Air Permit Application

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Solvay Specialty Polymers

Augusta, Georgia

February 2024

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1.0 Background

Solvay Specialty Polymers USA, LLC (Solvay) operates several manufacturing units at the facility in Augusta, Georgia. This plant is used to produce several high-performance polymers. Solvay proposes to make modifications to the Amodel, Compounding, KetaSpire/NovaSpire (aka PEEK), Sulfone, and Verian areas which are individually permitted processes and add a new process identified as the "Sarsaparilla" project. This application addresses these changes as well as the new process and requests timely review of this application. Solvay intends to begin construction of the first project in the third quarter of 2024; other projects will be initiated thereafter. All projects are expected to be complete by 2030. Sections 2 through 8 describe the proposed changes and additions as well as emissions from each area. Sections 9 and 10 provide a detailed regulatory applicability analyses and summarizes the requirements for each applicable regulation. Section 11 contains air dispersion modeling analysis information for toxic air pollutants (TAPs). Appendices A through O contain process flow diagrams and detailed air emission calculations for each of the process areas.

Information in this report and its appendices are considered confidential and Solvay is submitting a claim of confidentiality pursuant to Georgia regulations. Pages containing confidential information are labeled as such. A public version of this document with confidential information redacted is being submitted concurrent with this document. Appendix A contains the claim to confidentiality information.

Solvay has prepared and submitted concurrent with this document air permit application information using the Georgia EPD Online System (GEOS) for Permitting, Compliance and Facility Information. This narrative serves to provide complete and relevant information to support the electronic GEOS application.

Prior to, during, and after completion of the projects described in this application, the facility will be considered a synthetic minor source for Prevention of Significant Deterioration (PSD). The facility is and will remain a Title V major source due to emissions of hazardous air pollutants (HAPs).

1.1 Facility Location and Contact Personnel

The Solvay facility is located in Augusta, Georgia. The facility location, mailing address, and facility contact are as follows:

Site Location and Mailing Address

Solvay Specialty Polymers USA, LLC
3702 Clanton Road
Augusta, Georgia 30906

Facility Contact

Michael Ray
HSE Manager Augusta & Greenville Sites

Mobile Telephone: 706.829.1567
Office Telephone: 706.771.3356
Email: Michael.Ray@syensqo.com

2.0
Amodel Project Description

Solvay plans to modify the Amodel process unit by adding solid stating process equipment to increase production. [redacted][1] due to operational uptime constraints such as routine maintenance. The proposed process and equipment changes will increase production capacity gradually, in a stepwise fashion, [redacted][2]. Some of this increase in production is attributed to addition of solid stating equipment, whereas other increases are attributed to previous and future debottlenecking efforts. Solid stating increases overall unit throughput and therefore requires shorter cycle times in existing equipment, allowing for quicker overall processing. As part of this application, Solvay is also incorporating administrative changes to the process related to previous off-permit changes that have already been approved, but not necessarily incorporated into the permit.

2.1 Existing Process Description

Amodel is a strong, tough, high temperature polymer known as a polyphthalamide and is used in automotive, electronic, and other consumer applications. Amodel represents an entirely new class of plastics, produced for the first time commercially at the Augusta site. In the production of Amodel, the raw materials are first mixed together in the feed preparation area and later concentrated and heated before entering the reaction vessel. After reaction, the Amodel product is sent through an extruder where the molten material is made into small pellets. The pellets are then screened to remove large and small particles before packaging.

2.2 Proposed Process and Administrative Changes

2.2.1 Additions to 700 Area – [redacted]

[redacted][3] Four new emission points are associated with this process, A-70, A-71, A-72, and A-73.

2.2.2 100 And 200 Areas

No equipment will be added to this area as part of this project, but previously Solvay added an adipic acid (AA) sack unloading system (KM-120) controlled by a new filter (KH-120) as well as adding the capability to unload 'Mongo' trailers directly to the AA storage silo. Solvay previously removed the catalyst hopper (KF-227, also referred to as KP-227) and weighing and their associated filters.

2.2.3 200, 300, 400, 500 areas

No changes are proposed for these areas. These areas contain an antifoam tank, deionized water (DIW) flush tank, and concentrator knockout pot that were added after 2001 and do not have emissions of regulated pollutants due to the nature of their operations. Solvay identified an existing catalyst addition hopper (KF-306) that was inadvertently omitted from the permit. Solvay added these to the Appendix B diagrams for completeness. Two tanks have names that did not accurately represent the operations and have been updated in the flow diagrams, KD-350 and KD-310.

2.2.4 600 area

No changes are proposed for this area. As part of an off-permit change, Solvay added an HMDA Recovery Tank to the 600 area. Equipment added since original permitting includes a parts cleaning oven and fume collection system as well as the following:

—
— [4]
— Underwater pelletizer
— Centrifugal dryer and associated fan

These sources vent through existing equipment such as the vacuum pumps or have emissions that are included in Appendix C.

2.2.5 700 Area

No changes are proposed for this area and no updates to the permit are necessary.

2.2.6 800 area

As part of an off-permit change, Solvay added an HMDA Recovery system to the 800 area. HMDA recovery equipment includes a feed tank, seal pot, recovery column, condenser, reflux drum, and recovered water tank. Solvay requests changes to the equipment descriptions as depicted in the flow diagram to better reflect the actual operations associated with the individual equipment.

2.2.7 900, 1000, and 1200 Areas

No changes are proposed for this area and no updates to the permit are necessary.

2.2.8 Utilities

An oil heater (KB-901) and a boiler (UB-1210) are associated with the Amodel area. No new fossil fuel fired oil heaters are proposed as part of this project, but Solvay may replace existing natural gas fueled oil heaters with electric heaters. The electric heaters operate without emissions; thus these would be exempt from permitting. Solvay plans to add a new boiler to ultimately replace UB-1210 and provide steam for the Amodel process as well as other plant processes. The new boiler will have a heat input capacity of 99.5 x 10^6 British thermal units per hour (Btu/hr) and will be similar to the boiler installed as part of the original KetaSpire/NovaSpire project. The boiler will primarily operate on natural gas with fuel oil as a backup for periods of natural gas curtailment. The boiler will be equipped with highly efficient low NOX and low CO burners. Solvay plans to keep UB-1210 in place for a period time up to and after installation of the new boiler to serve as a spare boiler until such time as Solvay is confident that the new boiler is operating properly and UB-1210 is no longer needed. Solvay does not expect to operate UB-1210 concurrent with the new boiler.

2.3 Emissions Changes

Previous estimates compiled in 2001 were the basis for the original air emission calculations. Where equipment capacity needed to be increased to achieve the desired production capacity, calculations have been updated. Likewise, if equipment has been removed or added since 2001, calculations have been updated. The emission updates also include the contributions from the solid stating process. All prior assumptions for emissions are valid, but emissions have been updated to reflect better understanding of the process which result in a net reduction of emissions relative to previous estimates. An overall emission summary by source and for the process as well as detailed emission calculations are contained in Appendix C

3.0
Compounding Project Description

Solvay plans to modify the compounding process unit by adding equipment to increase production and utilize new chemicals. Two new extruding lines will be added and are referred to as the D6 and D7 lines.

3.1 Existing Process Description

The production of compounds is accomplished by the melting of polymers and additives in extruders. Reinforcement additives are introduced into the melted polymer and formed into pellets. Pellets are cooled, size screened, and stored prior to packing and shipping. The Solvay compounding facility has been designed to compound polymer products. Following is a brief description of the existing process which has four extruders and associated equipment.

For Amodel, neat pellets are fed to the compounding plant via a closed loop pneumatic lift. The lift is equipped with an in-line diverter which can deliver the neat pellets to either the packaging bin or the pellet feed bin. During compounding, the neat pellets are sent to the pellet feed bin (CF-110 or respective silo). Depending on desired final product mix, various additives, fillers, resins, and stabilizers are added to appropriate blenders by means of supersacks, boxes, bags, and drums. The various feed stations are exhausted via a baghouse (CH—860 or respective baghouse). The neat pellets, additives, filler, resins, and stabilizers are introduced to the extruder (CH-410 or respective extruder) through their respective feeder. The extruder off- gas is collected and transferred by liquid ring vacuum pumps to the existing caustic scrubber (T--701). The extruded product is transferred through a water bath/belt conveyor to the pelletizer. The pellets are screened and cooled in the pellet cooler/screener (CM-530 of respective classifier). The cooled product is transferred to one of eight product test bins. If specifications are met, the product is packaged in the specific packaging type for shipment to a warehouse or the customer.

3.2 Proposed Process Changes

Solvay plans to add two extruders and associated raw material receiving and conveying equipment as well as product processing equipment.

The D6 line consists of three polymer hoppers and two additive hoppers. Each of the conveying steps is controlled by a filter system. The initial conveying step is a vacuum system controlled by a central dedusting system. The subsequent steps are gravity conveying and emissions are controlled by inherent filters similar to a baghouse sock to capture particulate in the displaced air from conveying. The raw materials are fed into a hopper attached to the extruder. The extruder is equipped with a collection system and liquid ring vacuum pump. After extrusion, the polymer is cooled to solidify the polymer and then pelletized. A system will be added to convey, screen, and package the pellets. The pellets are not dusty at this point but the system is equipped with a filter system to capture particulate. A detailed process flow diagram is contained in Appendix D.

The second extruder to be added is the D7 system. This system is more complicated than the D6 system because it has the capability to utilize a broader spectrum of raw materials. The categories of components are polymer powder or pellets and additive powders. Depending on the type and amount of material used, gravity drop and/or vacuum conveying systems are used. In both cases, the emissions are controlled by inherent process filters or control device filters. Appendix D contains a detailed process flow diagram for the D7 process indicating each conveying step. As with D6, the extruder is equipped with a liquid ring vacuum pump and the polymer is cooled and solidified to form pellets. D7 will have two packaging and screening systems routed to a filter. [redacted][5] Appendix E contains emission calculations for the new compounding processes.

4.0
KetaSpire/NovaSpire Project Description

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Solvay plans to modify the KetaSpire/NovaSpire process unit by adding new equipment and modifying existing equipment to increase production. [redacted][6] Solvay will add a new oil heater, a reactor and associated scrubber, raw material bins, a new solvent extractor, dryer, and powder system. Solvay plans to install equipment over the course of several years to make incremental increases in production. The project is divided into two phases for planning purposes. [redacted][7]

4.1 Existing Process Description

Solvay installed and began operation of a new unit for manufacturing a new product that is classified as an ultra-performance polymer in 2017. The process is described in the permit as the KetaSpire / NovaSpire process referred hereafter as KetaSpire (and was formerly known as the Jupiter project). The KetaSpire process involves a batch reaction, [redacted][8] drying, and solvent recovery.

4.1.1 Reaction Area

A reaction solvent is melted and charged as a liquid to the reaction batch. The dry powder reactants including [redacted][9] and salts are then charged to the reactor. All the powder materials are handled in enclosed systems that vent through baghouses to the atmosphere.

A polymerization reaction is carried out at high temperature and atmospheric pressure. The vent from the reactor is vented to a scrubber that captures low concentration hydrogen fluoride (HF) emissions. Once the reaction is complete, it is terminated [redacted][10]

4.1.2 Solidification and Grinding

The reactor is discharged onto a belt cooler, solidified and then ground into a powder. The powder which consists of solvent, salts and polymer is pneumatically conveyed to ground powder storage bins.

4.1.3 Extraction, Washing, and Slurry Filtration

The powder is then fed to the extraction vessels where an exempt wash solvent (*i.e.,* non-volatile organic compound [VOC] and non-hazardous air pollutant [non-HAP]) and water washing are used to remove the salts and the reaction solvent. The extraction vessels are fed from a tank farm that holds several extraction solvent and water tanks. All the tanks containing high concentration extraction solvent are in equilibrium with the gas phase and vent through a common condenser before being released to atmosphere.

An acidified water wash is used to assist in removal of residual salts. The acid is fed from a hydrochloric acid (HCl) storage tank located in the tank farm that vents to a scrubber.

After extraction and water washing is complete, the polymer is separated from the wash water in an agitated filter and the wet cake is sent to a wet cake bin.

4.1.4 Drying and Packaging

[redacted][11] The final polymer is in a granular or powder form and is collected into storage bins before being packaged.

4.1.5 Solvent Recovery and Waste Treatment

The extraction solvent and wash water used for extraction and washing are treated through a set of columns that reclaims the extraction solvent and the reaction solvent.

The water, freed of wash solvent and reaction solvent, is sent to the waste treatment section [redacted][12]

A deionized water unit, cooling water unit, a refrigeration unit, a hot oil heater, and a boiler are also included in the process.

4.1.6 Post Processing

Further processing of the final polymer includes grinding the polymer into larger particle size powders using a fluidized grinder. The ground polymer is conveyed to a bag house before being sieved and packaged.

Solvay plans to install a new duplicate grinding line as described above.

4.2 Proposed Process Changes

A detailed process flow diagram containing new and existing equipment for this process is contained in Appendix F. The following subsections describe the new equipment in detail organized by process area.

4.2.1 Reaction Area

Solvay plans to add a second reactor and scrubber system. The raw material systems will also be modified. [13]

4.2.2

Solvay does not plan to make modifications to existing equipment in this area. The existing are capable of handling the additional reactor because the reaction process is batch and the [14] is only used for a portion of each day.

4.2.3

Solvay plans to replace the following tanks as part of this project with larger tanks: PD-401, PD-402, PD-403, PD-404, PF-502, PF-503, PF-504, & PF-506 (note these tanks process exempt wash solvent *i.e.,* non-volatile organic compound [VOC] and non-hazardous air pollutant [non-HAP]). A new [15] equipped with a condenser will be added to this area. The equipment serves the same purpose as analogous equipment installed as part of the original application.

4.2.4 Drying and Packaging

Solvay plans to upgrade the existing dryer system in this area. A new dryer that serves the same purpose as the existing dryer will be installed. The wet cake is then dried in a fluidized bed dryer. The final polymer is in a granular or powder form and is collected into storage bins before being packaged.

4.2.5 Solvent Recovery and Waste Treatment

In addition to the existing emission control equipment in this area, a new vent and condenser will be added to control emission from the [16] and other solvent changes. Modifications to an existing distillation column and the installation of a new distillation column for recovery of exempt was solvent will be added.

A new oil heater with a capacity of 9.5 x 10^6 Btu/hr will be added. The heater will primarily use natural gas as fuel, but it will be equipped to burn oil as a backup during curtailment periods and for periodic testing purposes up to 48 hours per year. For purposes of estimating reasonable potential emissions, fuel oil use was limited to one month per year (720 hours). The oil heater will be equipped with a low NOX burner.

4.2.6 Post Processing

Solvay plans to install a new duplicate grinding line as described in section 4.1.6

4.3 Emissions Changes

The original permit application submitted to GA EPD in 2014 contained detailed calculations for this process. These calculations have been updated to include the new equipment and associated emissions. Appendix G contains a summary of potential emissions from the process before and after the changes and also provides the detailed emission calculations by emission source.

5.0
Sulfone Project Description

Solvay plans to increase the annual Sulfone monomer production from currently permitted level [redacted][17] No equipment modifications or additions are required for the waste heat boiler. New and modified equipment in a limited number of areas is needed to accomplish this production increase. A current process description as well as a discussion of each addition or modification by process area is contained in the following subsections.

5.1 Existing Process Description

The Sulfone monomer that the facility produces is a white granular product used primarily by Solvay Specialty Polymers to produce Udel, Radel A, and Radel R at other manufacturing locations. These polymers are used to manufacture materials and parts for medical, aircraft, automotive, and electronics industries. Sulfone monomer is also used in the manufacturing of pharmaceuticals and specialty chemicals. [redacted][18] The Sulfone product can be produced as a molten material or as a granular product. The final product is stored in bins and is transported in bulk trucks and in 1000-kilogram supersacks.

[redacted][19] After reacting, the monomer is further processed and purified until the final granulated product is generated. The pure Sulfone monomer is shipped off site in either hopper trucks or super sacks.

The Sulfone Monomer Process Unit is comprised of the following areas:

AREA	DESCRIPTION	PERMIT APPLICATION SOURCE CODE(S)
100 Area – Raw Material Storage	Storage	01, 02, 03, 11
200 Area – Sulfonation	Reaction	04
300 Area – Sulfonylation	Reaction	05
400 Area – Extraction	Extraction	06
500 Area – Primary Crystallization	Product Purification	07
600 Area – Scavenger Crystallization	Product Purification	07
700 Area – Tar System	Product Purification	07
800 Area – Product Distillation	Product Purification	07
900 Area – Product Storage	Storage	09
1600 Area – Wastewater Pretreatment	Waste Treatment	10
1700 Area – Product Granulation	Final Processing	13

5.2 Proposed Process Changes

The proposed expansion project will allow Solvay to increase the annual monomer production [redacted][20] No equipment modifications or additions are required for the waste heat boiler. The following are the activities which will added with this project:

- [redacted][21]
- Second Reactor II Sulfonylation
- Extraction line
- Concentration and purification line
- MIS cracking unit
- Three Melt crystallizers and three pastillation processes to the product purification process
- Voluntary Carbon adsorption for MCB

The details of specific equipment are provided in the process flow diagram in Appendix H.

5.2.1 Area Equipment Modifications

The following subsections describe each process area and a process description of any modifications or additions occurring within each process area:

100 Area – Raw Material Storage

Existing: SO_3 is received in bulk shipments and stored on site. [redacted][22] Refer to the process flow diagram (PFD) for SO_3 storage in Appendix H.

MCB is also received in bulk tank trucks, isocontainers, or railcars (shown in the PFD in Appendix H). Storage tank vapor is vented through a condenser, LE-114 (C2A), to remove and recycle valuable MCB product. The MCB storage tank condenser LE-114 vents through stack S2A. Two MCB supply filters remove tank scale or rust before the raw material is used in the process.

Sodium hydroxide (NaOH, caustic) is delivered as an aqueous solution by tank truck or railcar as shown in the PFD in Appendix H. The NaOH is diluted with water before use in the Waste Heat Boiler stack gas scrubber and wastewater treatment system. Solvay can also receive and use magnesium hydroxide to neutralize wastewater. The caustic storage tanks vent through S3A and S3B stacks. Emissions from these tanks are primarily water and contain no hydrocarbons. Five percent sodium carbonate solution for use during Sulfone neutralization is prepared in a 450-gallon mix/storage tank by mixing bags of dry raw material with deionized water (see PFD in Appendix H). The mixing and storage tank vents through a baghouse (C11A) and stack (S11A).

New: The Sulfone Monomer Expansion will include the addition of raw material production unit. Raw material will be manufactured in a unit [redacted][23]

200 and 300 Areas - Reaction

Existing: [redacted]

[redacted][24]

New: The Sulfone Monomer Expansion will add no new emission points to the 200 and 300 Areas. Solvay will add another Sulfonylation II [redacted][25] The modification within the Sulfonylation II System will not affect emissions.

400 Area - Extraction

Existing: After the material is reacted, the product is collected in an extraction feed tank. [redacted][26] An additional condenser, LE-477 (C6F), with vent stack (S6F), recovers raw material from the Sulfone product dehydration tower.

New: The Sulfone Monomer Expansion will require a new surge drum, LD-441, and a new extraction line. The LD-441 surge drum will vent to the new LE-580 condenser (discussed in the next section). The new extraction line will consist of a set of acid and neutralization columns (identical to the existing) and a wash step (identical to the existing). [redacted][27]

500, 600, 700, and 800 Areas – Production Purification

Existing: Sulfone product purification involves crystallization, tar (Undesired Sulfone Isomers) removal, and product distillation. [redacted][28]

New: A second line for [redacted][29] will be installed. The line II concentrator/purification system consists of twelve unique sources as follows:

- LD-585 MCB Surge Drum
- LD-880 Surge Drum
- LD-688 Surge Drum
- LE-882 Condenser
- LT-681 Tower
- LT-881 Tower
- LE-685 Condenser
- LD-890 Dissolver Drum
- LD-788 Surge Drum
- LD-893 Drum
- LT-781 Tower
- LE-782 Condenser

The condensers and equipment described in the list above all vent to the LE-580 condenser.

900 Area – Product Storage

Existing: After product granulation, the finished Sulfone product is sent to two storage bins and a product sacking system. Particulate emissions generated within this area are controlled by baghouses C9D, C9E, and C9F.

The Sulfone Monomer Expansion will add no new emission points to the 900 Area. Changes in emissions due to increased production are shown in Appendix I.

Waste Heat Boiler

Existing: The Waste Heat Boiler (B8) (shown in PFD in Appendix H) generates steam by
[redacted][30]

The off-gas from the boiler is passed through water (C8A) and caustic (C8B) scrubbers to remove and neutralize acid gases. The scrubbed boiler off-gas then passes through an entrainment separator (C8C) and then vented to the atmosphere through stack S8A. The scrubber blowdown neutralization tank is vented through stack S8B.

No changes or additions are proposed for the WHB.

1700 Area – Product Granulation [redacted][31]

Existing: After product purification, the Sulfone product is transferred to two molten storage tanks with associated exhaust vents, S13A and S13E. The Sulfone is then processed through the Product Granulation system where it is granulated, cooled, and then sent to Product Storage (Area 900). Baghouses in this area (C13B, C13C, and C13D) are used to remove Sulfone dust from various closed loop nitrogen loops within the Granulation system.

New: The Sulfone Monomer Expansion will add [redacted][32] Baghouses in this area (C13G/C13H/C13I) will be used to remove Sulfone dust. Stacks associated with this equipment shall be S13G/S13H/S13I. Also, an additional molten storage tank will be installed with an atmospheric vent (S13F). The total number of tanks for this process will be four; two tanks were previously considered insignificant. Emissions for the four tanks are contained in the Appendix I.

Wastewater Pretreatment

Existing: Wastewater from the Sulfone Monomer Unit is pretreated on site before being discharged to the city sewer. There are vents on the organic wastewater equalization tank LF-1601 (S10A), the wastewater holding tank LF-1618 (S10B) and the process wastewater neutralization tank LD-1631 (S10C).

The Sulfone Monomer Expansion will add no new emission points to the Wastewater Area nor change the concentration.

MIS Cracking

Existing: Solvay operates an MIS unit to “crack” a byproduct stream of MIS. This process recovers MCB which is one of the component raw materials of Sulfone manufacturing. Once recovered, the MCB is recycled back into the process where it reduces the consumption of this valuable raw material. In a letter dated November 6, 2023, Solvay notified the GA EPD of a project to add a condenser to the permitted Sulfone process to optimize operational conditions; the condenser was identified as LE-368. The project did not involve adding new process equipment such as tanks or reactors, but additional piping, valves, and instrumentation were required to vent emissions to the new condenser. The project has been completed and the following equipment are now routed to condenser LE-368: 0S7D which includes LT-790; LD-792; LR-350; and LT-363.

New: The Sulfone Monomer Expansion will require addition of an MIS cracking system which is identical to the existing system and includes equipment LR-320, LE331, LH-337, LD-791, LD-335, LT-333, and LE-347. Updated emissions are contained in Appendix I.

Voluntary Carbon Adsorption System

In a letter dated September 29, 2023, Solvay notified GA EPD of plans to install two voluntary carbon adsorption beds in parallel (LF-1673 and LF-1674). When one is active, the other will serve as backup. Emissions from the following existing condensers which currently vent to the atmosphere, will be routed to the carbon adsorption system: LD-430, LE-309, LE-679, LE-405, LE-680, LE-467, LE-576, LE-477, LE-330, and LE-114. Solvay will also route the new condenser, LE-368, to this system. In the event of a malfunction of the condensers or loss of cooling that results in a temperature above the allowable range, the emissions from the condensers will be routed to the backup carbon beds, as is currently the case (reference condition 6.1.7 c.iv.). This system will be installed in 2024. Solvay requests that as part of this permit revision, this system be added to the permit.

5.3 Emissions Changes

The original permit application submitted to GA EPD in 2014 contained detailed calculations for this process. These calculations have been updated to include the new equipment and associated emissions. Appendix I contains a summary of potential emissions from the process before and after the changes and also provides the detailed emission calculations by emission source. Within the process, some equipment has emissions proportional to production whereas other equipment does not have emissions that increase due to production. For the equipment that does not increase emissions the reason is that the equipment has a typical setpoint flow rate of gas, normally inert gas such as nitrogen, to sweep emissions from the vessel. An increase in production does not require an increase in flow of inert gas; thus, there is no increase in emissions when there is no increase in gas flow. Other calculations were updated to recognize stack test results submitted to GA EPD. These test results include the waste heat boiler, LE-576 and LE-580. Detailed emission calculations are contained in Appendix I.

6.0
Verian / Xydar Project Description

In March 2018, Solvay received a permit revision to modify the three existing Xydar lines to produce a new polymer, Verian. To-date, one line has been converted, but it has not reached full production capacity. The converted line has produced sellable product and a stack test was conducted to establish [redacted][33] Solvay still plans to complete the conversion that is in progress on one line as well as modify one or both the other lines to produce Verian. As such, Solvay is requesting that the permit allow modifications to continue as described in the previous permit application. No new equipment or changes from the previous application are requested.

6.1 Existing Process Description

Xydar is a high temperature liquid crystal polymer. Because of its good flow properties, Xydar is frequently used to make very small, intricate parts for the computer and electronics industries. The production of Xydar polymer is carried out by the reaction of liquid and solid monomers in a batch reactor. The material from the batch reactors is transferred to a mixing system that allows the polymer to form as a solid. The polymer is then transferred to the final product handling system as a powder and stored in 500-kilogram Gaylord boxes.

The production of Verian polymer is carried out by [redacted][34] a pellet and stored in Gaylord boxes.

Solvay has modified [redacted][35]

The process is configured in the following steps:

- Monomer handling and storage
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- Cooling, classifying and packaging
- New equipment approved to be added to the Xydar process by the previous permit modification to allow for [redacted]
- [redacted]
- [redacted][36]
- Polymer conveying, crystallization, classifying, and packaging

Other activities which are related to the main process flow include off-gas discharge and treatment as well as wastewater treatment. A block flow diagram is contained in Appendix J. Solvay intends to continue to make incremental changes in equipment, operational changes, and production rates in several phases over a period of up to approximately five more years. Solvay has determined that the polymer may require further processing to meet customer demands. This processing would involve [redacted][37] Solvay will pursue authorization for approval of this equipment as a second phase once the design has been developed. Solvay anticipates that the polymer processing equipment construction would commence in 2-5 years.

6.2 Emissions Changes

Potential criteria pollutant emissions, for purposes of this application, are assumed to be the potential emissions, with consideration of controls at the maximum production rates No restriction on production capacity beyond the equipment capabilities is requested. The emissions associated with the process are shown Appendix K.

7.0 PUSH Project Description

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Solvay received a permit to construct a new process to produce a new ultra-high-performance polymer named Project PUSH. Solvay has not completed construction on this process but still intends to install and operate this new unit at the Augusta, Georgia facility. Solvay proposes to add several raw materials and a [redacted][38] to the current authorization, but otherwise the process remains the same as permitted previously. The added raw materials are non-HAP and non-TAP chemicals. The added [redacted][39] The process will be constructed on the east side of the Augusta plant site. The PUSH process involves a batch reaction and purification steps. A process flow diagram for the process is contained in Appendix L and emission calculations are contained in Appendix M. [redacted][40]

7.1 Reaction Area

PUSH Polymer is produced through the polymerization of non-HAP monomer raw materials in a solvent. Both monomers are unloaded and prepared for the polymerization in the 1200 area of the unit. Monomer 1 is transferred from incoming drums/totes to a storage tank for use. [redacted][41]

The polymerization takes place in solvent in the presence of multiple additives and catalysts. Solid ingredients used in this part of the process are prepared and handled in areas using dust collectors/baghouses to control PM per the block flow diagram shown in Appendix L. [redacted][42]

7.2 Purification

The polymer is further processed following the polymerization steps to remove impurities. This is completed by first reacting the impurities to increase solubility and then removing the impurities through [redacted]. The reaction steps take place in the 200 area. Solvay proposes to [redacted][43]

The purified polymer is thermally dried to produce a dry finished product. [redacted][44]

Both the used reaction solvents and extraction solvents are collected and processed through a solvent recovery unit for reuse in the process. The [redacted].[45]

8.0
Project Sarsaparilla

Solvay proposes to construct an entirely new process to produce an isolated intermediate that can be shipped as a product, VDF, and a polymer product, PVDF. The process equipment to produce the intermediate and the polymer product are referred to as Project Sarsaparilla. These two chemicals are produced by other Solvay facilities outside of the USA. The new process is being constructed to supply polymer to the rapidly growing advanced battery production industry. The Sarsaparilla process starts with a primary raw material, 1-Chloro-1,1-difluoroethane (aka HCFC-142b or 142b) which is a haloalkane with the chemical formula CH_3CClF_2. The Solvay process will pyrolyze 142b to produce vinylidene difluoride (VDF) which is an intermediate that can be shipped as a product or polymerized onsite to form polyvinylidene fluoride (PVDF). As part of this project, Solvay will also install a 99.5 million Btu/hr boiler fired with natural gas; the boiler will be tied to the site's steam system, thus it may supply steam to processes other than the Sarsaparilla unit.

8.1 Vinylidene Difluoride (VDF) Production Area

HCFC-142b will be received in rail cars and unloaded into pressurized storage vessels. The storage vessels will feed [redacted]. The pyrolysis creates process gas [redacted][46] The process gas from the furnaces is then routed to the quench section to separate and [redacted][47] The purified process gas rich in VDF is then dried and compressed. The VDF enters a rectification area to further purify the VDF. The final stage is a cooling stage to convert the VDF to a liquid for storage. VDF can be shipped offsite as a liquid or routed to the polymerization section. Emissions from the VDF process are routed to one of two thermal oxidizers followed by caustic scrubbers for treatment of organics and capture of halogens. The halogens captured by the scrubbers are discharged to wastewater treatment. A process flow diagram is contained in Appendix N. Emission calculations are contained in Appendix O.

8.2 Polymerization and [redacted][48] Area

Liquid VDF is stored within the process and is fed to a batch reactor with additives to polymerize the VDF into PVDF. The resulting polymer is a solid that is contained in a water slurry. The slurry is [redacted][49] to remove impurities and then dried using [redacted][50] Dried polymer is then packaged for shipping to customers as a powder. Sources of particulate are controlled by baghouses. VDF as well as comonomers and other additives are introduced into the reactor where they combine to produce PVDF polymer. The reactors do not have a vent; the reactors convert raw material to polymer.

8.3 Utilities

The process includes a 99.5 x 10^6 Btu/hr boiler that uses natural gas to produce steam. Fuel oil may be used during periods of curtailment and for routine testing and maintenance. The boiler will be a water-tube boiler equipped with a highly efficient, low NOX burner to minimize NO_X and CO production. Solvay will also install a wastewater pH neutralization process. The wastewater from the process contains halogens; prior to discharge to the city of Augusta, the wastewater pH must be in the range of 6-10 standard units. Solvay will use a basic material to neutralize. Dry powder lime will be received from rail cars or trucks and pneumatically conveyed to a silo equipped with a filtration system to capture the lime. The filter is inherent to the process because the conveying system would not function without the filter. After conveying to the silo, the base is mixed with water in a 'hydrator' to dissolve it in water.

8.4 Emergency Scrubbing Operations

Because the process involves flammable and gaseous materials, an emergency scrubber system will be installed to capture halogens in the event that the thermal oxidizer and scrubber system cannot be used for emission control, i.e., during a malfunction or unplanned shutdown.

8.5 Alternate Operating Scenario

Due to process issues, there may be times when emissions from HT-305 may not be able to be vented to the thermal oxidizer system. The vent from HT-305 does not contain any HAP (organic, halogen, or halogenated). [redacted][51] Solvay will track hours operating in this mode and prepare emission estimates to include in monthly emission calculations.

9.0
Regulatory Analysis for Modified Processes

Facility operations are currently subject to air quality regulations that establish emissions limits and require an air permit. The Amodel, Compounding, KetaSpire/Novaspire, Sulfone, Verian/Xydar, and PUSH process areas are currently listed in the Title V permit. The following sections provide a summary of potentially applicable regulations. Where the proposed modifications or equipment additions affect a process(es) the new or modified requirements are discussed. If no changes are required, the section states that.

Chapter 391-3-1 of the Georgia Environmental Protection Division (GA EPD) regulations provides emissions limits and permitting requirements in Sections .02 and .03, respectively. The potentially applicable requirements of Section .02 are described in subsequent sections of this report. Section .03 provides the permitting procedures for State Implementation Plan (SIP) permits and Title V permits.

Section .03(1)(a) requires that facilities obtain permits prior to beginning construction. This report serves as the permit application to gain authorization from GA EPD to add the equipment necessary for the proposed expansion. GA EPD uses electronic permitting for new and modified equipment. The changes to the processes are contained in the GEOS system.

9.1 Environmental Protection Division, Rule 1 – Air Quality Control Emission Limits and Standards

9.1.1 Visible Emissions (391-3-1-.02 (2)(b)), Rule b

This rule regulates emissions from emission sources to no greater than 40 percent opacity except as provided by more restrictive or specific rules. The emissions from equipment within the existing processes are subject to this requirement:

- Amodel: Flare KB-807, Extruder KM-601, and Mix Tank KD-260
- Sulfone: Tank LD-101 and Reactor LR-201
- Xydar: Reactors R-201 A/B/C, Mixers R-202 A/B/C
- KetaSpire/NovaSpire: Hot oil heater and boiler

For new and modified equipment associated with this application the following sources will need to be added:

- Amodel: 52
- Sulfone: Raw material production process

9.1.2 Incinerators (391-3-1-.02 (2)(c)), Rule c

The existing Waste Heat Recovery Boiler (WHB) in the Sulfone process area is subject to this rule. No changes are proposed for the WHB as part of this project; thus, no changes in applicability or requirements for the WHB are needed. None of the other existing processes contain incinerators and none are proposed for the existing processes; therefore, no new equipment needs to be added for this project.

9.1.3 Fuel-burning Equipment (391-3-1-.02 (2)(d)), Rule d

The existing processes have fuel-burning equipment as defined by this rule, but none of the existing equipment is being modified as part of this this project. One new oil heater will be added to the KetaSpire/NovaSpire process that will be subject to this rule. The new heater will only be capable of burning natural gas and fuel oil for periods of natural gas curtailment at a heat input less than 10 million Btu/hr.

9.1.4 Particulate Emissions from Manufacturing Processes (391-3-1-.02 (2)(e)), Rule e

PM emissions are quantified from manufacturing processes on a pound per hour (lb/hr) basis by Rule e as follows:

For process weights up to 30 tph: $E = 4.10\ P^{0.67}$

Or,

For process weight rates greater than 30 tph: $E = 55.0\ P^{0.11} - 40$

Where:

E = the allowable emission rate in lbs/hr,

P = process weight rate in tons per hour (tph).

The existing processes are subject to this regulation as described in Condition 3.4.2 of the Title V permit. The Amodel solid stating process is subject to this requirement as well as the SO_3 process.

9.1.5 Sulfur Dioxide Limits From Fuel-burning Sources (391-3-1-.02(2)(g)), Rule g

This rule requires that for all fuel burning sources below 100×10^6 Btu/hr shall not burn fuel containing more than 2.5 percent sulfur, by weight. Solvay's boilers and heaters are limited to use of natural gas and distillate fuel oil. The natural gas sulfur content is negligible, and the distillate oil sulfur content is less than 0.5 percent by weight.

9.1.6 Sulfuric Acid Plants (391-3-1-.02(2)(g)), Rule j

Solvay does not currently operate a sulfuric acid plant. [redacted][53] The GA EPD rules do not define sulfuric acid plant, but a US EPA regulation provides the following definition:

(a) *Sulfuric acid production unit means any facility producing sulfuric acid by the contact process by burning elemental sulfur, alkylation acid, hydrogen sulfide,* *organic sulfides and mercaptans, or acid sludge, but does not include facilities where conversion to sulfuric acid is utilized primarily as a means of preventing emissions to the atmosphere of sulfur dioxide or other sulfur compounds.*

The proposed process unit does not produce sulfuric acid; thus, this rule does not apply. A 2002 EPA NSPS applicability determination supports this conclusion and can be accessed from the following link:

https://cfpub.epa.gov/adi/index.cfm?fuseaction=home.dsp_show_file_contents&CFID=26212343&CFTOKEN=ae820ad226c1907e-FCB77F9E-B757-6825-9CDBC1E9F6B16F73&id=0200085.

9.1.7 Fugitive Dust (391-3-1-.02(2)(n)), Rule n

This rule requires that all processing, handling, transportation, or storage facility operations resulting in fugitive dust must take reasonable precautions to prevent the dust from being airborne through the application of suppressants, covering, or vents. Opacity is limited to 20 percent. Solvay does not anticipate any fugitive dust will be generated by these processes under normal conditions because operations are enclosed, dusty materials are not stored outside such as in piles, conveying operations are completely enclosed, and filters are used to collect PM emissions from transfer operations.

9.1.8 Nitrogen Oxides Emissions From Fuel-burning Equipment (391-3-1-.02(2)(lll)), Rule lll

This regulation limits the emission of NO_X from an affected unit under this subparagraph that is installed or modified on or after May 1, 1999, to exceed 30 parts per million (ppm) at 3 percent oxygen on a dry basis. This regulation only applies to operations that are located in the counties of Banks, Barrow, Bartow, Butts, Carroll, Chattooga, Cherokee, Clarke, Clayton, Cobb, Coweta, Dawson, DeKalb, Douglas, Fayette, Floyd, Forsyth, Fulton, Gordon, Gwinnett, Hall, Haralson, Heard, Henry, Jackson, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Newton, Oconee, Paulding, Pickens, Pike, Polk, Putnam, Rockdale, Spalding, Troup, Upson, and Walton. Solvay is located in Richmond County; thus this regulation does not apply.

9.1.9 Prevention of Significant Deterioration (391-3-1-.02(7))

The potential emissions of the existing equipment without considering controls and permits limits is above the Prevention of Significant Deterioration (PSD) threshold for qualification as a major source of 100 tpy for all PSD pollutants. Solvay has federally enforceable limits on SO2, CO, NOX and VOC of 100 tpy each, thus the facility is not a major source considering emission controls and federally enforceable limits. No change in current limits is needed to classify the source as non-major as the potential-to-emit (PTE) for the sum of existing sources considering controls and permit limits is less than the PSD major source thresholds.

The proposed projects related to modification of the existing processes as well as the new Sarsaparilla process will result in increases in emissions of PSD pollutants. Table 9-1 summarizes the maximum anticipated actual emissions, which are also representative of projected actual emissions for the facility after completion of all projects.

Table 9-1
Summary of Maximum Anticipate Actual Emissions for the Augusta Facility

CRITERIA POLLUTANT	Amodel (tpy)	Compounding (tpy) (1)	KetaSpire / NovaSpire (tpy)	Sulfone (tpy) (2)	Verian / Xydar (tpy)	PUSH (tpy)	Sarsaparilla (tpy)	TOTAL PTE (tpy)
CO	8.13	--	13.27	28.13	7.41	--	10.32	68.1
NO_X	13.89	--	21.19	33.86	--	--	28.30	98.3
PM	2.16	15.69	37.64	9.25	0.01	0.27	19.94	86.7
PM_{10}	1.96	15.69	37.64	9.25	0.01	0.27	19.94	86.5
$PM_{2.5}$	1.96	15.69	37.64	9.25	0.01	0.27	19.94	86.5
SO_2	7.02	--	19.68	0.27	--	--	25.38	52.4
VOCs	7.87	5.09	5.48	32.11	0.11	9.59	32.42	94.4

After implementation of these projects, the Solvay facility will remain a minor source of emissions for PSD applicability considering the 100 tpy permit limits in Condition 3.2.1, 3.2.2., and 3.2.3 of the Title V permit. For consistency, the new heater in the KetaSpire process as well as the boiler and thermal oxidizers in the Sarsaparilla process should be added to the table in 3.2.1.

9.2 Part 60 New Source Performance Standards

GA EPD is the designated authority for New Source Performance Standards (NSPS) regulations; these regulations are incorporated by reference into Georgia's regulations. The following subsections described the potentially applicable NSPS and the applicable limits.

9.2.1 USEPA Regulation 40 CFR 60 Subpart Db

This NSPS applies to boilers with a capacity greater than 100 x 10^6 Btu/hr heat. No boilers exceeding this capacity are proposed for this project.

9.2.2 USEPA Regulation 40 CFR 60 Subpart Dc

This NSPS applies to boilers with a capacity between 10 x 10^6 and 100 x 10^6 Btu/hr heat input (2.9 and 29 megawatts). The new boiler is potentially subject to the requirements of this rule, but the new oil heater has a heat input capacity less than 10 x 10^6 Btu/hr, thus it is not subject to the requirements of this rule. If the boiler only burns natural gas, then there are no limits under this rule. If No. 2 fuel oil is used as a fuel, even as a backup, then the following limits apply:

- 20 percent opacity
- Limit fuel oil to 0.5 percent sulfur by weight or limit SO2 emissions to 0.50 lb/MMBtu
- limit PM emissions to 0.030 lb/MMBtu if the boiler is greater than 30 MMBtu/hr

Paragraph (4) of 60.43c(d) exempts sources that burn only fuels not subject to a PM limit and fuel oil with a sulfur content of less than 0.5 weight percent sulfur from this standard. Solvay requests a limit of 0.5 weight percent sulfur be added to the permit to exempt the 99.5 MMBtu/hr boiler from PM limits, PM testing, and PM monitoring.

9.2.3 USEPA Regulation 40 CFR 60 Subpart Kb

This NSPS applies to storage vessels with a capacity that exceeds 75 m^3 (19,813 gallons) and are used to store volatile organic liquid (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984.

Most of the tanks at Solvay qualify as process tanks, as defined below:

> *Process tank means a tank that is used within a process (including a solvent or raw material recovery process) to collect material discharged from a feedstock storage vessel or equipment within the process before the material is transferred to other equipment within the process, to a product or by-product storage vessel, or to a vessel used to store recovered solvent or raw material. In many process tanks, unit operations such as reactions and blending are conducted. Other process tanks, such as surge control vessels and bottoms receivers, however, may not involve unit operations.*

Process tanks are specifically excluded from the regulation; therefore, the requirements of this regulation do not apply to process tanks. With the exception of certain Udel tanks, the other tanks at the Solvay facility are exempt from control requirements due to their size and / or vapor pressure. The current Title V provides the necessary requirements for Subpart Kb for the Udel tanks.

The proposed projects for Amodel, Compounding, Xydar/Verian, and PUSH areas do not include any new storage vessels for organic liquids.

The Compounding process modifications include addition of a [54] storage vessel to feed the process. The vessel will have a capacity of approximately 12 liters, which is much less than the 19,813 gallons threshold for applicability in the rule.

The KetaSpire/NovaSpire area does include eight new wash vessels, but these are process tanks as defined above and the material stored in these tanks is non-VOC solvent with water. The wash vessels are specifically exempt from the definition of VOCs by 51.100(s); thus, the requirements of this regulation will not be applicable.

The additional tanks for the Sulfone area are process tanks exempt from this rule.

9.2.4 USEPA Regulation 40 CFR 60 Subpart Kc

This NSPS is a proposed rule that will apply to storage vessels with a capacity that exceeds 75.7 m^3 (20,0000 gallons) and are used to store volatile organic liquid (VOL) for which construction, reconstruction, or modification is commenced after October 4, 2023. In general, the requirements and applicability for Kc are similar to Kb except that all affected storage vessels with a VOL that has a maximum true vapor pressure greater than 11.1 psia are subject to control requirements and VOLs with a vapor pressure greater than 1.5 psia stored in a tank with a capacity greater than 1,000,000 gallons require control. Solvay does not have any tanks that meet these criteria and none of the proposed tanks will exceed the Subpart Kc volume and / or vapor pressure thresholds. (Ethanol has a vapor pressure of 13 kPa (1.89 psia) and methanol has a vapor pressure of 26 kPa (3.77 psia), but these tanks have a capacity of much less than 1,000,000 gallons).

9.2.5 Standards of Performance for Synthetic Organic Chemicals Manufacturing Industry; Subparts VV, III, and RRR

These three Synthetic Organic Chemical Manufacturing Industry (SOCMI) standards of 40 CFR 60 that apply to facilities which manufacture a SOCMI chemical as listed in 60.489, 60.617, and 60.707. The existing processes (PUSH, Sulfone, Amodel, KetaSpire, and Verian) use listed chemicals as a raw materials and produce listed chemicals as contaminants which are listed chemicals in these rules. However, these processes do not produce these materials and these rules do not apply.

9.2.6 Standards of Performance for Synthetic Organic Chemicals Manufacturing Industry; Subpart NNN

This SOCMI standard of 40 CFR 60 applies to facilities that manufacture a SOCMI chemical as listed in 60.667. The existing processes (PUSH, Sulfone, Amodel, KetaSpire, and Verian) use listed chemicals as raw materials and produce listed chemicals as contaminants which are listed chemicals in these rules. However, since these processes do not produce these materials, these rules do not apply. Two applicability determinations posted on the USEPA's Clean Air Act (CAA) Applicability Determination Index (ADI) relevant to this determination are included in Appendix P.

9.2.7 Standards of Performance for Volatile Organic Compound Emissions from the Polymer Manufacturing Industry; Subpart DDD

These standards apply to polypropylene, polyethylene, polystyrene, or poly (ethylene terephthalate) manufacture. The proposed equipment will be involved in productions of polymers or monomers that are not listed in this rule; thus, this regulation does not apply.

9.2.8 Standards of Performance for Synthetic Fiber Production Facilities; Subpart HHH

Subpart HHH applies to *solvent-spun synthetic fiber processes*. The Solvay processes are not fiber manufacturing processes.

9.2.9 Standards of Performance for Synthetic Organic Chemical Manufacturing Industry Wastewater Treatment Plants; Subpart YYY (Proposed Rule)

This proposed rule currently applies to organic wastewater compounds at SOCMI production facilities. SOCMI production facilities are delineated in Table 1 of the rule. The manufacturing processes utilize compounds listed in Table 1 of the Rule; however, the facility does not produce these chemicals, so the requirements of the regulation are not applicable.

9.3 Part 61 National Emission Standards for Hazardous Air Pollutants

GA EPD is the designated authority for these National Emission Standards for Hazardous Air Pollutants (NESHAPs) regulations; these regulations are incorporated by reference into Georgia's regulations. The following subsection describes the potentially applicable NESHAPs and the applicable limits.

9.3.1 National Emission Standards for Hazardous Air Pollutant for Benzene Operations; Subparts J, Y, V, BB, and FF

These standards apply to benzene operations as defined in the applicable regulations. Since the proposed operations may contain benzene, these regulations may apply. Benzene is created as a product of degradation of raw material used in the process. Specifically, applicability criteria and thresholds are described below.

Storage vessels less than 10,000 gallons capacity are exempted. Solvay does not currently nor does it plan to operate any storage vessels with a capacity of greater than 10,000 gallons that store benzene; thus, the storage vessel provisions do not apply.

Benzene waste operations that exceed 11 tpy of benzene in all waste streams are subject to provisions for wastes. The Solvay facility does not and will not produce benzene at a rate that exceeds 11 tpy. Benzene concentrations in proposed processes will be less than 10 ppmw.

Leak Detection and Repair (LDAR) requirements apply to equipment which contacts a fluid with a concentration of greater than 10 percent benzene by weight. Solvay does not have any streams that have greater than 10 percent benzene by weight.

9.4 Part 63 National Emission Standards for Hazardous Air Pollutants for Source Categories

GA EPD is the designated authority for these NESHAPs regulations; these regulations are incorporated by reference into Georgia's regulations. The following subsections describe the potentially applicable NESHAPs and the applicable limits.

9.4.1 National Emission Standards for Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry; Subparts F, G, H, and I

The Sulfone and Xydar process utilizes HAPs which are listed in Table 1 of 40 CFR 63 Subpart F. These processes do not produce any Table 1 HAP; thus these Subparts do not apply.

9.4.2 National Emission Standards for Hazardous Air Pollutant Emissions: Group I Polymers and Resins; Subpart U

Subpart U applies to elastomer production; elastomers are defined in the regulation to include the following:

- Butyl Rubber
- Halobutyl Rubber
- Epichlorohydrin Elastomer
- Ethylene Propylene Rubber
- HypalonTM
- Polybutadiene Rubber/Styrene Butadiene Rubber by Solution
- Neoprene
- Nitrile Butadiene Rubber
- Nitrile Butadiene Latex
- Polysulfide Rubber
- Styrene Butadiene Latex
- Styrene Butadiene Rubber by Emulsion

Since the processes do not produce any of these elastomers and the proposed changes do not result in the capacity to produce elastomers, the equipment is not subject to this regulation.

9.4.3 National Emission Standards for Pharmaceuticals Production and National Emission Standards for Hazardous Air Pollutants for Pesticide Active Ingredient Production; Subparts GGG and MMM

These regulations apply to pharmaceutical and pesticide production as defined in the regulations. Because the existing processes will not produce pharmaceuticals or pesticides, this regulation is not applicable.

9.4.4 National Emission Standards for Hazardous Air Pollutant Emissions: Group IV Polymers and Resins, Subpart JJJ

Subpart JJJ applies to *thermoplastic product process units*. Since the products for the existing processes are not listed thermoplastic products, the requirements of this regulation are not applicable.

9.4.5 National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline); Subpart EEEE

The applicability of this standard, referred to as the Organic Liquid Distribution (OLD) Maximum Achievable Control Technology (MACT), is determined by the material(s) stored and transferred into or out of the facility. The standard exempts equipment subject to the requirements of another 40 CFR 63 NESHAPs. Since the Xydar, Sulfone, PEEK, and PUSH processes are subject to 40 CFR 63 Subpart FFFF (MON), they are exempt from this regulation. The Compounding process modifications include addition of a [55] storage vessel to feed the process with a capacity of 12 liters. Because it does not contain any HAP, it is not subject to this rule. The KetaSpire/NovaSpire project includes eight new [56] vessels, but these are process tanks and the material contained in these tanks is non-VOC and non-HAP solvent with water; thus these tanks are not subject to this rule.

9.4.6 National Emission Standards for Hazardous Air Pollutants: Industrial and Commercial Boilers; Subpart DDDDD

This standard applies to all facilities that own or operate an industrial, commercial, or institutional boiler or process heater that is located at a major source of HAP. The Solvay facility is currently a major source of HAP and will be subject to this subpart. Solvay plans to add one oil heater and one boiler as part of this project. These combustion devices are subject to this regulation. Because these units will primarily burn natural gas and only use fuel oil No.2 during periods of curtailment and for testing, there are no applicable emissions limits. The only requirement is a work practice to perform a tune up of the associated burners.

9.4.7 National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing; Subpart FFFF

This NESHAP requirement, referred to as the Miscellaneous Organic Chemical Manufacturing National Emission Standards for Hazardous Air Pollutant (MON), applies to major sources of HAP that produce a MON chemical. MON chemicals are defined as those with the following Standard Industrial Classification (SIC) or North American Industry Classification System (NAICS) codes: 282, 283, 284, 285, 286, 287, 289, or 386 and NAICS code 325. The Solvay facility, as currently configured, is subject to the MON requirements because it is a major source and has MON-regulated sources. Specifically, the PUSH, KetaSpire/NovaSpire, Sulfone and Xydar production processes are subject to MON. Compounding is currently exempt because it does not use or produce HAPs. The current Title V permit reflects applicable MON requirements for each of these processes. The following sections describe applicability and requirements for new or changed equipment.

Amodel

The Amodel process is not currently regulated as a MON process. The proposed change to the Amodel process involves addition of a [57] step to allow for an increase in production. The solid stating equipment performs the same function as existing equipment; there is no change in process chemistry. The Amodel process does not use, produce, or emit HAP, nor will it use, produce, or emit HAP after the addition of the solid stating equipment. Thus, the MON is not and will not be applicable to Amodel.

Compounding

The Compounding process is not currently regulated as a MON process. The proposed changes to the Compounding process involve installing additive feeders, extruders, and solids conveying equipment similar to existing equipment. The existing and new compounding processes do not use or produce HAP. The D7 extruder will utilize [58] to produce certain specific polymers. [59] is not a HAP or TAP, but it produces methanol in the extrusion process, which is a HAP and TAP. The methanol will be emitted from the process in the air and a portion will be captured by the liquid ring vacuum pump which results in a discharge of methanol containing wastewater. Thus, the air emissions and wastewater discharge are potentially subject to MON emission limits.

The air emissions limits for processes in the MON rule are categorized as either batch or continuous process vents. Batch operation "…means a noncontinuous operation involving intermittent or discontinuous feed into equipment, and, in general, involves the emptying of the equipment after the operation ceases and prior to beginning a new operation. Addition of raw material and withdrawal of product do not occur simultaneously in a batch operation." Continuous process vents (CPV's) are vents from any operation that is not a batch operation. The D7 process involves continuously feeding raw materials to the extruder system and continuously removing product where feeding and removal operations generally occur simultaneously except for periods of startup and shutdown. Thus, this operation's vents are considered CPVs. The estimated TRE values are greater than 1.9; the vacuum pump vent has a TRE less than 5.0. The other two vents have a TRE greater than 10. As such, each of these is a group 2 vent. Because the vacuum pump vent has a TRE less than 5.0, testing will be required after startup to verify the TRE calculation inputs.

The liquid ring vacuum pump will capture methanol and route it to wastewater. Wastewater designated as 'group 1' requires control while 'group 2' wastewater does not. Group 1 wastewater designation is based on the 63.2485(c). Methanol is a Table 9 compound; several other HAP are contained in the wastewater at low concentrations as summarized in Appendix E. The sum of Table 8 and 9 compounds is less than 30,000 ppm and the sum of Table 8 compounds is much less than 1,000 ppm. Thus this wastewater stream is a group 2 stream.

The Compounding process does not have any of the following:

- Process vents that emit hydrogen halide and halogen HAP or HAP metals
- Storage tanks
- Surge control vessels and bottoms receivers
- Equipment contacting > 5% HAP
- Heat exchange systems
- Transfer Racks

Thus, there are not any MON requirements associated with these operations.

KetaSpire / NovaSpire

The KetaSpire/NovaSPire product is classified as a thermoplastic resin and covered by SIC Code 2821 and NAICS 325211. [redacted].[60] Each of these chemicals are either hydrogen halide, halogen HAP, or organic HAP as listed by 63.2435(b)(2). The miscellaneous organic chemical manufacturing process units (MCPUs) is not an affected source or part of an affected source under another subpart of this Part 63 and is not a batch operation within a chemical manufacturing process unit (CMPU), as identified in §63.100(j)(4). Therefore, the process is subject to MON.

The pertinent changes in the KetaSpire/NovaSpire area are addition of raw material handling, a reactor with scrubber, replacement of [redacted],[61] a new dryer, and distillation column with condenser. This equipment serves the same purpose as existing equipment in this area. The additional equipment does not change the product, raw materials or chemistry of the process; this equipment allows for increased production. As such, there is no impact on the regulatory requirements for the existing equipment, and this discussion focuses on the new equipment.

The process contains the following categories of sources that may be regulated by MON:

- Continuous process vents
- Batch process vents
- Process vents that emit hydrogen halide and halogen HAP or HAP metals
- Storage tanks
- Equipment leaks
- Wastewater

The following MON-regulated categories of sources are not part of the process:

- Transfer racks
- Heat exchange systems

Transfer racks regulated by MON are limited to those that are, "…used to fill tank trucks and/or rail cars with organic liquids that contain one or more of the organic HAP." The existing and proposed equipment does not include any systems for conveying organic liquids for rail or truck loading.

The definition of heat exchange system is contained in 63.101 and is provided for reference:

> *Heat exchange system means any cooling tower system or once-through cooling water system (e.g., river or pond water). A heat exchange system can include more than one heat exchanger and can include an entire recirculating or once-through cooling system.*

The existing and proposed equipment does include a heat exchange system. Heat exchange systems that contact materials listed in Table 4 of Subpart F at a level above 5 percent by weight are applicable to the standard. The existing and proposed equipment do not contain any of the materials in Table 4 at concentration above 5 percent by weight in the process.

The MON regulations provide different levels of applicability and control for new versus existing sources. A *new affected source* is described in the rule by the following paragraphs in 63.2440:

> *Each affected source defined in paragraph (b) of this section for which you commenced construction or reconstruction after April 4, 2002, and you meet the applicability criteria at the time you commenced construction or reconstruction.*
>
> *Each dedicated MCPU that has the potential to emit 10 tons per year (tpy) of any one HAP or 25 tpy of combined HAP, and you commenced construction or reconstruction of the MCPU after April 4, 2002. For the purposes of this paragraph, an MCPU is an affected source in the definition of the term "reconstruction" in §63.2.*

The affected source for this rule is delineated as, "…the facility-wide collection of MCPU and heat exchange systems, wastewater, and waste management units that are associated with manufacturing materials described in §63.2435(b)(1)." Since the process will be part of the facility-wide collection of MCPU and is not being reconstructed, this is not a new source.

Continuous Process Vent

A continuous process vent is the point of discharge of an operation that is not a batch operation, storage tank, or equipment leak. Emissions for vents that are less than or equal to 0.005 weight percent (50 ppmw) total HAP are not continuous process vents. Table 9-2 summarizes the new emission sources at the facility and the basis for inclusion or exclusion from consideration of a continuous process vent. The existing process does not have any continuous process vents.

Table 9-2
Continuous Process Vent Determination

STACK IDS	SOURCE DESCRIPTION	CONTINUOUS PROCESS VENT	IF NO, BASIS FOR EXCLUSION
SD-23, SD-24, SD-25, SD-26, SD-27, SD-29, SM-10, SM-11, SM-12, SM-13	Non-HAP unloading and conveying	No	<50 ppmw total HAP
SD-22, SD-28	HQ and DFBP Sack unloading and conveying	No	Batch Process Vents
SB-3	Hot oil heater	No	Ancillary activity, see 63.2550
SH-3	Reactor	No	Batch process vent
SA-7, SA-8	[redacted][62] and tank farm	No	<50 ppmw total HAP
SA-9	Drying	No	<50 ppmw total HAP

Batch Process Vents

Batch process vents are vents from one or more unit operations within a process such as vents on condensers used for product recovery, reactors, filters, centrifuges, and process tanks. The following are not batch process vents for the purposes of this subpart:

- Continuous process vents;
- Bottoms receivers;
- Surge control vessels;
- Vents on storage tanks, wastewater emission sources, or pieces of equipment subject to the emission limits and work practice standards in Tables 4, 6, and 7 to this subpart;
- Emission streams from emission episodes that are undiluted and uncontrolled containing less than 50 ppmv HAP are not part of any batch process vent. A vent from a unit operation, or a vent from multiple unit operations that are manifolded together, from which total uncontrolled HAP emissions are less than 200 lb/yr is not a batch process vent; emissions for all emission episodes associated with the unit operation(s) must be included in the determination of the total mass emitted.

The units listed in Table 4 with a concentration of less than 50 ppmw are also less than 50 ppmv and are not batch process vents based on the HAP concentration. (To avoid confusion, note that continuous process vents are exempt based on a level of 50 ppmw and batch process vents are exempt based on a level 50 ppmv.) The KetaSpire/NovaSpire process reactor vent is considered a batch process vent. The HAP emitted from the reactor is HF. The emissions of HF exceed 50 ppmv, so this is a batch process vent.

Under Subpart FFFF, batch process vents require control if they are designated as Group 1. Group 2 vents do not require control. Group 1 batch process vent is defined in the rule as a vent that is greater than or equal to 10,000 lb/yr of organic HAP at an existing source or greater than or equal to 3,000 lb/yr of organic HAP at a new source. The reactor vent does not emit organic HAP; it is only a source of hydrogen halide or halogen HAP.

The HQ conveying bins are considered batch process vents. The sum of the emissions from the new and existing sources is 1,578 lbs/yr. Because the sum is less than 10,000 lb/yr, these are considered a group 2 batch process vent.

Process Vents That Emit Hydrogen Halide and Halogen HAP or HAP Metals

Subpart FFFF defines hydrogen halide and halogen HAP as hydrogen chloride, hydrogen fluoride, and chlorine. Process vents are batch and continuous process vents; storage tanks, and equipment leaks are specifically exempted from the definitions of batch and continuous process vents. Table 9-3 summarizes the sources that emit hydrogen halide and halogen HAP and are considered process vents.

Table 9-3
Summary of Hydrogen Halide and Halogen HAP Emission Sources

SOURCE ID	SOURCE DESCRIPTION	HYDROGEN HALIDE OF HALOGEN HAP EMITTED	HYDROGEN HALIDE OR HALOGEN HAP UNCONTROLLED EMISSION RATE (lb/yr)
PR-200	Reactor	Yes	462
PR-2200	Reactor	Yes	462
Total			924

1. PR-200 is the existing reactor, PR-2200 is the new reactor.
2. Uncontrolled emissions for PR-200 are from uncontrolled emissions 8,760 hr/yr basis from May 1-5, 2017 test report plus a ratioed capacity increase to account for increase in production achieved through shortening the reactor cycle.
3. Uncontrolled emissions from PR-2200 are equivalent to PR-200 because the reactors are identical in design capacity and throughput.

Because the collective uncontrolled hydrogen halide and halogen HAP emissions from the KetaSpire/NovaSpire process vents are less than 1,000 pounds per year (lb/yr), the control requirements in the rule do not apply.

If emissions exceed 1,000 lb/yr then the requirements of Table 3 in Subpart FFFF would apply. Table 3 provides for three control options as follows:

- Reduce hydrogen halide and halogen HAP by 99 percent
- Meet an outlet hydrogen halide and halogen HAP concentration of less than or equal to 20 ppmv
- Reduce the halogen atom mass emission rate from the sum of all batch process vents and each individual continuous process vent to ≤0.45 kg/hr

Scrubbers SC-1 and SC-3 are designed to meet the 20 ppmv requirement; the scrubber vendor will provide a guarantee of 20 ppmv for the PR-2200.

HAP metals are the metal portion of the following compounds: antimony, arsenic, beryllium, cadmium compounds, chromium, cobalt, lead, manganese, mercury, nickel, and selenium. The KetaSpire/NovaSpire process does not use, produce, or generate HAP metals so the requirements of this section are not applicable. Further, the HAP metals requirements only apply to new sources. The KetaSpire/NovaSpire process is considered existing as described previously, thus the requirements for HAP metals do not apply.

Storage Tanks

The only vessel used in the KetaSpire/NovaSpire process that is considered a storage tank is the existing acid storage tank. The acid storage tank has a capacity of less than 10,000 gallons, thus it is classified as Group 2 storage tank and does not require control. No changes to the acid storage tank are proposed as part of this application.

Equipment Leaks

The equipment leak requirements contained in Table 6 of Subpart FFFF apply to equipment that either contains or contacts a fluid (liquid or gas) that is at least 5 percent by weight of total organic HAP. The only organic HAP in this process is hydroquinone, which is a solid with low vapor pressure. Based on current operational information, none of the equipment exceeds the LDAR applicability thresholds. Solvay will implement one of the leak detection and repair program (LDAR) options in Table 6 of the MON rule if any new equipment exceeds the applicability thresholds, but Solvay expects that process will continue to be exempt from LDAR requirements.

Wastewater

Wastewaters potentially subject to requirements of Subpart FFFF are those that meet one of the following two criteria:

- annual average concentration of compounds in Tables 8 and 9 to Subpart FFFF of at least 5 ppmw and has an annual average flow rate of 0.02 liters per minute or greater; or
- annual average concentration of compounds in Tables 8 and 9 to this Subpart of at least 10,000 ppmw at any flow rate

The KetaSpire/NovaSpire process does not use, produce, or generate any of the compounds listed in Table 8 or 9 at a concentration above 5 ppmw, thus the process does not generate wastewater subject to the provisions of this rule.

This application also serves to satisfy the notification requirements under

- Subpart A, §63.9(b) and 63.5 Table 11 of Subpart FFFF: Pre-compliance Report 63.2520(c)

Sulfone

The Sulfone production process manufactures a product that has an SIC of 2865, which is one of the MON categories and uses MCB, a HAP, as a raw material. Therefore, the Sulfone process is subject to MON. The Sulfone process contains the following categories of sources that may be regulated by MON:

- Continuous process vents
- Batch process vents
- Process vents that emit hydrogen halide and halogen HAP or HAP metals
- Storage tanks
- Surge control vessels and bottoms receivers.
- Equipment leaks
- Wastewater
- Heat exchange systems

The following MON-regulated category of sources is not part of the process:

- Transfer racks

Transfer racks regulated by MON are limited to those that are, "…used to fill tank trucks and/or railcars with organic liquids that contain one or more of the organic

HAP." The process does not include any systems for conveying organic liquids for rail or truck loading.

The definition of heat exchange system is contained in 63.101 and is quoted below for reference:

> *Heat exchange system means any cooling tower system or once-through cooling water system (e.g., river or pond water). A heat exchange system can include more than one heat exchanger and can include an entire recirculating or once-through cooling system.*

The process does include a heat exchange system. However, each of the heat exchangers within this system qualify for one or more of the exemptions outlined within this subpart and therefore are exempt from MON standards. No new heat exchangers are proposed as part of the expansion project.

The MON regulations provide different levels of applicability and control for new versus existing sources. A *new affected source* is described in the rule by the following paragraphs in 63.2440:

1. *Each affected source defined in paragraph (b) of this section for which you commenced construction or reconstruction after April 4, 2002, and you meet the applicability criteria at the time you commenced construction or reconstruction.*
2. *Each dedicated MCPU that has the potential to emit 10 tons per year (tpy) of any one HAP or 25 tpy of combined HAP, and you commenced construction or reconstruction of the MCPU after April 4, 2002. For the purposes of this paragraph, an MCPU is an affected source in the definition of the term "reconstruction" in §63.2.*

The affected source for this rule is delineated as, "…the facility-wide collection of MCPU and heat exchange systems, wastewater, and waste management units that are associated with manufacturing materials described in §63.2435(b)(1)." Since the process will be part of the facility-wide collection of MCPU and does not have emissions of HAP that exceed 10/25 tpy thresholds it is not considered a new source under MON.

Continuous Process Vent

A continuous process vent is the point of discharge of an operation that is not a batch operation, storage tank, or equipment leak. Emissions for vents that are less than or equal to 0.005 weight percent (50 ppmw) total HAP are not continuous process vents. All vents associated with the Sulfone process, other than the MIS reactor vent, are considered continuous process vents (CPVs). For existing sources, only Group 1 CPVs, defined as having a Total Resource Effectiveness (TRE) index value ≤1.9, are subject to MON emission control requirements. All other CPVs (*i.e.,* TRE >1.9) are called Group 2 CPVs and not subject to MON. However, Group 2 CPVs that have a TRE >1.9 but <5.0 are subject to certain requirements for its condensers.

TRE is determined using values from engineering assessment data or from field measurement data. If the TRE calculated using engineering assessment data is <5.0, the regulations require that TRE be re-calculated using measured values for vent stream flow rate, emission rate of organic HAP and net heating value. No field measurements are required if the TRE estimated using engineering assessment is ≥5.0.

The TRE values for the new and modified vents were calculated and all vents have TRE values greater than 1.9, which removes them from Group 1 category and places them into the Group 2 CPVs category. However, TRE values for vents LE-679, LE-576 and LE-680 are less than 5.0, so additional monitoring will be required as specified in 40 CFR 63.993 (c)(2). The facility proposes that the outlet coolant temperature of each of these vent condensers be monitored once per shift consistent with current permit Conditions 5.2.1.h. and 6.1.7.c.iv., which require a maximum outlet coolant temperature 12.8°C.

Revised TRE calculations are contained in Appendix I.

Batch Process Vents

Batch process vents are vents from one or more unit operations within a process such as vents on condensers used for product recovery, reactors, filters, centrifuges, and process tanks. The following are not batch process vents for the purposes of this subpart:

- CPVs;
- Bottoms receivers;
- Surge control vessels;
- Vents on storage tanks, wastewater emission sources, or pieces of equipment subject to the emission limits and work practice standards in Tables 4, 6, and 7 to this subpart; and
- Emission streams from emission episodes that are undiluted and uncontrolled containing less than 50 ppmv HAP are not part of any batch process vent. A vent from a unit operation, or a vent from multiple unit operations that are manifolded together, from which total uncontrolled HAP emissions are less than 200 lb/yr is not a batch process vent; emissions for all emission episodes associated with the unit operation(s) must be included in the determination of the total mass emitted.

The existing and new MIS cracking reactor vent is the only *batch process vent*. The determination of whether control of this vent is required depends on the determination of group status; Group 1 vents require control, while Group 2 vents are exempted from control requirements.

Group 1 batch process vent means each of the batch process vents in a process for which the collective uncontrolled organic HAP emissions from all of the batch process vents are greater than or equal to 10,000 lb/yr at an existing source or greater than or equal to 3,000 lb/yr at a new source.

The uncontrolled HAP emissions rate from the MIS cracking reactors is 5,400 lb/yr. Since this is less than the emission thresholds for categorization as a Group 1 batch process vent, this vent is categorized as a Group 2 batch process vent.

Process Vents That Emit Hydrogen Halide and Halogen HAP or HAP Metals

Subpart FFFF defines hydrogen halide and halogen HAP as hydrogen chloride, hydrogen fluoride, and chlorine. Process vents are batch and CPVs; storage tanks, and equipment leaks are specifically exempted from the definitions of batch and CPVs. No source within the Sulfone process emits hydrogen halide and halogen HAP.

Storage Tanks

Under Subpart FFFF, storage tanks require control if they are designated as Group 1. Group 2 tanks do not require control. Group 1 tanks are defined in the rule as a tank that meets the following criteria:

- a capacity greater than or equal to 10,000 gal; and
- stores a material that has a maximum true vapor pressure of total HAP greater than or equal to 6.9 kilopascals (kPa) at an existing source or greater than or equal to 0.69 kPa at a new source.

Vessels within the Sulfone process stored either Sulfone monomer or MCB. Sulfone monomer does not contain HAP. The true vapor pressure of MCB at storage conditions is 2.756 kPa which is lower than the 6.9 kPa to be considered a Group 1 tank. Therefore, all tanks within the Sulfone process are Group 2 tanks, are exempt from MON, and no additional controls or monitoring will be necessary.

Equipment Leaks

The equipment leak requirements contained in Table 6 of Subpart FFFF apply to equipment that either contains or contacts a fluid (liquid or gas) that is at least 5 percent by weight of total organic HAP. The organic HAP in this process is MCB. For equipment that exceeds 5 percent of HAP by weight, Solvay will implement the Leak Detection and Repair (LDAR) options listed in 40 CFR 63, Subpart UU – National Emission Standards for Equipment Leaks.

Wastewater

Wastewaters potentially subject to requirements of Subpart FFFF are those that meet one of the following two criteria:

- Annual average concentration of compounds in Tables 8 and 9 to Subpart FFFF of at least 5 ppmw and has an annual average flow rate of 0.02 liters per minute or greater; or
- Annual average concentration of compounds in Tables 8 and 9 to this Subpart of at least 10,000 ppmw at any flow rate

The following are categorically not considered wastewater:

- Stormwater from segregated sewers;
- Water from fire-fighting and deluge systems, including test of such systems;
- Spills;
- Water from safety showers;
- Samples of a size not greater than reasonably necessary for the method of analysis that is used;
- Equipment leaks;
- Wastewater drips from procedures such as disconnecting hoses after cleaning lines; and
- Noncontact cooling water.

Process wastewaters are further categorized as Group 1 or 2 wastewaters . Only the following streams are considered Group 1 process wastewaters:

- The total annual average concentration of compounds in Table 8 to this subpart is ≥10,000 ppmw at any flow rate, and the total annual load of compounds in Table 8 to this subpart is ≥ 200 lb/yr.
- The total annual average concentration of compounds in Table 8 to this subpart is ≥1,000 ppmw, and the annual average flow rate is ≥1 l/min; or
- The combined total annual average concentration of compounds in Tables 8 and 9 to this subpart is ≥30,000 ppmw, and the combined total annual load of compounds in Tables 8 and 9 to this subpart ≥1 tpy.

Only Group 1 wastewaters are subject to emission/treatment standards. Group 2 streams are subject only to monitoring requirements, if any.

Organic wastewater discharges from various points of the Sulfone process are collected in the wastewater Equalization Tank LF-1601. This wastewater, containing mainly MCB as a pollutant, is then passed through several stages of carbon adsorption beds. Treated wastewater is discharged to the POTW under the authority of a discharge permit issued by the City of Augusta. Spent carbon (containing MCB) is periodically removed from carbon beds and held in a storage tank prior to being shipped for off-site recycling/disposal in compliance with appropriate Resource Conservation and Recovery Act (RCRA) standards.

Solvay has determined that MCB is the only HAP present in the Sulfone process's wastewater. Multiple stream discharge points and tanks consisting of sumps, drains, storage tanks and out of service tanks were identified. The MIS Cracking Equipment wastewater stream contains MCB which is a Table 8 compound. Its flow exceeds the second criteria listed above; however, its concentration is <1,000 ppmw and therefore this is a Group 2 wastewater stream. Six sumps located within this process are considered Group 2 wastewater streams due to their concentrations. All other streams are classified as "not-a-wastewater" for the purposes of this regulations because of low level of HAP concentation. and are therefore, along with the Group 2 streams, not subject to any control or treatment requirements.

Table 9-4
Sulfone Process Liquid Streams

STREAM NAME	COLLECT PURPOSE	HAP (MCB) CONCENTRATION (ppmw)	FLOW RATE (lpm)	WASTEWATER CATEGORY
MIS Cracking Wastewater	Wastewater Stream	500	57.84	Process Wastewater Group 2
LD-310/314 Sump #1	Decant	100	0.04	Process Wastewater Group 2
LD-310/314 Sump #2	Decant	100	0.04	Process Wastewater Group 2
LF-1601 Sump #1	Stormwater/ Leaks	250	0.07	Process Wastewater Group 2
LF-1601 Sump #2	Stormwater/ Leaks	250	0.07	Process Wastewater Group 2

The wastewater equalization tank (LF-1601) is required to have a fixed roof providing the tank contents are not heated (atmospheric vents allowed). Other waste management units are in enclosed tanks/structures meeting MON standards. Wastewater treatment residues (spent carbon, any sludge, etc.) are required to be handled in compliance with RCRA regulations and/or sold offsite for recycling. Solvay already is managing the wastes per RCRA standards as well as selling the product for recycling. The proposed changes for Sulfone described in this application are not expected to increase the concentration of MCB in wastewater streams.

Other Requirements

The MIS Cracking process is equipped with an emergency quench drum which will only be used in the event that there is an overpressure situation in the reactor due to an uncontrolled reaction. There is also an emergency scrubber located downstream of the quench drum which is used to prevent the escape of hazardous gases to the atmosphere from the MIS Cracking process. The MON allows opening of safety devices [see 63.2450(p)] to avoid unsafe conditions and does not require control of these releases. Safety device is defined in the MON as follows:

> *Safety device means a closure device such as a pressure relief valve, frangible disc, fusible plug, or any other type of device which functions exclusively to prevent physical damage or permanent deformation to a unit or its air emission control equipment by venting gases or vapors directly to the atmosphere during unsafe conditions resulting from an unplanned, accidental, or emergency event. For the purposes of this subpart, a safety device is not used for routine venting of gases or vapors from the vapor headspace underneath a cover such as during filling of the unit or to adjust the pressure in response to normal daily diurnal ambient temperature fluctuations. A safety device is designed to remain in a closed position during normal operations and open only when the internal pressure, or another relevant parameter, exceeds the device threshold setting applicable to the air emission control equipment as determined by the owner or operator based on manufacturer recommendations, applicable regulations, fire protection and prevention codes and practices, or other requirements for the safe handling of flammable, combustible, explosive, reactive, or hazardous materials.*

Solvay only needs to keep records of the safety device opening as required in 40 CFR 63.2525(f).

This application also serves to satisfy the notification requirements under

- Subpart A, §63.9(b) and 63.5
- Table 11 of Subpart FFFF: Pre-compliance Report 63.2520(c)

Verian / Xydar

The Verian process is not currently regulated as a MON process. Solvay intends to continue to make incremental changes in equipment, operational, and production rates in several phases over a period of up to approximately five more years. These changes are consistent with the current Title V permit and the application submitted for this process. The process does not use, produce, or emit HAP, nor will it use, produce, or emit HAP after the addition of the solid stating equipment. Thus, the MON is not and will not be applicable to Verian.

The Xydar process is subject to MON when using HAP as a raw material. No changes to the Xydar process are proposed as part of this application.

PUSH

The PUSH polymer is classified as a thermoplastic resin and covered by SIC Code 2821 and NAICS 325211. The PUSH production process uses HAPs and produces a small amount of benzene. Each of these chemicals are either HAP metal, hydrogen halide, halogen HAP, or organic HAP as listed by 63.2435(b)(2). The miscellaneous organic chemical manufacturing process units (MCPUs) is not an affected source or part of an affected source under another subpart of this Part 63 and is not a batch operation within a chemical manufacturing process unit (CMPU), as identified in §63.100(j)(4). Therefore, the PUSH process is subject to MON.

The PUSH process contains the following categories of sources that may be regulated by MON:

- Continuous process vents
- Batch process vents
- Process vents that emit hydrogen halide and halogen HAP or HAP metals
- Storage tanks
- Surge control vessels and bottoms receivers.
- Equipment leaks
- Wastewater
- Heat exchange systems

The following MON-regulated categories of sources are not part of the proposed design:

- Transfer racks

Solvay proposes to add several raw materials and washing aid to the current authorization, but otherwise the process remains the same as permitted previously. The added raw materials are non-HAP and non-TAP chemicals. The added processing aid is sulfuric acid. Because the proposed changes do not require new equipment or change the HAP emission profile, there are no changes in applicability or requirements for MON. The current permit does not need to be modified to account for these changes.

9.5 Part 64 Compliance Assurance Monitoring

USEPA Regulations 40 CFR 64.2 and 40 CFR 64.5(a) require that certain sources prepare and submit a compliance assurance monitoring (CAM) plan.

Whether or not a CAM plan is required depends on the pre-control emission rates of pollutants as well as the applicability of an emission limit. The first criterion is the applicability of an emission limitation such as a PSD avoidance limit or a federally-enforceable state regulation. The second criterion is that a control device must be used to meet this limit and the uncontrolled emission rate must be greater than the Title V applicability thresholds.

The proposed application contains regulatory limitation from state and federal standards and requests for limitations certain sources to avoid applicability of PSD. Considering the fact that any applicable limits under post-1990 MACT and NSPS and that PSD avoidance limits are exempt, a CAM plan is not required for this project.

9.6 Ambient Impact Analysis for Air Toxics

Operation of the process results in emissions of several substances that must be evaluated following the Georgia Department of Natural Resources' (GA DNR's) *Guidelines for Ambient Impact Assessment of Toxic Air Pollutant Emissions, June 21, 1998*. An analysis of these emissions has been prepared and is included in Section 11.

10.0 Regulatory Analysis for Project Sarsaparilla

Based on the emissions and the control equipment, Sarsaparilla operations are potentially subject to air quality regulations that establish emissions limits and require an air permit modification.

Chapter 391-3-1 of the Georgia Environmental Protection Division (GA EPD) regulations provides emissions limits and permitting requirements in Sections .02 and .03, respectively. The potentially applicable requirements of Section .02 are described in subsequent sections of this report. Section .03 provides the permitting procedures for State Implementation Plan (SIP) permits and Title V permits.

Section .03(1)(a) requires that facilities obtain permits prior to beginning construction. This report serves as the permit application to gain authorization from GA EPD to add the equipment necessary for the proposed expansion. An electronic application was created in GEOS and submitted concurrent with this document.

The following subsections provide a summary of potentially applicable air regulations. Where the regulation is applicable, the applicable limits are provided. Where the equipment is exempt, a discussion of the exemption is provided.

10.1 Environmental Protection Division, Rule 1 – Air Quality Control Emission Limits and Standards

10.1.1 Visible Emissions (391-3-1-.02 (2)(b)), Rule b

This rule regulates emissions from emission sources to no greater than 40 percent opacity except as provided by more restrictive or specific rules. The emissions from the Sarsaparilla process will be subject to this requirement. The process is not expected to generate opacity under normal circumstances.

10.1.2 Fuel-burning Equipment (391-3-1-.02 (2)(d)), Rule d

The Sarsaparilla project includes a gas-fired boiler subject to this rule. The new boiler will only be capable of burning natural gas and fuel oil for periods of natural gas curtailment. The proposed boiler will be subject to the PM portion of this regulation, but the NOX requirement does not apply because the boiler heat input is less than 250 million Btu/hr. The applicable PM limit is given by the following formula: $P= 0.5\ (10/R)^{0.5}$ lbs/MMBtu heat input per hour.

10.1.3 Particulate Emissions from Manufacturing Processes (391-3-1-.02 (2)(e)), Rule e

PM emissions are quantified from manufacturing processes on a pound per hour (lb/hr) basis by Rule e as follows:

For process weights up to 30 tph: $E = 4.10\ P^{0.67}$

Or,

For process weight rates greater than 30 tph: $E = 55.0\ P^{0.11} - 40$

Where:

E = the allowable emission rate in lbs/hr,

P = process weight rate in tons per hour (tph).

The proposed process is subject to this regulation. The potential emission rate of PM from the process is much less than the allowable limit.

10.1.4 Sulfur Dioxide Limits From Fuel-burning Sources (391-3-1-.02(2)(g)), Rule g

This rule requires that for all fuel burning sources below 100 MMBtus of heat input per hour shall not burn fuel containing more than 2.5 percent sulfur, by weight. The new boiler will only burn fuel with a sulfur content much less than 2.5 percent sulfur by weight.

10.1.5 Fugitive Dust (391-3-1-.02(2)(n)), Rule n

All processing, handling, transportation, or storage facility operations resulting in fugitive dust must take reasonable precautions to prevent the dust from being airborne through the application of suppressants, covering, or vents. Opacity is limited to 20 percent. Solvay does not anticipate any fugitive dust will be generated by this process under normal conditions.

10.1.6 Nitrogen Oxides Emissions From Fuel-burning Equipment (391-3-1-.02(2)(lll)), Rule lll

This regulation limits the emission of NO_X from an affected unit under this subparagraph that is installed or modified on or after May 1, 1999, to exceed 30 parts per million (ppm) at 3 percent oxygen on a dry basis. This regulation only applies to operations that are located in the counties of Banks, Barrow, Bartow, Butts, Carroll, Chattooga, Cherokee, Clarke, Clayton, Cobb, Coweta, Dawson, DeKalb, Douglas, Fayette, Floyd, Forsyth, Fulton, Gordon, Gwinnett, Hall, Haralson, Heard, Henry, Jackson, Jasper, Jones, Lamar, Lumpkin, Madison, Meriwether, Monroe, Morgan, Newton, Oconee, Paulding, Pickens, Pike, Polk, Putnam, Rockdale, Spalding, Troup, Upson, and Walton. Solvay is located in Richmond County; thus this regulation does not apply.

10.1.7 Prevention of Significant Deterioration (391-3-1-.02(7))

The potential emissions of the existing equipment without considering controls and permits limits is above the Prevention of Significant Deterioration (PSD) threshold for qualification as a major source of 100 tpy for all PSD pollutants. Solvay has federally enforceable limits on SO2, CO, NOX and VOC of 100 tpy each, thus the facility is not a major source considering emission controls and federally enforceable limits. No change in current limits is needed to classify the source as non-major as the potential-to-emit (PTE) for the sum of existing sources considering controls and permit limits is less than the PSD major source thresholds.

The proposed projects related to modification of the existing processes as well as the new Sarsaparilla process will result in increases in emissions of PSD pollutants. Table 10-1 summarizes the maximum anticipated actual emissions for the facility after completion of all projects, which are also representative of projected actual emissions for the facility after completion of all projects.

Table 10-1
Summary of Maximum Anticipate Actual Emissions for the Augusta Facility

CRITERIA POLLUTANT	Amodel (tpy)	Compounding (tpy) (1)	KetaSpire / NovaSpire (tpy)	Sulfone (tpy) (2)	Verian / Xydar (tpy)	PUSH (tpy)	Sarsaparilla (tpy)	TOTAL PTE (tpy)
CO	8.13	--	13.27	28.13	7.41	--	10.32	68.1
NO_X	13.89	--	21.19	33.86	--	--	28.30	98.3
PM	2.16	15.69	37.64	9.25	0.01	0.27	19.94	86.7
PM_{10}	1.96	15.69	37.64	9.25	0.01	0.27	19.94	86.5
$PM_{2.5}$	1.96	15.69	37.64	9.25	0.01	0.27	19.94	86.5
SO_2	7.02	--	19.68	0.27	--	--	25.38	52.4
VOCs	7.87	5.09	5.48	32.11	0.11	9.59	32.42	94.4

After implementation of these projects, the Solvay facility will remain a minor source of emissions for PSD applicability considering the 100 tpy permit limits in Condition 3.2.1, 3.2.2., and 3.2.3 of the Title V permit. For consistency, the new heater in the KetaSpire process as well as the boiler and thermal oxidizers in the Sarsaparilla process should be added to the table in 3.2.1.

10.2 Part 60 New Source Performance Standards

GA EPD is the designated authority for New Source Performance Standards (NSPS) regulations; these regulations are incorporated by reference into Georgia's regulations. The following subsections describe the potentially applicable NSPS and the applicable limits.

10.2.1 USEPA Regulation 40 CFR 60 Subpart Db

This NSPS applies to boilers with a capacity greater than 100 x 10^6 Btu/hr heat. No boilers exceeding this capacity are proposed for this project.

10.2.2 USEPA Regulation 40 CFR 60 Subpart Dc

This NSPS applies to boilers with a capacity between 10 x 10^6 and 100 x 10^6 Btu/hr heat input (2.9 and 29 megawatts). The new boiler is potentially subject to the requirements of this rule.

If the boiler only burns natural gas, there are no limits under this rule. If No. 2 fuel oil is used as a fuel, even as a backup, then the following limits apply:

- 20 percent opacity
- Limit fuel oil to 0.5 percent sulfur by weight or limit SO2 emissions to 0.50 lb/MMBtu
- limit PM emissions to 0.030 lb/MMBtu if the boiler is greater than 30 MMBtu/hr

Paragraph (4) of 60.43c(d) exempt sources that burn only fuels not subject to a PM limit and fuel oil with a sulfur content of less than 0.5 weight percent sulfur from this standard. Solvay requests a limit of 0.5 weight percent sulfur be added to the permit to exempt the 99 MMBtu/hr boiler from PM limits, PM testing, and PM monitoring.

The furnaces also combust natural gas to indirectly heat and react raw material. The furnaces are considered process heaters because they are used to heat a material (142b) to promote a chemical reaction. The definition of steam generating unit specifically excludes process heaters as defined by the rule.

10.2.3 USEPA Regulation 40 CFR 60 Subpart Kb

This NSPS applies to storage vessels with a capacity that exceeds 75 m^3 (19,813 gallons) and are used to store volatile organic liquid (VOL) for which construction, reconstruction, or modification is commenced after July 23, 1984.

Most of the tanks in the Sarsaparilla process qualify as process tanks, as defined below:

> *Process tank means a tank that is used within a process (including a solvent or raw material recovery process) to collect material discharged from a feedstock storage vessel or equipment within the process before the material is transferred to other equipment within the process, to a product or by-product storage vessel, or to a vessel used to store recovered solvent or raw material. In many process tanks, unit operations such as reactions and blending are conducted. Other process tanks, such as surge control vessels and bottoms receivers, however, may not involve unit operations.*

Process tanks are specifically excluded from the regulation. Therefore, the requirements of this regulation do not apply to these tanks. The potentially applicable storage tanks are listed in Table 3. Only the VDF and 142b tank store compounds potentially considered volatile organic liquids and have a capacity greater than 75 m^3; therefore, they are the only tanks that are potentially subject to the requirements of this rule. The storage pressure of 142b and VDF exceeds 100 psig. This rule specifically exempts Pressure vessels designed to operate in excess of 204.9 kPa (29.7 psi) and without emissions to the atmosphere. The Solvay facility will use vapor balancing or pressurization to eliminate emission during loading, and these tanks will not vent to atmosphere during normal operations. Furthermore, 142b is an exempt VOC thus it is not considered a Volatile Organic Liquid under Subpart Kb.

The PVDF product is stored in silos prior to loading for shipment. Because these silos store a solid material (not a liquid), these are exempt from Subpart Kb.

Solvay may also store HCl in tanks prior to shipment. Because HCl is not a VOL, it is exempt from this rule.

Table 10-2
Tank Capacities

TANK ID	TANK CONTENTS	CAPACITY (gal)	Exempt?
HD-102 A	1-Chloro-1,1-difluoroethane (HCFC-142b)	33,000	Yes, pressurized tank
HD-102 B	142b	33,000	Yes, pressurized tank
HD-102 C	142b	33,000	Yes, pressurized tank
HD-102 D	142b	33,000	Yes, pressurized tank
HD-152 A	vinylidene difluoride (VDF)	28,000	Yes, pressurized tank
HD-152 B	VDF	28,000	Yes, pressurized tank
HD-152 C	VDF	28,000	Yes, pressurized tank
HF-461	COMO6 Storage Tank	658	Yes, <19,813 gallons
HC-456	COMO6 unloading blower for tote	250	Yes, <19,813 gallons
HF-440	COMO3 Storage	12,000	Yes, <19,813 gallons

10.2.4 Standards of Performance for Synthetic Organic Chemicals Manufacturing Industry; Subparts VV, III, NNN, and RRR

These Synthetic Organic Chemical Manufacturing Industry (SOCMI) standards of 40 CFR 60 apply to facilities that manufacture a SOCMI chemical as listed in 60.489, 60.617, 60.667, and 60.707. The Sarsaparilla process may use raw materials or produce as contaminants chemicals which are listed in these rules, but the intermediate and final products, VDF and PVDF respectively, are not listed. Because the process will not produce listed chemicals, it will be exempt from the regulation. Two applicability determinations posted on the USEPA's Clean Air Act (CAA) Applicability Determination Index (ADI) relevant to this determination are included in Appendix N.

10.2.5 Standards of Performance for Volatile Organic Compound Emissions from the Polymer Manufacturing Industry; Subpart DDD

These standards apply to polypropylene, polyethylene, polystyrene, or poly (ethylene terephthalate) manufacture. The proposed equipment will produce VDF and PVDF; therefore, the requirements of this regulation do not apply.

10.2.6 Standards of Performance for Standards of Performance for Volatile Organic Compound (VOC) Emissions From the Synthetic Organic Chemical Manufacturing Industry (SOCMI) Air Oxidation Unit Processes; Subpart III

Subpart III applies to processes that use an air oxidation process to produce one or more chemicals listed on 60.617. This process will not use air oxidation reactors and will not produce any of the listed chemicals.

10.2.7 Standards of Performance for Synthetic Fiber Production Facilities; Subpart HHH

Subpart HHH applies to *solvent-spun synthetic fiber processes*. The process is not a fiber manufacturing process.

10.2.8 Standards of Performance for Synthetic Organic Chemical Manufacturing Industry Wastewater Treatment Plants; Subpart YYY (Proposed Rule)

The only wastewater potentially subject to the requirements of this proposed rule is from the chemical recovery area of the production process. This proposed rule currently applies to organic wastewater compounds at SOCMI production facilities. SOCMI production facilities are delineated in Table 1 of the rule. The Sarsaparilla process utilizes compounds listed in Table 1 of the Rule; however, the facility does not produce these chemicals, so the requirements of the regulation are not applicable.

10.3 Part 61 National Emission Standards for Hazardous Air Pollutants

GA EPD is the designated authority for these National Emission Standards for Hazardous Air Pollutants (NESHAPs) regulations; these regulations are incorporated by reference into Georgia's regulations. The following subsection describes the potentially applicable NESHAPs and the applicable limits.

10.3.1 National Emission Standards for Hazardous Air Pollutant for Benzene Operations; Subparts J, Y, V, BB, and FF

These standards apply to benzene operations as defined in the applicable regulations. Since the proposed operations and Sarsaparilla contain benzene, these regulations may apply. Benzene is not expected to be present in concentrations greater than 10 ppmw anywhere in this process. Thus, there are no applicable requirements under this rule.

10.4 Part 63 National Emission Standards for Hazardous Air Pollutants for Source Categories

GA EPD is the designated authority for these NESHAPs regulations; these regulations are incorporated by reference into Georgia's regulations. The following subsections describe the potentially applicable NESHAPs and the applicable limits.

10.4.1 National Emission Standards for Organic Hazardous Air Pollutants from the Synthetic Organic Chemical Manufacturing Industry; Subparts F, G, H and I

The proposed processes will not manufacture any of the chemicals listed in 40 CFR 63 Subpart F Table 1 as a primary product (i.e., VDF and PVDF are not in Table 1); therefore, these manufacturing operations are not subject to these standards.

10.4.2 National Emission Standards for Hazardous Air Pollutant Emissions: Group I Polymers and Resins; Subpart U

Subpart U applies to elastomer production; elastomers are defined in the regulation to include the following:

- Butyl Rubber
- Halobutyl Rubber
- Epichlorohydrin Elastomer
- Ethylene Propylene Rubber
- HypalonTM
- Polybutadiene Rubber/Styrene Butadiene Rubber by Solution
- Neoprene
- Nitrile Butadiene Rubber
- Nitrile Butadiene Latex
- Polysulfide Rubber
- Styrene Butadiene Latex
- Styrene Butadiene Rubber by Emulsion

Since the Sarsaparilla process will not produce any of these elastomers, the equipment is not subject to this regulation.

10.4.3 National Emission Standards for Pharmaceuticals Production and National Emission Standards for Hazardous Air Pollutants for Pesticide Active Ingredient Production; Subparts GGG and MMM

These regulations apply to pharmaceutical and pesticide production as defined in the regulations. Since the Sarsaparilla process will not produce pharmaceuticals or pesticides, this regulation is not applicable.

10.4.4 National Emission Standards for Hazardous Air Pollutant Emissions: Group IV Polymers and Resins, Subpart JJJ

Subpart JJJ applies to *thermoplastic product process units*. Since the Sarsaparilla products are not listed thermoplastic products, the requirements of this regulation are not applicable.

10.4.5 National Emission Standards for Hazardous Air Pollutants: Organic Liquids Distribution (Non-Gasoline); Subpart EEEE

The applicability of this standard, referred to as the Organic Liquid Distribution (OLD) Maximum Achievable Control Technology (MACT), is determined by the material(s) stored and transferred into or out of the facility. The standard exempts equipment subject to the requirements of another 40 CFR 63 NESHAPs. Since the VDF and PVDF process will be subject to 40 CFR 63 Subpart FFFF (MON), it will be exempt from this regulation.

10.4.6 National Emission Standards for Hazardous Air Pollutants: Miscellaneous Organic Chemical Manufacturing; Subpart FFFF

This NESHAP requirement, referred to as the Miscellaneous Organic Chemical Manufacturing National Emission Standards for Hazardous Air Pollutant (MON), applies to major sources of HAP that produce a MON chemical. MON chemicals are defined as those with the following Standard Industrial Classification (SIC) or North American Industry Classification System (NAICS) codes: 282, 283, 284, 285, 286, 287, 289, or 386 and NAICS code 325. The production of VDF and PVDF belong to category 2821 Plastics Materials, Synthetic Resins, and Nonvulcanizable Elastomers which calls out fluorohydrocarbon resins.

The Solvay facility, as currently configured, is subject to the MON requirements. Specifically, the KetaSpire/NovaSpire, Xydar and Sulfone production processes are subject to MON and the facility is a major source of HAP. The details related to MON for the existing equipment are detailed in the previous regulatory analysis.

The Sarsaparilla production process will use 142b as a primary raw material and produces organic halogens as well as *hydrogen halide and halogen HAP, e.g.*, HF and HCl. The miscellaneous organic chemical manufacturing process unit (MCPU) is not an affected source or part of an affected source under another subpart of this Part 63 and is not a batch operation within a chemical manufacturing process unit (CMPU), as identified in §63.100(j)(4). Therefore, the Sarsaparilla process is subject to MON.

The Sarsaparilla process contains the following categories of sources that may be regulated by MON:

- Continuous process vents
- Batch process vents
- Process vents that emit hydrogen halide and halogen HAP or HAP metals
- Storage tanks
- Equipment leaks
- Wastewater
- Transfer racks
- Heat exchange systems

Transfer racks regulated by MON are limited to those that are, "…used to fill tank trucks and/or rail cars with organic liquids that contain one or more of the organic HAP." The proposed equipment does include a system for loading VDF for transport, but it does not contain any HAP; thus, it is exempt.

The definition of heat exchange system is contained in 63.101 and is quoted below for reference:

> *Heat exchange system means any cooling tower system or once-through cooling water system (e.g., river or pond water). A heat exchange system can include more*

than one heat exchanger and can include an entire recirculating or once-through cooling system.

The proposed process does include heat exchange systems. Heat exchange systems that contact materials listed in Table 4 of Subpart F at a level above 5 percent by weight are applicable to the standard. The Sarsaparilla process does not contain any of the materials in Table 4 at concentration above 5 percent by weight in the process.

The MON regulations provide different levels of applicability and control for new versus existing sources. A *new affected source* is described in the rule by the following paragraphs in 63.2440:

- *Each affected source defined in paragraph (b) of this section for which you commenced construction or reconstruction after April 4, 2002, and you meet the applicability criteria at the time you commenced construction or reconstruction.*
- *Each dedicated MCPU that has the potential to emit 10 tons per year (tpy) of any one HAP or 25 tpy of combined HAP, and you commenced construction or reconstruction of the MCPU after April 4, 2002. For the purposes of this paragraph, an MCPU is an affected source in the definition of the term "reconstruction" in §63.2.*

The affected source for this rule is delineated as, "…the facility-wide collection of MCPU and heat exchange systems, wastewater, and waste management units that are associated with manufacturing materials described in §63.2435(b)(1)." Since the Sarsaparilla process will be part of the facility-wide collection of MCPU and does not have emissions of HAP that exceed 10/25 tpy thresholds, it is not considered a new source under MON.

Continuous Process Vent

A continuous process vent is the point of discharge of an operation from continuous operation that is not a batch operation, storage tank, surge control vessel, wastewater equipment, or equipment leak. Emissions for vents that are less than or equal to 0.005 weight percent (50 ppmw) total HAP are not continuous process vents. There is only one vent (HR-305) that meet these criteria, and it is routed to the thermal oxidizer. (Note that Section 8 contains a description of an alternate operating scenario where emissions from HT-305 are emitted without abatement. This vent is not a continuous process vent because it does not contain HAP.) TRE calculations for the two continuous process vents indicate that these are Group 1 continuous process vents; Solvay has designated these as Group 1. Group 1 continuous process vents require control. Solvay will route these emissions to a thermal oxidizer to achieve the required 98% control or 20 ppmv organic HAP or TOC outlet concentration. The thermal oxidizer is followed by a scrubber to control halogens by >99%. The vent stream is also considered a halogenated group 1 vent stream because the emissions of halogen atoms exceed 0.45 kg/hr. The specific requirements for these are as follows:

i. *Use a halogen reduction device after the combustion device to reduce emissions of hydrogen halide and halogen HAP by ≥99 percent by weight, or to ≤0.45 kg/hr, or to ≤20 ppmv; or*

ii. *Use a halogen reduction device before the combustion device to reduce the halogen atom mass emission rate to ≤0.45 kg/hr or to a concentration ≤20 ppmv.*

The proposed design for the exhaust system from the process will meet one or more of these requirements.

Batch Process Vents

Batch process vents are vents from one or more unit operations within a process such as vents on condensers used for product recovery, reactors, filters, centrifuges, and process tanks. The following are not batch process vents for the purposes of this subpart:

- Continuous process vents;
- Bottoms receivers;
- Surge control vessels;
- Vents on storage tanks, wastewater emission sources, or pieces of equipment subject to the emission limits and work practice standards in Tables 4, 6, and 7 to this subpart;
- Emission streams from emission episodes that are undiluted and uncontrolled containing less than 50 ppmv HAP are not part of any batch process vent. A vent from a unit operation, or a vent from multiple unit operations that are manifolded together, from which total uncontrolled HAP emissions are less than 200 lb/yr is not a batch process vent; emissions for all emission episodes associated with the unit operation(s) must be included in the determination of the total mass emitted.

The proposed process does not have any batch process vents because the vents are either categorized as another type of regulated source (*e.g.*, CPVs, storage tanks, surge control vessels, and bottoms receivers) or the concentration of HAP is less than 50 ppmv.

Process Vents That Emit Hydrogen Halide and Halogen HAP or HAP Metals

Subpart FFFF defines hydrogen halide and halogen HAP as hydrogen chloride, hydrogen fluoride, and chlorine. Process vents that emit hydrogen halide and halogen HAP include batch and continuous process vents; storage tanks and equipment leaks are specifically exempted from the definitions of batch and continuous process vents. Since the collective uncontrolled hydrogen halide and halogen HAP emissions from the Sarsaparilla process vents will be greater than or equal to 1,000 pounds per year (lb/yr) prior to control, the requirements of Table 3 in Subpart FFFF apply. Table 3 provides for three control options as follows:

- Reduce hydrogen halide and halogen HAP by 99 percent
- Meet an outlet hydrogen halide and halogen HAP concentration of less than or equal to 20 ppmv
- Reduce the halogen atom mass emission rate from the sum of all batch process vents and each individual continuous process vent to ≤0.45 kg/hr

The halogenated vents from the VDF and PVDF portions of the process are vented to the thermal oxidizers which create hydrogen halide HAP. The scrubber will reduce HAP to levels required in the rule. The PVDF portion of the process associated with washing and drying does not emit hydrogen halide and halogen HAP.

HAP metals are regulated from new sources and include the metal portion of the following compounds: antimony, arsenic, beryllium, cadmium compounds, chromium, cobalt, lead, manganese, mercury, nickel, and selenium. The Sarsaparilla process does not use, produce, or generate HAP metals so emissions are expected to be less than 150 lb/yr. The requirements of this section are not applicable to sources with less than 150 lb/yr of HAP metals. Further, the HAP metals requirements only apply to new sources. The Sarsaparilla process is considered an existing process as described previously, thus the requirements for HAP metals do not apply.

Storage Tanks

Storage tank for purposes of this rules includes tanks and vessels that are used to store liquids that contain organic HAP and/or hydrogen halide and halogen HAP. The following are not considered storage tanks for the purposes of this subpart:

1. Vessels permanently attached to motor vehicles such as trucks, railcars, barges, or ships;
2. Pressure vessels designed to operate in excess of 204.9 kilopascals and without emissions to the atmosphere;
3. Vessels storing organic liquids that contain HAP only as impurities;
4. Wastewater storage tanks;
5. Bottoms receivers;
6. Surge control vessels; and
7. Process tanks.

Under Subpart FFFF, storage tanks require control if they are designated as Group 1. Group 2 tanks do not require control. Group 1 tanks are defined in the rule as a tank that meets the following criteria:

- a capacity greater than or equal to 10,000 gallons; and

- stores a material that has a maximum true vapor pressure of total HAP greater than or equal to 6.9 kilopascals (kPa) at an existing source or greater than or equal to 0.69 kPa at a new source.

The only vessels used in the Sarsaparilla process that are considered storage tanks and exceed 10,000 gallons are the COMO3 and HCl storage tanks. The three HCl storage tanks have a capacity 40,000 gallons each. The maximum true vapor pressure for these tanks is 53 kPa. Solvay will use a scrubber to reduce HAP emissions by ≥95 percent by weight or ≤20 ppmv of hydrogen halide and halogen HAP. The COMO3 storage tank has a maximum true vapor pressure of 0.5 kPa; thus, it is considered a Group 2 storage vessel and does not require control.

Surge Control Vessels And Bottoms Receivers

Although surge control vessels and bottoms receivers are excluded from the definition of storage tanks, they are required to meet similar requirements. There are four surge control vessels that exceed a capacity of 10,000 gallons as follows:

- HD-878-Off Gas Buffer Tank,
- HF-450 COMO3 Batching Tank1
- HF-452 COMO3 Batching Tank2
- HF-460 COMO7 Prep Tank1.

The maximum true vapor pressure for each of these tanks is less than 0.02 kPa; thus, these are considered group 2 and are not required to have any emission control and do have any applicable work practice requirements.

Equipment Leaks

The equipment leak requirements contained in Table 6 of Subpart FFFF apply to equipment that either contains or contacts a fluid (liquid or gas) that is at least 5 percent by weight of total organic HAP. Organic HAP in this process is expected to exceed 5 percent in certain areas, thus the requirements apply. Where organic HAP exceeds 5 percent by weight, Solvay will implement one of the leak detection and repair program (LDAR) options in Table 6 of the MON rule. The existing Solvay facility already has an LDAR program for MON compliance and the permit contains the necessary LDAR requirements.

Wastewater

Wastewaters potentially subject to requirements of Subpart FFFF are those that meet one of the following two criteria:

- annual average concentration of compounds in Tables 8 and 9 to Subpart FFFF of at least 5 ppmw and has an annual average flow rate of 0.02 liters per minute or greater; or

- annual average concentration of compounds in Tables 8 and 9 to this Subpart of at least 10,000 ppmw at any flow rate

The Sarsaparilla process is not expected to generate any of the compounds listed in Table 8 or 9 at a concentration above 5 ppmw in wastewater, thus the process does not generate wastewater subject to the provisions of this rule.

This application also serves to satisfy the notification requirements under

- Subpart A, §63.9(b) and 63.5 Table 11 of Subpart FFFF: Pre-compliance Report 63.2520(c)

10.4.7 National Emission Standards for Hazardous Air Pollutants: Industrial and Commercial Boilers; Subpart DDDDD

This standard applies to all facilities that own or operate an industrial, commercial, or institutional boiler or process heater that is located at a major source of HAP. The Solvay facility is currently a major source of HAP and is and will continue to be subject to this subpart. The Sarsaparilla process includes several combustion devices as follows: one gas-fired boiler, three gas-fired furnaces, and two thermal oxidizers. The thermal oxidizers are not subject to this rule because they do not meet the definition of boiler or process heater based on review of their proposed design. The boiler is subject to the regulation, but there are not any emission limits because it is a gas-1 boiler. The furnaces are process heaters as defined under this rule; thus they are subject. As with the gas-fired boilers, there are no emission limits because these units are in the gas-1 category. Note that the process gases being pyrolyzed in the furnace do not come into contact with the combustion gases and are subject to the requirements of another MACT, 40 CFR 63 Subpart FFFF. The applicable Boiler MACT requirements for the new boiler and combustion emissions from furnaces are confined to a requirement to conduct periodic tune-ups.

10.4.8 National Emission Standards for Hazardous Air Pollutants: Hydrochloric Acid Production - Subpart NNNNN

This standard applies to facilities that produce a liquid HCl product at a concentration of 30 weight percent or greater during its normal operations. Solvay will produce a 30% or greater by weight solution as part of the VDF process. The solution will initially be neutralized on site using lime. The resulting neutralized material is filtered to remove solids which will be disposed of in a landfill. The liquid portion will be discharged to the local POTW. Because the initial design does not include production of an HCl product, this regulation does not apply to initial operations.

Solvay requests that the permit allow for an operating scenario where the HCl solution is sold as a commercial project. Under this operating scenario, the 'HCl production facility' is subject to the requirements of Subpart NNNNN. As such, Solvay requests that GA EPD add the applicable requirements for this alternate operating scenario to the permit. The rule applies to the following:

- Process vents
- Storage tanks
- Transfer operations
- Equipment leaks
- Wastewater operations

Per the rule. "there are no emission limitations or other requirements in this subpart that apply to HCl wastewater operations." The wastewater operations are part of the affected sources nonetheless. Because this operation will be constructed after September 18, 2001, it is considered a new source. Solvay will operate process vents, tanks, transfer operations, and equipment subject to leak requirements potentially subject to emission limits and work practice standards. Table 1 of the rule specifies the emission control options for compliance with the rule. Solvay will operate caustic scrubbers on the process vents, storage tanks, and transfer operations to reduce emissions below the requirements specified in Table 1. The applicable compliance options are listed as follows:

HCl process vent	a. Reduce HCl emissions by 99.4 percent or greater or achieve an outlet concentration of 12 ppm by volume or less; and
	b. Reduce Cl_2 emissions by 99.8 percent or greater or achieve an outlet concentration of 20 ppm by volume or less.
HCl storage tank	Reduce HCl emissions by 99.9 percent or greater or achieve an outlet concentration of 12 ppm by volume or less.
HCl transfer operation	Reduce HCl emissions by 99 percent or greater or achieve an outlet concentration of 120 ppm by volume or less.

The applicable monitoring requirements for caustic scrubbers are scrubber inlet liquid or recirculating liquid flow rate and pH. Solvay will establish the operating limits based on performance testing after startup. Solvay will also develop an LDAR plan that describes the measures put in place to detect and repair leaks from equipment (e.g., pumps, compressors, valves, connectors, etc.) that contacts liquid HCl streams with a concentration of greater than 30% and vapor streams with a concentration greater than 5%.

10.5 Part 64 Compliance Assurance Monitoring

USEPA Regulations 40 CFR 64.2 and 40 CFR 64.5(a) require that certain sources prepare and submit a compliance assurance monitoring (CAM) plan.

Whether or not a CAM plan is required depends on the pre-control emission rates of pollutants as well as the applicability of an emission limit. The first criterion is the applicability of an emission limitation such as a PSD avoidance limit or a federally-enforceable state regulation. The second criterion is that a control device must be used to meet this limit and the uncontrolled emission rate must be greater than the Title V applicability thresholds.

The proposed application contains regulatory limitations from state and federal standards and requests for limitations on certain sources to avoid applicability of PSD. Considering the fact that any applicable limits under post-1990 MACT and NSPS are specifically exempt from CAM and that control devices will be complaint with post-1990 MACT standards, a CAM plan is not required for this project.

10.6 Ambient Impact Analysis for Air Toxics

Operation of the Sarsaparilla process will result in emissions of several substances that must be evaluated following the Georgia Department of Natural Resources' (GA DNR's) *Guidelines for Ambient Impact Assessment of Toxic Air Pollutant Emissions, June 21, 1998*. An analysis of these emissions has been prepared and is included in Section 11.

11.0 Air Dispersion Modeling Analysis

Solvay Specialty Polymers (Solvay) is proposing changes at its Augusta Georgia facility (see Figure 1). These changes will result in the installation of new processes. The changes have triggered the need for air pollution control permits. Part of the permitting process includes an evaluation of emissions of air toxic substances listed by the State of Georgia's in its air toxic regulations. Emissions of 11 air toxic substances have emission levels that trigger a requirement for further evaluation. In Georgia, further analysis involves the use of a dispersion model to predict the off-site impact of the emissions. The analysis must follow procedures defined in the Georgia Environmental Protection Division's (GA EPD's) document; "Guideline for Ambient Impact Assessment of Toxic Air Pollutant Emissions" dated May 2017. This document presents the air quality analysis of emissions of the 11 substances following the GA EPD's required procedures.

Figure 1: Site Location

11.1 Ambient Air Impact Analysis Methodology

Air quality impact assessments (AQIAs) are performed using dispersion modeling techniques in accordance with the EPA's Guideline on Air Quality Models (codified as Appendix W to 40 CFR Part 51, hereafter referred to as the Guideline).

11.1.1 Dispersion Model Selection and Application

The rationale for the dispersion modeling approach is based on EPA and Georgia guidelines, considerations of the local terrain, and the emission unit characteristics. AERMOD is currently the preferred dispersion model recommended by the Guideline for complex source configurations and emission units subject to exhaust plume downwash.

11.1.2 Modeling Procedures

AERMOD has been applied to calculate worst-case ground level concentrations using the regulatory default options in addition to the options and data discussed in this section. As indicated earlier, 11 substances have calculated (calculations presented elsewhere in this application) emissions that exceed Georgia's Minimum Emission Rate (MER) threshold and are subject to further analysis. These substances are as follows:

- Acetone
- Benzene
- Hydrogen chloride
- Hydroquinone
- Methanol
- Monochlorobenzne
- Nickel
- Hydrogen Flouride
- Flourine
- Chlorine
- Acrylic Acid

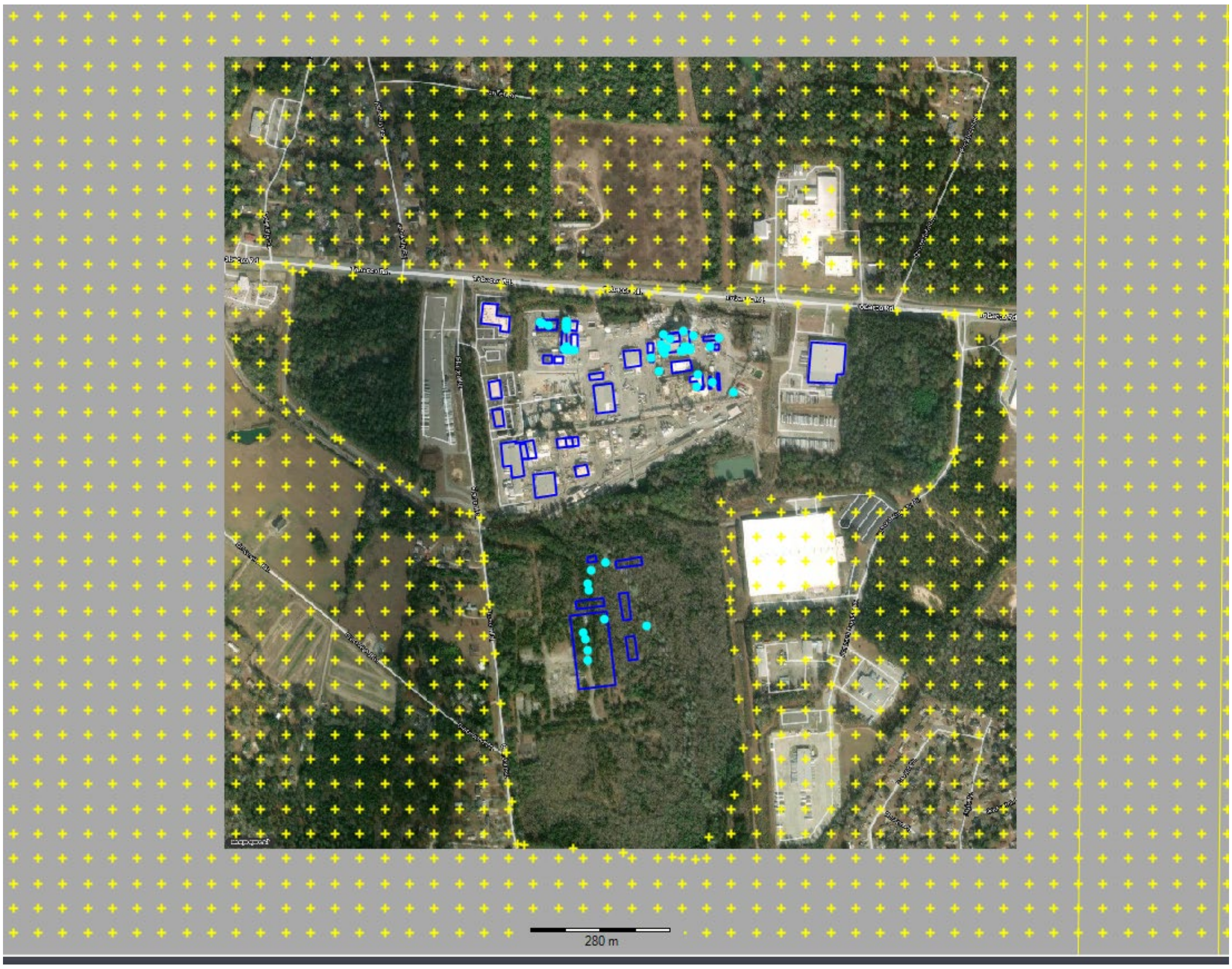
TRC used the default AERMOD options for dispersion that depend on local meteorological data, regional upper air data, and the local physical characteristics of land use surrounding the primary meteorological site. The area surrounding the facility is a combination of open forested and unforested land, limited commercial use and residential land use. As such the land use would not meet criteria for "urban" settings, so the default rural land use was assumed in the model.

Meteorological data from the Augusta Daniel Field surface and GA/Peachtree City-Falcon Field, upper air stations for the years 2016-2020 were used. This data set is recommended by the GA EPD for use for facilities located in Richmond County.

The effects of building downwash were considered through use of the BPIP Prime algorithm for determining wind direction dependent building dimensions. No stacks at the facility meet the regulatory definition of Good Engineering Practice stack height.

Receptors were spaced at 25-meter intervals around the facility boundary and at 50-meter intervals away from the boundary (see Figure 2). Maximum predicted impacts of all substances were found at the interior boundary of the receptor network. Receptor, building and stack base elevations were obtained from a National Elevation Dataset (NED) file and the USEPA's AERMAP terrain processor algorithm.

Figure 2. Receptor Layout



11.2 Modeled Emission Sources and Emission Rates

Tables 11-1 and 11-2 shows the stack parameters for the emissions sources included in the analysis. All coordinates listed are in NAD 83 Datum. Table 11-3 shows the calculated emissions for the project for those substances found to have emissions exceeding the corresponding Georgia defined MERs.

Table 11-1
Vertical Exhaust Stacks

Stack	X (m)	Y (m)	Hgt (m)	Temp (K)	m/s	Diam (m)
SA6	405790.6	3692684.3	24.39	293	3.35	0.203
SA7	405790.6	3692682.3	24.39	293	5.09	0.076
SA8	405790.6	3692680.3	24.39	293	10.23	0.076
SA9	405790.6	3692678.3	15.24	293	1.06	0.051
SH1	405790.6	3692676.3	24.39	293	1.8	0.076
SH2	405790.6	3692674.3	24.39	293	5.06	0.152
SH3	405790.6	3692672.3	24.39	293	1.8	0.076
SD4	405790.6	3692670.3	24.39	293	10.23	0.076
SD8	405754.9	3692677	3.05	293	0.84	0.102
SD11	405738.7	3692682.1	15.24	343	1.43	0.152
SD22	405742	3692680	15.24	343	1.43	0.152
SD27	405800.3	3692625.9	5.49	293	11.6	0.203
SD28	405807.4	3692626.5	3.66	293	4.7	0.051
OXS5	405792.4	3692632.5	24.39	293	1.6	0.076
OXS8	405787	3692628.3	21.34	293	1.6	0.076
FS6	405791.5	3692628.9	24.39	293	1.6	0.076
FS8	405792.4	3692625.9	21.34	293	1.6	0.076
FS9	405870.1	3692197.1	30.8	313	1.03	0.457
FH5	405840.2	3692181.2	3.66	308	0.51	0.152
SA6	406056.4	3692576.7	6.1	302	0.014	0.356
SA7	406129.3	3692540.9	6.1	277	0.003	0.152
SA8	406085.9	3692562.8	6.1	302	0.009	0.102
SA9	406054.3	3692552.7	3.05	293	0.03	0.102
TOX1	405837	3692142.8	48.78	311	11.02	0.3303
TOX2	405835.1	3692154.9	48.78	311	11.02	0.3303
X1X2SC	405868.7	3692083.1	35.37	313	4.55	0.305
L1DRY	405833.2	3692020.7	35.37	373	14.21	0.915
L2DRY	405833.2	3692001.1	35.37	373	14.21	0.915
SLWASH1	405825.8	3692056.1	35.37	313	4.87	0.152
SLWASH2	405829.5	3692043.1	35.37	313	4.87	0.152
WWSCR	405953.6	3692070.3	24.39	293	0.26	0.192

Table 11-2
Horizontal Exhaust Stacks

Stack	X (m)	Y (m)	Hgt (m)	Temp (K)	m/s	Diam (m)
LE114	405978.4	3692585.1	13.72	283	0.001	0.051
LE208	405992.4	3692629.1	17.99	283	0.001	0.051
LE210	405985.5	3692626.2	9.15	283	0.015	0.038
LE309	406029.4	3692634.4	18.29	283	0.03	0.025
LE330	406034.2	3692634.5	12.2	283	0.03	0.038
LE405	406023.2	3692625.3	15.24	283	0.064	0.038
LE430	406032.8	3692626.1	1.52	313	0.137	0.025
LE467	405994.7	3692631.5	16.77	283	0.021	0.038
LD425	406041.5	3692626.3	12.2	313	0.146	0.051
LD435	406041.5	3692632	12.2	313	0.146	0.051
LE680	406001.1	3692649.6	21.34	283	0.006	0.076
LT750	406100	3692652.3	27.44	294.1	0.122	0.457
LF1601	406081.4	3692634.1	13.72	313	0.634	0.102
LE448	405988.6	3692619.6	18.29	283	0.021	0.038
LE477	405982.1	3692638.3	21.34	283	0.957	0.038
LE576	405986.1	3692659.2	0.1	283	0.012	0.076
LE679	406027.4	3692665.5	21.34	283	0.659	0.076
LE368	406047.1	3692655.7	19.82	283	0.244	0.051
LT103	405962.4	3692610.6	10.37	294.1	0.201	0.102

Table 11-3
Emission Rates in Grams per Second

Stack	Acetone	Hydroquinone	Hydrogen Chloride	Monchloro benzene	Methanol	Nickel	Benzene
SA1	8.51	0	0	0	0	0	0
SA2	4.16	0	0	0	0	0	0
SA3	1.01	0	0	0	0	0	0
SA4	0.25	0	0	0	0	0	0
SA5	0.13	0	0	0	0	0	0
SA6	0.25	0	0	0	0	0	0
SA7	8.51	0	0	0	0	0	0
SA8	0.16	0	0	0	0	0	0
SA9	0.16	0	0	0	0	0	0
SH1	0	0	0.00252	0	0	0	0
SH2	0	0	0	0	0	0	0
SH3	0	0	0	0	0	0	0
SD4	0	8.61E-03	0	0	0	0	0
SD8	0	0	0	0	0	0	0
SD11	0	1.64E-04	0	0	0	0	0
SD22	0	1.64E-04	0	0	0	0	0
SD27	0	1.64E-04	0	0	0	0	0
SD28	0	1.64E-04	0	0	0	0	0
OXS5	0	6.30E-04	0	0	0	0	0
OXS8	0	6.30E-04	0	0	0	0	0
FS6	0	0	0.0034	2.02E-05	0.0063	0	2.94E-04
FS8	0	0	0	0	0.208	0	0
FS9	0	0	0	0	0	0	3.78E-06
FH5	0	0	0	0	0	5.29E-04	0
LE114	0	0	0	0.0275	0	0	0
LE208	0	0	0	0.0101	0	0	0
LE210	0	0	0	0.0003	0	0	0
LE309	0	0	0	0.0499	0	0	0
LE330	0	0	0	0.0097	0	0	0
LE405	0	0	0	0.0038	0	0	0
LE430	0	0	0	0.0075	0	0	0
LE467	0	0	0	0.0299	0	0	0
LD435	0	0	0	0.0342	0	0	0
LE680	0	0	0	0.1431	0	0	0
LT750	0	0.063	1.0	0.0195	0	0	0
LF1601	0	0	0	0.1590	0	0	0
LE448	0	0	0	0.0327	0	0	0
LE477	0	0	0	0.0314	0	0	0

Table 11-3
Emission Rates in Grams per Second

Stack	Acetone	Hydroquinone	Hydrogen Chloride	Monchloro benzene	Methanol	Nickel	Benzene
LE576	0	0	0	0.0996	0	0	0
LE679	0	0	0	0.0962	0	0	0
LE368	0	0	0	0.0169	0	0	0

Table 11-3 (Continued)

Stack	Hydrogen Chloride	Hydrogen Flouride	Chlorine	Acrylic Acid	Flourine
TOX1	0.00932	0.000932	0.00186	0	0.000932
TOX2	0.00932	0.000932	0.00186	0	0.000932
X1X2SC	0	0	0	0.005556	0
L1DRY	0	0	0	0.04445	0
L2DRY	0	0	0	0.04445	0
SLWASH1	0	0	0	0.00139	0
SLWASH2	0	0	0	0.00139	0
WWSCR	0.0272	0	0	0	0

11.3 Modeling Results

A summary of the worst-case initial modeling results for all substances are shown in Table 11-4 for each year of meteorological data. The modeling results in Table 11-4 indicate the facility is predicted to be in compliance with Georgia defined acceptable ambient concentrations.

Table 11-4
Air Quality Modeling Results (ug/m^3)

Substance	2016	2017	2018	2019	2020	Worst Case	AAC
Acetone -24-hr	1270	1349	1467	1561	1475	1561	**5700**
Acetone -15 min	9152	10613	8641	9571	10285	10613	**176200**
Benzene Annual	0.005	0.005	0.005	0.005	0.004	0.005	**0.13**
Chlorobenzene (24-hr)	327	307	335	335	411	411	**833**
Hydrogen Chloride(Annual)	0.56	0.64	0.51	0.50	0.52	0.64	**20**
Hydrogen Chloride (15-min)	44.6	40.4	33.4	35.7	39.7	44.6	**700**
Hydroquinone (24-hr)	2.03	1.98	2.67	2.15	2.02	2.67	**4.8**
Hydroquinone (15-min)	22.3	19.4	18.6	19.5	20.9	22.3	**200**
Methanol (Annual)	4.8	5.9	4.6	4.4	4.5	5.9	**20000**
Methanol (15-min)	668	631	579	655	605	668	**32800**
Nickel (Annual)	0.008	0.009	0.008	0.008	0.008	0.009	**0.794**
HF(24-hr)	1.44	1.48	1.62	1.29	1.55	1.62	**5.84**
HF(15-min)	14.5	14.8	20.5	23.6	17.7	23.6	**245**

Table 11-4
Air Quality Modeling Results (ug/m^3)

Substance	2016	2017	2018	2019	2020	Worst Case	AAC
Fluorine (24-hr)	0.013	0.016	0.013	0.015	0.016	0.016	**0.476**
Fluorine (15-min)	0.14	0.11	0.11	0.12	0.12	0.14	**155.4**
Chlorine(24-hr)	0.026	0.031	0.026	0.03	0.033	0.033	**3.6**
Chlorine (15-min)	0.28	0.22	0.21	0.24	0.22	0.28	**300**
COMO3 (annual)	0.22	0.23	0.28	0.25	0.21	0.28	**1**

Appendix A1
Claim to Confidentiality[63]

STATE OF **Georgia**

COUNTY OF **Richmond**

AFFIDAVIT OF Alain DeGreef IN SUPPORT OF CLAIMS THAT INFORMATION IS PROTECTED UNDER GEORGIA LAW FROM DISCLOSURE TO THE PUBLIC

PERSONALLY APPEARED before the undersigned officer, authorized to administer oaths, Alain DeGreef, Affiant who, first being duly sworn, testifies as follows:

1. My name is Alain DeGreef. I am of the age of majority and am competent in all respects to give this Affidavit. My testimony herein is based on personal knowledge and upon documents maintained in the files of the Solvay.

2. Solvay is a corporation with operations in Augusta, Georgia. I am the Site Manager of Solvay with primary responsibility for [the Augusta Site]. In my role as Site Manager, I am authorized to provide this Affidavit on behalf of the Solvay.

3. On February 28, 2024, Solvay submitted a "Redacted Copy" and a "Protected Copy" of an air permit application (referred to hereinafter as the "Submittal") to the Air Branch of the Georgia Environmental Protection Division ("EPD") in compliance with EPD's Procedures for Submitting Information Pursuant to a Claim that Information in the Submittal is Protected Under Georgia Law from Disclosure to the Public. I affirmatively declare that information contained in the Submittal to EPD is protected under the Georgia Open Records Act, O.C.G.A. § 50-18-70, *et seq.*, from disclosure to the public and that the Redacted Copy is submitted to EPD for disclosure to the public as is. Support for this declaration, including citation to the specific provisions of Georgia law, is included below.

[CLAIM UNDER THE TRADE SECRETS PROVISION OF THE GEORGIA OPEN RECORDS ACT]

4. The Georgia Open Records Act provides in pertinent part that –

(a) Public disclosure shall not be required for records that are:

(34) Any trade secrets obtained from a person or business entity that are required by law, regulation, bid, or request for proposal to be submitted to an agency. An entity submitting records containing trade secrets that wishes to keep such records confidential under this paragraph shall submit and attach to the records an affidavit affirmatively declaring that specific information in the records constitute trade secrets pursuant to Article 27 of Chapter 1 of Title 10.

O.C.G.A. § 50-18-72(a)(34).

5. The Georgia Trade Secrets Act, O.C.G.A. § 10-1-760, *et seq.*, provides that a -

(4) 'Trade secret' means information, without regard to form, including, but not limited to, technical or nontechnical data, a formula, a pattern, a compilation, a program, a device, a method, a technique, a drawing, a process, financial data, financial plans, product plans, or a list of actual or potential customers or suppliers which is not commonly known by or available to the public and which information:

(A) Derives economic value, actual or potential, from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use; and

(B) Is the subject of efforts that are reasonable under the circumstances to maintain its secrecy.

O.C.G.A. § 10-1-761(4).

6. The Submittal was required to be submitted to EPD pursuant to 391-3-1-.02.

7. On behalf of the Solvay, I affirmatively declare that the identity of the products, certain raw materials, process descriptions, flow diagrams, and calculations in the Submittal constitute trade secrets pursuant to the Georgia Trade Secrets Act as shown herein.

8. The IDENTITY OF THE PRODUCT AND THE METHOD BY WHICH IT WILL BE MANUFACTURED constitute trade secrets, because THEPRODUCT PLAN IS CONFIDENTIAL AND THE PROCESS BY WHICH THE PRODUCT WILL BE MADE HAS BEEN DEVELOPED BY SOLVAY, IS UNKNOWN TO THE PUBLIC, AND WILL PROVIDE SIGNIFICANT ECONOMIC BENEFIT TO SOLVAY. SOLVAY HAS ENGAGED IN REASONABLE EFFORTS TO MAINTAIN THE SECRECY OF THIS INFORMATION. IF THE INFORMATION WERE DISCOVERED BY A

COMPETITOR, SOLVAY'S BUSINEES WOULD BE HAMPERED SIGNIFICANTLY

9. Solvay understands that receipt by EPD of this Affidavit and the Submittal does not mean that EPD agrees or has made a determination that the information identified in this Affidavit is protected under the Georgia Open Records Act from disclosure to the public. However, for claims made in this Affidavit that information in the Submittal constitute trade secrets pursuant to the Georgia Trade Secrets Act, I understand that Section 50-18-72(a)(34) of the Georgia Open Records Act proscribes a procedure for producing such information in response to a request under that Act.

FURTHER Affiant saith not.

Alain DeGreef
Site Manager
Solvay
706-790-3100
Alain.DeGreef@synesqo.com

Subscribed and sworn to before me this 28th day of February, 2024.

Shannon Matlock

My Commission expires: 2/10/2025

Claim to Confidentiality

Substantiation of Claim to Confidentiality for Redacted Information Reference numbers: [1] through [78]

Pursuant to O.C.G.A § 50-18-72(b)(1), the redacted information constitutes trade secrets of a privileged or confidential nature and is therefore not applicable to O.C.G.A. § 50-18-72(b)(1) et seq. Additionally, pursuant to O.C.G.A. § 12-9-19 and Rules 391-3-1- 08, the redacted information is related to secret processes, devices or methods of manufacture or production and shall therefore be kept confidential by the Georgia Environmental Protection Division (GA EPD). Solvay Specialty Polymers USA, LLC (Solvay) requests that each separate piece of such information be retained as confidential by the GA EPD until such time Solvay makes such separate piece of information public knowledge.

The trade secret information is a trade secret as defined in O.C.G.A. § 10-1- 761(4) because it has economic value to Solvay from not being generally known to, and not being readily ascertainable by proper means by, other persons who can obtain economic benefit from its disclosure or use, and because it is the subject of efforts that are reasonable under the circumstances to maintain its secrecy. If the redacted information were to be obtained by a competitor, person or entity capable of operating a similar business, it would be detrimental to Solvay's business position on the world market. Therefore, Solvay requests such information be withheld from the public by GA EPD.

Solvay asserts that any information that has been marked confidential or redacted herein as trade secrets, proprietary information, privileged information or company property has never been previously made available to the public by publication, dissemination or other method of distribution.

Solvay has not in any way waived any rights to its claim of confidentiality for the redacted information. If GA EPD is not satisfied that the enclosed information requires confidential treatment, Solvay requests a meeting to substantiate its claims of confidentiality.

Appendix B
Amodel Process Flow Diagram[64]

Appendix C
Amodel Emission Calculations[65]

POTENTIAL TO EMIT (PTE) SUMMARY

Stack Code	Control Source Code	Source Code	Pollutant Emitted	Compound	Uncontrolled Emissions	Units	Emissions Factor Reference	Operating Hours / Year	Control Efficiency	Capacity (MMlbs / year)	
										TPY Emitted (PTE)	2001 estimate TPY
A1		KF-150	PM	TA / IPA / AA			Eng. Calcs	8760	N/A	0.03	0.03
			PM_{10}				Eng. Calcs	8760	N/A	0.03	0.03
- A1A	C101	KM101	PM		945	lb/hr	Eng. Calcs	8760	99.90%	-	-
			PM_{10}		472.5	lb/hr	Eng. Calcs	8760	99.80%	-	-
- A1B	C111	KM111	PM		945	lb/hr	Eng. Calcs	8760	99.90%	-	-
			PM_{10}		472.5	lb/hr	Eng. Calcs	8760	99.80%	-	-
- A1C	C121	KM121	PM	AA	386.4	lb/hr	Eng. Calcs	8760	99.90%	-	1.69
	ROUTED TO A1		PM_{10}		193.2	lb/hr	Eng. Calcs	8760	99.80%	-	1.69
- A1D	C226	KM226	PM		386.4	lb/hr	Eng. Calcs	8760	99.90%	-	-
	REMOVED FROM SERVICE		PM_{10}		193.2	lb/hr	Eng. Calcs	8760	99.80%	-	-
A1F	C201	KM201	PM		0.51	lb/hr	Eng. Calcs	8760	99.90%	0.0022	0.00
			PM_{10}		0.26	lb/hr	Eng. Calcs	8760	99.80%	0.0022	0.00
A1G	C211	KM211	PM		0.20	lb/hr	Eng. Calcs	8760	99.90%	0.0009	0.00
			PM_{10}		0.10	lb/hr	Eng. Calcs	8760	99.80%	0.0009	0.00
A1H	C221	KM221	PM	AA	0.07	lb/hr	Eng. Calcs	8760	99.90%	0.0003	0.00
			PM_{10}		0.03	lb/hr	Eng. Calcs	8760	99.80%	0.0003	0.00
A2	C143	KF143	VOC	HMDA	1.20	lb/hr	Eng. Calcs	47	99.00%	0.0003	0.00
A3	C142	KF142	VOC	HMDA	0.02	lb/hr	Eng. Calcs	8760	99.06%	0.0008	0.00
A5	C227	KM227	PM		27.15	lb/hr	Eng. Calcs	8760	99.90%	-	0.12
	REMOVED FROM SERVICE		PM_{10}		13.58	lb/hr	Eng. Calcs	8760	99.80%	-	0.12
A6			VOC	HMDA	615.38	lb/hr	Eng. Calcs	8760	N/A	2.54	1.31
			VOC		0.18	lb/hr	Eng. Calcs	8760	N/A	0.07	0.04
			VOC		0.0005	lb/hr	Eng. Calcs	8760	N/A	0.0002	0.00
	C610	KD610-1	VOC	HMDA	553.00	lb/hr	Eng. Calcs	8760	99.75%	-	-
	C603B&C	KC603B&C	VOC	HMDA	1.38	lb/hr	Eng. Calcs	8760	99.07%	-	-
	C601B	KC601B	VOC	HMDA	55.00	lb/hr	Eng. Calcs	8760	99.07%	-	-
	C601A	KC601A	VOC	HMDA	6.00	lb/hr	Eng. Calcs	8760	99.07%	-	-
					0.18	lb/hr	Eng. Calcs	747	66.67%	-	-
					0.0005	lb/hr	Eng. Calcs	747	66.67%	-	-
A6A		KF690	VOC	HMDA	1.13E-05	lb/hr	Eng. Calcs	8760	N/A	4.96E-05	-
A6B		KC692	PM	PPA	0.72	lb/hr	Eng. Calcs	8760	99.00%	0.03	-
			PM_{10}	PPA	0.36	lb/hr	Eng. Calcs	8760	98.00%	0.03	-
A7	C104	KM104	PM		18.51	lb/hr	Eng. Calcs	7,392	99.90%	0.07	0.07
			PM_{10}		9.25	lb/hr	Eng. Calcs	7,392	99.80%	0.07	0.07
A8	C633	KF633	VOC	HMDA	292.00	lb/hr	Eng. Calcs	8760	99.86%	1.79	1.02
A9	C703	KM703	PM	PPA	12.49	lb/hr	Eng. Calcs	8760	99.90%	0.05	2.28
			PM_{10}		6.24	lb/hr	Eng. Calcs	8760	99.80%	0.05	2.28
A10	C728	KM728	PM	PPA	0.40	lb/hr	Eng. Calcs	8760	100.00%	1.85E-05	0.01
			PM_{10}		0.20	lb/hr	Eng. Calcs	8760	100.00%	1.85E-05	0.01
A11	C733	KM733	PM	PPA	1.53	lb/hr	Eng. Calcs	8760	100.00%	5.20E-05	0.02
			PM_{10}		0.76	lb/hr	Eng. Calcs	8760	100.00%	5.20E-05	0.02
A12		KF801	VOC		0.0030	lb/hr	Eng. Calcs	8760	N/A	0.013	0.0011
A13		KF802	VOC		0.0053	lb/hr	Eng. Calcs	8760	N/A	0.0234	0.0101
					0.0002	lb/hr	Eng. Calcs	8760	N/A	0.0009	0.0004
A14		KF803	VOC		0.00002	lb/hr	Eng. Calcs	8760	N/A	-	0
	DOES NOT EXIST										

Stack Code	Control Source Code	Source Code	Pollutant Emitted	Compound	Uncontrolled Emissions	Units	Emissions Factor Reference	Operating Hours / Year	Control Efficiency	Capacity (MMlbs / year)	
										TPY Emitted (PTE)	2001 estimate TPY
A15	C807	KB807	VOC		835.00	lb/hr	Eng. Calcs	8760	95%	2.6303	3.4762
			CO		84	lb/MMscf	AP-42	8760	N/A	0.3093	0.3339
			SOx		0.6	lb/MMscf	AP-42	8760	N/A	0.0022	0.0024
			PM		7.6	lb/MMscf	AP-42	8760	N/A	0.0280	0.0304
			PM_{10}		5.7	lb/MMscf	AP-42	8760	N/A	0.0210	0.0227
			VOC		2.3	lb/MMscf	AP-42	8760	N/A	0.0203	0.0219
					5.5	lb/MMscf	AP-42	8760	N/A	0.0085	0.0093
			NOx		100	lb/MMscf	AP-42	8760	N/A	0.3682	0.3971
A16		KD908	VOC		0.1607	lb/hr	Eng. Calcs	8760	N/A	0.70	2.53
A17		KB901			0.05	lb/hr	Eng. Calcs	8760	N/A	0.19	0.2
			NOx		1.63	lb/hr	Manufacturer	8760	N/A	7.13	7.13
			SOx		0.6	lb/MMscf	AP-42	8760	N/A	1.66	1.53
			CO		84	lb/MMscf	AP-42	8760	N/A	7.16	7.18
			PM		7.6	lb/MMscf	AP-42	8760	N/A	0.72	0.72
			PM_{10}		5.7	lb/MMscf	AP-42	8760	N/A	0.51	0.51
			VOC		2.3	lb/MMscf	AP-42	8760	N/A	0.47	0.47
A18	C1001	KT1001	VOC	HMDA	680.67	lb/hr	Eng. Calcs	8760	99.99%	0.0020	0.0008
A19		KF1011	VOC	HMDA	0.028	lb/hr	Eng. Calcs	8760	N/A	0.1208	0.026
A22	C2105	KH2105	PM		4.65	lb/hr	Eng. Calcs	8760	99.90%	0.02	0.02
			PM_{10}		2.33	lb/hr	Eng. Calcs	8760	99.90%	0.02	0.02
A23	KH120	KM120	PM	AA	0.55	lb/hr	Eng. Calcs	8760	99.90%	0.002	-
			PM_{10}		0.28	lb/hr	Eng. Calcs	8760	99.80%	0.002	-
A24	KF851	KF850	VOC	HMDA	0.0023	lb/hr	Eng. Calcs	8760	99.00%	0.0001	-
A50		BD101	VOC		0.0086	lb/hr	Eng. Calcs	8760	N/A	0.04	0.03
A51		KF306			7.94E-06	lb/hr	Eng. Calcs	8760	N/A	0.00003	0.0147
			PM		9.45E-02	lb/hr	Eng. Calcs	46	N/A	0.00216	
			PM_{10}		4.73E-02	lb/hr	Eng. Calcs	46	N/A	0.00108	
A52	C630	KM-630	PM		14.6	lb/hr	Eng. Calcs	2232	99.90%	-	0.02
	DOES NOT EXIST		PM_{10}		7.3	lb/hr	Eng. Calcs	2232	99.80%	-	0.02
A53	C702	KM-702	PM		18.2	lb/hr	Eng. Calcs	2232	99.90%	-	0.02
	DOES NOT EXIST		PM_{10}		9.1	lb/hr	Eng. Calcs	2232	99.80%	-	0.02
A54		KF-270	VOC	HMDA	0.0028	lb/hr	Eng. Calcs	8760	N/A	0.012	0.0005
A55		CM-642	CO		84	lb/MMscf	AP-42	8760	N/A	0.130	0
			SOx		0.6	lb/MMscf	AP-42	8760	N/A	0.001	0.01
			PM		7.6	lb/MMscf	AP-42	8760	N/A	0.012	0
			PM_{10}		5.7	lb/MMscf	AP-42	8760	N/A	0.009	0
			VOC		2.3	lb/MMscf	AP-42	8760	N/A	0.004	0
					5.5	lb/MMscf	AP-42	8760	N/A	0.008	0
			NOx		100	lb/MMscf	AP-42	8760	N/A	1.31	0.44
			VOC	Amodel	0.02	lb/hr	Eng. Calcs	8760	N/A	0	0
A56		KM-640	VOC	Amodel	0.02	lb/hr	Eng. Calcs	260	N/A	-	0
	DOES NOT EXIST										
A70	KH751	KM750	PM	PPA	15.23	lb/hr	Eng. Calcs	8760	99.90%	0.067	-
			PM_{10}		7.61	lb/hr	Eng. Calcs	8760	99.80%	0.067	-
A71	KH759	KC757	PM	PPA	0.98	lb/hr	Eng. Calcs	8760	99.90%	0.004	-
			PM_{10}		0.49	lb/hr	Eng. Calcs	8760	99.80%	0.004	-
A72	KH761	KD760	PM	PPA	9.45	lb/hr	Eng. Calcs	8760	99.90%	0.041	-
			PM_{10}		4.73	lb/hr	Eng. Calcs	8760	99.80%	0.041	-
A73	KH781	KM780	PM	PPA	15.05	lb/hr	Eng. Calcs	8760	99.90%	0.066	-
			PM_{10}		7.52	lb/hr	Eng. Calcs	8760	99.80%	0.066	-
TOTAL	TOTAL		VOC	HMDA						4.47	2.36
			VOC							2.72	3.53
			VOC							0.014	0.0015
			VOC							0.04	0.03
			VOC	Amodel						0	0
			VOC							0.70	2.53
										0.21	0.21
										0.000035	0.0147
			NOx							8.81	7.97
			SOx							1.66	1.54
			CO							7.60	7.51
			PM							1.15	5.03
			PM_{10}							0.93	4.81

Emissions (lb/hr)

PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD	HCl	HMDA	THF	HAC
0.26	0.21	0.21	0.38	1.74	2.01	1.81	0.00	0.00	0.00	1.02	0.62	0.01

Emissions (tpy)

PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD	HCl	HMDA	THF	HAC
1.15	0.93	0.93	1.66	7.60	8.81	7.95				4.47	2.72	0.04

Amodel Unit - Air Emissions Estimate 2023

[redacted]

A-1 INERT GAS RESERVOIR KF-150

Assumptions:

1. Bin filter concentration is estimated to be no more than 0.005 lb PM / scf air based on standard baghouse design from previous projects.
2. Flow from KM-101 and KM-111 cannot occur at the same time, but flow from KM-101 or KM-111 and KM-121 can occur at the same time.
3. The catalyst system has been moved downstream in the Amodel process, so KM-226 is no longer considered as part of these emissions calculations.
4. Vast majority of nitrogen reaching KF-150 is recycled. Blowdown assumed in the original calculations is 22 scfm average; 600 scfm maximum.
5. Filtration efficiency is 99.9% of PM of 2 micron diameter.
6. PM10 concentration is 50% of PM concentration in uncontrolled flows.
7. Controlled PM10 emissions are equal to controlled PM emissions.
8. Bin filter operation is based on 24 hr/day, 365 day/yr operation.
9. Design parameters for each filter are as follows:

Description	Flow rate (scfm)	Temp (F)	Pressure (psig)	Flow rate (acfm)
[redacted]	3150	120	0.5	3346
	3150	120	0.5	3346
AA KM-121	1288	120	0.5	1368

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY (%)	EXHAUST LOADING RATE	OPERATING HOURS	BIN FILTER EXHAUST LOAD
A-1A	[redacted]	PM	3150	0.005	945	99.9%	0.945	8760	4.14
		PM_{10}	3150	0.0025	472.5	99.8%	0.945	8760	4.14
A-1B	[redacted]	PM	3150	0.005	945	99.9%	0.945	8760	4.14
		PM_{10}	3150	0.0025	472.5	99.8%	0.945	8760	4.14
A-1C	AA SILO VENT FILTER KM-121	PM	1288	0.005	386.4	99.9%	0.3864	8760	1.69
		PM_{10}	1288	0.0025	193.2	99.8%	0.3864	8760	1.69
A-1D	[redacted]	PM	1288	0.005	386.4	99.9%	0.3864	8760	1.69
	REMOVED FROM SERVICE	PM_{10}	1288	0.0025	193.2	99.8%	0.3864	8760	1.69

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	EXHAUST LOADING RATE	EXHAUST FLOW RATE	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A1	INERT GAS RESERVOIR KF-150	PM	4438	1.3314	22	0.0066	8760	0.029
INCLUDES A-1C; NO LONGER INCLUDES A-1D		PM_{10}	4438	1.3314	22	0.0066	8760	0.029
MAXIMUM ASSUMING 600 SCFM VENT RATE AND A CONTROL EFFICIENCY OF 99.9%		PM	600	180	600	0.18		
		PM_{10}	600	90	600	0.09		

A-1F, A-1G, A-1H - RAW MATERIAL WEIGH FEEDERS C201, C211, AND C221

Assumptions:

1. Bin filter concentration is estimated to be no more than 0.005 lb PM / scf air based on standard baghouse design from previous projects.
2. Filtration efficiency is 99.9% of PM and 99.8% for PM10.
3. PM10 concentration is 50% of PM concentration in uncontrolled flows.
4. Controlled PM10 emissions are equal to controlled PM emissions.
5. Bin filter operation is based on displacement of gas during time of filling.
6. Average solids density is 45 lb/cuft.

[redacted]

10. Typical bin exhaust temperature and pressure is 120 F at 0.5 psig.
11. Bin filter operation is based on 24 hr/day, 365 day/yr operation.

	Original 2001 Estimate				Updated 2023 Estimate			
[redacted]								

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY (%)	EXHAUST LOADING RATE	OPERATING HOURS	BIN FILTER EXHAUST LOAD
A-1F	[redacted]	PM	1.70	0.005	0.51	99.9%	0.00051	8760	0.0022
		PM_{10}	1.70	0.0025	0.26	99.8%	0.00051	8760	0.0022
A-1G	[redacted]	PM	0.66	0.005	0.20	99.9%	0.00020	8760	0.0009
		PM_{10}	0.66	0.0025	0.10	99.8%	0.00020	8760	0.0009
A-1H	[redacted]	PM	0.23	0.005	0.07	99.9%	0.00007	8760	0.0003
		PM_{10}	0.23	0.0025	0.03	99.8%	0.00007	8760	0.0003
A-1F, A-1G, A-1H	MAXIMUM EMISSIONS	PM	5.49	0.005	1.65	99.9%	0.00165		
		PM_{10}	5.49	0.0025	0.82	99.8%	0.00165		

A-2 - SEAL POT KF-143

Assumptions:

[redacted]

4. Information from the 1990 mass balance shows:

Parameter	Inlet Stream	Outlet Stream
HMDA (lb/hr)	0.1	0
Water (lb/hr)	1.6	1.6
Nitrogen (lb/hr)	78	78
Temperature (F)	95	95
Pressure (psia)	15.2	14.7
Flow Rate (acfm)	111.46	115.25

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	CONTROL EFFICIENCY (%)	CONTROLLED EMISSIONS	OPERATING HOURS	ANNUAL EMISSIONS	ANNUAL EMISSIONS
A-2	SEAL POT KF-143	HMDA	1.20	99.0%	0.012	47	0.5652	0.0003

[redacted]

A-3 - SEAL POT KF-142

Assumptions:

[redacted]

4. Tank pressure is atmospheric.
5. Maximum tank temperature is 150 F.

[redacted]

8. Vapor pressure of HMDA at 140 F is 3 mm Hg (0.058 psia).

[redacted]

10. Information from the 1990 mass balance shows:

Parameter	Inlet Stream	Outlet Stream
HMDA (lb/hr)	0.2	0
Water (lb/hr)	4.9	4.9
Nitrogen (lb/hr)	234.9	234.9
Temperature (F)	95	95
Pressure (psia)	15.2	14.7
Flow Rate (acfm)	20.22	20.88

Working Emissions

Uncontrolled working	Operating Hours	Uncontrolled Emissions (lb/yr)	Total Uncontrolled
0.2	782	156.4	156.4

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.696	14.696
Temperature (F)	140	150
Volume (acf)	3770	3832.87

Breathing volume = 3,833 acf - 3770 acf = 63 acf / day * 365 days = 22,947 acf/yr

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)	HMDA (lb/yr)
22,947	150	14.696	19,559	23.64

Uncontrolled HMDA breathing emissions = 19,559 scf/yr * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / lbmol HMDA * 0.058 psia / 14.696 psia = 23.64 lb HMDA / year

Uncontrolled working	Operating Hours	Uncontrolled Emissions (lb/yr)	Total Uncontrolled	Total Uncontrolled
0.2	782	156.4	180.04	0.02055

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	CONTROL EFFICIENCY (%)	CONTROLLED EMISSIONS	OPERATING HOURS	ANNUAL EMISSIONS	ANNUAL EMISSIONS
A-3	SEAL POT KF-142	HMDA	0.0206	99.1%	0.00019	8760	1.6955	0.0008

The maximum VOC emissions rate as HMDA is: 0.2 lb HMDA / hr uncontrolled rate * (1 - 0.99 efficiency) = 0.002 lb/hr HMDA

A-5 - BIN FILTER KM-227 - REMOVED FROM SERVICE SINCE 2001 ESTIMATE

A-6 - SEAL WATER TANK KF-613

Assumptions:

[redacted]

2001 Estimate (1990 Mass Balance)										
Parameter	Inlet to KD-610	Outlet from KD-610	Outlet from KC-603A	Inlet to KT-602	Outlet from KC-601B	Inlet to KD-602A	Outlet from KC-601A	Inlet to BD vac pump	Outlet from BD vac pump	Outlet from KF-613
HMDA (lb/hr)	121.6	0.30	0.10	10.8	0.1	0	0.1	-	-	0.30
Water (lb/hr)	1214.7	138.5	112.5	96.5	62.5	41.6	75	279.6	55.8	305.8
Nitrogen (lb/hr)	225	225	225	125	125	150	150.5	5.5	5.5	506
[redacted]	-	-	-	-	-	-	-	0.54	0.18	0.18
[redacted]	-	-	-	-	-	-	-	0.0014	0.0005	0.0005
Temperature (F)	650	133	111	650	103	650	100	160	111	111
Pressure (psia)	4.86	4.86	14.7	1.4	14.7	1.4	14.7	4.86	14.7	14.7
Flow Rate (acfm)	3123	343	99.1	1405	54.3	1086	64.9	358.4	49.1	267.4
Flow Rate (scfm)	483.7	99.5	90.3	62.7	50.2	48.4	60.3	99.4	44.7	243.6

2023 Estimate (6 klb/hr)										
Parameter	Inlet to KD-610-1	Outlet from KD-610-1	Outlet from KC-603B&C	Inlet to KT-602	Outlet from KC-601B	Inlet to KD-602A	Inlet to KC-601A from	Inlet to KC-601A from	Outlet from KC-601A	Outlet from KF-613
HMDA (lb/hr)	221	0.55	0.01	33	0.31	4	0.01	-	0.04	0.35
Water (lb/hr)	1018	116.07	94.28	210	210	74	29.3	279.6	382.90	716.48
Nitrogen (lb/hr)	-	-	-	-	-	-	-	5.5	5.50	5.50
[redacted]	-	-	-	-	-	-	-	0.54	0.18	0.18
[redacted]	-	-	-	-	-	-	-	0.0014	0.0005	0.0005

2023 Estimate (10 klb/hr)										
Parameter	Inlet to KD-610	Outlet from KD-610	Outlet from KC-603B&C	Inlet to KT-602	Outlet from KC-601B	Inlet to KD-602A	Inlet to KC-601A from	Inlet to KC-601A from	Outlet from KC-601A	Outlet from KF-613
HMDA (lb/hr)	553	1.38	0.01	55	0.51	6	0.01	-	0.06	0.58
Water (lb/hr)	2584	294.63	239.32	354	354	124	48.83	279.6	452.43	1094.59
Nitrogen (lb/hr)	-	-	-	-	-	-	-	5.5	5.50	5.50
[redacted]	-	-	-	-	-	-	-	0.54	0.18	0.18
[redacted]	-	-	-	-	-	-	-	0.0014	0.0005	0.0005

[redacted]

EMISSION POINT	Pollutant	Controlled Emission Rate	Operating Hours	Annual Emissions	Maximum Rate Factor	Maximum Emissions
A-6	HMDA	0.58	8760.00	2.5415	1.0862	0.000315
	THF	0.18	747.00	0.0672	1.0862	0.000098
	BD	0.0005	747.00	0.0002	1.0862	0.000000

A-6A - HMDA RECOVERY TANK KF-690

Assumptions:

[redacted]

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.696	14.696
Temperature (F)	130	140
Volume (acf)	71	72

[redacted]

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
365	140	14.696	316

Breathing emissions = 316 scf/yr * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / 1 lbmol HMDA * 0.0753 psia / 14.696 psia * 20% HMDA = 0.09916 lb HMDA / year

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS	ANNUAL EMISSIONS
A-6A	HMDA RECOVERY TANK KF-690	VOC - HMDA	1.13E-05	8760	0.09916	4.96E-05

[redacted]

A-6B - CENTRIFUGAL DRYER FAN KC-692

Assumptions:

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-6B	CENTRIFUGAL DRYER FAN KC-692	PM	795	0.000015	0.72	99.00%	0.0072	8760	0.03
		PM_{10}	795	0.0000075	0.36	98.00%	0.0072	8760	0.03

Due to its continuous operation, maximum and average emissions are the same for the centrifugal dryer fan KC-692.

A-7 VACUUM LOADING RECEIVER KM-104

Assumptions:

[redacted]

11. Design parameters for this source are:

	Flow rate (scfm)	Temp (F)	Pressure (psig)	Flow rate (acfm)
Unloading	849	110	-4.9	1396
Baghouse exhaust (max)	109	110	0	120
Baghouse exhaust (avg)	20	110	0	22

Particulate loading to baghouse:

2001 estimate:

190,000	scfm unloading flow rate	min/railcar	90%	0.049
lb/railcar	849	456	separation efficiency	lb/scf baghouse loading

2023 estimate:

55,000	scfm unloading flow rate	min/railcar compartment	90%	0.015
lb/railcar compartment	849	420	separation efficiency	lb/scf baghouse loading

EMISSION POINT	DESCRIPTION	POLLUTANT	EXHAUST FLOW RATE	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY (%)	EXHAUST LOADING RATE	OPERATING HOURS	BIN FILTER EXHAUST LOAD
A-7	VACUUM UNLOADING RECEIVER	PM	20	0.015	18.5	99.9%	0.019	7,392	0.068
		PM_{10}	20	0.008	9.3	99.8%	0.019	7,392	0.068
	MAXIMUM EMISSIONS	PM	109	0.015	100.87	99.9%	0.101		
		PM_{10}	109	0.008	50.44	99.8%	0.101		

A-8 FUME COLLECTION KC-633-1

Assumptions:

[redacted]

4. Design parameters for this source are:

Flow rate (scfm)	Temp (F)	Pressure (psig)	Flow rate (acfm)
2030	122	0	2272

Emission Point	Description	Pollutant	Uncontrolled Emissions	Control Efficiency	Controlled Emission Rate	Operating Hours	Annual Emissions
A-8	Fume Collection KC-633-1	**HMDA**	292.00	99.86%	0.4088	8760	1.79

Maximum Emissions

Pollutant	Controlled Emissions Rate (lb/hr)	Maximum Rate Factor	Maximum Emissions
HMDA	0.4088	1.0862	0.4440

Redacted Copy

A-9 - Pellet Cooler Chips Collector KM-703 (Baghouse)

[redacted]

Assumptions:

[redacted]

8. Design parameters for this source are:

Flow rate (scfm)	Temp (F)	Pressure (psig)	Flow rate (acfm)
13,876	160	0.5	16,000

KCV run time = 4,000,000 lbs produced / 6,000 lbs/hr production rate = 400 hours * 60 min / hr = 24,000 min run time
Fines produced / KCV run = 3 boxes * 750 kg * 2.20462 lb/kg = 4,960.17 lb pellet fines / KCV run
Solids loading rate = 4,960.17 lb pellet fines / 24,000 min / 13,876 scfm = 0.000015 lb/scf

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-9	Peller Cooler Chips Collector KM-703	PM	13,876	0.000015	12.49	99.90%	0.0125	8760	0.05
		PM_{10}	13,876	0.0000075	6.24	99.80%	0.0125	8760	0.05

Due to the continuous nature of the baghouse, controlled emissions rate is both the average and the maximum emissions rate.

A-10 - Test Bin Chips Collector KM-728 (Baghouse)

Assumptions:

[redacted]

8. Design parameters for this source are:

	Flow rate (scfm)	Temp (F)	Pressure (psig)	Flow rate (acfm)
Chip Collector Flow	443	110	0.5	470
Exhaust Flow, avg	4.7	110	0.5	5
Exhaust Flow, max	99	110	0.5	105

POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	FILTER CONTROL	TOTAL FILTER EMISSION	OPERATING HOURS	TOTAL FILTER EMISSIONS
PM	443	0.000015	0.40	99.90%	0.0004	8760	0.002
PM_{10}	443	0.0000075	0.20	99.80%	0.0004	8760	0.002

Emissions are reduced by a partial recycle of Chip Collector exhaust (4.7 scfm vs. 443 scfm).

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	TOTAL FILTER EMISSION	EXHAUST FLOW RATE	RECYCLE CONTROL	TOTAL CONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-10	Test Bin Chips Collector KM-728	PM	443	0.0004	4.70	98.94%	4.23E-06	8760	1.85E-05
		PM_{10}	443	0.0004	4.70	98.94%	4.23E-06	8760	1.85E-05

Maximum Emissions

Pollutant	Maximum Exhaust Rate (scfm)	Controlled Concentration	Maximum Emissions
PM	99	1.50E-08	8.91E-05
PM_{10}	99	1.50E-08	8.91E-05

A-11 - Product Silo Chips Collector KM-733 (Baghouse)

Assumptions:

[redacted]

8. Design parameters for this source are:

	Flow rate (scfm)	Temp (F)	Pressure (psig)	Flow rate (acfm)
Chip Collector Flow	1698	110	0.5	1800
Exhaust Flow, avg	13.2	110	0.5	14
Exhaust Flow, max	104	110	0.5	110

POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	FILTER CONTROL	TOTAL FILTER EMISSION	OPERATING HOURS	TOTAL FILTER EMISSIONS
PM	1,698	0.000015	1.53	99.90%	0.0015	8760	0.007
PM_{10}	1,698	0.0000075	0.76	99.80%	0.0015	8760	0.007

Emissions are reduced by a partial recycle of Chip Collector exhaust (4.7 scfm vs. 443 scfm).

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	TOTAL FILTER EMISSION	EXHAUST FLOW RATE	RECYCLE CONTROL	TOTAL CONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-11	Product Silo Chips Collector KM-733	PM	1,698	0.0015	13.20	99.22%	1.19E-05	8760	5.20E-05
		PM_{10}	1,698	0.0015	13.20	99.22%	1.19E-05	8760	5.20E-05

Maximum Emissions

Pollutant	Maximum Exhaust Rate (scfm)	Controlled Concentration	Maximum Emissions
PM	104	1.50E-08	9.36E-05
PM_{10}	104	1.50E-08	9.36E-05

A-12 / KF-801

Assumptions:

[redacted]

VOC Loading

[redacted]

Working Emissions

[redacted]

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
24,815	215	14.896	19,374

[redacted]

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.896	14.896
Temperature (F)	205	215
Volume (acf)	1805	1832

[redacted]

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
9,855	215	14.896	7,694

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-12	[redacted]	[redacted]	0.0030	8760	0.01295

Flow Rate (gpm)	Flow Rate (acfm)	Temp (F)	Pressure (psia)	Flow Rate (scfm)
125	16.71	215	14.896	13.05

Maximum Emissions

Pollutant	Maximum Exhaust Rate (scfm)	Controlled Concentration	Maximum Emissions
VOC - BD	13.05	0.00096	0.75

A-13 / KF-802

Assumptions:

[redacted]

VOC Loading

[redacted]

Working Emissions

[redacted]

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
32,618	160	14.896	27,726

[redacted]

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.896	14.896
Temperature (F)	150	160
Volume (acf)	1805	1835

Breathing volume = 1835 acf - 1805 acf = 30 acf / day * 365 days = 10,950 acf/yr

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
10,950	160	14.896	9,308

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-13	[redacted]	[redacted]	0.0002	8760	0.00092
		[redacted]	0.0053	8760	0.02338

Flow Rate (gpm)	Flow Rate (acfm)	Temp (F)	Pressure (psia)	Flow Rate (scfm)
125	16.71	160	14.896	14.21

Maximum Emissions

Pollutant	Maximum Exhaust Rate (scfm)	Controlled Concentration	Maximum Emissions
[redacted]	14.21	0.00005	0.04
[redacted]	14.21	0.00126	1.08

A-14 / KF-803 - DOES NOT EXIST. Water cut from BD recovery is pumped directly to wastewater.

A-15 / KB-807

Assumptions:

[redacted]

Flush hours / year = 120 min/flush * 1 hr/60 min * 63 flushes per year = 126 hours/year

Because BD flush compositions are assumed the same, the 2001 estimates for the compositions of the flash from BD recovery are used. Each flush is assumed to take 120 min, so the rate can be calculated by taking the amount per flush over the flush duration.

Component	Flash Amount to Flare (lb)	Rate (lb/min) (amount/120
[redacted]	1,670	13.92
Water	556.7	4.64
[redacted]	0	0.00
Nitrogen	8.7	0.07

Combustion assumptions made include that natural gas density is 23.5 cf/lb, the natural gas heating value is 1020 BTU/cf, 30% excess oxygen is used for complete combustion of natural gas and organics, and air is 21% oxygen. Furthermore, AP-42 emission factors are used in the calculation of emissions of combustion byproducts, and are shown below:

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas
CO	84	0.0824
SOx	0.6	0.0006
PM	7.6	0.0075
PM_{10}	5.7	0.0056
Methane	2.3	0.0023
VOC	5.5	0.0054
Nox	100	0.0980

[redacted]			
C4H8O + 5.5 O2 = 4 CO2 + 4 H2O			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
[redacted]	13.22	72.11	0.1833
O2 required	32.27	32.00	1.0084
CO2 created	32.28	44.01	0.7334
H2O created	13.22	18.02	0.7334

Natural Gas Combustion			
CH4 + 2 O2 = CO2 + 2 H2O			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
Natural Gas combusted	16.59	16.04	1.0340
O2 required	66.18	32.00	2.0681
CO2 created	45.51	44.01	1.0340
H2O created	37.27	18.02	2.0681

[redacted]

Pre-Combustion Flow (Flushes)			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
[redacted]	13.92	72.11	73.23
Water	4.64	18.02	97.69
Natural Gas	16.67	16.04	394.29
Nitrogen	481.47	28.01	6,522.66
Oxygen	127.97	32.00	1,517.48

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
8,605	150	0	10,095

Natural gas thermal rate = 16.67 lb/min * 23.5 scf/lb * 1020 BTU/scf = 0.399580 MMBTU/min

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas	Amount generated (lb/min)
CO	84	0.0824	0.03291
SOx	0.6	0.0006	0.00024
PM	7.6	0.0075	0.00298
PM_{10}	5.7	0.0056	0.00223
Methane	2.3	0.0023	0.00090
VOC	5.5	0.0054	0.00215
Nox	100	0.0980	0.03917
Natural Gas Consumed			0.08058

Post-Combustion Emissions (Recovery)			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
	0.696	72.11	3.66
Water	55.12	18.02	1,160.73
Nitrogen	481.47	28.01	6,522.66
Oxygen	29.52	32.00	350.09
CO2	77.78	44.01	670.66
CO	0.03291	28.01	0.45
SOx	0.00024	64	0.00
PM	0.00298		
PM_{10}	0.00223		
Methane	0.00090	16.04	0.02
VOC	0.00215		
Nox	0.03917	46	0.32

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
8,709	150	0	10,216

Natural Gas Combustion (Down time)			
CH4 + 2 O2 = CO2 + 2 H2O			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
Natural Gas combusted	0.36	16.04	0.0224
O2 required	1.44	32.00	0.0449
CO2 created	0.99	44.01	0.0224
H2O created	0.81	18.02	0.0449

Natural gas thermal rate = 0.3616 lb/min * 23.5 scf/lb * 1020 BTU/scf = 0.008668 MMBTU/min

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas	Amount generated (lb/min)
CO	84	0.0824	0.00071
SOx	0.6	0.0006	0.00001
PM	7.6	0.0075	0.00006
PM_{10}	5.7	0.0056	0.00005
Methane	2.3	0.0023	0.00002
VOC	5.5	0.0054	0.00005
Nox	100	0.0980	0.00085
Natural Gas Consumed			0.00175

Pre-Combustion Flow (Downtime)			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Natural Gas	0.3616	16.04	8.55
Nitrogen	7.0559	28.01	95.59
Oxygen	1.8756	32.00	22.24

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
126	150	0	148

Post-Combustion Emissions (Downtime)			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Water	0.81	18.02	17.03
Nitrogen	7.06	28.01	95.59
Oxygen	0.44	32.00	5.21
CO2	0.99	44.01	8.51
CO	0.00071	28.01	0.01
SOx	0.00001	64	0.00
PM	0.00006		
PM_{10}	0.00005		
Methane	0.00002	16.04	0.00
VOC	0.00005		
Nox	0.00085	46	0.01

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
126	150	0	148

Component	Recovery Rate (lb/min)	Recovery Time (hrs/year)	Down Time Rate (lb/min)	Down Time (hrs/year)	Annual Emissions (lb/yr)	Emissions rate
THF	0.69583	126	0.00000	8634	5,260.50	0.69
CO2	77.78396	126	0.98735	8634	1,099,533.19	144.89
CO	0.03291	126	0.00071	8634	618.57	0.08
SOx	0.00024	126	0.00001	8634	4.42	0.00
PM	0.00298	126	0.00006	8634	55.97	0.01
PM_{10}	0.00223	126	0.00005	8634	41.97	0.01
Methane	0.00090	126	0.00002	8634	16.94	0.00
VOC	0.00215	126	0.00005	8634	40.50	0.01
Nox	0.03917	126	0.00085	8634	736.39	0.10

EMISSION POINT	DESCRIPTION	POLLUTANT	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-15	FLARE KB-807	THF	0.6005	8760	2.63
		CO2	125.5175	8760	549.8
		CO	0.0706	8760	0.309
		SOx	0.0005	8760	0.002
		PM	0.0064	8760	0.028
		PM_{10}	0.0048	8760	0.021
		Methane	0.0019	8760	0.008
		VOC	0.0046	8760	0.020
		Nox	0.0841	8760	0.368

Emergency Combustion Calculation

The emergency combustion calculations remain unchanged from the 2001 estimate. The load to flare per emergency batch is the same as in the 2001 estimate:

Component	Load to flare per emergency batch	Loading rate (load to flare
[redacted]	800	1.86
Water	1580	3.67
[redacted]	987	2.30
Nitrogen	31.18 (1 scfm for 430 min)	0.07

THF Combustion			
C4H8O + 5.5 O2 = 4 CO2 + 4 H2O			
Component	**Rate (lb/min)**	**MW (lb/lbmol)**	**Rate (lbmol/min)**
[redacted]	1.77	72.11	0.0245
O2 required	4.31	32.00	0.1348
CO2 created	4.31	44.01	0.0980
H2O created	1.77	18.02	0.0980

BD Combustion			
C4H10O2 + 5.5 O2 = 4 CO2 + 5 H2O			
Component	**Rate (lb/min)**	**MW (lb/lbmol)**	**Rate (lbmol/min)**
[redacted]	2.18	90.12	0.0242
O2 required	4.26	32.00	0.1331
CO2 created	4.26	44.01	0.0968
H2O created	2.18	18.02	0.1210

Natural gas flow rate = 1,000 lb/hr max / 60 min / hr = 16.67 lb/min

Natural Gas Combustion			
CH4 + 2 O2 = CO2 + 2 H2O			
Component	**Rate (lb/min)**	**MW (lb/lbmol)**	**Rate (lbmol/min)**
Natural Gas combusted	16.67	16.04	1.0391
O2 required	66.50	32.00	2.0781
CO2 created	45.73	44.01	1.0391
H2O created	37.45	18.02	2.0781

Total air required = total O2 required * 130% (30% excess) / 21% (21% oxygen in air)
Total air required = (4.31 + 4.26 + 66.50) * 130% / 21% = 464.74 lb/min
Combustion nitrogen = 464.74 * 0.79 = 367.14 lb/min
Combustion oxygen = 464.74 * 0.21 = 97.59 lb/min

Pre-Combustion Flow (Emergency)			
Component	**Rate (lb/min)**	**MW (lb/lbmol)**	**Flow (scfm)**
[redacted]	1.86	72.11	9.79
[redacted]	2.30	90.12	9.66
Water	3.67	18.02	77.37
Natural Gas	16.67	16.04	394.29
Nitrogen	367.21	28.01	4,974.71
Oxygen	97.59	32.00	1,157.23

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
6,623	150	0	7,769

Natural gas thermal rate = 16.67 lb/min * 23.5 scf/lb * 1020 BTU/scf = 0.399580 MMBTU/min

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas	Amount generated (lb/min)
CO	84	0.0824	0.03291
SOx	0.6	0.0006	0.00024
PM	7.6	0.0075	0.00298
PM_{10}	5.7	0.0056	0.00223
Methane	2.3	0.0023	0.00090
VOC	5.5	0.0054	0.00215
Nox	100	0.0980	0.03917
Natural Gas Consumed			0.08058

Post-Combustion Emissions (Emergency)			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
[redacted]	0.093	72.11	0.49
[redacted]	0.115	90.12	0.48
Water	45.07	18.02	949.06
Nitrogen	367.21	28.01	4,974.71
Oxygen	22.52	32.00	267.01
CO2	54.30	44.01	468.21
CO	0.03291	28.01	0.45
SOx	0.00024	64	0.00
PM	0.00298		
PM_{10}	0.00223		
Methane	0.00090	16.04	0.02
VOC	0.00215		
Nox	0.03917	46	0.32

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
6,661	150	0	7,814

EMISSION POINT	DESCRIPTION	POLLUTANT	CONTROLLED EMISSION
A-15	FLARE KB-807 **MAXIMUM EMISSIONS**	THF	5.5814
		BD	6.8860
		CO2	3258.2232
		CO	1.9744
		SOx	0.0141
		PM	0.1786
		PM_{10}	0.1340
		Methane	0.0541
		VOC	0.1293
		Nox	2.3505

A-16 - Hot Oil Drain Tank KD-908

The 2001 emissions calculations overestimated emissions from KD-908, estimating 0.58 lb/hr and 2.53 TPY. Based on actual Syltherm 800 consumption data, these numbers are incorrect. Calculations providing a more accurate estimate are shown below:

Assumptions:

[redacted]

Average hot oil consumption rate = 10 drums / 3 years * 55 gal / drum / 7.48052 gal / cuft * 57.44 lb/cuft Syltherm 800 * 1 year / 365 day * 1 day / 24 hr = 0.1607 lb/hr
Average hot oil vent rate = 0.1607 lb/hr * 1 hr / 60 min / 331.8 lb/lbmol * 379.5 scf / lbmol = 8.07E-06 scfm

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	EMISSION RATE (LB/HR)	OPERATING HOURS	ANNUAL EMISSIONS
A-16	Hot Oil Drain Tank KD-908	Syltherm 800	8.07E-06	331.89	0.1607	8760	0.70

Due to its continuous operation, maximum and average emissions are the same for the hot oil drain tank KD-908.

A-17 - Hot Oil Heater KB-901

Assumptions:

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas
CO	84	0.0824
SOx	0.6	0.0006
PM	7.6	0.0075
PM_{10}	5.7	0.0056
Methane	2.3	0.0023
VOC	5.5	0.0054

Byproduct	lb/1000 gal distillate oil	MMBTU / 1000 gal	lb / MMBTU
CO	5	140	0.03571
PM	3.3	140	0.02357
PM_{10}	1.3	140	0.00929
Methane	0.052	140	0.00037
VOC	0.2	140	0.00143

Natural Gas Combustion Calculation

Natural Gas Combustion			
$CH_4 + 2 O_2 = CO_2 + 2 H_2O$			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
Natural Gas combusted	14.42	16.04	0.8990
O2 required	57.54	32.00	1.7980
CO2 created	39.57	44.01	0.8990
H2O created	32.40	18.02	1.7980

Total air required = total O2 required * 120% (20% excess) / 21% (21% oxygen in air)
Total air required = 57.54 lb/min * 120% / 21% = 328.80 lb/min
Combustion nitrogen = 356.20 * 0.79 = 259.75 lb/min
Combustion oxygen = 356.20 * 0.21 = 69.05 lb/min

Pre-Combustion Flow			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Natural Gas	14.42	16.04	341.14
Nitrogen	259.75	28.01	3,518.91
Oxygen	69.05	32.00	818.80

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas	Amount generated (lb/min)
CO	84	0.0824	0.02792
SOx	0.6	0.0006	0.00020
PM	7.6	0.0075	0.00253
PM_{10}	5.7	0.0056	0.00189
Methane	2.3	0.0023	0.00076
VOC	5.5	0.0054	0.00183
Nox	81.6	0.0800	0.02712
Natural Gas Consumed			0.06225

Post-Combustion Emissions			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Water	32.40	18.02	682.27
Nitrogen	259.75	28.01	3,518.91
Oxygen	11.51	32.00	136.53
CO2	39.57	44.01	341.14
CO	0.02792	28.01	0.38
SOx	0.00020	64	0.00
PM	0.00253		
PM_{10}	0.00189		
Methane	0.00076	16.04	0.02
VOC	0.00183		
Nox	0.02712	46	0.22

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
4,679	150	0	5,489

Fuel Oil Combustion Calculation

Fuel Oil Composition

Component	Weight %	Usage Rate (lb/min)
Fuel Oil	100%	18.38
Hydrogen	12.31%	2.26
Carbon	87.25%	16.04
Sulfur	0.40%	0.07

Fuel Oil Combustion			
2 H2 + O2 = 2 H2O			
C + O2 = CO2			
S + O2 = SOx			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
H2 combusted	2.26	2.02	1.1223
O2 required	17.96	32.00	0.5612
H2O created	20.22	18.02	1.1223
C combusted	16.04	12.01	1.3352
O2 required	42.72	32.00	1.3352
CO2 created	58.76	44.01	1.3352
S combusted	0.07	32.07	0.0023
O2 required	0.07	32.00	0.0023
SOx created	0.15	64.07	0.0023

Total air required = total O2 required * 120% (20% excess) / 21% (21% oxygen in air)
Total air required = (17.96 + 42.72 + 0.07) * 120% / 21% = 347.17 lb/min
Combustion nitrogen = 347.17 * 0.79 = 274.27 lb/min
Combustion oxygen = 347.17 * 0.21 = 72.91 lb/min

Pre-Combustion Flow			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Fuel Oil	*18.38*	*10.86*	*642.45*
Hydrogen	**2.26**	**2.02**	**425.87**
Carbon	**16.04**	**12.01**	**506.64**
Sulfur	**0.07**	**32.07**	**0.87**
Nitrogen	274.27	28.01	3,715.62
Oxygen	72.91	32.00	864.58

Byproduct	lb/1000 gal distillate oil fired	lb / MMBTU distillate oil	Amount generated
CO	5	0.03571	0.01211
PM	3.3	0.02357	0.00799
PM_{10}	1.3	0.00929	0.00315
Methane	0.052	0.00037	0.00013
VOC	0.2	0.00143	0.00048
NOx	11.2	0.08000	0.02712
		Fuel Oil Consumed	0.05098

Post-Combustion Emissions			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Water	20.22	18.02	425.87
Nitrogen	274.27	28.01	3,715.62
Oxygen	12.15	32.00	144.13
CO2	58.76	44.01	506.64
CO	0.01211	28.01	0.16
SOx	0.14689	64	0.87
PM	0.00799		
PM_{10}	0.00315		
Methane	0.00013	16.04	0.00
VOC	0.00048		
Nox	0.02712	46	0.22

EMISSION POINT	DESCRIPTION	POLLUTANT	Natural Gas Emission Rate	Natural Gas Usage (hr/yr)	Fuel Oil Emission Rate	Fuel Oil Usage (hr/yr)	Annual Emissions (lb/yr)	Average Emissions Rate	Annual Emissions	Maximum Emissions Rate
A-17	Hot Oil Heater KB-901	CO	0.0279	8,395	0.01211	365	14,327	1.64	7.16	1.6751
		SOx	0.0002	8,395	0.14689	365	3,317	0.38	1.66	8.8136
		PM	0.0025	8,395	0.00799	365	1,447	0.17	0.72	0.4794
		PM_{10}	0.0019	8,395	0.00315	365	1,023	0.12	0.51	0.1889
		Methane	0.0008	8,395	0.00013	365	388	0.04	0.19	0.0459
		VOC	0.0018	8,395	0.00048	365	931	0.11	0.47	0.1097
		NOx	0.0271	8,395	0.02712	365	14,254	1.63	7.13	1.6272

A-18- Vent Scrubber KT-1001

KD-260 Feed Prep Mix Tank

Many of the assumptions made during the 2001 estimate are no longer true. See below for updated calculations.

Assumptions:

[redacted]

Compound	Mass (lb)	MW (lb/lbmol)	Moles	Mole %	Density (lb/cf)	Volume (cf)
[redacted]	34,782	166.13	209.37	7.74%	45	772.93
[redacted]	13,377	166.13	80.52	2.98%	45	297.27
AA	4,707	146.14	32.21	1.19%	45	104.60
HMDA	41,479	116.21	356.93	13.20%	58.22	712.45
Water	36,506	18.02	2,025.86	74.90%	62.4	585.03
Total	130,851		2,704.89	100.00%		2,472.28

Inerting Volume = 3 volume exchanges / inerting * 256.2 cf / exchange * 4 inerting/day * 365 days/year = 1,122,156 acfy

Venting Volume = 2,473 cf/batch * 1 batch / 7 hours * 8760 hours / year = 3,094,783 acfy

Action	Flow rate (scf)	Temperature (F)	Pressure (psig)	Flow rate (acf)
Inerting (per year)	789,998	290	0	1,122,156
Venting (per year)	8,848,300	290	45	3,094,783
Total (per year)	9,638,298	290	45	4,216,939
Maximum (per min)	143	290	45	50
Average (per min)	18.34	290	45	6

VOC Loading

HMDA vapor pressure @ 290 F = 2.78 psia * 13.2% HMDA mol % = 0.367 psia

HMDA emissions = 9,638,298 scf/year * 0.367 psia HMDA / 59.7 psia total = 59,251 scf HMDA /year
HMDA emissions = 59,251 scf HMDA /year * 1lbmol / 379.5 scf *116.21 lb / 1 lbmol = 18,144 lb HMDA / year

Average Process Emissions from KD-260					
Pollutant	Flow Rate (scfm)	Uncontrolled Emission Rate	Control Efficiency %	Controlled Emission Rate	Annual Emissions (TPY)
HMDA	0.11	2.07	99.99%	**0.00021**	**0.00091**

Maximum Process Emissions from KD-260				
Pollutant	Flow Rate (scfm)	Uncontrolled Emission Rate	Control Efficiency %	Controlled Emission Rate
HMDA	143	16.15	99.99%	**0.0016**

Emissions are controlled by control device C1001, vent scrubber KT-1001.

KD-266 Surge Tank

Many of the assumptions made during the 2001 estimate are no longer true. See below for updated calculations.

Assumptions:

[redacted]

Action	Flow rate (scf)	Temperature (F)	Pressure (psig)	Flow rate (acf)
Venting (per year)	8,848,300	290	45	3,094,783
Total (per year)	8,848,300	290	45	3,094,783
Maximum (per min)	143	290	45	50
Average (per min)	16.83	290	45	6

VOC Loading

HMDA vapor pressure @ 290 F = 2.78 psia * 13.2% HMDA mol % = 0.367 psia

HMDA emissions = 8,848,300 scf/year * 0.367 psia HMDA / 59.7 psia total = 54,394 scf HMDA /year
HMDA emissions = 54,934 scf HMDA /year * 1lbmol / 379.5 scf *116.21 lb / 1 lbmol = 16,656 lb HMDA / year

Average Process Emissions from KD-266					
Pollutant	Flow Rate (scfm)	Uncontrolled Emission Rate	Control Efficiency %	Controlled Emission Rate	Annual Emissions (TPY)
HMDA	0.10	1.90	99.99%	**0.00019**	**0.00083**

Maximum Process Emissions from KD-266				
Pollutant	Flow Rate (scfm)	Uncontrolled Emission Rate	Control Efficiency %	Controlled Emission Rate
HMDA	143	16.15	99.99%	**0.0016**

Emissions are controlled by control device C1001, vent scrubber KT-1001.

KF-302 Reflux Pot

Assumptions:

[redacted]

VOC Loading

Component	Weight %	MW (lb/lbmol)	Flow Rate (lb/hr)	Flow Rate (lbmol/hr)	Mole %
Water	96%	18.02	3,840	213.10	99.36%
HMDA	4%	116.21	160	1.38	0.64%
Total	100%	18.65	4,000	214.47	100.00%

HMDA vapor pressure at 140 F = 0.058 psia * 0.64% = 0.0003712 psia

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
433	140	0	500

HMDA emissions at 140 F = 433 scfm * 0.0003712 psia / 14.696 psia * 1 lbmol HMDA / 379.5 scf * 116.21 lb / lbmol HMDA * 60 min / hr = 0.2009 lb/hr HMDA

DESCRIPTION	POLLUTANT	UNCONTROLLED EMISSION	CONTROL EFFICIENCY (%)	MAXIMUM EMISSIONS
REFLUX POT KF-302	HMDA	0.2009	99.99%	0.00002

Emissions are controlled by control device C1001, vent scrubber KT-1001.

KD-310 Concentrator KO POT

KD-310 is used as an emergency divert for KD-301 and only triggers when the unit experiences plugging.

Assumptions:

[redacted]

HMDA emissions = 615 lb/hr HMDA * 1 lb mol / 116.21 lb * 379.5 scf / 1lbmol * 1 hr / 60 min = 33.472 scfm HMDA

Average Process Emissions from KD-310								
Pollutant	**Flow Rate (scfm)**	**Uncontrolled Emission Rate**	**Control Efficiency %**	**Controlled Emission Rate**	**Operating Hours**	**Annual Emissions (TPE)**	**Total Hours (hr/yr)**	**Average Emission Rate**
HMDA	33.47	615.00	99.99%	0.06150	3.5	0.00011	8760	2.46E-05

Maximum Process Emissions from KD-550				
Pollutant	**Flow Rate (scfm)**	**Uncontrolled Emission Rate**	**Control Efficiency %**	**Controlled Emission Rate**
HMDA	33.47	615.00	99.99%	0.0615

Emissions are controlled by control device C1001, vent scrubber KT-1001.

KD-350 DIW Flush Tank - KD-350 has been repurposed from the concentrator divert tank to the DIW flush tank. Its contents is ONLY deionized water, so no tracked emissions are sent to the scrubber.

KD-550 Polymer Divert Tank

[redacted]

Assumptions:

[redacted]

Total divert hours = 21 shutdowns/year * 3 hours flush / shutdown = 63 hours / year

HMDA emissions = 615 lb/hr HMDA * (1 - 90% condensed) = 61.5 lb/hr HMDA emitted
HMDA emissions = 61.5 lb/hr HMDA * 1 lb mol / 116.21 lb * 379.5 scf / 1lbmol * 1 hr / 60 min = 3.3472 scfm HMDA

Average Process Emissions from KD-550								
Pollutant	**Flow Rate (scfm)**	**Uncontrolled Emission Rate**	**Control Efficiency %**	**Controlled Emission Rate**	**Operating Hours**	**Annual Emissions (TPY)**	**Total Hours (hr/yr)**	**Average Emission Rate**
HMDA	3.35	61.50	99.99%	0.00615	63	0.00019	8760	4.42E-05

Maximum Process Emissions from KD-550				
Pollutant	**Flow Rate (scfm)**	**Uncontrolled Emission Rate**	**Control Efficiency %**	**Controlled Emission Rate**
HMDA	3.35	61.50	99.99%	0.0061

Emissions are controlled by control device C1001, vent scrubber KT-1001.

A-18 - KT-1001 Vent Scrubber

Assumptions:

[redacted]

EMISSION POINT	Compound	KD-260	KD-266	KF-302	KD-310	KD-550	Total KT-1001
A-18	Average Flow Rate (scfm)	0.11	0.10	0.00	0.000	0.024	0.2403
	Max Flow Rate (scfm)	142.96	142.96	433.33	33.47	3.35	756.06
	Avg Emissions Rate (lb/hr)	0.00021	0.00019	0.00E+00	0.00000	4.42E-05	0.00044
	Max Emissions Rate (lb/hr)	0.00161	0.00161	2.01E-05	0.06150	0.0061	0.07090
	Annual Emissions (TPY)	0.00091	0.00083	0.00E+00	0.00011	0.00019	0.00204

A-19 - KF-1011 Waste Water Neutralization

Assumptions:

[redacted]

Working Emissions

[redacted]

Action	Flow rate (scf)	Temperature (F)	Pressure (psig)	Flow rate (acf)
Total Throughput (per	23,186,623	100	0	24,591,873
Maximum Venting (per	44.11	100	0	46.78

Working HMDA emissions = 23,186,623 scf / year * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / lbmol HMDA * 0.0005 psia / 14.696 psia = 241.57 lb HN

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.768	14.768
Temperature (F)	85	115
Volume (acf)	521.8	550.5

Breathing volume = 550.5 acf - 521.8 acf = 28.7 acf / day * 365 days = 10,476 acf/yr

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
10,476	100	14.768	9,775

Breathing HMDA emissions = 9,775 scf / year * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / lbmol HMDA * 0.0005 psia / 14.696 psia = 0.1018 lb HMDA

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-19	Wastewater Neutralization	VOC - HMDA	0.0276	8760	0.1208

A-22 - PACKAGING BAGHOUSE KH-2105

Assumptions:

[redacted]

Exhaust Flow, avg	15.5	110	0.5	17
Exhaust Flow, max	100.4	110	0.5	110

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	FILTER CONTROL	TOTAL FILTER EMISSION	OPERATING HOURS	TOTAL FILTER EMISSIONS
A-22	PACKAGING BAGHOUSE KH-2105	PM	15.5	0.005	4.65	99.90%	0.0047	8760	0.020
		PM_{10}	15.5	0.0025	2.33	99.80%	0.0047	8760	0.020

Maximum Emissions

Pollutant	Maximum Exhaust Rate (scfm)	Controlled Concentration	Maximum Emissions
PM	100.4	5.00E-06	0.0301
PM_{10}	100.4	5.00E-06	0.0301

A-23 - Adipic Acid Sack Station Filter KH-120

Assumptions:

[redacted]

Gas emission rate during AA super-sack unloading: 2,204 lb / 30 min * 1 cuft / 40 lb (bulk density) = 1.84 scfm (conditions are ambient, so scfm acceptable)

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY (%)	EXHAUST LOADING RATE	OPERATING HOURS	BIN FILTER EXHAUST LOAD
A-23	AA SACK STATION FILTER	PM	1.84	0.005	0.552	99.9%	0.0006	8760	0.002
		PM_{10}	1.84	0.0025	0.276	99.8%	0.0006	8760	0.002

Due to its continuous operation, the maximum emissions for AA sack station filter are the same as the average emissions.

A-24 - HMDA FEED TANK SEAL POT KF-851

Assumptions:

[redacted]

Working Emissions

[redacted]

Action	Flow rate (scf)	Temperature (F)	Pressure (psig)	Flow rate (acf)
Total Throughput (per	494,253	140	0	561,651

Working HMDA emissions = 494,253 scf / year * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / lbmol HMDA * 0.002165 psia / (14.696 + 1.5) psia = 20.2316 lb HMDA/year

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	16.196	16.196
Temperature (F)	140	150
Volume (acf)	802.085	815.46

[redacted]

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)	HMDA (lb/yr)
4,882	150	16.196	4,586	0.19

Uncontrolled HMDA breathing emissions = 4,586 scf/yr * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / lbmol HMDA * 0.002165 psia / (14.696 + 1.5) psia = 0.1877 lb HMDA / year

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED EMISSION RATE (LB/HR)	CONTROL EFFICIENCY (%)	CONTROLLED EMISSIONS RATE (LB/HR)	OPERATING HOURS	ANNUAL EMISSIONS (LB/YR)	ANNUAL EMISSIONS (TONS/YR)
A-24	HMDA FEED TANK SEAL POT KF-851	HMDA	0.0023	99.0%	0.00002	8760	0.2042	0.0001

Due to its continuous operation, the maximum emissions for KF-851 HMDA feed tank seal pot are the same as its average emissions (0.00002 lb/hr).

A-50 - Acetic Acid Storage BD-101

Assumptions:

[redacted]

VOC Loading

[redacted]

Working Emissions

[redacted]

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
8,783	95	14.696	8,229
15.4	95	14.696	14.4

Working emissions = 8,229 scf/yr * 1 lbmol acetic acid / 379.5 scf * 60.052 lb acetic acid / 1 lbmol acetic acid * 2.0155% = 26.2437 lb acetic acid / year

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.696	14.696
Temperature (F)	80	110
Volume (acf)	802	847

Breathing volume = 847 acf - 802 acf = 45 acf / day * 365 days = 16,425 acf/yr

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
16,425	95	14.696	15,389

Breathing emissions = 15,389 scf/yr * 1 lbmol acetic acid / 379.5 scf * 60.052 lb acetic acid / 1 lbmol acetic acid * 2.0155% = 49.0791 lb acetic acid / year

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-50	ACETIC ACID STORAGE BD-101	VOC - ACETIC ACID	0.0086	8760	0.03766

Flow Rate (gpm)	Flow Rate (acfm)	Temp (F)	Pressure (psia)	Flow Rate (scfm)
115	15.37	95	14.696	14.40

Maximum Emissions

Pollutant	Maximum Exhaust Rate (scfm)	Controlled Concentration	Maximum Emissions
VOC - ACETIC ACID	14.40	0.00319	2.76

A-51 - KF-306 Catalyst Addition

Assumptions:

[redacted]

Working Emissions

[redacted]

Action	Flow rate (scf)	Temperature (F)	Pressure (psig)	Flow rate (acf)
Total Throughput (per	5,560.34	100	0	5,897.33
Maximum Venting (per	1.89	100	0	2.00

[redacted]

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.768	14.768
Temperature (F)	85	115
Volume (acf)	17.38	18.34

Breathing volume = 18.34 acf - 17.38 acf = 0.96 acf / day * 365 days = 350 acf/yr

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
350	100	14.768	327

[redacted]

Powder Emissions

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS	AVG ANNUAL EMISSION
A-51	KF-306 Catalyst Addition	Phosphorous Acid	0.011	0.000012	0.000008	8760	0.000035	0.0000079
		PM	0.315	0.005	0.0945	45.61	0.002155	0.0004920
		PM_{10}	0.315	0.0025	0.0473	45.61	0.001078	0.0002460

Maximum Emissions

Particulate maximum emissions are assumed to be the same as continuous (0.0945 lb/hr PM and 0.0473 lb/hr PM10). Maximum gas emissions = 15 gpm or 2 acfm or 1.89 scfm * 0.000012 lb/scf = 0.00002268 lb/hr

A-54 - KF-270 Water / HMDA Recovery Tank

Assumptions:

[redacted]

Working Emissions

[redacted]

Action	Flow rate (scf)	Temperature (F)	Pressure (psig)	Flow rate (acf)
Total Throughput (per	741,379	140	0	842,476

[redacted]

Breathing Emissions

Parameter	Initial Conditions	Final Conditions
Pressure (psia)	14.696	14.696
Temperature (F)	85	115
Volume (acf)	1738	1834

Breathing volume = 1834 acf - 1738 acf = 96 acf / day * 365 days = 35,040 acf/yr

Flow Rate (acf/yr)	Temp (F)	Pressure (psia)	Flow Rate (scf/yr)
35,040	140	14.696	30,365

Breathing HMDA emissions = 30,365 scf / year * 1 lbmol HMDA / 379.5 scf * 116.21 lb HMDA / lbmol HMDA * 0.001545 psia / 14.696 psia = 0.9775 lb HMDA/year

EMISSION POINT	DESCRIPTION	POLLUTANT	UNCONTROLLED	OPERATING HOURS	ANNUAL EMISSIONS
A-54	KF-270 Water/HMDA tank	VOC - HMDA	0.00284	8760	0.012

Maximum Emissions

POLLUTANT	UNCONTROLLED EMISSION RATE	MAXIMUM RATE FACTOR	MAXIMUM EMISSIONS
VOC - HMDA	0.00284	1.0862	0.00308

A-55 - CM-642 Parts Cleaning Oven

Assumptions:

[redacted]

Compound	Mass (lb)	Formula	MW (lb/lbmol)	Moles (lbmol)	Mol %
TA	34,782	C8H6O4	166.13	209	30.83%
IPA	13,377	C8H6O4	166.13	81	11.86%
AA	4,707	C6H10O4	146.14	32	4.74%
HMDA	41,479	C6H16N2	116.21	357	52.57%
TOTAL	94,345			679	100.00%

Polymer Content		
Carbon	= 8 mol C / mol TA * 30.8% TA + 8 mol C / mol IPA * 11.9% IPA + 6 mol C / mol AA * 4.7% AA + 6 mol C / mol HMDA * 52.6% HMDA	7
Hydrogen	= 6 mol H / mol TA * 30.8% TA + 6 mol H / mol IPA * 11.9% IPA + 10 mol H / mol AA * 4.7% AA + 16 mol H / mol HMDA * 52.6% HMDA	11
Oxygen	= 4 mol O / mol TA * 30.8% TA + 4 mol O / mol IPA * 11.9% IPA + 4 mol O / mol AA * 4.7% AA + 0 mol O / mol HMDA * 52.6% HMDA	2
Nitrogen	= 0 mol N / mol TA * 30.8% TA + 0 mol N / mol IPA * 11.9% IPA + 0 mol N / mol AA * 4.7% AA + 2 mol N / mol HMDA * 52.6% HMDA	1

[redacted]

	AP-42 Emission Factors	
Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas
CO	84	0.0824
SOx	0.6	0.0006
PM	7.6	0.0075
PM_{10}	5.7	0.0056
Methane	2.3	0.0023
VOC	5.5	0.0054
Nox	100	0.0980

Polymer Combustion			
C7H11O2N + 9.75 O2 = 7 CO2 + 5.5 H2O + NO2			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
Polymer combusted	0.01350	141.19	0.0001
O2 required	0.030	32.00	0.0009
CO2 created	0.029	44.01	0.0007
H2O created	0.009	18.02	0.0005
NO2 created	0.004	46.01	0.0001

Natural gas flow rate = 350,000 BTU/hr * 1 cuft / 1,000 BTU * 1 hr / 60 min * 1 lb / 23.5 cuft = 0.25 lb/min natural gas

Natural Gas Combustion			
CH4 + 2 O2 = CO2 + 2 H2O			
Component	Rate (lb/min)	MW (lb/lbmol)	Rate (lbmol/min)
Natural Gas combusted	0.25	16.04	0.0156
O2 required	1.00	32.00	0.0312
CO2 created	0.69	44.01	0.0156
H2O created	0.56	18.02	0.0312

Total air required = total O2 required * 130% (30% excess) / 21% (21% oxygen in air)
Total air required = (0.030 lb/min + 1 lb / min) * 130% / 21% = 6.38 lb/min air
Combustion nitrogen = 6.38 lb/min * 0.79 = 5.04 lb/min nitrogen
Combustion oxygen = 6.38 lb/min * 0.21 = 1.34 lb/min oxygen

Pre-Combustion Flow			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Polymer	0.01	141.19	0.04
Natural Gas	0.25	16.04	5.91
Nitrogen	5.40	28.01	73.16
Oxygen	1.44	32.00	17.08

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
96	150	0	113

Natural gas thermal rate = 0.25 lb/min * 23.5 scf/lb * 1020 BTU/scf = 0.0059925 MMBTU/min

Byproduct	lb/MMscf natural gas	lb/MMBTU natural gas	Amount generated (lb/min)
CO	84	0.0824	0.00049
SOx	0.6	0.0006	0.00000
PM	7.6	0.0075	0.00004
PM_{10}	5.7	0.0056	0.00003
Methane	2.3	0.0023	0.00001
VOC	5.5	0.0054	0.00003
Nox	100	0.0980	0.00059
Natural Gas Consumed			0.00121

Post-Combustion Emissions			
Component	Rate (lb/min)	MW (lb/lbmol)	Flow (scfm)
Polymer	0.000	141.19	0.00
Water	0.57	18.02	12.03
Nitrogen	5.40	28.01	73.16
Oxygen	0.41	32.00	4.89
CO2	0.72	44.01	6.17
CO	0.00049	28.01	0.01
SOx	0.00000	64	0.00
PM	0.00004		
PM_{10}	0.00003		
Methane	0.00001	16.04	0.00
VOC	0.00003		
NOx	0.00499	46	0.04

Flow rate (scfm)	Temperature (F)	Pressure (psig)	Flow rate (acfm)
96	150	0	113

EMISSION POINT	DESCRIPTION	POLLUTANT	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-55	PARTS CLEANING OVEN CM-642	Polymer	0.0000	8760	0.00
		CO2	42.9239	8760	188.0
		CO	0.0296	8760	0.130
		SOx	0.0002	8760	0.001
		PM	0.0027	8760	0.012
		PM_{10}	0.0020	8760	0.009
		Methane	0.0008	8760	0.004
		VOC	0.0019	8760	0.008
		NOx	0.2992	8760	1.311

Due to the near-continuous operation of the CM-642 parts cleaning oven, the maximum emissions are the same as the average emissions.

A-70 - KH-751 Preheater Filter

Assumptions:

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-70	PREHEATER FILTER KH-751	PM	16,918	0.000015	15.23	99.90%	0.0152	8760	0.07
		PM_{10}	16,918	0.0000075	7.61	99.80%	0.0152	8760	0.07

A-71 - KH-759 Conveyor Separator

Assumptions:

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-71	CONVEYOR SEPARATOR KH-759	PM	1,087	0.000015	0.98	99.90%	0.0010	8760	0.004
		PM_{10}	1,087	0.0000075	0.49	99.80%	0.0010	8760	0.004

A-72 - KH-761 Solid Stating Silo Filter

Assumptions:

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-72	KH-761 SSP SILO FILTER	PM	10,502	0.000015	9.45	99.90%	0.0095	8760	0.04
		PM_{10}	10,502	0.0000075	4.73	99.80%	0.0095	8760	0.04

A-73 - KH-781 Cooler Filter

Assumptions:

[redacted]

EMISSION POINT	DESCRIPTION	POLLUTANT	FLOW RATE (SCFM)	CONCENTRATION FACTOR	UNCONTROLLED	CONTROL EFFICIENCY	CONTROLLED EMISSION	OPERATING HOURS	ANNUAL EMISSIONS
A-73	KH-781 PELLET COOLER FILTER	PM	16,719	0.000015	15.05	99.90%	0.0150	8760	0.07
		PM_{10}	16,719	0.0000075	7.52	99.80%	0.0150	8760	0.07

NON-EXISTENT OR ZERO EMISSION SOURCES

1. Anti-foam tank KF-315 contains a low volatility silica-based chemical that is not a source of emissions.
2. Divert water tank KF-554 is a water-based system not contaminated with other pollutants.
3. Condensate return tank KD-1201 receives condensate from the steam system and is not contaminated with other pollutants.
4. Oil water separator KT-1009 receives wash water from floor wash down and is not contaminated with airborne pollutants.

Solvay Augusta Facility-Amodel New Boiler

Boiler, Existing	99.5	MMBtu/hr

Boiler NG Usage

Boiler	99,500,000	Btu/hr
	1021	Btu/scf
	97453	scf/hr

Pollutant	Emission Factor*	Emission	Emission
	(lb/10^6 scf)	lb/hr	tpy
CO_2	120,000	11694	51222
CH_4	2	0.22	0.982
Lead	0.0005	0.00	0.000
N_2O (Uncontrolled)	2.2	0.21	0.939
N_2O (Controlled low-NO_X Burner)	0.64	0.06	0.273
PM (total)	7.6	0.74	3.244
PM (condensible)	7.6	0.74	3.244
PM (filterable)	7.6	0.74	3.244
SO_2	0.6	0.06	0.256
TOC	11	1.07	4.695
Methane	2.3	0.22	0.982
VOC	5.5	0.54	2.348
NO_X (Small Boiler-low nox)	34.6	3.37	14.76
CO	7.0	0.69	3.0

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

Boiler Fuel Oil Usage

Boiler (Btu/hr)	99,500,000
Boiler (gal/hr)	711

Max hours per yea 720

POLLUTANT	FACTOR (lb/1000 gal)	EMISSIONS (lb/hr)	EMISSIONS (tpy)
CO_2	22,300	15849	5705.61
N_2O	0.26	0.2	0.07
PM	2	1.4	0.51
SO_2	71	50.5	18.17
TOC	0.252	0.18	0.06
CH_4	0.052	0.04	0.01
VOC	0.2	0.1	0.05
NO_X	20	14.2	5.12
CO	5	3.6	1.28

Appendix D
Compounding Process Flow Diagrams[66]

Appendix E
Compounding Emission Calculations[67]

Existing Emissions from Compouding

Equipment	Stack	Air Flow	P&ID	Baghouse	Concen.	PM Emissions (lb/hr)	PM Emissions (tpy)	voe Emissions (lb/hr)	voe Emissions (tpy)
CH-3860/70 D3 Baghouse	S386	10000	10000	Yes	0.001	0.09	0.38		
CH3536 Compounding Pellet Sorter Baghouse Stack	S353	2000		Yes	0.001	0.02	0.08		
CH-3103 D3 Neat Pellet Baghouse	S310	4000	400	Yes	0.001	0.03	0.15		
CH-1860 D2 Baghouse	S186	4000	10000	Yes	0.001	0.03	0.15		
CH-860 Compounding Baghouse	XS74	4000		Yes	0.001	0.03	0.15		
CH-543 Line D Final Product	S543	690			0.001	0.01	0.03		
CH-1543 D2 Compounding Final Product Baghouse	S154	2000		Yes	0.001	0.02	0.08		
CH-3543 D3 Compounding Final Product Baghouse	S354	2000	8000	Yes	0.001	0.02	0.08		
CH-4543 D4 Final Product Baghouse	S454	2000	not built?	Yes	0.001	0.02	0.08		
	S486	10000	not built?	Yes	0.001	0.09	0.38		
	Total					0.35	1.53		

Summary or Emissions from D5

	PM Emissions (lb/hr)	PM Emissions (tpy)	VOC Emissions (lb/hr)	VOC Emissions (tpy)
Stacks 1-8	0.56	2.45	0.04	0.18

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Summary of D6 and D7 Emissions

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD	HAPs
Existing	1.53	1.53	1.53							
D5	2.45	2.45	2.45				0.18			
D6 and D7	11.71	11.71	11.71				4.91			
Total	15.69	15.69	15.69				5.09			

D6 Compounding (ZSK 45 Mc18)

Equip	Process Step	Type	Control Device	Emis.	Throughput	Uncontrolled	Emission	Uncontrolled	Controlled	Emis. Factor	Controlled
H1	Polymer 1	vacuum	Inherent Filter	1	0.59	6.00E-04	1	3.52E-04	6.00E-04	1	3.52E-04
H2	Polymer 2	vacuum	Inherent Filter	2	0.59	6.00E-04	1	3.52E-04	6.00E-04	1	3.52E-04
H3	Polymer 3	vacuum	Inherent Filter	3	0.59	6.00E-04	1	3.52E-04	6.00E-04	1	3.52E-04
H4	Additive 1	Gravity	Baghouse	4	0.01	8.00E-01	1	4.83E-03	6.00E-04	1	3.62E-06
H1b	Additive 2	Gravity	Baghouse	4	0.12	8.00E-01	1	9.66E-02	6.00E-04	1	7.25E-05
H2b	Additive 3	Gravity	Baghouse	4	0.12	8.00E-01	1	9.66E-02	6.00E-04	1	7.25E-05
H3b	Additive 4	Gravity	Baghouse	4	0.12	8.00E-01	1	9.66E-02	6.00E-04	2	7.25E-05
H5	Additive 5	Gravity	Baghouse	4	0.12	8.00E-01	1	9.66E-02	6.00E-04	1	7.25E-05
H6	Additive 6	Gravity	Baghouse	4	0.12	8.00E-01	1	9.66E-02	6.00E-04	1	7.25E-05
H7	Additve 5&6	Gravity	Baghouse	5	0.24	8.00E-01	1	1.93E-01	6.00E-04	1	1.45E-04
H8	Product Hopper	Vacuum	Baghouse	8	0.28	8.00E-01	1	2.21E-01	6.00E-04	1	1.66E-04
ZSB	Feed Hopper	Vacuum	Baghouse	9	0.24	8.00E-01	2	1.93E-01	6.00E-04	2	1.45E-04
ZSK45	ZSK Fume	Extruder	None	7	0.28	2.61E-01	2	7.23E-02	2.61E-01	2	7.23E-02
ZSK45	ZSK LRVP	Extruder	None	6	0.28	1.04E+00	2	2.89E-01	1.04E+00	2	2.89E-01
							Total New	**1.46**	**lb/hr**	**0.36**	**lb/hr**
								6.39	**tpy**	**1.59**	**tpy**

Notes:

1. AP-42 Table 6.6.2-2, Product Storage, https://www3.epa.gov/ttn/chief/ap42/ch06/final/c06s06-2.pdf
2. Table 5., *Development of Emission Factors for Polypropylene Processing* , Journal of the Air & Waste Management Association https://www.tandfonline.com/doi/pdf/10.1080/10473289.1999.10463782?needAccess=true&

[redacted]

4. Emissons for extrusion are split 20:80 between the feeder fume collectoin and the Vacuum pump.
5. For sources with an inherent filter device, uncontrolled emissions are after the filter.
6. These sources are in contact with graphite powder, an air toxic. The sum of emissions = 1.90E+00 lb/yr. The MER is 290 yr.

D7 Compounding (ZSK 70 Mc18)

Equip	Process Step	Type	Control Device	Emis.	Throughput	Uncontrolled	Emission	Uncontrolled	Controlled	Emis. Factor	Controlled
H1	Master Batch	vacuum	Baghouse	1	0.59	8.00E-01	1	4.70E-01	6.00E-04	1	3.52E-04
H2	Additive pellet	vacuum	Baghouse	1	0.59	8.00E-01	1	4.70E-01	6.00E-04	1	3.52E-04
H3	Polymer Pellet	vacuum	Baghouse	1	0.59	8.00E-01	1	4.70E-01	6.00E-04	1	3.52E-04
H4	Rework	vacuum	Baghouse	1	0.01	8.00E-01	1	4.83E-03	6.00E-04	1	3.62E-06
H5		Gravity	Inherent Filter	2	0.60	6.00E-04	1	3.62E-04	6.00E-04	1	3.62E-04
H6	PPS	Gravity	Inherent Filter	3	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H7	PPS	Gravity	Inherent Filter	4	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H8	PPS	Vacuum	Inherent Filter	5	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H9	PPS	Vacuum	Inherent Filter	5	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H10		Vacuum	Inherent Filter	5	0.60	6.00E-04	1	3.62E-04	6.00E-04	1	3.62E-04
H11	PPS	vacuum	Inherent Filter	6	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H12	PPS	vacuum	Inherent Filter	6	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H13	CaCO3	vacuum	Inherent Filter	6	0.60	6.00E-04	1	3.62E-04	6.00E-04	1	3.62E-04
H14	Fiberglass	Gravity	Baghouse	7	0.60	8.00E-01	1	4.83E-01	6.00E-04	1	3.62E-04
H15	ZSK Feeder	Gravity	Baghouse	8	1.76	8.00E-01	1	1.41E+00	6.00E-04	1	1.06E-03
H16	ZSK Feeder	Gravity	Baghouse	9	0.62	8.00E-01	1	4.94E-01	6.00E-04	1	3.70E-04
H17	ZSK Feeder	Gravity	Baghouse	10	0.30	8.00E-01	1	2.42E-01	6.00E-04	1	1.81E-04
H18	ZSK Feeder	Gravity	Baghouse	11	0.30	8.00E-01	1	2.42E-01	6.00E-04	1	1.81E-04
H19	Product	vacuum	Baghouse	13	0.88	8.00E-01	1	7.05E-01	6.00E-04	1	5.29E-04
H20	Product	vacuum	Baghouse	13	0.88	8.00E-01	1	7.05E-01	6.00E-04	1	5.29E-04
H4b	Rework	Gravity	Inherent Filter	14	0.01	6.00E-04	1	3.62E-06	6.00E-04	1	3.62E-06
H5b	Polymer Pellet	Gravity	Inherent Filter	15	0.59	6.00E-04	1	3.52E-04	6.00E-04	1	3.52E-04
H6b	Additive Pellet	Gravity	Inherent Filter	16	0.59	6.00E-04	1	3.52E-04	6.00E-04	1	3.52E-04
H7b	Master Batch	Gravity	Inherent Filter	17	0.59	6.00E-04	1	3.52E-04	6.00E-04	1	3.52E-04
H21	Additive Powder	Gravity	Inherent Filter	18	0.03	6.00E-04	1	1.81E-05	6.00E-04	1	1.81E-05
H6	PPS Resin	Gravity	Inherent Filter	19	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H7	PPS Resin	Gravity	Inherent Filter	20	0.30	6.00E-04	1	1.81E-04	6.00E-04	1	1.81E-04
H8				21			1	0.00E+00	0.00E+00		0.00E+00
H8		Gravity	Inherent Filter	22	0.60	6.00E-04	1	3.62E-04	6.00E-04	1	3.62E-04
H9	Fiberglass	Gravity	Inherent Filter	23	0.60	6.00E-04	1	3.62E-04	6.00E-04	1	3.62E-04
ZSK70	ZSK Fume	Extruder	None	24	1.76	2.61E-01	2	4.60E-01	2.61E-01	2	4.60E-01
ZSK70	ZSK LRVP	Extruder	None	12	1.76	1.04E+00	2	1.84E+00	1.04E+00	2	1.84E+00
							Total New	**8.00**	**lb/hr**	**2.31**	**lb/hr**
								35.03	**tpy**	**10.12**	**tpy**

Notes:

1. AP-42 Table 6.6.2-2, Product Storage, https://www3.epa.gov/ttn/chief/ap42/ch06/final/c06s06-2.pdf
2. Table 5., *Development of Emission Factors for Polypropylene Processing* , Journal of the Air & Waste Management Association
   https://www.tandfonline.com/doi/pdf/10.1080/10473289.1999.10463782?needAccess=true&

4. Emissons for extrusion are split 20:80 between the feeder fume collectoin and the Vacuum pump.
5. For sources with an inherent filter device, uncontrolled emissions are after the filter.
6. These sources are in contact with graphite powder, an air toxic. The sum of emissions = 3.40 lb/yr. The MER is 290 yr.

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VOC Emissions:

Equip	Process Step	Type	Control Device	Emision	Throughput	Uncontrolled	Emission	Uncontrolled
EXT1	ZSK Fume	Extruder	None	7	1.76	0.01	1	0.024
EXT1	ZSK LRVP	Extruder	None	6	1.76	0.05	1	0.094
EXT1	ZSK LRVP	Silane	None	6	0.0012	814.14	2	1.004
Total								**1.12**

Total New 4.91 tpy 9825.74 lb/yr

Notes:

1. VOC is based on Table 5., *Development of Emission Factors for Polypropylene Processing* , Journal of the Air & Waste Management
   https://www.tandfonline.com/doi/pdf/10.1080/10473289.1999.10463782?needAccess=true&
2. Silane methanol/VOC generation from process chemistry model.
   Silane usage: 2.4664 lb/hr

WW Concentrations:

Flow	36 gpm	300.42 lb/hr	139.5144 l/min	Table 8 or 9?
[redacted]	4.18 kg/yr	3.5 ppmw		N/A
	5425.08 kg/yr	4544.7 ppmw	5.98 tpy	Table 9
	0.38 kg/yr	0.3 ppmw		Table 8
	0.22 kg/yr	0.2 ppmw		Table 8
	0.66 kg/yr	0.6 ppmw		Table 8
	32.51 kg/yr	27.2 ppmw		N/A
	9.19 kg/yr	7.7 ppmw		N/A
	11.84 kg/yr	9.9 ppmw		N/A

MON Group 1:
10,000 ppmw at any flow rate & 200 lb/yr T8
1,000 ppmw & 1 l/min T8
30,000 ppmw T8 + T9 & 1 tpy

Sum of Table 8 & 9:	4545.8 ppmv	group 2
Sum of Table 9:	1.1 ppmv	group 2

Appendix F
KetaSpire / NovaSpire Process Flow Diagram[68]

Appendix G
KetaSpire / NovaSpire Emission Calculations[69]

Solvay received a permit for the PEEK process in 2015 (aka Project Jupiter). Solvay plans to modify this process by adding new equipment and ultimately increasing production capacity. The 2015 permit included a new boiler and oil heater as part of this unit. An oil heater addition is part of this PEEK expansion. The following is a summary of the current, permitted production capacity:

Emission Totals

Emissions lb/hr

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD	Acetone	HF	HCl	HQ
Process	7.69	7.69	7.69				0.60			184	0.025	0.02	0.08
Boiler	1.39	1.39	1.39	49.19	3.46	13.86	0.52						
Heaters	0.27	0.27	0.27	9.64	1.56	2.71	0.10						
Total	9.35	9.35	9.35	58.83	5.03	16.57	1.22	0.00	0.00	183.50	0.03	0.02	0.08

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD	Acetone	HF	HCl	HQ
Process	33.7	33.7	33.7				3.0	0.0	0.0	612.3	0.0	0.0	0.0
Boiler	3.40	3.4	3.4	17.9	7.0	17.2	2.2						
Heaters	0.7	0.7	0.7	3.5	6.5	4.7	0.4						
Total	37.75	37.75	37.75	21.45	13.50	21.93	5.53	0.00	0.00	612.32	0.00	0.00	0.00

								lbs/hr	Permit Basis						
								2014 Permit Controlled Emmissions (lbs/hr)							
Stack ID	APCD ID	rce ID [Titl	Expansion	Equipment ID	Description	Compounds of interest		Non-VOC solvent	PM	HQ	HF	CO2	Breathing Emmis	Therminol XP	Syltherm 800
SA-1	CD-1		Current	PE-115	Vent collection condenser vent	Non-VOC solvent		54							
SA-2	None		Current	502, PF- 503, PF-504, PF-505, PF-5	Water slop tanks vent	Non-VOC solvent		16.5							
SA-3	None		Current	PM-645	Reactor wash vent	Non-VOC solvent		4							
SA-4	None		Current	PM-700, PF-701	Wet cake bin vent	Non-VOC solvent		1							
SA-5	CD-2		Current	PD-609/PD-610 -> PE-612	PS batch column condenser ve	Non-VOC solvent		0.5							
SA-6	BH-18		Current	PM-701, PM-714	Drier	Non-VOC solvent		1	0.02						
SA-7	CD-3			PE-2115, PD-440, PD-2605	Vent collection condenser vent	Non-VOC solvent		54							
SA-8	None			PM-2700, PF-2701	Wet cake bin vent	Non-VOC solvent		1							
SA-9	None			PM-2701, PM-2714, PM-2700	Drier	Non-VOC solvent		1	0.02						
SH-1	SC-2	HE-1	Current	PT-801/PF-801	HCl tank vent	HCl							0.01		
SH-2	SC-1	HE-2	Current	PT-208/PF-208	Reactor scrubber - PR-200	CO2, HF					0.01	53			
SH-3	SC-3			PT-2208/PF-2208	Reactor scrubber - PR-2200	CO2, HF					0.01	53			
SD-1	BH-1		Current	PH-230/PM-230					0.03						
SD-2	BH-2		Current	PH-235/PM-235					0.02						
SD-3	BH-3		Current	PH-240/PM-240	FBP/Na2CO3 sack unloading ve	DFBP			0.16						
SD-4	BH-4	DE-4	Current	PH-250/PM-250	HQ sack unloading vent	HQ			0.06	0.06					
~~SD-5~~	~~BH-3~~		~~Current~~	~~PH-260/PM-260~~	~~Na2CO3 sack unloading vent~~	~~Na2CO3~~			~~0.00~~						
SD-6	BH-6		Current	PH-270/PM-270					0.02						
SD-7	BH-7		Current	PH-265					0.10						
SD-8	BH-8	DE-8	Current	PH-245	DFBP convey line vent	DFBP			0.20						
SD-9	BH-9	DE-8	Current		HQ convey line vent	HQ			0.06	0.06					
SD-10	BH-10		Current	PH-241/PF-242, PF-260	DFBP bin vent	DFBP			0.10						
SD-11	BH-11	DE-11	Current	PH-251/PF-252, PF-260	HQ bin vent	HQ			0.05	0.06					
SD-12	BH-12		Current	PH-261/PF-262					0.05						
SD-13	BH-13		Current	PM-307					0.32						
SD-14	BH-14		Current	/PF-413/PF-642/PH-411/PH-413/	Convey system										
SD-14	BH-15		Current	/PF-413/PF-642/PH-411/PH-413/	Convey system				0.86						
SD-14	BH-16		Current	/PF-413/PF-642/PH-411/PH-413/	Convey system										
SD-17	BH-17		Current	PM-710, PM-707	Product packaging	Product			0.12						
SD-19	BH-19		Current	PF-702/PF-703, PH-702	Product storage bins	Product			0.10						
SD-21	BH-21		Current	PH-208/PM-208					0.20						
SD-22	BH-22		Current	PF-260	Monomer bin vent	DFBP, HQ			0.15	0.06					
SD-23	BH-23		Current	PM-755	Powder product collector	Product			0.11						
SD-24	BH-23			PM-765	Powder product collector	Product			0.11						
SD-25	BH-25			PD-286		DFBP			0.10						
SD-26	BH-26			PH-2241/PF-2242	DFBP bin vent	DFBP			0.10						
SD-27	BH-27			PH-2251/PF-2252		HQ			0.05	0.06					
SD-28	BH-28			PF-2260	HQ bin vent	DFBP, HQ			0.15	0.06					
SD-29	BH-29			PH-2261/PF-2262					0.05						
SM-1	None		Current	PF-210					0.02						
SM-2	None		Current	PF-211					0.02						
SM-3	None		Current	PD-202					0.60						
SM-4	None		Current	PD-203					0.15						
SM-5	None		Current	PD-204					0.04						
SM-7	None		Current	PD-617										0.1	
SM-8	None		Current	PD-1101	Blowdown tank										0.1
SM-9	None		Current	PD-1102	Expansion tank										0.1
SM-10	None			PF-286					0.10						
SM-11	None			PF-2210		DPS			0.02						
SM-12	None			PD-2203		DFBP			0.15						
SM-13	None			PD-2204					0.04						
SB-1	None	BE-1	Current	PM-1100	Hot Oil Heater PM-1100	CO, NOx, PM, SO2, CO2									
SB-2	None	BE-2	Current	PM-1000	Boiler	CO, NOx, PM, SO2, CO2									
SB-3	None	BE-3		PM-3100	Hot Oil Heater PM-3100	CO, NOx, PM, SO2, CO2									
Total							**lbs/hr**	**133**	**4.45**	**0.36**	**0.02**	**106**	**0.01**	**0.1**	**0.2**

Notes:

The following provides a summary of revised PEEK emissions for PM/HQ emitting sources.

The air flow was multiplied by the EPA concentration factor from the CATC of 0.01 grains/cf.

	Velocity	Stack Area	Volume (cf/min)	Emissions
SD-4	2283	0.3491	797	0.0683
SD-8				
SD-9	925	0.0218	20	0.0017
SD-11	315	0.0491	15	0.0013
SD-22	315	0.0491	15	0.0013
SD-27	315	0.0491	15	0.0013
SD-28	315	0.0491	15	0.0013

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					lbs/hr								2000	lbs/yr	Permit Basis						
					2023 Permit Controlled Emmissions (lbs/hr)									2014 Permit Controlled Emmissions (lbs/yr)							
Stack ID	APCD ID	rce ID [Titl	Expansion	Equipment ID	Non-VOC solvent	PM	HQ	HF	CO2	Breathing Emmis	Therminol XP	Syltherm 800		Non-VOC solvent	PM	HQ	HF	CO2	Breathing Emmis	Therminol XP	Syltherm 800
SA-1	CD-1		Current	PE-115	68									315360							
SA-2	None		Current	502, PF- 503, PF-504, PF-505, PF-5	33									56940							
SA-3	None		Current	PM-645	8									35040							
SA-4	None		Current	PM-700, PF-701	2									8760							
SA-5	CD-2		Current	PD-609/PD-610 -> PE-612	1									2628							
SA-6	BH-18		Current	PM-701, PM-714	2	0.04								8760	88						
SA-7	CD-3			PE-2115, PD-440, PD-2605	68									315360							
SA-8	None			PM-2700, PF-2701	1									8760							
SA-9	None			PM-2701, PM-2714, PM-2700	1	0.03								8760	88						
SH-1	SC-2	HE-1	Current	PT-801/PF-801						0.02									2		
SH-2	SC-1	HE-2	Current	PT-208/PF-208				0.0125	66.25								2	317250			
SH-3	SC-3			PT-2208/PF-2208				0.0125	66.25								2	317250			
SD-1	BH-1		Current	PH-230/PM-230		0.06									88						
SD-2	BH-2		Current	PH-235/PM-235		0.04									88						
SD-3	BH-3		Current	PH-240/PM-240		0.32									701						
SD-4	BH-4	DE-4	Current	PH-250/PM-250		0.12	0.07								263	263					
~~SD-5~~	~~BH-3~~		~~Current~~	~~PH-260/PM-260~~		~~0.00~~									~~0~~						
SD-6	BH-6		Current	PH-270/PM-270		0.04									88						
SD-7	BH-7		Current	PH-265		0.20									438						
SD-8	BH-8	DE-8	Current	PH-245		0.40									876						
SD-9	BH-9	DE-8	Current			0.12	0.0017								263	263					
SD-10	BH-10		Current	PH-241/PF-242, PF-260		0.13									438						
SD-11	BH-11	DE-11	Current	PH-251/PF-252, PF-260		0.06	0.0013								219	263					
SD-12	BH-12		Current	PH-261/PF-262		0.06									219						
SD-13	BH-13		Current	PM-307		1									1402						
SD-14	BH-14		Current	/PF-413/PF-642/PH-411/PH-413/																	
SD-14	BH-15		Current	/PF-413/PF-642/PH-411/PH-413/		1.72									3767						
SD-14	BH-16		Current	/PF-413/PF-642/PH-411/PH-413/																	
SD-17	BH-17		Current	PM-710, PM-707		0.24									526						
SD-19	BH-19		Current	PF-702/PF-703, PH-702		0.20									438						
SD-21	BH-21		Current	PH-208/PM-208		0.25									876						
SD-22	BH-22		Current	PF-260		0.19	0.0013								657	263					
SD-23	BH-23		Current	PM-755		0.11									480						
SD-24	BH-23			PM-765		0.11									480						
SD-25	BH-25			PD-286		0.20									438						
SD-26	BH-26			PH-2241/PF-2242		0.13									438						
SD-27	BH-27			PH-2251/PF-2252		0.06	0.0013								219	263					
SD-28	BH-28			PF-2260		0.19	0.0013								657	263					
SD-29	BH-29			PH-2261/PF-2262		0.06									219						
SM-1	None		Current	PF-210		0.04									88						
SM-2	None		Current	PF-211		0.04									88						
SM-3	None		Current	PD-202		1.20									2628						
SM-4	None		Current	PD-203		0.19									657						
SM-5	None		Current	PD-204		0.05									175						
SM-7	None		Current	PD-617							0.2									876	
SM-8	None		Current	PD-1101								0.2									876
SM-9	None		Current	PD-1102								0.2									876
SM-10	None			PF-286		0.20									438						
SM-11	None			PF-2210		0.03									88						
SM-12	None			PD-2203		0.19									657						
SM-13	None			PD-2204		0.05									175						
SB-1	None	BE-1	Current	PM-1100																	
SB-2	None	BE-2	Current	PM-1000																	
SB-3	None	BE-3		PM-3100																	
Total					184	7.69	0.08	0.025	132.5	0.02	0.2	0.4	lbs/yr	760368	19448	1578	4	634500	2	876	1752

Notes:

The following provides a summary of revised l

The air flow was multiplied by the EPA concer

	Velocity
SD-4	2283
~~SD-8~~	
SD-9	925
SD-11	315
SD-22	315
SD-27	315
SD-28	315

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Stack ID	APCD ID	rce ID [Titl	Expansion	Equipment ID	lbs/yr 2023 Permit Controlled Emmissions (lbs/yr) Non-VOC solvent	PM	HQ	HF	CO2	HCl	Therminol XP	Syltherm 800	tns/yr 2023 Permit Controlled Emmissions (tns/yr) Non-VOC solvent	PM	HQ	HF	CO2	Breathing Emmis	Therminol XP	Syltherm 800
SA-1	CD-1		Current	PE-115	473040								237							
SA-2	None		Current	502, PF- 503, PF-504, PF-505, PF-5	128115								64							
SA-3	None		Current	PM-645	78840								39							
SA-4	None		Current	PM-700, PF-701	19710								10							
SA-5	CD-2		Current	PD-609/PD-610 -> PE-612	5913								3							
SA-6	BH-18		Current	PM-701, PM-714	19710	198.00							10	0.10						
SA-7	CD-3			PE-2115, PD-440, PD-2605	473040								237							
SA-8	None			PM-2700, PF-2701	13140								7							
SA-9	None			PM-2701, PM-2714, PM-2700	13140	132.00							7	0.07						
SH-1	SC-2	HE-1	Current	PT-801/PF-801						4.5								0.00225		
SH-2	SC-1	HE-2	Current	PT-208/PF-208				3	475875							0.0015	237.9			
SH-3	SC-3			PT-2208/PF-2208				3	475875							0.0015	237.9			
SD-1	BH-1		Current	PH-230/PM-230		198.00								0.10						
SD-2	BH-2		Current	PH-235/PM-235		198.00								0.10						
SD-3	BH-3		Current	PH-240/PM-240		1577.25								0.79						
SD-4	BH-4	DE-4	Current	PH-250/PM-250		591.75	0.30							0.30	1.50E-04					
~~SD-5~~	~~BH-3~~		~~Current~~	~~PH-260/PM-260~~		~~0.00~~								~~0.00~~						
SD-6	BH-6		Current	PH-270/PM-270		198.00								0.10						
SD-7	BH-7		Current	PH-265		985.50								0.49						
SD-8	BH-8	DE-8	Current	PH-245		1971.00								0.99						
SD-9	BH-9	DE-8	Current			591.75	0.01							0.30	3.79E-06					
SD-10	BH-10		Current	PH-241/PF-242, PF-260		657.00								0.33						
SD-11	BH-11	DE-11	Current	PH-251/PF-252, PF-260		328.50	0.01							0.16	2.90E-06					
SD-12	BH-12		Current	PH-261/PF-262		328.50								0.16						
SD-13	BH-13		Current	PM-307		3155								2						
SD-14	BH-14		Current	/PF-413/PF-642/PH-411/PH-413/																
SD-14	BH-15		Current	/PF-413/PF-642/PH-411/PH-413/		8475.75								4.24						
SD-14	BH-16		Current	/PF-413/PF-642/PH-411/PH-413/																
SD-17	BH-17		Current	PM-710, PM-707		1183.50								0.59						
SD-19	BH-19		Current	PF-702/PF-703, PH-702		985.50								0.49						
SD-21	BH-21		Current	PH-208/PM-208		1314.00								0.66						
SD-22	BH-22		Current	PF-260		985.50	0.01							0.49	2.90E-06					
SD-23	BH-23		Current	PM-755		480.00								0.24						
SD-24	BH-23			PM-765		480.00								0.24						
SD-25	BH-25			PD-286		985.50								0.49						
SD-26	BH-26			PH-2241/PF-2242		657.00								0.33						
SD-27	BH-27			PH-2251/PF-2252		328.50	0.01							0.16	2.90E-06					
SD-28	BH-28			PF-2260		985.50	0.01							0.49	2.90E-06					
SD-29	BH-29			PH-2261/PF-2262		328.50								0.16						
SM-1	None		Current	PF-210		198.00								0.10						
SM-2	None		Current	PF-211		198.00								0.10						
SM-3	None		Current	PD-202		5913.00								2.96						
SM-4	None		Current	PD-203		985.50								0.49						
SM-5	None		Current	PD-204		262.50								0.13						
SM-7	None		Current	PD-617							1971								0.99	
SM-8	None		Current	PD-1101								1971								0.99
SM-9	None		Current	PD-1102								1971								0.99
SM-10	None			PF-286		985.50								0.49						
SM-11	None			PF-2210		132.00								0.07						
SM-12	None			PD-2203		985.50								0.49						
SM-13	None			PD-2204		262.50								0.13						
SB-1	None	BE-1	Current	PM-1100																
SB-2	None	BE-2	Current	PM-1000																
SB-3	None	BE-3		PM-3100																
Total					**1224648**	**38221.50**	**0.33**	**6**	**951750**	**4.5**	**1971**	**3942**	**612**	**19.11**	**1.65E-04**	**0.003**	**475.875**	**0.00225**	**0.99**	**1.97**

Notes:

The following provides a summary of revised

The air flow was multiplied by the EPA concer

	Velocity
SD-4	2283
~~SD-8~~	
SD-9	925
SD-11	315
SD-22	315
SD-27	315
SD-28	315

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Solvay Augusta Facility-Project Jupiter
Boiler and Hot Oil Heater

Boiler, Existing	97	MMBtu/hr
Hot Oil Heaters (2)	9.5	MMBtu/hr

Boiler NG Usage

Boiler	97,000,000	Btu/hr
	1021	Btu/scf
	95005	scf/hr

Pollutant	Emission Factor* (lb/10^6 scf)	Emission lb/hr	Emission tpy
CO_2	120,000	11401	49935
CH_4	2	0.22	0.957
N_2O (Uncontrolled)	2.2	0.21	0.915
N_2O(Controlled low-NO_X Burner)	0.64	0.06	0.266
PM (total)	7.6	0.72	3.163
PM(condensible)	7.6	0.72	3.163
PM (filterable)	7.6	0.72	3.163
SO_2	0.6	0.06	0.250
TOC	11	1.05	4.577
Methane	2.3	0.22	0.957
VOC	5.5	0.52	2.289
NO_X (Small Boiler-low nox)	32	3.04	13.32
CO	15	1.43	6.2

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

Boiler Fuel Oil Usage

Boiler (Btu/hr)	97,000,000
Boiler (gal/hr)	693
Max hours per year	720

POLLUTANT	FACTOR (lb/1000 gal)	EMISSIONS (lb/hr)	EMISSIONS (tpy)
CO_2	22,300	15451	5562.26
N_20	0.26	0.2	0.06
PM	2	1.4	0.50
SO_2	71	49.2	17.71
TOC	0.252	0.17	0.06
CH_4	0.052	0.04	0.01
VOC	0.2	0.1	0.05
NO_X	20	13.9	4.99
CO	5	3.5	1.25

Hot Oil Heater NG Usage (1 new and 1 existing)

Hot Oil Heater	9,500,000	Btu/hr (each)
	1021	Btu/scf
	9305	scf/hr (each)

Pollutant	Emission Factor* (lb/10^6 scf)	Emission (x2) lb/hr	Emission tpy
CO_2	120,000	2233.10	9780.999
CH_4	2	0.04	0.187
N_2O (Uncontrolled)	2.2	0.04	0.179
N_2O(Controlled low-NOx Burner)	0.64	0.01	0.052
PM (total)	7.6	0.14	0.619
PM(condensible)	7.6	0.14	0.619
PM (filterable)	7.6	0.14	0.619
SO_2	0.6	0.01	0.049
TOC	11	0.20	0.897
Methane	2.3	0.04	0.187
VOC	5.5	0.10	0.448
NO_X (Small Boiler-Uncontrolled)	50	0.93	4.08
CO	84	1.56	6.847

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

Hot Oil Heater Fuel Oil Usage (1 new and 1 existing)

HO Heater (Btu/hr)	9,500,000
HO Heater (gal/hr)	68
Max hours per year	720

POLLUTANT	FACTOR (lb/1000 gal)	EMISSIONS (x2) (lb/hr)	EMISSIONS (tpy)
CO_2	22,300	3026.43	1089.51
N_2O	0.26	0.04	0.01
PM	2	0.27	0.10
SO_2	71	9.64	3.47
TOC	0.252	0.03	0.01
CH_4	0.052	0.01	0.00
VOC	0.2	0.03	0.01
NO_X	20	2.71	0.98
CO	5	0.68	0.24

Appendix H
Sulfone Process Flow Diagram[70]

Appendix I
Sulfone Emissions Calculations[71]

Source No.	Equipment No.	Description	Total VOC [tons/yr] 1996 Permit	Total VOC [tons/yr] Calculated @ 80MM
SA1	LD-107	SO3 Acid Scrubber	0.000	0.000
S1B	LD-1621	Scrubber Neutralizer	0.000	0.000
S2A	LE-114	MCB Storage Tank Condenser	1.410	0.957
S3A	LF-121	50% Caustic Storage tank	0.000	0.000
S3B	LF-124	20% Caustic Storage tank	0.000	0.000
S4A	LE-208	Reactor Srubber Condenser	1.930	0.349
S4B	LE-210	Reactor Cooler Condenser	1.930	0.010
S5A	LE-309	Dehydration Tower Condenser	1.930	1.734
S5B	LE-330	Recycle MCB Storage Tank Condenser	0.640	0.336
S6A	LE-405	Extraction Feed Tank Condenser	0.700	0.133
S6B	LD-430	Sulfone Extractor	1.410	0.260
S6C	LE-467	LT-460 Scavenger Conc Tower Condenser	1.930	1.038
S6D	LD-425 (Eliminated 2014)	Recycle Water Tank	0.190	
S6E	LD-435	Make-up Water Tank	0.000	1.190
S6F	LE-477	Product Dehydration Vent Condenser	N/A	1.090
S7B	LE-448	445 / 455 Karr Columns Vent Condenser	2.020	1.136
S488	LE-488	New Karr Columns Vent Condenser	N/A	1.136
S7C	LE-576	Crude Crystallizer Vacuum After-Condenser	N/A	3.462
S7A	LE-680	Prim Crystal and Prod Dist Vent Condenser	2.940	4.974
S7D	LE-679	Scavenger I and 790 Vent Condenser	N/A	3.343
S368	LE-368	MIS Cracking Vent Condenser	N/A	0.586
S347	LE-347	New MIS Cracking II Vent Condenser	N/A	0.586
S580	LE-580	New 681 / 781 / 881 Tower Vent Condenser	N/A	1.707
S8A	LT-750	Waste Heat Boiler Caustic Scrubber	0.930	0.000
S8B	Scrubber Sump	WHB Scrubber Neutralizer	0.000	
S9A	Eliminated 3/2/02	Product Flaker & Grinder Baghouse	0.000	
S9B	Eliminated 3/2/02	Day Bin Baghouse	0.000	
S9C	Eliminated 3/2/02	Day Bin Baghouse	0.000	
S9D	LM-913	Storage Bin Baghouse	0.000	
S9E	LM-914	Storage Bin Baghouse	0.000	
S9F	LM-916	Product Sacking Baghouse	0.000	
S10A	LF-1601	Organic Wastewater EQ Tank	3.070	5.527
S10B	LF-1618 out of service	Wastewater Holding Tank	0.000	
S10C	LD-1631	Wastewater Neutralization Tank	0.000	
S11A	LP-134	Carbonate Mix & Storage Baghouse	0.000	
S13A	LH-1700 (Eliminated)	Vent Bag Filter for Storage Melt Tank	0.000	
S13B	LH-1754	Prilling Baghouse	0.000	
S13C	LH-1710	Granulation Baghouse	0.000	
S13D	LH-1722	Product Cooling Baghouse	0.000	
S13E	LF-970	Sulfone Storage Tank (atmospheric)		
S13F	LF-980 (New)	Sulfone Storage Tank (atmospheric)		
S13G				
S13H				
		TOTAL	21.030	29.554

SOLVAY SPECIALTY POLYMERS LLC

3702 Clanton Rd.
Augusta, Georgia 30906

		DATE	6/12/2023
JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: LF-115 is only used for storage. Has breathing losses only, no working losses due to filling tank during truck unload.
Only N2 and MCB in storage tank.
Ideal Gas Law and Raoult's Law apply.
N2 is noncondensible and liquid content in storage tanks is 100% MCB.
LF-111/115 pressure is atmospheric (P = 760 mmHg).
MCB Vapor Pressure @ 22°C = 10.06 mmHg
MCB Vapor Pressure @ 10°C = 4.83 mmHg

Calculations:

Source No. S2A — MCB Storage Tank Condenser for LF-111 and LF-115
Equipment No. LE-114 — Vent Condenser for MCB

From TANKS: Total emissions were calculated to be

	LF-111	LF-115	
Working	2759	0	lbs/yr
Breathing	824	403	lbs/yr

Total Emisions to control device are breathing losses plus working losses from LF-111 only, since LF-115 is storage only.

Inlet to control device 3985.8 lbs/yr
0.5 lbs/hr

Assume inlet temp is 22 C
Outlet temp is 10 C

Calculated condenser efficiency is	52%
Calculated outlet emissions from control point	0.218 lbs/hr
Calculated yearly emissions from control point	0.957 tons/yr

SOLVAY SPECIALTY POLYMERS LLC
3702 Clanton Rd.
Augusta, Georgia 30906

		DATE	6/12/2023
JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Ideal Gas Law and Raoult's Law apply.
MCB Vapor Pressure @ 70°C = 99.60 mmHg
MCB Vapor Pressure @ 10°C = 4.83 mmHg

Calculations:

Source No. S4A — Reactor Scrubber Condenser
Equipment No. LE-208 — Vent Condenser for MCB

Inlet Temp 70 C

LE-208 Calcs:		#	FT^3/hr	Max		
Inerts:	Instruments	5	10	50	CFH	@ 70°C
				0.111	lbmole/hr	
				3.1	lbs/hr	

	Max	
Total inert inlet into LE-208 =	0.11	lbmole/hr

1 LFI-206A	Mole fraction of MCB in vapor	0.13		
2 LFI-206B	Mole fraction of inets in vapor	0.87		
3 LFI-2011	Max MCB entering LE-208	0.017	lbmole MCB or	1.9 lbs/hr
4 LFI-2012				
5 LFI-2013				

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Augusta, Georgia 30906

DATE 6/12/2023

JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions:
LD-210 Operates at ~10 IN W.C.
67% Vapor space in tank breathing calculation
LD-207 is filled twice per year (to 33 % level)
Typical temp range is between 30-70C
1 temp cycle per day; 365 per year plus 2 fills/yr

n=PV/RT
LD-207

moles, n	Temp	Vap Press
0.7295253	10	4.8265975
0.7046551	20	8.8593386
0.6814248	30	15.513871
0.6596772	40	26.044694
0.6392748	50	42.097042
0.6200965	60	65.757105
0.6020355	70	99.591963
0.5849967	80	146.67709
Start up 0.3407124	30	15.513871

Calculations:
Source No. S4B — Reactor Cooler Condenser
Equipment No. LE-210 — Vent Condenser for MCB; exit temp is 10C

	moles/hr avg
Daily breathing	0.0033
Startup (averaged)	0.0001
Total inert inlet flow into LE-210 =	0.0034 moles/hr avg
	0.3407 moles/hr max -------------->

0.341 lbmoles/hr	MAX	Moleflow	Mass flow	3.39E-03 lbmoles/hr	AVG	Moleflow	Mass flow
30C	mole frac	lbmoles/hr	lbs/hr	0.022495067 ACFM	mole frac	lbmoles/hr	lbs/hr
MCB	0.020	0.007	0.783	30C MCB	0.020	6.91E-05	7.78E-03
Inerts	0.980	0.334	9.345	Inerts	0.980	3.32E-03	9.29E-02
TOTAL	1	0.341	10.128	TOTAL	1	3.39E-03	1.01E-01

LE-210 Outlet	MAX	Moleflow	Mass flow	**LE-210 Outlet**	AVG	Moleflow	Mass flow
10C	mole frac	lbmoles/hr	lbs/hr	10C	mole frac	lbmoles/hr	lbs/hr
MCB	0.006	0.002	0.240	MCB	0.006	2.12E-05	2.39E-03
Inerts	0.994	0.334	9.345	Inerts	0.994	3.32E-03	9.29E-02
TOTAL	1	0.336	9.585	TOTAL	1	3.34E-03	9.52E-02

Max MCB exiting LE-210	0.240	lbs/hr	During 1 hr fill time	
Max volumetric flow exiting LE-210	2.085	ACFM		
Avg MCB exiting LE-210	0.0024	lbs/hr		
Avg MCB exiting LE-210	0.0105	tons/yr		6.93E-01

Rate dependence of this source point is negligible as production rates increase

Source No. S5A — Dehydration Tower Condenser
Equipment No. LE-309 — LE-308 aftercondenser

	MCB	Azeotrope	Water
Vapor pressure @ 40C	26.04	64.6	55.4
Vapor pressure @ 10C	4.83	11.0	9.21

		MCB	water
Azeotrope	70C	0.17	0.83
	269 mmHg		
Azeotrope	40C	0.175	0.825
	64.6 mmHg		
Azeotrope	10C	0.185	0.815
	11 mmHg	MOLE FRACS	

Temp in 40 C
Inert Flow 20 flow meters @ 15CFH each (includes new LR-395); 7 gas seal pumps @ 2 SCFH/pump
314 CFH Max Rate of inerts — 157 CFH Average Rate of inerts

0.763 lbmoles/hr	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr	0.381 lbmoles/hr, 2.970997171 ACFM	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.034	0.030	3.34	MCB	0.034	0.015	1.67
Azeo(H2O)	0.070	0.061	1.094	Azeo(H2O)	0.070	0.030	0.547
Azeo(MCB)	0.015	0.013	1.450	Azeo(MCB)	0.015	0.006	0.725
Inerts	0.881	0.763	21.35	Inerts	0.881	0.381	10.68
TOTAL	1.000	0.866	27.233	TOTAL	1.000	0.433	13.617

Temp Out 10 C
Outlet flow

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr		mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.006	0.005	0.56	MCB	0.006	0.002	0.28
Azeo(H2O)	0.012	0.009	0.166	Azeo(H2O)	0.012	0.005	0.083
Azeo(MCB)	0.003	0.002	0.235	Azeo(MCB)	0.003	0.001	0.117
Inerts	0.979	0.763	21.35	Inerts	0.979	0.381	10.68
TOTAL	1.000	0.779	22.308	TOTAL	1.000	0.389	11.154

Max MCB exiting LE-309	0.792	lbs/hr	0.835
Max volumetric flow exiting LE-309	4.833	ACFM	
Avg volumetric flow exiting LE-309	2.416	ACFM	
Avg MCB exiting LE-309 (1/2 max rate)	1.734	tons/yr	

SOLVAY SPECIALTY POLYMERS LLC

3702 Clanton Rd.
Augusta, Georgia 30906

DATE 6/12/2023

JOB NAME 80MM Sulfone Momner Expansion

COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued)

CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Pressure control setpoint allows system to stay closed during normal operation.
Emissions calculations are based on an average number of decants per year (once per week)
50% Level change during decant
Pressure increases to 2 psig setpoint
Conservative average temp of 20C

Calculations:

Source No. S5B Recycle MCB Storage Tank Condenser
Equipment No. LE-330 Vent Condenser for MCB for LD-310 & LD-314

n=PV/RT
LD-310/314

moles, n	Temp	Vap Press
3.52333379	10	4.8266
3.46223552	15	6.57992
Decant per hour---> 3.40322014	20	8.85934
3.34618293	25	11.789
3.29102607	30	15.5139

Calculate Average Breathing for decanting
52 Decants per year
3.4032201 moles of gas per decant per hour
2 hrs, Time to perform a decant
353.9349 Total moles of gas emmitted/yr
8760 total hours per year
0.0808071 avg lbmoles/hr for year (2x - two tanks)

Temp in 20 C

1.702 lbmoles/hr					0.0808 lbmoles/hr					
MAX		Moleflow	Mass flow		AVG			Moleflow	Mass flow	
	mole frac	lbmoles/hr	lbs/hr		0.5191974 ACFM		mole frac	lbmoles/hr	lbs/hr	
MCB	0.012	0.0198	2.233			MCB	0.012	0.0009	0.106	45267.6
Inerts	0.988	1.6818	47.090			Inerts	0.988	0.0799	2.236	
TOTAL	1	1.7016	49.322		TOTAL		1	0.0808	2.342	

Temp out 10 C
Outlet flow

		Moleflow	Mass flow				Moleflow	Mass flow	
	mole frac	lbmoles/hr	lbs/hr			mole frac	lbmoles/hr	lbs/hr	
MCB	0.0064	0.0107	1.210		MCB	0.0064	0.0005	0.057	25049.7
Inerts	0.9936	1.6818	47.090		Inerts	0.9936	0.0799	2.236	
TOTAL	1	1.6925	48.300	TOTAL		1	0.0804	2.294	

Max MCB exiting LE-330	1.210	lbs/hr
Max volumetric flow exiting LE-330	10.504	ACFM
Avg volumetric flow exiting LE-330	0.499	ACFM
Avg MCB exiting LE-330	0.057	lbs/hr
Avg MCB exiting LE-330	0.252	tons/yr
Avg MCB exiting LE-330 (80MM)	0.336	tons/yr

SOLVAY SPECIALTY POLYMERS LLC

3702 Clanton Rd.
Augusta, Georgia 30906

		SHEET #	5 of 18
		DATE	6/12/2023
JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Average emissions calculated using max average daily level change over past 6 years.

Calculations: **Source No.** S6A — Extraction Feed Tank Condenser
Equipment No. LE-405 — Vent Condenser for MCB for LT-455/LD-401 and LD-458

Calculate average breathing: n=PV/RT

LD-458 moles, n	LD-401 moles, n	Temp	MCB Vap Press
0.124	0.128	10	4.83
0.214	0.080	54	50.52
0.101	0.210	73.5	114.39

Average flow 0.424 lbmoles/day
0.01765521 lbmoles/hr

Average Daily Level Change

	LD-401	LD-458
2016	2.7	5.0
2017	2.6	5.0
2018	1.5	2.8
2019	1.8	3.1
2020	1.7	2.5
2021	1.9	3.6
2022	3.7	4.0

Calculate start-up emissions (max rate):

Fill LD-401 and LD-458 twice per year to 50% level (3 hours to fill)

LD-458 moles, n	LD-401 moles, n	Temp	Vap Press
2.34	3.27	25	11.79

Total = 1.87 lbmoles/hr start up
Avg for year 0.001281866 lbmoles/hr

	SCFH
LFI405	10
Purge N2 Mole Flow (lbmol/hr)	0.03
Total N2 M	0.042

Temp in 25 C — 1.872 lbmoles/hr

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.033	0.062	6.930
Inerts	0.967	1.810	50.679
TOTAL	1	1.872	57.608

Temp out 10 C — Outlet flow

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.0064	0.012	1.302
Inerts	0.9936	1.8100	50.679
TOTAL	1	1.8215	51.981

Temp in 54 C — 0.018 lbmoles/hr — 0.3154833 ACFM

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.108	0.002	0.216
Inerts	0.892	0.042	1.178
TOTAL	1	0.044	1.394

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.006	0.000	0.030
Inerts	0.994	0.042	1.178
TOTAL	1.000	0.042	1.209

Max MCB exiting LE-405	1.302	lbs/hr
Max volumetric flow exiting LE-405	11.305	ACFM
Avg volumetric flow exiting LE-405	0.263	ACFM
Avg MCB exiting LE-405	0.133	tons/yr

SOLVAY SPECIALTY POLYMERS LLC

3702 Clanton Rd.
Augusta, Georgia 30906

DATE 6/12/2023

JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Unless otherwise noted, all inlet and outlet temperatures to each MCB condenser are 60°C and 10°C respectively.
MCB Layer forms on surface of LD-430 (extreme conservative case)

Calculations:

Source No. S6B — Sulfone Extractor
Equipment No. LD-430 — Atm vent from LD-430

	MCB	Water	CBSA
Vapor pressure @ 60C	65.12	149.56	0.0005

Temp in 60 C

In/Out Max flow in 6.1 CFM 364 CFH
Avg flow = breathing 24 hr avg ------------------> 0.0062 lbmoles/hr

n=PV/RT
LD-430

moles, n	Temp	Vap Press	Total yr
0.147859	60	65.757105	#NAME?
54.0			

LD-430 Level Change (Daily Avg)

2016	1.6
2017	2.0
2018	1.0
2019	2.0
2020	1.0
2021	1.2
2022	2.3

364.1 CFH max rate of inerts
0.831 lbmoles/hr

	Liquid mass frac	Liquid mole frac	Vapor mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	1	1.000	0.086	0.078	8.766
Water	0	0.000	0.000	0.000	0.000
Inerts	0	0.000	0.914	0.831	23.269
CBSA	0	0.000	0.000	0.000	0.000
TOTAL	1	1	1	0.909	32.035

CFH average rate of inerts
0.006 lbmoles/hr

	Liquid mass frac	Liquid mole frac	Vapor mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	1.00	1.00	0.086	0.001	0.059
Water	0.00	0.00	0.000	0.000	0.000
Inerts	0.00	0.00	0.914	0.006	0.158
CBSA	0.00	0.00	0.000	0.000	0.000
TOTAL	1	1	1	0.006	0.217

Max MCB exiting LD-430	8.766	lbs/hr
Max volumetric flow exiting LD-430	6.84	ACFM
Avg MCB exiting LD-430	0.260	tons/yr
Avg volumetric flow exiting LD-430	0.05	ACFM

SOLVAY SPECIALTY POLYMERS LLC
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Augusta, Georgia 30906

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JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Unless otherwise noted, all inlet and outlet temperatures to each MCB condenser are 70°C and 10°C respectively.

Calculations:

Source No. S6C — Product Dehydration Condenser
Equipment No. LE-467 — Vent Condenser for MCB for LT-460

	MCB	Water
Vapor pressure @ 40C	26.04	55.4
Vapor pressure @ 10C	4.83	9.21

Temp in 40 C

Inert Flow				
Instruments			20	CFH
Max Flow in	60.0	GPM or	481	CFH
Avg Flow in (1/4 of max)	15.0	GPM or	120	CFH

Inlet Flow

501 CFH Max Rate of inerts				140 CFH Average Rate of inerts			
1.217 lbmoles/hr		Moleflow	Mass flow	0.341 lbmoles/hr		Moleflow	Mass flow
	mole frac	lbmoles/hr	lbs/hr	2.339 ACFM	mole frac	lbmoles/hr	lbs/hr
MCB	0.034	0.043	4.86	MCB	0.034	0.012	1.31
Inerts	0.966	1.217	34.08	Inerts	0.966	0.329	9.21
TOTAL	1.000	1.261	4.861	TOTAL	1.000	0.341	1.314

Temp Out 10 C
Outlet flow

		Moleflow	Mass flow			Moleflow	Mass flow
	mole frac	lbmoles/hr	lbs/hr		mole frac	lbmoles/hr	lbs/hr
MCB	0.006	0.008	0.88	MCB	0.006	0.002	0.24
Inerts	0.994	1.217	34.08	Inerts	0.994	0.329	9.21
TOTAL	1.000	1.225	34.961	TOTAL	1.000	0.331	9.451

Max MCB exiting LE-467	0.876	lbs/hr
Max volumetric flow exiting LE-467	7.603	ACFM
Avg volumetric flow exiting LE-467	2.055	ACFM
Avg MCB exiting LE-467	1.038	tons/yr

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JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance

Assumptions: Assume dilute solution of MCB in water bahaves the same as pure MCB in terms of vapor pressure of MCB. (Savatsky 1991 Amoco

Calculations: **Source No.** S6E Make-up Water Tank
Equipment No. LD-435 Atm vent from LD-435

Vapor Pressure of Components (mm Hg)

Temp	MCB	Water	CBSA
26	12.6	25.2	4.30E-06

Total Flow 0.146 lbmoles/hr

	Liquid mass frac	Liquid mole frac	Vapor mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.001	0.0002	0.017	0.002	0.3
Water	0.998	0.9998	0.033	0.005	0.1
Inerts	0.000	0.0000	0.950	0.138	3.9
CBSA	0.001	0.0001	0.000	0.000	0.0
TOTAL	1	1	1	0.146	4.2

Avg MCB exiting LD-435 1.190 tons/yr

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JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Unless otherwise noted, all inlet and outlet temperatures to each MCB condenser are 70°C and 10°C respectively.

Calculations:

Source No. S6F Product Dehydration Condenser
Equipment No. LE-477 Vent Condenser for MCB for LT-470

	MCB	Azeotrope	Water
Vapor pressure @ 40C	26.04	64.6	55.4
Vapor pressure @ 10C	4.83	11.0	9.21

Temp in 40 C

		MCB	water
Azeotrope 70C	269 mmHg	0.17	0.83
Azeotrope 40C	64.6 mmHg	0.175	0.825
Azeotrope 10C	11 mmHg	0.185	0.815
		MOLE FRACS	

Inert Flow				
Instruments			20	CFH
Max Flow in	60.0	GPM or	481	CFH
Avg Flow in (1/4 of max)	15.0	GPM or	120	CFH

Inlet Flow

501 CFH Max Rate of inerts — 1.217 lbmoles/hr

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.034	0.047	5.33
Azeo(H2O)	0.070	0.097	1.747
Azeo(MCB)	0.015	0.021	2.314
Inerts	0.881	1.217	34.08
TOTAL	1.000	1.382	9.391

140 CFH Average Rate of inerts — 0.341 lbmoles/hr, 2.655 ACFM

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.034	0.013	1.49
Azeo(H2O)	0.070	0.027	0.489
Azeo(MCB)	0.015	0.006	0.648
Inerts	0.881	0.341	9.54
TOTAL	1.000	0.387	2.629

Temp Out 10 C
Outlet flow

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.006	0.008	0.89
Azeo(H2O)	0.012	0.015	0.264
Azeo(MCB)	0.003	0.003	0.375
Inerts	0.979	1.217	34.08
TOTAL	1.000	1.243	35.613

	mole frac	Moleflow lbmoles/hr	Mass flow lbs/hr
MCB	0.006	0.002	0.25
Azeo(H2O)	0.012	0.004	0.074
Azeo(MCB)	0.003	0.001	0.000
Inerts	0.979	0.341	9.54
TOTAL	1.000	0.348	9.864

Current permit is larger than calcula

Max MCB exiting LE-467	1.264	lbs/hr
Max volumetric flow exiting LE-467	7.716	ACFM
Avg volumetric flow exiting LE-467	2.160	ACFM
Avg MCB exiting LE-467	1.090	tons/yr

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JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB
SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Unless otherwise noted, all inlet and outlet temperatures to each MCB condenser are 70°C and 10°C respectively.
Assume dilute solution of MCB in water bahaves the same as pure MCB in terms of vapor pressure of MCB. (Savatsky 1991 Amoco

Calculations: **Source No.** S7B Acid Extractor
Equipment No. LE-448 Vent Condenser for MCB for LT-445 & LT-455

Vapor Pressure @10C		Vapor Pressure @70C	
Componen	mmHg	Component	mmHg
MCB	4.83	MCB	98.46
Water	9.21	Water	233.88

5	LB/HR AVG Rate of Inerts
0.179	MOL/HR AVG Rate of Inerts

Vapor Out of LT-445 (Assume 70C & 760 mmHg)						
	Liquid Phase			Vapor Phase		
	Mass Flow	Mole Flow	Mole Frac	Mole Frac	Mole Flow	Mass Flow
Components	(lbm/hr)	(mol/hr)	(mol/mol)	(mol/mol)	(mol/hr)	(lbm/hr)
MCB	13.8	0.1	0.000	0.130	0.0	4.6
Water	4542.0	252.1	0.998	0.307	0.1	1.8
CBSA	66.7	0.3	0.001	0.000	0.0	0.0
Inerts	0.0	0.0	0.000	0.563	0.2	5.0
TOTAL	4622.4	252.5	1.000	1.000	0.3	11.4

Vapor Out of LT-455 (Assume 70C & 760 mmHg)						
	Liquid Phase			Vapor Phase		
	Mass Flow	Mole Flow	Mole Frac	Mole Frac	Mole Flow	Mass Flow
Components	(lbm/hr)	(mol/hr)	(mol/mol)	(mol/mol)	(mol/hr)	(lbm/hr)
MCB	17.1	0.2	0.000	0.130	0.0	4.6
Water	5639.0	312.9	1.000	0.308	0.1	1.8
CBSA	0.0	0.0	0.000	0.000	0.0	0.0
Inerts	0.0	0.0	0.000	0.563	0.2	5.0
TOTAL	5656.1	313.1	1.000	1.000	0.3	11.4

Into LE-448 (T = 70C)			
	Mole Frac	Mole Flow	Mass Flow
Components	mol/mol	mol/hr	lbm/hr
MCB	0.130	0.1	9.2
Water	0.307	0.2	3.5
Inerts	0.563	0.4	10.0
TOTAL	1.000	0.6	22.8

Difference
0.000

Out of LE-448 (T = 10C)							
	Guess Liquid	Vapor Vent			Liquid Condensate		
	Mole Frac	Mole Frac	Mole Flow	Mass Flow	Mole Flow	Mole Frac	Mass Flow
Components	mol/mol	mol/mol	mol/hr	lbm/hr	mol/hr	mol/mol	lbm/hr
MCB	0.294	0.006	0.0	0.3	0.1	0.294	9.0
Water	0.706	0.009	0.0	0.1	0.2	0.706	21.6
Inerts	0.000	0.985	0.4	10.0	0.0	0.000	0.0
TOTAL	1.000	1.000	0.4	10.3	0.3	1.000	30.6

Avg MCB exiting LE-448 1.136 tons/yr

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JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Unless otherwise noted, all inlet and outlet temperatures to each MCB condenser are 70°C and 10°C respectively.
Assume dilute solution of MCB in water bahaves the same as pure MCB in terms of vapor pressure of MCB. (Savatsky 1991 Amoco

Calculations: **Source No.** S488 New Karr Column Vent Condenser
Equipment No. LE-488 Vent Condenser for New 80MM Project Karr Columns (LT-XX1 and LT-XX2 Below)

Vapor Pressure @10C		Vapor Pressure @70C	
Componen	mmHg	Component	mmHg
MCB	4.83	MCB	98.46
Water	9.21	Water	233.88

5	LB/HR AVG Rate of Inerts
0.179	MOL/HR AVG Rate of Inerts

NOTE: This vent condenser is assumed to be identical to LE-448, and the calculations were completed with the same conditions and inert vent rate as with LT-445 / LT-455.

Vapor Out of LT-XX1 (Assume 70C & 760 mmHg)						
	Liquid Phase			Vapor Phase		
	Mass Flow	Mole Flow	Mole Frac	Mole Frac	Mole Flow	Mass Flow
Components	(lbm/hr)	(mol/hr)	(mol/mol)	(mol/mol)	(mol/hr)	(lbm/hr)
MCB	13.8	0.1	0.000	0.130	0.0	4.6
Water	4542.0	252.1	0.998	0.307	0.1	1.8
CBSA	66.7	0.3	0.001	0.000	0.0	0.0
Inerts	0.0	0.0	0.000	0.563	0.2	5.0
TOTAL	4622.4	252.5	1.000	1.000	0.3	11.4

Vapor Out of LT-XX2 (Assume 70C & 760 mmHg)						
	Liquid Phase			Vapor Phase		
	Mass Flow	Mole Flow	Mole Frac	Mole Frac	Mole Flow	Mass Flow
Components	(lbm/hr)	(mol/hr)	(mol/mol)	(mol/mol)	(mol/hr)	(lbm/hr)
MCB	17.1	0.2	0.000	0.130	0.0	4.6
Water	5639.0	312.9	1.000	0.308	0.1	1.8
CBSA	0.0	0.0	0.000	0.000	0.0	0.0
Inerts	0.0	0.0	0.000	0.563	0.2	5.0
TOTAL	5656.1	313.1	1.000	1.000	0.3	11.4

Into LE-488 (T = 70C)			
	Mole Frac	Mole Flow	Mass Flow
Components	mol/mol	mol/hr	lbm/hr
MCB	0.130	0.1	9.2
Water	0.307	0.2	3.5
Inerts	0.563	0.4	10.0
TOTAL	1.000	0.6	22.8

Difference
0.000

Out of LE-488 (T = 10C)							
	Guess Liquid	Vapor Vent			Liquid Condensate		
	Mole Frac	Mole Frac	Mole Flow	Mass Flow	Mole Flow	Mole Frac	Mass Flow
Components	mol/mol	mol/mol	mol/hr	lbm/hr	mol/hr	mol/mol	lbm/hr
MCB	0.294	0.006	0.0	0.259	0.1	0.294	9.0
Water	0.706	0.009	0.0	0.1	0.2	0.706	21.6
Inerts	0.000	0.985	0.4	10.0	0.0	0.000	0.0
TOTAL	1.000	1.000	0.4	10.3	0.3	1.000	30.6

Avg MCB exiting LE-488 1.136 tons/yr

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JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions:

Calculations: **Source No.** S7C Product Purification Vent Condenser - Crude Crystallizer
Equipment No. LE-576 3rd Crystallizer vent Condenser

NOTE: Stack testing was completed on the vent from LE-576. Estimated yearly emissions are based on this stack testing. Screenshots for MCB mass flow rate calculation are provided below.

Vent Condenser	LE-576
Volumetric Flow (ACFM)	6.9
Volumetric Flow (SCMM)	0.190
Vapor MCB Content (ppmv)	6732
Unit Conversion Constant, K2	2.49E-06
MCB Molecular Weight (kg/kg-mole)	112.56
MCB Mass Flow (lbm/hr)	0.8

Input Data

	MCB	
Bws	0.008	volume
Cj	6732	ppmv
Hj	735	kcal/mol
Lj,i	1	halogen atom(s)
Mj,i	35.45	g/g-mole
Mj	112.56	g/g-mole
T	27.2	C
Qs	6.9	acfm
Qs	0.190	stnd m3/min

Avg MCB exiting LE-576 3.462 tons/yr

Support calculations

$$E_{HAP} = K_2 * Q_s * (\sum(C_j * M_j))$$
$$= 0.35761 \text{ kg/hr}$$

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		DATE	6/12/2023
JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions:

Calculations: **Source No.** S7A Product Purification Vent Condenser
Equipment No. LE-680 North Side Vent Condenser

NOTE: Stack testing was completed on the vent from LE-680. Estimated yearly emissions are based on this stack testing. Screenshots for MCB mass flow rate calculation are provided below.

Vent Condenser	LE-680	
Volumetric Flow (ACFM)	16.9	
Volumetric Flow (SCMM)	0.460	
Vapor MCB Content (ppmv)	3995	
Unit Conversion Constant, K2	2.49E-06	
MCB Molecular Weight (kg/kg-mole)	112.56	
MCB Mass Flow (lbm/hr)	1.1	
Avg MCB exiting LE-680	4.974	tons/yr

Input Data

	MCB	
Bws	0.01	volume
Cj	3995	ppmv
Hj	711.2	kcal/mol
Lj,i	1	halogen atom(s)
Mj,i	35.45	g/g-mole
Mj	112.56	g/g-mole
T	30.4	C
Qs	16.9	acfm
Qs	0.459	stnd m3/min

Support calculations

$$E_{HAP} = K_2 * Q_s * (\sum(C_j * M_j))$$
$$= 0.51337 \text{ kg/hr}$$

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JOB NAME 80MM Sulfone Momner Expansion — COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued) — CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Assume dilute solution of MCB in water bahaves the same as pure MCB in terms of vapor pressure of MCB. (Savatsky 1991 Amoco Report)

Calculations:

Source No. S7C — Product Purification Vent Condenser - Crude Crystallizer
Equipment No. LE-679 — 3rd Crystallizer vent Condenser

K2	MW
2.5E-06	112.56

ACFM Flow	Vent Condenser	Qs (SCMM)	MCB PPMV	MCB Mass Flow (kg/hr)	MCB Mass Flow (lbm/hr)	Emission Est (tn/yr)	(tn/yr)/CFM	MB ACFM	MB LB/HR
6.9	LE-576	0.190	6732	0.4	0.8	3.462	0.5	15.7	1.8
16.9	LE-680	0.460	3995	0.5	1.1	4.974	0.3	22.9	2.3

LE-679 MB Volume Flow (ACFM)	8.4
LE-679 MCB Emissions (tn/yr)	3.343
LE-679 MCB Emissions (lbm/hr)	0.8

LE-679 emissions estimate is calculated from the measured emissions from LE-576 and LE-680 from stack testing completed in 2016. The measured values from the report were used to calculate a (tn/yr)/ACFM value, which was then applied to the mass balance ACFM flow from LE-679 for an overall emissions estimate.

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DATE **6/12/2023**

JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	EH
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	SMB

Control Device: LE-368
Description: MIS Cracking System Vent Condenser
Soruces: LD-792 (LT-790) and LT-363 (LR-350)

Assumptions:
Max temperature of inlet stream to LE-368 is assumed to be 40°C
Outlet temperature from LE-368 is 10°C (Assume 10°C temperature of approach to Chilled MCB header at 0°C)

Temperature (°C)	MCB Vapor Pressure (mm Hg)
40	26.61
10	4.97

MCB vapor pressure calculated using Antoine Equation Constants.

Assume ideal gas behavior and use Raoult's Law to predict MCB concentration in vent stream:

$$y_{MCB}P=x_{MCB}P^{*}_{MCB}$$

Assume liquid composition in all vessels is 100% MCB. This condition will only occur at start up but will give the most conservation estimate of loading for LE-368.

$$y_{MCB}P=P^{*}_{MCB}$$

Vapor fraction of MCB in vent stream is estimated by:

$$y_{MCB}=P^{*}_{MCB}/P$$

Assume nitrogen is the only other compound present in vent stream.

$$y_{Nitrogen}=1-y_{MCB}$$

Vapor fraction MCB in vent stream at 40°C = 0.035
Vapor fraction MCB in vent stream at 10°C = 0.007

Vapor fraction nitrogen in vent stream at 40°C = 0.965
Vapor fraction nitrogen in vent stream at 10°C = 0.993

The maximum fill rate for the LE-368 Vent System is assumed to be the maximum fill rate experienced during charging/filling of the LR-350 Reactor.

Max fill rate for LE-368 vent system (mainly LR-350 during sulfuric acid and MIS charging):

50.0 gpm
802.1 CFH

Average fill rate for LE-368 vent header vessels is based on the average amount of material charged to the LR-350 MIS reactor:

3.1 gpm
49.4 CFH

Instrument loadings for the LE-368 system are listed below (the list includes instruments that will not be accounted for by the vacuum systems, i.e. instruments purges on crystallizer systems):

Instrument	Flowrate (SCFH)
LFIC-350	25

Max Instrument loading on LE-368: 25.0 CFH

The average max loading on LE-368 is the sum of the average fill rate, instrument loading, and vacuum system loading.

Max loading on LE-368: 827.1 CFH
Average loading on LE-368: 74.4 CFH

Convert loading from CFH to lbmoles/hr using ideal gas law:

Max inert loading on LE-368: 2.009 lbmoles/hr Inerts
Average inert loading on LE-368: 0.181 lbmoles/hr Inerts

Maximum Loading

Temp in 40 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.035	0.073	8.204
Inerts	0.965	2.009	56.241
TOTAL	1	2.082	64.446

Temp out 10 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.0065	0.013	1.489
Inerts	0.9935	2.009	56.241
TOTAL	1	2.022	57.731

Average Loading

Temp in 40 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.035	0.007	0.738
Inerts	0.965	0.181	5.056
TOTAL	1	0.187	5.794

Temp out 10 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.0065	0.001	0.134
Inerts	0.9935	0.181	5.056
TOTAL	1	0.182	5.190

Max hourly inlet rate of MCB to condenser: 8.204 lbs/hr
Max hourly exit rate of MCB from condenser: 1.489 lbs/hr
Average hourly inlet rate of MCB to condenser: 0.738 lbs/hr
Average hourly exit rate of MCB from condenser: 0.134 lbs/hr
Yearly MCB Emissions from condenser: 0.586 tons/yr

Max exit flow from condenser 747.97 CFH
Average exit flow from condenser 67.24 CFH

Percent recovery: 81.85 %

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JOB NAME	80MM Sulfone Momner Expansion	COMPUTED BY	SMB
SUBJECT	VOC calculations for Revised Title V Permit Notification (continued)	CHECKED BY	NJA

Control Device: LE-347
Description: New MIS Cracking II Vent Condenser
Soruces: New MIS Cracking II Equipment (TBD)

Assumptions:
Max temperature of inlet stream to LE-347 is assumed to be 40°C
Outlet temperature from LE-347 is 10°C (Assume 10°C temperature of approach to Chilled MCB header at 0°C)

Temperature (°C)	MCB Vapor Pressure (mm Hg)
40	26.61
10	4.97

MCB vapor pressure calculated using Antoine Equation Constants.

Assume ideal gas behavior and use Raoult's Law to predict MCB concentration in vent stream:

$$y_{MCB}P = x_{MCB}P^*_{MCB}$$

Assume liquid composition in all vessels is 100% MCB. This condition will only occur at start up but will give the most conservation estimate of loading for LE-347.

$$y_{MCB}P = P^*_{MCB}$$

Vapor fraction of MCB in vent stream is estimated by:

$$y_{MCB} = P^*_{MCB}/P$$

Assume nitrogen is the only other compound present in vent stream.

$$y_{Nitrogen} = 1 - y_{MCB}$$

Vapor fraction MCB in vent stream at 40°C = 0.035
Vapor fraction MCB in vent stream at 10°C = 0.007

Vapor fraction nitrogen in vent stream at 40°C = 0.965
Vapor fraction nitrogen in vent stream at 10°C = 0.993

The maximum fill rate for the LE-347 Vent System is assumed to be the maximum fill rate experienced during charging/filling of the Future MIS II Reactor.

Max fill rate for LE-347 vent system (mainly reactor during sulfuric acid and MIS charging):

50.0 gpm
802.1 CFH

Average fill rate for LE-347 vent header vessels is based on the average amount of material charged to the Future MIS II reactor:

3.1 gpm
49.4 CFH

Instrument loadings for the LE-347 system are listed below (the list includes instruments that will not be accounted for by the vacuum systems, i.e. instruments purges on crystallizer systems):

Instrument	Flowrate (SCFH)
LFIC-XXX	25

Max Instrument loading on LE-347: 25.0 CFH

The average max loading on LE-347 is the sum of the average fill rate, instrument loading, and vacuum system loading.

Max loading on LE-347: 827.1 CFH
Average loading on LE-347: 74.4 CFH

Convert loading from CFH to lbmoles/hr using ideal gas law:

Max inert loading on LE-347: 2.009 lbmoles/hr Inerts
Average inert loading on LE-347: 0.181 lbmoles/hr Inerts

Maximum Loading

Temp in 40 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.035	0.073	8.204
Inerts	0.965	2.009	56.241
TOTAL	1	2.082	64.446

Temp out 10 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.0065	0.013	1.489
Inerts	0.9935	2.009	56.241
TOTAL	1	2.022	57.731

Average Loading

Temp in 40 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.035	0.007	0.738
Inerts	0.965	0.181	5.056
TOTAL	1	0.187	5.794

Temp out 10 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.0065	0.001	0.134
Inerts	0.9935	0.181	5.056
TOTAL	1	0.182	5.190

Max hourly inlet rate of MCB to condenser: 8.204 lbs/hr
Max hourly exit rate of MCB from condenser: 1.489 lbs/hr
Average hourly inlet rate of MCB to condenser: 0.738 lbs/hr
Average hourly exit rate of MCB from condenser: 0.134 lbs/hr
Yearly MCB Emissions from condenser: 0.586 tons/yr

Max exit flow from condenser: 747.97 CFH
Average exit flow from condenser: 67.24 CFH

Percent recovery: 81.85 %

JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB
SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Control Device: LE-580
Description: Vent Condenser for New Columns 681 / 781 / 881 (80MM Expansion)
Soruces: LT-681, LT-781, and LT-881

Assumptions:
Max temperature of inlet stream to LE-580 is assumed to be 40°C
Outlet temperature from LE-580 is 10°C (Assume 10°C temperature of approach to Chilled MCB header at 0°C)

Temperature (°C)	MCB Vapor Pressure (mm Hg)
40	26.61
10	4.97

MCB vapor pressure calculated using Antoine Equation Constants.

Assume ideal gas behavior and use Raoult's Law to predict MCB concentration in vent stream:

$$y_{MCB}P=x_{MCB}P^{*}_{MCB}$$

Assume liquid composition in all vessels is 100% MCB. This condition will only occur at start up but will give the most conservation estimate of loading for LE-580.

$$y_{MCB}P=P^{*}_{MCB}$$

Vapor fraction of MCB in vent stream is estimated by:

$$y_{MCB}=P^{*}_{MCB}/P$$

Assume nitrogen is the only other compound present in vent stream.

$$y_{Nitrogen}=1-y_{MCB}$$

Vapor fraction MCB in vent stream at 40°C = 0.035
Vapor fraction MCB in vent stream at 10°C = 0.007

Vapor fraction nitrogen in vent stream at 40°C = 0.965
Vapor fraction nitrogen in vent stream at 10°C = 0.993

Other than instrument purges, the anticipated inert flow will come from the LT-881 vacuum system. This is modeled after existing LT-801 vacuum system inert flows (12 lbm/hr).

12 lbm/hr
176.5 CFH

Instrument loadings for the LE-580 system are listed below (the list includes instruments that will not be accounted for by the vacuum systems, i.e. instruments purges on crystallizer systems):

Instrument	Flowrate (SCFH)
Various	40

Max Instrument loading on LE-580: 40.0 CFH

The average loading on LE-580 is the sum of the average fill rate, instrument loading, and vacuum system loading.

Average loading on LE-580: 216.5 CFH

Convert loading from CFH to lbmoles/hr using ideal gas law:

Average inert loading on LE-580: 0.526 lbmoles/hr Inerts

Average Loading

Temp in 40 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.035	0.019	2.147
Inerts	0.965	0.526	14.720
TOTAL	1	0.545	16.867

Temp out 10 C

	Mole Fraction	Mole flow lbmoles/hr	Mass flow lbs/hr
MCB	0.0065	0.003	0.390
Inerts	0.9935	0.526	14.720
TOTAL	1	0.529	15.110

Average hourly inlet rate of MCB to condenser: 2.147 lbs/hr
Average hourly exit rate of MCB from condenser: 0.390 lbs/hr
Average exit flow from condenser: 195.76 CFH
Yearly MCB Emissions from condenser: 1.707 tons/yr

DATE 6/12/2023

JOB NAME 80MM Sulfone Momner Expansion
COMPUTED BY SMB

SUBJECT VOC calculations for Revised Title V Permit Notification (continued)
CHECKED BY NJA

Purpose: Complete VOC calcs for all MCB controlled emission sources in the Sulfone Monomer Unit per revised 80MM material balance.

Assumptions: Use average level change data in LF-1601 during a two month operational period to estimate average venting rates.
Assume dilute solution of MCB in water bahaves the same as pure MCB in terms of vapor pressure of MCB. (Savatsky 1991 Amoco Repc

Calculations: **Source No.** S10A Organic Wastewater Tank
Equipment No. LF-1601 Atmospheric vent from LF-1601

10.7

1.4	86	**ACFH AVG Rate of Vapor Stream**
	0.207	**MOL/HR AVG Rate of Vapor Strean**

System Pressure		
PSIA	**mmHg**	**Temp, C**
15.0	776	50

Out of LF-1601 (T = 50C)							
	Liquid			**Vap Press**	Vapor		
	Mass Flow	**Mole Flow**	**Mole Frac**	**"@ 50C"**	**Mole Frac**	**Mole Flow**	**Mass Flow**
Components	**lbm/hr**	**mol/hr**	**mol/mol**	**mmHg**	**mol/mol**	**mol/hr**	**lbm/hr**
Water	23111.1	1282.5	1.000	92.65	0.119	0.0	0.4
MCB	20.4	0.2	0.000	42.10	0.054	0.0	1.3
Air	0.0	0.0	0.000	-	0.826	0.2	4.9
TOTAL	23131.5	1282.7	1.0000	-	1.000	0.2	6.6

Avg MCB exiting LF-1601 5.527 tons/yr

Flow	80	scfm	
SO2 Conc.	5	ppmv SO2 (after the SO2 absorber)	
SO2 Flow	0.024	scfh SO2	(Flow x Conc. x 60 min/hr)

The volumetric flow rate can be converted to mass via the ideal gas law equation:

n = PV/RT

Solving for n, n = PV/RT

P =	1	atm
V =	0.024	scfh SO2
R =	0.7302	atm-cf / mol R
T =	459.72	R
n =	7.15E-05	mol/hr

The moles of SO2 can be converted to mass by multiplying by the molecular weight:

MW SO2 =	64	lb/lb-mol
	4.58E-03	lb/hr
	0.02	tpy

An uncontrolled emission rate can be calculated by assuming a control efficiency for the SO2 absorber: 99%

4.58E-01	lb/hr
1.04E-01	tpy

Emissions of PM, sulfuric acid, and other pollutants is not expected based on vendor info.

S usage:	1760	lb/hr
Moles S:	55	moles/hr
	55	moles/hr
Efficiency:	99.9%	
	0.055	moles/hr
H2SO4 Emitted:	0.055	moles/hr
H2SO4 Emitted:	0.17	lb/hr
H2SO4 Emitted:	0.74	tpy

Emissions lb/hr

PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
			4.58E-03				0.17	

Emissions (tpy)

PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.74	0.00

Solvay Augusta - Pastillation

Line 1 Emissions:

Maximum Process Rate	1.88	tons/hr

EPA does not have a factor for emissions from pastillation of sulfone monomer. Uncontrolled emissions from adipic acid storage/transfer are used as an analgous operation to simulate emissions from this process. Controlled emissions are based on the process air flow and the expected outlet concentration of PM from EPA guidance document. Solvay will provide this concentration as a specification to the baghouse vendor.

Uncontrolled Emissions

Pollutant	Factor[1]	lbs/hr	tpy
PM	0.8	1.50	6.57
PM_{10}[2]	0.8	1.50	6.57
$PM_{2.5}$[2]	0.8	1.50	6.57

[1]AP-42, Table 6.2-2 (Metric And English Units). UNCONTROLLED EMISSION FACTORS FOR SECONDARY OXIDATION ADIPIC ACID MANUFACTUREa

[2]No factors available for PM_{10} and $PM_{2.5}$, so assume PM = PM_{10} = $PM_{2.5}$

Controlled Emissions

Pollutant	Factor[1]	lbs/hr	tpy
PM	0.01	0.07	0.30
PM_{10}[2]	0.01	0.07	0.30
$PM_{2.5}$[2]	0.01	0.07	0.30

1. EPA Air Pollution Control Technology Fact Sheet; Fabric Filter Pulse-Jet Cleaned Type; EPA-452/F-03-025

2. Assume PM=PM10=PM2.5.

3. Condensable PM not expected from this non-combustion related source

4. Line air flow: 800 cfm

Lines 2 and 3 are identical to 1. Summary of emissions:

Emissions lb/hr

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
Line 1	0.07	0.07	0.07						
Line 2	0.07	0.07	0.07						
Line 3	0.07	0.07	0.07						
Total	0.21	0.21	0.21						

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
Line 1	0.30	0.30	0.30						
Line 2	0.30	0.30	0.30						
Line 3	0.30	0.30	0.30						
Total	0.90	0.90	0.90						

The volumetric flow rate can be converted to mass via the ideal gas law equation:

n = PV/RT

Solving for n, n = PV/RT

P =	1	atm
V =	1.089947	scfh Sulfone
R =	0.7302	atm-cf / mol R
T =	459.72	R
n =	3.25E-03	mol/hr

The moles of sulfone can be converted to mass by multiplying by the molecular weight:

MW Sulfone=	287.15	lb/lb-mol
	0.93	lb/hr
	4.08	tpy

The Sulfone will condense to a liquid and then solidify under ambient conditions.

Extrapolating the vapor pressure to ambient temperature shows that the vapor pressure is

0.004031 mmHg at 25 degrees C

And, the concentration is 5.3 ppmv

Thus, the sulfone is assumed to condense to a solid, and does not contribute to VOC.

0.93	lb/hr
4.08	tpy

EMISSION SUMMARY

Emissions lb/hr

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
Line 1	0.07	0.07	0.07						
Line 2	0.07	0.07	0.07						
Line 3	0.07	0.07	0.07						
Tanks (3)*	0.93	0.93	0.93						
Total	1.14	1.14	1.14						

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
Line 1	0.30	0.30	0.30						
Line 2	0.30	0.30	0.30						
Line 3	0.30	0.30	0.30						
Tanks (3)*	4.08	4.08	4.08						
Total	4.98	4.98	4.98						

*960, 970, 980 tanks

Solvay Augusta Facility-Sulfoone Combustion Sources
Boiler and Hot Oil Heaters

WHB	20	MMBtu/hr

WHB Emissions Natural Gas

WHB	20,000,000	Btu/hr
	1021	Btu/scf
	19589	scf/hr

Pollutant	Emission Factor* (lb/10^6 scf)	Emission lb/hr	Emission tpy
CO_2	120,000	4701.27	20591.58
CH_4	2	0.09	0.395
N_2O (Uncontrolled)	2.2	0.09	0.378
N_2O(Controlled low-NOx Burner)	0.64	0.03	0.110
PM (total)	7.6	0.30	1.304
PM(condensible)	2.4	0.09	0.412
PM (filterable)	5.2	0.20	0.892
SO_2	0.6	0.02	0.103
TOC	11	0.43	1.888
Methane	2.3	0.09	0.395
VOC	5.5	0.22	0.944
NO_X (Small Boiler-Uncontrolled)	50	1.96	8.58
CO	84	3.29	14.414

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

WHB Emissions MIS

Pollutant	Emission Factor* (lb/lb MIS)	Emission lb/hr	Emission tpy
CO_2		4701.27	20591.58
CH_4		0.09	0.395
N_2O (Uncontrolled)		0.09	0.378
N_2O(Controlled low-NOx Burner)		0.03	0.000
PM (total)		0.98	4.280
PM(condensible)		0.09	0.41
PM (filterable)	0.000552	0.88	3.868
SO_2	0.0000195	0.03	0.137
TOC		0.43	1.888
Methane		0.09	0.395
VOC		0.22	0.944
NO_X (Small Boiler-Uncontrolled)	0.000338	0.54	2.369
CO	0.0000109	0.02	0.076

lb/lb MIS factors for 2022 stack test. Otherwise, assume MIS emissions same as Natural Gas

	PM	PM10	PM2.5	SO2	CO	NOX	VOC
WHB Gas	1.30	1.30	1.30	0.024	3.291	1.96	1.959
WHB MIS	0.98	0.98	0.98	0.031	0.017	0.54	0.215
Total	1.30	1.30	1.30	0.03	3.29	1.96	1.96

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC
WHB Gas	5.71	5.71	5.71	0.10	14.41	8.58	8.58
WHB MIS	4.28	4.28	4.28	0.14	0.08	2.37	0.94
Total	5.71	5.71	5.71	0.14	14.41	8.58	8.58

Solvay Augusta Facility-Sulfoone Combustion Sources
Boiler and Hot Oil Heaters

Hot Oil Heater#1	38	MMBtu/hr
Hot Oil Heater#2	38	MMBtu/hr

Hot Oil Heater#1 NG Usage

Hot Oil Heater	38,000,000	Btu/hr
	1021	Btu/scf
	37218	scf/hr

Pollutant	Emission Factor* (lb/10^6 scf)	Emission lb/hr	Emission tpy
CO_2	120,000	8932.42	39123.996
CH_4	2	0.17	0.750
N_2O (Uncontrolled)	2.2	0.16	0.717
N_2O(Controlled low-NOx Burner)	0.64	0.05	0.209
PM (total)	7.6	0.57	2.478
PM(condensible)	7.6	0.57	2.478
PM (filterable)	7.6	0.57	2.478
SO_2	0.6	0.04	0.196
TOC	11	0.82	3.586
Methane	2.3	0.17	0.750
VOC	5.5	0.41	1.793
NO_X (Small Boiler-Uncontrolled)	100	7.44	32.60
CO	84	6.25	27.387

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

Hot Oil Heater#2 NG Usage

Hot Oil Heater	38,000,000	Btu/hr
	1021	Btu/scf
	37218	scf/hr

Pollutant	Emission Factor* (lb/10^6 scf)	Emission lb/hr	Emission tpy
CO_2	120,000	8932.42	39123.996
CO_2 (from Uncontrolled VOC emissions)	2	0.15	0.652
CO_2 (from Controlled VOC emissions)	2.2	0.16	0.717
CH_4	2	0.17	0.750
Lead	0.0005	0.00	0.000
N_2O (Uncontrolled)	2.2	0.16	0.717
N_2O(Controlled low-NOx Burner)	0.64	0.05	0.209
PM (total)	7.6	0.57	2.478
PM(condensible)	7.6	0.57	2.478
PM (filterable)	7.6	0.57	2.478
SO_2	0.6	0.04	0.196
TOC	11	0.82	3.586
Methane	2.3	0.17	0.750
VOC	5.5	0.41	1.793
NO_X (Small Boiler-Uncontrolled)	100	7.44	32.60
CO	84	6.25	27.387

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

	PM	PM10	PM2.5	SO2	CO	NOX	VOC
Hot Oil Heater#1	0.57	0.57	0.57	0.045	6.253	7.44	0.409
Hot Oil Heater#2	0.57	0.57	0.57	0.045	6.253	7.44	0.409
Total	1.13	1.13	1.13	0.09	12.51	14.89	0.82

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC
Hot Oil Heater#1	2.48	2.48	2.48	0.20	27.39	32.60	1.79
Hot Oil Heater#2	2.48	2.48	2.48	0.20	27.39	32.60	1.79
Total	4.96	4.96	4.96	0.39	54.77	65.21	3.59

Solvay Specialty Polymers USA, LLC

CPV TRE Summary
MON Compliance Assessment
Solvay Augusta Plant

Recovery Device	Inlet Flow ACFM	Inlet Temp C	SCFM @ 20 C	Oulet Flow ACFM	Outlet Temp C	SCFM @ 20 C	TRE (Outlet)	≤1.9*	>1.9 & < 5.0?**
LE-114		70	0.000	10.000	10	10.353	42.69	No	No
LE-208	0.420	70	0.359	0.690	10	0.714	42.69	No	No
LE-210	0.022	30	0.021	0.021	10	0.022	1463.92	No	No
LE-309	2.971	40	2.781	2.416	10	2.501	8.53	No	No
LE-330	0.519	20	0.519	0.499	10	0.517	43.88	No	No
LE-405	0.757	70	0.647	0.546	10	0.565	109.29	No	No
LD-430	1.100	70	0.940	0.130	10	0.135	59.16	No	No
LE-467	2.339	40	2.190	2.055	10	2.128	14.15	No	No
LE-435	Makeup water tank,TRE not required								
LE-680	7.950	25	7.817	16.900	30.4	16.321	3.00	No	Yes
LE-750	WHB TRE not required								
LF-1601	WWEQ tank, no TRE required								
LE-448	3.313	70	2.831	2.391	10	2.475	12.89	No	No
LE-477	2.655	40	2.486	2.16	10	2.236	13.48	No	No
LE-576	10.796	80	8.963	6.9	27.2	6.735	4.27	No	Yes
LE-679	398.9	30	385.749	8.4	10	8.696	4.41	No	Yes
LE-368	2.58	40	2.415	1.12	10	1.160	24.85	No	No
LE-347	2.58	40	2.415	1.12	11	1.155	24.85	No	No
LE-488	3.31	70	2.831	2.391	10	2.475	12.92	No	No
LE-580	2.58	40	2.415	3.26	10	3.375	8.65	No	No

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-208 Reactor Scrubber Condenser			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	12780					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	0.35					acfm
	0.0101					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.01138 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

E_{HAP} = K2 * (∑(Cj * Mj)) * Qs
= 0.03614 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.03614 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 1.58152 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
53.3	42.69	70.3	110.5

Choose lowest TRE value for non-halogenated vent system

42.69

Redacted Copy

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date: =('Intermediates'!J2	Project:	
Subject: LE-210 Reactor Cooler Condenser			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	6103					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	0.021					acfm
	0.0006					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.00033 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.00104 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.00104 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.75526 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
1863.1	1463.92	2441.9	3856.4

Choose lowest TRE value for non-halogenated vent system

1463.92

Calculation No.				Sheet	
By:		Date:		Project No.	
Chkd. By:		Date:		Project:	
Subject:	LE-309 Dehydration Tower Condenser				

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	9199					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.416					acfm
	0.0697					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.05656 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.17957 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.17957 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 1.13833 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
10.9	8.53	14.2	22.3

Choose lowest TRE value for non-halogenated vent system

Calculation No.	______			Sheet	______
By:	______	Date:	______	Project No.	______
Chkd. By:	______	Date:	______	Project:	______
Subject:	LE-330 Recycle MCB Storage Tank Condenser				

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	8630					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	0.499					acfm
	0.0144					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.01096 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.03480 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.03480 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 1.06796 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
55.5	43.88	72.8	114.8

Choose lowest TRE value for non-halogenated vent system

43.88

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-405 Extraction Feed Tank Condenser			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	3122					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	0.546					acfm
	0.0157					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.00434 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.01377 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.01377 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.38635 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
140.7	109.29	183.3	290.1

Choose lowest TRE value for non-halogenated vent system

109.29

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LD-430			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	25633					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	0.13					acfm
	0.0037					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.00848 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.02693 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.02693 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 3.17211 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
71.0	59.16	95.1	148.2

Choose lowest TRE value for non-halogenated vent system

59.16

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	

Subject: LE-467 Product Dehydration Condenser

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	6474					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.055					acfm
	0.0592					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.03385 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.10750 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.10750 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.80113 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
18.1	14.15	23.6	37.2

Choose lowest TRE value for non-halogenated vent system

14.15

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-477 Product Dehydration Condenser			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	6468					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.16					acfm
	0.0623					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.03555 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.11288 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.11288 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.80037 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
17.3	13.48	22.5	35.4

Choose lowest TRE value for non-halogenated vent system

13.48

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-448 Acid Extractor			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	5057					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.8792					acfm
	0.0830					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.03705 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.11764 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.11764 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.62578 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
16.7	12.89	21.5	34.0

Choose lowest TRE value for non-halogenated vent system

12.89

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-576 Product Purification Vent Condenser - Crude Crystallizer			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	6431					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	6.9					acfm
	0.1989					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.11291 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.35852 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.35852 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.79579 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
5.6	4.27	7.1	11.2

Choose lowest TRE value for non-halogenated vent system

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-679			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	5101					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	8.4					acfm
	0.2422					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.10903 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.34620 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.34620 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.63121 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
5.8	4.41	7.4	11.6

Choose lowest TRE value for non-halogenated vent system

4.41

Calculation No.			Sheet		
By:		Date:		Project No.	
Chkd. By:		Date:		Project:	
Subject:	LE-680 Product Purification Vent Condenser				

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	3752					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	16.9					acfm
	0.4872					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.16135 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.51231 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.51231 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.46427 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
4.1	3.00	5.0	7.8

Choose lowest TRE value for non-halogenated vent system

3.00

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	

Subject: LE-368 Recycle MCB Purification - Vent Condenser

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	2911					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.58					acfm
	0.0744					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum(C_j * L_{j,i} * M_{j,i})$
= 0.01911 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.06069 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.06069 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.36024 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
32.3	24.85	41.6	65.9

Choose lowest TRE value for non-halogenated vent system

24.85

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-347			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	2921					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	11					C
Q_s	2.58					acfm
	0.0741					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.01911 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.06069 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.06069 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.36152 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
32.3	24.85	41.6	65.9

Choose lowest TRE value for non-halogenated vent system

24.85

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-488			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	6089					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.391					acfm
	0.0689					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.03705 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.11764 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.11764 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 0.75356 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
16.6	12.92	21.6	34.0

Choose lowest TRE value for non-halogenated vent system

12.92

Calculation No.		Sheet	
By:	Date:	Project No.	
Chkd. By:	Date:	Project:	
Subject: LE-580			

Assumptions 1) Water vapor content, compound concentration, net heat of combustion, temperature, and

Variables

B_{ws} = Water content of vent stream (% by volume)
C_j = Concentration of compound j in vent stream (ppmv)
E_{HAP} = Emission rate of total organic HAP (kg/hr)
E_{TOC} = Emission rate of TOC (minus methane and ethane) (kg/hr)
H_j = Net heat of combustion of compound j (kcal/g-mole)
H_T = Net heating value (MJ/cubic meter)
$L_{j,i}$ = Number of atoms of halogen i in compound j (g/g-mole)
$M_{j,i}$ = Molecular weight of halogen i in compound j (kg/kg-mole)
Mj,i = Molecular weight of compound j (g/g-mole)
T = Vent stream temperature (F)
Q_s = Vent stream flow (dry stnd cubic meter/mon)

Constants

K_1 1.74E-07 (g-mole/m3)(MJ/kcal)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)
K_2 2.49E-06 (kg-mole/m3)(min/hr)/ppm (from 40 CFR, Part 63, Subpart G, Section 115)

Input data

	MCB	Inerts (N2)	Chemical 3	Chemical 4	Chemical 5	
B_{ws}	0					%
C_j	8480					ppmv
H_j	711.2					kcal/mol
$L_{j,i}$	1					halogen atom(s)
$M_{j,i}$	35.45					g/g-mole
M_j	112.56					g/g-mole
T	10					C
Q_s	2.58					acfm
	0.0744					stnd m3/min (Group 2 CPV if <0.005 scm/min)

Mass emission rate of halogen atoms

$E_{halogen} = K_2 * Q_s * \sum \sum (C_j * L_{j,i} * M_{j,i})$
= 0.05567 kg/hr (non-halogenated vent stream based on Ehalogen <0.45 kg/hr)

Support calculations

$E_{HAP} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.17678 kg/hr
$E_{TOC} = K_2 * (\sum(C_j * M_j)) * Q_s$
= 0.17678 kg/hr

$H_T = K_1 * (\sum C_j * H_j) * (1 - B_{ws})$
= 1.04938 MJ/m3

Coefficients (from 40 CFR, Part 63, Subpart G, Table 1)

Case 1 = Flare (non-halogenated vent stream)
Case 2 = Thermal Incinerator, 0% heat recovery (non-halogenated vent stream)
Case 3 = Thermal Incinerator, 70% heat recovery (non-halogenated vent stream)
Case 4 = Thermal Incinerator and Scrubber (halogenated vent stream)

	Case 1	Case 2	Case 3	Case 4
a =	1.935	1.492	2.519	3.995
b =	3.66E-01	6.27E-02	1.18E-02	5.20E-02
c =	-7.69E-03	3.18E-02	1.30E-02	-1.77E-03
d =	-7.33E-04	-1.16E-03	4.79E-02	9.70E-04

TRE calculation

$TRE = (a + b * Q_s + c * H_T + d * E_{TOC})/E_{HAP}$

Case 1	Case 2	Case 3	Case 4
11.1	8.65	14.4	22.6

Choose lowest TRE value for non-halogenated vent system

8.65

	VOC [tpy]	E_{HAP} [kg/hr]	C_j ppmv	Notes
LE-114	0.957	0.099		
LE-208	0.349	0.036	12780	
LE-210	0.01	0.001	6103	
LE-309	1.734	0.180	9199	
LE-330	0.336	0.035	8630	
LE-405	0.133	0.014	3122	
LE-430	0.26	0.027	25633	
LE-467	1.038	0.107	6474	
LD-435	1.19	0.123		Makeup water tank,TRE not required
LE-680	4.947	0.512	3752	
LT-750	0.006789	0.001		WHB TRE not required
LF-1601	5.527	0.572		WWEQ tank, no TRE required
LE-448	1.136	0.118	5057	
LE-477	1.09	0.113	6468	
LE-576	3.462	0.359	6431	
LE-679	3.343	0.346	5101	
LE-368	0.586	0.061	2911	(Previously known as LE-788)
LE-347	0.586	0.061	2921	New, same as LE-368
LE-488	1.136	0.118	6089	New, same as LE-448
LE-580	1.707	0.177	8480	New, same as LE-580

K_2 2.49E-06 (kg-mole/m3)(min/hr) (from 40 CFR, Part 63, Subpart G, Section 115)

C_j = EHAP/K2*QS*Mj

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Appendix J
Verian Process Flow Diagram[72]

Appendix K
Verian Emission Calculations[73]

Solvay Augusta - PGA Project Emissions Summary

Uncontrolled Emissions Summary		
Pollutant	**lbs/hr**	**tpy**
CO	3.76	16.46
VOC	26.68	116.84
PM	0.0032	0.0139
PM10	0.0032	0.0139
PM2.5	0.0032	0.0139

Controlled Emissions Summary		
Pollutant	**lbs/hr**	**tpy**
CO	3.76	16.46
VOC	0.0534	0.2337
PM	0.0032	0.0139
PM10	0.0032	0.0139
PM2.5	0.0032	0.0139

PSD Summary Table			
	Emissions (tpy)		
Pollutant	**Current PTE**	**Increase**	**PTE**
CO	89.60	16.46	<100
VOC	<100	0.23	<100
PM	79.50	0.01	79.51
PM10	32.40	0.01	32.41
PM2.5	32.40	0.01	32.41

Site-wide limits of <100 tpy requested for CO; VOC limit already in place.

Solvay Augusta - PGA CO Emissions

CO Emissions Estimates	
CO (lbs/hr)	3.76
CO (short tons per year)	16.46

Divided by 3 since only one line

Solvay Augusta - PGA VOC Emissions

VOC Emissions	
lbs/hr (uncontrolled)	26.68
tpy (uncontrolled)	116.84
% Control Effciency (scrubber)	99.8%
lbs/hr (controlled)	0.053
tpy (controlled)	0.234

[1]Based on 10,000 mT production rate and 8760 hr/yr operation.

Solvay Augusta - PGA PM Emissions

Maximum		mT/yr
Process Rate		tons/hr
Batch Size		lbs/batch
Batch Time		hrs/batch

Emission Source	Pollutant	Emissions		
		Emission Factor[1] (lbs PM/ton)	lbs/hr	tpy
JME-302	PM	0.0036	0.002	0.007
	PM_{10}[2]	NA	0.002	0.007
	$PM_{2.5}$[2]	NA	0.002	0.007

[1]Pellet transfer to storage, with wet scrubber. AP-42, Table 11.23-

[2]No factors available for PM_{10} and $PM_{2.5}$, so assume PM = PM_{10} = $PM_{2.5}$

Emissions per Batch

	Emission Factor[1] (lbs PlvUton)	lbs/batch	tons/batch
PM	0.0036	0.014	7.20E-06
PM10[2]	ND	0.014	7.20E-06
$PM_{2.5}$[2]	ND	0.014	7.20E-06

[1]Pellet transfer to storage, with wet scrubber. AP-42, Table 11.23-

[2]No factors available for PM_{10} and $PM_{2.5}$, so assume PM = PM_{10} = $PM_{2.5}$

Emissions per Batch

	Emission Factor[1] (lbs PlvUton)	lbs/batch	tons/batch
PM	0.0036	0.030	1.5 1E-05
PM_{10}[2]	ND	0.030	1.5 1E-05
$PM_{2.5}$[2]	ND	0.030	1.5 1E-05

[1]Pellet transfer to storage, with wet scrubber. AP-42, Table 11.23-

[2]No factors available for PM_{10} and $PM_{2.5}$, so assume PM = PM_{10} = $PM_{2.5}$

kta	=	kilotons per annum	
1 kt	=	2000000	lbs
1 kt	=	1000	ton

		Emission Factor[3]	PM/PM10/PM2.5 Emissions	
Emission Source	**CFM**	**gr/cf**	**lb/hr**	**tpy**
JME-306	11.27	0.01	0.0010	0.0042
JH-306	7.12	0.01	0.0006	0.0027
JH-402A/B, JD-402	1.00	0.01	0.0001	0.0004

[3]Air Pollution Control Technology Fact Sheet: EPA-452/F-03-025

	Total PM Emissions	
Pollutant	**lb/hr**	**tpy**
PM	0.0032	0.0139
PM_{10}	0.0032	0.0139
$PM_{2.5}$	0.0032	0.0139

Xydar Emissions

PM 1.69 tpy @ 20000000 lb/yr

Xydar is only a source of VOC. The permitted PTE factor is 0.188 lb/hr for one line

Two lines could operate, thus emissions = 0.38 lb/hr

1.65 tpy

Solvay Augusta Facility-Xydar Combustion Sources
Boiler and Hot Oil Heaters

Hot Oil Heater#1	13	MMBtu/hr
Hot Oil Heater#2	13	MMBtu/hr

Hot Oil Heater#1 NG Usage

Hot Oil Heater	13,000,000	Btu/hr
	1021	Btu/scf
	12733	scf/hr

Pollutant	Emission Factor* (lb/10^6 scf)	Emission lb/hr	Emission tpy
CO_2	120,000	3055.83	13384.525
CH_4	2	0.06	0.257
N_2O (Uncontrolled)	2.2	0.06	0.245
N_2O(Controlled low-NOx Burner)	0.64	0.02	0.071
PM (total)	7.6	0.19	0.848
PM(condensible)	7.6	0.19	0.848
PM (filterable)	7.6	0.19	0.848
SO_2	0.6	0.02	0.067
TOC	11	0.28	1.227
Methane	2.3	0.06	0.257
VOC	5.5	0.14	0.613
NO_X (Small Boiler-Uncontrolled)	100	2.55	11.15
CO	84	2.14	9.369

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

Hot Oil Heater#2 NG Usage

Hot Oil Heater	13,000,000	Btu/hr
	1021	Btu/scf
	12733	scf/hr

Pollutant	Emission Factor* (lb/10^6 scf)	Emission lb/hr	Emission tpy
CO_2	120,000	3055.83	13384.525
CO_2 (from Uncontrolled VOC emissions)	2	0.05	0.223
CO_2 (from Controlled VOC emissions)	2.2	0.06	0.245
CH_4	2	0.06	0.257
Lead	0.0005	0.00	0.000
N_2O (Uncontrolled)	2.2	0.06	0.245
N_2O(Controlled low-NOx Burner)	0.64	0.02	0.071
PM (total)	7.6	0.19	0.848
PM(condensible)	7.6	0.19	0.848
PM (filterable)	7.6	0.19	0.848
SO_2	0.6	0.02	0.067
TOC	11	0.28	1.227
Methane	2.3	0.06	0.257
VOC	5.5	0.14	0.613
NO_X (Small Boiler-Uncontrolled)	100	2.55	11.15
CO	84	2.14	9.369

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

	PM	PM10	PM2.5	SO2	CO	NOX	VOC
Hot Oil Heater#1	0.19	0.19	0.19	0.015	2.139	2.55	0.140
Hot Oil Heater#2	0.19	0.19	0.19	0.015	2.139	2.55	0.140
Total	0.39	0.39	0.39	0.03	4.28	5.09	0.28

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC
Hot Oil Heater#1	0.85	0.85	0.85	0.07	9.37	11.15	0.61
Hot Oil Heater#2	0.85	0.85	0.85	0.07	9.37	11.15	0.61
Total	1.70	1.70	1.70	0.13	18.74	22.31	1.23

Appendix L
PUSH Process Flow Diagram[74]

Appendix M
PUSH Emission Calculations[75]

CRITERIA POLLUTANT	Uncontrolled (lb/hr)	Uncontrolled (tpy)	Controlled (lb/hr)	Controlled (tpy)
Carbon Monoxide (CO)	0	0	0	0
Nitrogen Oxides (NOx)	0	0	0	0
Particulate Matter (PM) (filterable only)	6.70	29.34	6.73E-02	0.29
PM <10 microns (PM_{10})	6.70	29	6.73E-02	0.29
PM <2.5 microns ($PM_{2.5}$)	6.70	29	6.73E-02	0.29
Sulfur Dioxide (SO_2)	0	0	0	0
Volatile Organic Compounds (VOC)[1]	176.1	771.5	2.43	10.7
HCl	2.70	11.8	0.027	0.118
Ni Compound	0.42	1.84	0.004	0.018
Benzene	0.236	1.03	0.002	0.010
Chlorobenzene (MCB)	1.57E-02	6.86E-02	1.57E-04	6.86E-04
Methanol	119.8	524.8	1.71	7.48
Total Hazardous Air Pollutants (HAPs)	123.2	539.5	1.74	7.63

[1]Includes ethanol emissions

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HAP	Uncontrolled (lb/hr)	Uncontrolled (tpy)	Controlled (lb/hr)	Controlled (tpy)
HCl	2.700	11.826	0.027	0.118
Ni Compound	0.420	1.840	0.004	0.018
Benzene	0.236	1.034	0.002	0.010
Chlorobenzene (MCB)	1.57E-02	6.86E-02	1.57E-04	6.86E-04
Methanol	119.81	524.77	1.71	7.48
Total Hazardous Air Pollutants (HAPs)	123.2	539.5	1.74	7.63

Solvay- PUSH Uncontrolled Emissions

	Pollutant (lbs/hr)							
Stack ID	**VOC**	**PM**	**NiCl2-TPP (HAP)**	**HCl (HAP)**	**Benzene (HAP)**	**MCB (HAP)**	**Sulfuric Acid (TAP)**	**Methanol (HAP)**
FS1	6.00E-04	0	0	0	0	0		0
FS2	1.32E+01	0	0	0	0	0		0
FS6	4.20E+01	0	0	2.7	0.233	1.56E-02		5.1
FS7	0	0	0	0	0	0		0
FS8	1.20E+02	0	0	0	0	0	9.47E-16	114.3
FS9	4.85E-01	0	0	0	0.003	5.20E-05		0.4
FH1	0	1.76E+00	0	0	0	0		0
FH2	0	3.00E-03	0	0	0	0		0
FH3	0	1.65E+00	0	0	0	0		0
FH4	0	1.28E+00	0	0	0	0		0
FH5	0	1.70E+00	0.42	0	0	0		0
FH6	0	2.70E-01	0	0	0	0		0
FH7	6.25E-02	1.80E-02	0	0	0	0		0
FH8	6.25E-02	1.80E-02	0	0	0	0		0
Total (lbs/hr)	176.14	6.70	0.42	2.70	0.236	1.57E-02	9.47E-16	119.81

	Pollutant (tpy)							
Stack ID	**VOC**	**PM**	**NiCl2-TPP (PM.HAP)**	**HCl (HAP)**	**Benzene (HAP)**	**MCB (HAP)**	**Sulfuric Acid (TAP)**	**Methanol (HAP)**
FS1	0.003	0	0	0	0	0		0
FS2	57.835	0	0	0	0	0		0
FS6	183.998	0	0	11.826	1.021	0.068		22.3
FS7	0	0	0	0	0	0		0
FS8	526.997	0	0	0	0	0	4.15E-15	500.8
FS9	2.123	0	0	0	0.013	2.28E-04		1.666
FH1	0	7.709	0	0	0	0		0
FH2	0	0.013	0	0	0	0		0
FH3	0	7.227	0	0	0	0		0
FH4	0	5.606	0	0	0	0		0
FH5	0	7.446	1.840	0	0	0		0
FH6	0	1.183	0	0	0	0		0
FH7	0.274	0.079	0	0	0	0		0
FH8	0.274	0.079	0	0	0	0		0
Total (tpy)	771.5	29.3	1.84	11.8	1.03	6.86E-02	4.15E-15	524.8

Solvay- PUSH Controlled Annual Emission

	Pollutant (lbs/hr)						
Stack ID	VOC	PM	NiCl2-TPP (HAP)	HCl (HAP)	Benzene (HAP)	MCB (HAP)	Methanol (HAP)
FS1	4.11E-05	0	0	0	0	0	0
FS2	1.10E-01	0	0	0	0	0	0
FS6	4.20E-01	0	0	2.70E-02	2.33E-03	1.56E-04	5.10E-02
FS7	0	0	0	0	0	0	0
FS8	1.77E+00	0	0	0	0	0	1.65
FS9	5.75E-03	0	0	0	3.00E-05	5.20E-07	3.80E-03
FH1	0	1.76E-02	0	0	0	0	0
FH2	0	3.00E-04	0	0	0	0	0
FH3	0	1.65E-02	0	0	0	0	0
FH4	0	1.28E-02	0	0	0	0	0
FH5	0	1.70E-02	0.004	0	0	0	0
FH6	0	2.70E-03	0	0	0	0	0
FH7	6.25E-02	1.80E-04	0	0	0	0	0
FH8	6.25E-02	1.80E-04	0	0	0	0	0
Total (lbs/hr)	2.43	6.73E-02	0.004	0.027	0.002	1.57E-04	1.71

	Pollutant (tpy)						
Stack ID	VOC	PM	NiCl2-TPP (HAP)	HCl (HAP)	Benzene (HAP)	MCB (HAP)	Methanol (HAP)
FS1	1.80E-04	0	0	0	0	0	0
FS2	4.82E-01	0	0	0	0	0	0
FS6	1.84E+00	0	0	1.18E-01	1.02E-02	6.83E-04	2.23E-01
FS7	0	0	0	0	0	0	0
FS8	7.76E+00	0	0	0	0	0	7.24
FS9	2.52E-02	0	0	0	1.31E-04	2.28E-06	1.67E-02
FH1	0	7.71E-02	0	0	0	0	0
FH2	0	1.31E-03	0	0	0	0	0
FH3	0	7.23E-02	0	0	0	0	0
FH4	0	5.61E-02	0	0	0	0	0
FH5	0	7.45E-02	1.84E-02	0	0	0	0
FH6	0	1.18E-02	0	0	0	0	0
FH7	2.74E-01	7.88E-04	0	0	0	0	0
FH8	2.74E-01	7.88E-04	0	0	0	0	0
Total (tpy)	10.7	0.29	0.018	0.118	0.010	6.86E-04	7.48

Appendix N
Project Sarsaparilla Process Flow Diagrams[76]

Appendix O
Project Sarsaparilla Emission Calculations[77]

Sarsaparilla

Emission Factors (lb/MMSCF)

PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
7.6	7.6	7.6	0.6	40	32	5.5		0.0005

Furnaces:

Boiler:

Emissions lb/hr

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
Process	3.89	3.89	3.89	2.22	0.74	1.92	6.29		
Furnaces	0.17	0.17	0.17	0.01	0.90	0.72	0.12	0.00	0.00
Boiler	1.42	1.42	1.42	50.46	3.55	14.21	0.54	0.00	0.00
Total	5.48	5.48	5.48	52.69	5.19	16.86	6.95	0.00	0.00

Emissions (tpy)

	PM	PM10	PM2.5	SO2	CO	NOX	VOC	SAM	LEAD
Process	17.02	17.02	17.02	9.72	3.24	8.42	33.08	0.00	0.00
Furnaces	0.75	0.75	0.75	0.06	3.94	3.15	0.54	0.00	0.00
Boiler	3.76	3.76	3.76	18.42	4.29	19.87	2.40	0.00	0.00
Total	24.00	24.00	24.00	230.79	22.75	73.83	30.46	0.00	0.00

Sarsaparilla Process Emissions

			Emissions	
Pollutant	**EU limit**		**lb/yr**	**tpy**
PM	5	[mg/Nm3]	323.9	0.16
TVOC	20	[mg/Nm3]	1295.7	0.65
NOx	130	[mg/Nm3]	8422.1	4.21
CO	50	[mg/Nm3]	3239.3	1.62
CH4	50	[mg/Nm3]	3239.3	1.62
HCl	10.0	[mg/Nm3]	647.9	0.32
HF	1.0	[mg/Nm3]	64.8	0.03
SO2	150	[mg/Nm3]	9717.9	4.86
Dioxins	0.05	[ng-TEQ/Nm3]	3.24E-06	0.00
Cl2	2.0	[mg/Nm3]	129.6	0.06
F2	1.0	[mg/Nm3]	64.8	0.03

Source	Pollutant	Waste Gas Flowrate [Nm3/h]	Concentration [mg/Nm3]	Pollutant lb/hr	Pollutant lb/yr	Pollutant tpy
Slurry Washing Waste Gas	PM	6264	0	0.00	0.00	0.00
	X4	6264	2	0.03	241.95	0.12
	COMO3	6264	2	0.03	241.95	0.12
	VOC	6264	47.1	0.65	5,697.85	2.85
Drying Waste Gas	PM	64380	20	2.84	24,866.79	12.43
	X4	64380	35	4.97	43,516.88	21.76
	COMO3	64380	5	0.71	6,216.70	3.11
	VOC	64380	27.6	3.92	34,316.17	17.16
Powder Storage (Silo) vents	PM	9452	20	0.42	3,650.84	1.83
Packaging Silo Vents	PM	3105	20	0.14	1,199.31	0.60
Process suction vent	PM	685	20	0.03	264.58	0.13
Packaging Dedusting vent	PM	7215	20	0.32	2,786.80	1.39
SA Charging Vent	PM	1200	5	0.01	115.88	0.06
Vacuum cleaning vent	PM	1324	20	0.06	511.40	0.26
Scrubber waste gas	COMO3	1200	20	0.05	463.50	0.23
	COMO6	1200	20	0.05	463.50	0.23
	VOC	1200	30.4	0.08	704.52	0.35
Fugitive Emissions	VOC	N/A	N/A	1.35	11,826.00	5.91

Furnace Emissions from Combustion of Natural Gas Only (indirect fired units):

Emission Factors (lb/MMSCF)

	PM/PM10/	SO2	CO	NOX	VOC
	7.6	0.6	40	32	5.5

Furnaces: 375 scfm ng

Emissions lb/hr

	PM/PM10/	SO2	CO	NOX	VOC
Furnaces	0.17	0.01	0.90	0.72	0.12

Total Fugitive Emissions

Pollutant	Potential Fugitive Emissions	
	lb/hr	tpy
VOC	1.35	5.93
COMO3	0.34	1.47
X4	0.08	0.33
HCl	0.20	0.86
Ethylene Glycol	0.14	0.62
Total HAPs	0.75	3.28

VOC Fugitive Emissions

Emission Unit ID	
Stack ID	N/A
Emission Unit Description	Fugitive Emissions
Control Device IDs	N/A
Control Device Description	N/A

Percent of Equipment Assumed Leaking	2%
Leaking Equipment Screening Value	2000 ppm

Equipment Type[1]	Total Equipment Count		Leaking Equipment Count[2]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	2	2	1	1
Connectors	3,240	3,240	65	65
Open-ended Lines	152	152	4	4
Pumps	-	-	-	-
Valves	1,998	1,998	40	40
Sampling connections	22	22	1	1
Pressure relief valves	25	25	1	1

Equipment Type	Non-Leaking EF (kg/hr/component) [3]		Leaking EF (kg/hr/component) [4]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Connectors	6.10E-07	6.10E-07	2.55E-03	2.55E-03
Open-ended Lines	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pumps		7.50E-06		9.97E-03
Valves	6.60E-07	4.90E-07	1.42E-03	2.74E-03
Sampling connections	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pressure relief valves	6.10E-07	6.10E-07	3.90E-03	3.90E-03

Non-Leaking Equipment Emissions				
Equipment Type	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	8.27E-06	8.27E-06	3.62E-05	3.62E-05
Connectors	4.27E-03	4.27E-03	1.87E-02	1.87E-02
Open-ended Lines	2.44E-03	2.44E-03	1.07E-02	1.07E-02
Pumps	-	-	-	-
Valves	2.85E-03	2.12E-03	1.25E-02	9.27E-03
Sampling connections	3.47E-04	3.47E-04	1.52E-03	1.52E-03
Pressure relief valves	3.16E-05	3.16E-05	1.38E-04	1.38E-04
Total PTE	**0.02**		**0.08**	

Leaking Equipment Emissions				
Equipment Type	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Connectors	3.65E-01	3.65E-01	1.60E+00	1.60E+00
Open-ended Lines	8.80E-02	8.80E-02	3.85E-01	3.85E-01
Pumps	-	-	-	-
Valves	1.26E-01	2.42E-01	5.50E-01	1.06E+00
Sampling connections	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pressure relief valves	8.60E-03	8.60E-03	3.77E-02	3.77E-02
Total PTE	**1.33**		**5.84**	

Notes:

1. All agitators are assumed seal-less.
2. Assume 2% of equipment leaking.
3. Emissions Factors from Table 2-11, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.
4. Emissions Factors from Table 2-9, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.

COMO3 Fugitive Emissions

Emission Unit ID	
Stack ID	N/A
Emission Unit Description	Fugitive Emissions
Control Device IDs	N/A
Control Device Description	N/A

Percent of Equipment Assumed Leaking	2%	
Leaking Equipment Screening Value	2000	ppm

Equipment Type[1]	Total Equipment Count		Leaking Equipment Count[2]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	660	660	14	14
Open-ended Lines	31	31	1	1
Pumps	-	-	-	-
Valves	407	407	9	9
Sampling connections	5	5	1	1
Pressure relief valves	5	5	1	1

Equipment Type	Non-Leaking EF (kg/hr/component) [3]		Leaking EF (kg/hr/component) [4]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Connectors	6.10E-07	6.10E-07	2.55E-03	2.55E-03
Open-ended Lines	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pumps		7.50E-06		9.97E-03
Valves	6.60E-07	4.90E-07	1.42E-03	2.74E-03
Sampling connections	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pressure relief valves	6.10E-07	6.10E-07	9.54E-04	9.54E-04

Equipment Type	Non-Leaking Equipment Emissions			
	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	8.69E-04	8.69E-04	3.81E-03	3.81E-03
Open-ended Lines	4.96E-04	4.96E-04	2.17E-03	2.17E-03
Pumps	-	-	-	-
Valves	5.79E-04	4.30E-04	2.54E-03	1.88E-03
Sampling connections	5.79E-05	5.79E-05	2.54E-04	2.54E-04
Pressure relief valves	5.38E-06	5.38E-06	2.36E-05	2.36E-05
Total PTE	**3.87E-03**		**0.02**	

Equipment Type	Leaking Equipment Emissions			
	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	7.86E-02	7.86E-02	3.44E-01	3.44E-01
Open-ended Lines	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pumps	-	-	-	-
Valves	2.83E-02	5.44E-02	1.24E-01	2.38E-01
Sampling connections	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pressure relief valves	2.10E-03	2.10E-03	9.21E-03	9.21E-03
Total PTE	**0.33**		**1.45**	

Notes:

1. All agitators are assumed seal-less.
2. Assume 2% of equipment leaking.
3. Emissions Factors from Table 2-11, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.
4. Emissions Factors from Table 2-9, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.

X4 Fugitive Emissions

Emission Unit ID	
Stack ID	N/A
Emission Unit Description	Fugitive Emissions
Control Device IDs	N/A
Control Device Description	N/A

Percent of Equipment Assumed Leaking	2%
Leaking Equipment Screening Value	2000 ppm

Equipment Type[1]	Total Equipment Count		Leaking Equipment Count[2]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	60	60	2	2
Open-ended Lines	3	3	1	1
Pumps	-	-	-	-
Valves	37	37	1	1
Sampling connections	1	1	-	-
Pressure relief valves	1	1	-	-

Equipment Type	Non-Leaking EF (kg/hr/component) [3]		Leaking EF (kg/hr/component) [4]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Connectors	6.10E-07	6.10E-07	2.55E-03	2.55E-03
Open-ended Lines	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pumps		7.50E-06		9.97E-03
Valves	6.60E-07	4.90E-07	1.42E-03	2.74E-03
Sampling connections	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pressure relief valves	6.10E-07	6.10E-07	1.14E-04	1.14E-04

Equipment Type	Non-Leaking Equipment Emissions			
	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	7.80E-05	7.80E-05	3.42E-04	3.42E-04
Open-ended Lines	3.31E-05	3.31E-05	1.45E-04	1.45E-04
Pumps	-	-	-	-
Valves	5.24E-05	3.89E-05	2.29E-04	1.70E-04
Sampling connections	8.27E-06	8.27E-06	3.62E-05	3.62E-05
Pressure relief valves	6.73E-07	6.73E-07	2.95E-06	2.95E-06
Total PTE	**3.31E-04**		**1.45E-03**	

Equipment Type	Leaking Equipment Emissions			
	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	1.12E-02	1.12E-02	4.92E-02	4.92E-02
Open-ended Lines	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pumps	-	-	-	-
Valves	3.14E-03	6.04E-03	1.38E-02	2.65E-02
Sampling connections	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pressure relief valves	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total PTE	**0.08**		**0.33**	

Notes:

1. All agitators are assumed seal-less.
2. Assume 2% of equipment leaking.
3. Emissions Factors from Table 2-11, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.
4. Emissions Factors from Table 2-9, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.

HCl Fugitive Emissions

Emission Unit ID	
Stack ID	N/A
Emission Unit Description	Fugitive Emissions
Control Device IDs	N/A
Control Device Description	N/A

Percent of Equipment Assumed Leaking	2%
Leaking Equipment Screening Value	2000 ppm

Equipment Type[1]	Total Equipment Count		Leaking Equipment Count[2]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	300	300	6	6
Open-ended Lines	14	14	1	1
Pumps	-	-	-	-
Valves	185	185	4	4
Sampling connections	2	2	1	1
Pressure relief valves	3	3	1	1

Equipment Type	Non-Leaking EF (kg/hr/component) [3]		Leaking EF (kg/hr/component) [4]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Connectors	6.10E-07	6.10E-07	2.55E-03	2.55E-03
Open-ended Lines	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pumps		7.50E-06		9.97E-03
Valves	6.60E-07	4.90E-07	1.42E-03	2.74E-03
Sampling connections	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pressure relief valves	6.10E-07	6.10E-07	4.75E-04	4.75E-04

Non-Leaking Equipment Emissions				
Equipment Type	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	3.95E-04	3.95E-04	1.73E-03	1.73E-03
Open-ended Lines	2.15E-04	2.15E-04	9.42E-04	9.42E-04
Pumps	-	-	-	-
Valves	2.63E-04	1.96E-04	1.15E-03	8.57E-04
Sampling connections	1.65E-05	1.65E-05	7.24E-05	7.24E-05
Pressure relief valves	2.02E-06	2.02E-06	8.84E-06	8.84E-06
Total PTE	**1.72E-03**		**7.52E-03**	

Leaking Equipment Emissions				
Equipment Type	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	3.37E-02	3.37E-02	1.47E-01	1.47E-01
Open-ended Lines	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pumps	-	-	-	-
Valves	1.26E-02	2.42E-02	5.50E-02	1.06E-01
Sampling connections	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pressure relief valves	1.05E-03	1.05E-03	4.59E-03	4.59E-03
Total PTE	**0.19**		**0.85**	

Notes:

1. All agitators are assumed seal-less.
2. Assume 2% of equipment leaking.
3. Emissions Factors from Table 2-11, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.
4. Emissions Factors from Table 2-9, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.

Ethylene Glycol Fugitive Emissions

Emission Unit ID	
Stack ID	N/A
Emission Unit Description	Fugitive Emissions
Control Device IDs	N/A
Control Device Description	N/A

Percent of Equipment Assumed Leaking	2%
Leaking Equipment Screening Value	2000 ppm

Equipment Type[1]	Total Equipment Count		Leaking Equipment Count[2]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	120	120	3	3
Open-ended Lines	6	6	1	1
Pumps	-	-	-	-
Valves	74	74	2	2
Sampling connections	1	1	1	1
Pressure relief valves	1	1	1	1

Equipment Type	Non-Leaking EF (kg/hr/component) [3]		Leaking EF (kg/hr/component) [4]	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Connectors	6.10E-07	6.10E-07	2.55E-03	2.55E-03
Open-ended Lines	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pumps		7.50E-06		9.97E-03
Valves	6.60E-07	4.90E-07	1.42E-03	2.74E-03
Sampling connections	7.50E-06	7.50E-06	9.97E-03	9.97E-03
Pressure relief valves	6.10E-07	6.10E-07	2.11E-04	2.11E-04

Non-Leaking Equipment Emissions				
Equipment Type	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	1.57E-04	1.57E-04	6.89E-04	6.89E-04
Open-ended Lines	8.27E-05	8.27E-05	3.62E-04	3.62E-04
Pumps	-	-	-	-
Valves	1.05E-04	7.78E-05	4.59E-04	3.41E-04
Sampling connections	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Pressure relief valves	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total PTE	**6.63E-04**		**2.90E-03**	

Leaking Equipment Emissions				
Equipment Type	PTE (lb/hr)		PTE (tpy)	
	Gas	Light Liquid	Gas	Light Liquid
Compressors	-	-	-	-
Connectors	1.68E-02	1.68E-02	7.37E-02	7.37E-02
Open-ended Lines	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pumps	-	-	-	-
Valves	6.28E-03	1.21E-02	2.75E-02	5.29E-02
Sampling connections	2.20E-02	2.20E-02	9.63E-02	9.63E-02
Pressure relief valves	4.65E-04	4.65E-04	2.04E-03	2.04E-03
Total PTE	**0.14**		**0.62**	

Notes:

1. All agitators are assumed seal-less.
2. Assume 2% of equipment leaking.
3. Emissions Factors from Table 2-11, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.
4. Emissions Factors from Table 2-9, EPA-453/R-95-017, "Protocol for Equipment Leak Emission Estimates", November 1995. Since there is no specific rate given for sample lines, compressor seals, and OELs, the light liquid pump rate is assumed.

Vendor Package Number	Equipment Tag									
	HG-45X									
	HG45X									
	HA-450									
HM-474	HA-474									
	HG-413									
	HG-423									
	HG-433									
	HG-443									
	HG-450									
	HG-452									
	HG-453									
	HG-460									
	HG-461									
	HG-485									
HM-201	HG-201A									
HM-201	HG-201B									
HM-1610	HG-1636									
	HG-1811A									
	HG-1811B									
	HG-913A									
	HG-913B									

Vendor Package Number	Equipment Tag									
HM-203	HC-203									
	HA-460									
HM-510	HA-510									
HM-514	HA-514									
HM-520	HA-520									
HM-524	HA-524									
HM-530	HA-530									
HM-534	HA-534									
HM-540	HA-540									
HM-544	HA-544									
HM-560	HA-550									
HM-564	HA-554									
HM-550	HA-550									
HM-554	HA-554									
HM-505	HC-515									
HM-505	HC-525									
HM-505	HC-535									
HM-508	HC-545									
HM-508	HC-565									
HM-508	HC-555									
	HC-875A									
	HG-401									
	HG-415									
	HG-425									
	HG-435									
	HG-445									
	HG-455									
	HG-474									
	HG-475									
	HG-478									
HM-505	HG-505A									
HM-505	HG-505B									
HM-508	HG-516A									
HM-508	HG-516B									
	HG-830A									
	HG-830B									
	HG-832									
	HG-852									
	HG-870A									
	HG-870B									
	HG-876									
	HG-880A									
	HG-880B									
	HG-885									
	HG-1862A									
	HG-1862B									
	HA-1819									
	HA-1820									
	HA-1821									
	HA-1822									
HM-909	HM-909									
	HG-102A									
	HG-102B									
	HG-114A									
	HG-114B									
	HG-152A									
	HG-152B									
	HG-1542									
	HG-1543									
	HG-1802									

Solvay Augusta Facility-Sarsaprilla Boiler

Boiler, Existing	99.5	MMBtu/hr

Boiler NG Usage

Boiler	99,500,000	Btu/hr
	1021	Btu/scf
	97453	scf/hr

Pollutant	Emission Factor*	Emission	Emission
	(lb/10^6 scf)	lb/hr	tpy
CO_2	120,000	11694	51222
CH_4	2	0.22	0.982
Lead	0.0005	0.00	0.000
N_2O (Uncontrolled)	2.2	0.21	0.939
N_2O(Controlled low-NO_X Burner)	0.64	0.06	0.273
PM (total)	7.6	0.74	3.244
PM(condensible)	7.6	0.74	3.244
PM (filterable)	7.6	0.74	3.244
SO_2	0.6	0.06	0.256
TOC	11	1.07	4.695
Methane	2.3	0.22	0.982
VOC	5.5	0.54	2.348
NO_X (Small Boiler-low nox)	34.6	3.37	14.76
CO	7.0	0.69	3.0

* Emissions factors are derived from AP-42 Chapter 1.4, Tables 1.4-1 and 1.4-2.

Boiler Fuel Oil Usage

Boiler (Btu/hr)	99,500,000
Boiler (gal/hr)	711

Max hours per year 720

POLLUTANT	FACTOR (lb/1000 gal)	EMISSIONS (lb/hr)	EMISSIONS (tpy)
CO_2	22,300	15849	5705.61
N_2O	0.26	0.2	0.07
PM	2	1.4	0.51
SO_2	71	50.5	18.17
TOC	0.252	0.18	0.06
CH_4	0.052	0.04	0.01
VOC	0.2	0.1	0.05
NO_X	20	14.2	5.12
CO	5	3.6	1.28

The following AP-42 emissions factors represent the emissions from this process:

	PM (kg/1000 kg)		
	filterable	condensable	total
Cement unloading to elevated storage silo (pneumatic)1	--	--	0.0005
Atmospheric hydrator with wet scrubber2	0.033	0.0067	0.0397

1 Table 11.17-1 (Metric Units).
2 TABLE 11.12-1 (METRIC UNITS)

Emissions of PM

Cement unloading to elevated storage silo (pneumatic)	0.0018	lb/hr		
Atmospheric hydrator with wet scrubber	0.1423	lb/hr		
total	0.1441	lb/hr	0.63	tpy

Sarsaparilla Alternate Operating Scenario

The total flow rate of these compounds will be up to	100	kg/hr
Annual estimated maximum venting will be up to	50	hr/yr
Total Annual emissions:	11,023.10	lb/yr
	5.51	tpy

Appendix P
Pertinent Applicability Determinations for New Source Performance Standards[78]

U.S. Environmental Protection Agency
Applicability Determination Index

Control Number: 9700112

Category: NSPS
EPA Office: Region 3
Date: 06/19/1997
Title: Pharmaceutical Solvent Recovery
Recipient: Tarantino, Brian
Author: Maslany, Thomas

Subparts: Part 60, III, SOCMI Air Oxidation Units
Part 60, NNN, SOCMI Distillation Operations
Part 60, RRR, VOC Emissions from SOCMI Reactor Processes
Part 60, VV, SOCMI Equipment Leaks

References: 60.489

Abstract:

Q: Are Merck & Co., Inc.'s pharmaceutical solvent distillation facilities subject to the Synthetic Organic Chemicals Manufacturing Industry (SOCMI) NSPS (Subparts VV, III, NNN, RRR)?

A: No. Solvent recovery operations do not "produce" chemicals, and would thus not be subject to the referenced SOCMI NSPS Subparts, so long as Merck continues to operate these processes as outlined in its letter.

Letter:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107-4431

June 19, 1997

Mr. Brian J. Tarantino, P.E.
Merck & Co., Inc.
One Merck Drive
P.O. Box 100
Whitehouse Station, NJ 08889-0100

Re: Applicability of New Source Performance Standards (NSPS) for the Synthetic Organic Chemicals Manufacturing Industry (SOCMI)

Dear Mr. Tarantino:

This letter is in response to your January 10, 1997 letter to Ms. Robin Moran of my staff and Mr. David Beck of the Office of Air Quality Planning and Standards, regarding the applicability of the SOCMI NSPS. In your letter, you requested the U.S. Environmental Protection Agency's (EPA) written concurrence that Merck's solvent distillation facilities are not subject to the SOCMI NSPS (40 CFR 60, Subparts VV, III, NNN, and RRR), provided that they are operated as described in your letter.

The four NSPS referenced above regulate the following types of SOCMI operations: 1) Subpart VV - equipment leaks; 2) Subpart III - air oxidation processes; 3) Subpart NNN - distillation operations; 4) Subpart RRR - reactor processes. Generally, Subparts III, NNN, and RRR apply to each affected facility (as defined in the respective Subpart) that "produces" any of the listed chemicals (as defined in the respective Subparts) as a product, co-product, by-product, or intermediate. Subpart VV, written in a similar fashion, states that the provisions apply to affected facilities in the synthetic organic chemicals manufacturing industry, and the term "synthetic organic chemicals manufacturing industry" is defined as "the industry that produces, as intermediates or final products, one or more of the chemicals listed in 40 CFR 60.489."

From your letter, we understand that Merck purchases all of the solvent it uses and that Merck's solvent recovery operations do not "produce" solvents, but merely separate the solvents from complex mixtures for reuse. We further understand that the solvents in the waste stream for recovery are not chemically changed in the course of pharmaceutical processing, but rather are simply mixed with other solvents and impurities. Your letter also provided an illustrative example of a typical solvent recovery process to demonstrate that the solvents are not "produced".

Based on the description of Merck's processes contained in your letter, EPA concurs that the solvent recovery operations do not "produce" chemicals, and thus would not be subject to the SOCMI NSPS (Subparts VV, III, NNN, and RRR), provided that Merck continues to operate these processes in the manner described in your letter. I want to clarify, however, that EPA does not agree that Merck's operations are not subject to these NSPS on the basis that they are not considered part of the SOCMI industry (i.e., because Merck's batch chemical manufacturing activities fall under SIC Codes 2833 (medicinal chemicals and botanical products) and 2834 (pharmaceutical preparations, rather than the SOCMI industry). As described above, these NSPS Subparts apply to each affected facility that "produces" any of the listed chemicals (as defined in each Subpart). Again, EPA does agree that Merck's solvent recovery operations do not "produce" chemicals and, thus, are not subject to these NSPS on that basis.

Should you have any further questions on this determination, please contact Ms. Robin Moran at (215) 566-2064.

Sincerely,

Thomas J. Maslany, Director
Air, Radiation & Toxics Division

U.S. Environmental Protection Agency
Applicability Determination Index

Control Number: 9800007

Category: NSPS
EPA Office: Region 5
Date: 08/14/1997
Title: Subpart NNN -- Methanol Recovery Process
Recipient: Miller, Bradley
Author: Czerniak, George

Subparts: Part 60, NNN, SOCMI Distillation Operations

References: 60.660

Abstract:

Q: Does 40 CFR part 60 Subpart NNN apply to a methanol recovery process? A: Solvent recovery for SOCMI distillation operations are generally exempt if the distillation operation, which is used to recover and purify listed feedstock chemical, reuses the recovered and purified chemicals in the same distillation process unit to produce a non-listed SOCMI chemical. In this case, the methanol recovered replaces virgin methanol in a process unit instead of sending it through the sewer system. Therefore, the methanol recovery process is not subject to 40 CFR Part 60 Subpart NNN.

Letter:

August 14, 1997

Mr. Bradley Miller
Hamilton County Environmental Services
Air Quality Division
1632 Central Parkway
Cincinnati, Ohio 45210

Dear Mr. Miller:

This is in response to your February 25, 1997, letter addressed to William MacDowell, of my staff, regarding an applicability determination for Cincinnati Specialties located in Cincinnati, Ohio. The applicable rule in question is 40 CFR Part 60 Subpart NNN, Standards of Performance for Volatile Organic Compound (VOC) Emissions From Synthetic Organic Chemical Manufacturing Industry (SOCMI) Distillation Operations.

According to an October 5, 1990, applicability determination, solvent recovery for SOCMI distillation operations are generally exempt if the distillation operation, which is used to recover and purify listed feedstock chemicals, reuses the recovered and purified chemicals in the same distillation process unit to produce a non-listed SOCMI chemical. Conversely, solvent recovery is subject to the standard if the final product of the distillation operation is a listed chemical, if the final product is used in another process, or if it is sold. Cincinnati Specialties operates a methanol recovery process. The methanol recovered replaces virgin methanol in one of its process units instead of sending it through the sewer system.

After reviewing the regulation and the facility's operation, this office and the Office of Enforcement and Compliance Assurance at our headquarters have both determined that Cincinnati Specialties is not subject to 40 CFR Part 60 Subpart NNN. However, if modifications are made to the distillation operation, another review will be necessary to determine whether or not it is subject to 40 CFR Part 60 Subpart NNN.

If you should have any questions regarding this determination please call Margaret Sieffert, of my staff, at (312) 353-1151.

Sincerely yours,

George T. Czerniak, Chief
Air Enforcement and Compliance Assurance Branch