

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

ENGINEERING DIVISION

APPLICATION PROCESSING AND CALCULATIONS

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APPLICANT'S NAME: NORTHROP GRUMMAN SPACE AND MISSION SYSTEMS CORP.

FACILITY PERMIT ID# 800408

CONTACT PERSON: Ron Frazer (310) 812-3021

MAILING ADDRESS: ONE SPACE PARK
BUILDING CS1/1800
REDONDO BEACH, CA 90278

EQUIPMENT ADDRESS: 3301 Aviation Blvd
Manhattan Beach, CA 90266

Title V Permit Revision:
Application No. 516127

**PERMIT TO CONSTRUCT
SECTION "H"**

Equipment Description: (Previous Application 503381)

PROCESS 11: D1 WEST LAB SYSTEM 2: Integrated Circuit Fabrication.					
Equipment	Device ID	Connected To	Source Type/ Monitoring Unit	Emissions	Equipment Specific Conditions
PLASMA ETCHER, ETCH NO. 1, 65-KVA Reference A/N 503381 516129	D374	C160			B59.8
PLASMA ETCHER, ETCH NO. 2, 65-KVA Reference A/N 503381 516129	D375	C160			B59.8
PLASMA ETCHER, CLEAN NO. 1, MATRIX, 6-KVA Reference A/N 503381 516129	D378	C160			B59.8
PLASMA ETCHER, CLEAN NO. 5, MATRIX, 6-KVA Reference A/N 503381 516129	D382	C160			B59.8
PLASMA ETCHER, CLEAN NO. 6, MATRIX, 6-KVA Reference A/N 503381 516129	D383	C232			B59.8
PLASMA ETCHER, CLEAN NO. 9, MATRIX, 6-KVA Reference A/N 503381 516129	D386	C160			B59.8

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PLASMA ETCHER, CLEAN NO. 11, MATRIX, 6-KVA Reference A/N <u>503384 516129</u>	D388	C160			B59.8
PLASMA ETCHER, DEPOSITION NO. 1, PLASMA THERM INC., 65-KVA Reference A/N <u>503384 516129</u>	D390	C160			B59.8
PLASMA ETCHER, DEPOSITION NO. 2, PLASMA THERM INC., 65-KVA Reference A/N <u>503384 516129</u>	D391	C160			B59.8
PLASMA ETCHER, CLEAN NO. 1, MATRIX, 6.0-KVA Reference A/N <u>503384 516129</u>	D403	C160			B59.52
PLASMA ETCHER, CLEAN NO. 2, MATRIX, 6.0-KVA Reference A/N <u>503384 516129</u>	D404	C160			B59.52
PLASMA ETCHER, CLEAN NO. 4, MATRIX, 21.5-KVA Reference A/N <u>503384 516129</u>	D406	C232			B59.52
PLASMA ETCHER, MATRIX, MODEL EHP500, WIDTH: 4FT; LENGTH: 3FT; HEIGHT: 6FT; WITH THREE VACUUM PUMPS Reference A/N <u>503384 516129</u>	D450	C233			B59.13
PLASMA ETCHER, ICP NO. 1, TRIKON, MODEL OMEGA, LENGTH: 3FT; WIDTH: 4FT; HEIGHT: 6FT; 65-KVA WITH THREE VACUUM PUMPS, 2.0-HP TOTAL Reference A/N <u>503384 516129</u>	D507	C232			B59.52
PLASMA ETCHER, ICP NO. 2, TRIKON, MODEL OMEGA, LENGTH: 3FT; WIDTH: 4FT; HEIGHT: 6FT; 65-KVA WITH THREE VACUUM PUMPS, 2.0-HP TOTAL Reference A/N <u>503384 516129</u>	D508	C232			B59.52
PLASMA ETCHER, ICP NO. 3, TRIKON, MODEL OMEGA, LENGTH: 3FT; WIDTH: 4FT; HEIGHT: 6FT; 65-KVA WITH THREE VACUUM PUMPS, 2.0-HP TOTAL Reference A/N <u>503384 516129</u>	D509	C232			B59.52
PLASMA ETCHER, DESCUMMER, BRANSON/IPC, MODEL REACTOR CENTER PM 1813, DIMENSIONS: HEIGHT: 3FT; LENGTH: 3FT; WIDTH: 3FT. Reference A/N <u>503384 516129</u>	D528	C160			B27.7

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FURNACE, PHOTORESIST COATER/DEVELOPER, THERMCO Reference A/N 503384 516129	D183	C160			
ION IMPLANTER, ION BEAM MILL, VACUUM PUMP Reference A/N 503384 516129	D182	C233			
EVAPORATOR, CHA MK50 Reference A/N 503384 516129	D191				
DEPOSITION REACTOR, SPUTTERING NO. 1, 21.4-KVA Reference A/N 503384 516129	D407	C232			B59.52
PROCESS TANK, PASS-THRU ACID UNIT Reference A/N 503384 516129	D189	C160			
DEPOSITION REACTOR, VAPOR PRIME, Y.E.S., LENGTH: 19.5 IN; WIDTH: 23.75 IN; HEIGHT: 27.5IN, 2.2-KVA ELECTRICALLY HEATED, 2.2-KVA Reference A/N 503384 516129	D552	C232			B59.52 C1.46
PLASMA ETCHER, ICP NO.3, TRIKON, MODEL OMEGA, LENGTH: 3FT; WIDTH: 4FT; HEIGHT: 6FT; 65-KVA WITH THREE VACUUM PUMPS, 2.0-HP TOTAL Reference A/N 503384 516129	D584	C232			B59.58
DEPOSITION REACTOR, PECVD DIELECTRIC, TRIKON TECHNOLOGIES, DELTA 201, LENGTH: 5FT; WIDTH: 3FT 4IN; HEIGHT: 6FT 1IN, 65-KVA, WITH THREE VACUUM PUMPS, 4.0-HP TOTAL Reference A/N 503384 516129	D585				B59.59
PLASMA ETCHER, NO. 1, MATRIX, MODEL 105E, WIDTH: 4FT; LENGTH: 3FT; HEIGHT: 6FT Reference A/N 503384 516129	D540	C233			B59.55
PLASMA ETCHER, TEGAL, MODEL 110, LENGTH:2FT 9IN; WIDTH: 6FT 4IN; HEIGHT: 6FT 10IN; WITH TWO VACUUM PUMPS Reference A/N 503384 516129	D596	C232			B59.66, C1.55
PLASMA ETCHER, SURFACE TECHNOLOGY SYSTEMS, MPX Reference A/N 516129	D613	C160	ADD		B59.71

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Conditions:

B27.7 THE OPERATOR SHALL NOT USE MATERIALS CONTAINING ANY TOXIC AIR CONTAMINANTS (TAC) IDENTIFIED IN THE SCAQMD RULE 1401, AS AMENDED 5/02/03

B59.8 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS(S) IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 3/17/00 or earlier except ammonia.

B59.13 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 8/18/00 or earlier

B59.52 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 5/02/03 or earlier except hydrofluoric acid, hydrochloric acid, ammonia, chlorine or isopropyl alcohol.

B59.55 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 3/04/05 or earlier

B59.58 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 5/02/03 or earlier except hydrofluoric acid or chlorine.

B59.59 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 3/04/05 or earlier except Ammonia.

B59.66 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

Toxic air contaminants in table 1 of rule 1401 with a listing date of 3/07/08 or earlier

B59.71 THE OPERATOR SHALL NOT USE THE FOLLOWING MATERIALS IN THIS DEVICE:

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Toxic air contaminants in table 1 of rule 1401 with a listing date of 9/10/10 or earlier except chlorine.

C1.46 THE OPERATOR SHALL LIMIT THE MATERIAL PROCESSED TO NO MORE THAN 2.0 GALLONS PER MONTH.

For the purpose of this condition, material processed shall be defined as materials containing VOC. The limit shall be based on the total combined limit for equipment D349 and D552.

C1.55 THE OPERATOR SHALL LIMIT THE MATERIAL PROCESSED TO NO MORE THAN 240 IN ANY ONE MONTH.

For the purpose of this condition, material processed shall be defined as number of wafers processed in this equipment.

**PERMIT TO CONSTRUCT
SECTION "H"**

Equipment Description: (Previous Application 509410)

PROCESS 1: CONTROL EQUIPMENT					
Equipment	Device ID	Connected To	Source Type/ Monitoring Unit	Emissions	Equipment Specific Conditions
SCRUBBER, FS21, HARRINGTON, WITH A MIST ELIMINATOR SECTION Reference A/N 509410 516486	C-160	D183, D189, D211, D371, D373, D374, D375, D378, D382, D386, D388, D390, D391, D394, D395, D403, D404, D478, D539, D574 D613 ADD			C8.3, C8.9, D90.1, E158.1, E159.1, I331.1, K67.3

Conditions:

C8.3 THE OPERATOR SHALL USE THIS EQUIPMENT IN SUCH A MANNER THAT THE FLOW RATE BEING MONITORED, AS INDICATED BELOW, IS NOT LESS THAN 150 GPM.

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To comply with this condition, the operator shall install and maintain a(n) flow meter to accurately indicate the flow rate of the recirculating scrubbing solution.

C8.9 THE OPERATOR SHALL USE THIS EQUIPMENT IN SUCH A MANNER THAT THE pH BEING MONITORED, AS INDICATED BELOW, IS NOT LESS THAN 8 OF THE pH SCALE

To comply with this condition, the operator shall monitor and record the pH as specified in condition D90.1.

D90.1 THE OPERATOR SHALL PERIODICALLY MONITOR THE pH OF THE SCRUBBING SOLUTION ACCORDING TO THE FOLLOWING SPECIFICATIONS:

The operator shall use litmus paper or a portable pH analyzer to monitor the parameter.

The operator shall monitor once every day provided any equipment served by this control system is in operation.

E158.1 THE OPERATOR SHALL MAINTAIN A CONTINUOUS OVERFLOW OF WATER FROM THE SCRUBBER SUMP TO PREVENT THE BUILD UP OF CONTAMINATION.

E159.1 THE OPERATOR SHALL MAINTAIN INSPECTION PORTS WHICH, WHEN OPENED, ALLOW THE OBSERVATION OF THE SPRAY NOZZLES AND SCRUBBING SOLUTION BEING SPRAYED ON THE PACKING.

K67.3 THE OPERATOR SHALL KEEP RECORDS, IN A MANNER APPROVED BY THE DISTRICT, FOR THE FOLLOWING PARAMETERS OR ITEMS:

pH of scrubbing solution on a daily basis.

Flow rate of recirculating scrubbing solution on a daily basis.

I331.1 THE CONDITIONS AND REQUIREMENTS FOR THIS DEVICE IN SECTION H SHALL TAKE EFFECT, AND SHALL SUPERSEDE THOSE IN SECTION D, WHEN THE MODIFICATIONS AUTHORIZED IN SECTION H ARE COMPLETED. THE OPERATOR SHALL NOTIFY THE AQMD WHEN THE MODIFICATIONS ARE COMPLETE.

Background:

Northrop filed application 516129 on 11/09/10 as a new construction of a plasma etcher (D613) assigned to process 11, system 2. Application 516486 was later on 12/07/10 to vent the new plasma etcher to scrubber C160.

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This is a RECLAIM Cycle 2 and title V facility. The proposed project is considered as a "de minimus" significant permit revision to this facility title V permit.

District records indicate that during the last five years Northrop Grumman was issued two Notices of Violation (NOV). Notice P49771 was issued on 11/08/2006 for operating without submitting the 3rd quarter, cycle 1 emissions report in a timely manner. NOV P50342 was issued on 5/5/2010 for failure to conduct the source tests for boilers D365 and D457. These issues have been resolved and Northrop is now in full compliance.

Scrubber Evaluation:

Scrubber C160 has a exhaust capacity of 24,000cfm. The ventilation needs from the current system venting draws 5,700 cfm. This current amendment will add one device (D613) which will draw an additional 15 cfm. The final cfm resulting from these changes will be 5,715 cfm. The scrubber will have no problem meeting the exhaust needs.

Emissions Calculations:

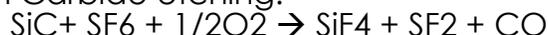
Application 516129(D613)

Plasma Etcher: The plasma etcher will use the following as reactive gases SF₆, CF₄, CHF₃, Ar, O₂ & Cl₂ are used to etch silicon carbide and indium phosphorus wafers. The Argon & O₂ are used to clean deposits from the plasma chamber. It takes 2.0 minutes to etch a wafer and 10 wafers per week are processed. Assume 50% control efficiency for the scrubber

Reactive Gas usage:

Gas	Gas Flow Rate (sccm)	Density (gm/cc)	Molecular weight (gm/mole)	Molar gas flow (moles/min)	gm/ per 2min etch
SF ₆	100	0.006164	146.05	0.00422	1.2328
CF ₄	100	0.00372	88.00	0.00423	0.744
CHF ₃	100	0.00299	130.19	0.00230	0.598
Ar	100	0.001784	39.948	0.00447	0.3568
O ₂	100	0.001429	32.0	0.00447	0.5716
Cl ₂	100	0.00304	70.91	0.00429	0.608

Silicon Carbide etching:



Indium Phosphide etching:



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Uncontrolled Products:

Products	Molecular Weight	Molar ratio	Gm/batch
SiF4	104.08	1:1	0.878
SF2	70.06	1:1	0.591
CO	28.01	1:1	0.236
InF3	171.82	1:1	0.790
PCl3	137.33	1:1	0.632
HCl	36.46	1:1	0.168
C	12.011	1:1	0.0553
Total			3.35 gm/batch

PM10 Emissions:

R1 = 3.35 gm/batch(10 batches/week)/(7 days/week)
= 4.78 gm/day, 0.0105lbs/day

@ 2minutes/batch, 10 batches/week, 7 days/week

Operating time = 0.0476 hrs/day

R1 Hourly = 0.221 lbs/hr < 1.0 hour/week

Scrubber Efficiency 50%

R2 = 0.0105 lbs/day(1-0.5)

= 0.00525 lbs/day

= 0.11 lbs/hr

Risk Assessment:

The only material used in this device that is listed in Rule 1401 is Chlorine Gas. The reaction products may yield some toxic substances as listed under Rule 1401 such as residual chlorine gas or hydrochloric acid. But the amount of feed gas and resulting byproducts are in grams per day of which the suspect contaminants will not cause an increased health risk in excess of one in a million MICR or a hazard index greater than 1.0.

RULE EVALUATION

Rule 212 (c)(1):This section requires a public notice for all new or modified permit units that emit air contaminants located within 1,000 feet from the outer boundary of a school.

No public notice is required since no school is located within 1,000 ft from the above site.

Rule 212 (c)(2):This section requires a public notice for all new or modified facilities that have on-site emission increases exceeding any of the daily maximums as specified by Rule 212(g).

The proposed project will not result in an emission increase for the entire facility that will exceed the daily maximums as

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specified under 212(g). A Rule 212(c)(2) notice will not be triggered.

Rule 212(c)(3): This section requires a public notice for all new or modified permit unit with increases in emissions of toxic air contaminants listed in Table I of Rule 1401 resulting in MICR greater than 1E-6 per permit unit or greater than 10E-6 per facility.

The proposed project will not result in an increase of toxic emissions that will cause a MICR of one in a million or greater or generate a hazard index in excess of one. Therefore Public Notice is not required under this section of the rule.

Rule 212(g): This section requires a public notice for all new or modified sources that result in emission increases exceeding any of the daily maximums as specified by Rule 212(g).

There is no emission increase due to the operation of this equipment. The following summarizes emissions from this project:

	Maximum Daily Emissions					
	<u>ROG</u>	<u>NO_x</u>	<u>PM₁₀</u>	<u>SO₂</u>	<u>CO</u>	<u>Pb</u>
Emission increase	0	0	0	0	0	0
MAX Limit (lb/day)	30	40	30	60	220	3
Compliance Status	Yes	Yes	Yes	Yes	Yes	Yes

No public notice is required since no emission increase has occurred.

Rule 401: With the proper maintenance and operation of this equipment, compliance with this rule is expected.

Rule 402: With proper maintenance and operation, this equipment is not expected to create a nuisance.

Rule 1164: The etcher is vented to a scrubber which will comply with the BACT requirements but otherwise there are no VOCs to be controlled. Compliance with this rule is expected.

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Rule 1303(a):The emissions from the plasma etcher are vented to a scrubber which is BACT for this type of operation. Compliance with BACT is achieved.

Rules 1303(b)(1) modeling:

The hourly PM10 emissions from this equipment are 0.11 lbs/hr for the etcher which is less than the Appendix A screening level of 0.41 lbs/hr. Compliance is expected.

Rule 1303(b)(2) Offsets:

No offsets are required for this operation since the emissions are less than 0.49 lbs/day.

Rule 1303(b)(4): The facility is expected to be in full compliance with all applicable rules and regulations of the District.

Rule 1401: The etcher will be conditioned such that no toxic material listed under rule 1401 with an effective date of 9/10/10 except Chlorine. Compliance with this rule is expected.

RULE 2005: Northrop Grumman is a NOx RECLAIM facility. The proposed project will not result in an increase in NOx emissions. Compliance with rule is expected.

REGULATION XXX:

This facility is in the RECLAIM program. The proposed project is considered as a "de minimis significant permit revision" for non-RECLAIM pollutants or hazardous air pollutants (HAPs), and a "minor permit revision" for RECLAIM pollutants to the RECLAIM/Title V permit for this facility.

Non-RECLAIM Pollutants or HAPs

Rule 3000(b)(6) defines a "de minimis significant permit revision" as any Title V permit revision where the cumulative emission increases of non-RECLAIM pollutants or HAPs from these permit revisions during the term of the permit are not greater than any of the following emission threshold levels:

Air Contaminant	Daily Maximum (lbs/day)
HAP	30
VOC	30
NOx*	40
PM10	30
SOx*	60
CO	220

* Not applicable if this is a RECLAIM pollutant

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To determine if a project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants or HAPs, emission increases for non-RECLAIM pollutants or HAPs resulting from all permit revisions that are made after the issuance of the Title V renewal permit shall be accumulated and compared to the above threshold levels. This proposed project is the 2nd permit revision to the Title V renewal permit issued to this facility on June 8, 2010. The following table summarizes the cumulative emission increases resulting from all permit revisions since the Title V renewal permit was issued:

Revision	HAP	VOC	NOx*	PM10	SOx	CO
Previous Permit Revision Total Cumulative to date. Title V permit renewed June 8, 2010	0	0	0	1.0	0	0
2 nd Permit Revision; <u>A/N 516127</u> Facility permit revision to; <u>A/N 516124-125</u> add one vacuum metalizer(E611) and vent to scrubber C161. <u>A/N 516126</u> replace existing open top vapor degreaser D309 by a new a new degreaser D612. <u>A/N 516129 & 516486</u> add one Plasma Etcher(D613) and vent to scrubber C160.	0	1.0	0	0	0	0
Cumulative Total	0	1.0	0	1.0	0	0
Maximum Daily	30	30	40*	30	60	220

* RECLAIM pollutant, not subject to emission accumulation requirements

Since the cumulative emission increases resulting from all permit revisions are not greater than any of the emission threshold levels, this proposed project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants or HAPs.

RECOMMENDATION

The proposed project is expected to comply with all applicable District Rules and Regulations. Since the proposed project is considered as a “de minimis significant permit revision” for non-RECLAIM pollutants and a “minor permit revision”, for RECLAIM pollutant, it is exempt from the public participation requirements under Rule 3006 (b). A proposed permit incorporating this

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permit revision will be submitted to EPA for a 45-day review pursuant to Rule 3003(j). If EPA does not raise any objections within the review period, a revised Title V permit will be issued to this facility.

Conclusion:

This equipment will operate in compliance with all District Rule and Regulations. A Permits to Construct are recommended for application numbers 516124-126, 516129 & 516486 subject to preceding conditions.