**Significant Modification to a Covered Source**
**Review Summary**

**Application File Nos.:** 0212-34

**Permit No.:** 0212-01-C

**Applicant:** Tesoro Hawaii Corporation

**Facility Title:** Petroleum Refinery
Tesoro Hawaii Corporation
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Kapolei, Hawaii 96707

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**Responsible Official:** Mr. Daniel L. Carlson
Refinery Manager
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**Point of Contact:** Mr. Theodore K. Metrose
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**Application Dates:** Significant Modification Application No. 0212-34 received on November 16, 2010 and supplemental information dated June 22, 2011, June 27, 2011, September 12, 2011, October 18, 2011 and October 25, 2011

**Proposed Project:**

SICC 2911 (Petroleum Refining)

This is a permit application to install an air pre-heater on the 4 heater system used in the Catalytic Reformer Unit (CRU). The refinery intends to install an air pre-heater (APH) on the H500 series heaters as a means of reducing the amount of fuel needed to convert naphtha into gasoline blend stock (reformate). The fuel savings afforded by the APH will generally have the additional benefit of reducing criteria pollutants and greenhouse gases. Upon closer review the heat input requirements both with and without the air pre-heater in service we have determined:

- 2 of the 8 burners on H501 will be removed, leaving just 6 burners;
- The total heat input (fired duty) of the H501 heater and the entire CRU will be lower;
- The remaining 19 burners must be replaced in order to accommodate the plenum and ductwork required for the APH.

As indicated previously, with two fewer burners being required and installed in H501 and the total fired duty being reduced, the Potential-to-Emit (PTE) for all pollutants from H501 will be reduced by about 35%.

Similarly, with this supplement we are also proposing to further limit the PTE by de-rating the other heaters, and effectively restricting the amount of fuel that will be burned. Overall the PTE for all four heaters is expecting to decline in aggregate by 27%. As a consequence of derating and limiting the permitted firing rate of the four (4) CRU heaters, the potential to emit $NO_x$, $SO_2$ and PM emissions will be reduced by 172, 178 and 22 TPY respectively.

**New Burners for the APH**

Aside from H501, the number and the size of the new combination fuel oil and refinery fuel gas burners to be installed as part of the air preheater project are nearly identical to those currently installed in the series 500 heaters. The future design basis for operating and revising the permitting duty for the 500 series heaters is presented below.

| Heater | Current Burners per Heater | Future Burners per Heater | Current Burner Design Duty (LHV) (MMBtu/hr) | Future Burner Design Duty (LHV) (MMBtu/hr) | Current Heater Design Duty (LHV) (MMBtu/hr) | Future Heater Design Duty (LHV) (MMBtu/hr) |
|---|---|---|---|---|---|---|
| H501 | 8 | 6 | 11.92 | 12.23 | 95.4 | 73.4 |
| H502 | 6 | 6 | 12.32 | 11.27 | 73.9 | 67.6 |
| H503 | 4 | 4 | 8.52 | 8.28 | 34.1 | 33.1 |
| H504 | 3 | 3 | 5.52 | 5.6 | 16.6 | 16.8 |
| Total | 21 | 19 | | | 219.9 | 190.9 |

Notably the table above depicts burner and heater duties on the basis of the LHV. Heaters are normally designed and sized on the basis of the amount of actual net useable heat release from combustion (LHV), whereas air pollution emission factors and consequently many air permits are represented on the basis of gross heat release or HHV. The table below depicts the revised design limit on the basis of both lower heating value (LLV) and higher heating value (HHV).

| Future Heater | LHV Design Duty (MMBtu/hr) | HHV LHV Ratio | HHV Design Duty (MMBtu/hr) |
|---|---|---|---|
| H501 | 73.4 | 1.095 | 80.4 |
| H502 | 67.6 | 1.095 | 74.0 |
| H503 | 33.1 | 1.095 | 36.3 |
| H504 | 16.8 | 1.095 | 18.4 |
| Total | 190.9 | | 209.1 |

- The ratio of HHV to LHV was based on the composition of the refinery fuel gas (RFG) which was used to design the heaters. Although composition of the RFG is subject to variability, the ratio is a virtual constant.

The new burners have been sized to accommodate maximum firing in the natural draft mode, so the CRU may continue to operate at full capacity (even when the APH is not in service). However the installation of the APH reduces the likelihood of over-firing burners (for any material duration) and since the heaters will normally be operated with the APH in service, the HHV design duty may be used as the basis to establish a lower permitted basis, as shown below.

| Heater | Current Heater Permitted Duty (HHV) (MMBtu/hr) | Future Heater Permitted Duty (HHV) (MMBtu/hr) | Permitted Duty Reduction Percent (%) |
|---|---|---|---|
| H501 | 124.4 | 80.4 | 35 |
| H502 | 96.4 | 74.0 | 23 |
| H503 | 44.5 | 36.3 | 19 |
| H504 | 21.7 | 18.4 | 15 |
| Total | 287.0 | 209.1 | 27 |

- The current permit does not specify either HHV or LHV, but HHV is inferred by several air permit applications.

In essence the engineering review and installation of the APH has effectively enabled the permitted firing rate to be aligned with the maximum design duty, which represents a weighted average reduction of 27%.

In addition to revising the fired duty rates listed on the Title V permit, the applicant is proposing to add several permit conditions that would ensure that fuel use and thus the PTE is truly limited, as consequence of this change. More specifically the conditions would be amended to require installation and maintenance of RFG and fuel oil meters, periodic fuel sampling and analysis and the average combined firing rate of all four 500 series heaters would be limited to less than 209.1 MMBtu/hr (HHV) on a rolling 12 month basis.

**Impact on PTE Emissions**

As a consequence of the lower permitted duty firing rates, the potential-to-emit is also projected to decline in aggregate by 27%. The table below depicts PTE emissions as presented in the April 2005 renewal application and compares it to the revised PTE for each of the heaters with a lower permitted duty rating.

**Project Emissions**

| | Permitted MMBtu/hr (HHV) | $NO_x$ PTE (TPY) | $H_2S$ PTE (TPY) | $SO_2$ PTE (TPY) | CO PTE (TPY) | VOC PTE (TPY) | Pb PTE (TPY) | PM(tot) PTE (tpy) | $PM_{10}$ PTE (TPY) | $PM_{2.5}$ PTE (TPY) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Current** | | | | | | | | | | |
| H501 | 124.4 | 273.9 | 0.08 | 284.0 | 44.9 | 2.9 | 0.006 | 34.9 | 30.8 | 22.0 |
| H502 | 96.4 | 212.2 | 0.06 | 220.1 | 34.8 | 2.3 | 0.004 | 27.0 | 23.8 | 17.0 |
| H503 | 44.5 | 98.0 | 0.03 | 101.6 | 16.1 | 1.1 | 0.002 | 12.5 | 11.0 | 7.9 |
| H504 | 21.7 | 47.8 | 0.01 | 49.5 | 7.8 | 0.5 | 0.001 | 6.1 | 5.4 | 3.8 |
| Total | 287.0 | 631.9 | 0.19 | 655.2 | 103.5 | 6.8 | 0.013 | 80.4 | 71.0 | 50.8 |
| **Future** | | | | | | | | | | |
| H501 | 80.4 | 176.9 | 0.05 | 183.4 | 29.0 | 1.9 | 0.004 | 22.5 | 19.9 | 14.2 |
| H502 | 74.0 | 163.0 | 0.05 | 169.0 | 26.7 | 1.7 | 0.003 | 20.7 | 18.3 | 13.1 |
| H503 | 36.3 | 79.8 | 0.02 | 82.8 | 13.1 | 0.9 | 0.002 | 10.2 | 9.0 | 6.4 |
| H504 | 18.4 | 40.5 | 0.01 | 42.0 | 6.6 | 0.4 | 0.001 | 5.2 | 4.5 | 3.3 |
| Total | 209.1 | 460.3 | 0.14 | 477.3 | 75.4 | 4.9 | 0.010 | 58.6 | 51.7 | 37.0 |
| **Reduction** | | | | | | | | | | |
| H501 | 44.0 | 97.0 | 0.03 | 100.6 | 15.9 | 1.0 | 0.002 | 12.3 | 10.9 | 7.8 |
| H502 | 22.4 | 49.2 | 0.01 | 51.0 | 8.1 | 0.5 | 0.001 | 6.3 | 5.5 | 4.0 |
| H503 | 8.2 | 18.1 | 0.01 | 18.8 | 3.0 | 0.2 | 0 | 2.3 | 2.0 | 1.5 |
| H504 | 3.3 | 7.3 | 0 | 7.5 | 1.2 | 0.1 | 0 | 0.9 | 0.8 | 0.6 |
| Total | 77.9 | 171.6 | 0.05 | 177.9 | 28.1 | 1.8 | 0.004 | 21.8 | 19.3 | 13.8 |

The reduction in PTE emissions listed above is indicative of the reduction of the permitted firing rate, (while operating in natural draft mode). The PTE emission estimates for the reformer heaters in the original Title V permit application as well as the 2005 application (reproduced above and labeled as "Current") are conservative and generally overstated because they were based on the original burner design and fuel guns which effectively enabled the CRU heaters to be fired at full permitted rates exclusively on fuel oil and operated in that mode for an entire year. In fact, the fuel guns to all the CRU heaters were replaced with smaller fuel guns which improved the control of fuel oil burning, in part by limiting their capacity to burn fuel oil. Since the smaller fuel oil guns effectively reduced the amount of fuel oil used and lowered emissions, the DOH approved replacement of the fuel oil guns as an insignificant activity on May 26, 1988. Based on a review of refinery records, the smaller fuel oil guns were installed in 1999.

The new burners, (being installed as part of the APH project) will also retain the similar smaller sized fuel oil guns. Likewise the future PTE estimates (presented in the comparison table above) retain the conservative assumption that the heaters could be fired exclusively on fuel oil, even though operation in that mode, at full permitted duty, even for a single day is unlikely. On most days with the APH operating and when firing the heaters on a mix of RFG and fuel oil, actual emissions will be substantially less than the PTE estimates provided above.

**Nitrogen Content Limit**

In addition to firing rate limits, the refinery proposes to limit the nitrogen content of the fuel oil to less than 0.5 wt %. The request to add a nitrogen content condition was originally proposed in the April 2005 Title V permit application. Even though the Title V permit does not currently embody the 0.50% nitrogen limit as a condition, the 0.50% criteria has been used as an upper bound for determining emissions under the original 1999 Title V application and as well as the April 2005 application.

The PTE estimates listed for H500-series heaters as well as all liquid fired heaters and boilers was based on a maximum nitrogen content of 0.50 wt % and the emission factor for $NO_x$ emissions from AP-42 is listed below.

$NO_x$ EF = 104.39 * N% + 20.5
= 72.7 $NO_x$ lbs/M gal

When N = 0.5% nitrogen content

The addition of this condition to the reformer heaters (upon issuance of the APH permit), will effectively limit the nitrogen content of all liquid fuel oil boilers and heaters, since fuel oil is charged and supplied by a common unit fuel tank (Tk1103). Moreover the addition of this condition will more formally establish the current basis upon which the PTE for all heaters were calculated and modeled (even if not specifically listed under each permit section). Proposed permit language has already been provided to the DOH and we believe a good basis for its inclusion has already been established.

A permit modification application fee of $1000.00 for a significant modification was submitted by the applicant and processed.

**Equipment:**

One (1) Air Pre-heater (APH) for the four heater system (H501, H502, H503, H504) used in the Catalytic Reformer Unit.

**Applicable Requirements:**

Hawaii Administrative Rules (HAR)
Title 11, Chapter 59 Ambient Air Quality Standards
Title 11, Chapter 60.1 Air Pollution Control
- Subchapter 1 General Requirements
- Subchapter 2 General Prohibition
  - HAR 11-60.1-31 Applicability
  - HAR 11-60.1-39 Storage of Volatile Organic Compounds
- Subchapter 5 Covered Sources
- Subchapter 6 Fees for Covered Sources, Noncovered Sources, and Agricultural Burning
  - HAR 11-60.1-111 Definitions
  - HAR 11-60.1-112 General Fee Provisions for Covered Sources
  - HAR 11-60.1-113 Application Fees for Covered Sources
  - HAR 11-60.1-114 Annual Fees for Covered Sources
  - HAR 11-60.1-115 Basis of Annual Fees for Covered Sources
- Subchapter 8 Standards of Performance for Stationary Sources
- Subchapter 9 Hazardous Air Pollutant Sources

Federal Requirements
40 CFR Part 63 - National Emission Standards for Hazardous Air Pollutants for Source Categories (Maximum Achievable Control Technologies (MACT) Standards)
- Subpart CC - National Emission Standards for Hazardous Air Pollutants from Petroleum Refineries

**Non-Applicable Requirements:**

Hawaii Administrative Rules (HAR)
Title 11, Chapter 60.1 Air Pollution Control
- Subchapter 7 Prevention of Significant Deterioration

**Best Available Control Technology (BACT):**

A Best Available Control Technology (BACT) analysis is applicable only to new covered sources and significant modifications to covered sources that have the potential to emit or a net emissions increase above significant levels as defined in HAR §11-60.1-1. A BACT analysis is not applicable since the there are no emission increases.

**Prevention of Significant Deterioration (PSD):**

Overall the PTE for all four heaters is expecting to decline in aggregate by 27% by derating the heaters and installing the air pre-heater. Therefore, PSD is not triggered.

**Consolidated Emissions Reporting Rule (CERR):**

40 CFR Part 51, Subpart A - Emission Inventory Reporting Requirements, determines CER based on the emissions of criteria air pollutants from Type A and Type B point sources (as defined in 40 CFR Part 51, Subpart A), that emit at the CER triggering levels shown in the table below

**CERR/In-House Reporting Applicability**

| Pollutant | Type A CER Triggering Levels [1,2] (tpy) | Type B CER Triggering Levels [1] (tpy) | Pollutant | In-house Total Facility Triggering Levels [3] (tpy) |
|---|---|---|---|---|
| $NO_x$ | ≥2500 | ≥100 | $NO_x$ | ≥25 |
| $SO_x$ | ≥2500 | ≥100 | $SO_x$ | ≥25 |
| CO | ≥2500 | ≥1000 | CO | ≥250 |
| $PM_{10}/PM_{2.5}$ | ≥250/250 | ≥100/100 | $PM/PM_{10}$ | ≥25/25 |
| VOC | ≥250 | ≥100 | VOC | ≥25 |
| | | | HAPS | ≥5 |

[1]Based on actual emissions
[2]Type A sources are a subset of Type B sources and are the larger emitting sources by pollutant
[3]Based on potential emissions

There is no change from Covered Source Permit No. 0212-01-C. This Type A facility emits above the Type A CER and in-house triggering levels. Therefore, CER and annual emissions reporting requirements are applicable. Also, annual emissions reporting is required for covered sources.

**Compliance Assurance Monitoring (CAM):**

No change from Covered Source Permit No. 0212-01-C. This facility is not subject to CAM. See the Covered Source Permit Review Summary for Covered Source Permit Application No. 0212-21 for more detail.

**Synthetic Minor Source:**

No change from Covered Source Permit No. 0212-01-C. This facility is not a synthetic minor.

**Insignificant Activities:**

No change from Covered Source Permit No. 0212-01-C.

**Alternate Operating Scenarios:**

No change from Covered Source Permit No. 0212-01-C.

**Ambient Air Quality Assessment:**

Through the Title V permit modeling process the refinery has already demonstrated that air quality in the surrounding areas meets both state and federal ambient air quality standards. As a result of de-rating the four CRU heaters, the PTE for all pollutants is being dramatically reduced; therefore there will be no adverse impact on air quality as a consequence of the APH project.

**Significant Permit Conditions:**

1. Revised Attachment II(B), Special Condition No. A.1.c.

    c. Catalytic Reformer Charge Heater, ID n. H501
        i. 80.4 [124.4]MMBtu/hr heat input
        ii. Equipped with a combustion air preheater

2. Revised Attachment II(B), Special Condition No. A.1.d.

    d. Interheater, ID no. H502
        i. 74 [96.4]MMBtu/hr heat input
        ii. Equipped with a combustion air preheater

3. Revised Attachment II(B), Special Condition No. A.1.e.

    e. Interheater, ID no. H503
        i. 36.3 [44.5]MMBtu/hr heat input
        ii. Equipped with a combustion air preheater

4. Revised Attachment II(B), Special Condition No. A.1.f.

    f. Interheater, ID no. H504
        i. 18.4 [21.7]MMBtu/hr heat input
        ii. Equipped with a combustion air preheater

5. Revised Attachment II(B), Special Condition No. C.1.

    1. The naphtha hydrotreater charge heater H401 and naphtha hydrotreater reboiler H402 shall be fired only on refinery fuel gas (RFG) with a hydrogen sulfide ($H_2S$) content not to exceed 230 mg/dscm (0.10 gr/dscf). Catalytic reformer charge heaters/interheaters H501, H502, H503, and H504 shall be fired only on refinery fuel gas (RFG) with a hydrogen sulfide ($H_2S$) content not to exceed 230 mg/dscm (0.10 gr/dscf) or fuel oil with a maximum sulfur and nitrogen content not to exceed 0.50% by weight or a combination of both fuels. The total of all sulfur compounds in the refinery fuel gas (RFG) shall not exceed the total sulfur equivalent of 258 ppm.

6. Added Attachment II(B), Special Condition No. C.6.

    6. The combined firing rate of H501, H502, H503 and H504 on both liquid and gaseous fuel shall not exceed 209.1 MMBtu/hr (HHV) based on a rolling twelve-month (12-month) average.

7. Revised Attachment II(B), Special Condition No. D.3.

    3. Sulfur and Nitrogen Content and Higher Heating Value of[in] the Fuel

        a. The sulfur content of the fuel oil to be fired shall be tested in accordance with the most current American Society for Testing and Materials (ASTM) methods as specified by this permit or by alternative methods as authorized by the Department of Health. ASTM Method D4294-02[90] is a suitable alternative to Method D129-64 for determining the sulfur content. The fuel oil sulfur content shall be verified by having a representative sample [of each batch] of fuel oil analyzed for sulfur content by weight at least twice[once] per **month**. [Records of the sulfur content of the fuel oil shall be maintained on a **monthly** basis]. Compliance with the sulfur standard shall be determined by averaging the analytical results obtained throughout the month.

        b. The nitrogen content of the fuel oil to be fired shall be tested in accordance with the most current version of American Society for Testing and Materials (ASTM) method D5762 or by alternative methods as authorized by the Department of Health. The fuel oil nitrogen content shall be verified by having a representative sample of fuel oil analyzed for nitrogen content by weight at least twice per **month**. Compliance with the nitrogen standard shall be determined by averaging the analytical results obtained throughout the month.

        c. The higher or gross heating value (GHV) of the fuel oil to be fired shall be tested in accordance with the most current version of American Society for Testing and Materials (ASTM) method D4868-00 or D240-02 or by alternative methods as authorized by the Department of Health. The fuel oil HHV content shall be verified by having a representative sample of fuel oil analyzed for HHV at least twice per **month**.

        d. The total sulfur (TS) content of the RFG to be fired shall be tested in accordance with the most current version of American Society for Testing and Materials (ASTM) method D5504 or by alternative methods as authorized by the Department of Health. A representative sample of the RFG shall be taken and analyzed for the total sulfur content by weight at least twice per **month**. Compliance with the total sulfur standard shall be determined by averaging the analytical results obtained throughout the month.

        e. The higher heating value (HHV) of the RFG to be fired shall be tested using gas chromatography (ASTM methods D2504, D2597 and/or D2163), and calculated according to ASTM method 2598 or by alternative methods as authorized by the Department of Health. The HHV of the RFG shall be verified by having a representative sample of the RFG analyzed for HHV at least twice per **month**.

8. Added Attachment II(B), Special Condition No. D.6.

    6. The permittee shall operate and maintain (either individual or collective) non-resetting fuel meters to record the amount of RFG and liquid fuel oil fired in the reformer heaters H501, H502, H503 and H504. The non-resetting meters shall not allow the manual

resetting or other manual adjustment of the meter readings. The installation of any new non-resetting meter or the replacement of any existing non-resetting meter shall be designed to accommodate a minimum of five (5) years of equipment operation, considering any operational limitations, before the meter returns to a zero reading.

9 Revised Attachment II(B), Special Condition No. E.2.

2. The permittee shall submit **semi-annually** written reports to the Department of Health for monitoring purposes. The reports shall be submitted **within sixty (60) days** *after the end of each semi-annual calendar period (January 1 to June 30 and July 1 to December 31)* and shall include the following:

   a. Any opacity exceedances as determined by the required VE monitoring. Each exceedance reported shall include the date, six (6) minute average opacity reading, possible reason for exceedance, duration of exceedance, and corrective actions taken. If there were no exceedances, the permittee shall submit in writing a statement indicating that for each equipment there were no exceedances for that semi-annual period.

      The enclosed **Monitoring Report Form: Opacity Exceedances** or an equivalent form shall be used.

   b. Any fuel analysis conducted by the permittee or permittee's laboratory during the reporting period showing the total sulfur content of the RFG and the sulfur and nitrogen content of fuel oil, along with the monthly averages.

   c. Any fuel analysis conducted by the permittee or permittee's laboratory during the reporting period showing the higher heating value (HHV) of the RFG and gross or higher heating value (GHV) of the fuel oil, along with the monthly averages.

   d. Any other laboratory data such as API gravity which may be necessary to accurately calculate a firing rate based the meters that are used to measure the gaseous and liquid firing rate.

   e. The average aggregated firing rate for all four (4) of catalytic reformer heaters H501, H502, H503 and H504 in MMBtu/hr (HHV) on a monthly and rolling twelve (12) month basis. The basis for that calculation including fuel rates and heating values shall be clearly defined and reported.

   f. Any periods during which required fuel meters were malfunctioning, being maintained or otherwise unavailable shall be reported.

   g[c]. Any deviations from permit requirements shall be clearly identified.

**Conclusion and Recommendations:**

Recommend issuance of the significant modification to existing Covered Source Permit No. 0212-01-C based on the significant permit conditions shown above. Compliance with all State and Federal regulations will be maintained, including the State and National ambient air quality standards. A 30-day public comment period and a 45-day EPA review period are also required before issuance of the permit modification.

Reviewer: Darin Lum
Date:11/2011