San Joaquin Valley
AIR POLLUTION CONTROL DISTRICT

AUG 15 2014

Mr. Dallas Belcher
NAS Lemoore
Building 750 Code 50800
Lemoore, CA 93246

Re: Proposed ATC / Certificate of Conformity (Significant Mod)
District Facility # C-2106
Project # C-1123183

Dear Mr. Belcher:

Enclosed for your review is the District's analysis of an application for Authorities to Construct for the facility identified above. You requested that Certificates of Conformity with the procedural requirements of 40 CFR Part 70 be issued with this project. The facility is proposing to add a Specific Limiting Condition (SLC), as defined in Rule 2201 Section 3.38, for the two jet engine test cells and jet engine test pad operation permits with a combined daily fuel use limit of 13,080 gallons per day.

After addressing all comments made during the 30-day public notice and the 45-day EPA comment periods, the District intends to issue the Authorities to Construct with Certificates of Conformity. Please submit your comments within the 30-day public comment period, as specified in the enclosed public notice. Prior to operating with modifications authorized by the Authorities to Construct, the facility must submit an application to modify the Title V permit as an administrative amendment, in accordance with District Rule 2520, Section 11.5.

If you have any questions, please contact Mr. Jim Swaney, Permit Services Manager, at (559) 230-5900.

Thank you for your cooperation in this matter.

Sincerely,

Arnaud Marjollet

Arnaud Marjollet
Director of Permit Services

Enclosures

cc: Mike Tollstrup, CARB (w/enclosure) via email
cc: Gerardo C. Rios, EPA (w/enclosure) via email

Seyed Sadredin
Executive Director/Air Pollution Control Officer

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4800 Enterprise Way
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Tel: (209) 557-6400 FAX: (209) 557-6475

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www.valleyair.org www.healthyairliving.com

San Joaquin Valley Air Pollution Control District
Authority to Construct Application Review
Jet Engine Test Cell/Pad

Facility Name:	NAS Lemoore	Date:	July 24, 2014
Mailing Address:	Building 750 Code 50800	Engineer:	Stanley Tom
	Lemoore, CA 93246	Lead Engineer:	Joven Refuerzo
Contact Person:	Dallas Belcher		
Telephone:	(559) 998-2838		
E-Mail:	dallas.belcher@navy.mil		
Application #:	C-2106-23-4, '70-5, '74-4		
Project #:	C-1123183		
Deemed Complete:	November 8, 2012		

I. Proposal

NAS Lemoore has submitted an Authority to Construct application to modify two jet engine test cells listed in permits C-2106-23 and '74 and one jet engine test pad operation listed in permit C-2106-70 (see Appendix A for current PTOs). The facility is proposing to add a Specific Limiting Condition (SLC), as defined in Rule 2201 Section 3.38, for the two jet engine test cells and jet engine test pad operation permits with a combined daily fuel use limit of 13,080 gallons per day.

NAS Lemoore has received their Title V Permit. This modification can be classified as a Title V significant modification pursuant to Rule 2520, and can be processed with a Certificate of Conformity (COC). The facility has requested that this project be processed in that manner; therefore, NAS Lemoore will be required to submit a Title V administrative amendment application prior to operating under the revised provisions of the ATC permits issued with this project.

II. Applicable Rules

Rule 2201	New and Modified Stationary Source Review Rule (4/21/11)
Rule 2410	Prevention of Significant Deterioration (6/16/11)
Rule 2520	Federally Mandated Operating Permits (6/21/01)
Rule 4001	New Source Performance Standards (4/14/99)
Rule 4002	National Emissions Standards for Hazardous Air Pollutants (5/20/04)
Rule 4101	Visible Emissions (2/17/05)
Rule 4102	Nuisance (12/17/92)
Rule 4201	Particulate Matter Concentration (12/17/92)
Rule 4301	Fuel Burning Equipment (12/17/92)
Rule 4703	Stationary Gas Turbines (9/20/07)
Rule 4801	Sulfur Compounds (12/17/92)
CH&SC 41700	Health Risk Assessment
CH&SC 42301.6	School Notice

Public Resources Code 21000-21177: California Environmental Quality Act (CEQA)
California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387: CEQA Guidelines

III. Project Location

The emission units are located at Naval Air Station Lemoore in Lemoore, CA.

Permit	Location
C-2106-23	Building 175
C-2106-70	Building 242
C-2106-74	Building 176

The equipment is not located within 1,000 feet of the outer boundary of a K-12 school. Therefore, the public notification requirement of California Health and Safety Code 42301.6 is not applicable to this project.

IV. Process Description

NAS Lemoore operates engine test cells/pad in which uninstalled combustion turbine (jet) engines are run through various power settings equivalent to operational conditions, as quality control after performing maintenance/repair and prior to installation in operational aircraft. Engines are mounted on stands and then connected to test equipment consisting of fuel supply and controls which include monitoring equipment to assess proper performance.

The jet engine test pad T-14/T-17 site is an open test pad used to test F-18-404 jet engines and T-400-CP-400 helicopter engines.

V. Equipment Listing

Pre-Project Equipment Description

Current Permit #	Pre-Project Equipment Description
C-2106-23-3	JET TEST CELL #3 (BLDG 175)
C-2106-70-4	T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242)
C-2106-74-3	JET TEST CELL #4 (BLDG 176)

Proposed Modification

ATC Permit #	ATC Equipment Description
C-2106-23-4	MODIFICATION OF JET TEST CELL #3 (BLDG 175): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY
C-2106-70-5	MODIFICATION OF T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY
C-2106-74-4	MODIFICATION OF JET TEST CELL #4 (BLDG 176): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY

Post Project Equipment Description

Proposed Permit #	Post-Project Equipment Description
C-2106-23-4	JET TEST CELL #3 (BLDG 175)
C-2106-70-5	T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242)
C-2106-74-4	JET TEST CELL #4 (BLDG 176)

VI. Emission Control Technology Evaluation

The jet engine test cells and pad do not operate with any emission control equipment. The facilities are whole-engine repair/testing facilities for the engines installed in US Navy FA-18E/F/G aircraft. At NAS Lemoore, the Navy performs maintenance and repairs on the engines for specific aircraft mentioned.

VII. General Calculations

A. Assumptions

- The jet engine test cells and jet engine test pad can operate 24 hours per day and 365 days per year
- Heating value of jet fuel is 135,000 Btu/gal (Ref. AP-42, Fifth Edition, Volume I, Appendix A for kerosene)
- F factor of jet fuel is 9,190 dscf/MMBtu (Ref. 40 CFR Part 60, App. A, Method 19 for oil)

Pre-Project

C-2106-23-4 and '74-4

- Pre-project combined fuel usage limit for test cells #3 and #4 is 3,080 gallons/day. (per current permit)

C-2106-70-5

- No more than five F-404-GE-400 and F-404-GE-402 engines may be tested per day. (per current permit)
- Only F-404-GE-400, F-404-GE-402, and T-400-CP-400 engines may be tested at this test pad (per current permit)
- Gallons of JP-5 fuel use is based on maximum number of engine tests per day and fuel consumed per test.
- Maximum number of engine tests per day is supplied by the applicant and reflects the maximum number of possible tests including setup and removal time.
- Site T-14 and T-17 cannot be used simultaneously; therefore, the higher fuel consumption value will be used for calculations.

Per project C-930399,

Site	Tests/day	Gallons/test	Gallons/day
T-14	5	1,000	5,000
T-17	1	200	200

However, the facility has provided actual fuel use values. In September 2012, for the test cells the facility used 114,321 gallons of fuel to test 49 engines for an average of 2,333 gallons per test. In October 2012, for the test cells the facility used 128,978 gallons of fuel to test 56 engines for an average of 2,303 gallons per test. A value of 2,000 gallons per test will be used as a conservative value.

Site	Tests/day	Gallons/test	Gallons/day
T-14	5	2,000	10,000
T-17	1	200	200

<u>Post-Project</u>

<u>C-2106-23-4, '70-5, and '74-4</u>

- Post-project combined emission limit for test cells #3 and #4 and T-14/T-17 test pad is based upon a combined daily fuel usage of 13,080 gallons/day for test cells #3 and #4 and T-14/T-17 test pad (per applicant).

B. Emission Factors

<u>Pre-Project Emission Factors</u>

<u>C-2106-23-4 and '74-4</u>

Current Emission Factors

The following emission factors were taken from the test cell permits C-2106-23-3 and '74-3. The emission factors were provided by the Aircraft Environmental Support Office (AESO) in Report No. 4-85, *Emissions at Naval Air Station, Lemoore, California, July 1985.*

Current Emission Factors C-2106-23-4 and '74-4		
Pollutant	lb/gal	Source
NO_X	0.106	PTO C-2106-23-3 and '74-3
SO_X	0.054	PTO C-2106-23-3 and '74-3
PM_{10}	0.052	PTO C-2106-23-3 and '74-3
CO	0.472	PTO C-2106-23-3 and '74-3
VOC	0.199	PTO C-2106-23-3 and '74-3

Revised Emission Factors

SOx

As shown in project C-940268 and Memorandum dated January 26, 1995, the SOx emission factor for the test cells and pad was revised from a military fuel sulfur content of 0.039% to 0.02% by weight as determined by the Naval Air Station Aircraft Environmental Support Office. However, the current permits list a SOx emission factor equivalent to a fuel sulfur content limit of 0.4% by weight. The facility has provided a Department of Defense fuel specification sheet that indicates the total sulfur content of turbine fuel, aviation grades JP-4 and JP-5 is 0.30 mass percent maximum. The SOx emission factor in this project will be based upon a fuel sulfur content limit of 0.3% by weight.

Weight of sulfur = 0.30% lb-S/lb-fuel x 6.82 lb-fuel/gal JP-5
= 0.02046 lb-S/gal

Assuming 100% of sulfur is converted to SO2,

Weight of SO2 = 2 lb-SO2/lb-S x 0.02046 lb-S/gal
= 0.041 lb-SOx/gal

NOx, PM_{10}, CO, VOC

The applicant has proposed revised emission factors based on AESO Memorandum Report No. 2000-22 Revision A March 2011 entitled "F414-GE-400 Engine Test Cell Emissions Estimates". This report provides estimated emissions for a F414-GE-400 performance test and a break-in test in test cells. The two types of F414-GE-400 engine test cell tests addressed in this report are engine performance test and break-in test. The performance test is a 7-step test, with additional steps to verify that the engine functions correctly. The engine break-in test has 13 steady state steps, 22 transient steps and again with additional steps that verify the engine functions correctly.

In July 2000 NAS Lemoore furnished thirty-three F414-GE-400 engine run and summary log sheets. There were twenty-one engine performance and twelve engine break-in test sheets provided.

Engine testing steps, time-in-mode and total fuel consumption can vary from engine to engine depending on problems that may occur. However, the provided values are representative for the jet engine test cells and will be used to calculate the emissions from the test cells.

The sulfur content of 0.40 lb-SO2/1000 lb fuel listed for these tests were for a specific type of fuel. The applicant proposes to use the worst case sulfur content of 0.041 lb-SOx/gal to allow for any type of jet fuel to be used in the operation.

The emission factor for each pollutant is calculated with the following equation:

- Emission Factor (lb/gal) = Emissions per test (lb) × Fuel Used per Test (gallons)

F414-GE-400 Performance Test Emissions			
Pollutant	Emissions per Test (lb)	Fuel Used per Test (gallons)	Emission Factor (lb/gal)
NO_X	270.16	1,533.5	0.176
PM_{10}	36.72	1,533.5	0.0239
CO	587.18	1,533.5	0.383
VOC	78.22	1,533.5	0.0510

F414-GE-400 Break-In Test Emissions			
Pollutant	Emissions per Test (lb)	Fuel Used per Test (gallons)	Emission Factor (lb/gal)
NO_X	578.5	3,013.3	0.192
PM_{10}	78.7	3,013.3	0.0261
CO	617.7	3,013.3	0.205
VOC	90.7	3,013.3	0.0301

The highest emission factor from the performance test and break-in test will be used as the worst case emission factor for the project. The test cell emission factors will be revised according to District Policy APR 1110. Per District Policy APR 1110, revision of the emission factors will have no NSR implications.

Revised Emission Factors C-2106-23-4 and '74-4		
Pollutant	lb/gal	Source
NO_X	0.192	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
SO_X	0.041	Mass Balance
PM_{10}	0.0261	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
CO	0.383	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
VOC	0.0510	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011

C-2106-70-5

Current Emission Factors

The below emission factors were taken from project C-930399,

Current Emission Factors C-2106-70-5		
Pollutant	lb/gal	Source
NO_X	0.086	Project C-930399
SO_X	0.0063	Project C-930399
PM_{10}	0.034	Project C-930399
CO	0.302	Project C-930399
VOC	0.026	Project C-930399

However, the above emission factors were determined assuming the fuel used was JP-4. The facility uses JP-5 fuel for the test pad similar to the test cells. Therefore, the emission factors used for the test cells will be used for the test pad. The test pad emission factors will be revised according to District Policy APR 1110. Per District Policy APR 1110, revision of the emission factors will have no NSR implications.

Revised Emission Factors

Revised Emission Factors C-2106-70-5		
Pollutant	lb/gal	Source
NO_X	0.192	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
SO_X	0.041	Mass Balance
PM_{10}	0.0261	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
CO	0.383	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
VOC	0.0510	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011

Post-Project Emission Factors

C-2106-23-4, '70-5, and '74-4

Revised Emission Factors C-2106-23-4, '70-5, '74-4		
Pollutant	lb/gal	Source
NO_X	0.192	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
SO_X	0.041	Mass Balance
PM_{10}	0.0261	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
CO	0.383	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011
VOC	0.0510	AESO Report entitled "F414-GE-400 Engine Test Cell Emissions Estimates" March 2011

C. Calculations

1. Pre-Project Potential to Emit (PE1)

C-2106-23-4 and '74-4

Pre-Project emissions are calculated as follows:

Daily PE1 (lb/day) = Emission Factor (lb/gal) x Daily Fuel Usage (gal/day)

Daily Pre-Project Emissions (PE1) C-2106-23-4 and '74-4			
Pollutant	Emission Factor (lb/gal)	Fuel Usage (gal/day)	Daily PE1 (lb/day)
NO_X	0.192	3,080	591.4
SO_X	0.041	3,080	126.3
PM_{10}	0.0261	3,080	80.4
CO	0.383	3,080	1,179.6
VOC	0.0510	3,080	157.1

Annual PE1 (lb/year) = Daily PE1 (lb/day) x 365 days/year

Annual Pre-Project Emissions (PE1) C-2106-23-4 and '74-4			
Pollutant	Daily PE1 (lb/day)	Days of Operation (days/year)	Annual PE1 (lb/year)
NO_X	591.4	365	215,861
SO_X	126.3	365	46,100
PM_{10}	80.4	365	29,346
CO	1,179.6	365	430,554
VOC	157.1	365	57,342

C-2106-70-5

Pre-Project emissions are calculated as follows:

Daily PE1 (lb/day) = Emission Factor (lb/gal) x Daily Fuel Usage (gal/day)

Daily Pre-Project Emissions (PE1) C-2106-70-5			
Pollutant	Emission Factor (lb/gal)	Fuel Usage (gal/day)	Daily PE1 (lb/day)
NO_X	0.192	10,000	1,920.0
SO_X	0.041	10,000	410.0
PM_{10}	0.0261	10,000	261.0
CO	0.383	10,000	3,830.0
VOC	0.0510	10,000	510.0

Annual PE1 (lb/year) = Daily PE1 (lb/day) x 365 days/year

Annual Pre-Project Emissions (PE1) C-2106-70-5			
Pollutant	Daily PE1 (lb/day)	Days of Operation (days/year)	Annual PE1 (lb/year)
NO_X	1,920.0	365	700,800
SO_X	410.0	365	149,650
PM_{10}	261.0	365	95,265
CO	3,830.0	365	1,397,950
VOC	510.0	365	186,150

2. Post Project Potential to Emit (PE2)

C-2106-23-4, '70-5, and '74-4

The applicant has proposed post-project emissions based on a combined fuel use of 13,080 gallons/day for permit units C-2106-23-4, '70-5, and '74-4.

Daily PE2 (lb/day) = Emission Factor (lb/gal) x Daily Fuel Usage (gal/day)

Daily Post-Project Emissions (PE2) C-2106-23-4, '70-5, '74-4			
Pollutant	Emission Factor (lb/gal)	Fuel Usage (gal/day)	Daily PE2 (lb/day)
NO_X	0.192	13,080	2,511.4
SO_X	0.041	13,080	536.3
PM_{10}	0.0261	13,080	341.4
CO	0.383	13,080	5,009.6
VOC	0.0510	13,080	667.1

Annual PE2 (lb/year) = Daily PE2 (lb/day) x 365 days/year

Annual Post-Project Emissions (PE2) C-2106-23-4, '70-5, '74-4			
Pollutant	Daily PE2 (lb/day)	Days of Operation (days/year)	Annual PE2 (lb/year)
NO_X	2,511.4	365	916,661
SO_X	536.3	365	195,750
PM_{10}	341.4	365	124,611
CO	5,009.6	365	1,828,504
VOC	667.1	365	243,492

3. Pre-Project Stationary Source Potential to Emit (SSPE1)

Pursuant to District Rule 2201, the Pre-Project Stationary Source Potential to Emit (SSPE1) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

Pre-Project Stationary Source Potential to Emit [SSPE1] (lb/year)					
Permit Unit	NO_X	SO_X	PM_{10}	CO	VOC
C-2106-1-3	303	4	21	65	24
C-2106-2-3	466	6	33	100	38
C-2106-6-3	43	1	3	9	3
C-2106-7-3	233	3	17	50	19
C-2106-8-3	84	1	6	18	7
C-2106-9-4	466	6	33	100	38
C-2106-23-3 C-2106-74-3	215,861	46,100	29,346	430,554	57,342
C-2106-25-7	8,117	34	409	319,230	3,391
C-2106-26-6	8,117	34	409	319,230	3,391
C-2106-27-6	8,117	34	409	319,230	3,391
C-2106-28-6	8,117	34	409	319,230	3,391
C-2106-39-3	0	0	0	0	14,600
C-2106-69-2	3,139	219	621	11,023	949
C-2106-70-4	700,800	149,650	95,265	1,397,950	186,150
C-2106-78-4	59	0	4	13	5
C-2106-79-4	59	0	4	13	5
C-2106-117-6	0	0	6,034	0	14,130
C-2106-118-6	0	0	6,034	0	14,130
C-2106-119-6	0	0	6,034	0	14,130
C-2106-120-6	0	0	6,034	0	14,130
C-2106-121-6	0	0	6,034	0	14,130
C-2106-122-6	0	0	6,034	0	14,130
C-2106-123-6	0	0	6,034	0	14,130
C-2106-124-6	0	0	6,034	0	14,130
C-2106-125-6	0	0	6,034	0	14,130
C-2106-126-6	0	0	6,034	0	14,130
C-2106-127-6	0	0	6,034	0	14,130
C-2106-131-2 C-2106-170-1	596	3	275	1,013	796
C-2106-140-6	0	0	0	0	730
C-2106-149-2	0	0	2,373	0	16,863
C-2106-151-5	0	0	6,034	0	14,130
C-2106-153-4	0	0	6,034	0	14,130
C-2106-154-4	0	0	6,034	0	14,130
C-2106-155-4	0	0	6,034	0	14,130
C-2106-156-4	0	0	6,034	0	14,130
C-2106-157-4	0	0	6,034	0	14,130
C-2106-158-3	388	13	22	76	55
C-2106-162-2	0	0	0	0	365

C-2106-163-2	0	0	0	0	365
C-2106-165-2	0	0	0	0	365
C-2106-166-2	0	0	0	0	365
C-2106-167-2	0	0	6,034	0	14,130
C-2106-168-2	546	0	102	546	52
C-2106-174-0	48	0	2	23	3
Pre-Project SSPE (SSPE1)	955,559	196,142	238,375	3,118,473	547,043

4. Post Project Stationary Source Potential to Emit (SSPE2)

Pursuant to District Rule 2201, the Post Project Stationary Source Potential to Emit (SSPE2) is the Potential to Emit (PE) from all units with valid Authorities to Construct (ATC) or Permits to Operate (PTO) at the Stationary Source and the quantity of emission reduction credits (ERC) which have been banked since September 19, 1991 for Actual Emissions Reductions that have occurred at the source, and which have not been used on-site.

Post-Project Stationary Source Potential to Emit [SSPE2] (lb/year)					
Permit Unit	NO_X	SO_X	PM_{10}	CO	VOC
C-2106-1-3	303	4	21	65	24
C-2106-2-3	466	6	33	100	38
C-2106-6-3	43	1	3	9	3
C-2106-7-3	233	3	17	50	19
C-2106-8-3	84	1	6	18	7
C-2106-9-4	466	6	33	100	38
C-2106-23-4 C-2106-74-4 C-2106-70-5	916,661	195,750	124,611	1,828,504	243,492
C-2106-25-7	8,117	34	409	319,230	3,391
C-2106-26-6	8,117	34	409	319,230	3,391
C-2106-27-6	8,117	34	409	319,230	3,391
C-2106-28-6	8,117	34	409	319,230	3,391
C-2106-39-3	0	0	0	0	14,600
C-2106-69-2	3,139	219	621	11,023	949
C-2106-78-4	59	0	4	13	5
C-2106-79-4	59	0	4	13	5
C-2106-117-6	0	0	6,034	0	14,130
C-2106-118-6	0	0	6,034	0	14,130
C-2106-119-6	0	0	6,034	0	14,130
C-2106-120-6	0	0	6,034	0	14,130
C-2106-121-6	0	0	6,034	0	14,130
C-2106-122-6	0	0	6,034	0	14,130
C-2106-123-6	0	0	6,034	0	14,130

C-2106-124-6	0	0	6,034	0	14,130
C-2106-125-6	0	0	6,034	0	14,130
C-2106-126-6	0	0	6,034	0	14,130
C-2106-127-6	0	0	6,034	0	14,130
C-2106-131-2 C-2106-170-1	596	3	275	1,013	796
C-2106-140-6	0	0	0	0	730
C-2106-149-2	0	0	2,373	0	16,863
C-2106-151-5	0	0	6,034	0	14,130
C-2106-153-4	0	0	6,034	0	14,130
C-2106-154-4	0	0	6,034	0	14,130
C-2106-155-4	0	0	6,034	0	14,130
C-2106-156-4	0	0	6,034	0	14,130
C-2106-157-4	0	0	6,034	0	14,130
C-2106-158-3	388	13	22	76	55
C-2106-162-2	0	0	0	0	365
C-2106-163-2	0	0	0	0	365
C-2106-165-2	0	0	0	0	365
C-2106-166-2	0	0	0	0	365
C-2106-167-2	0	0	6,034	0	14,130
C-2106-168-2	546	0	102	546	52
C-2106-174-0	48	0	2	23	3
Post-Project SSPE (SSPE2)	955,559	196,142	238,375	3,118,473	547,043

5. Major Source Determination

<u>Rule 2201 Major Source Determination</u>

Pursuant to District Rule 2201, a Major Source is a stationary source with a SSPE2 equal to or exceeding one or more of the following threshold values. For the purposes of determining major source status the following shall not be included:

- any ERCs associated with the stationary source
- Emissions from non-road IC engines (i.e. IC engines at a particular site at the facility for less than 12 months)
- Fugitive emissions, except for the specific source categories specified in 40 CFR 51.165

Major Source Determination (lb/year)					
	NO_X	SO_X	PM_{10}	CO	VOC
Pre-Project SSPE (SSPE1)	955,559	196,142	238,375	3,118,473	547,043
Post Project SSPE (SSPE2)	955,559	196,142	238,375	3,118,473	547,043
Major Source Threshold	20,000	140,000	140,000	200,000	20,000
Major Source?	Yes	Yes	Yes	Yes	Yes

As seen in the table above, the facility is an existing Major Source and is not becoming a Major Source as a result of this project.

Rule 2410 Major Source Determination

The facility evaluated under this project is not listed as one of the categories specified in 40 CFR 52.21(b)(1)(i). Therefore, the following PSD Major Source threshold for VOC is applicable.

PSD Major Source Determination (tons/year)						
	NO_2	VOC	SO_2	CO	PM	PM_{10}
Facility PE before Project Increase	477.8	273.5	98.1	1,559.2	119.2	119.2
PSD Major Source Thresholds	250	250	250	250	250	250
PSD Major Source?	**Yes**	**Yes**	**No**	**Yes**	**No**	**No**

As shown above, the facility is an existing Major Source for PSD for NOx, CO, and VOC. Therefore, the facility is an existing Major Source for PSD.

6. Baseline Emissions (BE)

The BE calculation (in lbs/year) is performed pollutant-by-pollutant for each unit within the project, to calculate the QNEC and if applicable, to determine the amount of offsets required.

Pursuant to District Rule 2201, BE = Pre-project Potential to Emit for:

- Any unit located at a non-Major Source,
- Any Highly-Utilized Emissions Unit, located at a Major Source,
- Any Fully-Offset Emissions Unit, located at a Major Source, or
- Any Clean Emissions Unit, located at a Major Source.

otherwise,

BE = Historic Actual Emissions (HAE), calculated pursuant to District Rule 2201.

Clean Emissions Unit, Located at a Major Source

Pursuant to Rule 2201, a Clean Emissions Unit is defined as an emissions unit that is "equipped with an emissions control technology with a minimum control efficiency of at least 95% or is equipped with emission control technology that meets the requirements for achieved-in-practice BACT as accepted by the APCO during the five years immediately prior to the submission of the complete application.

As shown in Appendix B, the emission units in this project meet the requirements for achieved-in-practice BACT. Therefore, BE = PE1.

As calculated in Section VII.C.1 above, PE1 is summarized in the following table:

Baseline Emissions [BE] (lb/year)					
Permit Unit	NOx	SOx	PM_{10}	CO	VOC
C-2106-23-4 C-2106-74-4	215,861	46,100	29,346	430,554	57,342
C-2106-70-5	700,800	149,650	95,265	1,397,950	186,150

7. SB 288 Major Modification

SB 288 Major Modification is defined in 40 CFR Part 51.165 as "any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Act."

Since this facility is a major source for NOx, PM_{10}, and VOC, the PE2 for the emission units within this project is compared to the SB 288 Major Modification Threshold in the following table in order to determine if the SB 288 Major Modification calculation is required.

SB 288 Major Modification Threshold (Existing Major Source)			
Pollutant	Project PE2 (lb/year)	Threshold (lb/year)	SB 288 Major Modification Calculation Required?
NOx	916,661	50,000	Yes
SOx	195,750	80,000	Yes
PM_{10}	124,611	30,000	Yes
VOC	243,492	50,000	Yes

Baseline Actual Emissions (BAE)

The actual fuel use values were taken from the facility emission inventory submittals.

- BAE (C-2106-23-4 and '74-4) = EF (lb/gallon) × Fuel Use (gallons/year)
- BAE (C-2106-70-5) = EF (lb/gallon) × Fuel Use (gallons/year)

Per Rule 2201, the baseline period is the two consecutive years of operation immediately prior to the submission date of the Complete Application. Therefore, years 2011 and 2012 will be taken to be the baseline period for this project.

The 2012 emission inventory submittal indicates the facility had a fuel use of 1,135,470 gallons/year for the test cells listed in permits C-2106-23 and '74. However, the current permits for the test cells limit the test cells to a combined fuel use of 3,080 gallons/day which is equivalent to 1,124,200 gallons/year. Therefore, the permitted fuel use limit of 1,124,200 gallons/year will be used for the baseline actual emissions in this project.

NOx Annual Actual Emissions (BAE) C-2106-23-4 and '74-4			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	NO_X Emissions (lb/year)
2011	729,730	0.192	140,108
2012	1,124,200	0.192	215,846
Total			355,954
Annual Average			177,977

NOx Annual Actual Emissions (BAE) C-2106-70-5			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	NO_X Emissions (lb/year)
2011	0	0.192	0
2012	0	0.192	0
Total			0
Annual Average			0

SOx Annual Actual Emissions (BAE) C-2106-23-4 and '74-4			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	SO_X Emissions (lb/year)
2011	729,730	0.041	29,919
2012	1,124,200	0.041	46,092
Total			76,011
Annual Average			38,006

SOx Annual Actual Emissions (BAE) C-2106-70-5			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	SO_X Emissions (lb/year)
2011	0	0.041	0
2012	0	0.041	0
Total			0
Annual Average			0

PM_{10} Annual Actual Emissions (BAE) C-2106-23-4 and '74-4			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	PM_{10} Emissions (lb/year)
2011	729,730	0.0261	19,046
2012	1,124,200	0.0261	29,342
Total			48,388
Annual Average			24,194

C-2106-70-5 PM_{10} Annual Actual Emissions (BAE)			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	PM_{10} Emissions (lb/year)
2011	0	0.0261	0
2012	0	0.0261	0
Total			0
Annual Average			0

CO Annual Actual Emissions (BAE) C-2106-23-4 and '74-4			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	CO Emissions (lb/year)
2011	729,730	0.383	279,487
2012	1,124,200	0.383	430,569
Total			710,056
Annual Average			355,028

CO Annual Actual Emissions (BAE) C-2106-70-5			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	CO Emissions (lb/year)
2011	0	0.383	0
2012	0	0.383	0
Total			0
Annual Average			0

VOC Annual Actual Emissions (BAE) C-2106-23-4 and '74-4			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	VOC Emissions (lb/year)
2011	729,730	0.0510	37,216
2012	1,124,200	0.0510	57,334
Total			94,550
Annual Average			47,275

VOC Annual Actual Emissions (BAE) C-2106-70-5			
Year	Fuel Use (Gallons/year)	Emission Factor (lb/gallon)	VOC Emissions (lb/year)
2011	0	0.0510	0
2012	0	0.0510	0
Total			0
Annual Average			0

Potential to Emit (PE)

As shown above, the Potential to Emit values are as follows:

Potential to Emit (PE2)	
Pollutant	PE2 (lb/year) C-2106-23-4, '70-5, and '74-4
NO_X	916,661
SO_X	195,750
PM_{10}	124,611
VOC	243,492

Net Emissions Increase

Net Emissions Increase (NEI) is calculated as follows:

NEI = $(PE2 - BAE)_{C\text{-}2106\text{-}23\text{-}4,\ '70\text{-}5,\ \text{and}\ '74\text{-}4}$

Net Emissions Increase (NEI)			
Pollutant	**PE2 (lb/year)**	**BAE (lb/year)**	**NEI (lb/year)**
NO_X	916,661	177,977 + 0 = 177,977	738,684
SO_X	195,750	38,006 + 0 = 38,006	157,744
PM_{10}	124,611	24,194 + 0 = 24,194	100,417
VOC	243,492	47,275 + 0 = 47,275	196,217

SB 288 Major Modification Threshold (Existing Major Source)			
Pollutant	**NEI (lb/year)**	**Threshold (lb/year)**	**SB 288 Major Modification?**
NO_X	738,684	50,000	Yes
SO_X	157,744	80,000	Yes
PM_{10}	100,417	30,000	Yes
VOC	196,217	50,000	Yes

The NEI for this project will be greater than the SB 288 Major Modification thresholds for NOx, SOx, PM_{10}, and VOC. Therefore, this project does not qualify for a "Less-Than-Significant Emissions Increase" exclusion and is thus determined to be a SB 288 Major Modification for NOx, SOx, PM_{10}, and VOC.

8. Federal Major Modification

District Rule 2201 states that a Federal Major Modification is the same as a "Major Modification" as defined in 40 CFR 51.165 and part D of Title I of the CAA.

Since this facility is not a major source for $PM_{2.5}$, this project does not constitute a Federal Major Modification for $PM_{2.5}$.

A Less-Than-Significant Emissions Increase exclusion is for an emissions increase for the project, or a Net Emissions Increase for the project (as defined in 40 CFR 51.165 (a)(2)(ii)(B) through (D), and (F)), that is not significant for a given regulated NSR pollutant, and therefore is not a federal major modification for that pollutant.

- To determine the post-project projected actual emissions from existing units, the provisions of 40 CFR 51.165 (a)(1)(xxviii) shall be used.
- To determine the pre-project baseline actual emissions, the provisions of 40 CFR 51.165 (a)(1)(xxxv)(A) through (D) shall be used.
- If the project is determined not to be a federal major modification pursuant to the provisions of 40 CFR 51.165 (a)(2)(ii)(B), but there is a reasonable possibility that the project may result in a significant emissions increase, the owner or operator shall comply with all of the provisions of 40 CFR 51.165 (a)(6) and (a)(7).
- Emissions increases calculated pursuant to this section are significant if they exceed the significance thresholds specified in the table below.

Significant Threshold (lb/year)	
Pollutant	Threshold (lb/year)
VOC	0
NO_x	0
PM_{10}	30,000
SO_x	80,000

The Net Emissions Increases (NEI) for purposes of determination of a "Less-Than-Significant Emissions Increase" exclusion will be calculated below to determine if this project qualifies for such an exclusion.

Net Emission Increase for Existing Units (NEI_E)

The project's emission increase for each pollutant is equal to the sum of the differences between the projected actual emissions or PE and the baseline actual emissions (BAE) (for existing emission units) or the sum of the potentials to emit (for new emission units).

NEI_E = PAE – BAE – UBC

Where:	PAE	=	Projected Actual Emissions
	BAE	=	Baseline Actual Emissions
	UBC	=	Unused baseline capacity

If there is no increase in design capacity or potential to emit, the PAE is equal to the annual emission rate at which the unit is projected to emit in any one year, selected by the operator, within 5 years after the unit resumes normal operation (10 years for existing units with an increase in design capacity or potential to emit). If detailed PAE are not provided, the PAE is equal to the PE2 for each permit unit.

The BAE is calculated based on historical emissions and operating records for any 24 month period, selected by the operator, within the previous 10 year period (5 years for electric utility steam generating units). The BAE must be adjusted to exclude any non-compliant operation emissions and emissions that are no longer allowed due to lower applicable emission limits that were in effect when this application was deemed complete.

In calculating the emission increase (PAE – BAE) the portion of the emissions after the project that the unit could have accommodated before the project (during the same period used to determine BAE) and that are unrelated to the particular project (including emissions increases due to product demand growth) are to be excluded. In other words, the difference in emissions between what the unit could have actually accommodated (legally and physically) before the project and the BAE are to be subtracted from any calculated increase, if the ability to utilize the previously unused capacity is not related to the current project. This quantity is termed "unused baseline capacity emissions".

In estimating the unused baseline capacity emissions, only those emissions that could have actually been accommodated (legally and physically) by the emission unit prior to the modification can be excluded when calculating the emission increase. Any increase in capacity utilization that is a result of the proposed modification cannot be counted when determining the unused baseline capacity emissions.

The operator has selected years 2011 and 2012 to be the baseline period for the Federal Major Modification calculations.

For this project,

NEI_E = PAE – BAE – UBC

Projected Actual Emissions

The applicant has provided the following projected actual emissions based on historical production and projected future use of the two jet engine test cells (permits C-2106-23 and '74). The facility does not plan to use the test pad (permit C-2106-70) at this time.

Average fuel use per run in fiscal year 2013 = 2,013.45 gallons

Projected runs per day = 2
Projected runs per month = 59
Projected runs per year = 670

Projected fuel use per year = 2,013.45 gallons/run x 670 runs/year
= 1,349,012 gallons/year

Project Actual Emissions = Emission Factor x Maximum Projected fuel use per year

Projected Actual Emissions (PAE)				
Permit Unit	Pollutant	Emission Factor (lb/gal)	Fuel Usage (gal/year)	PAE (lb/year)
C-2106-23-4, C-2106-70-5, C-2106-74-4	NO_X	0.192	1,349,012	259,010
	SO_X	0.041	1,349,012	55,309
	PM_{10}	0.0261	1,349,012	35,209
	CO	0.383	1,349,012	516,672
	VOC	0.0510	1,349,012	68,800

Baseline Actual Emissions

The Federal Major Modification Baseline Actual Emissions will be calculated utilizing the Baseline Actual Emissions data shown in the SB 288 Major Modification section above and using the operator selected baseline period of years 2011 and 2012.

Baseline Actual Emissions (BAE)						
Permit Unit	Two Year Average	NO_X (lb/year)	SO_X (lb/year)	PM_{10} (lb/year)	CO (lb/year)	VOC (lb/year)
C-2106-23-4	2011-2012	177,977	38,006	24,194	355,028	47,275
C-2106-70-5						
C-2106-74-4						

Unused Baseline Capacity

The unused baseline capacity for this project is the difference between the pre-project potential to emit and the baseline actual emissions. Since the jet engine test pad listed in permit C-2106-70 has not been in use, the jet engine test pad will not be included in the UBC calculation. Therefore, the UBC will be based upon the values for the two jet engine test cells.

UBC = PE1 – BAE

Pre-Project Potential to Emit (PE1)					
Permit Unit	NO_X (lb/year)	SO_X (lb/year)	PM_{10} (lb/year)	CO (lb/year)	VOC (lb/year)
C-2106-23-4 C-2106-74-4	215,861	46,100	29,346	430,554	57,342

Baseline Actual Emissions (BAE)					
Permit Unit	NO_X (lb/year)	SO_X (lb/year)	PM_{10} (lb/year)	CO (lb/year)	VOC (lb/year)
C-2106-23-4 C-2106-74-4	177,977	38,006	24,194	355,028	47,275

Unused Baseline Capacity (UBC)					
Permit Unit	NO_X (lb/year)	SO_X (lb/year)	PM_{10} (lb/year)	CO (lb/year)	VOC (lb/year)
C-2106-23-4 C-2106-70-5 C-2106-74-4	37,884	8,094	5,152	75,526	10,067

Net Emissions Increase For Existing Units

NEI_E = PAE – BAE – UBC

Net Emissions Increase For Existing Units (NEI_E)					
Permit Unit		NO_X	SO_X	PM_{10}	VOC
C-2106-23-4, C-2106-70-5, C-2106-74-4	PAE (lb/year)	259,010	55,309	35,209	68,800
	BAE (lb/year)	177,977	38,006	24,194	47,275
	UBC (lb/year)	37,884	8,094	5,152	10,067
	NEI_E (lb/year)	43,149	9,209	5,863	11,458

Net Emissions Increase

The NEI for this project is thus calculated as follows:

NEI = NEI_E

Net Emissions Increase (NEI)				
Permit Unit	NOx (lb/year)	SOx (lb/year)	PM_{10} (lb/year)	VOC (lb/year)
C-2106-23-4 C-2106-70-5 C-2106-74-4	43,149	9,209	5,863	11,458

Federal Major Modification Threshold			
Pollutant	NEI (lb/year)	Threshold (lb/year)	Federal Major Modification?
NO_X	43,149	0	Yes
SO_X	9,209	80,000	No
PM_{10}	5,863	30,000	No
VOC	11,458	0	Yes

The NEI for this project will be greater than the federal Major Modification threshold for NOx and VOC. Therefore, this project does not qualify for a "Less-Than-Significant Emissions Increase" exclusion and is thus determined to be a Federal Major Modification for NOx and VOC.

9. Rule 2410 – Prevention of Significant Deterioration (PSD) Applicability Determination

Rule 2410 applies to pollutants for which the District is in attainment or for unclasssified, pollutants. The pollutants addressed in the PSD applicability determination are listed as follows:

- NO_2 (as a primary pollutant)
- SO_2 (as a primary pollutant)
- CO
- PM
- PM_{10}
- Greenhouse gases (GHG): CO_2, N_2O, CH_4, HFCs, PFCs, and SF_6

The first step of this PSD evaluation consists of determining whether the facility is an existing PSD Major Source or not (See Section VII.C.5 of this document).

In the case the facility is an existing PSD Major Source, the second step of the PSD evaluation is to determine if the project results in a PSD significant increase.

In the case the facility is NOT an existing PSD Major Source but is an existing source, the second step of the PSD evaluation is to determine if the project, by itself, would be a PSD major source.

In the case the facility is new source, the second step of the PSD evaluation is to determine if this new facility will become a new PSD major Source as a result of the project and if so, to determine which pollutant will result in a PSD significant increase.

I. Project Location Relative to Class 1 Area

As demonstrated in the "PSD Major Source Determination" Section above, the facility was determined to be a existing major source for PSD. Because the project is not located within 10 km of a Class 1 area – modeling of the emission increase is not required to determine if the project is subject to the requirements of Rule 2410.

II. Significance of Project Emission Increase Determination

a. Potential to Emit of attainment/unclassified pollutant for New or Modified Emission Units vs PSD Significant Emission Increase Thresholds

As a screening tool, the potential to emit from all new and modified units is compared to the PSD significant emission increase thresholds, and if total potential to emit from all new and modified units is below this threshold, no further analysis will be needed.

PSD Significant Emission Increase Determination: Potential to Emit (tons/year)						
	NO2	SO2	CO	PM	PM10	CO2e
Total PE from New and Modified Units	458.3	97.9	914.3	62.3	62.3	51,468
PSD Significant Emission Increase Thresholds	40	40	100	25	15	75,000
PSD Significant Emission Increase?	Y	Y	Y	Y	Y	N

GHG Calculations

Basis and Assumptions

- Kerosene-Type Jet Fuel Default high heat value = 0.135 MMBtu/gal (EPA 40 CFR Part 98, Subpart A, Table C-1)
- Emission factors and global warming potentials (GWP) are taken from EPA 40 CFR Part 98, Subpart A, Tables C-1 and C-2:

Kerosene-Type Jet Fuel
CO_2 72.2 kg/MMBtu (159.17 lb/MMBtu)
CH_4 3.0×10^{-3} kg/MMBtu (0.0066 lb/MMBtu)
N_2O 6.0×10^{-4} kg/MMBtu (0.0013 lb/MMBtu)

GWP for CH4 = 21 lb-CO2(eq) per lb-CH4
GWP for N2O = 310 lb-CO2(eq) per lb-N2O

Calculations

CO_2 Emissions	=	13,080 gal/day x 0.135 MMBtu/gal x 159.17 lb/MMBtu x 365 day/year
	=	102,587,770.9 lb-CO_2(eq)/year
CH_4 Emissions	=	13,080 gal/day x 0.135 MMBtu/gal x 0.0066 lb/MMBtu x 365 day/year x 21 lb-CO_2(eq) per lb-CH_4
	=	89,330 lb-CO_2(eq)/year
N_2O Emissions	=	13,080 gal/day x 0.135 MMBtu/gal x 0.0013 lb/MMBtu x 365 day/year x 310 lb-CO_2(eq) per lb-N_2O
	=	259,740 lb-CO_2(eq)/year

Total	=	102,587,770.9 + 89,330 + 259,740 lb-CO_2(eq)/year
	=	102,936,840.9 lb-CO_2(eq)/year
Total	=	102,936,840.9 lb-CO_2(eq)/year ÷ 2,000 lb/ton
	=	**51,468 short tons-CO_2(eq)/year**

As demonstrated above, because the project has a total potential to emit from all new and modified emission units greater than PSD significant emission increase thresholds, further analysis is required to determine if the project has an emission increase greater than the PSD significant emission increase thresholds, see step below.

b. Emission Increase for Each Attainment/Unclassified Pollutant with a Significant Emission Increase vs PSD Significant Emission Increase Thresholds

In this step, the emission increase for each attainment/unclassified pollutant is compared to the PSD significant emission increase thresholds, and if emission increase for each attainment pollutant is below this threshold, no further analysis is needed.

For new emissions units, the increase in emissions is equal to the PE2 for each new unit included in this project.

For existing emissions units, the increase in emissions is calculated as follows:

Emission Increase = PAE – BAE - UBC

Where: PAE = Projected Actual Emissions, and
BAE = Baseline Actual Emissions
UBC = Unused baseline capacity

The applicant has provided the projected actual emissions, baseline actual emissions, and unused baseline capacity values (see Section VII.C.8 above) for this project.

Projected Actual Emissions (PAE)				
Permit	NOx (ton/year)	SOx (ton/year)	PM_{10} (ton/year)	CO (ton/year)
C-2106-23-4	129.5	27.7	17.6	258.3
C-2106-70-5				
C-2106-74-4				

Baseline Actual Emissions (BAE)					
Permit Unit	Two Year Average	NO_X (ton/year)	SO_X (ton/year)	PM_{10} (ton/year)	CO (ton/year)
C-2106-23-4	2011-2012	89.0	19.0	12.1	177.5
C-2106-70-5					
C-2106-74-4					

Unused Baseline Capacity (UBC)				
Permit	NOx (ton/year)	SOx (ton/year)	PM_{10} (ton/year)	CO (ton/year)
C-2106-23-4	18.9	4.0	2.6	37.8
C-2106-70-5				
C-2106-74-4				

The project's combined total emission increases are compared to the PSD significant emission increase thresholds in the following table.

Emission Increase = PAE – BAE – UBC

Prevention of Significant Deterioration Threshold			
Pollutant	Emission Increase (ton/year)	Threshold (ton/year)	PSD Significant Increase?
NO_2	21.6	40	No
SO_2	4.7	40	No
PM	2.9	25	No
PM_{10}	2.9	25	No
CO	43.0	100	No

As shown in the table above, the project emission increase, for all new and modified emission units, does not exceed any of the PSD significant emission increase thresholds. Therefore the project does not result in a PSD major modification due to a significant emission increase and no further discussion is required.

10. Quarterly Net Emissions Change (QNEC)

The Quarterly Net Emissions Change is used to complete the emission profile screen for the District's PAS database. The QNEC shall be calculated as follows:

QNEC = PE2 - PE1, where:

QNEC = Quarterly Net Emissions Change for each emissions unit, lb/qtr.
PE2 = Post Project Potential to Emit for each emissions unit, lb/qtr.
PE1 = Pre-Project Potential to Emit for each emissions unit, lb/qtr.

Using the values in Sections VII.C.2 and VII.C.6 in the evaluation above, quarterly PE2 and quarterly PE1 can be calculated as follows. As three permit units share the project annual PE2, the shared annual limit will be distributed evenly for the three permit units.

Quarterly NEC [QNEC] C-2106-23-4 and '74-4			
	PE2 (lb/qtr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NO_X	76,388	26,983	49,406
SO_X	16,313	5,763	10,550
PM_{10}	10,384	3,669	6,716
CO	152,375	53,820	98,556
VOC	20,291	7,168	13,123

Quarterly NEC [QNEC] C-2106-70-5			
	PE2 (lb/qtr)	PE1 (lb/qtr)	QNEC (lb/qtr)
NO_X	76,388	175,200	-98,812
SO_X	16,313	37,413	-21,100
PM_{10}	10,384	23,816	-13,432
CO	152,375	349,488	-197,113
VOC	20,291	46,538	-26,247

VIII. Compliance

Rule 2201 New and Modified Stationary Source Review Rule

A. Best Available Control Technology (BACT)

1. BACT Applicability

BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis for the following*:

a. Any new emissions unit with a potential to emit exceeding two pounds per day,
b. The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day,

c. Modifications to an existing emissions unit with a valid Permit to Operate resulting in an AIPE exceeding two pounds per day, and/or
d. Any new or modified emissions unit, in a stationary source project, which results in a Major Modification.

*Except for CO emissions from a new or modified emissions unit at a Stationary Source with an SSPE2 of less than 200,000 pounds per year of CO.

a. New emissions units – PE > 2 lb/day

As discussed in Section I above, there are no new emissions units associated with this project; therefore BACT for new units with PE > 2 lb/day purposes is not triggered.

b. Relocation of emissions units – PE > 2 lb/day

As discussed in Section I above, there are no emissions units being relocated from one stationary source to another; therefore BACT is not triggered.

c. Modification of emissions units – AIPE > 2 lb/day

AIPE = PE2 – HAPE

Where,
AIPE = Adjusted Increase in Permitted Emissions, (lb/day)
PE2 = Post-Project Potential to Emit, (lb/day)
HAPE = Historically Adjusted Potential to Emit, (lb/day)

HAPE = PE1 x (EF2/EF1)

Where,
PE1 = The emissions unit's Potential to Emit prior to modification or relocation, (lb/day)
EF2 = The emissions unit's permitted emission factor for the pollutant after modification or relocation. If EF2 is greater than EF1 then EF2/EF1 shall be set to 1
EF1 = The emissions unit's permitted emission factor for the pollutant before the modification or relocation

AIPE = PE2 – (PE1 * (EF2 / EF1))

There are no emission factor changes in this project; therefore, EF2 / EF1 = 1.

Adjusted Increase in Permitted Emissions C-2106-23-4 and '74-4				
Pollutant	PE2 (lb/day)	PE1 (lb/day)	AIPE (lb/day)	BACT Triggered?
NO_X	2,511.4	591.4	1,920.0	Yes
SO_X	536.3	126.3	410.0	Yes
PM_{10}	341.4	80.4	261.0	Yes
CO	5,009.6	1,179.6	3,830.0	Yes
VOC	667.1	157.1	510.0	Yes

Adjusted Increase in Permitted Emissions C-2106-70-5				
Pollutant	PE2 (lb/day)	PE1 (lb/day)	AIPE (lb/day)	BACT Triggered?
NO_X	2,511.4	1,920.0	591.4	Yes
SO_X	536.3	410.0	126.3	Yes
PM_{10}	341.4	261.0	80.4	Yes
CO	5,009.6	3,830.0	1,179.6	Yes
VOC	667.1	510.0	157.1	Yes

As demonstrated above, the AIPE is greater than 2 lb/day for NOx, SOx, PM_{10}, CO, and VOC for permits C-2106-23-4, '70-5, and '74-4; therefore BACT is triggered for NOx, SOx, PM_{10}, CO, and VOC for permits C-2106-23-4, '70-5, and '74-4.

d. SB 288/Federal Major Modification

As discussed in Section VII.C.7 and VII.C.8 above, this project does constitute a SB 288 Major Modification for NOx, SOx, PM_{10}, and VOC and a Federal Major Modification for NOx and VOC; therefore BACT is triggered for NOx, SOx, PM_{10}, and VOC.

2. BACT Guideline

BACT Guideline 3.4.XX, applies to the jet engine test cells. [Jet Engine Test Facility] (See Appendix B)

3. Top-Down BACT Analysis

Per Permit Services Policies and Procedures for BACT, a Top-Down BACT analysis shall be performed as a part of the application review for each application subject to the BACT requirements pursuant to the District's NSR Rule.

Pursuant to the attached Top-Down BACT Analysis (see Appendix B), BACT has been satisfied with the following:

NO_X: Direct Atmospheric Exhaust (No emission control)
SO_X: Sulfur content of Jet Fuel ≤ 3,000 ppm by weight
PM_{10}: Sulfur content of Jet Fuel ≤ 3,000 ppm by weight
CO: Direct Atmospheric Exhaust (No emission control)
VOC: Direct Atmospheric Exhaust (No emission control)

B. Offsets

1. Offset Applicability

Pursuant to District Rule 2201, offset requirements shall be triggered on a pollutant by pollutant basis and shall be required if the Post Project Stationary Source Potential to Emit (SSPE2) equals to or exceeds the offset threshold levels in Table 4-1 of Rule 2201.

The following table compares the post-project facility-wide annual emissions in order to determine if offsets will be required for this project.

Offset Determination (lb/year)					
	NO_X	SO_X	PM_{10}	CO	VOC
Post Project SSPE (SSPE2)	955,559	196,142	238,375	3,118,473	547,043
Offset Threshold	20,000	54,750	29,200	200,000	20,000
Offsets triggered?	Yes	Yes	Yes	Yes	Yes

2. Quantity of Offsets Required

As seen above, the facility is an existing Major Source and the SSPE2 is greater than the offset thresholds for all pollutants. Therefore offset calculations will be required for this project.

The quantity of offsets in pounds per year is calculated as follows for sources with an SSPE1 greater than the offset threshold levels before implementing the project being evaluated.

Offsets Required (lb/year) = $(\Sigma[PE2 - BE] + ICCE) \times DOR$, for all new or modified emissions units in the project,

Where,
PE2 = Post Project Potential to Emit, (lb/year)
BE = Baseline Emissions, (lb/year)
ICCE = Increase in Cargo Carrier Emissions, (lb/year)
DOR = Distance Offset Ratio, determined pursuant to Section 4.8

BE = PE1 for:

- Any unit located at a non-Major Source,
- Any Highly-Utilized Emissions Unit, located at a Major Source,
- Any Fully-Offset Emissions Unit, located at a Major Source, or
- Any Clean Emissions Unit, Located at a Major Source.

otherwise,

BE = HAE

As calculated in Section VII.C.6 above, the BE from these units are equal to the PE1 since the units are Clean Emission Units (see Appendix B).

Also, there are no increases in cargo carrier emissions. Therefore offsets can be determined as follows:

Offsets Required (lb/year) = $([PE2 - BE]_{C\text{-}2106\text{-}23\text{-}4 \text{ and } '74\text{-}4} + [PE2 - BE]_{C\text{-}2106\text{-}70\text{-}5}) \times DOR$

Offset Requirement C-2106-23-4, '70-5, and '74-4					
Pollutant	NOx (lb/year)	SOx (lb/year)	PM_{10} (lb/year)	CO (lb/year)	VOC (lb/year)
PE2	916,661	195,750	124,611	1,828,504	243,492
$BE_{C\text{-}2106\text{-}23\text{-}4 \text{ and } '74\text{-}4}$	215,861	46,100	29,346	430,554	57,342
$BE_{C\text{-}2106\text{-}70\text{-}5}$	700,800	149,650	95,265	1,397,950	186,150
$\Sigma(PE2 - BE)$	0	0	0	0	0

As demonstrated in the calculation above, the amount of offsets is zero. Therefore, offsets will not be required for this project.

C. Public Notification

1. Applicability

Public noticing is required for:

a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications,
b. Any new emissions unit with a Potential to Emit greater than 100 pounds during any one day for any one pollutant,
c. Any project which results in the offset thresholds being surpassed, and/or
d. Any project with an SSIPE of greater than 20,000 lb/year for any pollutant.

a. New Major Sources, Federal Major Modifications, and SB 288 Major Modifications

New Major Sources are new facilities, which are also Major Sources. Since this is not a new facility, public noticing is not required for this project for New Major Source purposes.

As demonstrated in VII.C.7 and VII.C.8, this project is a SB 288 Major Modification for NOx, SOx, PM_{10}, and VOC and a Federal Major Modification for NOx and VOC. Therefore, public noticing for SB 288 and Federal Major Modification purposes is required.

b. PE > 100 lb/day

Applications which include a new emissions unit with a PE greater than 100 pounds during any one day for any pollutant will trigger public noticing requirements. There are no new emissions units associated with this project. Therefore public noticing is not required for this project for PE > 100 lb/day.

c. Offset Threshold

The following table compares the SSPE1 with the SSPE2 in order to determine if any offset thresholds have been surpassed with this project.

Offset Threshold				
Pollutant	SSPE1 (lb/year)	SSPE2 (lb/year)	Offset Threshold	Public Notice Required?
NO_X	955,559	955,559	20,000 lb/year	No
SO_X	196,142	196,142	54,750 lb/year	No
PM_{10}	238,375	238,375	29,200 lb/year	No
CO	3,118,473	3,118,473	200,000 lb/year	No
VOC	547,043	547,043	20,000 lb/year	No

As detailed above, there were no thresholds surpassed with this project; therefore public noticing is not required for offset purposes.

d. SSIPE > 20,000 lb/year

Public notification is required for any permitting action that results in a Stationary Source Increase in Permitted Emissions (SSIPE) of more than 20,000 lb/year of any affected pollutant. According to District policy, the SSIPE is calculated as the Post Project Stationary Source Potential to Emit (SSPE2) minus the Pre-Project Stationary Source Potential to Emit (SSPE1), i.e. SSIPE = SSPE2 – SSPE1. The values for SSPE2 and SSPE1 are calculated according to Rule 2201. The SSIPE is compared to the SSIPE Public Notice thresholds in the following table:

Stationary Source Increase in Permitted Emissions [SSIPE] – Public Notice					
Pollutant	SSPE2 (lb/year)	SSPE1 (lb/year)	SSIPE (lb/year)	SSIPE Public Notice Threshold	Public Notice Required?
NO_x	955,559	955,559	0	20,000 lb/year	No
SO_x	196,142	196,142	0	20,000 lb/year	No
PM_{10}	238,375	238,375	0	20,000 lb/year	No
CO	3,118,473	3,118,473	0	20,000 lb/year	No
VOC	547,043	547,043	0	20,000 lb/year	No

As demonstrated above, the SSIPEs for all pollutants were less than 20,000 lb/year; therefore public noticing for SSIPE purposes is not required.

2. Public Notice Action

As discussed above, public noticing is required for this project for SB 288 Major Modification for NO_X, SO_X, PM_{10}, and VOC and for Federal Major Modification for NO_X and VOC. Therefore, public notice documents will be submitted to the California Air Resources Board (CARB), US Environmental Protection Agency (US EPA), and a public notice will be published in a local newspaper of general circulation prior to the issuance of the ATC permit for this equipment.

D. Daily Emission Limits (DELs)

DELs and other enforceable conditions are required by Rule 2201 to restrict a unit's maximum daily emissions, to a level at or below the emissions associated with the maximum design capacity. The DEL must be contained in the latest ATC permit and contained in or enforced by the latest PTO and enforceable, in a practicable manner, on a daily basis. DELs are also required to enforce the applicability of BACT.

<u>Proposed Rule 2201 (DEL) Conditions</u>

<u>C-2106-23-4 and '74-4</u>

- Daily combined fuel usage from jet engine test cells #3 and #4 (permits C-2106-23 and '74) and jet engine test pad (C-2106-70) shall not exceed 13,080 gallons per day. [District Rule 2201]
- Emissions from this test cell shall not exceed any of the following limits: 0.192 lb-NOx/gal, 0.041 lb-SOx/gal, 0.0261 lb-PM10/gal, 0.383 lb-CO/gal, or 0.0510 lb-VOC/gal. [District Rule 2201]
- Fuel sulfur content shall not exceed 3,000 ppm by weight. [District Rule 2201]

C-2106-70-5

- Daily combined fuel usage from jet engine test cells #3 and #4 (permits C-2106-23 and '74) and jet engine test pad (C-2106-70) shall not exceed 13,080 gallons per day. [District Rule 2201]
- Emissions from this test pad shall not exceed any of the following limits: 0.192 lb-NOx/gal, 0.041 lb-SOx/gal, 0.0261 lb-PM10/gal, 0.383 lb-CO/gal, or 0.0510 lb-VOC/gal. [District Rule 2201]
- Fuel sulfur content shall not exceed 3,000 ppm by weight. [District Rule 2201]

E. Compliance Assurance

1. Source Testing

Pursuant to District Policy APR 1705, source testing is not required to demonstrate compliance with Rule 2201.

2. Monitoring

No monitoring is required to demonstrate compliance with Rule 2201.

3. Recordkeeping

Recordkeeping is required to demonstrate compliance with the offset, public notification and daily emission limit requirements of Rule 2201. The following condition will be listed on the permits to ensure compliance:

- A record shall be maintained of the date and quantity of engines tested, quantity of fuel used during each test of each engine, and fuel sulfur content. [District Rule 2201]
- All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 1070]

4. Reporting

No reporting is required to demonstrate compliance with Rule 2201.

F. Ambient Air Quality Analysis (AAQA)

An AAQA shall be conducted for the purpose of determining whether a new or modified Stationary Source will cause or make worse a violation of an air quality standard. The District's Technical Services Division conducted the required analysis. Refer to Appendix D of this document for the AAQA summary sheet.

The proposed location is in an attainment area for NO_X, CO, and SO_X. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for NO_X, CO, or SO_X.

The proposed location is in a non-attainment area for the state's PM_{10} as well as federal and state $PM_{2.5}$ thresholds. As shown by the AAQA summary sheet the proposed equipment will not cause a violation of an air quality standard for PM_{10} and $PM_{2.5}$.

Rule 2410 Prevention of Significant Deterioration

The prevention of significant deterioration (PSD) program is a construction permitting program for new major stationary sources and major modifications to existing major stationary sources located in areas classified as attainment or in areas that are unclassifiable for any criteria air pollutant.

As demonstrated above, this project is not subject to the requirements of Rule 2410 due to a significant emission increase and no further discussion is required.

Rule 2520 Federally Mandated Operating Permits

This facility is subject to this Rule, and has received their Title V Operating Permit. Section 3.29 defines a significant permit modification as a "permit amendment that does not qualify as a minor permit modification or administrative amendment."

Section 3.20.5 states that a minor permit modification is a permit modification that does not meet the definition of modification as given in Section 111 or Section 112 of the Federal Clean Air Act. Since this project is a Title I modification (i.e. SB 288 Major Modification), the proposed project is considered to be a modification under the Federal Clean Air Act. As a result, the proposed project constitutes a Significant Modification to the Title V Permit pursuant to Section 3.29.

As discussed above, the facility has applied for a Certificate of Conformity (COC) (see Appendix C); therefore, the facility must apply to modify their Title V permit with an administrative amendment, prior to operating with the proposed modifications. Continued compliance with this rule is expected. The facility shall not implement the changes requested until the final permit is issued.

40 CFR Part 64 – Compliance Assurance Monitoring (CAM)

40 CFR Part 64 requires Compliance Assurance Monitoring (CAM) for units that meet the following three criteria:

1) the unit must have an emission limit for the pollutant;
2) the unit must have add-on controls for the pollutant; these are devices such as flue gas recirculation (FGR), baghouses, and catalytic oxidizers; and
3) the unit must have a pre-control potential to emit of greater than the major source thresholds.

Pollutant	Major Source Threshold (lb/year)
VOC	20,000
NO_X	20,000
CO	200,000
PM_{10}	140,000
SO_X	140,000

Compliance Assurance Monitoring Applicability				
Permit	Pollutant	Emission Limit?	Add-On Control?	Pre-Control Potential to Emit > Major Source Threshold?
C-2106-23-4 and '74-4	NOx	Y	N	N/A
	SOx	Y	N	N/A
	PM_{10}	Y	N	N/A
	CO	Y	N	N/A
	VOC	Y	N	N/A
C-2106-70-5	NOx	Y	N	N/A
	SOx	Y	N	N/A
	PM_{10}	Y	N	N/A
	CO	Y	N	N/A
	VOC	Y	N	N/A

The jet engine test cells and pad do not have add-on controls for NOx, SOx, PM_{10}, CO, or VOC. Therefore, these emission units are not subject to CAM.

Rule 4001 New Source Performance Standards (NSPS)

This rule incorporates NSPS from Part 60, Chapter 1, Title 40, Code of Federal Regulations (CFR); and applies to all new sources of air pollution and modifications of existing sources of air pollution listed in 40 CFR Part 60.

40 CFR Part 60 Subpart KKKK – Standards of Performance for Stationary Combustion Turbines

This subpart establishes emission standards and compliance schedules for the control of emissions from stationary combustion turbines that commenced construction, modification or reconstruction after February 18, 2005.

Section 60.4310(d) states combustion turbine test cells/stands are exempt from this subpart. Therefore, the requirements of this subpart are not applicable to this project.

Rule 4002 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

This rule incorporates NESHAPs from Part 61, Chapter I, Subchapter C, Title 40, CFR and the NESHAPs from Part 63, Chapter I, Subchapter C, Title 40, CFR; and applies to all sources of hazardous air pollution listed in 40 CFR Part 61 or 40 CFR Part 63.

40 CFR Part 63 Subpart PPPPP – National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands

This subpart PPPPP establishes national emission standards for hazardous air pollutants (NESHAP) for engine test cells/stands located at major sources of hazardous air pollutants (HAP) emissions. This subpart also establishes requirements to demonstrate initial and continuous compliance with the emission limitations contained in this NESHAP.

§ 63.9290(d) states any portion of a new or reconstructed affected source located at a major source that meets any of the criteria specified in paragraphs (d)(1) through (4) of this section does not have to meet the requirements of this subpart and of subpart A of this part.

§ 63.9290(d)(1) states any portion of the affected source used exclusively for testing combustion turbine engines.

As the emission units in this project are used exclusively for testing combustion turbine engines, the requirements of this subpart are not applicable to this project.

Rule 4101 Visible Emissions

Per Section 5.0, no person shall discharge into the atmosphere emissions of any air contaminant aggregating more than 3 minutes in any hour which is as dark as or darker than Ringelmann 1 (or 20% opacity). The following condition will be placed on the permits to ensure compliance with this rule.

- No air contaminant shall be discharged into the atmosphere for a period or periods aggregating more than three minutes in any one hour which is as dark as, or darker than, Ringelmann 1 or 20% opacity. [District Rule 4101]

Rule 4102 Nuisance

Section 4.0 prohibits discharge of air contaminants which could cause injury, detriment, nuisance or annoyance to the public. Public nuisance conditions are not expected as a result of these operations, provided the equipment is well maintained. Therefore, compliance with this rule is expected.

California Health & Safety Code 41700 (Health Risk Assessment)

District Policy APR 1905 – Risk Management Policy for Permitting New and Modified Sources specifies that for an increase in emissions associated with a proposed new source or modification, the District perform an analysis to determine the possible impact to the nearest resident or worksite.

An HRA is not required for a project with a total facility prioritization score of less than one. According to the Technical Services Memo for this project (Appendix D), the total facility prioritization score including this project was greater than one. Therefore, an HRA was required to determine the short-term acute and long-term chronic exposure from this project.

The cancer risk for this project is shown below:

HRA Summary		
Unit	Cancer Risk	T-BACT Required
C-2106-23-4, '70-5, '74-4	0.264 per million	No

Discussion of T-BACT

BACT for toxic emission control (T-BACT) is required if the cancer risk exceeds one in one million. As demonstrated above, T-BACT is not required for this project because the HRA indicates that the risk is not above the District's thresholds for triggering T-BACT requirements; therefore, compliance with the District's Risk Management Policy is expected.

District policy APR 1905 also specifies that the increase in emissions associated with a proposed new source or modification not have acute or chronic indices, or a cancer risk greater than the District's significance levels (i.e. acute and/or chronic indices greater than 1 and a cancer risk greater than 10 in a million). As outlined by the HRA Summary in Appendix D of this report, the emissions increases for this project was determined to be less than significant.

The following condition will be listed on the permit to ensure compliance:

- The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]

Rule 4201 Particulate Matter Concentration

Section 3.1 prohibits discharge of dust, fumes, or total particulate matter into the atmosphere from any single source operation in excess of 0.1 grain per dry standard cubic foot.

$$\text{PM Conc. (gr/scf)} = \frac{\text{(PM emission rate)} \times \text{(7,000 gr/lb)}}{\text{(Exhaust gas flow rate)} \times \text{(60 min/hr)} \times \text{(8760 hr/year)}}$$

PM_{10} emission rate = 124,611 lb/year. Assuming 100% of PM is PM_{10}.
Exhaust Gas Flow = 583,128 scfm

PM Conc. (gr/scf) = [(124,611 lb/year) ∗ (7,000 gr/lb)] ÷ [(583,128 ft^3/min) ∗ (60 min/hr) ∗ (8,760 hr/year)]
PM Conc. (gr/scf) = 0.0028 gr/scf

As shown above, PM emissions from the test cells/pad will be less than 0.1 gr/dscf. Compliance is expected.

Rule 4301 Fuel Burning Equipment

Rule 4301 limits air contaminant emissions from fuel burning equipment as defined in the rule. Section 3.1 defines fuel burning equipment as "any furnace, boiler, apparatus, stack, and all appurtenances thereto, used in the process of burning fuel for the primary purpose of producing heat or power by indirect heat transfer".

The jet engine turbines primarily produce power mechanically, i.e. the products of combustion pass across the power turbine blades which causes the turbine shaft to rotate. The turbine shaft is coupled to an engine which is rotated to produce power. Because the turbines primarily produce power by mechanical means, it does not meet the definition of fuel burning equipment.

Therefore, the requirements of this rule are not applicable to this project.

Rule 4703 Stationary Gas Turbines

The purpose of this rule is to limit oxides of nitrogen (NOx) emissions from stationary gas turbine systems.

The provisions of this rule apply to all stationary gas turbine systems, which are subject to District permitting requirements, and with ratings equal to or greater than 0.3 megawatt (MW) or a maximum heat input rating of more than 3,000,000 Btu per hour, except as provided in Section 4.0.

Section 3.30 defines stationary gas turbine as a gas turbine that is attached to a foundation, or a portable gas turbine that is operated at a facility for more than 90 days in any 12-month period.

The jet engines being tested in the jet engine test cells and pad are not attached to a foundation and are not portable as the jet engines are considered mobile equipment.

Therefore, the requirements of this rule are not applicable to this project.

Rule 4801 Sulfur Compounds

Per Section 3.1, a person shall not discharge into the atmosphere sulfur compounds, which would exist as a liquid or gas at standard conditions, exceeding in concentration at the point of discharge: 0.2 % by volume calculated as SO_2 on a dry basis averaged over 15 consecutive minutes:

The ratio of the volume of the SO_x exhaust to the entire exhaust for one MMBtu of fuel combusted is:

Volume of SO_x: $V = \frac{n \cdot R \cdot T}{P}$

Where:

- n = number of moles of SO_x produced per MMBtu of fuel.
- Weight of SO_x as SO_2 is 64 lb/(lb-mol)
- $n = \frac{0.041\ lb}{gal} \times \frac{gal}{135{,}000\ Btu} \times \frac{1\ (lb-mol)}{64\ lb} = 0.004745\ (lb-mol)$
- $R = \frac{0.7302\ ft^3 \cdot atm}{(lb-mol)\,°R}$
- T = 500 °R
- P = 1 atm

Thus, volume of SO_X per MMBtu is:

$$V = \frac{n \cdot R \cdot T}{P}$$

$$V = \frac{0.004745\ (lb-mol) \cdot \frac{0.7302\ ft^3 \cdot atm}{(lb-mol)\ °R} \cdot 500\ °R}{1\ atm}$$

$$V = 1.73\ ft^3$$

Since the total volume of exhaust per MMBtu is 9,190 scf, the ratio of SO_X volume to exhaust volume is

$$= \frac{1.73}{9{,}190} = 0.0001885 = 188.5\ ppmv$$

Since 188.5 ppmv ≤ 2000 ppmv, the jet engine test cells and pad are expected to comply with Rule 4801.

California Health & Safety Code 42301.6 (School Notice)

The District has verified that this site is not located within 1,000 feet of a school. Therefore, pursuant to California Health and Safety Code 42301.6, a school notice is not required.

California Environmental Quality Act (CEQA)

The California Environmental Quality Act (CEQA) requires each public agency to adopt objectives, criteria, and specific procedures consistent with CEQA Statutes and the CEQA Guidelines for administering its responsibilities under CEQA, including the orderly evaluation of projects and preparation of environmental documents. The San Joaquin Valley Unified Air Pollution Control District (District) adopted its *Environmental Review Guidelines* (ERG) in 2001. The basic purposes of CEQA are to:

- Inform governmental decision-makers and the public about the potential, significant environmental effects of proposed activities.
- Identify the ways that environmental damage can be avoided or significantly reduced.
- Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
- Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

The District performed an Engineering Evaluation (this document) for the proposed project and determined that the project will not have a significant effect on the environment. The District finds that the project is exempt per the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment (CEQA Guidelines §15061(b)(3)).

IX. Recommendation

Compliance with all applicable rules and regulations is expected. Pending a successful NSR Public Noticing period, issue ATC permits C-2106-23-4, '70-5, '74-4 subject to the permit conditions on the attached draft ATC permits in Appendix E.

X. Billing Information

Annual Permit Fees			
Permit Number	Fee Schedule	Fee Description	Annual Fee
C-2106-23-4	3020-02-H	> 15.0 MMBtu/hr	$1030.00
C-2106-70-5	3020-02-H	> 15.0 MMBtu/hr	$1030.00
C-2106-74-4	3020-02-H	> 15.0 MMBtu/hr	$1030.00

Appendices

A: Current PTOs
B: BACT Determination and Top Down BACT Analysis
C: Certificate of Conformity
D: Health Risk Assessment and Ambient Air Quality Analysis
E: Draft Authority to Construct Permits

APPENDIX A

Current PTOs

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: C-2106-23-3 **EXPIRATION DATE:** 04/30/2016

EQUIPMENT DESCRIPTION:
JET TEST CELL #3 (BLDG 175)

PERMIT UNIT REQUIREMENTS

1. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District NSR Rule] Federally Enforceable Through Title V Permit
2. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
3. The average daily combined emissions from test cells #3 and #4, permit units C-2106-23 and -74, shall not exceed any of the following limits, during any calendar month: 327 lb-NOx/day, 166 lb-SOx/day, 160 lb-PM10/day, 1,454 lb-CO/day, or 613 lb-VOC/day. [District NSR Rule] Federally Enforceable Through Title V Permit
4. Emissions shall be calculated using the following emission factors: 0.106 lb-NOx/gal, 0.054 lb-SOx/gal, 0.052 lb-PM10/gal, 0.472 lb-CO/gal, and 0.199 lb-VOC/gal. [District NSR Rule] Federally Enforceable Through Title V Permit
5. The average daily combined fuel usage for test cells #3 and #4, permit units C-2106-23 and -74, shall not exceed 3,080 gallons/day, for any calendar month. [District NSR Rule] Federally Enforceable Through Title V Permit
6. A record shall be maintained of the date, type, and quantity of engines tested, and daily fuel usage based on based on a monthly average at this test cell. The record shall be retained on-site for at least five years and made available for District inspection upon request. [District Rule 1070 and 2520, and 9.4.2] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: C-2106-70-4 **EXPIRATION DATE:** 04/30/2016

EQUIPMENT DESCRIPTION:
T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242)

PERMIT UNIT REQUIREMENTS

1. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District NSR Rule] Federally Enforceable Through Title V Permit
2. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
3. Only F-404-GE-400, F404-GE-402, and T-400-CP-400 engines shall be tested at this site. [District NSR Rule] Federally Enforceable Through Title V Permit
4. Engine test rate shall not exceed five F-404-GE-400 or F404-GE-402 tests/day. [District NSR Rule] Federally Enforceable Through Title V Permit
5. Permittee shall keep daily records of the number of engine tests, engine types, and fuel usage. Records shall be retained for at least five years and provided for District inspection upon request. [District NSR Rule] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

PERMIT UNIT: C-2106-74-3 **EXPIRATION DATE:** 04/30/2016

EQUIPMENT DESCRIPTION:
JET TEST CELL #4 (BLDG 176)

PERMIT UNIT REQUIREMENTS

1. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District NSR Rule] Federally Enforceable Through Title V Permit
2. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
3. The average daily combined emissions from test cells #3 and #4, permit units C-2106-23 and -74, shall not exceed any of the following limits, during any calendar month: 327 lb-NOx/day, 166 lb-SOx/day, 160 lb-PM10/day, 1,454 lb-CO/day, or 613 lb-VOC/day. [District NSR Rule] Federally Enforceable Through Title V Permit
4. Emissions shall be calculated using the following emission factors: 0.106 lb-NOx/gal, 0.054 lb-SOx/gal, 0.052 lb-PM10/gal, 0.472 lb-CO/gal, and 0.199 lb-VOC/gal. [District NSR Rule] Federally Enforceable Through Title V Permit
5. The average daily combined fuel usage for test cells #3 and #4, permit units C-2106-23 and -74, shall not exceed 3,080 gallons/day, for any calendar month. [District NSR Rule] Federally Enforceable Through Title V Permit
6. A record shall be maintained of the date, type, and quantity of engines tested, and daily fuel usage based on based on a monthly average at this test cell. The record shall be retained on-site for at least five years and made available for District inspection upon request. [District Rule 1070 and 2520, and 9.4.2] Federally Enforceable Through Title V Permit

APPENDIX B

BACT Determination and Top Down BACT Analysis

New BACT Determination 3.4.XX:
Jet Engine Test Facility

Facility Name:	NAS Lemoore	Date:	November 3, 2013
Mailing Address:	Building 750 Code 50800 Lemoore, CA 93246	Engineer: Lead Engineer:	Stanley Tom Joven Refuerzo
Contact Person:	Dallas Belcher		
Telephone:	(559) 998-2838		
Application #:	C-2106-23-4, '70-5, '74-4		
Project #:	C-1123183		
Location:	Naval Air Station Lemoore, Lemoore, CA		
Complete:	November 8, 2012		

I. PROPOSAL

NAS Lemoore has submitted an Authority to Construct application to modify two jet engine test cells listed in permits C-2106-23 and '74 and one jet engine test pad operation listed in permit C-2106-70 (see Appendix A for current PTOs). The facility is proposing to add a Specific Limiting Condition (SLC), as defined in Rule 2201 Section 3.38, for the two jet engine test cells and jet engine test pad operation permits with a combined daily fuel use limit of 13,080 gallons per day.

II. Applicable Rules

Rule 2201	New and Modified Stationary Source Review Rule (4/21/11)
Rule 2520	Federally Mandated Operating Permits (6/21/01)
Rule 4001	New Source Performance Standards (4/14/99)
Rule 4002	National Emissions Standards for Hazardous Air Pollutants (5/20/04)
Rule 4101	Visible Emissions (2/17/05)
Rule 4102	Nuisance (12/17/92)
Rule 4201	Particulate Matter Concentration (12/17/92)
Rule 4301	Fuel Burning Equipment (12/17/92)
Rule 4703	Stationary Gas Turbines (9/20/07)
Rule 4801	Sulfur Compounds (12/17/92)
CH&SC 41700	Health Risk Assessment
CH&SC 42301.6	School Notice

Public Resources Code 21000-21177: California Environmental Quality Act (CEQA)
California Code of Regulations, Title 14, Division 6, Chapter 3, Sections 15000-15387: CEQA Guidelines

II. PROJECT LOCATION

The emission units are located at Naval Air Station Lemoore in Lemoore, CA.

Permit	Location
C-2106-23	Building 175
C-2106-70	Building 242
C-2106-74	Building 176

III. EQUIPMENT LISTING

Pre-Project Equipment Description:

Current Permit #	Pre-Project Equipment Description
C-2106-23-3	JET TEST CELL #3 (BLDG 175)
C-2106-70-4	T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242)
C-2106-74-3	JET TEST CELL #4 (BLDG 176)

Proposed Modification:

ATC Permit #	ATC Equipment Description
C-2106-23-4	MODIFICATION OF JET TEST CELL #3 (BLDG 175): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY
C-2106-70-5	MODIFICATION OF T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY
C-2106-74-4	MODIFICATION OF JET TEST CELL #4 (BLDG 176): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY

Post Project Equipment Description:

Proposed Permit #	Post-Project Equipment Description
C-2106-23-4	JET TEST CELL #3 (BLDG 175)
C-2106-70-5	T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242)
C-2106-74-4	JET TEST CELL #4 (BLDG 176)

IV. PROCESS DESCRIPTION

NAS Lemoore operates engine test cells/pad in which uninstalled combustion turbine (jet) engines are run through various power settings equivalent to operational conditions, as quality control after performing maintenance/repair and prior to installation in operational aircraft. Engines are mounted on stands and then connected to test equipment consisting of fuel supply and controls which include monitoring equipment to assess proper performance.

The jet engine test pad T-14/T-17 site is an open test pad used to test F-18-404 jet engines and T-400-CP-400 helicopter engines.

IV. CONTROL EQUIPMENT EVALUATION

The jet engine test cells and pad do not operate with any emission control equipment. The facilities are whole-engine repair/testing facilities for the engines installed in US Navy FA-18E/F/G aircraft. At NAS Lemoore, the Navy performs maintenance and repairs on the engines for specific aircraft mentioned.

A. Best Available Control Technology (BACT) for Permit Units C-2106-23-4, '70-5, and '74-4

Applicability

District Rule 2201 states that BACT requirements are triggered on a pollutant-by-pollutant basis and on an emissions unit-by-emissions unit basis for the following:

a) Any new emissions unit with a potential to emit exceeding two pounds per day,
b) The relocation from one Stationary Source to another of an existing emissions unit with a potential to emit exceeding two pounds per day, and/or
c) Modifications to an existing emissions unit with a valid Permit to Operate resulting in an AIPE exceeding two pounds per day.
d) When a Major Modification is triggered for a modification project at a facility that is a Major Source.

As shown below, BACT is triggered for NOx, SOx, PM10, CO, and VOC emissions for the jet engine test cells.

AIPE = PE2 – (PE1 ∗ (EF2 / EF1))

There are no emission factor changes in this project; therefore, EF2 / EF1 = 1.

Adjusted Increase in Permitted Emissions C-2106-23-4 and '74-4				
Pollutant	PE2 (lb/day)	PE1 (lb/day)	AIPE (lb/day)	BACT Triggered?
NO_X	2,511.4	591.4	1,920.0	Yes
SO_X	536.3	126.3	410.0	Yes
PM_{10}	341.4	80.4	261.0	Yes
CO	5,009.6	1,179.6	3,830.0	Yes
VOC	667.1	157.1	510.0	Yes

Adjusted Increase in Permitted Emissions C-2106-70-5				
Pollutant	PE2 (lb/day)	PE1 (lb/day)	AIPE (lb/day)	BACT Triggered?
NO_X	2,511.4	1,920.0	591.4	Yes
SO_X	536.3	410.0	126.3	No
PM_{10}	341.4	261.0	80.4	Yes
CO	5,009.6	3,830.0	1,179.6	Yes
VOC	667.1	510.0	157.1	Yes

As demonstrated above, the AIPE is greater than 2 lb/day for NOx, SOx, PM_{10}, CO, and VOC for permits C-2106-23-4 and '74-4 and the AIPE is greater than 2 lb/day for NOx, PM_{10}, CO, and VOC for permits C-2106-70-5; therefore BACT is triggered for NOx, SOx, PM_{10}, CO, and VOC for permits C-2106-23-4 and '74-4 and NOx, PM_{10}, CO, and VOC for permits C-2106-70-5. However, this project is a SB 288 Major Modification for NOx, SOx, PM_{10}, and VOC. Therefore, BACT is triggered for all pollutants for all units in this project.

B. BACT Policy

Per District Policy APR 1305, Section IX, "A top-down BACT analysis shall be performed as a part of the Application Review for each application subject to the BACT requirements pursuant to the District's NSR Rule for source categories or classes covered in the BACT Clearinghouse, relevant information under each of the following steps may be simply cited from the Clearinghouse without further analysis".

The District's 4th quarter 2012 BACT Clearinghouse was surveyed to determine if an existing BACT guideline was applicable for this class and category of operation. No BACT guidelines were found that cover jet engine test facilities. Pursuant to the District's BACT policy, a Top-Down BACT analysis will be performed for inclusion of a new determination in the District's BACT Clearinghouse.

C. BACT Determination for Jet Engine Test Facility

The Environmental Protection Agency (EPA), California Air Resources Board (CARB), San Diego County Air Pollution Control District (SDCAPCD), South Coast Air Quality Management District (SCAQMD), Bay Area Air Quality Management District (BAAQMD) and the San Joaquin Valley Air Pollution Control District (SJVAPCD) BACT clearinghouses were reviewed to determine potential control technologies for this class and category of operation.

A search of Naval Air Stations and Air Force Bases around the United States was performed to determine potential controls for jet engine test cells/stands installations. The Wright-Patterson Air Force Base in Dayton, OH and Naval Air Station Jacksonville in Jacksonville, FL operate jet engine test cells/stands but the operations are not equipped with any emission control equipment.

General Electric Engine Services operates jet engine test cells in Los Angeles, CA and Ontario, CA but the operations are not equipped with any emission control equipment.

1. NOx Top-Down BACT Analysis for Permit Units C-2106-23-4, '70-5, and '74-4

NOx emissions from test facilities are generated by the engines tested within the facility. The NOx mass emission rate is determined solely by the test engine and is unaffected by the design of the test facility itself.

NOx emissions from jet engines are generated in the primary combustion zone of the engine, located in the forward volume of the combustor where the fuel is injected. Within the combustor, localized regions of stoichiometric fuel/air mixture exist at high engine power conditions, resulting in high flame temperatures. These high flame temperatures are responsible for most of the NOx emissions from jet engines.

Potential NOx control technologies for jet engine test cells were obtained from the EPA Report, 453/R-94-068, October 1994, entitled "Nitrogen Oxide Emissions and Their Control from Uninstalled Aircraft Engines in Enclosed Test Cell" and the Los Alamos National Laboratory presentation, LA-UR-99-3072, titled "NOx Removal in Jet Engine Test Cell Exhaust." Post-combustion control methods address NOx emissions after formation.

Step 1 – Identify all control technologies

Inherently lower emitting processes are not considered further because jet engine test facilities only test the engines in the Department of Defense inventory; therefore, it can neither alter the combustor in the engine nor the combustion characteristics of the engine.

The joint report submitted to the U.S. Congress in October 1994 by the EPA and the DOT entitled "Nitrogen Oxide Emissions and Their Control from Uninstalled Aircraft Engines in Enclosed Test Cell," Report No. EPA-453/R-94-068, October 1994 concludes that there are no existing technologies for control of NOx that have been applied (full scale) to aircraft engine test cells in the United States. The differences in engines, engine tests, engine test cell sizes, and engine types complicate the application of a NOx control system to engine test cells. The preparation and submittal of this study was mandated under Section 233(a) of the Clean Air Act Amendments of 1990.

The following control technologies have been identified for jet engine test facilities.

1) Direct Atmospheric Exhaust
2) Selective Catalytic Reduction (SCR) with Ammonia Injection
3) Non-Thermal Plasma (NTP) Systems
4) Selective Non-Catalytic Reduction (SNCR)
5) Reburn NOx Control Technology
6) NOx Sorbent Technology
7) Water or Steam Injection
8) Fuel Emulsion

Description of Control Technologies

1) Direct Atmospheric Exhaust (No Control)

The engine exhaust mixes with the augmentation/bypass air in the diffuser section, and is emitted to the atmosphere without use of any NOx reduction technology.

2) Selective Catalytic Reduction (SCR) with Ammonia Injection

Ammonia is injected to react with NO to form nitrogen and water. The required catalyst temperature is approximately 700°F, though some recent catalysts operate near 500°F. Several catalysts, including platinum and titanium oxide, are available. Proper operation depends on many factors including correct stoichiometric ratio of ammonia to NO, reaction temperature, and condition of catalyst, in addition to the space velocity, which is expressed as exhaust gas volumetric flow rate per unit catalyst volume. The NOx reduction efficiency for SCR with ammonia injection has been demonstrated at 80 to 90 percent.

3) Non-Thermal Plasma (NTP) Systems

NTP systems are a type of advanced oxidation and reduction process making use of "cold combustion" via free-radical reactions. Exhaust gases are contacted with electrical energy to create free radicals, which in turn decompose pollutants such as NOx, SO_2, and VOC in the gas phase. The removal efficiency depends on plasma chemistry (free radical yield), reaction chemistry, and applied plasma specific energy. The process is carried out on the exhaust gases without any preheating and has demonstrated removal efficiencies greater than 50 percent in bench-scale and field-pilot demonstration studies. There are five candidate NTP systems: pulsed corona, dielectric barrier, hybrid NTP reactor-adsorber, plasma-catalytic hybrid, and corona radical shower. In pulsed corona, dielectric barrier, and corona radical shower systems, ammonia or methane can be added to generate radicals that drive reactions leading to the formation of particulates which can be removed using an electrostatic precipitator.

4) Selective Non-Catalytic Reduction (SNCR)

SNCR uses injection of chemicals such as ammonia or urea to the exhaust gases, for non-catalytic reactions that result in formation of nitrogen and water. Without proper process control, a competing reaction can actually generate NO. The desired reaction for NOx reduction occurs in the temperature range of 1,800°F to 2,000°F. This increased temperature requirement removes pressure drop and elevated back pressure concerns. This technology has been demonstrated on utility boilers and other fossil-fuel systems to achieve 50 to 60 percent NOx removal.

5) Reburn NOx Control Technology

Natural gas is injected at a region just above the main combustion zone, followed by downstream injection of additional combustion air. The injection of the gas lowers NOx formation in the main combustion zone, where the NOx is reduced by reaction with hydrocarbon fragments formed by the natural gas combustion in fuel-rich conditions. For gas reburning to be effective, the natural gas must be injected into the flue gas stream and mixed rapidly with the primary combustion zone combustion products. Penetration of the flue gas stream can be improved by use of a carrier gas such as recirculated flue gas. Recirculated flue gas is convenient as it contains minimal oxygen content (to create a fuel rich region) and is preheated. Depending on the initial NOx level and specific design, NOx emission control in the range of 60 percent is achievable.

6) NOx Sorbent Technology

The exhaust gas passes through a bed of vermiculite impregnated with magnesium oxide. The NOx is adsorbed on the bed and forms magnesium nitrate. When used with a bed of virgin vermiculite upstream of the one containing magnesium oxide, a removal efficiency of 50 to 70 percent has been reported. The vermiculite sorbent technology operates in a temperature region more suited to test cell application than either SCR or SNCR. The system is designed for exposure to the entire exit gas flow. However, due to excessive pressure drop only a small portion of the gas stream is exposed to the sorbent beds. This technology has not been demonstrated on a full-scale working test cell.

7) Water or Steam Injection

Water/steam injection is an established NOx control technology for stationary gas turbines. The water or steam injected into the primary combustion zone of a gas turbine engine provides a heat sink, which lowers the flame temperature and thereby reduces thermal NOx formation. Water/steam injection is used to achieve NOx removal efficiencies of 70 to 85 percent.

8) Fuel Emulsion

Water-in-fuel emulsion reduces NOx in primarily the same manner as water/steam injection by lowering the peak flame temperature. The water-in-fuel suspension allows heat absorption to occur due to the homogenous nature of the emulsion and close vicinity to the burning fuel droplet. The process creates the emulsion prior to injection and combustion. In contrast, water/steam injection fluid is a heterogeneous post-combustion mixture. Water-in-fuel emulsion allows for a lower water to fuel ratio than water/steam injection. Unlike water/steam injection, injection nozzles mounted within the combustor are not required. NOx emission reductions of 70 percent are achievable.

Step 2 – Eliminate Technologically Infeasible Options

The technical feasibility of the control methods described above are summarized based on the feasibility analysis given in the EPA-DOT report 453/R-94-068.

1) Direct Atmospheric Exhaust

In the absence of any feasible NOx control technologies currently available, the direct atmospheric exhaust is determined to be BACT.

2) Selective Catalytic Reduction

This technology is available in the United States, and is used with stationary gas turbine applications for power plants. However, there are significant differences between exhaust gas characteristics of power plants and those from test cells. The test cell stack gas temperatures are below those required by SCR systems. Also, the stack gas temperature and the NOx emission rates will vary with engine thrust and the augmentation air. The stack gas flow rate and the stack gas temperature vary significantly as the augmentation ratio increases as occurs with turbojet and turbofan engines. Reduction in the level of augmentation air flow would elevate the exhaust gas temperature to levels suitable for the SCR catalyst. However, the level of augmentation air is determined from the calibration and cooling requirements of the test cell. Therefore, it is not feasible to introduce a system to automatically adjust the level of augmentation air flow to minimize reheat requirements and maintain engine test integrity. The jet engine test cell back pressure affects the augmentation air and calibration of the jet engine. Excessive back pressure can cause exhaust gas recirculation and engine stall and may affect representative test measurements. However, if a minimum augmentation ratio is maintained, inlet air vortices may be avoided. The stack gas from test cells can be heated using a duct burner to raise and maintain the stack gas temperature to the catalyst operating temperature. However, the use of a duct burner would increase the NOx emissions entering the SCR system. In addition, the use of a duct burner in afterburner applications could result in a flashback of the well mixed fuel should flame out or failure of the afterburner occur. The NH_3 injection system must track NOx emission rates, and maintain the proper NOx to NH_3 ratio. The rapid and frequent changes in engine output will place demands on the SCR controller not found in current (non-test cell) installations where SCR technology is used. Improper NOx to NH_3 ratio will result in excess release of either NOx or NH_3.

3) Non-Thermal Plasma Systems

This is an emerging technology, and has only been demonstrated on a field-pilot scale in one test cell in practice. This technology is capable of achieving greater than 50 percent NOx removal under normal jet engine test cell operating conditions. Although most testing has been performed in laboratory settings, the results of this work indicate that non-thermal plasma systems are completely practical at much larger scales than investigated.

4) Selective Non-Catalytic Reduction (SNCR)

Test cell stack gas temperatures are significantly below the 1,800°F to 2,000°F range where SNCR is viable. In addition, a uniform NOx control distribution and an ammonia or urea injection system are required to ensure maximum NOx reduction, and to prevent release of excess NH_3. There is actually a potential for greater NOx production associated with heating of exhaust gases with a duct burner to raise temperature to that required by SNCR. The reheat requirements are a function of test cell operating characteristics which are highly transient and differ by type of engine tested.

5) Reburn NOx Control Technology

Bench-scale studies of reburning in an oxygen-rich gas such as that from a test cell exhaust have been performed. The respective removal efficiencies for 1,000 parts per million (ppm) and 500 ppm NOx inlet concentrations were reported at 50 and 30 percent. No studies have been conducted at NOx concentration of 100 ppm, which is typical of test cell operation. Assuming removal efficiency of 10 percent for 100 ppm of NOx was based upon the "Study of Nitrogen Oxide Emissions and Their Control From Uninstalled Aircraft Engines in Enclosed Test Cells (EPA-453/R-94-068)."

Elimination of Infeasible Control Options

All of the options listed above are considered to be feasible with the exception of options 6, 7, and 8. The technical feasibility of the control methods described are summarized based on the feasibility analysis given in the EPA-DOT report 453/R-94-068.

6) NOx Sorbent Technology

This is an emerging technology and has not been demonstrated on a full scale test cell in practice. Until more research and evaluations are performed, the safety and performance issues of this technology cannot be addressed. Therefore, this control option is considered technologically infeasible.

7) Water or Steam Injection

The use of water/steam injection would require temporary engine modifications and would alter the performance characteristics of the engine being tested. Specifically, the fuel usage would increase directly related to the latent and sensible heat of the water, the increased fuel and water flow would increase turbine rotor speed and engine thrust, the increase in turbine rotor speed would increase compressor speed and result in an increase in engine pressure ratio, and engine tests to a specific thrust could be reached at a lower inlet temperature due to increased mass flow and at reduced fan speeds which would limit information regarding blade failures and vibrations. Since the engines are tested in a cell to evaluate their performance characteristics, any modifications affecting performance would run counter to the actual reason for testing the engines. In addition, it would result in generating significant quantities of wastewater contaminated with hydrocarbons, requiring treatment. Therefore, this control option is considered technologically infeasible.

8) Fuel Emulsion

Similarly to water/steam injection, the use of water-in-fuel emulsion would require temporary engine modifications and would alter the performance characteristics of the engine being tested. Since the engines are tested in a cell to evaluate their performance characteristics, any modifications affecting performance would run counter to the actual reason for testing the engines. Therefore, this control option is considered technologically infeasible.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Rank	Control Technology	Achieved in Practice
1	Selective Catalytic Reduction	N
2	Non-Thermal Plasma System	N
3	Selective Non-Catalytic Reduction	N
4	Reburn NOx Control Technology	N
5	Direct Atmospheric Exhaust	Y

There are no remaining control technologies for NOx.

Step 4 – Cost Effectiveness Analysis

Pursuant to Section IX.D of District Policy APR 1305 – BACT Policy, a cost effectiveness analysis is required for the options that have not been determined to be achieved in practice. In accordance with the District's Revised BACT Cost Effectiveness Thresholds Memo (5/14/08), to determine the cost effectiveness of particular technologically feasible control options or alternate equipment options, the amount of emissions resulting from each option will be quantified and compared to the District Standard Emissions allowed by the District Rule that is applicable to the particular unit. The emission reductions will be equal to the difference between the District Standard Emissions and the emissions resulting from the particular option being evaluated.

Option 1 – Selective Catalytic Reduction (Technologically Feasible)

URS Technology Development Department has provided up to date capital cost information for SCR. The capital cost information was submitted in October 2013.

The exhaust gas flow rate from the jet engines tested in the jet engine test cells is 71,071 acf per second as determined by the Navy Aircraft Environmental Support Office (AESO).

The exhaust gas from the test cells must be heated to raise and maintain the stack gas temperature to the catalyst operating temperature. For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to heat the exhaust.

<u>Design Basis</u>

- Exhaust gas flow rate = 71,071 acf per second (per applicant)
- Warmup Heater Heat Input Rating = 564 MMBtu/hr (per applicant)
- Warmup Time = 1.5 hours (estimated per applicant)
- Annual Number of Tests = 1,873 (per applicant)

- Natural Gas Cost = \$5/MMBtu (per applicant)
- Ammonia cost = \$700/ton (per applicant)
- NH_3 stoichiometric consumption = 1.1 mol NH_3 per mol NO_2 (per applicant)
- SCR control efficiency = 80% (per EPA-DOT report 453/R-94-068)
- Catalyst cost = \$10,000/m^3 (per applicant)
- Catalyst space velocity = 12,000 hr^{-1} (per applicant)
- Standard temperature = 60 deg F (District Rule 1020)
- SCR temperature = 700 deg F (per applicant)
- Standard molar volume = 379.5 scf/lbmol
- Air molecular weight = 29 lb/lbmol
- NO2 molecular weight = 46 lb/lbmol
- NH3 molecular weight = 17 lb/lbmol

Capital Cost Selective Catalytic Reduction System

The basis for the SCR system capital cost is the recent purchased cost of \$2,516,000 for a SCR system serving a gas turbine engine with an exhaust mass flow rate of 2,296,000 lb/hr.

Exhaust flow rate = 71,071 acf per second
= 71,071 acf/s x (460+60)/(460+700)
= 31,859 scf/s

Assuming the exhaust is primarily air,

Mass flow rate = 31,859 scf/s x lbmol/379.5 scf x 29 lb/lbmol
= 2,434.58 lb/s
= 8,764,487 lb/hr

Using the six-tenths rule to scale the capital cost for this project,

Capital Cost = \$2,516,000 x (8,764,487 ÷ 2,296,000)$^{0.6}$
= \$5,620,351

Catalyst Costs

Exhaust flow rate = 71,071 acf per second
= 71,071 acf/s x 60 s/min x 60 min/hr
= 255,855,600 acf/hr

Catalyst volume = Exhaust flow rate ÷ Catalyst space velocity
= 255,855,600 acf/hr ÷ 12,000 hr^{-1}
= 21,321.3 ft^3
= 603.75 m^3

Catalyst cost = 603.75 m^3 x \$10,000/m^3
= \$6,037,520

Selective Catalytic Reduction – Cost Estimate	
Cost Description	Cost ($)
Direct Costs (DC)	
Catalyst	6,037,520
SCR System	5,620,351
Warm up System (Burner, fan, etc.)	1,100,000
Ducting and Stack	2,500,000
Base Equipment Costs (Total)	15,257,871
Instrumentation	0.10 x 15,257,871 = 1,525,787
Sales Tax (7.5% in Lemoore, CA October 2013)	0.075 x 15,257,871 = 1,144,340
Freight	0.05 x 15,257,871 = 762,894
Purchased equipment cost	**18,690,892**
Foundations & supports	0.08 x 18,690,892 = 1,495,271
Handling & erection	0.14 x 18,690,892 = 2,616,725
Electrical	0.04 x 18,690,892 = 747,636
Piping	0.02 x 18,690,892 = 373,818
Painting	0.01 x 18,690,892 = 186,909
Insulation	0.01 x 18,690,892 = 186,909
Direct installation costs	**5,607,268**
Total Direct Costs	**24,298,160**
Indirect Costs (IC)	
Engineering	0.10 x 18,690,892 = 1,869,089
Construction and field expenses	0.05 x 18,690,892 = 934,545
Contractor fees	0.10 x 18,690,892 = 1,869,089
Start-up	0.02 x 18,690,892 = 373,818
Performance test	0.01 x 18,690,892 = 186,909
Contingencies	0.03 x 18,690,892 = 560,727
Total Indirect Costs	**5,794,177**
Total Capital Cost (DC + IC + Catalyst Cost)	**30,092,336**

Annualized Capital Cost

Pursuant to District Policy APR 1305, section X (11/09/99), the capital cost for the purchase of the SCR system will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system will be estimated at 10 years. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$$A = [P \times i(i+1)^n]/[(i+1)^n-1]$$

Where:
- A = Annual Cost
- P = Present Value
- i = Interest Rate (10%)
- N = Equipment Life (10 years)

$$A = [\$30,092,336 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$$
$$= \mathbf{\$4,897,389/year}$$

Annual Costs

Operation and Maintenance Costs

The Direct annual costs include labor (operating, supervisory, and maintenance), maintenance, and fuel.

Ammonia Costs

Assuming a stoichiometric ratio of 1.1 moles of NH_3 per mole of NO_2,

Uncontrolled NOx emissions = 916,661 lb/year (per Engineering Evaluation)

Controlled NOx emissions = 916,661 lb/year x 0.80 = 733,329 lb/year

NH_3 usage = 733,329 lb-NOx/year x 17 lb NH_3/46 lb NO_2 x 1.1 mol NH_3/mol NO_2
= 298,114 lb NH_3
= 149.1 ton NH_3

Annual Ammonia Cost = 149.1 ton NH_3 x \$700/ton = \$104,340/year

Fuel Costs

A warmup heater would be required to heat up the exhaust prior to treatment through the SCR system.

Annual Heat Input Required = 564 MMBtu/hr x 1.5 hr/test x 1,873 tests/yr = 1,584,558 MMBtu/yr

Fuel Cost = 1,584,558 MMBtu/year x $5/MMBtu
= $7,922,790/year

Total Annual Cost

Total Annual Cost			
Operator	0.5 h/shift, 3 shifts/day	$30/h	$16,425
Supervisor	15% of operator		$2,464
Maintenance			
Labor	0.5 h/shift, 3 shifts/day	$30/h	$16,425
Material	100% of labor		$16,425
Utility			
Ammonia Solution			$104,340
Natural Gas			$7,922,790
Indirect Annual Cost (IC)			
Overhead	60% of Labor Cost		$9,855
Administrative	2% TCI		$601,847
Property Taxes	1% TCI		$300,923
Insurance	1% TCI		$300,923
Total Annual Cost			**$9,292,417**

Total Costs

Total Costs = Annualized Capital Cost + Total Annual Cost

Total Costs = $4,897,389 + $9,292,417 = $14,189,806

Emission Reductions

The EPA-DOT report 453/R-94-068 indicates SCR would achieve a 80% NOx reduction.

Annual Emission Reduction = Uncontrolled Emissions x 0.80
= 916,661 lb-NOx/year x 0.80
= 733,329 lb-NOx/year
= 366.7 tons-NOx/year

Cost Effectiveness

Cost Effectiveness = $14,189,806/year ÷ 366.7 tons-NOx/year
= $38,700/ton-NOx

The analysis demonstrates that the annualized capital cost and annual operation and maintenance costs of the Selective Catalytic Reduction system and associated utility costs results in a cost effectiveness which exceeds the District's Guideline of $24,500/ton-NOx. Therefore, this option is not cost effective and is being removed from consideration.

Option 2 – Non-Thermal Plasma Systems (Technologically Feasible)

The facility has contacted various vendors and the control technology of non-thermal plasma systems are not commercially available in today's market place. Therefore, the capital and annual cost from the report entitled NOx Removal in Jet Engine Test Cell Exhaust, Los Alamos National Laboratory, LA-UR-99-3072 will be used for this project.

Per applicant, the maximum exhaust flow rate from the jet engine tested in the test cells is 583,128 scfm. The report entitled NOx Removal in Jet Engine Test Cell Exhaust, Los Alamos National Laboratory, LA-UR-99-3072 provides cost data for two gas flow rate scenarios. The cost data from gas flow rate scenario of 5.89×10^4 scfm will be used as a conservative estimate.

Total Annual Cost

The report entitled NOx Removal in Jet Engine Test Cell Exhaust, Los Alamos National Laboratory, LA-UR-99-3072 provides total annual costs assuming 108 hours per week operation for three types of Non-Thermal Plasma Systems: pulsed corona, corona shower, and electron beam.

Total Annual Cost			
	Pulsed Corona	Corona Shower	Electron Beam
Total Annual Cost ($/ton)	7,139,000	8,230,000	10,931,000
Total Annual Cost adjust from 1997 to 2012 dollars, multiply by 1.4125, 2.75% inflation per year ($/ton)	10,083,838	11,624,875	15,440,038

Emission Reductions

The report entitled NOx Removal in Jet Engine Test Cell Exhaust, Los Alamos National Laboratory, LA-UR-99-3072 provides the NOx emission reduction percentage for the three types of Non-Thermal Plasma Systems: pulsed corona, corona shower, and electron beam.

NOx Removal Percentage			
	Pulsed Corona	Corona Shower	Electron Beam
NOx Removal (%)	56%	90%	70%

Annual Emission Reduction = Uncontrolled Emissions x NOx Removal Percentage
= 916,661 lb-NOx/year x NOx Removal Percentage

Annual Emission Reduction			
	Pulsed Corona	Corona Shower	Electron Beam
Annual Emission Reduction (tons)	256.7	412.5	320.8

Cost Effectiveness

Cost Effectiveness = Total Annual Cost ÷ Annual Emission Reduction

Cost Effectiveness			
	Pulsed Corona	Corona Shower	Electron Beam
Cost Effectiveness ($/ton)	39,283	28,182	48,130

The analysis demonstrates that the total annual costs of the Non-Thermal Plasma System results in a cost effectiveness which exceeds the District's Guideline of $24,500/ton-NOx. Therefore, this option is not cost effective and is being removed from consideration.

Option 3 – Selective Non-Catalytic Reduction (Technologically Feasible)

URS Technology Development Department has provided up to date capital cost information for SNCR.

As stated previously, the exhaust gas flow rate from the jet engines tested in the jet engine test cells is 71,071 acf per second as determined by the Navy Aircraft Environmental Support Office (AESO).

The exhaust gas from the test cells must be heated to raise and maintain the stack gas temperature to the SNCR operating temperature. For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to heat the exhaust.

Design Basis

- Exhaust gas flow rate = 71,071 acf per second (per applicant)
- Warmup Heater Heat Input Rating = 3,588.5 MMBtu/test (per applicant)
- Annual Number of Tests = 1,873 (per applicant)
- Natural Gas Cost = $5/MMBtu (per applicant)
- Ammonia cost = $700/ton (per applicant)
- NH_3 stoichiometric consumption = 1.1 mol NH_3 per mol NO_2 (per applicant)
- SNCR control efficiency = 50% (per EPA-DOT report 453/R-94-068)
- Standard temperature = 60 deg F (District Rule 1020)
- SNCR temperature = 1500 deg F (per applicant)
- Standard molar volume = 379.5 scf/lbmol
- Air molecular weight = 29 lb/lbmol
- NO2 molecular weight = 46 lb/lbmol
- NH3 molecular weight = 17 lb/lbmol

Capital Cost Selective Non-Catalytic Reduction System

The basis for the SNCR system capital cost provided by the applicant is the 2001 purchased cost of $1,427,402 for a SNCR system serving a gas turbine engine at the exhaust mass flow rate of the jet engine test cells in this project.

Capital Cost = $1,427,402 (2001 dollars)

Selective Non-Catalytic Reduction – Cost Estimate	
Cost Description	Cost ($)
Direct Costs (DC)	
SNCR System (2001 dollars)	1,427,402
Adjusting factor from 2001 dollars to 2013 dollars (2.75% inflation/year)	1.38
Inflation adjusted SNCR System	1,976,643
Warm up System (Burner, fan, etc.)	1,100,000
Ducting and Stack	2,500,000
Base Equipment Costs (Total)	5,576,643
Instrumentation	0.10 x 5,576,643 = 557,664
Sales Tax (7.5% in Lemoore, CA October 2013)	0.075 x 5,576,643 = 418,248
Freight	0.05 x 5,576,643 = 278,832
Purchased equipment cost	**6,831,388**
Foundations & supports	0.08 x 6,831,388 = 546,511
Handling & erection	0.14 x 6,831,388 = 956,394
Electrical	0.04 x 6,831,388 = 273,256
Piping	0.02 x 6,831,388 = 136,628
Painting	0.01 x 6,831,388 = 68,314
Insulation	0.01 x 6,831,388 = 68,314
Direct installation costs	**2,049,416**
Total Direct Costs	**8,880,804**
Indirect Costs (IC)	
Engineering	0.10 x 6,831,388 = 683,139
Construction and field expenses	0.05 x 6,831,388 = 341,569

Contractor fees	0.10 x 6,831,388 = 683,139
Start-up	0.02 x 6,831,388 = 136,628
Performance test	0.01 x 6,831,388 = 68,314
Contingencies	0.03 x 6,831,388 = 204,942
Total Indirect Costs	**2,117,730**
Total Capital Cost (DC + IC + Catalyst Cost)	**10,998,534**

Annualized Capital Cost

Pursuant to District Policy APR 1305, section X (11/09/99), the capital cost for the purchase of the SCR system will be spread over the expected life of the system using the capital recovery equation. The expected life of the entire system will be estimated at 10 years. A 10% interest rate is assumed in the equation and the assumption will be made that the equipment has no salvage value at the end of the ten-year cycle.

$$A = [P \times i(i+1)^n]/[(i+1)^n-1]$$

Where: A = Annual Cost
P = Present Value
i = Interest Rate (10%)
N = Equipment Life (10 years)

$$A = [\$10,998,534 \times 0.1(1.1)^{10}]/[(1.1)^{10}-1]$$
$$= \mathbf{\$1,789,961/year}$$

Annual Costs

Operation and Maintenance Costs

The Direct annual costs include labor (operating, supervisory, and maintenance), maintenance, and fuel.

Ammonia Costs

Uncontrolled NOx emissions = 916,661 lb/year (per Engineering Evaluation)

Controlled NOx emissions = 916,661 lb/year x 0.50 = 458,331 lb/year

NH_3 usage = 458,331 lb-NOx/year x 17 lb NH_3/46 lb NO_2 x 1.1 mol NH_3/mol NO_2
= 186,322 lb NH_3
= 93.2 ton NH_3

Annual Ammonia Cost = 93.2 ton NH_3 x \$700/ton = \$65,213/year

Fuel Costs

A warmup heater would be required to heat up the exhaust prior to treatment through the SNCR system.

Annual Heat Input Required = 3,588.5 MMBtu/test x 1,873 tests/yr = 6,721,260.5 MMBtu/yr

Fuel Cost = 6,721,260.5 MMBtu/year x $5/MMBtu
= $33,606,303/year

Total Annual Cost

Total Annual Cost			
Operator	0.5 h/shift, 3 shifts/day	$30/h	$16,425
Supervisor	15% of operator		$2,464
Maintenance			
Labor	0.5 h/shift, 3 shifts/day	$30/h	$16,425
Material	100% of labor		$16,425
Utility			
Ammonia Solution			$65,213
Natural Gas			$33,606,303
Indirect Annual Cost (IC)			
Overhead	60% of Labor Cost		$9,855
Administrative	2% TCI		$219,971
Property Taxes	1% TCI		$109,985
Insurance	1% TCI		$109,985
Total Annual Cost			**$34,173,051**

Total Costs

Total Costs = Annualized Capital Cost + Total Annual Cost

Total Costs = $1,789,961 + $34,173,051 = $35,963,012

Emission Reductions

The EPA-DOT report 453/R-94-068 indicates SNCR would achieve a 50% NOx reduction.

Annual Emission Reduction = Uncontrolled Emissions x 0.50
= 916,661 lb-NOx/year x 0.50
= 458,331 lb-NOx/year
= 229.2 tons-NOx/year

Cost Effectiveness

Cost Effectiveness = $35,963,012/year ÷ 229.2 tons-NOx/year
= $156,930/ton-NOx

The analysis demonstrates that the annualized capital cost and annual operation and maintenance costs of the Selective Non-Catalytic Reduction system and associated utility costs results in a cost effectiveness which exceeds the District's Guideline of $24,500/ton-NOx. Therefore, this option is not cost effective and is being removed from consideration.

Option 4 – Reburn NOx Control Technology (Technologically Feasible)

The EPA-DOT report 453/R-94-068 indicates that the cost effectiveness estimates do not reflect any costs beyond those associated with the methane gas consumption.

For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to combust the exhaust.

Analysis Basis

- Standard temperature = 60 deg F (District Rule 1020)
- SNCR temperature = 900 deg F (per applicant)
- Heat Required = 1,936 MMBtu/test (per applicant)
- Annual Number of Tests = 1,873 (per applicant)
- Natural Gas Cost = $5/MMBtu (per applicant)

Fuel Costs

The applicant has indicated the amount of heat required to perform a reburn for the jet engine test cells in this project is 1936 MMBtu per test.

Fuel Cost = 1,936 MMBtu x 1,873 tests/year x $5/MMBtu
= $18,130,640/year

Emission Reductions

The EPA-DOT report 453/R-94-068 indicates that the cost effectiveness of Reburn NOx was based on bench scale studies for inlet NOx concentration in the range of 500 to 1,000 ppm. The report further indicates that an optimistic 10 percent reduction in NOx was assumed based on an estimate of mean stack NOx concentrations levels of 100 ppm; actual NOx concentrations could be lower because it depends on the augmentation air flow. The report adds that the assumption of 10 percent NOx reduction has not been proven.

Annual Emission Reduction = Uncontrolled Emissions x 0.10
= 916,661 lb-NOx/year x 0.10
= 91,666 lb-NOx/year
= 45.8 tons-NOx/year

Cost Effectiveness

Cost Effectiveness = \$18,130,640/year ÷ 45.8 tons-NOx/year
= \$395,580/ton-NOx

The analysis demonstrates that the Reburn system utility costs alone results in a cost effectiveness which exceeds the District's Guideline of \$24,500/ton-NOx. Therefore, this option is not cost effective and is being removed from consideration.

Option 5 – Direct Atmospheric Exhaust (Achieved in Practice)

This option listed above has been identified as achieved in practice for NOx emissions. Therefore, a cost analysis is not necessary.

Step 5 – Select BACT

Pursuant to the above Top-Down BACT Analysis, BACT for the jet engine test facility must be satisfied with the following:

NOx: Direct Atmospheric Exhaust (Achieved in Practice)

The applicant has proposed direct atmospheric exhaust for the jet engine test cells and pad in this project. Therefore, the BACT requirements are satisfied.

2. SOx and PM10 Top-Down BACT Analysis for Permit Units C-2106-23-4, '70-5, and '74-4

Sulfur oxides (SOx) and Particulate Matter are the result of combustion of sulfur containing compounds in the fuel, and thus are proportional to fuel sulfur content.

Particulate control technologies were obtained from the EPA Report entitled, "Stationary Source Control Techniques Document for Fine Particulate Matter," EPA Contract Number 68-D-98-026, Work Assignment Number 0-08, October 1998, and "Airborne Particulate Matter: Pollution Prevention and Control," Pollution Prevention and Abatement Handbook, World Bank Group, July 1998.

Step 1 – Identify all control technologies

The operational complexity of altitude simulating test cells further complicates the development of flue gas abatement techniques. Typically, the altitude facility will have less available plot space to install control devices. Large temperature swings will place greater demands on flue gas conditions, and potential failure in temperature control can result in catastrophic failure in downstream systems due to the thermal shock. Altitude facilities are less uniform in design, and site-specific factors will dominate potential control design. As NAS Lemoore operates sea level jet engine test cells and pads, this BACT determination is applicable for sea level jet engine test cells and pads.

<u>South Coast AQMD BACT Guideline</u>

South Coast AQMD BACT Guideline for Non-Major Polluting Facilities lists a BACT requirement for PM10 of Venturi Scrubber with Water Spray in Exhaust for Subcategory Experimental High Altitude Testing. The Subcategory Experimental Sea Level (Low Altitude) Testing does not list a control technology for PM10. As the jet engine test cells and pad at NAS Lemoore are at sea level, the South Coast AQMD BACT requirement of Venturi Scrubber with Water Spray in Exhaust for experimental high altitude testing is not applicable.

The following control technologies have been identified for jet engine test facilities.

1) Jet Fuel Sulfur Content ≤ 3,000 ppmw
2) Settling Chamber
3) Elutriator
4) Momentum Separator
5) Mechanically-aided Separator
6) Flue Gas Conditioning
7) Inertial or Impingement (Cyclone) Separator
8) Electrostatic Precipitator
9) Filter and Dust Collector (Baghouse)
10) Wet Scrubber

<u>Description of Control Technologies</u>

The performance of particulate control devices can often be improved through pretreatment of the gas stream. For PM control devices, pretreatment consists of two categories: 1) precollection and 2) flue gas conditioning. Precollection devices remove large particles from the gas stream, reducing the particulate loading on the primary control device. Flue gas conditioning techniques alter the characteristics of the particles and/or the gas stream to allow the primary control device to function more effectively. Both types of pretreatment can lead to increased collection efficiency and operating life, while reducing operating costs.

The vast majority of precollection devices are mechanical collectors. They can be used in combination with other particulate control equipment or as a stand-alone control method depending upon the particulate density in the gas stream and the desired removal efficiency. The five major types of mechanical collectors are settling chambers, elutriators, momentum separators, mechanically aided collectors, and centrifugal separators (cyclones), which are described below.

1) Jet Fuel Sulfur Content ≤ 3,000 ppmw

Over the past decade there has been a worldwide trend to lower sulfur content in motor gasoline and diesel fuel with some countries requiring near-zero sulfur today or in the near future. A similar reduction has not occurred for jet fuel; the specifications continue to allow a maximum of 4000 ppmw sulfur although the worldwide average sulfur content in jet fuel appears to be between 500 and 1000 ppmw.

There has been discussion within the aviation industry over the past few years about taking proactive steps to reduce the maximum sulfur content in the fuel specifications, but no changes have been made to date. Reducing sulfur content significantly could lead to changes in other fuel properties, which would have to be considered before introducing the change.

In the case of the jet engine test cells and pad at NAS Lemoore, the jet engines are required to go through maintenance testing for the purposes of certifying the safe operation. Any change to fuel properties may result in an increased engine maintenance backlog or incomplete testing that may have serious effect on the military operational readiness of the Navy.

The SOx emissions for the jet engine test cells and pad are based upon a maximum fuel sulfur content of 0.3% by weight (equivalent to 3,000 ppmw) per a Department of Defense fuel specification sheet that indicates the total sulfur content of turbine fuel, aviation grades JP-4 and JP-5.

The applicant has provided a fuel solicitation document that is issued as a request for proposal to fuel suppliers. The document lists a fuel sulfur content limit of 2,000 ppmw. The applicant has provided fuel tests that show JP-5 sulfur content can be as low as 400 ppm by weight. The refiner of the fuel used at this facility, Valero, has performed fuel tests that show a JP-5 fuel sulfur content of 200-1,000 ppm by weight from the period of January 2012 to May 2014.

Although the fuel used in this operation has a sulfur content lower than the Department of Defense fuel specification requirements, the engines tested have to be able to operate on all fuels used by the military worldwide which include fuels with a sulfur content up to 0.3% by weight. In addition, the San Diego County Air Pollution Control District (SDCAPCD) has issued a Permit to Operate to the MCAS Miramar facility for a jet engine test cell (P/O Nos. 960118–960123) with a jet fuel sulfur content limit of 0.3% by weight. In 2010, the SDCAPCD revised the MCAS Miramar jet engine test cell permit by increasing the allowable fuel sulfur content from 0.05% by weight to 0.3% by weight in order to reflect the types of fuels needed to be purchased in accordance with military specifications for use throughout the world. Therefore, a jet fuel sulfur content limit of 0.3% by weight has been established as Achieved in Practice.

2) Settling Chambers

Settling chambers rely on gravitational settling as a collection mechanism. There are two primary types of settling chambers: the expansion chamber and the multiple-tray chamber. In the expansion chamber, the velocity of the gas stream is significantly reduced as the gas expands into a large chamber. The reduction in velocity allows larger particles to settle out of the gas stream. Collection efficiency for PM_{10} is very low, typically less than 10 percent.

3) Elutriators

Like settling chambers, elutriators also rely on gravitational settling to collect particles and have similar collection efficiency. An elutriator is made up of one or more vertical tubes or towers in series, where the gas stream passes upward through the tubes. Larger particles whose terminal settling velocity is greater than the upward gas velocity are collected at the bottom of the tube, while smaller particles are carried out of the top of the tube.

4) Momentum Separators

Momentum separators utilize both gravity and inertia to separate particles from the gas stream. Separation is accomplished by forcing the gas flow to sharply change direction within a gravity settling chamber through the use of strategically placed baffles. Because these devices utilize inertia in addition to gravity, momentum separators achieve collection efficiencies approaching 20 percent for PM_{10}.

5) Mechanically-aided Separators

Mechanically-aided separators rely on inertia as a separation mechanism. The gas stream is accelerated mechanically, which increases the effectiveness of the inertia separation. As a result, mechanically-aided separators can collect smaller particles than momentum separators. Mechanically-aided separators have higher operating costs as a result of higher pressure drops. Mechanically-aided separators are capable of collection efficiencies approaching 30 percent for PM_{10}.

6) Flue Gas Conditioning

Flue gas conditioning is used to modify the characteristics of the gas stream and particles to enhance particle removal in the primary collection device. Flue gas conditioning is primarily used at coal fired power plants and can be of different types: sulfur trioxide conditioning, ammonia conditioning, ammonium compound (ammonium sulfate and ammonium bisulfate) conditioning, organic amine (triethylamine) conditioning, and alkali conditioning. Usually, flue gas conditioning involves the use of chemicals that are added to the gas stream to improve the fly ash properties and electrical conditions in electrostatic precipitators. Fabric filter and scrubber performance is far less dependent on the chemical composition of the gas and particles, so these devices typically do not employ chemical conditioning for particle removal.

7) Inertial or Impingement (Cyclone) Separators

While cyclones rely on the same separation mechanism as momentum separators, cyclones are more effective because they have a more complex gas flow pattern. Cyclones use inertia to remove particles from a spinning gas stream, usually conical-shaped chamber. Cyclone collectors can be designed for many applications, and they are typically categorized as high efficiency, conventional, or high throughput. High efficiency cyclones are likely to have the highest pressure drops of the three cyclone types; high throughput cyclones can treat large volumes of gas with a low pressure drop.

Inertial or impingement separators rely on the inertial properties of the particles to separate them from the carrier gas stream and are used for the collection of medium-size and coarse particles. Cyclones are low-cost, low-maintenance centrifugal collectors that are typically used to remove particulates in the size range of 10–100 microns.

For single cyclones, conventional cyclones can remove particles of diameter 10 microns with 85 to 90 percent efficiency, particles of diameter 5 microns with 75 to 85 percent efficiency, and particles of diameter 2.5 microns or less with 60 to 75 percent efficiency. High efficiency single cyclones can remove particles of diameter 5 microns at efficiencies reaching 90 percent, with higher efficiencies achievable for larger particles. High throughput cyclones are only guaranteed to remove particles of diameter greater than 20 microns, although collection of smaller particles does occur to some extent. Multi-cyclones are reported to achieve from 80 to 95 percent efficiency for particles of diameter 5 microns. In some cases, multiple cyclones have been used as primary collection devices.

The fine-dust-removal efficiency of cyclones is typically below 70 percent, whereas ESPs and baghouses have removal efficiencies of 99.9 percent or more. Cyclones are often used as a primary stage before other PM removal mechanisms.

Advantages

- Low capital cost
- Relative simplicity and few maintenance problems
- Relatively low operating pressure drop of approximately 2 to 6 inches of water column (w.c.)
- Temperature and pressure limitations based only on the materials of construction used
- Dry collection and disposal
- Relatively small space requirements

Disadvantages

- Relatively low overall particulate collection efficiencies, especially for particulate sizes below 10 microns
- Inability to handle tarry or sticky material

8) Electrostatic Precipitators

Electrostatic precipitators (ESPs) remove particles by using an electrostatic field to attract the particles to the electrodes. ESP collection efficiencies for fine particulates and trace emissions of some toxic metals are typically in the order of 99 percent or more of the inlet dust loading. The collection efficiency is dependent on the design, proper operation, and maintenance. ESPs are less sensitive to maximum temperatures than fabric filters are, and they operate with a very low pressure drop. The power requirement for ESPs is similar to that of fabric filters.

Temperature and chemical composition of the dust and gas stream are factors that can influence dust resistivity. Current is conducted through dust by two means: volume conduction and surface conduction. Volume conduction takes place through the material itself and is dependent on the chemical composition of the dust. Surface conduction occurs through the gases or the liquids adsorbed by the particles and is dependent on the chemical composition of the gas stream. Volume resistivity increases with increasing temperatures and is the dominant resistant force at temperatures above approximately 350°F. Surface resistivity decreases as temperature increases and predominates at temperatures below about 250°F. Between 250°F and 350°F, volume and surface resistivity exert a combined effect, with total resistivity highest in this temperature range. Dust resistivity is generally not a factor for wet ESPs.

Advantages

- Collection efficiencies of 99.9 percent or greater for coarse and fine particulates at relatively low energy consumption
- Dry collection and disposal of dust
- Low pressure drop--typically less than 1 inch of w.c.
- Continuous operation with minimum maintenance
- Relatively low operation costs
- Operation capability at high temperatures up to 1,300°F and high pressures up to 150 pounds per square inch or under vacuum

Disadvantages

- High sensitivity to fluctuations in gas stream conditions (flow rates, temperature, particulate and gas composition, and particulate loadings)
- Difficulties with the collection of particles with extremely high or low resistivity
- Relatively large space requirement for installation
- Explosion hazard when dealing with combustible gases or particulates
- Special precautionary requirements for safeguarding personnel from high voltage during ESP maintenance by de-energizing equipment before work commencement
- Production of ozone by the negatively charged electrodes during gas ionization
- Highly trained maintenance personnel required

9) Filters and Dust Collectors (Baghouses)

Baghouses collect dust by passing flue gases through a filter media that includes woven fabric, needled felt, plastic, ceramic, and metal. The operating temperature of the baghouse gas influences the choice of fabric. Accumulated particles are removed by mechanical shaking, reversal of the gas flow, or a stream of high-pressure air. Fabric filters are efficient (99.9 percent removal) for both high and low concentrations of particles but are suitable only for dry and free-flowing particles. Their efficiency in removing toxic metals such as arsenic, cadmium, chromium, lead, and nickel is greater than 99 percent.

Although fabric filters are 99.9 percent efficient in removing both high and low concentrations of particles, they are suitable only for dry and free-flowing particles. Other advantages and disadvantages are as follows:

Advantages

- Very high collection efficiency (up to 99.9 percent) for both coarse and fine particulates
- Can accommodate gas stream fluctuations and large changes in inlet dust loadings if filters are cleaned continuously
- Dry recovery of collected material for subsequent processing and disposal
- No corrosion problems
- Low maintenance
- High collection efficiency of submicron smoke and gaseous contaminants through the use of selected fibrous or granular filter aids
- Various configurations and dimensions of filter collectors
- Relatively simple operation

Disadvantages

- Requires costly refractory mineral or metallic fabric at temperatures in excess of 550°F
- Fabric treatment is needed to remove collected dust and reduce seepage of certain dusts
- Explosion and fire hazard of certain dusts in the presence of accidental spark or flame, and fabric fire hazard in case of readily oxidizable dust collection
- Shortened fabric life at elevated temperatures and in the presence of acid or alkaline particulate or gas constituents
- Potential plugging of the fabric due to caking and need for special additives due to moisture condensation or adhesive (tarry) components
- Respiratory protection requirement for fabric replacement
- Pressure-drop requirements are typically in the range 4 to 10 inches of w.c.

10)Wet Scrubbers

Wet scrubbers remove dust particles from the gas stream using a liquid spray. The primary use of wet scrubbers is to remove gaseous emissions, with the added benefit of removing particulates. The dominant means of PM capture in most industrial wet scrubbers is inertial impaction of the PM onto liquid droplets.

Efficiency of scrubbers that rely on inertial impaction is dependent on the following:

- Particle size – Scrubber efficiency increases as particle size increases; conversely the collection efficiency for small particles (less than 1 micrometer) is expected to be low. The efficiency of scrubbers for small particles can be improved by increasing the relative velocity between the PM and the liquid droplets. This can be accomplished in most scrubbers by increasing the gas stream velocity. The downside of increasing the gas velocity is increased pressure drop, energy demand, and operating costs for the scrubber.

- Particle residence time – Typically, a particle is in the contact zone of a scrubber for only a few seconds. This is sufficient time to collect large particles that are affected by impaction mechanisms. However, since sub-micron particles are most effectively collected by diffusion mechanisms that depend on the random motion of the particles, sufficient time in the contact zone is needed for this mechanism to be effective. Consequently, increasing the gas residence time should also increase the particle/liquid contact time and the collection efficiency for small particles.
- Inlet dust concentration – Collection efficiency for scrubbers has been found to be directly proportional to the inlet dust concentration; efficiency increases with increasing dust loading.

Advantages

- No secondary dust sources
- Relatively small space requirement
- Ability to collect gases as well as "sticky" particulates
- Ability to handle high-temperature, high-humidity gas streams
- Capital cost lower, provided wastewater treatment system is not required
- Insignificant pressure drop concerns for processes where the gas stream is already at high pressure
- High collection efficiency of fine particulates at the expense of pressure drop

Disadvantages

- Potential water disposal/effluent treatment problem
- Corrosion problems (more severe than with dry systems)
- Potentially objectionable steam plume opacity or droplet entrainment
- Higher power requirement due to potentially high pressure drop of approximately 10 inches of w.c.
- Potential problem of solid buildup at the wet-dry interface
- Relatively high maintenance costs

While all wet scrubbers are similar to some extent, there are several distinct methods of using the scrubbing liquid to achieve particle collection.

Wet scrubbers are usually classified according to the method that is used to contact the gas and the liquid. The main types of wet scrubbers include:

- Spray chambers
- Packed bed scrubbers
- Venturi scrubbers
- Jet (fume) scrubbers
- Wet impingement scrubbers

Spray Chambers

The most common scrubber design introduces liquid droplets into a spray chamber, where the liquid mixes with the gas stream and contacts the PM, thereby removing it. Spray chambers are very simple, low-energy wet scrubbers. In these scrubbers, the particulate-laden gas stream is introduced into a chamber where it comes into contact with liquid droplets generated by spray nozzles. Spray chambers can handle larger gas flows with minimal pressure drop and are therefore often used as precoolers.

Packed Bed Scrubbers

In a packed bed scrubber, layers of liquid are used to coat various shapes of packing material that become impaction surfaces for the particle-laden gas.

Venturi Scrubbers

A venturi scrubber accelerates the gas stream to atomize the scrubbing liquid and to improve gas-liquid contact. In a venturi scrubber, a "throat" section is built into the duct. The venturi throat forces the gas stream to accelerate as the duct narrows and then expands. The scrubbing liquid is sprayed into the gas stream before the gas encounters the venturi throat. As the gas enters the venturi throat, both gas velocity and turbulence increase. The scrubbing liquid is then atomized into small droplets by the turbulence in the throat and droplet-particle interaction is increased. Venturi scrubbers have the advantage of being simple in design, easy to install, and low maintenance. Venturi scrubbers can be designed to allow velocity control by varying the width of the venturi throat. Because of the high interaction between the PM and droplets, venturi scrubbers are capable of high collection efficiencies for small PM. Venturi scrubbers consume large quantities of scrubbing liquid (such as water), electric power, and incur high pressure drops.

Jet (Fume) Scrubbers

Jet or fume scrubbers rely on the kinetic energy of the liquid stream. The typical removal efficiency of a jet or fume scrubber (for particles 10 microns or less) is lower than that of a venturi scrubber.

Wet Impingement Scrubbers

An impingement plate scrubber is a vertical chamber with plates mounted horizontally inside a hollow shell. Impingement plate scrubbers operate as countercurrent PM collection devices. The scrubbing liquid flows down the tower while the gas stream flows upward. Contact between the liquid and the particle-laden gas occurs on the plates. Impingement plate scrubbers are more suitable for PM collection than packed-bed scrubbers.

Step 2 – Eliminate Technologically Infeasible Options

The technical feasibility of the particulate control methods previously described is summarized in this subsection. The advantages and disadvantages of each control method were obtained from *"Airborne Particulate Matter: Pollution Prevention and Control,"* Pollution Prevention and Abatement Handbook, World Bank Group, July 1998.

Older jet engines do not incorporate technological features such as the reduced emission combustors or advanced fuel injection, which increase combustion efficiency. Combustion efficiency is directly proportional to the pressure ratio developed in the engine. The pressure ratio of older engines ranges from 12 to 15, compared with the pressure ratio range of 20 to 25 of the technologically advanced engines.

Although no data on particle size distribution for jet engine exhaust is available, it should be expected that the particle size distribution for the older engines and the technologically advance engines would be significantly different. The technologically advanced engines, which operate at a higher pressure ratio, are characterized by a higher thermodynamic efficiency and better fuel atomization. These characteristics, combined with better mixing of fuel with the combustion air, results in higher combustion efficiency and lower particulate emissions and smaller particle size. Older engines with their lower pressure ratio regime have a lower degree of atomization and have lower combustion efficiency, which is thought to move the particle size distribution to a higher range. In addition, the low degree of atomization and lower combustion efficiency tends to produce more soot and greater particulate emissions.

1) Settling Chambers

Settling chambers would not be useful because the exhaust contains fine particulates in the range of 1 to 10 microns and the exhaust does not have a high particulate density. Settling chambers would also add to the pressure drop, if it is used in conjunction with another particulate control method. Therefore, this control option is considered technologically infeasible.

2) Elutriators

Elutriators would not be useful because of the same reasons mentioned for the settling chambers. The exhaust contains fine particulates in the range of 1 to 10 microns and the exhaust does not have a high particulate density. Elutriators would also add to the pressure drop, if it is used in conjunction with another particulate control method. Therefore, this control option is considered technologically infeasible.

3) Momentum Separators

The collection efficiency of momentum separators is too low and will introduce significant back pressure to the engine test cell. Therefore, this control option is considered technologically infeasible.

4) Mechanically-aided Separators

Although collection efficiency is slightly better than the momentum separators, this type of equipment would not be able to handle the large engine exhaust flow rate ranging from 300,000 to 3,600,000 actual cubic feet per minute (acfm). Therefore, this control option is considered technologically infeasible.

5) Flue Gas Conditioning

This control method is not suitable for the engine test cells because particulate density of the exhaust is significantly lower than that encountered in coal-fired combustion processes or cement plants. Therefore, this control option is considered technologically infeasible.

6) Inertial or Impingement (Cyclone) Separators

The use of cyclones is not feasible because cyclones are suitable for dry exhaust streams only and the drop in pressure would adversely affect the performance characteristics of the engine test cell. Therefore, this control option is considered technologically infeasible.

7) Electrostatic Precipitators

The jet engine exhaust temperature is in the range of 500°F to 1,500°F. ESPs are sensitive to fluctuations in gas stream conditions and suitable for dry exhaust streams only. When the exhaust is dry, the ESP particulate removal efficiency is affected because of the increased volume conduction and surface conduction resistance at high exhaust temperatures. Significant pressure drop would affect the performance characteristics of the engine test cell. Therefore, this control option is considered technologically infeasible.

8) Filters and Dust Collectors (Baghouses)

If the exhaust contains moisture or water droplets, the fabric will clog and offer very high resistance, which can affect the operation of the engine test cell. In addition, unburned fuel in the exhaust can mix with the cake and create a significant fire hazard. Baghouses are not suitable for removing particulates from the jet engine exhaust. Therefore, this control option is considered technologically infeasible.

9) Wet Scrubbers

The dust loading per unit volume of jet engine exhaust is much lower than what is encountered from a majority of stationary external combustion sources; therefore, lower scrubber efficiency may be expected. For improved efficiency, the exhaust gas velocity must be increased, which will result in higher pressure drop, which in turn affects the calibration of the engine test cell. Therefore, this control option is considered technologically infeasible.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Rank	Control Technology	Achieved in Practice
1	Jet Fuel Sulfur Content ≤ 3,000 ppmw	Y

There are no remaining control technologies for SOx or PM10.

Step 4 – Cost Effectiveness Analysis

This option listed above has been identified as achieved in practice for SOx and PM10 emissions. Therefore, a cost analysis is not necessary.

Step 5 – Select BACT

Pursuant to the above Top-Down BACT Analysis, BACT for the jet engine test facility must be satisfied with the following:

SOx and PM10: Jet Fuel Sulfur Content ≤ 3,000 ppmw (Achieved in Practice)

The applicant has proposed jet fuel with a sulfur content ≤ 3,000 ppmw. Therefore, the BACT requirements are satisfied.

4. CO Top-Down BACT Analysis for Permit Units C-2106-23-4, '70-5, and '74-4

Many control strategies require changes to the combustor. By increasing the pressure and temperature in the combustor more energy is available for combustion. This makes for a more complete burning of the fuel-air mixture. A more complete burning means lower production of hydrocarbons. The maximum temperature and pressure in the combustor are limited by the materials comprising the combustion liner and turbine blades. By using ceramics and routing bypass air around and into the combustor, the upper limit on temperature and pressure can be extended. A high swirl region is also desirable to promote better mixing of fuel molecules among the air molecules to encourage thorough burning.

Combustor changes are not feasible because existing engines are tested for maintenance and certification.

<u>40 CFR Part 63 Subpart PPPPP – National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands</u>

40 CFR Part 63 Subpart PPPPP establishes national emission standards for hazardous air pollutants (NESHAP) for engine test cells/stands located at major sources of hazardous air pollutants (HAP) emissions. Table 2 of the Subpart indicates the use of two control devices: thermal and catalytic oxidizers. As these two control devices are listed as control options for CO, thermal and catalytic oxidizers will be listed as technologically feasible control equipment for CO.

Step 1 – Identify all control technologies

The following control technologies have been identified for jet engine test facilities.

1) Direct Atmospheric Exhaust
2) Thermal Oxidizer
3) Catalytic Oxidizer

Description of Control Technologies

1) Direct Atmospheric Exhaust (No Control)

The engine exhaust mixes with the augmentation/bypass air in the diffuser section, and is emitted to the atmosphere without use of any CO reduction technology.

2) Thermal Oxidizer

A typical thermal incinerator is a refractory-lined chamber containing a burner (or set of burners) at one end. Thermal incinerators typically use natural gas to supplement the caloric content of the waste gas stream. In a thermal incinerator, the combustible waste gases pass over or around a burner flame into a residence chamber where oxidation of the waste gases is then completed. The most recent guidelines for incinerators to promote more complete destruction of CO are:

- A chamber temperature high enough to enable the oxidation reaction to proceed rapidly to completion (1200-2000 °F or greater);
- Flow velocities of 20-40 feet per second, to promote turbulent mixing between the hot combustion products from the burner, combustion air, and waste stream components; and
- Sufficient residence time (approximately 0.75 seconds or more) at the chosen temperature for the oxidation reaction to reach completion.

3) Catalytic Oxidizer

Catalytic incinerators are very similar to thermal oxidation, with the primary difference that the gas, after passing through the flame area, passes through a catalyst bed. The catalyst has the effect of increasing the oxidation reaction rate, enabling conversion at lower reaction temperatures than in thermal incinerator units. Catalysts, therefore, also reduce the incinerator volume/size. Catalysts typically used for CO incineration include platinum and palladium. Other formulations include metal oxides, which are used for gas streams containing chlorinated compounds.

The gas stream is introduced into a mixing chamber where it is also heated. The waste gas usually passes through a recuperative heat exchanger, where it is preheated by post combustion gas. The heated gas then passes through the catalyst bed. Oxygen and CO migrate to the catalyst surface by gas diffusion and are adsorbed onto the catalyst active sites on the surface of the catalyst where oxidation then occurs. The oxidation reaction products are then desorbed from the active sites by the gas and transferred by diffusion back into the gas stream.

Advantages

- Lower fuel requirements
- Lower operating temperatures
- Little or no insulation requirements
- Reduced fire hazards
- Reduced flashback problems

Disadvantages

- Higher capital costs
- Catalyst blinding causes operational problems and/or higher maintenance requirements (annual costs)
- PM may need to be precollected
- Spent catalyst that cannot be regenerated may need to be disposed

Step 2 – Eliminate Technologically Infeasible Options

All of the options listed above are considered to be feasible.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Rank	Control Technology	Achieved in Practice
1	Thermal Oxidizer	N
2	Catalytic Oxidizer	N
3	Direct Atmospheric Exhaust	Y

There are no remaining control technologies for CO.

Step 4 – Cost Effectiveness Analysis

Pursuant to Section IX.D of District Policy APR 1305 – BACT Policy, a cost effectiveness analysis is required for the options that have not been determined to be achieved in practice. In accordance with the District's Revised BACT Cost Effectiveness Thresholds Memo (5/14/08), to determine the cost effectiveness of particular technologically feasible control options or alternate equipment options, the amount of emissions resulting from each option will be quantified and compared to the District Standard Emissions allowed by the District Rule that is applicable to the particular unit. The emission reductions will be equal to the difference between the District Standard Emissions and the emissions resulting from the particular option being evaluated.

Option 1 – Thermal Oxidizer (Technologically Feasible)

Since thermal oxidizer reduces CO and VOC emissions, a Multi-Pollutant Cost Effectiveness Threshold (MCET) will be used to determine if this option is cost-effective.

For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to combust the exhaust.

<u>Analysis Basis</u>

- Standard temperature = 60 deg F (District Rule 1020)
- Thermal Oxidizer temperature = 1,600 deg F (per applicant)

- Heat Required = 3,878 MMBtu/test (per applicant)
- Annual Number of Tests = 1,873 (per applicant)
- Natural Gas Cost = $5/MMBtu (per applicant)

Fuel Costs

The applicant has indicated the amount of heat required to operate a thermal oxidizer for the jet engine test cells in this project is 3,878 MMBtu per test.

Fuel Cost = 3,878 MMBtu x 1,873 tests/year x $5/MMBtu
= $36,317,470/year

Emission Reductions

Assuming a thermal oxidizer would achieve a 98% CO reduction,

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 1,828,504 lb-CO/year x 0.98
= 1,791,934 lb-CO/year
= 896.0 tons-CO/year

The EPA Report entitled, "Stationary Source Control Techniques Document for Fine Particulate Matter," EPA Contract Number 68-D-98-026, Work Assignment Number 0-08, October 1998 indicates a thermal oxidizer would achieve a 98% VOC reduction.

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 243,492 lb-VOC/year x 0.98
= 238,622 lb-VOC/year
= 119.3 tons-VOC/year

Cost Effectiveness

Multi-Pollutant Cost Effectiveness Thresholds (MCET)

MCET = (CO Emission Reductions x CO Cost Effectiveness Threshold) + (VOC Emission Reductions x VOC Cost Effectiveness Threshold)

MCET = (896.0 tons-CO/year x $300/ton) + (119.3 tons-VOC/year x $17,500/ton)
= $2,356,550/year

As shown above, the total costs of this technologically feasible option exceeds the Multi-Pollutant Cost Effectiveness Threshold (MCET) calculated for the CO and VOC emission reductions. Therefore, the option of a thermal oxidizer is not cost effective and the control option is being removed from consideration.

Option 2 – Catalytic Oxidizer (Technologically Feasible)

Since thermal oxidizer reduces CO and VOC emissions, a Multi-Pollutant Cost Effectiveness Threshold (MCET) will be used to determine if this option is cost-effective.

For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to combust the exhaust.

Analysis Basis

- Standard temperature = 60 deg F (District Rule 1020)
- Thermal Oxidizer temperature = 900 deg F (per applicant)
- Heat Required = 1,931 MMBtu/test (per applicant)
- Annual Number of Tests = 1,873 (per applicant)
- Natural Gas Cost = $5/MMBtu (per applicant)

Fuel Costs

The applicant has indicated the amount of heat required to operate a catalytic oxidizer for the jet engine test cells in this project is 1,931 MMBtu per test.

Fuel Cost = 1,931 MMBtu x 1,873 tests/year x $5/MMBtu
= $18,083,815/year

Emission Reductions

Assuming a thermal oxidizer would achieve a 98% CO reduction,

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 1,828,504 lb-CO/year x 0.98
= 1,791,934 lb-CO/year
= 896.0 tons-CO/year

The EPA Report entitled, "Stationary Source Control Techniques Document for Fine Particulate Matter," EPA Contract Number 68-D-98-026, Work Assignment Number 0-08, October 1998 indicates a catalytic oxidizer would achieve a 98% VOC reduction.

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 243,492 lb-VOC/year x 0.98
= 238,622 lb-VOC/year
= 119.3 tons-VOC/year

Cost Effectiveness

Multi-Pollutant Cost Effectiveness Thresholds (MCET)

MCET = (CO Emission Reductions x CO Cost Effectiveness Threshold) + (VOC Emission Reductions x VOC Cost Effectiveness Threshold)

MCET = (896.0 tons-CO/year x $300/ton) + (119.3 tons-VOC/year x $17,500/ton)
= $2,356,550/year

As shown above, the total costs of this technologically feasible option exceeds the Multi-Pollutant Cost Effectiveness Threshold (MCET) calculated for the CO and VOC emission reductions. Therefore, the option of a catalytic oxidizer is not cost effective and the control option is being removed from consideration.

Option 3 – Direct Atmospheric Exhaust (Achieved in Practice)

This option listed above has been identified as achieved in practice for CO emissions. Therefore, a cost analysis is not necessary.

Step 5 – Select BACT

Pursuant to the above Top-Down BACT Analysis, BACT for the jet engine test facility must be satisfied with the following:

CO: Direct Atmospheric Exhaust (Achieved in Practice)

The applicant has proposed direct atmospheric exhaust for the jet engine test cells and pad in this project. Therefore, the BACT requirements are satisfied.

5. VOC Top-Down BACT Analysis for Permit Units C-2106-23-4, '70-5, and '74-4

Many control strategies require changes to the combustor. By increasing the pressure and temperature in the combustor more energy is available for combustion. This makes for a more complete burning of the fuel-air mixture. A more complete burning means lower production of hydrocarbons. The maximum temperature and pressure in the combustor are limited by the materials comprising the combustion liner and turbine blades. By using ceramics and routing bypass air around and into the combustor, the upper limit on temperature and pressure can be extended. A high swirl region is also desirable to promote better mixing of fuel molecules among the air molecules to encourage thorough burning.

Combustor changes are not feasible because existing engines are tested for maintenance and certification.

<u>40 CFR Part 63 Subpart PPPPP – National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands</u>

40 CFR Part 63 Subpart PPPPP establishes national emission standards for hazardous air pollutants (NESHAP) for engine test cells/stands located at major sources of hazardous air pollutants (HAP) emissions. Table 2 of the Subpart indicates the use of two control devices: thermal and catalytic oxidizers. As these two control devices are listed as control options for VOC, thermal and catalytic oxidizers will be listed as technologically feasible control equipment for VOC.

Step 1 – Identify all control technologies

The following control technologies have been identified for jet engine test facilities.

1) Direct Atmospheric Exhaust
2) Thermal Oxidizer
3) Catalytic Oxidizer

<u>Description of Control Technologies</u>

1) Direct Atmospheric Exhaust (No Control)

The engine exhaust mixes with the augmentation/bypass air in the diffuser section, and is emitted to the atmosphere without use of any VOC reduction technology.

2) Thermal Oxidizer

A typical thermal incinerator is a refractory-lined chamber containing a burner (or set of burners) at one end. Thermal incinerators typically use natural gas to supplement the caloric content of the waste gas stream. In a thermal incinerator, the combustible waste gases pass over or around a burner flame into a residence chamber where oxidation of the waste gases is then completed. The most recent guidelines for incinerators to promote more complete destruction of VOC are:

- A chamber temperature high enough to enable the oxidation reaction to proceed rapidly to completion (1200-2000 °F or greater);
- Flow velocities of 20-40 feet per second, to promote turbulent mixing between the hot combustion products from the burner, combustion air, and waste stream components; and
- Sufficient residence time (approximately 0.75 seconds or more) at the chosen temperature for the oxidation reaction to reach completion.

3) Catalytic Oxidizer

Catalytic incinerators are very similar to thermal oxidation, with the primary difference that the gas, after passing through the flame area, passes through a catalyst bed. The catalyst has the effect of increasing the oxidation reaction rate, enabling conversion at lower reaction temperatures than in thermal incinerator units. Catalysts, therefore, also reduce the incinerator volume/size. Catalysts typically used for VOC incineration include platinum and palladium. Other formulations include metal oxides, which are used for gas streams containing chlorinated compounds.

The gas stream is introduced into a mixing chamber where it is also heated. The waste gas usually passes through a recuperative heat exchanger, where it is preheated by post combustion gas. The heated gas then passes through the catalyst bed. Oxygen and VOCs migrate to the catalyst surface by gas diffusion and are adsorbed onto the catalyst active sites on the surface of the catalyst where oxidation then occurs. The oxidation reaction products are then desorbed from the active sites by the gas and transferred by diffusion back into the gas stream.

Advantages

- Lower fuel requirements
- Lower operating temperatures
- Little or no insulation requirements
- Reduced fire hazards
- Reduced flashback problems

Disadvantages

- Higher capital costs
- Catalyst blinding causes operational problems and/or higher maintenance requirements (annual costs)
- PM may need to be precollected
- Spent catalyst that cannot be regenerated may need to be disposed

Step 2 – Eliminate Technologically Infeasible Options

All of the options listed above are considered to be feasible.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

Rank	Control Technology	Achieved in Practice
1	Thermal Oxidizer	N
2	Catalytic Oxidizer	N
3	Direct Atmospheric Exhaust	Y

There are no remaining control technologies for VOC.

Step 4 – Cost Effectiveness Analysis

Pursuant to Section IX.D of District Policy APR 1305 – BACT Policy, a cost effectiveness analysis is required for the options that have not been determined to be achieved in practice. In accordance with the District's Revised BACT Cost Effectiveness Thresholds Memo (5/14/08), to determine the cost effectiveness of particular technologically feasible control options or alternate equipment options, the amount of emissions resulting from each option will be quantified and compared to the District Standard Emissions allowed by the District Rule that is applicable to the particular unit. The emission reductions will be equal to the difference between the District Standard Emissions and the emissions resulting from the particular option being evaluated.

Option 1 – Thermal Oxidizer (Technologically Feasible)

Since thermal oxidizer reduces CO and VOC emissions, a Multi-Pollutant Cost Effectiveness Threshold (MCET) will be used to determine if this option is cost-effective.

For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to combust the exhaust.

Analysis Basis

- Standard temperature = 60 deg F (District Rule 1020)
- Thermal Oxidizer temperature = 1,600 deg F (per applicant)
- Heat Required = 3,878 MMBtu/test (per applicant)
- Annual Number of Tests = 1,873 (per applicant)
- Natural Gas Cost = $5/MMBtu (per applicant)

Fuel Costs

The applicant has indicated the amount of heat required to operate a thermal oxidizer for the jet engine test cells in this project is 3,878 MMBtu per test.

Fuel Cost = 3,878 MMBtu x 1,873 tests/year x $5/MMBtu
= $36,317,470/year

Emission Reductions

Assuming a thermal oxidizer would achieve a 98% CO reduction,

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 1,828,504 lb-CO/year x 0.98
= 1,791,934 lb-CO/year
= 896.0 tons-CO/year

The EPA Report entitled, "Stationary Source Control Techniques Document for Fine Particulate Matter," EPA Contract Number 68-D-98-026, Work Assignment Number 0-08, October 1998 indicates a thermal oxidizer would achieve a 98% VOC reduction.

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 243,492 lb-VOC/year x 0.98
= 238,622 lb-VOC/year
= 119.3 tons-VOC/year

Cost Effectiveness

Multi-Pollutant Cost Effectiveness Thresholds (MCET)

MCET = (CO Emission Reductions x CO Cost Effectiveness Threshold) + (VOC Emission Reductions x VOC Cost Effectiveness Threshold)

MCET = (896.0 tons-CO/year x $300/ton) + (119.3 tons-VOC/year x $17,500/ton)
= $2,356,550/year

As shown above, the total costs of this technologically feasible option exceeds the Multi-Pollutant Cost Effectiveness Threshold (MCET) calculated for the CO and VOC emission reductions. Therefore, the option of a thermal oxidizer is not cost effective and the control option is being removed from consideration.

Option 2 – Catalytic Oxidizer (Technologically Feasible)

Since thermal oxidizer reduces CO and VOC emissions, a Multi-Pollutant Cost Effectiveness Threshold (MCET) will be used to determine if this option is cost-effective.

For this application, the applicant performed mass balance calculations for the jet engine testing protocol to determine the amount of exhaust flow created during each step and the corresponding amount of fuel required to combust the exhaust.

Analysis Basis

- Standard temperature = 60 deg F (District Rule 1020)
- Thermal Oxidizer temperature = 900 deg F (per applicant)
- Heat Required = 1,931 MMBtu/test (per applicant)

- Annual Number of Tests = 1,873 (per applicant)
- Natural Gas Cost = $5/MMBtu (per applicant)

Fuel Costs

The applicant has indicated the amount of heat required to operate a catalytic oxidizer for the jet engine test cells in this project is 1,931 MMBtu per test.

Fuel Cost = 1,931 MMBtu x 1,873 tests/year x $5/MMBtu
= $18,083,815/year

Emission Reductions

Assuming a thermal oxidizer would achieve a 98% CO reduction,

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 1,828,504 lb-CO/year x 0.98
= 1,791,934 lb-CO/year
= 896.0 tons-CO/year

The EPA Report entitled, "Stationary Source Control Techniques Document for Fine Particulate Matter," EPA Contract Number 68-D-98-026, Work Assignment Number 0-08, October 1998 indicates a catalytic oxidizer would achieve a 98% VOC reduction.

Annual Emission Reduction = Uncontrolled Emissions x 0.98
= 243,492 lb-VOC/year x 0.98
= 238,622 lb-VOC/year
= 119.3 tons-VOC/year

Cost Effectiveness

Multi-Pollutant Cost Effectiveness Thresholds (MCET)

MCET = (CO Emission Reductions x CO Cost Effectiveness Threshold) + (VOC Emission Reductions x VOC Cost Effectiveness Threshold)

MCET = (896.0 tons-CO/year x $300/ton) + (119.3 tons-VOC/year x $17,500/ton)
= $2,356,550/year

As shown above, the total costs of this technologically feasible option exceeds the Multi-Pollutant Cost Effectiveness Threshold (MCET) calculated for the CO and VOC emission reductions. Therefore, the option of a catalytic oxidizer is not cost effective and the control option is being removed from consideration.

Option 3 – Direct Atmospheric Exhaust (Achieved in Practice)

This option listed above has been identified as achieved in practice for VOC emissions. Therefore, a cost analysis is not necessary.

Step 5 – Select BACT

Pursuant to the above Top-Down BACT Analysis, BACT for the jet engine test facility must be satisfied with the following:

VOC: Direct Atmospheric Exhaust (Achieved in Practice)

The applicant has proposed direct atmospheric exhaust for the jet engine test cells in this project. Therefore, the BACT requirements are satisfied.

Proposed Pages For the BACT Clearinghouse

San Joaquin Valley Unified Air Pollution Control District

Best Available Control Technology (BACT) Guideline 3.4.XX

Emission Unit: Jet Engine Test Facility **Industry Type:** All

Equipment Rating: None **Last Update:** November 24, 2012

Pollutant	Achieved in Practice or contained in SIP	Technologically Feasible	Alternate Basic Equipment
NOx	Direct Atmospheric Exhaust	1. Selective Catalytic Reduction 2. Non-Thermal Plasma 3. Selective Non-Catalytic Reduction 4. Reburn NOx Control	
SOx	Jet Fuel Sulfur Content ≤ 3,000 ppm by weight		
PM10	Jet Fuel Sulfur Content ≤ 3,000 ppm by weight		
CO	Direct Atmospheric Exhaust	1. Thermal Oxidizer 2. Catalytic Oxidizer	
VOC	Direct Atmospheric Exhaust	1. Thermal Oxidizer 2. Catalytic Oxidizer	

BACT is the most stringent control technique for the emissions unit and class of source. Control techniques that are not achieved in practice or contained in a state implementation plan must be cost effective as well as feasible. Economic analysis to demonstrate cost effectiveness is required for all determinations that are not achieved in practice or contained in an EPA approved State Implementation Plan.

***This is a Summary Page for this Class of Source - Permit Specific BACT Determinations on Next Page(s)**

San Joaquin Valley
Unified Air Pollution Control District

Best Available Control Technology (BACT) Guideline 3.4.XX A

Emission Unit: Jet Engine Test Facility

Equipment Rating: None

Facility: NAS Lemoore

References: ATC #: C-2106-23-4 and '74-4
Project #: 1123183

Location: Naval Air Station Lemoore, Lemoore, CA

Date of Determination: November 24, 2012

Pollutant	BACT Requirements
NOx	Direct Atmospheric Exhaust
SOx	Jet Fuel Sulfur Content ≤ 3,000 ppm by weight
PM10	Jet Fuel Sulfur Content ≤ 3,000 ppm by weight
CO	Direct Atmospheric Exhaust
VOC	Direct Atmospheric Exhaust

BACT Status:

X Achieved in practice _ Small Emitter _ T-BACT
__ Technologically feasible BACT
__ At the time of this determination achieved in practice BACT was equivalent to technologically feasible BACT
__ Contained in EPA approved SIP
__ The following technologically feasible options were not cost effective:
1) Selective Catalytic Reduction
2) Non-Thermal Plasma
3) Selective Non-Catalytic Reduction
4) Reburn NOx Control
5) Thermal Oxidizer
6) Catalytic Oxidizer
__ Alternate Basic Equipment
__ The following alternate basic equipment was not cost effective:

BACT CLEARINGHOUSE

--Submission Form--

Category

Source Category	Military Base	
SIC Code	9711	**View SIC Code List**
NAICS Code		View NAICS Code List

Emission Unit Information

Manufacturer	
Type	
Model	
Equipment Description	JET TEST CELL #3 (BLDG 175); T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242); JET TEST CELL #4 (BLDG 176)
Capacity/Dimensions	
Fuel Type	Jet Fuel
Multiple Fuel Types	
Operating Schedule	Continuous 24 hrs/day, 8,760 hrs/yr
Function of Equipment	The engine test facility tests uninstalled combustion turbine (jet) engines and are run through various power settings equivalent to operational conditions, as quality control after performing maintenance/repair and prior to installation in operational aircraft.

Facility/District Information

Facility Name	NAS Lemoore
Facility County	Kings County
Facility Zip Code	93246
District Contact	David Warner, San Joaquin Valley Air Pollution District
District Contact Phone	(559) 230-6000
District Contact E-mail	carlos.garcia@valleyair.org

Project/Permit Information

Application or Permit Number	C-2106-23-4, '70-5, '74-4

New Construction/Modification	Modification
ATC Date (mm-dd-yyyy)	TBD
PTO Date (mm-dd-yyyy)	TBD
Startup Date (mm-dd-yyyy)	TBD
Technology Status	None
Source Test Available	No
Source Test Results	TBD

BACT Information

Pollutant Limit(s) and Control Method(s) – Please include proper units

NOx	Limit: 0.192	Units: lb/gal	Averaging Time:
	Control Method Type:		
	Control Method Description:		
CO	Limit: 0.383	Units: lb/gal	Averaging Time:
	Control Method Type:		
	Control Method Description:		
VOC	Limit: 0.0510	Units: lb/gal	Averaging Time:
	Control Method Type:		
	Control Method Description:		
PM	Limit:	Units:	Averaging Time:
	Control Method Type:		
	Control Method Description:		
PM 2.5	Limit:	Units:	Averaging Time:
	Control Method Type:		
	Control Method Description:		
PM 10	Limit: 0.0261	Units: lb/gal	Averaging Time:
	Control Method Type:		
	Control Method Description:		
SOx	Limit: 0.041	Units: lb/gal	Averaging Time:
	Control Method Type:		
	Control Method Description:		

APPENDIX C

Certificate of Conformity

San Joaquin Valley
Unified Air Pollution Control District

TITLE V MODIFICATION - COMPLIANCE CERTIFICATION FORM

I. TYPE OF PERMIT ACTION (Check appropriate box)

[X] SIGNIFICANT PERMIT MODIFICATION
[ ] MINOR PERMIT MODIFICATION
[ ] ADMINISTRATIVE AMENDMENT

COMPANY NAME: Naval Air Station Lemoore	FACILITY ID: C - 2106
1. Type of Organization: [ ] Corporation [ ] Sole Ownership [X] Government [ ] Partnership [ ] Utility	
2. Owner's Name: US Navy	
3. Agent to the Owner: Scott Tarbox, Installation Environmental Program Director	

II. COMPLIANCE CERTIFICATION (Read each statement carefully and initial all circles for confirmation):

(ST) Based on information and belief formed after reasonable inquiry, the equipment identified in this application will continue to comply with the applicable federal requirement(s).

(ST) Based on information and belief formed after reasonable inquiry, the equipment identified in this application will comply with applicable federal requirement(s) that will become effective during the permit term, on a timely basis.

(ST) Corrected information will be provided to the District when I become aware that incorrect or incomplete information has been submitted.

(ST) Based on information and belief formed after reasonable inquiry, information and statements in the submitted application package, including all accompanying reports, and required certifications are true accurate and complete.

I declare, under penalty of perjury under the laws of the state of California, that the forgoing is correct and true:

Signature of Responsible Official

November 13, 2012
Date

Scott Tarbox
Name of Responsible Official (please print)

Installation Environmental Program Director
Title of Responsible Official (please print)

APPENDIX D

Health Risk Assessment and Ambient Air Quality Analysis

San Joaquin Valley Air Pollution Control District
Risk Management Review

To:	Stanley Tom – Permit Services
From:	Kyle Melching – Technical Services
Date:	November 9, 2012
Facility Name:	NAS Lemoore
Location:	Building 750 Code 50800, Lemoore
Application #(s):	C-2106-23-4, 70-5, & 74-4
Project #:	C-1123183

A. RMR SUMMARY

RMR Summary			
Categories	**Jet Engine Test Cell (Unit 23-4)**	**Project Totals**	**Facility Totals**
Prioritization Score	0.06	0.06	>1
Acute Hazard Index	0.00	0.00	0.00
Chronic Hazard Index	0.00	0.00	0.00
Maximum Individual Cancer Risk	**2.64E-09**	2.64E-09	1.36E-06
T-BACT Required?	**No**		
Special Permit Conditions?	**Yes**		

Proposed Permit Conditions

To ensure that human health risks will not exceed District allowable levels; the following permit conditions must be included for:

Unit # 23-4

1. {1898} The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102] N

I. Project Description

Technical Services received a request on November 6, 2012, to perform a Risk Management Review to increase the daily fuel use of jet engine test cells (Unit 23-4) from 3,080 gallons/day to 8080 gallons/day.

II. Analysis

Toxic emissions from the project were calculated using a District approved Flexible Engine Diagnostic System (FEDS) Emissions spreadsheet and information provided by the engineer. In accordance with the District's *Risk Management Policy for Permitting New and Modified Sources* (APR 1905-1, March 2, 2001), risks from the proposed project were prioritized using the procedures in the 1990 CAPCOA Facility Prioritization Guidelines and incorporated in the District's HEART's database. The prioritization score for the proposed project was less than 1.0 (see RMR Summary Table); however the facility's total prioritization was greater than 1.0. Therefore, a refined Health Risk Assessment was required and performed for the project. AERMOD was used with point source parameters outlined below and concatenated 5-year meteorological data from Lemoore to determine maximum dispersion factors at the nearest residential and business receptors. The dispersion factors were input into the HARP model to calculate the Chronic and Acute Hazard Indices and the Carcinogenic Risk.

The following parameters were used for the review:

Analysis Parameters (Unit 23-4)			
Source Type	Point	**Closest Receptor (m)**	7315
Stack Height (m)	5.03	**Type of Receptor**	Residence
Stack Diameter (m)	8.04	**Location Type**	Rural
Stack Gas Temperature (K)	1200	**Stack Gas Velocity (m/sec)**	5.43

Technical Services also performed modeling for criteria pollutants CO, NOx, SOx, PM_{10}, and $PM_{2.5}$, as well as the RMR. Emission rates used for criteria pollutant modeling were 98.34 lb/hr CO, 22 lb/hr NOx, 11.25 lb/hr SOx, 10.83 lb/hr PM_{10}, and 10.83 lb/hr $PM_{2.5}$.

The results from the Criteria Pollutant Modeling are as follows:

Criteria Pollutant Modeling Results*
Values are in μg/m³

Unit 23-4	1 Hour	3 Hours	8 Hours	24 Hours	Annual
CO	Pass	**X**	Pass	**X**	**X**
NO_x	Pass[1]	**X**	**X**	**X**	Pass
SO_x	Pass	Pass	**X**	Pass	Pass
PM_{10}	**X**	**X**	**X**	Pass[2]	Pass[2]
$PM_{2.5}$	**X**	**X**	**X**	Pass[2]	Pass[2]

*Results were taken from the attached PSD spreadsheet.
[1]The project was compared to the 1-hour NO2 National Ambient Air Quality Standard that became effective on April 12, 2010, using the District's approved procedures.
[2]The criteria pollutants are below EPA's level of significance as found in 40 CFR Part 51.165 (b)(2).

III. Conclusion

The criteria modeling runs indicate the emissions from the proposed equipment will not cause or significantly contribute to a violation of a State or National AAQS.

The acute and chronic indices are below 1.0; and the maximum individual cancer risk associated with the project is **2.64E-09**, which is less than the 1 in a million threshold. In accordance with the District's Risk Management Policy, the project is approved **without** Toxic Best Available Control Technology (T-BACT).

To ensure that human health risks will not exceed District allowable levels; the permit conditions listed on Page 1 of this report must be included for the proposed unit.

These conclusions are based on the data provided by the applicant and the project engineer. Therefore, this analysis is valid only as long as the proposed data and parameters do not change.

IV. Attachments

A. RMR request from the project engineer
B. Additional information from the applicant/project engineer
C. Toxic emissions summary
D. Prioritization score
E. Facility Summary
F. AAQA spreadsheet

AAQA for NAS Lemoore (C-2106-23-4, 70-5, & 74-4)
All Values are in ug/m^3

	NOx 1 Hour	NOx Annual	CO 1 Hour	CO 8 Hour	SOx 1 Hour	SOx 3 Hour	SOx 24 Hour	SOx Annual	PM 24 Hour	PM Annual
STCK1	1.680E+00	5.251E-02	1.001E+01	2.952E+00	1.145E+00	5.035E-01	1.641E-01	3.579E-02	1.580E-01	3.446E-02
Background	1.110E+02	2.104E+01	3.612E+03	2.680E+03	1.598E+02	1.332E+02	7.193E+01	2.664E+01	2.860E+02	6.800E+01
Facility Totals	1.126E+02	2.109E+01	3.622E+03	2.682E+03	1.610E+02	1.337E+02	7.209E+01	2.668E+01	2.862E+02	6.803E+01
AAQS	188.68	56	23000	10000	195	1300	105	80	50	30
	Pass	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Fail**	**Fail**

EPA's Significance Level (ug/m^3)

NOx 1 Hour	NOx Annual	CO 1 Hour	CO 8 Hour	SOx 1 Hour	SOx 3 Hour	SOx 24 Hour	SOx Annual	PM 24 Hour	PM Annual
0.0	1.0	2000.0	500.0	0.0	25.0	5.0	1.0	5.0	1.0

AAQA Emission (g/sec)

Device	NOx 1 Hour	NOx Annual	CO 1 Hour	CO 8 Hour	SOx 1 Hour	SOx 3 Hour	SOx 24 Hour	SOx Annual	PM 24 Hour	PM Annual
STCK1	2.77E+00	2.77E+00	1.24E+01	1.24E+01	1.42E+00	1.42E+00	1.42E+00	1.42E+00	1.36E+00	1.36E+00

APPENDIX E

Draft Authority to Construct Permits

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: C-2106-23-4 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: NAS LEMOORE
MAILING ADDRESS: BUILDING 750 CODE 50800
LEMOORE, CA 93246-5001

LOCATION: NAVAL AIR STATION LEMOORE
LEMOORE, CA 93246-5001

EQUIPMENT DESCRIPTION:
MODIFICATION OF JET TEST CELL #3 (BLDG 175): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY

CONDITIONS

1. {1830} This Authority to Construct serves as a written certificate of conformity with the procedural requirements of 40 CFR 70.7 and 70.8 and with the compliance requirements of 40 CFR 70.6(c). [District Rule 2201] Federally Enforceable Through Title V Permit
2. {1831} Prior to operating with modifications authorized by this Authority to Construct, the facility shall submit an application to modify the Title V permit with an administrative amendment in accordance with District Rule 2520 Section 5.3.4. [District Rule 2520, 5.3.4] Federally Enforceable Through Title V Permit
3. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
4. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
5. The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]
6. Daily combined fuel usage from jet engine test cells #3 and #4 (permits C-2106-23 and '74) and jet engine test pad (C-2106-70) shall not exceed 13,080 gallons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (559) 230-5950 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of all other governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

DRAFT

DAVID WARNER, Director of Permit Services
C-2106-23-4 : Jan 31 2014 2:07PM – TOMS : Joint Inspection NOT Required

7. Emissions from this test cell shall not exceed any of the following limits: 0.192 lb-NOx/gal, 0.041 lb-SOx/gal, 0.0261 lb-PM10/gal, 0.383 lb-CO/gal, or 0.0510 lb-VOC/gal. [District Rule 2201] Federally Enforceable Through Title V Permit
8. Fuel sulfur content shall not exceed 3,000 ppm by weight. [District Rule 2201] Federally Enforceable Through Title V Permit
9. Permittee shall determine fuel sulfur content annually. Samples of the fuel be taken at the facility or at the refinery, valid purchase contracts, supplier certifications, tariff sheets, or transportation contracts may be used to satisfy this requirement. [District Rule 2201] Federally Enforceable Through Title V Permit
10. A record shall be maintained of the date and quantity of engines tested, quantity of fuel used during each test of each engine, and fuel sulfur content. [District Rules 2201 and 2520] Federally Enforceable Through Title V Permit
11. All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

DRAFT

PERMIT NO: C-2106-70-5 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: NAS LEMOORE
MAILING ADDRESS: BUILDING 750 CODE 50800
LEMOORE, CA 93246-5001

LOCATION: NAVAL AIR STATION LEMOORE
LEMOORE, CA 93246-5001

EQUIPMENT DESCRIPTION:
MODIFICATION OF T-14/T-17 OPEN ENGINE TEST PADS (BLDG 242): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY

CONDITIONS

1. {1830} This Authority to Construct serves as a written certificate of conformity with the procedural requirements of 40 CFR 70.7 and 70.8 and with the compliance requirements of 40 CFR 70.6(c). [District Rule 2201] Federally Enforceable Through Title V Permit
2. {1831} Prior to operating with modifications authorized by this Authority to Construct, the facility shall submit an application to modify the Title V permit with an administrative amendment in accordance with District Rule 2520 Section 5.3.4. [District Rule 2520, 5.3.4] Federally Enforceable Through Title V Permit
3. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
4. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
5. Only F-404-GE-400, F404-GE-402, and T-400-CP-400 engines shall be tested at this site. [District Rule 2201] Federally Enforceable Through Title V Permit
6. Engine test rate shall not exceed five F-404-GE-400 or F404-GE-402 tests/day. [District Rule 2201] Federally Enforceable Through Title V Permit
7. Daily combined fuel usage from jet engine test cells #3 and #4 (permits C-2106-23 and '74) and jet engine test pad (C-2106-70) shall not exceed 13,080 gallons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

YOU MUST NOTIFY THE DISTRICT COMPLIANCE DIVISION AT (559) 230-5950 WHEN CONSTRUCTION IS COMPLETED AND PRIOR TO OPERATING THE EQUIPMENT OR MODIFICATIONS AUTHORIZED BY THIS AUTHORITY TO CONSTRUCT. This is NOT a PERMIT TO OPERATE. Approval or denial of a PERMIT TO OPERATE will be made after an inspection to verify that the equipment has been constructed in accordance with the approved plans, specifications and conditions of this Authority to Construct, and to determine if the equipment can be operated in compliance with all Rules and Regulations of the San Joaquin Valley Unified Air Pollution Control District. Unless construction has commenced pursuant to Rule 2050, this Authority to Construct shall expire and application shall be cancelled two years from the date of issuance. The applicant is responsible for complying with all laws, ordinances and regulations of ~~all other~~ governmental agencies which may pertain to the above equipment.

Seyed Sadredin, Executive Director / APCO

DRAFT

DAVID WARNER, Director of Permit Services

8. Emissions from this test pad shall not exceed any of the following limits: 0.192 lb-NOx/gal, 0.041 lb-SOx/gal, 0.0261 lb-PM10/gal, 0.383 lb-CO/gal, or 0.0510 lb-VOC/gal. [District Rule 2201] Federally Enforceable Through Title V Permit
9. Fuel sulfur content shall not exceed 3,000 ppm by weight. [District Rule 2201] Federally Enforceable Through Title V Permit
10. Permittee shall determine fuel sulfur content annually. Samples of the fuel be taken at the facility or at the refinery, valid purchase contracts, supplier certifications, tariff sheets, or transportation contracts may be used to satisfy this requirement. [District Rule 2201] Federally Enforceable Through Title V Permit
11. A record shall be maintained of the date, type, and quantity of engines tested, quantity of fuel used during each test of each engine, and fuel sulfur content. [District Rules 2201 and 2520] Federally Enforceable Through Title V Permit
12. All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit

San Joaquin Valley
Air Pollution Control District

AUTHORITY TO CONSTRUCT

PERMIT NO: C-2106-74-4 **ISSUANCE DATE:** DRAFT

LEGAL OWNER OR OPERATOR: NAS LEMOORE
MAILING ADDRESS: BUILDING 750 CODE 50800
LEMOORE, CA 93246-5001

LOCATION: NAVAL AIR STATION LEMOORE
LEMOORE, CA 93246-5001

EQUIPMENT DESCRIPTION:
MODIFICATION OF JET TEST CELL #4 (BLDG 176): ADD SPECIFIC LIMITING CONDITION (SLC) FOR PERMITS C-2106-23, '70, '74 WITH A COMBINED DAILY FUEL USE LIMIT OF 13,080 GALLONS PER DAY

CONDITIONS

1. {1830} This Authority to Construct serves as a written certificate of conformity with the procedural requirements of 40 CFR 70.7 and 70.8 and with the compliance requirements of 40 CFR 70.6(c). [District Rule 2201] Federally Enforceable Through Title V Permit
2. {1831} Prior to operating with modifications authorized by this Authority to Construct, the facility shall submit an application to modify the Title V permit with an administrative amendment in accordance with District Rule 2520 Section 5.3.4. [District Rule 2520, 5.3.4] Federally Enforceable Through Title V Permit
3. All equipment shall be maintained in good operating condition and shall be operated in a manner to minimize emissions of air contaminants into the atmosphere. [District Rule 2201] Federally Enforceable Through Title V Permit
4. Particulate matter emissions shall not exceed 0.1 grains/dscf in concentration. [District Rule 4201] Federally Enforceable Through Title V Permit
5. The exhaust stack shall vent vertically upward. The vertical exhaust flow shall not be impeded by a rain cap (flapper ok), roof overhang, or any other obstruction. [District Rule 4102]
6. Daily combined fuel usage from jet engine test cells #3 and #4 (permits C-2106-23 and '74) and jet engine test pad (C-2106-70) shall not exceed 13,080 gallons per day. [District Rule 2201] Federally Enforceable Through Title V Permit

CONDITIONS CONTINUE ON NEXT PAGE

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Seyed Sadredin, Executive Director / APCO

DRAFT

DAVID WARNER, Director of Permit Services

C-2106-74-4 : Jan 31 2014 2:07PM -- TOMS : Joint Inspection NOT Required

7. Emissions from this test cell shall not exceed any of the following limits: 0.192 lb-NOx/gal, 0.041 lb-SOx/gal, 0.0261 lb-PM10/gal, 0.383 lb-CO/gal, or 0.0510 lb-VOC/gal. [District Rule 2201] Federally Enforceable Through Title V Permit
8. Fuel sulfur content shall not exceed 3,000 ppm by weight. [District Rule 2201] Federally Enforceable Through Title V Permit
9. Permittee shall determine fuel sulfur content annually. Samples of the fuel be taken at the facility or at the refinery, valid purchase contracts, supplier certifications, tariff sheets, or transportation contracts may be used to satisfy this requirement. [District Rule 2201] Federally Enforceable Through Title V Permit
10. A record shall be maintained of the date and quantity of engines tested, quantity of fuel used during each test of each engine, and fuel sulfur content. [District Rules 2201 and 2520] Federally Enforceable Through Title V Permit
11. All records shall be maintained and retained on-site for a minimum of five (5) years, and shall be made available for District inspection upon request. [District Rule 1070] Federally Enforceable Through Title V Permit