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Technical Support Document for Prevention of Significant Deterioration No. 7, Amendment 1

Permit Revision

BP Cherry Point Refinery
Blaine, Washington

Air Quality Program
Washington Department of Ecology
Olympia, Washington
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1. Executive Summary

The BP Cherry Point Refinery is a petroleum refinery near Birch Bay in Whatcom County. It produces gasoline, diesel, jet fuel, green coke, calcined coke, liquefied petroleum gas (LPG), butane, pentane, and elemental sulfur.

BP applied for an amendment of their Prevention of Significant Deterioration (PSD) permit to:

- Remove the hourly average firing rate limit of 60 MMBtu/hr for the proposed NHDS heater that was never built
- Revise hydrogen sulfide emission limits
- Remove continuous oxygen monitor on the #2 reformer
- Revise the nitrogen oxide and carbon monoxide emission limits

After reviewing BP’s request, Ecology proposes to approve this amendment. This technical support document shows Ecology’s analysis supporting our decision to approve this amendment and more detailed explanation of the changes.
2. Introduction

2.1. The permitting process

2.1.1. The Prevention of Significant Deterioration process

Prevention of Significant Deterioration (PSD) permitting requirements in Washington State are established in Title 40, Code of Federal Regulations (CFR) §52.21; Washington Administrative Code (WAC) 173-400-700 through 750. Washington State implements its PSD program as a State Implementation Plan (SIP)-approved program. This SIP-approved program became effective May 29, 2015.

Federal and state rules require PSD review of all new or modified air pollution sources that meet certain criteria in an attainment or unclassifiable area with the National Ambient Air Quality Standards (NAAQS). The objective of the PSD program is to prevent significant adverse environmental impact from emissions into the atmosphere by a proposed new major source, or major modification to an existing major source. The program limits degradation of air quality to that which is not considered “significant.” PSD rules require the utilization of Best Available Control Technology (BACT) for certain new or modified emission units, which is the most effective air pollution control equipment and procedures that are determined to be available after considering environmental, economic, and energy factors.

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

This change is not a major modification therefore the following is not triggered:

- BACT review – Prior BACT review will be unchanged – March 13, 1986.
- Impact analysis is not required – Prior impact analysis was evaluated on March 13, 1986.

2.1.2. The Notice of Construction process

This project is subject to Notice of Construction (NOC) permitting requirements under state of Washington regulations Chapters 173-400 and 173-460 (and/or local air regulations where applicable). The Northwest Clean Air Agency (NWCAA) is the permitting authority for air pollutants not included in PSD permitting. This includes the New Source Review (NSR) permitting of criteria pollutants that are not PSD-applicable,
Air toxics issues under federal maximum achievable control technology (MACT) and state 173-460 WAC, and Title V permitting requirements. Note WAC 173-460 was first effective on September 18, 1991. The procedure for issuing an NOC permit was established in Chapter 70.94 RCW.

WAC 173-400-110 outlines the NSR procedures for permitting criteria pollutants. These procedures are further refined in WAC 173-400-113 (requirements for new sources located in attainment or unclassifiable areas) and/or local air requirements where applicable. WAC 173-460-040 NSR supplements the requirements contained in Chapter 173-400 WAC (and/or local air requirements where applicable) by adding additional requirements for sources of toxic air pollutants (TAPs).
3. Site and Project Description

3.1. Site description

The BP Cherry Point Refinery is located in the City of Blaine in Whatcom County, Washington. BP is situated in Sections 7 and 8, Township 39N, Range 1E Willamette Meridian.

The BP facility is located in a Class II area that is designated as “attainment or unclassifiable” for the purpose of PSD permitting for all pollutants.

3.2. PSD permitting history

Ecology issued PSD 7 on March 13, 1986, to approve the construction and operation of a gasoline reformer unit, the #2 Reformer, for the Clean Gasoline Project (“the Project”) at the Cherry Point Refinery. The Project was to provide additional capacity for producing high-octane gasoline components from low octane hydrocarbon stream without the use of tetraethyl lead, in compliance with the EPA lead phase down regulation.

The Project consists of a 60 million British thermal units per hour (MMBtu/hr) Naphtha Hydrogen Desulfurization (NHDS) Heater and 340 MMBtu/hr #2 Reformer Heaters (total). The heaters burn refinery fuel gas as fuel.

The #2 Reformer Heater is internally divided into four separate cells (1421-1424) with Cell 1421 containing eight (8) burners, Cell 1422 containing eight (8) burners, Cell 1423 containing six (6) burners, and Cell 1424 containing six (6) burners. The burners in each cell are staged fuel low-NOx burners.

3.3. Project description

BP owns and operates the BP Cherry Point Refinery. The requested revisions are as follows:

- Revise Condition 2 to remove the hourly average firing rate limit of 60 MMBtu/hr for the Project’s proposed NHDS Heater. This heater was never constructed as part of the Clean Gasoline Project that installed the #2 Reformer unit at the refinery.
- Revise Condition 4 to change the 160 parts per million (ppm) hydrogen sulfide (H₂S) three-hour rolling average limit to 162 ppm H₂S 3-hour rolling average limit.
- Revise Condition 4 to change the 90 ppm H₂S monthly average limit to a more stringent 50 ppm H₂S 24-hour average limit.
- Remove Condition 3 that requires continuous oxygen monitor on the #2 Refomer Heaters. Revise Condition 1 to clarify the existing nitrogen oxides (NOX) and CO mass-based emissions limits.

Details of the revisions are described in Section 4 of this technical support document.
4. Changes to the PSD Permit

4.1. Permit Condition No. 1

“Emissions from the new gasoline reformer shall not exceed any of the following limitations:

a. 11.0 pounds per hour of carbon monoxide or 48.3 tons/year, based on the average of any 60 consecutive minutes;

b. 32.0 pounds per hour of nitrogen oxides (as NO2) or 140 tons/year, based on the average of any 60 consecutive minutes.”

As discussed in Section 4.2, the Project’s proposed NHDS Heater was never constructed as part of the Project. The CO and NOX emission limits in Condition No. 1 of the permit were established based on the total heat input (400 MMBtu/hr) of the Project’s heaters. The original estimation from PSD 7 for CO and NOX emission is as shown below.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission Factor (lb/MMBtu)</th>
<th>Original Emission Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>lb/hr</td>
</tr>
<tr>
<td>CO</td>
<td>0.028</td>
<td>11.0</td>
</tr>
<tr>
<td>NOX</td>
<td>0.080</td>
<td>32.0</td>
</tr>
</tbody>
</table>

Ecology is revising the CO and NOX emission limits in Condition No. 1 to exclude the emissions from the NHDS heater. The revision is consistent with the original assumptions made in PSD 7. The revised emission limits are based on 340 MMBtu/hr heat input rate and are shown below.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Emission Factor (lb/MMBtu)</th>
<th>Revised Emission Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>lb/hr</td>
</tr>
<tr>
<td>CO</td>
<td>0.028</td>
<td>9.5</td>
</tr>
<tr>
<td>NOX</td>
<td>0.080</td>
<td>27.2</td>
</tr>
</tbody>
</table>

As required in the Air Operating Permit, BP must conduct source testing using EPA’s reference method test at least once every other calendar year to demonstrate compliance with these limits.

PSD 7 only establishes the mass/time based BACT emission limits for CO and NOX. One of the shortcoming in this approach is when the emission factors used in the assumption are not sufficiently conservative, the mass/time based emission limit could be exceeded if the unit operates at a heat input rate significantly higher than the operating rate during the test.
For example, if the unit was operated at 200 MMBtu/hour during the compliance test, with the test result of 0.10 lb NOx/MMBtu, the NOx emission is approximately 20 lb/hr. If during the previous 12 rolling months, BP had operated the unit occasionally at 300 MMBtu/hr, the NOx emission rate is estimated to be 30 lb/hr using the same test result. Therefore, it is important for the unit to be operated at representative maximum operating rate during the compliance test. While “maximum operating rate” is not clearly defined, consider the hourly averaging period of the NOx and CO emission limits, it should be close to or at the maximum hourly actual operating rate achieved during the previous 12 operating months of the unit.

4.2. Permit Condition No. 2

“Firing of the naphtha hydrogen desulfurization (HDS) and reformer heaters shall not exceed 60 and 340 million Btu per hour, respectively, based on the hourly average calculated heat content of the fuel.”

BP has requested to remove the firing rate limit of 60 MMBtu/hr for the NHDS heater. This heater was never constructed as part of the Clean Gasoline Project approved under PSD 7.

The refinery has only one NHDS unit, which has two fired sources: a 110 MMBtu/hr NHDS Charge Heater and an 86 MMBtu/hr NHDS Stripper Reboiler. The NHDS unit along with both fired sources was installed in 1970. This predates PSD No. 7, which was issued on March 13, 1986.

Ecology finds the revision to reflect that the 60 MMBtu/hr NHDS Heater was never constructed can be considered an administrative revision per WAC 173-400-750(3)(b).

4.3. Permit Condition No. 3

“A continuous oxygen monitor shall be operated on the reformer heaters in accordance with Performance Specification 3 (40 CFR 60, Appendix B). Oxygen monitoring records shall be kept on site by ARCO for two years and made available to the air authorities for inspection.”

BP has requested to remove the oxygen monitoring requirements because there appears to be a lack of basis for the requirements. BP has provided the results of the last three source tests and the oxygen concentration during the tests as shown below.

<table>
<thead>
<tr>
<th>Year</th>
<th>NOx (lb/hr)</th>
<th>NOx (lb/MMBtu)</th>
<th>O2 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td>11.6</td>
<td>0.0962</td>
<td>5.8</td>
</tr>
<tr>
<td>2019</td>
<td>14.4</td>
<td>0.0994</td>
<td>4.8</td>
</tr>
<tr>
<td>2021</td>
<td>10.6</td>
<td>0.0997</td>
<td>5.9</td>
</tr>
</tbody>
</table>
Currently, Condition No. 1.b. of the permit consists of NOX emission limits of 32.0 lb/hr and 140 tons per year (tpy). Ecology finds that the oxygen monitoring has no association with the emission limits in this permit. Ecology also finds there is no clear explanation of this requirement in the original review and there is no clear purpose of this requirement.

Ecology finds that this will not reduce stringency and affect compliance with any of the requirements in the permit and proposes to approve the request.

4.4. Permit Condition No. 4

“Hydrogen sulfide (H2S) shall not exceed 160 ppm in the fuel to the vacuum heater, based on a three-hour rolling average, or 90 ppm on a monthly average.”

BP has requested to change the H2S limits as described below:

- 160 ppm to 162 ppm, on a 3-hour rolling average
- 90 ppm on a monthly average to 50 ppm, on a 24-hour rolling average

BP stated that it is understood that during the early days of New Source Performance Standard (NSPS) Subpart J, the wide variability in H2S limits, expressed as ppm in fuel gas, were an artifact of rounding when converting the two significant figure 230 mg/dscm (0.10 gr/dscf) limit from 40 CFR 60.104(a)(1) to ppm (which was done for ease of continuous monitoring). In 2009, NSPS Subpart Ja fixed the confusion by employing a three significant figure concentration limit of 162 ppm H2S.

The following two cases illustrate the variability in the conversion of the NSPS Subpart J H2S limit from mg/dscm or gr/dscf to ppm:

- Case 1 – using an ideal gas molar volume of 379.48 dscf/lb-mol (@ 60°F and 14.696 psi), MW of H2S = 34.08…the dimensional analysis yields ~ (0.10 gr/dscf)*(1 lb/7000 gr)(1 lb-mol H2S /34.08 lb H2S)*(379.48 dscf/lb-mol)* 1 x 10^6 = 159 ppm H2S
- Case 2 – using an ideal gas molar volume of 379.48 dscf/lb-mol (@ 60°F and 14.696 psi), MW of H2S = 34.08 (only two significant figures), and an emission standard of 0.104 gr/dscf (which is still below the two significant figures limit), the same dimensional analysis gives 166 ppm H2S

The 160 ppm H2S limit in PSD No. 7 is a conversion from the NSPS Subpart J gr/dscf limit that is rounded to two significant figures, similar to Case 1 above, in accordance with the rounding conventions of NSPS Subpart A (40 CFR 60.13(h)(3)).

This revision is to remove the discrepancy between the old 160 ppm H2S limit with 162 ppm H2S limit. Ecology finds that the revision is intended to be more consistent with the NSPS Subpart Ja emission limit, which is the basis of BACT at the time.
BP also proposes to revise the 90 ppm H₂S monthly average limit to 50 ppm H₂S 24-hour average limit. This is to be more consistent with the 50 ppm H₂S limit in NWCAA issued Order of Approvals and reduce the complexity of compliance monitoring. This revision increases the stringency of the H₂S longer-term emission limit significantly.

Overall, Ecology finds this request is to resolve the discrepancy of the conversion method and increase the stringency of the H₂S emission limit on 24-hr averaging period. Ecology finds that these changes can be considered administrative revision per WAC 173-400-750(3)(b).
5. State Environmental Policy Act

Under Washington State rules, a final PSD permit shall not be issued for a project until the applicant has demonstrated that State Environmental Policy Act (SEPA) review has been completed for the project.

NWCAA was the SEPA lead for OAC 305b and issued Determination of Nonsignificance (NDS) SEP 2021-03005 on June 7, 2021.

Ecology concludes that the applicant has adequately demonstrated compliance with SEPA requirements.
6. Environmental Justice Review

Environmental Justice (EJ) is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Ecology conducts an EJ review to ensure no group of people bear a disproportionate share of the negative environmental consequences as the result of the permitting action.

Since this is a non-project permit action, Ecology finds that enhanced outreach is not needed to further engage EJ populations in environmental decision-making.
7. Public Involvement

This PSD permitting action was subject to a minimum 30-day public comment period under WAC 173-400-740. Ecology posts the public notice on Ecology's web site and accepts public comment from March 17, 2022 – April 18, 2022.
9. Agency Contact

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Acronyms and Abbreviations

BACT  Best Available Control Technology
CFR  Code of Federal Regulations
CO  carbon monoxide
Ecology  Washington Department of Ecology
EJ  Environmental Justice
EPA  United States Environmental Protection Agency
H₂S  hydrogen sulfide
hr/yr  hour(s) per year
MACT  maximum achievable control technology
MMBtu/hr  million British thermal units per hour
NAAQS  National Ambient Air Quality Standards
NDS  Determination of Nonsignificance
NOC  Notice of Construction
NOₓ  nitrogen oxides
NSR  New Source Review
NSPS  New Source Performance Standard
NWCAA  Northwest Clean Air Agency
ppm  parts per million
PSD  Prevention of Significant Deterioration
SEPA  State Environmental Policy Act
TAP  toxic air pollutant
tpy  tons per year
WAC  Washington Administrative Code