U.S. Department of Energy
Office of River Protection
P.O. Box 450, MSIN H6-60
Richland, Washington 99352

RECEIVED
SEP 27 2012
DEPARTMENT OF ECOLOGY
NWP - RICHLAND

SEP 26 2012

12-ECD-0051

COPY
Review & Recycle

Ms. Jane A. Hedges, Program Manager
Nuclear Waste Program
Washington State
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99354

Dear Ms. Hedges:

RE-SUBMITTAL OF WASTE TREATMENT AND IMMOBILIZATION PLANT (WTP) NONRADIOACTIVE AIR EMISSIONS NOTICE OF CONSTRUCTION (NOC) PERMIT APPLICATION SUPPLEMENT TO DE02NWP-002

References:
1. ORP letter from S. L. Samuelson to J. A. Hedges, Ecology, "Waste Treatment and Immobilization Plant (WTP) Nonradioactive Air Emissions Notice of Construction (NOC) Permit Application Supplement to DE02NWP-002," 12-ECD-0010, dated June 5, 2012.

2. Ecology letter from P. M. Gent to S. L. Samuelson, ORP, "Determination of Incomplete Application, Waste Treatment and Immobilization Plant (WTP) Nonradioactive Air Emissions Notice of Construction (NOC) Permit Application Supplement to DE02NWP-002," 12-NWP-126, dated July 20, 2012.

3. ORP letter from S. L. Samuelson to R. Hibbard, Ecology, "Waste Treatment and Immobilization Plant (WTP) Prevention of Significant Deterioration (PSD) Permit Application Supplement to PSD-02-01, Amendment 2," 12-ECD-0004, dated May 21, 2012.

Attached for your review is the Nonradioactive Air Emissions NOC Permit Application Supplement to DE02NWP-002, 24590-WTP-RPT-ENV-12-002, Revision 1 (Attachment 1). The Application Supplement was previously submitted to the Washington State Department of Ecology (Ecology) (Reference 1) and has been revised to incorporate comments received during their formal review (Reference 2). Also provided for transmittal to Ecology is electronic media 24590-RMCD-04284 (Attachment 2) air dispersion modeling input and output files.

The Application Supplement proposes to eliminate the Type II emergency diesel generators from WTP design and replace them with turbine generators for emergency power production. The Application Supplement also proposes an increase to the annual operating hour restriction on each of the diesel engine-driven fire pumps from 110 hours per year to 230 hours per year to support maintenance and testing of WTP fire water systems. All other emission units, including the Type I emergency diesel generator, remain unchanged and continue under construction.

Based on estimated maximum projected emissions resulting from the proposed changes, all criteria pollutant emissions increases are less than Washington Administrative Code (WAC) 173-400-030, Prevision of Significant Deterioration (PSD) significance thresholds. The WTP is subject to PSD since the original project's estimated maximum projected emissions of oxides of nitrogen (NOx and particulate matter of 10 microns or less exceeded PSD significance thresholds. A separate PSD Application Supplement addressing emissions of NOx and particulate matter has been submitted to Ecology's Lacey Office (Reference 3).

Projected emissions of NOx are reduced by approximately three tons per year and particulate matter is reduced by less than one ton per year. Slight increases in maximum projected emissions of carbon monoxide, sulfur dioxide, and volatile organic compounds result from the changes but are well below significance thresholds. Toxic Air Pollutant (TAP) emissions from the turbine generators and fire pumps were assessed using the Environmental Protection Agency approved AERMOD air dispersion model. Results of the assessment show that all TAP emissions are below corresponding WAC 173-460-150 acceptable source impact levels.

If you have any questions, please contact me, or your staff may contact Dennis W. Bowser, Environmental Compliance Division, (509) 373-2566.

Sincerely,

Stacy Charboneau for

Scott L. Samuelson, Manager
Office of River Protection

ECD:DWB

Attachments: (2)

cc: See page 2

cc w/attachs:
P. M. Gent, Ecology

cc w/o attachs:
B. G. Erlandson, BNI
J. A. Bates, CHPRC
J. Cox, CTUIR
S. Harris, CTUIR
K. A. Conaway, Ecology
S. L. Dahl, Ecology
S. L. Derrick, Ecology
D. Bartus, EPA (Region 10, Seattle)
D. Zhen, EPA (Region 10, Seattle)
R. H. Anderson, MSA
T. G. Beam, MSA
K. A. Peterson, MSA
P. C. Miller, North Wind
G. Bohnee, NPT
K. Niles, Oregon Energy
D. E. Jackson, RL
J. Martell, WDOH
L. L. Penn, WRPS
B. P. Rumburg, WRPS
R. Jim, YN
Administrative Record
BNI Correspondence
Environmental Portal, LMSI
WRPS Correspondence

Attachment 1
12-ECD-0051
(18 Pages – Double-Sided)

Nonradioactive Air Emissions Notice of Construction
Permit Application Supplement to DE02NWP-002
24590-WTP-RPT-ENV-12-002, Revision 1

R11545396

ISSUED BY
RPP-WTP POC

Nonradioactive Air Emissions Notice of Construction Permit Application Supplement to DE02NWP-002

Document title:

Document number: 24590-WTP-RPT-ENV-12-002, Rev 1

Contract number: DE-AC27-01RV14136

Department: Environmental

Author(s): Robert Haggard RDH 8/14/12

Checked by: Lee Bostic 8/14/12

Issue status: Approved

Approved by: Brad Erlandson

Approver's position: Environmental Manager

Approver's signature: Brad E Erlandson 8/16/12
Signature *Date*

River Protection Project
Waste Treatment Plant
2435 Stevens Center Place
Richland, WA 99354
United States of America
Tel: 509 371 2000

History Sheet

Rev	Reason for revision	Revised by
0	Initial issue.	R. Haggard
1	Document is revised to incorporate comments received during Ecology's review of Revision 0 of the document. Section 5, "Emissions Estimates and Air Impact Analysis" and Appendix A, "Emission Estimates Supporting Supplemental Nonradioactive Air Permit Application" have been revised. Minor editorial changes throughout the document.	R. Haggard

Contents

Appendices

Tables

1 Introduction

This Nonradioactive Air Emissions Notice of Construction Permit Application Supplement (Application Supplement) is provided to obtain Washington State Department of Ecology (Ecology) approval of planned design changes associated with the Hanford Tank Waste Treatment and Immobilization Plant (WTP) that will impact Air Permit Approval DE02NWP-002. The Application Supplement is being revised to address comments received from Ecology during their 30-day completeness review of the original document. To address Ecology comments, Section 5, "Emissions Estimates and Air Impact Analysis" and Appendix A, "Emission Estimates Supporting Supplemental Nonradioactive Air Permit Application" have been revised.

The original DE02NWP-002 was approved by Ecology on July 8, 2002, which allowed start of construction of the WTP with a design consisting of a Pretreatment Facility (PTF), three (3) Low-Activity Waste (LAW) facility melters and one (1) High-Level Waste (HLW) facility melter. Amendment 1 of DE02NWP-002 was issued on November 4, 2003 to incorporate a redesigned WTP that included two (2) LAW melters and two (2) HLW melters.

On August 23, 2004, Ecology approved a DE02NWP-002 Revision to allow operation of an air stripper to reduce trihalomethanes concentrations to meet criteria for the WTP Nonradioactive Liquid Waste Disposal (NLD) system wastewater discharge required for acceptance at the 200 Area Treated Effluent Disposal Facility (TEDF). On November 11, 2005, Amendment 2 to DE02NWP-002 was issued to approve an alternative compliance demonstration method for the steam boilers. On May 11, 2006, Ecology issued Amendment 3 to DE02NWP-002 that clarified Condition 3.4 associated with access to performance test ports. On November 20, 2006, Ecology issued Amendment 4 to DE02NWP-002 to clarify WTP construction phase Dust Control Plan requirements. Finally, on August 3, 2010, Ecology approved a best available control technology for toxic air pollutants (T-BACT) change for the Pretreatment Facility (PTF) vessel vent emission unit.

Today's Application Supplement proposes to eliminate the Type II emergency diesel generators from design and replace them with emergency turbine generators. The Application Supplement also proposes to increase the annual operating hour restriction for each of the diesel engine driven fire pumps from 110 hour per year to 230 hour per year to support maintenance and testing of WTP fire water systems. All other WTP emissions units, including the Type I emergency diesel generator, remain unchanged and continue under construction.

The Application Supplement is prepared consistent with the requirements in WAC 173-400 for control of potential criteria pollutant emissions and WAC 173-460 for control of toxic air pollutants (TAPs). The format of the Application Supplement is consistent with the approach taken for the preparation of the Prevention of Significant Deterioration (PSD) Supplement to PSD-02-01, Amendment 2 (24590-WTP-RPT-ENV-12-001, Rev 0). The PSD application supplement serves as the mechanism to amend the existing *PSD Application*, 24590-WTP-RPT-ENV-01-007, Rev. 1 instead of replacing it in its entirety. The new source review requirements under PSD apply to the WTP because the maximum projected emissions of NO_x exceeded the significance threshold of 40 tons per year and emissions of PM_{10} [particulate matter - 10 micron diameter] exceeded the significance threshold of 15 tons/per year. The maximum projected emissions resulting from the proposed change to turbines are all below PSD significance thresholds.

Similarly, this Application Supplement is intended to supplement the *Nonradioactive Air Emissions Notice of Construction Permit Application for the Hanford Tank Waste Treatment and Immobilization Plant*, 24590-WTP-RPT-ENV-01-009, Rev. 1, instead of replacing it. The approach to supplement the permit approvals was based on the following:

- Emissions of all PSD pollutants from the proposed project are less than PSD significance thresholds.
- The changes are minor because the fundamental nature of the permitted WTP systems are unchanged (i.e., the replacement generator performs the same function and the Standard Industrial Code (SIC) of the WTP is unchanged).
- All other WTP emission units associated with the PTF, HLW Facility, LAW Facility, Analytical Laboratory, Steam Plant, Type I Emergency Diesel Generator, Non-Dangerous and Non-Radioactive Liquid Effluent Discharge Facility, and Glass Former Storage Facility have commenced construction and remain unchanged.

Section 5 and Appendix A provide an emissions analysis that compares existing maximum projected WTP emissions of PM, PM_{10}, $PM_{2.5}$, NO_x, CO, SO_2, and VOC to those resulting from the proposed changes. The analyses in Tables 5-1 and 5-2 demonstrate that the maximum projected emissions from both the turbine generators and fire pump engines are below PSD significant emission rates. The proposed project reduces NO_x emissions by approximately 3 tons per year and particulate matter by less than a ton per year. Slight increases in maximum projected CO, SO_2, and VOC emissions result from the changes but emissions are well below PSD significance levels.

Emissions of toxic air pollutants (TAPs) and ambient air impact analysis from the turbines and fire pumps are also included in Section 5. The TAP ambient air impact analysis utilized EPAs approved AERMOD dispersion model to assess emissions from the turbines and fire pumps. Results of the analysis demonstrate that all pollutant emissions fall below corresponding Acceptable Source Impact Levels (ASIL).

2 Scope

Since the existing *Nonradioactive Air Emissions Notice of Construction Permit Application for the Hanford Tank Waste Treatment and Immobilization Plant*, 24590-WTP-RPT-ENV-01-009, Rev. 1 addresses all WTP emission sources including those described above that remain unchanged, the Application Supplement will focus on the emission units that are being changed. Unmodified emission units that continue to be constructed will be highlighted where appropriate but emissions estimates and best available control technology (BACT) and toxics-BACT (T-BACT) conclusions remain as identified in the existing application and approvals. To support Ecology review, the Application Supplement includes the following information:

- **Summary of Proposed Project** - Discussion of the original project and the proposed changes being pursued in the Application Supplement.
- **Review of Applicable Regulatory Requirements** - Summary of applicable requirements and discussion of emissions standards.
- **Process Description** - Summary of the existing WTP emission units and description of the new emergency turbine generators.

- **BACT/T-BACT** - Summary of BACT/T-BACT conclusions for all WTP emission units and proposed BACT/T-BACT for criteria and toxic air pollutant (TAP) emissions from the turbine generators.
- **Emissions Estimates and TAP Analysis** - Summary of existing WTP emissions and TAP analysis and comparison to emissions resulting from change to turbine generators and fire water pump operating hour increase.

3 Review of Applicable Regulatory Requirements

In Washington State, Ecology is responsible for establishing and maintaining the air quality standards to protect the public health (RCW 70.94.011). Facilities with new sources of criteria and TAPs emissions are required to comply with the general standards for ambient air protection and to obtain approval of projects prior to construction. The existing *Nonradioactive Air Emissions Notice of Construction Permit Application for the Hanford Tank Waste Treatment and Immobilization Plant*, 24590-WTP-RPT-ENV-01-009, Rev 1, was prepared to fulfill these requirements and support Ecology issuance of DE02NWP-002 and associated Amendments.

This Application Supplement is proposing to substitute two (2) turbine generators (2) for diesel generators and increase the annual operating hours for diesel driven fire water pump testing and maintenance. Review of the emissions estimates and ambient air impacts in Section 5 show that NO_x and PM emissions resulting from the change to turbines are reduced or remain unchanged when compared to emissions from the currently permitted Type II diesel generators. Review of the PSD regulated emissions of NO_x show an overall 3 ton per year reduction when substituting diesel engine generators with turbine generators. Slight increases in maximum projected CO, SOx, and VOC emissions result from the changes but emissions are well below PSD significance thresholds. To ensure consistency, the format of this Nonradioactive NOC Supplement is very similar to the format of the PSD Application Supplement to PSD-02-01 (24590-WTP-RPT-ENV-12-001, Rev 0).

3.1 Other Clean Air Act Regulations

As described above, this Application Supplement is prepared in parallel with a separate PSD Application Supplement, 24590-WTP-RPT-ENV-12-001 which addresses emissions of NO_x and particulate matter regulated under PSD-02-01, Amendment 2.

The WAC 173-401, *Operating Permit Regulation*, specifies the permitting requirements to be met for major sources, including the Hanford Site. Both PSD-02-01 and DE02NWP-002 are included in the Hanford Site Air Operating Permit (AOP) # 00-05-006. In parallel with submittal of the PSD Application Supplement and Nonradioactive NOC Application Supplement, an Administrative Amendment Request will be submitted to Ecology's NWP to request incorporation of the amended PSD-02-01 and DE02NWP-002 into the Hanford Site AOP.

3.1.1 New Source Performance Standards

The Clean Air Act (CAA) requires certain categories of emissions sources to meet the New Source Performance Standards (NSPS) under 40 CFR 60. The 40 CFR 60.4300 (Subpart KKKK) is applicable to the new emergency turbine generators because each unit's potential heat input is greater than 10 MMBtu per hour and the turbines will be constructed after calendar year 2005. The NSPS includes emissions criteria for both NO_x and SO_2.

Review of the criteria in the NSPS regulations confirms that the WTP turbines will be exempt from NO_x emissions limits because the units are classified as "emergency combustion turbines" used to produce power for critical networks and equipment when electric power from the local utility is interrupted. Compliance with the SO_2 emissions limit will be maintained by limiting turbine fuel to ultra low sulfur diesel fuel with a sulfur content of 15 ppm or less. The NSPS requires liquid fuel sulfur content less than 500 ppm.

3.1.2 National Emissions Standards For Hazardous Air Pollutants

The WTP turbines will be subject to the CAA National Emissions Standards for Hazardous Air Pollutants for Stationary Combustion Turbines in 40 CFR 63.6080 (Subpart YYYY), because the WTP is located on the Hanford Site which is a major source of hazardous air pollutant emissions. Review of Subpart YYYY, Section 63.6090(b)(i) establishes that the WTP turbines will only be subject to the initial notification requirements under 63.6145(d) within 120 days following startup because the units are classified as emergency stationary combustion turbines. No other requirements under this standard apply. Ecology will be notified of the initial startup concurrent with the notification to the Environmental Protection Agency (EPA).

4 Process Description and Planned Changes

4.1 WTP Process Overview

The WTP is being constructed to store and treat mixed waste from the Hanford Site Double Shell Tank system and will consist of three (3) main processing plants which include the PTF, LAW vitrification, and HLW vitrification. Tank waste will be received in the PTF where it will be separated into LAW and HLW feed. Waste will be immobilized in a glass matrix and poured into steel containers. Offgas generated by the pretreatment and vitrification processes will be treated in independent offgas treatment systems. Typical offgas streams include process vessel ventilation, melter offgas, and exhaust from fluidic transfer devices, such as reverse flow diverters (RFD) and pulse jet mixers (PJM).

Building ventilation systems will also be incorporated into each of the processing plants and are designated as C2, C3, and C5 area emission units. Treated building air ventilation systems will be vented to the atmosphere through dedicated flues.

The WTP will have an onsite analytical laboratory to support sampling and analysis activities. The offgases generated from sampling and analysis activities will be treated and vented to the atmosphere through three (3) dedicated emission units classified as C2, C3, and C5.

Support systems and utilities required for the WTP will be provided by the balance of facilities (BOF). The BOF facilities include Steam Plant boilers, Type I diesel generator, turbine generators, diesel engine driven fire water pumps, and glass former storage facility.

Detailed process descriptions of each emissions unit are provided in the *Nonradioactive Air Emissions Notice of Construction Permit Application for the Hanford Tank Waste Treatment and Immobilization Plant*, 24590-WTP-RPT-ENV-01-009, Rev 1, Sections 4.2 through 4.8 with the exception of the new turbine generators which are described in Section 4.7.6 below. Sections 4.2 through 4.7 are provided to summarize each WTP emission source currently being constructed and will not be changed.

4.2 Pretreatment Facility Emission Sources

The emission sources from pretreatment processes are plant building air ventilation, process vessel vents, RFD offgas, and PJM offgas. The plant building air is expected to contain particulates. The offgases from process vessels, RFD, and PJM will contain particulates, volatile organics, semi-volatile organics, and acid gases. Descriptions of controls for the pretreatment plant are provided in Section 6 of this document.

Insignificant amounts of particulates, organics, and acid gases are expected to be emitted from the building ventilation systems (less than 0.1 US ton). Particulate emissions from the pretreatment processes are produced from the entrained solids in the fluidic device exhausts and the process vessel vents.

4.3 LAW Building Ventilation and Process Offgas Emission Sources

The emission sources from the LAW vitrification processes are plant building air ventilation, process vessel vents, and LAW melter offgas. The offgases from process vessels will contain particulates, volatile and semi-volatile organics, and acid gases. The LAW melter offgas will contain particulates, radioactive gases, volatile and semi-volatile organics, acid gases, and NO_x gases at relatively high temperature and moisture content. Descriptions of selected BACT for the LAW vitrification plant are provided in Section 6 of this document.

Insignificant amounts of particulates are expected to be emitted from the building ventilation systems (less than 0.1 US ton per year). The building ventilation systems are described in Section 4.6. Particulate emissions from the LAW vitrification processes are the entrained particulates produced from the feed and the glass melt processes. Descriptions of selected controls are provided in Section 6 of this document.

4.4 HLW Building Ventilation and Process Offgas Emission Sources

The emission sources from the HLW vitrification processes include plant building air ventilation, process vessel vents, RFD/PJM exhausts, and HLW melter offgas. The plant building air is expected to contain particulates. The offgases from process vessels and RFD/PJM will contain particulates, volatile organics, and acid gases. The HLW melter offgas will contain particulates, radioactive gases, volatile organics, acid gases, and NO_x gases. Section 6 identifies selected controls.

Insignificant amounts of particulates are expected to be emitted from the HLW building ventilation systems (less than 0.1 US ton per year). The building ventilation systems are described in Section 4.6 below.

4.5 Analytical Laboratory

The WTP analytical laboratory emissions will consist of emissions from building air ventilation, hot cell ventilation, and sample analysis fume hood exhaust. Based on anticipated sampling and analytical activities, insignificant particulate emissions (less than 0.1 US ton per year) are expected. Inorganic emissions have been estimated from laboratory activities and documented in 24590-WTP-RPT-ENV-01-009, *Non-Radioactive Air Emissions Notice of Construction Permit Application for the River Protection Project-Waste Treatment Plant.*

4.6 WTP Building Ventilation Systems

The building air supply for WTP process facilities (PTF, LAW vitrification, and HLW vitrification plants) and the analytical laboratory will be divided into four (4) numbered zones: C1 to C5 (C4 is not used). The higher number indicates greater radioactive contamination potential, and therefore requires a greater degree of control or restriction. A separate zoning system for the ventilation systems will be based on the system for classifying building areas for potential contamination. Zones classified as C5 will have the potential for the greatest contamination, and will include the pretreatment cells, melter cells, and glass pouring and cooling cells. All C5 zones will be operated remotely. Zones classified as C1 will be those areas that have no risk of contamination such as equipment rooms and offices.

Confinement will be achieved by maintaining the lowest pressure for areas with greatest contamination (such as C5 areas), with airflows cascading from least-to most-contaminated areas (such as from C2 to C5 areas). The principle of a cascade system is that air passes through more than one area, effectively reducing the number of separate ventilation streams and, hence, the amount of air requiring treatment.

The confinement provided by physical barriers is enhanced by the ventilation system, which creates a pressure gradient and causes air to flow through engineered routes, from an area of lower contamination potential to an area of higher contamination potential.

C1 Ventilation System

Typically, the C1 areas will consist of offices, workshops, control rooms, and equipment rooms. Emissions are not expected for the C1 areas.

C2 Ventilation System

Typically, the C2 areas will consist of non-process operating areas, access corridors, control and instrumentation, and electrical rooms. Filtered and tempered air will be supplied to these areas by the C2 supply system, and will be cascaded into adjacent C3 areas, or be exhausted by the C2 exhaust system. C2 areas can normally be accessed in street clothes and do not require personal protective equipment.

C3 Ventilation System

Typically, the C3 areas will consist of filter plant rooms, workshops, maintenance areas, and monitoring areas. Access from a C2 area to a C3 area will be through a C2/C3 sub-change room. Air will generally be drawn from C2 areas, and cascaded through the C3 areas, into C5 areas. In general, air cascaded into the C3 areas will be from adjacent C2/C3 sub-change rooms. In some areas, where higher flow may be required into C3 areas, C2/C3 boundary walls will be provided, with engineered transfer grilles equipped with backflow dampers.

C5 Ventilation System

In general, air cascaded into the C5 areas will be from adjacent C3 areas. If there is a requirement for engineered duct entries through the C3 boundary, they will be protected by backflow dampers and HEPA filters with penetrations through the boundary sealed.

The pretreatment plant C5 areas are designed with the cell or cave perimeter providing radiation shielding, as well as a confinement zone for ventilation purposes. C5 areas typically consist of a series of

process cells where waste will be stored and treated. The PTF hot cell will house major pumps and valves and other process equipment.

The C5 areas in the LAW and HLW vitrification plants will be composed of the following:

- Pour caves
- Transfer tunnel
- Buffer storage area
- C3/C5 drain tank room
- Process cells

Air will be cascaded into the C5 areas and be exhausted by the C5 exhaust system.

4.7 Balance of Facilities

The BOF will include support systems and utilities required for the waste treatment processes within the PTF, LAW vitrification and HLW vitrification plants, and the analytical laboratory. Criteria and TAP emissions are expected from the steam boilers, diesel generator, turbine generators, and the diesel-driven fire water pumps. Descriptions of emissions and proposed controls are provided in Sections 5 and 6.

4.7.1 Steam Boilers

There will be six (6) Cleaver-Brooks fire tube steam boilers at the WTP and each is rated at 50.2 million British thermal units (BTU) per hour. The steam boilers will provide process steam and building heat to the PT, LAW vitrification and HLW vitrification plants, and the laboratories.

4.7.2 Fire Water Pumps

Two (2) 300 horsepower diesel engine-driven fire water pumps are used to support testing and maintenance of fire water systems as well as to provide fire water during loss of off-site power events. A diesel fuel day tank will be located inside the fire pumphouse in a curbed area. The fire water tanks will be located adjacent to the fire water pumphouse and are used to store the fire water, which is delivered to fire hydrants, standpipes, and fixed fire suppression systems.

4.7.3 Type I Diesel Generator

The 2,500 KW Type I generator will provide electrical power to selected equipment and components within the BOF, the PTF, LAW vitrification plant, and the HLW vitrification plant. The Type I generator is a model year 2004 unit and is onsite awaiting installation.

4.7.4 Glass Former Facility

A glass former facility is designed to receive, store, weigh, blend, and transport glass former materials to the LAW and HLW vitrification plants. The glass former facility building provides an enclosed facility that contains the bulk glass former material receipt and unloading area and an outdoor pad for storage silos and material handling equipment. The material receipt and unload area houses a bulk bag material storage area, the bulk bag handling equipment (bulk bag loaders and unloaders), a vacuum unloader, a

transporter, the air handling equipment (compressors, air dryers, and receivers that support the glass former handling and pneumatic transport), and an operations office. The outdoor storage area will contain the material storage silos, weight hoppers, transporters, blending silos, and blended glass former transporters. The storage silos and blending silos will have baghouse filters to minimize emissions during loading and unloading. Transfer of the glass formers between the weigh hoppers, the blending silos, and the melter feed hoppers will occur through sealed, dense-phase pneumatic conveying.

4.7.5 Non-Dangerous/Non-Radioactive Liquid Effluent Systems

As discussed in Section 1, source water changes associated with the NLD Facility wastewater discharge required a WTP design change to install an air stripper to remove trihalomethane from the wastewater stream to meet 200 Area TEDF State Waste Discharge Permit ST 4502 effluent limits. The resulting air stripper changes were approved by Ecology and incorporated into DE02NWP-002 in 2004 via an approval letter.

4.7.6 Turbine Generators

The DE02NPW-002 permits operation of two Type II diesel generators to provide emergency electrical power to selected equipment and components within the WTP facilities. The Type II generator design activity was terminated because WTP determined that turbine generator technology improves the cost-risk profile compared to diesel engine generator use, while continuing to assure a reliable source of emergency power for critical Nuclear Safety systems, structures, and components. Elements that support the change to turbine technology includes:

- Deletion of necessary diesel engine water cooling systems that include air-cooled radiators and associated volcanic ash protection filtration systems.
- Improvement in efficiency and reduction in parasitic loads associated with three (3) otherwise-required 400 hp radiator cooling fans to support diesel engines.
- Turbine engine maintenance is eased, performed less frequently, and the systems typically involve approximately one-third the number of parts compared to diesel engine generators.
- Turbine technology results in a lower NO_x and particulate matter emissions alternative to equivalently sized diesel engine technology.

The Rolls-Royce Corporation has been selected to manufacture two (2) identical turbine generator Model 501-KB7s rated at 3,800 kilowatt (KW) generator output each. Each turbine unit is a simple cycle design.

5 Emission Estimates and Air Impact Analysis

5.1 Original Project Criteria Pollutant Emissions

Emission estimates for each source described in Sections 4.2 through 4.7.5 were provided in the *Non-Radioactive Air Emissions Notice of Construction Permit Application for the River Protection Project-Waste Treatment Plant*, 24590-WTP-RPT-ENV-01-009 and remain unchanged. The criteria pollutant analysis showed that both NO_x and PM_{10} emissions exceeded the PSD significance thresholds. These pollutants were subsequently permitted under a separate PSD permit application as previously discussed. Table 5-3 provides an overview of the criteria pollutant emissions from the existing Project.

5.2 Original Project Toxic Air Pollutant Emissions

TAP concentrations were determined by using the EPA's Industrial Source Complex-Short Term (ISCST3) air dispersion model. The maximum impact sites were determined to be located along the Hanford Site boundary to the east and east-northeast of the WTP site. The offsite concentrations for each emission unit and source were totaled for comparison to the Washington Administrative Code (WAC) 173-460 acceptable source impact levels Acceptable Source Impact Levels (ASIL). Results of the comparison showed that all TAP emissions were below corresponding ASILs.

5.3 Proposed Project Criteria Pollutant Emissions

The proposed project results in an overall reduction of NO_x and particulate matter emissions from the substitution of turbine generators for diesel generators, and increasing fire water pump operating hours from 110 hours per year each to 230 hours per year each. The Table 5-4 provides an overview of the resulting criteria pollutant emissions. Slight increases in maximum projected CO, SO_2, and VOC emissions result from the changes but are well below PSD significance levels.

The methodology used to calculate turbine emissions is detailed in Appendix A. The estimated maximum projected turbine emissions of NO_x, CO, SO_2, and VOCs are based on limiting planned operating hours to 164 per year and using Rolls-Royce emissions factors. For emissions of total PM, PM_{10}, $PM_{2.5}$, and GHG, EPAs AP-42 (EPA 2000) emission factors, turbine maximum fuel consumption rates, and planned operating hours were used since vendor emissions data are not available for these pollutants.

The previous Type II generator criteria pollutant emission rates are also provided for comparison. Results of the comparison show that Type II generators NOx emissions totaled approximately 15 tons per year while emissions from the turbines are approximately 11.45 tons per year. Accounting for the slight increase in fire water pump NO_x emissions, summation of all WTP NO_x sources shows a 3 ton per year net reduction.

Emissions of all forms of particulate matter resulting from the change to turbines showed a small reduction from previous Type II generator technology. Factoring in the slight increase from the fire water pump engine operating hour increase, overall WTP emissions of PM have been reduced by less than 1 ton per year.

Fire water pump emission changes were calculated based on vendor emission factors. Considering that the fire water pumps are only 300 horsepower engines, the additional operating hours result in a slight criteria pollutant emissions increase. However, the increases are considered insignificant since all are less than 0.4 tons per year for each criteria pollutant.

5.4 Proposed Project Toxic Air Pollutant Emissions

Toxic air pollutant changes associated with turbines and the fire water pump engine were based on EPA's AP-42 emission factors and vendor supplied fuel consumption rates. Details of the emission estimate methodology, example calculations, ambient impact assessment, and vendor emissions data are provided in Appendix A and summarized in Tables 5-5 and 5-6 below.

5.5 Ambient Air Impact Assessment

Annual, 24-hr, and 1-hr ground level TAP concentrations, expressed as micrograms per cubic meter (µg/m3), were determined using EPAs approved air dispersion model AERMOD version 11103 and pre-processors AERMET version 11059, AERMAP version 11103 and BPIP-Prime version 04273. The modeling analysis used BEE-Line Software's BEEST Version 9.93 to assess WTP impacts to ASILs. The BEEST program is a Windows based user interface to the EPA approved AERMOD.

AERMOD utilizes individual emission point release characteristics, source emission rates, surface and upper air meteorological data, terrain data, and receptor data to determine maximum annual, 24-hr, and 1-hr concentrations affecting offsite receptors. Details of the modeling analysis are provided below.

Release Characteristics

Stack characteristics were modeled as point sources with release parameters corresponding to design specifications or manufacturer data. A summary of the release parameters for the modeled sources is provided in Table 5-1.

The turbine release characteristic was originally modeled as a horizontal release in revision 0 of the Application Supplement. Subsequent design evolution of the turbine stack determined that a vertical release was appropriate. Revision 1 of the application supplement reflects an updated modeling effort based on vertical release characteristics.

Table 5-1 WTP Stack Release Parameters

Stack Parameter	Turbines	Fire Pumps
Stack height (ft)	57	10
Stack Temperature (°F)	989	829
Exit Diameter (ft)	3	0.5
Exit Velocity (ft/s)	168	0.001
Exit Flowrate (acfm)	71251	0.011

The basis for the stack parameters included:

- Turbines - 24590-CD-POA-MUTC-00001-02-00001, Rev. C, *Rolls Royce Industrial Engine Performance & Emissions*
- Turbines - 24590-BOF-P1-89-00016, Rev. 0, *Balance of Facilities ETG Plant Sections*
- Fire Pumps - 24590-WTP-HAC-50-00006, Sheet 37, *Emission Estimates for the Prevention of Significant Deterioration Permit Application*

Building Downwash

The building profile input program (BPIP-Prime) was used to determine dominant structures for building downwash calculations made in AERMOD for point sources. Direction-specific building heights and

widths of the dominant downwash structures were included in the AERMOD input file directly from the BPIP-Prime results.

AERMET Meteorological Data

The AERMET pre-processing program was run with a sequential hourly meteorological data set. Because comparison to other years showed insignificant differences in the modeling results, calendar year 2003 was selected for modeling.

Surface air data such as wind direction, wind speed, temperature, and precipitation have been obtained from Station 21 of the Hanford Meteorological Monitoring Network, which is located in the 200 East Area within 1 mile of the location of the WTP. The surface data is read into the model in CD-144 format.

Upper air data used to calculate mixing heights has been obtained from the National Weather Service (NWS) station number 04106 in Spokane, Washington which is representative of upper air east of the Cascade Mountains. The upper air data is read into the model in FSL format.

AERMAP

The AERMAP preprocessor required input of 10-Meter Digital Elevation Model (DEM) files which were loaded from the Geomorphological Research Group website at http://rocky.ess.washington.edu/data/raster/tenmeter/byquad/wallawalla/index.html. The website contains free 10-meter DEM files for download into AERMAP. Review of the Washington State 10-meter DEMs plot shows "Walla Walla" quadrangle contained the necessary DEM files for the Hanford Site Boundary. Table 5-2 lists the DEM file numbers used in the modeling analysis:

Table 5-2 DEMs

1841	1842	1843	1844	1845	1846	1847
1941	1942	1943	1944	1945	1946	1947
2041	2042	2043	2044	2045	2046	2047
2141	2142	2143	2144	2145	2146	2147
2241	2242	2243	2244	2245	2246	2247
					2346	2347

Modeled Receptors

The modeling analysis used discrete receptor locations to identify the maximum impact for NO_2, SO_2, and $PM_{2.5}$. Because past modeling efforts showed prevailing winds to the east, a receptor grid with 500-meter spacing was extended 10 kilometers around the eastern property boundary to be sure that the maximum impacts were identified.

The model was run for a turbine stack and fire water pump stack using a unitized emission rate of 1 gram per second. Results of the analysis showed that the maximum average impact sites are all located along the Hanford boundary to the east and east-northeast of the WTP site.

The resulting concentrations from the AERMOD model were multiplied by each sources' TAP emission rates. For comparison to TAPs with an annual averaging period, these values were also multiplied by a fraction representing actual hours of operation per year. In the case of the turbine, the value was 164 hr divided by 8,760 hrs per year, which equates to 0.018. In the case of the fire pumps, the value was 230 hrs divided by 8760 hrs which equates to 0.026. The resulting value was then compared to corresponding ASILs identified in WAC 173-460-150. The analysis included the ASILs for NO_2, CO, SO_2, and Diesel Engine Exhaust Particulates for the fire pumps. Results of the analysis in Tables 5-5 and 5-6 showed that all TAP emissions are below corresponding ASILs.

Table 5-3 Existing Annual WTP Controlled Criteria Pollutant Emission Estimates (US tons per year) [a]

Criteria Pollutant	Pretreatment Facilities	LAW Vitrification Facility	HLW Vitrification Facility	Boiler Plant	Diesel Generators [e]	Miscellaneous Facility Sources [b]	Total Emissions	PSD Significance Limits
CO	7.94E-21	2.20	0.36	65.6	2.4	0.02	70.58	100
NO_x	0.44	36.7	8.5	84.3	20.4	0.4	150.37	40
SO_2	1.09E-21	3.68	4.84	2.9[d]	0.03[d]	6.0E-04[d]	11.44	40
PM_{10} [c]	2.03	1.57	1.18	18.7	0.7	0.06	24.24	15
VOCs (as total volatile and semi-volatile organics)	3.84	0.47	0.38	28.1	0.8	0.01	33.60	40
Pb	1.03E-09	2.65E-9	1.99E-11	8.43E-03	4.7E-03	3.99E-04	0.01	0.6

Notes:

a See *Prevention of Significant Deterioration Application for the Hanford Tank Waste Treatment and Immobilization Plant*, 24590-WTP-RPT-ENV-01-007, Rev 1, Appendix B for detailed emissions calculations and assumptions.

b Miscellaneous Facility Sources represent the emissions from the diesel fire water pumps and particulate emissions from the glass former facility.

c All particulate matter was assumed to be PM_{10}.

d Ultra-low sulfur fuel (30 ppm, 0.003%) was used for estimating emissions for the steam boilers, generators, and fire water pumps.

e Type I diesel generators emit 5.4 tons NOx and Type II generators emit 15 tons/yr for a total of 20.4 tons/yr

Table 5-4 Proposed Annual WTP Controlled Criteria Pollutant Emissions (US tons per year)

Criteria Pollutant	[a] Pretreatment Facilities	[a] LAW Vitrification Facility	[a] HLW Vitrification Facility	[a] Steam Plant Boilers	[b] Type I Diesel Generator	[b] Turbine Generators	[b] Fire Pumps	Total WTP Emissions	PSD Emissions Threshold
CO	7.94E-21	2.20	0.36	65.6	0.64	6.33	0.03	75.2	100
NO_x	0.44	36.7	8.5	84.3	5.4	11.4	0.78	**147.5**	40
SO_2	1.09E-21	3.68	4.84	2.9 [c]	0.01 [c]	0.04 [c]	6.0E-04 [c]	11.46	40
PM_{10}	2.03	1.57	1.18	18.7	0.18	0.1	0.03 [d]	**23.77**	15
$PM_{2.5}$ [e]	NA	NA	NA	NA	NA	0.04	0.01	0.05	10
VOCs (as total volatile and semi-volatile organics)	3.84	0.47	0.38	28.1	0.21	1.80	0.03	34.83	40
GHG [e]	NA	NA	NA	NA	NA	1352	79.35	1432	75,000
Pb	1.03E-09	2.65E-9	1.99E-11	8.43E-03	1.25E-03	1.20E-04	0	0.01	0.6

Notes:

a Based on *Prevention of Significant Deterioration Application for the Hanford Tank Waste Treatment and Immobilization Plant*, 24590-WTP-RPT- ENV-01-007, Rev 1, Appendix B

b See Appendix A for Emission Estimate

c Ultra-low sulfur fuel (30 ppm) was used for estimating emissions for the steam boilers and type I diesel generator. Turbine and fire water pump emissions were based on 15 ppm sulfur.

d Glass Former Facility particulate emissions are included in estimate

e $PM_{2.5}$ and GHG emission rates are only provided for the turbines and fire pumps since these are the only emission sources proposed for change and therefore subject to the new standards.

Table 5-5 Toxic Air Pollutant Emissions From Turbines

Pollutant	CAS	Emission Factor (lb/MMBTU)	Emission Factor (lb/1000gal)	Turbine Fuel Use Rate (1000gal/hr)	Number of Turbines	Emission Rate (g/s)	AERMOD Concentration (ug/m3)	Annual Operating Hour Fraction (164 hr/ 8,760 hr)	Ambient Air Impact (ug/m3)	ASIL (ug/m3)	ASIL Averaging Period (Annual, 24-hr, 1-hr)	Percent of ASIL
1.3-Butadiene	106-99-0	1.60E-05	2.22E-03	0.378	2	2.12E-04	0.00669	0.0187	2.65E-08	5.88E-03	Annual	0.00%
Arsenic	na	1.10E-05	1.53E-03	0.378	2	1.46E-04	0.00669	0.0187	1.82E-08	3.30E-04	Annual	0.01%
Benzene	71-43-2	5.50E-05	7.65E-03	0.378	2	7.28E-04	0.00669	0.0187	9.12E-08	3.45E-02	Annual	0.00%
Beryllium	na	3.10E-07	4.31E-05	0.378	2	4.10E-06	0.00669	0.0187	5.14E-10	4.17E-04	Annual	0.00%
Cadmium	7440-43-9	4.80E-06	6.67E-04	0.378	2	6.35E-05	0.00669	0.0187	7.96E-09	2.38E-04	Annual	0.00%
Formaldehyde	50-00-0	2.80E-04	3.89E-02	0.378	2	3.71E-03	0.00669	0.0187	4.64E-07	1.67E-01	Annual	0.00%
Lead	na	1.40E-05	1.95E-03	0.378	2	1.85E-04	0.00669	0.0187	2.32E-08	8.33E-02	Annual	0.00%
Manganese	na	7.90E-04	1.10E-01	0.378	2	1.05E-02	0.21235	-	2.22E-03	4.00E-02	24-hr	5.55%
Mercury	na	1.20E-06	1.67E-04	0.378	2	1.59E-05	0.21235	-	3.37E-06	9.00E-02	24-hr	0.00%
Napthalene	91-20-3	3.50E-05	4.87E-03	0.378	2	4.63E-04	0.00669	0.0187	5.80E-08	2.94E-02	Annual	0.00%
Selenium	N/A	2.50E-05	3.48E-03	0.378	2	3.31E-04	0.21235	-	7.03E-05	2.00E+01	24-hr	0.00%
Nitrogen dioxide	10102-44-0	N/A	N/A	N/A	N/A	1.76E+01	2.92196	-	5.14E+01	4.70E+02	1-hr	10.94%
Carbon Monoxide	630-08-0	N/A	N/A	N/A	N/A	9.73E+00	2.92196	-	2.84E+01	2.30E+04	1-hr	0.12%
Sulfur Dioxide	7446-09-05	N/A	N/A	N/A	N/A	6.05E-02	2.92196	-	1.77E-01	6.60E+02	1-hr	0.03%

Notes:

1. Emission Factors from EPA's AP-42, Chapter 3, Section 3.1, "Stationary Gas Turbines," Table 3.1-4 & 3.1-5 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf)
2. Factors are provided in units of lb/MMBtu and were converted to lb/1000 gal by multiplying by 139.
3. Fuel Flow Rate from 24590-CD-POA-MUTC-00001-02-00002

Table 5-6 Toxic Air Pollutant Emissions From Fire Pumps

Pollutant	CAS	Emission Factor (lb/MMBtu)	Emission Factor (lbs/hp-hr)	Number of Fire Pumps	Fire Pump Output (HP)	Emission Rate (g/s)	AERMOD Output (ug/m3)	Annual Operating Hour Fraction (230 hr/ 8,760 hr)	Ambient Air Impact (ug/m3)	ASIL Averaging Period (Annual, 24-hr, 1-hr)	ASIL (ug/m3)	Percent of ASIL
1,3-Butadiene	106-99-0	3.91E-05	2.74E-07	2	300	2.07E-05	0.02536	0.0263	1.38E-08	Annual	5.88E-03	0.00%
Acetaldehyde	75-07-0	7.67E-04	5.37E-06	2	300	4.06E-04	0.02536	0.0263	2.70E-07	Annual	3.70E-01	0.00%
Acrolein	107-02-8	9.25E-05	6.48E-07	2	300	4.89E-05	0.02536	0.0263	3.26E-08	Annual	6.00E-02	0.00%
Benz(a)anthracene	56-55-3	1.68E-06	1.18E-08	2	300	8.89E-07	0.02536	0.0263	5.92E-10	Annual	9.09E-03	0.00%
Benzene	71-43-2	9.33E-04	6.53E-06	2	300	4.94E-04	0.02536	0.0263	3.29E-07	Annual	3.45E-02	0.00%
Benzo(a)pyrene	50-32-8	1.88E-07	1.32E-09	2	300	9.95E-08	0.02536	0.0263	6.62E-11	Annual	9.09E-04	0.00%
Benzo(b)fluoranthene	205-99-2	9.91E-08	6.94E-10	2	300	5.24E-08	0.02536	0.0263	3.49E-11	Annual	9.09E-03	0.00%
Benzo(k)fluoranthene	207-08-9	1.55E-07	1.09E-09	2	300	8.20E-08	0.02536	0.0263	5.46E-11	Annual	9.09E-03	0.00%
Chrysene	218-01-9	3.53E-07	2.47E-09	2	300	1.87E-07	0.02536	0.0263	1.24E-10	Annual	9.09E-02	0.00%
Dibenz(a,h)anthracene	53-70-3	5.83E-07	4.08E-09	2	300	3.09E-07	0.02536	0.0263	2.05E-10	Annual	8.33E-04	0.00%
Formaldehyde	50-00-0	1.18E-03	8.26E-06	2	300	6.24E-04	0.02536	0.0263	4.16E-07	Annual	1.67E-01	0.00%
Indeno(1,2,3-cd)pyrene	193-39-5	3.75E-07	2.63E-09	2	300	1.98E-07	0.02536	0.0263	1.32E-10	Annual	9.09E-03	0.00%
Naphthalene	91-20-3	8.48E-05	5.94E-07	2	300	4.49E-05	0.02536	0.0263	2.99E-08	Annual	2.94E-02	0.00%
Propylene	115-07-1	2.58E-03	1.81E-05	2	300	1.37E-03	1.16086	-	1.58E-03	24-hr	3.00E+03	0.00%
Toluene	108-88-3	4.09E-04	2.86E-06	2	300	2.16E-04	1.16086	-	2.51E-04	24-hr	5.00E+03	0.00%
Diesel Engine Exhaust, Particulates	DEEP	N/A	N/A	N/A	N/A	1.17E-02	0.02536	0.0263	7.77E-06	Annual	3.33E-03	0.23%
Nitrogen dioxide	10102-44-0	N/A	N/A	N/A	N/A	8.50E-01	14.27432	-	1.21E+01	1-hr	4.70E+02	2.58%
Carbon Monoxide	630-08-0	N/A	N/A	N/A	N/A	3.67E-02	14.27432	-	5.23E-01	1-hr	2.30E+03	0.02%
Sulfur Dioxide	7446-09-05	N/A	N/A	N/A	N/A	7.00E-04	14.27432	-	9.99E-03	1-hr	6.60E+02	0.00%
					7000	Btu/hp-hr						

Table 5-6 Toxic Air Pollutant Emissions From Fire Pumps

Pollutant	CAS	Emission Factor (lb/MMBtu)	Emission Factor (lbs/hp-hr)	Number of Fire Pumps	Fire Pump Output (HP)	Emission Rate (g/s)	AERMOD Output (ug/m3)	Annual Operating Hour Fraction (230 hr/ 8,760 hr)	Ambient Air Impact (ug/m3)	ASIL Averaging Period (Annual, 24-hr, 1-hr)	ASIL (ug/m3)	Percent of ASIL

Notes:

1. Brake Specific Fuel Consumption for Engines
2. Organics emission factors from EPA's AP-42 document, Section 3.3, *Gasoline and Diesel Industrial Engines.Volume 2*

6 Best Available Control Technology for Emissions of Criteria and Toxic Air Pollutants

6.1 Selected BACT/T-BACT For Existing WTP Emission Units

The *Non-Radioactive Air Emissions Notice of Construction Permit Application for the River Protection Project-Waste Treatment Plant* 24590-WTP-RPT-ENV-01-009 identifies the BACT/T-BACT conclusions that were approved by Ecology via DE02NWP-002. The BACT/T-BACT conclusions for WTP emission sources that continue under construction or have commenced operation will remain unchanged. The approved BACT/T-BACT are provided in Table 6-1 below.

6.2 Selection of BACT/T-BACT for Turbine Generators

As discussed in Section 4.9, two Rolls-Royce turbine generators rated at 3,800 KW will replace the Type II diesel generators for backup power production. As a new source, an evaluation and selection of BACT/T-BACT control for turbine generator emissions are required. The previously discussed PSD Supplement, 24590-WTP-RPT-ENV-12-001 includes a BACT Analysis for both emissions of NO_x and particulate matter. Results of the PSD BACT analysis concluded that the most technically feasible control technologies for limiting emissions of NO_x and particulate matter from emergency turbine generators includes a combination of burning ultra low sulfur diesel fuel, limiting hours of operation, and ensuring good combustion engineering practices are followed.

Since control of SO_2, CO, VOC and TAPs are directly related to the controls selected for reducing NO_x and particulate matter emissions, the proposed BACT/T-BACT for the turbine generators includes:

- Limiting hours of operation to 164 hours per year,
- Combustion of ultra low sulfur diesel fuel with a sulfur content of 15 ppm or less. Note that ULSD fuel with a maximum sulfur content of 30 ppm was selected as BACT for all other WTP diesel combustion sources. During preparation of the original *Non-Radioactive Air Emissions Notice of Construction Permit Application for the River Protection Project-Waste Treatment Plant* 24590-WTP-RPT-ENV-01-009, EPA had not finalized the maximum sulfur limit of ULSD fuel. Since issuance of DE02NWP-002 in 2003, EPA finalized sulfur content limits of ULSD fuel at 15 ppm.
- Good combustion engineering practices will be followed, which includes adhering to the Rolls-Royce specifications for operation, maintenance, and combustion control. Specified combustion feed ratios (including the fuel-to-air ratio), monitoring, and startup/shutdown procedures will be followed to maximize combustion efficiency and minimize discharge to the atmosphere.

The selected BACT/T-BACT for the emergency turbine generators is also identified in Table 6-1.

Table 6-1 BACT/T-BACT

Process/Facility	Abated Emission Point	Flue Name	Unabated Emission Sources	Proposed Controls			
				Acid Gas (SO_x)	NO_x	Particulates and Aerosols	Volatile Organics
Pretreatment	Pretreatment stack	PT-S1	C3 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
		PT-S2	C5 building air	NA	NA	HEPA [RE=99.9995 %]	NA
		PT-S3	Process vessel vent LAW evaporator offgas LAW melter offgas	Caustic scrubber [RE=97 %]	NA	HEPA [RE=99.9995 %]	Thermal Catalytic Oxidizer [RE=95 %]
		PT-S4	RFD/PJM exhausts	NA	NA	HEPA [RE=99.9995 %]	NA
	C2 air discharge	PT-C2	C2 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
LAW vitrification	LAW vitrification stack	LV-S1	C3 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
		LV-S2	C5 building air	NA	NA	HEPA [RE=99.9995 %]	NA
		LV-S3	LAW melter offgas process vessel vent	Carbon Adsorber [RE=97 %]	Selective catalytic reducer [RE=95 %]	HEPA [RE=99.9995 %]	Thermal Catalytic Oxidizer [RE=95 %]
	C2 air discharge	LV-C2	C2 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA

Table 6-1 BACT/T-BACT

Process/Facility	Abated Emission Point	Flue Name	Unabated Emission Sources	Proposed Controls			
				Acid Gas (SO_x)	NO_x	Particulates and Aerosols	Volatile Organics
HLW vitrification	HLW vitrification stack	HV-S1	C3 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
		HV-S2	C5 building air	NA	NA	HEPA [RE=99.9995 %]	NA
		HV-S3A and HV-S3B	HLW melter offgas	Silver mordenite adsorber[a] [RE=99.9 %]	Selective catalytic reducer [RE=95 %]	HEPA [RE=99.9995 %]	TCO [RE=95 %]
			Process vessel vent				
		HV-S4	RFD/PJM exhausts	NA	NA	HEPA [RE=99.9995 %]	NA
	C2 air	HV-C2 and HV-C2R	C2 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
WTP laboratory	WTP laboratory stack	LB-S1	C3 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
		LB-S2	C5 building air	NA	NA	HEPA [RE=99.9995 %]	NA
	C2 air	LB-C2	C2 building air	NA	NA	HEPA (single) [RE=99.95 %]	NA
BOF	Glass former storage	NA	Glass former materials	NA	NA	Baghouse Filters	NA
	Steam plant	NA	Diesel-fired boilers	Ultra Low Sulfur Fuel (30 ppm), Good combustion practices	Low NO_x burners, Steam atomization	Good combustion practices	Good combustion practices

Table 6-1 BACT/T-BACT

Process/Facility	Abated Emission Point	Flue Name	Unabated Emission Sources	Proposed Controls			
				Acid Gas (SO_x)	NO_x	Particulates and Aerosols	Volatile Organics
	Backup generators	NA	Diesel-fired engines	Ultra Low Sulfur Fuel (30 ppm)	Limit operating hours and good combustion practices	Good combustion practices	Good combustion practices
	Turbine Generators	NA	Diesel-fired turbine	Ultra Low Sulfur Fuel (15 ppm)	Limit operating hours and good combustion practices	ULSD Fuel and good combustion practices	Good combustion practices
	Fire water pump	NA	Diesel-fired engines	Ultra Low Sulfur Fuel (15 ppm)	Limit operating hours and good combustion practices	Good combustion practices	Good combustion practices

BOF balance of facilities
NA not applicable: no gaseous toxics emitted requiring T-BACT control technology
RE removal efficiency

Appendix A

Emissions Estimates Supporting Supplemental Nonradioactive Air Permit Application

A.1 Objective

The objective of this emissions estimate is to support submittal of supplemental air permit applications to the Washington State Department of Ecology for incorporating WTP design changes associated with substituting turbine generators for the previously permitted Type II diesel generators. The estimate also supports increasing the annual operating hours for the diesel fire pumps from 110 hours per year each to 230 hours per year each. The results of this estimate support Ecology approval of Non-radioactive Air Emissions Notice of Construction Approval DE02NWP-002. The emission estimate provides examples of the methodology used to estimate air emissions and ambient air impacts required by WAC 173-400 "General Regulations for Air Pollutant Sources" and WAC 173-460, "Controls for New Sources of Toxic Air Pollutants."

The emissions estimate is prepared consistent with the *Engineering Studies Procedure*, Section 3.3.2 because it does not support and is not intended to be used as input to WTP design. The emissions estimate describes the method used to estimate emissions for air permitting purposes.

A.2 Inputs

There are no design inputs associated with this estimate since it does not support WTP design.

A.3 Background

The WTP Project has determined that substituting turbine generators for emergency power supply is a better alternative to the previously planned Type II diesel generators for Nuclear Safety required backup power supply. Because the DE02NWP-002 Air Permit approval is based on type II diesel generator design, amendment to the Ecology approvals are necessary prior to installation of the turbines to ensure applicable regulatory requirements are met.

The additional annual operating hours for the diesel engine fire pumps are being pursued to support future startup and testing of fire systems.

A.4 Applicable Codes and Standards

There are no engineering design codes or standards associated with this estimate since it is not used for design of the WTP.

From an air permitting perspective, WAC 173-400 and WAC 173-460 are the regulatory drivers for preparation of air emission estimates to support the *Nonradioactive Air Emissions Notice of Construction Permit Application Supplement to DE02NWP-002*, 24590-WTP-RPT-ENV-12-002.

A.5 Methodology

The methodology used to estimate criteria pollutant emissions includes employing manufacturer emissions data as the basis. If manufacturer emission factors are not available for certain pollutants, then EPAs AP-42 emission factors are used. The emissions factors are then multiplied or divided by common unit conversion factors to calculate emissions data for comparison to applicable regulatory standards.

The methodology used to calculate TAP emissions were based on AP-42 with the exception of the criteria pollutant TAPs such as NO_2, CO, and SO_2 which utilized vender data.

The following example methodology provide the equations necessary to prepare the emission estimates.

Criteria Pollutant Emissions from Turbines

The equation for annual turbine emissions in tons per year using manufacturer emissions data is as follows:

- **Emissions (ton/yr)** = Number of turbines * annual operating hours (hr/yr) * vendor emission rate (lb/hr) * conversion to tons (ton/lb)

The equation for annual turbine emissions in tons/yr using AP-42 data is as follows:

- Emissions (tons/yr = Number of turbines * annual operating hours (hr/yr) * AP-42 factor (lb/1000gal) * turbine fuel use rate (1000 gal/hr) * conversion to tons (tons/lb)

Criteria Pollutant Emissions for Diesel Fire Pumps

- **Emissions (ton/yr)** = Number of engines * annual operating hours (hr/yr) * generator output (hp) * vender emission rate (lb/hp-hr) * conversion to tons (ton/lb)

Toxic Air Pollutant (TAP) Emissions from Turbines and Fire Pumps

The equation for TAP emissions using AP-42 includes the following.

- **Emissions (g/s)** = Number of turbines * AP-42 emission factor (lb/1000gal) * fuel use rate (1000 gal/hr) * * conversion to grams (g/lb) * conversion from hour to seconds

The equation for criteria pollutant TAPs using vender data includes the following:

- **Emissions (g/s)** = Number of turbines * vender emission rate (lb/hp-hr) * horsepower * conversion from lbs to grams * conversion from hour to seconds

TAP Ambient Air Impacts

A unitized emission rate of 1 g/s is used in the model and therefore the modeled impacts are directly proportional to emission levels from a stack. The emission rate in grams per second are then multiplied by the AERMOD output to determine ambient air impacts. For comparison to TAPs with an annual averaging period, these values were also multiplied by a fraction representing actual hours of operation per year. In the case of the turbine, the fraction is based on

164 hr divided by 8,760 hrs per year, which equates to 0.018. In the case of the fire pumps, the fraction is based on 230 hrs divided by 8760 hrs which equates to 0.026. TAPs with averaging periods of 24 hour or 1 hour were not multiplied by these fractions since the emission units could operate during an entire modeling averaging period. The resulting values are then compared to corresponding acceptable source impact levels (ASIL) to determine ambient air impacts.

- **Ambient impacts ($\mu g/m^3$)** = emission rate (g/s) * AERMOD maximum impact concentration ($\mu g/m^3$) * Annual operating hour fraction

A.6 Assumptions

There are no assumptions.

A.7 Calculations

Criteria Pollutant Emissions for Turbine

The emissions of NO_x and CO_2 are used for the examples.

Data

Turbine NO_x Emission Rate = 69.8 lb/hr (Reference 1)
AP-42 CO_2 Emission Factor = 157 lb/MMBtu * 139 MMBtu/1000 gal = 21,823 lb/1000 gallons (Ref 4)
Number of Turbines = 2
Annual operating hours = 164 hr/yr
1 pound = 0.0005 ton
Turbine Max Fuel Use Rate = 0.378 10^3 gallons/hr (Reference 2)

Using Rolls-Royce Data

- Annual NO_x Emissions = (2 turbines) * (69.8 lb/hr) * (164 hrs/yr) * (0.0005 ton/lb)
  = 11.45 tons/yr

Using AP-42 Data

- Annual CO_2 Emissions = (2 turbines)*(164 hrs/yr)*(21,823 lb/10^3 gal)* (0.378 10^3 gal/hr)* (0.0005 ton/lb)
  = 1,353 tons/yr

Criteria Pollutant Emissions for Diesel Fire Pumps

The emissions of NO_x are used for the example.

Data

NO_x Emission Rate	= 5.1 gram/hp-hr (Reference 3)
1 pound	= 453.59 grams
Number of Diesel Eng.	= 2
Diesel Engine Output	= 300 hp (Reference 1)
Annual operating hours	= 230 hr/yr (Reference 7)
1 pound	= 0.0005 ton

- Annual NO_x Emissions = (2 fire pumps)*(230 hr/yr)*(300 hp)*(5.1 g/hp-hr) * (1lb/453.59 g) * (0.0005 ton/lb)
  = 0.78 tons/yr

Toxic Air Pollutant Emissions from Turbine

The emissions of 1,3 Butadiene are used in the example.

Calculation Data

1,3-Butadiene Emission Rate	= 2.22E-03 lb/10^3 gal (Reference 4, page 3.1-14)
1,3-Butadiene ASIL (annual)	= 5.88E-03 µg/m^3 (Reference 6)
Turbine Fuel Use Rate	= 0.378 10^3gal/hr (Reference 2)
Number of Turbines	= 2
Annual Operating Hr Fraction	= 164/8760
1 hr	= 3600 seconds
AERMOD Results (annual)	= 0.00669 µg/m^3
1 lb	= 453.59 g

- Emission Rate (g/s) = (2 turbines)*(2.22E-03 lb/10^3 gal)*(0.378 10^3gal/hr) * (453.59 g/lb)* (1 hr/3600 s)
  = 2.12E-04 g/s

- Ambient Air Impacts (µg/m^3) = (2.12E-04 g/s) * (0.00669 µg/m^3) * (164/8,760)
  = 2.65E-08 µg/m^3

- Percent of ASIL = (2.65E-08 µg/m^3 / 5.88E-03 µg/m^3) * 100
  = 0.00%

A complete summary of all pollutant calculations are provided in the tables below.

A.8 Results and Conclusions

A.8.1 Criteria Pollutants

Results of criteria pollutant emission estimates show that there has been an overall WTP NO_x and particulate matter emissions reduction associated with utilizing turbine generators instead of the previous Type II diesel generators even when considering the additional fire pump operating hours. There has been a slight increase in overall emissions of CO, VOC, and SO_2 however the increases are below PSD significance thresholds.

Since WTP previously exceeded the PSD significance levels for NO_x and PM_{10}, these pollutants were of primary concern when considering turbine generators over diesel generators. Review of Section 5, Table 5-1 above shows that both the Type I and Type II diesel generators contributed approximately 20.4 tons on NO_x and less than 1 ton of PM_{10} each year. Since the Type I generator is not being changed, the emissions from the Type II generators were removed to show that 5.4 tons of the 20.4 tons of NO_x are contributed by the Type I units. Therefore the Type II generators accounted for 15.0 tons per year. Results in this estimate show that turbines will generate 11.45 tons of NO_x per year considering an identical operating hour restriction of 164 hrs per year as used for the Type II diesel engines. Factoring in the 0.41 ton per year increase in NOx emissions from the additional fire pump operating hours, overall WTP emissions of NO_x are being decreased by approximately 3 ton per year from previously permitted levels

Review of particulate matter emission rates shows a slight reduction due to clean burning turbine engines. Review of other criteria pollutant emissions of SO_2, VOC, and CO shows slight increases but the increases are below PSD significance levels.

A.8.2 Toxic Air Pollutant Emissions

Review of TAP emissions also show that the changes will have an insignificant impact to ambient air quality since emission rate modeling show that all TAP emissions are below their corresponding Acceptable Source Impact Levels (ASILs). In addition, new criteria pollutant TAPs for diesel engine particulates, NO_2, CO, and SO_2 are all below corresponding ASILs.

A.9 References

1. 24590-CD-POA-MUTC-00001-02-00001, Rev C *Rolls-Royce Corporation Industrial Engine Performance & Emissions*

2. 24590-CD-POA-MUTC-00001-02-00002, Turbine Fuel Flow Rate

3. 24590-WTP-HAC-50-0006, Sheet 24 (Diesel Generator) and Sheets 28 & 37 (Fire Pump)

4. AP-42, Compilation of Emission Factors Chapter 3.1, Stationary Gas Turbines, (www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf)

5. WAC 173-460-150, *Controls for New Sources of Toxic Air Pollutants*

6. CCN 242590, *Fire Pump Hours In Air Permit Modification.*

Table 1: Criteria Pollutant Emissions Comparison Diesel Generators VS Combustion Turbines

Existing Design - Two 5,530 Hp Type II Diesel Engine Emergency Generators

Pollutant	Number of Diesel Engines	Op. Hours per year per generator (hr/yr)	Generator Size (Hp)	Emission Factor (lb/hp-hr)	Conversion (lb to tons)	Annual Gen Emissions (Ton/yr)
NOx	2	164	5530	1.65E-02	0.0005	15.0
CO	2	164	5530	1.98E-03	0.0005	1.80
SOx	2	164	5530	2.43E-05	0.0005	0.02
PM	2	164	5530	5.51E-04	0.0005	0.50
VOC	2	164	5530	6.61E-04	0.0005	0.60
Notes						
1. The emission factors for NOx, CO, PM and VOCs are based on vendor quotes for a 2500 KW generator (24590-WTP-HAC-50-00006, Rev A Sheet 24).						
2. The emission factor for SO_2 is based on EPA AP-42, Section 3.4, Table 3.4-1.A for large stationary diesel engines. http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf						
3. Sulfur content is based on 30 ppm sulfur diesel fuel.						

New Design - Two 3.8 MW Diesel Combustion Turbine Emergency Generators

Pollutant	Number of turbines	Op. Hours per year per turbine (hr/yr)	Turbine Emission Rate (lb/hr)	Conversion (lb to tons)	Annual Turbine Emissions (Tons/yr)
NOx	2	164	69.8	0.0005	11.45
CO	2	164	38.6	0.0005	6.33
SO2	2	164	0.24	0.0005	0.04
HC (VOC)	2	164	11	0.0005	1.80
Note: Turbine emission factors based on 24590-CD-POA-MUTC-00001-02-00001, Rev. C "Rolls-Royce Corporation Industrial Engine Performance & Emissions Estimate (EDR 19252I) for Engine Configuration 501-KB7, Uncontrolled Emissions, ultra-low sulfur (15 ppm) diesel fuel					

	Number of turbines	Op. Hours per year per turbine (hr/yr)	[2]Fuel Consumption Rate (1000 gal/hr)	AP-42 PM Emission Factor (lb/1000 gal)	Conversion (lb to tons)	Annual Turbine Emissions (Tons/yr)
PM_{total}	2	164	0.378	1.67	0.0005	0.1
PM_{10}	2	164	0.378	1.00	0.0005	0.06
$PM_{2.5}$	2	164	0.378	0.6	0.0005	0.04
CO_2	2	164	0.378	21823	0.0005	1352
Pb	2	164	0.378	0.002	0.0005	1.21E-04
Notes	1. Turbine fuel consumption rate based on Rolls Royce data, 24590-CD-POA-MUTC-00001-02-00002.					
	2. Emission Factors from AP-42, Fifth Edition, Volume 1, Chapter 3.1, Stationary Gas Turbines, (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf)					
	3. Emission factors based on an average distillate oil heating value of 139 MMBtu/1000 gallons. To convert from (lb/MMBtu) to (lb/1000 gallons), multiply by 139					
	4. Assume filterable PM from AP-42 is 2.5 micron in size.					

Table 2: Criteria Pollutant Emissions from Diesel Driven Fire Pumps

Existing Diesel Fire Pump Emissions Operating 110 hours per year each

Pollutant	Number of Diesels	Op. Hours per year per generator (hr/yr)	Generator Size (Hp)	Emission Factor (gm/hp-hr)	Emission Factor (lb/hp-hr)	Conversion (lb to tons)	Annual Gen Emissions (Ton/yr)		
NOx	2	110	300	5.1	0.0112	0.00050	0.37		
CO	2	110	300	0.22	0.0005	0.00050	0.02		
SOx	2	110	300	0.0042	9.26E-06	0.00050	0.00		
PM	2	110	300	0.07	0.0002	0.00050	0.01		
VOC	2	110	300	0.07	0.0004	0.00050	0.01		

Proposed Diesel Fire Pump Emissions Operating at 230 hours per year each

Pollutant	Number of Diesels	Op. Hours per year per generator (hr/yr)	Generator Size (Hp)	Emission Factor (gm/hp-hr)	Emission Factor (lb/hp-hr)	Conversion (lb to tons)	Annual Gen Emissions (Ton/yr)		
NOx	2	230	300	5.1	0.0112	0.00050	0.78		
CO	2	230	300	0.22	0.0005	0.00050	0.03		
SOx	2	230	300	0.0042	9.26E-06	0.00050	0.0006		
PM	2	230	300	0.11	0.0002	0.00050	0.02		
VOC	2	230	300	0.2	0.0004	0.00050	0.03		
CO2	2	230	300		1.15	0.00050	79.35		
Notes									

1. The emission factor for Nox, SO2, CO, VOC and PM are based on vendor emissions identified in 24590-WTP-HAC-50-00006 Sheets 28 and 37
2. The vendor factor for SO2 was based on 0.05% S fuel. Adjusted to 0.0015% for ultra low sulfur fuel by multiplying by a ration of 0.000015/0.0005.
3. CO2 emission rate based on AP-42, Chapter 3.3, Gasoline and Diesel Industrial Engines (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s03.pdf)
4. The VOC calculation was based on total hydrocarbon emissions.

Table 3:Toxic Air Pollutant Emissions From Turbines

Pollutant	CAS	Emission Factor (lb/MMBTU)	Emission Factor (lb/1000gal)	Turbine Fuel Use Rate (1000gal/hr)	Number of Turbines	Emission Rate (g/s)	AERMOD Concentration (ug/m3)	Annual Operating Hour Fraction (164 hr/8,760 hr)	Ambient Air Impact (ug/m3)	ASIL (ug/m3)	ASIL Averaging Period (Annual, 24-hr, 1-hr)	Percent of ASIL
1,3-Butadiene	106-99-0	1.60E-05	2.22E-03	0.378	2	2.12E-04	0.00669	0.0187	2.65E-08	5.88E-03	Annual	0.00%
Arsenic	na	1.10E-05	1.53E-03	0.378	2	1.46E-04	0.00669	0.0187	1.82E-08	3.30E-04	Annual	0.01%
Benzene	71-43-2	5.50E-05	7.65E-03	0.378	2	7.28E-04	0.00669	0.0187	9.12E-08	3.45E-02	Annual	0.00%
Beryllium	na	3.10E-07	4.31E-05	0.378	2	4.10E-06	0.00669	0.0187	5.14E-10	4.17E-04	Annual	0.00%
Cadmium	7440-43-9	4.80E-06	6.67E-04	0.378	2	6.35E-05	0.00669	0.0187	7.96E-09	2.38E-04	Annual	0.00%
Formaldehyde	50-00-0	2.80E-04	3.89E-02	0.378	2	3.71E-03	0.00669	0.0187	4.64E-07	1.67E-01	Annual	0.00%
Lead	na	1.40E-05	1.95E-03	0.378	2	1.85E-04	0.00669	0.0187	2.32E-08	8.33E-02	Annual	0.00%
Manganese	na	7.90E-04	1.10E-01	0.378	2	1.05E-02	0.21235	-	2.22E-03	4.00E-02	24-hr	5.55%
Mercury	na	1.20E-06	1.67E-04	0.378	2	1.59E-05	0.21235	-	3.37E-06	9.00E-02	24-hr	0.00%
Napthalene	91-20-3	3.50E-05	4.87E-03	0.378	2	4.63E-04	0.00669	0.0187	5.80E-08	2.94E-02	Annual	0.00%
Selenium	N/A	2.50E-05	3.48E-03	0.378	2	3.31E-04	0.21235	-	7.03E-05	2.00E+01	24-hr	0.00%
Nitrogen dioxide	10102-44-0	N/A	N/A	N/A	N/A	1.76E+01	2.92196	-	5.14E+01	4.70E+02	1-hr	10.94%
Carbon Monoxide	630-08-0	N/A	N/A	N/A	N/A	9.73E+00	2.92196	-	2.84E+01	2.30E+04	1-hr	0.12%
Sulfur Dioxide	7446-09-05	N/A	N/A	N/A	N/A	6.05E-02	2.92196	-	1.77E-01	6.60E+02	1-hr	0.03%
Notes:												
1. Emission Factors from EPA's AP-42, Chapter 3, Section 3.1, "Stationary Gas Turbines," Table 3.1-4 & 3.1-5 (http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf)												
2. Factors are provided in units of lb/MMBtu and were converted to lb/1000 gal by multiplying by 139.												
3. Fuel Flow Rate from 24590-CD-POA-MUTC-00001-02-00002												

Table 4: Toxic Air Pollutant Emissions From Fire Pumps

Pollutant	CAS	Emission Factor (lb/MMBtu)	Emission Factor (lbs/hp-hr)	Number of Fire Pumps	Fire Pump Output (HP)	Emission Rate (g/s)	AERMOD Output (ug/m3)	Annual Operating Hour Fraction (230 hr/8,760 hr)	Ambient Air Impact (ug/m3)	ASIL Averaging Period (Annual, 24-hr, 1-hr)	ASIL (ug/m3)	Percent of ASIL
1,3-Butadiene	106-99-0	3.91E-05	2.74E-07	2	300	2.07E-05	0.02536	0.0263	1.38E-08	Annual	5.88E-03	0.00%
Acetaldehyde	75-07-0	7.67E-04	5.37E-06	2	300	4.06E-04	0.02536	0.0263	2.70E-07	Annual	3.70E-01	0.00%
Acrolein	107-02-8	9.25E-05	6.48E-07	2	300	4.89E-05	0.02536	0.0263	3.26E-08	Annual	6.00E-02	0.00%
Benz(a)anthracene	56-55-3	1.68E-06	1.18E-08	2	300	8.89E-07	0.02536	0.0263	5.92E-10	Annual	9.09E-03	0.00%
Benzene	71-43-2	9.33E-04	6.53E-06	2	300	4.94E-04	0.02536	0.0263	3.29E-07	Annual	3.45E-02	0.00%
Benzo(a)pyrene	50-32-8	1.88E-07	1.32E-09	2	300	9.95E-08	0.02536	0.0263	6.62E-11	Annual	9.09E-04	0.00%
Benzo(b)fluoranthene	205-99-2	9.91E-08	6.94E-10	2	300	5.24E-08	0.02536	0.0263	3.49E-11	Annual	9.09E-03	0.00%
Benzo(k)fluoranthene	207-08-9	1.55E-07	1.09E-09	2	300	8.20E-08	0.02536	0.0263	5.46E-11	Annual	9.09E-03	0.00%
Chrysene	218-01-9	3.53E-07	2.47E-09	2	300	1.87E-07	0.02536	0.0263	1.24E-10	Annual	9.09E-02	0.00%
Dibenz(a,h)anthracene	53-70-3	5.83E-07	4.08E-09	2	300	3.09E-07	0.02536	0.0263	2.05E-10	Annual	8.33E-04	0.00%
Formaldehyde	50-00-0	1.18E-03	8.26E-06	2	300	6.24E-04	0.02536	0.0263	4.16E-07	Annual	1.67E-01	0.00%
Indeno(1,2,3-cd)pyrene	193-39-5	3.75E-07	2.63E-09	2	300	1.98E-07	0.02536	0.0263	1.32E-10	Annual	9.09E-03	0.00%
Naphthalene	91-20-3	8.48E-05	5.94E-07	2	300	4.49E-05	0.02536	0.0263	2.99E-08	Annual	2.94E-02	0.00%
Propylene	115-07-1	2.58E-03	1.81E-05	2	300	1.37E-03	1.16086	-	1.58E-03	24-hr	3.00E+03	0.00%
Toluene	108-88-3	4.09E-04	2.86E-06	2	300	2.16E-04	1.16086	-	2.51E-04	24-hr	5.00E+03	0.00%
Diesel Engine Exhaust, Particulates	DEEP	N/A	N/A	N/A	N/A	1.17E-02	0.02536	0.0263	7.77E-06	Annual	3.33E-03	0.23%
Nitrogen dioxide	10102-44-0	N/A	N/A	N/A	N/A	8.50E-01	14.27432	-	1.21E+01	1-hr	4.70E+02	2.58%
Carbon Monoxide	630-08-0	N/A	N/A	N/A	N/A	3.67E-02	14.27432	-	5.23E-01	1-hr	2.30E+03	0.02%
Sulfur Dioxide	7446-09-05	N/A	N/A	N/A	N/A	7.00E-04	14.27432	-	9.99E-03	1-hr	6.60E+02	0.00%
Notes:												
1. Brake Specific Fuel Consumption for Engines					7000	Btu/hp-hr						
2. Organics emission factors from EPA's AP-42 document, Section 3.3, *Gasoline and Diesel Industrial Engines.Volume 2*												

Attachment 2
12-ECD-0051
(3,765 Pages)

Electronic Media 24590-RMCD-04284

Compact Disk