ENGINEERING ANALYSIS

Project Description

Total Petrochemical & Refining USA, Inc. is a manufacturer of metallic diacrylates and metallic acrylate monomer operating under a Title V permit. TPRI has elected to take a limit below 100 tpy to change to a Synthetic Minor Operating Permit (SMOP). The initial application was submitted to the Department on June 27, 2019.

Process Description

TPRI produces metallic diacrylates and metallic acrylate monomer, cross-linking agents used as additives in rubber-based products and used as strong adhesive bonds to metal surfaces. Heptane is used as a carrier solvent in the process.

The Zinc Diacrylate (ZDA) Unit is used to produce ZDA which is made by mixing proprietary components in a carrier solvent, heptane. After reaction, the solvent and ZDA are sent to a rotary vacuum dryer where the solvent is volatilized, condensed and sent to a holding tank to be reused.

Metallic Acrylates are produced in a batch reactor/dryers. Heptane is used as a solvent for the reaction between proprietary components. After the reaction, the water and heptane are stripped from the product, and the heptane used in subsequent batches.

Raw material tanks are used to feed the process. There is a boiler and a cooling tower that provides utilities to the process. The ZDA process uses baghouses as Utility Vacuum Systems to provide transport and packaging.

Equipment List

Total Petrochemical and Refining USA, Inc. has the following equipment in place:

- Zinc Diacrylate/Metallic Acrylate Unit (ZDA/MA Unit) and solvent tanks – EPN ST002
- 3.08 MMBtu/hr Boiler – EPN ST04 (Insignificant Activity)
- 449 BHP Diesel-Fired, CI ICE, Emergency Generator – EPN ST19

Notable Changes

TPRI is requesting the current Title V Permit be replaced with a Synthetic Minor Operating Permit (SMOP), with a 95 tpy limit of VOC emission, which would include heptane and trace amounts of acrylic acid emissions. The request would also incorporate eleven old Emission Point Numbers (EPN) into one EPN which aligns with the current emissions inventory and semi-annual reporting for the site. The Zinc Diacrylate Unit and Metallic Acrylate Unit emissions points will be combined into the one new EPN, ST002.

The VOC emissions contain a HAP pollutant, acrylic acid, but below the HAP threshold of 10 tpy for an individual HAP, making this an area source for HAP.

There are two 6,000 gallon solvent storage tanks on site that are used to store heptane. Loading and unloading activities as well as VOC from the tanks themselves are vented to the east solvent tank which is incorporated into EPN ST002.

All process vents have been combined into the new emission point, EPN ST002.

Emissions

The potential emissions were obtained from the application. The ZDA process emissions are based on purchase records for heptane using a mass basis approach assuming that all purchased heptane will be emitted. Sample calculations for the boiler and emergency generator CI RICE are in Appendix A.

Facility Wide Emissions					
Source	VOC (tpy)	NOx (tpy)	PM (tpy)	CO (tpy)	SOx (tpy)
Zinc Diacrylate/Metallic Acrylate Unit	95*	--	2.6	--	--
Boiler	< 0.1	1.3	0.1	1.1	t
Emergency Generator	0.2	2.7	0.2	0.6	0.2
Total	95.3	4.0	2.9	1.7	0.2

* = emissions inclusive of Acrylic Acid emissions

Table 1 – Facility Potential Emissions

TPRI has requested a proposed limit of 95 tpy for its VOC emission in order to qualify for a SMOP.

Regulations

State Regulations

ADEM Administrative Code r. 335-3-4-.01(1)(a and b), "Visible Emission"

ADEM 335-3-4-.01(a) states that no person shall emit to the atmosphere an opacity of greater than twenty percent (20%) over a six (6) minute period. **ADEM 335-3-4-.01(b)** states that during one six minute period in any sixty minute period a person may discharge into the atmosphere from any source of emissions, particulate of an opacity not greater than that designated as forty percent (40%) opacity. The engine and boiler will be subject to this regulation. If visible emissions are observed, the opacity should be determined using Method 9 of 40 CFR Part 60 Appendix A.

ADEM Administrative Code r. 335-3-4-.03,"Fuel Burning Equipment"

This regulation covers particulate matter (PM) emissions from fuel burning equipment. According to ADEM Admin, Code r. 335-3-1-.02(ee), the emergency engine does not meet the definition for "Fuel Burning Equipment" as defined in the code, however, the boiler does meet this definition.

ADEM Administrative Code r. 335-3-5-.01(b), "Fuel Combustion"

This regulation covers fuel combustion sulfur limitations for Category II counties, which includes Washington County. This regulation requires that fuel combustion source in Category II counties limit sulfur compounds to less than 4.0 lb/MMBtu. The boiler will demonstrate compliance by burning only natural gas.

ADEM Administrative Code, r. 335-3-14-.04*, *"Prevention of Significant Deterioration (PSD) Permitting"

Based on the emissions found in Table 1, all sources would not be expected to exceed the 250 tons per year (TPY) major source threshold for criteria pollutants for this type of facility. Greenhouse Gas (GHG) Regulations require a facility that would be subject to PSD to address PSD regulations for Greenhouse Gases. Greenhouse Gases of concern for these sources would be CO_2, N_2O, and CH_4. Per Rule 335-3-14-.04(2)(a)1.(iii), no PSD review would be required.

ADEM Admin. r. 335-3-14-.06, "Determinations for Major Sources in Accordance with Clean Air Act Section 112(g)"

This regulation applies to major sources of hazardous air pollutants (HAPs) constructed after March 27, 1998. Since this facility is not a major source of HAPs, a 112(g) case by case MACT review would not be necessary.

ADEM Administrative Code, r. 335-3-15, "Synthetic Minor Operating Permits (SMOPs)" and 335-3-16, "Major Source Operating Permits (MSOPs)"

TPRI has the potential to emit greater than the 100 TPY threshold for criterion pollutants but would not have the potential to emit greater than 10 TPY or more of a single HAP or 25 TPY or more of a combination of HAPs as shown in Table 1 of the emissions section. The facility has requested a PTE < 100 TPY limit and applied for a Synthetic Minor Operating Permit.

ADEM Admin. r. 335-3-15-.04, "General Provisions"

Monitoring and Record keeping requirements shall incorporate all requirements for monitoring VOC emissions including:

- weight of the heptane purchased,
- date of delivery, and
- cumulative weight of heptane purchased in each consecutive 12-month period.

Air Toxic Program

The application did not indicate a significant amount of Air Toxics from the emission sources, nor does the Department expect any Air Toxic emissions of significant quantities to be emitted. Therefore, no Air Toxics review will be performed for this project.

Class I Area

The nearest Class I Area to this well site would be the Breton Wildlife Refuge; however, this facility would be located more than 100 km from this area.

FEDERAL REGULATIONS

40 CFR 63 Subpart A, "General Provisions"

This subpart will be applicable provided that the facility is subject to one of the applicable subparts found under 40 CFR Part 63.

40 CFR Part 63 Subpart ZZZZ, "National Emission Standards for Hazardous Air Pollutant for Stationary Reciprocating Internal Combustion Engines (RICE)"

This regulation is also referred to as the RICE MACT and is applicable to any stationary reciprocating internal combustion engine that would be located at a major source of HAPs emissions or an area source of HAPs emissions. A stationary RICE at an area source of HAP emissions is existing if construction of that unit is commenced before June 12, 2006 (§63.6590(a)(1)(iii)). Since the engine was first placed into service prior to the effective date for this regulation it would be classified as existing RICE. Altogether, it would be classified as existing, non-black start, <500 HP, emergency CI stationary RICE located at an area source. The following requirements shall be met for this engine:

Emission Standards

Compliance with this subpart is met by meeting the following work/management practices specified in Table 2d (No. 4) of subpart ZZZZ upon startup (§63.6595(a)):

- For the engine, work/management practices involving:
  - Change oil and filter every 500 hours of operation or annually, whichever comes first (you have the option of utilizing an oil analysis program in order to extend the specified oil change requirements as specified in 40 CFR §63.6625(i)).
  - Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first, and replace as necessary.
  - Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary.

At all times, the engine shall be in compliance with the applicable emission limitations, operating limitations, and other requirements (§63.6605(a)). At all times an affected source must be operated and maintained, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions (§63.6605(b)).

The engine's time spent at idle and the engine's time at startup shall be minimized to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes after which time the non-startup emission limitations apply (§63.6625(h)).

Operation

This emergency engine will be limited to 100 hours/year or less for non-emergency operation for maintenance and readiness testing and emergency demand response (§63.6640(f)(2)) and 50 hours/year or less for non-emergency situations (counted as part of the 100 hours/year) (§63.6640(f)(4)).

Compliance and Performance Test Methods and Procedures

No performance testing is required by Subpart ZZZZ for this engine since there are no Subpart ZZZZ numerical emission standards to comply with.

Emission Monitoring

Continuous compliance with the requirements of this subpart is demonstrated by complying with the requirements specified in Table 6 (No. 9) as follows:

- To show compliance with work/management practices:
  - Operate and maintain the stationary RICE according to the manufacturer's emission-related operation and maintenance instructions.
    OR

- Develop and follow your own maintenance plan which provides, to the extent practicable, maintenance and operation of the engine in a manner consistent with good air pollution control practices for minimizing emissions (§63.6625(e)(3)).

A non-resettable hour meter must be installed if one is not already installed. (§63.6625(f)).

Recordkeeping and Reporting Requirements

Per §63.6655(e)(2), records used to show continuous compliance with items in Table 6 must be maintained. These records should include the hours of operation for both emergency and non-emergency operation, including what classified the operation as emergency and how many hours for non-emergency operation (§63.6655(f)(2)).

The records must be in a form suitable and readily available for review and kept for at least 5 years for each occurrence, measurement, maintenance, corrective action, report or record (§63.6660(a)).

RECOMMENDATIONS

This analysis indicates that the facility would meet the requirements of all federal and state rules and regulations. I recommend that Total Petrochemical & Refining USA, Inc. be issued SMOP No. 108-0010-X004.

September 26, 2019

J. Douglas Hallford
Industrial Minerals Section
Energy Branch
Air Division
ADEM

Date

Appendix

Emissions Calculations

Total Petrochemical & Refining, Inc.

Boiler Emission Calculation

Emission Factors AP-42 Gas from July 1998		Gas Used MMCF		
	lb/MMCF	26.98	lbs	tons
PM10	7.6		205	0.10
SOx	0.6		16	0.01
NOx	100		2698	1.35
VOC	5.5		148	0.07
CO	84		2266	1.13

DATA:			
		Engine	
ENGINE TYPE	=	Diesel	
FUEL HEAT CONTENT	=	19,300	Btu/lb
FUEL S CONTENT	=	3,000.00	ppmm
MAXIMUM ENGINE HP	=	449	HP
ENGINE OP HOURS	=	500	Hr
ENGINE RATING	=	3.14	MMBtu/hr
BRAKE-SPECIFIC FUEL CONSUMPTION	=	7,000	Btu/ HP-hr
CALCULATION BASIS	=	Controlled and Uncontrolled	
EMISSION FACTORS (EF)		MANUFACTURER'S EF	
		Uncontrolled	Controlled
NO_X	=	g/HP-hr	g/HP-hr
CO	=	g/HP-hr	g/HP-hr
VOC	=	g/HP-hr	g/HP-hr
CH_2O	=	g/HP-hr	g/HP-hr
CH_4	=	g/HP-hr	g/HP-hr

AP-42 Emission Factors (lb/MMBtu)

Type	PM	SO_2[1]	NO_X	CO	VOC	CH_2O	Other HAPs	
Diesel	3.10E-1	[By Mass]	4.41E+0	9.50E-1	3.50E-1	1.18E-3	2.69E-3	(Tables 3.3-1,2
2SLB	3.84E-2	5.88E-4	3.17E+0	3.86E-1	1.20E-1	5.52E-2	2.53E-2	(Table 3.2-1)
4SLB	7.71E-5	5.88E-4	4.08E+0	3.17E-1	1.18E-1	5.28E-2	2.10E-2	(Table 3.2-2)
4SRB	9.50E-3	5.88E-4	2.27E+0	3.72E+0	2.96E-2	2.05E-2	1.20E-2	(Table 3.2-3)

40 CFR Part 98 Subpart C Greenhouse Gas Emission Factors

Tables C-1 & C-2

(kg/MMBtu)

	N_2O	CO_2	CH_4
Diesel	0.0006	75.04	0.003
NG	0.0001	53.06	0.001
LPG	0.0006	62.72	0.003
Propane	0.0006	61.46	0.003

GWP	
N_2O=	298
CO_2=	1
CH_4=	25

Controlled and Uncontrolled 449 HP Engine Emissions Calculations

															Uncontrolled	Controlled
PM	0.3100	Lb	3.14	MMBtu	500 Hrs	1 Ton		S.F.			=	0.24	Tons		0.24	Tons
	MMBtu		Hr		Year	2000 Lb						Year			Year	
SO_2	51.8135	lb fuel	3.14	MMBtu	500 Hrs	1 Ton	64.08	lb SO2	3000	ppmm S	=	0.24	Tons		0.24	Tons
	MMBtu		Hr		Year	2000 Lb	32.06	lb S	1000000	total ppm		Year			Year	
NO_X	4.41E+0	lb	3.14	MMBtu		500 Hr	1 Ton		S.F.		=	3.47	Tons		3.47	Tons
	MMBtu		hr			Year	2000 Lb					Year			Year	
CO	9.50E-1	lb	3.14	MMBtu		500 Hr	1 Ton		S.F.		=	0.75	Tons		0.75	Tons
	MMBtu		hr			Year	2000 Lb					Year			Year	
VOC	0.35	lb	3.14	MMBtu		500 Hr	1 Ton		S.F.		=	0.28	Tons		0.28	Tons
	MMBtu		hr			Year	2000 Lb					Year			Year	
CH_2O	0.0012	lb	3.14	MMBtu		500 Hr	1 Ton		S.F.		=	0.00	Tons		0.00	Tons
	MMBtu		hr			Year	2000 Lb					Year			Year	
non-CH_2O HAPs	0.0027	lb	3.14	MMBtu		500 Hr	1 Ton		S.F.		=	0.00	Tons		0.00	Tons
	MMBtu		Hr			Year	2000 Lb					Year			Year	
CO_2	3.14	MMBtu	75.04	kg	0.001 Metric Ton		500	Hr	1.10231	Tons	=	129.99	Tons		129.99	Tons
	Hr		MMBtu		kg		Year		1 M Ton			Year			Year	
N_2O	3.14	MMBtu	0.0006	kg	0.001 Metric Ton		500	Hr	1.10231	Tons	=	0.00	Tons		0.00	Tons
	Hr		MMBtu		kg		Year		1 M Ton			Year			Year	
CH_4	3.14	MMBtu	0.003	kg	0.001 Metric Ton		500	Hr	1.10231	Tons	=	0.01	Tons		0.01	Tons
	Hr		MMBtu		kg		Year		1 M Ton			Year			Year	
Mass Sum	129.99	Tons	+	0.0010	Tons	+	0.0052	Tons			=	130.00	Tons		130.00	Tons
	Year			Year			Year					Year			Year	
	CO_2			N_2O			CH_4									
CO_2e	129.99	TPY*1		0.0010	TPY*298	+	0.005	TPY*25			=	130.43	Tons		130.43	Tons
	129.99		+	0.31			0.13					Year			Year	
	CO_2			N_2O			CH_4									

[1] EPA AP-42 factors assume gas to have 2000 gr S/MMScf (at EPA STP). This equates to 3.44 ppmv S, assuming ideal gas. AP-42 factor can be corrected to sulfur value of facility gas by comparing actual sulfur values to EPA reference point. Assume ppmv H_2S = ppmv S (true if H_2S = TRS and TRS is entirely monosulfur compounds).