TECHNICAL SUPPORT DOCUMENT

Air Discharge Permit 23-3562
Air Discharge Permit Application CL-3185

Issued: January 26, 2022

VTC Sunlight

SWCAA ID – 2539

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Southwest Clean Air Agency

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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
BART ..... Best Available Retrofit Technology
CAM ..... Compliance Assurance Monitoring
CFR..... Code of Federal Regulations
EPA..... U.S. Environmental Protection Agency
GWP..... Global Warming Potential
LAER..... Lowest achievable emission rate
MACT..... Maximum Achievable Control Technologies
Mwt..... Molecular weight
NESHAP..... National Emission Standards for Hazardous Air Pollutants
NSPS..... New Source Performance Standard
PSD..... Prevention of Significant Deterioration
RACT..... Reasonably Available Control Technology
RCW ..... Revised Code of Washington
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

µg/m³..... Micrograms per cubic meter
µm..... Micrometer (10^{-6} meter)
cfm ..... Cubic foot per minute
dscfm..... Dry Standard cubic foot per minute
g/kW-hr..... Grams per kilowatt hour
gpm ..... Gallon per minute
g/s..... Grams per second
kg/MMBtu ... Kilograms per million British thermal units
lb/hr.....Pounds per hour
lb/yr.....Pounds per year
lb/MMBtu .....Pounds per million British thermal units
lbs .....Pounds
MMBtu .....Million British thermal unit
ppm .....Parts per million
ppmv .....Parts per million by volume
ppmvd.....Parts per million by volume, dry
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
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
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:	VTC Sunlight
Applicant Address:	18110 SE 34th Street, Building 4, Suite 410, Vancouver, WA 98683
Facility Name:	VTC Sunlight
Facility Address:	18110 SE 34th Street, Building 4, Suite 410, Vancouver, WA 98683
SWCAA Identification:	2539
Contact Person:	Kalin Puent
Primary Process:	Research and Development – Semiconductor Wafers
SIC/NAICS Code:	3674: Semiconductor and related devices 334413: Semiconductor and related device manufacturing
Facility Classification:	Natural Minor

2. FACILITY DESCRIPTION

VTC Sunlight is a semiconductor research and development facility.

3. CURRENT PERMITTING ACTION

This permitting action is in response to Air Discharge Permit (ADP) application number CL-3185 received March 18, 2022. VTC Sunlight submitted ADP application CL-3185 requesting the following:

- Approval of Reactor R1 and the associated ammonia scrubber

ADP 23-3562 will supersede ADP 18-3315 in its entirety.

4. PROCESS DESCRIPTION

Raw materials are cleaned with solvents and acids in workbenches. Solvent and acid emission are possible from this step. Raw materials are processed into crystals (boules) in process vessels in fully enclosed furnaces. A small amount of welding is associated with equipment preparation activities. Ammonia and hydrofluoric acid emissions are possible from the furnaces along with small amounts of welding fume from setup activities. The harvested boules (crystals grown from the raw materials) and process vessels are cleaned with acid to remove byproducts. Acid emissions are possible from this activity.

The resulting boules are processed into wafers and the wafers machined, polished, and cleaned. During the wafer processing steps the wafers are mounted and demounted with a wax that is removed by soaking in acetone. Acid and acetone emissions are possible from these activities. Cutting, machining, and polishing utilizes a wet slurry therefore, particulate matter emissions are expected to be negligible. A slightly basic cleaning solution may be used but since there is no aerosolization of this solution, emissions are expected to be negligible.

Operating at full capacity, the facility could produce up to 500 wafers per month.

In ADP Application CL-3185 the applicant proposed a new reactor process (R1) with gaseous inputs of chlorine and ammonia. Chlorine is consumed in the process, but ammonia is sent to a wet scrubber prior to discharge to ambient air.

A diesel-fired emergency generator set has been installed to provide power to the facility if utility power is lost.

5. EQUIPMENT/ACTIVITY IDENTIFICATION

5.a. Semiconductor Wafer Manufacturing. The entire work area is fully contained with the building envelope and exhausted through a single Greenheck model VEKTOR-MS-24-4-85 fume exhaust system. The system is designed to provide 10,000 – 20,000 cfm exhaust capability with three fans, each exhausting above the building roof through a separate stack. Each stack has a rectangular exhaust measuring approximately 29″ x 35″ and discharging approximately 159″ above the building roof. Location: ~45°36′0.04″N, ~122°29′13.97″W

Boule Preparation and Maintenance. Raw materials are cleaned with solvents and acids in workbenches. Solvent and acid emission are possible from this step. Raw materials are be processed into crystals (boules) in process vessels in up to four fully enclosed furnaces. A small amount of welding is associated with equipment preparation activities. Ammonia and hydrofluoric acid emissions are possible from the furnaces along with small amounts of welding fume from setup activities. The harvested boules (crystals grown from the raw

materials) and process vessels are cleaned with acid to remove byproducts. Acid emissions are possible from this activity.

Chemicals that may be used or produced during boule preparation and maintenance include:

Ammonia (NH_3)
Hydrofluoric Acid (HF)
Ammonium Fluoride (NH_4F)

Inorganic Workstations. Equipment in this category includes all acid and base workstations, cutting, polishing, and lapping equipment. All cutting, machining, and polishing utilizes a wet slurry therefore uncontrolled particulate matter emissions are expected to be negligible. The only equipment with potential for significant emissions is the acid workstations from which acids mists or vapor may be emitted. Chemicals that may be used include:

Ammonium Hydroxide (NH_4OH)
Bromothane-S (n-propyl bromide, $CH_3CH_2CH_2Br$)
Formic Acid (HCOOH)
Hydrochloric Acid (HCl)
Hydrofluoric Acid (HF)
Hydrogen Peroxide (H_2O_2)
Nitric Acid (HNO_3)
N-Methyl-2-Pyrrolidone (C_5H_9NO)
Phosphoric Acid (H_3PO_4)
Sodium Hydroxide (NaOH)
Sulfuric Acid (H_2SO_4)
Potassium Hydroxide (KOH)

All workstations have covers that will be in place when not in use to minimize evaporation potential.

Evaporation of Organic Chemicals. Evaporative emissions result from the use of solvents for cleaning activities and the use of ethanol as a heat transfer fluid. Most solvent are used in dedicated solvent benches. All solvent workstations have covers that will be in place when not in use to minimize evaporation potential. One Ultronix model HE541915 ultrasonic liquid vapor water cooled spray degreaser is used to clean parts and equipment. The degreaser utilizes a "Zer-o-coil" system to provide cooling at the vapor air interface and minimize solvent evaporation. Solvents that may be used include:

Acetone (C_3H_6O)
Ethanol (C_2H_5OH)
Isopropyl Alcohol (IPA, C_3H_7OH)
Tergo Flux Remover HP - mixture of the following used in an Ultronix Degreaser:
Trans-dichloroethylene ($C_2H_2Cl_2$)

1,1,1,2,2,3,4,5,5,5,-decafluoropentane ($C_5H_2F_{10}$)
1,1,1,3,3-Pentafluorobutane ($C_4H_5F_5$)
Methanol (CH_3OH)

5.b. Emergency Generator Engine. One emergency generator engine has been installed to drive a 275 kW (standby) generator set that will provide power to the facility if utility power is lost.

Equipment details are provided below:

Generator Set Make / Model:	Detroit Diesel – MTU Power Generation / 275DSEB
Generator Output:	275 kW (standby)
Generator Set Serial Number:	2069937
Engine Make / Model:	Detroit Diesel / S60, 4-Cycle
Engine Serial Number:	To be determined
Fuel:	Diesel, 20.3 gallons per hour at full standby load
Engine Power:	455 bhp
Engine Built:	To be determined – genset has 11/05 date
Engine Certification:	EPA Tier 2
Stack Description:	Exhausting vertically ~139" above ground level, 2,350 cfm @ 800°F. Exhaust diameter not known. ~ 45°36'1.33"N, 122°29'14.61"
NSPS/NESHAP/MACT:	40 CFR 63 Subpart ZZZZ applicable

5.c. Reactor 1 (R1) *(new)*. Reactor 1 is a small research and development batch reactor that uses both ammonia and chlorine gas. Ammonia is always used in great excess to prevent the possibility of chlorine gas exiting the reactor. Potential ammonia gas emissions are controlled by a wet scrubber. The reactor effluent passes through a filter system, through one of two wet eductors (providing the first level of scrubbing), then vertically through a packed column measuring approximately 3′ tall and 4″ in diameter. Sodium bisulfate ($NaHSO_4$) is added to the scrubber water as necessary to maintain a discharge pH of less than 10.5. An acidic scrubber solution (e.g., sulfuric acid) would likely provide a better level of ammonia control, especially if the scrubber is initially charged only with water, however by maintaining a relatively high pH, chlorine gas could also be scrubbed in the event of a process upset.

The following additional scrubber details were available:

Gas Flow:	~1 cfm non-condensable gas
Scrubber Recirculation Rate:	~ 1 gallon per minute
Maximum Scrubber pH:	10.5
Overflow (blowdown):	5 – 20 gallons per hour
Sump Capacity:	10 gallons (filled to ~65 gallons normally)

5.d. Insignificant Emission Units:

Cooling Tower. One EVAPCO cooling tower with 650 gallons per minute recirculation rate utilizing deionized water.

5.e. Equipment/Activity Summary.

ID No.	Equipment/Activity	Control Equipment/Measure
1	Semiconductor Wafer Manufacturing	Inorganic workstations and solvent baths covered when not in use
2	Emergency Generator Diesel Engine (455 hp Detroit Diesel)	Ultra Low Sulfur Diesel (≤ 0.0015% S) Limited operation - (≤ 100 hr/yr + emergency usage)
3	Reactor R1	Wet Scrubber

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. Boule Preparation and Maintenance. Ammonia is the only pollutant expected in significant quantities from this activity. Based on the maximum boule production rate it is expected that up to 3,500 pounds of ammonia could be vented per year. Annual emissions must be calculated using a material balance approach with the assumption that all unreacted ammonia used is emitted to the ambient air. This is a conservative assumption because unreacted ammonia is bubbled into tanks of water prior to discharge, collecting an unquantified amount of the ammonia.

6.b. Inorganic Workstations. Based on a review of the potential equipment and acids in use, potential emissions will be well below the "Small Quantity Emission Rate" listed in WAC 173-460. SWCAA estimated emissions from the acid workstations based on the following equation: $Q = 5.10x10^{-6} * U^{0.78} * Pv * Mw^{0.67} * Ap^{0.94}$ where Q is the emission rate in grams per second, U is the air speed in meters per second, Pv is the vapor pressure in Pascal, Mw is the molecular weight and Ap is the surface area in square meters. An initial estimate was made with the assumptions that the surface area of each bath could be up to 0.16 square meters (16″ square), the baths will be at room temperature, exhaust will be maintained at 100 feet per minute, and the baths will be uncovered a maximum of 5 minutes per day. Actual bath concentrations, dimensions, temperature, and usage will need to be determined for the annual emissions inventory.

Inorganic Workstations				
Haz Mat Release Equation:				
$Q=5.10x10^{-6} \times U^{0.78} \times Pv \times Mw^{0.67} \times Ap^{0.94}$				
		Pv	Q	
	Bath Wt	Vap Press	E Rate	Emissions
Pollutant	%	(Pa)	(g/s)	(lb/yr)
Formic acid	100	5,411	3.9E-02	9.4
Hydrochloric acid	37	36,930	2.3E-01	54.6
Hydrofluoric acid	50	2,000	8.2E-03	2.0
Nitric acid	69	548	4.8E-03	1.2
Phosphoric acid	85	285	3.4E-03	0.8
Sulfuric acid	96	0.0121	1.4E-07	3.5E-05

6.c. Evaporation of Organic Chemicals. Emissions of solvents and ethanol must be estimated from a material balance with the assumption that all solvent purchased but not accounted for in waste streams evaporated to the ambient air. If the composition of a mixed waste solvent waste stream is not known, the permittee may assume that the solvent ratios in the waste are the same as the purchased solvent ratios unless otherwise directed by SWCAA.

Potential annual emissions are assumed to be significantly less than 1.00 tons per year VOC, 4.00 tons per year TAP, and 0.50 tons per year HAP. Because this is a research and development facility with no operating history a more detailed estimate is not possible. Based on the fact that methanol (a HAP) may be used at the facility and is relatively volatile, SWCAA assumed that up to half of the VOC content could be a HAP such as methanol.

Tergo Flux Remover is used in the spray degreaser. This product is a mixture of four solvents, two of which are VOCs, and two of which are not VOCs but have a significant global warming potential. The permittee estimated perhaps 1 gallon of solution would be used per month so SWCAA estimated potential emissions based on an annual usage of 20 gallons.

	Total Used (gallons)	Specific Gravity	Total Used (lbs)			
Tergo Flux Remover	20	1.304	218			
				Global		
		Median		Warming	CO_2e	VOC
Component	CAS #	Concentration	VOC?	Potential	(tons)	(tons)
Trans-dichloroethylene	156-60-5	45%	Yes	0	0.00	0.049
1,1,1,2,2,3,4,5,5,5,-decafluoropentane	138495-42-8	45%	No	1,640	80.26	
1,1,1,3,3-Pentafluorobutane	406-58-6	20%	No	794	17.27	
Methanol	67-56-1	3%	Yes	0	0.00	0.003
				Totals =	97.53	0.052

6.d. Emergency Generator Diesel 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 Diesel Engine						
Hours of Operation =		200	hours			
Power Output =		455	horsepower			
Diesel Density =		7.206	pounds per gallon			
Fuel Sulfur Content =		0.0015	% by weight			
Fuel Consumption Rate =		20.3	gallons per hour (from Detroit Diesel)			
Fuel Heat Content =		0.138	MMBtu/gal (for use with GHG factors from 40 CFR 98)			
	Emissions	Emissions	Emissions	Emission Factor		
Pollutant	g/kW-hr	lb/hr	tpy	Source		
NO_X	6.5	4.86	0.49	EPA Tier 2 Limit		
CO	3.5	2.62	0.26	EPA Tier 2 Limit		
VOC	1.53	1.14	0.11	AP-42 Table 3.3-1 (10/96)		
SO_X as SO_2		0.0044	0.00044	Mass Balance		
PM	0.2	0.15	0.015	EPA Tier 2 Limit		
PM_{10}	0.2	0.15	0.015	EPA Tier 2 Limit		
$PM_{2.5}$	0.2	0.15	0.015	EPA Tier 2 Limit		
			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	46	40 CFR 98
CH_4	0.003	25	0.17	0.023	0.046	40 CFR 98
N_2O	0.0006	298	0.39	0.054	0.11	40 CFR 98
Total GHG - CO_2e	73.9636		163.61	23	46	

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. Reactor R1. The two potential gaseous pollutants from Reactor R1 are chlorine and ammonia. The potential to emit chlorine is extremely limited due to its reaction with ammonia unless there is a process upset that interrupts ammonia flow. For this reason, the permit will contain provisions requiring immediate shutdown of the reactor in the event of a process upset. The wet scrubber is installed to control emissions of ammonia. Potential Cl_2 and NH_3 emissions were limited to a level approximately equivalent to a 99.99% and

99.8% reduction respectively, and emission rates well below the respective Small Quantity Emission Rates (SQERs) listed in WAC 173-460.

Reactor R1					
Ideal gas law constant =			0.08206	(L*atm)/(mol°K)	
Exhaust Flow =			26	standard liters per minute	
		Exhaust	Exhaust	Exhaust	Exhaust
Pollutant	Mwt	ppm	lb/hr	lb/24-hr	lb/yr
Chlorine	70.9	10	1.0E-04	2.4E-03	0.89
Ammonia	17.031	2,000	4.9E-03	1.2E-01	42.66

Emissions must be calculated using the hourly emission rates shown above unless new emission factors are available through source testing.

6.f. Emissions Summary

Air Pollutant	Potential to Emit (tpy)	Project Impact (tpy)
NO_X	0.49	0
CO	0.26	0
VOC	1.17	0
SO_2	0.0004	0
Lead	0	0
PM	0.015	0
PM_{10}	0.015	0
$PM_{2.5}$	0.015	0
TAP	5.77	0.022
HAP	0.50	0.00044
CO_2/CO_2e	46 / 143	0 / 0
NH_3	1.77	0.02
H_2S	0	0
O_3	0	0

Toxic/Hazardous Air Pollutant	Potential to Emit (tpy)	Project Impact (tpy)
Acetone [67-64-1]	3.00	3.00
Ammonia [7664-41-7]	1.77	0.022
Chlorine [7782-50-5]	0.00044	0.00044
Isopropanol [67-63-0]	0.50	0
Methanol [67-56-1]	0.50	0

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 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 is not an affected source because it was manufactured before the relevant applicability date (April 1, 2006).

7.b. 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 Emergency Generator Engine is 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.c. Revised Code of Washington (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.d. 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.e. 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.f. 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. The facility does not emit lead; therefore, the lead regulation section does not apply.

7.g. 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.h. 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.i. 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.j. 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.k. SWCAA 400-040(5) "Emissions Detrimental to Persons or Property" prohibits the emission of any air contaminant from any "source" if it is detrimental to the health, safety, or welfare of any person, or causes damage to property or business.

7.l. 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.m. SWCAA 400-110 "New Source Review" requires that SWCAA issue an ADP in response to an ADP application prior to establishment of the new source, emission unit, or modification. The new units meet the definition of a new source; therefore, this regulation applies to the facility.

7.n. SWCAA 400-111 "Requirements for Sources in a Maintenance Plan Area" 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) Emissions will be minimized to the extent that the new source will not exceed emission levels or other requirements provided in the maintenance plan;
(3) BACT will be employed for all air contaminants to be emitted by the proposed equipment;
(4) The proposed equipment will not cause any ambient air quality standard to be exceeded; and

(5) 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 a maintenance plan area; therefore, this regulation applies to the facility.

8. RACT/BACT/BART/LAER/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:

New BACT Determination(s)

8.a. BACT Determination – Reactor R1. The proposed wet scrubbing system and process monitoring will provide a high level of control for Cl_2 and NH_3 emissions. Potential Cl_2 and NH_3 emissions were limited to a level approximately equivalent to a 99.99% and 99.8% reduction respectively, resulting in emission rates below the respective SQERs for each pollutant. This level of control meets the requirements of BACT.

Previous BACT Determination(s)

8.b. BACT Determination – Ammonia Emissions (ADP 18-3315). Ammonia emissions originate from enclosed vessels vented at a total of 2,000 cfm. The emission limit of 3,500 pounds per year accounts for the maximum production possible and is further constrained by the requirement that the facility only be used for research and development. If this maximum level of activity is reached, it will likely be for a very limited period of time before commercial operations would be commenced. Ammonia is probably most commonly controlled with the use of an acidic scrubber (e.g. using dilute sulfuric or hydrochloric acid). Considering the limited nature of the activity (research and development only) SWCAA believes that installation of ammonia emission controls (such as an acidic scrubber) would not be warranted unless ammonia emission result in adverse impacts (e.g., odor). Wet scrubbing too expensive to be required as BACT unless otherwise justified by direct impact (e.g., odor) in the local area.

8.c. BACT Determination – Acid Emissions (ADP 18-3315). Acid emissions can be effectively controlled with a wet scrubber. Based on the limited potential to emit acid gases due to the nature of the facility (research and development only) SWCAA believes that installation of a wet scrubber is not warranted.

8.d. BACT Determination – Emergency Generator Engine (ADP 18-3315). Available control measures for new diesel engines include engine design, the use of ultra-low sulfur fuel and add-on control equipment such as selective catalytic reduction (SCR) units and oxidation catalysts. SWCAA believes that SCR is not feasible for this unit based on a combination of cost and practicality (most operation will be short-term and intermittent). SWCAA has found that an oxidation catalyst is not a cost-effective control for CO, VOC, and PM for relatively small emergency engines.

The use of modern diesel-fired engine design meeting the relevant EPA emission standard for the new engine as applicable, the use of ultra-low sulfur diesel fuel (≤ 0.0015% sulfur by weight), limitation of visible emissions to 5% opacity or less, and limitation of engine operation has been determined to meet the requirements of BACT for the types and quantities of air contaminants emitted. The use of ultra-low sulfur fuel is also required by 40 CFR 60 Subpart IIII for "new" engines.

8.e. 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.f. 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, NH_3 (as a precursor to PM), VOC (as a precursor to O_3), and SO_2 are emitted at levels where no adverse ambient air quality impact is anticipated.

9.b. Toxic Air Pollutant Review.
Incremental increases in toxic air pollutant emissions will not exceed the applicable Small Quantity Emission Rates (SQER) listed in WAC 173-460; therefore, toxic impacts are presumed to be below regulatory significance.

Conclusions

9.c. The semiconductor research and development activities proposed in ADP application CL-3185 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. The semiconductor research and development activities proposed in ADP application CL-3185 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. The semiconductor research and development activities proposed in ADP application CL-3185 will not cause a violation of 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 23-3562 in response to ADP application CL-3185. ADP 23-3562 contains approval requirements deemed necessary to assure compliance with applicable regulations and emission standards as discussed below.

10.a. Supersession of Previous Permits. ADP 23-3562 supersedes ADP 18-3315 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 except that the facility-wide VOC limit was adjusted to include emissions from the spray degreaser and the emergency generator engine.

10.b. Emission Limits. Emission limits from research and development activities were established at levels that are protective of public health and the environment (i.e., below the SQER for each TAP) at levels that are not expected to constrain activities. The ammonia concentration emission limit for Reactor R1 was set at a level somewhat higher than tested emissions, and at a level that meets the requirements of BACT.

10.c. Operational Limits and Requirements. Consistent with good air pollution control practice, whenever possible the permittee must maintain covers on all containers of chemicals that may evaporate. During boule production the canisters could release hydrogen fluoride emissions if opened before cooling, so a requirement was included to cool the canisters to a maximum temperature before opening.

Monitoring of operating parameters (e.g., scrubber flow, pH, blowdown rate) were not required for the Reactor R1 scrubber because even uncontrolled ammonia emissions are below the small quantity emission rate and a significant deviation is unlikely.

10.d. Monitoring and Recordkeeping Requirements. Sufficient monitoring and recordkeeping was established to document compliance with the annual emission limits and provide for general requirements (e.g. excess emission reporting, annual emission inventory submission).

10.e. Emission Monitoring and Testing Requirements. See Section 12.

10.e. Reporting Requirements. The permit requires reporting of the annual air emissions inventory, and reporting of the data necessary to develop the inventory. Excess emissions must be reported immediately in order to qualify for relief from monetary penalty in accordance with SWCAA 400-107. In addition, prompt reporting was required because it allows for accurate investigation into the cause of the event and prevention of similar future incidents.

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.

To SWCAA's knowledge, this facility can comply with all applicable standards during startup and shutdown.

Emergency Generator. The emergency generator engine may exhibit excess opacity upon startup. Accordingly, the opacity limit for the engine is not applicable during the startup period defined in the permit.

11.b. Alternate Operating Scenarios. SWCAA conducted a review of alternate operating scenarios applicable to equipment affected by this permitting action. Neither SWCAA nor the permittee identified or proposed 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

With the exception of ammonia from Reactor R1, potential emissions are too small to warrant initial or periodic testing in the permit. However, SWCAA expects to require some emission measurements to better understanding the short-term emission rates from batch process (e.g., canister opening). The permit requires annual sampling of the ammonia concentration in the exhaust of Reactor R1 to confirm the scrubber is operating properly. More comprehensive testing and monitoring was not required because even uncontrolled ammonia emissions are below the small quantity emission rate and do not present a threat to health or safety. Similarly, the potential for significant Cl_2 and HCl emissions was too small to warrant periodic sampling for these chemicals.

13. FACILITY HISTORY

13.a. General History. This facility began operation with limited activities beginning in 2019.

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

Permit	Application	Date Issued	Description
18-3315	CL-3062	12/13/2018	Approval to operate a semiconductor research and development facility.

13.c. Compliance History. A search of source records on file at SWCAA did not identify any previous or outstanding compliance issues

14. PUBLIC INVOLVEMENT OPPORTUNITY

14.a. Public Notice for ADP Application CL-3185. Public notice for ADP application CL-3185 was published on the SWCAA website for a minimum of fifteen (15) days beginning on March 22, 2022.

14.b. Public/Applicant Comment for ADP Application CL-3185. SWCAA did not receive specific comments, a comment period request, or any other inquiry from the public or the applicant regarding ADP application CL-3185. Therefore, no public comment period was provided for this permitting action.

14.c. State Environmental Policy Act. After review of the SEPA Checklist for this project, SWCAA has determined that the project does not have a probable significant impact on the environment and has issued Determination of Non-Significance 23-004. An Environmental Impact Statement is not required under RCW 43.21C.030(2)(c).