approximately 73 miles from southern Virginia into central North Carolina through the counties of Pittsylvania, Rockingham, and Alamance, as shown below in Figure 1.

Figure 1 - Proposed MVP Southgate Pipeline Route



Specifically, the MVP Southgate pipeline would interconnect with the Mountain Valley Pipeline in Pittsylvania County, Virginia, pass through the county and by the City of Danville to Rockingham County, North Carolina, where it would interconnect with the PSNC Energy and East Tennessee pipelines, and terminate in Alamance County, North Carolina at an additional interconnect with PSNC Energy. The project would also include a new compressor station in Pittsylvania County, Virginia.

Three types of economic benefits would occur from the construction and operation of the MVP Southgate project. These benefits include:

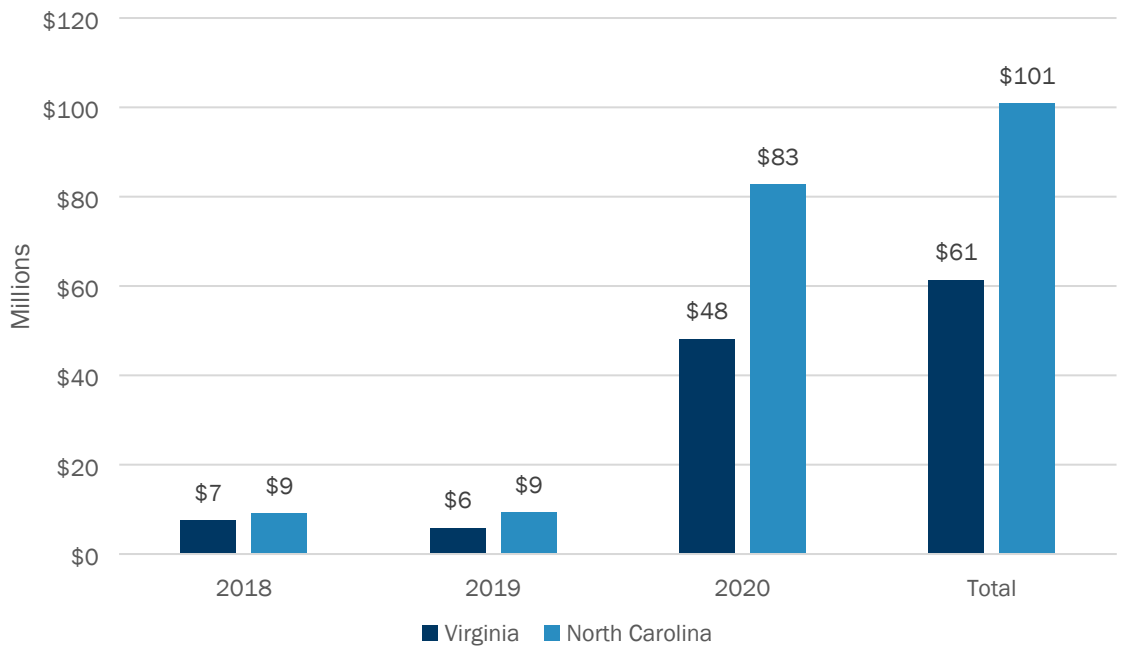
- **Construction Spending Benefits:** Expenditures on goods and services in each state would translate into job creation along with economic benefits to Virginia and North Carolina suppliers, their employees, and the overall economy.

- **Operational Benefits:** Once in service, the project would generate annual property tax revenues for the counties, providing an additional stream of funds.
- **Direct-Use Benefits:** Each state would benefit from the potential direct use of gas from the MVP Southgate project. The project would enhance gas service already available, help enable new gas service, and expand opportunities for commercial and manufacturing activities.

Construction Spending Benefits

From 2018 to 2020, the MVP Southgate project owners plan to spend a total of almost $468 million[1] on construction of the pipeline, spending $68 million and $113 million of this total directly on resources (equipment, materials, labor, and services) in Virginia and North Carolina, respectively. This direct spending would translate into approximately $60 million and $97 million in cumulative gross regional product ("GRP") over the three-year period in Virginia and North Carolina, respectively, as shown in Figure 2 below.

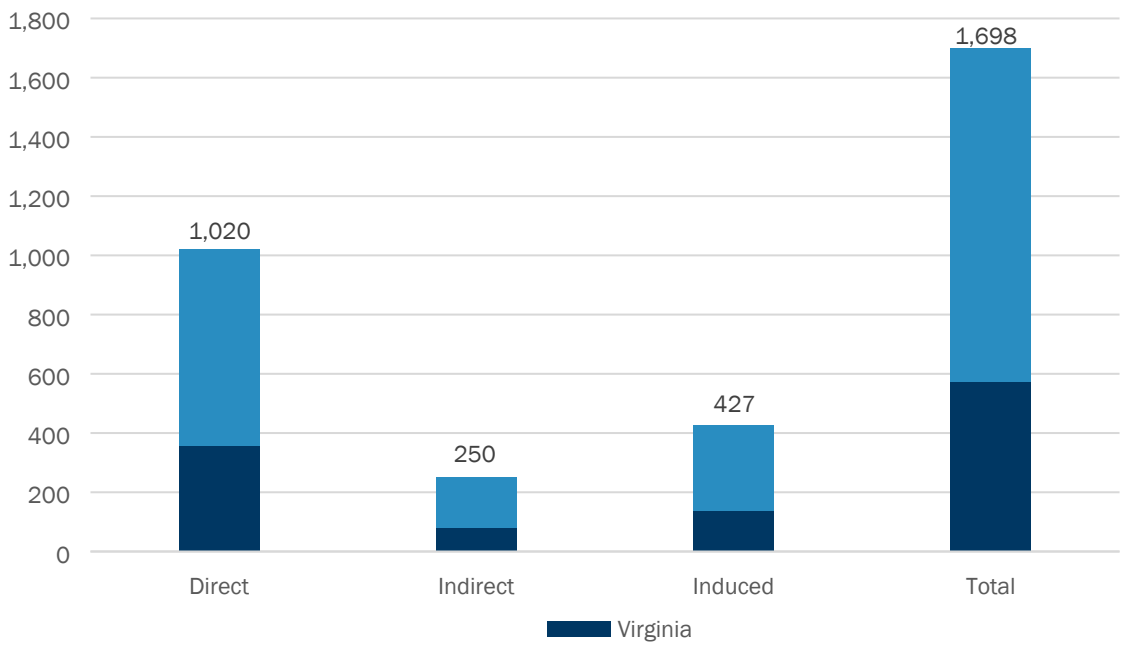
Figure 2 - Value Added (GRP) by State from Construction Spending, 2018-2020 (Millions)



The MVP Southgate project would create approximately 1,700 jobs at the peak of construction in 2020. Approximately 1,020 of these jobs would be directly associated with the project (labeled "direct" in Figure 3); 250 jobs would be created along the supply-chain ("indirect"); and 430 jobs would be created in the general economy ("induced").

[1] This figure includes approximately $4.6 million in ad valorem tax revenue during the first year of operations.

Figure 3 - Employment from Construction in 2020 by Category



Cumulatively, the MVP Southgate project would create approximately 2,020 job-years over the course of construction.[2]

Another benefit of the MVP project is the increased state and local tax revenues that result from the economic ripple effect of construction expenditures. As shown in Figure 4, the project would generate approximately $4.1 million in aggregate tax revenues from 2018 to 2020 during construction in Virginia. In addition, as shown in Figure 5, the project would generate approximately $6.3 million in aggregate tax revenues over this same three-year period during construction in North Carolina.

[2] The MVP Southgate employment contributions are directly tied to the capital spending in each year and are best expressed in 'job-years.' A job-year is the equivalent of one full-time job lasting a single year.

Figure 4 - Virginia State and Local Tax Revenues Generated during Construction, 2018-2020

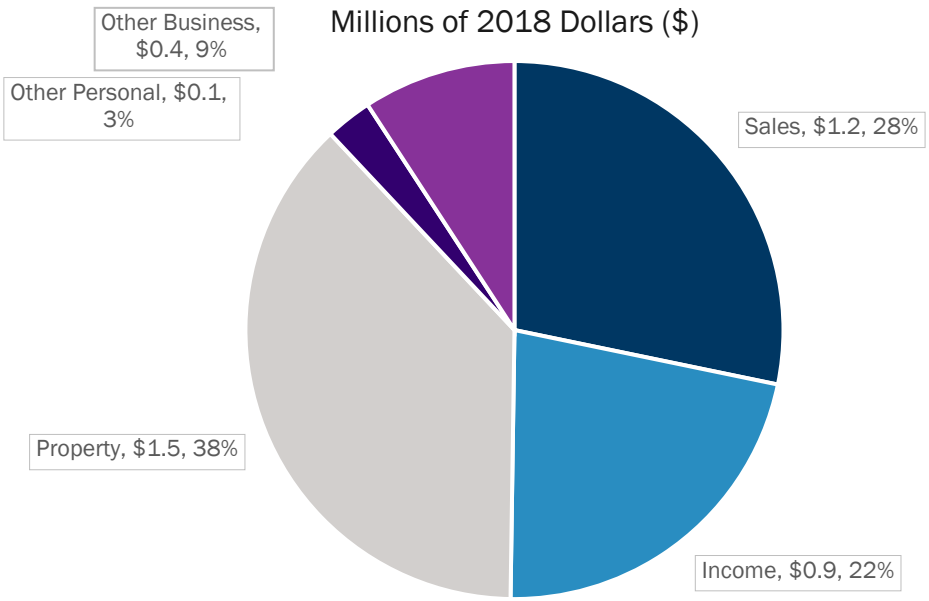
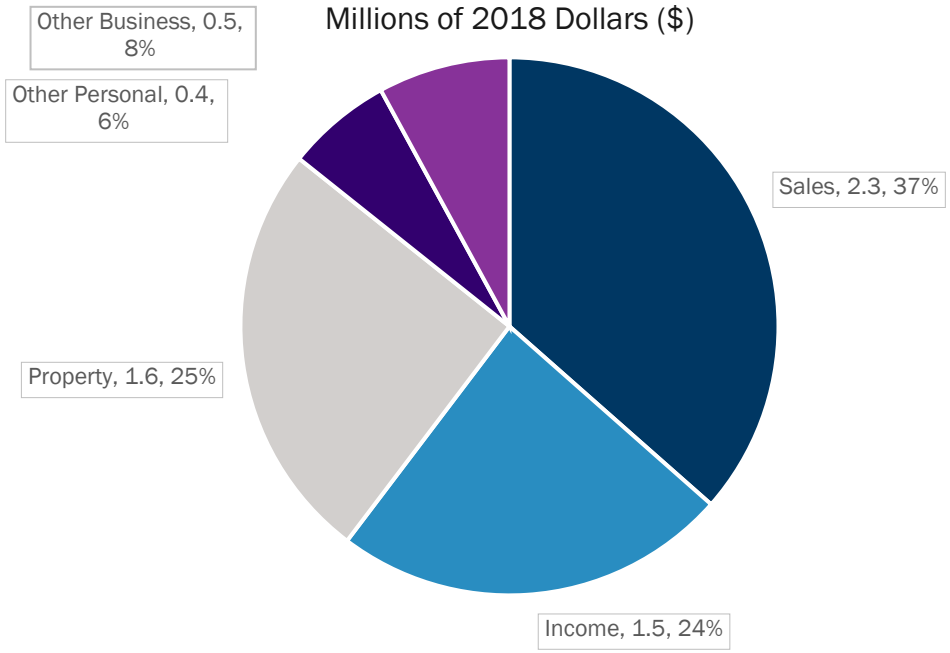


Figure 5 - North Carolina State and Local Tax Revenues Generated during Construction, 2018-2020



Operational Benefits

Once in service, the MVP Southgate project would continue to benefit Virginia and North Carolina's economies along three main areas. The first is in operational employment and spending. Ongoing operation and maintenance of the MVP Southgate pipeline would support 12 jobs across both state economies, with four of these jobs directly supporting the pipeline's operations (two in North Carolina

and two in Virginia) and eight additional jobs across both states' economies (four in North Carlina and four in Virginia). These jobs would provide average annual wages and benefits of approximately $79,000 and $71,000 in Virginia and North Carolina, respectively. Notably, the Mountain Valley Pipeline and MVP Southgate pipelines together would support 40 jobs in Virginia.

The second area of economic impact during operations is tax revenue. Based on estimated pipeline investments and county property tax rates, the MVP Southgate project owners estimate that they would pay approximately $1.2 and $3.4 million in ad valorem taxes annually in counties in Virginia and North Carolina, respectively. Of the total for North Carolina, Alamance County would receive $681,000 million in ad valorem tax revenues, Rockingham County would receive over $1 million, and municipalities in the state of North Carolina would receive the remaining $1.7 million. In addition, the MVP Southgate project would generate approximately $269,000 and $226,000 annually in other federal, state, and local taxes, in Virginia and North Carolina, respectively, during operations.

Finally, in addition to employment, labor income, and tax revenue benefits, the MVP Southgate project would generate almost $1.6 million annually in GRP, with approximately $732,000 and $684,000 in Virginia and North Carolina, respectively.

Direct-use benefits of the pipeline's natural gas represent the third area where each state potentially could benefit from the project and are discussed in further detail below.

Direct-Use Benefits

In terms of direct gas-use benefits, the MVP Southgate project could provide substantial savings from fuel switching (i.e., switching from propane, fuel oil, diesel, or electricity to natural gas) across Pittsylvania, Danville, Alamance, and Rockingham. For this analysis, we consider the impact of converting county vehicles, such as school buses and solid waste trucks, to natural gas, as well as converting residential households using electricity as their primary heating fuel to natural gas. Table 1 below summarizes our results, which show that fuel savings for switching to natural gas would total approximately $1.8 million for municipal vehicles and $8.4 million for household electricity consumption.

Table 1 - Direct-Use Benefits from Fuel Switching

County/City	Annual Savings from Fleet Vehicle Fuel Switching	Annual Savings from Home Fuel Switching	Total Savings
Pittsylvania	$289,000	$172,000	$461,000
Danville	$222,000	$2,236,000	$2,458,000
Alamance	$802,000	$2,185,000	$2,987,000
Rockingham	$478,000	$3,833,000	$4,311,000
Total	**$1,791,000**	**$8,426,000**	**$10,217,000**

FTI's interviews with county leaders indicated that natural gas access can play a major role in business decisions to expand operations, particularly energy-intensive and advanced technology manufacturing. These manufacturers can provide significant economic benefits to communities from an employment, wage, and tax revenue perspective. For example, the average annual manufacturing wage in the City of Danville, where manufacturing employs 16 percent of workers, is approximately $56,680, or 56 percent higher than the average annual wage of $36,300 for all jobs in the city in 2017.

Altogether, the proposed MVP Southgate project would provide a number of economic and employment benefits to Virginia and North Carolina along the proposed route. During construction, these benefits would result from capital spent directly within Virginia and North Carolina, and the jobs created. Once in service, MVP Southgate would employ people within the state to help operate and maintain the pipeline. Also, counties would collect property taxes from the project. Finally, MVP Southgate would provide sizable opportunities for direct gas use, including additional supply reliability, fuel-switching savings, and new energy-intensive and advanced technology businesses started in both states.

1. Introduction

1.1. Project Background

The MVP Southgate project is a 24-inch and 16-inch diameter underground natural gas pipeline that would span approximately 73 miles from Pittsylvania County, Virginia, to Alamance County, North Carolina.[3] The pipeline would be regulated by the Federal Energy Regulatory Commission ("FERC").

The line would interconnect with the Mountain Valley Pipeline in Pittsylvania County, and traverse past the City of Danville into North Carolina. It would then continue through Rockingham County, North Carolina, interconnecting with PSNC Energy and East Tennessee pipelines, and terminate at an interconnect with PSNC Energy in Alamance County, North Carolina. The MVP Southgate project would also include a new compressor station in Pittsylvania County. The project's developers expect the Mountain Valley Pipeline to provide at least two billion cubic feet per day, or approximately three percent of current U.S. gas demand to markets in the Mid and South Atlantic regions.[4] In addition, PSNC Energy has already committed to 300 million cubic feet per day of firm transportation service on the MVP Southgate pipeline.[5]

Mountain Valley has retained FTI to examine the MVP Southgate project's potential economic benefits along three areas: (1) economic growth and employment resulting from construction expenditures, (2) operational benefits in terms of jobs created and ad valorem taxes paid by the MVP Southgate project owners, and (3) direct gas-use opportunities that would result within each state.

1.2. Approach

1.2.1. Construction Economic Impacts and Job Creation Benefits

FTI applied the IMPLAN model to estimate the economic impact and jobs created from construction activities in Virginia and North Carolina. The IMPLAN model is a general input-output modeling software and data system that tracks the movement of money through an economy, looking at linkages between industries along the supply chain, to measure the cumulative effect of spending in terms of job creation, income, production, and taxes. The IMPLAN data sets represent all industries within the regional economy – rather than extrapolating from national averages – and are derived primarily from data collected by federal agencies.[6]

---

[3] The MVP Southgate project would be constructed and owned by Mountain Valley Pipeline, LLC, a joint venture in which the primary partners are EQM Midstream Partners and NextEra US Gas Assets, LLC.
[4] https://www.mountainvalleypipeline.info/overview
[5] Draft Resource Report No. 1, Summary of Alternatives, and MOU of Mountain Valley Pipeline, LLC, Docket No. PF18-4-000, June 18, 2018.
[6] The 2012 IMPLAN Dataset includes data from the U.S. Bureau of Labor Statistics ("BLS") Covered Employment and Wages program; U.S. Bureau of Economic Analysis ("BEA") Regional Economic Information System program; U.S. BEA Benchmark I/O Accounts of the U.S.; BEA Output estimates; BLS Consumer Expenditure Survey; U.S. Census Bureau

The economic impacts that IMPLAN calculates can be broken into direct impacts, indirect impacts, and induced impacts, defined as follows:

- **Direct impacts:** the economic activity resulting from the MVP Southgate project's capital costs spent on industries residing in Virginia and North Carolina. These are the industries that provide the "direct" materials, construction labor, construction management, and technical services (e.g., engineering and design, surveying, and permitting) for the project. This is the first order impact of the MVP Southgate project expenditures within the two states.
- **Indirect impacts:** the economic activity resulting from the "direct" industries spending a portion of their revenues on goods and services provided by their supply chain in Virginia and North Carolina. These supply chain industries represent the second order or 'indirect' impacts of the original MVP Southgate project expenditures in Virginia and North Carolina.
- **Induced impacts:** the economic activity resulting from the spending of the income earned by employees within the "directly" and "indirectly" affected industries. The benefactors of induced impact are primarily consumer-related businesses such as retail stores, restaurants, and personal service industries. These 'induced' impacts represent the third order impact.

Through the direct, indirect, and induced impact calculations, IMPLAN provides the economic ripple effect, or multiplier, that tracks how each dollar of input, or direct spending, cycles through the economy to suppliers and ultimately to households.

The first step of the IMPLAN process was to collect the estimate for state-only spending for each of the major project cost categories. These categories included the following:

- Pipeline Materials
- Compressor materials
- Meters and regulator devices
- Technical services such as engineering design, survey, and permitting
- Construction and commissioning services
- Land and right of way acquisitions

The MVP Southgate project owners anticipate spending $68 million and $113 million in Virginia and North Carolina, respectively, of the project's total $468 million estimated cost.[7]

FTI then assigned these cost categories to one of more than 500 IMPLAN economic sectors as inputs to the model. The model was then run from 2018 to 2020 to provide the following direct, indirect, and induced economic impacts:

County Business Patterns Program; U.S. Census Bureau Decennial Census and Population Surveys; U.S. Census Bureau Censuses and Surveys; and U.S. Department of Agriculture Census.

[7] This figure includes approximately $4.6 million in ad valorem tax revenue during the first year of operations.

- **GRP:** an industry's value of production over the cost of its purchasing the goods and services required to make its products. GRP includes wages and benefits paid to wage and salary employees and profits earned by self-employed individuals (labor income), monies collected by industry that are not paid into operations (profits, capital consumption allowance, payments for rent, royalties and interest income), and all payments to government (excise taxes, sales taxes, customs duties) with the exception of payroll and income taxes.

- **Employment Contributions:** direct, indirect, and induced annual average jobs for full-time, part-time, and seasonal employees and self-employed workers.

- **State, Local, and Federal Taxes:** payments to government that represent employer collected and paid social security taxes on wages, excise taxes, sales taxes, customs duties, property taxes, severance taxes, personal income taxes, corporate profits taxes, and other taxes.

- **Labor Income:** the wages and benefits paid to wage and salary employees and profits earned by self-employed individuals. Labor income demonstrates a complete picture of the income paid to the entire labor force within the model.

Section 2 provides the results of the IMPLAN construction and employment benefits analysis.

1.2.2. Operational Job Creation and Ad Valorem Tax Benefits

The MVP Southgate project would create jobs within the state to operate and maintain the pipeline and would generate ad valorem tax (property tax) revenues for the counties along the proposed route. To estimate the job benefits of ongoing operations, FTI collected data from the project owners on the annual direct employment (i.e., the number of full-time employees) and the amount of money they anticipate spending annually to support the pipeline's operations in Virginia and North Carolina. We then applied the data within the IMPLAN framework described above to determine the total statewide direct, indirect, and induced employment numbers and average wages.

In addition, Mountain Valley provided FTI with estimates for ad valorem taxes that were based upon the number of miles the MVP Southgate project would traverse in each county, the various county tax rates, and the monetary value of the project. FTI then reviewed the ad valorem tax estimates to verify that it is consistent with the methodology applied in the October 2, 2015 report on the Mountain Valley Pipeline ("2015 Mountain Valley Pipeline Report").[8]

1.2.3. Direct-Use Benefits

For this report, we supplemented the direct-use benefit data from the 2015 Mountain Valley Pipeline Report by calculating the amount of natural gas that could be used in municipal vehicles and residential households.

---

[8] 2015 Mountain Valley Pipeline Report: https://www.mountainvalleypipeline.info/en/Location/VA.aspx

For municipal vehicles, we estimated the number of county vehicles, other school vehicles, and solid waste trucks based on the estimates obtained in the 2015 Mountain Valley Pipeline Report. We were also able to obtain the number of school buses for each county from state data. We then used the same methodology as in the 2015 Mountain Valley Pipeline to estimate the amount of gasoline and diesel consumption these vehicles consume and converted our results to MMSCF to demonstrate how much natural gas these vehicles would consume if converted.

To infer the effect of fuel-switching for households, we used data from the U.S. Census Bureau on the number of households that used various types of fuel for heating in 2016. We also obtained the average annual household site end-use consumption by fuel from the Energy Information Administration ("EIA") for the South Atlantic census region. Next, we calculated the fuel consumption of households using electricity, propane, and fuel oil/kerosene for space and water heating and then calculated the approximate cost of using these fuels based on EIA prices. We then calculated the equivalent amount of natural gas and associated costs using EIA prices,

2. Economic Benefits of the MVP Southgate

1.1. Construction Benefits

The MVP Southgate project owners plan to spend a total of $468 million on goods and services on constructing the pipeline, spending $68 million and $113 million of this total in Virginia and North Carolina, respectively. The project owners plan to spend the remaining $283 million outside Virginia and North Carolina. The combined $181 million in spending in Virginia and North Carolina would translate into job creation and economic growth for both states, as shown below in Figure 6.

Figure 6 - Economic Benefits of Construction in Virginia and North Carolina, 2018 - 2020

Economic Indicator	Virginia	North Carolina	Total
Aggregate GRP	$60 million	$97 million	$157 million
Peak Employment (2020)	570	1,130	1,700
Aggregate Labor Income	$38.7 million	$65.6 million	$104.3 million
Average Labor Income	$55,800	$49,300	$51,600
Aggregate State and Local Tax Revenues	$4.1 million	$6.3 million	$10.4 million

As shown above in Figure 6, the construction of MVP Southgate would generate over $157 million in additional GRP during the three-year construction period. Figure 7 and Figure 8 below show the composition of MVP Southgate capital expenditures by category for Virginia and North Carolina.

Figure 7 - MVP Southgate Capital Expenditures in Virginia by Major Spending Category

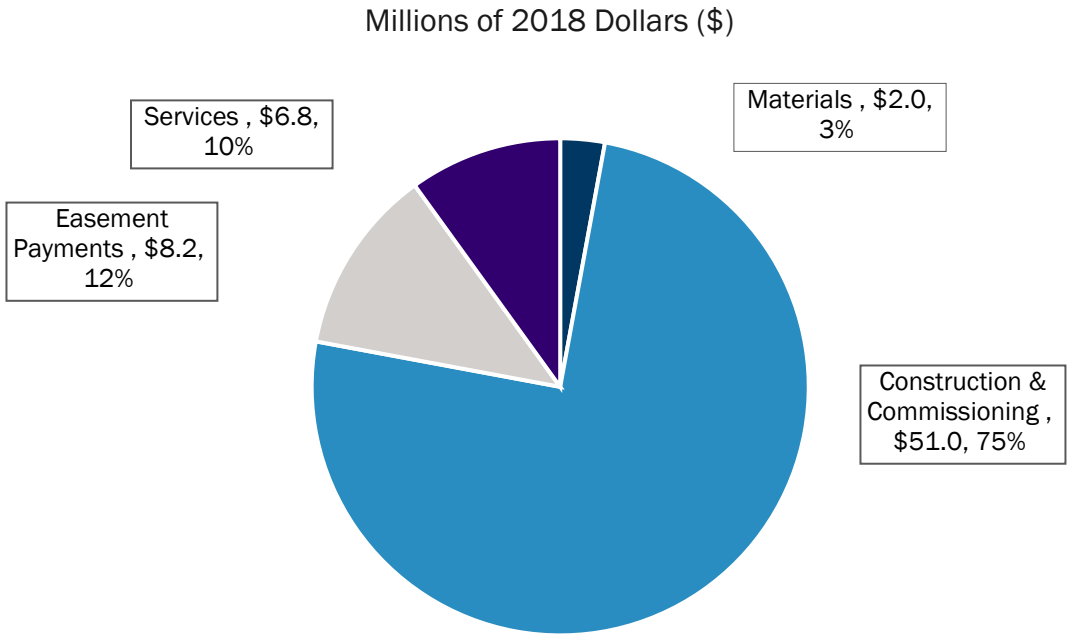
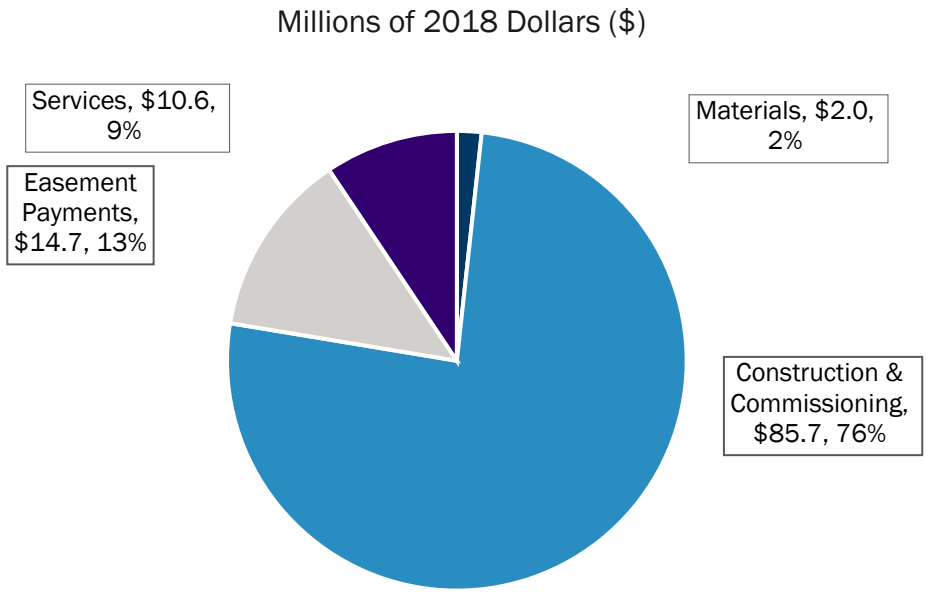


Figure 8 - MVP Southgate Capital Expenditures in North Carolina by Major Spending Category



This spending would also increase GRP by almost $47 million in Virginia in the peak construction year (i.e., 2020). Over the course of the project construction, the project would generate over $60 million in cumulative GRP in Virginia, as shown below in Figure 9.

Figure 9 - Impact of Construction Spending on Virginia GRP, 2018 - 2020

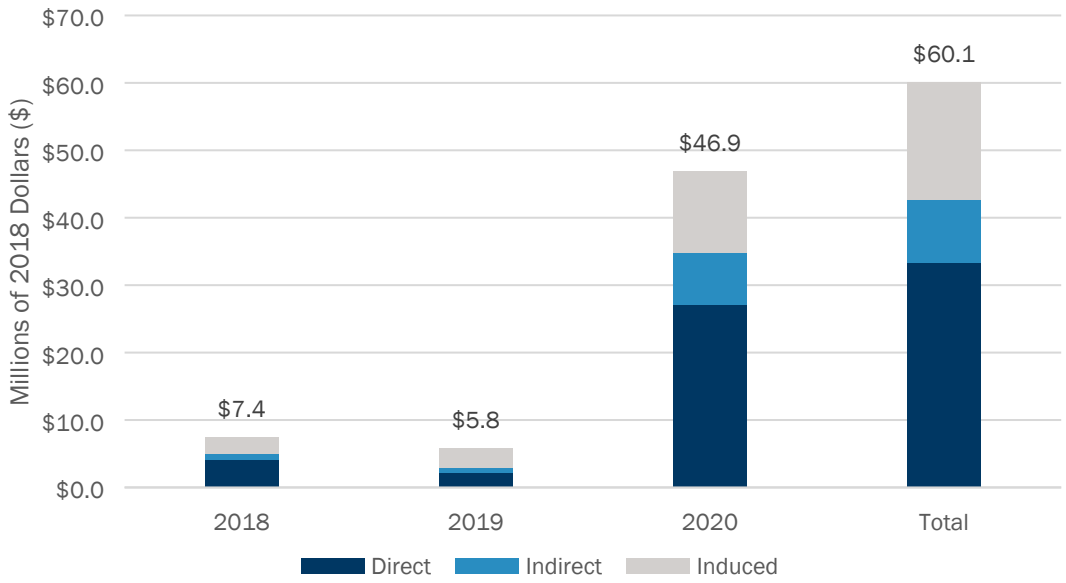
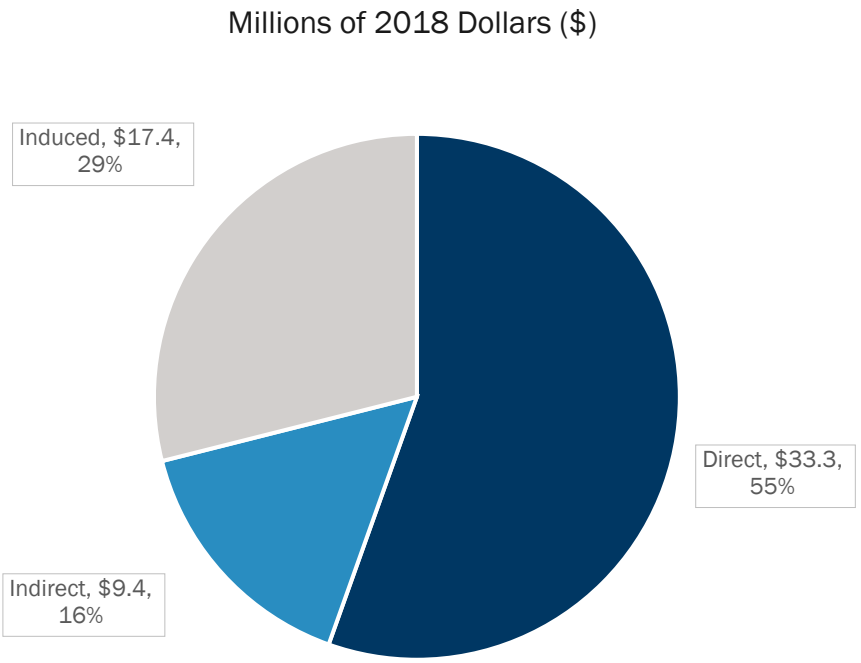


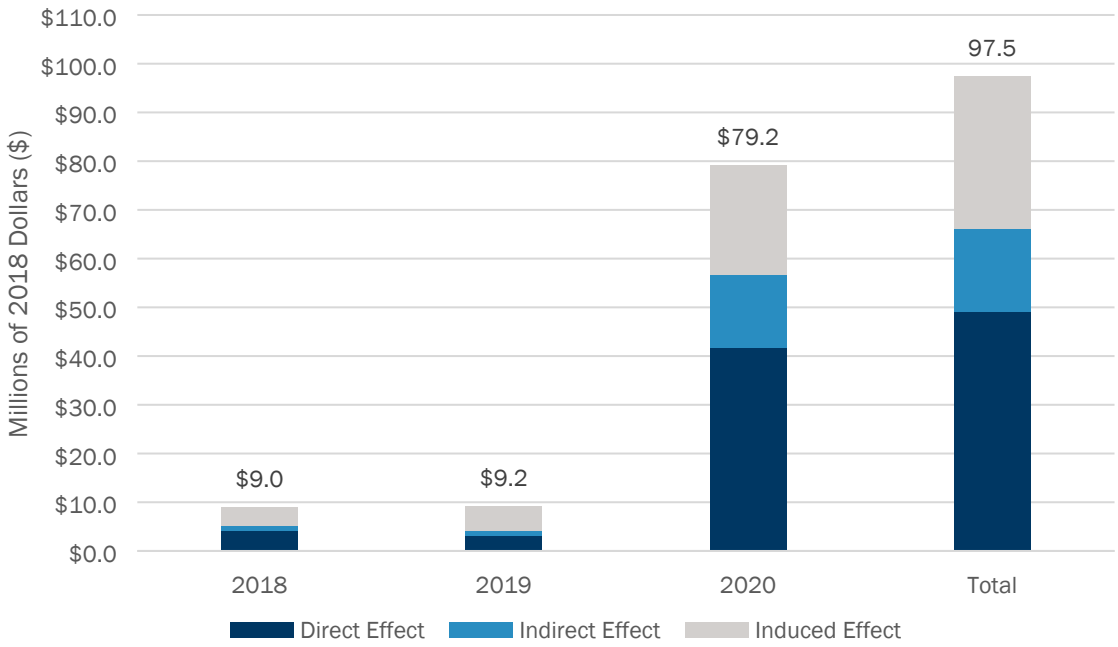
Figure 10 below shows the Virginia GRP added by MVP Southgate segmented into direct, indirect, and induced GRP. As discussed above, "direct" refers to the GRP occurring from the capital expenditures within the industry sectors immediately impacted. "Indirect" represents the GRP impacts from suppliers to the directly impacted industries. "Induced" GRP reflects the local spending of employee's wages and salaries of directly and indirectly affected industries. Notably, construction of the MVP Southgate project would have the largest direct impact on Virginia's GRP.

Figure 10 - Impact of MVP Southgate Construction Spending on Virginia GRP by Category, 2018 – 2020



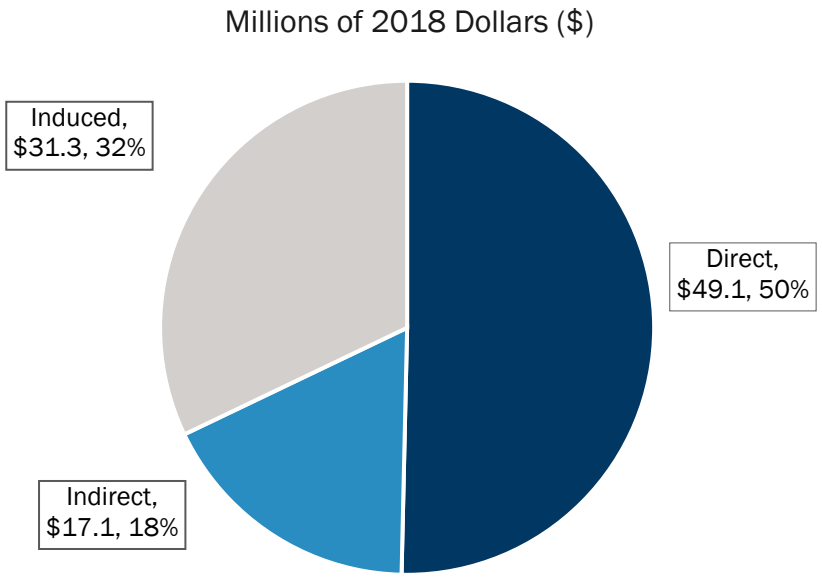
Construction spending for the MVP Southgate project would also generate over $79 million in GRP for North Carolina in 2020 at construction's peak and over $97 million over the three-year construction period, shown in Figure 11 below.

Figure 11 - Impact of Construction Spending on North Carolina GRP, 2018 - 2020



In addition, Figure 12 below shows MVP Southgate's contributions to GRP by spending category both annually and in aggregate. Similar to spending in Virginia, construction of the MVP Southgate project would have the largest direct impact on North Carolina's GRP.

Figure 12 - Impact of MVP Southgate Construction Spending on North Carolina's GRP by Category, 2018 – 2020



GRP is defined as the summation of employee compensation, proprietors' income, other property income, and federal, state, and local taxes on production and imports. Figure 13 and Figure 14 show employee compensation would have the largest impact on GRP in both states.

Figure 13 - Composition of MVP Southgate's Cumulative GRP Contributions in Virginia

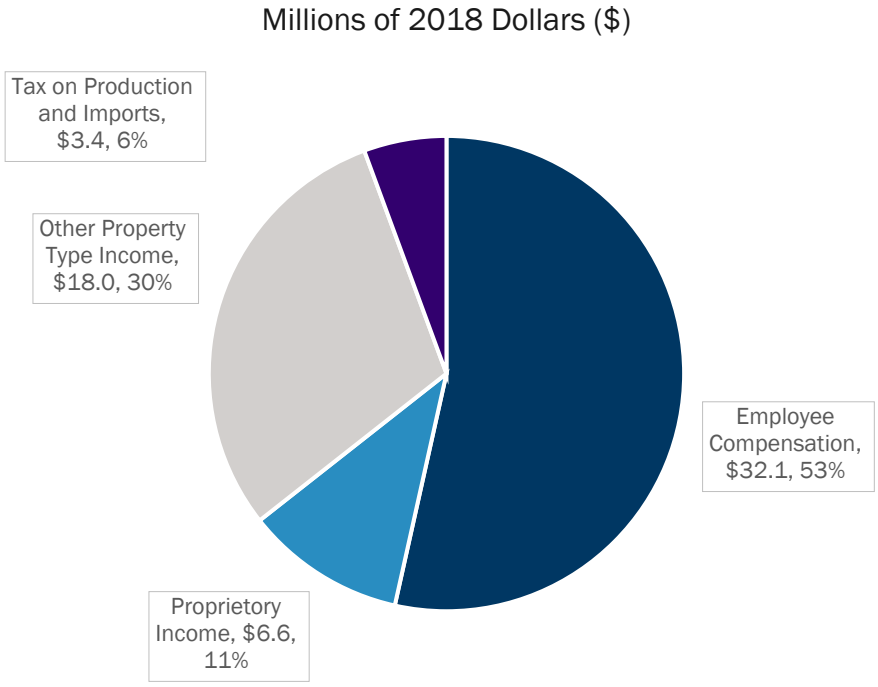
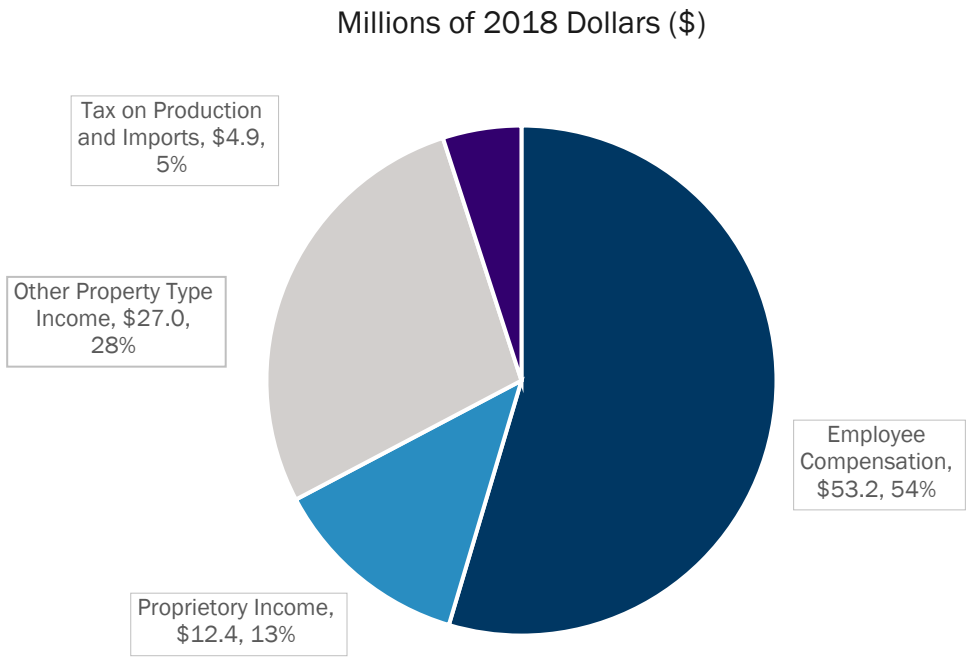
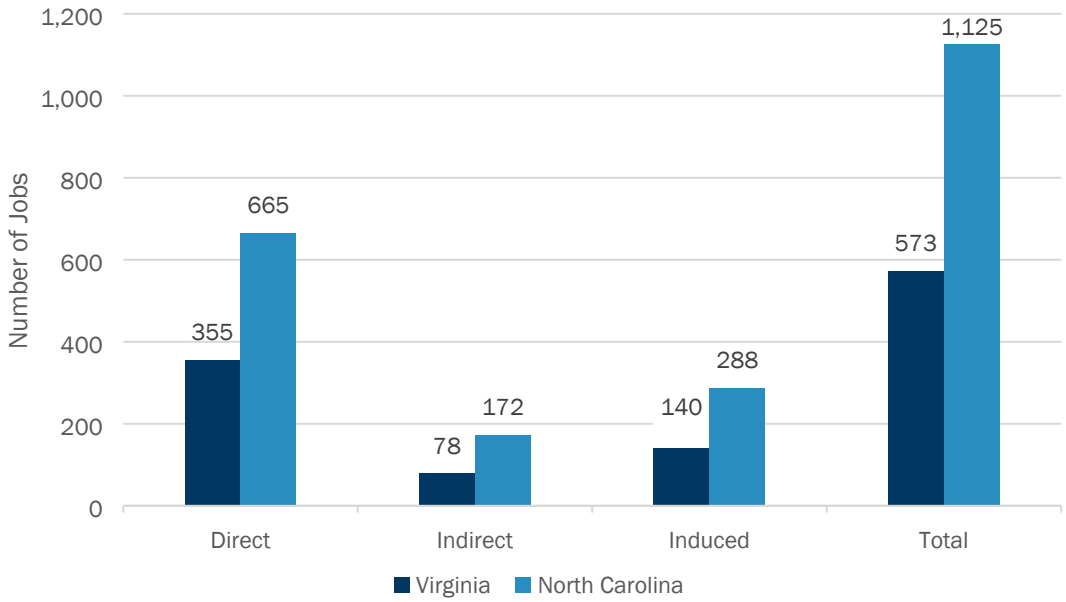


Figure 14 - Composition of MVP Southgate's Cumulative GRP Contributions in North Carolina



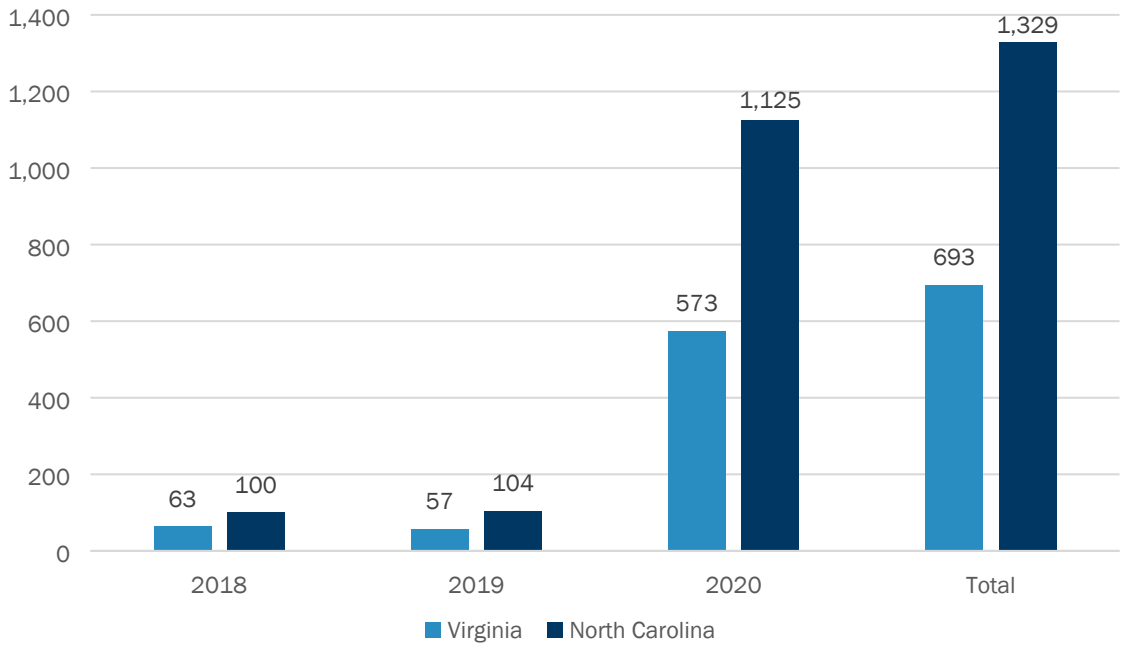
In addition to the GRP benefits, the project would generate approximately 570 and 1,130 jobs in Virginia and North Carolina, respectively, in 2020 at peak construction activity. These jobs include construction jobs, indirect jobs (i.e., jobs created in the state by suppliers to the direct industries impacted), and induced jobs (i.e., jobs created in the state via the spending of construction workers and employees of businesses hired to construct the pipeline). Figure 15 shows the impact of construction on employment in both states in 2020.

Figure 15 - Impact of MVP Southgate Construction Spending on Employment in 2020 by Category



Construction of the MVP Southgate project would create about 690 and 1,330 job-years in Virginia and North Carolina, respectively, over the three-year construction period as shown in Figure 16.[9]

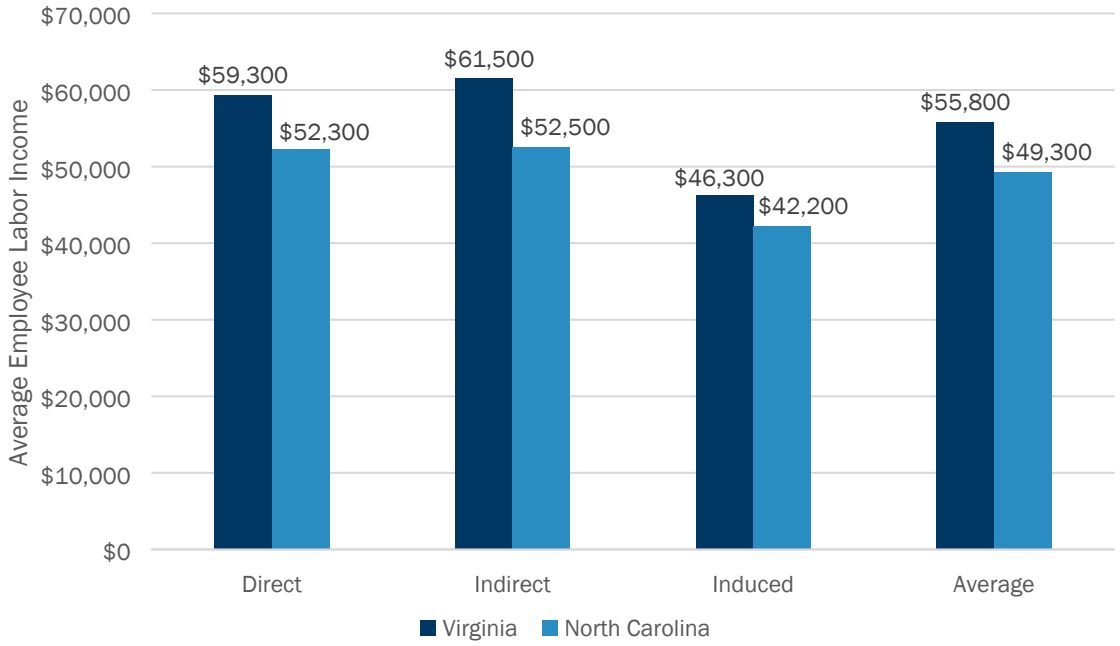
Figure 16 - Impact of MVP Southgate Construction Spending on Employment, 2018 - 2020



The MVP Southgate employment contribution also would have a positive impact on employee compensation relative to the median income in the state. Figure 17 shows the average employee compensation for direct, indirect, and induced jobs from the MVP Southgate project. Notably, the BLS reports that the average wage for construction occupations was $44,610 and $39,940 per year in Virginia and North Carolina, respectively, in 2017.[10]

[9] The MVP Southgate employment contributions are directly tied to capital spending in each year and are best expressed in "job-years." A job-year is the equivalent of one full-time job lasting a single year.
[10] https://www.bls.gov/oes/current/oessrcst.htm

Figure 17 - Average Employee Labor Income by Category



As shown above, workers would earn an average of approximately $55,800 and $49,300 in Virginia and North Carolina, respectively, both of which are higher than the average annual wage for residents in counties along the pipeline route.

1.2. Operational Benefits

The MVP Southgate project would continue to contribute to employment and generate county property or ad valorem taxes after construction once it becomes operational, employing 12 people across both state economies. Specifically, ongoing operation and maintenance of the pipeline in Virginia would employ six people (two of whom would be employed directly by the pipeline) with average annual wages and benefits of approximately $79,000. In combination with the Mountain Valley Pipeline, both pipelines would employ a total of 40 people in Virginia. In North Carolina, ongoing operation and maintenance of the MVP Southgate pipeline would also employ six people (two of whom would be employed directly by the pipeline), with average annual wages and benefits of almost $71,000.

The MVP Southgate project would also continue to contribute to GRP, sales output, and tax revenue for each state while it is operational. Table 2 below summarizes the annual operational benefits of the project in each state.

Table 2 - Annual Operational Benefits in Virginia and North Carolina

Category	Virginia	North Carolina	Total
GRP	$732,000	$684,000	$1.4 million
Ad Valorem Taxes	$1.2 million	$3.4 million[11]	$4.6 million
Other State, Local, and Federal Taxes	$269,000	$226,000	$495,000

1.3. Direct-Use Benefits

The following section reviews and discusses existing opportunities and savings in each county that could occur as a result of switching to natural gas from gasoline, propane, and diesel for transportation fuels and from electricity, fuel oil, or propane for household heating fuels. These opportunities exist in each of the city/county's end-use energy consumption sectors – residential & commercial, municipal buildings, manufacturing, and transportation (fleet vehicles). The shale gas revolution has enabled these switching opportunities as it has increased the supply of natural gas, lowered its cost, and stabilized prices.

1.3.1. Fleet Vehicles

For transportation, we used the same methodology as in the 2015 Mountain Valley Pipeline Report to estimate the number of fleet vehicles located in each county or town as well as their consumption of transportation fuels. Fleet vehicles include municipal solid waste trucks, school buses, other school vehicles, and county vehicles. Table 3 below shows estimates for the number of vehicles, current fuel consumption, and equivalent natural gas consumption.

[11] Rockingham and Alamance counties will directly receive $1.7 million of this total whereas municipalities in the state of North Carolina will receive the remaining $1.7 million.

Table 3 - Estimated Municipal Fleet Vehicle Annual Energy Consumption

County/City	Number of Fleet Vehicles	Annual Gasoline/ Diesel Consumption (Gallons)	Equivalent Natural Gas Consumption (MMSCF)	Annual Savings
Pittsylvania	450	684,000	90	$289,000
Danville	290	441,000	60	$222,000
Alamance	1,150	1,748,000	230	$802,000
Rockingham	640	973,000	1,130	$478,000
Total	**2,530**	**3,846,000**	**1,510**	**$1,791,000**

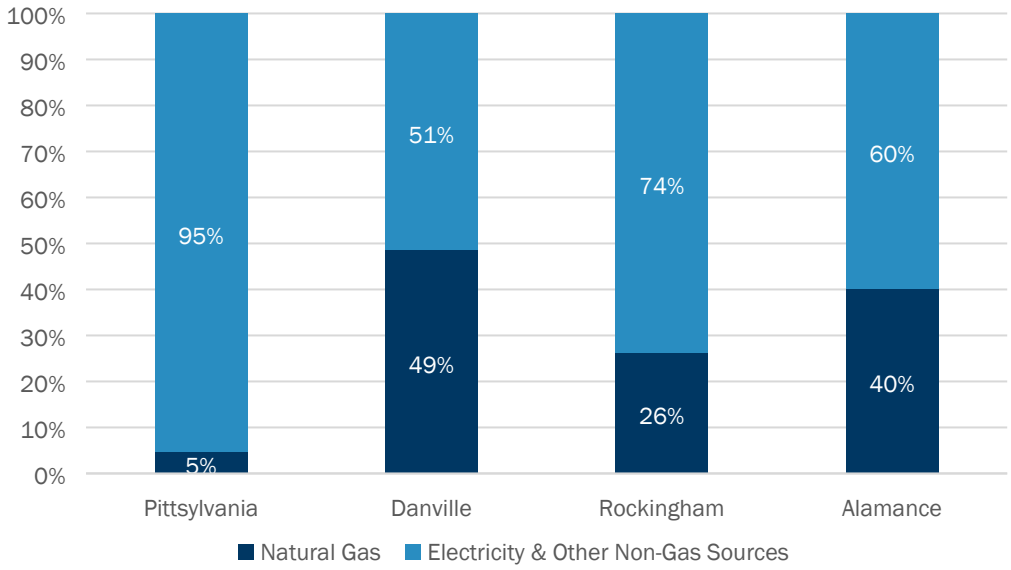
We estimate the natural gas switching potential in Pittsylvania, Alamance, and Rockingham counties and the city of Danville to be 1,510 MMSCF per year if all 2,530 fleet vehicles were switched to natural gas. The annual savings of switching to natural gas vehicles, inclusive fuel costs, compressed natural gas station costs, and vehicle conversion, would equate to approximately $1.8 million.

1.3.2. Residential Space Heating, Water Heating, and Cooking

All four areas considered in this report have varying degrees of natural gas access; however, most households use electricity, propane, and fuel oil for space heating, water heating, and cooking. Figure 18 below highlights the percentage of households in Pittsylvania, Danville, Rockingham, and Alamance that use natural gas versus other fuels for space heating.[12]

[12] https://www.census.gov/acs/www/data/data-tables-and-tools/data-profiles/2016/

Figure 18 – Household Heating Fuel by County, 2016



To compute the economic switching potential to natural gas for the four areas, FTI applied the following sets of data:

- Values in Figure 18
- 2018 delivered energy price data from the EIA
- Residential consumption by fuel type from EIA's Residential Energy Consumption Survey
- Urban populations percentages

Table 4 below shows the economic switching potential by area. We assume that only urban populations would have access to natural gas and thus natural gas distribution upgrades would be nominal. The values in Table 4 also do not include the costs for equipment and ventilation upgrades. For propane and fuel oil, these upgrades, relative to fuel cost savings, would be nominal at the point when existing furnaces reach the end of their useful lives.

Table 4 – Residential Natural Gas Switching Annual Fuel Cost Savings by Area

County/City	Natural Gas Switching Annual Fuel Cost Savings
Pittsylvania	$172,000
Danville	$2,236,000
Rockingham	$2,185,000
Alamance	$3,833,000
Total	**$8,426,000**

Note: Cost savings exclude distribution, equipment, and ventilation upgrades

Table 4 shows that Pittsylvania County has the lowest economic switching potential. The reason is that Pittsylvania County's urban residences account for only six percent of the county's population and that five percent of the county's households (conservatively assumed to be urban) already use natural gas for space heating, water heating, and cooking. As a result, there is limited technical potential for residential natural gas switching in Pittsylvania. However, Danville, Rockingham, and Alamance households have sizable urban populations that could switch to natural gas and save $2 million to $4 million annually.

1.3.3. Manufacturing

The manufacturing sector accounts for almost 17 percent of the jobs in Pittsylvania, Danville, Rockingham, and Alamance, and is a sector that could benefit significantly from having more reliable natural gas service. Natural gas is an influencing factor in retaining existing manufacturers and attracting new ones to the county. With annual wages that are, on average, 37 percent higher than the average wages across all sectors in each city/county, the manufacturing sector is crucial to the local economy and would benefit from the MVP Southgate project. Notably, access to natural gas is a major factor when businesses decide to invest in facilities, expand and modernize operations, and locate or relocate plants. Thus, access to natural gas can draw new businesses to areas and ensure current businesses remain committed to the long-term success of their operations within the community.

3. Summary

The proposed MVP Southgate project would provide several benefits to the areas in Virginia and North Carolina through which the pipeline would run. The pipeline would benefit existing natural gas customers by helping to ensure future access to a reliable supply of natural gas. These customers

include manufacturing firms, which pay higher wages and make up a substantial portion of these counties' economies.

The shale gas revolution has helped lower natural gas prices, making natural gas an economically attractive alternative to existing fuel sources. FTI estimated the potential demand for switching to natural gas for both municipal vehicles and households using electricity as their primary heat source.

The MVP Southgate pipeline could also help retain or attract manufacturers. Interviews with country representatives, regional partnership leaders, and manufacturers identified that businesses value abundant and reliable gas service. All four areas already maintain a significant manufacturing presence, with the sector employing 17 percent of workers on average, and have plans to continue expanding with the development of additional industrial parks.

These types of investments can provide large economic benefits to communities from an employment, wage, and tax revenue perspective. Input-output modeling software such as IMPLAN can help to estimate the magnitude of these impacts. In addition to the initial economic impact of the investment, businesses along the supply chain benefit through ripple, or multiplier, effects, as do households in the form of higher wages and disposable income.

Appendix I: County Economic and Energy Profiles

Pittsylvania County, Virginia

Economic Profile

Pittsylvania County, Virginia, is a 978-square mile county located in the Piedmont region of Virginia with a 2017 population of 63,506.[13] In 2016, Pittsylvania's GDP was $3.24 billion[14] and its median household income was median household income of $43,087.[15] The largest towns in Pittsylvania are Chatham, Gretna, and Hurt. Pittsylvania County's 2017 unemployment rate was 4.5 percent, higher than the unemployment rates of both Virginia and the United States of 3.8 percent and 4.3 percent, respectively.[16]

12,357 people work in Pittsylvania County, approximately 24 percent of which work for the federal, state, or local government. The next largest sectors are manufacturing, health care and social assistance, and construction, which employ approximately 15 percent, 11 percent, and nine percent, respectively, of Pittsylvania workers.[17] In addition, the average annual wage in Pittsylvania County is $35,776, almost 39 percent less than the average annual state wage of $58,292 in Virginia.[18] Table 5 below shows employment and average wage by industry for Pittsylvania County.[19]

---

[13] U.S. Census QuickFacts: Pittsylvania County, Virginia, https://www.census.gov/quickfacts/fact/table/danvillecityvirginia,pittsylvaniacountyvirginia/PST045217
[14] National Association of Counties. http://explorer.naco.org/
[15] U.S. Census QuickFacts: Pittsylvania County, Virginia, https://www.census.gov/quickfacts/fact/table/danvillecityvirginia,pittsylvaniacountyvirginia/PST045217
[16] http://virginialmi.com/report_center/community_profiles/5104000143.pdf; https://data.bls.gov/timeseries/LNS14000000
[17] http://virginialmi.com/report_center/community_profiles/5104000143.pdf
[18] http://virginialmi.com/report_center/community_profiles/5101000000.pdf
[19] http://virginialmi.com/report_center/community_profiles/5104000143.pdf

Table 5 - Employment and Wages in Pittsylvania County by Industry

Industry	Employment	Percent of Total Employment	Average Annual County Wage	Percent Higher/Lower than County Wage
Government (Total)	2,919	23.6%	$38,948	8.9%
Government (Local)	2,359	19.1%	$30,992	-13.4%
Manufacturing	1,815	14.7%	$52,988	48.1%
Health Care and Social Assistance	1,358	11.0%	$24,752	-30.8%
Construction	1,102	8.9%	$43,940	22.8%
All Industries	11,824		$35,776	

As shown above in Table 5, manufacturing is one of the highest paying industries in Pittsylvania County, paying approximately 48 percent more than the average county wage. Manufacturing is also one of the largest employers in the county; DTI, Intertape Polymer Group, Swedwood Danville, Times Fiber Communications, and Unique Industries, described below, are Pittsylvania's largest manufacturing employers.[20]

- **Intertape Polymer Group ("IPG"):** IPG develops and manufactures paper and film-based sensitive and water-active tapes, polyethylene and specialized polyolefin films, and complementary packaging systems for diverse industrial and retail uses. IPG also produces woven coated fabrics. IPG currently employs 280 people in Pittsylvania and is the fifth largest employer in the county.[21] IPG recently announced that it is expanding its manufacturing operations by investing $7 million in the county and hiring an additional 15 employees.[22]

- **Owens-Illinois Inc.("O-I"):** O-I is a global producer of glass containers, primarily for beverages, and maintains a manufacturing center in Ringgold. O-I is the eleventh largest employer in Pittsylvania County with up to 300 employees.[23]

- **Swedwood Danville:** Swedwood Danville is a subsidiary of the Swedish furniture company, IKEA. Also located in Ringgold, Swedwood Danville employs approximately 400 people at its

[20] http://virginialmi.com/report_center/community_profiles/5104000143.pdf
[21] http://www.dpchamber.org/employment
[22] https://www.gosouthernvirginia.com/about-svra/news/intertape-polymer-group-bringing-15-new-jobs-to-pittsylvania-county
[23] https://www.gosouthernvirginia.com/workforce/major-employers

930,000-square foot facility at the Cane Creek Centre and is the third largest employer in the county.[24]

- **Times Fiber Communication:** Times Fiber Communication is a global manufacturer of high quality cables, fiber optic management equipment, and interconnect products for cable television, satellite, data, and powering applications for broadband communications networks. With operations located in Chatham employing up to 300 people, Times Fiber Communication is the twelfth largest employer in Pittsylvania.[25]

- **Unique Industries:** A wholesale manufacturer and supplier of party goods with manufacturing operations located in Blairs, Unique Industries employs 325 people and is Pittsylvania's second largest employer behind the county school board.[26]

Pittsylvania County has shown its commitment to new manufacturing by breaking ground on the new, 3,700-acre Berry Hill Industrial Park, located in Pittsylvania County near the Virginia-North Carolina border. The park, which will cost $29.8 million to construct, is the largest industrial park in Virginia and the fifth largest on the East Coast.[27] While still under development, the park, shown in Figure 19 below,[28] will be located close to both the Norfolk Southern Railroad and interstate highways 58 and 40.[29]

[24] http://www.dpchamber.org/employment
[25] https://www.gosouthernvirginia.com/workforce/major-employers
[26] http://www.dpchamber.org/employment
[27] https://www.greensboro.com/rockingham_now/business/berry-hill-industrial-park-breaks-ground/article_24faef7c-126f-11e7-8aad-37409504e5ee.html
[28] https://maps.vedp.org/LaborMaps/242790.pdf
[29] http://www.gosouthernvirginia.com/sites-buildings/sites-buildings

Figure 19 – Map of Berry Hill Industrial Park

The park's developers anticipate it to maintain water and sewer capacities of 12 million gallons/day and four million gallons/day, respectively.[30] Appalachian Power, owned by American Electric Power, provides electrical service to the Berry Hill Industrial Park.[31] In addition, the Transco pipeline, which serves the City of Danville, passes directly past the park and will run parallel to the MVP Southgate project, offering another source of natural gas supply for industrial and residential customers.

Pittsylvania County maintains several industrial parks, including the 900-acre Cane Creek Centre,[32] and has plans to develop additional facilities. These plans include a new 800-acre industrial park in Hurt that will be a joint development project between Pittsylvania County, the Town of Hurt, the Town of Altavista, the City of Danville, and Southern Virginia Multimodal Park, LLC.[33]

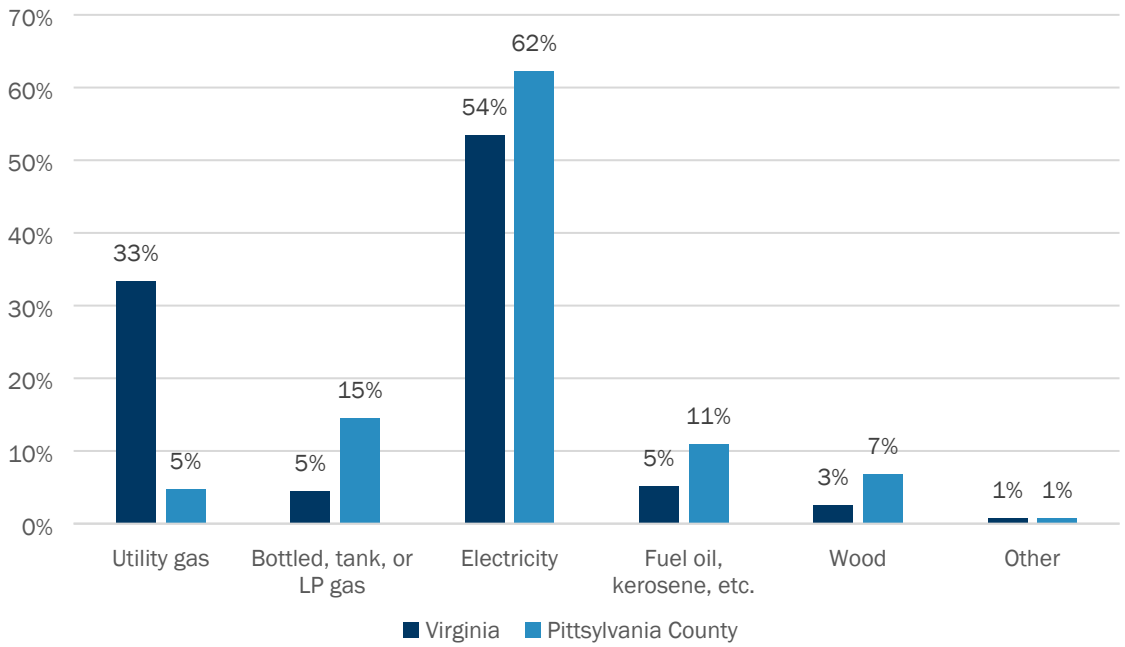
Energy Profile

As mentioned above, the Transco pipeline passes directly through Pittsylvania; however, as shown in Figure 20 below, only five percent of households use natural gas provided by local utilities Columbia Gas and Southwestern Virginia Gas as their primary fuel for household heating.[34] Both Dominion Power and Appalachian Power provide electric service to Pittsylvania.[35]

---

[30] https://bloximages.newyork1.vip.townnews.com/godanriver.com/content/tncms/assets/v3/editorial/3/d2/3d25cccc-1024-11e7-9800-6b457e241a5f/58d46084d9e16.image.jpg
[31] https://virginiascan.yesvirginia.org/GetBinary?id=184992
[32] http://www.discoverdanville.com/index.aspx?NID=252
[33] https://townofhurtva.gov/economic-development/; https://d2oc0ihd6a5bt.cloudfront.net/wp-content/uploads/sites/1667/2016/06/SVMP2.pdf
[34] American FactFinder, U.S. Census, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk

Figure 20 – Primary Household Heating Fuel in Virginia and Pittsylvania County, 2016



In contrast to the state of Virginia and the other areas described further below, many more households in Pittsylvania use fuel sources other than electricity and natural gas, such as propane, petroleum, and wood. In addition, some counties near Pittsylvania, such as Franklin, Floyd, and Patrick counties, do not have natural gas access, and could also benefit from enhanced natural gas capacity provided by MVP Southgate.[36]

Natural gas is also important to retaining existing manufacturers and attracting new manufacturers to the county. Our interviews and analysis identified that manufacturers value abundant and reliable gas service and that access to natural gas is a primary criterion for determining where to locate new manufacturing facilities. Thus, enhanced natural gas access via the MVP Southgate project could provide an additional incentive for companies considering opening or relocating manufacturing operations to the city.

Danville, Virginia

Economic Profile

Danville, Virginia, is an approximately 45-square mile independent city located next to Pittsylvania County in the Piedmont region of Virginia. Danville maintained a population of 41,130 in 2017 and a 2016 median household income of $33,721.[37] Danville's 2017 unemployment rate was six percent,

[35] https://www.scc.virginia.gov/pur/elec/el_map.pdf
[36] https://www.scc.virginia.gov/pur/gas/gas_map.pdf
[37] https://www.census.gov/quickfacts/fact/table/danvillecityvirginia,pittsylvaniacountyvirginia/PST045217

higher than the unemployment rates of both Virginia and the United States of 3.8 percent and 4.3 percent, respectively.[38]

27,062 people work in the city of Danville, approximately 19 percent of which work in the health care and social assistance industry. The next largest sectors are manufacturing, retail, and government, which employ approximately 16 percent, 16 percent, and 14 percent, respectively, of Danville workers.[39] In addition, the average annual wage in Danville is $36,296, almost 38 percent less than the average annual state wage of $58,292 in Virginia.[40] Table 6 below shows employment and average wage by industry for Danville.[41]

Table 6 - Employment and Average Wages in Danville by Industry, 2016

Industry	Employment	Percent of Total Employment	Average Annual County Wage	Percent Higher/Lower than County Wage
Health Care and Social Assistance	5,061	18.7%	$40,924	12.8%
Manufacturing	4,355	16.1%	$56,680	56.2%
Retail	4,264	15.8%	$25,272	-30.4%
Government (total)	3,673	13.6%	$45,084	24.2%
All Industries	27,062		$36,296	

As shown above in Table 6, manufacturing is one of the highest paying industries in Danville, paying approximately 56 percent more than the average county wage. Manufacturing is also one of the largest employers in the county; EBI, Essel Propack, Goodyear Tire & Rubber, Nestle, and Unlin, described below, are among Danville's largest manufacturing employers.

- **EBI**: EBI is a Polish company that manufactures and distributes upholstered furniture and mattresses for Com.40, Ltd. IKEA is one of EBI's main buyers.[42] The eighth largest employer in Danville, EBI's manufacturing center in the city employs approximately 270 people.[43]

- **Essel Propack**: Essel Propack is a global specialty packaging manufacturer of laminated plastic tubes primarily used for fast-moving consumer goods and pharmaceuticals. Essel

[38] http://virginialmi.com/report_center/community_profiles/5104000590.pdf; https://data.bls.gov/timeseries/LNS14000000
[39] http://virginialmi.com/report_center/community_profiles/5104000143.pdf
[40] http://virginialmi.com/report_center/community_profiles/5101000000.pdf
[41] http://virginialmi.com/report_center/community_profiles/5104000143.pdf
[42] https://www.tradeandindustrydev.com/industry/manufacturing/com40-ltd-danville-virginia-2370
[43] http://www.dpchamber.org/employment

Propack is one of the top 20 largest employers in Danville and employs over 230 people at its Airside Industrial Park location, which it expanded in 2011 by adding 105,000 square feet.[44]

- **Goodyear Tire & Rubber**: Goodyear is one of the largest tire manufacturers in the world and has expanded its business to include commercial truck service, tire retreading centers, and auto service outlets. Goodyear is also the largest employer in Danville with over 2,300 employees.[45]

- **Nestle**: Nestle is a Swiss company and one of the largest food companies in the world, producing food and beverages, including pet foods, under various brands in more than 47 states. Nestle's manufacturing center, located in Danville's Airside Industrial Park, which produces Toll House cookie dough and Buitoni pasta products, employs approximately 6450 people.[46]

- **Unlin**: This Belgian company, known mostly for its Quick-Step floors, also manufactures flooring, panels, and insulation. In 2005, Unlin acquired Mohawk Industries, which owns a manufacturing center in Danville, and is now the thirteenth largest employer in the city.

The City of Danville has shown its commitment to new manufacturing by breaking ground on the new, 3,700-acre Berry Hill Industrial Park, located in Pittsylvania County near the Virginia-North Carolina border. The park, which will cost $29.8 million to construct, is the largest industrial park in Virginia and the fifth largest on the East Coast.[47] While still under development, the park, shown in Figure 21 below,[48] will be located close to both the Norfolk Southern Railroad and interstate highways 58 and 40.[49]

---

[44] http://www.dpchamber.org/employment
[45] http://www.dpchamber.org/employment
[46] http://www.dpchamber.org/employment
[47] https://www.greensboro.com/rockingham_now/business/berry-hill-industrial-park-breaks-ground/article_24faef7c-126f-11e7-8aad-37409504e5ee.html
[48] https://maps.vedp.org/LaborMaps/242790.pdf
[49] http://www.gosouthernvirginia.com/sites-buildings/sites-buildings

Figure 21 – Map of Berry Hilly Industrial Park Site

The park's developers anticipate it to maintain water and sewer capacities of 12 million gallons/day and four million gallons/day, respectively.[50] Appalachian Power, owned by American Electric Power, provides electrical service to the Berry Hill Industrial Park.[51] In addition, the Transco pipeline, which serves the City of Danville, passes directly past the park and will run parallel to the MVP Southgate project, offering another source of natural gas supply for industrial and residential customers.

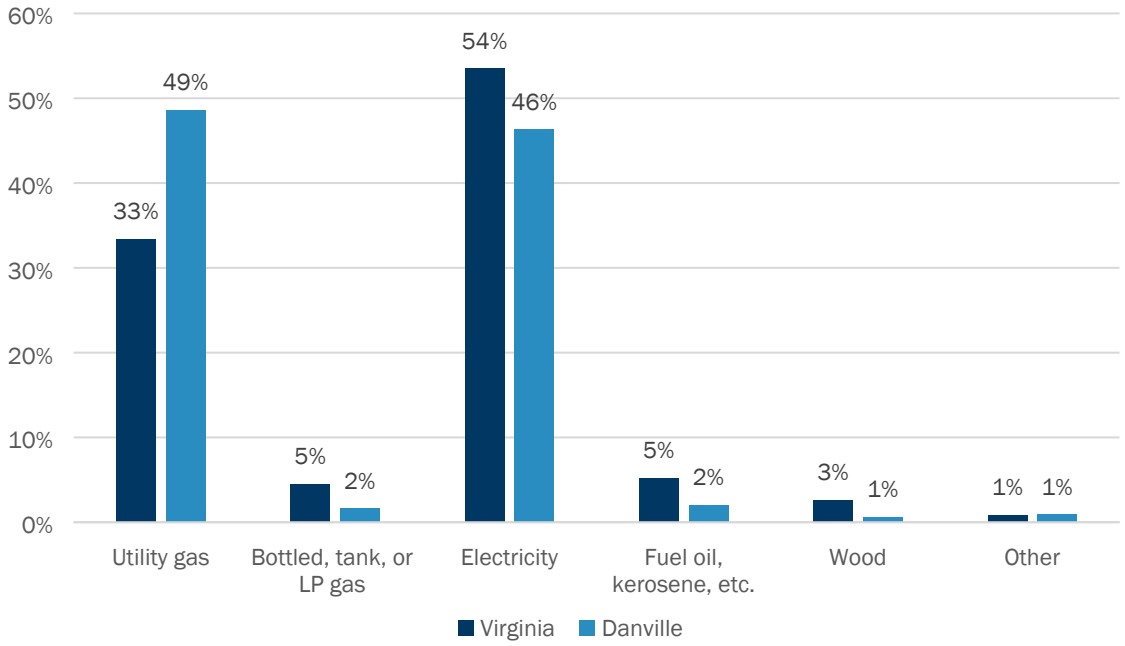
There are three other major industrial parks in the city – the Airside Industrial Park, Riverview Industrial Park, and Cyber Park – all of which have lots currently available.[52]

Energy Profile

As mentioned above, the Transco pipeline provides natural gas service to the City of Danville through Danville Utilities, which also offers electricity service. As shown in Figure 22 below, almost half of Danville households use natural gas as their primarcy fuel for household heating while slightly fewer use electricity.

[50] https://bloximages.newyork1.vip.townnews.com/godanriver.com/content/tncms/assets/v3/editorial/3/d2/3d25cccc-1024-11e7-9800-6b457e241a5f/58d46084d9e16.image.jpg
[51] https://virginiascan.yesvirginia.org/GetBinary?id=184992
[52] http://www.discoverdanville.com/index.aspx?NID=229

Figure 22 - Primary Household Heating Fuel in Virginia and the City of Danville, 2016



Natural gas is also important to retaining existing manufacturers and attracting new manufacturers to the county. Our interviews and analysis identified that manufacturers value abundant and reliable gas service and that access to natural gas is a primary criterion for determining where to locate new manufacturing facilities. Thus, enhanced natural gas access via the MVP Southgate project could provide an additional incentive for companies considering opening or relocating manufacturing operations to the city.

Alamance County, North Carolina

Economic Profile

Alamance County, North Carolina, is a 424-square mile county located in the Piedmont region of North Carolina with a 2017 population of 162,391.[53] In 2016, Alamance's GDP was $6.15 billion[54] and its 2017 median household income was $43,209.[55] Large cities and areas in Alamance County include Burlington, Graham, and Mebane.[56] Alamance County's unemployment rate is 4.3 percent, lower than the unemployment rate of 3.8 percent in North Carolina and the same as the unemployment rate of 4.3 percent in the United States.[57]

61,317 people work in Alamance County, approximately 16 percent of which work for in the healthcare and social assistance industry. The next largest sectors are manufacturing, retail, and accommodation and food service, which employ approximately 15 percent, 15 percent, and 12 percent, respectively, of Alamance workers. In addition, the average annual wage in Alamance County is $40,092,[58] about 13 percent less than the average annual state wage of $46,080 in North Carolina.[59] Table 7 below shows employment and average wage by industry for Alamance County.

---

[53] U.S. Census QuickFacts: Alamance County, North Carolina, https://www.census.gov/quickfacts/fact/table/alamancecountynorthcarolina,rockinghamcountynorthcarolina/PST045217

[54] National Association of Counties. http://explorer.naco.org/

[55] U.S. Census QuickFacts: Alamance County, North Carolina, https://www.census.gov/quickfacts/fact/table/alamancecountynorthcarolina,rockinghamcountynorthcarolina/PST045217

[56] https://www.alamance-nc.com/about-alamance-county/communities/

[57] Access NC: North Carolina, https://accessnc.nccommerce.com/DemoGraphicsReports/pdfs/stateComparison/NC_NC.pdf; https://data.bls.gov/timeseries/LNS14000000

[58] Access NC: Alamance County, https://accessnc.nccommerce.com/DemoGraphicsReports/pdfs/countyProfile/NC/37001.pdf

[59] https://www.bls.gov/oes/current/oes_nc.htm

Table 7 - Employment and Average Wages in Alamance County by Industry

Industry	Employment	Percent of Total Employment	Average Annual County Wage	Percent Higher/Lower than County Wage
Health Care and Social Assistance	9,853	16.07%	$54,080	34.89%
Manufacturing	9,240	15.07%	$47,476	18.42%
Retail	9,082	14.81%	$25,272	-36.96%
Accommodation and Food Service	7,190	11.73%	$32,240	-19.58%
Government (total)	6,851	11.17%	$47,476	18.42%
All Industries	61,317		$40,092	

As shown above in Table 7, manufacturing is one of the highest paying industries in Alamance County, paying approximately 18 percent more than the average county wage. Manufacturing is also one of the largest employers in the county; GKN Driveline, Glen Raven, Honda, Jabil Packaging Solutions, and Kayser-Roth Corp, described below, are Alamance's largest manufacturing employers.[60]

- **GKN Driveline**: GKN Driveline is a multinational automotive components manufacturer that specializes in various driveline technologies. GKN Driveline's Mebane facility employs approximately 800 people.
- **Glen Raven, Inc. ("Glen Raven")**: Glen Raven is a fabrics manufacturer for the awning, marine, furniture, protective, military, and geosynthetics markets. Glen Raven operates multiple locations, including both corporate functions and manufacturing, in the town of Glen Raven, located in Alamance County, and employs approximately 500 people.
- **Honda Power Equipment Mfg., Inc. ("Honda")**: Honda operates a manufacturing facility in Haw River that produces engines for lawn mowers, generators, and water pumps. Honda also operates a second location in Burlington at its Honda Aero headquarters and manufacturing building that designs gas turbine engines for the Honda Jet. At these locations, Honda employs approximately 750 people.
- **Jabil**: Jabil is a product solutions company that engineers and manufactures products in a variety of spaces, including electrical, optical, software, and mechanical. Jabil's Mebane

[60] Alamance Chamber: Industries, http://b49826eovvwg61335b3co132.wpengine.netdna-cdn.com/wp-content/uploads/2018/03/AC_EconDev_ProfileSheet3_Industries_v5.pdf

location specializes in the design and manufacture of rigid food containers, closures, and devices and employs approximately 400 people.

- Kayser-Roth: Kayser-Roth, owned by the Italian company Golden Lady, manufactures intimate apparel and hosiery. Kayser-Roth's Graham manufacturing facility employs approximately 460 people.

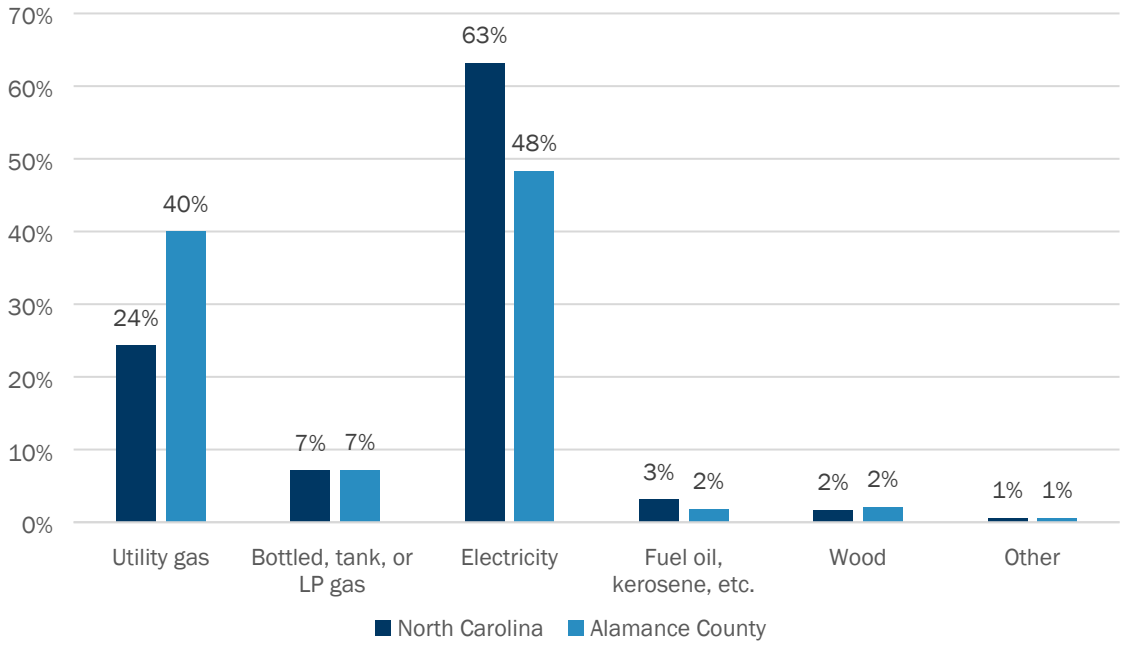
The county has three main industrials parks: Alamance County has three industrial parks: North Carolina Commerce Park and North Carolina Industrial Park, both located in Mebane, and Buckhorn Economic Development Zone, which is located in both Alamance and Orange counties. Notably, Lotus Bakeries, based in Belgium, plans to open its first U.S. manufacturing plant in Mebane in 2020. According to the company, the new manufacturing center, located at the North Carolina Industrial Center, will cost $48 million and employ 60 people.[61]

Energy Profile

Both Piedmont Natural Gas and PSNC Energy provide natural gas service to Alamance, while Duke Energy provides electric service.[62] As shown in Figure 23 below, most Alamance County households use electricity as their primary fuel for household heating; however, more Alamance households use natural gas than North Carolina residents.[63]

[61] http://www.areadevelopment.com/newsItems/11-7-2016/lotus-bakeries-manufacturing-operation-mebane-north-carolina.shtml
[62] http://pubstaff.s3.amazonaws.com/s3fs-public/documents/files/natural-gas-service-areas.pdf; http://www.ncuc.commerce.state.nc.us/overview/overview.pdf
[63] U.S. Census, American FactFinder, Alamance County and North Carolina, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_DP04&prodType=table

Figure 23 – Primary Household Heating Fuel in Alamance County, 2016



Natural gas is also important to retaining existing manufacturers and attracting new manufacturers to the county. Our interviews and analysis identified that manufacturers value abundant and reliable gas service and that access to natural gas is a primary criterion for determining where to locate new manufacturing facilities. Thus, enhanced natural gas access via the MVP Southgate project could provide an additional incentive for companies considering opening or relocating manufacturing operations to the city.

Rockingham, North Carolina

Economic Profile

Rockingham County, North Carolina, is a 573-square mile county located in the Piedmont region of North Carolina with a 2017 population of 90,949. Rockingham is made up of six municipalities, the largest of which are Madison and Reidsville.[64] In 2016, Rockingham's GDP was $2.57 billion[65] and its 2017 median household income was $40,003.[66] Rockingham County's unemployment rate is 5.2 percent,[67] higher than the unemployment rates of both North Carolina and the United States of 3.8 percent and 4.3 percent, respectively.[68]

25,507 people work in Rockingham County, approximately 22 percent of which work in the manufacturing industry. The next largest sectors are retail, government, and accommodation and food service, which employ approximately 15 percent, 15 percent, and 12 percent, respectively, of Rockingham workers. In addition, the average annual wage in Alamance County is $34,996,[69] about 24 percent less than the average annual state wage of $46,080 in North Carolina.[70] Table 8 below shows employment and average wage by industry for Rockingham County.

---

[64] http://www.co.rockingham.nc.us/pview.aspx?id=14872&catid=0
[65] National Association of Counties. http://explorer.naco.org/
[66] U.S. Census QuickFacts: Rockingham County, North Carolina, https://www.census.gov/quickfacts/fact/table/alamancecountynorthcarolina,rockinghamcountynorthcarolina/PST045217
[67] Access NC: Rockingham County, https://accessnc.nccommerce.com/DemoGraphicsReports/pdfs/countyProfile/NC/37157.pdf
[68] Access NC: North Carolina, https://accessnc.nccommerce.com/DemoGraphicsReports/pdfs/stateComparison/NC_NC.pdf; https://data.bls.gov/timeseries/LNS14000000
[69] Access NC: Alamance County, https://accessnc.nccommerce.com/DemoGraphicsReports/pdfs/countyProfile/NC/37001.pdf
[70] https://www.bls.gov/oes/current/oes_nc.htm

Table 8 - Employment and Average Wages in Rockingham County by Industry

Industry	Employment	Percent of Total Employment	Average Annual County Wage	Percent Higher/Lower than County Wage
Manufacturing	5,635	22.1	$44,096	26.0%
Retail	3,849	15.1%	$24,596	-29.7%
Government (total)	3,845	15.1%	$37,492	7.1%
Health Care and Social Assistance	3,085	12.1%	$36,192	3.4%
Accommodation and Food Service	2,222	8.7%	$14,040	-59.9%
All Industries	25,507		$34,996	

As shown above in Table 8, manufacturing is one of the highest paying industries in Rockingham County, paying approximately 26 percent more than the average county wage. Manufacturing is also one of the largest employers in the county; Frontier Spinning Mills; Gildan; Keystone Foods; Sturm, Ruger & Co.; and Unifi, described below, are Rockingham's largest manufacturing employers.

- **Frontier Spinning Mills:** Frontier Spinning Mills produces spun yarns for the knitting and weaving industries. With two manufacturing plants in Mayodan, Frontier Spinning Mills employs 515 people.

- **Gildan:** Gildan is manufacturer of branded basic family apparel sold under a variety of company-owned brands. Gildan also produces other clothing items, primarily socks, for other private labels as well as unbranded activewear. Gildan operates a large distribution center in Mebane, which employs over 515 people.

- **Keystone Foods:** Keystone Foods, owned by Marfrig Global Foods, is a global food services company that supplies frozen animal protein products. Keystone Foods operates a manufacturing center in Reidsville that employs over 420 people.

- **Sturm, Ruger & Co ("Ruger"):** Ruger is one of the country's largest firearm manufacturers for the commercial sporting market. Located in Mayodan, Ruger employs over 365 people.

- **Unifi:** Unifi is a global textile company known for its production of repreve, a recycled performance fiber. With a manufacturing center located in Reidsville, Unifi employs almost 800 people.

Rockingham County also has five industrial parks: Eden Industrial Center, Madison Business Park, Osborne Industrial Park, Reidsville Industrial Park, and Stone Industrial Site. Duke Energy owns a 620-megawatt combined cycle natural gas plant in Rockingham, and Piedmont Natural Gas provides natural gas service to the industrial parks.[71]

Natural gas is important to retaining existing manufacturers and attracting new manufacturers to the county. Our interviews and analysis identified that manufacturers value abundant and reliable gas service and that access to natural gas is a primary criterion for determining where to locate new manufacturing facilities. In fact, NTE Energy is currently developing a 500-megawatt combined cycle natural gas plant in Rockingham and expects to begin construction this year with operations beginning in 2021.[72] The Transco pipeline also passes through Rockingham County but, instead of traversing east into Alamance County, the pipeline travels west through Guilford and Forsyth counties.

Regarding transportation, Rockingham recently undertook a new I-73 connector project to improve secondary roads. Norfolk Southern Railway also runs 48 miles of track through the county, with 21 miles cleared for double-stack container movement.[73] Our interviews, however, revealed that projects have turned down sites in Rockingham because of lacking infrastructure, including high costs of getting needed materials to project sites and inadequate highway access.

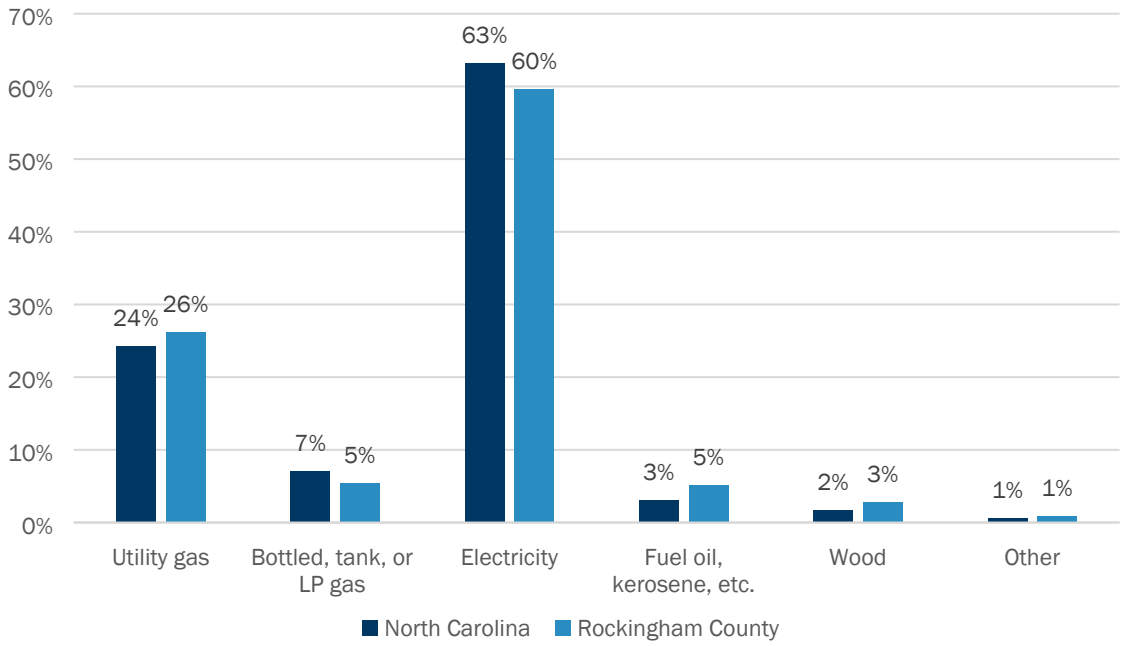
Energy Profile

Piedmont Natural Gas provides natural gas service to Rockingham, while Duke Energy provides electric service.[74] As shown in Figure 24 below, the distribution of household fuel sources in Rockingham County closely mirrors that of North Carolina as a whole, with most households using electricity as their primary household heating source.[75]

---

[71] http://www.gorockinghamcountync.com/site-selection-2/infrastructure/
[72] http://reidsvilleenergy.com/#project-overview
[73] http://www.gorockinghamcountync.com/site-selection-2/infrastructure/
[74] http://pubstaff.s3.amazonaws.com/s3fs-public/documents/files/natural-gas-service-areas.pdf; http://www.ncuc.commerce.state.nc.us/overview/overview.pdf
[75] U.S. Census, American FactFinder, Rockingham County and North Carolina, https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_16_5YR_DP04&prodType=table

Figure 24 - Primary Household Heating Fuel in Rockingham County, 2016



Natural gas is also important to retaining existing manufacturers and attracting new manufacturers to the county. Our interviews and analysis identified that manufacturers value abundant and reliable gas service and that access to natural gas is a primary criterion for determining where to locate new manufacturing facilities. Thus, enhanced natural gas access via the MVP Southgate project could provide an additional incentive for companies considering opening or relocating manufacturing operations to the city.

EXPERTS WITH IMPACT™

About FTI Consulting

FTI Consulting, Inc. is a global business advisory firm dedicated to helping organizations protect and enhance enterprise value in an increasingly complex legal, regulatory and economic environment. FTI Consulting professionals, who are located in all major business centers throughout the world, work closely with clients to anticipate, illuminate and overcome complex business challenges in areas such as investigations, litigation, mergers and acquisitions, regulatory issues, reputation management and restructuring.

www.fticonsulting.com

Attachment F

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 6 – Geology

Appendix 6-C

Geotechnical Investigation Reports [Privileged Information- Provided Under Separate Cover]

January 2019

Attachment G

MVP Southgate Project

Docket No. CP19-14-000

Resource Report 9 –
Air and Noise

Appendix 9-C
Virginia Air Permit Application

January 2019

625 Liberty Avenue, Suite 1700 | Pittsburgh, PA 15222
833-MV-SOUTH | mail@mvpsouthgate.com
www.mvpsouthgate.com

Mr. Paul Jenkins
Regional Air Permit Manager
Virginia DEQ – Blue Ridge Regional Office
3019 Peters Creek Road
Roanoke, VA 24179

November 8, 2018

Re: MVP Southgate Project – Lambert Compressor Station
Minor New Source Article 6 Air Permit Application

Dear Mr. Jenkins,

Please find attached a Minor New Source Article 6 Air Permit Application for the MVP Southgate Project ("Project") in Pittsylvania County, Virginia. As you are aware, Mountain Valley Pipeline, LLC ("Mountain Valley") is seeking a Certificate of Public Convenience and Necessity from the Federal Energy Regulatory Commission pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project ("Project"). The Project will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina. Mountain Valley proposes to construct approximately a 0.4-mile-long 24-inch-diameter pipeline (H-605) and 73 miles of 24- and 16-inch-diameter natural gas pipeline (H-650) to provide timely, cost-effective access to new natural gas supplies to meet the growing needs of natural gas users in the southeastern United States.

In addition to the pipeline, Mountain Valley proposes to construct and operate a new compressor station (Lambert Compressor Station) near the beginning of the pipeline at milepost 0.0. As part of the Southgate Project and in order to boost pressures on Mountain Valley's transmission pipeline system, Mountain Valley is proposing to construct and operate one Solar Taurus 70 compressor turbine (11,792 hp) and one Solar Mars 100 compressor turbine (17,123 hp) at the Lambert Compressor Station.

At the federal level, because the emission increases from the Lambert Compressor Station equipment are less than applicable major source thresholds, Mountain Valley Pipeline will not trigger federal New Source Review (NSR) requirements for any regulated air pollutant under the Prevention of Significant Deterioration (PSD) permitting program. At the state level, the Project triggers air permitting through the VADEQ as a minor source of air emissions.

Please note that the local governing body certification form has been provided to the Pittsylvania County officials and Mountain Valley is anticipating a response within the 45-day statutory time period. Mountain Valley understands that the local government officials are required to respond in writing within 45 days of receipt of the certification form or the certification requirement will be deemed as met.

We look forward to working with you and your staff on this project. If you have any questions or comments regarding the information provided in the attached Article 6 air permit application, or need additional information, please do not to hesitate to contact me (561-691-2808; matthew.raffenberg@nee.com) or Christina Akly (561-691-7065; christina.akly@nee.com).

Regards,

Matthew Raffenberg
Senior Director, Environmental Services

CC: Mike Kiss, VADEQ – Central Office
Anita Walthall, VADEQ – Blue Ridge Regional Office
Tamera Thompson, VADEQ – Central Office
Alex Miller, NextEra Energy, Inc
Kristin Ryan, EQM Midstream Partners, LP
Darin Ometz, TRC

MVP SOUTHGATE

Mountain Valley Pipeline, LLC
Lambert Compressor Station
Southgate Project
Article 6 Air Permit Application

Prepared for:

Mountain Valley Pipeline, LLC

Prepared by:

TRC Environmental Corporation
1200 Wall Street West, 5th Floor
Lyndhurst, New Jersey 07071

November 2018

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Project Overview

Mountain Valley Pipeline, LLC ("Mountain Valley") is seeking a Certificate of Public Convenience and Necessity ("Certificate") from the Federal Energy Regulatory Commission ("FERC") pursuant to Section 7(c) of the Natural Gas Act to construct and operate the MVP Southgate Project ("Project"). The Project will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina. Mountain Valley proposes to construct approximately a 0.4-mile-long 24-inch-diameter pipeline (H-605) and 73 miles of 24- and 16-inch-diameter natural gas pipeline (H-650) to provide timely, cost-effective access to new natural gas supplies to meet the growing needs of natural gas users in the southeastern United States ("U.S."), including for the Project's anchor shipper, a local distribution company serving customers in North Carolina.

The proposed pipeline will interconnect with and receive gas from the existing Mountain Valley Pipeline near Chatham, Virginia, and deliver to or receive gas from the East Tennessee Natural Gas, LLC mainline near Eden, North Carolina, and will deliver gas to connections with customers' existing facilities in Eden and Graham, North Carolina. The Project is a stand-alone project from the Mountain Valley Pipeline and has an expected in-service date of late 2020.

In addition to the proposed pipeline, Mountain Valley proposes to construct and operate a new compressor station (Lambert Compressor Station) near the beginning of the pipeline at milepost 0.0. As part of the Southgate Project and in order to boost pressures on Mountain Valley's transmission pipeline system, Mountain Valley is proposing to construct and operate one Solar Taurus 70 compressor turbine (11,792 hp) and one Solar Mars 100 compressor turbine (17,123 hp) at the Lambert Compressor Station. The Lambert Compressor Station (CS) will be a new natural gas transmission facility covered by Standard Industrial Classification (SIC) 4922. Ancillary project emission sources include five (5) Capstone microturbines rated at 200 kW each, one (1) 0.77 MMBtu/hr natural gas fired heater, and two (2) 10,000 gallon produced fluids tanks.

1.2 Application Summary

The Lambert Compressor Station (Project or Lambert Station) is a proposed minor stationary source (as defined under the Prevention of Significant Deterioration of Air

Quality (PSD) and Title V rules) located in Pittsylvania County, Virginia. As demonstrated in Section 3 of this application, the proposed project is not subject to major source air permitting requirements.

The Project will be located near the town of Chatham, Pittsylvania County, Virginia, which is part of the Central Virginia Interstate Air Quality Control Region (AQCR) in Virginia. Pittsylvania County is considered attainment or unclassifiable for all criteria pollutants.

The air quality regulations for the Commonwealth of Virginia are codified in Title 9 of the Virginia Administrative Code (9 VAC) Agency 5, State Air Pollution Control Board. The proposed project involves the installation of new emission units and will be considered a minor source with respect to New Source Review (NSR) permitting requirements at 9 VAC 5-80-1100 and Title V major source permitting requirements at 9 VAC-5-80-50. This Article 6 Air Permit Application package per 9 VAC 5-80-1100 is designed to address the air regulatory requirements of Virginia Department of Environmental Quality (VADEQ). As such, Mountain Valley is submitting an initial minor source State Facility air permit application for the new Lambert Compressor Station. The new Solar Taurus 70 and Mars 100 combustion turbines will be subject to 40 CFR 60 Subpart KKKK, New Source Performance Standards for Stationary Gas Turbines as well as the applicable state regulations as outlined in Section 3 of this application.

Appendix A of this Article 6 Air Permit application contains the VADEQ Form 7 application forms. Emission calculation spreadsheets providing supporting calculations for the application forms are included as Appendix B of this application. Appendix C contains the electronic air quality modeling files.

2.0 PROJECT DESCRIPTION

2.1 Site Location and Surroundings

The proposed Lambert Compressor Station, as shown in Figure 2-1, is proposed to be located on an undeveloped parcel of land in a rural area near to Chatham, Virginia. The Lambert Compressor Station will be constructed at the beginning of the pipeline at milepost 0.0 in Pittsylvania County, Virginia on a parcel of land owned by Mountain Valley.

The approximate Universal Transverse Mercator (UTM) coordinates of the facility are: 647,900 meters east and 4,076,900 meters north in Zone 17 (North American Datum of 1983(NAD83)). A detailed plot plan of the proposed facility is shown in Figure 2-2.

2.2 Facility Conceptual Design

As a part of the Southgate Project, Mountain Valley is proposing to install the following equipment at the Lambert Compressor Station:

- One Solar Taurus 70, 11,792 hp natural gas fired turbine-driven compressor unit;
- One Solar Mars 100, 17,123 hp natural gas fired turbine-driven compressor unit;
- Five (5) Capstone Microturbines each rated at 200 kW;
- One 0.77 MMBtu/hr heater; and
- Two 10,000 gallon produced fluids storage tanks.

Potential Project emissions include trivial station blowdowns consisting of two types of gas blowdown events that could occur at the Station: (1) a type of maintenance gas blowdown that could occur when a compressor is stopped and gas between the suction/discharge valves and compressors is vented to the atmosphere via a blowdown vent, and (2) an emergency full station shutdown (ESD) that would only occur infrequently at required U.S. Department of Transportation (DOT) test intervals or in an emergency situation.

The installation of the above equipment will include a number of piping components at the station which could result in additional fugitive emissions due to equipment leaks.

Mountain Valley has provided fugitive emissions estimates for VOC and greenhouse gas (GHG) emissions. Estimates of fugitive emissions are required to be included for Title V applicability assessments, per 9VAC5-80-90. Typical sources of fugitive emissions from

natural gas compressor stations include leaks from piping components (valves, flanges, connectors and open-ended lines) as well as potential gas release events.

2.2.1 Compressor Turbines

The proposed Solar Taurus 70 and Mars 100 natural gas-fired turbines to be installed at the Lambert Compressor Station will be equipped with Solar's SoLoNOx dry low NOx combustor technology for NOx control. Potential emissions for the Solar Turbines conservatively assume that the units will operate up to 8,760 hours per year and up to 100% rated output. The vendor provided emission rates for normal operating conditions are as follows (all emissions rates are in terms of parts per million dry volume (ppmvd) @ 15% O2):

- 15 ppmvd NOx;
- 25 ppmvd CO;
- 25 ppmvd unburned hydrocarbons (UHC); and
- 5 ppmvd VOC.

Depending upon demand, the turbines may operate at loads ranging from 50% to 100% of full capacity. Because of the different emission rates and exhaust characteristics that occur at different loads and ambient temperatures, a matrix of operating modes is presented in this air permit application. Emission parameters for three turbine loads (50%, 75%, and 100%) and six ambient temperatures (0°F, 20°F, 40°F, 60°F, 80 °F, and 100°F) are accounted for in this air permit application to cover the range of steady-state turbine operations.

At very low load and cold temperature extremes, the turbine system must be controlled differently in order to assure stable operation. The required adjustments to the turbine controls at these conditions cause emissions of NOx, CO and VOC to increase (emission rates of other pollutants are unchanged). Low-load operation (non-normal SoLoNOx operation) of the turbines is expected to occur only during periods of startup and shutdown and for maintenance or unforeseen emergency events. Solar has provided emissions estimates during start-up and shutdown and low load operation (see Solar Product Information Letter (PIL) 170, included as part of the vendor attachments in Appendix B).

Similarly, Solar has provided emission estimates for low temperature operation (inlet combustion air temperature less than 0° F and greater than -20° F) in Solar PIL 167 (SoLoNOx Products: Emissions in Non-SoLoNOx Modes). Solar PIL 167 provides estimated pre-control emissions from the turbines at low temperature conditions.

- 120 ppmvd NOx;
- 150 ppmvd CO;
- 50 ppmvd unburned hydrocarbons (UHC); and
- 10 ppmvd VOC.

Mountain Valley reviewed historic meteorological data from the previous five years for the region to estimate the worst case number of hours per year under sub-zero (less than 0° F) conditions. Based on that review, the annual hours of operation during sub-zero conditions was assumed to be not more than 24 hours per year.

Turbine emission rates during start-up and shutdown events increase for CO and VOC as compared to operating above 50% load. The start-up process for the Solar Taurus 70 and Mars 100 turbines takes approximately 10 minutes from the initiation of start-up to normal operation (equal to or greater than 50% load). Shutdown takes approximately 10 minutes. Mountain Valley has estimated there would be 52 start-up/shutdown events per year. Emissions per start-up and shutdown event for the turbine were estimated based on Table 3 from the Solar PIL 170 entitled "Emission Estimates at Start-up, Shutdown, and Commissioning for SoLoNOx Combustion Products". Appendix B contains these per-event emission calculations for start-up and shutdown and the associated Solar PIL 170.

2.2.2 Ancillary Equipment

Mountain Valley is proposing to install five (5) new natural gas fired Capstone C200 (200 kW) microturbines to provide electrical power to the Station. Maximum hourly and annual emission rates for the microturbines are provided in Appendix B. Emissions of NOx, CO, and VOC are based on vendor data. Emission rates for SO_2, particulates, and hazardous air pollutants (HAPs) are based on USEPA AP-42 emission factors (Table 3.1-2a). GHG emissions are based on 40 CFR Part 98 Tables A-1, C-1, and C-2. The emission rates are based on the microturbines operating at peak load.

Mountain Valley is also proposing to install one new 0.77 MMBtu/hr (heat input) heater. Appendix B provides information on the emission factors used to calculate emissions from the heater.

2.3 Fuel

The Lambert Station will utilize pipeline natural gas as the sole fuel for all proposed equipment. The natural gas is assumed to have a higher heating value (HHV) of

approximately 1,100 Btu/standard cubic foot (SCF) and will contain no more than 2.0 grains of sulfur per 100 SCF of gas on an annual average basis.

2.4 Fugitive Emissions and Tanks

Fugitive emissions are defined as those emissions which do not pass through a stack, vent, or other functionally equivalent opening, and include natural gas leaks from valves, flanges, pumps, compressors, seals, connections, etc. Vented emissions are defined as those emissions which pass through a stack, vent, or equivalent opening. A compressor may be vented for startup, shutdown, maintenance, or for protection of gas seals from contamination. An individual compressor or the entire station may be blown down (i.e., vented) for testing, or in the event of an emergency.

Fugitive emissions at natural gas compressor stations include leaks from piping components (valves, flanges, connectors and open-ended lines) as well as potential gas release events. The vast majority of gas release events are associated with startup, shutdown, or maintenance activities. Mountain Valley has provided fugitive emissions estimates for VOC and greenhouse gas (GHG) emissions in Appendix B.

Proposed tanks at the Lambert Station may have associated emissions, such as the flashing losses that occur when the pressure of a liquid is decreased or the temperature is increased. At the Lambert Station, flashing losses will occur at the 10,000 gallon produced fluids storage tanks and include VOCs and GHGs as provided in Appendix B.

2.5 Proposed Project Emission Potential

Table 2-1 presents project emission potentials from the new units to be installed as a part of the proposed Lambert Compressor Station. For new emission units, project emission potential is equal to potential to emit. Detailed emission calculations and supporting vendor data can be found in Appendix B of this permit application.

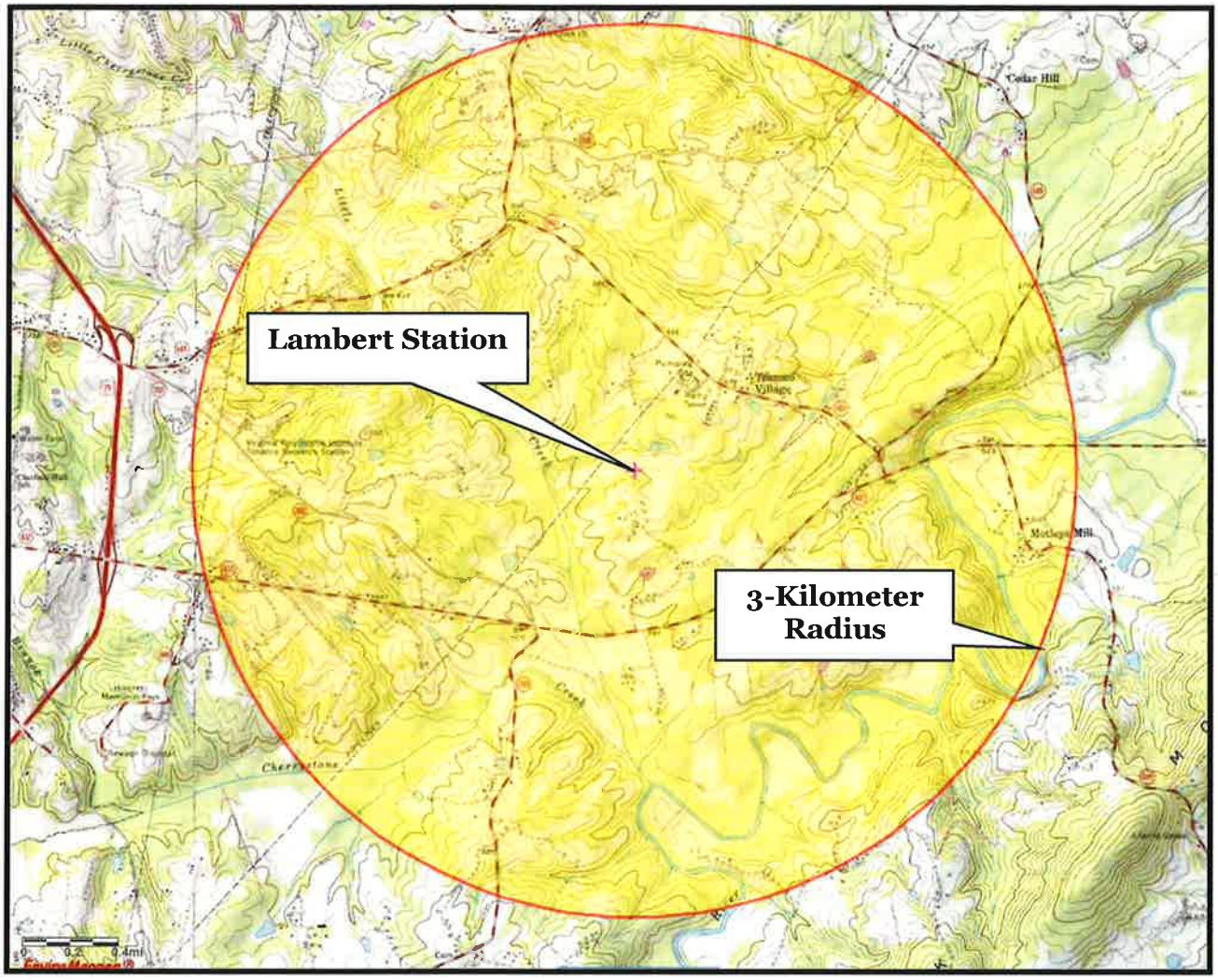
Table 2-1: Proposed Facility Emissions

Pollutant	Solar Taurus 70 Turbine	Solar Mars 100 Turbine	Capstone Microturbines	Heater	Produced Fluids Tanks	Station Blowdowns	Station Fugitives	Proposed Project Total
NO_X	21.81	31.66	1.81	0.31	-	-	-	55.58
VOC	3.16	3.85	0.44	0.02	0.43	0.46	0.72	9.07
CO	25.85	35.18	4.79	0.26	-	-	-	66.08
SO_2	2.07	3.00	0.17	0.018	-	-	-	5.25
$PM_{10}/PM_{2.5}$	5.96	8.65	0.33	0.02	-	-	-	14.96
CO_2e[1]	46,466	67,463	5,847	395	4.2	1,109	1,740	124,024
HAPs	1.26	1.90	0.21	0.01	-	0.05	0.03	3.46
Maximum Individual HAP[2]	0.87	1.31	0.15	0.00025	-	-	-	2.33

(1) Greenhouse gases calculated as CO_2e.

(2) The individual HAP with the highest total annual emission rate is formaldehyde.

(3) Emissions are in units of tons per year.

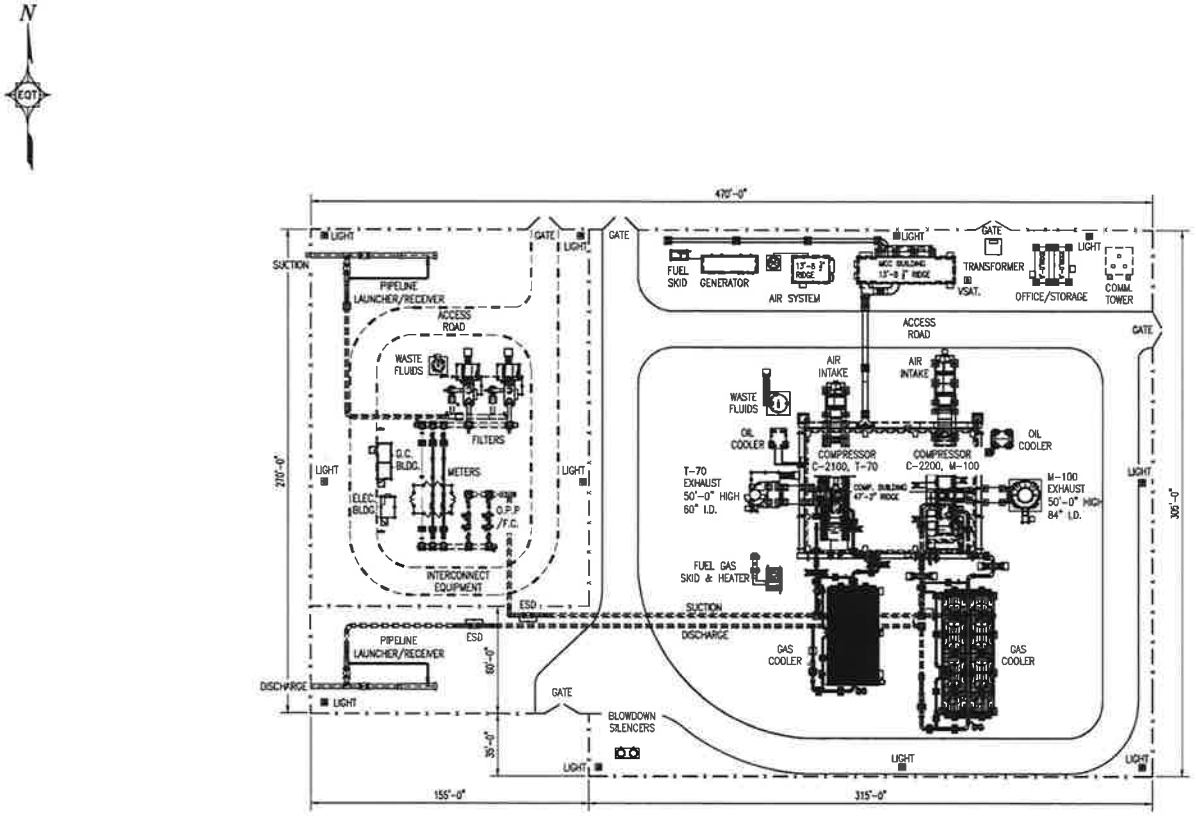


Mountain Valley Pipeline, LLC
Lambert Compressor Station
Pittsylvania County, Virginia

Figure 2-1. Site Location Map

Source: USGS, USEPA EJSCREEN

Figure 2-2: Facility Plot Plan



REFERENCE DRAWINGS		NO.	DATE	REVISION	BY	CHK	APPD	NO.	DATE	REVISION	BY	CHK	APPD
DRAWING NUMBER	DRAWING TITLE	P	8-14-2018	PRELIMINARY									
		P	10-09-2018	PRELIMINARY									
		P	10-10-2018	PRELIMINARY									

TO THE BEST OF MY KNOWLEDGE, ALL COMPONENTS OF THIS DRAWING ARE DESIGNED IN ACCORDANCE WITH APPLICABLE GUIDELINES AND SPECIFICATIONS

DOUG MACE — MECHANICAL DESIGN ENGINEER — 8-14-2018 — DATE

ELECTRICAL DESIGN ENGINEER — DATE

NOTE: ANY CHANGES TO THE DESIGN SHOWN ON THIS DRAWING MUST BE APPROVED BY THE DESIGN ENGINEER.

Mountain Valley Pipeline

PROJECT #: ######

DRAWING SCALE: 1/32" = 1'-0"

DRAWING TITLE: LAMBERT COMPRESSOR STATION MECHANICAL PIPING PLOT PLAN

FACILITY	STATE	IDENTIFICATION	SERIES	SHEET	REVISION
C	V	LAM	1100	01	P

Plotted by: Hess, Dwayne October 10, 2018 - 2:43 PM

File Path: C:\Working\PROJECTS\SOUTHGATE\PLOT PLANS\Lambert CS 10-10-2018 DWG.DWG

3.0 APPLICABLE REQUIREMENTS AND REQUIRED ANALYSES

This section contains an analysis of the applicability of federal and state air quality regulations to the proposed Project. The specific regulations included in this applicability review are the Federal New Source Performance Standards (NSPS), Prevention of Significant Deterioration (PSD) and New Source Review (NSR) requirements, Maximum Achievable Control Technology (MACT) requirements for HAPs, and VADEQ Regulations and Policy.

3.1 Federal New Source Performance Standards

The 40 CFR 60 NSPS are technology-based standards that apply to new, modified, and reconstructed stationary sources. The 40 CFR 60 NSPS requirements have been established for approximately 70 source categories. The proposed Project is subject to the following three subparts: General Provisions (40 CFR Part 60, Subpart A), Standards of Performance for Stationary Combustion Turbines (40 CFR Part 60, Subpart KKKK), and the Standards of Performance for Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources (40 CFR Part 60, Subpart OOOOa).

3.1.1 40 CFR Part 60, Subpart A – General Provisions

The new Solar Taurus 70 and Mars 100 turbines are subject to the general provisions for NSPS units in 40 CFR Part 60 Subpart A. These include the requirements for notification, record keeping, and performance testing contained in 40 CFR Parts 60.7 and 60.8.

3.1.2 40 CFR Part 60 Subpart Kb - Volatile Organic Liquid Storage Vessels

Subpart Kb potentially applies to storage vessels with a capacity greater than 75 cubic meters (m^3) (19,813 gallons) that will store volatile organic liquids. Tanks with a capacity greater than 75 m^3 are not proposed to be constructed, reconstructed, or modified at the Lambert Compressor Station. Therefore, this subpart will not apply.

3.1.3 40 CFR Part 60, Subpart KKKK – Stationary Combustion Turbines

On July 6, 2006, the USEPA promulgated Subpart KKKK to establish emission standards and compliance schedules for the control of emissions from new stationary combustion turbines that commence construction, modification, or reconstruction after

February 18, 2005. Note that stationary combustion turbines regulated under Subpart KKKK are exempt from Subpart GG requirements, which are applicable to units constructed, modified, or reconstructed prior to February 18, 2005.

Pursuant to 40 CFR 60.4305(a), the new Solar Taurus 70 and Mars 100 gas turbines are subject to requirements of 40 CFR 60 Subpart KKKK, because the heat input at peak load will be greater than or equal to 10 MMBtu/hr (HHV) and Mountain Valley will have commenced the construction or modification of the turbines after February 18, 2005. Pursuant to 40 CFR 60.4320(a) and Table 1 to Subpart KKKK of Part 60 – Nitrogen Oxide Emission Limits for New Stationary Combustion Turbines, the new gas turbines, which will have HHV heat inputs of between 50 and 850 MMBtu/hr, will comply with a NOx emission standard of 25 ppm at 15 percent O_2 or 1.2 lb/MWh useful output as indicated by the vendor guarantee of 15 ppm shown in Appendix B. Subpart KKKK also includes a NOx limit of 150 ppmvd at 15% O2 or 8.7 lb/MWh for turbine operation at temperatures less than 0°F and turbine operation at loads less than 75 % of peak load which the new turbine will meet as indicated by the vendor guarantee shown in Appendix B. The new turbines will not burn any fuel that has the potential to emit in excess of 0.060 lb/MMBtu SO_2 heat input, pursuant to 40 CFR 60.4330(a)(1) and (2), respectively.

3.1.4 40 CFR 60, Subparts OOOO and OOOOa – Crude Oil and Natural Gas Production, Transmission and Distribution

Subpart OOOO currently applies to affected facilities that commenced construction, reconstruction, or modification after August 23, 2011 and on or before September 18, 2015. The equipment at the proposed Lambert Compressor station will have a construction date after September 18, 2015, and therefore will not be subject to Subpart OOOO.

Oil and gas facilities constructed, modified or reconstructed after September 18, 2015, such as the proposed compressor station, are subject to the requirements under NSPS 60 Subpart OOOOa. Potential equipment at compressor stations regulated under Subpart OOOOa includes storage tanks, continuous bleed pneumatic controllers, pneumatic pumps, reciprocating and wet seal centrifugal compressors, and fugitive emission components. The Lambert compressor station will not include continuous bleed pneumatic controllers, pneumatic pumps or reciprocating or wet seal centrifugal compressors. The storage vessels that will be located at the facility have the potential for VOC emissions equal to or greater than 6 tons per year, so they are not subject to this subpart. Fugitive emissions components at the facility will be subject to Subpart

OOOOa. For equipment leaks, Subpart OOOOa requires periodic surveys using optical gas imaging (OGI) tcchnology and subsequent repair of any identified leaks. The project will comply with all applicable leak detection and repair provisions of Subpart OOOOa.

3.2 Prevention of Significant Deterioration (PSD)

Preconstruction air permitting programs that regulate the construction of new stationary sources of air pollution and the modification of existing stationary sources are commonly referred to as NSR. NSR can be divided into major NSR and minor NSR. Major NSR is comprised of the PSD program. Major NSR requirements are established on a federal level but may be implemented by state or local permitting authorities under either a delegation agreement with USEPA or as a state implementation plan (SIP) program approved by USEPA.

The Lambert Compressor Station is not classified as one of the 28 named source categories listed in Section 169 of the Clean Air Act. Therefore, to be considered a "major stationary source" subject to PSD, the facility would need to have potential emissions of 250 tons per year or more of any regulated pollutant (except CO_2). The final PSD and Title V GHG Tailoring Rule was published in the Federal Register on June 3, 2010 (75 FR 31514) but was ultimately overturned on June 23, 2014 by the US Supreme Court. Under the formerly effective rule, GHGs could, as of July 1, 2011, become "subject to regulation" under the PSD program for construction projects that would result in potential GHG emissions of 100,000 tons per year (tpy) carbon dioxide equivalents (CO2e) or more. However, the June 23, 2014 Supreme Court Decision clarifies that construction projects cannot trigger major NSR for GHGs unless major NSR is otherwise triggered for any other criteria pollutants.

As shown in Table 3-1, the proposed Lambert Compressor Station is a minor stationary source with respect to NSR as all pollutants with the exception of CO2e are below the PSD source thresholds. Therefore, the Project is not subject to PSD requirements.

Table 3-1: PSD/NNSR Applicability Assessment

Pollutant	PSD/NNSR Major Source Threshold (tons/year)	Total Facility Emissions (tons/year)	Emissions Exceed PSD/NNSR Major Source Threshold
Carbon Monoxide (CO)	250	66.08	No
Sulfur Dioxide (SO2)	250	5.25	No
TSP	250	14.96	No
PM10	250	14.96	No
PM2.5	250	14.96	No
Nitrogen Oxides (NOx)	250	55.58	No
VOC	250	9.07	No
Greenhouse Gases (CO2e)	100,000	124,024	Yes
Total HAP	25	3.46	No
Individual HAP - Formaldehyde	10	2.33	No

3.3 Title V Operating Permit and State Preconstruction and Operating Permit Programs

The Title V permit program in 40 CFR Part 70 requires major sources of air pollutants to obtain federal operating permits. The major source thresholds under the Title V program, as defined in 40 CFR 70.2 and which are different from the federal NSR major source thresholds, are 100 tpy of any air pollutant, 10 tpy of any single hazardous air pollutant (HAP), or 25 tpy of total HAPs.

Virginia's Title V Operating Permit Program is administered through a USEPA-approved program at 9 VAC-5-80. The Lambert Compressor Station will have two Solar turbines with heat inputs greater than 50 MMBtu/hr and as a such, is required to obtain a State Article 6 Construction Air Permit per 9 VAC 5-80-1100. Emission sources or activities listed under 9VAC5-80-1105 are exempt from the registration and permitting provisions of 9 VAC 5-80-1100.

As shown in Table 3-1, potential emissions of all regulated pollutants are below the Title V major source thresholds. As such, the facility is not subject to Title V permitting requirements for these pollutants and is required to obtain a State Article 6 Air Permit per 9 VAC 5-80-1100. The VADEQ issues minor NSR permits to sources whose uncontrolled emission rate for a regulated criteria pollutant is above exemption thresholds and permitting allowable emissions are below Title V thresholds and issued to sources whose potential to emit for a toxic pollutant is above state toxic exemption thresholds and permitting allowable emissions are below Title V thresholds.

The uncontrolled emission rates from the Lambert Compressor Station are below the major source thresholds and above the VADEQ exemption thresholds. Thus, the Project

will be permitted as a true minor source (i.e., not a synthetic minor source) with a State Article 6 Construction Permit.

3.4 National Emission Standards for Hazardous Air Pollutants

The USEPA has established National Emission Standards for Hazardous Air Pollutants (NESHAP) for specific pollutants and industries in 40 CFR Part 61. The Project does not include any of the specific sources for which NESHAP have been established in Part 61. Therefore, Part 61 NESHAP requirements will not apply to the Project. The USEPA has also established NESHAP requirements in 40 CFR Part 63 for various source categories. The Part 63 NESHAP apply to certain emission units at facilities that are major sources of HAP. The applicability to the Project of several NESHAP rules is discussed below.

3.4.1 40 CFR Part 63 Subpart HHH (National Emission Standards for Hazardous Air Pollutants from Natural Gas Transmission and Storage Facilities)

Subpart HHH applies to natural gas transmission and storage facilities that are major sources of HAPs and that transport or store natural gas prior to entering the pipeline to a local distribution company or to a final end user (if there is no local distribution company). The Lambert Station is an area (minor) source (i.e., not major source) of HAPs. Therefore, this subpart will not apply because it only applies to major sources of HAPs.

3.4.2 40 CFR Part 63 Subpart YYYY (National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines)

Subpart YYYY applies to stationary combustion turbines at major sources of HAPs. Emissions and operating limitations under Subpart YYYY apply to new and reconstructed stationary combustion turbine. The Lambert Station is an area source (i.e., not major source) of HAPs. Therefore, this subpart will not apply because it only applies to major sources of HAPs.

3.4.3 40 CFR Part 63 Subpart DDDDD (National Emission Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

Subpart DDDDD applies to certain new and existing boilers and process heaters at major HAP sources. The Lambert Station is an area source (i.e., not major source) of

HAPs. Therefore, this subpart will not apply because it only applies to major sources of HAPs. The area source regulation for boilers, Subpart JJJJJJ, exempts all process heaters and also exempts boilers that are natural gas-fired. The proposed heater at the site will be only fired with natural gas, so it is therefore exempted from the area source NESHAP under subpart JJJJJJ.

3.5 Greenhouse Gas Reporting Rule

Per 40 CFR 98.2(a)(2), facilities that contain a source category listed in Table A-4 and emit 25,000 metric tons or more per year of carbon dioxide equivalent ("CO2e") in combined emissions from stationary fuel combustion units, miscellaneous uses of carbonate, and all applicable source categories in Tables A-3 and A-4 are subject to reporting under the Greenhouse Gas Mandatory Reporting Rule ("MRR"). Table A-4 of 40 CFR 98 Subpart A includes Petroleum and Natural Gas Systems. Greenhouse gas emissions from the compressor station are over 25,000 metric tpy on a potential basis. The actual emissions will be calculated annually following subpart W applicability and calculation methodology and compared with the 25,000 metric tpy of CO2 to address the applicability of the rule. The Project will meet all requirements of the MRR for the new compressor station, as applicable. No other subparts under the MRR are applicable to the compressor station.

3.6 Virginia Regulations

The air quality regulations for the Commonwealth of Virginia are codified in Title 9 of the Virginia Administrative Code (9 VAC) Agency 5, State Air Pollution Control Board. Potentially applicable regulations are identified below:

- 9 VAC 5-30 "Ambient Air Quality Standards" are required to assure that ambient concentrations of air pollutants are consistent with established criteria and shall serve as the basis for effective and reasonable management of the air resources of the Commonwealth of Virginia. An air quality analysis utilizing dispersion modeling was conducted to demonstrate compliance with the NAAQS as discussed in Section 5.0.
- 9 VAC 5-50-260 "Best Available Control Technology (BACT)" is a requirement to reduce emissions through the use of available reduction techniques (i.e., control devices, adjustments to prevent pollution formation, work practices, etc.). This requirement considers whether or not the emission reduction is BACT using various factors including the cost effectiveness of the control system. BACT review is relative to a specific pollutant and a specific type of operation. Generally, for BACT, minor sources in Virginia undergo a review to compare the relative level of control with other similar Virginia sources.

BACT applicability is determined pollutant-by-pollutant, based on the corresponding permit applicability thresholds. For a new stationary source, BACT shall apply for each pollutant with an increase in the uncontrolled emission rate equal to or greater than the levels in 9VAC 5-80-1105C. Each affected emissions unit emitting a pollutant that is subject to permitting shall apply BACT for that pollutant (9VAC5-50-260B). For the proposed Lambert Compressor Station as shown in Table 4-1, BACT is applicable for NOx and PM2.5. A BACT analysis is provided in Section 4.0.

- 9 VAC 5-60 "State Toxics Rule" contains the emissions standards for toxic air pollutants from new and modified sources. Emissions of toxic air pollutants discharged into the atmosphere from any affected facility may not cause, or contribute to, the endangerment of human health. Facilities that have a potential to emit toxic air pollutants in quantities that endanger human health are required to employ BACT for the control of toxic air pollutants. The Project emissions of toxic air pollutants were compared to the exemption thresholds contained in 9VAC5-60-300C. The only toxic air pollutant that is potentially emitted above the exemption thresholds is formaldehyde. The ambient air quality modeling analysis in Section 5 demonstrates that the Project will not cause, or contribute to, any significant ambient air concentration that may cause, or contribute to, the endangerment of human health.

4.0 BEST AVAILABLE CONTROL TECHNOLOGY REVIEW

Consistent with Virginia's June 12, 2015 memo APG-354; Permitting and BACT Applicability under Chapter 80 Article 6 (VADEQ, 2015), Mountain Valley has reviewed the proposed sources to determine applicability of BACT review. Per 9 VAC 5-80-1005C, new stationary sources with uncontrolled emission rates less than all of the emission rates specified shall be exempt from the provisions of Chapter 80 Article 6. The uncontrolled emission rate of a new stationary source is the sum of the uncontrolled emission rates of the individual affected emission units. A summary of the VADEQ procedure is provided below:

Step 1: List all of the emission units at the new stationary source.

Step 2: Delete from the list developed in Step 1, any emission units that are individually exempt under 9 VAC 5-80-105B.

Step 3: Calculate the annual uncontrolled emission rate (UER) for each regulated pollutant listed in 9 VAC 5-80-1105C for each of the affected emissions units. Include fugitive emissions unless all of the emissions at the new stationary source are fugitive.

Step 4: Sum the annual UER from the affected emission units and compare the result with the exempt emission rates listed in 9 VAC 5-80-1105C.

A new stationary source is required to apply BACT for each regulated pollutant for which there would be an UER equal to or greater than the exemption levels in 9 VAC 5-80-1105C. Mountain Valley conducted a BACT analysis for the Lambert Compressor Station as shown below.

Step 1 – Emission Units

Mountain Valley seeks the authority to construct and operate several new emission sources as shown below:

- One Solar Taurus 70, 11,792 hp natural gas fired turbine-driven compressor unit;
- One Solar Mars 100, 17,123 hp natural gas fired turbine-driven compressor unit;
- Five (5) Capstone Microturbines each rated at 200 kW;
- One 0.77 MMBtu/hr heater; and
- Two 10,000 gallon produced fluids storage tanks.

Potential Project emissions also include trivial station blowdowns and fugitive emissions as detailed in Appendix B. The fugitive emissions at natural gas compressor stations

include leaks from piping components (valves, flanges, connectors and open-ended lines).

Step 2 – Individually Exempt Equipment

The emission units exempted under 9 VAC 5-80-1105B are listed below:

- One 0.77 MMBtu/hr heater – exempt as a combustion source < 50 MMBtu/hr; and
- Two 10,000 gallon produced fluids storage tanks – exempt as storage tanks < 40,000 gallons.

Step 3 – Annual UER Increase

The Uncontrolled Emission Rate (UER) for each new stationary source is summarized in Table 4-1 below.

Table 4-1: BACT Exemption Analysis

Pollutant	Solar Taurus 70 Turbine	Solar Mars 100 Turbine	Capstone Micro-turbines	Station Blowdowns	Station Fugitives	Proposed Project Total	BACT Exemption Levels	Triggers BACT?
NO_X	21.81	31.66	1.81	-	-	55.28	40	Yes
VOC	3.16	3.85	0.44	0.46	0.72	8.63	25	No
CO	25.85	35.18	4.79	-	-	65.82	100	No
SO_2	2.07	3.00	0.17	-	-	5.25	40	No
PM	5.96	8.65	0.33	-	-	14.94	25	No
PM_{10}	5.96	8.65	0.33	-	-	14.94	15	No
$PM_{2.5}$	5.96	8.65	0.33	-	-	14.94	10	Yes
Note: Emissions are in units of tons per year.								

Step 4 –UER Increases vs. Exempt Emission Rates

As shown in Table 4-1, the total UER for $PM_{2.5}$ and NO_x exceed the BACT exemption threshold values and thus, are subject to BACT review. Thus, Mountain Valley

conducted a BACT analysis for the $PM_{2.5}$ and NO_x emissions from the Solar Taurus 70 turbine, Solar Mars 100 turbine, and five Capstone microturbines.

4.1 Approach used in BACT Analysis

The BACT analysis for the proposed Project was conducted consistent with the USEPA's five step "top-down" BACT process as discussed in the USEPA's October 1990 draft New Source Review Workshop Manual. This methodology results in the selection of the most stringent control technology in consideration of the technical feasibility and the energy, environmental, and economic impacts. Control options are first identified for each pollutant subject to BACT and evaluated for their technical feasibility. Options found to be technically feasible are ranked in order of their effectiveness and then evaluated for their energy, economic, and environmental impacts. In the event that the most stringent control identified is selected, no further analysis of impacts is performed. If the most stringent control is ruled out based upon economic, energy, or environmental impacts, the next most stringent technology is similarly evaluated until BACT is determined.

The "top-down" procedure followed for each pollutant subject to BACT is outlined as follows:

Step 1: Identify available control options from review of agency permits for similar sources, literature review and contacts with air pollution control system vendors.

Step 2: Eliminate technically infeasible options - evaluation of each identified control to rule out those technologies that are not technically feasible (i.e., not available and applicable per USEPA guidance).

Step 3: Rank remaining control technologies - "Top-down" analysis, involving ranking of control technology effectiveness.

Step 4: Evaluate most effective controls and document results - Economic, energy, and environmental impact analyses are conducted if the "top" or most stringent control technology is not selected to determine if an option can be ruled out based on unreasonable economic, energy or environmental impacts.

Step 5: Select the BACT based upon the highest ranked option that cannot be eliminated, which includes development of an achievable emission limitation based on that technology.

4.2 BACT for Particulate Matter ($PM_{2.5}$)

The Solar Taurus 70, Solar Mars 100, and Capstone C200 combustion turbines are all sources of $PM_{2.5}$ emissions. The following provides the $PM_{2.5}$ BACT evaluation conducted for the Lambert Compressor Station.

Step 1 – Identify Potential Control Technologies

The major sources of $PM_{2.5}$ emissions from the gaseous fuel-fired combustion turbines are:

- The conversion of any fuel sulfur to sulfates and ammonium sulfates; and
- Unburned hydrocarbons that can lead to the formation of PM in the exhaust stack.

Pre-Combustion Control Technologies

Pre-combustion technologies that minimize the formation of $PM_{2.5}$ include:

- Use of clean-burning, low-sulfur gaseous fuels
- Good combustion practices.

The use of clean-burning, low-sulfur gaseous fuels will result in minimal formation of $PM_{2.5}$ during combustion. Good combustion practices will ensure proper air/fuel mixing ratios to achieve complete combustion, which will minimize emissions of unburned hydrocarbons that can lead to the formation of $PM_{2.5}$ emissions.

Post-Combustion Control Technologies

There are several post-combustion PM control systems potentially feasible to reduce $PM_{2.5}$ emissions from the combustion turbine including:

- Cyclones/centrifugal collectors;
- Fabric filters/baghouses;
- Electrostatic precipitators (ESPs); and
- Scrubbers.

Cyclones/centrifugal collectors are generally used in industrial applications to control large diameter particles (>10 microns). Cyclones impart a centrifugal force on the gas stream, which directs entrained particles outward. Upon contact with an outer wall, the particles slide down the cyclone wall, and are collected at the bottom of the unit. The design of a centrifugal collector provides for a means of allowing the clean gas to exit

through the top of the device. However, cyclones are inefficient at removing small particles, such as $PM_{2.5}$.

Fabric filters/baghouses use a filter material to remove particles from a gas stream. The exhaust gas stream flows through filters/bags onto which particles are collected. Baghouses are typically employed for industrial applications to provide particulate emission control at relatively high efficiencies.

ESPs are used on a wide variety of industrial sources, including certain boilers. ESPs use electrical forces to move particles out of a flowing gas stream onto collector plates. The particles are given an electric charge by forcing them to pass through a region of gaseous ion flow called a "corona." An electrical field generated by electrodes at the center of the gas stream forces the charged particles to ESP's collecting plates.

Removal of the particles from the collecting plates is required to maintain sufficient surface area to clean the flowing gas stream. Removal must be performed in a manner to minimize re-entrainment of the collected particles. The particles are typically removed from the plates by "rapping" or knocking them loose, and collecting the fallen particles in a hopper below the plates.

Scrubber technology may also be employed to control PM in certain industrial applications. With wet scrubbers, flue gas passes through a water (or other solvent) stream, whereby particles in the gas stream are removed through inertial impaction and/or condensation of liquid droplets on the particles in the gas stream.

Step 2 - Eliminate Technically Infeasible Options

Pre-Combustion Control Technologies

The pre-combustion control technologies identified above (i.e., clean-burning, low-sulfur fuels and good combustion practices) are available and technically feasible for reducing $PM_{2.5}$ emissions from the combustion turbine exhaust streams.

Post-Combustion Control Technologies

Each of the post-combustion control technologies described above (i.e., cyclones, baghouses, ESPs, scrubbers) are generally available. However, none of these technologies are considered practical or technically feasible for installation on gaseous fuel-fired combustion turbines. Post combustion controls, such as baghouses, scrubbers and electrostatic precipitators are impractical due to the high pressure drops associated with these units, the large flue gas volumes, and the low concentrations of $PM_{2.5}$ present in the exhaust gas.

The particles emitted from gaseous fuel-fired combustion turbines are typically less than 1 micron in diameter. Cyclones are not effective on particles with diameters of 10 microns or less. Therefore, a cyclone/centrifugal collection device is not a technically feasible alternative.

Baghouses, ESPs, and scrubbers have not been applied to commercial combustion turbines burning gaseous fuels. Baghouses, ESPs, and scrubbers are typically used on solid or liquid-fuel fired sources with high PM emission concentrations, and are not used in gaseous fuel-fired applications, which have inherently low PM emission concentrations. None of these control technologies are appropriate for use on gaseous fuel-fired combustion turbines because of their very low PM emissions levels, and the small aerodynamic diameter of PM from gaseous fuel combustion. Therefore, the use of baghouses, ESPs, and scrubbers is not considered technically feasible.

Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The use of clean-burning fuels and good combustion practices are technically feasible technologies to control $PM_{2.5}$ emissions.

Step 4 - Evaluate Most Effective Controls and Document Results

Based on the information presented in this BACT analysis, using the proposed good combustion practices and natural gas fuel to control $PM_{2.5}$ emissions are considered BACT. This is consistent with BACT at other similar sources. Therefore, an assessment of the economic and environmental impacts is not necessary.

Step 5 – Select BACT

Mountain Valley's proposed BACT for $PM_{2.5}$ emissions from the combustion turbines is the use of clean-burning fuels and good combustion practices.

4.3 BACT For NOx

The Solar Taurus 70, Solar Mars 100, and Capstone C200 combustion turbines are all sources of NO_x emissions. The following provides the NO_x BACT evaluation conducted for the Lambert Compressor Station.

Step 1 – Identify Potential Control Technologies

The potentially applicable controls to reduce NO_x emissions from turbines include:

- Dry Low NO_x (DLN) Combustor Technology;
- Wet Controls - Water and Steam Injection;

- Selective Catalytic Reduction (SCR); and
- Selective Non-Catalytic Reduction (SNCR).

Dry Low NOx (DLN) Combustors

DLN combustion control techniques reduce NO_x emissions without the use of water or steam injection. Two DLN combustion designs are available: lean pre-mixed combustion and rich/quench/lean staged combustion. Historically, gas turbine combustors were designed for operation with a 1:1 stoichiometric ratio (equal ratio of fuel and air). However, with fuel lean combustion (sub-stoichiometric conditions), the additional excess air cools the flame and reduces the rate of thermal NO_x formation. With reduced residence time combustors, dilution air is added sooner than with standard combustors resulting in the combustion gases attaining a high temperature for a shorter time, thus reducing the rate of thermal NO_x formation. Pilot flames are used to maintain combustion stability to maintain the fuel-lean conditions.

Wet Controls - Water and Steam Injection

Water and steam injection directly into the flame area of the turbine combustor results in a lower flame temperature and reduces thermal NOx formation; however, fuel NOx formation is not reduced with this technique.

Selective Catalytic Reduction (SCR)

In the SCR process, ammonia (NH_3), usually diluted with air or steam, is injected through a grid system into the flue/exhaust gas stream upstream of a catalyst bed. The catalyst could be titanium dioxide, vanadium pentoxide or zeolite-based catalysts. On the catalyst surface, the NH_3 reacts with NO_x to form molecular nitrogen and water. Depending on system design and the inlet NO_x level, NO_x removal can vary. The reaction of NH_3 and NO_x is favored by the presence of excess oxygen. Another variable affecting NO_x reduction is exhaust gas temperature.

Selective Non-Catalytic Reduction (SNCR)

SNCR technology involves using ammonia or urea injection similar to SCR technology but at a much higher temperature window of 1,600°- 2,200°F. The operating temperature can be lowered from 1,600°F to 1,300°F by injecting readily oxidizable hydrogen with the ammonia. However, beyond the upper temperature limit, the ammonia is converted to NO_x, resulting in increased NOx emissions.

Step 2 - Eliminate Technically Infeasible Options

Dry Low NOx (DLN) Combustors

The proposed simple-cycle turbines are Solar turbines equipped with SoLoNOx dry low NOx combustors. SoLoNOx uses lean combustion control technology to ensure uniform air/fuel mixture and to minimize formation of regulated pollutants while maintaining the same power and heat rate as equivalent models with conventional combustion technology.

The proposed Capstone microturbines also use lean premix combustion technology. Lean-premix operation requires operating at a high air to fuel ratio within the primary combustion zone. The large amount of air is thoroughly mixed with the fuel before combustion. This premixing of the air and fuel enables clean combustion to occur at a relatively low temperature, which minimizes NO_x formation. Injectors control the air to fuel ratio and the air-fuel mixture in the primary zone to ensure that the optimal flame temperature is achieved for NOx minimization.

Accordingly, DLN combustion technology is considered technically feasible and considered further in this analysis.

Wet Controls - Water and Steam Injection

The water or steam injection rate is typically described on a mass basis by a water-to-fuel ratio (WFR) or steam-to-fuel ratio (SFR). Higher WFRs and SFRs translate to greater NOx reductions, but may also cause potential flameouts, increasing maintenance requirements and reducing turbine efficiency. During startup and shutdown events for the combustion turbines, introduction of water or steam injection into the DLN combustors would cause severe disruption to combustion dynamics and would likely result in damage to the combustion system and related components. Therefore, the use of water or steam injection will not be considered further in this BACT analysis for the turbines.

Selective Catalytic Reduction (SCR)

The SCR catalysts deteriorate quickly when continuously subjected to higher than optimal temperatures (i.e., 400°F and 1000°F) or under thermal cycling, which commonly occurs in turbines in gas compression service. In effect, if these catalyst systems are operated beyond their specified temperature ranges, oxidation of the ammonia to either additional nitrogen oxides or ammonium nitrate may result. Moreover, the variable load demands on turbines in gas compression services create significant operational complexities for use of SCRs.

Based on a review of USEPA's RACT/BACT/LAER Clearinghouse (RBLC) database, SCR systems have been installed on some simple cycle combustion turbines and are therefore considered technically feasible, and SCR is considered further in the BACT analysis for the Solar Turbines. The application of SCR systems on the Capstone microturbines is considered to be technically infeasible and thus, was removed from consideration.

Selective Non-Catalytic Reduction (SNCR)

The exhaust temperatures in gas turbines typically do not exceed 1,100°F. Therefore, the operative temperature window of this control alternative is not technically feasible for this application. Exhaust temperatures for the proposed Solar and Capstone gas turbines are approximately 900 °F and 500 °F, respectively. These operating temperatures are well below the range for SNCR applications.

Further, a review of the RBLC database for recent BACT/LAER determinations for this particular source category do not indicate that SNCR systems have been successfully installed for NOx control for similar simple cycle turbines. In view of the above limitations in utilizing SNCR control, this control alternative is not considered technically feasible and will be precluded from further consideration in this BACT determination.

Step 3 - Rank Remaining Control Technologies by Control Effectiveness

The control technologies, which have been demonstrated in commercial practice on turbines are:

- Dry Low NOx Combustor Technology, SoLoNOx Technology; and
- Selective Catalytic Reduction.

Step 4 - Evaluate Most Effective Controls and Document Results

Mountain Valley is proposing the use of DLN Combustor Technology for the Capstone microturbines and SoLoNOx Technology for the Solar turbines as BACT for NO_x control. For the types and designs of turbines proposed for this project, SCR is commonly disqualified from BACT through cost effectiveness calculations.

A detailed cost analysis is provided in Appendix B for the Solar Taurus 70 and Solar Mars 100 turbines. As can be seen, the cost effectiveness ranges from $21,100 to $25,700 per ton of NOx control. At these cost to control levels, the SCR technology is not cost effective for the Lambert Compressor Station.

Based upon a review of permits issued for compressor stations in Virginia, most turbines are uncontrolled (i.e., no add on controls such as SCR) with emission limits of 15 ppm for NOx. Recently, a draft air permit was issued by VADEQ for the Atlantic Coast Pipeline (ACP)– Buckingham Compressor Station, that includes SCR emission controls on Solar Taurus 70 and Mars 100 compressor turbines. Mountain Valley understands that air permits issued for the ACP compressor stations in West Virginia and North Carolina include SCR emissions control systems on similar Solar turbines to those proposed at the Lambert Compressor Station.

Based upon the air permit applications prepared by ACP for the Buckingham and Northampton Compressor Stations, SCR emissions controls were not proposed as BACT for NOx control. Similar to the cost-effectiveness ranges calculated for the Lambert Compressor Station for the application of SCR on the Solar Taurus 70 and Mars 100 turbines, ACP concluded that the cost effectiveness of SCR is between $56,000 and $74,000 per ton of NOx control for these compressor turbines. Thus, ACP concluded that "At these cost to control levels, the technology is not cost effective and should not be considered BACT." For the Buckingham Compressor Station in Virginia, ACP concluded that NOx BACT is SoLoNOx Technology and good combustion practices.

Thus, Mountain Valley understands that ACP made a business decision to voluntarily apply SCR controls on the Solar turbines at the Buckingham Compressor Station and other ACP compressor stations as opposed to applying SCR on the basis of a BACT requirement. A case by case business decision to voluntarily install pollution controls can be driven by issues such as the desire to avoid major source permit reviews, Title V permits and compliance requirements or to mitigate modeled air quality impacts. For example, the owner or operator of a compressor station could avoid major source NSR review by voluntarily installing SCR emission controls to reduce the potential NOx emission below major source thresholds, such that it could be permitted with a minor NSR air permit.

Provided the foregoing reasons, the application of SCR for NOx control is not considered BACT for the Lambert Compressor Station and is removed from consideration.

Step 5 – Select BACT

The proposed Lambert Compressor Station turbines will be equipped with DLN combustors. The vendor performance specifications for NOx emissions are 15 and 9 ppm for the Solar and Capstone turbine, respectively. Therefore, the use of DLN combustors and good combustion practices is considered BACT for reducing NOx emissions from the proposed Lambert Compressor Station turbines.

5.0 AIR QUALITY MODELING ANALYSIS

At the federal level, because the emission increases from the Lambert Compressor Station equipment are less than applicable major source thresholds, the Project will not trigger federal NSR requirements for any regulated air pollutant under either PSD or NNSR permitting programs. At the state level, the Project triggers air permitting through the VADEQ as a minor source of air emissions. If the agency considers that any project triggering minor NSR permitting could threaten attainment with the National Ambient Air Quality Standards (NAAQSs), VADEQ can require air dispersion modeling for the Project. A site wide modeling analysis for criteria pollutants has been performed to demonstrate that the Project will comply with the NAAQS. This section details the NAAQS and toxic air pollutant modeling assessments for the proposed Lambert Compressor Station.

5.1 Background Ambient Air Quality

Background ambient air quality data was obtained from various existing monitoring locations. Based on a review of the locations of Virginia and North Carolina ambient air quality monitoring sites, the closest representative monitoring sites were used to represent the current background air quality in the site area.

The monitoring data for the most recent three years (2015 – 2017) are presented and compared to the NAAQS in Table 5-1. The maximum measured concentrations for each of these pollutants during the last three years are all below applicable standards and are proposed to be used as representative background values for comparison of facility concentrations to the NAAQS.

Table 5-1: Maximum Measured Ambient Air Quality Concentrations

Pollutant	Averaging Period	Monitoring Station	AQS Site ID	County	State	Approx. Distance from Facility (km)	Background Concentration	Primary NAAQS	Units a/
CO	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	1.1	35	ppm
CO	8-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	0.7	9	ppm
NO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	33.3	100	ppb
NO_2	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	5.7	53	ppb
PM_{10}	24-hour	Mendenhall School	37-081-0013	Guilford	NC	90	35	150	ug/m^3
$PM_{2.5}$	24-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	15.7	35	ug/m^3
$PM_{2.5}$	Annual	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	7.0	12	ug/m^3
SO_2	1-hour	East Vinton Elementary School	51-161-1004	Roanoke	VA	69	4.0	75	ppb

a/ ppm = parts per million by volume. ppb = parts per billion by volume. µg/m3 = micrograms per cubic meter.

5.2 Modeling Methodology

An air quality modeling analysis was performed consistent with the procedures found in the following documents: Virginia Modeling Guideline for Air Quality Permits (VADEQ, 2015), Guideline on Air Quality Models (Revised) (USEPA, 2017), and New Source Review Workshop Manual (USEPA, 1990).

5.2.1 Model Selection

The USEPA has compiled a set of preferred and alternative computer models for the calculation of pollutant impacts. The selection of a model depends on the characteristics of the source, as well as the nature of the surrounding study area. Of the four classes of models available, the Gaussian type model is the most widely used technique for estimating the impacts of nonreactive pollutants.

The AERMOD model was designed for assessing pollutant concentrations from a wide variety of sources (point, area, and volume). AERMOD is currently recommended by the USEPA for modeling studies in rural or urban areas, flat or complex terrain, and transport distances less than 50 kilometers, with one hour to annual averaging times.

The latest version of USEPA's AERMOD model (Version 18081) was used in the analysis. AERMOD was applied with the regulatory default options and 5-years (2013-2017) of hourly meteorological data consisting of surface data observed at the Danville Regional Airport meteorological station (WBAN #13728) and upper air data collected from Greensboro, North Carolina upper air sounding station (WBAN #13723).

5.2.2 Urban/Rural Area Analysis

A land cover classification analysis was performed to determine whether the URBAN option in the AERMOD model should be used in quantifying ground-level concentrations. The methodology utilized to determine whether the project is located in an urban or rural area is described below.

The following classifications relate the colors on a United States Geological Survey (USGS) topographic quadrangle map to the land use type that they represent:

- Blue – water (rural);
- Green – wooded areas (rural);

- White – parks, unwooded, non-densely packed structures (rural);
- Purple – industrial; identified by large buildings, tanks, sewage disposal or filtration plants, rail yards, roadways, and, intersections (urban);
- Pink – densely packed structures (urban); and,
- Red – roadways and intersections (urban)

The USGS map covering the area within a 3-kilometer radius of the facility (Figure 2-1) was reviewed and indicated that the clear majority of the surrounding area is denoted as green or white, which represent wooded areas, parks, and non-densely packed structures (all designated as rural land uses). Although a small percent of the surrounding area is designated as urban land use, the "AERMOD Implementation Guide" published on August 3, 2015 cautions users against applying the Land Use Procedure on a source-by-source basis and instead to consider the potential for urban heat island influences across the full modeling domain. This approach is consistent with the fact that the urban heat island is not a localized effect, but is more regional in character.

Because the urban heat island is more of a regional effect, the Urban Source option in AERMOD was not utilized since the area within 3 kilometers of the facility as well as the full modeling domain (20 kilometers by 20 kilometers) is predominantly rural.

5.2.3 Good Engineering Practice Stack Height

Section 123 of the Clean Air Act (CAA) required the USEPA to promulgate regulations to assure that the degree of emission limitation for the control of any air pollutant under an applicable SIP was not affected by (1) stack heights that exceed Good Engineering Practice (GEP) or (2) any other dispersion technique. The USEPA provides specific guidance for determining GEP stack height and for determining whether building downwash will occur in the Guidance for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations), (USEPA, 1985). GEP is defined as "...the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, and wakes that may be created by the source itself, or nearby structures, or nearby terrain "obstacles"."

The GEP definition is based on the observed phenomenon of atmospheric flow in the immediate vicinity of a structure. It identifies the minimum stack height at which significant adverse aerodynamics (downwash) are avoided. The USEPA GEP stack

height regulations (40 CFR 51.100) specify that the GEP stack height (H_{GEP}) be calculated in the following manner:

$$H_{GEP} = H_B + 1.5L$$

Where: H_B = the height of adjacent or nearby structures, and
L = the lesser dimension (height or projected width of the adjacent or nearby structures).

A detailed plot plan of the proposed facility is shown in Figure 2-2. A GEP stack height analysis was conducted using the USEPA approved Building Profile Input Program with PRIME (BPIPPRM, version 04274). The maximum calculated GEP stack height for the new emission sources is 117.9 feet; the controlling structure is the proposed compressor building (peak height of 47.17 feet). As such, all of the exhaust stacks are subject to downwash and the downwash parameters from the BPIP program were included in the AERMOD analysis. Electronic input and output files for the BPIPPRM model have been provided on the DVD-ROM contained in Appendix C.

While the proposed exhaust stacks are lower than the calculated GEP height, the modeling analysis demonstrates that the proposed exhaust stack heights will result in potential air quality impacts that are lower than the NAAQS and VADEQ's Significant Ambient Air Concentrations for toxic air pollutants.

5.2.4 Meteorological Data

If at least one year of hourly on-site meteorological data is not available, the application of the AERMOD dispersion model requires five years of hourly meteorological data that are representative of the project site. In addition to being representative, the data must meet quality and completeness requirements per USEPA guidelines. The closest source of representative hourly surface meteorological data is Danville Regional Airport located in Danville, VA, approximately 18 miles to the south of the Lambert Compressor Station.

The meteorological data at the Danville Regional Airport is recorded by an Automated Surface Observing System (ASOS) that records 1-minute measurements of wind direction and wind speed along with hourly surface observations necessary. The USEPA AERMINUTE program was used by the VADEQ to process 1-minute ASOS wind data (2013 – 2017) from the Danville Regional Airport surface station in order to generate hourly averaged wind speed and wind direction data to supplement the standard hourly ASOS observations. The hourly averaged wind speed and direction data generated by AERMINUTE was merged with the aforementioned hourly surface data.

The AERMOD assessment utilized five (5) years (2013–2017) of concurrent meteorological data collected from a meteorological tower at the Danville Regional Airport and from radiosondes launched from Greensboro, North Carolina. Both the surface and upper air sounding data were processed by the VADEQ using AERMOD's meteorological processor, AERMET (version 18081). The output from AERMET was used as the meteorological database for the modeling analysis and consists of a surface data file and a vertical profile data file. This data, which were prepared and processed to AERMOD format by the VADEQ, was provided for use in the modeling analyses for the proposed facility.

5.3 Receptor Grid

5.3.1 Basic Grid

The AERMOD model requires receptor data consisting of location coordinates and ground-level elevations. The receptor generating program, AERMAP (Version 18081), was used to develop a complete receptor grid to a distance of 10 kilometers from the proposed facility. AERMAP uses digital elevation model (DEM) or the National Elevation Dataset (NED) data obtained from the USGS. The preferred elevation dataset based on NED data was used in AERMAP to process the receptor grid. This is currently the preferred data to be used with AERMAP as indicated in the USEPA AERMOD Implementation Guide published August 3, 2015. AERMAP was run to determine the representative elevation for each receptor using 1/3 arc second NED files that were obtained for an area covering at least 10 kilometers in all directions from the proposed facility. The NED data was obtained through the USGS Seamless Data Server (http://seamless.usgs.gov/index.php).

The following rectangular (i.e. Cartesian) receptors were used to assess the air quality impact of the proposed facility:

- Fine grid receptors (100 meter spacing) for a 20 km (east-west) x 20 km (north-south) grid centered on the proposed facility site.
- Fine grid receptors (50 meter spacing) for a 2 km (east-west) x 2 km (north-south) grid centered on the proposed facility site.

5.3.2 Property Line Receptors

The facility will have a fenced property line that precludes public access to the site. Ambient air is therefore defined as the area at and beyond the fence. The modeling receptor grid includes receptors spaced at 25-meter intervals along the entire fence line. Any Cartesian receptors located within the fence line were removed.

5.4 Selection of Sources for Modeling

The emission sources responsible for most of the potential emissions from the Lambert Compressor Station are the two Solar combustion turbines. These units were included in and are the main focus of the modeling analyses. The modeling includes consideration of operation over a range of turbine loads, ambient temperatures, and operating scenarios.

Ancillary sources (Capstone microturbines) were also included in the modeling for appropriate pollutants and averaging periods.

5.4.1 Emission Rates and Exhaust Parameters

The dispersion modeling analysis was conducted with emission rates and flue gas exhaust characteristics (flow rate and temperature) that are expected to represent the range of possible operation parameters for the proposed natural gas fired turbines. Because emission rates and flue gas characteristics for a given turbine load vary as a function of ambient temperature and fuel use, data were derived for a number of ambient temperature cases for natural gas fuel at 100%, 75% and 50% operating loads. The temperatures were:

- 0°F, 20°F, 40°F, 60°F, 80°F and 100°F.

To be conservative and limit the number of cases to be modeled, the modeling analyses were conducted using the lowest stack exhaust temperature and exit velocity coupled with the maximum emission rate over all ambient temperature cases for each operating load. Tables 5-2 and 5-3 summarize the stack parameters and emission rates that were used in the modeling for the two compressor turbines.

Table 5-2: Stack Parameters and Emission Rates – Proposed Solar Taurus 70 Compressor Turbine

Parameter		Values		
Load		50%	75%	100%
Stack Height (m)		15.24	15.24	15.24
Stack Diameter (m)		1.52	1.52	1.52
Exhaust Velocity (m/s)		23.74	25.76	29.10
Exhaust Temperature (K)		747.6	738.2	730.9
Pollutant Emissions (g/s)	NOx	0.459	0.556	0.633
	CO	0.466	0.564	0.641
	SO2	0.044	0.054	0.061
	PM10/PM2.5	0.128	0.155	0.176
	Formaldehyde	0.018	0.022	0.025
Note: Exhaust velocity and temperature conservatively based upon the lowest stack exit velocity and temperature across all ambient temperature cases.				

Table 5-3: Stack Parameters and Emission Rates – Proposed Solar Mars 100 Compressor Turbine

Parameter		Values		
Load		50%	75%	100%
Stack Height (m)		15.24	15.24	15.24
Stack Diameter (m)		2.13	2.13	2.13
Exhaust Velocity (m/s)		18.19	21.43	23.26
Exhaust Temperature (K)		617.0	739.3	736.5
Pollutant Emissions (g/s)	NOx	0.684	0.853	0.958
	CO	0.694	0.866	0.971
	SO2	0.066	0.082	0.092
	PM10/PM2.5	0.191	0.237	0.266
	Formaldehyde	0.027	0.034	0.038
Note: Exhaust velocity and temperature conservatively based upon the lowest stack exit velocity and temperature across all ambient temperature cases.				

Table 5-4 provide the stack parameters and emission rates for the Capstone microturbines.

Table 5-4: Stack Parameters and Emission Rates – Proposed Mircoturbines

Parameter		Values
Stack Height (m)		3.89
Stack Diameter (m)		0.30
Exhaust Velocity (m/s)		32.18
Exhaust Temperature (K)		552.6
Pollutant Emissions (g/sec)	NOx	0.010
	CO	0.0276
	SO_2	0.001
	$PM_{10}/PM_{2.5}$	0.0019
	Formaldehyde	0.00085

5.5 Maximum Modeled Facility Concentrations

Table 5-5 presents the maximum modeled air quality concentrations of the proposed facility calculated by AERMOD. As shown in this table, the maximum modeled concentrations when combined with a representative background concentration as provided in Table 5-1, are less than the applicable NAAQS for all pollutants.

Table 5-5: Facility Maximum Modeled Concentrations Compared to NAAQS

Pollutant	Averaging Period	NAAQS (µg/m³)	Maximum Modeled Concentration (µg/m³)	Background Concentration (µg/m³)	Total Concentration (µg/m³)
CO	1-Hour	40,000	59.1	1,265	1,324.1
	8-Hour	10,000	54.0	805	859.0
SO_2	1-Hour	196	4.1	10.5	14.6
	3-Hour	1,300	3.7	10.5	14.2
PM-10	24-Hour	150	7.4	35	42.4
PM-2.5	24-Hour	35	3.3[a]	15.7	19.0
	Annual	12	0.2	7	7.2
NO_2	1-Hour	188	31.5[b]	62.6	94.1
	Annual	100	0.9[b]	10.7	11.6

[a]Conservatively based upon maximum 98% percentile daily maximum modeled concentrations.

[b]Based upon USEPA Ambient Ratio Method 2 (ARM2) modeling guidance.

5.6 Toxic Air Pollutant Analysis

New and modified sources that emit toxic pollutants must meet the standards in 9 VAC 5-60-300. Virginia defines a toxic pollutant in 9 VAC 5-60-310 as "any air pollutant listed in §112(b) of the federal Clean Air Act, as revised by 40 CFR §63.60, or any other air pollutant that the board determines, through adoption of regulation, to present a significant risk to public health." As HAPs are emitted from the proposed sources at the Lambert Compressor Station, Mountain Valley completed a dispersion modeling evaluation to confirm the Project complies with toxic air pollutant requirements in Virginia.

The Project emissions of toxic air pollutants were compared to the exemption thresholds contained in 9VAC5-60-300C. The only toxic air pollutant that is potentially emitted above the exemption thresholds is formaldehyde. Thus, an air quality dispersion modeling analysis is required by VADEQ to demonstrate that the emissions of formaldehyde will not cause, or contribute to, any significant ambient air concentration that may cause, or contribute to, the endangerment of human health.

An air toxics modeling analysis was conducted for formaldehyde by comparing the modeled 1-hour and annual formaldehyde impacts to the VADEQ's Significant Ambient Air Concentrations (SAAC) for formaldehyde. The SAAC is the concentration of a toxic pollutant in the ambient air that, if exceeded, may have an adverse effect to human health.

As shown in Table 5-6, the maximum modeled impacts are well below the SAACs and thus, the Project complies with the VADEQ toxic pollutant requirements.

Table 5-6: Toxic Air Pollutant Impact Analysis

Pollutant	Averaging Period	VADEQ Screening Level($\mu g/m^3$)	Maximum Modeled Concentration ($\mu g/m^3$)
Formaldehyde	1-Hour	62.5	2.1
	Annual	2.4	0.1

5.7 Modeling Data Files

All modeling data files to determine the maximum ambient ground-level concentrations from the proposed facility are included on DVD-ROM in Appendix C.

5.8 References

USEPA, 2015. AERMOD Implementation Guide. AERMOD Implementation Workgroup, Office of Air Quality Planning and Standards, Air Quality Assessment Division, Research Triangle Park, North Carolina. August 3, 2015.

USEPA, 2014. Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard. USEPA. September 30, 2014.

USEPA, 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-Hour NO_2 NAAQS. USEPA. March 1, 2011.

USEPA, 2017. Guideline on Air Quality Models (Revised). Appendix W to Title 40 U.S. Code of Federal Regulations (CFR) Parts 51 and 52, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina. January 7, 2017.

USEPA, 1992. "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised". EPA Document 454/R-92-019, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

USEPA, 1990. "New Source Review Workshop Manual, Draft". Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency. Research Triangle Park, North Carolina.

USEPA, 1985. Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations-Revised). EPA-450/4-80-023R. U.S. Environmental Protection Agency.

VADEQ, 2015. "Virginia Modeling Guideline for Air Quality Permits". Office of Air Quality Assessments, Virginia Department of Environmental Quality. March 2015.

VADEQ, 2015. " APG-354; Permitting and BACT Applicability under Chapter 80 Article 6". Virginia Department of Environmental Quality. June 2015.

APPENDIX A
VADEQ APPLICATION FORMS

November 2018

PERMIT FORMS
PURSUANT TO
REGULATIONS FOR THE CONTROL AND ABATEMENT OF AIR POLLUTION

COMMONWEALTH OF VIRGINIA
DEPARTMENT OF ENVIRONMENTAL QUALITY

AIR PERMITS
FORM 7 APPLICATION

NEW SOURCE REVIEW PERMITS
and STATE OPERATING PERMITS

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY - AIR PERMITS

LOCAL GOVERNING BODY CERTIFICATION FORM	
Facility Name: Lambert Compressor Station	Registration Number:
Applicant's Name: Mountain Valley Pipeline, LLC	Name of Contact Person at the site: Kristin Ryan
Applicant's Mailing address: 625 Liberty Avenue, Suite 1700 Pittsburgh, PA 15222	Contact Person Telephone Number: 412-400-6887
Facility location (also attach map): Chatham, Pittsylvania County, Virginia (See Figures 2-1 and 2-2 of Application)	
Facility type, and list of activities to be conducted: Natural Gas Compressor Station for MVP Southgate pipeline.	
The applicant is in the process of completing an application for an air pollution control permit from the Virginia Department of Environmental Quality. In accordance with § 10.1-1321.1. Title 10.1, Code of Virginia (1950), as amended, before such a permit application can be considered complete, the applicant must obtain a certification from the governing body of the county, city or town in which the facility is to be located that the location and operation of the facility are consistent with all applicable ordinances adopted pursuant to Chapter 22 (§§ 15.2-2200 et seq.) of Title 15.2. The undersigned requests that an authorized representative of the local governing body sign the certification below.	
Applicant's signature:	Date:
The undersigned local government representative certifies to the consistency of the proposed location and operation of the facility described above with all applicable local ordinances adopted pursuant to Chapter 22 (§§15.2-2200 et seq.) of Title 15.2. of the Code of Virginia (1950) as amended, as follows: (**Check one block**) ☐ The proposed facility is **fully consistent** with all applicable local ordinances. ☐ The proposed facility is **inconsistent** with applicable local ordinances; see attached information.	
Signature of authorized local government representative:	Date:
Type or print name:	Title:
County, city or town:	

[THE LOCAL GOVERNMENT REPRESENTATIVE SHOULD FORWARD THE SIGNED CERTIFICATION TO THE APPROPRIATE DEQ REGIONAL OFFICE AND SEND A COPY TO THE APPLICANT.]

AIR PERMIT APPLICATION
CHECK ALL PAGES ATTACHED AND LIST ALL ATTACHED DOCUMENTS

1	Local Government Certification Form, Page 3	___	Proposed Permit Limits for GHGs on CO_2e Basis, Page 26
___	Application Fee Form, Pages 4-6	___	BAE for Criteria Pollutants, Page 27
1	Document Certification Form, Page 7	___	BAE for GHGs on Mass Basis, Page 28
1	General Information, Pages 8-9	___	BAE for GHGs on CO_2e Basis, Page 29
1	Fuel Burning Equipment, Page 10	1	Operating Periods, Page 30
___	Stationary Internal Combustion Engines, Page 11		
___	Incinerators, Page 12	___	ATTACHED DOCUMENTS:
___	Processing, Page 13	1	Map of Site Location
___	Inks, Coatings, Stains, and Adhesives, Page 14	1	Facility Site Plan
1	VOC/Petroleum Storage Tanks, Pages 15-16	___	Process Flow Diagram/Schematic
___	Loading Rack and Oil-Water Separators, Page 17	___	MSDS or CPDS Sheets
___	Fumigation Operations, Page 18	1	Estimated Emission Calculations
___	Air Pollution Control and Monitoring Equipment, Page 19	___	Stack Tests
___	Air Pollution Control/Supplemental Information, Page 20	1	Air Modeling Data
1	Stack Parameters and Fuel Data, Page 21	___	Confidential Information (see Instructions)
1	Proposed Permit Limits for Criteria Pollutants, Page 22	1	BACT Analysis
1	Proposed Permit Limits for Toxic Pollutants/HAPs, Page 23	1	Permit Application Narrative
___	Proposed Permit Limits for Other Reg. Pollutants, Page 24	1	Equipment Vendor Specifications
___	Proposed Permit Limits for GHGs on Mass Basis, Page 25		

Check added form sheets above; also indicate the number of copies of each form in blank provided.

DOCUMENT CERTIFICATION FORM

I certify under penalty of law that this document and all attachments [as noted above] were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering and evaluating the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I certify that I understand that the existence of a permit under [Article 6 of the Regulations] does not shield the source from potential enforcement of any regulation of the board governing the major NSR program and does not relieve the source of the responsibility to comply with any applicable provision of the major NSR regulations.

SIGNATURE: Clifford W. Baker DATE: 11-5-18

NAME: Clifford Baker REGISTRATION NO:

TITLE: Senior VP of Midstream Field Operations COMPANY: Mountain Valley Pipeline, LLC

PHONE: 412-395-3654 ADDRESS: 625 Liberty Ave, Suite 1700

EMAIL: CBaker@eqt.com Pittsburgh, PA 15222

References: Virginia Regulations for the Control and Abatement of Air Pollution (Regulations), 9 VAC 5-20-230B and 9 VAC 5-80-1140E.

GENERAL INFORMATION

Person Completing Form: Darin Ometz	Date:11/6/18	Registration Number:
Company and Division Name: Mountain Valley Pipeline, LLC		FIN:
Mailing Address:		
Exact Source Location – Include Name of City (County) and Full Street Address or Directions: Chatham, Pittsylvania County, Virginia (See Figures 2-1 and 2-2 of Application)		
Telephone Number: 713-374-1599	No. of Employees:	Property Area at Site: 3.8 acres
Person to Contact on Air Pollution Matters – Name and Title: Christina Akly Senior Environmental Specialist	Phone Number: 561-691-7065 Fax: Email: Christina.Akly@fpl.com	
Latitude and Longitude Coordinates **OR** UTM Coordinates of Facility: 647,900 meters East, 4,076,900 meter North (UTM – NAD83, Zone 17)		

Reason(s) for Submission (Check all that apply):

☐ State Operating Permit

This permit is applied for pursuant to provisions of the Virginia Administrative Code, 9 VAC 5 Chapter 80, Article 5 (SOP)

☒ New Source

☐ Modification of a Source

☐ Relocation of a Source

This permit is applied for pursuant to the following provisions of the Virginia Administrative Code:

- ☒ 9 VAC 5 Chapter 80, Article 6 (Minor Sources)
- ☐ 9 VAC 5 Chapter 80, Article 8 (PSD Major Sources)
- ☐ 9 VAC 5 Chapter 80, Article 9 (Non-Attainment Major Sources)

☐ Amendment to a Permit Dated: _____ Permit Type: ☐ SOP (Art. 5) ☐ NSR (Art. 6, 8, 9)

Amendment Type:

- ☐ Administrative Amendment
- ☐ Minor Amendment
- ☐ Significant Amendment

This amendment is requested pursuant to the provisions of:

- ☐ 9 VAC 5-80-970 (Art. 5 Adm.)
- ☐ 9 VAC 5-80-980 (Art. 5 Minor)
- ☐ 9 VAC 5-80-990 (Art. 5 Sig.)
- ☐ 9 VAC 5-80-1270 (Art. 6 Adm.)
- ☐ 9 VAC 5-80-1280 (Art. 6 Minor)
- ☐ 9 VAC 5-80-1290 (Art. 6 Sig.)
- ☐ 9 VAC 5-80-1935 (Art. 8 Adm.)
- ☐ 9 VAC 5-80-1945 (Art. 8 Minor)
- ☐ 9 VAC 5-80-1955 (Art. 8 Sig.)
- ☐ 9 VAC 5-80-2210 (Art. 9 Adm.)
- ☐ 9 VAC 5-80-2220 (Art. 9 Minor)
- ☐ 9 VAC 5-80-2230 (Art. 9 Sig.)

☐ Other (specify): _____

Explanation of Permit Request (attach documents if needed):

Mountain Valley Pipeline, LLC ("Mountain Valley") is proposing to construct and operate the MVP Southgate Project ("Project"). The Project will be located in Pittsylvania County, Virginia and Rockingham and Alamance counties, North Carolina. Mountain Valley proposes to construct approximately 73 miles of 24- and 16-inch diameter natural gas pipeline. In addition to the pipeline, Mountain Valley proposes to construct and operate a new compressor station (Lambert Compressor Station) near the beginning of the pipeline at milepost 0.0.
The proposed Project involves the installation of new emission units and will be considered a minor source with respect to New Source Review (NSR) permitting requirements at 9 VAC 5-80-1100 and Title V major source permitting requirements at 9 VAC-5-80-50.
See Application Narrative for Additional Details.

GENERAL INFORMATION (CONTINUED)

For Portable Plants:

Is this facility designed to be portable? ☐ Yes ☒ No

- If yes, is this facility already permitted as a portable plant? ☐ Yes ☐ No Permit Date: _____

If not permitted, is this an application to be permitted as a portable plant? ☐ Yes ☐ No

If permitted as a portable facility, is this a notification of relocation? ☐ Yes ☐ No

- Describe the new location or address (include a site map): _____
- Will the portable facility be co-located with another source? ☐ Yes ☐ No Reg. No. _____
- Will the portable facility be modified or reconstructed as a result of the relocation? ☐ Yes ☐ No
- Will there be any new emissions other than those associated with the relocation? ☐ Yes ☐ No
- Is the facility suitable for the area to which it will be located? (attach documentation) ☐ Yes ☐ No

Describe the products manufactured and/or services performed at this facility:

The facility will serve as a natural gas compression and transmission station along the proposed 73-mile pipeline. This pipeline will receive natural gas from the existing Mountain Valley Pipeline near Chatham, VA and deliver or receive natural gas to the East Tennessee Natural Gas, LLC Mainline near Eden, NC.

List the Standard Industrial Classification (SIC) Code(s) for the facility:

4	9	2	2																

List the North American Industry Classification System (NAICS) Code(s) for the facility:

4	8	6	2	1	0																		

List all the facilities in Virginia under common ownership or control by the owner of this facility:

Milestones: This section is to be completed if the permit application includes a new emissions unit or modification to existing operations.

Milestones*:	Starting Date:	Estimated Completion Date:
New Equipment Installation	Q1 2020	Q4 2020
Modification of Existing Process or Equipment		
Start-up Dates		Q4 2020

*For new or modified installations to be constructed in phased schedule, give construction/installation starting and completion date for each phase.

FUEL BURNING EQUIPMENT: (Boilers, Turbines, Kilns, and Other External Combustion Units)

Company Name: Mountain Valley Pipeline, LLC	Date: 11/6/18	Registration Number:

Unit Ref. No.	Equipment Manufacturer, Type, and Model Number	Date of Manuf.	Date of Const.	Max. Rated Input Heat Capacity For Each Fuel (Million Btu/hr)	Type of Fuel	Type of Equip. (use Code A)	Usage (use Code B)	Requested Throughput* (hrs/yr OR fuel/yr)	Federal Regulations that Apply
CT-01	Solar, Mars 100		Q1-2020	140.84	Natural Gas	19	8	8760 hrs/year	NSPS Subpart KKKK, NSPS Subpart OOOOa 40 CFR Part 98
CT-02	Solar, Taurus 70		Q1-2020	93.03	Natural Gas	19	8	8760 hrs/year	NSPS Subpart KKKK, NSPS Subpart OOOOa 40 CFR Part 98
MT-01	Capstone Microturbine, C200		Q1-2020	2.28	Natural Gas	19	6	8760 hrs/year	40 CFR Part 98
MT-02	Capstone Microturbine, C200		Q1-2020	2.28	Natural Gas	19	6	8760 hrs/year	40 CFR Part 98
MT-03	Capstone Microturbine, C200		Q1-2020	2.28	Natural Gas	19	6	8760 hrs/year	40 CFR Part 98
MT-04	Capstone Microturbine, C200		Q1-2020	2.28	Natural Gas	19	6	8760 hrs/year	40 CFR Part 98
MT-05	Capstone Microturbine, C200		Q1-2020	2.28	Natural Gas	19	6	8760 hrs/year	40 CFR Part 98
HT-01	Gas Heater, TBD		Q1-2020	0.77	Natural Gas	12	4	8760 hrs/year	40 CFR Part 98

[X] Estimated Emission Calculations Attached (include references of emission factors) and/or Stack Test Results if Available

Code A – Equipment

BOILER TYPE:
1. Pulverized Coal - Wet Bottom
2. Pulverized Coal - Dry Bottom
3. Pulverized Coal - Cyclone Furnace
4. Circulating Fluidized Bed
5. Spreader Stoke
6. Chain or Travelling Grate Stoker
7. Underfeed Stoker
8. Hand Fired Coal
9. Oil, Tangentially Fired
10. Oil, Horizontally Fired (except rotary cup)
11. Gas, Tangentially Fired
12. Gas, Horizontally Fired
13. Wood with Flyash Reinjection
14. Wood without Flyash Reinjection
15. Other (specify) _____

OTHER COMBUSTION UNITS:
16. Oven / Kiln
17. Rotary Kiln
18. Process Furnace
19. Other (specify):Turbine

Code B - Usage

1. Steam Production
2. Drying / Curing
3. Space Heating
4. Process Heat
5. Food Processing
6. Electrical Generation
7. Mechanical Work
8. Other (specify) : Gas Compression

***Pick only one option for a requested throughput.**

NOTE: Dryers, kilns, and furnaces also have to fill out Page 13.

VOLATILE ORGANIC COMPOUND (VOC)/PETROLEUM LIQUID STORAGE TANKS:

Company Name: Mountain Va ley Pipeline, LLC	**Date:** 11/6/18	**Registration Number:**

Unit Ref. No.	Tank Type (use Code H)	Source of Tank Contents (use Code I)	Date of Manuf.	Date of Const.	Material Stored - Name and CAS # (include Reid Vapor Pressure for Gasoline)	Max. True Vapor Pressure (psia)	Density* (lbs/gal)	Max. Average Storage Temp. (°F)	Tank Diameter (feet)	Tank Capacity (gal)	Requested Throughput (gal/yr)	Federal Regulations that Apply
TK-01	1a	5		Q1-2020	Condensate Liquids	10.6	Varies	Ambient	10	10,000	126,000	None
TK-02	1a	5		Q1-2020	Condensate Liquids	10.6	Varies	Ambient	10	10,000	126,000	None

[X] Estimated Emission Calculations Attached (include TANKS Program printouts)

Code H – Tank Type		**Code I – Source of Tank Contents**
1. Fixed Roof a. Vertical Tank b. Horizontal Tank 2. Floating Roof a. Internal (welded deck) b. Internal (bolted deck) – Specify Panel or Sheet c. External (welded deck) d. External (riveted deck)	3. Variable Vapor Space 4. Pressure Tank (over 15 psig) 5. Underground Splash Loading 6. Underground Submerged Loading 7. Underground Submerged Loading, Balanced 8. Other:_____	1. Pipeline 2. Rail Car 3. Tank Truck 4. Ship or Barge 5. Process

*** Specify the ASTM temperature standard at which the density was measured.**

VOLATILE ORGANIC COMPOUND (VOC)/PETROLEUM LIQUID STORAGE TANKS (CONTINUED):

Company Name: Mountain Valley Pipeline, LLC	**Date:** 11/6/18	**Registration Number:**

Unit Ref. No.	Tank Color		Fixed Roof Only					Floating Roof Only				
	Shell	Roof	Internal Tank Height or Length (feet)	Max. Hourly Filling (gallons)	External Fixed Roof			Seal Type (use Code J)	Max. Hourly Withdrawal (gallons)	Internal Floating Roof		
					Type of Roof (cone or dome)	Cone height (ft) and slope (ft/ft)	Dome height (ft) and radius (ft)			Self Supporting?	If no, No. of Columns	If no, Column Diameter (ft)
TK-01	Light Gray	Light Gray	15.5									
TK-02	Light Gray	Light Gray	15.5									

Code J – Seal Type (Pontoon External Only)

1. Mechanical Shoe
   a. Primary only
   b. Shoe mounted secondary
   c. Rim mounted secondary
2. Liquid Mounted
   a. Primary only
   b. Weather shield secondary
   c. Rim mounted secondary
3. Vapor Mounted
   a. Primary only
   b. Weather shield secondary
   c. Rim mounted secondary

(Double Deck External Only)

4. Mechanical Shoe
   a. Primary only
   b. Shoe mounted secondary
   c. Rim mounted secondary
5. Liquid Mounted
   a. Primary only
   b. Weather shield secondary
   c. Rim mounted secondary
6. Vapor Mounted
   a. Primary only
   b. Weather shield secondary
   c. Rim mounted secondary

(Internal Only)

7. Mechanical Shoe
   a. Primary only
   b. Shoe mounted secondary
   c. Rim mounted secondary
8. Liquid Mounted
   a. Primary only
   b. Rim mounted secondary
9. Vapor Mounted
   a. Primary only
   b. Rim mounted secondary

STACK PARAMETERS AND FUEL DATA:

Company Name: Mountain Valley Pipeline, LLC	Date: 11/6/18	Registration Number:

Unit Ref. No.	Vent/ Stack No.	Vent/Stack or Exhaust Data						Fuel(s) Data				
		Vent/Stack Config. (use Code O)	Vent/Stack Height (feet)	Exit Diameter (feet)	Exit Gas Velocity (ft/sec)	Exit Gas Flow Rate (acfm)	Exit Gas Temp. (°F)	Type of Fuel	Heating Value* (Btu/scf)	Max. Rated Burned/hr (specify units)	Max. Sulfur %	Max. Ash %
CT-01	CT-01	5	50.0	7.0	84.7	195,584	893	Natural Gas	1,100	140.84 mmBtu	2.0 grains/ 100 scf	0
CT-02	CT-02	5	50.0	5.0	109.3	128,765	920	Natural Gas	1,100	93.03 mmBtu	2.0 grains/ 100 scf	0
MT-01	MT-01	5	12.75	1.0	105.6	4,975	535	Natural Gas	1,100	2.28 mmBtu	2.0 grains/ 100 scf	0
MT-02	MT-02	5	12.75	1.0	105.6	4,975	535	Natural Gas	1,100	2.28 mmBtu	2.0 grains/ 100 scf	0
MT-03	MT-03	5	12.75	1.0	105.6	4,975	535	Natural Gas	1,100	2.28 mmBtu	2.0 grains/ 100 scf	0
MT-04	MT-04	5	12.75	1.0	105.6	4,975	535	Natural Gas	1,100	2.28 mmBtu	2.0 grains/ 100 scf	0
MT-05	MT-05	5	12.75	1.0	105.6	4,975	535	Natural Gas	1,100	2.28 mmBtu	2.0 grains/ 100 scf	0
HT-01	HT-01	6	14.8	0.67	49.0	330	460	Natural Gas	1,100	0.77 mmBtu	2.0 grains/ 100 scf	0

Code O – Vent/Stack Configuration

1. Stack discharging downward, or nearly download
2. Equivalent stack representing a combination of multiple actual stacks
3. Gooseneck stack
4. Stack discharging in a horizontal direction
5. Stack with an unobstructed opening discharge in a vertical direction
6. Vertical stack with a weather cap or similar obstruction in exhaust system

*** Specify units for each heating value in Btus per unit of fuel.**

PROPOSED PERMIT LIMITS FOR CRITERIA POLLUTANTS:

Company Name: Mountain Valley Pipeline, LLC	**Date:** 11/6/18	**Registration Number:**

Unit Ref. No.	Proposed Permit Limits for Criteria Pollutants															
	PM [a] (Particulate Matter)		**PM-10 [a,b]** (10 µM or smaller particulate matter)		**PM 2.5 [a,b]** (2.5 µM or smaller particulate matter)		**SO_2** (Sulfur Dioxide)		**NO_X** (Nitrogen Oxides)		**CO** (Carbon Monoxide)		**VOC [a]** (Volatile Organic Compounds)		**Pb** (Lead)	
	lbs/hr	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**
CT-01[1]	2.11	8.65	2.11	8.65	2.11	8.65	0.73	3.00	7.60	31.66	7.71	35.18	0.88	3.85	-	-
CT-02[1]	1.40	5.96	1.40	5.96	1.40	5.96	0.48	2.07	5.02	21.81	5.09	25.85	0.58	3.16	-	-
MT-01	0.02	0.066	0.02	0.066	0.02	0.066	0.008	0.034	0.08	0.36	0.22	0.96	0.02	0.088	-	-
MT-02	0.02	0.066	0.02	0.066	0.02	0.066	0.008	0.034	0.08	0.36	0.22	0.96	0.02	0.088	-	-
MT-03	0.02	0.066	0.02	0.066	0.02	0.066	0.008	0.034	0.08	0.36	0.22	0.96	0.02	0.088	-	-
MT-04	0.02	0.066	0.02	0.066	0.02	0.066	0.008	0.034	0.08	0.36	0.22	0.96	0.02	0.088	-	-
MT-05	0.02	0.066	0.02	0.066	0.02	0.066	0.008	0.034	0.08	0.36	0.22	0.96	0.02	0.088	-	-
HT-01	0.005	0.02	0.005	0.02	0.005	0.02	0.004	0.02	0.070	0.31	0.06	0.26	0.004	0.02	-	-
TK-01	-	-	-	-	-	-	-	-	-	-	-	-	0.049	0.21	-	-
TK-02	-	-	-	-	-	-	-	-	-	-	-	-	0.049	0.21	-	-
TOTAL:	NA	14.96	NA	14.96	NA	14.96	NA	5.25	NA	55.58	NA	66.08	NA	9.07	-	-

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No)

[a] PM, PM-10, PM 2.5, and VOC should also be split up by component and reported under the Proposed Permit Limits for Toxic Pollutants/HAPs.
[b] PM-10 and PM 2.5 includes filterable and condensable.
Notes: [1] The emissions presented are for steady state operation of the turbine. Startup, Shutdown, and extremely low temperature operation emissions are included in Appendix B.
[2] Total emissions include those from fugitives and natural gas blowdowns as provided in Appendix B.

PROPOSED PERMIT LIMITS FOR TOXIC POLLUTANTS/HAPS:

Company Name: Mountain Valley Pipeline, LLC	**Date:** 11/6/2018	**Registration Number:**

Unit Ref. No.	Proposed Permit Limits for Toxic/HAP Pollutants*															
	HAP Name: Formaldehyde CAS #: 50-00-0		**HAP Name: CAS #:**		**HAP Name: CAS #:**		**HAP Name: CAS #:**		**HAP Name: CAS #:**		**HAP Name: CAS #:**		**HAP Name: CAS #:**		**HAP Name: CAS #:**	
	lbs/hr	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**	**lbs/hr**	**tons/yr**
CT-01	0.31	1.31														
CT-02	0.20	0.87														
MT-01	0.007	0.03														
MT-02	0.007	0.03														
MT-03	0.007	0.03														
MT-04	0.007	0.03														
MT-05	0.007	0.03														
HT-01	0.000057	0.00025														
TK-01	-	-														
TK-02	-	-														
TOTAL:	NA	2.33														

[X] Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

*** Specify the name of the toxic pollutant/HAP for each Unit Ref. No. along with the respective CAS Number**. Toxic Pollutant means a pollutant on the designated list in the Form 7 Instructions document. Particulate matter and volatile organic compounds are not toxic pollutants as generic classes of substances, but individual substances within these classes may be toxic pollutants because their toxic properties or because a TLV (tm) has been established.

PROPOSED PERMIT LIMITS FOR OTHER REGULATED POLLUTANTS:

Company Name: Mountain Valley Pipeline, L_C	**Date:** 11/6/2018	**Registration Number:**

Unit Ref. No.	Proposed Permit Limits for Other Regulated Pollutants*															
	Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:		Pollutant Name:	
	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr	lbs/hr	tons/yr
No additional proposed permit limits																
TOTAL:																

☐ Estimated Emission Calculations Attached (totals and per Unit Ref. No.)

* **Other Regulated Pollutant** include Fluorides, Sulfuric Acid Mist, Hydrogen Sulfide (H_2S), Total Reduced Sulfur (including H_2S), Reduced Sulfur Compounds (including H_2S), Municipal Waste Combustor Organics (measured as total tetra-through octa-chlorinated dibenzo-p-dioxins and dibenzofurans), Municipal Waste Combustor Metals (measured as particulate matter), Municipal Waste Combustor Acid Gases (measured as the sum of SO_2 and HCl), and Municipal Solid Waste Landfill Emissions (measured as nonmethane organic compounds).

OPERATING PERIODS:

Company Name: Mountain Valley Pipeline, LLC	Date: 11/6/2018	Registration Number:

Unit Ref. No.	Percent Annual Use/Throughput by Season				Normal Process/Equipment Operating Schedule			Maximum Process/Equipment Operating Schedule		
	December February	March May	June August	September November	Hours per Day	Days per Week	Weeks per Year	Hours per Day	Days per Week	Weeks per Year
CT-01	25	25	25	25	24	7	52	24	7	52
CT-02	25	25	25	25	24	7	52	24	7	52
MT-01	25	25	25	25	24	7	52	24	7	52
MT-02	25	25	25	25	24	7	52	24	7	52
MT-03	25	25	25	25	24	7	52	24	7	52
MT-04	25	25	25	25	24	7	52	24	7	52
MT-05	25	25	25	25	24	7	52	24	7	52
HT-01	25	25	25	25	24	7	52	24	7	52
TK-01	25	25	25	25	24	7	52	24	7	52
TK-02	25	25	25	25	24	7	52	24	7	52

Maximum Facility Operating Schedule		
Hours per Day	Days per Week	Weeks per Year
24	7	52

APPENDIX B
EMISSION CALCULATIONS, BACT EVALUATION, AND VENDOR DATA

November 2018

MVP Southgate Project
Lambert Compressor Station

Table B-1. Total Facility Potential Emissions Summary

Proposed Sources	NOx	CO	VOC	SO2	PM/PM-10/ PM-2.5	CO2	Total HAPS	CH4	N2O	CO2e
Solar Taurus 70	21.81	25.85	3.16	2.07	5.96	46,418	1.26	0.88	0.09	46,466
Solar Mars 100	31.66	35.18	3.85	3.00	8.65	67,393	1.90	1.27	0.13	67,463
Capstone C200 Microturbines (5 Units)	1.81	4.79	0.44	0.17	0.33	5,841.0	0.21	0.11	0.011	5,847
Fuel Gas Heater	0.31	0.26	0.02	0.018	0.02	394.5	0.01	0.01	0.001	395
Produced Fluids Tanks	-	-	0.43	-	-	-	-	-	-	4.2
Blowdowns	-	-	0.46	-	-	0.23	0.02	44.35	-	1,109
Station Fugitives	-	-	0.72	-	-	0.36	0.03	69.59	-	1,740
Totals (ton/year)	**55.58**	**66.08**	**9.07**	**5.25**	**14.96**	**120,047**	**3.43**	**116.20**	**0.23**	**123,024**

MVP Southgate Project
Lambert Compressor Station

Table B-2. Solar Taurus 70 Specifications

Fuel	Natural Gas																				
Load	50	50	50	50	50	50	50	75	75	75	75	75	75	75	100	100	100	100	100	100	100
Hp Output (Net)	5,896	5,896	5,791	5,678	9,657	8,832	8,474	8,844	8,844	8,686	8,518	7,876	10,056	9,603	11,792	11,792	11,581	11,358	10,502	11,189	10,796
Ambient Temperature (F)	below 0	0	20	40	60	80	100	below 0	0	20	40	60	80	100	below 0	0	20	40	60	80	100
% RH	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Elevation ft	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660
Fuel LHV (Btu/scf)	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20
Heat Input LHV (MMBtu/hr)	60.78	60.78	58.84	56.89	53.59	50.22	46.71	73.56	73.56	71.10	68.60	64.39	60.11	55.59	83.62	83.62	82.54	81.49	76.98	72.04	66.64
Heat Input HHV (MMBtu/hr) (=LHV*1.1125)	67.62	67.62	65.46	63.29	59.62	55.87	51.96	81.84	81.84	79.10	76.32	71.63	66.87	61.84	93.03	93.03	91.83	90.56	85.64	80.14	74.14
Exhaust lb/hr	193,726	193,726	184,513	175,520	164,699	154,855	144,524	218,893	218,893	209,712	200,436	187,412	174,269	159,827	231,761	231,761	225,326	218,319	207,302	194,517	179,098
Exhaust ACFM	111,151	111,151	107,948	104,557	100,113	95,916	91,765	124,004	124,004	120,454	116,562	111,039	105,408	99,557	130,010	130,010	129,423	128,765	124,151	118,653	112,486
Stack Height (ft)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Stack Height (m)	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24
Stack Equiv Diameter (ft)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Stack Exhaust Velocity (m/s)	28.76	28.76	27.93	27.05	25.90	24.82	23.74	32.08	32.08	31.16	30.15	28.73	27.27	25.76	33.64	33.64	33.48	33.31	32.12	30.70	29.10
Exhaust Temperature (F)	886	886	912	937	964	989	1016	869	869	887	904	928	955	988	856	856	887	920	943	967	1000
Exhaust Temperature (K)	747.6	747.6	762.0	775.9	790.9	804.8	819.8	738.2	738.2	748.2	757.6	770.9	785.9	804.3	730.9	730.9	748.2	766.5	779.3	792.6	810.9
NOx ppm@ 15% O_2	120	15	15	15	15	15	15	120	15	15	15	15	15	15	120	15	15	15	15	15	15
NOx lb/hr	29.120	3.640	3.520	3.400	3.190	2.970	2.730	35.280	4.410	4.260	4.100	3.840	3.560	3.250	40.160	5.020	4.950	4.830	4.590	4.270	3.900
NOx g/s	3.669	0.459	0.444	0.428	0.402	0.374	0.344	4.445	0.556	0.537	0.517	0.484	0.449	0.410	5.060	0.633	0.624	0.615	0.578	0.538	0.491
CO ppm@ 15% O_2	150	25	25	25	25	25	25	150	25	25	25	25	25	25	150	25	25	25	25	25	25
CO lb/hr	22.200	3.700	3.580	3.450	3.240	3.020	2.770	26.880	4.480	4.320	4.160	3.890	3.610	3.300	30.540	5.090	5.020	4.950	4.660	4.330	3.960
CO g/s	2.797	0.466	0.451	0.435	0.408	0.381	0.349	3.387	0.564	0.544	0.524	0.490	0.455	0.416	3.848	0.641	0.633	0.624	0.587	0.546	0.499
UHC ppm@ 15% O_2	50	25	25	25	25	25	25	50	25	25	25	25	25	25	50	25	25	25	25	25	25
UHC lb/hr	4.240	2.120	2.050	1.980	1.860	1.730	1.590	5.120	2.560	2.480	2.380	2.230	2.070	1.890	5.840	2.920	2.880	2.840	2.670	2.480	2.270
VOC ppm@ 15% O_2 (20% of UHC)	10	5	5	5	5	5	5	10	5	5	5	5	5	5	10	5	5	5	5	5	5
VOC lb/hr	0.848	0.424	0.410	0.396	0.372	0.346	0.318	1.024	0.512	0.496	0.476	0.446	0.414	0.378	1.168	0.584	0.576	0.568	0.534	0.496	0.454
sulfur gr/100 scf	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SO2 lb/hr	0.352	0.352	0.341	0.329	0.310	0.291	0.270	0.426	0.426	0.412	0.397	0.373	0.348	0.322	0.484	0.484	0.478	0.472	0.446	0.417	0.386
SO2 g/s	0.044	0.044	0.043	0.042	0.039	0.037	0.034	0.054	0.054	0.052	0.050	0.047	0.044	0.041	0.061	0.061	0.060	0.059	0.056	0.053	0.049
Particulates lb/MMBtu	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
$PM_{10/2.5}$ lb/hr	1.01	1.01	0.98	0.95	0.89	0.84	0.78	1.23	1.23	1.19	1.14	1.07	1.00	0.93	1.40	1.40	1.38	1.36	1.28	1.20	1.11
$PM_{10/2.5}$ g/s	0.128	0.128	0.124	0.120	0.113	0.106	0.098	0.155	0.155	0.149	0.143	0.135	0.126	0.117	0.176	0.176	0.174	0.171	0.162	0.151	0.140
CO2 lb/mmBtu	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
CO_2 lb/hr	7,904	7,904	7,651	7,398	6,969	6,531	6,074	9,566	9,566	9,246	8,921	8,373	7,817	7,229	10,874	10,874	10,733	10,597	10,010	9,368	8,666
CH_4 lb/mmBtu	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
CH_4 lb/hr	0.1491	0.1491	0.1443	0.1395	0.1314	0.1232	0.1146	0.1804	0.1804	0.1744	0.1683	0.1579	0.1474	0.1363	0.2051	0.2051	0.2024	0.1999	0.1888	0.1767	0.1634
N_2O lb/mmBtu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N_2O lb/hr	0.0149	0.0149	0.0144	0.0140	0.0131	0.0123	0.0115	0.0180	0.0180	0.0174	0.0168	0.0158	0.0147	0.0136	0.0205	0.0205	0.0202	0.0200	0.0189	0.0177	0.0163
CO2e lb/mmBtu	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0
CO2e lb/hr	7,912	7,912	7,659	7,406	6,976	6,537	6,080	9,576	9,576	9,255	8,930	8,382	7,825	7,236	10,885	10,885	10,745	10,608	10,021	9,378	8,675

Notes

1. Data provided by Solar for 100%, 75%, and 50% load cases: net output power, fuel flow (MMBtu/hr, LHV), exhaust flow (lb/hr), exhaust temperature, NOx/CO/UHC concentrations and lb/hr.
2. Below zero and low load operation uses 0°F for operating parameters and uses concentrations from Solar PIL 167. Data for Particulate Matter based upon Solar PIL 171.
3. Greenhouse gases are calculated using emission factors from Part 98, Tables C-1 and C-2 and global warming potentials from Table A-1 (CO_2 = 1, CH_4 = 25, N_2O = 298).
4. VOC as 20% of UHC based on Solar PIL 168 for natural gas.

MVP Southgate Project
Lambert Compressor Station

Table B-3. Solar Taurus 70 Potential to Emit

Operations	**Normal Ambient Temperatures (>0 degrees F)**		**Startup**		**Shutdown**		**Potential to Emit Including Startup/Shutdown during Normal Temperature Operation**	**Low Ambient Temperatures (<0 degrees F)**		**Maximum Yearly Potential to Emit (Includes Startup, Shutdown, and Low Temperature Operation)**
Maximum Annual Combined Event Frequency	8,760 hrs/yr		52 Events/Yr (10 Minute Event Duration)		52 Events/Year (10 Minute Event Duration)		8,760 hrs/yr	24 hrs/yr		8,760 hrs/yr
Pollutant	Hourly (lb/hr)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Maximum Annual (tpy)	Hourly (lb/hr)	Maximum Annual (tpy)	Maximum Annual (tpy)
NO_X	4.88	21.37	1.00	0.03	1.00	0.03	21.38	40.16	0.48	21.81
CO	4.95	21.68	88.00	2.29	62.00	1.61	25.54	30.54	0.37	25.85
SO2	0.47	2.07	0	0	0	0	2.07	0.48	0.01	2.07
PM10/2.5	1.36	5.96	0	0	0	0	5.96	1.40	0.02	5.96
CO2e	10,608	46,462	0	0	0	0	46,462	10,885	131	46,466
CO2	10,597	46,414	0	0	0	0	46,414	10,874	130	46,418
N2O	0.02	0.09	0	0	0	0	0.09	0.02	0.000	0.09
TOC (Total)	2.84	12.44	88.00	2.29	40.00	1.04	15.74	5.84	0.07	15.78
CH4	0.20	0.88	0	0	0	0	0.88	0.21	0.00	0.88
VOC (Total)	0.57	2.49	17.60	0.46	8.00	0.21	3.15	1.17	0.01	3.16

MVP Southgate Project
Lambert Compressor Station

Table B-4. Solar Mars 100 Specifications

Fuel	Natural Gas																				
Load	50	50	50	50	50	50	50	75	75	75	75	75	75	75	100	100	100	100	100	100	100
Hp Output (Net)	8,562	8,562	8,300	7,959	7,521	6,986	6,393	12,842	12,842	12,456	11,939	11,282	10,480	9,585	17,123	17,123	16,600	15,918	15,042	13,973	12,786
Ambient Temperature (F)	below 0	0	20	40	60	80	100	below 0	0	20	40	60	80	100	below 0	0	20	40	60	80	100
% RH	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60	60
Elevation ft	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660	660
Fuel LHV (Btu/scf)	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20	939.20	989.20	989.20	989.20	989.20	989.20	989.20	989.20
Heat Inpu LHV (MMBtu/hr) by volume	71.43	71.43	90.64	86.81	82.93	78.41	74.07	112.88	112.88	108.63	104.25	99.18	93.60	87.86	126.60	126.60	122.73	118.30	113.23	107.44	101.48
Heat Input HHV (MMBtu/hr) (=LHV*1.1125)	79.47	79.47	100.84	96.58	92.26	87.23	82.40	125.58	125.58	120.92	115.98	110.34	104.13	97.74	140.84	140.84	136.54	131.61	125.97	119.53	112.90
Exhaust lb/hr	291,037	291,037	297,633	289,272	267,923	251,220	234,805	346,736	346,736	353,007	318,188	301,449	283,287	264,650	358,083	358,083	349,335	338,647	325,252	309,604	291,077
Exhaust ACFM	137,829	137,829	171,716	166,278	161,598	155,290	148,483	196,724	196,724	190,959	184,855	177,567	169,837	162,347	202,398	202,398	199,459	195,584	190,475	184,076	176,179
Stack Height (ft)	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Stack Height (m)	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24	15.24
Stack Equiv Diameter (ft)	7.00		7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
Stack Exhaust Velocity (m/s)	18.19	#VALUE!	22.67	21.95	21.33	20.50	19.60	25.97	25.97	25.21	24.40	23.44	22.43	21.43	26.72	26.72	26.33	25.82	25.14	24.30	23.26
Exhaust Temperature (F)	651	651	893	920	951	981	1010	871	871	885	901	918	938	956	866	866	879	893	910	926	947
Exhaust Temperature (K)	617.0	617.0	751.5	766.5	783.7	800.4	816.5	739.3	739.3	747.5	755.9	765.4	776.5	792.5	736.5	736.5	743.7	751.5	760.9	769.8	781.5
NOx ppm@ 15% O2	120	15	15	15	15	15	15	120	15	15	15	15	15	15	120	15	15	15	15	15	15
NOx lb/hr	34.160	4.270	5.430	5.190	4.940	4.640	4.330	54.160	6.770	6.512	6.240	5.918	5.543	5.143	60.800	7.600	7.360	7.080	6.750	6.370	5.940
NOx g/s	4.304	0.538	0.684	0.654	0.622	0.585	0.546	6.824	0.853	0.820	0.786	0.745	0.698	0.648	7.661	0.958	0.927	0.892	0.851	0.803	0.748
CO ppm@ 15% O2	150	25	25	25	25	25	25	150	25	25	25	25	25	25	150	25	25	25	25	25	25
CO lb/hr	25.980	4.330	5.510	5.270	5.010	4.710	4.400	41.220	6.870	6.611	6.330	6.000	5.620	5.220	46.260	7.710	7.470	7.180	6.850	6.460	6.030
CO g/s	3.273	0.546	0.694	0.664	0.631	0.593	0.554	5.194	0.866	0.833	0.798	0.756	0.708	0.658	5.829	0.971	0.941	0.905	0.863	0.814	0.760
UHC ppm@ 15% O2	50	25	25	25	25	25	25	50	25	25	25	25	25	25	50	25	25	25	25	25	25
UHC lb/hr	4.960	2.480	3.150	3.020	2.870	2.700	2.520	7.860	3.930	3.790	3.620	3.440	3.220	2.990	8.840	4.420	4.280	4.120	3.920	3.700	3.450
VOC ppm@ 15% O2 (20% of UHC)	10	5	5	5	5	5	5	10	5	5	5	5	5	5	10	5	5	5	5	5	5
VOC lb/hr	0.992	0.496	0.630	0.604	0.574	0.540	0.504	1.572	0.786	0.758	0.724	0.688	0.644	0.598	1.768	0.884	0.856	0.824	0.784	0.740	0.690
sulfur gr/100 scf	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
SO2 lb/hr	0.414	0.414	0.525	0.503	0.480	0.454	0.429	0.654	0.654	0.629	0.604	0.574	0.542	0.509	0.733	0.733	0.711	0.685	0.656	0.622	0.588
SO2 g/s	0.052	0.052	0.066	0.063	0.060	0.057	0.054	0.082	0.082	0.079	0.076	0.072	0.068	0.064	0.092	0.092	0.090	0.086	0.083	0.078	0.074
Particulates lb/MMBtu	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
PM10/2.5 lb/hr	1.19	1.19	1.51	1.45	1.38	1.31	1.24	1.88	1.88	1.81	1.74	1.66	1.56	1.47	2.11	2.11	2.05	1.97	1.89	1.79	1.69
PM10/2.5 g/s	0.150	0.150	0.191	0.183	0.174	0.165	0.156	0.237	0.237	0.229	0.219	0.209	0.197	0.185	0.266	0.266	0.258	0.249	0.238	0.226	0.213
CO2 lb/mmBtu	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
CO2 lb/hr	9,289	9,289	11,787	11,289	10,784	10,196	9,632	14,679	14,679	14,154	13,557	12,897	12,172	11,415	16,463	16,463	15,960	15,384	14,724	13,971	13,196
CH4 lb/mmBtu	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022	0.0022
CH4 lb/hr	0.1752	0.1752	0.2223	0.2129	0.2034	0.1923	0.1817	0.2769	0.2769	0.2666	0.2557	0.2433	0.2296	0.2155	0.3105	0.3105	0.3010	0.2901	0.2777	0.2635	0.2489
N2O lb/mmBtu	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0022	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
N2O lb/hr	0.0175	0.0175	0.0222	0.0213	0.0203	0.0192	0.0182	0.0277	0.0277	0.0267	0.0256	0.0243	0.0230	0.0215	0.0311	0.0311	0.0301	0.0290	0.0278	0.0264	0.0249
CO2e lb/mmBtu	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.2	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0	117.0
CO2e lb/hr	9,298	9,298	11,799	11,300	10,795	10,207	9,642	14,694	14,694	14,169	13,571	12,911	12,184	11,427	16,480	16,480	15,976	15,400	14,740	13,986	13,210

Notes

1. Data provided by Solar for 100%, 75%, and 50% load cases: net output power, fuel flow (MMBtu/hr, LHV), exhaust flow (lb/hr), exhaust temperature, NOx/CO/UHC concentrations and lb/hr.
2. Below zero and low load operation uses 0°F for operating parameters and uses concentrations from Solar PIL 167. Data for Particulate Matter based upon Solar PIL 171.
3. Greenhouse gases are calculated using emission factors from Part 98, Tables C-1 and C-2 and global warming potentials from Table A-1 (CO_2 = 1, CH_4 = 25, N_2O = 298).
4. VOC as 20% of UHC based on Solar PIL 168 for natural gas.

MVP Southgate Project
Lambert Compressor Station

Table B-5. Solar Mars 100 Potential to Emit

Operations	**Normal Ambient Temperatures (>0 degrees F)**		**Startup**		**Shutdown**		**Potential to Emit Including Startup/Shutdown during Normal Temperature Operation**	**Low Ambient Temperatures (<0 degrees F)**		**Maximum Yearly Potential to Emit (Includes Startup, Shutdown, and Low Temperature Operation)**
Maximum Annual Combined Event Frequency	8,760 hrs/yr		52 Events/Yr (10 Minute Event Duration)		52 Events/Year (10 Minute Event Duration)		8,760 hrs/yr	24 hrs/yr		8,760 hrs/yr
Pollutant	Hourly (lb/hr)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Event (lb/event)	Maximum Annual (tpy)	Maximum Annual (tpy)	Hourly (lb/hr)	Maximum Annual (tpy)	Maximum Annual (tpy)
NO_X	7.08	31.01	1.00	0.03	1.00	0.03	31.01	60.80	0.73	31.66
CO	7.18	31.45	46.00	1.20	82.00	2.13	34.71	46.26	0.56	35.18
SO_2	0.68	3.00	0	0	0	0	3.00	0.73	0.01	3.00
PM10/2.5	1.97	8.65	0	0	0	0	8.65	2.11	0.03	8.65
CO_2e	15,400	67,450	0	0	0	0	67,450	16,480	198	67,463
CO_2	15,384	67,380	0	0	0	0	67,380	16,463	198	67,393
N_2O	0.03	0.13	0	0	0	0	0.13	0.03	0.000	0.13
TOC (Total)	4.12	18.05	20.00	0.52	26.00	0.68	19.21	8.84	0.11	19.26
CH_4	0.29	1.27	0	0	0	0	1.27	0.31	0.00	1.27
VOC (Total)	0.82	3.61	4.00	0.10	5.20	0.14	3.84	1.77	0.02	3.85

MVP Southgate Project
Lambert Compressor Station

Table B-6. Capstone Microturbine Potential Emissions Summary (C200)

Engine parameters

Power output base load	268.2	hp
Power output base load	200	kW
Heat Input Capacity (HHV)	2.28	MMBtu/hr
Maximum Annual Operation	8760	hr/yr
Number of Units	5	Units

Pollutant	Potential Emissions			
	g/bhp-hr[1]	lb/MMBtu[2]	lb/hr	Total Annual (ton/yr)[3]
NO_x	0.14		0.08	1.81
CO	0.37		0.22	4.79
VOC	0.03		0.02	0.44
PM10/2.5		0.0066	0.02	0.330
SO2		0.0034	0.008	0.1698
CO2e		117.10	266.990	5847.07
CO2		116.9800	266.714	5841.05
CH4		0.0022	0.005	0.11
N2O		0.0002	0.001	0.011

Notes:

[1] NOx, CO, VOC based on vendor data.

[2] Emissions for PM10/PM2.5 and SO2 calculated using AP-42 emission factors (Table 3.1-2a). Emission for GHGs based upon 40 CFR Part 98, Subpart C.

[3] Represents 5 x Capstone C200 Microturbines, each limited to 8,760 hours / year.

MVP Southgate Project
Lambert Compressor Station

Table B-7. Gas-Fired Heater Potential Emissions Summary

Heater parameters

Heat Input Capacity (HHV)	0.77	MMBtu/hr
Fuel Firing Rate	700	SCF/hr
Maximum Annual Operation	8,760	hr/yr

Pollutant	Potential Emissions		
	lb/mmscf	lb/hr	Total Annual (ton/yr)
NO_x	100	0.07	0.31
CO	84	0.06	0.26
VOC	5.5	0.004	0.017
PM/PM-10/PM-2.5	7.6	0.005	0.023
SO_2 [2]	5.71	0.0040	0.018
CO2e	128,868	90.17	394.93
CO2	128,735	90.07	394.53
CH4	2.42	0.0017	0.01
N2O	0.24	0.00017	0.0007

[1] NO_x, CO, VOC and PM emissions are based upon AP-42 Emission Factors

[2] Emissions of SO_2 from based on mass balance of sulfur in fuel:

Sulfur Content	2.0	grains/100 SCF
Higher Heating Value	1,100	Btu/SCF
Molecular Weight of S =	32	lb/lbmol
Molecular Weight of SO_2 =	64	lb/lbmol

[3] GHG Emissions are based upon 40 CFR Part 98, Subpart C

MVP Southgate Project
Lambert Compressor Station

Table B-8. Fugitive Blowdowns Potential Emissions Summary

Natural Gas Specifications

Constituent	Mol Percent	Molecular Weight	Lb/Lb-Mol NG	Mass Percent	VOC
CO_2	0.165	44.01	0.073	0.41%	No
Nitrogen	0.396	28.01	0.111	0.62%	No
Methane	87.823	16.04	14.089	79.08%	No
Ethane	11.303	30.07	3.399	19.08%	No
Propane	0.28	44.10	0.123	0.69%	Yes
i-Butane	0.009	58.12	0.005	0.03%	Yes
i-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Hexane	0.008	86.18	0.007	0.04%	Yes
N-Butane	0.01	58.12	0.006	0.03%	Yes

Notes: Based upon representative gas analyses for Project.

Natural Gas Properties	
Molecular Weight	17.817
Specific Gravity	0.615
lb/Scf	0.047
Scf/lb	21.26

Parameter	Blowdown Events							
	Taurus 70 Shutdown	Mars 100 Shutdown	Pig Receiver	Pig Launcher	Suction Filter	Station Discharge	Miscellaneous Filters	Emergency Station Shutdown (ESD)[1]
Gas Blowdown (scf/event)	42,000	64,000	6,500	13,000	19,000	67,000	3,500	218,000
Blowdowns per Year	12	12	2	2	12	12	12	1
VOC Emissions (lb/event)	16.2	24.6	2.5	5.0	7.3	25.8	1.3	83.9
CO_2 Emissions (lb/event)	8.1	12.3	1.25	2.49	3.6	12.8	0.7	41.8
CH_4 Emissions (lb/event)	1,562.0	2,380.2	241.7	483.5	705.6	2,491.8	130.2	8,107.5
CO_2e Emissions (lb/event)	39,058.1	59,517.1	6,044.7	12,089.4	17,669.1	62,306.9	3,254.8	202,730.0
HAP Emissions (lb/event)	0.8	1.2	0.1	0.2	0.3	1.2	0.1	4.0
VOC Emissions (tpy)	0.0969	0.1477	0.0025	0.0050	0.0489	0.1546	0.0081	0.0419
CO_2 Emissions (tpy)	0.0483	0.0736	0.0012	0.0025	0.0219	0.0771	0.0040	0.0209
CH_4 Emissions (tpy)	9.4	14.3	0.24	0.48	4.2	15.0	0.8	4.1
CO_2e Emissions (tpy)	234.3	357.1	6.0	12.1	106.0	373.8	19.5	101.4
HAP Emissions (tpy)	0.005	0.007	0.00012	0.00024	0.002	0.007	0.0004	0.002

Note: Facility-wide blowdown events may occur for unplanned reasons (e.g. when an unsafe operating condition is detected). To prepare for such events, Mountain Valley Pipeline, LLC must perform ESD testing once every 5 years to ensure proper operation of the ESD system. A full station blowdown will only occur during emegency conditions. Emergency events are expected to be very infrequent and cannot be predicted. Accordingly, emergency station shutdown events are provided for informational purposes only.

MVP Southgate Project
Lambert Compressor Station

Table B-9. Produced Fluids Tank Potential Emissions Summary

Storage Tank Design Data

Capacity (gal)	10,080
Liquids Input Rate (gal/yr)	126,000
Daily Input Rate (bbl/day)	8
Percent Condensate (%)	1
Condensate Throughput (bbl/day)	0.1
Number of Tanks	2
Max. Hours of Operation	8760

Pollutant	Single Tank Total Emissions (Working + Breathing + Flashing)		
	lbs/hr	lbs/year	tons/year
VOC (Total)	0.049	429.2	0.21
CO2e	0.475	4161.0	2.08

Notes: Source - E&P Tanks 2.0

MVP Southgate Project
Lambert Compressor Station

Table B-10. Potential Fugitive Emissions Summary

Component	CH_4 Emission Factor[1,2]	CO_2 Emission Factor[1,2]	Units
Compressor Station Fugitives	135,260.0	7,813.1	lb/station-yr
Centrifugal Compressor Fugitives	467,660.0	27,013.7	lb/compressor-yr

[1]Greenhouse Gas Emission Estimation Guidelines for Natural Gas Transmission and Storage, Volume 1 - GHG Emission Estimation Methodologies and Procedures, Interstate Natural Gas Association of America (INGAA), September 28 2005. See Table 4.4.

[2]Based on 93.4 vol% CH_4 and 2 vol% CO_2 in natural gas, per INGAA Guideline

Natural Gas Specifications

Constituent	Mol Percent	Molecular Weight	Lb/Lb-Mol NG	Mass Percent	VOC
CO2	0.165	44.01	0.073	0.41%	No
Nitrogen	0.396	28.01	0.111	0.62%	No
Methane	87.823	16.04	14.089	79.08%	No
Ethane	11.303	30.07	3.399	19.08%	No
Propane	0.28	44.10	0.123	0.69%	Yes
i-Butane	0.009	58.12	0.005	0.03%	Yes
i-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Pentane	0.003	72.15	0.002	0.01%	Yes
N-Hexane	0.008	86.18	0.007	0.04%	Yes
N-Butane	0.01	58.12	0.006	0.03%	Yes

Natural Gas Properties	
Molecular Weight	17.817
Specific Gravity	0.615
lb/Scf	0.047
Scf/lb	21.26

Fugitive Componont Leak Emissions

Component Type	Estimated Component Count	Gas Leak Emission Factor		Hourly Average Gas Leak Rate	Annual Gas Leak Rate		Potential VOC Emissions	Potential HAP Emissions	CO_2 Emissions	CH_4 Emissions	CO_2e Emissions
		(scf/hr/component)	Factor Source	(scf/hr)	(scf/year)	lb/year	(tpy)	(tpy)	(tpy)	(tpy)	(tpy)
Connectors	1000	0.003	40 CFR 98, Table W-1A	3.00	26,280	1,236	0.01	0.0002	0.003	0.49	12.22
Flanges	500	0.003	40 CFR 98, Table W-1A	1.50	13,140	618	0.00	0.0001	0.001	0.24	6.11
Open-Ended	0	0.061	40 CFR 98, Table W-1A	0	0	0	0	0	0	0	0
Pump Seals	0	13.300	40 CFR 98, Table W-1A	0	0	0	0	0	0	0	0
Valves	100	0.027	40 CFR 98, Table W-1A	2.70	23,652	1,112	0.00	0.0002	0.002	0.44	11.00
Other	0	0.040	40 CFR 98, Table W-1A	0	0	0	0	0	0	0	0

Notes:
1. "Other" equipment types include compressor seals, relief valves, diaphragms, drains, meters, etc
2. The component count is a preliminary estimate based on the proposed design of the station
3. VOC, HAP, CO2, and CH4 emissions are based on fractions of these pollutants in the site-specific gas analysis
4. CO2e calculated using global warming potentials from Part 98, Table A-1 (CO2 = 1, CH4 = 25)

Dry Seal Emissions

Number of Compressors	Leak Rate (scf/hr/compressor)	Annual Natural Gas Released (scf/yr)	Annual Natural Gas Released (lb/yr)[1]	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	CO_2 Emissions (tpy)	CH_4 Emissions (tpy)	CO_2e Emissions (tpy)
2	210	3,679,200	173,037	0.71	0.03	0.35	68.4	1,710.7

Notes:
1. Leak rate and seal information from EPA Natural Gas Star Program (https://www.epa.gov/sites/production/files/2016-06/documents/ll_wetseals.pdf)
2. VOC, HAP, CO2, and CH4 emissions are based on fractions of these pollutants in the site-specific gas analysis
3. CO2e calculated using global warming potentials from Part 98, Table A-1 (CO2 = 1, CH4 = 25)

Fugitive Emissions Summary

Segment	Potential VOC Emissions (tpy)	Potential HAP Emissions (tpy)	CO_2 Emissions (tpy)	CH_4 Emissions (tpy)	CO_2e Emissions (tpy)
Compressor Station Fugitives	0.01	0.001	0.01	1.2	29.3
Dry Seal Emissions	0.71	0.03	0.35	68.4	1,710.7
Total	0.72	0.03	0.36	69.6	1,740.1

MVP Southgate Project
Lambert Compressor Station

Table B-11. Proposed Project Potential HAP Emissions Summary

	Solar Taurus 70			Solar Mars 100			Fuel Gas Heater			Capstone Microturbines			
Hazardous Air Pollutants (HAPs)	**Emission Factor Basis[1] lb/MMBtu**	**Max Hourly lb/hr**	**Annual Potential tons/year**	**Emission Factor Basis[1] lb/MMBtu**	**Max Hourly lb/hr**	**Annual Potential tons/year**	**Emission Factor Basis[2] lb/MMBtu**	**Max Hourly lb/hr**	**Annual Potential tons/year**	**EF Basis[3] lb/MMBtu**	**Max Hourly lb/hr**	**Annual Potential tons/year**	**Facility PTE tons/yr**
VOC-HAP													
Acetaldehyde	1.20E-04	1.12E-02	4.89E-02	1.20E-04	1.69E-02	7.40E-02				1.68E-04	3.82E-04	8.37E-03	1.31E-01
Acrolein	1.92E-05	1.79E-03	7.82E-03	1.92E-05	2.70E-03	1.18E-02				2.68E-05	6.11E-05	1.34E-03	2.10E-02
Benzene	3.60E-05	3.35E-03	1.47E-02	3.60E-05	5.07E-03	2.22E-02	2.06E-06	1.59E-06	6.94E-06	5.03E-05	1.15E-04	2.51E-03	3.94E-02
1,3-Butadiene	1.29E-06	1.20E-04	5.26E-04	1.29E-06	1.82E-04	7.96E-04				1.80E-06	4.11E-06	9.00E-05	1.41E-03
Dichlorobenzene							1.18E-06	9.06E-07	3.97E-06				3.97E-06
Ethylbenzene	9.60E-05	8.93E-03	3.91E-02	9.60E-05	1.35E-02	5.92E-02				1.34E-04	3.06E-04	6.70E-03	1.05E-01
Formaldehyde	2.13E-03	1.98E-01	8.68E-01	2.13E-03	3.00E-01	1.31E+00	7.35E-05	5.66E-05	2.48E-04	2.98E-03	6.78E-03	1.49E-01	2.33E+00
Hexane							1.76E-03	1.36E-03	5.95E-03				5.95E-03
Naphthalene	3.90E-06	3.63E-04	1.59E-03	3.90E-06	5.49E-04	2.41E-03	5.98E-07	4.60E-07	2.02E-06	5.45E-06	1.24E-05	2.72E-04	4.27E-03
PAH	6.60E-06	6.14E-04	2.69E-03	6.60E-06	9.30E-04	4.07E-03				9.22E-06	2.10E-05	4.60E-04	7.22E-03
Propylene Oxide	8.70E-05	8.09E-03	3.54E-02	8.70E-05	1.23E-02	5.37E-02				1.22E-04	2.77E-04	6.07E-03	9.52E-02
Toluene	3.90E-04	3.63E-02	1.59E-01	3.90E-04	5.49E-02	2.41E-01	3.33E-06	2.57E-06	1.12E-05	5.45E-04	1.24E-03	2.72E-02	4.27E-01
Xylenes	1.92E-04	1.79E-02	7.82E-02	1.92E-04	2.70E-02	1.18E-01				2.68E-04	6.11E-04	1.34E-02	2.10E-01
Polycyclic Organic Compounds (POM)													
Acenaphthene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Acenaphthylene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Anthracene	2.35E-09	2.19E-07	9.59E-07	2.35E-09	3.31E-07	1.45E-06	2.35E-09	1.81E-09	7.94E-09	2.35E-09	5.36E-09	1.17E-07	2.54E-06
Benz(a)anthracene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Benzo(a)pyrene	1.18E-09	1.09E-07	4.79E-07	1.18E-09	1.66E-07	7.26E-07	1.18E-09	9.06E-10	3.97E-09	1.18E-09	2.68E-09	5.87E-08	1.27E-06
Benzo(b)fluoranthene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Benzo(g,h,i)perylene	1.18E-09	1.09E-07	4.79E-07	1.18E-09	1.66E-07	7.26E-07	1.18E-09	9.06E-10	3.97E-09	1.18E-09	2.68E-09	5.87E-08	1.27E-06
Benzo(k)fluoranthene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Chrysene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Dibenzo(a,h)anthracene	1.18E-09	1.09E-07	4.79E-07	1.18E-09	1.66E-07	7.26E-07	1.18E-09	9.06E-10	3.97E-09	1.18E-09	2.68E-09	5.87E-08	1.27E-06
7,12-Dimethylbenz(a)anthracene	1.57E-08	1.46E-06	6.39E-06	1.57E-08	2.21E-06	9.68E-06	1.57E-08	1.21E-08	5.29E-08	1.57E-08	3.58E-08	7.83E-07	1.69E-05
Fluoranthene	2.94E-09	2.74E-07	1.20E-06	2.94E-09	4.14E-07	1.81E-06	2.94E-09	2.26E-09	9.92E-09	2.94E-09	6.71E-09	1.47E-07	3.17E-06
Fluorene	2.75E-09	2.55E-07	1.12E-06	2.75E-09	3.87E-07	1.69E-06	2.75E-09	2.11E-09	9.26E-09	2.75E-09	6.26E-09	1.37E-07	2.96E-06
3-Methylchloranthrene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
2-Methylnaphthalene	2.35E-08	2.19E-06	9.59E-06	2.35E-08	3.31E-06	1.45E-05	2.35E-08	1.81E-08	7.94E-08	2.35E-08	5.36E-08	1.17E-06	2.54E-05
Indeno(1,2,3-cd)pyrene	1.76E-09	1.64E-07	7.19E-07	1.76E-09	2.49E-07	1.09E-06	1.76E-09	1.36E-09	5.95E-09	1.76E-09	4.02E-09	8.81E-08	1.90E-06
Phenanthrene	1.67E-08	1.55E-06	6.79E-06	1.67E-08	2.35E-06	1.03E-05	1.67E-08	1.28E-08	5.62E-08	1.67E-08	3.80E-08	8.32E-07	1.80E-05
Pyrene	4.90E-09	4.56E-07	2.00E-06	4.90E-09	6.90E-07	3.02E-06	4.90E-09	3.77E-09	1.65E-08	4.90E-09	1.12E-08	2.45E-07	5.28E-06
Total POM	8.65E-08	8.04E-06	3.52E-05	8.65E-08	1.22E-05	5.33E-05	8.65E-08	6.66E-08	2.92E-07	8.65E-08	1.97E-07	4.32E-06	9.32E-05
Total HAPs													
												Maximum Individual HAP:	**2.3**
												Total Project HAPs:	**3.4**

[1] Emissions based on AP-42 5th Edition, Section 3.1. Emissions based on scaling of AP-42 values using Vendor Guarantee for TOC.

[2] Emissions based on AP-42 5th Edition, Section 1.4.

[3] Emissions based on AP-42 5th Edition, Section 3.1.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **TAURUS 70-10802S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 5896 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	15.95	16.19	9.27
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.83	0.84	0.48
(gas turbine shaft pwr) lbm/hr	3.64	3.70	2.12
2 — 8844 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	19.32	19.60	11.23
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.67	0.68	0.39
(gas turbine shaft pwr) lbm/hr	4.41	4.48	2.56
3 — 11792 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	21.98	22.30	12.77
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.57	0.58	0.33
(gas turbine shaft pwr) lbm/hr	5.02	5.09	2.92

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **TAURUS 70-10802S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 5791 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	15.43	15.66	8.97
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.82	0.83	0.47
(gas turbine shaft pwr) lbm/hr	3.52	3.58	2.05
5 — 8686 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	18.66	18.93	10.84
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.66	0.67	0.38
(gas turbine shaft pwr) lbm/hr	4.26	4.32	2.48
6 — 11581 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	21.68	22.00	12.60
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.57	0.58	0.33
(gas turbine shaft pwr) lbm/hr	4.95	5.02	2.88

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **TAURUS 70-10802S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 5678 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	14.90	15.12	8.66
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.80	0.82	0.47
(gas turbine shaft pwr) lbm/hr	3.40	3.45	1.98
2 — 8518 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	17.97	18.24	10.45
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.65	0.66	0.38
(gas turbine shaft pwr) lbm/hr	4.10	4.16	2.38
3 — 11358 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	21.37	21.68	12.42
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.58	0.58	0.33
(gas turbine shaft pwr) lbm/hr	4.88	4.95	2.84

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **TAURUS 70-10802S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 5251 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	13.99	14.19	8.13
lbm/MMBtu (Fuel LHV)	0.060	0.060	0.035
lbm/(MW-hr)	0.82	0.83	0.47
(gas turbine shaft pwr) lbm/hr	3.19	3.24	1.86
5 — 7876 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	16.81	17.06	9.77
lbm/MMBtu (Fuel LHV)	0.060	0.060	0.035
lbm/(MW-hr)	0.65	0.66	0.38
(gas turbine shaft pwr) lbm/hr	3.84	3.89	2.23
6 — 10502 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	20.11	20.41	11.69
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.59	0.59	0.34
(gas turbine shaft pwr) lbm/hr	4.59	4.66	2.67

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: Equitrans Midstream	Engine Model: TAURUS 70-10802S CS/MD STANDARD
Job ID: Lambert	
Inquiry Number:	Fuel Type: CHOICE GAS / Water Injection: NO
Run By: Andrew P Desmarais / Date Run: 10-Oct-18	Engine Emissions Data: REV. 0.1

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 4765 HP — 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	13.02	13.21	7.57
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr)	0.84	0.85	0.49
(gas turbine shaft pwr) lbm/hr	2.97	3.02	1.73
2 — 7147 HP — 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	15.59	15.82	9.06
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr)	0.67	0.68	0.39
(gas turbine shaft pwr) lbm/hr	3.56	3.61	2.07
3 — 9530 HP — 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	18.70	18.97	10.87
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr)	0.60	0.61	0.35
(gas turbine shaft pwr) lbm/hr	4.27	4.33	2.48

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **TAURUS 70-10802S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 0.1**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 4213 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	11.96	12.14	6.95
lbm/MMBtu (Fuel LHV)	0.058	0.059	0.034
lbm/(MW-hr)	0.87	0.88	0.51
(gas turbine shaft pwr) lbm/hr	2.73	2.77	1.59
5 — 6320 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	14.25	14.46	8.28
lbm/MMBtu (Fuel LHV)	0.059	0.059	0.034
lbm/(MW-hr)	0.69	0.70	0.40
(gas turbine shaft pwr) lbm/hr	3.25	3.30	1.89
6 — 8426 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	17.09	17.34	9.93
lbm/MMBtu (Fuel LHV)	0.059	0.059	0.034
lbm/(MW-hr)	0.62	0.63	0.36
(gas turbine shaft pwr) lbm/hr	3.90	3.96	2.27

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Equitrans Midstream*	Model: **TAURUS 70-10802S**
Job ID: **Lambert**	Package Type: **CS/MD**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Match: **STANDARD**
Engine Performance Code: **REV. 4.20.1.23.12** / Engine Performance Data: **REV. 2.0**	Fuel System: **GAS**
	Fuel Type: **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	660
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	5.0
Accessory on GP Shaft	HP	23.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	0	0	0	20.0	20.0	20.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	9598	10836	11860	9491	10756	11842
Specified Load	HP	50.0%	75.0%	FULL	50.0%	75.0%	FULL
Net Output Power	HP	5896	8844	11792	5791	8686	11581
Fuel Flow	mmBtu/hr	60.78	73.56	83.62	58.84	71.10	82.54
Heat Rate	Btu/HP-hr	10310	8318	7092	10161	8186	7127
Therm Eff	%	24.680	30.591	35.880	25.041	31.084	35.702
Engine Exhaust Flow	lbm/hr	193726	218893	231761	184513	209712	225326
PT Exit Temperature	deg F	964	897	856	974	905	887
Exhaust Temperature	deg F	886	869	856	912	887	887

Fuel Gas Composition (Volume Percent)

Methane (CH4)	87.82
Ethane (C2H6)	11.30
Propane (C3H8)	0.28
I-Butane (C4H10)	0.0090
N-Butane (C4H10)	0.01
I-Pentane (C5H12)	0.0030
N-Pentane (C5H12)	0.0030
Hexane (C6H14)	0.0080
Carbon Dioxide (CO2)	0.16
Nitrogen (N2)	0.40
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	989.2	Specific Gravity	0.6151	Wobbe Index at 60F	1261.3

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Equitrans Midstream*	Model: **TAURUS 70-10802S**
Job ID: **Lambert**	Package Type: **CS/MD**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Match: **STANDARD**
Engine Performance Code: **REV. 4.20.1.23.12** / Engine Performance Data: **REV. 2.0**	Fuel System: **GAS**
	Fuel Type: **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	660
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	5.0
Accessory on GP Shaft	HP	23.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	40.0	40.0	40.0	60.0	60.0	60.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	9371	10671	11765	9103	10400	11495
Specified Load	HP	50.0%	75.0%	FULL	50.0%	75.0%	FULL
Net Output Power	HP	5678	8518	11358	5251	7876	10502
Fuel Flow	mmBtu/hr	56.89	68.60	81.49	53.59	64.39	76.98
Heat Rate	Btu/HP-hr	10018	8054	7175	10206	8175	7330
Therm Eff	%	25.398	31.594	35.462	24.931	31.125	34.715
Engine Exhaust Flow	lbm/hr	175520	200406	218819	164699	187412	207302
PT Exit Temperature	deg F	984	915	920	1003	935	943
Exhaust Temperature	deg F	937	904	920	964	928	943

Fuel Gas Composition (Volume Percent)

Methane (CH4)	87.82
Ethane (C2H6)	11.30
Propane (C3H8)	0.28
I-Butane (C4H10)	0.0090
N-Butane (C4H10)	0.01
I-Pentane (C5H12)	0.0030
N-Pentane (C5H12)	0.0030
Hexane (C6H14)	0.0080
Carbon Dioxide (CO2)	0.16
Nitrogen (N2)	0.40
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	989.2	Specific Gravity	0.6151	Wobbe Index at 60F	1261.3

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Equitrans Midstream*	Model: TAURUS 70-10802S
Job ID: Lambert	Package Type: CS/MD
Run By: Andrew P Desmarais / Date Run: 10-Oct-18	Match: STANDARD
Engine Performance Code: REV. 4.20.1.23.12 / Engine Performance Data: REV. 2.0	Fuel System: GAS
	Fuel Type: CHOICE GAS

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	660
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	5.0
Accessory on GP Shaft	HP	23.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	80.0	80.0	80.0	100.0	100.0	100.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	8832	10056	11189	8474	9603	10796
Specified Load	HP	50.0%	75.0%	FULL	50.0%	75.0%	FULL
Net Output Power	HP	4765	7147	9530	4213	6320	8426
Fuel Flow	mmBtu/hr	50.22	60.11	72.04	46.71	55.59	66.64
Heat Rate	Btu/HP-hr	10540	8410	7559	11088	8797	7908
Therm Eff	%	24.141	30.255	33.660	22.949	28.923	32.174
Engine Exhaust Flow	lbm/hr	154855	174269	194517	144524	159827	179098
PT Exit Temperature	deg F	1022	960	967	1045	991	1000
Exhaust Temperature	deg F	989	955	967	1016	988	1000

Fuel Gas Composition (Volume Percent)

Methane (CH4)	87.82
Ethane (C2H6)	11.30
Propane (C3H8)	0.28
I-Butane (C4H10)	0.0090
N-Butane (C4H10)	0.01
I-Pentane (C5H12)	0.0030
N-Pentane (C5H12)	0.0030
Hexane (C6H14)	0.0080
Carbon Dioxide (CO2)	0.16
Nitrogen (N2)	0.40
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	989.2	Specific Gravity	0.6151	Wobbe Index at 60F	1261.3

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **MARS 100-16000S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 1.0**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 8562 HP, 50.0% Load, Elev. 660 ft, Rel. Humidity 60.0%, Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	18.70	18.98	10.87
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.67	0.68	0.39
(gas turbine shaft pwr) lbm/hr	4.27	4.33	2.48
2 — 12842 HP, 75.0% Load, Elev. 660 ft, Rel. Humidity 60.0%, Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	29.65	30.08	17.23
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.71	0.72	0.41
(gas turbine shaft pwr) lbm/hr	6.77	6.87	3.93
3 — 17123 HP, 100.0% Load, Elev. 660 ft, Rel. Humidity 60.0%, Temperature 0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	33.28	33.77	19.34
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.60	0.60	0.35
(gas turbine shaft pwr) lbm/hr	7.60	7.71	4.42

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **MARS 100-16000S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 1.0**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 8300 HP — 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	23.77	24.12	13.82
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.88	0.89	0.51
(gas turbine shaft pwr) lbm/hr	5.43	5.51	3.15
5 — 12450 HP — 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	28.53	28.95	16.58
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.70	0.71	0.41
(gas turbine shaft pwr) lbm/hr	6.51	6.61	3.79
6 — 16600 HP — 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 20.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	32.23	32.71	18.73
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.59	0.60	0.35
(gas turbine shaft pwr) lbm/hr	7.36	7.47	4.28

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **MARS 100-16000S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 1.0**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 7959 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	22.73	23.06	13.21
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.87	0.89	0.51
(gas turbine shaft pwr) lbm/hr	5.19	5.27	3.02
2 — 11939 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	27.31	27.71	15.87
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.70	0.71	0.41
(gas turbine shaft pwr) lbm/hr	6.24	6.33	3.62
3 — 15918 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 40.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	31.01	31.47	18.02
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.60	0.61	0.35
(gas turbine shaft pwr) lbm/hr	7.08	7.18	4.12

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **MARS 100-16000S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 1.0**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 7521 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	21.64	21.96	12.58
lbm/MMBtu (Fuel LHV)	0.060	0.060	0.035
lbm/(MW-hr)	0.88	0.89	0.51
(gas turbine shaft pwr) lbm/hr	4.94	5.01	2.87
5 — 11282 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	25.90	26.28	15.05
lbm/MMBtu (Fuel LHV)	0.060	0.060	0.035
lbm/(MW-hr)	0.70	0.71	0.41
(gas turbine shaft pwr) lbm/hr	5.91	6.00	3.44
6 — 15042 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 60.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	29.58	30.01	17.19
lbm/MMBtu (Fuel LHV)	0.060	0.061	0.035
lbm/(MW-hr)	0.60	0.61	0.35
(gas turbine shaft pwr) lbm/hr	6.75	6.85	3.92

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **MARS 100-16000S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 1.0**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
1 — 6986 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	20.33	20.63	11.81
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr)	0.89	0.90	0.52
(gas turbine shaft pwr) lbm/hr	4.64	4.71	2.70
2 — 10480 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	24.28	24.63	14.11
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr)	0.71	0.72	0.41
(gas turbine shaft pwr) lbm/hr	5.54	5.62	3.22
3 — 13973 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 80.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	27.88	28.29	16.20
lbm/MMBtu (Fuel LHV)	0.059	0.060	0.034
lbm/(MW-hr)	0.61	0.62	0.36
(gas turbine shaft pwr) lbm/hr	6.37	6.46	3.70

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED EMISSION PERFORMANCE

Customer: **Equitrans Midstream**	Engine Model: **MARS 100-16000S CS/MD STANDARD**
Job ID: **Lambert**	
Inquiry Number:	Fuel Type: **CHOICE GAS** / Water Injection: **NO**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Engine Emissions Data: **REV. 1.0**

	NOx EMISSIONS	CO EMISSIONS	UHC EMISSIONS
4 — 6393 HP 50.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	18.98	19.25	11.03
lbm/MMBtu (Fuel LHV)	0.058	0.059	0.034
lbm/(MW-hr)	0.91	0.92	0.53
(gas turbine shaft pwr) lbm/hr	4.33	4.40	2.52
5 — 9589 HP 75.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	22.52	22.85	13.09
lbm/MMBtu (Fuel LHV)	0.059	0.059	0.034
lbm/(MW-hr)	0.72	0.73	0.42
(gas turbine shaft pwr) lbm/hr	5.14	5.22	2.99
6 — 12786 HP 100.0% Load — Elev. 660 ft — Rel. Humidity 60.0% — Temperature 100.0 Deg. F			
PPMvd at 15% O2	15.00	25.00	25.00
ton/yr	26.02	26.40	15.12
lbm/MMBtu (Fuel LHV)	0.059	0.059	0.034
lbm/(MW-hr)	0.62	0.63	0.36
(gas turbine shaft pwr) lbm/hr	5.94	6.03	3.45

Notes

1. For short-term emission limits such as lbs/hr., Solar recommends using "worst case" anticipated operating conditions specific to the application and the site conditions. Worst case for one pollutant is not necessarily the same for another.
2. Solar's typical SoLoNOx warranty, for ppm values, is available for greater than 0 deg F or -20 deg C, and between 50% and 100% load for gas, fuel, and between 65% and 100% load for liquid fuel (except f or the Centaur 40). An emission warranty for non-SoLoNOx equipment is available for greater than 0 deg F or -20 deg C and betwee
3. Fuel must meet Solar standard fuel specification ES 9-98. Emissions are based on the attached fuel composition, or, San Diego natural gas or equivalent.
4. If needed, Solar can provide Product Information Letters to address turbine operation outside typical warranty ranges, as well as non-warranted emissions of SO2, PM10/2.5, VOC, and formaldehyde.
5. Solar can provide factory testing in San Diego to ensure the actual unit(s) meet the above values within the tolerances quoted. Pricing and schedule impact will be provided upon request.
6. Any emissions warranty is applicable only for steady-state conditions and does not apply during start-up, shut-down, malfunction, or transient event.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Equitrans Midstream*	Model: **MARS 100-16000S**
Job ID: **Lambert**	Package Type: **CS/MD**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Match: **STANDARD**
Engine Performance Code: **REV. 4.20.1.23.12** / Engine Performance Data: **REV. 1.0**	Fuel System: **GAS**
	Fuel Type: **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	660
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	5.0
Accessory on GP Shaft	HP	27.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	0	0	0	20.0	20.0	20.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	6802	8663	9382	7506	8559	9308
Specified Load	HP	50.0%	75.0%	FULL	50.0%	75.0%	FULL
Net Output Power	HP	8562	12842	17123	8300	12450	16600
Fuel Flow	mmBtu/hr	71.43	112.88	126.60	90.64	108.69	122.73
Heat Rate	Btu/HP-hr	8343	8790	7394	10920	8730	7393
Therm Eff	%	30.499	28.948	34.414	23.300	29.144	34.415
Engine Exhaust Flow	lbm/hr	291037	346736	358083	297633	333007	349335
PT Exit Temperature	deg F	651	903	866	963	911	879
Exhaust Temperature	deg F	651	871	866	893	885	879

Fuel Gas Composition (Volume Percent)

Methane (CH4)	87.82
Ethane (C2H6)	11.30
Propane (C3H8)	0.28
I-Butane (C4H10)	0.0090
N-Butane (C4H10)	0.01
I-Pentane (C5H12)	0.0030
N-Pentane (C5H12)	0.0030
Hexane (C6H14)	0.0080
Carbon Dioxide (CO2)	0.16
Nitrogen (N2)	0.40
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	989.2	Specific Gravity	0.6151	Wobbe Index at 60F	1261.3

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Equitrans Midstream*	Model: **MARS 100-16000S**
Job ID: **Lambert**	Package Type: **CS/MD**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Match: **STANDARD**
Engine Performance Code: **REV. 4.20.1.23.12** / Engine Performance Data: **REV. 1.0**	Fuel System: **GAS**
	Fuel Type: **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	660
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	5.0
Accessory on GP Shaft	HP	27.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	40.0	40.0	40.0	60.0	60.0	60.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	7365	8424	9200	7173	8249	9042
Specified Load	HP	50.0%	75.0%	FULL	50.0%	75.0%	FULL
Net Output Power	HP	7959	11939	15918	7521	11282	15042
Fuel Flow	mmBtu/hr	86.81	104.25	118.30	82.93	99.18	113.23
Heat Rate	Btu/HP-hr	10907	8732	7432	11026	8791	7527
Therm Eff	%	23.328	29.140	34.236	23.077	28.942	33.803
Engine Exhaust Flow	lbm/hr	282272	318188	338647	267923	301449	325252
PT Exit Temperature	deg F	980	920	893	1004	933	910
Exhaust Temperature	deg F	920	901	893	951	918	910

Fuel Gas Composition (Volume Percent)

Methane (CH4)	87.82
Ethane (C2H6)	11.30
Propane (C3H8)	0.28
I-Butane (C4H10)	0.0090
N-Butane (C4H10)	0.01
I-Pentane (C5H12)	0.0030
N-Pentane (C5H12)	0.0030
Hexane (C6H14)	0.0080
Carbon Dioxide (CO2)	0.16
Nitrogen (N2)	0.40
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	989.2	Specific Gravity	0.6151	Wobbe Index at 60F	1261.3

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PREDICTED ENGINE PERFORMANCE

Customer: *Equitrans Midstream*	Model: **MARS 100-16000S**
Job ID: **Lambert**	Package Type: **CS/MD**
Run By: **Andrew P Desmarais** / Date Run: **10-Oct-18**	Match: **STANDARD**
Engine Performance Code: **REV. 4.20.1.23.12** / Engine Performance Data: **REV. 1.0**	Fuel System: **GAS**
	Fuel Type: **CHOICE GAS**

DATA FOR NOMINAL PERFORMANCE

Elevation	feet	660
Inlet Loss	in H2O	4.0
Exhaust Loss	in H2O	5.0
Accessory on GP Shaft	HP	27.8

		1	2	3	4	5	6
Engine Inlet Temperature	deg F	80.0	80.0	80.0	100.0	100.0	100.0
Relative Humidity	%	60.0	60.0	60.0	60.0	60.0	60.0
Driven Equipment Speed	RPM	7003	8032	8844	6853	7778	8608
Specified Load	HP	50.0%	75.0%	FULL	50.0%	75.0%	FULL
Net Output Power	HP	6986	10480	13973	6393	9589	12786
Fuel Flow	mmBtu/hr	78.41	93.60	107.44	74.07	87.86	101.48
Heat Rate	Btu/HP-hr	11224	8931	7689	11586	9163	7937
Therm Eff	%	22.670	28.489	33.091	21.960	27.769	32.059
Engine Exhaust Flow	lbm/hr	251220	283287	309604	234805	264650	291077
PT Exit Temperature	deg F	1028	950	926	1054	976	947
Exhaust Temperature	deg F	981	938	926	1010	966	947

Fuel Gas Composition (Volume Percent)

Methane (CH4)	87.82
Ethane (C2H6)	11.30
Propane (C3H8)	0.28
I-Butane (C4H10)	0.0090
N-Butane (C4H10)	0.01
I-Pentane (C5H12)	0.0030
N-Pentane (C5H12)	0.0030
Hexane (C6H14)	0.0080
Carbon Dioxide (CO2)	0.16
Nitrogen (N2)	0.40
Sulfur Dioxide (SO2)	0.0001

Fuel Gas Properties

LHV (Btu/Scf)	989.2	Specific Gravity	0.6151	Wobbe Index at 60F	1261.3

This performance was calculated with a basic inlet and exhaust system. Special equipment such as low noise silencers, special filters, heat recovery systems or cooling devices will affect engine performance. Performance shown is "Expected" performance at the pressure drops stated, not guaranteed.

Solar Turbines
A Caterpillar Company

PIL 168
Product Information Letter

Volatile Organic Compound, Sulfur Dioxide, and Formaldehyde Emission Estimates

Leslie Witherspoon
Solar Turbines Incorporated

PURPOSE

This Product Information Letter (PIL) summarizes recommended emission factors often utilized to estimate emissions of volatile organic compounds (VOC), sulfur dioxide (SO_2), and formaldehyde from gas turbines.

INTRODUCTION

Emissions estimates of VOC, SO2, and formaldehyde are often necessary during the air permitting process. In absence of manufacturer, site-specific or representative source test data, gas turbine users often refer to EPA (or state) reference documents or databases. The emissions estimates in this PIL are assumed valid at ambient temperatures >0 °F and for natural gas from 50-100% load (40-100% load for the *Titan*™ 250 and 80-100% load for the *Saturn*® 20) or for liquid fuel from 65-100% load (80-100% for the *Saturn* 20 and *Centaur*® 40).

Volatile Organic Compounds

Permitting agencies usually require gas turbine users to include emissions of VOC, a subpart of the unburned hydrocarbon (UHC) emissions, during the air permitting process. Volatile organic compounds, non-methane hydrocarbons (NMHC), and reactive organic gases (ROG) are some of the ways of referring to the non-methane (and non-ethane) portion of an "unburned hydrocarbon" emission estimate.

For natural gas fuel, most Solar customers use a 5 ppm VOC level to estimate emissions for the air permit. For liquid fuel, Solar's customers usually assume UHC emissions equal VOC emissions. The UHC/VOC value typically used is 25 ppm.

EPA's AP-42[1] document and WebFIRE[2] database also contain VOC emissions estimates for gas turbines. These sources are seldom used by Solar's customers.

Sulfur Dioxide

Sulfur dioxide emissions are produced by conversion of sulfur in the fuel to SO_2. Solar customers usually either use a mass balance calculation or AP-42/WebFIRE to estimate SO_2 emissions. Because Solar does not control the amount of sulfur in the fuel, no SO_2 emissions warranty is available.

The mass balance method assumes that any sulfur in the fuel converts to SO_2. For reference, the typical mass balance equation is shown below.

$$\frac{\text{lb SO}_2}{\text{hr}} = \left(\frac{\text{wt\% Sulfur}}{100}\right)\left(\frac{\text{lb fuel}}{\text{Btu}}\right)\left(\frac{10^6\ \text{Btu}}{\text{MMBtu}}\right)\left(\frac{\text{MMBtu fuel}}{\text{hr}}\right)\left(\frac{\text{MW SO}_2}{\text{MW Sulfur}}\right)$$

[1] AP-42 is an EPA document containing a compilation of air pollutant emission factors by source category.
[2] WebFIRE is an EPA electronic based repository and retrieval tool for emission factors.

Variables: wt % of sulfur in fuel
Btu/lb fuel (LHV)
MMBtu/hr fuel flow (LHV)

As an alternative to the mass balance calculation, EPA's AP-42 document can be used. AP-42 (Table 3.1-2a, April 2000) suggests emission factors of 0.94S lb/MMBtu (HHV) (where S=sulfur % in fuel) or 0.0034 lb/MMBtu (HHV) for gas fuel and 1.01S lb/MMBtu (HHV) (where S=sulfur % in fuel) or 0.033 lb/MMBtu (HHV) for liquid fuel.

Formaldehyde

For gas turbines, formaldehyde emissions are a result of incomplete combustion. Formaldehyde in the exhaust stream is unstable and difficult to measure. In addition to turbine characteristics including combustor design, size, maintenance history, and load profile, the formaldehyde emissions level is also affected by: ambient temperature, humidity, atmospheric pressure, fuel quality, formaldehyde concentration in the ambient air, test method measurement variability, and operational factors.

The emission factor data in Table 1 is an excerpt from an EPA memo: "Revised HAP Emission Factors for Stationary Combustion Turbines, 8/22/03." The memo presents hazardous air pollutant (HAP) emission factor data in several categories. The emission factors in the memo are a compilation of the HAP data EPA collected during the Maximum Achievable Control Technology (MACT) standard development process. The emission factor documentation shows there is a high degree of variability in formaldehyde emissions from gas turbines, depending on the manufacturer, rating size of equipment, combustor design, and testing events.

Table 1. EPA's Total HAP and Formaldehyde Emission Factors for <50 MW Lean-Premix Gas Turbines burning Natural Gas

(Source: Revised HAP Emission Factors for Stationary Combustion Turbines, OAR-2002-0060, IV-B-09, 8/22/03)

Pollutant	Engine Load	95% Upper Confidence of Mean, lb/MMBtu HHV	95% Upper Confidence of Data, lb/MMBtu HHV	Memo Reference
Total HAP	> 90%	0.00144	0.00258	Table 19
Total HAP	All	0.00160	0.00305	Table 16
Formaldehyde	> 90%	0.00127	0.00241	Table 19
Formaldehyde	All	0.00143	0.00288	Table 16

AP-42 and the California Air Toxics Emission Factor (CATEF) database also contain formaldehyde emission factors. Both sources reference data that is older than the data summarized in Table 1.

To estimate formaldehyde emissions from gas turbines, users should use the emission factor that best represents the gas turbine's actual/planned operating profile. Solar does not offer a formaldehyde emissions warranty.

Solar Turbines Incorporated
9330 Sky Park Court
San Diego, CA 92123-5398

Solar Turbines
A Caterpillar Company

PIL 170
Product Information Letter

Emission Estimates at Start-up, Shutdown, and Commissioning for SoLoNOx Combustion Products

Leslie Witherspoon
Solar Turbines Incorporated

PURPOSE

The purpose of this Product Information Letter (PIL) is to provide emission estimates for start-up and shutdown events for *Solar*® gas turbines with *SoLoNOx*™ dry low emissions combustion systems. The commissioning process is also discussed.

INTRODUCTION

The information presented in this document is representative for both generator set (GS) and compressor set / mechanical drive (CS/MD) combustion turbine applications. Operation of duct burners and/or any add-on control equipment is not accounted for in the emissions estimates. Emissions related to the start-up, shutdown, and commissioning of combustion turbines will not be warranted. The estimates in this document are based on limited engine testing and analysis. The estimates are most commonly used for potential to emit calculations to determine air permitting status. **Solar discourages customers from accepting the estimates as start-up and shutdown event permit limits.**

Combustion turbine start-up occurs in one of three modes: cold, warm, or hot. The nominal start-up duration for a hot, warm, or cold start is the same for a *Solar* turbine.

The start-up and shutdown time for a *Solar* turbine in a simple-cycle or combined heat and power application is the same. Heat recovery steam generator (HRSG) steam pressure is usually 250 psig or less. At 250 psig or less, thermal stress within the HRSG is minimized and, therefore, firing ramp-up/ramp-down is not limited. However, some combined heat and power plant applications will desire or dictate longer start-up/shutdown times due to external requirements.

Start-up and shutdown emissions estimates for the *Mercury*™ 50 engine are found in PIL 205.

For start-up and shutdown emissions estimates for conventional combustion turbines, landfill gas, digester gas, or other alternative fuel applications, contact Solar's Environmental Programs Department.

START-UP SEQUENCE

The start-up sequence and attaining *SoLoNOx* combustion mode, takes three steps:

1. Purge-crank
2. Ignition and acceleration to idle
3. Loading / thermal stabilization

During the "purge-crank" step, rotation of the turbine shaft is accomplished with a starter motor to remove any residual fuel gas in the engine flow path and exhaust. During

"ignition and acceleration to idle," fuel is introduced into the combustor and ignited in a diffusion flame mode and the engine rotor is accelerated to idle speed.

The third step consists of applying up to 50% load[1] while allowing the combustion flame to transition and stabilize. Once 50% load is achieved, the turbine transitions to *SoLoNOx* combustion mode and the engine control system begins to maintain the combustion primary zone temperature and limit pilot fuel to achieve the targeted nitrogen oxides (NOx), carbon monoxide (CO), and unburned hydrocarbons (UHC) emission levels.

SHUTDOWN PROCESS

Normal, planned cool down/shutdown duration varies by engine model. Once the shutdown process starts the engine unloads and moves into a cooldown mode.

START-UP AND SHUTDOWN EMISSIONS ESTIMATES

Tables 1 through 3 summarize the estimated pounds of emissions per start-up and shutdown event for each SoLoNOx product. The mass emissions estimates are calculated using empirical exhaust characteristics. The estimates in Tables 1-3 are representative of production units ordered from 2006 to present. In mid to late 2017 Solar will begin a transition to a new control regime that will result in lower CO and UHC values at lower loads thus reducing the estimated emissions per start-up and shutdown sequence. The *Titan*™ 250 has the new control scheme and thus estimated emissions will not change. As testing is completed and other models/ratings are qualified and able to be equipped with the updated controls, additional tables will be added to PIL 170. Unfortunately for turbines going through the air permitting process now that will be equipped with updated controls we are unable to provide emissions estimates until the testing and qualification is complete. Please contact Environmental Programs, Leslie Witherspoon (858.694.6609) or Anthony Pocengal (858.505.8554) for support.

COMMISSIONING EMISSIONS

Commissioning generally takes place over a two-week period. Static testing, where no combustion occurs, usually requires one week and no emissions are expected. Dynamic testing, where combustion will occur, typically includes a number of engine start and shutdown cycles and a variety of loads will be placed on the system. It is impossible to predict how long the turbine will run and in what combustion / emissions mode it will be running. The dynamic testing period is generally followed by one to two days of final commissioning during which the turbine is running at various loads.

Solar Turbines Incorporated
9330 Sky Park Court
San Diego, CA 92123-5398

[1] 40% load for the *Titan* 250 engine on natural gas. 65% load for all engines on liquid fuel (except 80% load for the *Centaur* 40).

Table 1. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
Nominal Start-up and Shutdown, Natural Gas Fuel

Data will NOT be warranted under any circumstances

	Centaur 40 4701S					Centaur 50 6201S					Taurus 60 7901S					Taurus 65 8401S				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	2	158	83	17	247	1	67	84	17	333	1	86	110	22	338	1	73	66	13	362
Total Emissions per Shutdown (lbs)	2	149	74	15	286	1	65	75	15	367	1	79	92	18	392	1	72	53	11	421

	Taurus 70 10801S					Mars 90 13000S GSC					Mars 100 16000S GSC					Titan 130 20501S				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	1	78	67	13	544	1	84	41	8	640	1	81	39	8	669	3	172	138	28	832
Total Emissions per Shutdown (lbs)	1	77	52	10	513	1	91	33	7	711	1	91	33	7	775	3	169	111	22	961

	Titan 130 22401S					Titan 250 30000S GSC				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	2	101	75	15	883	2	38	14	3	1445
Total Emissions per Shutdown (lbs)	2	106	63	13	1005	2	23	9	2	1200

Assumes ISO conditions: 59F, 60% RH, sea level, no losses

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 compliant.

Table 2. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx CS/MD Applications

Nominal Start-up and Shutdown, Natural Gas Fuel

Data will NOT be warranted under any circumstances

	Centaur 40 4702S					Centaur 50 6102S					Taurus 60 7802S				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	1	48	24	5	188	0.3	21	17	3	184	0.4	22	17	3	180
Total Emissions per Shutdown (lbs)	1	81	37	7	285	1	37	23	5	318	1	40	25	5	319

	Taurus 70 10802S					Mars 90 13000S CS/MD					Mars 100 16000S CS/MD				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	1	88	88	18	381	1	45	20	4	437	1	46	20	4	385
Total Emissions per Shutdown (lbs)	1	62	40	8	473	1	79	26	5	674	1	82	26	5	676

	Titan 130 20502S					Titan 130 22402S					Titan 250 30000S CS/MD				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	1	55	37	7	662	1	70	50	10	690	2	32	12	2	1135
Total Emissions per Shutdown (lbs)	2	91	46	9	945	2	104	54	11	1044	2	21	8	2	1122

Assumes ISO conditions: 59F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes natural gas fuel; ES 9-98 compliant.

Table 3. Estimation of Start-up and Shutdown Emissions (lbs/event) for SoLoNOx Generator Set Applications
Nominal Start-up and Shutdown, Liquid Fuel (Diesel #2)

Data will NOT be warranted under any circumstances

	Centaur 40 4701S					Centaur 50 6201S					Taurus 60 7901S				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	4	140	23	23	419	3	130	22	22	472	4	147	25	25	483
Total Emissions per Shutdown (lbs)	4	126	21	21	452	3	103	17	17	536	4	116	19	19	580

	Taurus 70 10801S					Mars 100 16000S GSC					Titan 130 20501S				
	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2	NOx	CO	UHC	VOC	CO2
Total Emissions per Start (lbs)	6	251	42	42	754	4	119	20	20	854	8	336	57	57	1164
Total Emissions per Shutdown (lbs)	4	144	24	24	737	5	128	20	20	1135	8	265	44	44	1374

Assumes ISO conditions: 59F, 60% RH, sea level, no losses.

Assumes unit is operating at >50% load prior to shutdown.

Assumes #2 Diesel fuel; ES 9-98 complaint.

Particulate Matter Emission Estimates

Leslie Witherspoon
Solar Turbines Incorporated

PURPOSE

This document summarizes Solar's recommended $PM_{10/2.5}$ emission levels for our combustion turbines. The recommended levels are based on an analysis of emissions tests collected from customer sites.

Particulate Matter Definition

National Ambient Air Quality Standards (NAAQS) for particulate matter were first set in 1971. Total suspended particulate (TSP) was the first indicator used to represent suspended particles in the ambient air. Since July 1, 1987, the Environmental Protection Agency (EPA) has used the indicator PM_{10}, which includes only the particles with aerodynamic diameter smaller than 10 micrometers (μm). PM_{10} (coarse particles) come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads by vehicle traffic.

The EPA added a $PM_{2.5}$ ambient air standard in 1997. $PM_{2.5}$ includes particles with an aerodynamic diameter less than 2.5 μm. $PM_{2.5}$ (fine particles) are generally emitted from industrial and residential combustion and from vehicle exhaust. Fine particles are also formed in the atmosphere when gases such as sulfur dioxide, nitrogen oxides, and volatile organic compounds, emitted by combustion activities, are transformed by chemical reactions.

Nearly all particulate matter from gas turbine exhaust is less than one micrometer (micron) in diameter. Thus the emission rates of TSP, PM_{10}, and $PM_{2.5}$ from gas turbines are theoretically equivalent although source testing will show variation due to test method detection levels and processes.

TESTING FOR PARTICULATE MATTER

The turbine combustion process has little effect on the particulate matter generated and measured. The largest contributor to particulate matter emissions for gas and liquid fired combustion turbines is measurement technique and error. Other, minor contributing, sources of particulate matter emissions include carbon, ash, fuel-bound sulfur, artifact sulfate formation, compressor/lubricating oils, and inlet air.

Historical customer particulate matter source test data show that there is significant variability from test to test. The source test results support the common industry argument that particulate matter from natural gas fired combustion sources is difficult to measure accurately. The reference test methods for particulate matter were developed primarily for measuring emissions from coal-fired power plants and other major emitters of particulates. Particulate concentrations from gas turbine can be 100 to 10,000 times lower than the "traditional" particulate sources. The test methods were not developed or verified for low emission levels. There are interferences, insignificant at higher exhaust particulate matter concentrations that result in emissions greater than the actual emissions from gas turbines. New methods are being developed to address this problem.

Due to measurement and procedural errors, the measured results, in most cases, may not be representative of actual particulate matter emitted. There are many potential error sources in measuring particulate matter. Most of these have to do with contamination of the samples, material from the sampling apparatus getting into the samples, and general human error in samples and analysis. Over the past few years, source test firms are gaining experience in measuring particulate matter and the variability that we've seen historically from test to test and the emissions levels measured has decreased.

Recommended Particulate Matter Emission Factors

When necessary to support the air permitting process Solar recommends the following $PM_{10/2.5}$ emission factors:

- Pipeline Natural Gas*: 0.015 lb/MMBtu fuel input (HHV)
- Landfill Gas†: 0.03 lb/MMBtu fuel input (HHV)
- Liquid Fuel#: 0.039 lb/MMBtu fuel input (HHV)

* Pipeline natural gas emissions factor assumes <1 grains of Sulfur per 100 standard cubic feet.
† Landfill gas emissions factor assumes <0.15 lb SO2/MMBtu heat input.
# Liquid fuel emission factor assumes fuel sulfur content is <500 ppm and ash content is <0.005% by wt.

Contact Solar's Environmental Programs group for particulate matter emissions estimates for fuels not listed above.

The conversion of a particulate matter emissions request from mg/Nm^3 to lb/MMBtu (HHV) units involves several specific turbine parameters. Please contact Solar if you need the calculation performed.

Recent customer source testing has shown that AP-42 (EPA AP-42 "Compilation of Air Pollutant Emission Factors.") emission factors for natural gas are achievable in the field, when the test method recommendations shown below are followed. Historically, Solar did not recommend using AP-42 because while some source test firms have measured below AP-42 levels, others have measured higher. Because particulate matter emissions levels are highly dependent on the test firm and have very little to do with the turbine, Solar does not warrant AP-42 levels but does recognize they are achievable in the field. Customers generally choose a particulate matter emissions factor at or above the AP 42 level that works for their site permitting recognizing that the lower the emissions factor the higher the risk for source testing.

Test Method Recommendation

Solar recommends that EPA Methods 201/201A[1] be used to measure the "front half". "Front half" represents filterable particulate matter.

EPA Method 202[2] (with nitrogen purge and field blanks) should be used to measure the "back half". "Back half" measurements represent the condensable portion of particulate matter.

EPA Method 5[3], which measures the front and back halves may be substituted (e.g. where exhaust temperatures do not allow the use of Method 202).

The turbine should have a minimum of 300 operating hours prior to conducting particulate matter source testing. The turbine should be running for 3-4 hours prior to conducting a particulate matter source test so that the turbine and auxiliary equipment is in a sustained "typical" operating mode prior to gathering samples.

Testing should include three 4-hour test runs.

Solar recommends using the aforementioned test methods until more representative test methods are developed and widely commercially available.

References

[1] EPA Method 201, Determination of PM10 Emissions, Exhaust Gas Recycle Procedure. EPA Method 201A, Determination of PM10 Emissions, Constant Sampling Rate Procedure, 40 CFR 60, Part 60, Appendix A.

[2] EPA Method 202, Determination of Condensible Particulate Emissions from Stationary Sources, 40 CFR 60, Part 60, Appendix A.

[3] EPA Method 5, Determination of Particulate Emissions from Stationary Sources, 40 CFR 60, Part 60, Appendix A.

Solar Turbines Incorporated
9330 Sky Park Court
San Diego, CA 92123-5398

Capstone Turbine Corporation • 21211 Nordhoff Street • Chatsworth • CA 91311 • USA
Phone: (818) 734-5300 • Fax: (818) 734-5320 • Web: www.microturbine.com

Technical Reference

Capstone MicroTurbine™ Systems Emissions

Summary

Capstone MicroTurbine™ systems are inherently clean and can meet some of the strictest emissions standards in the world. This technical reference is to provide customers with information that may be requested by local air permitting organizations or to compare air quality impacts of different technologies for a specific project. The preferred units of measure are "output based"; meaning that the quantity of a particular exhaust emission is reported relative to the useable output of the microturbine – typically in pounds per megawatt hour for electrical generating equipment. This technical reference also provides volumetric measurements in parts per million and milligrams per normal cubic meter. A conversion between several common units is also provided.

Maximum Exhaust Emissions at ISO Conditions

Table 1 below summarizes the exhaust emissions at full power and ISO conditions for different Capstone microturbine models. Note that the fuel can have a significant impact on certain emissions. For example landfill and digester gas can be made up of a wide variety of fuel elements and impurities, and typically contains some percentage of carbon dioxide (CO_2). This CO_2 dilutes the fuel, makes complete combustion more difficult, and results in higher carbon monoxide emissions (CO) than for pipeline-quality natural gas.

Table 1. Emission for Different Capstone Microturbine Models in [lb/MWhe]

Model	Fuel	NOx	CO	VOC (5)
C30 NG	Natural Gas (1)	0.64	1.8	0.23
CR30 MBTU	Landfill Gas (2)	0.64	22.0	1.00
CR30 MBTU	Digester Gas (3)	0.64	11.0	1.00
C30 Liquid	Diesel #2 (4)	2.60	0.41	0.23
C65 NG Standard	Natural Gas (1)	0.46	1.25	0.10
C65 NG Low NOx	Natural Gas (1)	0.17	1.30	0.10
C65 NG CARB	Natural Gas (1)	0.17	0.24	0.05
CR65 Landfill	Landfill Gas (2)	0.46	4.0	0.10
CR65 Digester	Digester Gas (3)	0.46	4.0	0.10
C200 NG	Natural Gas (1)	0.40	1.10	0.10
C200 NG CARB	Natural Gas (1)	0.14	0.20	0.04
CR200 Digester	Digester Gas (3)	0.40	3.6	0.10

Notes:

(1) Emissions for standard natural gas at 1,000 BTU/scf (HHV) or 39.4 MJ/m3 (HHV)
(2) Emissions for surrogate gas containing 42% natural gas, 39% CO2, and 19% Nitrogen
(3) Emissions for surrogate gas containing 63% natural gas and 37% CO2
(4) Emissions for Diesel #2 according to ASTM D975-07b
(5) Expressed as Methane

Table 2 provides the same output-based information shown in Table 1, but expressed in grams per horsepower hour (g/hp-hr).

Table 2. Emission for Different Capstone Microturbine Models in [g/hp-hr]

Model	Fuel	NOx	CO	VOC [6]
C30 NG	Natural Gas [1]	0.22	0.60	0.078
CR30 MBTU	Landfill Gas [2]	0.22	7.4	0.340
CR30 MBTU	Digester Gas [3]	0.22	3.7	0.340
C30 Liquid	Diesel #2 [4]	0.90	0.14	0.078
C65 NG Standard	Natural Gas [1]	0.16	0.42	0.034
C65 NG Low NOx	Natural Gas [1]	0.06	0.44	0.034
C65 NG CARB	Natural Gas [1]	0.06	0.08	0.017
CR65 Landfill	Landfill Gas [2]	0.16	1.4	0.034
CR65 Digester	Digester Gas [3]	0.16	1.4	0.034
C200 NG	Natural Gas [1]	0.14	0.37	0.034
C200 NG CARB	Natural Gas [1]	0.05	0.07	0.014
CR200 Digester	Digester Gas [3]	0.14	1.3	0.034

Notes: - same as for Table 1

Emissions may also be reported on a volumetric basis, with the most common unit of measurement being parts per million. This is typically a measurement that is corrected to specific oxygen content in the exhaust and without considering moisture content. The abbreviation for this unit of measurement is "ppmvd" (parts per million by volume, dry) and is corrected to 15% oxygen for electrical generating equipment such as microturbines. The relationship between an output based measurement like pounds per MWh and a volumetric measurement like ppmvd depends on the characteristics of the generating equipment and the molecular weight of the criteria pollutant being measured. Table 3 expresses the emissions in ppmvd at 15% oxygen for the Capstone microturbine models shown in Table 1. Note that raw measurements expressed in ppmv will typically be lower than the corrected values shown in Table 3 because the microturbine exhaust has greater than 15% oxygen.

Another volumetric unit of measurement expresses the mass of a specific criteria pollutant per standard unit of volume. Table 4 expresses the emissions in milligrams per normal cubic meter at 15% oxygen. Normal conditions for this purpose are expresses as one atmosphere of pressure and zero degrees Celsius. Note that both the ppmvd and mg/m3 measurements are for specific oxygen content. A conversion can be made to adjust either unit of measurement to other reference oxygen contents, if required. Use the equation below to convert from one reference oxygen content to another:

$$\text{Emissions at New } O_2 = \frac{(20.9 - \text{New } O_2 \text{ Percent})}{(20.9 - \text{Current } O_2 \text{ Percent})} \text{ X Emissions at Current } O_2$$

For example, to express 9 ppmvd of NOx at 15% oxygen to ppmvd at 3% oxygen:

$$\text{Emissions at 3\% } O_2 = \frac{(20.9 - 3.0)}{(20.9 - 15.0)} \text{ X } 9 = 27 \text{ ppmvd}$$

Table 3. Emission for Different Capstone Microturbine Models in [ppmvd] at 15% O2

Model	Fuel	NOx	CO	VOC
C30 NG	Natural Gas (1)	9	40	9
CR30 MBTU	Landfill Gas (2)	9	500	40
CR30 MBTU	Digester Gas (3)	9	250	40
C30 Liquid	Diesel #2 (4)	35	9	9
C65 NG Standard	Natural Gas (1)	9	40	7
C65 NG Low NOx	Natural Gas (1)	4	40	7
C65 NG CARB	Natural Gas (1)	4	8	3
CR65 Landfill	Landfill Gas (2)	9	130	7
CR65 Digester	Digester Gas (3)	9	130	7
C200 NG	Natural Gas (1)	9	40	7
C200 NG CARB	Natural Gas (1)	4	8	3
CR200 Digester	Digester Gas (3)	9	130	7

Notes: same as Table 1

Table 4. Emission for Different Capstone Microturbine Models in [mg/m3] at 15% O2

Model	Fuel	NOx	CO	VOC (5)
C30 NG	Natural Gas (1)	18	50	6
CR30 MBTU	Landfill Gas (2)	18	620	30
CR30 MBTU	Digester Gas (3)	18	310	30
C30 Liquid	Diesel #2 (4)	72	11	6
C65 NG Standard	Natural Gas (1)	19	50	5
C65 NG Low NOx	Natural Gas (1)	8	50	5
C65 NG CARB	Natural Gas (1)	8	9	2
CR65 Landfill	Landfill Gas (2)	18	160	5
CR65 Digester	Digester Gas (3)	18	160	5
C200 NG	Natural Gas (1)	18	50	5
C200 NG CARB	Natural Gas (1)	8	9	2
CR200 Digester	Digester Gas (3)	18	160	5

Notes: same as Table 1

The emissions stated in Tables 1, 2, 3 and 4 are guaranteed by Capstone for new microturbines during the standard warranty period. They are also the expected emissions for a properly maintained microturbine according to manufacturer's published maintenance schedule for the useful life of the equipment.

Emissions at Full Power but Not at ISO Conditions

The maximum emissions in Tables 1, 2, 3 and 4 are at full power under ISO conditions. These levels are also the expected values at full power operation over the published allowable ambient temperature and elevation ranges.

Emissions at Part Power

Capstone microturbines are designed to maintain combustion stability and low emissions over a wide operating range. Capstone microturbines utilize multiple fuel injectors, which are switched on or off depending on the power output of the turbine. All injectors are typically on when maximum power is demanded, regardless of the ambient temperature or elevation. As the load requirements of the microturbine are decreased, injectors will be switched off to maintain stability and low emissions. However, the emissions relative to the lower power output may increase. This effect differs for each microturbine model.

Emissions Calculations for Permitting

Air Permitting agencies are normally concerned with the maximum amount of a given pollutant being emitted per unit of time (for example pounds per day of NOx). The simplest way to make this calculation is to use the maximum microturbine full electrical power output (expressed in MW) multiplied by the emissions rate in pounds per MWhe times the number of hours per day. For example, the C65 CARB microturbine operating on natural gas would have a NOx emissions rate of:

NOx = .17 X (65/1000) X 24 = .27 pounds per day

This would be representative of operating the equipment full time, 24 hours per day, at full power output of 65 kWe.

As a general rule, if local permitting is required, use the published agency levels as the stated emissions for the permit and make sure that this permitted level is above the calculated values in this technical reference.

Consideration of Useful Thermal Output

Capstone microturbines are often deployed where their clean exhaust can be used to provide heating or cooling, either directly or using hot water or other heat transfer fluids. In this case, the local permitting or standards agencies will usually consider the emissions from traditional heating sources as being displaced by the useful thermal output of the microturbine exhaust energy. This increases the useful output of the microturbine, and decreases the relative emissions of the combined heat and power system. For example, the CARB version C65 ICHP system with integral heat recovery can achieve a total system efficiency of 70% or more, depending on inlet water temperatures and other installation-specific characteristics. The electric efficiency of the CARB version C65 microturbine is 28% at ISO conditions. This means that the total NOx output based emissions, including the captured thermal value, is the electric-only emissions times the ratio of electric efficiency divided by total system efficiency:

NOx = .17 X 28/70 = .068 pounds per MWh (based on total system output)

This is typically much less than the emissions that would result from providing electric power using traditional central power plants, plus the emissions from a local hot water heater or boiler. In fact microturbine emissions are so low compared with traditional hot water heaters that installing a Capstone microturbine with heat recovery can actually decrease the local emissions of NOx and other criteria pollutants, without even considering the elimination of emissions from a remote power plant.

Greenhouse Gas Emissions

Many gasses are considered "greenhouse gasses", and agencies have ranked them based on their global warming potential (GWP) in the atmosphere compared with carbon dioxide (CO_2), as well as their ability to maintain this effect over time. For example, methane is a greenhouse gas with a GWP of 21. Criteria pollutants like NOx and organic compounds like methane are monitored by local air permitting authorities, and are subject to strong emissions controls. Even though some of these criteria pollutants can be more troublesome for global warming than CO_2, they are released in small quantities – especially from Capstone microturbines. So the major contributor of concern is carbon dioxide, or CO_2. Emission of CO_2 depends on two things:

1. Carbon content in the fuel
2. Efficiency of converting fuel to useful energy

It is for these reasons that many local authorities are focused on using clean fuels (for example natural gas compared with diesel fuel), achieving high efficiency using combined heat and power systems, and displacing emissions from traditional power plants using renewable fuels like waste landfill and digester gasses.

Table 5 shows the typical CO_2 emissions due to combustion for different Capstone microturbine models at full power and ISO conditions. The values do not include CO_2 that may already exist in the fuel itself, which is typical for renewable fuels like landfill and digester gas. These values are expressed on an output basis, as is done for criteria pollutants in Table 1. The table shows the pounds per megawatt hour based on electric power output only, as well as considering total useful output in a CHP system with total 70% efficiency (LHV). As for criteria pollutants, the relative quantity of CO_2 released is substantially less when useful thermal output is also considered in the measurement.

Table 5. CO_2 Emission for Capstone Microturbine Models in [lb/MWh]

Model	Fuel	CO_2	
		Electric Only	70% Total CHP
C30 NG	Natural Gas (1)	1,690	625
CR30 MBTU	Landfill Gas (1)	1,690	625
CR30 MBTU	Digester Gas (1)	1,690	625
C30 Liquid	Diesel #2 (2)	2,400	855
C65 NG Standard	Natural Gas (1)	1,520	625
C65 NG Low NOx	Natural Gas (1)	1,570	625
C65 NG CARB	Natural Gas (1)	1,570	625
CR65 Landfill	Landfill Gas (1)	1,520	625
CR65 Digester	Digester Gas (1)	1,520	625
C200 NG	Natural Gas (1)	1,330	625
C200 NG CARB	Natural Gas (1)	1,330	625
CR200 Digester	Digester Gas (1)	1,330	625

Notes:

(1) Emissions due to combustion, assuming natural gas with CO_2 content of 117 lb/MMBTU (HHV)

(2) Emissions due to combustion, assuming diesel fuel with CO_2 content of 160 lb/MMBTU (HHV)

Useful Conversions

The conversions shown in Table 6 can be used to obtain other units of emissions outputs. These are approximate conversions.

Table 6. Useful Unit Conversions

From	Multiply By	To Get
lb/MWh	0.338	g/bhp-hr
g/bhp-hr	2.96	lb/MWh
lb	0.454	kg
kg	2.20	lb
kg	1,000	g
hp (electric)	.746	kW
kW	1.34	hp (electric)
MW	1,000	kW
kW	0.001	MW

Definitions

- ISO conditions are defined as: 15 °C (59 °F), 60% relative humidity, and sea level pressure of 101.3 kPa (14.696 psia).
- HHV: Higher Heating Value
- LHV: Lower Heating Value
- kW_{th}: Kilowatt (thermal)
- kW_e : Kilowatt (electric)
- MWh: Megawatt-hour
- hp-hr: horsepower-hour (sometimes referred to as "electric horsepower-hour")
- Scf: Standard cubic foot (standard references ISO temperature and pressure)
- m3: Normal cubic meter (normal references 0 °C and one atmosphere pressure)

Capstone Contact Information

If questions arise regarding this technical reference, please contact Capstone Turbine Corporation for assistance and information:

Capstone Applications

Toll Free Telephone: (866) 4-CAPSTONE or (866) 422-7786

Fax: (818) 734-5385

E-mail: applications@capstoneturbine.com

****
* Project Setup Information *
****

Project File : \\Pit-dc1\p\Client\EQT Corporation\Corporate\02 Projects\143901.0087 Mountain Valley

Flowsheet Selection : Oil Tank with Separator
Calculation Method : RVP Distillation
Control Efficiency : 0.0%
Known Separator Stream : Low Pressure Oil
Entering Air Composition : No

Filed Name :
Well Name : PTE
Date :

****
* Data Input *
****

Separator Pressure : 414.00[psig]
Separator Temperature : 60.00[F]
Ambient Pressure : 14.70[psia]
Ambient Temperature : 55.00[F]
C10+ SG : 0.8024
C10+ MW : 163.342

-- Low Pressure Oil ----------

No.	Component	mol %
1	H2S	0.0000
2	O2	0.0000
3	CO2	0.0840
4	N2	0.0000
5	C1	9.9570
6	C2	8.1140
7	C3	6.8240
8	i-C4	1.8640
9	n-C4	4.8700
10	i-C5	2.9440
11	n-C5	3.3610
12	C6	2.2410
13	C7	9.7080
14	C8	11.4500
15	C9	8.4380
16	C10+	25.3730
17	Benzene	0.0910
18	Toluene	0.7580
19	E-Benzene	0.1130
20	Xylenes	1.3570
21	n-C6	2.4330
22	224Trimethylp	0.0200

-- Sales Oil ----------
Production Rate : 0.1[bbl/day]
Days of Annual Operation : 365 [days/year]
API Gravity : 59.11
Reid Vapor Pressure : 10.60[psia]

****
* Calculation Results *
****

-- Emission Summary ----------

Item	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]	Controlled [ton/yr]	Controlled [lb/hr]
Total HAPs	0.000	0.000	0.000	0.000
Page 1---------- E&P TANK				
Total HC	0.423	0.097	0.423	0.097
VOCs, C2+	0.339	0.077	0.339	0.077
VOCs, C3+	0.213	0.049	0.213	0.049

Uncontrolled Recovery Info.
Vapor 28.1600 x1E-3 [MSCFD]
HC Vapor 28.0700 x1E-3 [MSCFD]
GOR 281.60 [SCF/bbl]

-- Emission Composition ----------

No	Component	Uncontrolled [ton/yr]	Uncontrolled [lb/hr]	Controlled [ton/yr]	Controlled [lb/hr]
1	H2S	0.000	0.000	0.000	0.000
2	O2	0.000	0.000	0.000	0.000
3	CO2	0.002	0.000	0.002	0.000
4	N2	0.000	0.000	0.000	0.000
5	C1	0.084	0.019	0.084	0.019
6	C2	0.125	0.029	0.125	0.029
7	C3	0.109	0.025	0.109	0.025
8	i-C4	0.023	0.005	0.023	0.005
9	n-C4	0.045	0.010	0.045	0.010
10	i-C5	0.014	0.003	0.014	0.003
11	n-C5	0.012	0.003	0.012	0.003
12	C6	0.003	0.001	0.003	0.001
13	C7	0.004	0.001	0.004	0.001
14	C8	0.001	0.000	0.001	0.000
15	C9	0.000	0.000	0.000	0.000
16	C10+	0.000	0.000	0.000	0.000
17	Benzene	0.000	0.000	0.000	0.000
18	Toluene	0.000	0.000	0.000	0.000
19	E-Benzene	0.000	0.000	0.000	0.000
20	Xylenes	0.000	0.000	0.000	0.000
21	n-C6	0.002	0.000	0.002	0.000
22	224Trimethylp	0.000	0.000	0.000	0.000
	Total	0.424	0.097	0.424	0.097

-- Stream Data ----------

No.	Component	MW	LP Oil	Flash Oil	Sale Oil	Flash Gas	W&S Gas	Total Emissions

		mol %	mol %	mol %	mol %	mol %	mol %	
1	H2S	34.80	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2	O2	32.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
3	CO2	44.01	0.0840	0.0069	0.0001	0.3251	0.3289	0.3254
4	N2	28.01	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5	C1	16.04	9.9570	0.2491	0.0001	40.3145	12.0792	38.6045
6	C2	30.07	8.1140	1.3061	0.2375	29.4027	52.0759	30.7759
7	C3	44.10	6.8240	3.2946	2.8877	17.8607	22.6275	18.1494
8	i-C4	58.12	1.8640	1.5368	1.5034	2.8873	3.1206	2.9014
9	n-C4	58.12	4.8700	4.6049	4.5743	5.6989	6.0623	5.7209
10	i-C5	72.15	2.9440	3.4237	3.4639	1.4439	1.5163	1.4483
11	n-C5	72.15	3.3610	4.0550	4.1140	1.1907	1.2521	1.1944
12	C6	86.16	2.2410	2.8819	2.9372	0.2370	0.2510	0.2378
13	C7	100.20	9.7080	12.7165	12.9774	0.3002	0.3211	0.3015
14	C8	114.23	11.4500	15.0807	15.3960	0.0965	0.1043	0.0969
15	C9	128.28	8.4380	11.1296	11.3633	0.0212	0.0250	0.0215
16	C10+	163.34	25.3730	33.4860	34.1908	0.0030	0.0034	0.0030
17	Benzene	78.11	0.0910	0.1181	0.1204	0.0064	0.0068	0.0064
18	Toluene	92.13	0.7580	0.9963	1.0170	0.0128	0.0138	0.0128
19	E-Benzene	106.17	0.1130	0.1490	0.1521	0.0005	0.0006	0.0005
20	Xylenes	106.17	1.3570	1.7892	1.8267	0.0056	0.0061	0.0056
21	n-C6	86.18	2.4330	3.1494	3.2114	0.1926	0.2046	0.1933
22	224Trimethylp	114.24	0.0200	0.0262	0.0268	0.0005	0.0005	0.0005

MW	95.74	116.43	118.13	31.04	35.93	31.33
Stream Mole Ratio	1.0000	0.7577	0.7421	0.2423	0.0156	0.2579
Heating Value [BTU/SCF]				1808.07	2072.28	1824.07
Gas Gravity [Gas/Air]				1.07	1.24	1.08
Bubble Pt. @ 100F [psia]	406.75	28.61	13.23			
RVP @ 100F [psia]	101.88	15.92	10.81			

Spec. Gravity @ 100F	0.685	0.715	0.717

LAFAYETTE AREA LABORATORY
4790 N.E. EVANGELINE THRUWAY
CARENCRO, LA 70520
PHONE (337) 896-3055
FAX (337) 896-3077

Certificate of Analysis : 13050161-002A

Company:	Gas Analytical Services	**For:**	Gas Analytical Services
Well:	OXF 131 Pad		Alan Ball
Field:	EQT Production		PO Box 1028
Sample of:	Condensate-Spot		
Conditions:	414 @ N.G.		Bridgeport, WV, 26330
Sampled by:	GR-GAS		
Sample date:	5/14/2013	**Report Date:**	5/29/2013
Remarks:	Cylinder No.: GAS		
Remarks:			

Analysis: (*GPA 2186M*)	**Mol. %**	**MW**	**Wt. %**	**Sp. Gravity**	**L.V. %**
Nitrogen	0.000	28.013	0.000	0.8094	0.000
Methane	9.957	16.043	1.664	0.3000	3.884
Carbon Dioxide	0.084	44.010	0.039	0.8180	0.033
Ethane	8.114	30.070	2.542	0.3562	4.991
Propane	6.824	44.097	3.135	0.5070	4.324
Iso-butane	1.864	58.123	1.129	0.5629	1.403
N-butane	4.870	58.123	2.948	0.5840	3.533
Iso-pentane	2.944	72.150	2.213	0.6244	2.479
N-pentane	3.361	72.150	2.526	0.6311	2.801
i-Hexanes	2.241	86.177	1.990	0.6795	2.104
n-Hexane	2.433	85.734	2.184	0.6640	2.288
2,2,4 trimethylpentane	0.020	114.231	0.024	0.6967	0.024
Benzene	0.091	78.114	0.065	0.8846	0.059
Heptanes	9.708	98.181	9.953	0.7010	9.943
Toluene	0.758	92.141	0.641	0.8719	0.588
Octanes	11.460	107.956	13.087	0.7610	12.206
E-benzene	0.113	106.167	0.053	0.8718	0.102
M-,O-,P-xylene	1.357	106.167	1.501	0.8731	1.214
Nonanes	8.438	122.962	11.137	0.7603	10.366
Decanes Plus	25.373	163.342	43.169	0.8024	37.658
	100.000		100.000		100.000

Calculated Values	**Total Sample**	**Decanes Plus**
Specific Gravity at 60 °F	0.6999	0.8024
Api Gravity at 60 °F	70.675	44.841
Molecular Weight	96.001	163.342
Pounds per Gallon (In Vacuum)	5.835	6.690
Pounds per Gallon (in Air)	5.829	6.683
Cu. Ft. Vapor per Gallon @ 14.73 psia	23.120	15.507

Brian Gaspard

Southern Petroleum Laboratories, Inc.

Appendix B

Lambert Compressor Station
NOx BACT Cost Analysis - Solar Taurus 70 Turbine

Turbine Exhaust Volumetric Flowrate, (acfm)	Q		128,765
Exhaust Temperature, (°F)	T		920
Turbine Power Output (hp)	hp		11,358
Turbine Power Output (TMW)	MW		8.470
Hours of Operation	hr		8,760
Overall NO_x Reduction Efficiency, (%)			75
Uncontrolled NO_x Emissions, (lb/hr)	100% Load @ 40 °F	(15 ppmv NO_x)	4.88
Uncontrolled NO_x Emissions, (ton/yr)			21.37
Controlled NO_x Emissions, (ton/yr)			5.34
Annual Interest Rate, (%)			6
Equipment Life, (yrs)	yr		15
Capital Recovery Factor, CRF	CRF		0.103
Catalyst Life, (yrs)	yr		5
Catalyst Capital Recovery Factor	Catalyst CRF		0.237
Consumer Price Index, July 2018			252.006
Consumer Price Index, December 1998			163.9
Consumer Price Index, 1990			130.7

Cost Item			Suggested Factor	Item Cost
Direct Capital Costs				
Purchased Equipment Costs				
One SCR System [1]	($49,700 x TMW) + $459,000		1990 $	$879,949
			April 2018 $ EC	$1,696,652
Instrumentation			0.10 x EC	Included
Sales Tax [2]			0.000 x EC	$0
Freight			0.05 x EC	Included
Purchased Equipment Costs, PEC		PEC =	1.150 x EC	$1,696,652
Direct Installation Costs				
Foundations and Supports			0.08 x PEC	Included
Handling and Erection			0.14 x PEC	Included
Electrical			0.04 x PEC	Included
Piping			0.02 x PEC	Included
Insulation for Ductwork			0.01 x PEC	Included
Painting			0.01 x PEC	Included
Direct Installation Cost, DIC		DIC =	0.3 x PEC	Included
Site Preparation			As Required, SP	$0
Building			As Required, BLDG	$0
Total Direct Capital Costs, DC		DC =	1.3 x PEC + SP + BLDG	Included
Indirect Capital Costs				
Engineering			0.10 x PEC	Included
Construction and Field Expenses			0.05 x PEC	Included
Contractor Fees			0.10 x PEC	Included
Start-Up			0.02 x PEC	Included
Performance Test			0.01 x PEC	Included
Contingencies			0.03 x PEC	Included
Total Indirect Capital Costs, IC		IC =	0.31 x PEC	Included
Total Capital Costs, TCC = DC + IC			**TCC**	$1,696,652

Appendix B

Lambert Compressor Station
NOx BACT Cost Analysis - Solar Taurus 70 Turbine

Direct Annual Costs				
Utilities [3]				
Ammonia Costs (19% aqueous solution) [4]		$0.155	$/lb soln	$25,825
SCR Performance Loss [5]	0.9% * TMW	$0.068	$/kw hr	$45,141
Electricity for Cooling Air Blower	Fp = 40 HP (29.8 kW)	$0.068	$/kw hr	$17,647
Ammonia Vaporizer (15 kW) and Blower (3 HP)		$0.068	$/kw hr	$10,208
Operating Labor [6]				
Operator	1.0 hr/shift	$25.00	$/hr	$27,375
Supervisor	15% of Operator			$4,106
Maintenance [1]				
Labor & Materials	($1,250 x TMW) + $25,800			$70,159
Catalyst Replacement Cost [7]	($4,700 x TMW) + $37,200	Annualized		$35,249
Total Direct Annual Costs, DAC				$235,710
Indirect Annual Costs				
Insurance		0.01 x TCC		$16,967
Capital Recovery		CRF x TCC		$159,404
Total Indirect Annual Costs, IAC				$176,370
Total Annual Costs, TAC = DAC + IAC		**TAC**		$412,080
Cost Effectiveness ($/ton pollutant Removed)				$25,706

Sources:

EPA Air Pollution Control Cost Manual, Sixth Edition, EPA/452/B-02-001, January 2002.

Alternative Control Techniques Document, NOx Emissions from Stationary Gas Turbines, EPA-453/R-93-007, January 1993.

Control Technologies for Hazardous Air Pollutants, EPA/625/6-91/014, June 1991.

Notes:

[1] 1993 Alternative Control Techniques Document, Table 6-8, scaled from 1990 $ to April 2018 $ using Consumer Price Indices (https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201804.pdf). SCR system cost estimate includes the catalyst reactor, air injection system for exhaust temperature control, ammonia storage and injection system, instrumentation, and continuous emission monitoring equipment.

[2] The Virginia Sales Tax is 5.3%. Pollution Control equipment is exempt from Virginia Sales Tax.

[3] Electricity costs based on data published by U.S. Energy Information Administration, "Virginia Average Retail Price of Electricity to Ultimate Customers by End-Use Sector - July 2018".

[4] Ammonia solution cost data taken from Section 4, Chapter 2, pg 2-50 of 2002 EPA Air Pollution Cost Manual. Cost for 19% ammonia solution assumed to = cost for 29% ammonia solution = $0.101/lb, scaled from December 1998 $ to July 2018 $ using Consumer Price Indices.

[5] 1993 Alternative Control Techniques Document, Table 6-8.

[6] Labor costs based on typical rates.

[7] From 1993 ACT Document, Table 6-8, annual investment to purchase replacement catalyst in year 5, scaled from 1990 $ to July 2018 $ using Consumer Price Indices.

Appendix B

Lambert Compressor Station
NOx BACT Cost Analysis - Solar Mars 100 Turbine

Turbine Exhaust Volumetric Flowrate, (acfm)	Q		195,584
Exhaust Temperature, (°F)	T		893
Turbine Power Output (hp)	hp		15,918
Turbine Power Output (TMW)	MW		11.870
Hours of Operation	hr		8,760
Overall NO_x Reduction Efficiency, (%)			75
Uncontrolled NO_x Emissions, (lb/hr)	100% Load @ 40 °F	(15 ppmv NO_x)	7.08
Uncontrolled NO_x Emissions, (ton/yr)			31.01
Controlled NO_x Emissions, (ton/yr)			7.75
Annual Interest Rate, (%)			6
Equipment Life, (yrs)	yr		15
Capital Recovery Factor, CRF	CRF		0.103
Catalyst Life, (yrs)	yr		5
Catalyst Capital Recovery Factor	Catalyst CRF		0.237
Consumer Price Index, July 2018			252.006
Consumer Price Index, December 1998			163.9
Consumer Price Index, 1990			130.7

Cost Item			Suggested Factor	Item Cost
Direct Capital Costs				
Purchased Equipment Costs				
One SCR System [1]	($49,700 x TMW) + $459,000		1990 $	$1,048,951
			April 2018 $ EC	$2,022,510
Instrumentation			0.10 x EC	Included
Sales Tax [2]			0.000 x EC	$0
Freight			0.05 x EC	Included
Purchased Equipment Costs, PEC		PEC =	1.150 x EC	$2,022,510
Direct Installation Costs				
Foundations and Supports			0.08 x PEC	Included
Handling and Erection			0.14 x PEC	Included
Electrical			0.04 x PEC	Included
Piping			0.02 x PEC	Included
Insulation for Ductwork			0.01 x PEC	Included
Painting			0.01 x PEC	Included
Direct Installation Cost, DIC		DIC =	0.3 x PEC	Included
Site Preparation			As Required, SP	$0
Building			As Required, BLDG	$0
Total Direct Capital Costs, DC		DC =	1.3 x PEC + SP + BLDG	Included
Indirect Capital Costs				
Engineering			0.10 x PEC	Included
Construction and Field Expenses			0.05 x PEC	Included
Contractor Fees			0.10 x PEC	Included
Start-Up			0.02 x PEC	Included
Performance Test			0.01 x PEC	Included
Contingencies			0.03 x PEC	Included
Total Indirect Capital Costs, IC		IC =	0.31 x PEC	Included
Total Capital Costs, TCC = DC + IC			**TCC**	$2,022,510

Appendix B

Lambert Compressor Station
NOx BACT Cost Analysis - Solar Mars 100 Turbine

Direct Annual Costs				
Utilities [3]				
Ammonia Costs (19% aqueous solution) [4]		$0.155	$/lb soln	$37,468
SCR Performance Loss [5]	0.9% * TMW	$0.068	$/kw hr	$63,263
Electricity for Cooling Air Blower	Fp = 40 HP (29.8 kW)	$0.068	$/kw hr	$17,647
Ammonia Vaporizer (15 kW) and Blower (3 HP)		$0.068	$/kw hr	$10,208
Operating Labor [6]				
Operator	1.0 hr/shift	$25.00	$/hr	$27,375
Supervisor	15% of Operator			$4,106
Maintenance [1]				
Labor & Materials	($1,250 x TMW) + $25,800			$78,355
Catalyst Replacement Cost [7]	($4,700 x TMW) + $37,200	Annualized		$42,564
Total Direct Annual Costs, DAC				$280,986
Indirect Annual Costs				
Insurance		0.01 x TCC		$20,225
Capital Recovery		CRF x TCC		$189,782
Total Indirect Annual Costs, IAC				$210,007
Total Annual Costs, TAC = DAC + IAC		**TAC**		$490,994
Cost Effectiveness ($/ton pollutant Removed)				$21,111

Sources:

EPA Air Pollution Control Cost Manual, Sixth Edition, EPA/452/B-02-001, January 2002.

Alternative Control Techniques Document, NOx Emissions from Stationary Gas Turbines, EPA-453/R-93-007, January 1993.

Control Technologies for Hazardous Air Pollutants, EPA/625/6-91/014, June 1991.

Notes:

[1] 1993 Alternative Control Techniques Document, Table 6-8, scaled from 1990 $ to April 2018 $ using Consumer Price Indices (https://www.bls.gov/cpi/tables/supplemental-files/historical-cpi-u-201804.pdf). SCR system cost estimate includes the catalyst reactor, air injection system for exhaust temperature control, ammonia storage and injection system, instrumentation, and continuous emission monitoring equipment.

[2] The Virginia Sales Tax is 5.3%. Pollution Control equipment is exempt from Virginia Sales Tax.

[3] Electricity costs based on data published by U.S. Energy Information Administration, "Virginia Average Retail Price of Electricity to Ultimate Customers by End-Use Sector - July 2018".

[4] Ammonia solution cost data taken from Section 4, Chapter 2, pg 2-50 of 2002 EPA Air Pollution Cost Manual. Cost for 19% ammonia solution assumed to = cost for 29% ammonia solution = $0.101/lb, scaled from December 1998 $ to July 2018 $ using Consumer Price Indices.

[5] 1993 Alternative Control Techniques Document, Table 6-8.

[6] Labor costs based on typical rates.

[7] From 1993 ACT Document, Table 6-8, annual investment to purchase replacement catalyst in year 5, scaled from 1990 $ to July 2018 $ using Consumer Price Indices.

APPENDIX C
ELECTRONIC AIR QUALITY MODELING FILES

November 2018

Attachment H

Number	Source Name [1]	Issue of Concern	Addressed in Resource Reports	Response
A - FERC Process				
A-1	Sappony Tribe Monacan Indian Nation Occaneechi Band of Saponi Nation Upper Mattaponi Indian Tribe Preservation Virginia Blue Ridge Environmental Defense Fund	Stakeholders request meaningful, government-to-government consultation on all permits and authorizations and to participate actively in the FERC Process for the proposed MVP Southgate Project.	Not Applicable ("NA")	The MVP Southgate Project ("Project or Southgate Project") appreciates that Federal Energy Regulatory Commission ("FERC") will coordinate the National Environmental Policy Act ("NEPA") review and National Historic Preservation Act processes.
B - Eminent Domain				
B-1	Multiple Individuals	Land acquisition and involuntary taking of land through eminent domain for private gain is wrong.	NA	If the FERC authorizes the Project, the pipeline company is granted the right of eminent domain under Section 7(h) of the Natural Gas Act. In this case, it would be the court that would determine the fair compensation given to a landowner in return for an easement. The Project will attempt to negotiate a mutually agreed-upon easement for the pipeline with the affected landowners.
C – Support Project				
C-1	Virginia Chamber of Commerce Virginia Petroleum Council Public Service Company of North Carolina North Carolina Economic Development Association	Support for the Project due to economic gains.	NA	Thank you for your support. Mountain Valley agrees that the Project will provide substantial economic benefits. Economic benefits are discussed further in its application to FERC. In addition, the Project will file a supplemental report on the economic benefits of the Project in Virginia and North Carolina early 2019.
C - Oppose Project				
C-1	Multiple Individuals	Multiple individuals oppose the Project.	NA	Comment noted.
C-2	Preserve Bent Mountain	Oppose development of fracked gas infrastructure and promote solutions for sustainable energy and thriving communities.	NA	The Project is a natural gas transmission project. Natural gas production, including hydraulic fracturing, is outside the scope of FERC's jurisdiction and of the Project. NEPA does not require FERC to review impacts that are not causally related to the proposed project or reasonably foreseeable. The impacts of natural gas production are not generally considered by FERC in its assessment of natural gas pipeline projects. The impacts from the exploration, drilling, and processing of natural gas should not be considered here because the timing of such development is uncertain, the activities involve different types of physical processes, and the production and processing of natural gas prior to shipment in a pipeline is regulated separately by federal, state, and local regulations. In addition, it is not possible to foresee the precise natural gas supplies that will be transported by the Project because it is not possible to trace back each molecule of gas to its source.
D - Purpose and Need				
D-1	North Carolina Department of Environmental Quality ("NCDEQ")	Questions whether the Project is in the public interest and is needed.	Resource Report 1, Section 1.1.2	Mountain Valley addressed this concern in its Answer to Protests and Comments filed January 8, 2019.
D-2	Multiple Individuals Mark Walker, Member of Congress Waterkeeper Alliance Appalachian Mountain Advocates Friends of Central Shenandoah	This project is not needed and does not serve the public convenience and necessity.	Resource Report 1, Section 1.1.2	See Response to Comment No. D-1.

[1] Agencies, organizations, and/or individuals that made similar comments were grouped accordingly to avoid repetition in this table. Additional agencies, organizations, and/or individuals may not all be listed; however, all relevant issues of concerns have been identified. In addition, certain individuals have raised concerns about impacts on specific features (such as wetlands, waterbodies, etc.) that may be present on their property; the Project will address these features in the final design after civil and environmental surveys are complete.

Number	Source Name [1]	Issue of Concern	Addressed in Resource Reports	Response
E - Benefit				
E-1	Multiple Individuals	Jobs and taxes will be short-term, no long-term benefit to community	Resource Report 5, Sections 5.4.1 and 5.4.2.1	Based on current discussions with qualified construction contractors, the Project estimates that local workers will account for approximately 55 percent of construction jobs for each spread for the duration of the Project. During peak construction in 2020, the Project estimates that it would generate and support an estimated 570 total (direct, indirect, and induced) jobs in Virginia during Project construction, and an estimated 1,130 total jobs in North Carolina. Additional contractor and consultant jobs will be created during the lifetime of the Project facilities. The Project estimates that it will generate $4.1 million and $6.3 million in tax revenue in Virginia and North Carolina, respectively, with the largest impact from property taxes.
F – Mountain Valley Pipeline, LLC				
F-1	North Carolina Utilities Commission	MVP failed to meet its burden and demonstrate that (i) the recourse rates available to shippers at the time they were considering whether to enter into negotiated rate precedent agreements for service on the Southgate Project were not tainted by the exercise of market power, and (ii) the recourse rates proposed in the Application are consistent with the public convenience and necessity as required by section 7 of the Natural Gas Act (NGA).	Resource Report 1, Section 1.1.2	Mountain Valley addressed this concern in its Answer to Protests and Comments filed January 8, 2019.
F-2	NCDEQ	Public Service Company of North Carolina is an indirect affiliate of MVP with direct interest in the Project.	NA	On December 20, 2018, the Project filed a letter with the FERC on *Change in Ownership* and stated that the Public Service Company of North Carolina, Inc. (“PSNC”) no longer has any equity interest in the Southgate Project. Therefore, PSNC is no longer an affiliate of Mountain Valley. This ownership change has not affected PSNC’s anchor shipper status on the Southgate Project. Mountain Valley further addressed this concern in its Answer to Protests and Comments filed January 8, 2019.
F-3	Individual	The communications and construction history of MVP Southgate is poor.	NA Resource Report 1, Sections 1.4, 1.8	The Project has made a good faith effort to provide open, honest, and transparent communications to all stakeholders who may have an interest in or be impacted by the Project. Additionally, the Project team has been dedicated to providing accurate responses to questions and comments made during the scoping process, as well as during open houses and individual meetings with local officials and landowners along the proposed and alternate routes As discussed in Resource Report 1, Section 1.8, the Project has developed and implemented a comprehensive Public, Stakeholder, and Agency Participation Plan that outlines a commitment to engage actively with stakeholders currently and throughout the life of the Project. The Project continues to identify and hold meetings with local associations, affected public groups, and other non-governmental organizations and meet with state and local government representatives as well as state and federal agencies. Project information and updates are also provided via periodic newsletters and a publicly available website (www.mvpsouthgate.com) In addition, the Project will adopt the FERC Upland Erosion Control, Revegetation, and Maintenance Plan (“Plan”) and FERC Wetland and Waterbody Construction and Mitigation Procedures (“Procedures”) to minimize impacts on the environment and it will develop its own Project-specific Erosion and Sediment Control Plan (“E&SCP”) that will outline best management practices (“BMPs”) to minimize impacts. In addition, the Project will train construction personnel on the environmental restrictions and/or requirements applicable to their particular job duties. The Project will provide construction management personnel and environmental inspectors with the appropriate environmental information/materials specific to the Project.
G - Alternatives				
G-1	Individual	The Proposed MVP application shows the pipeline to be going right through a homesite, septic field, well and actual house. Request that FERC ask MVP to relocate their pipeline to the alternate routes that had been proposed in the pre-filing stages.	NA	The Project continues to evaluate its pipeline route and will contact the landowner regarding this concern.
H - Water Use and Quality				
H-1	Appalachian Mountain Advocates Multiple Individuals	Concerned about construction and operation impacts on waterbodies and the Haw River.	Resource Report 2, Section 2.3.6	Potential project impacts and mitigation for waterbody crossings, including the Haw River, along the Project route are described in Resource Report 2, Section 2.3.6. The Project will implement the measures in the FERC Procedures and Project-specific E&SCP to minimize impacts on surface and groundwater resources.
H-2	Monacan Indian Nation Multiple Individuals	Concerned about construction impacts on private water wells and water quality.	Resource Report 2, Sections 2.2.4.1	As discussed in Resource Report 2, Section 2.2.4.1, the Project will conduct pre-construction testing of all private wells located within 150 feet of the construction workspace. The Project will conduct post-construction tests if requested by a landowner who had a pre-construction test. The Project will evaluate landowner complaints or damage associated with construction. In the unlikely event that a private well is impacted by Project construction, the Project will negotiate a settlement with the landowner that will include a temporary water supply to affected homeowners while their well is repaired or replaced.

Number	Source Name [1]	Issue of Concern	Addressed in Resource Reports	Response
I - Vegetation, Wildlife, and Rare Threatened and Endangered Species				
I-1	Monacan Indian Nation Multiple Individuals	The Nation is very concerned about deforestation and other potential impacts on the forest, such as effects on water quality and wildlife.	Resource Report 3, Sections 3.3 and 3.4 Resource Report 2, Sections 2.2.4 and 2.3.6	The Project discusses potential impacts on wildlife and vegetation along the Project route in Resource Report 3, Sections 3.3 and 3.4. Potential impacts on water quality and mitigation are discussed in Resource Report 2, Section 2.2.4 and 2.3.6.
I-2	Appalachian Mountain Advocates	The pipeline would threaten the aquatic habitat of the Atlantic pigtoe, an imperiled freshwater mussel currently proposed for listing under the Endangered Species Act.	Resource Report 3, Section 3.5.1.1	Atlantic pigtoe is discussed in Resource Report 3, Section 3.5.1.1. Surveys for listed mussels are planned to begin April 2019. Upon completion of recommended field surveys, results will be submitted to applicable state and federal agencies for review and comment. If Atlantic pigtoe are found during surveys, the Project will consult with U.S. Fish and Wildlife Service on appropriate avoidance and/or minimization measures.
J - Cultural Resources				
J-1	Monacan Indian Nation	The Nation has historically, and continues today, to have a strong presence in the Area of Potential Effects (APE) for the MVP Southgate Project. The route of MVP Southgate is Monacan territory.	NA	Comment noted.
J-2	Monacan Indian Nation	In order to develop an understanding of the Monacan ancestral territory and how the tribe's resources have been under-studied and misunderstood, the Nation requests that the cultural resources consultants closely review important sources on tribal history and archaeology.	Resource Report 4, Section 4.3	The Project has conducted and continues to conduct cultural resources investigations as part of the Section 106 review as discussed in Resource Report 4, Section 4.3, the Project is assisting the FERC in meeting its Section 106 obligations by conducting Section 106 coordination with various state and local agencies and Native American groups located in or having interests regarding cultural resources in Virginia and North Carolina. Section 4.3 details the correspondence the Project has conducted to date with each of these entities.
J-3	Monacan Indian Nation	However, we note that the current alignment of the pipeline is set to impact five historic cemeteries recorded by the Commonwealth of Virginia (44PY0275; 44PY0274; 44PY0273; 44PY0272; and 44PY0284). The Nation is still in the process of identifying whether they are associated with these identified cemeteries. The Nation is greatly concerned with the extent of human remains relocation proposed by the project in its current form.	Resource Report, 4, Section 4.5	The Project has conducted and continues to conduct comprehensive cultural resources studies of the proposed route in accordance with State Historic Preservation Office and FERC procedures, and is also contacting tribes and local heritage groups to solicit information concerning cultural resources in the Project area. Potential impacts to cultural resources, including historic cemeteries, will be fully addressed in technical reports and in the FERC's Environmental Impact Statement.
J-4	Monacan Indian Nation Sappony Tribe	The proposed pipeline will directly and adversely affect the Nation's ancestral lands and historic properties, human burials, and natural and cultural resources.	Resource Report, 4	See Response to Comment No. J-3.
J-5	Individual	Family land and Alamance County has Native American Historical Significance.	Resource Report, 4	See Response to Comment Nos. J-2 and J-3.
K - Geologic Resources				
K-1	Individual	Concerned about the proximity to a mining operation that blasts to remove earth. The blasts are felt beyond the proposed location of the pipeline.	Resource Report 6, Section 6.4	The Martin Marietta – East Alamance Quarry is approximately 0.1 mile east of the pipeline route. The Project facilities will be designed, constructed, operated, and maintained by experienced firms in accordance with or to exceed the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration minimum federal safety standards in 49 CFR 192 (see Resource Report 11 for more detail). These regulations, which are aimed at protecting the public and preventing natural gas facility accidents and failures, apply to all areas along the proposed pipeline routes. No effects on the quarry operation are anticipated from construction or operation of the Project.
L - Soils				
L-1	Multiple Individuals	The erosion and sediment from the construction of the proposed Mountain Valley Pipeline could have severe negative consequences for the County's resources.	Resource Report 7, Section 7.4.1	Resource Report 7, Section 7.4.1 provides information on soil erosion and sediment control. The Project's objective is to minimize the potential for soil erosion and sedimentation during construction of the Project facilities and to effectively restore and revegetate disturbed areas upon completion of construction activities. The Project will implement the FERC Plan to establish a baseline for minimizing the potential for erosion to aid in reestablishing vegetation after construction. In addition, the Project will minimize disturbance associated with construction activities through the application of BMPs included the Project-Specific E&SCP.
M – Land Use				
M-1	Individual	Concerned that land/neighborhood has Duke Energy power lines and the Cardinal gas pipeline currently and feels that they have given our part for the public utilities.	Resource Report 8, Section 8.2.3	As discussed in Resource Report 8, Section 8.2.3, following construction, the Project will restore impacted lands to pre-construction conditions in accordance with the FERC Plan. The primary Project-related impacts on existing land uses will be associated with vegetation clearing during construction. Following construction, most existing land uses will be allowed to continue within temporary workspace areas as well as within the permanent operational right-of-way for the pipeline. However, to ensure operational safety and allow for routine maintenance of the facilities following construction, no structures will be allowed within the 50-foot permanent right-of-way. Additionally, vegetation on the permanent right-

Number	Source Name [1]	Issue of Concern	Addressed in Resource Reports	Response
				of-way will be maintained by mowing, cutting, and trimming. The right-of-way will be allowed to revegetate; however, large brush and trees will be periodically removed in accordance with the FERC Plan and Procedures. In addition, the FERC also prefers that applicants co-locate the proposed facilities with existing facilities to minimize incremental environmental impacts.
M-2	Individual	Existing home site crossed and septic tank lines.	Resource Report 8, Section 8.3.2	The Project continues to evaluate its pipeline route and will contact the landowner regarding this concern. As discussed in Resource Report 8, Section 8.3.2, if septic systems are identified that may be affected by construction, the Project will first attempt to identify a minor pipeline deviation to avoid direct impact on the septic system. If avoidance is not possible, the Project will work with the individual landowner to coordinate relocation and / or replacement of the septic system prior to construction.
N - Property Value and Use				
N-1	Multiple Individuals Waterkeeper Alliance	Concerned about negative effects on property values.	Resource Report 5, Section 5.4.4	As discussed in Resource Report 5, Section 5.4.4, several studies have examined the effects of gas pipelines on sales and property values. A study on "The Effect of Natural Gas Pipeline on Residential Value" performed by Diskin et al. (2011) could "not identify a systematic relationship between proximity to [a] pipeline and sale price or value." A study conducted by Integra Realty Resources for the Interstate Natural Gas Association of America ("INGAA") Foundation in 2016 found that "There is no measurable impact on the sales price of properties located along or in proximity to a natural gas pipeline versus properties which are not located along or in proximity to the same pipeline." The 2016 INGAA Foundation study reviewed underground FERC-regulated natural gas transmission pipelines in residential areas in the Midwest, Northeast, Mid-Atlantic and Southeast. In addition, a study by Gnarus Advisors LLC (2012) examined whether proximity to pipelines, with a focus on natural gas pipelines, has an effect on residential property values. The study contains a literature review specific to pipelines and property values, with a focus on actual sales data. The authors conclude that there is "no credible evidence based on actual sales data that proximity to pipelines reduces property values." Further, they found that "hypothetical surveys of actual or potential market participants should not be used as a substitute for the systematic analysis of market data, as they may overstate the effects, if any, of proximity to disamenities, including pipelines, on property values."
O - Air and Noise Quality				
O-1	Oil Change International	Concerned with mounting climate crisis that requires a reduction in greenhouse gases. This project will lock in gas consumption over a period in which drastic reductions in gas consumption must occur. The project risks contributing to an overshoot of emissions limits or, in the event that it is shut down in order to prevent such overshoot, risks landing ratepayers with the cost of a stranded asset.	Resource Report 9, Section 9.2.6	The Project considered climate change and greenhouse gases in Resource Report 9, Section 9.2.6.
O-2	Individual	Concerned about effects on air quality.	Resource Report 9	The Project considered air quality and potential impacts in Resource Report 9, Section 9.2. Air Quality Mitigation Measures are discussed in Section 9.2.6.
P - Reliability and Safety				
P-1	Multiple Individuals	This proposed pipeline would pose physical dangers to the community and irreparable damage to the environment.	Resource Report 11, Section 11.3	As discussed in Resource Report 11, Section 11.3, the Project is committed to safely operating and maintaining the Project and will instill the existing corporate risk management philosophies of its parent companies to efficiently identify and control or eliminate hazards throughout the life of the pipeline. The Project facilities will fully adhere to U.S. Department of Transportation Minimum Federal Safety Standards in 49 CFR Part 192. These safety regulations will be reinforced by the comprehensive and strictly enforced practices of the Project.
P-2	Individual	The Project will be close to three schools and a couple of churches. Concerns for leaks/explosions and overall exposure to gas emissions and fumes to population close by and health issues.	Resource Report 11	Reliability and safety of the Project is fully discussed in Draft Resource Report 11. The Project facilities will be designed, constructed, operated, and maintained in accordance with or to exceed the U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration minimum federal safety standards in 49 CFR 192 (see Resource Report 11 for more detail). These regulations, which are aimed at protecting the public and preventing natural gas facility accidents and failures, apply to all areas along the proposed pipeline routes.
P-32	Appalachian Mountain Advocates	The pipeline's route would threaten the environmental health of the communities through which it would pass with hazardous spills.	Resource Report 1, Section 1.4	As discussed in Resource Report 1, Section 1.4, the Project will handle any hazardous materials stored or encountered during construction in accordance with the Project-specific Spill, Prevention, Control, and Countermeasures Plan and Unanticipated Discovery of Contamination Plan (see Resource Report 1, Appendix 1-G). All waste would be disposed of at an approved, off-site facility.

Number	Source Name [1]	Issue of Concern	Addressed in Resource Reports	Response
Q - Reponses to Other Agency Comments				
Q-1	North Carolina Wildlife Resource Commission	MVP Southgate Project Responses to Comments Letter issued November 2, 2018. Sent on January 23, 2019.	---	See Attachment A for the Project's response.
Q-2	Virginia Department of Game & Inland Fisheries	MVP Southgate Project Comments issued November 15, 2018. Sent on January 23, 2019.	---	See Attachment A for the Project's response.

List of Acronyms and Abbreviations

BMPs	best management practices
E&SCP	Erosion and Sediment Control Plan
FERC	Federal Energy Regulatory Commission
INGAA	Interstate Natural Gas Association of America
NA	Not Applicable
NCDEQ	North Carolina Department of Environmental Quality
NEPA	National Environmental Policy Act
Plan	FERC's Upland Erosion Control, Revegetation, and Maintenance Plan
Procedures	FERC's Wetland and Waterbody Construction and Mitigation Procedures
Project or Southgate Project	MVP Southgate Project
PSNC	Public Service Company of North Carolina, Inc.