National Park Service (NPS) Regional Haze SIP feedback for the Hawaii State Department of Health Clean Air Branch

May 26, 2022

1. Executive Summary

The National Park Service (NPS) appreciates the opportunity to review the draft Hawaii Regional Haze State Implementation Plan (SIP) for the second planning period. On May 19, 2022, staff from the NPS Air Resources Division; NPS Interior Regions 8, 9, 10, and 12; and several national park units in Hawai'i hosted a regional haze SIP review consultation meeting with the Hawaii State Department of Health Clean Air Branch (DOH-CAB) staff. During the meeting, NPS staff shared input on the draft Hawaii Regional Haze SIP.

As discussed during the consultation meeting, NPS review of the draft SIP supports the control determinations identified by Hawaii DOH-CAB and finds that there may be additional reasonable emission reduction opportunities for one of the facilities considered. Specifically, for the Maalaea Power Plant on Maui there may be additional cost-effective opportunities to control NO_x emissions from the facility's four larger diesel engines (M10–M13). Section 2 of this technical feedback document provides facility-specific feedback, analyses, and recommendations. Section 3 provides some editorial suggestions.

Hawai'i is home to two NPS-managed Class I areas—Haleakalā National Park on Maui and Hawai'i Volcanoes National Park on Hawai'i. The NPS values clean air and clear views and recognizes these as essential to our visitor experience and the very purpose of our Class I areas. The NPS appreciates the steps Hawaii DOH-CAB is taking to reduce haze causing pollution and address regional haze in our national parks in this planning period. The NPS welcomes future opportunities to engage with Hawaii DOH-CAB and work together as we strive toward the goal of unimpaired visibility.

2. Four-factor Analyses

Hawaii DOH-CAB selected eight facilities for four-factor analysis:

Table 1. Facilities selected for four-factor analysis.

Facility	Location
1. Kalaeloa Partners, L.P. Plant	Oahu
2. Kahe Power Plant	Oahu
3. Waiau Power Plant	Oahu
4. Kanoelehua-Hill Power Plant	Hawai'i
5. Puna Power Plant	Hawai'i
6. Kahului Power Plant	Maui
7. Maalaea Generating Station	Maui
8. Mauna Loa Macadamia Nut Corporation Plant	Hawai'i

In evaluating the first seven facilities identified for potential emission controls, the state reviewed a weighted emissions potential and area of influence (WEP/AOI) analysis described in Section 6.5 of the draft SIP. This analysis helps define the relative contributions of emissions from point sources to haze-causing particulates at the two Class I areas, Hawai'i Volcanoes and Haleakalā National Parks. The results of this analysis led the state to conclude that the three facilities located on Oahu (Kalaeloa, Kahe, and Waiau) have relatively little impact to haze in Class I areas in Hawai'i. In addition, an analysis of surface wind patterns on Oahu shows that winds are predominantly from the northeast and thus tend to blow pollutants away from the parks, which are located on the islands of Maui and Hawai'i. As a result, the three Oahu facilities were excluded from consideration for additional controls in this planning period.

The same WEP/AOI analysis identified the Mauna Loa plant as a potential source of haze causing emissions for Hawai'i Volcanoes National Park. Hawaii DOH-CAB therefore added this source to the list for consideration in this planning period and will provide a four-factor analysis for the Mauna Loa Macadamia Nut Corporation Plant in supplementary documents.

The NPS agrees with the refinement of facility selection for reasonable progress analysis and requests an opportunity to review and provide feedback on the Mauna Loa Macadamia Nut Corporation analysis when it becomes available. NPS comments on the Hawai'i four-factor analyses from the draft SIP therefore are focused on: Kanoelehua-Hill Power Plant, Puna Power Plant, Kahului Power Plant, and the Maalaea Generating Station.

2.1. Kanoelehua-Hill Power Plant

The Kanoelehua-Hill Power Plant, located on Hawai'i, consists of two boilers combusting No. 6 fuel oil (Hill 5 and Hill 6), one combustion turbine, and four diesel generators. Baseline sulfur dioxide (SO_2) and nitrogen oxide (NO_x) emissions given in the four-factor analysis are shown in the following table.

Table 2. Kanoelehua-Hill baseline emissions.

Kanoelehua-Hill Emissions		
Source	SO_2 (tons/year)	NO_X (tons/year)
Hill 5	821	252
Hill 6	1,347	354
D-11	< 0.1	0.4
D-15	< 0.1	1.9
D-16	< 0.1	0.7
D-17	< 0.1	1
CT-1	< 0.1	0.3

Hawaii DOH-CAB reviewed the four-factor analysis submitted by the company and determined that Hill 5 and Hill 6 would be required to switch to ultra-low sulfur diesel and to install selective catalytic reduction (SCR) and combustion controls. In lieu of installing these controls, Hawaiian Electric has committed to an enforceable shutdown of the Hill 5 and Hill 6 boilers by 2028. The NPS supports the state's control determination for this facility.

2.2. Puna Power Plant

The Puna plant sources consist of one boiler combusting No. 6 fuel oil and one combustion turbine using No. 2 fuel oil. Baseline SO_2 and nitrogen oxide NO_X emissions given in the four-factor analysis are shown in the following table.

Table 3. Puna baseline emissions.

Puna Emissions		
Source	SO_2 (tons/year)	NO_x (tons/year)
Boiler	184	22.7
CT-3	2.9	6.8

Hawaii DOH-CAB reviewed the four-factor analysis submitted by the company and determined that the boiler would be required to switch from No. 6 fuel oil to ultra-low sulfur diesel by four years from the issuance of a new permit. The NPS supports the state's control determination for this facility.

2.3. Kahului Power Plant

The Kahului power plant includes two 5.0 MW boilers, one 11.5 MW boiler, and one 12.5 MW boiler. Baseline SO_2 and NO_X emissions for the facility are shown in the following table. All four boilers are currently combusting No. 6 fuel oil. Kahului baseline emissions are shown in the following table.

Table 4. Kahului baseline emissions.

Kahului Emissions		
Source	SO_2 (tons/year)	NO_X (tons/year)
K1	293	66
K2	253	62
K3	899	293
K4	776	183

Hawaii DOH-CAB reviewed the four-factor analysis submitted by the company and determined that all four boilers would be required to switch to ultra-low sulfur diesel and to install SCR and combustion controls. Hawaiian Electric has committed to an enforceable shutdown of boilers K1–K4 by 2028 instead of adopting the required control measures. The NPS supports the state's control determination for this facility.

2.4. Maalaea Power Plant

The Maalaea power plant includes 19 emissions sources:

- Five 2.5 megawatt (MW) diesel engine generators (M1, M2, M3, X1, and X2) currently firing ultra-low sulfur diesel (ULSD);
- Six 5.9 MW diesel engine generators (M4, M5, M6, M7, M8, and M9) currently firing diesel with a maximum sulfur content of 0.4 percent by weight;
- Four 12.5 MW diesel engine generators (M10, M11, M12, and M13) currently firing diesel with a maximum sulfur content of 0.4 percent by weight; and
- Four 20 MW combustion turbine generators (M14, M16, M17, and M19) currently firing diesel with a maximum sulfur content of 0.4 percent by weight.

Baseline emissions for these sources are shown in the following table:

Table 5. Maalaea baseline emissions.

Maalaea Emissions		
Source	SO_2 (tons/year)	NO_X (tons/year)
M1	0.001	10
M2	0.001	6
M3	0.001	10
M4	2	81
M5	2	83
M6	1	61
M7	2	123
M8	1	61
M9	2	102
M10	12	580
M11	10	506
M12	11	406
M13	11	420
X1	0.002	5
X2	0.002	5
M14	32	85
M16	37	99
M17	59	77
M19	54	66

Based on the results of the four-factor analysis, Hawaii DOH-CAB determined that fuel injection timing retard (FITR) would be required for diesel engine generators M1, M2, and M3 and SCR would be required for diesel engine generator M7 by 2028. No controls were determined to be cost-effective for the other 15 emissions sources at the facility.

As shown in Table 5, engines M10–M13 together account for 1,912 tons/year of NO_x emissions, this is approximately 69% of the total NO_x emissions at the facility. These four engines are rated at 17,520 hp each. Appendix I, Rev 1 of the SIP contains the four-factor analysis for Maalaea. Hawaii DOH-CAB's estimated costs for SCR on the 15 diesel engine generators are presented in Table 4-3 on page 147. The cost-effectiveness for SCR on the four largest engines, M10–M13, are:

- \$8,757/ton NO_X removed for M10,
- \$8,895/ton NO_X removed for M11,
- \$12,423/ton NO_X removed for M12, and
- \$11,292/ton NO_X removed for M13.

These costs are all above the Hawaii DOH-CAB cost-effectiveness threshold of $5,800/ton and were therefore not considered cost effective.

M10–M13 NO_x control cost estimates

Draft SIP analysis

The total annualized cost estimates for controls are the sum of estimated annualized capital recovery costs and annual operating costs. According to the notes in Table 4-3, the capital recovery costs were determined using a cost factor of $27,837 per MW, based on a 2012 internal engineering report for units M5–M9. The internal report that this cost factor was based upon is not included in the draft SIP and has not been provided for NPS review. Therefore, the NPS is unable to directly evaluate the capital recovery cost estimates for the diesel engine generators.

Available information indicates that the annual operating costs were determined using a cost factor $0.0452 per engine horsepower per operating hour. As detailed in Appendix A, Table A-1 on page 153 of the four-factor analysis, the annual operating cost factor was determined using information in an EPA document titled *Assessment of Non-EGU NO_X Emission Controls, Cost of Controls, and Time for Compliance, Technical Support Document (TSD) for the Cross-State Air Pollution Rule for the 2008 Ozone NAAQS*, Docket ID No. EPA-HQ-OAR-2015-0500, November 2015. Table 5-6 of the TSD, SCR for Diesel Lean Burn Engines—Assumptions, page 5–13, presents cost factors of $98/hp for capital costs and annual costs of $40/hp (including capital recovery). These figures are use in the SIP's Appendix A, Table A-1 to derive the annual operating cost factor.

According to the EPA TSD, "The costs and cost effectiveness for applying SCR to diesel lean burn engines is provided in *Alternative Control Techniques Document: Stationary Diesel Engines* (EPA 2010)." According to this 2010 report, the source for capital cost estimates for diesel engine SCR applications is a 2006 memorandum titled "Memorandum from Brenda Riddle, AGTI to Jaime Pagán, EPA Energy Strategies Group, Control Technologies for Internal Combustion Engines, May 22, 2006." The cost methodology used to estimate the costs for operating/supervisory labor, maintenance, ammonia, steam diluent, and fuel penalty were calculated using the EPA Control Cost Manual; this methodology was used to derive the annual operating cost factor. The source documents for the SIP's annual operating cost factor thus appear to be from 2010 and 2006.

Control cost reference

EPA's 2017 update to the Control Cost Manual, Section 1, Introduction, Chapter 2, Cost Estimation: Concepts and Methodology, p. 19, says: *"It should be noted that the accuracy associated with escalation (and its reverse, de-escalation) declines the longer the time period over which this is done. Escalation with a time horizon of more than five years is typically not considered appropriate as such escalation does not yield a reasonably accurate estimate. [9] Thus, obtaining new price quotes for cost items is advisable beyond five years."*

NPS analysis

To estimate SCR costs for engines M10–M13, the NPS used the SCR cost estimation Excel worksheet provided with the 7th edition of the Control Cost Manual, available online at https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution#cost%20manual. This resulted in cost-effectiveness estimates of $931–$1,240/ton NO_X removed (see attached calculation workbooks).

NPS analyses assumed:

- a retrofit factor of 1,
- a remaining useful life of 20 years,
- a NO_X removal efficiency of 90%, and
- an interest rate of 5.31% for Maui as specified by Hawaii DOH-CAB in the draft SIP.

This is a preliminary analysis because information was not available for all input parameters. As a result, some values required by the worksheet (e.g., annual MW-hours) have been estimated and others (such as net plant heat rate, electricity and labor costs, etc.) were left at their default values. The results suggest that SCR may be significantly more cost-effective than the estimates provided in the four-factor analysis.

The NPS recommends that Hawaii DOH-CAB reconsider the cost factors and methodology used for the Maalaea diesel engines M10–M13 and update the cost-effectiveness estimates if needed. Further, the NPS recommends that Hawaii DOH-CAB require SCR for these engines as a technically feasible cost-effective control to reduce NO_x emissions if cost-effectiveness is found to be within the established threshold. The NPS supports Hawaii DOH-CAB's request for a vendor quote as this would provide the highest level of certainty for evaluating the cost-effectiveness of SCR for these engines.

3. Editorial recommendations

In some locations in the text of the draft SIP, the name of Hawai'i Volcanoes National Park is incorrectly given as "Volcanoes National Park." These locations include the list of figures (for Figure 1.3–2), in Table 1.2–1 page 3, and in the title of Figure 1.3–2 on page 5. Please correct these with the full park name "Hawai'i Volcanoes National Park."