PREVENTION OF SIGNIFICANT
DEGRADATION APPLICATION
FOR THE 787 PROJECT

BOEING COMMERCIAL
AIRPLANES
EVERETT, WASHINGTON
MARCH 2005
March 25, 2005

John Fosberg, MC 0P-88
The Boeing Company
P.O. Box 3707
Seattle, WA 98124-2207

Dear Mr. Fosberg:

Support Facilities for the Production of the Boeing 787 Airplane

Enclosed, please find a request for information regarding support facilities referenced in our March 11, 2005 conference call. We understand that your PSD permit application is on its way to us. We do not recommend that you delay sending the application while you work to supply the information requested herein. Ecology will determine whether the application is complete based upon all of the information received.

On March 11, 2005 your legal counsel, (Matt Iwicky) asked the Washington State Department of Ecology (Ecology) to assemble a list of criteria that it would use to evaluate support facilities for the Boeing 787 project proposed for the Boeing Everett facility. This letter lays out the background and the issue, discusses the guidance documents Ecology reviewed, and requests additional information from Boeing.

As a preliminary matter, it is important to emphasize that the state of Washington operates under a delegation agreement from the Environmental Protection Agency (EPA) Region 10. As a delegated state, we implement the federal rules; however, EPA retains the authority to evaluate whether our decisions are appropriate under federal law. The information we seek is intended to help us evaluate criteria that EPA has used in making determinations about support facilities for other facilities. It is our belief that collecting this information will allow us to make well-supported determinations regarding support facilities without delaying the issuance of your Prevention of Significant Deterioration (PSD) permit.

BACKGROUND:

The construction of the Boeing 787, formally the 7E7, will be different from any airplane previously built by Boeing. The difference is that Boeing will only perform the final assembly and final painting of the aircraft. The distinct pieces (nose, fuselage, tail, landing gear, etc.) will
be manufactured and may be primed or painted by contractors before they are transported to the Boeing Everett facility for final assembly.

Boeing has repeatedly informed Ecology that time is very important and would like to receive the PSD permit by September 1, 2005. Ecology fully intends to work to avoid any delay in beginning construction of this project and is specifically committed to preparing the required permits in a timely manner. Teams from Ecology and Boeing have been meeting extensively to gather as much information as possible prior to the submission of the permit application. Ecology understands and appreciates Boeing’s concern, but recognizes that the PSD permitting process includes mandatory timeframes. If an application is perfect the first time it is submitted, the minimum time necessary to issue a PSD permit is 120 days. Allowing 30 days for filing any potential appeals, it will be a minimum of 150 days from when the application is received until the time construction can begin. It is unusual for a facility to submit a PSD application that is complete the first time Ecology sees it. As a result, few permits (fewer than five) have ever been able to begin construction within 150 days and none of those permits were as complex as Boeing’s 787 project. To date, Ecology has not yet received Boeing’s PSD permit application leaving little time for additional information requests. To facilitate timely processing of the PSD permit by Boeing’s desired date, Ecology will need Boeing to submit more information up front than would normally be required.

Boeing indicated it expects to submit the PSD permit application on April 1, 2005. Boeing told us that the only regulated pollutant above the PSD Significant Emission Rate (SER) is volatile organic compounds (VOC). However, should support facilities become part of the 787 PSD permit, it is possible that other pollutants would be included that emit above the PSD SER’s.

Ecology identified the support facility issue to Boeing in September of 2004. On February 10, 2005, Boeing presented a Power Point Presentation to Ecology that identified the locations of some of the contractors and subcontractors. This presentation was followed up by a memorandum and copy of the Power Point presentation on February 17, 2005.

Ecology still requires additional information to make a decision regarding the support facility issue. Once we are able to make a determination, we strongly advise meeting with EPA to discuss this matter and gain consensus. We believe that failure to do so early on in the process may result in later issues that could adversely impact Boeing’s project timeline.

**REGULATORY ANALYSIS:**

In determining the scope of the project for PSD purposes, Ecology reviewed the federal rule (40 CFR 52.21) and EPA’s guidance documents and letters. Ecology focused on definitions of stationary source, control, and support facilities.
The definition of Stationary Source in 40 CFR 52.21(b)(5) is:
Stationary Source means any building, structure, facility, or installation which emits or may emit a regulated NSR pollutant.

The definition of building, structure, facility, or installation in 40 CFR 52.21(b)(6) is:
Building, structure, facility, or installation means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control) except the activities of any vessel. Pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same "Major Group" (i.e., which have the same first two digit code) as described in the Standard Industrial Classification Manual, 1972, as amended by the 1977 Supplement (U.S. Government Printing Office stock numbers 4101-0066 and 003-005-00176-0, respectively).

Originally, Ecology identified four criteria that should be considered when making a support facility determination. Those criteria included: the same Standard Industrial Classification (SIC) code, contiguous and adjacent properties, common control, and the so called "but for" test. Upon further review of EPA's guidance documents Ecology believes that the "but for" test is not a stand-alone test. Rather it is a subset of the common control category listed above.

EPA permit regulations do not provide a definition for control. Webster's dictionary defines control as "to exercise restraining or directing influence over," "to have power over," "power or authority to guide or manage," and "the regulation of economic activity." Obviously common ownership is not the only evidence of control.

Ecology found the following definition of support facility: "Support facilities are typically those that convey, store, or otherwise assist in the production of the principal product". Contractors or subcontractors that produce parts for the 787 airplane could be considered support facilities based upon this definition.

DISCUSSION:
Numerous EPA guidance documents were reviewed in the preparation of this letter. Wherever possible a reference to an EPA document is given. The topics are broken up into the three categories: contiguous/adjacent location, industrial grouping, and common control.

1 Letter, William A. Sprattin (EPA) to Peter Hamlin (Iowa DNR) September 18, 1995
2 43 FR 53695 (August 7, 1978)
Contiguous/Adjacent Location:

Ecology found that a specific distance between pollutant emitting activities has never been established by EPA for determining when facilities should be considered separate or one source for PSD purposes. Whether facilities are contiguous or adjacent is determined on a case-by-case basis, based on the relationship between the facilities.

Industrial Grouping:

Ecology assumes that all the companies associated with producing parts for the Boeing 787 airplane will fall under the same first two digit SIC code 37 (transportation).

Common Control:

Several EPA letters and guidance memos were reviewed in order to determine what the issues are with respect to the facilities that will assemble and paint parts for the 787 airplane. Ecology believes that if the contractor and subcontractor facilities are under common control of Boeing, they may qualify as support facilities. All information we receive regarding this issue will be evaluated quickly and no decision can be made without Ecology's review of the real facilities not hypothetical examples.

CONCLUSION:

Ecology has not yet seen the PSD application for the 787 project. Boeing has indicated it will be submitted on April 1, 2005. We request that Boeing provide the following information requested below as quickly as possible so that it can be considered as part of the review of your application.

Contiguous/Adjacent Location:

Ecology has not yet decided what the proper distance is for the outer boundary of facility locations for the analysis of what is contiguous and adjacent for the Boeing project. We are therefore asking that Boeing answer the following questions for each potential support facility that is located within 6 miles north and south of the Boeing Everett facility. It is not necessary to consider facilities beyond the boundary of Puget Sound on the West and Interstate 5 on the East.

For facilities located in Washington State but greater than 5-miles, Ecology would like to be notified about their location and the airplane parts that those contractors will be producing. Additional information about these facilities is not being requested at this time. However, Ecology may seek additional information after reviewing location information.

\[\text{Memorandum, Robert Kellam (EPA) to Richard Long (EPA), August 27, 1996}\]
Industrial Grouping:

Additional information is not being requested about industrial grouping at this time unless Boeing changes its position to assert that any of the facilities do not fall under the same grouping.

Common Control:

Please answer each of the following questions for each contractor or subcontractor that is proposed to be located within the geographical boundaries above at the Boeing Everett facility. If any of the answers are the same as those offered in the February, 17, 2005 memorandum please include those answers in the response to these questions as well.

1. Does the contractor or subcontractor share common workforces, plant managers, security forces, corporate executive officers, or board of executives with Boeing?
2. Does the contractor or subcontractor share equipment, other property, or pollution control equipment with Boeing?
3. What does the contractor or subcontractor contract specify with regard to Boeing’s pollution control responsibilities for the contractor or subcontractor?
4. Can Boeing or the contractor or subcontractor make pollution control decisions for each other?
5. Do Boeing and the contractor or subcontractor share common payroll activities, employee benefits, health plans, retirement funds, insurance coverage, or administrative functions?
6. Does the contractor or subcontractor share intermediates, products, byproducts, or other manufacturing equipment with Boeing?
7. Can the contractor or subcontractor purchase raw materials from and sell products or byproducts to other customers besides Boeing?
8. What are the contractual arrangements for providing goods and services between Boeing and the contractor or subcontractor?
9. Who accepts the responsibility for compliance with air quality control requirements?
10. What is the dependency of one facility on the other?
11. What are the financial arrangements between the two entities?
12. Will the contractor or subcontractor sell all of its product to Boeing under a single purchaser contact?

13. Does the facility's operation support the operation of Boeing?

14. Is there a support or dependency relationship between the two entities, such that the facility would not exist "but for" the existence of Boeing Everett?*

15. Does one operation support the operation of the other?

If you would like clarification on any of these questions or would like to discuss this letter, please contact me at (360) 407-6897.

Sincerely,

[Signature]

Richard B. Hibbard P.E.
Project Engineer

cc: Phyllis Baas, Ecology
    Doug Brown, Ecology
    Sarah Rees, Ecology
    Tiffany Yelton, Ecology
    Dan Meyer, EPA
    Agata McIntyre, PSCAA
    Leslie Seffern, AAG

* Letter from John Seitz (EPA) to John Hombach (Kentucky Division of Air Quality) March 29, 2001.
March 24, 2005  
E-1320-JTF-021

Richard Hibbard, P.E.  
Environmental Engineer  
Air Quality Program  
Washington State Department of Ecology  
P.O. Box 47600  
Olympia, WA  98504-7600

Subject: Prevention of Significant Deterioration Permit Application for the 787 Project

Enclosed is a Prevention of Significant Deterioration (PSD) permit application for the 787 project at The Boeing Company’s existing airplane manufacturing facility in Everett, Washington. Of the pollutants regulated by the PSD program, the 787 project is only significant for volatile organic compounds.

Please note that the following appendices contain Confidential Business Information (CBI) and have been correspondingly marked in the enclosed application:

- Appendix B  VOC Emissions Estimate for the Airplane Interiors Manufacturing Operations at the Boeing Everett Facility
- Appendix C  VOC Emissions Estimate for the Final Assembly Operations at the Boeing Everett Facility
- Appendix D  VOC Emissions Estimate for the Exterior Paint Process at the Boeing Everett Facility
- Appendix E  Particulate Matter Emissions Estimate for the 787 Project

Boeing requests that these appendices be treated as CBI and protected from public disclosure pursuant to RCW 42.17.260(1); RCW 70.94.205, WAC 197-06-100(1), 5 USC § 552(b)(3); 42 USC §7414(c), and 40 CFR Part 2, Subpart B, §§2.201, et.seq., and §§3.201, et seq. Boeing believes that the information contained within these appendices is CBI because it discloses, or can be used to derive, anticipated future maximum airplane production rates, which, if released, could adversely affect
the competitive position of Boeing. We understand that if Ecology, EPA or the Puget Sound Clean Air Agency receives a request for disclosure of any of these appendices, the agency receiving such request will notify Boeing, and work with Boeing to determine the appropriate redaction to protect Boeing’s CBI information while also providing the requestor any non-CBI information to which it is entitled.

Certification by a responsible official to the truth, accuracy, and completeness of the permit application as required by Section V.Q.1(c) of Boeing Everett’s Air Operating Permit application will follow under separate cover.

Please contact me or John Fosberg, at (425) 717-0988, if you have any questions regarding the application.

Frank J. Migliolo
Manager, Everett Environmental Affairs
M/C OP-88
(425) 342-3360

Enclosure

Cc (with enclosure):

Clint Bowman, Washington Department of Ecology
Doug Brown, Washington Department of Ecology
Tiffany Yelton, Washington Department Of Ecology
Laurie Halvorson, Puget Sound Clean Air Agency
Dee Morse, National Park Service
Johan Notar, National Park Service
Elizabeth Waddell, National Park Service
Bob Rachman, United States Forest Service
Dan Meyer, United States Environmental Protection Agency
Ken Berg, Western Washington Fish and Wildlife Office
Steve Landino, National Marine Fisheries Service
TABLE OF CONTENTS

1.0 APPLICANT ADMINISTRATIVE INFORMATION.................................................. 1

2.0 INTRODUCTION.......................................................................................... 2
  2.1 PROJECT LOCATION.................................................................................. 2
  2.2 PROJECT DESCRIPTION............................................................................. 2
    2.2.1 Building 40-56 – Interior Parts......................................................... 2
    2.2.2 Building 40-23 – Final Assembly...................................................... 3
    2.2.3 Buildings 45-01, 45-03, and 45-04 – Exterior Painting.................... 3
    2.2.4 Other Potential Activities................................................................. 5

3.0 AIR EMISSIONS INVENTORY........................................................................... 5
  3.1 VOC EMISSIONS......................................................................................... 5
    3.1.1 Building 40-56 – Interiors Manufacturing Operations Estimated Emissions 6
    3.1.2 Building 40-23 – Final Assembly Estimated Emissions....................... 6
    3.1.3 Buildings 45-01, 45-03 and 45-04 – Exterior Paint Estimated Emissions 7
  3.2 NON-VOC EMISSIONS................................................................................. 8

4.0 REGULATORY ANALYSIS.............................................................................. 8
  4.1 OVERVIEW................................................................................................ 8
  4.2 PSD APPLICABILITY.................................................................................. 8
  4.3 PSD APPLICATION REQUIREMENTS......................................................... 9
  4.4 OTHER REGULATORY REQUIREMENTS.................................................... 10
    4.4.1 National Emission Standards for Hazardous Air Pollutants (NESHAPs) 10
    4.4.2 State and Local Permit Requirements.............................................. 11

5.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS............................ 11
  5.1 BACT REQUIREMENT................................................................................. 11
    5.1.1 Buildings 40-01, 40-03, and 40-04 Paint Hangars............................ 13
    5.1.2 Interiors Manufacturing Operations in Building 40-56......................... 14
    5.1.3 Assembly Operations in Building 40-25............................................ 14
  5.2 "TOP-DOWN" BACT APPROACH............................................................... 15
    5.2.1 Identify All Control Technologies..................................................... 15
    5.2.2 Eliminate Technically Infeasible Options........................................... 20
    5.2.3 Rank Control Technologies by Control Effectiveness......................... 20
    5.2.4 Evaluate Most Cost Effective Controls............................................. 20
    5.2.5 Proposed BACT................................................................................. 22

6.0 AMBIENT AIR QUALITY ANALYSIS.............................................................. 23
  6.1 MODELING METHODOLOGY.................................................................... 23
  6.2 EXISTING AIR QUALITY AND STANDARDS............................................. 23
  6.3 CUMULATIVE IMPACT ANALYSIS............................................................. 24
    6.3.1 Meteorological Data......................................................................... 24
    6.3.2 Source Input Data............................................................................ 25
  6.4 NEAR-FIELD AMBIENT AIR IMPACTS...................................................... 26

7.0 ADDITIONAL AIR IMPACT ANALYSIS......................................................... 26
  7.1 SECONDARY GROWTH IMPACTS............................................................... 26
  7.2 AIR QUALITY-RELATED VALUES............................................................... 28
    7.2.1 Aquatic/Soil Impacts........................................................................... 28
    7.2.2 Vegetation Impacts............................................................................ 28
  7.3 VISIBILITY IMPACTS.................................................................................. 30

i

URS CORPORATION
LIST OF ACRONYMS

ANESHAP National Emission Standards for Aerospace Manufacturing and Rework Facilities
AQCD Air Quality Criteria Document
AQRV Air Quality Related Values
BAAQMD Bay Area Air Quality Management District
BACT Best Available Control Technology
CAPCOA California Air Pollution Control Officers Association
CAA Clean Air Act
cfm cubic feet per minute
CMAQ Community Multi-scale Air Quality
CO carbon monoxide
CFR Code of Federal Regulations
CTED Washington State Department of Community, Trade and Economic Development
EIS Environmental Impact Statement
EPA United States Environmental Protection Agency
FHM Forest Health Monitoring
FLAQA Federal Land Managers Air Quality Related Values Work Group
FLM Federal Land Managers
HAP Hazardous Air Pollutants
MACT Maximum Achievable Control Technology
MM5v3 Mesoscale Meteorological Model Version 5-Version 3
NAAQS National Ambient Air Quality Standards
NEI National Emissions Inventory
NESHAP National Emission Standards for Hazardous Air Pollutants
NOC Notice of Construction
NP National Park
NPS National Parks Service
NSR New Source Review
O3 ozone
PM10 particulate matter less than 10 microns in diameter
PM2.5 particulate matter less than 2.5 microns in diameter
ppb parts per billion
ppm parts per million
ppt parts per trillion
PTE Potential to Emit
PSU/NCAR Penn State University/National Center for Atmospheric Research
PSCAA Puget Sound Clean Air Agency
PSD Prevention of Significant Deterioration
PSRC Puget Sound Regional Council
RBLC RACT/BACT/LAER Clearinghouse
SCAQMD South Coast Air Quality Management District
SEPA State Environmental Protection Act
SVAPCD San Joaquin Valley Air Pollution Control District
tpy tons per year
USDA United States Department of Agriculture
VOC volatile organic compound
WAC Washington Administrative Code
WDOE Washington State Department of Ecology
WSU Washington State University

iii URS CORPORATION
1.0 APPLICANT ADMINISTRATIVE INFORMATION

Project: Boeing 787 Assembly

Facility Owner: The Boeing Company
Boeing Commercial Airplanes – Everett Facility

Facility Address: Boeing Everett Facility
3003 West Casino Road
Everett, Washington 98203

County: Snohomish County

SIC Code: 3721

Contact: Mr. John T. Fosberg, P.E.
Boeing Everett Environmental Affairs
(425) 717-0988
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2.0 INTRODUCTION

2.1 PROJECT LOCATION

The Boeing Company’s Everett Facility is located in the City of Everett in Snohomish County, Washington. The Everett facility is situated in the south half of Section 10 and the north half of Section 15, Township 24N, Range 4E, Willamette Meridian, (Figure 1-1). The Everett facility consists of the North and South Complex located north and south, respectively, of Highway 526 (Figure 1-2). A building number starting with 40 identifies North Complex buildings, and buildings on the South Complex are identified with a number starting with 45. Buildings addressed in this Prevention of Signification, Deterioration (PSD) permit application are located in both the North and South Complexes and include Buildings 40-56, 40-25, 45-01, 45-03, and 45-04 (Figure 1-3).

2.2 PROJECT DESCRIPTION

Boeing currently manufactures the 747, 767, and 777 model airplanes at the Everett facility, as well as certain components such as interiors (e.g. sidewalls, stow bins, etc.) for those and other models manufactured by Boeing. Boeing plans to assemble the new 787 model airplane and manufacture certain 787 components (e.g. interiors) at the Everett facility. Unlike the existing airplane programs, much more of the main structure of the 787 (e.g. the wings, fuselage sections, and empennage) will be manufactured, assembled, and have systems installed by distant, out-of-state, and/or foreign suppliers and sent to the Everett facility for final assembly. Also unique to the 787 program is that much more of the airplane, including the fuselage and wing structure, will be primarily made of composites rather than metal.

This section describes the proposed changes at Buildings 40-56, 40-25, 45-01, 45-03, and 45-04 associated with the manufacture of components for, and assembly of, 787 airplanes that would potentially increase air emissions. Potential emission increases would primarily occur in existing coating application operations in existing booths, from fugitive emissions (i.e., volatile organic compound [VOC] emissions that are not captured with dedicated exhaust ventilation) associated with interiors manufacturing and airplane assembly operations in open areas within the Buildings 40-56 and 40-25, and from the cleaning and coating operations located in the existing paint hangs, as described below.

2.2.1 Building 40-56 – Interior Parts

Interior parts for the 787 model such as stow bins, crew rests, partitions/class dividers, closets, and other miscellaneous items will be fabricated and coated primarily in Building 40-56. Interior parts are typically made from composite panels (e.g. a lightweight honeycomb core sandwiched between resin-impregnated fiberglass or carbon fiber fabric called “prepreg”) and covered by a decorative laminate. Typical interior fabrication operations involve: curing of panel layups in ovens or heated presses; routing, drilling, and trimming of cured panels; surface finishing (e.g. filling and sanding operations) of the panels and installation of panel inserts using various resin and/or sealant products; silk screening and digital inkjet printing of decorative laminates; adhesive spray coating of panels for decorative laminate application and curing of the laminates to the panels in vacuum formers; other miscellaneous coating operations; part assembly; and miscellaneous solvent wipe cleaning operations.
Figure 1-2
Facility Map

SOURC:E: The Boeing Company
Job No. 33759097

Boeing Commercial Airplane Group, Everett Plant
PSD Application
New assembly lines for the 787 model stow bins, crew rests, and other miscellaneous items will be installed in Building 40-56. These new assembly lines will be potential sources of fugitive VOC emissions from solvent cleaners and miscellaneous products such as resins, adhesives, and other coatings used in the fabrication process. In addition, at least two new routers, two new electric ovens for resin curing, and two new vacuum formers with infrared (IR) curing will be installed. VOC emissions from the ovens and vacuum formers are anticipated to be negligible due to the nature of the curing operations and/or the negligible VOC content of the products involved. Particulate emissions from the routers, which will be captured by existing or new dust collection equipment (e.g., cyclone separators and baghouses), are expected to be negligible. At this time, no new spray booths, presses, or silkscreen machines are anticipated for 787 interiors production.

2.2.2 Building 40-25 – Final Assembly

Final assembly of the 787 model airplanes will be completed in Building 40-25. The final assembly operations in this building will include: joining the body sections into a complete fuselage, involving circumferential joins of separate body sections; joining the wings to the fuselage; joining the tail horizontal stabilizers and the vertical fin to the rear of the airplane; installing the wing-to-body fairings, engines, main landing gear, main landing gear doors, nose landing gear, auxiliary power system, interiors (e.g., seats, stow bins, ceilings, sidewalks, partitions, etc.), and performing functional testing.

Assembly operations in Building 40-25 will be largely mechanical in nature, although these activities will result in potential fugitive emissions from solvent cleaning, touch-up spray coating and the use of miscellaneous products such as resins, adhesives, and sealants. New tooling and equipment needed for the assembly operations discussed above will be installed in Building 40-25, however, at this time, no new spray booths, ovens, or other similar equipment potentially emitting VOCs with dedicated exhaust ventilation are anticipated to be installed in the final assembly building.

2.2.3 Buildings 45-01, 45-93, and 45-04 – Exterior Painting

Once the final assembly of the 787 model airplane has been completed, the aircraft will be moved to one of three existing paint hangars at the Everett facility for final exterior coating. At this time, it is anticipated that the fuselage sections from the suppliers will be delivered to the Everett facility with a primer, intermediate coat, and first topcoat applied. In addition, it is anticipated the wings will be delivered to the Everett facility fully painted. Under this scenario, operations in the paint hangar for the 787 will include solvent cleaning and reactivation of the first topcoat, applying a "tie-coat" to enhance the adhesion of the second topcoat to the first topcoat, applying a sealer, and subsequent topcoats as necessary, and applying speed lines, logos, registration numbers, warning signs, etc. In addition, the pre-painted wings may require touch-up coating.

If the fuselage sections are not delivered to the Everett facility pre-coated, then paint hangar operations at the Everett facility would involve application of a primer and intermediate coat in addition to the above operations, with the exception of tie-coat application. Under either scenario, depainting may occasionally be required to correct errors in the original coating work. Potential VOC emissions from exterior painting operations will primarily occur from solvent cleaning, reactivation, and coating operations.
The paint hangar operations described above for the 787 model airplanes are in addition to the existing cleaning, coating, and depainting operations that currently take place in the hangars on existing airplane models. Although the materials used on the 787, as well as the application equipment used to apply the materials, may differ from those used on the existing models due to the composite nature of the 787, all such materials and equipment will comply with existing requirements of permits and the Aerospace National Emission Standards for Hazardous Air Pollutants (ANESHAP) (40 CFR Part 63, Subpart GG).

No new spray booths, ovens or other similar equipment with dedicated exhaust ventilation for VOCs are anticipated to be installed in the hangars. However, several changes are planned for the three paint hangars and are listed below. The changes identified in italics are required to accommodate the 787 program in particular, but are being undertaken to ensure consistent, reliable operation of the hangars for all model lines generally.

Building 45-01 and 45-04 Paint Hangars:

- Acquire new engine inserts for under wing scaffolding to accommodate 787 engines.
- Acquire new main gear work stands/gear filler area to accommodate 787 main landing gear.
- Program existing stacker collision avoidance system for 787 profile (Stackers are the automated moving work platforms the painters work from to prep/paint the fuselage).
- Balance existing ventilation system for 787 profile (e.g. adjust supply air dampers as necessary to achieve desired air flow around the 787 profile, and program the damper settings into the existing control system).  
- Program existing weights scale system for 787 footprint.
- Acquire 787-3 winglet stands.
- Upgrade electrical power to airplanes from 45 to 90 kVA.
- Acquire new material lift to wing stands for freight.
- Replace four 100,000 CFM exhaust fans with new (45-01 only).

Building 45-03 Paint Hangar:

- Acquire new engine inserts for under wing scaffolding to accommodate 787 engines.
- Acquire new main gear work stands/gear filler area to accommodate 787 main landing gear.
- Program existing weights scale system for 787 footprint.
- Replace under wing scaffolding.
- Acquire 787-3 winglet stands.
- Upgrade electrical power to airplanes from 45 to 90 kVA.
- Replace stackers.
- Install new collision avoidance system.
- Perform structural analysis, and upgrade if necessary.
- Replace the supply ventilation system (i.e. replace entire supply system, including intake louvers, supply fans, filter banks, heating coils, supply ducts and balance for all models).
- Install drop ceiling and modify fire protection system.
- Modify lighting system.

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This application conservatively lists the changes to the hangars. As presented by Boeing in Section 5.1.1, most or all of these changes are exempt from any PSD review and need not have been included as part of this 787 project.
• Perform weigh scale analysis and upgrades.
• Acquire new center tail stand and modify existing horizontal stabilizer tail stands.
• Acquire new floor stacker (forklift).
• Acquire new material lift to wing nacelles for freight.
• Install new swing away/folding stacker rails for 767-200.
• Acquire engine insert hoists and provide for engine insert storage.
• Modify over wing safety.

2.2.4 Other Potential Activities
In addition to the activities described above, and depending on final decisions made regarding certain work packages, it is possible that other minor cleaning, coating, and manufacturing activities will be performed at the Everett facility that have potential VOC emissions. For example, it is possible that the Everett facility, instead of the supplier, will coat the 787 vertical fin and rudder and an existing spray booth on site. No new or modified spray booths, ovens, or other similar equipment with dedicated exhaust ventilation for VOCs are anticipated for these possible activities. Also, based upon the conservative assumptions used in the VOC emission estimates for the 787 project described in Section 3, any VOC emissions from these possible activities should not increase actual emissions above those estimated.

3.0 AIR EMISSIONS INVENTORY

3.1 VOC EMISSIONS
Criteria pollutants regulated under the PSD program, including VOCs and particulate matter (PM), will increase with the 787 project. Of the pollutants regulated by the PSD program, the 787 project is only significant for VOCs as shown in Table 3-1.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Estimated Emissions Increase (tons per year) (tpy)</th>
<th>PSD Significant Emissions Rate (Qy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>VOC</td>
<td>297</td>
<td>40</td>
</tr>
<tr>
<td>PM (including PM10)</td>
<td>1</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3-1. Criteria Pollutant Estimated Emissions Increases

5 URS CORPORATION
Any emissions increase from potential 787 vendor operations that might be established on nearby property are not included in this PSD permit application for the Everett facility because they do not meet the criteria for aggregation with the emissions increase from Boeing Everett. 2

Emissions of VOCS from the 787 production will primarily occur from three distinct activities: cleaning and coating operations in the paint hangars, assembly operations in Building 40-25, and interiors manufacturing operations in Building 40-56. Table 3-2 presents the maximum estimated VOC emissions from 787 production alone. Table 3-3 presents the maximum estimated emissions increase from the paint hangars, the 40-25 final assembly building, and the 40-56 interiors manufacturing building once the changes associated with the 787 project are complete, using the years 2000 and 2001 to determine pre-change emissions. This estimated emissions increase includes emissions from 787 production as well as emissions from the existing airplane programs.

3.1.1 Building 40-56 -- Interiors Manufacturing Operations Estimated Emissions
For interiors manufacturing operations, a "tons of VOC emission/seat" emission factor was estimated using interiors manufacturing-related point segment data from the Boeing Everett Facility's Annual Emission Statement reports from 1998 through 2003 at filed with the Puget Sound Clean Air Agency (PSCAA). Under this scenario, the Everett facility would build the 787 ceilings, sidewalls, stow bins, crew seats, perform silk screening, etc. This resulting "tons of VOC emission/seat" factor was then multiplied by the estimated number of seats in a typical 787 and the maximum anticipated annual 787 production rate to estimate VOC emissions from 787 interiors manufacturing. The estimate conservatively assumed that the scope of the 787 interior components that would be manufactured at the Everett facility would be similar to that for the existing Boeing models, when in fact the actual scope of interior components manufactured at the Everett facility for the 787 will likely not be as broad as for the existing models. A more detailed description of the emission estimate is presented in Appendix B.

3.1.2 Building 40-25 -- Final Assembly Estimated Emissions
For Building 40-25 an extract from the hazardous materials (HazMat) records for the 767 final body join/final assembly process in Building 40-24 was used to derive a VOC emission estimate on a per-plane basis for the 787 final assembly process. This value likely overestimates the actual 787 final assembly emissions since the 787 would have fewer joints and the 787 sections would be delivered to the Everett facility pre-stuffed (i.e. insulation and systems such as electrical and plumbing will already be installed) unlike the 767 sections. A description of the assumptions and estimated emissions is presented in Appendix C.

1 Even if a determination were made that any potential emissions from potential 787 vendor operations should be included in the evaluation of this PSD application, the modeling conducted for this application is conservative, and the air quality from the 787 project as presented in Section 6 are so slight, that Boeing believes that the only obligation remaining to address such vendor emissions would involve the vendor(s) obtaining any required permit(s) from the appropriate agency or agencies.

2 For purposes of calculating the emissions increase due to the 787 project, Washington State Department of Ecology (WDOE) has agreed that, as a result of the airline industry downturn after the terrorist attacks on September 11, 2001, Boeing may use the years 2000 and 2001 for determining the pre-change actual emissions. See Appendix A to this application for the email from Rich Thompson (WDOE) to John Fobert (Boeing), RE: Time Period for Calculating Pre-Change Actual Emissions, dated October 5, 2004.

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3.1.3 Buildings 45-01, 45-03 and 45-04 – Exterior Paint Estimated Emissions

The proposed exterior paint emission estimate assumes that the 787 fuselage sections would arrive at the Everett facility with the existing prime coat, intermediate coat, and a first topcoat applied. In this case, the 787 decorative paint process in the paint hangar(s) would consist of cleaning/reactivating the topcoat, applying a tie-coat, applying a second topcoat and subsequent topcoats as necessary, and applying speedlines, logos, markings, etc. The estimate assumed that the quantities of cleaning solvent, tie-coat, and topcoat used on the 787 fuselage would be similar to the amount of cleaner, primer, and topcoat, respectively, used on the 767 fuselage since the 767 is the closest existing Boeing airplane model in size to the 787 model. Little or no wing coating would be required since the wings would be delivered to the Everett facility service-ready (i.e., fully pre-coated). For purposes of the estimate, it was assumed that the VOC contents of the primers, topcoats, and other coatings would be equivalent to either the ANESHAP VOC content limits for those ANESHAP regulated primers and topcoats, or the maximum expected VOC content of coatings not regulated by the ANESHAP. A description of the assumptions and estimated emissions using solvent tank inventory schedules and primer and topcoat logs/customer order information is presented in Appendix D.

Even if the 787 was not pre-coated off-site, VOC emissions from the decorative paint process associated with coating the fuselage and wings would only be approximately 0.02 tons per plane greater since a lower VOC prime coat and intermediate coat would be applied in place of the higher VOC tie-coat. This estimated value is included in Appendix D but is not the basis for the PSD application emissions estimate.

<table>
<thead>
<tr>
<th>Process</th>
<th>Location (45-01, 45-03, &amp; 45-04)</th>
<th>Maximum Estimated Emissions from 787 Production (tons/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decorative Paint</td>
<td>Paint hangar(s) (45-01, 45-03, &amp; 45-04)</td>
<td>177</td>
</tr>
<tr>
<td>Assembly</td>
<td>40-25</td>
<td>49</td>
</tr>
<tr>
<td>Interiors</td>
<td>Manufacturing (40-56)</td>
<td>61</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>287</td>
</tr>
</tbody>
</table>

Table 3-2. Maximum Estimated VOC Emissions from 787 Production
Table 3.3. Maximum Estimated VOC Emissions Increase from the Paint Hangars, Bldg. 40-25, and Bldg. 40-56

<table>
<thead>
<tr>
<th>Location</th>
<th>Maximum Estimated Emissions Increase at 90% 787 Project Changes (tons/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paint Hangars (45-01, 45-03, &amp; 45-04)</td>
<td>188 tons/yr*</td>
</tr>
<tr>
<td>Bldg. 40-25</td>
<td>49 tons/yr</td>
</tr>
<tr>
<td>Bldg. 40-56</td>
<td>60 tons/yr</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>297 tons/yr</td>
</tr>
</tbody>
</table>

* See Table D-5 in Appendix D. The Maximum Estimated Emissions Increase in Paint Hangars = Total Maximum Estimated Annual VOC Emissions After the Project (412 tons) - Total Average Annual VOC Emissions in 2000/2001 (214 tons).

** See Table B-2 in Appendix B. Maximum Estimated Emissions Increase in Bldg. 40-56 = Total Maximum Estimated Annual VOC Emissions After the Project (205 tons) - Total Average Annual VOC Emissions in 2000/2001 (145 tons).

3.2 NON-VOC EMISSIONS

Other non-VOC pollutants, if any, emitted from the 787 project will be addressed as necessary by Boeing through a separate Notice of Construction (NOC) application submitted to PSCAA for approval as described in Section 4.

4.0 REGULATORY ANALYSIS

4.1 OVERVIEW

The United States Environmental Protection Agency (EPA), Washington State Department of Ecology (WDOE), and PSCAA have promulgated air quality regulations under the PSD and/or New Source Review (NSR) NOC programs. The proposed 787 program described in Section 2 of this application will comply with the applicable requirements of these federal, state, and local regulations. This application addresses the PSD program, as described below. NOC requirements are discussed in the Section 4.5. If an NOC application is required by the PSCAA regulations, a separate application will be submitted to that agency under separate cover.

4.2 PSD APPLICABILITY

In the state of Washington there are two sets of rules for the PSD program: federal and state. Recent revisions to the Washington State program effective February 10, 2005 have resulted in the two programs being substantially the same. The federal program is found in 40 Code of Federal Regulations (CFR) 52.21, as in effect July 1, 2004, and was delegated to WDOE by EPA Region 10 on February 23, 2005. The state PSD program is based upon the federal PSD regulations at 40 CFR 52.21, as in effect on July 2,
2004, which are adopted by reference, with certain minor changes, in Washington Administrative Code (WAC) 173-400-700 through 730 (adopted January 10, 2005; effective February 10, 2005). This application demonstrates compliance with the both the federal and state PSD requirements, which do not differ in any respect relevant to his permitting.

The Boeing Everett facility is classified as a "major source" under the PSD regulations because it has the potential to emit (ITE) 250 tons per year (tpy) or more of a criteria pollutant. This application seeks PSD permitting of the 787 project at the Boeing Everett facility as a "major modification" to the Everett facility.

4.3 PSD APPLICATION REQUIREMENTS

Applications for PSD permits must provide information adequate for the permitting authority to determine compliance with all PSD program requirements (WAC 173-400-730(1)(a)). As required by WAC 173-400-720(l), the resulting PSD permit must assure compliance with the applicable PSD requirement, including the list of requirements below. Other elements of the PSD application, i.e., project description, emission estimates, and PSD applicability are included in this application to support the demonstration of these requirements.

- The allowable emissions from the proposed major modification will not delay the attainment date for an area not in attainment or cause or contribute to a violation of any ambient air quality standard. This requirement will be considered to be met if the projected impact of the increase in allowable emissions from the proposed major modification at any location within a nonattainment area does not exceed the levels identified in WAC 173-400-720(4)(a)(i) and 40 CFR 51.165(b)(2), for the pollutants for which the area has been designated nonattainment.

- The allowable emissions from the proposed project, in conjunction with all other applicable emissions increases, would not cause or contribute to air pollution in violation of any national ambient air quality standard (NAAQS) or any applicable maximum allowable increase over the baseline concentration in the area (WAC 173-400-720(c)(a)(v) and 40 CFR 52.21(k)).

- The applicant must also provide an additional impact analysis of the impairment to visibility, sails, and vegetation that would occur as a result of the project (WAC 173-400-720(4)(a)(v) and 40 CFR 52.21(o)).

- The proposed project will comply with the special protection requirements for federal Class I areas required by WAC 173-400-117 and 40 CFR 52.21(g).

- The proposed project will meet each applicable emissions limitation under the SIP and each applicable emissions standard and standard of performance under 40 CFR Part 60 and 61 (WAC 173-400-720(4)(a)(v) and 40 CFR 51.21(j)(a)). There are no Part 60 or 61 standards applicable to the proposed 787 project.
• The proposed project will apply Best Available Control Technology (BACT) as defined in 40 CFR 52.21(b)(12) and if required pursuant to WAC 173-400-720(4)(a)(v) and 40 CFR 52.21(j).

• The applicant will provide pre-application monitoring data of meteorology and air quality conditions. WDOE has determined that representative data are available and therefore no pre-application monitoring of meteorology and air quality conditions is necessary, as required by WAC 173-400-720(4)(a)(v) and 40 CFR 52.21(m).

4.4 OTHER REGULATORY REQUIREMENTS

In addition to the PSD regulations, the proposed 787 program may need to comply with other federal and local requirements. This section lists the potential regulatory programs which may apply to the 787 operations.

4.4.1 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

Title III, Section 112 of the 1970 Clean Air Act established National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Title III, Section 112 of the 1990 Clean Air Act Amendments established additional NESHAPs for specific categories of sources, sometimes referred to as Maximum Achievable Control Technology (MACT) standards. The original NESHAPs and the more recent MACT-based NESHAPs are codified in 40 CFR Part 61 and Part 63, respectively. These standards have been adopted by reference and have been delegated to WDOE and PSCAA by EPA. No standards under 40 CFR 61 are applicable to the proposed 787 project. Under the requirements of 40 CFR Part 61, a facility must implement MACT to control air toxic emissions if the facility is subject to an adopted MACT standard identified in 40 CFR Part 63 which has been promulgated pursuant to Clean Air Act Section 112(d). A MACT standard has been promulgated for aerospace manufacturing, 40 CFR 63, Subpart G, the ANESHAP, which applies to facilities that are engaged in the manufacture or rework of commercial, civil, or military aerospace vehicles or components and that are major sources of Hazardous Air Pollutants (HAPs). The proposed 787 project involves the manufacture of commercial aerospace vehicles and components and the facility exceeds the major source thresholds of 10 tpy for any single HAP or 25 tpy for all HAPs; therefore, these ANESHAP requirements apply.

The ANESHAP covers the following "affected sources":

• Each cleaning operation as follows: all hand-wipe cleaning operations constitute an affected source; each spray gun cleaning operation constitutes an affected source; all flush cleaning operations constitute an affected source.

• For organic HAP or VOC emissions, each primer application operation, which is the total of all primer applications at the facility.

Although the applicability of 40 CFR Part 63 requirements need not necessarily be addressed in a PSD application, it is discussed here because the Aerospace NESHAP is relevant to the BACT analysis in Section 5 of this application.
For organic HAP or VOC emissions, each topcoat application operation, which is the total of all topcoat applications at the facility.

For organic HAP or VOC emissions, each depainting operation, which is the total of all depainting at the facility.

Each chemical milling maskant application operation, which is the total of all chemical milling maskant applications at the facility. (There are no chemical milling maskant application operations at the Everett facility.)

Each waste storage and handling operation, which is the total of all waste handling and storage at the facility.

For inorganic HAP emissions, each spray booth or hangar that contains a paint or topcoat application operation subject to §63.745(g) or a depainting operation subject to §63.746(b)(6).

All affected sources at the Boeing Everett facility, whether associated with the proposed project or not, comply with all applicable requirements of 40 CFR Part 63, Subpart GG.

4.4.2 State and Local Permit Requirements

The construction of a project subject to the special PSD requirements might also be subject to the general NOC permitting program under WAC 173-400-110 (New Source Review), WAC 173-400-113 (Requirements for new sources in attainment or unclassified areas) and WAC 173-400-040 et seq. (new source review for sources of toxic air pollutants). However, as contemplated in WAC 173-400-110(4)(e) and 173-400-030, PSCAA’s new source review program (PSCAA Reg. 1, Article 6) applies in lieu of WAC 173-400-110 and WAC 173-400-113, and PSCAA implement the new source review program for toxic air pollutants.

Except for the PSD permit, PSCAA is the permitting authority for the 787 program. If required, these non-PSD requirements, including conformance with the ANESHAP will be addressed by the Boeing Everett facility through submittal of a NOC application to PSCAA.

5.0 BEST AVAILABLE CONTROL TECHNOLOGY ANALYSIS

5.1 BACT REQUIREMENT

Pursuant to the PSD regulations and relevant guidance, BACT is required to be implemented for a project which is a major modification, at (a) any new emission unit or activity which is part of the project that will emit the attainment pollutant(s) (for which the project results in a plant-wide significant emission increase and net emissions increase), and (b) any "modified" emission unit or activity — i.e., a unit or activity that would undergo a physical change or change in the method of operation as part of the project and would experience a net emission increase of such pollutant(s) "as a result" of that change. (40 CFR 52.21(a)(2) & (j)(3)). Thus, emission units and activities that are associated with a project, but that are
not new or modified, are not subject to BACT, regardless of whether such units or activities will experience an increase in emissions of that pollutant as a result of the project. Further, new or modified units or activities that are associated with a project, but will not emit that pollutant (for new units or activities) or experience an increase in emissions of that pollutant "as a result of" the project (for modified units or activities) will not be subject to BACT.

40 CFR 52.21(b)(12) defines BACT as follows:

_best available control technology_ means an emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under Act [sic] which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the Administrator determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

As presented in Section 3, for the 787 program, only VOC emission increases are anticipated to be significant. Emission increases of other pollutants as a result of the 787 program are insignificant and are not be included in the BACT analysis.

VOC emissions from the 787 program will primarily occur from three distinct activities as described in Section 2 of this application: airplane exterior coating operations in the existing paint hangars (45-01, 45-03, and 45-04), interior manufacturing operations in the existing 40-56 building, and assembly operations in the existing 40-25 building. The exact location of these activities within these existing structures (beds initially and thereafter) will vary depending on manufacturing logistics. The emissions will primarily be from cleaning and coating operations conducted in spray booths, paint hangars, and other enclosed, or otherwise served by dedicated exhaust systems, and from similar operations in open areas of the Buildings 40-56 and 40-25 which are not otherwise enclosed or served by dedicated exhaust systems because of the size or complexity of the parts or operations involved and/or because the nature of the operations (e.g. minor spray coating operations, sealing, hand-wipe cleaning) result in relatively low concentrations of contaminants in the indoor air and therefore booths are not necessary for worker protection or process control. The term "coating operation" as used here includes the application of primers, topcoats, sealants, adhesives, resins, and other VOC-containing materials with the use of spray equipment and other (i.e. non-spray) application techniques. The emission estimates for these activities in each building are shown in Table 5-1.
### Table 5-1
Total VOCs from Cleaning and Coating Operations*

<table>
<thead>
<tr>
<th>Building</th>
<th>Operation</th>
<th>Hangars, booths or other equip. (ppm)</th>
<th>Fugitive (ppm)</th>
<th>Ventilation Rate (cfm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-01</td>
<td>Cleaning and Coating Operations within Paint Hangar</td>
<td>155</td>
<td>0</td>
<td>400,000</td>
</tr>
<tr>
<td>45-03</td>
<td>Cleaning and Coating Operations within Paint Hangar</td>
<td>155</td>
<td>0</td>
<td>400,000</td>
</tr>
<tr>
<td>45-04</td>
<td>Cleaning and Coating Operations within Paint Hangar</td>
<td>155</td>
<td>0</td>
<td>500,000</td>
</tr>
<tr>
<td>40-25</td>
<td>Final Assembly</td>
<td>0</td>
<td>49</td>
<td>See Bldg 40-25 discussion</td>
</tr>
<tr>
<td>40-56</td>
<td>Interior manufacturing</td>
<td>164</td>
<td>47</td>
<td>See Bldg 40-56 discussion</td>
</tr>
</tbody>
</table>

*Including emissions from operations involving existing airplane models and emission increases from the 787 program.

#### 5.1.1 Buildings 45-01, 45-03, and 45-04 Paint Hangars

Cleaning and coating activities produce VOC emissions within the paint hangars when cleaning solvents and coatings are applied to the airplane using equipment ranging from spray guns to absorbent applicators, when that equipment is cleaned, and when raw materials and wastes are handled within the hangars. All three hangars have dedicated supply and exhaust ventilation systems, and use ANESHAP-compliant dry filter systems to remove particulates from spray coating operations before the air is exhausted to the outside atmosphere through multiple stacks. VOCs are not removed by these filter systems. The level of VOC emissions depends on the VOC content of the cleaning solvents and coatings applied, the equipment and methods by which they are handled and applied, the methods by which the application equipment is cleaned, and the methods by which waste solvent and coatings are handled and disposed of. Trenches within the basements of each hangar capture wastewaters from cleaning and other paint prep operations such as alodining and chemical abrasion, as well as from occasional de-painting operations.

This BACT analysis takes a conservative approach with respect to the paint hangars. As Boeing has discussed with Ecology, the BACT analysis analyzes end-of-stack controls under the Top-Down BACT approach, but does so even though it appears that the paint hangars are not subject to a control technology review per 40 CFR 52.21(j)(3). A number of factors affect this issue including that the relevant technologies are spray cleaning and coating operations, which are not undergoing any physical change or change in the method of operation, or "modifications", and therefore BACT does not apply to them. In addition, the paint hangar enclosures themselves, their ventilation systems, and their particulate filter systems (that do not control VOCs) are not considered emissions units. Even if they are, all of the changes to the paint hangars are exempt from PSD permitting as routine changes or otherwise exempt changes to multi-function facilities which were contemplated in the original facilities' designs and permits, and therefore are not "modifications" that would trigger BACT applicability. Finally, even if the

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13

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5.1.2 Interiors Manufacturing Operations in Building 40-56

Building 40-56 is an approximately 800,000 square foot manufacturing building. Approximately half of this area is used for interiors manufacturing. A variety of equipment with dedicated exhaust ventilation is used in the interiors manufacturing process, including spray coating booths, ovens, presses, and silkscreen printlines. Approximately 80% of the VOC emissions from the 40-56 come from such equipment and are exhausted to the atmosphere through their dedicated ventilation systems. The remaining 20% of VOC emissions from Building 40-56 are from manufacturing operations in open work areas. These fugitive emissions ultimately escape to the outside atmosphere through one of approximately 40 roof mounted exhaust ventilators (located throughout the building housing the interiors operations) which provide area exhaust ventilation at approximately 1.5 CFM per square foot of floor space for worker protection and comfort, through the exhaust fans associated with the spray booths and other ventilated equipment, or passively through doors and other building openings. The exhaust systems are interspersed throughout the building and many of their exhaust stacks/openings are physically separated from each other by hundreds of feet. Due to the multiplicity of exhaust fans and other escape routes for the fugitive emissions in Building 40-56, end-of-pipe controls for these fugitive emissions are not technically feasible. Thus, end-of-pipe controls were not evaluated.

No additional new spray booths, silkscreen printlines, or presses are anticipated for the 787 interiors production. No existing spray booths, silkscreen printlines, presses or other VOC emitting equipment will be modified. Changes that are anticipated in Building 40-56 to accommodate 787 interiors production include the addition of new equipment such as composite routers, vacuum formers, insert cure ovens, and moving assembly lines. Any new equipment with dedicated exhaust systems is anticipated to be a negligible source of VOC emissions.

5.1.3 Assembly Operations in Building 40-25

Building 40-25 is a 450,000 square foot bay within a larger open building complex that makes up the main factory where models 747, 767, and 777 airplanes are also assembled. This building complex covers approximately 7.5 million square feet with a roof height of over 100 feet. Given the size and complexity of the assembly operations, the parts involved, and the small scale of the anticipated cleaning and coating operations, there will not be any dedicated VOC exhaust ventilation systems associated with the 787 final assembly operations in the Building 40-25. As such, VOC emissions from the final assembly process will be fugitive, naturally circulating throughout the larger building complex before...
ultimately escaping to the outside through a multitude of general building exhaust systems (e.g. trench and tunnel exhaust fans, and roof ventilators) process exhaust systems the large bay doors, and other building openings. For example, Building 40-25 has twenty 38,000 CFM roof ventilators occasionally used to provide area ventilation during the summer, eight air handling units rated at 30,000 CFM of which typically two are operating at any one time, and five main tunnel and trench exhaust fans rated between 9100 to 29,050 CFM which typically operate continuously. These systems are intermixed throughout the building and many of their exhaust stacks/openings are physically separated from each other by hundreds of feet. Due to the multiplicity of exhaust fans and other escape routes for the fugitive emissions in Building 40-25, end-of-pipe controls for these fugitive emissions are not technically feasible. Thus, end-of-pipe controls were not evaluated.

In the following top-down analysis, emissions in the paint hangers (Buildings 45-01, 45-03, and 45-04) are conservatively evaluated to determine whether end-of-pipe controls on ventilation system ducts are economically feasible. For the reasons discussed above, end-of-pipe controls were not evaluated for the 40-56 (interiors) and 40-25 (assembly) operations. However, activities which generate fugitive VOC emissions associated with any new or modified emission units or activities in the 40-25 (assembly) and 40-56 (interiors) operations (e.g. solvent hand wiping of parts on the new 747 assembly line), were evaluated in terms of controls of the VOC content of the cleaning solvents and coatings applied, the equipment and techniques by which they are applied, and best management practices.

5.2 “TOP-DOWN” BACT APPROACH

The approach to determine BACT based on consideration of the most stringent technology first is commonly referred to as a “Top-Down” BACT assessment. The Top-Down approach includes the following steps:

- Identify all control technologies.
- Eliminate technically infeasible options.
- Rank remaining control technologies by control effectiveness.
- Evaluate most effective controls and document results.
- Select BACT.

5.2.1 Identify All Control Technologies

In order to identify potential control alternatives, several information sources were consulted, including the EPA’s RACT/LAER Clearinghouse (RRLG) Database (October 5, 2004, EPA) the South Coast Air Quality Management District (SCAQMD) BACT database, the Bay Area Air Quality Management District (BAAQMD) BACT guidelines, the California Air Pollution Control Officers Association (CAPCOA) BACT guidelines, the San Joaquin Valley Air Pollution Control District (SVAPCD) BACT guidelines, and recent Aerospace Surface Coating NSR and PSD applications. A summary of the BACT and Lowest Achievable Emission Rate (LAER) determinations from enclosed aerospace surface coating operations is shown in Tables 5-2 through 5-5. All determinations made from similar and like-kind operations from 1970 (the earliest date at which entries were submitted) to October 5, 2004 under the heading of “Aerospace Surface Coating” have been included to provide an exhaustive listing of technologies implemented.
<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Source</th>
<th>Emission Limit</th>
<th>Controls</th>
<th>BACT/LAER</th>
<th>Permit Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Aviation Services, Inc.</td>
<td>CA</td>
<td>Two M&amp;W oily filter automotive spray booths treating aerospace coatings such as protective coatings and lacquer thinners to coat large and small aircraft parts</td>
<td>3.0 gal/dy</td>
<td>Usage limit and use of Aerospace NESHAP compliant materials</td>
<td>LAER</td>
<td>6/18/1999</td>
</tr>
<tr>
<td>Hill AFB</td>
<td>UT</td>
<td>Pilot plant study</td>
<td>201 tons/yr</td>
<td>Zeolite adsorption system (95% control efficiency)</td>
<td>OTHER CASE-BY-CASE</td>
<td>12/15/997</td>
</tr>
<tr>
<td>Kol-Gard Coating &amp; Milg</td>
<td>CA</td>
<td>The coating operation consists of nine spray booths and five ovens. VOCs are captured in the concentrator and described with hot air to the thermal oxidizer</td>
<td>516.0 lb/day</td>
<td>Zeolite concentrator and thermal oxidizer (97% control efficiency)</td>
<td>LAER</td>
<td>2/22/1987</td>
</tr>
<tr>
<td>CA Air National Guard, Fresno</td>
<td>CA</td>
<td>HVLP applicator used to coat aerospace parts</td>
<td>20.9 lb/day</td>
<td>HVLP</td>
<td>LAER</td>
<td>2/29/1996</td>
</tr>
<tr>
<td>T.B.M. Inc</td>
<td>CA</td>
<td>Aircraft refinishing operation</td>
<td>38.5 lb/day</td>
<td>Low-VOC coatings and Hensig® GWW® enclosed gan</td>
<td>OTHER CASE-BY-CASE</td>
<td>11/6/1995</td>
</tr>
<tr>
<td>Huck International - Deutsch Operations</td>
<td>CA</td>
<td>Four spray booths and three bake ovens vented to thermal oxidizers</td>
<td>59.0 lb/day</td>
<td>Thermal oxidizer</td>
<td>LAER</td>
<td>3/9/1995</td>
</tr>
<tr>
<td>Douglas Products Division</td>
<td>CA</td>
<td>Spray booth and flash-off area operation is totally enclosed and vented to concentrator. VOCs captured in concentrator are vented to thermal oxidizer for destruction</td>
<td>341.5 gal/day</td>
<td>Concentrator and thermal oxidizer</td>
<td>LAER</td>
<td>3/30/1994</td>
</tr>
</tbody>
</table>
### Table 5-3
SCAQMD Search of Aerospace Surface Coating Operations

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Source</th>
<th>Emission Limit</th>
<th>Controls</th>
<th>BACT/LAER</th>
<th>Permit Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northrop-Gumman</td>
<td>CA</td>
<td>Two 10'W x 9'L x 14'H booths coating aircraft assemblies with noncompliant maskant</td>
<td>414 blday</td>
<td>Carbon adsorber (99.8% destruction efficiency, 94.6% overall efficiency)</td>
<td>LAER</td>
<td>PTC 2/25/1991</td>
</tr>
<tr>
<td>Barry Controls</td>
<td>CA</td>
<td>Four spray booths coating Adhesive Bonding Primers Rubber-to-Metal Bonding</td>
<td>400 lbmo</td>
<td>Thermal oxidizer (destruction efficiency 97%, overall efficiency 82.5%)</td>
<td>LAER</td>
<td>PTC 12/27/92</td>
</tr>
<tr>
<td>Northrop B-2 Division</td>
<td>CA</td>
<td>Aircraft paint spray facility in aircraft hanger</td>
<td>2 gal/day</td>
<td>Carbon adsorber with 90% control efficiency</td>
<td>LAER</td>
<td>PTC 5/3/90</td>
</tr>
</tbody>
</table>

### Table 5-4
BAAQMD Guidelines for Aerospace Surface Coating Operations

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>LAER</th>
<th>Typical Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precursor Organic Compounds (&gt;25 blday uncontrolled)</td>
<td>1. Coating at VOC content and transfer efficiency complying w/SCAQMD Reg. 8, Rule 29, and emissions controlled to overall capture/ destruction efficiency &gt;90%</td>
<td>Collection System Vented to Carbon Adsorber or Afterburner</td>
</tr>
<tr>
<td>Company</td>
<td>Location</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Naval Air Station Laypore</td>
<td>CA</td>
<td>Intermediate Maintenance Coating Operation</td>
</tr>
<tr>
<td>Advanced Industrial Coating, Inc.</td>
<td>CA</td>
<td>Coating of computer, medical specialty, and aerospace metal parts and products</td>
</tr>
<tr>
<td>Edwards AFB</td>
<td>CA</td>
<td>Hangar-sized spray booth for aircraft up to EC-18</td>
</tr>
<tr>
<td>Boeing Commercial Airplanes, Everett Division Pant</td>
<td>WA</td>
<td>Surface coating, aircraft</td>
</tr>
<tr>
<td>Health Zone Aerospace Co.</td>
<td>WA</td>
<td>Spray booth, adhesive</td>
</tr>
<tr>
<td>Boeing Commercial Airlines</td>
<td>WA</td>
<td>Surface coating, aircraft, corrosion inhibitor</td>
</tr>
<tr>
<td>Boeing Commercial Airlines</td>
<td>WA</td>
<td>Surface coating, aircraft parts</td>
</tr>
<tr>
<td>Tracer Flight Systems Inc.</td>
<td>CA</td>
<td>Coating operation aircraft</td>
</tr>
<tr>
<td>Boeing Commercial Airplanes, Everett Division Pant</td>
<td>WA</td>
<td>Surface coating, aircraft</td>
</tr>
<tr>
<td>Coorspin</td>
<td>CA</td>
<td>Dip tank</td>
</tr>
<tr>
<td>Boeing Commercial Airplanes</td>
<td>WA</td>
<td>Surface coating, aircraft</td>
</tr>
<tr>
<td>Northrop B-2 Division</td>
<td>CA</td>
<td>Aircraft paint spray facility in hangar</td>
</tr>
<tr>
<td>Company</td>
<td>Location</td>
<td>Source</td>
</tr>
<tr>
<td>-------------------------</td>
<td>----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Northrop</td>
<td>CA</td>
<td>Material application, aircraft spray facility</td>
</tr>
<tr>
<td>Pratt &amp; Whitney, UTC</td>
<td>CT</td>
<td>Oven</td>
</tr>
<tr>
<td>Boeing Commercial Airways</td>
<td>WA</td>
<td>Paint Hangar</td>
</tr>
<tr>
<td>Bell Helicopter Textron Inc.</td>
<td>TX</td>
<td>Spray booth, paint</td>
</tr>
<tr>
<td>Rockwell International</td>
<td>OK</td>
<td>Chemical maskant on ACFT skins</td>
</tr>
</tbody>
</table>
The technologies identified in the literature search include:

- Carbon/zeolite adsorption
- Thermal oxidation
- Concentrator/thermal oxidization
- Low VOC coatings
- High transfer efficiency coating equipment/techniques, and
- Best management practices.

5.2.2 Eliminate Technically infeasible Options

All of the above technologies have been demonstrated in practice and would be technically feasible for controlling VOC emissions from cleaning and coating operations conducted in paint hangars with dedicated exhaust systems. As discussed in Section 5.1, end-of-pipe controls are not technically feasible for fugitive emissions from Buildings 40-25 and 40-56.

5.2.3 Rank Control Technologies by Control Effectiveness

Table 5-6 ranks the identified control technologies by effectiveness.

<table>
<thead>
<tr>
<th>Control Technology</th>
<th>Control Efficiency (Percent)</th>
<th>Uncontrolled Emission Rate (tpy) **</th>
<th>Controlled Emission Rate (tpy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Adsorption</td>
<td>99</td>
<td>155</td>
<td>1.55</td>
</tr>
<tr>
<td>Thermal oxidation</td>
<td>99</td>
<td>155</td>
<td>1.55</td>
</tr>
<tr>
<td>Concentrator/thermal oxidizer</td>
<td>99</td>
<td>155</td>
<td>1.55</td>
</tr>
<tr>
<td>Low VOC coatings/HTE coating equipment/best management practices</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

*Low VOC coatings, high transfer efficiency coating equipment/techniques, and best management practices as specified in the Aerospace NESHAP are proposed as part of this project. No emission estimate without using these technologies has been made for the 787 program.

**Maximum uncontrolled emission in any one hangar.

5.2.4 Evaluate Most Cost Effective Controls

Based on the definition of BACT in 40 CFR 52.21(b)(12), cost effectiveness must be taken into consideration in determining BACT for each new or modified emission unit or activity. The cost effectiveness threshold used by the WDOE in a recent PSD draft permit was $10,000 per ton of emissions reduced (Darrington, 2004). That is, if the cost effectiveness of a technology exceeds $10,090 per ton, that technology is not considered cost effective. While the Darrington draft permit addressed emissions. 

20 URS CORPORATION
of carbon monoxide (CO), WDOE has confirmed in conversations with Boeing’s environmental consultant, URS, that this threshold applies to VOCs as well.

Carbon Adsorption
Carbon adsorption has been proven to be effective for control of a variety of low concentration VOCs. Chemical compounds adhere to the large surface area of pores in activated carbon canisters. Once VOCs are adsorbed onto the carbon, the carbon is either regenerated on site (with associated treatment of off gases) or transported off site for disposal or regeneration. Carbon adsorption has been demonstrated in large-scale paint hangars (Table 5-5, Edwards AFB). Based on vendor literature (Shepherd, 2001), the gas loading for an adsorber should be 100 cfm per square foot of face area. For a flow rate of 400,000 cfm in the 45-03 paint hangar, the face area will be 4000 square feet, requiring eighty 8 foot diameter vessels. For an average adsorption efficiency of 10 percent (for typical solvents used in aerospace coatings) and an emission rate of 155 tpy, the total quantity of carbon needed replacement or regeneration would be 610 tpy. At an estimated cost for regeneration of $2.00 per pound (ibid), the annual regeneration cost would be $2,440,000. Ignoring capital cost altogether, the estimate would yield a conservative cost effectiveness of $15,740 per ton, well above the threshold value of $10,000 per ton used by WDOE. Therefore, carbon adsorption is not cost effective for open area emission control for the 787 program and therefore does not represent BACT for the 787 program. Zeolite adsorption was also identified in the BACT technology search. However, zeolite adsorption is even more expensive than carbon adsorption, and thus was not further examined in this BACT analysis.

Thermal Oxidation
In thermal oxidation, VOCs react with oxygen in an enclosed combustion chamber at temperatures between 1400°F and 1800°F to form primarily water vapor and carbon dioxide. The high temperatures of thermal oxidizers are maintained by burning the VOC concentrations in the incoming gas and using a supplementary fuel, usually natural gas. In a regenerative thermal oxidizer, heat is recovered from the flue gas in a regenerative heat exchanger. If the concentration of VOC pollutant in the incoming stream is low, supplementary fuel requirements and costs are high. Consequently, thermal oxidizers are more commonly used with higher pollutant concentrations than those in paint hangar exhaust.

The cost effectiveness calculation for a regenerative thermal oxidizer is included as Appendix F. Using operating data from Boeing, vendor cost estimates, and EPA BACT cost sheet default values, with a capital cost estimate of $7 million, the cost effectiveness of thermal oxidation is $27,820 per ton VOC removed, well above the threshold value of $10,000 per ton used by WDOE. Therefore, for the coating and solvent use operations in the paint hangars, thermal oxidation is not cost effective, and does not represent BACT for the 787 program.

Rotary Concentrator/Regenerative Thermal Oxidizer
For air streams with relatively low VOC concentration, rotary concentrators can be used to concentrate the emissions into smaller air streams that can be cleaned more economically. The rotary concentrator is designed to continuously adsorb VOCs from an air stream onto an adsorbent media and discharge clean air. This is achieved through the use of a moving adsorbing wheel, a section of which is simultaneously
desorbed. This design eliminates the need for dual running and stand-by adsorption beds. VOCs are adsorbed onto the adsorbent material and the clean air exits through the hollow center of the cylinder. A portion of the rotating cylinder is simultaneously desorbed by passing hot air through a section of the cylinder. The description section is sealed off from the remaining adsorption section of the rotor so that very high efficiencies can be obtained in the system. Zeolite is usually used as the adsorption media (Blocki, 2004).

The estimated cost of a rotary concentrator/regenerative thermal oxidizer would be $7.5 million, with an estimated annual cost of $800,000. The cost effectiveness calculation for the concentrator/regenerative thermal oxidizer is shown in Appendix G. The cost effectiveness for the concentrator/regenerative thermal oxidizer is $19,320 per ton of VOC removed. Therefore, the rotary concentrator/regenerative thermal oxidizer combination is not cost effective and does not represent BACT for the 787 program.

Low VOC Coatings, High Transfer Efficiency Coating Equipment/Techniques, and Best Management Practices

Low VOC coatings, high transfer efficiency coating equipment/techniques and best management practices for cleaning and coating operations for the 787 program will be as specified in the ANESHAP (40 CFR Part 63 Subpart G0). These include:

- Use of low VOC or low vapor pressure cleaning solvents and low VOC primers and topcoats.
- Use of HVLP or other high application efficiency coating equipment/techniques for primers and topcoats.
- Low pressure application of bulk solvent.
- Capture and containment of paint gun cleaning solvents.
- Capture and containment of flush cleaning solvents and VOCs on spent cleaning rags.

The above practices are both feasible and cost effective in reducing VOC emissions from during the 787 production.

5.2.5 Proposed BACT

Based on the above analysis, none of the end-of-pipe control technologies represent BACT for the proposed 787 program. The results of the RBLC database search indicate that compliance with the requirements of the ANESHAP MACT is the industry standard for controlling VOC emissions from decorative painting operations in the paint hangars, interior manufacturing, and assembly operations. These practices and requirements when applied to the VOC emissions from the proposed operations are both feasible and cost effective. These practices have been established by the ANESHAP regulations as being effective in controlling emissions, representing the MACT. Boeing is meeting BACT requirements for its existing operations and will do so for those of the proposed 787 program as well.
6.0 AMBIENT AIR QUALITY ANALYSIS

The PSD permit process requires that an ambient Air Quality Impacts Analysis be performed for pollutants that are emitted in significant quantities, which as described in Section 3 includes only VOCs for the proposed 787 program. The ambient air analysis may include three parts: National Ambient Air Quality Standards (NAAQS) analysis, Significant Impact Analysis, and PSD Increment Analysis.

This section presents the ambient air impact analysis for the proposed 787 program and includes a NAAQS and Significant Impact Analysis, which are an assessment of existing air quality and predictions using dispersion modeling of ambient concentrations that will result from the proposed 787 program and future growth associated with the 787 program. There is no PSD increment for VOCs (or ozone), so a PSD increment analysis is not included.

6.1 MODELING METHODOLOGY

VOCs are the only criteria pollutant that would potentially be emitted in significant quantities from the proposed 787 program. VOC emissions from the emission units that will be used in 787 production will potentially result in a "significant emissions increase" as discussed in Section 4. Because the emissions increase from the 787 program could exceed 100 tpy for VOCs, the WDOE required that the potential effects on ambient ozone concentrations be evaluated and modeled.

Typical dispersion modeling techniques are not available to model or predict VOC emissions impacts. WDOE, therefore, suggested use of an EPA-approved model, the Community Multi-scale Air Quality (CMAQ) model to predict ambient air impacts from the proposed VOC emissions. A modeling protocol was submitted to WDOE on December 23, 2004 that proposed the use of the CMAQ model. The protocol was approved in an email from Clint Bowman, WDOE, on February 11, 2004. The approved CMAQ modeling protocol is included in Appendix H.

Consistent with the approved Modeling Protocol, the CMAQ Modeling was performed by the Washington State University (WSU) Laboratory for Atmospheric Research. The CMAQ Modeling Report is included as Appendix I to this application. The following sections briefly summarize information contained in that CMAQ Modeling Report related to potential air quality impacts. The CMAQ Modeling Report should be referenced for specific details.

6.2 EXISTING AIR QUALITY AND STANDARDS

The Central Puget Sound region is currently designated by the EPA as in attainment for all criteria pollutants. As some of these areas had previously designated as non-attainment for these pollutants, ten-year maintenance plans for CO, Ozone (O3), and PM10 have been submitted to and approved by EPA. The areas covering the maintenance plans for CO and O3 include the Everett facility; however, the maintenance plan areas for PM10 are limited to the Seattle Downwind Corridor, Kent Valley and Tacoma Tideflats, areas which do not include the Boeing Everett facility. The location of the maintenance plan area boundaries for CO, O3, and PM10 in the Puget Sound area are shown on Figure 6-1.
Designated Maintenance Areas for Criteria Pollutants
Carbon Monoxide, Ozone, and Particulate Matter

Source: Puget Sound Regional Council

May 10, 2021

Job No. 33756987

Boeing Commercial Airplane Group, Everett Plant
PSD Application
In 1991, EPA classified the Central Puget Sound region as a non-attainment area for CO and O3. In 1987, the industrial areas in the Seattle-Bremerton Corridor, Kent Valley and Tacoma Tidelands were classified as non-attainment areas for PM10. Areas designated as non-attainment have exceeded the NAAQS for those criteria pollutants. In 1996, having met the NAAQS for several years, EPA redesignated the Central Puget Sound Region as attainment for CO, effective October 11, 1996, and O3, effective November 25, 1996. In 1999, having met the NAAQS for PM10, the three PM10 areas were redesignated attainment on March 17, 2001 (effective May 14, 2001).

As required by the Clean Air Act (CAA), the maintenance plans for CO and O3 and the three PM10 maintenance areas have been developed. EPA approved these plans as of the following effective dates: the CO maintenance plan was initially approved effective October 11, 1996 and a second plan approved effective September 7, 2004; the O3 maintenance plan was initially approved effective November 25, 1996 and second plan was approved effective September 7, 2004; and the PM10 maintenance plan was approved effective May 14, 2001.

In 1997, EPA established a new 8-hour ozone NAAQS of 0.08 parts per million (ppm) or 80 parts per billion (ppb), a new 24-hour PM2.5 NAAQS of 65 ug/m3, and a new annual PM2.5 standard of 15 ug/m3 (62 FR 38852, July 18, 1997). EPA has designated the Puget Sound area as attainment for all of these NAAQS.

Since the Puget Sound region is now in attainment for ozone and all other NAAQS pollutants, the current air quality data does not represent the worst-case scenario for VOC emissions. Therefore, the CMAQ modeling performed by WSU did not use current air quality data. Instead, the concentrations used in the CMAQ modeling were for a three-day period in July of 1996 during which exceedances of the 1-hour NAAQS for ozone occurred in the Snohomish County area. This period was prior to the re-designation of the Central Puget Sound as an attainment area for O3. Therefore, the data from this three-day period in July 1996 that was used to analyze the air quality impacts of the proposed 787 program is the worst historical case.

6.3 CUMULATIVE IMPACT ANALYSIS

6.3.1 Meteorological Data

Meteorological data used in PSD air quality modeling must be spatially and climatologically representative of the area of interest. Meteorological data used in the CMAQ model were provided from the Fifth-Generation Penn State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Meteorological Model Version 5-Version 3 (hereinafter “MM5v3”) (Grell, Dudhia and Stouffer, 1994) MM5v3 is a limited-area, nonhydrostatic, terrain-following sigma-coordinate model designed to simulate or predict mesoscale atmospheric circulation. The model is supported by several pre- and post-processing programs. This MM5v3 modeling system software has been developed at Penn State and ICAR as a community mesoscale model with contributions from users worldwide. MM5v3 is considered the state-of-the-art meteorological model to use for grid-type models such as the CMAQ dispersion model used in the WSU analysis.

24 URS CORPORATION
6.3.2 Source Input Data

Source input data to the CMAQ model include proposed emission rates and other source-related data. These emission rates and other source data are used to estimate the ambient concentration resulting from the proposed 787 project and existing sources which could contribute to background criteria pollutant concentrations.

Boeing Everett emissions from those emission units associated with the 787 project are modeled at their maximum estimated emission rates proposed in the application. Estimated actual emission rates for Boeing Everett’s sources are based upon the average of emissions for 2000 and 2001, as reported to PSCAA. Emissions from non-Boeing Everett sources came from a national inventory, the National Emissions Inventory (NEI-2001).

6.3.3 Impact Assessment Under the CMAQ Model

The CMAQ model is one of the EPA-approved models for determining the impacts of the proposed 787 project’s emissions on existing air quality. The model first calculates the spatial distribution of ozone concentration without the proposed 787 project emissions, and then calculates another scenario that includes the proposed 787 project’s emissions. The calculation is performed for a specific historical period when ambient air quality and meteorological data are available.

As discussed above, the period selected to be used in the modeling of the potential 787 program’s emissions’ impacts was a period from July 13 through July 16, 1996. This period was selected because modeling has already been performed for that period, the period represents a worst-case scenario since actual monitoring data from that period includes exceedances of the NAAQs for ozone, and potential impacts from the 787 program emissions could be determined using these readily available data.

To predict local cumulative air quality impacts from the proposed Boeing 787 project, two scenarios were modeled: a Base Case utilizing the estimated actual emission rates for Boeing Everett source emissions, determined based upon the 2000-2001 average emissions reported, along with all other sources from NEI-2001, and a Potential-to-Emit (PTE) Case which modeled the Boeing Everett facility’s VOC emissions from emission units associated with the 787 project at their maximum estimated emission rates, along with all other sources, including those emission units at the Boeing Everett facility not associated with 787 project and NEI-2001 emissions, at the base Case estimated annual emission rates. The results of the Base Case and PTE Case were compared to provide an estimate of the 787 project’s potential impact on ozone concentrations and visibility impairment in the Snohomish County area.

Spatial distributions of ozone impacts from the proposed 787 project are presented in the CMAQ Modeling Report. The report concludes that the proposed increase in Boeing Everett facility emissions from the 787 project presents no significant effects on ozone, including effects to Class I and Class II Areas. The largest ozone enhancement predicted on a one-hour basis was 120 ppt, which occurred at Lynnwood, Washington. This is an increase of less than 0.25% above the Base Case. Larger averaging times, for the 8-hour ozone NAAQS, would result in even lower predicted impacts.
With respect to Class I areas, the largest increase of the PTE case over the Base Case near Mt. Rainier National Park (NP) (123 km SE) was 30 ppt and 70 ppt near North Cascades NP (108 km NE) during brief periods of the analyzed episode on July 15, 1996. At any Class I area, the ozone increases are less than 100 ppt. Larger averaging times for the 8-hour ozone NAAQS would result in even lower predicted impacts.

6.4 PSD INCREMENT CONSUMPTION

A PSD increment consumption analysis is not required because the 787 program would not cause a significant net increase in emissions of pollutants for which there are PSD increments.

6.5 NEAR-FIELD AMBIENT AIR IMPACTS

Near-field impacts of toxic air pollutants will be evaluated as part of the NOC application if required by PSCAA. Although near-field ambient air impact analysis is required for some criteria pollutants, VOC emissions do not require near-field ambient air impact analysis and therefore, this assessment is not included in the application.

7.0 ADDITIONAL AIR IMPACT ANALYSIS

The PSD regulations require an evaluation of the effects of estimated emissions from a proposed modification to a source related to additional air impacts associated with visibility, soils and vegetation in Class I and II areas and effects of increased emissions on flora and fauna in Class I areas, i.e., air quality-related values (AQRVs). This section presents the additional impact analyses and assesses the impacts of air, ground, and water pollution on soils, vegetation, and visibility caused by estimated increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth (40 CFR §210.6, WAC 173-400-720).

7.1 SECONDARY GROWTH IMPACTS

Growth impact analysis includes a projection of the associated industrial, commercial, and residential sources growth that would occur in the area due to the proposed modification and an estimate of the air emissions generated by this estimated associated growth. Construction-related activities and mobile sources, if any, should also be considered.

The Washington State Department of Community, Trade and Economic Development (CTED) performed an Employment and Income Analysis of the Boeing 787 Project (CTED, 2004). The CTED analysis estimated both direct and indirect employment, income, and output for four future years. The four future years included: 2004 Pre-Construction, 2006 Construction, 2008 Finished Construction/Early Operations, and 2012 Steady State Ongoing Operations. The employment forecasts from the CTED analysis are shown in Table 7.1.

26 URS CORPORATION
Table 7-1. Employment Forecasts for Boeing 787 Project (CTED, 2004, p. 5)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Impact</td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Direct</td>
<td>5,906</td>
<td>2,860</td>
<td>15,820</td>
<td>7,120</td>
</tr>
<tr>
<td>Indirect and Induced</td>
<td>8,050</td>
<td>4,570</td>
<td>21,070</td>
<td>10,830</td>
</tr>
<tr>
<td>Total</td>
<td>13,956</td>
<td>7,430</td>
<td>36,890</td>
<td>17,950</td>
</tr>
</tbody>
</table>

Based upon these employment forecasts, commuting travel emissions were estimated for the forecasted employees for the four unique employment periods. Emission factors and assumptions for the commuting emission estimates were estimated by the Puget Sound Regional Council (PSRC) using Mobile6 (McGuirty, 2005). These emission estimates are shown in Table 7-2.

Table 7-2. Commuting Emission Estimates for Boeing 787 Project* (tons/day)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>683.9</td>
<td>6.84</td>
<td>3.87</td>
<td>19.2</td>
</tr>
<tr>
<td>Volatile Organic Compounds</td>
<td>144.4</td>
<td>0.36</td>
<td>0.21</td>
<td>1.02</td>
</tr>
<tr>
<td>Nitrogen Oxides</td>
<td>189.4</td>
<td>0.62</td>
<td>0.35</td>
<td>1.74</td>
</tr>
</tbody>
</table>

* Assuming 11 mile commute distance each way, average speed 57 mph, for both direct and indirect employment from Table 7-1.

** Puget Sound Regional Council (PSRC), 2004

The largest impact for CO emissions occurs during the years 2006 and 2008 and is less than 3 percent of the regional emissions estimated for CO in 2010, and the steady-state operations impact for 2012 is less than 2 percent of the regional emissions estimated for CO in 2010. The impact from 787 project-related commuting emissions for the other two pollutants listed above is even smaller on a percentage basis than that for CO. Because of this nominal impact, no significant growth impacts on air quality are anticipated from the Boeing 787 program.

The associated commercial and industrial growth in Everett and within the Puget Sound region will be nominal and is not expected to result in the development of any specific new goods or services to personnel potentially employed at the Everett facility. Since existing buildings will be used as part of the proposed 787 program, emissions from construction-related activities will be insignificant. Further information about potential growth impacts is included in Boeing Everett’s 1991 Environmental Impact Statement.
(EIS). (The City of Everett, as the lead agency, has determined that the potential environmental impacts, with respect to State Environmental Policy Act (SEPA), resulting from the changes to the Everett facility for the 787 program have already been adequately addressed in the 1991 EIS and they will not require a new threshold determination or supplemental EIS under WAC 197-11-600.) Based upon this information, no significant growth impacts on air quality are anticipated from the Boeing 787 program.

7.2 AIR QUALITY-RELATED VALUES

The PSD regulations require the analysis of other impacts, or AQVRs, which are evaluated by the Federal Land Managers (FLM) (40 CFR 52.21(e); WAC 173-400-720).

The FLM have developed guidance, Federal Land Managers Air Quality Related Values Work Group (FLAG) report that provides recommendations for assessing AQVRs and visibility impacts of proposed source modifications on nearby Class 1 areas (as further described in Section 7.3 below) (FLAG, 2001). As noted in the document, the FLAG report is only a guidance document that explains factors and information the FLMs propose to use in evaluating proposed PSD permit applications.

The FLAG guidance provides information and recommendations for assessing ozone (with a primary focus on nitrogen oxide emissions), deposition and visibility impacts.

Impacts from other potential AQVRs, i.e., cultural-archeological and paleontological resources, and odor, are not further evaluated in this PSD application, as they are not considered potential impacts from the estimated VOC emissions from the 787 program.

7.2.1 Aquatic/Soil Impacts

The proposed 787 program will result in a significant increase in VOC emissions and very minor particulate emissions from spray coating & machining as described in Section 3 of this application. No sulfate, nitrate, or other deposition will result from the proposed 787 program VOC emissions. Therefore, no aquatic or soil impacts are anticipated.

7.2.2 Vegetation Impacts

The proposed 787 program has the potential to emit VOC emissions that are potential precursors of tropospheric ozone. Scientific research since the 1980s has indicated that VOCs are a potential tropospheric ozone precursor (Smith, 1984). The FLAG report indicates that ozone-related impacts to vegetation currently focus primarily on nitrogen oxide (NOx) emissions unless specific information regarding an impact to a Class I area is identified (FLAG, 2000). No specific research was identified specifically identifying the potential for VOC emission impacts to Class I areas in the Pacific Northwest.

As described in this section, scientific research regarding potential ozone impacts to forested areas indicates that ozone levels in Class I areas in Washington state continue to improve, no foliar injury has been documented in National Park Service (NPS) Class I or NPS monitored areas, and risk of potential future injury was rated at the lowest level based upon several different nationally recognized criteria.
Likewise, biomonitoring in USDA managed forests indicate almost no foliar injury (only one sample collected indicated the potential for such injury). The results of these studies are presented below.

Review of scientific literature by EPA is part of an update to the 1996 Ozone Air Quality Criteria Document (1996 Ozone AQCD) indicates that scientific research on potential impacts of ozone of vegetation has not changed (EPA, 2005). Therefore, assessment tools and conclusions presented in pre-1996 scientific studies remain valid.

Based upon the 1996 and the 2005 Draft Ozone AQCD, foliar impact studies from pre-1991 referenced in Boeing's prior PSD permit application for the Boeing Everett facility (Boeing, 1991) remain relevant to assessing potential impacts from ozone-emitting criteria pollutants in the Pacific Northwest. Studies on the West Coast performed on highly ozone-sensitive species, i.e., Ponderosa pine (Pinus ponderosa) and Jeffrey pine (Pinus jeffreyi), were related to studies conducted in California from 1991 to 1995, including Lassen Volcanic, Yosemite, and Sequoia Kings Canyon National Parks and the Tahoe, Eldorado, Stanislaus, Sierra, and Sequoia National Forests. Foliar injury attributable to ozone was found at these sites in California, however, the extent of injury generally increased in a southward direction along the Sierra Nevada (Miller et al., 1995) (FLAG, 2000).

Ozone monitoring has been conducted since 1981 in Washington State at FLM-managed areas, including Class I areas evaluated in this application. Ozone monitoring consists of measuring both ambient ozone with air quality monitors and visually evaluating the extent and severity of ozone-induced foliar injury to sensitive plants (biomarkers). Biomonitoring has been performed for over 20 years in California forests, primarily on pines (Dale 1996, Durall and 1990, Guthry et al. 1993, Miller 1996, Pronos and Vogler 1981, Pronos et al. 1978) and to a limited extent on other vegetation (Temple 1989, Temple 1999, Treshow and Stewart 1753). In 1998, the USDA developed the forest health monitoring (FHM) program which began biomonitoring for potential ozone injury on a number of highly-sensitive indicator plants on all forested lands in Washington, Oregon, and California (USDA Forest Service 1999). Little or no ozone injury was detected in Oregon and Washington in 1998. Only one plant sample positive for ozone was collected September 1, 1998, in Lewis County, WA. Further monitoring is needed to confirm the presence of high ozone in this area (Campbell, et. al, 2000).

The NPS has established monitors for ozone in the three NPS Class I areas in Washington State: Mount Rainier National Park (NP), Olympic NP, and North Cascade NP. Ozone monitoring at Tahoma Woods in Mount Rainier NP has occurred since 1991 (site #530531010) and at the Jackson Visitor Center at Paradise since 1998 (site #5305310012) as well as the Olympic NP since 1991 (site #530090012) and at North Cascades NP since 1996 (site #353670013).

More recent studies by the NPS report that ozone concentrations have not been high enough to either exceed the human health-based primary NAAQS or injure ozone-sensitive vegetation. Specifically at Mount Rainier NP, ozone-sensitive plant species have been systematically evaluated for ozone injury for the past three years and to date, no injury has been documented (NPS, 2004a).

Data from the NPS Class I ozone monitoring and reporting were used as part of a risk assessment of potential foliar injury from ozone for from 1993 through 1999. The risk assessment was part of a
nationwide study encompassing 32 NPS-managed areas, including Washington State NPS-managed areas. The NPS utilized three indices to assess potential effects. First, the Sum65 index and its attendant thresholds for injury (Heck and Cowling 1997), which is comprised of a 90-day maximum sum of the 0800 through 1559 hourly concentrations of ozone equal to or greater than 60 ppb (0.60 ppm). Second, the W126 and its associated thresholds (Lefohn et al. 1997), which is the weighted sum of the 24 one-hour ozone concentrations daily from April through October, and the number of hours of exposure to concentrations equal to or greater than 100 ppb (0.10 ppm) during that period. Third, the ozone exposure, designated N-value, which consists of the number of hours of exposure each year that exceeded 60, 80 and 100 ppb. Although no formal thresholds are associated with the N-values, these values are used by the scientific community to provide insight into the distribution of exposures among these concentrations, and to the numbers of hours at and above 80 and 100 ppb, levels of exposure that are associated with the production of foliar injury.

These indices were evaluated over a five-year assessment period. The NPS sites were then given a risk rating of high, medium or low. High risk sites have a probability of experiencing foliar injury in most years, while those rated low are not likely to experience injury in any year. Each of the NPS Class I areas in Washington State, as well as the NPS managed areas, were rated low.

Soil moisture data was also analyzed to evaluate whether a correlation existed between the threshold values and soil moisture. Since the ozone levels were so low at the Washington State sites, no comparative soil moisture analysis could be performed (NPS, 2004b).

Based on pre-1991 research summarized in Boeing’s previous PSD application and more recent studies performed in the Pacific Northwest in the late 1990s and early 2000s, ozone impacts to forest fauna would not be expected at average concentrations above 0.06 ppm (24-hour average during the growing season). The research indicates that ozone levels in Class I areas in Washington State continue to improve; no foliar injury has been documented in National Park Service (NPS) Class I or NPS monitored areas, and risk of potential future injury was rated at the lowest level based upon several different nationally recognized criteria.

Based on the results of the CMAQ modeling (Appendix I), the incremental increase in ozone concentration from the proposed 787 program in a Class I area is less than 100 ppt, or less than 0.1 percent of the 1-hour ozone NAAQS. Therefore, this incremental increase in ozone from potential VOC emissions from the 787 program would have no additional impacts on flora or fauna in Class I areas in Washington State.

7.3 VISIBILITY IMPACTS

The PSD regulations require that visibility impacts to Class I and II areas be evaluated as part of the PSD permit application (40 CFR 52.21(o); WAC 173-400-720 and 173-400-117). The FLAG guidance provides recommendations to assess visibility impacts of proposed source modifications on nearby Class I areas. The guidance generally addresses visibility assessments for proposed sources located near, i.e., within 50 km of a Class I area, and at larger distances, i.e., located more than 50 km from the source. The FLAG guidance includes recommendations for visibility impairment thresholds and identifies the
Although the FLAG guidance recommendations are generally provided for Class I areas, which is the jurisdiction of the FLM, the recommendations were also used in assessing visibility from the proposed 787 program on Class II areas as well.

Based on consultation with the United State Department of Agriculture (USDA) Forest Service (Buchman, 2004), potential impacts to visibility were evaluated for seven (7) Class I areas, located between 70 and 205 km of the Boeing Everett facility. Table 7-3 presents the Class I areas evaluated, their distances and orientation from the Everett facility.

<table>
<thead>
<tr>
<th>Class I Area</th>
<th>Distance (km) and Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glacier Peaks Wilderness Area</td>
<td>70 km East (E)</td>
</tr>
<tr>
<td>Alpine Lakes Wilderness Area</td>
<td>60 km Southeast (SE)</td>
</tr>
<tr>
<td>North Cascade National Park</td>
<td>108 km Northeast (NE)</td>
</tr>
<tr>
<td>Olympic National Park</td>
<td>91 km West (W)</td>
</tr>
<tr>
<td>Mount Rainier National Park</td>
<td>122 km SE</td>
</tr>
<tr>
<td>Goat Rocks Wilderness Area</td>
<td>205 km SE</td>
</tr>
<tr>
<td>Mount Baker Recreation Area*</td>
<td>93 km North (N)</td>
</tr>
</tbody>
</table>

* Not a Class I Area. (See WAC 173-406-118). Assessment of Mount Baker Recreation Area is provided for informational purposes only.

7.3.1 CMAQ Model

The CMAQ model was used to model particulate matter less than 2.5 microns in diameter (PM2.5) to evaluate the potential for visibility impacts from the proposed 787 program on the Class I and Class II Areas. The potential PM2.5 emissions modeled were evaluated based upon the FLAG guidance criteria, described below, and confirmed using other expressions of visibility, i.e., deciview and visual range measures. The CMAQ modeling protocol was requested by WDOE and is included as Appendix H. The CMAQ Modeling Report is included as Appendix I to this application.

7.3.2 Visibility Assessment

The FLAG guidance criteria were utilized in evaluating the CMAQ Modeling results. The FLAG guidance recommends that if visibility extinction of a proposed source is less than 5% a cumulative analysis would not be expected and visibility impacts would not be significant. Even in combination with other PSD increment consuming sources if the change in extinction for this source alone is de minimis, i.e., less than 0.4 percent, visibility impacts are not considered significant (FLAG, 2001, Section D.2.a., p.27). The CMAQ modeling performed by WSU (Appendix I) included an analysis of potential visibility.

31 URS CORPORATION
impacts at Class 1 areas identified in Table 7-3. The CMAQ modeling report concludes that the maximum increase in extinction is less than 0.1% and occurs between Alpine Lakes, WA and Glacier Peak, WA and is fleeting, persisting briefly under westerly flow up the Skykomish River Valley (Appendix I, Figure 8-2). The 0.1% visibility extinction is approximately 1/4th of the FLAG de minimis level.

The CMAQ PM2.5 modeling results were further evaluated using a deciview measure and visual range, i.e., other measures used to express the extinction coefficient. Both the deciview and visual range results suggest no significant deterioration of visibility indicating visibility impacts from the proposed 787 program are not significant.

Therefore, using worst-case historical ozone data from ozone exceedances in July 1996, the CMAQ Modeling Report concludes that the estimated increases from the proposed 787 program at the Boeing Everett facility presents no significant effects on PM2.5, the extinction coefficient, deciview or visual range.
8.0 REFERENCES


NPS, 2004a. http://www2.nature.nps.gov/air/Permits/ARIS/mora/index.htm


34 URS CORPORATION

