TECHNICAL SUPPORT DOCUMENT

Air Discharge Permit 23-3581
Air Discharge Permit Application CO-1071

Issued: May 17, 2023

Solvay Chemicals

SWCAA ID – 1225

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ABBREVIATIONS

List of Acronyms

- ADP .... Air Discharge Permit
- AP-42 .... Compilation of Emission Factors, AP-42, 5th Edition, Volume 1, Stationary Point and Area Sources – published by EPA
- ASIL............. Acceptable Source Impact Level
- BACT........... Best available control technology
- CAM .... Compliance Assurance Monitoring
- CAS#............ Chemical Abstracts Service registry number
- CFR.............. Code of Federal Regulations
- EPA.............. U.S. Environmental Protection Agency
- EU .... Emission Unit
- LAER........... Lowest achievable emission rate
- MACT.......... Maximum Achievable Control Technologies
- mfr................ Manufacturer
- NESHAP...... National Emission Standards for Hazardous Air Pollutants
- NOV............. Notice of Violation/
- NSPS............ New Source Performance Standard
- PSD.............. Prevention of Significant Deterioration
- RACT........... Reasonably Available Control Technology
- RCW .... Revised Code of Washington
- SCC.............. Source Classification Code
- SDS .... Safety Data Sheet
- SQER .... Small Quantity Emission Rate listed in WAC 173-460
- Standard .... Standard conditions at a temperature of 68°F (20°C) and a pressure of 29.92 in Hg (760 mm Hg)
- SWCAA....... Southwest Clean Air Agency
- T-BACT....... Best Available Control Technology for toxic air pollutants
- WAC .... Washington Administrative Code

List of Units and Measures

- µm .... Micrometer (10^{-6} meter)
- acfm .... Actual cubic foot per minute
- bhp .... Brake horsepower
- dscfm............ Dry Standard cubic foot per minute
- g/dscm.......... Grams per dry Standard cubic meter
- gpm .... Gallon per minute
- gr/dscf .... Grain per dry standard cubic foot
- hp .... Horsepower
- hp-hr............. Horsepower-hour
- kW................ Kilowatt
- MMBtu ....Million British thermal unit
- MMcf............Million cubic feet
- ppm ....Parts per million
- ppmv.............Parts per million by volume
- ppmvd...........Parts per million by volume, dry
- ppmw............Parts per million by weight
- psig ....Pounds per square inch, gauge
- rpm................Revolution per minute
- scfm ....Standard cubic foot per minute
- tph.................Ton per hour
- tpy.................Tons per year

List of Chemical Symbols, Formulas, and Pollutants

C_3H_8 .... Propane
CH_4.............. Methane
CO .... Carbon monoxide
CO_2.............. Carbon dioxide
CO_2e............ Carbon dioxide equivalent
H_2S .... Hydrogen sulfide
HAP .... Hazardous air pollutant listed pursuant to Section 112 of the Federal Clean Air Act
N_2O .... Nitrous oxide
NH_3 .... Ammonia
NO_2 .... Nitrogen dioxide
NO_x .... Nitrogen oxides
O_2 .... Oxygen
O_3 .... Ozone
PM ....Particulate Matter with an aerodynamic diameter 100 µm or less
PM_{10}.............PM with an aerodynamic diameter 10 µm or less
$PM_{2.5}$ ....PM with an aerodynamic diameter 2.5 µm or less
SO_2................Sulfur dioxide
SO_x................Sulfur oxides
TAP...............Toxic air pollutant pursuant to Chapter 173-460 WAC
TGOC ....Total Gaseous Organic Carbon
TOC ....Total Organic Carbon
TSP ....Total Suspended Particulate
VOC.............Volatile organic compound

Terms not otherwise defined have the meaning assigned to them in the referenced regulations or the dictionary definition, as appropriate.

1. FACILITY IDENTIFICATION

Applicant Name:	Solvay Chemicals, Inc.
Applicant Address:	3500 Industrial Way, Longview, Washington 98632
Facility Name:	Solvay Chemicals, Inc.
Facility Address:	3500 Industrial Way, Longview, Washington 98632
SWCAA Identification:	1225
Contact Person:	Stewart Larsen, Longview Site Manager
Primary Process:	Hydrogen peroxide production
SIC/NAICS Code:	2819: Industrial Inorganic Compounds 325188: All other Basic Inorganic Chemical Manufacturing
Facility Classification:	Synthetic Minor

2. FACILITY DESCRIPTION

Solvay Chemicals, Inc. manufactures industrial grade hydrogen peroxide. Their products are used in the pulp and paper industry, the chemical industry, the food industry, and for environmental applications. Hydrogen peroxide is sold in an aqueous solution (48% to 70%). Hydrogen peroxide is made by the catalytic hydrogenation and oxidation of a substituted anthraquinone dissolved in a mixture of organic solvents. The anthraquinone is recycled through the process. VOC emissions from the process are primarily controlled by a group of carbon beds. Two steam-methane reformers are used to produce hydrogen and steam from natural gas.

3. CURRENT PERMITTING ACTION

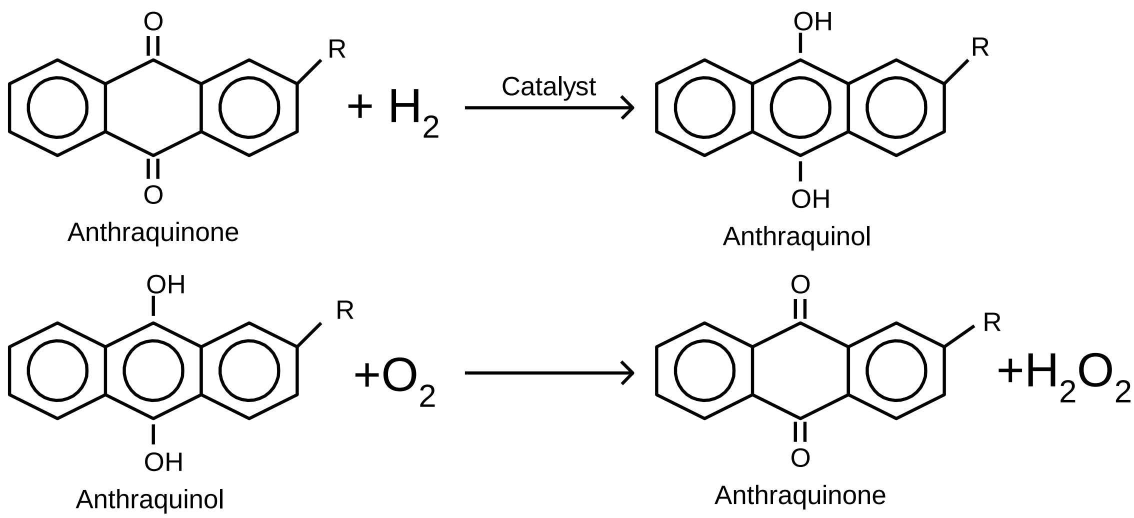
This permitting action is in response to Air Discharge Permit (ADP) application number CO-1071 dated April 19, 2023. Solvay Chemicals submitted ADP application CO-1071 requesting the following:

- Installation and operation of a 7th carbon bed

ADP 23-3581 will supersede ADP 16-3194 in its entirety.

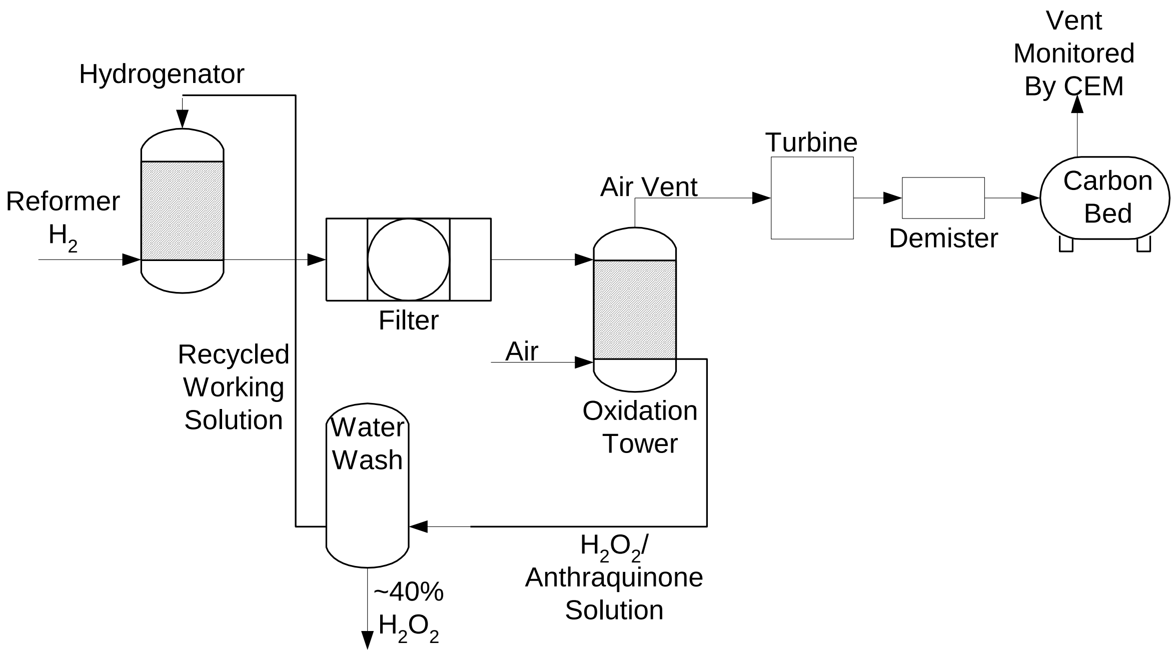
4. PROCESS DESCRIPTION

Hydrogen peroxide (H_2O_2) is made by the catalytic hydrogenation and oxidation of a substituted anthraquinone dissolved in a mixture of organic solvents (both polar and non-polar); the mixture of anthraquinone and solvents is called the working solution. The reactions used to produce hydrogen peroxide are shown below:



The hydrogen for the first reaction is supplied by a steam-methane reformer. The first reaction occurs in the hydrogenator, a catalyst containing reactor that is not normally vented. The working solution from this reactor is filtered to remove the catalyst, and the catalyst is backflushed back into the reactor. The oxidation stage occurs in an oxidizer using atmospheric oxygen. The vent stream from the oxidizer is saturated with VOCs. The main vent stream passes through a cyclone, a condenser, a demister, a turbine, and a second demister prior to passing through carbon beds to remove VOCs.

After oxidation, hydrogen peroxide is extracted from the working solution with water to produce a 48% hydrogen peroxide solution. The extracted solution is then washed with solvent to remove impurities. The majority of the 48% hydrogen peroxide solution is further purified through vacuum distillation to a product containing 50-70% hydrogen peroxide.



The primary sources of emissions are:

Source	**Primary Pollutants**
Reformer 1H07 Stack	Combustion Products (NO_X, CO, VOC, PM)
Reformer 1H07 Process Gas Vent	CO, CO_2, CH_4
Reformer 1H07 Condensate De-aeration	Ammonia, methanol
Reformer 2H07 Stack	Combustion Products (NO_X, CO, VOC, PM)
Reformer 2H07 Process Gas Vent	CO, CO_2, CH_4
Reformer 2H07 Condensate de-aeration	Ammonia, methanol
Continuous and intermittent purges	VOC
Fugitive leaks (piping, pumps, tanks)	VOC
Oxidation, reversion and distillation exhausts through carbon beds	VOC

5. EQUIPMENT/ACTIVITY IDENTIFICATION

5.a. Reformer 1H07 (*formerly H07*). The italicized reformer description was provided by the permittee:

The hydrogen plant was engineered and built by Howe-Baker Engineers, Inc. for Solvay Chemicals. The plant is designed to produce 482 kg/hr (1,060 lb/hr) of high purity hydrogen by utilizing steam reforming of natural gas. The hydrogen plant also produces 8,989 kg/hr (19,820 lb/hr) of steam as a byproduct at design conditions.

The hydrogen plant uses a feedstock of natural gas that is supplied from a pipeline. The natural gas from the pipeline is first compressed, heated, and fed to a hydrodesulfurizer to remove sulfur compounds from the natural gas. Then, steam is combined with the natural *gas and the mixture is heated and fed through catalyst filled reformer tubes. The reforming reaction produces hydrogen, CO, and CO_2. After exiting the reforming section, the process gas stream is cooled in a steam generating boiler. Then, it enters the high temperature shift reactor, in which CO and steam are converted to CO_2 and hydrogen. After passing through the shift converter, the gas is cooled in a series of heat exchangers which recover heat to produce additional steam. The cooled gas stream is then purified in the pressure swing adsorption (PSA) unit, which produces a stream of pure (99.7% minimum purity) hydrogen product and an off gas stream that is used as fuel in the reformer.*

The reforming of natural gas takes place under carefully controlled external combustion of off gas from the PSA unit and natural gas. Hydrogen can also be used as fuel, if available. There are four burners located at the bottom of the reformer which have a design heat release of 15.23 MMBtu/hr. The burners fire upward into the radiant section of the reformer and provide the combustion heat required by the reforming reaction. The combusted gas (flue gas) flows from the radiant section of the reformer through a duct to the convection section for heat recovery. After the heat is recovered from the flue gas, the cooled gas exits the stack to the atmosphere using an induced draft fan.

Emissions from the reformer consist of criteria pollutants from the combustion of natural gas and off gas, and CO from the reformer exhaust. Emissions of CO from the reformer exhaust are minimized if the oxygen level is controlled above 2%. Currently, the oxygen level is monitored and an alarm is sounded if the concentration falls below 2.1% on a 30-minute average. Plant operators manually adjust the air dampers to maintain oxygen levels greater than 2%.

During startup, shutdown and malfunction, syngas is vented out of a process vent when the PSA beds are offline.

Location:	Northeast of Reformer 2H07, ~ 46° 8'10.75"N, 122°58'51.34"W
Make / Model:	Custom by Howe-Baker Engineers
Hydrogen Production Capacity:	482 kg/hr (1,060 lb/hr) of pure H_2
Burner Make / Model:	John Zink / B-601-1
Burner Heat Input Capacity:	60.92 MMBtu/hr from the four 15.23 MMBtu/hour/burners
Burner O_2 Control:	Manual
Reformer Stack Description:	~62' tall, 35.5" diameter, 22,000 acfm @ 380°F.
Process Vent Description:	Vents process gas during startup, shutdown and malfunction. 68' tall, 6.0" diameter, 100°F. At full rates could exhaust at 12,811 scfm (13,580 acfm @ 100°F), typically startup would end (PSA beds online) at 40% of the above flow.
NSPS/NESHAP/MACT:	None

5.b. Reformer 2H07. Reformer 2H07 is used alongside Reformer 1H07 to produce hydrogen and steam for the facility. Reformer 2H07 differs from 1H07 because 1H07 is designed to produce hydrogen and steam, where 2H07 is designed to maximize hydrogen production and produce minimal steam. The following equipment information was provided:

Location:	Southwest of Reformer 1H07, ~ 46° 8.163'N, 122° 58.890'W
Make / Model:	Custom by Hydro-Chem
Hydrogen Production Capacity:	3.2 MMscfd (716 lb/hr based on material balance) of 99.99% pure H_2
Burner Make / Model:	Callidus / CUBL ultra-low-NO_X burner with 10:1 turndown, internal FGR
Burner Heat Input Capacity:	32 MMBtu/hr (~4.7 MMBtu/hr natural gas, ~27.3 MMBtu/hr tail gas)
Burner O_2 Control:	Automatic control with O_2 and air measurement, two controllable fans (ID and FD with VFD motors)
Reformer Stack Description:	72' 6" tall, 23.25" diameter, 4,429 dscfm @ 2%vd O_2
Process Vent Description:	Vents process gas during startup, shutdown and malfunction. 85'10" above grade, 10" schedule 10s pipe (10.42" inside diameter), 100°F. At full rates could exhaust at 3,991 scfm (4,230 acfm), typically startup would end (PSA beds online) at 40% of the above flow.
NSPS/NESHAP/MACT:	None

5.c. Hydrogen Peroxide Plant. The air discharges from the oxidation, reversion and distillation process condensers are ultimately routed through carbon beds before discharge to ambient air. The proposed permitting action will involve the addition of one carbon bed, for a total of seven carbon beds in parallel, each rated at 6,500 scfm. The beds measure 100" in diameter by 132" in length. Emissions from the carbon beds consist of unadsorbed VOCs. A Siemens model FIDAMAT 5E-E flame ionization detector calibrated daily with methane, is used to monitor emission concentrations. Flow rates are calculated using the measured inlet flowrate and the outlet oxygen content. The carbon beds cycle time can be up to 900 minutes of use, with a regeneration time of 150 minutes. One carbon bed is in regeneration while the remaining carbon beds are adsorbing. The cycle time may be adjusted in response to increased or reduced organic loading. A turbine is installed upstream of the carbon beds to recover energy. Condensers and demisters are utilized upstream of the turbine to eliminate the possibility of water droplet entrainment.

Sources without a significant organic emission component are vented to the atmosphere. Refer to Table 1 for hydrogen peroxide plant vessel details.

Fugitive emissions can be vented from valves, flanges, pumps, connectors, tanks, etc. within the hydrogen peroxide plant.

Carbon Bed Stack Description: 34' 10" tall. 20" schedule 10s pipe (19.56" inside diameter), 45°F.

5.d. <u>Storage Tanks</u>. Because emissions from the hydrogen peroxide plant are so well controlled by the carbon beds, the storage tanks may be the largest source of VOC emissions. Emissions from the hydrogen peroxide storage tanks are due to the stripping of trace VOCs from the final product during sparging of the tanks. The tanks are sparged as needed for mixing (not continuously). The following table of tank details was provided by Solvay Chemicals, Inc.

Table 1 – Hydrogen Peroxide and Storage Vessel Details

vessel	description	capacity (gal)	continuous gas flow?	cyclone	condenser	vent to location?	"active" vent?	comments
V080/1-5	effluent pit	1,500	N	N/A	N/A	atmosphere	N	
V082	effluent settling tank	4,700	N	N/A	N/A	atmosphere	N	
MS083	oil/water separator	-	N	V862	E860	atmosphere	N	
V089	effluent surge tank	24,000	N	N/A	N/A	atmosphere	N	
V131	solvent tank	360	N	N/A	N/A	atmosphere	N	
V210	Organics make-up vessel	2,600	N	N/A	N/A	atmosphere	N	
V250	Organics recovery vessel	2,600	N	N/A	N/A	atmosphere	N	
R301	hydrogenator	83,000	5,000 scfm H_2 supplemented with ≈10-20 scfm N_2	V326 (for normal venting) and V328/2 (for emergency blowing)	E325 (for normal venting)	atmosphere	N	H_2 consumed in reaction; R301 not normally vented
V306	Organics surge tank	18,300	N	V328/3 (for emergency blowing)	N/A	R301	N	part of R301 system (headspace tied-in to R301); not normally vented
V361	solvent receiver	270	2.0 scfm N_2	N/A	N/A	vents to V364	N	
V364	solvent decanter	270	Y - shares sweep w/ V361	N/A	N/A	atmosphere	Y	
T(2)416	oxidizer	-	21,000 scfm air flow to T2416, 7,000 scfm to T416	V(2)417	E(2)418	C beds	Y	

vessel	description	capacity (gal)	continuous gas flow?	cyclone	condenser	vent to location?	"active" vent?	comments
V420	degasser	42,400	Minor off-gas flow, accounted for in T(2)416 flow	N/A	E452	C beds	Y	New vessel
MS426	solvent decanter	-	N - N_2 sweep available, but not used	N/A	N/A	atmosphere	N	
T(2)505	extraction tower	-	N - N_2 sweep available, but not used	V(2)506	N/A	atmosphere	N	
V(2)508	surge tank	18,600	1.0 scfm N_2 when in service (V508 only, typically)	N/A	N/A	atmosphere	Y	
V530	water recycling tank	500	N	N/A	N/A	atmosphere	N	
T602	wash tower	-	N	V605	N/A	atmosphere	N	
V608	solvent collection tank	840	N	N/A	N/A	atmosphere	N	
V610	solvent surge tank	840	N	N/A	N/A	atmosphere	N	
V620/1-6	storage tank	80,000	intermittent air sparge	N/A	N/A	atmosphere	Y	
T(2)712	distillation tower	-	Y	N/A	E(2)713	C beds	Y	
V(2)718	purge receiver	2,900	N	N/A	N/A	atmosphere	N	
V(2)721	distillate receiver	1,400	N	N/A	N/A	atmosphere	N	
V724	condensate receiver	10,000	N	N/A	N/A	atmosphere	N	
V(2)730	water surge tank	1,400	N	N/A	N/A	atmosphere	N	
V770/1-6	storage tank	80,000	intermittent air sparge	N/A	N/A	atmosphere	Y	
V2770/1-2	storage tank	160,000	intermittent air sparge	N/A	N/A	atmosphere	Y	
V780/1-2	storage tank	18,000	intermittent air sparge	N/A	N/A	atmosphere	Y	
V811	feed tank	250	N2 pad to maintain pressure (not a constant flow)	N/A	water seal pot	atmosphere	N	

vessel	description	capacity (gal)	continuous gas flow?	cyclone	condenser	vent to location?	"active" vent?	comments
T815	reversion oxidizer	-	250 scfm air flow	V817/ V827	E818	C beds	Y	
T819	wash column	-	N	V819	N/A	atmosphere	N	
R825	Organics reactor 1	3,000	1 scfm N_2 sweep	V827	E826	C beds	Y	Repurposed
R829	Organics reactor 2	14,000	250 scfm	N/A	E826	C beds	Y	New vessel
CE830/1-2	Organics wash vessel	-	0.2, 0.1, and 0.2 scfm to /L, /S, and /D.	N/A	N/A	V832/1-2	N	
V832/1-2	overflow tank	530	Y- same as centrifuge purge total flow	N/A	N/A	atmosphere	Y	
CE840/1-2	Organics wash vessel	-	0.2, 0.1, and 0.2 scfm to /L, /S, and /D.	N/A	N/A	V832/1-2	N	
V842	Organics recycle tank	200	Y - shares sweep w/ V855	V862	E860	atmosphere	Y	
V844	Organics wash tank	9,300	N	N/A	E860	atmosphere	N	New vessel
V846	Organics return tank	2,200	N – N_2 sweep available, but not used	V862	E860	atmosphere	N	
V855	water decanter	4,100	Y	N/A	N/A	V842	N	
V848	wash vessel	2,048	N	N/A	E860	atmosphere	N	New vessel
V849	wash vessel	2,048	N	N/A	E860	atmosphere	N	New vessel
V910	Storage tank	8,800	N	N/A	N/A	atmosphere	N	
V920	Storage tank	8,800	N	N/A	N/A	atmosphere	N	
V950	Storage tank	27,000	N	N/A	N/A	atmosphere	N	
V970	Storage tank	5,000	N - N_2 sweep available, but not used	N/A	water seal pot	atmosphere	N	
-	fume hoods	-	N	N/A	N/A	atmosphere	Y	four lab fume hoods
-	hydrogen analyzers	-	6 L/min per analyzer	N/A	sample cooler	atmosphere	Y	two H_2 analyzers: AI R301/B6 and AI T2416/N.

vessel	description	capacity (gal)	continuous gas flow?	cyclone	condenser	vent to location?	"active" vent?	comments
-	oxygen analyzers	-	6-12 L/min per analyzer	N/A	sample cooler	atmosphere	Y	Ten O_2 analyzers: AI R301/B1-B3, AI V306/G, AI E332/K (no cooler), AI T2416/L-L2, AI T416/L, AI T(2)505/U, AI V420/X.

5.e. Emergency Generator Engine. The generator is used to power emergency systems in the event of a power outage and cannot be used to operate portions of the plant during an extended outage. The generator is operated approximately 30 minutes each month for testing purposes.

Engine Make:	Detroit Diesel
Engine Model:	10637305
Engine Serial Number:	06A0460671
Engine Output Rating:	315 bhp at 1,800 rpm
Installation Date:	September 1989
Fuel:	Diesel
Engine certification:	none
Generator Rating:	200 kW
Stack Height:	10′ from ground
Stack Diameter:	8″
Stack Temperature:	800°F
Stack Flow:	840 acfm
Engine Location:	Outside east corner of control building, 46° 8′ 12.78″N, 122°58′ 58.46″W
Regulations of Note:	40 CFR 63 Subpart ZZZZ

5.f. Emergency Fire Pump Engine #1. Emergency fire pump engine #1 is identified by Solvay Chemicals as P093/1. This fire pump provides water pressure for fire water systems (not including fire monitors) at the facility. The unit is housed in a building dedicated to Solvay's three fire water pumps.

Engine Make:	Caterpillar
Engine Model:	3408B
Engine Serial Number:	67U12454
Engine Output Rating:	510 bhp
Fuel:	Diesel
Engine Certification:	none
Installation Date:	1989
Stack Height:	12′ from ground, horizontally above the roof
Stack Diameter:	8″
Stack Temperature:	800°F

Stack Flow:	1,177 acfm
Stack Location:	Inside dedicated fire pump building on northern corner of facility, 46° 8′ 16.80″N, 122°58′ 59.03″W
Regulations of Note:	40 CFR 63 Subpart ZZZZ

5.g. Emergency Fire Pump Engine #2. Emergency fire pump engine #2 is identified by Solvay Chemicals as P093/2. This fire pump provides water pressure for fire water systems (not including fire monitors) at the facility. The unit is housed in a building dedicated to Solvay's three fire water pumps.

Engine Make:	Caterpillar
Engine Model:	3408B
Engine Serial Number:	67U12526
Engine Output Rating:	510 bhp
Fuel:	Diesel
Engine Certification:	none
Installation Date:	1989
Stack Height:	12′ from ground, horizontally above the roof
Stack Diameter:	8″
Stack Temperature:	800°F
Stack Flow:	1,177 acfm
Engine Location:	Inside dedicated fire pump building on northern corner of facility, 46° 8′ 16.79″N, 122°58′ 58.92″W
Regulations of Note:	40 CFR 63 Subpart ZZZZ

5.h. Emergency Fire Pump Engine #3. Emergency fire pump engine #3 is identified by Solvay Chemicals as P093/3. This fire pump provides water pressure for fire water systems (not including fire monitors) at the facility. The unit is housed in a building dedicated to Solvay's three fire water pumps. The engine is equipped with M95 injectors.

Engine Make:	Detroit Diesel
Engine Model:	DDFP-12AT 7019
Engine Serial Number:	12VA85194
Engine Output Rating:	662 bhp
Fuel:	Diesel
Engine Certification:	none
Installation Date:	1991
Stack Height:	12′ from ground, horizontally above the roof
Stack Diameter:	8″
Stack Temperature:	800°F
Stack Flow:	1,528 acfm
Engine Location:	Inside dedicated fire pump building on northern corner of facility, 46° 8′ 16.66″N, 122°58′ 58.74″W
Regulations of Note:	40 CFR 63 Subpart ZZZZ

5.i. Equipment/Activity Summary.

ID No.	Equipment/Activity	Control Equipment/Measure
1	Reformer 1H07 - Combustion Stack - Syngas Vent - Deaerator Vent	Low NO_X burners, O_2 monitoring of combustion process Ultralow Sulfur Fuel (Natural Gas)
2	Reformer 2H07 - Combustion Stack - Syngas Vent - Deaerator Vent	Low NO_X burners, remotely adjustable O_2 registers on combustion process Ultralow Sulfur Fuel (Natural Gas)
3	Hydrogen Peroxide Plant - Process Vents (oxidation, reversion and distillation) - Fugitive emissions, continuous and intermittent purges	Carbon beds for vents from oxidation, reversion and distillation. Leak detection and repair (LDAR) for fugitive emissions. Ultralow Sulfur Fuel (Natural Gas)
4	Storage Tanks, Continuous and Intermittent Purge Sources	None
5	Emergency Generator Engine	Ultralow Sulfur (≤15 ppm) Liquid Fuel
6	Fire Pump #1 Engine	Ultralow Sulfur (≤15 ppm) Liquid Fuel
7	Fire Pump #2 Engine	Ultralow Sulfur (≤15 ppm) Liquid Fuel
8	Fire Pump #3 Engine	Ultralow Sulfur (≤15 ppm) Liquid Fuel

6. EMISSIONS DETERMINATION

Unless otherwise specified by SWCAA, actual emissions must be determined using the specified input parameter listed for each emission unit and the following hierarchy of methodologies:
(a) Continuous emissions monitoring system (CEMS) data;
(b) Source emissions test data (EPA reference method). When source emissions test data conflicts with CEMS data for the time period of a source test, source test data must be used;
(c) Source emissions test data (other test method); and
(d) Emission factors or methodology provided in this TSD.

6.a. Reformer 1H07 (*formerly H07*). The italicized discussion was provided by the permittee:

There are two main sources of air emissions from the reformer. The first is the flue gas exiting the convection section of the reformer. This stream mostly consists of nitrogen and oxygen from atmospheric air that is used for combustion, CO_2, and trace amounts of CO, NOx, and SOx. The second source of air emissions is a process vent stack. Upset conditions that would cause venting of process gas or off gas are as follows:

- *Start-up of the reforming unit - During start-up, the process gas flow is slowly increased to a target flow that is required to place the PSA unit on-line. While the process gas flow is being increased, the gas that would normally be fed to the PSA unit is vented (syngas vent).*

- *Shutdown of the PSA unit - When the PSA unit shuts down, the process gas that would normally be fed to the PSA unit is vented. Since no off gas is available for fuel under this situation, process gas flow rates must be decreased to about half of the design flow rates to hold the temperature in the reformer.*

- *Unstable operation of the off gas system - If the pressure of the off gas system is too high, some off gas may be vented. This is an abnormal and undesirable condition because operation of the PSA unit becomes less efficient with the off gas header at a high pressure and valuable fuel is wasted. This condition is most likely to occur when process gas rates are being increased significantly through the reformer over a short period of time.*

- *Lifting of a pressure relief device - The PSVs on the process gas and off gas lines are vented to the vent header.*

In addition, there are two continuous nitrogen sweep flows through the process vent. The first is a line that is used as a vent for nitrogen purges on the internals (distance pieces) of the natural gas compressors. The second continuous nitrogen sweep is to create an inert environment in the vent header itself.

Maximum potential emissions of CO and NO_X during normal operation were based on annual emission limits provided in SWCAA 94-1715. Actual annual emissions must be calculated based on emission factors developed during source testing in units of lbs pollutant / lbs H_2 production multiplied by total hydrogen production unless an alternative method is approved by SWCAA. The actual gas exhaust flow rate at any instant will depend on the composition of the fuel gas (a mixture of natural gas and off-gas from the PSA beds). Maximum potential emissions of PM, VOCs, SO_X, benzene and formaldehyde can be estimated using emission factors for the combustion of natural gas and the total potential natural gas consumption of the reformer burners (~360 MMscf/yr, 41,099 scfh).

Reformer 1H07 - Combustion Emissions						
Maximum Firing Rate =		60.92	MMBtu/hr			
Natural Gas Combustion =		360,025,707	scf/yr			
H_2 Production Capacity =		1,103	lb/hr			
Annual H_2 Production =		9,660,000	lbs			
	Emission Factor Basis		Emission			
		ppmvd	Factor	Emissions	Emission Factor	
Pollutant	lb/MMscf NC	@ 2% O_2	lb/MM lb H_2	tpy	Source	
NO_X		40	3,685	17.80	BACT	
CO		50	2,070	10.00	BACT	
VOC	5.5		205	0.99	AP-42 Table 1.4-2 (7/98)	
SO_X as SO_2[1]	0.6		22	0.11	Mass Balance	
PM	7.6		283	1.37	AP-42 Table 1.4-2 (7/98)	
PM_{10}	7.6		283	1.37	AP-42 Table 1.4-2 (7/98)	
$PM_{2.5}$	7.6		283	1.37	AP-42 Table 1.4-2 (7/98)	
Benzene	0.0021		7.8E-02	3.8E-04	AP-42 Table 1.4-2 (7/98)	
Formaldehyde	0.075		2.8E+00	1.4E-02	AP-42 Table 1.4-2 (7/98)	
			CO_2e	CO_2e		Emission Factor
Greenhouse Gases	kg/MMBtu	GWP	lb/MMBtu	lb/MMscf	tpy, CO_2e	Source
CO_2	53.06	1	116.98	120,019	21,605	40 CFR 98
CH_4	0.001	25	0.055	57	10	40 CFR 98
N_2O	0.0001	298	0.066	67	12	40 CFR 98
Total GHG - CO_2e	53.0611		117.098	120,143	21,627	

[1] This is an upper bound estimate of SO_2 emissions, actual emissions are expected to be lower because the natural gas is desulfurized prior to use in the reformer.

In addition to the combustion emissions above, CO and CO_2 in the tail gas fed to the reformer burners contributes to CO_2 emissions. At full rates, an estimated total of 144,626 standard cubic feet per hour of tail gas, 49.07% of which is CO and CO_2 is burned in the reformer. The resulting CO_2 emissions would be 4.05 tons per hour and 35,499 tons per year.

The reformer is a significant source of CO during reformer startups, PSA unit shutdowns, and process upsets. CO emissions during these events can be calculated using a mass balance approach. At design rates, the reformer produces an average of 43.44 lb-moles CO/hr at a process natural gas flow rate of 2,117 Nm^3/hr exiting the hydrodesulfurizer. Assuming that the ratio of CO production to natural gas usage is constant, CO emissions during reformer startup, PSA unit shutdown, and process upsets can be calculated using the following formula:

$$\text{lbs CO} = \left(\frac{\text{Nm}^3\text{/hr Natural Gas During Event}}{2{,}117\ \text{Nm}^3\text{/hr}}\right) \bullet \left(43.44\ \text{lbmole/hr CO}\right) \bullet \left(\frac{28\ \text{lb CO}}{\text{lbmole CO}}\right) \bullet \left(\text{Event Duration (Hours)}\right)$$

It is assumed that all CO produced during the event is emitted through the process vent. The permittee estimates that up to 30.0 tons per year of CO can be emitted due to reformer startups, PSA unit shutdowns, and process upsets.

Condensate Deaerator Vent. Some ammonia and methanol are formed in the reformer and leave the process in the water condensate stream. The ammonia and methanol are steam stripped from the condensate stream in the deaerator and vented along with non-condensable gases and steam. Emissions Maximum potential emissions are estimated below:

Reformer 1H07 Process Condensate Impurities				
Condensate Generation =	2,441	kg/hr		
	Concentration			
Component	ppm	lb/hr	lb/yr	tpy
Ammonia	30	0.16	1,414	0.71
Methanol	100	0.54	4,714	2.36

6.b. Reformer 2H07. The italicized discussion was provided by the permittee for 1H07 and also describes emission sources from 2H07.

There are two main sources of air emissions from the reformer. The first is the flue gas exiting the convection section of the reformer. This stream mostly consists of nitrogen and oxygen from atmospheric air that is used for combustion, CO_2, and trace amounts of CO, NOx, and SOx. The second source of air emissions is a process vent stack. Upset conditions that would cause venting of process gas or off gas are as follows:

- *Start-up of the reforming unit - During start-up, the process gas flow is slowly increased to a target flow that is required to place the PSA unit on-line. While the process gas flow is being increased, the gas that would normally be fed to the PSA unit is vented (syngas vent).*

- *Shutdown of the PSA unit - When the PSA unit shuts down, the process gas that would normally be fed to the PSA unit is vented. Since no off gas is available for fuel under this situation, process gas flow rates must be decreased to about half of the design flow rates to hold the temperature in the reformer.*

- *Unstable operation of the off gas system - If the pressure of the off gas system is too high, some off gas may be vented. This is an abnormal and undesirable condition because the operation of the PSA unit becomes less efficient with the off gas header at a high pressure and valuable fuel is wasted. This condition is most likely to occur when process gas rates are being increased significantly through the reformer over a short period of time.*

- *Lifting of a pressure relief device - The PSVs on the process gas and off gas lines are vented to the vent header.*

Maximum potential emissions of NO_X and CO during normal operation are based on an exhaust concentration of NO_X and CO of 40 ppmvd and 50 ppmvd @ 2% O_2 respectively. Short term and annual mass emission limits utilize these concentrations and an estimated exhaust flow of 10,076 Nm^3/hr. When corrected to dry conditions and 2% O_2, this is equivalent to 5,406 dscfm. Actual annual emissions must be calculated based on emission factors developed during source testing in units of lbs pollutant / lbs H_2 production multiplied by total hydrogen production unless an alternative method is approved by SWCAA. The actual gas exhaust flow rate at instant will depend on the composition of the fuel gas (a mixture of natural gas and off-gas from the PSA beds). Maximum potential emissions of PM, VOCs, SO_X, benzene and formaldehyde must be estimated using emission factors for the combustion of natural gas and the total potential natural gas consumption of the reformer burners (~130 MMscf/yr, 14,887 scfh).

Reformer 2H07 - Combustion Emissions						
Maximum Firing Rate =		32.01	MMBtu/hr			
Natural Gas Combustion =		130,412,027	scf/yr			
Stack Flow =		5,406	dscfm @ 2% O_2			
Annual H_2 Production =		6,268,396	lb/yr			
	Emission Factor Basis		Emission			
		ppmvd	Factor	Emissions	Emission Factor	
Pollutant	lb/MMscf NG	@ 2% O_2	lb/MM lb H_2	tpy	Source	
NO_X		40	2,164	6.78	BACT	
CO		50	1,647	5.16	BACT	
VOC	5.5		114	0.36	AP-42 Table 1.4-2 (7/98)	
SO_X as SO_2[1]	0.6		12	0.04	Mass Balance	
PM	7.6		158	0.50	AP-42 Table 1.4-2 (7/98)	
PM_{10}	7.6		158	0.50	AP-42 Table 1.4-2 (7/98)	
$PM_{2.5}$	7.6		158	0.50	AP-42 Table 1.4-2 (7/98)	
Benzene	0.0021		4.4E-02	1.4E-04	AP-42 Table 1.4-2 (7/98)	
Formaldehyde	0.075		1.6E+00	4.9E-03	AP-42 Table 1.4-2 (7/98)	
			CO_2e		Emission Factor	
Greenhouse Gase	kg/MMBtu	GWP	lb/MMscf	tpy, CO_2e	Source	
CO_2	53.06	1	120,019	7,826	40 CFR 98	
CH_4	0.001	25	57	4	40 CFR 98	
N_2O	0.0001	298	67	4	40 CFR 98	
Total GHG - CO	53.0611		120,143	7,834		

[1] This is an upper bound estimate of SO_2 emissions, actual emissions are expected to be lower because the natural gas is desulfurized prior to use in the reformer.

In addition to the combustion emissions above, CO and CO_2 in the tail gas fed to the reformer burners contributes to CO_2 emissions. At full rates, an estimated total of 102,860 standard cubic feet per hour of tail gas, 46.5% of which is CO and CO_2 is burned in the reformer. The resulting CO_2 emissions would be 2.53 tons per hour and 22,156 tons per year.

The reformer is a significant source of carbon monoxide during reformer startups, PSA unit shutdowns, and process upsets. Carbon monoxide emissions during these events can be calculated using a mass balance approach. At design rates, the reformer produces an average of 25.54 lb-moles CO/hr at a process natural gas flow rate of 1,606 Nm^3/hr exiting the hydrodesulfurizer. Assuming that the ratio of CO production to natural gas usage is constant, CO emissions during reformer startup, PSA unit shutdown, and process upsets can be calculated using the following formula:

$$\text{lbs CO} = \left(\frac{\text{Nm}^3\text{/hr Natural Gas During Event}}{1{,}606\ \text{Nm}^3\text{/hr}}\right) \bullet \left(25.54\ \text{lbmole/hr CO}\right) \bullet \left(\frac{28\ \text{lb CO}}{\text{lbmole CO}}\right) \bullet \left(\text{Event Duration (Hours)}\right)$$

It was assumed that 2H07 could vent as much as 1H07 (equivalent to 49.3 hours per year at full rate) and assumed that all CO produced during the event is emitted through the process vent. At this rate, 13.38 tons per year of CO can be emitted due to reformer startups, PSA unit shutdowns, and process upsets.

<u>Condensate Deaerator Vent</u>. Some ammonia and methanol are formed in the reformer and leave the process in the water condensate stream. The ammonia and methanol are steam stripped from the condensate stream in the deaerator and vented along with non-condensable gases and steam. Maximum potential emissions are estimated below:

Reformer 2H07 Process Condensate Impurities				
Condensate Generation =	1,864	kg/hr		
	Concentration			
Component	ppm	lb/hr	lb/yr	tpy
Ammonia	30	0.12	1,080	0.54
Methanol	100	0.41	3,600	1.80

6.c. <u>Hydrogen Peroxide Plant and Storage Tanks</u>. Emissions from the hydrogen peroxide plant include fugitive VOC emissions from plant equipment, VOC emissions from continuous and intermittent purges, and VOC emissions from the air stream passing through the carbon beds.

Fugitive VOC emissions from plant equipment, including storage tanks, were estimated at 5.0 tons per year in ADP Application CO-495.

The 2016 expansion involved adding approximately 412 flanges and 137 valves. The fugitive emissions were calculated below using emission factors from EPA's Protocol for Leak Emission Rates (EPA-453/R-95-17), 1995. The organic solution containing VOCs has a vapor pressure of less than 0.1 kPa at 20°C and is a "heavy liquid" for the purpose of estimating potential fugitive emissions. The estimate below is expected to be extremely conservative because a Leak Detection and Repair (LDAR) requirement is expected to be more effective at controlling leaks at this facility than the reference facility used to generate the emission factors below. An increase in effectiveness is expected because the mixed organic solution contains a significant concentration of solute that is a solid at normal temperatures, forming a very visible, differently colored deposit at any leak point. SWCAA expects leaks to be easier to identify at this facility than at a typical facility utilizing a LDAR program, improving the overall effectiveness of the LDAR requirement. SWCAA has increased the LDAR control effectiveness in the calculation below from 84% for valves and 93% for connectors to 95% in an attempt to quantify the improved effectiveness. Because the exact number of valves, flanges, pumps, etc. is not yet knowns, SWCAA has assumed that increased fugitive emissions could be 0.5 tons per year, approximately 30% higher than indicated in the calculation below.

Fugitive Emissions							
Hours of Operation =	8,760						
			Uncontrolled		LDAR	Controlled	
		Leak Rate	VOC	VOC	Control	VOC	VOC
Equipment	#	kg/hr/source	lb/hr	tpy	%	lb/hr	tpy
Heavy Liquid Valves	137	0.00023	0.07	0.30	95%	0.00	0.02
Connectors (flanges)	412	0.00183	1.66	7.28	95%	0.08	0.36
					Total =	0.09	**0.38**

Total emissions from continuous and intermittent purges were estimated at 4.5 tons per year, and this emission rate was established as a permit limit in ADP 94-1602.

VOC emission estimates from fugitive sources and continuous and intermittent purges are based on plant design specification that do not change from year to year, therefore these are appropriate emission estimates to use for future emission inventories unless direct measurements are conducted.

The air discharges from the oxidation, reversion and distillation process condensers will be routed through a set of 6 carbon beds in parallel. Seven carbon beds will be available, however at least one will be in regeneration mode at all times. Each carbon bed is rated at 6,500 cfm. At full plant capacity, up to 39,000 scfm of gas could be routed through the carbon beds. An exhaust VOC concentration limit of 3.0 ppm (1-hour average) based on an average VOC molecular weight of 134.1 has been established. At a flowrate of 39,000 cfm this equates to an hourly exhaust emission rate of 2.44 pounds per hour. Actual exhaust concentrations are monitored with a VOC analyzer. Exhaust flow rates are determined from process flow data.

Hydrogen Peroxide Plant - Carbon Beds			
Carbon beds			
Max VOC concentration =	3	ppm as C10	
Max flow =	39,000	scfm	
VOC Mwt =	134.1		
	lb/hr	lb/yr	tpy
Potential VOC emissions =	2.44	21,400	**10.70**

ADP application CO-1071: As part of this permitting action, a seventh carbon bed will be installed. Six will be in operation at any given time because at least one of the carbon beds will be regenerating.

6.d. Emergency Generator Engine. Potential annual emissions from the combustion of ultra-low sulfur diesel (<0.0015% sulfur by weight) were calculated with the assumption that the equipment will operate at full load for up to 200 hours per year.

Emergency Generator Engine						
Hours of Operation =	200	hours				
Power Output =	315	horsepower				
Diesel Density =	7.206	pounds per gallon				
Fuel Sulfur Content =	0.0015	% by weight				
Fuel Consumption Rate =	16.0	gal/hr				
Fuel Heat Content =	0.138	MMBtu/gal (for use with GHG factors from 40 CFR 98)				
Pollutant	Emission Factor lb/hp-hr	Emissions lb/hr	Emissions tpy	Emission Factor Source		
NO_X		4.87	0.49	Manufacturer		
CO		4.50	0.45	Manufacturer		
VOC		0.17	0.02	Manufacturer		
SO_X as SO_2		0.0035	0.0003	Mass Balance		
PM	0.0022	0.69	0.07	AP-42 Table 3.3-1 (10/96)		
PM_{10}	0.0022	0.69	0.07	AP-42 Table 3.3-1 (10/96)		
$PM_{2.5}$	0.0022	0.69	0.07	AP-42 Table 3.3-1 (10/96)		
Greenhouse Gases	kg/MMBtu	GWP	CO_2e lb/MMBtu	CO_2e lb/gallon	tpy, CO_2e	Emission Factor Source
CO_2	73.96	1	163.05	23	36	40 CFR 98
CH_4	0.003	25	0.165	0.023	0.04	40 CFR 98
N_2O	0.0006	298	0.394	0.054	0.09	40 CFR 98
Total GHG - CO_2e	73.9636		163.613	23	36	

Emissions must be calculated using the emission factors identified above unless new emission factors are provided by the manufacturer or developed through source testing.

6.e. Fire Pump #1 Engine. Potential annual emissions from the combustion of ultra-low sulfur diesel (<0.0015% sulfur by weight) were calculated with the assumption that the equipment will operate at full load for up to hours per year.

Fire Pump #1 Engine						
Hours of Operation =	200	hours				
Power Output =	510	horsepower				
Diesel Density =	7.206	pounds per gallon				
Fuel Sulfur Content =	0.0015	% by weight				
Fuel Consumption Rate =	25.9	gal/hr				
Fuel Heat Content =	0.138	MMBtu/gal (for use with GHG factors from 40 CFR 98)				
	Emission					
	Factor	Emissions	Emissions	Emission Factor		
Pollutant	lb/hp-hr	lb/hr	tpy	Source		
NO_X	0.031	15.81	1.58	AP-42 Table 3.3-1 (10/96)		
CO	0.00668	3.41	0.34	AP-42 Table 3.3-1 (10/96)		
VOC	0.0025141	1.28	0.13	AP-42 Table 3.3-1 (10/96)		
SO_X as SO_2		0.0056	0.0006	Mass Balance		
PM	0.0022	1.12	0.11	AP-42 Table 3.3-1 (10/96)		
PM_{10}	0.0022	1.12	0.11	AP-42 Table 3.3-1 (10/96)		
$PM_{2.5}$	0.0022	1.12	0.11	AP-42 Table 3.3-1 (10/96)		
			CO_2e	CO_2e		Emission Factor
Greenhouse Gases	kg/MMBtu	GWP	lb/MMBtu	lb/gallon	tpy, CO_2e	Source
CO_2	73.96	1	163.05	23	58	40 CFR 98
CH_4	0.003	25	0.165	0.023	0.06	40 CFR 98
N_2O	0.0006	298	0.394	0.054	0.14	40 CFR 98
Total GHG - CO_2e	73.9636		163.613	23	58	

Emissions must be calculated using the emission factors identified above unless new emission factors are provided by the manufacturer or developed through source testing.

6.f. Fire Pump #2 Engine. Potential annual emissions from the combustion of ultra-low sulfur diesel (<0.0015% sulfur by weight) were calculated with the assumption that the equipment will operate at full load for up to 200 hours per year.

Fire Pump #2 Engine						
Hours of Operation =	200	hours				
Power Output =	510	horsepower				
Diesel Density =	7.206	pounds per gallon				
Fuel Sulfur Content =	0.0015	% by weight				
Fuel Consumption Rate =	25.9	gal/hr				
Fuel Heat Content =	0.138	MMBtu/gal (for use with GHG factors from 40 CFR 98)				
	Emission					
	Factor	Emissions	Emissions	Emission Factor		
Pollutant	lb/hp-hr	lb/hr	tpy	Source		
NO_X	0.031	15.81	1.58	AP-42 Table 3.3-1 (10/96)		
CO	0.00668	3.41	0.34	AP-42 Table 3.3-1 (10/96)		
VOC	0.0025141	1.28	0.13	AP-42 Table 3.3-1 (10/96)		
SO_X as SO_2		0.0056	0.0006	Mass Balance		
PM	0.0022	1.12	0.11	AP-42 Table 3.3-1 (10/96)		
PM_{10}	0.0022	1.12	0.11	AP-42 Table 3.3-1 (10/96)		
$PM_{2.5}$	0.0022	1.12	0.11	AP-42 Table 3.3-1 (10/96)		
			CO_2e	CO_2e		Emission Factor
Greenhouse Gases	kg/MMBtu	GWP	lb/MMBtu	lb/gallon	tpy, CO_2e	Source
CO_2	73.96	1	163.05	23	58	40 CFR 98
CH_4	0.003	25	0.165	0.023	0.06	40 CFR 98
N_2O	0.0006	298	0.394	0.054	0.14	40 CFR 98
Total GHG - CO_2e	73.9636		163.613	23	58	

Emissions must be calculated using the emission factors identified above unless new emission factors are provided by the manufacturer or developed through source testing.

6.g. Fire Pump #3 Engine. Potential annual emissions from the combustion of ultra-low sulfur diesel (<0.0015% sulfur by weight) were calculated with the assumption that the equipment will operate at full load for up to 200 hours per year.

Fire Pump #3 Engine						
Hours of Operation =	200	hours				
Power Output =	662	horsepower				
Diesel Density =	7.206	pounds per gallon				
Fuel Sulfur Content =	0.0015	% by weight				
Fuel Consumption Rate =	33.6	gal/hr				
Fuel Heat Content =	0.138	MMBtu/gal (for use with GHG factors from 40 CFR 98)				
Pollutant	Emission Factor lb/hp-hr	Emissions lb/hr	Emissions tpy	Emission Factor Source		
NO_X		21.27	2.13	Manufacturer		
CO		10.14	1.01	Manufacturer		
VOC		0.64	0.06	Manufacturer		
SO_X as SO_2		0.0073	0.0007	Mass Balance		
PM	0.0004879	0.32	0.03	AP-42 Table 3.4-1 (10/96)		
PM_{10}	0.0004011	0.27	0.03	AP-42 Table 3.4-1 (10/96)		
$PM_{2.5}$	0.0003892	0.26	0.03	AP-42 Table 3.4-1 (10/96)		
Greenhouse Gases	kg/MMBtu	GWP	CO_2e lb/MMBtu	CO_2e lb/gallon	tpy, CO_2e	Emission Factor Source
CO_2	73.96	1	163.05	23	76	40 CFR 98
CH_4	0.003	25	0.165	0.023	0.08	40 CFR 98
N_2O	0.0006	298	0.394	0.054	0.18	40 CFR 98
Total GHG - CO_2e	73.9636		163.613	23	76	

Emissions must be calculated using the emission factors identified above unless new emission factors are provided by the manufacturer or developed through source testing.

6.h. Emissions Summary

Air Pollutant	Potential to Emit (tpy)	Project Impact (tpy)
NO_x	30.36	N/A
CO	60.69	N/A
VOC	26.54	+3.67
SO_2	0.15	N/A
PM	2.19	N/A

PM_{10}	2.18	N/A
$PM_{2.5}$	2.18	N/A
TAPs	5.42	N/A
HAPs	4.18	N/A
CO_2/CO_2e	89,000	N/A

7. REGULATIONS AND EMISSION STANDARDS

Regulations have been established for the control of emissions of air pollutants to the ambient air. Regulations applicable to the proposed facility that have been used to evaluate the acceptability of the proposed facility and establish emission limits and control requirements include, but are not limited to, the following regulations, codes, or requirements. These items establish maximum emissions limits that could be allowed and are not to be exceeded for new or existing facilities. More stringent limits are established in this Permit consistent with implementation of Best Available Control Technology (BACT):

7.a. 40 CFR 60.7 "Notification and Recordkeeping" requires that notification must be submitted to SWCAA, the delegated authority, for date construction commenced, anticipated initial startup, and initial startup.

7.b. 40 CFR 60.8 "Performance Tests" requires that emission tests be conducted according to test methods approved in advance by the permitting authority and a copy of the results be submitted to the permitting authority.

7.c. 40 CFR 60 Subpart Dc "Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units" applies to any steam generating unit with a heat input greater than or equal to 10 MMBtu/hr, but less than or equal to 100 MMBtu/hr constructed, modified, or reconstructed after June 9, 1989. This regulation is not applicable to the reformers at this facility because the reformers are both considered "process heaters" which are excluded from the definition of "steam generating unit".

"Steam generating unit means a device that combusts any fuel and produces steam or heats water or heats any heat transfer medium. This term includes any duct burner that combusts fuel and is part of a combined cycle system. This term does not include process heaters as defined in this subpart."

"Process heater means a device that is primarily used to heat a material to initiate or promote a chemical reaction in which the material participates as a reactant or catalyst."

The primary purpose of burning fuel in the reformers is to raise the temperature of the reactants (methane, steam, CO) in the reformer to produce hydrogen, not the production of steam.

7.d. 40 CFR 60 Subpart IIII [§60.4200 *et seq*] "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines" applies to each compression ignition (CI) internal combustion engine (ICE) that commences construction after July 11, 2005 and is manufactured after April 1, 2006, or that is modified or reconstructed after July 11, 2005.

The emergency generator engine and fire pump engines are a CI ICE configuration and were manufactured prior to April 1, 2006; therefore, this regulation is not applicable to the engines.

7.e. 40 CFR 63.7 "Performance testing requirements" requires that emission tests be conducted according to test methods approved in advance by the permitting authority and a copy of the results be submitted to the permitting authority.

7.f. 40 CFR 63 Subpart ZZZZ [§63.6580 *et seq*] "National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines" establishes national emission limitations and operating limitations for HAP emitted from stationary reciprocating internal combustion engines located at major and area sources of HAP emissions. The existing emergency generator engine and fire pump engines are located at an area source of HAP and used in emergency situations; therefore, this regulation applies to the existing engine.

For existing emergency engines at an area source, the owner or operator is required to:

- Change oil and filter every 500 hours of operation or annually, whichever comes first except as allowed by 40 CFR 63.6625(i) [Table 2d(4)(a)];
- Inspect air cleaner every 1,000 hours of operation or annually, whichever comes first [Table 2d(4)(b)];
- Inspect all hoses and belts every 500 hours of operation or annually, whichever comes first, and replace as necessary [Table 2d(4)(c)];
- Install a non-resettable hour meter if one is not already installed. [§ 63.6625(f)]
- Report each instance in which the owner did not meet each operating limitation [§ 63.6640(b)];
- Limit operation of the engine to emergency use and maintenance checks and readiness testing. Operation for maintenance checks and readiness testing may be conducted only to the extent that the tests are recommended by Federal, State or local government, the manufacturer, the vendor, or the insurance company associated with the engine. Operation for maintenance checks and readiness testing is limited to 100 hours per year [§ 63.6640(f)(2)(i)];
- Record the occurrence and duration of each malfunction of operation (i.e., process equipment) [§ 63.6655(a)(2)];
- Record maintenance conducted on the engine in order to demonstrate that the engine was operated and maintained according to the applicable maintenance plan [§ 63.6655(e)]; and
- Record the hours of operation of the engine by use of a non-resettable hour meter. The owner or operator must document how many hours are spent for emergency operation,

including what classified the operation as emergency and how many hours are spent for non-emergency operation [§ 63.6655(f)].

There may be other requirements under the Subpart that apply to the facility that are not specified above. SWCAA has not yet taken delegation of this regulation; therefore, at this time, EPA is the Administrator of this regulation and the facility must communicate directly with EPA regarding compliance demonstrations and/or reporting required by this rule.

For purposes of this Subpart, "diesel fuel" also includes any non-distillate fuel with comparable physical and chemical properties (e.g., biodiesel) that is suitable for use in compression ignition engines per §63.6675.

7.g. 40 CFR 70 "State Operating Permit Programs" requires facilities with site emissions of any regulated air pollutant greater than 100 tpy, any single hazardous air pollutant greater than 10 tpy, or any aggregate combination of hazardous air pollutants greater than 25 tpy to obtain a Title V permit The facility does not emit any criteria pollutants or HAP above any of these thresholds; therefore, this regulation does not apply to the facility.

7.h. RCW 70A.15.2040 empowers any activated air pollution control authority to prepare and develop a comprehensive plan or plans for the prevention, abatement and control of air pollution within its jurisdiction. An air pollution control authority may issue such orders as may be necessary to effectuate the purposes of the Washington Clean Air Act (RCW 70A.15) and enforce the same by all appropriate administrative and judicial proceedings subject to the rights of appeal as provided in Chapter 62, Laws of 1970 ex. sess. This law applies to the facility.

7.i. RCW 70A.15.2210 provides for the inclusion of conditions of operation as are reasonably necessary to assure the maintenance of compliance with the applicable ordinances, resolutions, rules and regulations when issuing an ADP for installation and establishment of an air contaminant source. This law applies to the facility.

7.j. WAC 173-401 "Operating Permit Regulation" requires all major sources and other sources as defined in WAC 173-401-300 to obtain an operating permit. This regulation is not applicable because this source is not a potential major source and does not meet the applicability criteria set forth in WAC 173-401-300. The facility does not emit any criteria pollutants or HAP above major thresholds; therefore, this regulation does not apply to the facility.

7.k. WAC 173-460 "Controls for New Sources of Toxic Air Pollutants" requires BACT for toxic air pollutants (T-BACT), identification and quantification of emissions of toxic air pollutants and demonstration of protection of human health and safety.

The facility emits TAPs; therefore, this regulation applies to the facility.

7.l. WAC 173-476 "Ambient Air Quality Standards" establishes ambient air quality standards for PM_{10}, $PM_{2.5}$, lead, SO_2, NO_x, ozone, and CO in the ambient air, which must not be exceeded. The facility emits PM_{10}, $PM_{2.5}$, SO_x, NO_x, and CO; therefore, certain sections of this regulation apply.

7.m. SWCAA 400-040 "General Standards for Maximum Emissions" requires all new and existing sources and emission units to meet certain performance standards with respect to Reasonably Available Control Technology (RACT), visible emissions, fallout, fugitive emissions, odors, emissions detrimental to persons or property, SO_2, concealment and masking, and fugitive dust. This regulation applies to the facility.

7.n. SWCAA 400-040(1) "Visible Emissions" requires that emissions of an air contaminant from any emissions unit must not exceed twenty percent opacity for more than three minutes in any one hour at the emission point, or within a reasonable distance of the emission point. This regulation applies to the facility.

7.o. SWCAA 400-040(2) "Fallout" requires that emissions of PM from any source must not be deposited beyond the property under direct control of the owner(s) or operator(s) of the source in sufficient quantity to interfere unreasonably with the use and enjoyment of the property upon which the material is deposited. This regulation applies to the facility.

7.p. SWCAA 400-040(3) "Fugitive Emissions" requires that reasonable precautions be taken to prevent the fugitive release of air contaminants to the atmosphere. This regulation applies to the facility.

7.q. SWCAA 400-040(4) "Odors" requires any source which generates odors that may unreasonably interfere with any other property owner's use and enjoyment of their property to use recognized good practice and procedures to reduce these odors to a reasonable minimum. This source must be managed properly to maintain compliance with this regulation. This regulation applies to the facility.

7.r. SWCAA 400-040(6) "Sulfur Dioxide" requires that no person is allowed to emit a gas containing in excess of 1,000 ppmd of SO_2, corrected to 7% O_2 or 12% CO_2 as required by the applicable emission standard for combustion sources.

The facility emits SO_2; therefore, this regulation applies to the facility.

7.s. SWCAA 400-040(8) "Fugitive Dust Sources" requires that reasonable precautions be taken to prevent fugitive dust from becoming airborne, and minimize emissions. This regulation applies to the facility.

7.t. SWCAA 400-060 "Emission Standards for General Process Units" requires that all new and existing general process units do not emit PM in excess of 0.23 g/Nm^3_{dry} (0.1 gr/dscf) of exhaust gas. The facility has general process units; therefore, this regulation applies to the facility.

7.u. SWCAA 400-109 "Air Discharge Permit Applications" requires that an ADP application be submitted for all new installations, modifications, changes, or alterations to process and emission control equipment consistent with the definition of "new source". Sources wishing to modify existing permit terms may submit an ADP application to request such changes. An ADP must be issued, or written confirmation of exempt status must be received, before beginning any actual construction, or implementing any other modification, change, or alteration of existing equipment, processes, or permits. This regulation applies to the facility.

7.v. SWCAA 400-113 "Requirements for New Sources in Attainment or Nonclassifiable Areas" requires that no approval to construct or alter an air contaminant source will be granted unless it is evidenced that:

(1) The equipment or technology is designed and will be installed to operate without causing a violation of the applicable emission standards;
(2) BACT will be employed for all air contaminants to be emitted by the proposed equipment;
(3) The proposed equipment will not cause any ambient air quality standard to be exceeded; and
(4) If the proposed equipment or facility will emit any toxic air pollutant regulated under WAC 173-460, the proposed equipment and control measures will meet all the requirements of that Chapter.

The facility is located in an area that is in attainment for all pollutants (PM, NO_x, CO, SO_2, O_3); therefore, this regulation applies to the facility.

8. BACT/PSD/CAM DETERMINATIONS

The proposed equipment and control systems incorporate BACT for the types and amounts of air contaminants emitted by the processes as described below:

Previous BACT Determinations

8.a. BACT Determination – Reformer 2H07 Combustion Emissions. Low NO_X burners with staged fuel, internal flue gas recirculation and a 10:1 turndown ratio has been determined to meet the requirements of BACT. A remotely adjustable O_2 register system was installed to provide a stable air to fuel ratio, which is especially important with variable tail gas composition due to PSA bed operation. Burning the mixture of natural gas and tail gas may generate higher CO and NO_X emissions than when utilizing the same burners solely with natural gas. For this reason, BACT was established at 40 ppmvd NO_X @ 2% O_2 (1-hour average), and 50 ppmvd CO @ 2% O_2 (1-hour average).

8.b. BACT Determination – Reformer 2H07 PSA Process Vent. PSA syngas venting during startup, shutdown and malfunction is a significant source of carbon monoxide emissions. Based on past experience with this facility, SWCAA learned that an upper bound of 30 tons per year of CO emissions was reasonable for Reformer 1H07 (equivalent to 49.3 hours of operation at full rate). Applying this time period to 2H07 yields up to 13.4 tons per year of CO emissions. The applicant queried their reformer vendor and other Solvay facilities, and SWCAA's reviewed several RACT/BACT/LAER databases to determine if controls are in use for this episodic vent at comparable facilities. No controls were identified for comparable facilities. Reportedly, at least one much larger facility that utilizes a flare for other processes, directs a similar PSA vent to the flare. No dedicated control equipment was identified. An emission limit of 13.4 tons per year CO emissions was established to meet the requirements of BACT.

8.c. BACT Determination – Fugitive Emissions. Implementation of a monthly leak detection and repair requirement meets or exceeds the requirements of BACT for fugitive emissions at this facility.

8.d. BACT Determination – Ammonia and Methanol – Reformer Condensate. SWCAA understands that ammonia and methanol can be generated in the reformers and exhausted from the deaerator vents. Calculated potential maximum emission levels are well below the Small Quantity Emission Rate listed in WAC 173-460 for each of these pollutants, based on measurements of the condensate concentration. Neither SWCAA nor the applicant found any examples of ammonia or methanol emissions from steam methane reactors being controlled or even monitored routinely. SWCAA has concluded that the levels of these pollutants likely to be emitted do not pose a health threat.

8.e. BACT Determination – Diesel Engines. Available control measures for diesel engines include low sulfur fuel and add-on control equipment such as selective catalytic reduction units. Add-on control equipment is not economically or technically feasible because the engine will be operated only for short periods of time for testing, maintenance, and to provide emergency electricity and will not achieve the stable operating temperature required for operation of add-on control equipment.

40 CFR 60 Subpart III requires the use of diesel containing 15 ppmw sulfur or less. In addition, because diesel containing no more than 15 ppmw sulfur is now widely available, the use of diesel meeting this specification is required as implementation of BACT.

8.f. Prevention of Significant Deterioration (PSD) Applicability Determination. This permitting action will not result in a potential increase in emissions equal to or greater than the PSD thresholds. Therefore, PSD review is not applicable to this action.

8.g. Compliance Assurance Monitoring (CAM) Applicability Determination. CAM is not applicable to any emission unit at this facility because it is not a major source and is not required to obtain a Part 70 (Title V) permit.

9. AMBIENT IMPACT ANALYSIS

9.a. Criteria Air Pollutant Review. Emissions of NO_x, CO, PM, VOC (as a precursor to O_3), and SO_2 are emitted at levels where no adverse ambient air quality impact is anticipated. VOC emissions from the caron bed is expected to increase by less than 4 tons per year. At these emission rates, no significant adverse ambient air quality impact is anticipated from that equipment.

9.b. Toxic Air Pollutant Review. Based on the emission calculations in accordance with Section 6 for the emission units and activities described in ADP application CO-1071, none of the estimated emission rates exceed the Small Quantity Emission Rate (SQER) specified in WAC 173-460, therefore, no adverse ambient air quality impact is anticipated.

Conclusions

9.c. Construction and operation of an additional carbon bed, as proposed in ADP application CO-1071, will not cause the ambient air quality requirements of 40 CFR 50 "National Primary and Secondary Ambient Air Quality Standards" to be violated.

9.d. Construction and operation of an additional carbon bed, as proposed in ADP application CO-1071, will not cause the requirements of WAC 173-460 "Controls for New Sources of Toxic Air Pollutants" or WAC 173-476 "Ambient Air Quality Standards" to be violated.

9.e. Construction and operation of an additional carbon bed, as proposed in ADP application CO-1071, will not violate emission standards for sources as established under SWCAA General Regulations Sections 400-040 "General Standards for Maximum Emissions," 400-050 "Emission Standards for Combustion and Incineration Units," and 400-060 "Emission Standards for General Process Units."

10. DISCUSSION OF APPROVAL CONDITIONS

SWCAA has made a determination to issue ADP 23-3581 in response to ADP application CO-1071. ADP 23-3581 contains approval requirements deemed necessary to assure compliance with applicable regulations and emission standards as discussed below.

10.a. Supersession of Previous Permits. ADP 23-3581 supersedes ADP 16-3194 in its entirety. Compliance will be determined under this ADP, not previously superseded ADPs. Existing approval conditions for units not affected by this project have been carried forward unchanged.

10.b. Emission Limits. The TSD for ADP 16-3194 stated that the maximum flow rate through the carbon beds would be 25,597 scfm. As part of this permitting action, Solvay has stated that up to six carbon beds could be in operation at any given time. Each carbon bed has a max flow rate of 6,500 scfm. The maximum total flow rate through the carbon beds is therefore 39,000 scfm. The concentration limit is unchanged; therefore, the annual maximum emission limit has been increased.

10.c. Operational Limits and Requirements. The reformers must be operated with a minimum oxygen concentration to assure compliance with the CO emission limits. Nitrogen oxide emissions from these reformers are not expected to be strongly influenced by small changes in excess oxygen. A minimum level of 2% (dry volume basis) was originally established for Reformer H07, however testing has indicated that this level is not always sufficient to adequately control CO formation. For this reason, and to provide for greater flexibility for both units, the permit requires operating with at least as much excess O_2 as measured during the most recent emissions test that demonstrated compliance with the NO_X and CO emission limits.

Monitoring of the carbon beds is required continuously with a VOC analyzer to assure the beds are operating properly and breakthrough is not experienced. The use of a breakthrough monitor was specified rather than a continuous emissions monitor (CEM) because potential emissions from the carbon beds are not significant enough to justify the more burdensome quality assurance and quality control measures associated with a CEM.

10.d. Monitoring and Recordkeeping Requirements. Sufficient monitoring and recordkeeping were established to document compliance with the annual emission limits and provide for general requirements (e.g., excess emission reporting, annual emission inventory submission). In addition, upset conditions must be recorded for each occurrence. For the purposes of this requirement, an affected upset condition is a failure, breakdown, or malfunction of any piece of process equipment or pollution control equipment that causes, or has the potential to cause, excess emissions. This log can be useful to plant operators and SWCAA staff when evaluating whether equipment is being properly operated and maintained.

A simple leak detection and repair requirement has been established because there is the potential to reduce fugitive emissions by up to several tons per year with minimal effort. As described in Section 6 of this TSD, unlike most facilities, even small equipment leaks at this facility are visually apparent, therefore the leak detection and repair requirement established by the permit is expected to be especially effective without the need for instrumentation.

10.e. Reporting Requirements. ADP 23-3581 establishes general reporting requirements for annual air emissions, upset conditions and excess emissions. Specific reporting requirements are established for carbon be adsorber parameters, fuel consumption, emission monitoring and hydrogen production.

11. START-UP AND SHUTDOWN/ALTERNATIVE OPERATING SCENARIOS/POLLUTION PREVENTION

11.a. Start-up and Shutdown Provisions. Pursuant to SWCAA 400-081 "Start-up and Shutdown", technology-based emission standards and control technology determinations must take into consideration the physical and operational ability of a source to comply with the applicable standards during start-up or shutdown. Where it is determined that a source is not capable of achieving continuous compliance with an emission standard during start-up or shutdown, SWCAA will include appropriate emission limitations, operating parameters, or other criteria to regulate performance of the source during start-up or shutdown.

The reformers vent process gas containing CO during startups, PSA unit shutdowns, and upsets, therefore a separate carbon monoxide emission limit was established for these events. All other equipment is capable of achieving continuous compliance with applicable emission standards and approval conditions; therefore, no other startup or shutdown provisions were included in the ADP.

11.b. Alternate Operating Scenarios. SWCAA conducted a review of alternate operating scenarios applicable to equipment affected by this permitting action. The permittee did not propose or identify any applicable alternate operating scenarios. Therefore, none were included in the approval conditions.

11.c. Pollution Prevention Measures. SWCAA conducted a review of possible pollution prevention measures for the facility. No pollution prevention measures were identified by either the permittee or SWCAA separate or in addition to those measures required under BACT considerations. Therefore, none were included in the approval conditions.

12. EMISSION MONITORING AND TESTING

12.a. Emission Testing Requirements – Reformer 1H07 and Reformer 2H07. Emission testing of the reformer was last completed in October of 2021. Future emissions testing must be completed once every sixty (60) months).

12.b. Emission Monitoring Requirements – Reformer 1H07 and 2H07. Performance monitoring of Reformer 1H07 and Reformer 2H07 was required semi-annually, except that where performance monitoring of most combustion processes is required only for 5 minutes, the testing duration was extended to 60 minutes. The testing period was extended to ensure that several PSA bed cycles are encompassed by the testing. The fuel mixture to the reformer burners changes significantly over the duration of each PSA bed cycle, with a strong impact on CO emissions from Reformer 1H07 and a lesser potential to impact CO emissions from Reformer 2H07 because Reformer 2H07 is equipped with an oxygen analyzer and the ability to remotely control excess air, which will allow operators to more quickly respond to low oxygen levels.

13. FACILITY HISTORY

13.a. Previous Permitting Actions. The following past permitting actions have been taken by SWCAA for this facility:

Permit	Application	Date Issued	Description
16-3194	CO-965	9-7-16	Installation of a second steam reformer, hydrogen peroxide processing equipment, and installation of an additional carbon adsorption unit.

Permit	Application	Date Issued	Description
04-2535	CO-754	5-25-04	Consolidation of all permits, inclusion of startup, shutdown, upset conditions for reformer, and permitting of previously unpermitted engines (emergency generator engine and 3 emergency fire pump engines)
94-1715	CO-528	1-19-95	Title V opt-out (reformer emission limits established)
94-1602	CO-495	5-16-94	Expansion of hydrogen peroxide manufacturing facility to 130 million pounds per year (VOC emission limits established)
92-1450	CO-458	8-8-92	Installation and operation of natural gas reformer (no specific requirements)
90-1239	CO-407	7-13-90	Expansion of hydrogen peroxide manufacturing facility to 110 million pounds per year
88-977 Amended	N/A	3-11-91	Approval to allow Solvay to access hydrocarbon CEMS (prohibited by a condition in 88-977).
88-977	CO-336	3-28-88	Construction and operation of hydrogen peroxide manufacturing facility (45 million pounds per year)
88-905	CO-325	7-6-87	Construction and operation of hydrogen peroxide bulk handling facility

13.b. Compliance History. A search of source records on file at SWCAA did not identify any previous or outstanding compliance issues over the past five (5) years.

14. PUBLIC INVOLVEMENT OPPORTUNITY

14.a. Public Notice for ADP Application CO-1071. Public notice for ADP application CO-1071 was published on the SWCAA website for a minimum of fifteen (15) days beginning on April 26, 2023.

14.b. Public/Applicant Comment for ADP Application CO-1071. SWCAA did not receive specific comments, a comment period request, or any other inquiry from the public or the applicant regarding ADP application CO-1071. Therefore, no public comment period was provided for this permitting action.

14.c. State Environmental Policy Act. This project is exempt from SEPA requirements pursuant to WAC 197-11-800(3) since it only involves repair and/or maintenance of existing structures, equipment or facilities, and will not involve material expansions or changes in use. SWCAA issued a Determination of SEPA Exempt (SWCAA 23-022) concurrent with issuance of ADP 23-3581.