TECHNICAL SUPPORT DOCUMENT
FOR APPROVAL ORDER NO. 10AQ-E3XX
2010 MICROSOFT COLUMBIA DATA CENTER
MSN CO 3.1, CO 3.2, AND CO 3.3 EXPANSION (GSF, DO)
ISSUED AUGUST 12, 2010

BACKGROUND

Microsoft Corporation (Microsoft) submitted a Notice of Construction (NOC) application for the Columbia Data Center on October 23, 2006. The Columbia Data Center project consisted of twenty-four 2.5 MW generators powered by Caterpillar 3516C engines and 2 banks of evaporative coolers. The generators have a capacity of 60 Megawatts.

The Department of Ecology (Ecology) issued Order No. 07AQ-E230 on August 8, 2007 to Microsoft. Subsequently, Microsoft notified Ecology's Air Quality Program (AQP) that several small engines were missed in the original NOC application, and Microsoft submitted a NOC application for a minor modification on June 12, 2009. Ecology's Eastern Regional Office (ERO) approved the minor modification by issuing Order No. 09AQ-E308 on August 28, 2009. NOC Approval Order No. 09AQ-E308 included all the approval conditions of 07AQ-E230, and rescinded Order No. 07AQ-E230. The Microsoft Columbia Data Center has a single Air Quality permit.

NOC Approval Order No. 09AQ-E308 allows each engine to operate for an average of 285 hours per year, limits total fuel to 890,021 gallons of road specification diesel fuel, and restricts NO_x emissions to 89.4 tons per year.

1. EXECUTIVE SUMMARY

Microsoft submitted a NOC application on May 14, 2010 for the Phased CO3.2 (Phase 1), CO3.1 (Phase II), and CO3.3 (Phase II) Expansion of the Columbia Data Center, hereafter referred to as the Microsoft Expansion. The Microsoft Expansion consists of the addition of three new buildings with thirteen 2.5 electrical-megawatts (MW) generators powered by Caterpillar 3516C engines, one smaller 111 kWm diesel firewater pump, and no evaporative coolers.

Microsoft has asked for a NO_x emission limitation for the Columbia Data Center plus the Microsoft Expansion of 89.4 tons per year. Further, Microsoft would like to limit fuel usage at the original Columbia Data Center plus the Microsoft Expansion to 439,493 gallons of on-road specification ultra-low sulfur diesel fuel. The NO_x limit of 89.4 tons per year is currently allowed in NOC Approval Order No. 09AQ-E308. These limits will be achieved by reducing the hours of operation and fuel usage of the original 24 engines permitted at the Columbia Data Center.

Review of the May 14, 2010 NOC application began on May 17, 2010, and a completeness determination was issued on May 21, 2010 by the permit team (Flibbert, Ogulei) in coordination with the Science and Engineering Section Manager (Johnston) and the Eastern Regional Office

Section Manager (Wood). Additional information was submitted by Microsoft on May 24, June 1, June 4, 2010, June 25, 2010, and July 22, 2010. The NOC application was considered complete as of July 22, 2010. The final draft Preliminary Determination (i.e., Proposed Decision) was submitted to HQ on July 27, 2010, for review and to initiate the Tier II review.

2. PROJECT DESCRIPTION

2.1 The Microsoft Expansion consists of the addition of three new buildings with thirteen 2.5 MW generators powered by Caterpillar 3516C engines. Microsoft has proposed to reduce the fuel usage at the Columbia Data Center below what is currently allowed in NOC Approval Order No. 09AQ-E308, i.e., 890,021 gallons per year to 439,493 gallons per year. The 13 Microsoft Expansion engines will be limited to 139,493 gallons of on-road specification diesel fuel per year. The fuel limitation for the original 24 engines at the Columbia Data Center will be reduced to 300,000 gallons per year. The new facility-wide fuel limit will be 439,493 gallons of on-road specification diesel fuel per year. The new fuel limit will be achieved by reducing the hours of operation of the original 24 engines permitted.

Ecology submitted a draft approval order to Microsoft on June 14, 2010. The draft approval order proposed the use of diesel oxidation catalysts (DOCs) in each engine for the control of diesel engine exhaust particulate, carbon monoxide, and multiple organic compounds. On June 25, 2010 Microsoft requested an alternative means of achieving the emission reductions stipulated in the June 14, 2010 draft approval order. Microsoft proposed to take a reduction in the operating hours permitted for the existing CO1 and CO2 engines, and cap the annual number of gallons of fuel used. The original permits issued for CO1 and CO2 allowed for up to 890,021 gallons of total diesel fuel usage each year. Microsoft agreed to limit the fuel usage as follows:

Project	Historical allowed fuel usage (gallons per year)	Proposed allowed fuel usage (gallons per year)	Percent reduction (Total)
CO 1 & 2	890,021	300,000	66.3%
CO3.2 (Phase I), CO3.1 (Phase II), & CO3.3 (Phase II)	-	139,493	
Total	890,021	439,493	50.6%

The pollutant of greatest concern for this project is diesel engine exhaust particulate. By installing a DOC this project would have a reduction of approximately 0.1 ton of diesel engine exhaust particulate each year. By limiting the fuel to 439,493 gallons per year the facility, even with the new 13 engines would have a reduction of up to 0.8 tons per year of diesel engine exhaust particulate.

2.1.1 Potential to Emit for Criteria and Toxic Air Pollutant Emissions

Table 2: Potential to Emit for Microsoft Columbia Data Center					
Pollutant	**Emission Factor**	**Emission Factor Reference**	**Existing Units 1 thru 24 Potential To Emit[1]**	**Expansion Units 25 thru 37 Potential To Emit**	**Facility Potential to Emit**
Criteria Pollutant	g/kW-hr		tons/yr	tons/yr	tons/yr
NO_x	6.12	§89.112a	30.1	13.9	44.0
CO	3.50	§89.112a	2.1	8.0	10.1
SO_2	15 ppm/gal	MassBal	0.032	0.015	0.047
$PM_{2.5}$	0.200	§89.112a	0.58	0.45	1.03
VOC	0.282	CEC-05-049	1.4	0.60	2.0
Toxic Air Pollutants					
Primary NO_2	0.62	10% NO_x	3.01	1.39	4.40
Diesel Engine Exhaust Particulate	0.200	$PM_{2.5}$	0.58	0.45	1.03
Carbon monoxide	3.50	CO	2.1	8.0	10.1
Sulfur dioxide	15 ppm/gal	SO_2	0.032	0.015	0.047
Carbon based TAPs	lbs/MMBtu				
Acrolein	8.04E-06	AP-42 §3.4	2.29E-03	7.90E-05	2.37E-03
Benzene	7.92E-04	"	2.16E-02	7.80E-03	2.94E-02
Toluene	2.87E-04	"	7.75E-03	2.80E-03	1.06E-02
Xylenes	1.97E-04	"	5.39E-03	1.90E-03	7.29E-02
1,3 Butadiene	1.99E-05	"	2.02E-03	2.00E-04	2.22E-03
Formaldehyde	8/05E-05	"	5.39E-02	7.90E-04	5.47E-02
Acetaldehyde	2.57E-05	"	2.29E-02	2.50E-04	2.32E-02
Benzo(a)Pyrene	1.31E-07	"	3.71E-06	1.30E-06	5.01E-06
PAH (sum)	3.96E-06	"	na	3.90E-05	na
PAH (w/ TEF)	5.08E-07	"	na	5.00E-06	na

[1] **Potential to Emit** accounts for reduction in fuel use from the existing engines.

2.1.2 Maximum Operation

Table 2.1.2: Microsoft Expansion 13 Generator Engines Annual Operations				
No.	**Operation**	**Average Load**	**Annual Hours**	**kW-hr/yr**
1	Scheduled Testing	10%	12*	57,720
2	Power Outage	85%	48	1,342,560
3	UPS Maintenance	40%	44	659,516
4	Total Operations	53%	104	2,059,796

* Maximum of one hour per month operation.

2.2 Tier 4 transitional emissions referenced in NOC Approval Order No. 10AQ-E3xx can be found in the following EPA document:

Report No. NR-009c
EPA 420-P-04-009
Revised April 2004
Appendix A, Table A2, page A8

Table 2.2: Tier 4 Transitional emission factors				
Pollutant	**NMHC**	**CO**	**NO_x**	**PM**
g/hp-hr	0.282	0.076	0.460	0.069
g/kWm-hr[1]	0.378	0.102	0.617	0.093

[1] conversion factor of 0.74558

2.3 Total emissions from the two banks of cooling towers shall be less than or equal to the amounts contained in the following Table:

Table 2.3: Cooling Towers Emission Limits			
Pollutant	**Water supply conc. Mg/l**	**Recirc. water conc. Mg/l**	**Emission rate Lbs/yr**
2.2.1 Hexavalent Chromium*	0.00083	0.0023	0.0054
2.2.2 Arsenic	0.025	0.070	0.16
2.2.3 Barium	0.2	0.56	1.29
2.2.4 Nickel	0.05	0.14	0.32
2.2.5 Bromine	Na	75	173
2.2.6 TDS as PM_{10}	Na	1072	2,466.17

* There shall be no hexavalent chromium added to treat the cooling tower water. This value is a result of hexavalent chromium in the City of Quincy water supply.

2.4 The Columbia Data Center has four small emergency engines consist of three 149 bhp engines to power fire water pumps and one 398 bhp emergency engine to power the cooling water pre-treatment facility. The three fire water pump engines and the cooling water pre-treatment engine are considered permit exempt under Washington

Administrative Code (WAC) 173-400-110(4)(h)(xxxix), and will not be further addressed in the Approval Order.

3. APPLICABLE REQUIREMENTS

The proposal by Microsoft qualifies as a new source of air contaminants as defined in Washington Administrative Code (WAC) 173-400-110 and WAC 173-460-040, and requires Ecology approval. The installation and operation of the Columbia Data Center is regulated by the requirements specified in:

3.1 Chapter 70.94 Revised Code of Washington (RCW), Washington Clean Air Act,
3.2 Chapter 173-400 Washington Administrative Code (WAC), General Regulations for Air Pollution Sources,
3.3 Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants, and
3.4 40 CFR Part 60 Subpart IIII

All state and federal laws, statutes, and regulations cited in this approval shall be the versions that are current on the date the final approval order is signed and issued.

4. BEST AVAILABLE CONTROL TECHNOLOGY

Best Available Control Technology (BACT) is defined[1] as "*an emission limitation based on the maximum degree of reduction for each air pollutant subject to regulation under chapter 70.94 RCW emitted from or which results from any new or modified stationary source, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. In no event shall application of the "best available control technology" result in emissions of any pollutants which will exceed the emissions allowed by any applicable standard under 40 CFR Part 60 and Part 61….*"

For this project, Ecology is implementing the "top-down" approach for determining BACT for the proposed diesel engines. The first step in this approach is to determine, for each proposed emission unit, the most stringent control available for a similar or identical emission unit. If that review can show that this level of control is not technically or economically feasible for the proposed source, then the next most stringent level of control is determined and similarly evaluated. This process continues until the BACT level under consideration cannot be eliminated by any substantial or unique technical, environmental, or economic objections.[2] The "top-down" approach shifts the burden of proof to the applicant to justify why the proposed source is unable to apply the best technology available. The BACT analysis must be conducted for each pollutant that is subject to new source review.

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[1] RCW 70.94.030(7) and WAC 173-400-030(12)

[2] J. Craig Potter, EPA Assistant Administrator for Air and Radiation memorandum to EPA Regional Administrators, "Improving New Source Review (NSR) Implementation", December 1, 1987.

The proposed diesel engines will emit the following regulated pollutants which are subject to BACT review: nitrogen oxides (NOx), carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM, PM_{10} and $PM_{2.5}$) and sulfur dioxide.

4.1 BACT ANALYSIS FOR NOx

Microsoft reviewed EPA's RACT/BACT/LAER Clearinghouse (RBLC) database to look for NOx add-on controls recently installed on internal combustion engines. The RBLC provides a listing of BACT determinations that have been proposed or issued for large facilities within the United States, Canada and Mexico. Microsoft's review of the RBLC found that urea -based selective catalytic reduction (SCR) was the most stringent add-on control option demonstrated on diesel engines. The application of the SCR technology for NOx control was therefore considered the top-case control technology and evaluated for technical feasibility and cost-effectiveness.

The most common BACT determination identified in the RBLC for NOx control was compliance with EPA Tier 2 standards using engine design, including exhaust gas recirculation (EGR) or fuel injection timing retard with turbochargers. Other NOx control options identified through a literature review include water injection and NOx adsorbers.

4.1.1 ***Selective Catalytic Reduction.*** The SCR system functions by injecting a liquid reducing agent, such as urea, through a catalyst into the exhaust stream of the diesel engine. The urea reacts with the exhaust stream converting nitrogen oxides into nitrogen and water. The use of a lean ultralow sulfur fuel is required to achieve good NOx destruction efficiencies. SCR can reduce NOx emissions by up to 90-95 percent while simultaneously reducing hydrocarbon (HC), CO and PM emissions.

For SCR systems to function effectively, exhaust temperatures must be high enough (about 200 to 500^{o}C) to enable catalyst activation. For this reason, SCR control efficiencies are expected to be relatively low during the first 20 to 30 minutes after engine start up, especially during maintenance, testing and storm avoidance loads. There are also complications of managing and controlling the excess ammonia (ammonia slip) from SCR use.

Microsoft has evaluated the cost effectiveness of installing and operating SCR systems on each of the proposed diesel engines. The analysis indicates that the use of SCR systems would cost approximately $23,500 per ton of NOx removed from the exhaust stream. A previous survey by Ecology found that the permitting agencies surveyed have required installation of NOx controls as BACT with expected operational costs ranging from $143 to $9,473 per ton of NOx removed. Ecology concludes that while SCR is a demonstrated emission control technology for diesel engines, it is not economically feasible for this project. Therefore, Ecology rejects this NOx control option as BACT.

4.1.2 ***NOx adsorbers.*** The use of NOx adsorbers (sometimes called lean NOx traps) is a catalytic method being developed and tested by diesel engine manufacturers to reduce

NOx emissions, primarily from mobile sources. The NOx adsorber contains a catalyst (e.g., zeolite or platinum) that is used to "trap" NOx (NO and NO_2) molecules found in the exhaust. NOx adsorbers can achieve NOx reductions greater than 90% at typical steady-state exhaust gas temperatures.

However, as of this writing, NOx adsorbers are experimental technology and are, therefore, very expensive. Additionally, a literature search did not reveal any indication that this technology is commercially available for stationary backup generators. Thus, Ecology rejects NOx adsorbers as BACT for the proposed diesel engines.

4.1.3 ***Combustion Controls and Tier 2 compliance.*** Diesel engine manufacturers typically use proprietary combustion control methods to achieve the emission reductions needed to meet applicable EPA tier standards. Common controls include fuel injection timing retard and exhaust gas recirculation. Injection timing retard reduces the peak flame temperature and NOx emissions, but may lead to higher fuel consumption. Microsoft will install Caterpillar engines that will use a combination of combustion control methods, including fuel injection timing retard, to comply with EPA Tier-2 emission limits.

4.1.4 ***Other control options***. Other NOx control options, such as water injection, were rejected because there was no indication that they are commercially available and/or effective in new large diesel engines.

4.1.5 **BACT determination for NOx**

Ecology determines that BACT for NOx is the use of good combustion practices, an engine design that incorporates fuel injection timing retard, turbocharger and a low-temperature aftercooler, EPA Tier-2 certified engines, and compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII.

4.2 BACT ANALYSIS FOR PARTICULATE MATTER, CARBON MONOXIDE AND VOLATILE ORGANIC COMPOUNDS

Microsoft reviewed the available published literature and the RBLC and identified the following demonstrated technologies for the control of diesel engine exhaust particulate, carbon monoxide and volatile organic compounds from the proposed diesel engines:

4.2.1 ***Diesel particulate filters (DPFs)***. These add-on devices include passive and active DPFs, depending on the method used to clean the filters (i.e., regeneration). Passive filters rely on a catalyst while active filters typically use continuous heating with a fuel burner to clean the filters. The use of DPFs to control diesel engine exhaust particulate emissions has been demonstrated in multiple engine installations worldwide. Particulate matter reductions of up to 85% or more have been reported. Therefore, this technology was identified as the top case control option for diesel engine exhaust particulate emissions from the proposed engines.

Microsoft has evaluated the cost effectiveness of installing and operating DPFs on each of the proposed diesel engines. The analysis indicates that the use of DPFs would cost approximately $270,000 per ton of engine exhaust particulate removed from the exhaust stream, assuming 48 hours per year of emergency operation. A previous survey by Ecology found that none of the permitting agencies surveyed had required installation of a particulate matter control device (as BACT) that was expected to cost more than $23,200 per ton of particulate removed.

Since the estimated DPF cost effectiveness value for the proposed Microsoft project far exceeds the $23,200 per ton upper limit, Ecology concludes that the use of DPFs is not economically feasible for this project. Therefore, Ecology rejects this control option as BACT for particulate matter.

4.2.2 ***Diesel oxidation catalysts***. This method utilizes metal catalysts to oxidize carbon monoxide, particulate matter, and hydrocarbons in the diesel exhaust. Diesel oxidation catalysts (DOCs) are commercially available and reliable for controlling particulate matter, carbon monoxide and hydrocarbon emissions from diesel engines. While the primary pollutant controlled by DOCs is carbon monoxide (approximately 90% reduction), DOCs have also been demonstrated to reduce up to 30% of diesel engine exhaust particulate emissions, and more than 50% of hydrocarbon emissions.

Microsoft has evaluated the cost effectiveness of installing and operating DOCs on each of the proposed diesel engines. If the cost effectiveness of DOC use is evaluated using the total amount of carbon monoxide, particulate matter and hydrocarbons reduced, the normalized operational cost estimate becomes $4,500 per ton of pollutants removed, assuming 48 hours per year of emergency operation. The corresponding DOC cost effectiveness value assuming only carbon monoxide destruction is approximately $5,000 per ton of carbon monoxide removed. If particulate matter and hydrocarbons are individually considered, the cost effectiveness values become $387,610 and $116,500 per ton of pollutant removed, respectively.

Microsoft acknowledges that DOC technology is commercially available and “would be reliable”. A previous survey by Ecology found that the permitting agencies surveyed have required installation of carbon monoxide controls as BACT on other types of emission units, with expected operational costs ranging from $300 to $9,795 per ton of carbon monoxide removed. The upper level of that range is suspect and it is possible that that number actually reflects California BACT which is typically equivalent to a Lowest Achievable Emissions Rate (LAER) limit. In Washington, costs for controlling CO from combined cycle natural gas electric generating facilities are usually in the $3,500 to $5,000 range. The cost effectiveness estimates calculated for Microsoft’s project fall within this range when all pollutants to be controlled are considered, or if only carbon monoxide is considered.

4.2.3 <u>BACT Determination for Particulate Matter, Carbon Monoxide and Volatile Organic Compounds</u>

Diesel oxidation catalysts can reduce particulate matter by up to 30%, hydrocarbons by up to 50%, and carbon monoxide by approximately 90%, Ecology considered applying diesel oxidation catalysts as BACT for these compression ignition engines. The fact that the oxidation catalyst also reduced approximately 25% of the diesel engine exhaust particulate emissions from the proposed new engines made this option attractive to Ecology. Microsoft's offer to reduce fuel usage by 50% even with the instillation of the 13 new engines, would result in a reduction of more than 7 times the amount of diesel engine exhaust particulate being reduced over the use of an oxidation catalyst. Therefore, Ecology determines BACT for particulate matter, carbon monoxide and volatile organic compounds is restricted operation of the EPA Tier-2 certified engines, and compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII.

4.3 BACT ANALYSIS FOR SULFUR DIOXIDE

4.3.1 Ecology and Microsoft did not find any add-on control options commercially available and feasible for controlling sulfur dioxide emissions from diesel engines. Microsoft's proposed BACT for sulfur dioxide is the use of ultra-low sulfur diesel fuel (15 ppm by weight of sulfur). Using this control measure, sulfur dioxide emissions would be limited to 0.015 tons per year.

4.3.2 **<u>BACT Determination for Sulfur Dioxide</u>**
Ecology determines that BACT for sulfur dioxide is the use of ultra-low sulfur diesel fuel containing no more than 15 parts per million by weight of sulfur.

4.4 BEST AVAILABLE CONTROL TECHNOLOGY FOR TOXICS

Best Available Control Technology for Toxics (tBACT) means BACT, as applied to toxic air pollutants.[3] The procedure for determining tBACT follows the same procedure used above for determining BACT. Under state rules, tBACT is required for all toxic air pollutants for which the increase in emissions will exceed de minimis emission values as found in WAC 173-460-150.

For the proposed project, tBACT must be determined for each of the toxic air pollutants listed in Table 1 below. As illustrated by Table 1, Ecology has determined that compliance with BACT, as determined above, satisfies the tBACT requirement.

Table 1. tBACT Determination

Toxic Air Pollutant	**tBACT**
Acetaldehyde	Compliance with the VOC BACT requirement
Acrolein	Compliance with the VOC BACT requirement
Benzene	Compliance with the VOC BACT requirement
Benzo(a)pyrene	Compliance with the VOC BACT requirement
1,3-Butadiene	Compliance with the VOC BACT requirement

[3] WAC 173-460-020

Carbon monoxide	Compliance with the CO BACT requirement
Diesel engine exhaust particulate	Compliance with the PM BACT requirement
Formaldehyde	Compliance with the VOC BACT requirement
Nitrogen dioxide	Compliance with the NOx BACT requirement
Sulfur dioxide	Compliance with the SO_2 BACT requirement
Toluene	Compliance with the VOC BACT requirement
Total PAHs	Compliance with the VOC BACT requirement
Xylenes	Compliance with the VOC BACT requirement

5. AMBIENT AIR MODELING

Ambient air quality impacts at and beyond the property boundary were modeled using EPA's AERMOD dispersion model, with EPA's PRIME algorithm for building downwash. For purposes of demonstrating compliance with the national ambient air quality standards (NAAQS) and acceptable source impact levels (ASILs), Microsoft assumed the entire Columbia Data Center would experience 2 full days of power outage, in which case 12 backup engines were assumed to operate at their rated load at the same time, and the 13th engine running at idle (approximately 10% load). For engine testing, Microsoft assumed that all 13 engines were tested on a single day (with five engines operating at the same time) while operating at low (i.e., approximately 10%) load.

The AERMOD model used the following data and assumptions:

5.1 Five years of sequential hourly meteorological data (2004–2008) from Moses Lake Airport were used. Twice-daily upper air data from Spokane were used to define mixing heights.

5.2 Digital topographical data (in the form of Digital Elevation Model files) for the vicinity were obtained from BeeLine software.

5.3 Each generator was modeled with a stack height of 31- feet above local ground.

5.4 The existing CO1/CO2 data center building, the proposed new CO3.2 (Phase I), CO3.1 (Phase II) and CO3.3 (Phase II) server buildings, and each expansion generator's acoustical enclosure were included to account for building downwash.

5.5 The receptor grid for the AERMOD modeling was established using a 10-meter grid spacing along the facility boundary extending to a distance of 300 meters from each facility boundary. A grid spacing of 25 to 50 meters was used for distances more than 300 meters from the boundary.

5.6 1-hour NO_2 concentrations at and beyond the facility boundary were modeled using the Plume Volume Molar Ratio Method (PVMRM) module, with default concentrations of 40 parts per billion (ppb) of background ozone, and an equilibrium NO_2 to NOx ambient ratio of 90%. For purposes of modeling NO_2 impacts, the primary NOx emissions at the stack exit were assumed to consist of 10% NO_2 and 90% nitric oxide by mass.

5.7 Dispersion modeling is sensitive to the assumed stack parameters (i.e., flowrate and exhaust temperature). The stack temperature and stack exhaust velocity at each generator stack were set to values corresponding to the engine loads for each type of testing and power outage. Stack parameters are provided in Appendix E.

Except for diesel engine exhaust particulate which is predicted to exceed its ASIL, AERMOD model results show that no NAAQS or ASIL will be exceeded at or beyond the property boundary. As required by WAC 173-40-090, emissions of diesel engine exhaust particulate are further evaluated in the following section of this document.

6. THIRD TIER REVIEW FOR DIESEL ENGINE EXHAUST PARTICULATE

As discussed above, proposed emissions of diesel engine exhaust particulate (DEEP) from the 13 additional engines exceed the regulatory trigger level for toxic air pollutants (also called an Acceptable Source Impact Level, (ASIL). A second or third tier review is required for DEEP in accordance with WAC 173-460-090 or WAC 173-460-100, respectively.

Microsoft's existing computer data center is currently one of three data centers operating in the rural town of Quincy, WA. The three data centers utilize dozens of large (>2 MW) diesel engines to supply backup power in support of data center operations. Additionally, due to the April, 2010 enactment of the *Computer Data Centers – Sales and Tax Exemption* law in Washington State, several companies have expressed interest in expanding existing or developing new data centers in Quincy. Thus, more large diesel-powered generators will be needed to supply backup power for the additional data centers.

Large diesel-powered backup engines emit DEEP, which is a high priority toxic air pollutant in the state of Washington. In light of the potential rapid development of other data centers in the Quincy area, and recognizing the potency of DEEP emissions, Ecology decided to evaluate Microsoft's proposal on a community-wide basis. The community-wide evaluation approach considers the cumulative impacts of DEEP emissions resulting from Microsoft's project, and includes consideration of prevailing background emissions from existing permitted data centers and other DEEP sources in Quincy. This evaluation was conducted under the third tier review requirements of WAC 173-460-100.

The results of Ecology's evaluation of cumulative risks associated with Microsoft's project are included in a separate technical support document. Please refer to that technical support document for a discussion and evaluation of the risks associated with diesel engine exhaust particulate emitted by Microsoft.

7. CONCLUSION

Based on the above analysis, Ecology concludes that operation of the 13 generators will not have an adverse impact on air quality. Ecology finds that Microsoft has satisfied all requirements for NOC approval.

******END OF MICROSOFT 2010 EXPANSION TSD** ****

NOC APPROVAL ORDER NO. 09AQ-E308 NON-NSR MODIFICATIONS (RWK)

On June 12, 2009, Microsoft Corporation (MSN) submitted a request to modify its order of approval (No. 07AQ-E230) to add 3 emergency diesel engines MSN omitted from its original application (installed and operating at this time) and to extend the period of time allowed for construction of the 23rd and 24th large engines approved in Order 07AQ-E230. WAC 173-460 and WAC 173-400 were revised in the period of time since the MSN data center was approved, adding an exemption from NSR for emergency engines equal to or smaller than 500 HP. Each of the three existing engines included in the June 12, 2009 request qualifies for this exemption if it is new equipment. Because the engines are in place already, they were installed subject to the rules in place at the time of installation and so, are subject to BACT and t-BACT and the other requirements of NSR if their addition to this project involves increases in emissions. The application indicates that these engines will be operated solely for diagnostic and readiness testing, that the facility diesel fuel limit is not to be changed, and that the engines will satisfy the BACT requirements imposed on the large engine generators approved in 07AQ-E230, so this proposal is a project not subject to NSR under old 400 and 460 or new 400 and 460.

The emission inventory for this project does not change with the addition of these engines because MSN has agreed to retain the facility-wide fuel limit of Approval Order 07AQ-E230. The smaller engines emit not emit significantly different levels of pollutants for a given energy output, and will not change the inventory if the overall fuel consumption limit is not changed.

This modification to the MSN Approval Order, then, is to identify the 3 engines omitted from the earlier order, include NSPS paperwork requirements as approval conditions if they are not already requirements for the large engines, and to agree to extend the period of time allowed for MSN to start construction of engines 23 and 24.

FINDINGS & EVALUATIONS FOR NOC APPROVAL ORDER NO. 07AQ-E230 (RWK)

Microsoft Corporation (MSN) submitted a Notice of Construction (NOC) application on October 23, 2006, for the installation of the Columbia Data Center located at 501 Port Industrial Parkway, Quincy, in Grant County. The Columbia Data Center will be used by MSN as an electronic data storage facility. Air contaminant sources at the facility consist of twenty-four (24) Caterpillar Model 3516C-TA diesel powered generator units with a combined 100 percent standby rating capacity of 60 megawatts (MW) used for emergency backup power, six banks of evaporative cooling towers on three buildings, and associated support equipment such as fuel tanks, cooling water storage and treatment, and electrical systems. The generators will be used to provide emergency backup electrical power to the Grant County PUD hydroelectric power grid. Operation of each generator has been estimated at 70 hours per year for maintenance purposes and a maximum of 215 hours per year of operation for emergency backup electrical generation. The diesel generators will exclusively burn ultra-low sulfur (less than 0.0015 wt %), EPA on-road specification No. 2 distillate diesel oil.

The Ecology Air Quality Program (AQP or Ecology) reviewed the October 23, 2006, NOC application and responded to MSN with a completeness determination dated October 26, 2006.

MSN responded to the completeness determination on January 10, 2007, and Ecology informed MSN that a Tier II analysis would be necessary in correspondence dated January 11, 2007. The Tier II analysis was considered complete based on submittals from MSN dated March 14, May 10, June 5 and 6, 2007. The MSN NOC application was considered complete on June 25, 2007, and the Preliminary Determination was issued for the project on June 25, 2007. After a thirty day public comment period, NOC approval ORDER No. 07AQ-E230 was issued on August 8, 2007.

FINDINGS:

1. LAWS AND REGULATIONS

The proposal by Microsoft qualifies as a new source of air contaminants as defined in Washington Administrative Code (WAC) 173-400-110 and WAC 173-460-040, and requires Ecology approval. The installation and operation of the Columbia Data Center is regulated by the requirements specified in:

1.1 Chapter 70.94 Revised Code of Washington (RCW), Washington Clean Air Act,
3.5 Chapter 173-400 Washington Administrative Code (WAC), General Regulations for Air Pollution Sources,
3.6 Chapter 173-460 WAC, Controls for New Sources of Toxic Air Pollutants, and
3.7 40 CFR Part 60 Subpart IIII

All state and federal laws, statutes, and regulations cited in this approval shall be the versions that are current on the date the final approval order is signed and issued.

2. EMISSIONS

2.1 Operation of the twenty-four 2006 model year Caterpillar Model 3516C-TA diesel engines coupled to Caterpillar Model SR5 generators will result in the following potential emissions based on 70 hours of planned diagnostic testing and 215 hours of full standby operation per year. Emission factors for Criteria Pollutants are based upon emission rate guarantees by the manufacturer. The Toxic Air Pollutants (TAPs) are based on AP-42 emission rate factors.

Table 2.1: Generator and Fire Pump Engines Potential to Emit		
Pollutant	**Hourly Emissions**	**Annual Emissions**
Criteria Pollutant (Caterpillar)	(lbs/hr)	(tons/yr)
2.1.1 Nitrogen Oxides (NO_x)	648	89.4
2.1.2 Carbon Monoxide (CO)	45	6.27
2.1.3 Sulfur Dioxide (SO_2)	0.61	0.094
2.1.4 Particulate Matter (PM_{10})	12	1.71
2.1.5 Hydrocarbons (HC)	30	4.18
Toxic Air Pollutants (AP-42)		
2.1.6 Nitric Oxide (NO)	402	55.41

2.1.7 Acrolein	0.49	0.0068
2.1.8 Benzene	0.46	0.064
2.1.9 Toluene	0.17	0.023
2.1.10 Xylenes	0.12	0.016
2.1.11 1,3 Butadiene	0.01	0.006
2.1.12 Formaldehyde	1.18	0.16
2.1.13 Acetaldehyde	0.49	0.068
2.1.14 Benzo(a)Pyrene	0.000077	0.000011

2.2 Cooling tower emissions are mass balance calculations based on the concentrations of toxic air pollutants in the City of Quincy municipal water supply and the worst case amount of bromine in the NALCO biocide.

BACT

As required by WAC 173-400-113, this project shall use Best Available Control Technology (BACT) to control criteria air contaminant emissions. BACT for the diesel electric generators and the cooling towers is as follows:

3.1 The use of EPA on-road Specification No. 2 distillate fuel oil with a sulfur content of 0.0015 weight percent or less.

3.2 The use of generator engines certified to EPA Tier II (40 CFR 89) emission standards for NOx, CO, and HC.

3.3 The use of mist eliminators on all the cooling tower units that will maintain the maximum drift rate to less than 0.001 percent of the circulating water rate, reducing criteria and toxic air pollutant emissions.

4. T-BACT

As required in WAC 173-460-040(4)(b), this project shall use Best Available Control Technology for Toxics (T-BACT) to control toxic emissions. T-BACT for this project is the same as BACT.

MODELING

Dispersion modeling was conducted by the applicant to evaluate near-source and distant impacts. The modeling evaluation did not result in any exceedances of either criteria or toxic ambient air quality standards.

6.1 The dispersion modeling was conducted using ISCST3 for criteria and toxic air pollutants from the twenty-four (24) diesel electric generators. Acrolein and nitric oxide were the only air pollutants that exceeded the acceptable source impact level (ASIL). A Tier II risk analysis was required by Ecology in correspondence dated January 11, 2007. MSN submitted information dated March 14, May 10, June 5 and 6, 2007, to complete the Tier II risk analysis. Ecology determined that alternative risk based exposure limits to nitric oxide and acrolein that were above the ASIL would be adequately protective of public health with a five foot exhaust stack extension on all the diesel electric generators to reduce acrolein to below the alternative risk based exposure limit. Exhaust stack extensions raising the engine genset stacks five feet higher than proposed in the application were also determined to reduce impacts of NO emissions. NO is expected to be removed from the list of compounds requiring review under WAC 173-460 in the on-going WAC 173-460 rule revision process (anticipated to be completed prior to significant operations at this facility).

The facility will have six banks of cooling tower units installed, two banks in each of the three buildings. Each bank of cooling towers will have eighteen (18) cooling units (total 108 cooling towers). Dispersion modeling was also conducted for the worst-case toxic air pollutant and PM_{10} emission rates from the six sets of cooling towers. EPA model SCREEN3 ambient impacts were below the ASIL for toxic air pollutant and the National Ambient Air Quality Standards (NAAQS) for PM_{10} emissions. No further dispersion modeling was conducted.