**STATE OF WASHINGTON**

# TECHNICAL SUPPORT DOCUMENT FOR PREVENTION OF SIGNIFICANT DETERIORATION PERMIT

**PERMIT NO: PSD-11-01**

**The Boeing Company**
**Boeing Commercial Airplanes**
**777 Production Rate Increase Project**
**Everett (Snohomish County), Washington**

**Prepared by**

**Air Quality Program**
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# TABLE OF CONTENTS

## LIST OF FIGURES



## LIST OF TABLES

## EXECUTIVE SUMMARY

The Boeing Company (Boeing) proposes to make physical and operational changes to their airplane manufacturing facility in Everett, Washington, to enable an increase in the production rate of the 777 model airplane. The proposed project is intended to increase 777 production capacity at the Everett facility from a maximum production capacity of about 84 airplanes per year to a projected maximum production capacity of about 100 airplanes per year (based on a nominal 250 manufacturing days per year schedule).

The project proponent, herein referred to as "Boeing-Everett," intends to modify two of the four wing laydown spray booths (i.e., the two north booths) in Building 40-37 to accommodate robotic spray coating systems. The modified north booths are projected to operate at a maximum production rate of up to approximately 8.3 wing sets per month over the next 10 years (as per Boeing based on current internal Boeing Program Directives and recently completed rate studies), even though the modifications will allow the north booths to operate at a maximum production capacity of approximately 12 wing sets per month or approximately 144 wings sets per year (assuming a 365 manufacturing days per year schedule). Boeing-Everett also proposes to modify the southwest wing laydown spray booth in Building 40-37 to accommodate left-hand wings. The modified southwest booth is projected to operate at a maximum production rate of approximately seven wings per month until the north booth modifications are complete (including any necessary shakedown period). After the proposed modification is completed, Boeing-Everett intends to consolidate all of the wing coating operations that currently occur in six existing 777 wing spray booths into the two modified northern booths. However, Boeing intends to keep the existing wing booths as backup for 777 wings only. All six booths are currently only used to handle 777 wings manufactured at the Boeing-Everett facility. Boeing has no plans to use any of these booths to handle 777 wings manufactured at other facilities, or other wing types (i.e., 737, 747, 767, or 787) manufactured at the Boeing-Everett facility or elsewhere at anytime in the future following the completion of the north robotic wing laydown booth modifications.

The proposed project will result in a significant emissions increase of approximately 53 tons per year (tpy) of volatile organic compounds (VOCs) and a significant net emissions increase of approximately 94 tpy of VOCs. Other pollutants that are regulated under state and federal Prevention of Significant Deterioration (PSD) rules will not experience a significant emissions increase.

The Washington State Department of Ecology (Ecology) received the PSD application for the project on **April 14, 2011**. Additional information was received on May 4 and May 12, 2011. Ecology determined the application to be complete on **May 25, 2011**.

# 1. INTRODUCTION

## 1.1. PSD Permitting Requirements

PSD permitting requirements in Washington are established in Title 40, Code of Federal Regulations (C.F.R.) § 52.21; Washington Administrative Code (WAC) 173-400-700 through 750; pursuant to the agreement for the delegation of the federal PSD regulations by the United States Environmental Protection Agency (EPA) to Ecology, dated February 23, 2005. Federal and state rules require PSD review of all new or modified air pollution sources that meet certain criteria. The objective of the PSD program is to prevent significant adverse environmental impact from emissions into the atmosphere by a proposed new major source or major modification to an existing major source. The program limits degradation of air quality to that which is not considered "significant." It also sets up a mechanism for evaluating the effect that the proposed emissions might have on visibility, soils, and vegetation. PSD rules also require the utilization of Best Available Control Technology (BACT) for certain new or modified emission units, which is the most effective air pollution control equipment and procedures that are determined to be available after considering environmental, economic, and energy factors.

The PSD rules must be addressed when a company is adding a new emission unit or modifying an existing emission unit in an attainment or unclassifiable area. PSD rules apply to pollutants for which the area is classified as attainment with the National Ambient Air Quality Standards (NAAQS). PSD rules are designed to keep an area with "good" air in compliance with the NAAQS. The distinctive requirements of PSD are BACT, air quality analysis (allowable increments and comparison with the NAAQS), and analysis of impacts of the project on visibility, vegetations, and soils.

## 1.2. Site and Project Description

### 1.2.1. Site Description

Boeing-Everett is located in the City of Everett in Snohomish County, Washington. The Boeing-Everett facility is situated in the south half of Section 10 and the north half of Section 15, Township 28N, Range 4E Willamette Meridian, and consists of the North and South Complex located north and south, respectively, of State Route 526. A building number starting with 40 identifies North Complex buildings, and buildings on the South Complex are identified with a number starting with 45. Figure 1 shows a plant layout of the Boeing-Everett facility.

Boeing-Everett manufactures wide-body airplanes including 747, 767, 777, and 787 model airplanes, as well as certain other components such as interior components (e.g., sidewalls, stowbins) for those same model airplanes and for the Boeing 737 model airplane manufactured at Boeing's facility in Renton, Washington.

Boeing-Everett is located in a Class II area that is designated as "attainment or unclassifiable" for the purpose of PSD permitting for all pollutants.

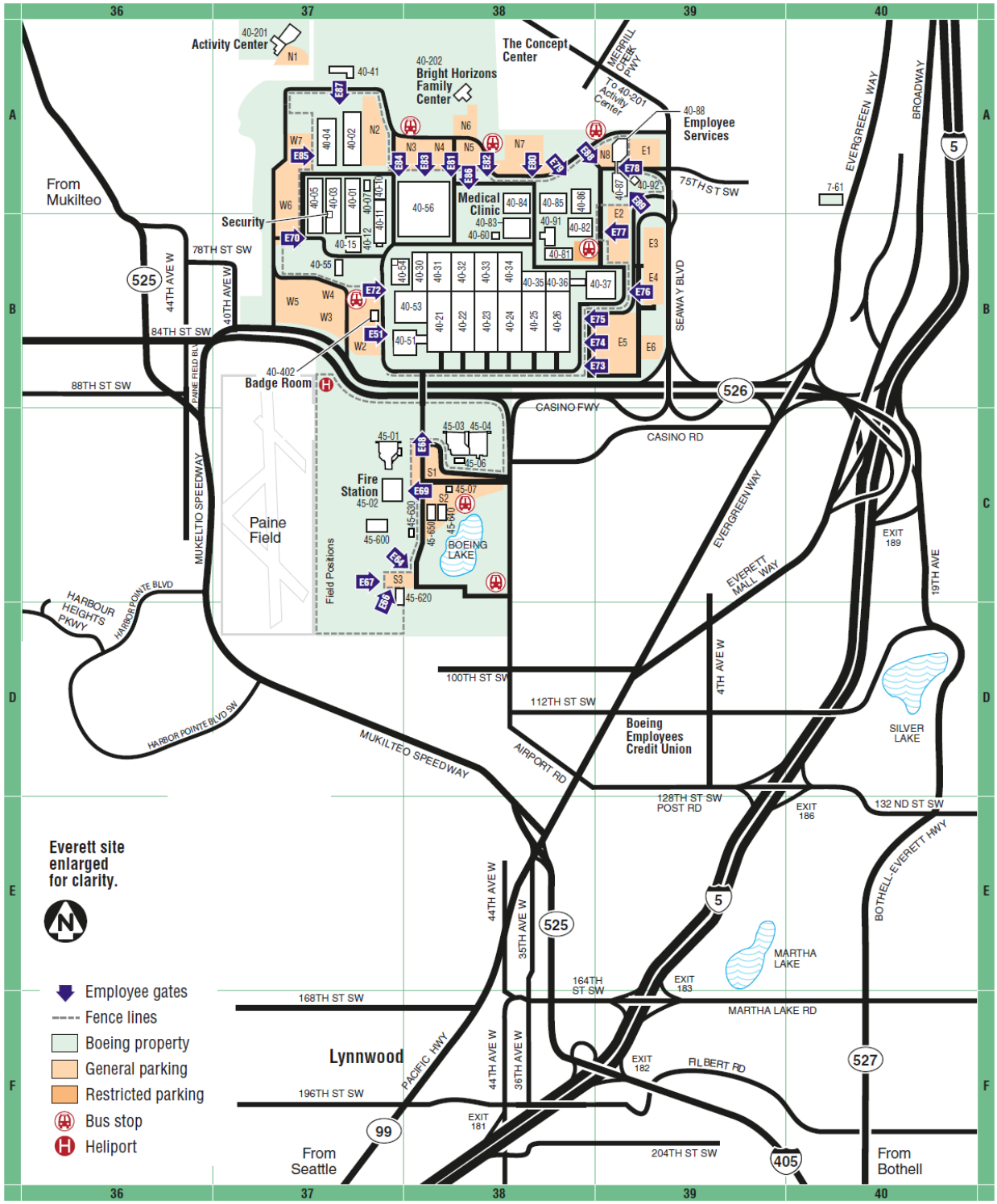


**Figure 1**. Boeing-Everett plant layout

(Source: Boeing's PSD application, Fig. 1-2, received April 14, 2011)

### 1.2.2. Project Description

The 777 airplane model has been manufactured at Boeing's Everett plant since the 777 program first began in the mid-1990s. According to the PSD application, the 777 production rate has never exceeded approximately seven airplanes per month during the history of the program. In the past 10 years, the 777 production rate has varied between approximately three airplanes a month (i.e., approximately 36 airplanes per year) and approximately seven airplanes a month (i.e., approximately 84 airplanes per year) in response to market demand and delivery schedules.

Boeing-Everett plans to increase the 777 model "protection rate" (i.e., the maximum production rate that the facility must be prepared to meet) to approximately 8.3 per month (i.e., approximately 100 airplanes per year), and increase the 777 production rate to approximately 8.3 per month beginning late 2012/early 2013. To achieve a 777 production rate of 8.3 per month, certain physical and operational changes to 777 production operations will be made.

The project will only affect 777-related operations at the Everett facility. The 777-related operations at Boeing-Everett affected by the project are described below.

#### 1.2.2.1. 777 Assembly Operations

Model 777 assembly operations primarily occur in Buildings 40-04, 40-25, 40-34, 40-35, 40-36, 40-37, and 40-53. Assembly operations include the assembly of various sub-assemblies (e.g., wing spars, floor grids, wings, body sections) from their component parts; the installation of various airplane systems (e.g., hydraulic, fuel, electrical) in the sub-assemblies; final assembly of a complete airplane structure and integration of the airplane systems; the installation of landing gear, engines, and interior components (e.g., seats, sidewalls, partitions); and functional testing. Air emissions primarily occur from activities such as spray coating, sealing, hand-wipe and flush cleaning, and the use of miscellaneous adhesives, resins, and other products that contain VOCs.

Permit No. PSD-91-06 imposes a VOC emission limit of 238.8 tpy for all 777 assembly operations. The current permitting action will not increase this VOC emission limit.

Boeing-Everett proposes to change the current process for coating 777 wings in Building 40-37. As shown in Figure 2, there are currently six existing 777 wing spray booths in Building 40-37, namely:

- Four wing laydown spray booths (two dedicated for left-hand wings and two dedicated for right-hand wings), which are primarily used for sealing and coating the exterior wing spars, the leading and trailing edge structure, and the fuel cells and dry bays inside the wings.

- One vertical wing booth, which is primarily used for coating the upper and lower exterior surfaces of the wings.

- One corrosion-inhibiting compound (CIC) booth, which is primarily used for applying CIC to the inside of the wings, the wing spars, and the leading and trailing edge structures.


**Figure 2**. Equipment layout in Building 40-37

(Source: Boeing's PSD application, Fig. 1-3, received April 14, 2011)

These booths are used exclusively for 777 wings and all 777 wings are processed in these booths.[1] As part of the project, two of the four wing laydown spray booths (i.e., the two north booths labeled "LHWB" in Figure 2) will be modified to accommodate robotic spray coating systems so that all of the wing coating operations that currently occur in the six existing booths can be consolidated and performed in the two modified booths; although the other wing booths will serve as backup in case of problems with the robotic booths. The new layout for wing laydown spray booths in Building 40-37 is shown in Figure 3. Certain hand-wipe cleaning and manual sealing operations that currently take place in the four existing wing laydown spray booths are expected to be transferred from Building 40-37 to an open shop floor area in Building 40-34.

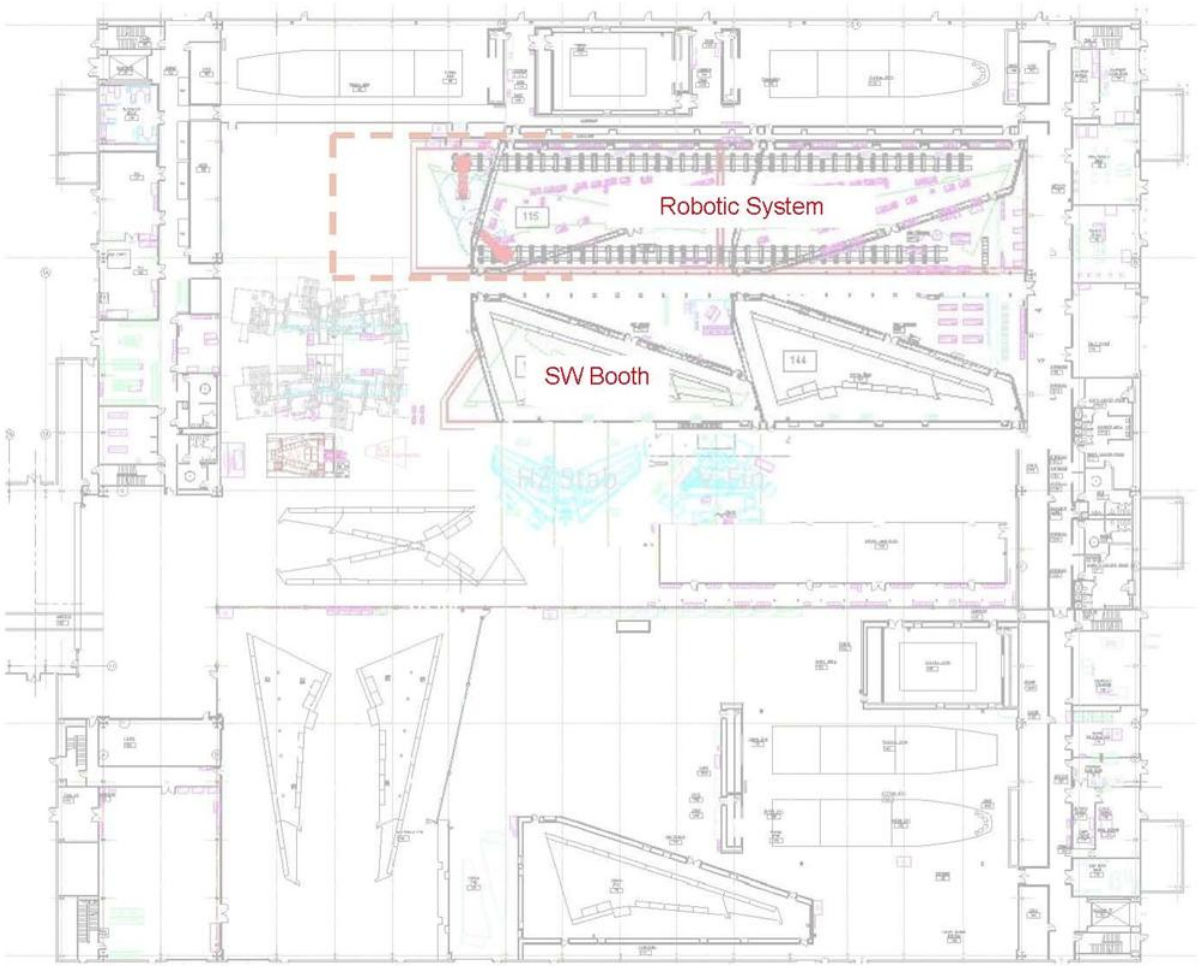


**Figure 3**. Future Building 40-37 Equipment Spray Booth layout

(Source: Amendment to Boeing's PSD application, Fig. 1-4, received June 14, 2011)

[1] The only wings that have ever been cleaned and coated in the four 777 wing laydown spray booths, the 777 vertical wing booth, and the 777 CIC wing booth, are 777 wings and all 777 wings have been cleaned and coated in these booths.

In preparation for the modification of the north wing booths, Boeing-Everett will make some minor changes to the southwest wing laydown spray booth in Building 40-37 to accommodate left-hand wings. The southwest and southeast wing laydown spray booths currently can accommodate right-hand wings only, so the changes to the southwest booth are necessary to continue processing left-hand wings while the two north wing laydown spray booths are undergoing modification, as well as to have the ability to handle left-hand wings in the event of problems with the robotic spray system.

Boeing-Everett also intends to make other related changes to 777 assembly operations that are not expected to involve changes to spray booths or other emission units that would allow the 777 production rate to increase to approximately 8.3 planes per month. These changes include, but are not necessarily limited to, the following:

a. Reconfiguration of an existing fuselage assembly position to accommodate both the freighter and passenger versions of the 777.

b. Installation of new drilling equipment used in wing assembly.

c. Installation of new floor assembly tooling.

d. Transfer of work from one location in the factory to another to better balance workloads.

e. Installation of a new sky bridge and/or material lift at the wing-to-body join position to facilitate movement of parts and equipment.

f. Installation of new wing and body staging positions.

g. Acquisition of miscellaneous tools and equipment (e.g., drill jigs, transportation tools).

VOC emissions from all 777 assembly operations average about 2.125 tons per airplane. Of this, the projected VOC emissions from each of the two modified north wing booths are estimated at 0.17 ton per wing, or 0.34 ton per airplane. At a production rate of 100 airplanes per year, projected VOC emissions are estimated at 17 tpy from each of the two modified north wing booths. The total VOC emissions from all 777 wing cleaning and coating operations conducted in Building 40-37 will not exceed 34 tpy combined from the two robotic wing laydown booths and the southeast and southwest wing laydown spray booths.

#### 1.2.2.2. Interiors Production Operations

Interiors production operations primarily occur in the Interiors Responsibility Center's Building 40-56, and support all airplane models produced at Boeing-Everett as well as the 737 model produced at Boeing's Renton, Washington, facility. Interiors production involves the manufacture of stowbins, sidewalls, ceilings, partitions, closets, and other interior components. Air emissions primarily occur from activities such as composite curing, spray coating, hand-wipe

cleaning, screen-printing, and the use of miscellaneous adhesives, resins, and other VOC-containing products.

Permit No. PSD-05-02 imposes a VOC emission limit of 205 tpy for all interiors production operations at Boeing-Everett. This VOC limit covers emissions from 777 interiors production as well as interiors production for other Boeing airplane models. The current permitting action will not increase this VOC emission limit.

No physical or operational changes will be made to emissions units located at the interiors production operations. Therefore, all projected emissions increases occurring at the interiors production operations are due to debottlenecking of those operations. Changes to 777 interior operations as part of the project will be minor and will not involve changes to emission units, including spray booths and other emissions-generating activities. Proposed changes include:

- Addition of a second vacuum form tool ("clam shell" IR vacuum form tool) for applying decorative laminates to interior sidewall panels; and

- Addition of a contoured worktable to perform edge-wrap of the adhered decorative laminate on sidewall panels.

Estimated VOC emissions from interiors production for each 777 airplane are 0.53 ton per airplane.

#### 1.2.2.3. Everett Delivery Center Operations

Everett Delivery Center (EDC) paint hangar and preflight/delivery operations primarily occur in Buildings 45-01, 45-03, and 45-04 paint hangars, Building 45-02, and the flightline. These operations support all airplane models produced at Boeing-Everett. Air emissions primarily occur from activities such as exterior prep and spray coating activities in the paint hangars, and the use of hand-wipe cleaning solvents and miscellaneous adhesives, resins, and other VOC-containing products on the flightline.

No physical or operational changes will be made to emissions units located at the EDC. Therefore, all projected emissions increases occurring at EDC operations are due to debottlenecking of those EDC operations affected by the project.

Permit No. PSD-05-02 establishes a VOC emission limit of 412 tpy for all airplane manufacturing operations that occur at the EDC, including 777 paint hangar and preflight/ delivery operations. The current permitting action will not increase this VOC emission limit.

Boeing-Everett's paint hangars, which are all part of EDC, are currently operating at capacity and there are no plans to increase paint hangar capacity to support the increased 777 production rate enabled by the project. In fact, a number of 777s have been flown off-site since 2007 to be

painted due to capacity constraints at the Boeing-Everett paint hangars. Table 1 shows the number of 777s painted off-site from 2007 to the present.

**Table 1. Number of 777s Painted Off-Site From 2007 to Present**

| Year | Number of 777s Painted Off-Site |
|---|---|
| 2007 | 12 |
| 2008 | 12 |
| 2009 | 19 |
| 2010 | 22 |
| 2011 | 14 (through June) |

Thus, the project will not result in an emission increase at the paint hangars. However, other EDC work, such as coating and cleaning of 777 rudders and elevators (i.e., the moving surfaces on the vertical fin and horizontal stabilizer, respectively), and the preflight/delivery work is expected to increase as a result of this project. Estimated VOC emissions from these activities are 0.15 ton of VOC per 777 produced.

#### 1.2.2.4. Propulsion Systems Operations

Propulsion systems operations primarily occur in Building 40-54 and involve receiving airplane engines and engine struts for 747, 767, and 777 models from off-site and preparing them for installation on the airplane. Air emissions are relatively minor and primarily occur from spray coating and the use of hand-wipe cleaning solvents and miscellaneous coatings, adhesives, resins, and other VOC-containing products.

No physical or operational changes will be made to emissions units located at propulsion systems operations. Therefore, all projected emissions increases occurring at propulsion systems operations are due to debottlenecking of those operations.

VOC emissions from propulsion systems operations are not currently subject to a PSD VOC emission limit. The estimated emissions from propulsion systems operations are 0.005 ton of VOC per engine, or 0.01 ton of VOC per 777 produced. Due to the extremely low VOC emissions from these operations, a VOC emission limit will not be imposed for propulsion systems operations as part of this permitting action.

#### 1.2.2.5. Emergent Operations

Emergent operations primarily involve the emergent, nonroutine fabrication and repair of aerospace components. Emergent operations support all airplane models produced at Boeing-

Everett. Air emissions are relatively minor and primarily occur from spray coating and the use of hand-wipe cleaning solvents and miscellaneous adhesives, resins, and other VOC-containing products.

No physical or operational changes will be made to emissions units located at emergent operations. Therefore, all projected emissions increases occurring at emergent operations are due to debottlenecking of those emergent operations affected by the project.

VOC emissions from emergent operations are not currently subject to a PSD VOC emission limit. Estimated VOC emissions from emergent operations activities are 0.06 ton of VOC per 777 produced. Due to the low VOC emissions from these operations, a VOC emission limit will not be imposed for emergent operations as part of this permitting action.

#### 1.2.2.6. Electrical Systems Production Operations

Electrical systems production operations primarily occur in the space that the Electrical Systems Responsibility Center (ESRC) shares with the Interiors Responsibility Center in Building 40-56, and in Building 40-02, and primarily support the 747, 767, and 777 airplane models produced at Boeing-Everett, as well as the 737 model produced at the Renton, Washington, facility. Electrical systems production operations involve the assembly of wiring harnesses, power panels, and other electrical components. Air emissions are relatively minor and occur from spray coating and the use of hand-wipe cleaning solvents and miscellaneous adhesives, resins, and other VOC-containing products.

No physical or operational changes will be made to emissions units located at the electrical systems production operations. Therefore, all projected emissions increases occurring at the electrical systems production operations are due to debottlenecking of those electrical systems production operations affected by the project.

VOC emissions from electrical systems production operations are not currently subject to a PSD VOC emission limit. Estimated VOC emissions from these operations are 0.013 ton of VOC per 777 produced. Due to the low VOC emissions from these operations, a VOC emission limit will not be imposed for electrical systems production operations as part of this permitting action.

## 2. PSD APPLICABILITY REVIEW

### 2.1. Overview and Permitting History

Boeing-Everett is an existing major stationary source under the PSD permitting program because it has the potential to emit (PTE) greater than 250 tpy of VOC. Under WAC 173-400-720 through 750, a project proposed at an existing major stationary source is subject to PSD review if the project either is a "major modification" to an existing "major stationary source," or is a major stationary source unto itself.

The Everett facility currently operates under multiple PSD permits issued by Ecology, including the following permits:

- PSD-91-01 for Building 45-04 paint hangar, issued in May 1991.
- PSD-92-05 for three steam boilers, issued on November 6, 1992.
- PSD-91-06, Amendment 2, for the 777 program, issued on June 10, 2005, which consolidates PSD-91-03, issued on July 10, 1991; and PSD-91-05, Amendment 2, issued on September 2, 1999.
- PSD-05-02 for the 787 program, issued on October 10, 2005.

Unless otherwise exempted by applicable regulation, a change to an existing major stationary source is a major modification if the change results in both a significant emissions increase and a significant net emissions increase at the source. "Significant emissions increase" means that the emissions increase for any regulated PSD pollutant is greater than the PSD Significant Emission Rate (SER) threshold for that regulated pollutant.

The changes being made to increase the 777 production rate will require a PSD permit if both the project's emissions increase and the net contemporaneous emissions increase caused by the project exceed the PSD significance levels for VOCs of 40 tpy. This PSD applicability review examines both the projects emissions increase and the net emissions increase. The emissions increase obtained through the PSD applicability review is used in the BACT and air quality analyses described in later sections.

### 2.1.1. Emissions Calculation Procedure

To determine whether the project is a major modification, Boeing-Everett used the procedure described in 40 C.F.R. § 52.21 and associated guidance to calculate emissions. That procedure can be summarized as follows:

1. Calculate project emission increases.
    a. For existing emissions units, the increase in emissions is calculated as the difference between projected actual emissions and baseline actual emissions.
    b. For new emissions units, the increase in emissions is equal to the PTE of the unit. However, in the case of the 777 rate increase project, there will be no new emission units.
    c. Boeing-Everett calculated the increase in emissions for:
        i. Existing emissions units that will be physically or operationally modified;

ii. Existing emissions units that will not be physically or operationally modified but will have an associated increase in emissions as a result of the project; and

iii. Existing emissions units from any past or future projects that must be aggregated with the current project.

2. Calculate net contemporaneous and creditable emission increases and decreases.

a. For all pollutants that will have a project emissions increase from Step 1 that is greater than the SER, a further analysis is used to determine the creditable emissions increases and decreases that occurred during the contemporaneous period for purposes of determining the "net emissions increase" of that pollutant associated with the project. Only VOC emissions exceeded the SER in Step 1.

b. An increase or decrease in actual emissions is contemporaneous with the increase from the project only if it occurs between:

i. The date five years before construction on the project commences; and

ii. The date that the increase from the project occurs.[2]

c. An increase or decrease in actual emissions is creditable only if:[3]

i. EPA or Ecology has not relied on it in issuing a PSD permit for the source, which permit is in effect when the increase in actual emissions from the project occurs; and

ii. As it pertains to an increase or decrease in fugitive emissions (to the extent quantifiable), it occurs at an emissions unit that is part of one of the source categories listed in 40 C.F.R. § 52.21(b)(1)(iii), or it occurs at an emissions unit that is located at a major stationary source that belongs to one of the listed source categories.

d. A decrease in actual emissions is creditable only to the extent that it is enforceable as a practical matter at and after the time that actual construction on the particular change begins.

[2] See 40 C.F.R. § 52.21(b)(3)(ii).
[3] See 40 C.F.R. § 52.21(b)(3) for a detailed list of creditability criteria. 40 C.F.R. § 52.21(b)(3)(iii)(b) also states that the increase or decrease should not have occurred at a Clean Unit. However, that requirement does not apply because EPA removed the Clean Unit provisions from 40 C.F.R. § 52.21 through rulemaking at 72 FR 32526, June 13, 2007.

3. Determine the net emissions increase.

    a. The emissions increase from the project alone is added to the net contemporaneous emissions change to determine the net emissions increase of a pollutant.

    b. If the net emissions increase is less than the respective SER, PSD permitting is not triggered for that particular pollutant.

### 2.1.2. Aggregation and Debottlenecking Analysis

#### 2.1.2.1. Project Aggregation Analysis

To understand the relatively complex issue of "project aggregation," it is important to provide verbatim a summary of EPA's explanation of the issue. The following paragraphs are quoted from 75 FR 19567 (April 15, 2010), with footnotes omitted:

> When undergoing a physical or operational change, a source determines major NSR applicability through a two-step analysis that first considers whether the increased emissions from a particular proposed change alone are significant, followed by a calculation of the change's net emissions increase considering all contemporaneous increases and decreases at the source (i.e., source-wide netting calculation) to determine if a major modification has occurred. See, for example, 40 CFR 52.21(b)(2)(i). The term ''aggregation'' comes into play in the first step (Step 1), and describes the process of grouping together multiple, nominally-separate but related physical changes or changes in the method of operation (''nominally-separate changes'') into one physical or operational change, or ''project.'' The emission increases of the nominally-separate but related changes must be combined in Step 1 for purposes of determining whether a significant emissions increase has occurred from the project. See, for example, 40 CFR 52.21(b)(40). When undertaking multiple nominally-separate changes, the source must consider whether NSR applicability should be determined collectively (i.e., ``aggregated'') or whether the emissions from each of these changes should separately undergo a Step 1 analysis.
>
> Neither the CAA nor current EPA rules specifically address the basis upon which to aggregate nominally-separate changes for the purpose of making NSR applicability determinations. Instead, our aggregation policy developed over time through statutory and regulatory interpretation and applicability determinations in response to a need to deter sources from attempting to expedite construction by permitting several changes separately as minor modifications. When related changes are evaluated separately, the source may circumvent the purpose of the NSR program by showing a less than significant emission increase for Step 1 of the applicability analysis,that could result in avoiding major NSR permitting requirements. This, in turn, could result in increases of emissions of air pollutants

> from the facility that would be higher than the increases would be had the changes been subject to NSR control requirements. The associated emissions increases could endanger the air quality health standard and adversely affect public health.

As explained above, the intent of EPA's aggregation policy is to deter sources from attempting to expedite construction by permitting several changes separately as minor modifications. In the case of a new project that is undergoing PSD permitting, the aggregation analysis is used to determine all of the pollutants and emissions units that are subject to PSD review (including an evaluation of projects that have previously been permitted as minor modifications yet they should be considered part of the present project).

To identify those emissions units and activities that should be reviewed as part of the 777 production rate increase project, Ecology directed Boeing-Everett to review past, current, and planned projects carefully to determine whether any should be considered and aggregated with the proposed 777 rate increase project. Boeing-Everett summarized the results of their review in a memo to Ecology dated May 12, 2011 (Memo #E-1320-JTF-064), which included the following discussion:

> Boeing uses an internal company document called a Program Directive to authorize and change both "protection" rates and actual production rates for all of its commercial airplane models looking ahead several years. Protection rates are the maximum production rates for which tools, facility support, capital equipment, and raw materials are to be maintained to achieve. Boeing Everett is not authorized by The Boeing Company to expend resources for the purpose of securing production capacity above the protection rate. The original protection rate established in Program Directives for the 777 model when the program first began in the mid-1990s was 7 airplanes per month. Up until December, 2010, the 777 protection rate has remained at 7 per month.
>
> During the history of the 777 program, the actual 777 production rate has been at 7 per month during the following periods:
>
> - July 1997 to February 1998
> - August 1998 to October 1999
> - November 2006 to May 2010
>
> More recently, the 777 production rate increased to 7 per month in May 2011. The actual production rate for 777 has never exceeded 7 per month.
>
> A decision to increase the 777 protection rate and production rate to 8.3 per month was made in December 2010. Prior to this decision, any changes made to the 777 factory had been governed by the requirement to "protect" (i.e. maintain) a 777 production rate capacity of 7 airplanes per month. Any changes to increase the production capacity above 7 airplanes per month would not have been

> authorized and therefore not undertaken. Therefore, there are no previous changes to the 777 factory that should be aggregated with the current project to increase the 777 production rate capacity to 8.3 airplanes per month.

Additionally, Boeing-Everett analyzed four factors, as suggested by Ecology, when evaluating whether projects need to be aggregated with the 777 rate increase project, including:

**1) Any minor source applications filed since the last PSD-approved project was completed at the facility.**

Boeing-Everett provided a list[4] of minor new source applications that have been filed since the 787 PSD (PSD-05-02) was issued in October 2005. Boeing-Everett explained that none of the projects represented by the listed minor source applications was part of the current project to increase the 777 production rate to 8.3 airplanes per month. Also, "none of the listed prior projects were related solely to 777 production and those projects that were related to multiple product lines did not assume a maximum production rate of 777s above 7 per month."

**2) Any funding information indicating one project.**

The memo stated the following: "According to [Boeing's] 777 Program Management Office, they are not aware of any funding information that would indicate a previous project should be aggregated with the current project. Funding decisions for the current project are made under the authority of the December 2010 Program Directive and are separate from and independent of the funding decisions for the prior projects which relied on earlier Program Directive for their authority. All the above-listed prior projects were determined to [be] economically viable without regard to any potential increase in 777 production rate above 7 per month. The proposed project is not necessary to meet any obligations to Boeing customers entered into prior to the December 2010 Rate Directive."

**3) Company statements or official reports that treat the separate projects on one project.**

The memo stated the following: "According to [Boeing's] 777 Program Management Office, they are not aware of any company statements or official reports that would indicate any previous project should be aggregated with the current project. Prior to the December 2010 Rate Directive, Boeing did not project actual 777 production levels above 7 per month."

**4) The relationship of the changes to the current project and the overall basic purpose of the plant.**

The memo stated the following: "The overall basic purpose of the plant is to produce commercial airplanes for delivery to airline customers. As discussed above, none of the

[4] See Tables 1-1 and 1-2 of Memo #E-1320-JTF-064, dated May 12, 2011.

previous changes to the 777 factory have been for the purpose of achieving a production rate capacity greater than 7 airplanes per month. None of the above-listed prior projects were related solely to 777 production and those projects that were related to multiple product lines did not assume a maximum production rate of 777s above 7 per month. Thus, none of these prior projects is sufficiently related to the proposed project to increase 777 production to 8.3 per month to consider it as part of the proposed project for purposes of PSD."

Boeing-Everett further explains that the proposed project is necessary to increase production of 777s to meet projected future market demand. Boeing-Everett provided the following additional information:

> Boeing follows a rigorous sales commitment process to avoid a situation that results in an over-commitment of its production capability. Based on sales forecasts, input from key suppliers, coordination with other Boeing programs and the actions of its competitors, Boeing determined that Feb 2013 would be an appropriate time to increase its 777 production rate to 8.3 per month. According to Boeing, airline customers execute fleet planning strategies and buy streams of aircraft that extend deliveries for several years. In general, increasing the 777 production capacity will not alter the delivery schedules for any aircraft contracted prior to the rate decision. In fact, increasing the production rate results mainly in incremental sales, which increases the number of airplanes in Boeing's backlog.
>
> Boeing's airplane "backlog" normally extends several years in the future and is not the same type of "backlog" as, say, a furniture manufacturer. Boeing's backlog is actually a delivery schedule, where [Boeing has] contracted with customers to deliver certain airplanes on certain dates in the future. The 777 backlog that existed prior to Boeing's decision in the 4$^{th}$ quarter of 2010 to move forward with facility changes to increase the 777 production rate to 8.3 per month was not the reason Boeing made the decision it did. The backlog that existed prior to that decision can be fully met at the agreed upon delivery dates at the 7 per month production rate. The reason Boeing decided to increase the production rate to 8.3 per month was because of the new sales [Boeing] anticipated making if [Boeing] could produce 777s at a higher production rate than 7 per month. Boeing did not begin contracting 777 airplanes that would require an 8.3 per month production rate until after the decision was made to make the changes to increase the 777 production rate to 8.3 per month. None of the proposed changes are necessary to meet the delivery dates for any of the backlog that existed prior to this decision.
>
> The fact that the 777 program has a backlog is normal and does not mean that this project was driven by overcommitted delivery schedules; instead it is driven by projected market demand.

As shown above, Boeing-Everett has determined that there are no past projects that need to be considered and aggregated when performing the PSD applicability analysis for the 777 rate increase project. Based on Ecology's review of Boeing-Everett's analysis, Ecology finds no reason to dispute this conclusion.

#### 2.1.2.2. Debottlenecking

Once the scope of the project has been identified, including aggregation of related activities or projects, if applicable, the source must then determine whether the project, as a whole, will result in a significant emissions increase from the modified and any affected emissions units. Affected units are those units upstream or downstream from the unit(s) undergoing a physical change or change in the method of operation that will experience an emission increase as a result of the project. Affected units include "debottlenecked units" and units that experience an "increase in utilization" as a result of the project.[5] The current EPA rules permit emissions increases from debottlenecked units (and any other unit that increases its utilization as a result of the project) to be calculated using an actual-to-projected-actual applicability test.[6]

The primary changes to be made at the Boeing-Everett facility in order to achieve the projected 8.3 per month production rate involve the modification of two existing wing laydown spray booths in Building 40-37 to install automated robotic spray machines. Other changes to 777 manufacturing operations to achieve the 8.3 per month production rate do not involve changes to spray booths or other emission units.

As directed by Ecology, Boeing-Everett evaluated all existing emissions units that will be "debottlenecked" by the 777 rate increase project and that will experience an emission increase as a result of the project. The analysis indicates that the 777 rate increase project will debottleneck airplane parts manufacturing operations at the Interiors Responsibility Center, Everett Delivery Center, Propulsion Systems Operations, Emergent Operations, and Electrical Systems Operations.

### 2.1.3. Baseline Actual Emissions

For an existing[7] emissions unit (other than an electric utility steam generating unit), baseline actual emissions are[8] the average rate, in tpy, at which the emissions unit actually emitted the

[5] To address the "confusion over [EPA's] past policies for calculating emissions from debottlenecked units and from units experiencing an ''increase in utilization," EPA proposed changes to the debottlenecking rule provisions that would "apply to any unchanged unit at a source that increases its utilization following a change elsewhere at the source." 71 FR 54238, Sept. 14, 2006.
[6] EPA does not require that sources use projected actual emissions to calculate their emissions increases. If a source prefers, it can calculate its emissions increases by comparing its past actual emissions to its future potential to emit. See 71 FR 54238 and footnote 7, Sept. 14, 2006.
[7] For a new emissions unit, the baseline actual emissions for purposes of determining the emissions increase that will result from the initial construction and operation of such unit shall equal zero.
[8] See 40 C.F.R. § 52.21(b)(48)(ii).

pollutant during any consecutive 24-month period selected by the owner or operator within the 10-year period immediately preceding either:

a. The date the owner or operator begins actual construction of the project, or
b. The date a complete permit application is received by Ecology, whichever is earlier.

The calculation of baseline actual emissions for each emissions unit that will undergo an emissions increase must:

a. Include emissions associated with start-ups, shutdowns, and malfunctions;

b. Include fugitive emissions (to the extent quantifiable);

c. Adjust downward to exclude any noncompliant emissions that occurred while the source was operating above an emission limitation that was legally enforceable during the consecutive 24-month baseline period;

d. Adjust downward to exclude any emissions that would have exceeded an emission limitation with which the major stationary source must currently comply, had such major stationary source been required to comply with such limitations during the consecutive 24-month period;[9]

e. Use only one consecutive 24-month period to determine the baseline actual emissions for all the emissions units being changed, but can use a different consecutive 24-month period for each regulated PSD pollutant; and

f. Not be based on any consecutive 24-month period for which there is inadequate information for determining annual emissions, in tpy, and for adjusting this amount if required by 40 C.F.R. § 52.21(b)(48)(ii)(b) and (c).

Boeing-Everett addressed each of the above requirements in calculating baseline actual emissions for 777 rate increase project. Boeing-Everett calculated the actual emissions using material transaction data from the Haztrax database and VOC content estimates provided by Sunhealth and Material Safety Data Sheets (MSDSs) supplied by material vendors. Baseline actual emissions and the selected baseline periods are summarized in Table 2.

[9] In Washington State, this adjustment does not currently apply to MACT limits per 40 C.F.R. § 52.21(b)(48)(ii)(c) because the state has not taken credit for such emissions reductions in an attainment demonstration or maintenance plan consistent with the requirements of 40 C.F.R. §51.165(a)(3)(ii)(G).

**Table 2. Baseline Actual Emissions (TPY)**

| Pollutant | PM | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_X$ | VOC | CO | Lead | ODS | $CO_2e$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Period | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 |
| 777 Assembly Operations | 0.4 | 0.4 | 0.4 | 0 | 0 | 157.5 | 0 | 0 | 0 | 0 |
| Interiors Operations | 0.4 | 0.4 | 0.4 | 0 | 0 | 40.0 | 0 | 0 | 0 | 0 |
| Everett Delivery Center | 0.4 | 0.4 | 0.4 | 0 | 0 | 11.3 | 0 | 0 | 0 | 0 |
| Propulsion Systems Operations | 0.0 | 0.0 | 0.0 | 0 | 0 | 0.0 | 0 | 0 | 0 | 0 |
| Emergent Operations | 0.4 | 0.4 | 0.4 | 0 | 0 | 4.5 | 0 | 0 | 0 | 0 |
| Electrical Systems Responsibility Center | 0.4 | 0.4 | 0.4 | 0 | 0 | 0.9 | 0 | 0 | 0 | 0 |
| Boilers and Other Stationary Fuel Burning Equipment | 4.6 | 4.6 | 4.6 | 0.4 | 62.0 | 3.3 | 48.8 | 0.0 | 0 | 71,381 |
| Miscellaneous Sources of Ozone Depleting Substances (ODS) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.8 | 0 |
| **TOTAL EMISSIONS** | **6.6** | **6.6** | **6.6** | **0.4** | **62.0** | **217.6** | **48.8** | **0.0** | **6.8** | **71,381** |

### 2.1.4. Projected Actual Emissions

Projected actual emissions are determined by projecting what the existing emission unit will emit once regular operation occurs following the project, as follows:

- Over a 5-year period following the project if there is not an increase in the emission unit's design capacity or PTE, or

- Over a 10-year period following the project if there is an increase in the emission unit's design capacity or PTE.[10]

The 777 rate increase project will involve an increase in the design capacity of the north and south wing laydown spray booths. Therefore, projected actual emissions are based on a 10-year projection. Boeing-Everett is projecting the maximum 777 production rate over the 10 years following the project at a level below the design capacity (i.e. below the production capacity assuming a 365 manufacturing days per year schedule) resulting from the project. When estimating projected actual emissions, Boeing-Everett:[11]

[10] See 40 C.F.R. § 52.21(b)(41)(i).
[11] See 40 C.F.R. § 52.21(b)(41)(ii).

a. Considered all relevant information regarding the intended operation of the 777 production line in the configuration that will exist after the proposed project, including but not limited to, historical operational data, the company's own representations, the company's expected business activity and the company's highest projections of business activity, the company's filings with the state or federal regulatory authorities, and compliance plans under the approved State Implementation Plan;

b. Included emissions associated with start-ups, shutdowns, and malfunctions, and quantifiable fugitive emissions, where applicable; and

c. Excluded, in calculating any increase in emissions that results from the particular project, that portion of the unit's emissions following the project that an existing unit could have accommodated during the consecutive 24-month period used to establish the baseline actual emissions and that are also unrelated to the particular project, including any increased utilization due to product demand growth. During the baseline period (2007 and 2008), the 777 factory emission units could have produced 15 additional airplanes in 2008 if it were not for the work stoppage that occurred in that year. Averaged over the two-year period, this equates to 7.5 airplanes per year. Boeing-Everett demonstrated that the additional 7.5 airplanes per year are completely unrelated to the proposed 777 rate increase, because the Everett plant operated at the higher rate in 2007 and in 2009. Also, the northern and southern wing laydown spray booths previously (and consistently) together produced 7.5 additional wing sets per year. As demonstrated by production data generated after the 24-month baseline period, modification of any of the wing laydown spray booths was not needed during the baseline period in order to produce the additional 7.5 wing sets per year. This implies that only the emissions increase associated with production beyond the additional 7.5 airplanes per year would be related to the project.

Table 3 shows the adjusted projected actual emissions reported by Boeing-Everett.

**Table 3. Projected Actual Emissions (TPY)**

| Pollutant | PM | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_X$ | VOC | CO | Lead | ODS | $CO_2e$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Period | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 | 2007-2008 |
| 777 Assembly Operations | 0.5 | 0.5 | 0.5 | 0 | 0 | 196.6 | 0 | 0 | 0 | 0 |
| Interiors Operations | 0.5 | 0.5 | 0.5 | 0 | 0 | 49.0 | 0 | 0 | 0 | 0 |
| Everett Delivery Center | 0.5 | 0.5 | 0.5 | 0 | 0 | 13.9 | 0 | 0 | 0 | 0 |
| Propulsion Systems Operations | 0.5 | 0.5 | 0.5 | 0 | 0 | 1.0 | 0 | 0 | 0 | 0 |
| Emergent Operations | 0.5 | 0.5 | 0.5 | 0 | 0 | 5.6 | 0 | 0 | 0 | 0 |
| Electrical Systems Responsibility Center | 0.5 | 0.5 | 0.5 | 0 | 0 | 1.2 | 0 | 0 | 0 | 0 |
| Boilers and Other Stationary Fuel Burning Equipment | 4.9 | 4.9 | 4.9 | 0.7 | 65.8 | 3.4 | 51.2 | 0.0 | 0 | 74,570 |
| Miscellaneous Sources of Ozone Depleting Substances (ODS) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8.3 | 0 |
| **TOTAL EMISSIONS** | **7.9** | **7.9** | **7.9** | **0.7** | **65.8** | **270.6** | **51.2** | **0.0** | **8.3** | **74,570** |

After the proposed modification is completed, Boeing-Everett intends to consolidate all of the wing coating operations that currently occur in six existing 777 wing spray booths into the two modified northern booths. However, Boeing-Everett intends to keep the other existing wing spray booths as backup for 777 wings only.

The projected actual emissions shown in Table 3 include all VOC emissions from cleaning and coating operations of 200 wings per year in Building 40-37 regardless of whether the wings are cleaned and coated in the robotic wing laydown spray booths or a combination of the existing wing spray booths and robotic wing laydown spray booths.

Ecology will impose a federally enforceable emission limit that will restrict VOC emissions from wing cleaning and coating operations in the two 777 robotic wing laydown spray booths and the nonrobotic southwest wing laydown spray booth in Building 40-37 to no more than a combined total of 34 tons in any twelve (12) consecutive months. Ecology is also imposing this limit under the control technology requirements of 40 C.F.R. § 52.21(j)(3). Additionally, consistent with the source impact analysis requirements of 40 C.F.R. § 52.21(k)(1), VOC emissions from wing cleaning and coating operations in the two 777 robotic wing laydown booths and the nonrobotic southwest and southeast wing laydown spray booths in Building 40-37 must not exceed a combined total of 36.3 tons in any twelve (12) consecutive months. This 36.3 ton limit was determined by adding the baseline actual emissions of the southeast wing laydown booth (i.e.,

2.3 tpy using the baseline period of 2007-2008) to the 34 ton per year limit for the robotic wing laydown spray booths and the nonrobotic southwest wing laydown spray booth.

By limiting VOC emissions from the southeast wing laydown spray booth as shown above, the project will not cause an emissions increase at the southeast wing laydown spray booth. Also, because the projected actual VOC emissions from 777 assembly operations was based on existing wing cleaning and coating techniques without adjustment for potential decreases in VOC emissions per wing due to implementation of robotic wing cleaning and coating, the projected VOC emissions increase due to the possible operation of the southwest and southeast wing laydown spray booths as backup units is already accounted for in the projected actual emissions shown in Table 3.

### 2.1.5. Project Emissions Increase

The project emissions increase is calculated by subtracting the baseline actual emissions from the projected actual emissions. As shown in Table 4, VOC emissions from the project exceed the PSD SER for VOC. Therefore, a "netting" analysis was conducted for VOC. No further analysis is required for other pollutants since emission increases from the project do not exceed the applicable PSD SER for those pollutants.

**Table 4. Project Emissions Change (TPY)**

| Pollutant | PM | $PM_{10}$ | $PM_{2.5}$ | $SO_2$ | $NO_X$ | VOC | CO | Lead | ODS | $CO_2e$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Significant Emission Rate | 25 | 15 | 10 | 40 | 40 | 40 | 100 | 0.6 | 100* | 75,000 |
| Baseline Actual Emissions | 6.6 | 6.6 | 6.6 | 0.4 | 62.0 | 217.6 | 48.8 | 0.0 | 6.8 | 71,381 |
| Projected Actual Emissions | 7.9 | 7.9 | 7.9 | 0.7 | 65.8 | 270.6 | 51.2 | 0.0 | 8.3 | 74,570 |
| Project Emissions Increase | 1.3 | 1.3 | 1.3 | 0.3 | 3.8 | 53.0 | 2.4 | 0.0 | 1.5 | 3,189 |
| **Is the Project Emissions Increase Significant?** | **No** | **No** | **No** | **No** | **No** | **Yes** | **No** | **No** | **No** | **No** |

*See WAC 173-400-720(4)(b)(iii)(B).

### 2.1.6. Contemporaneous Net Emissions Increase

Because the VOC emissions increase due to the project alone exceeds the VOC SER, Boeing-Everett conducted a "netting" analysis for VOC emissions as directed by Ecology. The "netting" analysis involves adding all creditable emission increases and decreases that occurred during the contemporaneous period to the project emission increases. The contemporaneous period begins five years before construction of the project is scheduled to commence, and ends when the increase from the project occurs. The net emissions increase is then compared to the SER to determine if PSD review is triggered.

Boeing-Everett submitted the PSD application for the 777 rate increase project to Ecology in April 2011. Based on the anticipated date of commencement of construction, which Ecology expects to be some time in December 2011, the contemporaneous period for the project covers the time period from December 2006 to the date that normal operation starts following the project.

Table 5 summarizes the contemporaneous VOC emissions changes at Boeing-Everett. From Table 5, the sum of all contemporaneous creditable VOC emissions increases is 41.2 tons of VOC per year. Therefore, the net emissions increase from the project is 94.2 tons of VOC per year, i.e., 41.2 (contemporaneous creditable increase) + 53.0 (project increase).

**Table 5. Summary of Contemporaneous Emission Changes at Boeing-Everett**

| Emissions Unit | Increase or Decrease | Date of Decrease or Increase | Is Decrease or Increase Creditable?[12] | VOC Emissions Change (TPY) | Explanation |
|---|---|---|---|---|---|
| New spray booth for propulsion systems division | Increase | February 2008 | Yes | +0.04 | Project approved by Notice of Construction (NOC) Order No. 9705, issued by Puget Sound Clean Air Agency (PSCAA). |
| Portable diesel generators for 787 storage stalls on Paine Field | Increase | September 2011, Estimated Completion Date | Yes | +39.4 | NOC application submitted to PSCAA. Permit not yet issued. |
| New 747 Horizontal Stabilizer Exhaust Ventilation System | Increase | August 2011, Estimated Completion Date | Yes | +1.8 | NOC application submitted to PSCAA. Permit not yet issued. |
| Relocation of existing spray booth from Building 40-02 to the Interiors Responsibility Center in Building 40-56 | Increase | April 2007 | No | +21.5 | Emission increases were relied upon in the issuance of Permit No. PSD-05-02. |
| New rotary screen printer for the Interiors Responsibility Center | Increase | May 2010 | No | +39.9 | Emission increases were relied upon in the issuance of Permit No. PSD-05-02. |

[12] The criteria for creditability are established in 40 C.F.R. § 52.21(b)(3).

| Emissions Unit | Increase or Decrease | Date of Decrease or Increase | Is Decrease or Increase Creditable?[12] | VOC Emissions Change (TPY) | Explanation |
|---|---|---|---|---|---|
| Three new 787 Hybrid laminar Flow Control Vertical Fin Spray Booths | Increase | 2012, Estimated Completion Date | No | +13.7 | Emission increases were relied upon in the issuance of Permit No. PSD-05-02. |
| **TOTAL CREDITABLE VOC EMISSIONS INCREASE** | | | | **41.2** | |
| **NET EMISSIONS INCREASE** | | | | **94.2** | |

Table 5 does not include VOC emissions from the southwest or southeast wing laydown spray booths because any emission increases from those booths have been included in the Step 1 analysis (Table 4) as part of the project emissions. The southwest and southeast wing laydown spray booths will generally be used when the two northern robotic wing laydown spray booths are not operating meaning that a decrease in the utilization rate of the southwest and southeast wing laydown spray booths will likely occur after the project. Boeing-Everett has not claimed creditable emission reductions from the possible underutilization of the southwest and southeast wing laydown spray booths as back-up units. Instead, Boeing-Everett will accept a federally-enforceable VOC emissions limit that covers emissions from the southeast and southwest wing laydown spray booths. As stated above, the projected actual emissions shown in Table 3 include all VOC emissions from cleaning and coating operations of 200 wings per year in Building 40-37 regardless of whether the wings are cleaned and coated in the robotic wing laydown spray booths or a combination of the other existing wing spray booths and robotic wing laydown spray booths.

### 2.2. New Source Performance Standards (NSPS) and National Emission Standards for Hazardous Air Pollutants (NESHAP)

NSPS apply to certain types of equipment that are newly constructed, modified, or reconstructed after a given applicability date. There are no NSPS that apply to the proposed 777 rate increase project.

NESHAP apply to categories of equipment with hazardous air pollutant emissions. 40 C.F.R. Part 63, Subpart GG., also known as the "Aerospace NESHAP," 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. The 777 rate increase project must comply with the Aerospace NESHAP requirements.

40 C.F.R. Part 63, Subpart WWWW, applies to facilities that are engaged in reinforced plastic composites production and are major sources of hazardous air pollutants. Although the proposed

777 activities are not by themselves subject to this NESHAP, other activities in Boeing-Everett are subject to this NESHAP (40 C.F.R. Part 63, Subpart WWWW).

## 3. BEST AVAILABLE CONTROL TECHNOLOGY (BACT) DETERMINATION

### 3.1. Definitions and Policy Concerning BACT

All new major sources or major modifications are required to utilize BACT for those new and modified emission units that will experience an increase in emissions as a result of the project. BACT is defined as an emissions limitation based on the maximum degree of reduction for each pollutant subject to regulation, emitted from any proposed major stationary source or major modification, on a case-by-case basis, taking into account cost-effectiveness, economic, energy, environmental and other impacts (40 C.F.R. § 52.21(b)(12)).

BACT is only applied to emission units that are new or existing and undergo a physical or operational change that results in the increased emissions. In the case of the 777 rate increase project, the only wing spray booths undergoing a physical change or change in the method of operation are the two north wing laydown booths and the southwest wing laydown spray booth. Therefore, BACT is triggered for VOC emissions from the two north wing laydown booths and the southwest wing laydown spray booth, all in Building 40-37. VOC emissions increases that result from increased utilization of existing emission units due to debottlenecking are not subject to BACT requirements.

Federal guidance requires each PSD permit applicant to implement a “top-down” BACT analysis process for each new or physically or operationally changed emissions unit. The "top down" BACT process starts by considering the most stringent form of emissions reduction technology possible, then determines if that technology is technically feasible and economically justifiable. If the technology is proven infeasible or unjustifiable based on technical and economical feasibility or energy or other environmental considerations, then the next less stringent level of reduction is considered. The most stringent level of emissions control that is not successfully ruled out by the applicant is selected as BACT. Ultimately, the burden is on the applicant to prove why the most stringent level of control should not be used.

### 3.2. BACT for VOC Emissions From Wing Laydown Spray Booths

Boeing-Everett submitted a review of relevant available technology including research on prior BACT determinations listed and described in EPA's RACT/BACT/LAER Clearinghouse (RBLC) and control technology determinations found in the South Coast Air Quality Management District (SCAQMD) and the California Air Resources Board (CARB) databases.

Boeing-Everett found the following control technologies for VOCs to have been successfully applied in spray-painting operations. Based on our independent research, Ecology believes this is a substantially complete list.

### 3.2.1. Thermal Oxidation

Thermal oxidation involves heating the VOC-laden air stream up enough that the VOCs will oxidize to $CO_2$ and water. A thermal oxidizer introduces the VOC emissions in an air stream to a burner that destroys those emissions prior to release to the atmosphere. This control technology has been improved upon over the years to include preheating the incoming air stream to obtain additional fuel efficiencies. Vendor information for thermal oxidizers with and without preheaters was obtained from Callidus and John Zink. The thermal oxidizer control technology overall cost-effectiveness in dollars per ton of VOC removed is shown in Table 6.

Large exhaust air systems general use a process called regenerative thermal oxidation (RTO). An RTO uses two or more chambers containing heat-absorbing material. The heat of combustion from oxidizing the VOCs, along with whatever supplementary heat, in the first chamber in the flow train is absorbed by the subsequent chambers. When the next chamber in the train is hot enough to oxidize the VOCs, flow is diverted to it, and it becomes the combustion chamber as it releases its heat to the exhaust gas. Overall, the system cycles back and forth between chambers. Up to about 95 percent of the heat load can be recovered, or in other words, the net heat load may be as low a five percent of the "direct heat" requirement.

To improve fuel efficiency, the RTO can be augmented by the addition of a concentrator "wheel." The wheel provides for a more concentrated VOC content in a smaller air stream for burning. Boeing-Everett obtained vendor information for the RTO with concentrator control technology from Anguil. Estimated overall cost-effectiveness for the RTO with a concentrator, in dollars per ton VOC removed, is shown in Table 6.

Based on the control cost estimates shown in Table 6, Ecology considers the cost of this control option to be unjustifiable for BACT purposes.

**Table 6. Summary of VOC Control Technology Costs**

| Type of Control Technology | Vendor Name | Estimated Maximum Control Efficiency | Total Cost Per Ton of VOC Removed | Total Capital Cost | Percent of Project Cost |
|---|---|---|---|---|---|
| Thermal Oxidizer | Callidus | 98.9% | $229,455 | $2,769,040 | 12% |
| Thermal Oxidizer with Preheater | John Zink | 98.9% | $164,938 | $9,230,130 | 40% |
| Thermal Oxidizer with Preheater | Callidus | 98.9% | $129,734 | $5,538,078 | 24% |
| Carbon Adsorption | Thermal Recovery Systems | 99.3% | $117,341 | $1,059,412 | 5% |

| Type of Control Technology | Vendor Name | Estimated Maximum Control Efficiency | Total Cost Per Ton of VOC Removed | Total Capital Cost | Percent of Project Cost |
|---|---|---|---|---|---|
| Regenerative Thermal Oxidizer (RTO) | Anguil | 99.3% | $48,556 | $5,538,078 | 24% |
| RTO with Concentrator | Anguil | 93.2% | $37,316 | $5,168,872 | 23% |
| Low-VOC coatings, HVLP coating gun, best management practices | N/A | N/A | N/A | N/A | 23% |
| **Project Cost Without Add-on Controls** | | | | **$22,900,000** | |

Each of the two booths at which Boeing-Everett will install automated spray coating equipment is anticipated to require airflow of at least 120,000 cubic feet per minute (cfm) (includes two stacks each handling about 60,000 cfm). Thus, the total airflow for both booths combined would be at least 240,000 cfm. A single RTO unit is limited by an airflow capacity of 75,000 to 120,000 cfm depending on the manufacturer. John Zink, an RTO vendor, claims that a single unit with an airflow capacity greater than 120,000 cfm cannot be shipped and must be built on site. John Zink's skid-mounted units can handle up to 75,000 actual cfm. To handle a greater airflow requires the installation of multiple units or the unit would have to be constructed on-site. On-site construction of a single unit that can handle airflow from two spray booths would drive up capital costs above what is shown in Table 6.

### 3.2.2. Carbon Adsorption

Carbon adsorption uses a filter bank of canisters that contain activated carbon or zeolite. The VOC-laden exhaust air is passed through granular adsorbents. Some of the VOCs are attracted to and attach themselves to the surface of the adsorbent, occupying available "active sites." When the active sites are all occupied, the adsorbent is saturated. The VOCs must be removed to reactivate the adsorbent for repeated use. This is usually done by heating the adsorbent in situ with either hot air or steam. If the VOCs can be stripped from the adsorbent at a sufficient concentration, they may be concentrated for recovery. Otherwise, the control technology must use an additional disposal method.

Vendor information for the carbon adsorption technology was obtained from Thermal Recovery Systems. Estimated overall cost-effectiveness for carbon adsorption, in dollars per ton VOC removed, is shown in Table 6.

Based on the control cost estimates shown in Table 6, Ecology considers the cost of this control option to be unjustifiable for BACT purposes.

#### 3.2.3. Low-VOC Coatings, High Transfer Efficiency Paint-Spraying Equipment and Techniques, and Best Management Practices

The use of low-VOC coatings, high transfer efficiency paint-spraying equipment and techniques, and best management practices are specified and required in the Aerospace NESHAP (40 C.F.R. Part 63, Subpart GG). Boeing Everett already uses low-VOC coatings that meet specifications required by the Aerospace NESHAP for airplane coating operations. Boeing-Everett also uses high transfer efficiency coating techniques, such as High Volume Low Pressure (HVLP) spray guns, which provide high transfer efficiency and reduce the overall amount of paint required to perform a coating job. In addition, Boeing-Everett uses good work practices to minimize VOC emissions, including storing coatings and solvents in closed containers, bagging solvent hand-wipe cleaning rags when not in use, and capturing and containing solvent used for cleaning spray equipment. The VOC emissions standards for uncontrolled use of cleaning solvents and coatings as defined in 40 C.F.R. Part 63, Subpart GG, Aerospace NESHAP and PSCAA Regulation II, 3.09 will be applied in this operation. No cost analysis was performed because Boeing-Everett has selected this option as BACT.

Ecology recognized these as BACT and required their application in previous PSD permits issued to Boeing-Everett.

#### 3.2.4. VOC BACT Determination

Ecology determines that BACT for VOC emissions from the 777 robotic wing laydown spray booths and the southwest wing laydown spray booth consists of the following:

- Compliance with all applicable VOC emission standards of the Aerospace NESHAP, 40 C.F.R. Part 63, Subpart GG, as in effect on July 1, 2011.
- Limiting combined VOC emissions from wing cleaning and coating operations from the modified 777 wing laydown spray booths, including the two robotic wing laydown spray booths and the nonrobotic southwest wing laydown spray booth, to no more than 0.17 ton per wing coated through each wing spray booth.
- Limiting VOC emissions from wing cleaning and coating operations in the two 777 robotic wing laydown spray booths and the nonrobotic southwest wing laydown spray booth in Building 40-37 to a combined total of no more than 34 tons in any twelve (12) consecutive months.

### 3.3. Toxic Air Pollutants

PSD rules require the applicant to consider emissions of toxic air pollutants during the course of a BACT analysis. One reason for this requirement is to ensure that the source does not employ an emissions control technique that controls the main pollutant of concern, but emits a new toxic air pollutant in large quantities.

Puget Sound Clean Air Agency will issue a Notice of Construction (NOC) approval for this project. The NOC approval will govern emissions of toxic air pollutants.

## 4. AMBIENT AIR QUALITY IMPACTS ANALYSIS

### 4.1. Regulatory Requirements

The PSD permitting program requires that an ambient Air Quality Impacts Analysis (AQIA) be conducted for those pollutants that are subject to PSD review. As discussed in Section 3 of this Technical Support Document, only VOC emissions are subject to PSD review.

The AQIA starts with preliminary modeling for each pollutant to determine whether an applicant can forego detailed analysis and preconstruction monitoring. If the projected ambient concentration increase for a given pollutant is below the modeling significance level (MSL) for each averaging period as given in 40 C.F.R. Part 51, Appendix S, no further analysis of the ambient impact is required for that pollutant.

For those pollutants and averaging periods that have impacts greater than the MSL, a NAAQS analysis is used to determine if the proposed project will cause or contribute to an exceedance of a NAAQS.

The PSD increment analysis is used to determine if the change in the air quality since the applicable baseline dates is greater than the Class I and Class II PSD Increment Levels. There is no PSD increment for ozone, or by extension for VOC. Typically, the AQIA includes an analysis of impacts to local areas that are within 50 kilometers of the project, and a regional air quality impact assessment for impacts beyond 50 kilometers. For projects in Washington State, this latter analysis usually includes impacts on Class I areas.

### 4.2. Modeled Impacts From the 777 Rate Increase Project

There is no MSL defined for ozone, or by extension for VOC. Instead, EPA has defined a policy that modeling for ozone is required for a proposed project only if the net emissions of either VOCs or $NO_X$ are 100 tpy or more.[13, 14, 15] As shown in Section 3, the net increase in VOC emissions from the 777 rate increase project is approximately 94 tpy. Since the 777 rate increase project's net emissions increase of VOC and $NO_X$ are both less than 100 tpy, no preliminary modeling is required for the proposed project, and none was conducted.

Also, in a previous PSD permit application for the 787 project (Permit No. PSD-05-02), Boeing-Everett demonstrated, and Ecology agreed, that 297 tons of increased VOC emissions per year

[13] Table I-C-4, NSR Workshop Manual, October 1990.
[14] "Interim guidance on New Source Review (NSR) Questions Raised in Letters Dated September 9 and 24, 1992," Stanley Meiburg, Director, Air, Pesticides and Toxics, Division, EPA Region VI to Mr. William R. Campbell, Executive Director Texas Air Control Board, November 19, 1992.
[15] Also see 40 C.F.R. § 52.21(i)(5)(i).

would not cause or significantly contribute to an exceedance of any NAAQS or PSD increment. Boeing also submitted that modeling in support of the current project. The projected net VOC increase of 94 tpy assumes the existence of a federally enforceable VOC limit of 34 tpy on all wing cleaning and coating operations performed in the two northern robotic and the two southern nonrobotic wing laydown spray booths. However, even if this federally enforceable VOC limit did not exist, and modeling were therefore required, this requirement would be satisfied by the prior modeling for any increase in VOC emissions resulting from the 777 rate increase project not exceeding the 297 tpy previously evaluated.

Additionally, Boeing-Everett is not requesting a change in PSD-91-06 Amendment 2, Condition 3, which limits VOC emissions from Model 777 assembly operations to 238.8 tpy; PSD-05-02, Condition 2.3, which limits VOC emissions from EDC operations to 412 tpy; or PSD-05-02, Condition 4.3, which limits VOC emissions from interiors production operations to 205 tpy.

## 5. ADDITIONAL IMPACTS ANALYSIS

PSD regulations and guidance require an additional impacts analysis to evaluate the effects of the project's emissions on visibility, local soils, and vegetation in Class I and II areas, and the effect of increased air pollutant concentrations on flora and fauna in the Class I areas. Class I areas are areas of special national or regional value from a natural, scenic, recreational, or historic perspective and are afforded the highest level of protection under the PSD rules. They include most national parks, national wilderness areas, and national memorial parks. The additional impacts analysis also evaluates the effect of the project on growth in the area surrounding the project.

The impacts analysis includes an assessment of increment consumption and impacts to Air Quality Related Values (AQRVs) in Class I areas. AQRVs include regional visibility or haze; the effects of primary and secondary pollutants on sensitive plants; the effects of pollutant deposition on soils and receiving water bodies; and other effects associated with secondary aerosol formation. The Federal Land Managers (FLMs) for the National Park Service (NPS), U.S. Fish and Wildlife Service (USFWS), and U.S. Forest Service (USFS) have the responsibility of ensuring AQRVs in the Class I areas are not adversely affected.

### 5.1. Visibility, $PM_{2.5}$, and Ozone Impacts in Class I Areas

Boeing-Everett previously modeled air quality impacts of the 787 project at seven (7) Western Washington Class I areas (Table 7), using the Community Multi-scale Air Quality (CMAQ) modeling system.[16] The CMAQ modeling was performed in support of the application for Permit No. PSD-05-02, issued October 10, 2005. Impacts on ambient ozone concentrations and visibility were simulated using CMAQ.

[16] CMAQ Models-3 User Manual, EPA/600/R-98/069b, National Exposure Research Laboratory, Research Triangle Park, North Carolina, 1998.

**Table 7. Distances from Boeing-Everett to the Nearest "Class I" and "Class II" Areas**

| Class I Area | Distance (km) | Approximate Direction From Boeing-Everett |
|---|---|---|
| Glacier Peak Wilderness Area | 70 | East |
| Alpine Lakes Wilderness Area | 60 | Southeast |
| North Cascades National Park | 108 | Northeast |
| Olympic National Park | 91 | West |
| Mount Rainier National Park | 123 | Southeast |
| Goat Rocks Wilderness Area | 205 | Southeast |
| Mount Baker Recreation Area* | 93 | North |
| *Mount Baker is not a designated Class I area, but it was evaluated at the request of Ecology and the FLMs. | | |

The CMAQ analysis concluded that the increase in $PM_{2.5}$ concentrations due to a VOC emissions increase of 297 tpy at Boeing-Everett was very small (about 0.14 percent over the base case–2000 and 2001) and would not cause nor significantly contribute to an exceedance of the $PM_{2.5}$ NAAQS over a Class I area.

The largest percentage ozone increases of interest, ~30 parts per trillion (ppt) or 0.03 percent near Mt. Rainier NP and ~70 ppt or 0.1 percent at North Cascades NP, occurred briefly on July 15, 1996. The ozone increases were less than 100 ppt at any Class I area, which is less than 0.2 percent of the ozone NAAQS.

Boeing-Everett also evaluated the 24-hour average percentage increase in extinction coefficient against a five percent increase criterion, as recommended by the 2000 FLAG guidance.[17] The modeled extinction coefficient showed a fleeting maximum 0.1 percent hourly increase, about 1/50th of the FLAG threshold without considering the difference in averaging time. Larger averaging times would result in lower estimates of extinction.

The CMAQ simulations indicated that an increase of 297 tpy of VOC at Boeing-Everett presents no significant effects on $PM_{2.5}$, ozone, extinction coefficient, deciview, or visual range. Based on those findings, and because the projected increase in VOC emissions from the 777 rate increase project is significantly lower, an additional air quality impact analysis was not conducted for the 777 rate increase project. Additionally, Boeing-Everett is not requesting a change in PSD-91-06 Amendment 2, Condition 3, which limits VOC emissions from Model 777 assembly operations to 238.8 tpy; PSD-05-02, Condition 2.3, which limits VOC emissions from EDC operations to 412 tpy; or PSD-05-02, Condition 4.3, which limits VOC emissions from interiors production operations to 205 tpy.

[17] http://www.nature.nps.gov/air/Pubs/pdf/flag/FlagFinal.pdf

### 5.2. Local Impacts on Soils, Vegetation, and Animals

According to EPA guidance,[18] for most types of soils and vegetation, ambient concentrations of criteria pollutants below the secondary NAAQS will not result in harmful effects. Only the VOC emissions from the 777 rate increase project are subject to PSD review. VOC is regulated as a precursor to ozone; however, ozone has no secondary NAAQS. The expected VOC emissions from the 777 rate increase project do not trigger a detailed ambient air quality impact analysis as discussed above.

Also, in a previous PSD permit application for the 787 project (Permit No. PSD-05-02), Boeing-Everett demonstrated, and Ecology agreed, that 297 tons of increased VOC emissions per year would not significantly negatively impact local soils, vegetation, or animals. Although the projected net VOC increase of 94 tpy assumes the existence of a federally enforceable VOC limit of 36.3 tpy on all wing cleaning and coating operations performed in the two northern robotic and the two southern nonrobotic wing laydown spray booths, it is unlikely that the unlimited net VOC increase from the project would exceed the 297 tpy previously evaluated for impacts to soils, vegetation, and animals. Additionally, Boeing Everett is not requesting a change in PSD-91-06 Amendment 2, Condition 3, which limits VOC emissions from Model 777 assembly operations to 238.8 tpy; PSD-05-02, Condition 2.3, which limits VOC emissions from EDC operations to 412 tpy; or PSD-05-02, Condition 4.3, which limits VOC emissions from interiors production operations to 205 tpy. Consequently, Ecology concludes that the impacts on local soils, vegetation, and animals attributable to the 777 rate increase project will be negligible.

FLAG guidance does not provide a specific VOC impact on vegetation in the Pacific Northwest. However, the FLAG Q/D screening value (where Q is the pollutant emissions in tpy and D is the distance in kilometers from a Class 1 area) for the project based on the net VOC emission increase of 94 tpy is less than 10 for the nearest Class 1 area. According to FLAG guidance, if a project will result in a Q/D less than 10, it is presumed that there will be no adverse impacts on the Class 1 area as a result of the project. NPS has established monitors for ozone in three Class I areas in Washington State: Mount Rainer National Park, Olympic National Park, and North Cascades National Park. As discussed above, Boeing-Everett estimated that the incremental increase in ozone concentrations directly attributable to the larger 787 project are less than 100 ppt. Ecology concludes that the increase in ozone from this project is not likely to cause or harm vegetation in any Class I area.

### 5.3. Construction and Growth Impacts

Employment at Boeing-Everett is not expected to increase significantly as a result of this project. Additionally, there will not be an increase in congestion on Washington's roads and highways as a result of the project. Therefore, the proposed project is not expected to cause adverse construction and growth-related impacts.

[18] Draft EPA New Source Review Workshop Manual, Chapter D, § IIC, 1990.

## 6. ENDANGERED SPECIES ACT

Pursuant to Section V.A. of the agreement for the delegation of the federal Prevention of Significant Deterioration regulations by the United States Environmental Protection Agency to the Washington State Department of Ecology, dated February 23, 2005, Ecology shall not issue a PSD permit until EPA has notified Ecology in writing that EPA has satisfied its obligations, if any, under Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1531 et seq., and 50 C.F.R. Part 402, Subpart B (Consultation Procedures), and with Section 305(b)(2) of the Magnuson-Stevens Fishery and Conservation Act (Magnuson-Stevens Act, MSA), 16 U.S.C. § 1801 et seq., 50 C.F.R. Part 600, Subpart K (EFH Coordination, Consultation, and Recommendations), for federal PSD permits, regarding essential fish habitat. Therefore, the final PSD permit will not be issued for this project until EPA has notified Ecology that this consultation has been completed.

On August 19, 2011, the EPA notified Ecology that they have satisfied their obligations under the Endangered Species Act and the Magnuson-Stevens Act relative to this permitting action. No further ESA or MSA consultation was undertaken relative to this action.

## 7. STATE ENVIRONMENTAL POLICY ACT (SEPA)

Under Washington State rules, a final PSD permit shall not be issued for a project until the applicant has demonstrated that SEPA review has been completed for the project. The City of Everett is the lead agency for SEPA review.

On May 4, 2011, Boeing-Everett submitted to Ecology a "Determination of SEPA Compliance" made by the City of Everett on May 3, 2011. The City of Everett explained that the proposed plant modifications and changes in air quality emissions at Boeing-Everett have been addressed through prior land use and environmental reviews. The City concluded that total site emissions of VOCs with the proposed project will be well below the maximum level established in the 1991 Environmental Impact Statement (EIS).

Ecology concludes that the applicant has adequately demonstrated compliance with SEPA requirements.

## 8. PUBLIC INVOLVEMENT

This permitting action is subject to a minimum 30-day public comment period under WAC 173-400-740. Newspaper public notices announcing the public comment period were published in the Daily Herald and the Daily Journal of Commerce on July 15, 2011. In accordance with WAC 173-400-740(2)(a), application materials and other related information were made available for public inspection at:

Washington State Department of Ecology
Air Quality Program
300 Desmond Drive
Lacey, WA 98503
Phone: (360) 407-6803

Puget Sound Clean Air Agency
Attn: Stella Nehen
1904 Third Avenue, Suite 105
Seattle, WA 98101
Phone: (206) 689-4011

City of Everett, Main Library
2702 Hoyt Avenue
Everett, WA 98201

A public hearing on the draft PSD permit was held at 6:30 pm on Thursday, August 18, 2011, at the Snohomish County PUD Training Center - Commission Meeting Room, 2320 California Street, Everett, Washington 98201. No members of the general public, other than Boeing-Everett's representatives, were present at the hearing. No comments were filed at the public hearing.

The public comment period closed on August 22, 2011. No comments were received during the public comment period. The City of Everett submitted a letter dated August 12, 2011 in support of the project but later withdrew that letter in an email dated August 17, 2011, in order to avoid the possible unintended consequence that their letter could have the effect of delaying the effective date of the final PSD permit.

## 9. CONCLUSION

The project will have no significant adverse impact on air quality. The Washington State Department of Ecology finds that the applicant, The Boeing Company, has satisfied all requirements for issuance of a PSD permit.

## 10. AGENCY CONTACT

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## ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Aerospace NESHAP | National Emission Standards for Aerospace Manufacturing and Rework Facilities (40 C.F.R. Part 63, Subpart GG) |
| AQIA | Air Quality Impacts Analysis |
| AQRVs | Air Quality Related Values |
| BACT | Best Available Control Technology |
| Boeing-Everett | The Boeing Company, Boeing Commercial Airplanes–Everett facility |
| CARB | California Air Resources Board |
| cfm | Cubic feet per minute |
| C.F.R. | Code of Federal Regulations |
| CIC | Corrosion-inhibiting compound |
| CAA | Clean Air Act |
| CO | Carbon monoxide |
| $CO_2e$ | Carbon dioxide equivalents |
| CMAQ | Community Multiscale Air Quality Modeling System |
| EAB | Environmental Appeals Board |
| Ecology | Washington State Department of Ecology |
| EDC | Everett Delivery Center |
| EIS | Environmental Impact Statement |
| EPA | United States Environmental Protection Agency |
| ESA | Endangered Species Act |
| ESRC | Electrical Systems Responsibility Center |
| FLAG | Federal Land Managers' Air Quality Related Values Workgroup |
| FLM | Federal Land Manager |
| gal | Gallon(s) |
| hr | Hour(s) |
| HVLP | High Volume Low Pressure |
| Km | Kilometer(s) |
| LAER | Lowest Achievable Emission Rate |
| lb | Pound(s) |
| $\mu g/m^3$ | Microgram per cubic meter |
| mm Hg | Millimeters of Mercury Column |
| MSA | Magnuson-Stevens Act |
| MSDS | Material Safety Data Sheet |
| MSL | Modeling Significance Level |
| NAAQS | National Ambient Air Quality Standards |

| | |
|---|---|
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| NOC | Notice of Construction |
| $NO_X$ | Nitrogen oxides |
| NP | National Park |
| NPS | National Park Service |
| NSPS | New Source Performance Standards |
| NSR | New Source Review |
| °C | Degrees Celsius |
| ODS | Ozone Depleting Substances |
| PM | Particulate Matter |
| $PM_{2.5}$ | Particulate matter with aerodynamic diameter less than or equal to 2.5 micrometers |
| $PM_{10}$ | Particulate matter with aerodynamic diameter less than or equal to 10 micrometers |
| PCHB | Pollution Control Hearings Board |
| ppt | Parts per trillion |
| PSCAA | Puget Sound Clean Air Agency |
| PSD | Prevention of Significant Deterioration of Air Quality |
| PTE | Potential to emit |
| RACT | Reasonably Available Control Technology |
| RBLC | EPA's RACT/BACT/LAER Clearinghouse |
| RCW | Revised Code of Washington |
| RTO | Regenerative Thermal Oxidizer |
| SCAQMD | South Coast Air Quality Management District |
| SEPA | State Environmental Policy Act |
| SER | Significant Emission Rate |
| $SO_2$ | Sulfur dioxide |
| TPY or tpy | Tons per year |
| U.S.C. | United States Code |
| USFS | U.S. Forest Service |
| USFWS | U.S. Fish and Wildlife Service |
| VOCs | Volatile Organic Compounds |
| WAC | Washington Administrative Code |