



GEORGIA

DEPARTMENT OF NATURAL RESOURCES

ENVIRONMENTAL PROTECTION DIVISION

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NARRATIVE

TO: Heather Brown
FROM: Susan Jenkins
DATE: May 18, 2018

Facility Name: **Stepan Company**
AIRS No.: 013-00001
Location: Winder, GA (Barrow County)
Application #: 26525
Date of Application: April 13, 2018 (Received April 25, 2018)

Background Information

Stepan Company (“Stepan”) produces intermediates for laundry detergent manufacturing. The Stepan Winder facility produces these intermediates through batch and continuous reaction processes, each within a dedicated process vessel. The Winder facility’s operations include four reactor vessels, three blenders, four batch neutralizers, two continuous sulfonation process lines, a re-blend tank, and numerous storage tanks. They operate under Air Quality Permit No. 2843-013-0001-S-02-0 issued September 8, 2017.

Purpose of Application

Stepan submitted an air permit application assigned App No. 26525 requesting revisions to the permit conditions as summarized in Table 1.

Table 1: Application No. 26525 Details	
Existing Permit Condition No.	Request
Equipment List	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> . Add 40 CFR 60 Subpart Kb as an applicable requirement for Tanks with ID Nos. T-3300 and T-3400.
4.5.f	Revise the daily pH block average operating range from <i>5 to 12</i> to <i>greater than 5</i> .
4.6.a	Revises the pressure drop operating range from <i>0.1 to 1.0 psi</i> to <i>0.01 to 1.0 psi</i> .
4.6.g	Revise the daily pH block average operating range from <i>5 to 12</i> to <i>greater than or equal to 5</i> .
4.9	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
4.10	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
4.11	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
4.12	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
4.12.a	Revise the frequency of recording the percent scrubbant acid from monthly to once per calendar week.

Table 1: Application No. 26525 Details	
Existing Permit Condition No.	Request
4.16.b	Delete the operating condition related to pressure drop across scrubber SCR-NAOHR02.
5.3.a	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> . Increase the frequency of recording the percent by weight of acid in the scrubbant for scrubber ID No. SCR-R01 from monthly to weekly.
5.4.d	Revise the label from <i>Tail Gas Demister 1</i> to <i>Tail Gas Demister</i> .
5.4.l	Revise the label from <i>Tail Gas Demister 1</i> to <i>Tail Gas Demister</i> . Add the sentence, <i>The Permittee shall use this data to compute and record a daily block average.</i>
5.4.p	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
5.4.q	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> . The Permittee shall use this data to compute and record a daily block average.
5.4.r	Delete the requirement to monitor and record the pressure drop across scrubber SCR-NAOHR02.
5.7	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
7.11.l	Revise device from <i>SCP-TAIL1</i> to <i>SCP-TAIL2</i> .
7.11.p	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
7.11.q	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
7.11.r	Rename scrubber referenced in the existing permit as <i>SCR-3500</i> to <i>SCR-R01</i> .
7.11.t	Delete the condition as it applies to Permit Condition No. 4.16.b.

Updated Equipment List

No new equipment is being added based on this permit application. No existing equipment is being removed based on this permit application.

Emissions Summary

The proposed permit amendment results in no changes to the facility's potential to emit. Emissions rates specified in Table 3 are taken from the narrative supporting Permit No. 2843-013-0001-S-02-0.

Table 4: Facility-Wide Emissions		
Pollutant	Potential Emissions	
	Uncontrolled (tpy)	Controlled (tpy)
PM _f	14.86	14.86
PM ₁₀	13.85	13.85
PM _{2.5}	11.99	11.99
NO _x	30.36	30.36

Table 4: Facility-Wide Emissions		
Pollutant	Potential Emissions	
	Uncontrolled (tpy)	Controlled (tpy)
SO ₂	614.1	18.56
CO	18.56	18.56
VOC	113.86	<100
Max. Individual HAP	4.34	0.50
Total HAP	5.47	1.63

Regulatory Applicability

The requested permit revisions do not trigger new or revise existing regulatory requirements.

Monitoring Requirements

Esterification Batch Process

Stepan produces chemical products through batch reaction processes, each within a dedicated process vessel, (ID Nos. R02, R04, and R05). The primary batch operation that generates VOC emissions includes the second vacuum stripping and final pump out of each reactor. The Esterification process scrubber (ID No. SCR-NAOHR02) controls emissions of VOCs from each of these batch reactors. Stepan assumes an 80% control efficiency of VOCs as the control efficiency of the Esterification process scrubber rather than a higher value. This is because they are unable to verify the VOC control efficiency through performance testing because the process is not equipped with test ports and the stack cannot be reached without overcoming safety concerns.

Stepan is required to measure the caustic content of the scrubbant once per calendar week and to continuously monitor the pressure drop across the scrubber and the scrubbant volumetric flow rate to ensure proper operation of the control device (ID No. SCR-NAOHR02). During the preparation of the semi-annual monitoring report for calendar year 2017, Stepan determined that its batch process is not able to demonstrate continuous compliance with the lower end of the permitted pressure drop range (minimum of 0.3 inches of water). The pressure drop readings for scrubber with ID No. SCR-NAOHR02 is commonly below 0.3 inches of water due to the low gas flow rate from the reactor to the scrubber.

Stepan requests that EPD remove the pressure drop monitoring requirement for the Esterification process scrubber (ID No. SCR-NAOHR02) from the permit. Instead, Stepan proposes to demonstrate proper operation of the scrubber with ID No. SCR-NAOHR02 through the weekly measurements of scrubbant caustic content and the continuous monitoring of the scrubbant volume flow rate.

A typical important physical factor that affects absorption of VOCs (in the gas stream) is the scrubbant flow rate (commonly referred to as the L/G ratio). Stepan's proposal to maintain existing monitoring of the scrubbant volume flow rate and the scrubbant caustic content is sufficient to ensure the credibility of the VOC emissions factors for each of these reactors.

The Division concurs with Stepan's request that removal of pressure drop monitoring (Permit Condition Nos. 4.16.b and 5.4.r) for the scrubber with ID No. SCR-NAOHR02 should have no adverse impact on Stepan's ability to remain a Title V minor source for VOC emissions.

Sulfonation II Continuous Process

Stepan operates two separate continuous process lines referenced as Sulfonation I and Sulfonation II. The Sulfonation II Process Line is subject to the requirements of 40 CFR 60 Subparts A and RRR. Specifically, Stepan shall maintain a *total resource effectiveness* (TRE) value greater than 1.0 without use of a VOC emission control device for the Sulfonation II Process Line *affected facility*. For purposes of Stepan's air permit, the term Sulfonation II Process Line *affected facility* shall mean the combination of the Sulfonation II Process Line reactor and cyclone/acid-gas separator system immediately downstream of the reactor.

The cyclone/acid-gas separator system is permitted as a product recovery device subject to monitoring under 40 CFR 60 Subpart RRR (40 CFR 60.703(e)). Accordingly, the permit requires that Stepan continuously monitor the pressure drop across the system to demonstrate that the pressure drop, determined on a daily block average, is within the range of 0.1 to 1.0 psi per Permit Condition No. 4.6.a. Stepan complies with the requirements of 40 CFR 60.703(e) by continuously monitoring the pressure drop across the cyclone/acid-gas separator.

Stepan has determined based on real-time operation that there may be periods where the pressure drop across the separator system is lower than 0.1 psi due to the nature of how the process operates. Even at very low pressure drop readings the separator system still operated properly. Specifically, the system is still producing a quantity of product consistent with what would be expected based on material balances, and the quality of product continues to meet customer specification. As such, Stepan is requesting that the Division revise the pressure drop range specified in Permit Condition No. 4.6.a from 0.1 to 1.0 psi to a range of 0.01 to 1.0 psi, determined on a daily block average.

The pressure drop across the cyclone/acid-gas separator system at a given time is dictated by the pressure within the process. In addition to monitoring the pressure drop across the separator system, Stepan also monitors the quantity and quality of production in the Sulfonation II process, which would be negatively impacted if the cyclone/acid-gas separator system were to malfunction.

Stepan's request does not violate 40 CFR 60 Subpart RRR nor should it reduce the assurance of compliance with the short-term SO₂ and H₂SO₄ emission limits. Therefore, the Division concurs with Stepan's request to revise the acceptable pressure drop range for operation of the cyclone/acid-gas separator system to 0.01 to 1.0 psi, determined on a daily block average.

Sulfonation Continuous Processes

Each sulfonation process has a train of control equipment to remove SO₂ and H₂SO₄ emissions. The control train starts with two demisters prior to the sulfonators. The main goal of these demisters is to remove the sulfuric acid mist (SAM) generated when the sulfur trioxide (an input to the sulfonator reactor) reacts with water vapor in the air. After the sulfonators, there will be a mixture of sulfonic acid and sulfuric acid mists in the air flow. To remove these pollutants, the air flow first enters dry packed bed scrubbers. These control devices contain inexpensive packing which would remove part of the sulfonic acid from the air flow, and the main goal is to elongate the life of the more expensive control devices that follow. The air flow then enters scrubber demisters, where the majority of the sulfonic acid is removed to ensure the organic acid will not foam in the scrubber interfering with the normal operation. Inside the caustic scrubbers, the sodium hydroxide reacts with the sulfuric acid generating sodium sulfate and water.

The resulting salt solution is continually removed from the caustic scrubbers during operation of the process lines. Make up water and sodium hydroxide are added as replenishment. The air flow will then enter the tail gas demisters to remove the water vapor and any sodium sulfate prior to the air flow being emitted to the atmosphere.

This permit application pertains to the operation caustic scrubbers (ID Nos. SCP-NAOH1 and SCP-NAOH2) immediately upstream of the tail gas demisters (ID Nos. SCP-TAIL1 and SCP-TAIL2). The permitted range of pH of the sodium hydroxide scrubbant is 5 to 12. Stepan has realized there may be periods after fresh caustic addition to the scrubbant in which the pH will exceed 12. There are no negative environmental effects from a higher pH, as it does not diminish control of SO₂ or acid gases from the process. It is thought that the tail gas demisters will remove any caustic film that may be present in the gases leaving the caustic scrubber prior to being emitted to the atmosphere. The Division concurs with Stepan's conclusion that allowing the pH of the sodium hydroxide scrubbant to reach above 12 in scrubbers with ID Nos. SCP-NAOH1 and SCP-NAOH2 should not interfere with complying with the short-term SO₂ and H₂SO₄ emission limits associated with the sulfonation processes. Permit Condition Nos. 4.5.f and 4.6.g are revised as requested.

Alkoxylation Batch Process

Reactor R01 is dedicated to producing products related to the first alkoxylation. The product vapors from this reactor along with pressurized vessels T-3300 and T-3400 are routed to the EO/PO¹ scrubber denoted as SCR-3500. Stepan is required to conduct a monthly measurement of the scrubbant acid content for scrubber ID No. SCR-3500 to ensure that the concentration is within the range specified in Permit Condition No. 4.12. Stepan requests to increase the frequency of recording the scrubbant acid content from once per calendar month to once per calendar week, consistent with the monitoring requirement for the Esterification process scrubber (ID No. SCR-NAOHR02).

In addition, Stepan requests a revision to the Alkoxylation Process Scrubber from ID No. SCR-3500 to SCR-R01.

Permit Conditions

Table 1 summarizes the permit conditions revised based on this permit application.

Toxic Impact Assessment

Not applicable.

Summary & Recommendations

Stepan submitted an air permit application (assigned Application No. 26525) requesting updates to their SM permit issued in September 2017. The updates pertain mostly to the acceptable operational values associated with specific monitoring requirements. Stepan has had the opportunity to review the permit amendment. The Division incorporated Stepan's edits.

I recommend issuance of Permit No. 2843-013-0001-S-02-1.

¹ EO stands for ethylene oxide. PO stands for propylene oxide.