ENERGY

Suncor Sarnia Refinery

Summary - Flares and other combustion equipment, minimization plan for O. Reg 530/18

Introduction

This report was prepared in accordance with section 9 of Ontario Regulation 530/18, Air Pollution – Discharge of Sulphur Dioxide from Petroleum Facilities

O. Reg 530/18 requires a "Flares and other combustion equipment, minimization plan" that sets out the following information.

1. For each piece of acid gas combustion equipment at the facility, a process flow diagram of all upstream equipment and process units that may vent to the piece of equipment.
2. For each flare at the facility that may flare acid gas, a diagram of the flare, details of the configuration of the flare nozzle and any associated air or steam injection equipment and conversion efficiency of sulphur compounds to sulphur dioxide.
3. An identification of the measures that have been taken at the facility to minimize the frequency, duration and magnitude of flaring or otherwise combusting acid gas, and the date each measure was implemented.
4. An identification of the measures that are intended to be implemented in the future to minimize the frequency, duration and magnitude of flaring or otherwise combusting acid gas at the facility, and the date those measures are expected to be implemented.
5. With respect to each measure identified under paragraphs 3 and 4, an indication of the operating condition during which the measure would minimize flaring or otherwise combusting acid gas.
6. The methodology to be followed when performing the analysis required by paragraph 6 of subsection 5 (7).
7. The methodology to be followed for the purpose of identifying the measures that are available to prevent or reduce the risk of recurrence of acid gas combustion under paragraph 9 of subsection 5 (7).
8. The following information with respect to each time sulphur dioxide was discharged from acid gas combustion equipment at the facility as a result of a sulphur recovery unit failing to operate in a normal manner in the previous calendar year:
    i. The date, time and duration of the acid gas combustion and the amount of sulphur dioxide discharged during the event.
    ii. The cause of the acid gas combustion, including an indication of whether the cause was recurrent failure of air pollution control equipment, process equipment or failure of a process to operate in a normal manner.
    iii. A summary of all measures taken to prevent or reduce the risk of a similar acid gas combustion occurring and the date each measure was taken, including, if applicable, any measures described in a Root Cause Analysis and Corrective Action Report that were taken to prevent or reduce the risk of a similar occurrence from happening again.

This plan is intended to fulfill the aforementioned requirements.

Interpretations

Interpretation of terms used in this document:

"AAG" – Amine Acid Gas. Acid gas produced from the process of regenerating or stripping amine.

"AGF" – Acid Gas Flare. Flare designed to burn off residual acid gas

"DHT" – Diesel Hydrotreater. Diesel Hydrotreating Process is designed to remove sulphur from diesel products to meet Canadian Regulations of 15 ppmw of sulphur at point of sale

"H_2S" – Hydrogen sulphide

"HYC" – Hydrocracker. The Hydrocracking Process is designed to upgrade gas oils; the principal objective is to produce naphtha, jet and diesel products

"OP&S" – Operations Planning and Scheduling. Planning group that manages feedstock purchases and sales of products from refinery

"POI" – Point of Impingement. A receptor location (outside of the company property boundaries) at which the highest concentration of contaminant is expected. Concentration limits for contaminants are set by Ontario Regulation 419

"SRU" – Sulphur Recovery Unit. Process for converting acid gas into elemental sulphur and recovering that elemental sulphur.

"SWAG" – Sour Water Acid. Acid gas produced from the process of stripping sour water.

"SWS" – Sour Water Stripper. Process unit that strips light compounds such as H2S and NH3 from process water

"TGTU" – Tailgas Treating Unit. A process for treating SRU tailgas that recycles sulphur in the form of H_2S back to the SRU acid gas feed system.

Process Description

The Suncor Sarnia Refinery has two (2) Sulphur Recovery Units (SRU1 and SRU2). Each SRU may receive two (2) types of acid gas feeds:

1) Sour Water Acid Gas (SWAG), and
2) Amine Acid Gas (AAG)

The potential sources of SWAG are listed below:

1) Plant 2 Sour Water Stripper
2) Plant 3 Sour Water Stripper
3) Plant 4 Sour Water Stripper

The potential sources of AAG are listed below:

1) Plant 3 Amine Regenerator
2) Plant 4 Amine Regenerator
3) TGTU Solvent Stripper

All SWAG sources combine into a SWAG feed system that feeds SWAG to SRU1 and SRU2. Each SRU has its own SWAG knock-out vessel to remove liquids from the SWAG prior to entering the SRU reactor.

All AAG sources combine into an AAG feed system that feeds AAG to SRU1 and SRU2. Each SRU has its own AAG knock-out vessel to remove liquids from the AAG prior to entering the SRU reactor.

The tail gas from SRU1 and SRU2 is combined and enters the TGTU unit. The TGTU has two outlet streams: gas to the incinerator and recycle gas which returns to the SRU1 or SRU2 inlet. The incinerator combusts sulphur compounds into sulphur dioxide prior to introduction to the atmosphere.

Operating Scenarios

Normal Operation:

Sulphur Recovery Units and Tail Gas Treatment Unit in operation

- Under normal operation, refinery AAG is typically split between the two sulphur recovery units that are in service.
- Refinery SWAG is typically routed to one of the sulphur recovery units.
- The tail gas exiting the sulphur recovery units is combined and processed in the tail gas treatment unit. The residual gas exiting the tail gas treatment unit is routed to the incinerator.
- The tail gas treatment unit is a processing unit that was commissioned in June 2008

Scenario 1:

Incinerator (or Both Sulphur Recovery Units) trips

- If the incinerator trips, both sulphur recovery units and the tail gas treatment unit are bypassed and all AAG and SWAG is directed to the acid gas flares.

Scenario 2:

Single Sulphur recovery Unit trips leaving the second Sulphur recovery Unit, TGTU and Incinerator still operating

- If a single sulphur recovery unit trips when both were in operation, the second sulphur recovery unit, TGTU and the incinerator remain in an operational state. In this case, the amine acid gas from the tripped train is first routed to the Acid Gas Flares with appropriate lift gas.
- Operations will then divert acid gas in a controlled manner for treatment in the operating sulphur recovery unit until its design capacity is reached.

Scenario 3:

TGTU trips leaving the both Sulphur Recovery Units running and bypassing gas to Incinerator.

- If the TGTU trips, both sulphur recovery units and the incinerator will remain in operation and the tail gas from the sulphur recovery units will be automatically diverted to the incinerator.
- Operations will start the TGTU as soon as possible and then divert the tail gas through the TGTU and then to incinerator.

Scenario 4:

Any flaring to Plant 3 and/or Plant 4 Acid Gas Flare due to upset operation of the Plant 3 and/or Plant 4 Sour Water Stripper and/or Amine Stripper and TGTU.

- SRU, TGTU and Incinerator will remain in service.
- If operations notice increased flaring to the Plant 3 or Plant 4 Acid Gas Flare due to unstable operation of any Sour Water Stripper and/or Amine Regenerator, operations will ensure that lift gas is introduced to the affected Acid Gas Flare.

The SWAG and AAG in the above mentioned scenarios will be directed to the Plant 3 or Plant 4 Acid Gas Flares as per our procedures.

In addition to the steps listed above which incorporate procedures from our Acid Gas Management Plan (AGMP) which was created in 2009 and continually optimized over the past years, the following measures have been put in place to minimize the frequency, duration and magnitude of acid gas flaring events:

- Upgrade to Main Plant Flare and installation of a Flare Gas Recovery Unit (FGRU)
- Additional Improvements to Sulphur Plant reliability
    - SRU reliability
    - TGTU reliability
    - Incinerator reliability
- New sour water storage tank
- TA start-up and shut-down sequencing procedures have also been optimized to minimize acid gas flaring.

While we continue to review and optimize our procedures to reduce and mitigate the potential for acid gas flaring, an additional measure we plan on implementing is an Operator Training Simulator in 2021. In an effort to continuously improve our Operators' knowledge of the sulphur recovery system and the sulphur treating units to ensure a safe and reliable operation, Suncor will be introducing the "Operator Training Simulator" that will complement the existing Operator Training Program.