



Connecticut Department of

**ENERGY &
ENVIRONMENTAL
PROTECTION**

**BUREAU OF AIR MANAGEMENT
NEW SOURCE REVIEW PERMIT
TO CONSTRUCT AND OPERATE A STATIONARY SOURCE**

Issued pursuant to Title 22a of the Connecticut General Statutes (CGS) and Section 22a-174-3a of the Regulations of Connecticut State Agencies (RCSA).

Owner/Operator	Sikorsky Aircraft Corporation
Address	6900 Main Street, Stratford, CT 06615
Equipment Location	6900 Main Street, Stratford, CT 06615
Equipment Description	Cogeneration Facility Consisting of a 10 Megawatt SOLAR Mars 100 Axial Gas Turbine, Cleaver Brooks Energy Recovery/Natcom Duct Burner and Cleaver Brooks Energy Recovery Heat Recovery Steam Generator
Town-Permit Numbers	178-0129
Premises Number	0005
Stack Number	49
Collateral Conditions	PART VIII – Premises Wide Cap for NOx
Minor Modification Issue Date	January 26, 2021
Prior Permit Issue Date(s)	March 3, 2009 August 19, 2011 November 20, 2012 January 11, 2014 October 5, 2018
Expiration Date	None

for Betsey C. Wingfield
Deputy Commissioner

January 26, 2021
Date

This permit specifies necessary terms and conditions for the operation of this equipment to comply with state and federal air quality standards. The Permittee shall at all times comply with the terms and conditions stated herein.

PART I. DESIGN SPECIFICATIONS

A. General Description

Sikorsky Aircraft Corporation operates a 10 MW combined heat and power (CHP) generation facility at its Stratford premises. The CHP consists of a SOLAR Mars 100 axial dry low NO_x, or lean premix, gas turbine with a natural gas fired 34.6 MMBTU/hr duct burner and a heat recovery steam generator (HRSG). The duct burner is not capable of being operated alone.

B. Equipment Design Specifications

1. Turbine
 - a. Maximum Fuel Firing Rates¹:
Natural Gas: 121,882 ft³/hr
ULSD: 810.1 gal/hr
 - b. Maximum Gross Heat Input¹:
Natural Gas: 124.3 MMBtu/hr
ULSD: 113.4 MMBtu/hr
2. Duct Burner
 - a. Maximum Fuel Firing Rate¹: 33,925 ft³/hr (Natural Gas)
 - b. Maximum Gross Heat Input¹: 34.65 MMBtu/hr

¹ at ISO conditions: 59°F, 14.7 psia and 60 percent relative humidity.

C. Control Equipment Design Specifications

1. Selective Catalytic Reduction (SCR)
 - a. Make and Model: Umicore SCR DeNO_x catalyst DNX®-series DNX GT-201
(Installed Nov. 27-30, 2020)
 - b. Catalyst Type: TiO₂ / V₂O₅ / WO₃
2. Oxidation Catalyst
 - a. Make and Model: Emerachem or equivalent
 - b. Catalyst Type: Stainless steel monolith with alumina/platinum catalytic coating or equivalent
3. Low NO_x Burner Turbine: SoLoNO_x dry low NO_x Combustor

D. Stack Parameters

1. Minimum Stack Height: 100 ft
2. Minimum Stack Diameter: 5.5 ft

3. Minimum Exhaust Gas Flow Rate at 100% Load: 104,100 acfm
4. Minimum Stack Exit Temperature at 100% Load: 300 °F
5. Minimum Distance from Stack to Property Line: 478 ft

PART II. OPERATIONAL CONDITIONS

A. Equipment

1. Turbine
 - a. Fuel Types: Natural Gas, No. 2 Oil (ULSD)
 - b. Maximum Fuel Consumption over any Consecutive 12 Month Period:
Natural Gas: 1,068 MMft³
ULSD: 810,110 gallons
 - c. Maximum Oil Sulfur Content (% by weight, dry basis): 0.0015
 - d. Maximum Natural Gas Sulfur Content: 20.0 grains/100scf
2. Duct Burner
 - a. Fuel Type: Natural Gas
 - b. Maximum Fuel Consumption over any Consecutive 12 Month Period: 298 MMft³
 - c. Maximum Natural Gas Sulfur Content: 20.0 grains/100scf

PART III. MONITORING, RECORD KEEPING AND REPORTING REQUIREMENTS

A. Monitoring

1. The Permittee shall use an individual non-resettable totalizing fuel metering device or a billing meter to continuously monitor the natural gas and ULSD feeds to the turbine and the natural gas feed to the duct burner.
2. The Permittee shall continuously monitor and continuously record the SCR aqueous ammonia injection rate (lb/hr), operating temperature (°F) and pressure drop (inches of water) across the catalyst bed. The Permittee shall maintain these parameters within the ranges recommended by the manufacturer to achieve compliance with the emission limits in this permit.
3. The Permittee shall continuously monitor and continuously record the oxidation catalyst inlet temperature (°F). The Permittee shall maintain this parameter within the range recommended by the manufacturer to achieve compliance with the emission limits in this permit.
4. The Permittee shall inspect the SCR and oxidation catalysts once per year, at a minimum, or more frequently if recommended by manufacturer.

B. Record Keeping

1. The Permittee shall keep records of monthly and consecutive 12 month fuel consumption. The consecutive 12 month fuel consumption shall be determined by adding (for each fuel) the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.
2. The Permittee shall keep records of the following to show compliance with the sulfur of fuel oil content in this permit:
 - a. The fuel certification for each delivery of fuel oil from a bulk petroleum provider; or
 - b. The sulfur content shall be analyzed in accordance with American Society for Testing and Material (ASTM) test method D4294-10, *Standard Test Method for Sulfur in Petroleum and Petroleum Products by Energy Dispersive X-ray Fluorescence Spectrometry*, or D7039-07, *Standard Test Method for Sulfur in Gasoline and Diesel Fuel by Monochromatic Wavelength Dispersive X-ray Fluorescence Spectrometry*, or the current active version thereof, and automatic sampling equipment shall conform to ASTM test method D4177-95(2010), *Standard Practice for Automatic Sampling of Petroleum and Petroleum Products*, or the current active version thereof.
[RCSA §22a-174-19b(f)(3)]
3. The Permittee shall keep records of a current valid purchase contract, tariff sheet, or transportation contract which demonstrates the maximum total sulfur content of the natural gas burned in the combustion turbine.
4. The Permittee shall calculate and record the monthly and consecutive 12 month PM_{2.5}, PM₁₀, SO₂, NO_x, CO, and VOC emissions in units of tons. The consecutive 12 month emissions shall be determined by adding (for each pollutant) the current month's emissions to that of the previous 11 months. Such records shall include a sample calculation for each pollutant. The Permittee shall make these calculations within 30 days of the end of the previous month.
5. The Permittee shall keep records of the inspection and maintenance of the SCR and oxidation catalysts. The records shall include the name of the person, the date, the results or actions and the date the catalyst is replaced.
6. The Permittee shall keep records of the occurrence and duration of any startup, shutdown, or malfunction in the operation of the stationary gas turbine, duct burner or any malfunction of the air pollution control equipment. [40 CFR §60.7(b)]
7. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

C. Reporting

The Permittee shall notify the commissioner in writing of any malfunction of the stationary gas turbine, duct burner, the air pollution control equipment or the continuous monitoring system. The Permittee shall submit such notification within 10 days of the malfunction. The notification shall include the following:

1. a description of the malfunction and a description of the circumstances surrounding the cause or likely cause of such malfunction; and
2. a description of all corrective actions and preventive measures taken and/or planned with respect to such malfunction and the dates of such actions and measures.

PART IV. OPERATION AND MAINTENANCE REQUIREMENTS

- A.** The Permittee shall operate and maintain this equipment in accordance with the manufacturer’s specifications and written recommendations. The Permittee shall operate and maintain this stationary combustion turbine, duct burner, air pollution control equipment, and monitoring equipment in a manner consistent with good air pollution control practices for minimizing emissions at all times including during startup, shutdown, and malfunction. [40 CFR §60.4333(a)]
- B.** The Permittee shall properly operate the control equipment at all times that this turbine/duct burner is in operation and emitting air pollutants.
- C.** The Permittee shall keep records, when the turbine/duct burner is changed for routine maintenance, to include the following:
1. The date the turbine/duct burner was changed;
 2. The reason for the change;
 3. Documentation that the replacement turbine/duct burner is the same make and model number;
 4. Documentation of all associated fixed capital costs; and
 5. Documentation showing that the replacement turbine/duct burner does not result in an increase in emissions, the emission of any new air pollutants, or increases in electrical output of the turbine.

PART V. ALLOWABLE EMISSION LIMITS

The Permittee shall not cause or allow this equipment to exceed the emission limits stated herein:

A. Short Term Emission Limits

These short term emission limits do not apply during periods of startup and shutdown, unless otherwise noted.

1. Turbine Operating on Natural Gas

Criteria Pollutants	ppmvd@15% O ₂ ¹	lb/MMBtu	lb/hr
PM ₁₀ /PM _{2.5}		0.021	2.61
SO ₂		6.58E-04	0.08
NO _x	2.5	0.011	1.37
VOC		7.77E-03	0.97
CO	7.5	0.02	2.50

2. Turbine Operating on ULSD

Criteria <u>Pollutants</u>	<u>ppmvd@15%</u> <u>O₂¹</u>	<u>lb/MMBtu</u>	<u>lb/hr</u>
PM ₁₀ /PM _{2.5}		0.039	4.42
SO ₂		1.52E-03	0.17
NO _x	9.6	0.042	4.78
VOC		0.039	4.37
CO	7.5	0.02	2.26
Pb		1.40E-05	1.59E-03

3. Turbine and Duct Burner Operating on Natural Gas

Criteria <u>Pollutants</u>	<u>ppmvd@15%</u> <u>O₂¹</u>	<u>lb/MMBtu</u>	<u>lb/hr</u>
PM ₁₀ /PM _{2.5}		0.028	2.87
SO ₂		1.25E-03	0.10
NO _x	2.5	0.021	1.73
VOC		1.32E-02	1.15
CO	7.5	0.032	2.93
Pb		4.90E-07	1.70E-05

4. Turbine Operating on ULSD / Duct Burner on Natural Gas

Criteria <u>Pollutants</u>	<u>ppmvd@15%</u> <u>O₂¹</u>	<u>lb/MMBtu</u>	<u>lb/hr</u>
PM ₁₀ /PM _{2.5}		0.046	4.68
SO ₂		2.10E-03	0.19
NO _x	9.6	0.052	5.14
VOC		0.044	4.55
CO	7.5	0.032	2.68
Pb		1.45E-05	1.61E-03
Non-Criteria <u>Pollutants</u>	<u>ppmvd@15% O₂¹</u>		
Ammonia	5.0		

¹ at ISO conditions: 59°F, 14.7 psia and 60 percent relative humidity.

B. Startup and Shutdown Emission Limits

The Permittee shall minimize emissions during periods of startup and shutdown by the following work practices and time constraints. Start the ammonia injection as soon as minimum catalyst temperature is reached. The oxidation catalyst shall not be bypassed during startup or shutdown.

The duration of startup shall not exceed 60 minutes for a hot start or a warm start, nor 240 minutes for a cold start.

A hot start shall be defined as startup when the turbine has been down for less than 8 hours.

A warm start shall be defined as startup when the turbine has been down for more than 8 hours.

A cold start shall be defined as startup when the turbine has been down for more than 24 hours.

The duration of shutdown shall not exceed 60 minutes. Emissions during these periods shall be counted towards the annual emission limits stated herein.

C. Annual Emission Limits

Criteria	tons per 12
<u>Pollutants</u>	<u>consecutive months</u>
PM ₁₀ /PM _{2.5}	13.5
SO ₂	0.5
NO _x	9.5
VOC/HC	7.0
CO	13.0

D. Hazardous Air Pollutants

This unit shall not cause an exceedance of the Maximum Allowable Stack Concentration (MASC) for any hazardous air pollutant (HAP) listed in RCOSA Section 22a-174-29.

[STATE ONLY REQUIREMENT]

E. Opacity

This unit shall not exceed 10% opacity during any six minute block average as measured by 40 CFR 60, Appendix A, Reference Method 9.

F. Demonstration of compliance with the above emission limits shall be met by calculating the emission rates using emission factors from the following sources:

1. NO_x: stack test data.
2. CO, Ammonia: Stack test data.
2. PM₁₀/PM_{2.5}, SO_x, VOC, HAPs: Compilation of Air Pollutant Emission Factors, AP-42, fifth edition, Section 3.1, April 2000, or most recent revision, and equipment manufacturer data (turbine) and Section 1.4, July 1998, or most recent revision, and equipment manufacturer data (duct burner).

4. Cold, hot and warm startup and shutdown:

Natural Gas:

CO: startup: 13.75 lbs/event
shutdown: 1.61 lbs/event

NOx: startup: 6.22 lbs/event
shutdown: 0.50 lbs/event

ULSD:

CO: startup: 26.31 lbs/event
shutdown: 0.87 lbs/event

NOx: startup: 5.44 lbs/event
shutdown: 1.11 lbs/event

The commissioner may require other means (e.g. stack testing) to demonstrate compliance with the above emission limits, as allowed by state or federal statute, law or regulation.

PART VI. STACK EMISSION TEST REQUIREMENTS

Stack emission testing shall be performed in accordance with the [Emission Test Guidelines](#) available on the DEEP website.

- A. The maximum rated capacity of the turbine may be corrected for the ambient temperature at the time of stack testing using the following equations:

The achievable maximum firing rates are dependent on actual ambient temperatures as expressed by the following equations provided by the manufacturer, at fuel low heating value (LHV):

$$\text{Natural Gas (MMBtu/hr)} = -6.00145E-04 * T^2 - 2.17845E-01 * T + 126.99$$

$$\text{No. 2 Fuel Oil (ULSD) (MMBtu/hr/HR)} = -4.46663E-04 * T^2 - 2.81833E-01 * T + 125.003$$

where T is in degree Fahrenheit (°F).

Natural Gas		No. 2 Fuel Oil (ULSD)	
Temperature (°F)	MRC (LHV) (MMBtu/hr)	Temperature (°F)	MRC (LHV) (MMBtu/hr)
-40	134.7	-40	135.6
-20	131.1	-20	130.5
0	127.0	0	125.0
10	124.8	10	122.1
20	122.4	20	119.2
30	119.9	30	116.1
40	117.3	40	113.0
50	114.6	50	109.8
60	111.8	60	106.5
70	108.8	70	103.1

- B. Annual stack testing shall be conducted to demonstrate compliance with the NO_x emission limits in accordance with 40 CFR §60.4400. If the NO_x emission result from the performance test is less than or equal to 75% of the NO_x emission limits of 25 ppmvd @ 15% O₂ when firing natural gas or 74 ppmvd @ 15% O₂ when firing No. 2 oil (Table 1 of 40 CFR Part 60 Subpart KKKK), the frequency of subsequent performance tests may be reduced to once every two years and as allowed by 40 CFR §60.4340 (14 (annual)/26 (biennial) months since last test).
- C. Recurrent stack testing for NO_x, CO and ammonia shall be conducted within five years from the date of the previous stack test to demonstrate compliance with their respective limits.
- D. Stack test results shall be reported as follows: all pollutants in units of lb/hr, PM₁₀/PM_{2.5} in units of lb/MMBTU, NO_x and CO in units of ppmvd at 15% O₂, ammonia in units of µg/m³ and ppmvd at 15% O₂. All values will be reported in ISO Conditions (59°F, 14.7 psia and 60 percent relative humidity)

PART VII. SPECIAL REQUIREMENTS

- A. The Permittee shall comply with all applicable sections of the following New Source Performance Standard at all times.

Title 40 CFR Part 60, Subparts KKKK and A.

- B. The Permittee shall comply with all applicable sections of the following National Emission Standards for Hazardous Air Pollutants at all times.

Title 40 CFR Part 63, Subparts YYYY and A.

Note: Copies of the CFR are available online at the U.S. Government Printing Office website.

- C. STATE ONLY REQUIREMENT: The Permittee shall operate this facility at all times in a manner so as not to violate or contribute significantly to the violation of any applicable state noise control regulations, as set forth in RCSA §§22a-69-1 through 22a-69-7.4.
- D. In the event a malfunction cannot be corrected within three hours, the Permittee shall immediately institute shutdown of the turbine.

E. Premises Emissions Summary

1. On January 1st of each calendar year, if the potential emissions of NO_x and/or VOC from the premises are equal to or greater than 25 tons per year per pollutant, then for such pollutant(s), the Permittee shall:
 - a. Monitor NO_x and/or VOC emissions, as applicable, from the premises for such calendar year.
 - b. Calculate and record annual NO_x and/or VOC emissions, as applicable, from the premises for such calendar year, in units of tons. The Permittee shall make these calculations on or before February 1st of the following year with respect to the previous calendar year. Such records shall include a sample calculation(s).
 - c. If actual NO_x and/or VOC emissions, as applicable, from the premises are equal to or greater than 25 tons for such calendar year, the Permittee shall submit to the commissioner, on or before March 1st of the following year, an annual emissions

summary with respect to the premises for the previous calendar year. Such summary shall be submitted on forms prescribed or provided by the commissioner.

2. A Permittee is exempt from Part VII.E.1 requirements of this permit if, on January 1st of the subject year, the premises was operating in accordance with any of the following:
 - a. A valid Title V permit issued pursuant to RCSA section 22a-174-33;
 - b. RCSA section 22a-174-33a; or
 - c. RCSA section 22a-174-33b

PART VIII. PREMISES WIDE CAP FOR NO_x

- A.** NO_x emissions for the premises shall not equal or exceed 25 tons over any consecutive 12 month period.

B. Monitoring Requirements

The Permittee shall monitor fuel consumption for each fuel burning emissions unit at the premises, excluding mobile sources as defined in RCSA §22a-174-1 and insignificant sources listed in RCSA §22a-174-33, under one of the following options:

1. Fuel Meter:
 - a. Using an individual non-resettable fuel meter; or
 - b. Using a fuel meter that measures fuel supplied to a group of emissions units.
2. Hourly Meter:
 - a. Using an individual hourly meter; or
 - b. Using an hourly meter for a group of emissions units.
3. In the absence of fuel or hourly meters, rental units may use purchase records or invoices.

C. Record Keeping Requirements

1. The Permittee shall make and keep a current record of all fuel burning equipment at the premises, excluding mobile sources as defined in RCSA §22a-174-1 and insignificant sources listed in RCSA §22a-174-33. The record shall include both permanent and temporary emissions units, as defined in RCSA §22a-174-22e, at the premises. The record shall include, at a minimum, the following information for each fuel burning emissions unit:
 - a. A description; including: make, model, location, and Emission Unit (EU) Number or other identification number;
 - b. The maximum rated capacity;
 - c. Identification of the fuel(s) used;
 - d. Monitoring method in accordance with Part VIII.B of this permit as well as the basis, i.e. New Source Review, Federal/State Regulation or Order number, where applicable;
 - e. Emission factor for NO_x and source of such factor; and
 - f. The construction or placement date of temporary units and removal date, as applicable.
2. For each emissions unit, or group of emissions units identified in Part VIII.C.1 of this permit as using a fuel meter to monitor fuel consumption: The Permittee shall make and keep records of monthly and consecutive 12 month fuel consumption (for each fuel, if applicable). The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these

calculations within 30 days of the end of the previous month.

3. For each emissions unit, or group of emissions units identified in Part VIII.C.1 of this permit as using an hourly meter to monitor hours of operation: The Permittee shall make and keep records of monthly and consecutive 12 month hours of operation. The consecutive 12 month hours of operation shall be determined by adding the current month's hours of operation to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.
4. For each emissions unit, or group of emission units identified in Part VIII.C.1 of this permit as using purchase records or invoices: The Permittee shall make and keep records of monthly and consecutive 12 month fuel consumption. The Permittee shall make and keep records of monthly and consecutive 12 month fuel consumption (for each fuel, if applicable). The consecutive 12 month fuel consumption shall be determined by adding the current month's fuel consumption to that of the previous 11 months. The Permittee shall make these calculations within 30 days of the end of the previous month.
5. The Permittee shall calculate and record the monthly and consecutive 12 month NO_x emissions for the premises. The consecutive 12 month NO_x emissions shall be determined by adding the current month's NO_x emissions to that of the previous 11 months for the premises. The Permittee shall make these calculations within 30 days of the end of the previous month.
6. The Permittee shall keep records of all purchase orders, invoices, emissions calculations methodology or other documents necessary to verify the records required by Part VIII of this permit.
7. The Permittee shall keep all records required by this permit for a period of no less than five years and shall submit such records to the commissioner upon request.

PART IX. ADDITIONAL TERMS AND CONDITIONS

- A. This permit does not relieve the Permittee of the responsibility to conduct, maintain and operate the regulated activity in compliance with all applicable requirements of any federal, municipal or other state agency. Nothing in this permit shall relieve the Permittee of other obligations under applicable federal, state and local law.
- B. Any representative of the DEEP may enter the Permittee's site in accordance with constitutional limitations at all reasonable times without prior notice, for the purposes of inspecting, monitoring and enforcing the terms and conditions of this permit and applicable state law.
- C. This permit may be revoked, suspended, modified or transferred in accordance with applicable law.
- D. This permit is subject to and in no way derogates from any present or future property rights or other rights or powers of the State of Connecticut and conveys no property rights in real estate or material, nor any exclusive privileges, and is further subject to any and all public and private rights and to any federal, state or local laws or regulations pertinent to the facility or regulated activity affected thereby. This permit shall neither create nor affect any rights of persons or municipalities who are not parties to this permit.

- E.** Any document, including any notice, which is required to be submitted to the commissioner under this permit shall be signed by a duly authorized representative of the Permittee and by the person who is responsible for actually preparing such document, each of whom shall certify in writing as follows: "I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that any false statement made in the submitted information may be punishable as a criminal offense under section 22a-175 of the Connecticut General Statutes, under section 53a-157b of the Connecticut General Statutes, and in accordance with any applicable statute."
- F.** Nothing in this permit shall affect the commissioner's authority to institute any proceeding or take any other action to prevent or abate violations of law, prevent or abate pollution, recover costs and natural resource damages, and to impose penalties for violations of law, including but not limited to violations of this or any other permit issued to the Permittee by the commissioner.
- G.** Within 15 days of the date the Permittee becomes aware of a change in any information submitted to the commissioner under this permit, or that any such information was inaccurate or misleading or that any relevant information was omitted, the Permittee shall submit the correct or omitted information to the commissioner.
- H.** The date of submission to the commissioner of any document required by this permit shall be the date such document is received by the commissioner. The date of any notice by the commissioner under this permit, including but not limited to notice of approval or disapproval of any document or other action, shall be the date such notice is personally delivered or the date three days after it is mailed by the commissioner, whichever is earlier. Except as otherwise specified in this permit, the word "day" means calendar day. Any document or action which is required by this permit to be submitted or performed by a date which falls on a Saturday, Sunday or legal holiday shall be submitted or performed by the next business day thereafter.
- I.** Any document required to be submitted to the commissioner under this permit shall, unless otherwise specified in writing by the commissioner, be directed to: Office of Director; Engineering & Enforcement Division; Bureau of Air Management; Department of Energy and Environmental Protection; 79 Elm Street, 5th Floor; Hartford, Connecticut 06106-5127.