

AIR COMPLIANCE ANALYSIS SUMMARY SHEET

COMPANY/FACILITY: Silfab Solar
LOCATION (COUNTY): Fort Mill (York) **DATE:** 07/22/24
PERMIT NUMBER: 2440-0293 **REVIEWED BY:** GSQ

REQUEST:	<input type="checkbox"/> CONSTRUCTION PERMIT	<input checked="" type="checkbox"/>	STATE PERMIT
	<input type="checkbox"/> OPERATING PERMIT - NEW	<input type="checkbox"/>	CONDITIONAL MAJOR
	<input type="checkbox"/> OPERATING PERMIT - RENEWAL	<input type="checkbox"/>	GENERAL CM
	<input type="checkbox"/> PERMIT - MODIFICATION	<input type="checkbox"/>	TITLE V PERMIT
	<input checked="" type="checkbox"/> AIR COMPLIANCE DEMO	<input type="checkbox"/>	PSD MAJOR
ANALYSIS:	<input type="checkbox"/> AMBIENT AIR QUALITY STANDARDS	<input type="checkbox"/>	PSD INCREMENT
	<input checked="" type="checkbox"/> TOXIC AIR POLLUTANTS	<input checked="" type="checkbox"/>	DE MINIMIS
	<input checked="" type="checkbox"/> EXEMPTION	<input type="checkbox"/>	DEFERRAL
OTHER:	<input type="checkbox"/> EXPEDITED	<input checked="" type="checkbox"/>	COLLOCATED (Y or N)

PROJECT DESCRIPTION: Silfab Solar is proposing to construct a solar panel manufacturing facility. The facility will consist of three panel module assembly lines, two cell manufacturing production lines, and storage tanks. The facility has submitted a compliance demonstration that includes changes to stack parameters and additional buildings associated with the facility. In addition, a construction permit exemption request was submitted to construct four 8.0 MMBtu/hr natural gas-fired boilers.

SUMMARY OF ANALYSIS & RESULTS: S&ME, Inc. submitted a modeling analysis on behalf of the facility. The additional boilers are categorically exempt from modeling requirements since their maximum heat input capacity is less than 10 MMBtu/hr each and burn only virgin fuels.

Standard 2: Emissions from cell manufacturing and the thermal oxidizer are exempt from Standard No. 2 modeling requirements on the basis that emissions are less than 1.14 lb/hr.

Standard 7: Since this is not a PSD project, no Standard 7 analysis is required.

Standard 8: Hydrochloric acid and hydrogen fluoride modeling analyses are revised from the compliance demonstration provided with the original application (see modeling summary dated 6/27/2023). The facility is modeled using AERMOD to demonstrate compliance with applicable Standard No. 8 Maximum Allowable Ambient Concentrations. Storage tank emissions are vented directly to the acid scrubbers (P1ACID and P2ACID, with 96% efficiency) and not directly to the atmosphere.

The modeling analysis involves two separate phases. Emissions from only one operating stack (P1ACID) are modeled with Phase 1, and two possible stacks are modeled with Phase 2. The two stacks (as shown by Phase 2) have identical stack parameters. Only the locations of the stacks and the distribution of emissions between the two stacks are different from each other. As a conservative measure, a worst-case stack scenario analysis was conducted to determine the worst-case concentration by modeling the entire emissions from each individual stack separately. The results revealed that Stack P2ACID is the worst-case stack, meaning that the maximum concentration is derived from modeling the entire quantity of emissions from P2ACID. As a result of this analysis, the permitted emissions from stacks P1ACID and P2ACID will have a lower impact than what was modeled from P2ACID.

The following changes are made in the modeling analyses to accommodate “as built” specifications in order to comply with Condition I.1 of the air construction permit issued on March 1, 2024:

1. The stack height was modified to 50 feet to comply with the county ordinance.
2. The “as built” stack diameter is increased from 1.5 feet to 5.5 feet to accommodate wind velocity design and seismic requirements since the stack is no longer designed to vent from the roof of the main building.
3. The fan speeds are increased significantly above the original design fan speed of 9,706 ACFM. Phase 1 fan speed from scrubber 1 will be 45,000 ACFM. Phase 2 fan speed from the scrubbers are increased to 70,000 ACFM. As a result, the modeled exit velocities are adjusted due to fan speeds and stack diameter revisions.
4. Two buildings will be constructed near the proposed scrubbers and have been included to account for downwash within the model.

This is a complete modeling summary for the facility. Changes from the 6/27/2023 modeling summary are marked in **bold**.

STANDARD NO. 8 - TOXIC AIR POLLUTANTS ANALYSIS: Phase 1					
Pollutant	CAS Number	Basis	Maximum Concentration (µg/m³)⁽¹⁾	Standard (µg/m³)	% Of Standard
Hydrochloric Acid	7647-01-0	AERMOD	12.18	175.00	7
Hydrogen Fluoride	7664-39-3	AERMOD	0.65	2.05	32

1) The highest 24-hour concentrations are rounded to two decimal places to compare to the standards.

STANDARD NO. 8 - TOXIC AIR POLLUTANTS ANALYSIS: Phase 2					
Pollutant	CAS Number	Basis	Maximum Concentration (µg/m³)⁽¹⁾⁽²⁾	Standard (µg/m³)	% Of Standard
Hydrochloric Acid	7647-01-0	AERMOD	17.60	175.00	10
Hydrogen Fluoride	7664-39-3	AERMOD	0.87	2.05	42

1) The highest 24-hour concentrations are rounded to two decimal places to compare to the standards.

2) The modeling analysis uses scenarios to determine the worst-case stack and the resulting worst-case off-property concentration regardless of which stack the permitted emissions are emitted from. The worst-case scenario result, when all emissions are routed through emission point ID P2ACID, is shown in this table. (The maximum concentration is slightly lower than this table shows when emissions are routed through P1ACID or any combination of P1ACID and P2ACID.)

STANDARD NO. 8 - TOXIC AIR POLLUTANTS DE MINIMIS ANALYSIS			
Pollutant	CAS Number	Emission Rate (LB/DAY)⁽¹⁾	De Minimis (LB/DAY)
Toluene	108-88-8	2.616	24.000

1) Emission rates are rounded to three decimal places to compare to the de minimis threshold.

STANDARD NO. 2 AND 7 - EXEMPTED AMBIENT AIR QUALITY STANDARDS EMISSION RATES (LB/HR)						
Emission Point ID	PM₁₀	PM_{2.5}	SO₂	NO_x	CO	Lead
P1ACID/P1ACID2 (CellP1/CellP2) ⁽¹⁾	0.46	0.46	--	--	--	--
P1ACID/P2ACID (DFTO-Combustion)	0.04	0.04	0.004	0.59	0.49	0.000003
FACILITY TOTAL	0.50	0.50	0.004	0.59	0.49	0.000003

1) Facility total process emissions after Phase 2 construction is complete (includes both PECVD and LPCVD processes)

STANDARD NO. 8 - TOXIC AIR POLLUTANTS EMISSION RATES (LB/HR): Phase 1					
Emission Point ID	Equipment ID	Hydrochloric Acid	Hydrogen Fluoride		
		7647-01-0	7664-39-3		
P1ACID	CellP1	0.993	5.30E-02		
	HCl-BST-01 ⁽¹⁾	0.001	--		
	HF-BST-01 ⁽¹⁾	--	2.33E-04		
FACILITY TOTAL		0.994	5.32E-02		

1) HF and HCl storage tank emissions are vented to the acid scrubber (P1ACID with 96% efficiency).

STANDARD NO. 8 - TOXIC AIR POLLUTANTS EMISSION RATES (LB/HR) Phase 2					
Emission Point ID	Equipment ID	Hydrochloric Acid	Hydrogen Fluoride	N/A	N/A
		7647-01-0	7664-39-3		
P1ACID	CellP1	0.993	5.30E-02	--	--
	HCl-BST-01 ⁽¹⁾	0.001	--	--	--
	HF-BST-01 ⁽¹⁾	--	2.33E-04	--	--
P2ACID ⁽²⁾	CellP2	0.746	3.30E-02	--	--
	HCl-BST-02 ⁽¹⁾	0.001	--	--	--
	HF-BST-02 ⁽¹⁾	--	2.33E-04	--	--
FACILITY TOTAL		1.741	8.64E-02	--	--

1) HF and HCl storage tank emissions are vented to the acid scrubbers (P1ACID and P2ACID, with 96% efficiency).

2) For Phase 2, the facility will route all emissions through both P1ACID and P2ACID, consistent with the approved construction permit as written, considering a similar distribution of emissions through each emission point, as shown in this table. The facility provided a conservative modeling analysis by defining the worst-case stack and by demonstrating that any distribution of emissions between the two stacks will comply with Standard No. 8. The results of this analysis demonstrates that any combination from both stacks would comply with SC Standard No. 8. The worst-case stack is P2ACID, which assumes that the total emissions (1.741 lb/hr) vent through the P2ACID stack.

STANDARD NO. 8 - DE MINIMIS TOXIC AIR POLLUTANTS EMISSION RATES (LB/HR)				
Emission Point ID (Equipment ID)	Toluene			
	108-88-3			
General Exhaust Area (MALGCT)	0.109			
FACILITY TOTAL	0.109			

EMISSION POINT DESCRIPTIVE INFORMATION				
Emission Point ID	Source Identification & Description (Equipment ID)	Date Installed (Modified)	Status	Other
BLR1	8.0 MMBtu/hr Phase 1 Boiler (BLR-1)	2024	Exempt Std 2, 7, 8: < 10 MM BTU/HR burning virgin gas fuels	
BLR2	8.0 MMBtu/hr Phase 1 Boiler (BLR-2)	2024	Exempt Std 2, 7, 8: < 10 MM BTU/HR burning virgin gas fuels	
BLR3	8.0 MMBtu/hr Phase 2 Boiler (BLR-3)	2024	Exempt Std 2, 7, 8: < 10 MM BTU/HR burning virgin gas fuels	
BLR4	8.0 MMBtu/hr Phase 2 Boiler (BLR-4)	2024	Exempt Std 2, 7, 8: < 10 MM BTU/HR burning virgin gas fuels	
EG1	300 HP Diesel Emergency Generator (EG1)	2024	Exempt Std 2, 7: Emergency generator operating <500 hr/yr, the application has less than 100 hours per year for routine testing and maintenance Exempt Std 8: Burns only virgin fuel or specification used oil.	
General Area Exhaust	Module Assembly Lab and Gel Content Testing (MALGCT)	2024	VOC and Toluene emissions only	
General Area Exhaust	Module Assembly Lines 1-3 (MAL1)	2024	Exempt: VOC emissions only	
General Area Exhaust	Paste	2024	Exempt: VOC emissions only	
General Area Exhaust	Printing	2024	Exempt: VOC emissions only	
P1ACID	Phase 1 Cell Manufacturing with Phase 1 Acid Scrubber (CellP1)	2024	Exempt Std 2, 7: PM₁₀, PM_{2.5} < 1.14 lb/hr	Control device: Wet Scrubber/ Phase 1 Acid Scrubber SCR1
	20,000-Liter (5,284-gal) Hydrochloric Acid Storage Tank 1 (HCL-BST-01)	2024		Emissions vented through SCR1/ EPID P1ACID
	30,000-Liter (7,926-gal) Hydrofluoric Acid Storage Tank 1 (HF-BST-01)	2024		Emissions vented through SCR1/ EPID P1ACID
P2ACID	Phase 2 Cell Manufacturing with Phase 2 Acid Scrubber (CellP2)	2024	Exempt Std 2, 7: PM₁₀, PM_{2.5} < 1.14 lb/hr	Control device: Wet Scrubber/ Phase 2 Acid Scrubber SCR2
	20,000-Liter (5,284-gal) Hydrochloric Acid Storage Tank 2 (HCL-BST-02)	2024		Emissions vented through SCR2/ EPID P2ACID
	30,000-Liter (7,926-gal) Hydrofluoric Acid Storage Tank 2 (HF-BST-02)	2024		Emissions vented through SCR2/ EPID P2ACID
P1ACID/P2ACID (DFTO-combustion)	Direct Fired Thermal Oxidizer (6.0 MMBTU/hr natural gas burner)	2024	Exempt Std 2, 7: PM₁₀, PM_{2.5}, SO₂, NO₂ < 1.14 lb/hr Exempt Std 2: CO < 10 lb/hr Exempt Std 2: Pb < 0.114 lb/hr (facility-wide) Exempt Std 8: Burns only virgin fuel	

POINT SOURCE PARAMETERS: Phase 1													
Emission Point ID ⁽¹⁾	Date Last Modeled	Location (UTM)		Release Height AGL (ft)	Exit Temp. (°F)	Exit Velocity (ft/sec)	Inside Diameter (ft)	Discharge Orientation	Cap? (Y/N)	Distance To Property Line (ft)	Building Parameters		
		East (m)	North (m)								Height (ft)	Length (ft)	Width (ft)
P1ACID	7/22/24	504946	3880896	50	78	31.6	5.5	Vertical	N	175	See Modeling Files ⁽¹⁾		
NAD83 datum unless otherwise noted.													
1) Two buildings are added to the modeling analysis to address building downwash completely. (7/19/2024)													

POINT SOURCE PARAMETERS: Phase 2													
Emission Point ID ⁽²⁾	Date Last Modeled	Location (UTM)		Release Height AGL (ft)	Exit Temp. (°F)	Exit Velocity (ft/sec)	Inside Diameter (ft)	Discharge Orientation	Cap? (Y/N)	Distance To Property Line (ft)	Building Parameters		
		East (m)	North (m)								Height (ft)	Length (ft)	Width (ft)
P1ACID	7/22/24	504946	3880896	50	78	49.1	5.5	Vertical	N	175	See Modeling Files ⁽¹⁾		
P2ACID (worst-case stack)	7/22/24	504955	3880901	50	78	49.1	5.5	Vertical	N	175			
NAD83 datum unless otherwise noted.													
1) Two buildings are added to the modeling analysis to address building downwash completely. (7/19/2024)													
2) In Phase 2, all emissions will be routed through both emission points (P1ACID and P2ACID) as permitted. Both stacks are identical by design, and their locations are about 10 meters from each other. The scenario modeling results identify that the worst-case stack is P2ACID.													

AERMOD / AERMAP SPECIFICATIONS TABLE												
MET DATA	UZA-GSO 2015-2019 [Surface = Rock Hill, SC (669 ft MSL); Upper Air = Greensboro, NC]											
	ADJ_U*	<input checked="" type="checkbox"/>	(Y/N)									
NED TERRAIN FILES	York, SC											
PROJECTION DATUM	NAD27	<input type="checkbox"/>		NAD83	<input checked="" type="checkbox"/>		WGS-84	<input type="checkbox"/>		NWS-84	<input type="checkbox"/>	
RURAL or URBAN?	Rural	<input checked="" type="checkbox"/>		Urban	<input type="checkbox"/>							
ELEVATIONS EXTRACTED	Buildings	<input checked="" type="checkbox"/>		Sources	<input checked="" type="checkbox"/>		Tanks	<input type="checkbox"/>		Receptors	<input checked="" type="checkbox"/>	

HISTORY			
Date	By	Reason	Description
7/22/2024	GSQ	Compliance Demo	Modeling revisions for HF and HCL using AERMOD for "as built" specifications in order to comply with Condition I.1 of the air construction permit. Criteria emissions and the newly added boilers are exempt from modeling.
6/27/2023	GSQ	Expedited CP	Modeled for HF and HCL using AERMOD. Criteria emissions are exempt.