PROPOSED
(August 20, 2003)

Significant Modification to a Covered Source
Review Summary

Application File No.: 0212-18

Permit No.: 0212-01-C

Applicant: Tesoro Hawaii Corporation

Facility Title: Petroleum Refinery
Located at 91-325 Komohana Street, Kapolei, Oahu

Mailing Address: Tesoro Hawaii Corporation
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Kapolei, HI 96707

Responsible Official: Mr. James Kappel
Vice President, Refinery Manager
Tesoro Hawaii Corporation
91-325 Komohana Street
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Point of Contact: Mr. Theodore K. Metrose
Manager, Refinery Environmental Affairs
Tesoro Hawaii Corporation

Application Date: Minor Modification application dated November 11, 2002
Significant Modification application and additional information dated March 31, 2003

Proposed Project:

SICC 2911 (Petroleum Refining)

The applicant plans to construct a flare gas vapor recovery system (VRS). The proposed modification will reduce the amount of offgas being flared and reduce emissions from the flare. Offgas will be collected from the flare gas header, using a compressor, and treated to remove sulfur-bearing compounds. After treatment the recovered offgas will be used as refinery fuel gas in heaters and boilers.

The 24" flare is 183.7 feet tall and was built in 1972 when the refinery was constructed. Waste gases from various process units are routed to the flare through a series of pipes and knock out drums, referred to as the flare header. The flare header is not specifically listed on the permit. The flare header is subject to periodic monitoring for fugitive leaks like other miscellaneous process piping and as a closed vent system.

Virtually every process unit in the refinery has the capacity to vent to the flare through the flare header system. The maximum diameter of the flare header is 24 inches. Aside from the knock-out/seal drum which is built into the base of the flare, there are two knockout drums D1111 and D1133 which are located well upstream of the flare. The knockout drums are configured in series, but offgases from several units are routed through a 20" header directly to D1133 bypassing D1111. The knockout drums are equipped with pumps, which are actuated on level control to remove liquids (hydrocarbons and water) from the flare system. Since the velocities are reduced in the knockout drum, particulates in the gas are also removed. The flare gas exiting the knock out drum (D1133) is routed through a 24" line approximately 350' in length and away from the process unit, to the flare's knockout/seal drum. In between D1133 and the flare, there is a Panametrics ultrasonic flow meter, which is used to measure the velocity and amount of waste gas. (The Panametrics meter also provides the molecular weight (MW) of the flare gas, which is determined by empirical equations that utilize specific heating values of typical waste gas.)

At its base, the flare (drum) is 8 feet in diameter. The height of the water column within the seal drum, which prevents air (oxygen) from entering the header, is maintained with city supplied water and drain pumps, which are also actuated on level control. There are three pilots spaced at an equal distance around the flare tip. The three pilots are fed through 1" assemblies and are augmented by 3 electronic igniters, which burn a mix of instrument air and filtered refinery fuel gas. An infrared sensor is used to ensure that the pilot' gas remains lit. To reduce the potential for smoking, steam is supplied to the top of the flare through 15 tips at the circumference. The steam to the flare is metered and controlled manually. The flare is also equipped with a retention or stability ring. The ring is actually a series of metal tabs about 1.5" by 1" high. The metal tabs are slotted and each is individually welded on to the 24" flare pipe, at a slight inward angle. The ring creates an eddy current, such that at least a portion of the flare gas stays close to the flare tip rather than being lifted off by its own velocity or by being blown off by crosswinds. Keeping the flare gas close to the tip helps ensure that the flare remains lit because of improved proximity to the pilots.

The proposed project will not modify the flare itself but rather the flare header system and the amount of gas being flared. The refinery proposes to install a flare gas VRS capable of recovering 466 MSCFD. The flare offgas is generated from a variety of sources throughout the refinery, such as equipment purges, process pressure control, and offgas vents. The recovered flare gas is a valuable source of energy that can be treated and used as refinery fuel gas. Emissions associated with the offgas flaring will be reduced since the recovered offgas will be desulfurized in the Amine Treatment Unit (ATU). After treatment the gas will then be burned as fuel in the various gas-fired heaters.

The flare gas VRS compressor will pull flare gas from the knockout drum closest to the flare (D1133) through an 8" line, boost its pressure and route it to the ATU for treatment. Hydrogen sulfide will be treated and ultimately removed from the recovered gas. As with other offgases, which are collected and amine treated, those collected from the flare header will be directed to the refinery's main fuel gas mix drum. The treated gas will continue to meet the NSPS Subpart J for hydrogen sulfide content. No changes are required to the ATU to treat the offgas as this

system has sufficient capacity to accept the quantity of gas being recovered from the flare.

New equipment to be installed includes a 2-stage reciprocating compressor, knock out drums, heat exchangers, condensers, pumping equipment, above ground vessels, piping and instrumentation.

The flare gas VRS will not operate on a continuous or fully loaded basis. The refinery anticipates on a rolling average basis, that the flare gas VRS will recover 85 MMSCF/yr. There will be malfunctions directly associated with the flare gas VRS, especially the compressor and other equipment that impact the flare gas VRS. In addition, the flare gas VRS will likely not operate when there are major turnarounds. Proper vessel depressurization often involves the use of N_2, which is ultimately purged to the flare. The is no economic benefit in recovering N_2 from the flare header. Moreover, collecting N_2 rich waste gas can actually be detrimental to the refinery's operation. Nitrogen recovered from the flare header would lower the heating value of the fuel gas and cause heaters and boilers to "sag" due to an insufficient amount of Btu input. Excessive amounts of hydrogen caused by emergency release events can have a similar though not as dramatic impact. The flare gas VRS will not be operated anytime there is a planned or unplanned outage of the Sulfur Recovery Unit/ Tail Gas Unit (SRU/TGU). When these systems are not operating, recovery of offgases from the flare is without merit. Although in theory the offgases can be collected and potentially treated, the concentrated sour offgas from the ATU, which is normally routed to the SRU/TGU still must be controlled (oxidized). The best and realistically the only place to burn sour offgas that cannot be removed by the (non-operational) SRU/TGU is the flare. Consequently, the flare gas VRS will not be operated when neither SRU #2 nor SRU #3 are operational, typically due to malfunctions or major turnarounds.

In summary, although the flare gas VRS was designed with a capacity to recover 466 MSCFD, it will not be operated on a continuous or fully loaded basis nor will it be used to recover all waste gas.

There will be times when the flare gas VRS will not be operated due to:
- Planned and unplanned shutdowns of the SRU/TGU
- Planned and unplanned shutdowns of the flare gas VRS for repairs and/or maintenance
- Insufficient BTU content of the flare gas

In addition, the VRS will not always be operated at its design capacity because:
- The amount of offgas being generated and routed to the flare header is less than the design basis
- The amount of offgas being routed to the flare is more than the design basis
- Actual flare gas VRS performance may be less than design
- Deterioration in performance of the compressor and VRS over time

Taking all of these factors into account leads to a utilization rate that could in any given year, due principally to turnarounds, be as low as 50%. Emission estimates and the reduction in air emissions have been projected accordingly based on an average annual recovery of 85 MMSCF/yr.

The new flare gas vapor recovery system and compressor C1180 will be subject to NSPS Subpart GGG. Pursuant to 40 CFR §60.482-3(h), it is exempt from monitoring of the compressor seals since the compressor seals are purged to the flare. All other valves associated with the compressor are subject to the standards for valves set forth in 40 CFR §60.482-7.

A permit modification application fee of $200.00 for a minor modification was submitted by the applicant on November 11, 2002, and processed. Later, as a result of the modification being determined to be a significant permit modification, an application fee of $1,000.00 for a significant modification was submitted by the applicant on March 31, 2003 and processed.

Equipment:

New equipment to be installed includes a 2-stage reciprocating compressor, knock out drums, heat exchangers, condensers, pumping equipment, above ground vessels, piping and instrumentation.

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
- 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

Federal Requirements
40 CFR Part 60 - Standards of Performance for New Stationary Sources (NSPS)
- Subpart GGG - Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries

Non-Applicable Requirements:

Hawaii Administrative Rules (HAR)
Title 11, Chapter 60.1 Air Pollution Control
Subchapter 7 Prevention of Significant Deterioration
Subchapter 9 Hazardous Air Pollutant Sources
HAR 11.60.1-174 Maximum Achievable Control Technology (MACT) Emission Standards

Federal Requirements
40 CFR Part 61 - National Emission Standards for Hazardous Air Pollutants (NESHAPS)

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

Reason: Subpart CC, i.e. 40 CFR §63.640, is not applicable to the flare gas vapor recovery system (VRS) because the HAPS content of the flare gas is less than 5% by weight per 40 CFR §63.640(d)(3).

New Source Performance Standards (NSPS):

The new flare gas vapor recovery system and compressor C1180 will be subject to NSPS Subpart GGG - Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries. Pursuant to 40 CFR §60.482-3(h), it is exempt from monitoring of the compressor seals since the compressor seals are purged to the flare. All other valves associated with the compressor are subject to the standards for valves set forth in 40 CFR §60.482-7.

Best Available Control Technology (BACT):

A Best Available Control Technology (BACT) analysis is not applicable since there is no net emissions increase from the proposed modification. There will be a net emissions reduction of NO_x, SO_2, CO, PM/PM_{10} and VOC as a result of the project.

Prevention of Significant Deterioration (PSD):

This significant modification is not subject to PSD review as the modification does not result in any net emission increases:

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 as shown in the table below.

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

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

This facility emits above the Type A CER (VOC) and in-house triggering levels. Therefore, CER and in-house reporting requirements are applicable.

Compliance Data System (CDS):

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

Compliance Assurance Monitoring (CAM):

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

Synthetic Minor Source:

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

Insignificant Activities:

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

Alternate Operating Scenarios:

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

Project Emissions:

The proposed flare gas VRS will result in an overall decrease in emissions since less offgas will be burned in the flare and the recovered offgas be used to fuel heaters and boilers as refinery fuel gas (RFG). The proposed project emissions are shown below:

Pollutant	Emissions Reduction at Flare (tpy)	Fugitive Emissions Increase from Project (tpy)	Net Emissions Reduction (tpy)
SO_2	30.27 [1]	0	**30.27**
NO_x	2.84 [2]	0	**2.84**
PM_{10}	0.11 [3]	0	**0.11**
CO	15.44 [4]	0	**15.44**
VOC	5.84 [5]	4.17	**1.67**

Flare Gas Vapor Recovery System Emissions Reduction
Offgas Recovery Design Basis - 466000 SCF/day
Flare Gas Recovery Utilization - 50%
Average Offgas Recovery Rate - 9708 SCF/hr or 85,042,080 SCF/yr (85 MMSCF/yr)
Average Sulfur Concentration - 4216 ppm total sulfur
Average Flare Gas Heat Value - 982 Btu/SCF

[1] SO_2 Emissions Reduction (based on flare offgas sulfur data)
(9708 SCF/hr) x (1 lb-mol/379 SCF) x (1 mol SO_2/1 mol S) x (64 lbs/lb-mol) x (4216/1,000,000) = 6.9 lbs/hr = **30.27 tpy**

[2] NO_x Emissions Reduction (AP-42, 9/91, Table 13.5-1 Emission Factors for Flare Operations)
(9708 SCF/hr) x (982 Btu/SCF) x (0.068 lbs/1,000,000 Btu) = 0.6 lbs/hr = **2.84 tpy**

[3] PM_{10} Emissions Reduction (AP-42, 9/91, Table 13.5-1 Emission Factors for Flare Operations, soot - lightly smoking flare)
(9708 SCF/hr) x (28.3 L/SCF) x (0.00004 g/L) x (1lb/453.6 g) = 0.024 lbs/hr = **0.11 tpy**

[4] CO Emissions Reduction (AP-42, 9/91, Table 13.5-1 Emission Factors for Flare Operations)
(9708 SCF/hr) x (982 Btu/SCF) x (0.37 lbs/1,000,000 Btu) = 3.5 lbs/hr = **15.44 tpy**

[5] VOC Emissions Reduction (AP-42, 9/91, Table 13.5-1 Emission Factors for Flare Operations)
(9708 SCF/hr) x 982 Btu/scf) x (0.14 lbs/1,000,000 Btu) = 1.3 lbs/hr = **5.84 tpy**

Flare Gas Vapor Recovery System Fugitive Emissions Increase [1]

Equipment Type	Service	Source Number [2]	Emission Factor (kg/hr per source)	Emissions (kg/hr)	Emissions (lb/hr)
Valves	Gas	17	0.0268	0.46	1.00
Valves	Light liquid	25	0.0109	0.27	0.60
Pump Seals	Light liquid	1	0.114	0.11	0.25
Compressor Seals	Gas	[3]	0.636	[3]	[3]
Pressure Relief Valves	Gas	2	0.16	[4]	[4]
Connectors	All	88	0.00025	0.02	0.05
Open End Lines	All	0	0.0023	0.00	0.00
Sample Connections	All	0	0.015	0.00	0.00
Total Emissions					1.90
Total Emissions [5]					**4.17 tpy**

[1] Preferred and Alternate Methods for Estimating Fugitive Emissions from Equipment Leaks Final Report, November 1996, by Eastern Research Group for Emission Inventory Improvement Program for Emission Inventory Improvement Program and US EPA, Table 4.5-2 Refinery Average Emission Factors

[2] Sources estimated from Flare Gas Compressor Project P&ID 8/29/02

[3] Compressor subject to NSPS Subpart GGG and compressor seals controlled by N_2 purge to flare on all piston rod packings per 40 CFR §60.592(a) and §60.482-3

[4] PRV piped to flare not to atmosphere

[5] This is based on 50% utilization during 365 days per year

Air Quality Assessment:

Air impacts from the flare will decrease as a result of this proposed project since flare emissions will be reduced.

Significant Permit Conditions:

The following permit conditions in the covered source permit were modified. As is custom when modifying regulatory language, new language is underlined, while [deleted language is shown in brackets].

1. (New Permit Condition) Attachment II(L), Special Condition No. C.5.

   The flare gas vapor recovery system (VRS) shall recover no less than 85 MMSCF of offgas per any rolling twelve (12) month period.

   (Auth.: HAR §11-60.1-3, §11-60.1-5, §11-60.1-90)[1]
   Reason: The quantity of offgas recovered by the VRS is being permitted for annual emissions reporting purposes. The VRS will result in a net emissions reduction by the flare.

2. (New Permit Condition) Attachment II(L), Special Condition No. D.3.

   The permittee shall install and maintain a device for recording the amount of offgas being recovered by the flare gas vapor recovery system (VRS).

   (Auth.: HAR §11-60.1-3, §11-60.1-5, §11-60.1-11, §11-60.1-90)[1]

   Reason: A monitoring device is necessary to monitor the quantity of offgas recovered by the VRS.

3. (New Permit Condition) Attachment II(L), Special Condition No. D.4.

   The permittee shall keep records of the quantity of offgas recovered by the flare gas vapor recovery system (VRS) in MMSCF on a monthly and rolling twelve (12) month basis.

   (Auth.: HAR §11-60.1-3, §11-60.1-5, §11-60.1-11, §11-60.1-90)[1]

   Reason: Recordkeeping for Attachment II(L), Special Condition No. C.5.

4. Renumber Attachment II(L), Special Condition No. D.3. to Special Condition No. D.5.

5. Attachment II(L), Special Condition No. E.5.

   The permittee shall submit **semi-annually** written reports to the Department of Health for monitoring purposes. The report 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. Results of any Method 22 visible emissions test performed. Include the time and date of test and the corrective actions taken.

   b. [Any deviations from permit requirements shall be clearly identified.]
   The monthly and rolling twelve (12) month quantity of offgas recovered by the flare gas vapor recovery system (VRS) in MMSCF. The **Monitoring Report Form: Flare Gas Vapor Recovery System**, shall be used for reporting the quantity of offgas

recovered.

c. Any deviations from permit requirements shall be clearly identified.

(Auth.: HAR §11-60.1-3, §11-60.1-5, §11-60.1-90, §11-60.1-174; 40 CFR §63.654)[1]

Reason: Reporting for Attachment II(L), Special Condition No. C.5.

6. Attachment II(O), Special Condition No. B.1.

All valves, pumps, pressure relief devices, sampling connection systems, open-ended valves or lines, and flanges or other connectors *in VOC service* as defined in §60.481 of 40 CFR Part 60, Subpart VV, at the Crude Distillation Unit (CDU), Vacuum Distillation Unit (VDU), Distillate Hydrocracker Unit (DHC), Asphalt Manufacturing Unit (AMU), Visbreaker Unit (VBK), Mercaptan Treatment Units, Amine Treatment Unit (ATU), Light Ends Recovery Unit (LERU) except for T2501 (Deethanizer) and T2502 (C3/C4 Splitter), Fuel Gas System in the Utilities Area, the Flare Gas Vapor Recovery System, and Compressors C103, C602C, C901, C1180 and C2503, are subject to the provisions of the following federal regulations:

a. 40 CFR Part 60, New Source Performance Standards (NSPS)

i. Subpart A, General Provisions; and
ii. Subpart GGG, Standards of Performance for Equipment Leaks of VOC in Petroleum Refineries.

The permittee shall comply with all applicable requirements of these standards, including all emission limits, notification, reporting, monitoring, testing and recordkeeping requirements. The major requirements of these standards are detailed in the special conditions of this permit.

(Auth.: HAR §11-60.1-3, §11-60.1-90, §11-60.1-161, 40 CFR §60.1, §60.590)[1]

Reason: The new flare gas vapor recovery system and compressor C1180 will be subject to NSPS Subpart GGG. Pursuant to 40 CFR §60.482-3(h), it is exempt from monitoring of the compressor seals since the compressor seals are purged to the flare. All other valves associated with the compressor are subject to the standards for valves set forth in 40 CFR §60.482-7.

7. The **Monitoring Report Form: Flare Gas Vapor Recovery System** was added to the permit for the semi-annual reporting of the quantity of offgas recovered.

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. The proposed project will

result in an emissions decrease from the flare. A 30-day public comment period and a 45-day EPA review period are also required.

Reviewer: Darin Lum
Date: 8/03