



ENGINEERING CALCULATION SHEET AIR RESOURCES DIVISION

6 Hazen Drive Concord, NH 03302-0095
Phone: 603-271-0905 Fax: 603-271-7053

| | | | |
|----------------------|--|-------------------------------|-------------|
| PROJECT NAME: | Sprague Energy Corporation (AFS # 3301500041) Title V Operating Permit (Renewal) SIC Code: 4226 (Bulk fuel storage facility) | ENGINEER: Padmaja Baru | |
| | | DATE: 6/14/06 | Page 1 of 7 |

DATE APPLICATION RECEIVED: February 28, 2005 (Application # FY05-0085)

FACILITY DESCRIPTION

Sprague Energy Corporation (Sprague), located on 194 Shattuck Way, is a bulk gasoline terminal with ancillary asphalt storage and truck loading facilities. Gasoline received by barge or ship is transferred to any one of three aboveground storage tanks. The gasoline is then transferred to tank trucks via a truck loading rack for hauling to retail locations using submerged loading. The gasoline vapors displaced from the loading trucks are captured and destructed by a flare (vapor incinerator). An electrical interlock will not allow for gasoline loading if the incinerator is not in operation. Gasoline additives, stored in small aboveground tanks near the truck loading rack are added to gasoline in metered quantities during the tank truck filling. In June 2004, the Methyl methacrylate (MMA) tank #11 and loading rack were converted for the storage and distribution of aviation gasoline. This action was permitted under the Temporary Permit TP-BP-0689. Under emergency conditions, barges or ships are loaded from the gasoline tanks. Emergency conditions include situations where a tank must be quickly removed from service. Barges and ships are loaded through submerged fill.

Sprague also receives an asphalt precursor (petroleum refinery bottoms) via ship or barge, and stores the asphalt in eight dedicated aboveground storage tanks. The asphalt is distributed via a truck loading rack separate from the gasoline truck loading area. Additives, kerosene and hydrolene, are applied to the asphalt in metered quantities upon tank truck filling. The kerosene and hydrolene are stored in aboveground storage tanks. The asphalt truck loading area is equipped with an active vent system connected to a mist eliminator to prevent asphalt mists from causing odors. The asphalt tanks are heated by a Dowtherm system to maintain the asphalt in a flowable state. The Dowtherm system uses two No. 2 fuel oil-fired boilers. The No. 2 fuel oil is stored in an aboveground storage tank. Sprague is a major source for Volatile Organic Compounds (VOCs) and is therefore required to obtain a Title V Operating Permit.

PROJECT DESCRIPTION

The purpose here is to renew the facility's Title V operating permit. TV-OP-030 expired on August 31, 2005. Sprague filed a complete Title V renewal application on February 28, 2005. The application was deemed complete by default. A site visit was conducted on March 23, 2006. This permit covers the following devices:

| ID | Description | Installation Dates |
|------|--|---|
| EU01 | Gasoline Storage Tank #1 - 3,722,533 gallons capacity | Originally stored JP-4 fuel; Modified RFG in 1997 |
| EU02 | Gasoline Storage Tank #2 - 3,722,533 gallons capacity | |
| EU03 | Gasoline Storage Tank #5 - 6,080,843 gallons capacity | |
| EU04 | Gasoline Truck loading operations- Annual throughput is limited to 210,000,000 gal/yr ¹ | 1997 |
| EU05 | Gasoline Barge/Ship loading operations | n/a |
| EU06 | Aviation Gasoline Storage Tank #11 - 616,818 gallons capacity | The tank was modified in 2004 (by adding an internal floating roof) to store aviation gasoline. |
| EU07 | Aviation Gasoline Truck loading operations - Annual throughput | 2004 (start-up date for aviation |

¹ The maximum throughput rate of gasoline through the terminal was limited to 155,000,000 gal/yr in the state operating permit PO-BP-2771 (issued on June 15, 1999). Sprague requested for an increase in the throughput limit in its 1996 Title V application.



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| | | DATE: 6/14/06 | Page 2 of 7 |

| ID | Description | Installation Dates |
|------|-----------------------------------|--|
| | is limited to 2,100,000 gal/yr | gasoline loading; this rack was previously used to load MMA) |
| EU08 | Dowtherm Boiler #1 - 8 MMBTU/hr | 1991 |
| EU09 | Dowtherm Boiler #2 - 9.9 MMBTU/hr | 1992 |

EMISSION CALCULATIONS

| VOC emissions from storage tanks | | | |
|---|---------------------|------------------------|------------------------|
| Emission Unit | Material stored | Annual Emissions (TPY) | Calculation Method |
| EU01 (Gasoline storage tank #1) | RFG (RVP 9, RVP 13) | 3.58 | EPA Tanks 4.09 program |
| EU02(Gasoline storage tank #2) | RFG (RVP 9, RVP 13) | 3.58 | |
| EU03 (Gasoline storage tank #5) | RFG (RVP 9, RVP 13) | 4.24 | |
| EU06 (Aviation Gasoline storage tank #11) | Aviation Gasoline | 0.9 | |
| | | Total = 12.3 TPY | |

RFG = Reformulated Gasoline; RVP = Reid vapor pressure

- Calculations for gasoline storage tanks 1, 2 & 5 are based on an annual throughput limit of 210,000,000 gallons.
- Calculations for aviation gasoline storage tank #11 are based on an annual throughput limit of 2,100,000 gallons.
- For detailed calculations, i.e., Tanks program output, please see Appendix E of the Title V application.

| HAP Emissions from storage tanks | | | |
|--|------------------------|--------------------------------|------------------------|
| Emission Unit | HAP | Weight % in vapor ² | Annual Emissions (TPY) |
| EU01, EU02, EU03 & EU06 (Combined) | MTBE | 11.12% | 1.37 |
| | Hexane | 1.4% | 0.17 |
| | Benzene | 0.4% | 0.05 |
| | Toluene | 1.1% | 0.14 |
| | Ethylbenzene | 0.1% | 0.01 |
| | o-Xylene | 0.4% | 0.05 |
| | 2,2,4-Trimethylpentane | 0.7% | 0.09 |

(sample calculation: MTBE = 12.3 x 11.12% = 1.37 tons)

² Gasoline Distribution Industry (Stage I) Background Information for Proposed Promulgated Standards (EPA-453/R-94-002b)



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| | | DATE: 6/14/06 | Page 3 of 7 |

VOC emissions from RFG & Aviation Gasoline truck loading operations (EU04 & EU07)

VOC emissions from gasoline truck loading operations are calculated using the following equation from AP-42 Chapter 5.2 *Transportation and Marketing of Petroleum Liquids*:

$$L_L = 12.46 * (SPM/T)$$

where

L_L = loading loss, pounds of VOCs per 1000 gallons of liquid loaded

S = saturation factor from Table 5.2-1 of AP-42 (Sprague uses submerged loading; S = 1.0)

P = true vapor pressure of liquid loaded, psi (2.211 for aviation gasoline, 4.2655 for RVP 9 & 4.83 for RVP 13)

M = molecular weight of vapors, lb/lb-mole (69 for aviation gasoline, 67 for RVP 9 & 62 for RVP 13)

T = temperature of bulk liquid loaded, °R (°F + 460) (i.e., in this case 45.3 + 460 = 505.3 °R)

Annual throughput limit for Aviation gasoline = 2,100,000 gallons/yr

Annual throughput limit for RFG = 210,000,000 gal/yr

Aviation Gasoline Loading loss, $L_L = 12.46 * (1.0 * 2.211 * 69/505.3) * 2,100,000$ gallons/yr * 1/1000 * 1 ton/2000 lbs
= 3.95 tons of VOCs uncontrolled

Using a destruction efficiency of 98.5%³ for the flare, VOC emissions = 3.95 * (1-0.985) = 0.06 tons/yr

RFG -RVP 9 Loading loss, $L_L = 12.46 * (1.0 * 4.2655 * 67/505.3) * 87,499,995$ gallons/yr * 1/1000 * 1 ton/2000 lbs
= 308.31 tons of VOCs (uncontrolled)

Using a destruction efficiency of 98.5% for the flare, VOC emissions = 308.31 * (1-0.985) = 4.63 tons/yr

RFG -RVP 13 Loading loss, $L_L = 12.46 * (1.0 * 4.831 * 62/505.3) * 122,499,993$ gallons/yr * 1/1000 * 1 ton/2000 lbs
= 452.38 tons of VOCs (uncontrolled)

Using a destruction efficiency of 98.5% for the flare, VOC emissions = 452.38 * (1-0.985) = 6.79 tons/yr

Total VOC emissions from RFG loading = 4.63 + 6.79 = 11.42 tons/yr

Total VOC emissions from RFG and aviation gasoline loading = 11.42 + 0.06 = 11.48 TPY

| HAP Emissions from RFG and Aviation gasoline loading | | | |
|---|------------------------|--------------------------------|------------------------|
| Emission Unit | HAP | Weight % in vapor ¹ | Annual Emissions (TPY) |
| EU04 & EU07 | MTBE | 11.12% | 1.28 |
| | Hexane | 1.4% | 0.16 |
| | Benzene | 0.4% | 0.046 |
| | Toluene | 1.1% | 0.126 |
| | Ethylbenzene | 0.1% | 0.011 |
| | o-Xylene | 0.4% | 0.046 |
| | 2,2,4-Trimethylpentane | 0.7% | 0.08 |

³ Based on stack test conducted in September 2004.



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| | | DATE: 6/14/06 | Page 4 of 7 |

VOC emissions from gasoline loading to Barge (EU05)

VOC emission factor = 3.4 lb/1000 gal transferred (Table 5.2-2 *VOC Emission factors for gasoline loading operations at marine terminals*, AP-42 Chapter 5.2)

Maximum throughput rate of gasoline for “non-emergency conditions” is limited to 40,000 barrels/yr or 1,704,000 gallons/yr

VOC emissions from gasoline loading to Barge = 3.4 lb/1000 gal x 1,704,000 gal/yr x 1 ton/2000 lbs = 2.9 tons

Dowtherm Boilers (EU08 & EU09)

| Pollutant | AP-42 Emission factor (lbs/1000 gal) | Boiler #1 (8 MMBTU/hr) Potential Emissions | | Boiler #2 (9.9 MMBTU/hr) Potential Emissions | | Actual Emissions in 2004 ^a for both the boilers combined TPY |
|------------------|---|---|-------|---|------|---|
| | | lb/hr | TPY | lb/hr | TPY | |
| TSP | 2 | 0.114 | 0.5 | 0.141 | 0.62 | 0.61 |
| PM ₁₀ | 1.10 | 0.063 | 0.275 | 0.078 | 0.34 | 0.34 |
| SO ₂ | 56.8 | 3.25 | 14.22 | 4.01 | 17.6 | 17.37 |
| NO _x | 20 | 1.14 | 5.0 | 1.41 | 6.2 | 6.12 |
| CO | 5 | 0.29 | 1.27 | 0.354 | 1.55 | 1.53 |
| VOCs | 0.34 | 0.019 | 0.09 | 0.024 | 0.11 | 0.1 |

^a Total consumption of #2 fuel oil in 2004 was 611,580 gallons.

Note: Both these boilers are below the permitting threshold of 10 MMBTU/hr (Env-A 607.01(a)). Since the actual emissions are greater than 1000 lbs/yr, the two boilers are significant activities under the Title V permit.



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| | | DATE: 6/14/06 | Page 5 of 7 |

INSIGNIFICANT ACTIVITIES

| Emission Unit | Reason | |
|---|--|--|
| Gasoline Additive storage tanks One 8000 gal tank and three 3000 gal tanks | Vapor pressure of additives is less than 1.52 psia @ 60°F; capacity < 40,000 gal | Env-A 609.04(d) |
| Eight Asphalt storage tanks including one 6,107,281 gal tank ⁴ | Vapor pressure is less than 1.52 psia @ 60°F Actual emissions < 1000 lbs/yr. | Env-A 609.04(d) |
| Asphalt additive tanks one 20,000 gal Kerosene storage tank one 20,000 gal Hydrolene storage tank | Vapor pressure of additives is less than 1.52 psia @ 60°F; capacity < 40,000 gal | |
| Asphalt loading rack - Two bays are connected to particulate mist control equipment | No applicable requirements | Specific calculations for the asphalt truck loading activities were not included in the application, as the physical properties of asphalt are highly variable and accurate data for asphalt under transfer conditions is difficult to obtain. |
| Diesel storage tank - 175,052 gal | Vapor pressure is less than 1.52 psia @ 60°F | Not subject to VOC RACT or NSPS subpart Kb based on low vapor pressure |
| Diesel transfer loading rack | | |
| #2 Fuel oil storage tank - 18,000 gal | Below permitting threshold | |
| Emergency fire pump - 179 hp | Below permitting threshold | |

PERMITTING HISTORY

1. Temporary permit TP-BP-0689 was issued on June 2, 2004 for the storage and distribution of Aviation gasoline.
2. Title V permit TV-OP-030 was issued on August 31, 2000. An administrative amendment to the permit was issued on December 1, 2000.
3. State operating permits PO-B-2771 (gasoline loading terminal) and PO-BP-2770 (four gasoline storage tanks) were issued on June 15, 1999.

CAM RULE

Compliance Assurance Monitoring (CAM) rule applies to Title V sources that operate emission units with pre-controlled potential emissions at or above the major source thresholds that rely on control devices to comply with applicable requirements. The purpose of CAM is to provide a reasonable assurance of compliance with the applicable requirements and emission standards. CAM rule establishes criteria for monitoring, record keeping and reporting that should be conducted by the facility to provide a reasonable assurance of compliance with the emission limits and standards.

Sprague is subject to CAM rule because it is a Title V facility that:

- ✓ Is subject to an applicable limit (in this case 20 mg VOCs/liter of gasoline loaded -- applicable to the loading rack);
- ✓ Uses a control device (i.e., a flare) to achieve compliance;
- ✓ Loading rack(s) is a major source of VOCs before control and a minor source after control; and
- ✓ Is not eligible for NSPS exemption under 40 CFR 64.2(b)(1)(i), as the promulgation of the applicable NSPS requirements for Bulk Gasoline Terminals (subpart XX) occurred prior to November 15, 1990.

The permit requires VOC stack testing every 3 years (not a new requirement) and weekly & semi-annual inspection and maintenance. Table 5A of the Title V permit outlines various monitoring requirements that will assure facility's compliance with the VOC limit.

⁴ Designated as EU03 in the old Title V permit. This tank was previously used to store gasoline and was converted to an asphalt storage tank in January 2004. This asphalt storage tank is not subject to VOC RACT or NSPS subpart Kb based on low vapor pressure.



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| | | DATE: 6/14/06 | Page 6 of 7 |

STACK TEST SUMMARY

| Date of stack test | Results | | Permit Requirements | |
|--------------------|------------------------------------|-------------------------------------|----------------------------|-------------------------------------|
| | VOCs emitted, mg/liter of gasoline | Destruction efficiency of the flare | VOCs, mg/liter of gasoline | Destruction efficiency of the flare |
| September 15, 2004 | 2.34 | 98.5 | 20 | 90% |
| May 21, 2003 | 8.63 | 97.05% | | |
| March 23, 2000 | 10.69 | 96.2% | | |

SUMMARY OF CHANGES

1. The permit incorporates TP-BP-0689 (issued on June 2, 2004) for the storage and distribution of Aviation gasoline.
2. Methyl methacrylate (MMA) is no longer stored or distributed at the facility. Storage tank #11 is currently used to store aviation gasoline.
3. Gasoline Tank #4 (previously designated as EU03) was converted to an asphalt storage tank in January 2004.
4. The permit includes CAM requirements for the flare.
5. Stack criteria table (Table 2 in the old TV permit) is not included in this permit as the facility is not subject to Env-A 1400.
6. Old Title V permit included NOx RACT requirements (Env-A 1211) for the two Dowtherm boilers (EU08 & EU09). These boilers are not subject to NOx RACT because the combined heat input is less than 50 MMBTU/hr. Hence item #14 of Table 6, items 15 & 17 of Table 7 and item #11 of Table 8 of the old permit are not included in the new permit.
7. Item #15 of the old permit which limits the sulfur content of the gasoline cites Env-A 1604.01(g) as the basis. The new Env-A 1600 rule (effective April 23, 2005) deleted several fuels (including gasoline) that are regulated exclusively by EPA.

Miscellaneous

Compliance inspections were conducted on 5/3/2002 & 4/16/2001.

REVIEW OF REGULATIONS

NSPS - Subparts kb (Storage Vessels) and XX (Bulk Gasoline Terminals) are applicable

NESHAP - N/A

Sprague is not a major source for HAPs. Hence Subparts R [*National Emission Standards for Gasoline Distribution Facilities (Bulk Gasoline Terminals and Pipeline Breakout Stations)*] and Y [*National Emission Standards for Marine Tank Vessel Loading Operations*] are not applicable to the facility. Sprague is also not subject to subpart EEEE for *Organic Liquids Distribution (non-gasoline)*. The facility permanently stopped storage and distribution of MMA, which is a HAP.

40 CFR 64 (Compliance Assurance Monitoring) - Applicable;

Env-A 300 - N/A

Env-A 609 (Title V Permits) - Applicable

Env-A 700 (Permit Fee System) - Applicable

✓ Sprague has paid emission based fees for the year 2004

Env-A 800 (Testing & Monitoring Procedures) - Applicable



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Table with project details: PROJECT NAME, ENGINEER: Padmaja Baru, DATE: 6/14/06, Page 7 of 7

Note: Env-A 808.18 & Env-A 804.20 are applicable to the facility. These requirements are also covered under NSPS subparts kb & XX respectively.

Env-A 900 (Owner/Operator Obligations) - Applicable

Env-A 1211 (NOx RACT) - N/A

Sprague is not subject to NOx RACT because the combined maximum heat input rate for the two boilers is less than 50 MMBTU/hr.

Env-A 1400 (RTAPs) - Not Applicable

Bulk gasoline terminals are exempt from Env-A 1400. Modeling was performed in April 2001 for methyl methacrylate (MMA). However, MMA is no longer stored at the facility. In June 2004, the MMA tank and loading rack were converted for the storage and distribution of aviation gasoline.

Env-A 1600 (Fuel specifications) - Applicable

Env-A 2000 (Fuel burning devices) - Applicable

SUMMARY AND CONCLUSIONS

In summary, the operations as applied for will be capable of meeting all regulations and standards for air quality. Title V Operating Permit shall therefore be issued.

6/14/2006

Following Ida McDonnell's comment on June 14, 2006, item #2 of Table 5 (Monitoring/Testing Requirements) has been changed to reflect the SIP approved rule, Env-A 1204.20(c)(6). The SIP approved rule requires monthly visible inspection of the internal floating roof and closure seal(s) through roof hatches. The new rule, Env-A 1204.38(d)(6)a and 40 CFR 60.113b(a)(2) require this inspection on an annual basis. Since the SIP approved rule is more stringent, the permit requires a monthly visual inspection for the storage tanks.