Response to EPA Information Request for C3 Petrochemicals LLC
Propane Dehydrogenation Plant - Chocolate Bayou Plant
Application for Greenhouse Gas Prevention of Significant Deterioration Permit

1. The process description should closely follow the process flow diagram that is provided and identify all emission points that emit GHG emissions or have the potential to emit. Also, include non-GHG sources, but please identify as such, if it is an integral part of process and feeds a GHG source. It is suggested that additional pages be created and provided to EPA to represent the process to avoid overcrowding and confusion. Please supplement the C3 Petrochemicals (C3P) propane dehydrogenation (PDH) plant process flow diagram with the following information:

   A. A representation of the two trains with four reactors in series along with the emission point identification numbers. Please include the charge heaters that are prior to the first reactors in series and the inter-heaters that are prior to the second, third and fourth reactors in series. On page 21 of the application, it is stated that ultra-low NOx burners and selective catalytic reduction (SCR) will be used on the charge heaters and the three inter-heaters on each reactor train. Please show the SCR add-on pollution control device to be used on the heater.

      C3P RESPONSE: A revised overall process flow diagram for the PDH process is included as Sheet 1 of the attachments. More detailed process flow diagrams for each reactor train are also attached. Sheet 3 provides the requested detail for reactors and heaters in Train 1. Sheet 4 provides this detail for the reactors and heaters in Train 2.

   B. The heat recovery that is mentioned throughout the process description should be shown on the process flow diagram. This includes, but is not limited to, after feed pre-treatment, propane feed is exchanged with hot reactor effluent to pre-heat the feed, the overhead product (propane) for the first and second depropanizer columns are cooled and routed to the separation section (coldbox) of the process, the cooled propane feed from the separation section is routed to the PDH reaction section where it is heated via the feed exchanger and then routed to the reactors.

      C3P RESPONSE: Process flow diagrams are included to provide additional detail regarding the heat recovery described in the PDH process description. This heat recovery is shown in the following: Sheet 2 (after feed pre-treatment), Sheet 6 (overhead product from depropanizer cooled and routed to the separation section), Sheets 3 and 4 (feed from the separation section routed to the PDH reaction section).

      i. Please provide the design or operating efficiency of the heat exchangers.

         C3P RESPONSE: The depropanizer feed preheaters are designed to recover 72% of the available heat from the compressed reactor effluent into the depropanizer feed stream (Sheet 2). The hot combined feed exchangers are designed to recover 85% of the available heat from the reactor 4 effluent stream (Sheets 3 and 4). It is difficult to quantify the overall efficiency of the cold box (Sheet 6), but the feed chiller and cold combined feed exchanger in the cold box use 100% of the available heat from the condensation of the *product liquid for vaporization of the propane feed and reheating of the product liquid and vapor streams and no additional energy is added to these exchangers.*

Heat integration is used throughout the PDH plant in order to avoid natural gas usage for additional fired heating. For the project, approximately 520 M Btu/hr of natural gas firing is saved in the heaters of each reactor train (1040 M Btu/hr total) as a result of heat recovery into the process through interchangers. An additional 1460 M Btu/hr of natural gas firing in boilers is avoided through the use of process heat exchange to replace steam consumption.

ii. What will be monitored and recorded to ensure the exchangers are operating according to design?

C3P RESPONSE: For each of the heat exchangers described above, temperature of the outlet stream will be continuously monitored to ensure that they are performing in accordance with the process design.

iii. Please provide the proposed compliance monitoring for these heat exchangers.

C3P RESPONSE: If the outlet temperature of any heat exchanger indicates that it is performing below design, opportunities to improve this performance will be evaluated and implemented during the next scheduled maintenance interval. Any decrease in efficiency will be reflected in higher steam demands for the PDH plant. Therefore, boiler fuel usage and steam output will be the most accurate methods for monitoring compliance.

C. On page 20 of the application in the "Feed Pretreatment" section, it is stated that before the propane enters the PDH reaction section of the unit, impurities and moisture are removed. Metals and sulfur compounds are removed via the use of guard beds. Moisture is removed from the propane feed via the use of feed driers and a small volume of waste water will be generated from the regeneration of the feed driers. Please update the process flow diagram to show this equipment and the waste water directed away from the drier.

C3P RESPONSE: Sheet 2 of the attached process flow diagrams provides the details of feed pretreatment, including the feed driers and waste water from these driers.

D. On page 20 of the application, it is stated that propane feedstock for the PDH plant will come from outside the battery limits (OSBL) of the Chocolate Bayou complex and will be stored in storage bullets. It is stated on page 23 of the application that there will be no routine venting from these vessels and each of the storage bullets will be equipped with a pressure safety valve (PSV) that will vent to the flare. Please update the process flow diagram to indicate these storage bullets. How many storage bullets will be installed? Please show on the process flow diagram the routing of the vents to the flare. Please indicate if the vents will be continuous, non-continuous, or only during MSS activities. Also, show the storage tanks on the process flow diagram that are discussed on page 23 of the permit application that will be used to store organic liquids used in the process (e.g., the heavy aromatic solvent tank and spent solvent tank). In addition, please show on the process flow diagram the storage tank that will used to store C5+ heavies from the depropanizer bottoms process. Please update the process flow diagram to show the venting to the unit flare.

C3P RESPONSE: Three OSBL propane storage bullets will be installed for the PDH plant. These will be equipped with PSVs that vent to the flare only during MSS or emergency events. These propane storage bullets and their vents to the flare are represented on Sheet 7 of the attached process flow diagrams. Sheet 7 also includes the heavy aromatic solvent tank, spent solvent tank, and C5+ heavies storage tank, with associated venting to the flare from each tank.

i. Since these tank vents are directed to the flare and the combustion of the tank vapors might generate GHG emissions, a BACT analysis should be developed for the tanks to be installed for the project. Please be sure to incorporate into the tank BACT analysis the factors that were considered when comparing internal (IFR) or external (EFR) floating roof, and fixed roof. Please provide any other additional information for the tanks, including whether the applicant chose to have the tanks painted white or another color of high refractive index to reduce vapor production.

   C3P RESPONSE: The propane storage bullets will not vent to the flare during routine operation, therefore, they do not contribute to the GHG emissions from the flare. VOC emissions from the fixed roof tanks storing heavy aromatic solvent, spent solvent, and C5+ heavies will vent to the flare during routine operation. The combustion of VOC emissions from fixed roof tanks will contribute to the total GHG emissions from the flare. Even though these fixed roof tanks do not directly emit GHG emissions, a five-step "top down" BACT analysis for these tanks is attached to this response.

E. On page 21 of the application in the "Heavies Removal" section, it is stated that the propane feed is routed to a series of two depropanizer columns and that overhead product (propane) is obtained from both columns. In the first depropanizer column, heavier components (primarily butane and heavier) are drawn off as bottom fraction (C4+ fraction). The second depropanizer column is subsequently utilized to separate butanes from heavier components. The butanes will be stripped in this second depropanizer column and sold as product. The bottoms from the second depropanizer column (C5+) are stored as liquids in a storage tank that is vented to the flare. These liquids are subsequently loaded into tank trucks and transported off-site. The process description given indicates that the overhead product from both depropanizer columns is propane. However, the process description indicates that butane will be stripped and obtained as product from the second depropanizer as well.

C3P RESPONSE: The design of the PDH plant has been modified since the permit application was submitted. This design now includes only one depropanizer column. The block flow diagram (Sheet 1) and the process description have been updated to reflect the change. A copy of each is attached to this response. C4 product will be recovered as a sidedraw from the single depropanizer column. The C5+ fraction is withdrawn from the column bottoms.

i. Will the C4 product be drawn from another tray in the second depropanizer? Currently, the process flow diagram shows both C4 product and C5+ coming from the bottom of the second depropanizer.

C3P RESPONSE: C4 product will be recovered as a sidedraw from a single depropanizer column.

ii. Will another column or stripper be used to separate the C4's from C5+'s? Please explain from where the C4 product will be obtained.

C3P RESPONSE: The depropanizer column will separate C4 as a sidedraw and C5+ as a bottoms product.

iii. Please update the process flow diagram and/or process description with this information, if applicable.

C3P RESPONSE: The block flow diagram (Sheet 1) and the process description have been updated to reflect the change to a single depropanizer column. A copy of each is attached.

iv. Also please provide supplemental information regarding the storage tank used for C5+ liquids (see previous Comment D (i)).

C3P RESPONSE: See the response to Comment D(i) above.

F. On page 21 of the permit application, it states that C5+ liquids are loaded into tank trucks. Also, on page 23 of the application it is stated that VOCs used in the process are received via tank truck and emissions are controlled by the PDH flare. Is this truck loading and unloading system new, modified, or affected (existing non-modified)? Will the vents from the operation of the system increase to the project? Please update the process flow diagram to show the truck loading and unloading system and vents directed to the flare.

C3P RESPONSE: All truck loading and unloading at the proposed PDH plant will be new systems. Sheet 7 of the process flow diagrams shows the truck loading, truck unloading, and vents directed to the flare.

i. Since the tank truck loading and unloading vents are directed to the flare and the combustion of the vapors might generate GHG emissions, a BACT analysis should be developed for the tank truck operation to be installed for the project.

C3P RESPONSE: The VOC materials loaded and unloaded do not contain GHGs, therefore, these activities will not directly result in GHG emissions. However, VOC emissions from these activities will be controlled by the flare, and combustion emissions will contribute to the total GHG emissions from the flare. Even though loading/unloading activities will not directly emit GHG emissions, a five-step "top down" BACT analysis for loading and unloading of VOCs is attached to this response.

ii. Can several trucks be loaded simultaneously? Please include the pollution controls that were evaluated for the reduction and/or minimization of GHG emissions during truck loading and the reasons for eliminating these controls from consideration.

C3P RESPONSE: C3P may have the ability to load more than one truck simultaneously, but this has not been confirmed by the detailed plant engineering at this time. A five-step "top down" BACT analysis for loading and unloading of VOCs is attached to this response.

iii. Will there be operating or work practice standards implemented to minimize GHG emissions generated during the truck loading operation? Please provide supplemental information that details these procedures.

C3P RESPONSE: C3P will develop operating procedures and work practices for the loading and unloading of tank trucks, however these procedures are not available at this time. At a minimum, these procedures will address TCEQ permit conditions for this loading and unloading. This includes visual inspection of loading lines and connectors for presence of any defect before hooking up the tank truck. Lines and/or connectors that are visibly damaged will be removed from service. Loading/unloading activities will cease immediately upon detection of any liquid leaking from lines or connectors.

G. Beginning on page 21 of the permit application of the "Continuous Catalyst Regeneration (CCR)" section, an explanation is provided for the CCR system. The application states that the four steps in catalyst regeneration involve the following: burning of coke, removal of excess moisture, and oxidation and dispersion of metal promoters. The coke burn step is a complete burn, leaving no VOCs or CO to be emitted to atmosphere. On page 45 of the permit application the BACT analysis for the CCR vents states that the vents will have small quantities of CO_2 and the proposed BACT for the CCR vents is the CCR design.

i. What is the proposed compliance strategy for this vent stream? How will it be monitored and recorded?

C3P RESPONSE: CO_2 emissions from the CCR regeneration tower will be a function of the amount of coke burned off the catalyst. To demonstrate compliance with the proposed emission rates, C3P will sample the catalyst and analyze for percent carbon using a proprietary laboratory procedure provided by the PDH technology vendor. Since the catalyst has a residence time of approximately 1 week before it reaches the regeneration tower, C3P proposed to conduct this laboratory analysis twice per week and record the results. The catalyst sample will be collected from Lift Engager #4 (see Sheet 5 of the attached process flow diagrams) as it reaches the regeneration tower. CO_2 emissions will then be calculated *based on the percent carbon measured on the catalyst multiplied by the catalyst recirculation rate.*

As stated in the permit application, the proprietary technology used by the C3P PDH plant minimizes the coke formation on the catalyst. Also, unlike some other PDH process technologies, the CCR section does not require steam-purging of the catalyst prior to regeneration, thus reducing the process consumption of steam.

i. Please provide supplemental benchmark data that compares the coke formation in the CCR section of other PDH technologies to the coke formation that is anticipated for the C3P project using the proposed technology.

C3P RESPONSE: C3P conducted a search and found that there is no credible data available in the public domain to compare the coke formation in the CCR section of the PDH plant proposed by C3P to the coke formation in facilities of comparable production capacity using other PDH process technologies.

ii. Please provide technical literature that supports the claims that lower coke formation will occur.

C3P RESPONSE: C3P conducted a patent search and other file search to identify any technical literature that would demonstrate that the proposed PDH plant will experience lower coke formation and found none in the public domain.

iii. Please provide the amount of energy consumption that will be saved due to the proposed CCR section not requiring steam-purging of catalyst prior to regeneration.

C3P RESPONSE: In the BACT section of the C3P permit application, it was stated that "the proprietary technology used by the C3P PDH plant minimizes the coke formation on the catalyst, providing for maximum heat transfer in the catalyst and minimizing emissions." This comment was intended to communicate that the plant proposed by C3P incorporates these features to minimize the coke deposition rate for the specific catalyst used. It was not intended to be a comparison to other catalysts used by other PDH technologies. Features included in the design of the C3P PDH plant to minimize coke formation are: the recycle of hydrogen to control reaction rates, removal of unsaturated molecules in the fractionation train in order to avoid their recycle and potential coke formation, and the continuous catalyst regeneration system which allows the reactor performance to remain stable and avoid high coke generation rates near the end of the cycle.

The BACT section of the permit application goes on to state that unlike "some other PDH process technologies, the CCR section does not require steam-purging of the catalyst prior to regeneration, thus reducing the process consumption of steam." This is true in that the CCR technology selected by C3P does not require steam-purging, therefore the CCR technology generates GHG emissions only by the process of burning coke. This assertion was intended to highlight the difference in the use of steam by one technology, as compared to the *technology selected by C3P. Since steam-purging is not used in the technology selected by C3P, the energy consumption savings cannot be formally quantified.*

H. Continuing on page 21 of the permit application, after the catalyst leaves the regeneration towers, it flows by gravity into a hopper where the nitrogen and oxygen atmosphere from the regeneration towers are purged from the catalyst and the atmosphere is changed to hydrogen. The catalyst then flows from the hopper to a lift engager, where high purity hydrogen is used to pneumatically lift the catalyst back to the top of reactor no. 1. It is unclear from the process description if the catalyst will only be used in reactor no. 1 in each train or in all four of the reactors in the train. The process description shows feed lines directed to and from reactor train 1 and 2. Please clarify.

C3P RESPONSE: The catalyst circulation and regeneration drawing (Sheet 5 of the attached process flow diagrams) shows the details of catalyst flow and regeneration. Each reactor train, consisting of 4 reactors operated in series, will have a dedicated regeneration tower. Catalyst regeneration is a continuous process. Catalyst is lifted with hydrogen from the bottom of the regeneration tower to the top of reactor 1. It flows by gravity down reactor 1 and is then lifted with process gas to reactor 2. Catalyst flows by gravity down reactor 2 and is lifted by process gas to reactor 3, where gravity flow leads to a lift with process gas to reactor 4. Catalyst is finally lifted to the regeneration tower after reactor 4. The entire cycle for catalyst takes approximately 1 week as the catalyst progresses through reactors 1-4 and ultimately to the regeneration tower.

i. Please provide supplemental information that explains the anticipated catalyst regeneration schedule and how reactor trains 1 and 2 will be operated. Can more than one reactor be regenerated at a time? How many regeneration towers are proposed for the project? Will there be a regeneration tower for each reactor in the series or one regeneration tower per train to be used for the four reactors in each train.

C3P RESPONSE: Reactor trains 1 and 2 will be operated simultaneously and continuously as described above. There will be one regeneration tower per reactor train, for a total of 2 regeneration towers in the proposed PDH plant.

I. On page 22 of the application in the "Reactor Effluent Compression and Treating" section, it is stated that the hot reactor effluent from the fourth reactor is cooled with the reactor feed exchanger and compressed. Is this the same heat exchange that is mentioned previously on page 21 in the "Heavies Removal" section of the application or is this a different heat exchanger? The application states that the reactor effluent is sent through a drier. The drier is not shown on the process flow diagram. Will waste water be generated from this system? If so, please update the process flow diagram. The dried, compressed reactor effluent is then sent to a cryogenic separation system. A heavy aromatic solvent is occasionally injected into this section. Please update the process flow diagram to show this solvent injection into this system. The heavy aromatic tank and spent solvent tank both vent to the unit flare. How is the solvent removed from the process? Is there additional equipment used? If so, please update the process flow diagram to show the additional equipment.

C3P RESPONSE: The heat exchange described in "Reactor Effluent Compression and Treating" section occurs in the hot combined feed exchangers. This heat exchange was described previously in the "PDH reaction" section. It is not the same heat exchange mentioned under "heavies removal" which describes the depropanizer feed preheaters. The process description has been revised to clarify this point. No waste water is generated from the reactor effluent drier. The drier removes extremely small amounts of water generated in the reactor. The rejected water is not condensed and is rejected into the process gas stream during regeneration of the driers. Ultimately the rejected water is part of the tail gas stream from the PSA and exits via the fuel gas system. The solvent drum used for solvent injection and removal has been added to the process flow diagram Sheet 1.

J. In the "Gas Separation" section, it is stated that the purpose of the gas separation section is to remove hydrogen that is formed in the dehydrogenation of propane as well as methane from the heavier hydrocarbons by cryogenic gas separation. What is the design efficiency of this system? Is this system a source for GHG emissions due to process leaks (i.e., methane)? If so, what is the compliance strategy for this system? What will be monitored and recorded to ensure the system is operating according to design? Please provide supplemental information on the operation of the cold box. Is there a potential for the unit to generate power to the electrical grid? If so, please update the process flow diagram by depicting this energy recovery.

C3P RESPONSE: At this time, the efficiency of the gas separation system (cold box) expanders is unknown. It will be defined by proposals from the vendors, which are not yet available. However, it is known that cooling for the cold box is provided by the vaporization of the feed propane and the expansion of the gases; no additional refrigeration is required. The only potential source of GHG emissions from this cold box will be fugitive emissions. These fugitive emissions will be monitored in accordance with TCEQ 28VHP and TCEQ 28CNTQ, as described in the BACT section of the permit application. Records of this monitoring will be maintained by the facility. A more detailed process flow diagram of the cold box is found in Sheet 6. This process flow diagram illustrates the power generated by the two expanders, which will used by other PDH process equipment.

K. On page 23 of the permit application, it is stated that fresh caustic is stored in vertical fixed roof tanks. The process description does not appear to include a discussion of where caustic is used in the process. On page 24 of the permit application in the "Wastewater Storage and Treatment" section, it is stated that the PDH unit will generate three waste water streams, one of them being spent caustic from the CCR vent gas scrubber. The process description for the CCR section doesn't include a discussion about a vent gas scrubber or caustic use. Will it be used in direct contact with the process streams? Will there be a potential for spent caustic to contain GHGs emissions (CH_4 or $C0_2e$)? If so, what is the proposed compliance strategy? Please provide supplemental data explaining this part of the process and if applicable, update the process flow diagram.

C3P RESPONSE: The purpose of the caustic storage tank is to provide fresh caustic solution for the CCR vent scrubber. This scrubber is designed to reduce chlorine and SO_X from the vent stream before discharge to the atmosphere. The spent caustic from this scrubber will not contain GHGs. Sheet 5 of the process flow diagram shows the vent gas scrubber and caustic streams, and the process description has been updated to include discussion of the scrubber.

L. On page 23 of the permit application, it is stated that the propylene product will be stored in a sphere and sold to customers. C_2 and H_2 products will also be transferred off-site via pipeline. C_4 products will be stored in spheres and loaded into barges under a contract with Ascend. Barge loading and the flare associated with this barge loading is authorized by PBR Registration Number 77064 issued to Ascend. Also, on page 21 of the permit application, it is stated that the wastewater that is generated in the PDH process will be hard-piped and transferred to the existing Ascend Chocolate Bayou wastewater treatment plant.

i. The loading operation and waste water treatment will support the proposed PDH project, therefore additional information regarding any associated GHG emission increases and/or decreases are required as part of this application. Will these areas of the facility be modified to accommodate the proposed project? Will there be a potential increase in GHG emissions generated from the combustion of vents from barge loading flare due to the loading of product from the proposed project? If so, please provide supplemental information and emission calculations pertaining to the GHG emissions from the barge loading flare. Also, update the emissions calculations to reflect these changes.

C3P Response: The Ascend waste water treatment plant will not require modification to accommodate the small quantity of waste water generated by the PDH plant. The barge loading dock is an existing facility at the Ascend, Chocolate Bayou Complex. It is believed that this barge loading operation will not require modification.

It is possible that some C4 barges will arrive at the Ascend barge dock padded with nitrogen. If this occurs, nitrogen will be routed to the Ascend flare as the barge is loaded. Emissions calculations for the GHGs emitted by this flaring are attached. These calculations assume that all barges arrive with a nitrogen pad and result in a conservatively high estimation of GHG emissions from this activity.

M. On page 24 of the application, it is stated that the fuel gas system includes natural gas and process fuel gases. The process flow diagram indicates the streams that comprise the fuel system, but does not appear to indicate the equipment that will utilize the fuel gas system. Please update the process flow diagram to show where the fuel from the fuel gas system will be used.

C3P RESPONSE: Fuel from the fuel gas system will be utilized by the boilers and by the process heaters in the reaction section of the PDH plant. The overall process flow diagram on Sheet 1 has been updated to show the users of the fuel gas system.

N. On page 24 of the application, the process description states that two boilers will be used for steam generation to produce high pressure. The fuel that will be utilized will come from the fuel gas system. The boilers will utilize ultra-low NOx burners and SCR. Both boilers will vent through a single stack and SCR unit. Please update the process flow diagram to show these two boilers with the common emission stack.

C3P RESPONSE: Sheet 9 of the process flow diagrams shows the configuration of the boilers, SCR, and stack.

O. The permit application states that the PDH unit will have a single cooling tower. Several of the heat exchangers used in VOC service will be operated with a water-side pressure that is less than the process-side pressure. Therefore, the cooling tower is considered a source for VOC emissions. Typically CO_2 emissions are associated with combustion pollutants and CH_4 pollutant is associated with VOC pollutants.

i. If there is a possibility for GHG emissions, please supplement the BACT analysis with an evaluation of leak repair and monitoring technologies and a proposal of what C3P would implement as BACT. What is the proposed compliance strategy for the cooling tower? Please update the process flow diagram to show the cooling tower with associated EPN.

C3P RESPONSE: The process flow diagram for the cooling tower is shown on Sheet 10 of the attached process flow diagrams. The cooling services provided by this cooling tower have the potential to contain VOCs and some process streams have the potential to contain GHGs. In the event of a leak into the cooling water, VOC and GHGs may be emitted from the cooling tower. A five-step "top down" BACT analysis for control of VOC/GHG emissions from the cooling tower is attached to this response.

P. The permit application states that the plant will utilize one ground flare for control of the analyzer vent streams, VOC loading/unloading emissions and intermittent process vent streams such as the emergency venting of pressure safety valves (PSVs) in the PDH unit. It is also utilized during process clearing and venting for routine maintenance, startup and shutdown.

i. How many analyzers will have vents directed to the flare? Since the combustion of the analyzer vents could potentially generate GHG emissions, a BACT analysis should be performed for the analyzers. Please include the different designs and factors that were considered, the reasons for elimination, and the design elements that were implemented to reduce or minimize vents to the flare.

C3P RESPONSE: Process engineering for the PDH plant has not progressed to the level of detail for selecting the design of process analyzers. The only information available at this time is the recommendation from the PDH technology vendor, including the number and general type of analyzers used for process control in similar PDH plants. Based on this vendor information, approximately 30 process analyzers are expected to be used by the PDH process. Approximately ½ of these analyzers vent back to the process. The remaining process analyzers vent to the flare. A five-step "top down" BACT analysis for these analyzers is attached to this response.

ii. If possible, please include a separate process flow diagram to depict the flare header and all the vessels that will have vents directed to the flare. Also, please include tank storage (e.g., aromatics that are used in the process, C5+ liquids storage tanks, ammonia storage, and product storage).

C3P RESPONSE: Sheet 7 of the process flow diagrams shows product storage and the ground flare. Sheet 8 shows C4 storage and the Ascend barge loading flare.

2. What is the design capacity of the PDH plant that C3P proposes to construct?

C3P RESPONSE: The proposed PDH plant will have an annual design capacity of 1173 kMT of propylene.

3. On page 37 of the application, the BACT analysis includes a statement that the eight process heaters that are utilized in two reactor trains will be designed and operated to achieve a maximum thermal efficiency of 90% without SCR. Since the PDH plant will utilize SCR, the thermal efficiency will be reduced to 87%. Also, on page 39 of the application, the BACT analysis includes a statement that the two gas-fired boilers will be designed and operated to achieve a thermal efficiency of 82%. The BACT related-information for both the heaters and boilers on pages 39 and 41, respectively, does not appear to propose to operate these combustion units at the stated thermal efficiency from the previous pages. Please explain the omission. What is the proposed compliance strategy and monitoring for the heaters and boilers? How will the efficiency of the heaters and boilers be demonstrated? What operating parameters will be monitored and recorded?

C3P RESPONSE: Although not specifically stated in the BACT section of the permit application, C3P will operate the heaters in each reactor train at a thermal efficiency of 87% and the boilers at a thermal efficiency of 82%. Heater and boiler CO_2 emissions will be calculated based on complete combustion of the fuels. NOx emission will be calculated from the CEMS analyzers and stack flow. Heater monitoring will include CEMS for NOx, CO, and excess oxygen, monitoring of the firebox temperature for each heater, monitoring of the fuel flow rate to the heaters, the process flow rate, process temperatures to and from each heater, and the water flow rate for boiler feed water and desuperheating water.

Heater efficiency will be calculated for the 4 heaters in each reactor train as a group because the heaters function as a unit with common steam and burner management systems. Efficiency will be calculated from the fuel heat value used by the heaters and the recovered heat in both steam generation (based on water flows with blowdown correction) and process heat increase.

Boiler monitoring will include CEMS for NOx, CO, and excess oxygen, monitoring of the firebox temperature for each boiler, monitoring of the fuel flow rate to the boilers, and the water flow rate for boiler feed water and desuperheating water. Efficiency will be calculated from the fuel heat value used by the boilers and the heat recovered as steam (based on water flows with blowdown correction.)

4. EPA typically will issue an output-based BACT emission limit (e.g., lb $C0_2$/ton propylene, MMBtu (heat required)) or a combination of an output- and input-based limit or efficiency-based, where feasible and appropriate. In addition to the annual GHG emissions summarized in Table A-1, for the combustion units under consideration for this project, please propose an output-based, combination of an output- and input based limit, or efficiency-based limits. Please provide an analysis that substantiates any reasons for infeasibility of a numerical emission limitation or an efficiency-based limit for individual emission units. For the emission sources where numerical emission limitations are infeasible, please propose an operating work practice standard that can be practically enforceable.

C3P RESPONSE: For each reactor train, C3P proposes the output based BACT limit of 712.44 lb CO_2e/ton propylene produced on an annual basis. For each CCR vent, C3P also proposes an output based BACT limit of 7.17.lb CO_2e/ton of propylene. For the boilers, C3P proposes a BACT limit of 0.38 lb CO_2e/lb of steam production on an annual basis. No numerical BACT limits are proposed for process fugitives and flaring. The proposed operating work practices for process fugitives and flaring are found in Appendix F of the GHG PSD permit application.

5. Table C-1 in the permit application, presents cost for construction and operation of a post-combustion carbon capture and sequestration system at C3P. The estimated cost to install, operate and maintain CCS is $80.9 million per year at the C3P facility at $113.15 per ton of $C0_2$ removed. The supporting calculations that were used to derive this estimate were not included in the application. Please provide the site-specific parameters that were used to evaluate and eliminate CCS from consideration. This material should contain detailed information on the quantity and concentration of $C0_2$ that is in the waste stream and the specific equipment to be used. This site-specific cost calculations should include, but are not limited to, size and distance of pipeline to be installed, pumps, compressors, the amine solution to be used, and the equipment necessary to employ the chosen post-combustion technology. Please include cost of construction, operation and maintenance, cost per ton of $C0_2$ removed by the technologies evaluated and include the feasibility and cost analysis for storage or transportation for these options. Please discuss in detail any site-specific safety or environmental impacts associated with such a removal system.

C3P RESPONSE: The site-specific costs for post-combustion carbon capture and sequestration systems were estimated using factors from the Report of the Interagency Task Force on Carbon Capture and Storage (dated August 2010). These site-specific costs were calculated in a manner that is consistent with other GHG PSD applications submitted and, in some cases approved, by EPA Region 6 (for example Formosa and ONEOK). The site-specific information in Table C-1 includes the annual system CO_2 throughput of 715,084 tons of CO_2 captured, transported, and stored, which is 90% of the sum of the combined CO_2 emissions from the boilers, heaters, and CCR vents in the PDH plant. The length of pipeline required for transport of CO_2 from the PDH plant to the nearest planned pipeline for gathering and transporting CO_2 for use in enhanced oil recovery is also site-specific. This pipeline length will be longer if the CO_2 is transported to the nearest location for permanent storage. Using this calculation methodology, the total cost for CO_2 capture, transport, and storage systems costs ranges from a minimum of $104/ton of CO_2 to a maximum of $122/ton of CO_2. The average cost is $113/ton of CO_2.

C3P cannot provide detailed information regarding the specific equipment to be used, such as pumps, compressors, etc., without conducting a detailed engineering study of this add-on CCS control. C3P attempted to investigate the cost and time required for performing one of these detailed engineering studies with little success. Of the three engineering firms contacted, one declined to participate, one was non-responsive, and only one provided a cost estimate for this work. According to the cost estimate provided by the third engineering firm, it would cost approximately $80,000 to conduct this study and would take approximately 6 months to complete.

In lieu of a detailed engineering assessment, the site-specific cost of \$113/ton of CO_2 captured, transported, and stored was compared to other PDH plant permits pending with EPA Region 6. These other PDH permits include a range of CCS cost from a minimum of \$82/ton (PL Propylene) to \$120/ton (Formosa). Enterprise Products estimates that the cost of CCS for their PDH plant will be \$104/ton. Therefore, C3P believes that the calculations as presented in Table C-1 are sufficient to demonstrate that CCS is not economically feasible for this plant.

1 Process Description and GHG Emission Sources

1.1 Process Description

Overview

C3P is planning to build a new propane dehydrogenation (PDH) unit near the city of Alvin in Brazoria County, Texas. This plant will use propane as its primary raw material. The sale of propylene and other products of the PDH reaction will vary in response to marketplace and customer demands.

Major sections of the PDH process at the proposed facility include:

- Feed Pre-Treatment;
- Heavies Removal;
- PDH Reaction;
- Continuous Catalyst Regeneration;
- Reactor Effluent Compression and Treating;
- Gas Separation;
- Fractionation;
- Hydrogen Pressure Swing Adsorption (PSA); and
- Support Operations such as unloading and storage of miscellaneous raw materials, product storage, product loading, fuel gas system, steam generation, cooling water system, flare, and routine maintenance, startup, and shutdown activities.

C3P is submitting this GHG permit application to authorize the construction of the PDH unit and other associated activities as described above. Each part of the chemical manufacturing process and associated emissions are identified in the following discussion of the PDH process.

Production Operations

Feed Pre-Treatment

Propane feedstock for the PDH plant will come from outside the battery limits (OSBL) of the Chocolate Bayou complex and will be stored in storage bullets.

Refer to Process Flow Diagram sheet 2 for details of feed pretreatment. Before propane enters the PDH Reaction section of the unit, impurities and moisture are removed. Metals and sulfur compounds are removed via the use of guard beds. Moisture is removed from the propane feed via the use of feed driers. A small volume of waste water will be generated from the regeneration of the feed driers. This waste water will be hard-piped and transferred to the existing Ascend Chocolate Bayou waste water treatment plant.

Heavies Removal

After Feed Pre-treatment, propane feed is exchanged with hot compressed reactor effluent to pre-heat the depropanizer feed in the depropanizer feed preheaters. The propane feed and recycle propane from fractionation are then routed to the Depropanizer Column. A C4 fraction is removed as a sidedraw to be sold as a product. C5+ material is removed from the bottom of the column and will be stored as liquid. The storage tank for these liquids (FIN 320T-102) is vented to the flare (EPN PDH-FLARE). These liquids are subsequently loaded into tank trucks and transported off-site for disposal.

The overhead product (propane) from Depropanizer Column is then routed to the Separation Section (Coldbox) of the process, where it is cooled, combined with recycle hydrogen, and exchanged against cold reactor effluent prior to use in the PDH Reaction section.

PDH Reaction

The cooled propane feed from the Separation Section (Coldbox) is routed to the PDH Reaction section. It is heated via the hot combined feed exchanger and then routed to the reactors.

The dehydrogenation of propane to propylene takes place in two parallel reaction trains. Each reaction train consists of four reactors in series which utilize a proprietary catalyst. Each of these reactors will have an associated gas-fired heater. The heaters are identified as the Charge Heater (EPNs PDH-H101 and PDH-H201) prior to the first reactor, Inter-Heater 1 (EPNs PDH-H102 and PDH-H202) prior to the second reactor, Inter-Heater 2 (EPNs EPNs PDH-H103 and PDH-H203) prior to the third reactor, and Inter-Heater 3 (EPNs PDH-H104 and PDH-H204) prior to the fourth reactor.

In addition to the desired propylene product, other hydrocarbons such as ethane, ethylene, and methane are also produced. Effluent from each reaction train is routed to the Reactor Effluent Compression and Treating section of the plant.

Emissions of NO_X produced in the charge heater and three inter-heaters on each reactor train will be controlled via the use of ultra-low NO_X burners and selective catalytic reduction (SCR).

Continuous Catalyst Regeneration

The continuous catalyst regeneration (CCR) section of the PDH process is designed to replenish the catalyst's activity in a continuous operation. Sheet 5 of the process flow diagram shows details of catalyst circulation and regeneration, typical of 1 for each reactor train. Catalyst flows down the reactors by gravity and is conveyed to the top of the next reactor. Catalyst from reactor 4 is conveyed to the Regneration Tower.

In the Regeneration Towers, three of the four basic steps of the catalyst regeneration process take place. These are (1) burning of the coke, (2) removal of excess moisture, and (3) oxidation and dispersion of metal promoters. The coke burn step is a complete burn, leaving no VOCs or CO to be emitted to the atmosphere. A vent gas treatment system uses caustic to remove small amounts of hydrogen chloride, chlorine, and sulfur dioxide.

After leaving the Regeneration Tower, catalyst flows by gravity into a hopper. In the hopper, nitrogen and oxygen atmosphere from the Regeneration Tower is purged from the catalyst and the atmosphere is changed to a hydrogen atmosphere. The catalyst then flows by gravity to a lift engager, where high purity hydrogen is used to pneumatically lift the catalyst back to the top of Reactor No. 1.

At the top of Reactor No. 1, the catalyst enters the upper portion of the reactor. As it enters the upper portion of the reactor, the platinum on the catalyst is changed from its oxidized state (resulting from the carbon burning in the Regeneration Tower) to its reduced state by reaction with high temperature hydrogen, thus completing the fourth step of the catalyst regeneration process.

Reactor Effluent Compression and Treating

The hot reactor effluent from the fourth reactor is cooled in the hot combined feed exchanger and compressed. It is then sent through a reactor effluent drier before entering the separation section. The dried, compressed reactor effluent is then sent to a cryogenic separation system to separate hydrogen and methane from heavier hydrocarbons. A heavy aromatic solvent (FIN 320T-101) is occasionally injected via the solvent drum to minimize reactor effluent and reactor effluent compressor cooler fouling. Spent solvent collected in the same solvent drum as a result of this solvent injection is stored (FIN 320T-103) and subsequently loaded into tank trucks for off-site disposal. The heavy aromatic solvent tank and spent solvent tank both vent to the unit flare (EPN PDH-FLARE).

Gas Separation (Coldbox)

In the dehydrogenation process, hydrogen (H_2) is formed as a result of the main reaction of propane. The purpose of the Gas Separation section is to remove this hydrogen as well as methane from the heavier hydrocarbons by cryogenic gas separation (Coldbox). Details of the Gas Separation system are shown on sheet 6 of the process flow diagrams. Cooling for the cold box is provided through the vaporization of the feed and the expansion of the compressed gases. Power from the gas expansion is recovered through turboexpanders with attached generators. Recovered power is used in other PDH process equipment.

The Coldbox is utilized to separate noncondensable process gas components like hydrogen and methane from the propane and propylene hydrocarbon phase by partial condensation. The hydrocarbon phase is condensed. The hydrogen and methane remain in the gas phase. Hydrocarbons condensed in the Gas Separation step are sent to the Fractionation section of the PDH unit. The gas phase from this step is sent to the Hydrogen PSA Unit.

Fractionation

Lower hydrocarbons such as ethane and ethylene are also formed as by-products of the PDH process and condensed in the Coldbox. The purpose of the Fractionation section of the PDH unit is to remove these by-products from the desired propylene product by distillation. This section of the PDH unit consists of a Selective Hydrogenation Process (SHP) reactor (for C_3 diene removal), Deethanizer, Demethanizer, and Propylene/Propane Splitter.

The purpose of the SHP reactor is to remove C_3 dienes from the hydrocarbon liquid phase from the Coldbox. This removal is accomplished by adding hydrogen from the PSA unit to selectively convert these C_3 dienes to propylene.

In the Deethanizer, ethane, ethylene, and other light components are removed from the hydrocarbon liquid phase from the SHP reactor. The overhead vapors from the Deethanizer go to the Demethanizer. The bottom product from the Deethanizer, consisting of a mixture of propylene and propane goes to the Propylene/Propane Splitter.

In the Demethanizer, lighter components (primarily CH_4) are removed in the overhead stream and blended into the Fuel Gas system of the PDH unit. Heavier components (primarily ethane and ethylene) from the bottom of the Demethanizer column are transported via pipeline to customers.

In the Propane/Propylene Splitter, propane is separated from the desired propylene product. Propylene is obtained as overhead product of the C3 Splitter. Propane and traces of higher boiling components are removed as the bottom product of this splitter. This bottom product is recycled to the first Depropanizer Column in the Feed Pre-Treatment section of the PDH unit.

Hydrogen Pressure Swing Adsorption (PSA)

The Hydrogen Pressure Swing Adsorption Unit takes feed from the Gas Separation section of the plant and produces saleable H_2 gas. This high-purity H_2 gas is also utilized in the CCR section of the plant as described previously and in the SHP section of the plant. The remaining tail gas from the PSA unit is blended into the Fuel Gas system of the PDH unit.

Raw Material and Product Storage

Primary feeds to the PDH process include propane, ammonia for the SCR Units, solvent injection for the Compression section of the plant, and caustic. Propane feed is stored in storage bullets prior to introduction into the PDH process. There will be no routine venting from these bullets. Each will be equipped with Pressure Safety Valves (PSVs) that will vent to the flare. Anhydrous ammonia will be received via pipeline and stored in a pressurized storage vessel, with PSV venting to the flare. Organic liquids used in the process will be stored in vertical fixed roof tanks that vent to the PDH flare. Fresh caustic will be stored in vertical fixed roof tanks. Other chemicals on-site are those used for boiler feed water treatment and cooling water treatment. These are either stored in atmospheric tanks or isotainers.

Propylene product will be stored in a sphere and sold to customers. C_2 and H_2 products will also be transferred off-site via pipeline. C_4 products will be stored in spheres and loaded into barges under a contract with Ascend. Barge loading and the flare associated with this barge loading is authorized by PBR Registration Number 77064 issued to Ascend. C_5+ heavies from the process will be stored in a horizontal tank that vents to the PDH flare.

Raw Material and Product Loading/Unloading

VOCs unloaded at the PDH plant will be received via tank truck. Dry couplings or the equivalent will be used and unloading emissions controlled by the PDH flare. With the exception of C_4, all products will be transferred from the PDH plant via pipeline. C_4 will be loaded into barges as discussed in the previous section.

Fuel Gas System

The Fuel Gas System is utilized to provide fuel for combustion in the two PDH Reaction trains and steam generators. Fuels include natural gas and process fuel gases.

Steam Generation

Two boilers (FINs PDH BOILER 1 and PDH BOILER 2) will be used for Steam Generation at the PDH unit to produce high pressure (HP) steam for various heating purposes in the unit. They will utilize a combination of fuel gas generated by the process and natural gas. Emissions of oxides of nitrogen (NO_X) from these boilers will be controlled via the use of ultra-low NO_X burners and selective catalytic reduction (SCR). Both boilers will vent to a single SCR unit (EPN PDH BOILERS).

Cooling Water System

The PDH unit will utilize a single cooling tower (EPN PDH-CT). Several of the heat exchangers on the loop in VOC service will be operated with a water-side pressure that is less than the process-side pressure. Therefore, the cooling water system is considered to be a potential source of VOC emission as well as particulate matter emissions (PM).

Flare

The PDH plant will utilize one ground flare (EPN PDH-FLARE) for the control of process analyzer vent streams, VOC loading/unloading emissions, and intermittent process vent streams such as the emergency venting of pressure safety valves (PSVs) in the PDH unit. It is also utilized during process clearing and venting for routine maintenance, startup and shutdown.

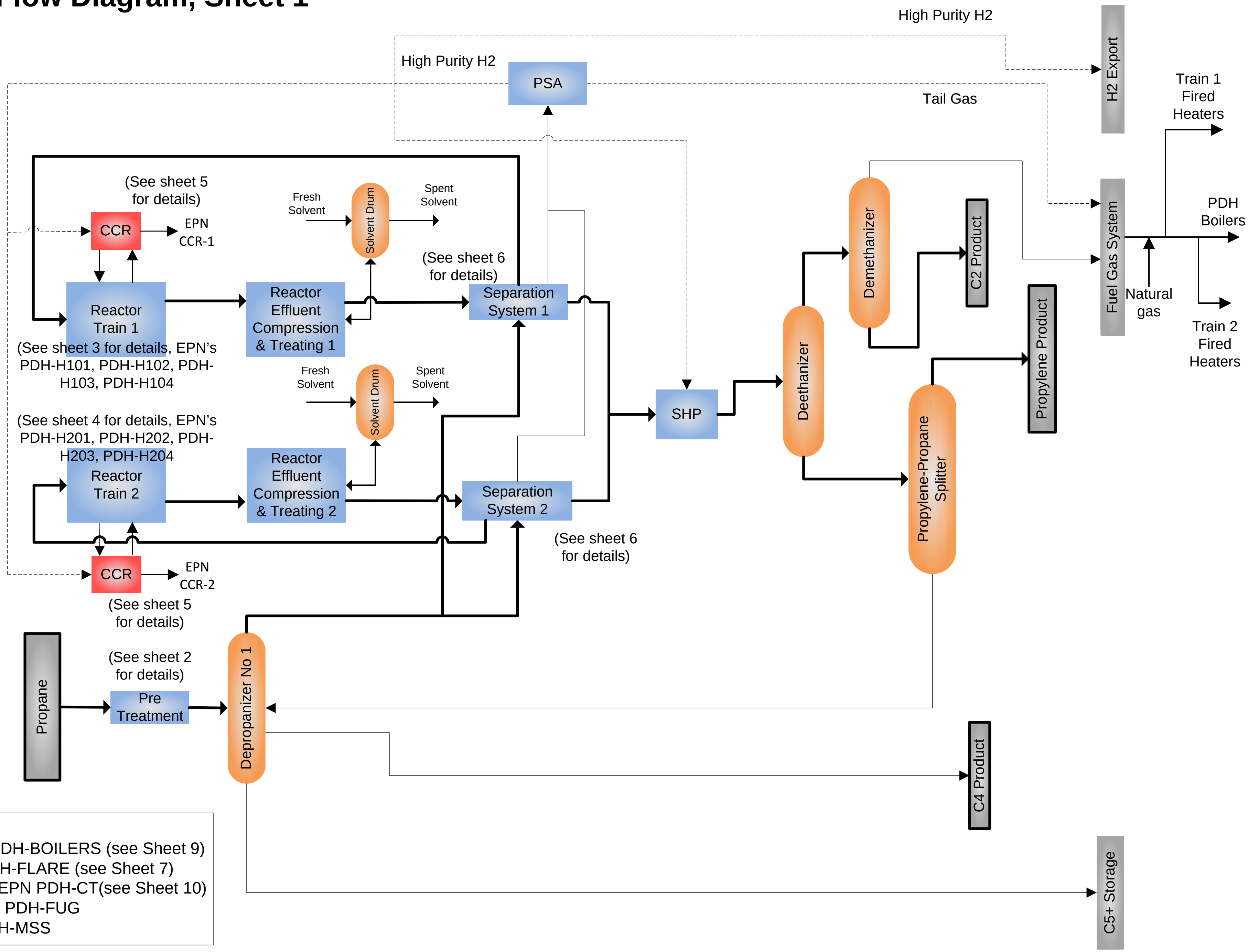
Wastewater Storage and Treatment

The PDH unit will generate three waste water streams. These are from regeneration of the propane feed dryer, regeneration of the reactor effluent dryer, and spent caustic from the CCR vent gas scrubber. As discussed previously, the waste water from all streams will be hard-piped to their ultimate disposition. Waste water from the regeneration of the reactor effluent dryer will be disposed in the existing deepwell disposal at the Ascend Chocolate Bayou plant. The other two waste water streams will be treated in the existing Chocolate Bayou waste water treatment plant.

Routine Maintenance, Startup, and Shutdown Activities

Planned and predictable maintenance, startup and shutdown (MSS) activities at the PDH unit will be conducted in a way that will minimize emissions to the atmosphere. This will generally be accomplished by clearing equipment before line openings or vessel opening. Where feasible, this equipment will be cleared back to the process or routed to the process flare. Additional details are found in the Emissions Data section of this application. These MSS emissions are identified as EPN PDH-MSS.

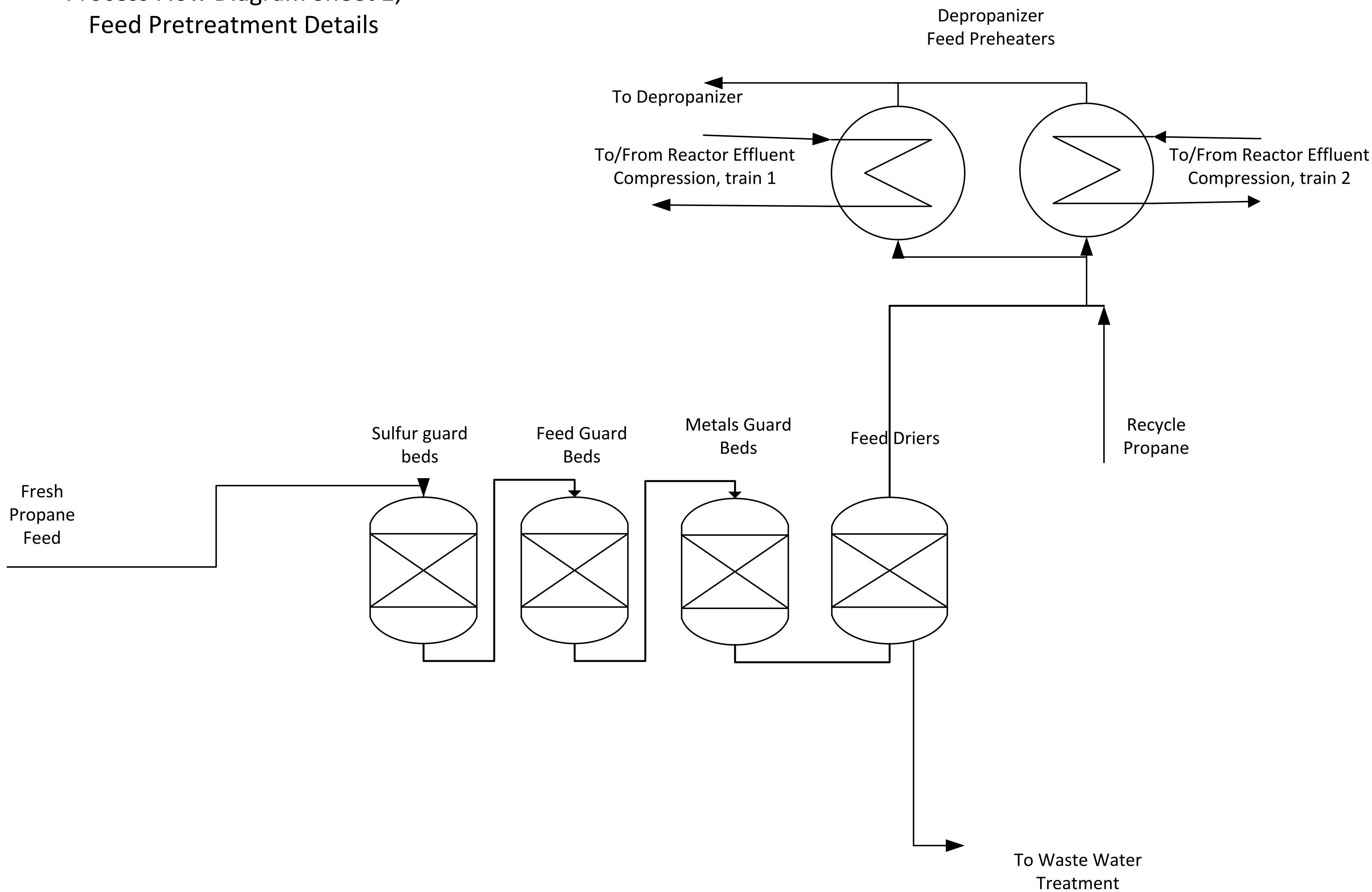
C3 Petrochemicals LLC - PDH Plant Process Flow Diagram, Sheet 1 Overall



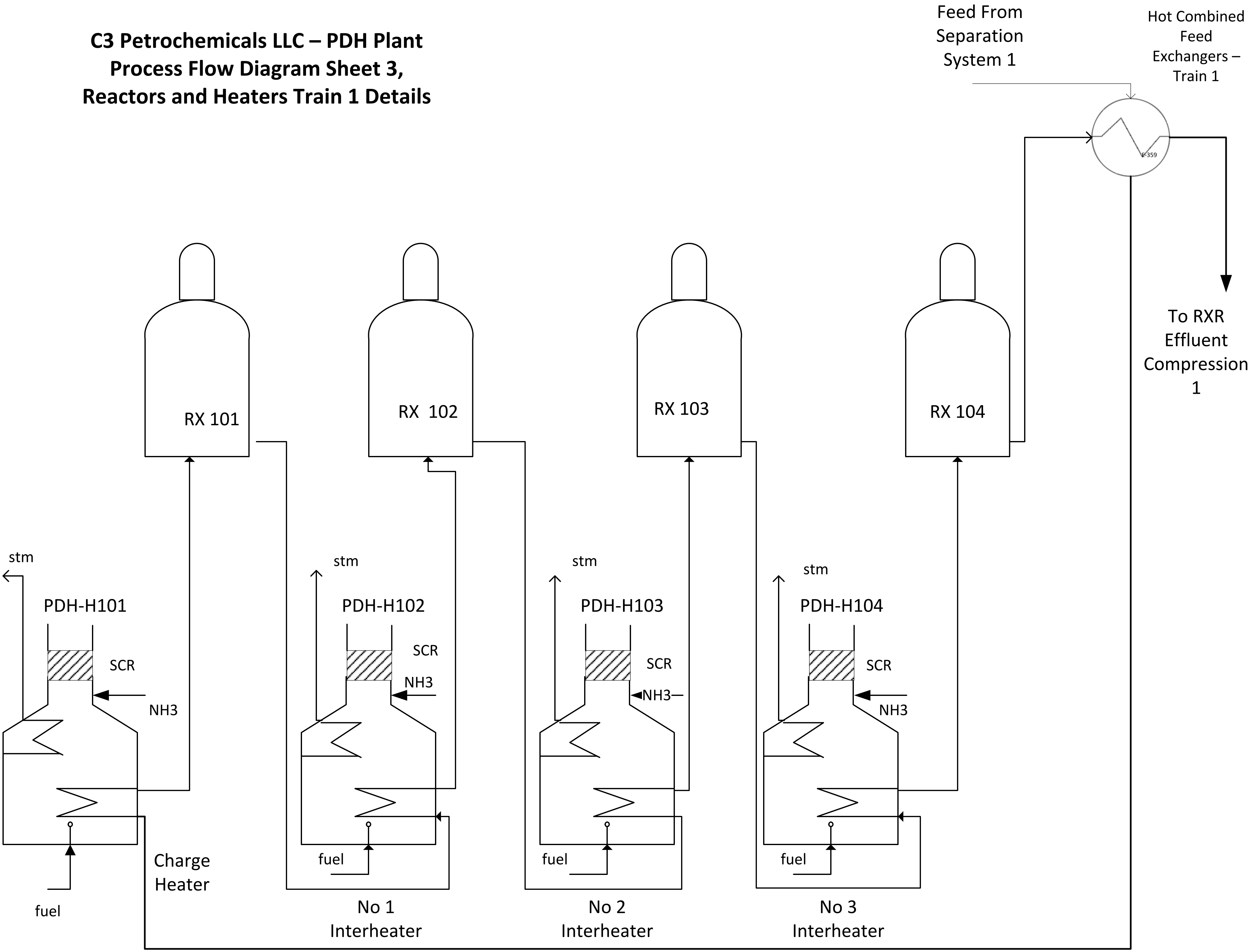
Site-wide EPNs
Boilers – EPN PDH-BOILERS (see Sheet 9)
Flare – EPN PDH-FLARE (see Sheet 7)
Cooling Tower–EPN PDH-CT(see Sheet 10)
Fugitives – EPN PDH-FUG
MSS – EPN PDH-MSS

ENVIRON

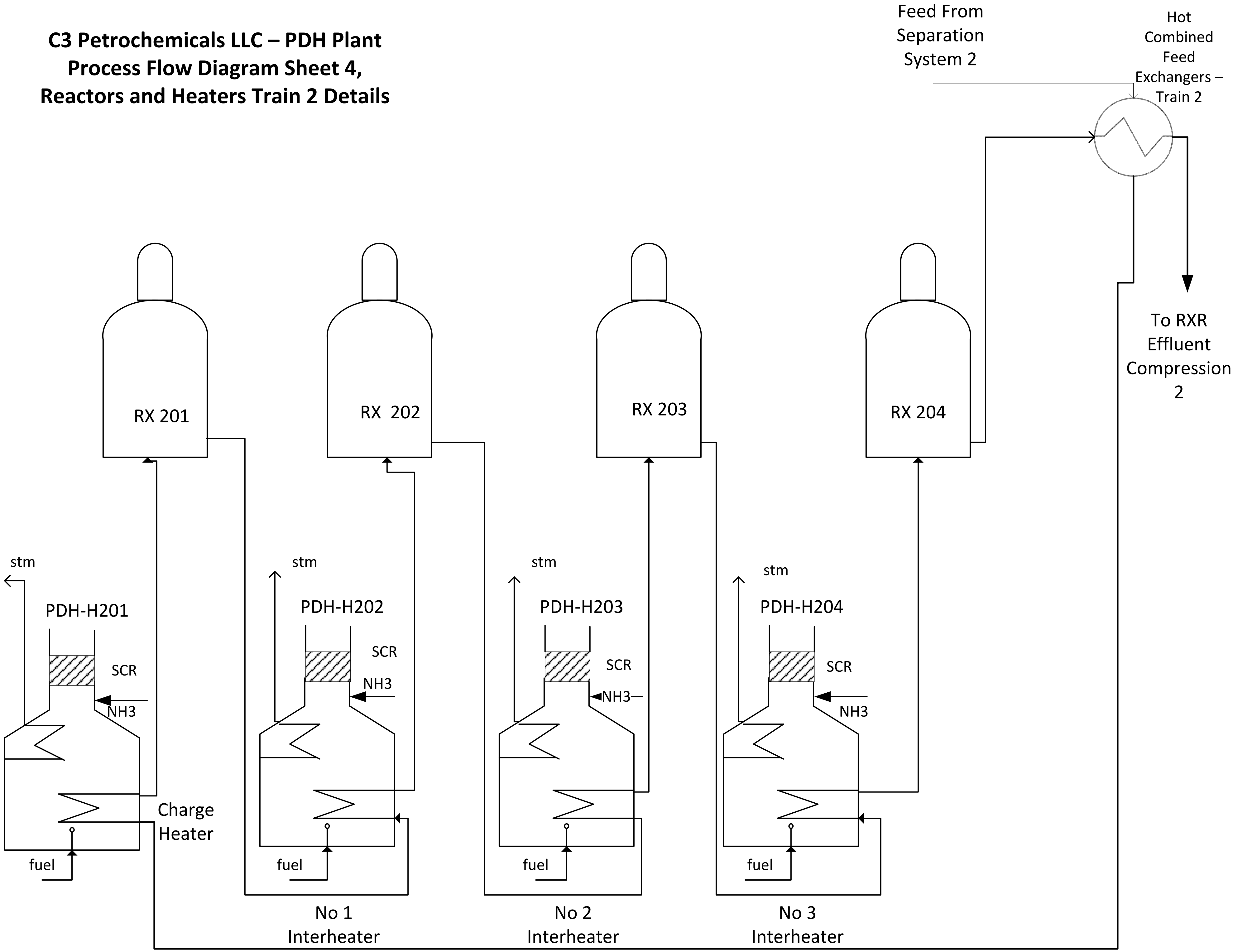
C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram Sheet 2,
Feed Pretreatment Details



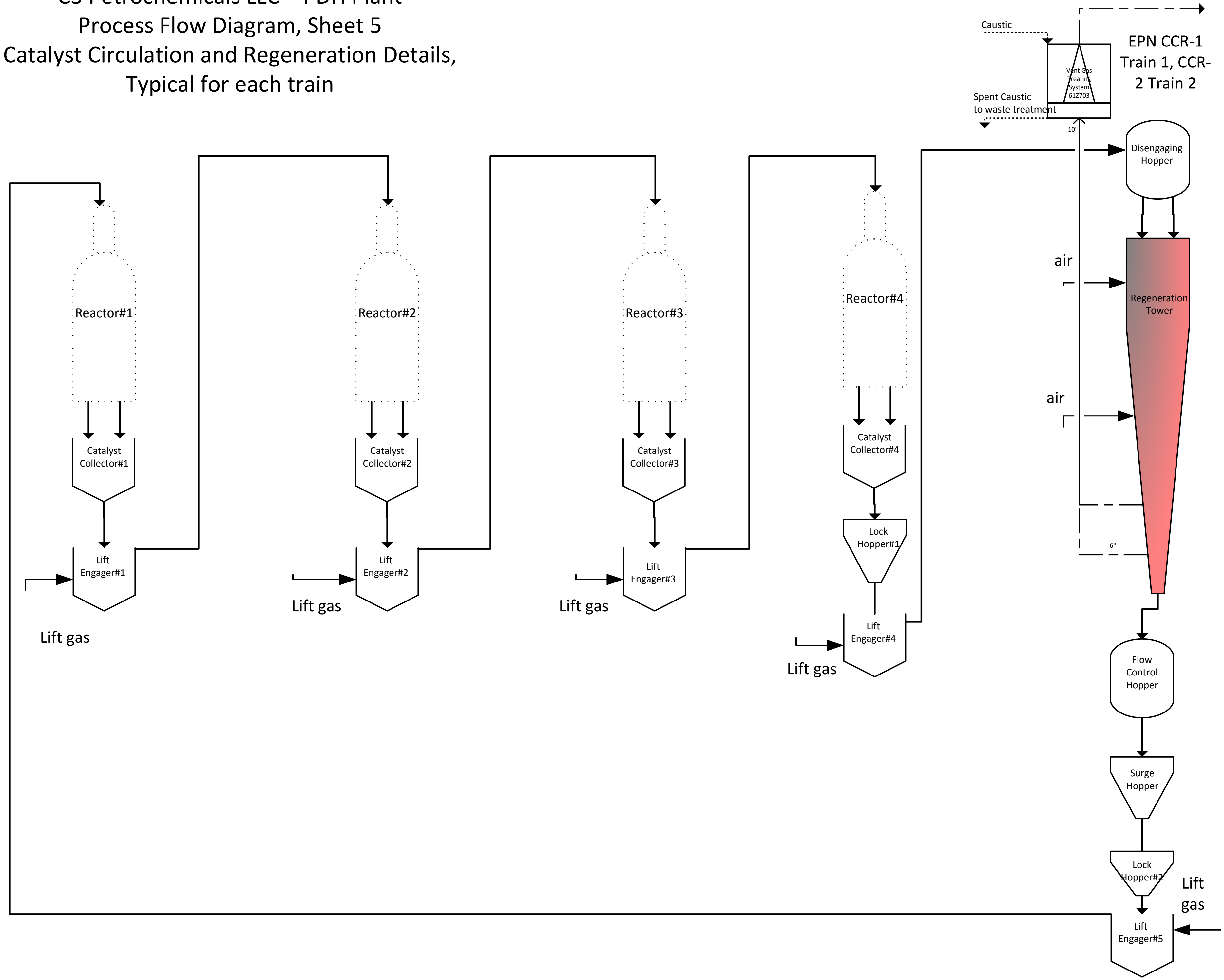
C3 Petrochemicals LLC – PDH Plant Process Flow Diagram Sheet 3, Reactors and Heaters Train 1 Details



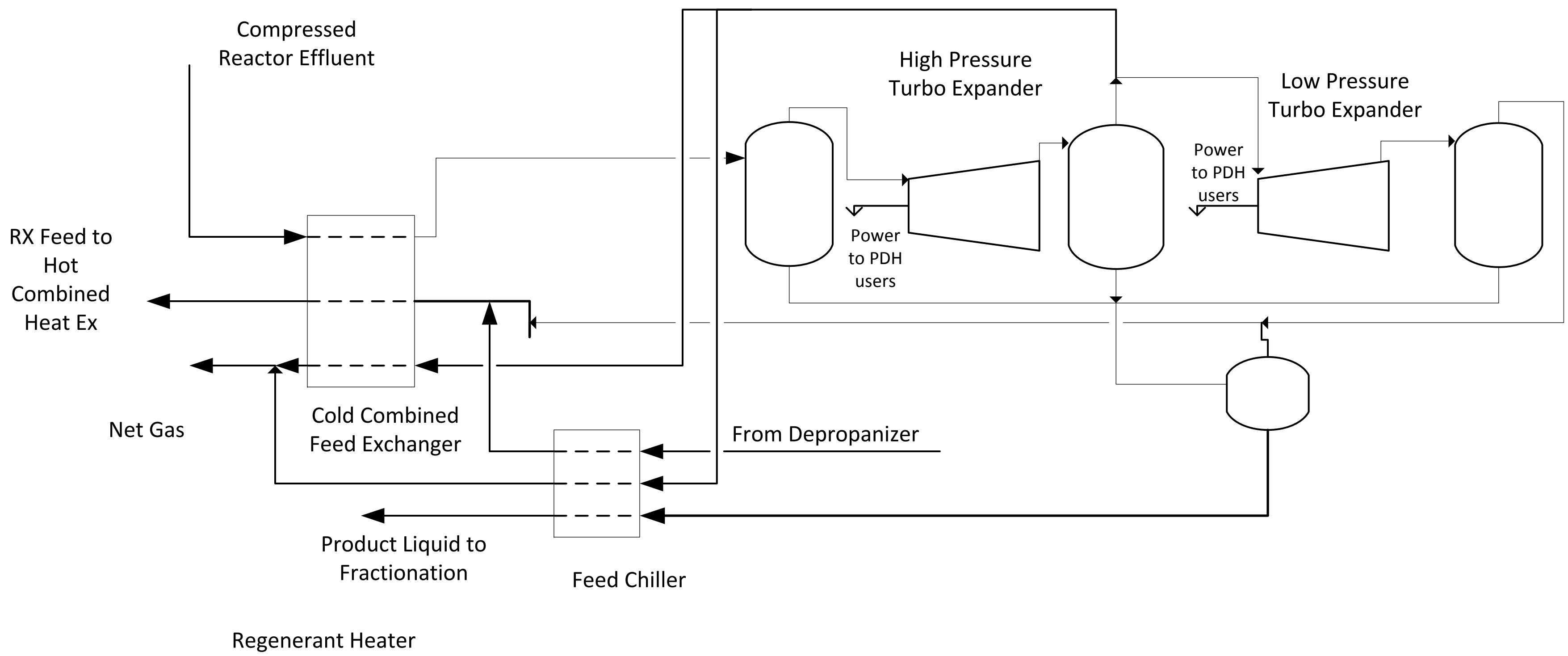
C3 Petrochemicals LLC – PDH Plant Process Flow Diagram Sheet 4, Reactors and Heaters Train 2 Details



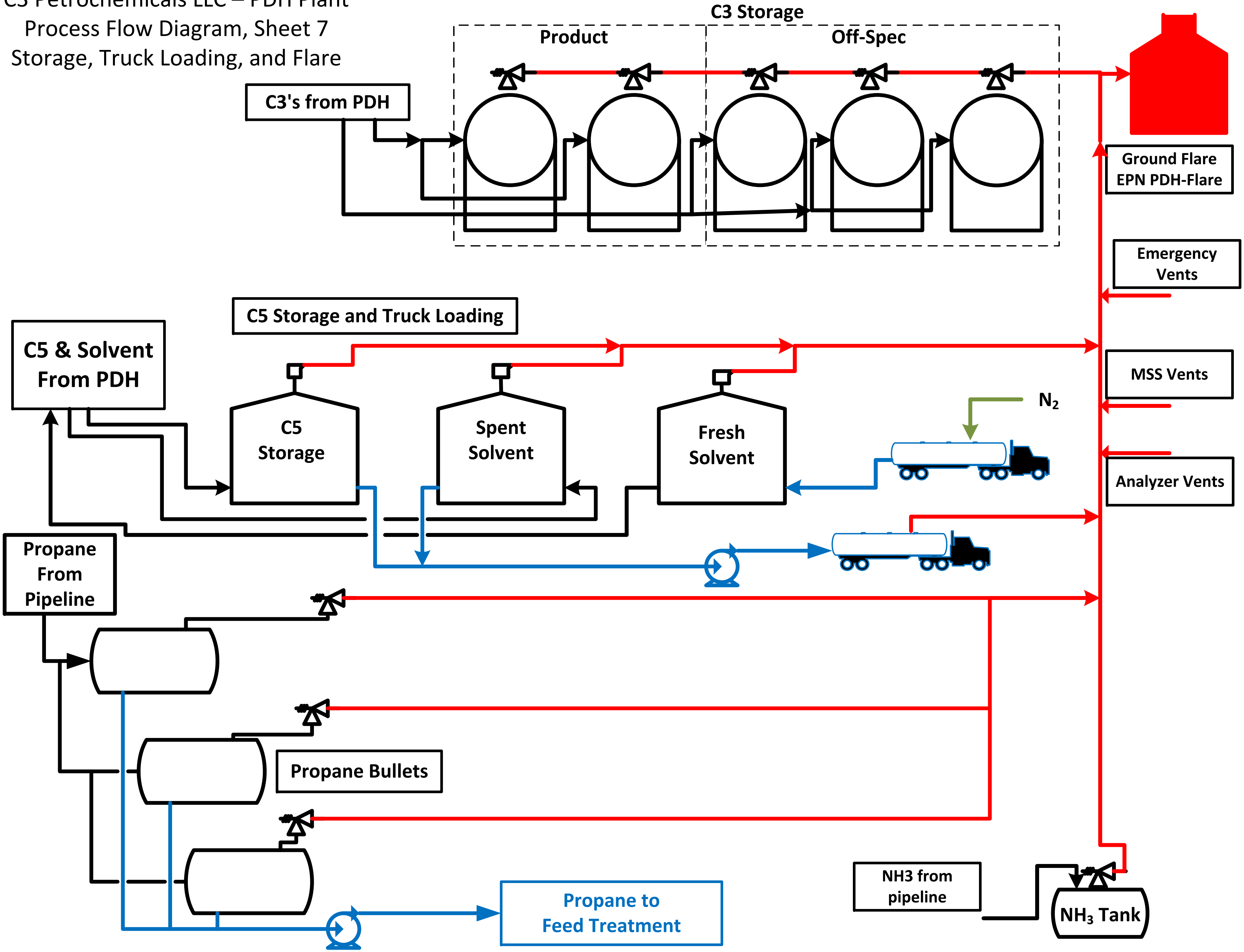
C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram, Sheet 5
Catalyst Circulation and Regeneration Details, Typical for each train



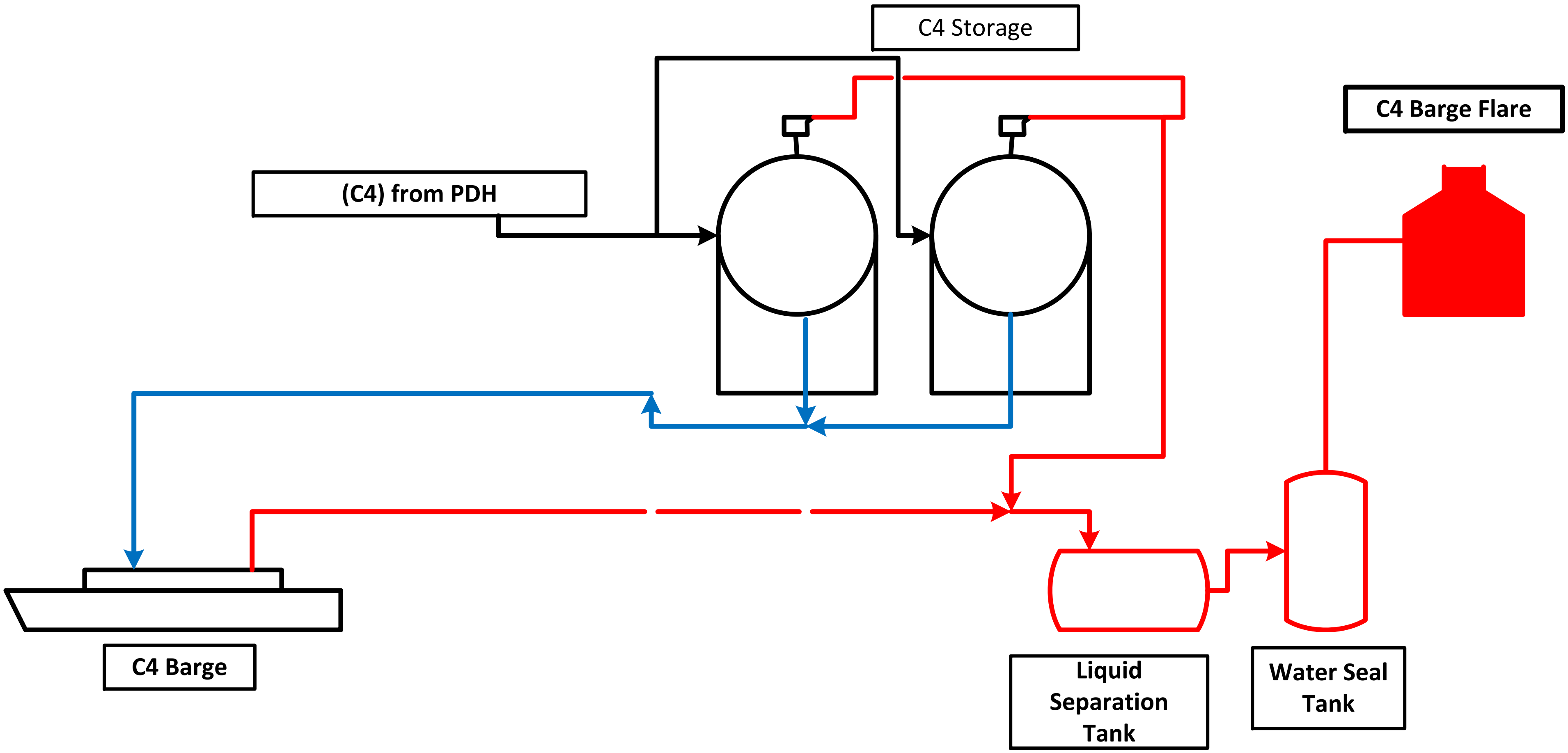
C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram, Sheet 6
Separation System Details, Typical for Each Train



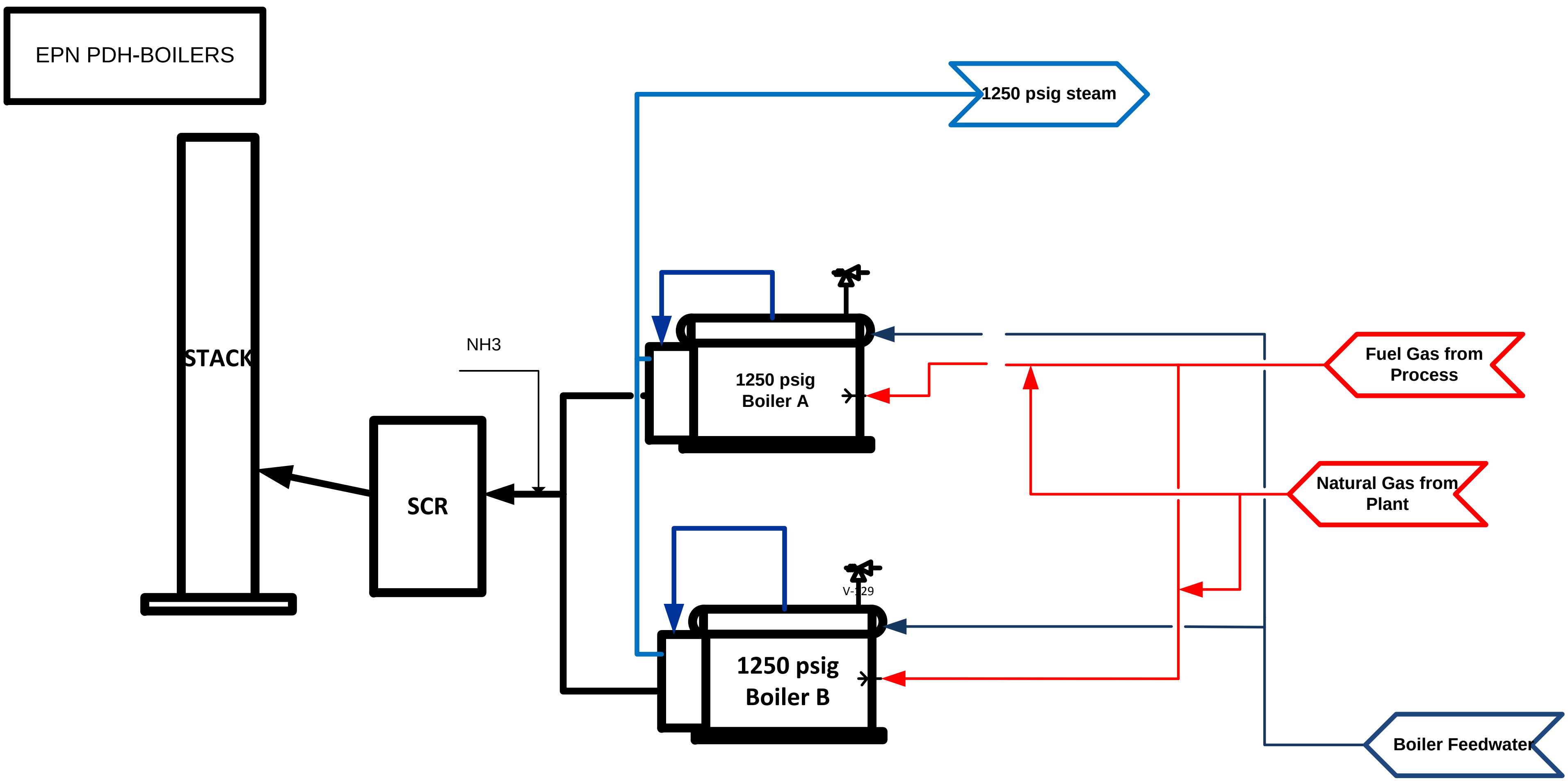
C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram, Sheet 7
Storage, Truck Loading, and Flare



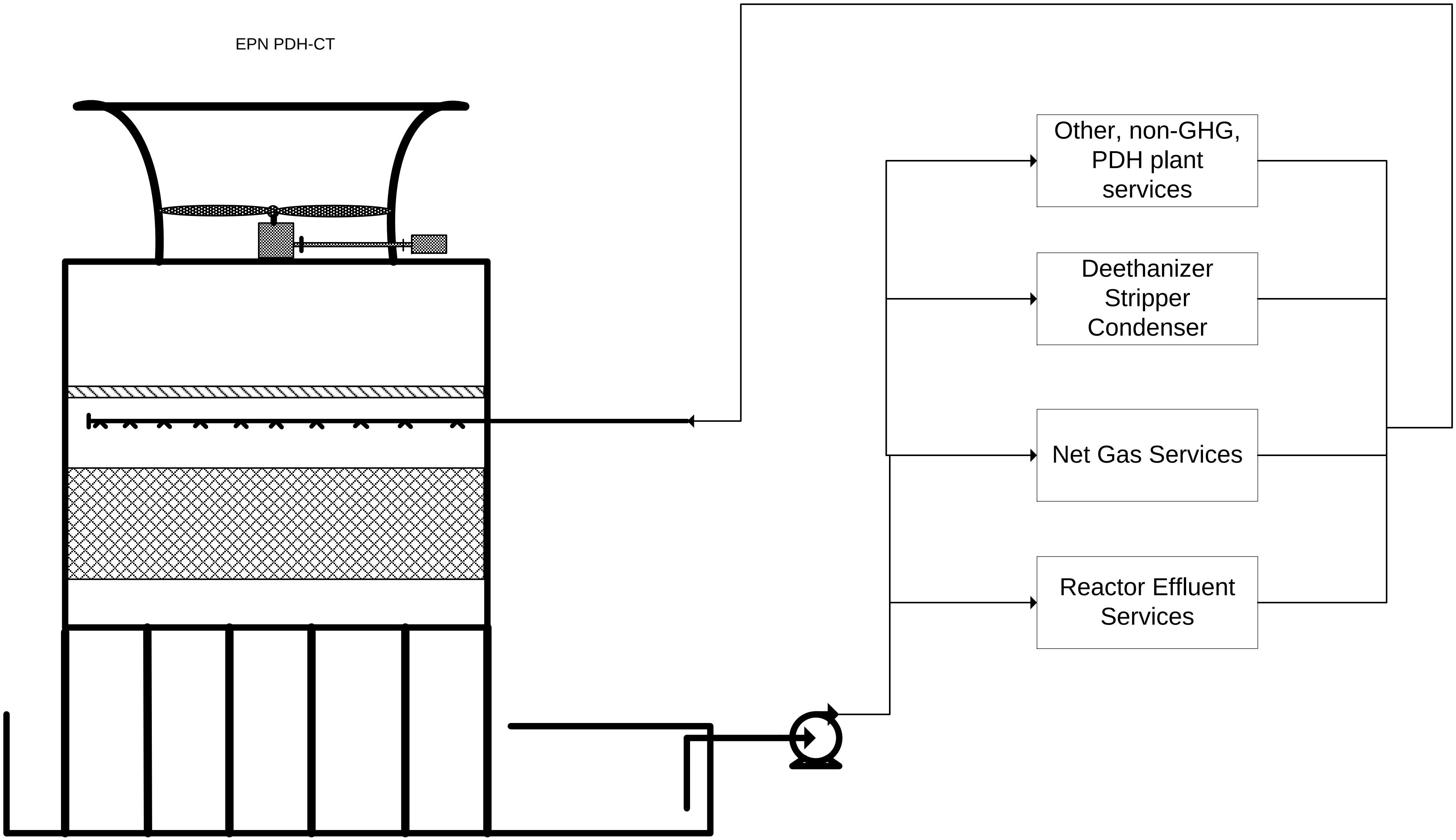
C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram, Sheet 8
C4 Storage and Barge Loading



C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram, Sheet 9
Boilers



C3 Petrochemicals LLC – PDH Plant
Process Flow Diagram, Sheet 10
Cooling Tower



C3P searched the EPA RACT/BACT/LAER Clearinghouse (RBLC) database to assist in the identification of potential GHG emission control technologies for storage tanks. There were no entries in this database for GHG from such equipment. The RBLC did contain methods for the control of VOC emissions from storage tanks, which can then result in the generation of GHGs when controlled with a thermal device such as a flare. The results of this RBLC search are attached.

BACT for Storage Tanks

There will be no direct GHG emissions from the VOC storage of raw materials, products, or by-products of the PDH process. There will, however, be GHG emissions as a result of venting VOC emissions from these storage tanks to the flare. All storage tanks at the C3P PDH plant will utilize submerged fill, be painted white and will vent to the plant flare.

C3P will utilize a total of four fixed roof tanks to contain VOC materials. These include two vertical fixed roof tanks containing fresh or spent solvent. Each of these tanks has a capacity of approximately 11,000 gallons and the vapor pressure of the VOC contents is 0.04 psia at the average storage temperature. A third vertical fixed roof tank with a capacity of approximately 7,600 gallons will be used to store dimethyl disulfide (DMDS). The vapor pressure of DMDS at the average storage temperature is 0.9 psia. The fourth fixed roof tank is a horizontal fixed roof tank used to store C5+ removed from the process. This horizontal fixed roof tank has a capacity of approximately 142,000 gallons and the vapor pressure of the contents is 2.7 psia at the average storage temperature.

Step 1: Identify All Available Control Technologies

The control options for VOC emissions from storage tanks include:

- Vapor balancing
- Submerged fill
- Paint tanks white to reduce absorption of solar heat
- Fixed roof vented to flare
- External floating roof
- Internal floating roof

Step 2: Eliminate Technically Infeasible Options

All of the options in Step 1 are considered technically feasible for controlling VOC emissions from the storage tanks.

Step 3: Rank Remaining Control Technologies

The following reductions in VOC emissions can be achieved by the technologies listed below:

- Internal floating roof – up to 99.8% (per the RBLC search)
- External floating roof – up 99.44% (per the RBLC search)
- Fixed roof vented to flare – 98%
- Vapor balancing – 90% (per the RBLC search)
- Submerged fill – 40% (based on AP-42)
- Paint tanks white or another color of high refractive index to reduce vapor production – not quantified

Step 4: Evaluate Economic, Energy and Environmental Impacts

The cost of floating roof tanks (internal or external) exceeds the cost of a fixed roof tank of the same capacity. The cost of vapor balancing was also considered excessive when compared to the amount of VOC reduction achieved. Based on the relatively small size of the tanks used by the C3P PDH plant, the vapor pressure of the materials stored, and level of VOC control achievable, it was concluded that fixed roof tanks vented to the flare would satisfy the requirement for BACT and that the additional cost to install floating roof tanks and vapor balancing was not justified.

Step 5: Select BACT

C3P will utilize all of the technologies listed in Step 3 except the installation of a floating roof or vapor balancing.

- All storage tanks will be either vertical or horizontal fixed roof tanks vented to the PDH flare
- All tanks will utilize submerged fill
- All tanks will be painted white

RBLC Summary for Storage Tanks

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
42.005 - Petroleum Liquid Storage in Fixed Roof Tanks									
12/3/2012	IN-0158	St. Joseph Energy Center, LLC	St. Joseph Energy Center, LLC	141-31003-00579	Emergency Generator ULSD Tank	VOC	Good combustion practice and fuel specification	Not listed	None
					Vehicle Diesel Tank	VOC	Good combustion practice and fuel specification	Not listed	None
					Fire Pump Engine ULSD Tanks	VOC	Good combustion practice and fuel specification	Not listed	None
					Emergency Generator ULSD Tanks	VOC	Good design and operating practices	Not listed	None
					Vehicle Gasoline Dispensing Tank	VOC	Submerged fill pipes and stage 1 vapor control	Not listed	The permittee shall not allow the transfer of gasoline between any transport and any gasoline storage tank unless such tank is equipped with a submerged fill pipe and either a pressure relief valve set to release at no less than seven-tenths (0.7) pounds per square inch or an orifice of five-tenths (0.5) inch in diameter. If the owner or employees of the owner of a gasoline dispensing facility are not present during loading, it shall be the responsibility of the owner or the operator of the transport to make certain the vapor recovery system is connected between the transport and the storage tank and is operating according to manufacturer's specifications.
10/2/2012	LA-0265	Valero Refining - New Orleans, LLC	St. Charles Refinery	PSD-LA-619 (M7)	FR Storage Tanks EQT0087 and EQT0088	VOC	Comply with 40 CFR 63 Subpart CC (Group 2)	Not listed	None
5/20/2010	LA-0237	International Matex Tank Terminal (IMTT)	St. Rose Terminal	PSD-LA-736 (M2)	Heavy Fuel Oil Storage Tanks (18)	VOC	Fixed roof	Not listed	VOC emissions cap for 18 heavy fuel oil tanks is 67.53 tons/year based on a twelve month rolling average. Total calculated VOC emissions based on actual products and throughputs of each tank are recorded each month, as well as total calculated VOC emissions for the last twelve months.
11/17/2009	LA-0213	Valero Refining - New Orleans, LLC	St. Charles Refinery	PSD-LA-619 (M5)	Tanks - For Heavy Materials	VOC	Equipped with fixed roof and comply with 40 CFR 63 Subpart CC	Not listed	No emission limits available
11/2/2009	LA-0228	Colonial Pipeline Company	Baton Rouge Junction Facility	PSD-LA-741 (M1)	EQT031-EQT035 Five Distillate Tanks (T006-T010)	VOC	Submerged fill pipes and pressure/vacuum vents	Not listed	None
11/20/2008	OH-0317	Ohio River Clean Fuels, LLC	Ohio River Clean Fuels, LLC	02-22896	Fixed Roof Tanks (8)	VOC	Submerged fill	Not listed	Limit for each of the 8 tanks; determined through latest version of TANKS computer software or equivalent.
6/24/2008	LA-0232	Gulf Crossing Pipeline Co. LLC.	Sterlington Compressor Station	PSD-LA-729	Condensate Storage Tank	VOC	Submerged fill	Not listed	None
2/26/2008	NV-0047	99 Civil Engineer Squadron of USAF	Nellis Air Force Base	114	Fuel Tanks/Loading Racks/Fuel Dispensing	VOC	Stage 1 and Stage 2 vapor recovery systems and limit of reid vapor pressure to 10 psi	95%	Emission limit 2 is based on the monthly throughput of 500,000 gal/mo for gasoline dispensed at this station
8/8/2007	IA-0089	Homeland Energy Solutions, LLC, PN 06-672	Homeland Energy Solutions, LLC, PN 06-672	07-A-955P to 07-A-982P	Additive (Corrosion Inhibitor) Tank, T66 (07-A-977P)	VOC	Not listed	Not listed	None
6/29/2007	IA-0088	Archer Daniels Midland	ADM Corn Processing - Cedar Rapids	57-01-080	Corrosion Inhibitor Storage Tank	VOC	Not listed	Not listed	None
1/26/2007	FL-0285	Progress Energy Florida (PEF)	Progress Bartow Power Plant	PSD-FL-381 and 1030011-010-AC	Two Nominal 3.5 Million Gallon Distillate Fuel Oil Storage Tanks	VOC	Not listed	Not listed	The permittee shall keep readily accesible records showing the maximum true vapor pressure of the stored liquid. The maximum true vapor pressure shall be less than 3.5 kPa. No emission limits available.
1/10/2007	FL-0286	Florida Power and Light Company	FPL West County Energy Center	PSD-FL-354 and 0990646-001-AC	Two Nominal 6.3 Million Gallon Distillate Fuel Oil Storage Tanks	VOC	Not listed	Not listed	The permittee shall keep accessible records showing the maximum true vapor pressure of the stored liquid. The maximum true vapor pressure shall be less than 3.5 kPa. Compliance with this condition may be demonstrated by using the information from their respective MSDS for the ultra low sulfur fuel oil(s) stored in the tanks.
12/27/2006	LA-0211	Marathon Petroleum Co LLC	Garyville Refinery	PSD-LA-719	Fixed Roof Storage Tanks	VOC	Comply with 40 CFR 63 Subpart CC	Not listed	No emission limits
6/13/2005	LA-0203	Martco Limited Partnership	Oakdale OSB Plant	PSD-LA-710	5000 Gal Gasoline Tanks (2)	VOC	Submerged fill pipe	Not listed	None
					10,000 Gal Diesel Tank	VOC	Submerged fill pipe	Not listed	None
4/14/2005	AZ-0046	Arizona Clean Fuels Yuma LLC	Arizona Clean Fuels Yuma	1001205	Group A Storage Tanks	VOC	The emissions from Group A storage tanks must be collected by a vapor compression system and routed to the refinery fuel gas system. No emissions are permitted to be released into the air except for equipment leaks.	Not listed	There is no numerical emissions limit for Group A tanks since the emissions must be collected and not emitted into the atmosphere.
					Group D Storage Tanks	VOC	The tanks are required to be under pressure so that no emissions are emitted to the atmosphere.	Not listed	The tanks are required to be under pressure so that no emissions are emitted to the atmosphere.
3/18/2005	TX-0464	Continental Carbon Company	Continental Carbon Sunray Plant	P1014	Small Storage Tank	VOC	The fixed roof tanks are considered BACT due to the low vapor pressure of the feedstock oil.	Not listed	None
					Large Storage Tank	VOC	The fixed roof tanks are considered BACT due to the low vapor pressure of the feedstock oil.	Not listed	None
11/2/2004	TX-0481	Air Products LP	Air Products Baytown I I	PSD-TX-1044 / 35873	Diesel Fuel Tank	VOC	Not listed	Not listed	None

RBLC Summary for Storage Tanks

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
10/13/2004	WI-0227	WE Energies (WEPCO)	Port Washington Generating Station	04-RV-175	Fuel Oil Storage Tank (T01)	VOC	Fixed roof tank with submerged fill pipe. Tank may only be used to store distillate fuel oil.	Not listed	RACT requires fixed roof tank with submerged fill pipe. Tank may only be used to store distillate fuel oil 2000 gal tank.
9/2/2004	OH-0279	Daimler Chrysler Corporation	Daimler Chrysler Corporation Assembly Plant	04-01359	Gasoline Dispensing Facility	VOC	Submerged fill, vapor balance or vapor control system	90%	None
1/14/2003	OH-0295	General Motors Corporation	GMC Truck and Bus, Moraine Assembly Plant	08-02506	Gasoline Dispensing (Tanks #1 and #2)	VOC	Vapor balance and submerged fill	Not listed	2,000,000 gallons per year for two tanks.
42.006 - Petroleum Liquid Storage in Floating Roof Tanks									
10/15/2013	TX-0637	KM Liquids Terminals LLC	Galena Park Terminal	N168	Petroleum Liquid Storage in Floating Roof Tanks	VOC	Welded decks, mechanical shoe primary and rim-mounted secondary seal for stock with VP > 0.10 psia. Control is required during loading of marine vessels and during roof landings for VP > 0.10 psia.	99.8%	Permit has a VOC cap for all tanks
10/15/2012	WY-0071	Sinclair Wyoming Refining Company	Sinclair Refinery	MD-12620	Storage Tank	VOC	External floating roof tank	Not listed	None
10/2/2012	LA-0265	Valero Refining - New Orleans, LLC	St. Charles Refinery	PSD-LA-619 (M7)	EFR Storage Tank EQT0169	VOC	Comply with 40 CFR 60 Subpart Kb using an EFR	Not listed	None
8/24/2011	CA-1180	Chevron Products Co	Chevron Products Co	22722	Recovered Oil Storage Tank, External Floating Roof with Dome	VOC	Requires domes on external floating roof tanks.	Not listed	The BACT determination is achieved in practice since the South Coast has a rule 1178, which requires domes on external floating roof tanks storing materials with greater than or equal to 3.0 psia and greater than 19.815 gallons.
10/25/2010	OK-0139	Plains Marketing LP	Cushing Terminal Crude Oil Storage Facility	2003-104-C(M-4)PSD	Crude Oil Storage in External Floating Roof Tanks	VOC	No controls feasible; external floating roof tanks	Not listed	None
4/22/2010	VA-0313	Transmontaigne Operating Company LP	Transmontaigne Norfolk Terminal	60242	Storage Tank Breathing, Working, and Floating Roof Landing Losses (including emergency roof landing)	VOC	Floating roof and seal systems meeting NSPS Kb, MACT BBBBBB requirements for tanks in gasoline service	Not listed	None
11/17/2009	LA-0213	Valero Refining - New Orleans, LLC	St. Charles Refinery	PSD-LA-619 (M5)	Tanks - For Light Materials, Sour Water, Naphtha, Raffinate	VOC	Equip with floating roofs (IFR or EFR) & comply with 40 CFR 60 Subpart Kb or 40 CFR 63 Subpart CC	Not listed	No emission limits
11/2/2009	LA-0228	Colonial Pipeline Company	Baton Rouge Junction Facility	PSD-LA-741 (M1)	EQT026-EQT030 Five Gasoline Tanks (T001-T005)	VOC	Internal floating roofs and submerged fill pipes	Not listed	None
					EQT036 Roof Landings	VOC	Limit roof landings to 60 times per any 12 consecutive month period and comply with 40 CFR 60.112B(A)(1)(I)	Not listed	None
7/21/2009	WI-0251	Enbridge Energy	Enbridge Energy	08-DCF-313	T36-T40 Crude Oil Storage Tanks	VOC	External floating roof tank	Not listed	Tanks are subject to NSPS (Kb). Shall meet or exceed welded external floating roof meeting the following. Required to apply controls to all guidepoles, use gasketed covers, sleeves and/or floats in slotted guide poles, wipers / gasketed covers on unslotted guidepol. Mechanical shoe primary with rim mounted secondary. Use socks or gaskets on roof legs (supports). Tank bottom shall be cone down (drain dry configuration). Roof landings may exceed 1 per year only in approved circumstances (e.g. public health, safety or welfare related). Emissions based on avg. 10.2 RVP crude oil and not more than 200 turnovers/year.
7/1/2009	TX-0582	LBC Houston, LP	LBC Bulk Liquid Storage Terminal	3467B and N99	Storage and Transfer	VOC	The new vessels' routine emissions are controlled by their internal floating roof, fitted with mechanical shoe primary seals, sim-mounted secondary seals, and slotted guidepoles featuring pole sleeves, cover gaskets and pole wipers. Tank roof landing re-fill emissions are controlled by 40CFR60.18-compliant flares, 98% effective. Degassing emissions attributable to roof landing activity are controlled to 10,000 ppmv by a 98% effective portable flare or internal combustion engine. New vessels will be constructed with drain dry bottoms and sumps that can be emptied to within 1% of their nominal volume. Also proposed is the restriction of this vessel's maximum off-float (landed roof position) period to 48 hrs. Best Management/Good Engineering Practices (e.g., minimized number and duration of tank landing events, degassing procedures implemented after a maximum "off-float" period) will be applied to the proposed and existing vessels. Emissions attributable to loading activity associated with the new tanks are controlled by the flares at 98 wt.-% DRE and otherwise compliant with 40CFR60.18. Uncontrolled loading at the barge/ship dock is proposed for the fixed roof vessels being incorporated, which together contribute 0.9 TPY to the total VOC increase proposed for this project. Controlled loading of xylene isomers will be conducted pursuant to applicability of 40CFR63EEEE. Fugitive emissions are subject to the 28VHP LDAR program and 28 LAER (new fugitives); two previously authorized (PBR) fixed roof tanks proposed for incorporation into this permit will remain in vacuum gas oil service (VP<0.01 psia).	Not listed	None

RBLC Summary for Storage Tanks

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
11/20/2008	OH-0317	Ohio River Clean Fuels, LLC	Ohio River Clean Fuels, LLC	02-22896	Internal Floating Roof Tanks (4)	VOC	Floating roof and submerged fill	99%	Limit for each of the 4 tanks; determined through latest version of TANKS computer softwater or equivalent. Subject to 40 CFR Part 60, Subpart Kb.
9/22/2008	WI-0248	Enbridge Energy	Enbridge Energy	08-DCF-102	Tanks T05, T09	VOC	External floating roof tank	99.44%	Tanks are considered subject to NSPS (Kb). Shall meet or exceed welded external floating roof meeting the following. Required to apply controls to all guidepoles, use gasketed covers, sleeves and/or floats in slotted guide poles, wipers / gasketed covers on unslotted guidepole. Mechanical shoe primary with rim mounted secondary. Use socks or gaskets on roof legs (supports). Tank bottom shall be cone down (drain dry configuration). Roof landings may exceed 1 per year only in approved circumstances (e.g. public health, safety or welfare related). Emissions based on avg. 10.2 RVP crude oil and not more than 200 turnovers/year.
9/19/2008	IA-0095	Tate & Lyle Ingredients Americas, Inc.	Tate & Lyle Ingredients Americas, Inc.	Project 08-126	Gasoline Storage Tank	VOC	Internal floating roof	Not listed	None
8/22/2008	WI-0249	Enbridge Energy	Enbridge Energy	08-DCF-082	Tank T35	VOC	External floating roof tank	Not listed	Tanks are considered subject to NSPS (Kb). Shall meet or exceed welded external floating roof meeting the following. Required to apply controls to all guidepoles, use gasketed covers, sleeves and/or floats in slotted guide poles, wipers / gasketed covers on unslotted guidepole. Mechanical shoe primary with rim mounted secondary. Use socks or gaskets on roof legs (supports). Tank bottom shall be cone down (drain dry configuration). Roof landings may exceed 1 per year only in approved circumstances (e.g. public health, safety or welfare related). Emissions based on avg. 10.2 RVP crude oil and not more than 200 turnovers/year.
12/14/2007	NM-0050	Navajo Refining Company LLC	Artesia Refinery	PSD-NM-195-M25	Storage Tanks	VOC	External floating roof tank equipped with double seals	Not listed	Not authorized to store hydrocarbon liquid having a vapor pressure greater than 11.0 psi. No emission limits available.
8/8/2007	IA-0089	Homeland Energy Solutions, LLC, PN 06-672	Homeland Energy Solutions, LLC, PN 06-672	07-A-955P to 07-A-982P	Denatured Ethanol Storage Tank, T61 and T62 (07-A-972P and 07-A-973P)	VOC	Internal floating roof	Not listed	None
					190-Proof Ethanol Storage Tank, T65 (07-A-976P)	VOC	Internal floating roof	Not listed	None
					Denaturant Storage Tank, T64 (07-A-975P)	VOC	Internal floating roof	Not listed	None
					200 Proof Anhydrous Ethanol Storage Tank, T63 (07-A-974P)	VOC	Internal floating roof	Not listed	None
6/29/2007	IA-0088	Archer Daniels Midland	ADM Corn Processing - Cedar Rapids	57-01-080	Denaturant Storage Tank	VOC	Internal floating roof	Not listed	None
2/1/2007	LA-0212	Marathon Pipe Line LLC	Zachary Station	PSD-LA-721	11.75 MM Gal Gasoline/Distillates Tanks (T-1 & T-14)	VOC	Internal floating roofs	Not listed	None
					6.61 MM Gal Gasoline/Distillates Tank (T-4)	VOC	Internal floating roof	Not listed	None
					6.61 MM Gal Gasoline/Distillates Tank (T-9)	VOC	Internal floating roof	Not listed	None
					394,813 Gal Transmix Tank (T-13)	VOC	Internal floating roof	Not listed	None
12/27/2006	LA-0211	Marathon Petroleum Co LLC	Garyville Refinery	PSD-LA-719	External Floating Roof Storage Tanks	VOC	External floating roofs; comply with 40 CFR 63 Subpart CC	Not listed	There are no emission limits
					Internal Floating Roof Storage Tanks	VOC	Internal floating roofs; comply with 40 CFR 63 Subpart CC	Not listed	No emission limits
4/14/2005	AZ-0046	Arizona Clean Fuels Yuma LLC	Arizona Clean Fuels Yuma	1001205	Group B Storage Tanks	VOC	Internal floating roofs with headspace routed to the tank farm thermal oxidizer	Not listed	There is no numerical emissions limit for Group A tanks since the emissions must be collected and not emitted into the atmosphere.
42.009 - Volatile Organic Liquid Storage									
7/12/2013	IA-0106	CF Industries Nitrogen, LLC	CF Industries Nitrogen, LLc - Port Neal Nitrogen Complex	PN 13-037	Methyl-diethanol Amine (MDEA) Storage Tank	VOC	Nitrogen gas blanket	Not listed	None
					Urea Uf-85 Storage Tank	VOC	Packed bed scrubber	Not listed	None
					Diesel Belly Tanks	VOC	Not listed	Not listed	None
3/27/2013	LA-0272	Dyno Nobel Louisiana Ammonia, LLc	Ammonia Production Facility	PSD-LA-768	AMDEA Storage Tank (2009-F)	VOC	Not listed	Not listed	The PSD permit does not establish mass emission limits for the AMDEA storage tank. Tank emits only 0.003 tpy VOC.
12/3/2012	IN-0158	St. Joseph Energy Center, LLC	St. Joseph Energy Center, LLC	141-31003-00579	Turbine Lube Oil Storage Tanks	VOC	Good combustion practice and fuel specification	Not listed	None

RBLC Summary for Storage Tanks

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
4/23/2012	TX-0613	Magellan Pipeline Terminals, L.P.	East Houston Terminal	94433 and N134	Storage Tanks	VOC	Internal floating roof with welded seams, mechanical shoe primary seal and rim mounted secondary seal	Not listed	None
					Storage Tank Terminal Piping/Components	VOC	Vent vapors to control if vapor pressure > 0.5 psia and maintain control until VOC concentration less than 5000 ppmv is reached	Not listed	None
					Storage Tanks - MSS	VOC	Vapor space must be routed to control at all times if liquid vapor pressure > 0.1 psia. Roof cannot stay landed for more than 3 days. Control may be relaxed if all liquid is removed (drain dry tanks) and VOC concentration 5000 ppmv or less.	Not listed	Emission limits apply for all 30 tanks
8/19/2010	TX-0595	Valero Refining - Texas LP	Corpus Christi East Refinery	2937 and PSDTX1023M2	Temporary Tanks	VOC	Submerge filled white tanks with < 25,000 gallon capacity	Not listed	None
4/22/2010	VA-0313	Transmontaigne Operating Company LP	Transmontaigne Norfolk Terminal	60242	Storage and Loading of Petroleum Products (Total VOC Emissions)	VOC	Not listed	Not listed	None
					Loading Rack Emissions from Loading Racks LR-1 and LR-2	VOC	Vapor combustion unit w/ 10 mg/L VOC limite for gasoline and denatured ethanol loading	Not listed	None
					Truck Loading Fugitive Emissions from Loading Rack LR-1	VOC	Not listed	Not listed	None
3/29/2010	TX-0592	Valero Refining - Texas LP	Corpus Christi West Refinery	38754 and PSDTX324M13	Temporary Tanks	VOC	Submerged filled, white tanks < 25,000 gallon capacity	Not listed	None
11/17/2009	LA-0213	Valero Refining - New Orleans, LLC	St. Charles Refinery	PSD-LA-619 (M5)	Tanks - for Benzene, Xylene, Sulfolane, Parex, Intermediate	VOC	Equipped with internal floating roofs followed by thermal oxidizers	Not listed	No emission limits
10/26/2009	TX-0537	LBC Houston LP	LBC Houston Bayport Terminal	N99	Two New Storage Tanks	VOC	IFR configuration for routine emissions @ each of 2 new tanks (limit 1) flares/ice for refill & degas (limit 2); overall permit limit is 19.74 tpy for affected flares; limit 2 attributable to 2 new tanks	98%	VOC emission limit at new tanks
10/26/2009	TX-0538	LBC Houston LP	LBC Houston Bayport Terminal	N99	Two New Storage Tanks	VOC	IFR configuration for routine emissions @ each of 2 new tanks (limit 1) flares/ice for refill & degas (limit 2); overall permit limit is 19.74 tpy for affected flares; limit 2 attributable to 2 new tanks	98%	VOC emission limit at new tanks
9/19/2008	IA-0095	Tate & Lyle Ingredients Americas, Inc.	Tate & Lyle Ingredients Americas, Inc.	Project 08-126	Alcohol QC Tank	VOC	Internal floating roof	Not listed	None
					Ethanol Storage Tanks (2)	VOC	Internal floating roof	Not listed	None
					Corrosion Inhibitor Tank	VOC	Carbon filtration system	Not listed	None
12/14/2007	NM-0050	Navajo Refining Company LLC	Artesia Refinery	PSD-NM-195-M25	Sour Water Tank	VOC	External floating roof equipped with double seals	Not listed	No emission limits available
6/29/2007	IA-0088	Archer Daniels Midland	ADM Corn Processing - Cedar Rapids	57-01-080	190 Proof Tank	VOC	Internal floating roof	Not listed	None
					Denatured Ethanol Storage Tank	VOC	Internal floating roof	Not listed	None
					Alcohol Quality Control Tank	VOC	Internal floating roof	Not listed	None
					Alcohol Reclaim Tank	VOC	Internal floating roof	Not listed	None
					Alcohol Day Tank (200 Proof)	VOC	Internal floating roof	Not listed	None
4/19/2007	IA-0092	Southwest Iowa Renewable Energy	Southwest Iowa Renewable Energy	06-A-571P thru 06-A-590P	Ethanol Storage Tanks	VOC	Internal floating roof	Not listed	NSPS VV and Kb no emission limits available
11/30/2006	IA-0084	ADM Corn Processing - Clinton	ADM Polymers	Project Number 06-203	Laidig Tanks	VOC	Not listed	Not listed	The 80 ton/yr limit is for total emissions on the polymer processing system which includes 9 emission points. Compliance is demonstrated through daily sampling of polymer powder.
					BDO Storage Tank	VOC	Not listed	Not listed	None
					Antifoam Storage Tank	VOC	Not listed	Not listed	None
8/29/2006	TX-0496	INEOS USA LLC	INEOS Chocolate Bayou Facility	PSD-TX 854 and 95	Tank Cap	VOC	Not listed	Not listed	None
4/20/2005	TX-0478	Citgo Refining and Chemicals Company LP	Citgo Corpus Christi Refinery - West Plant	PSD-TX-408M3	Storage Tanks 6011-6012	VOC	Not listed	Not listed	None
					Storage Tank 13A&B	VOC	Not listed	Not listed	None
					Storage Tanks 6020-6023	VOC	Not listed	Not listed	None
3/24/2005	TX-0487	Rohm and Haas Texas Incorporation	Rohm and Haas Chemicals LLC Lone Star Plant	PSD-TX-828M1	Alcohol Tank (3)	VOC	Not listed	Not listed	None
2/16/2005	LA-0182	International Matex Tank	St. Rose Terminal	PSD-LA-705	2,541,471 Gal Heavy Fuel Oil Storage Tanks (2)	VOC	Not listed	Not listed	Tanks are part of emissions cap. Cap sources include the 17 new fixed roof heavy fuel oil storage tanks addressed in the PSD permit and 3 existing heavy fuel oil storage tanks equipped with internal floating roofs.
					4,219,180 Gal Heavy Fuel Oil Storage Tanks (11)	VOC	Not listed	Not listed	Tanks are part of emissions cap. Cap sources include the 17 new fixed roof heavy fuel oil storage tanks addressed in the PSD permit and 3 existing heavy fuel oil storage tanks equipped with internal floating roofs.

RBLC Summary for Storage Tanks

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
2/10/2005	LA-0182	Terminals	St. Rose Terminal	PSD-LA-703	3,383,615 Heavy Fuel Oil Storage Tanks (2)	VOC	Not listed	Not listed	Tanks are part of emissions cap. Cap sources include the 17 new fixed roof heavy fuel oil storage tanks addressed in the PSD permit and 3 existing heavy fuel oil storage tanks equipped with internal floating roofs.
					1,286,714 Gal Heavy Fuel Oil Storage Tanks (2)	VOC	Not listed	Not listed	Tanks are part of emissions cap. Cap sources include the 17 new fixed roof heavy fuel oil storage tanks addressed in the PSD permit and 3 existing heavy fuel oil storage tanks equipped with internal floating roofs.
12/9/2004	LA-0208	Degussa Engineered Carbons, LP	Ivanhoe Carbon Black Plant	PSD-LA-585(M-1)	Tank #3 (2.31 MM Gals)	VOC	Not listed	Not listed	None
8/4/2004	ND-0020	Red Trail Energy, LLC	Richardton Plant	04004	Ethanol Storage Tanks	VOC	Internal floating roof	95%	None
3/23/2004	AL-0191	Hyundai Motor Manufacturing of Alabama, LLC	Hyundai Motor Manufacturing of Alabama, LLC	209-0090-X001, X002, X003	Storage Tanks	VOC	Submerged fill pipes, stage 1 on large gasoline tanks	Not listed	BACT is control, no emission rate limit
2/3/2004	OK-0097	Quad Graphics Inc	Quad Graphics OKC FAC	2000-306-C M-1 PSD	Storage Tanks	VOC	Tanks ducted to carbon adsorber	98%	Limit is for nonmethane hydrocarbons
					VOC Loading	VOC	Emission and throughput limits, bottom fill loading, and work practice procedures to minimize emissions	Not listed	Limits are for nonmethane hydrocarbons
1/21/2004	WI-0207	Ace Ethanol, LLC	Ace Ethanol - Stanley	03-DCF-184	Storage Tanks	VOC	Fixed roof tanks with internal floating roof (subject to NSPS)	Not listed	No emission rate limits
12/17/2003	TX-0439	Toyota Motor Manufacturing Texas Inc	Toyota Motor Manufacturing Texas	P1036	Bulk Material Storage Tanks	VOC	Not listed	Not listed	None
8/14/2003	WI-0204	United Wisconsin Grain Producers	UWGP - Fuel Grade Ethanol Plant	03-DCF-048	Large Storage Tanks, T61, T62, T63, T64, T65	VOC	Internal floating roof (NSPS) storage tanks, good operating practice	Not listed	Permit limit is internal floating roof and good operation practices. All noted tanks > 40,000 gal w/ max. true vapor pressures of 0.91 psia.
					Storage Tank, 2000 Gal, Corrosion Inhibitor, T66	VOC	2000 gal. fixed roof tank, pressure/vacuum conservation vent, submerged fill pipe (NSPS but only recordkeeping)	Not listed	Permit limit is controls and recordkeeping
7/22/2003	TX-0458	Duke Energy LP	Jack County Power Plant	P1026	Diesel Tank	VOC	Not listed	Not listed	None

C3P searched the EPA RACT/BACT/LAER Clearinghouse (RBLC) database to assist in the identification of potential GHG emission control technologies for loading and unloading activities. There were no entries in this database for GHGs from these activities. The RBLC did contain methods for the control of VOC emissions from loading and unloading, which may result in GHG emissions when controlled by a thermal device such as a flare. The results of this RBLC search are attached.

BACT for VOC Loading and Unloading

There will be no direct GHG emissions from the loading and unloading of raw materials, products, or by-products of the PDH process. There will, however, be GHG emissions as a result of loading and unloading VOC materials and control of these VOC emissions by combustion in the flare. All VOC loading/unloading at the C3P PDH plant will utilize submerged fill and the emissions will be vented to the PDH flare.

Step 1: Identify All Available Control Technologies

The control options identified for VOC/GHG emissions from the loading and unloading of VOC materials include:

- Vapor balancing
- Submerged fill or bottom loading (i.e. no splash loading)
- Use of add-on controls to reduce VOC emissions

Step 2: Eliminate Technically Infeasible Options

All options in Step 1 were considered technically feasible for controlling VOC emissions from loading and unloading.

Step 3: Rank Remaining Control Technologies

The following reductions in VOC emissions can be achieved by the technologies listed below:

- Vapor balancing - 90% (per RBLC search)
- Submerged fill or bottom loading (i.e. no splash loading) - 40% (based on AP-42)
- Use of add-on controls to reduce VOC emissions – 98% with flare

Step 4: Evaluate Economic, Energy and Environmental Impacts

The cost of vapor balancing was considered excessive when compared to the amount of VOC reduction achieved. Based on the quantities of VOC materials loaded/unloaded, the vapor pressure of these materials, and level of VOC control achievable, it was concluded that submerged fill and routing vapors to the flare would satisfy the requirement for BACT and that the additional cost of vapor balancing was not justified.

Step 5: Select BACT

With the exception of vapor balancing, C3P will utilize all of the technologies listed in Step 1. This will include:

- Submerged fill for all tank truck loading activities
- Submerged fill for all tanks into which VOCs are unloaded
- Use of the PDH flare to reduce VOC emissions from loading and unloading by at least 98%

RBLC Summary for Loading/Unloading

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
42.003 - Gasoline Marketing									
11/30/2009	NV-0050	MGM Mirage	MGM Mirage	825	Gasoline Storage and Dispensing Station - Unit BE108 at Bellagio	VOC	Stage 1 vapor recovery system for gasoline delivery to the tank and stage 2 vapor control system for gasoline dispensing	Not listed	None
10/5/2004	TX-0485	Inland Paperboard and Packaging Inc	Inland Paperboard and Packaging Orange Mill	PSD-TX-684M1 /9654A/833M1	Gasoline Tank/No. 2 Fuel Oil Tank	VOC	Not listed	Not listed	None
12/30/2003	TX-0462	Perkinelmer Automotive Research Inc	Perkinelmer Automotive Research	P1021	VOC Storage Tank	VOC	Not listed	Not listed	None
42.004 - Petroleum Liquid Marketing									
5/20/2010	LA-0237	International Matex Tank Terminal (IMTT)	St. Rose Terminal	PSD-LA-736(M-2)	Truck Rack	VOC	Submerged fill	Not listed	No emission limits available
42.010 - Volatile Organic Liquid Marketing									
6/26/2003	TX-0457	City Public Service	City Public Service Leon Creek Plant	P1027	Diesel Tank 1 (4) and (2)	VOC	Not listed	Not listed	None
42.999 - Other Liquid Marketing Sources									
6/24/2008	LA-0232	Gulf Crossing Pipeline Co. LLC.	Sterlington Compressor Station	PSD-LA-729	Truck Loading of Condensate	VOC	Submerged loading	Not listed	None
2/1/2007	LA-0212	Marathon Pipe Line LLC	Zachary Station	PSD-LA-721	Loading Rack (Vapor Combustor) (V-1)	VOC	Vapor combustor to control VOC emissions from products having a true vapor pressure greater than 1.5 psia	Not listed	None
64.005 - Transfer of SOCMI Chemicals (loading/unloading, filling, etc.)									
2/7/2011	IN-0131	Consolidated Terminals and Logistics Company	Consolidated Terminals and Logistics Company	129-29175-00054	Submerged Ethanol Barge Loadout Operations	VOC	Adsorption/absorption hydrocarbon vapor recovery system	98%	Emission limit 1 unit of measure: % capture and removal efficiency state BACT
8/4/2004	ND-0020	Red Trail Energy, LLC	Richardton Plant	04004	Ethanol Loadout	VOC	Vapor combustion unit (enclosed flare)	98%	The emission limit for VOC is 10 mg/liter of product loaded or 98% reduction of inlet VOC concentration to the vapor combustor (3 hour average).

C3P searched the EPA RACT/BACT/LAER Clearinghouse (RBLC) database to assist in the identification of potential GHG emission control technologies for cooling towers. There were no entries in this database for GHG emissions from cooling towers. The RBLC did, however, contain methods for the control of VOC emissions from cooling towers, which can be used as a surrogate to detect GHG emissions when they are present in VOC-containing process streams. The results of this RBLC search are attached.

BACT for Cooling Towers

The construction of the PDH plant will include one cooling tower for process cooling services. The majority of cooling service provided by this cooling tower will be for VOC-containing processes. Three cooling water services containing small quantities (≤ 5%) of CH_4 in the process stream have also been identified. The cooling water services that contain CH_4 also contain VOC in the process gas. In most cases, these VOC-containing process streams include propylene, a highly reactive VOC (HRVOC). Therefore, C3P will implement a monitoring program for the cooling tower in accordance with the TCEQ HRVOC rules and will maintain records of this monitoring in compliance with these rules.

Step 1: Identify All Available Control Technologies

The control options for VOC/GHG emissions from cooling towers include:

- Non-contact design
- Use of heat exchangers for which the water-side pressure is greater than the process-side pressure
- Implementation of a leak detection and repair program.

Step 2: Eliminate Technically Infeasible Options

All of the options in Step 1 are considered technically feasible for controlling VOC/GHG emissions from the cooling tower.

Step 3: Rank Remaining Control Technologies

No BACT options are being eliminated in this step.

Step 4: Evaluate Economic, Energy and Environmental Impacts

No BACT options are being eliminated in this step.

Step 5: Select BACT

The cooling water loop will include a number of heat exchangers. Approximately ½ of the cooling water service will operate with the water-side pressure greater than the process side pressure. In these instances, any leak in the exchanger would result in the leak of cooling water into the process and would not result in VOC/GHG emissions. The other heat exchangers operate with the process-side pressure greater than the water-side pressure. Therefore, if these heat exchangers leak, the process gas will enter the cooling tower and potentially be stripped out in the cooling tower.[1] To control VOC/GHG emissions from the cooling tower, C3P will monitor the cooling tower return water on a monthly basis, using Appendix P methodology, assuming all VOC is stripped out in the cooling tower.[2] Any leaks identified will be repaired as soon as possible. A plant shutdown will be triggered by a cooling water VOC concentration of 0.08 ppmw VOC or greater.[3]

The C3P heat exchange system will also be subject to the continuous HRVOC monitoring requirements of 30 TAC §115.764(a). These requirements will include the installation/operation of continuous flow monitors on each cooling tower inlet and the installation/operation of continuous strippable VOC concentration monitors on each cooling tower inlet.

C3P will utilize all of the technologies listed in Step 1. This will include:

- Non-contact design of the cooling services
- Where technically feasible, install heat exchangers that operate with the water-side pressure that is greater than the process-side pressure. Due to process pressures, this is only technically feasible prior to the compressor section of the PDH plant
- Implementation of a leak detection and repair program for HRVOCs in compliance with TCEQ rules

[1] Texas Commission on Environmental Quality, "Technical Supplement 2: Cooling Towers," TCEQ Publication RG-360A, Revised, January 2007 (http://www.tceq.state.tx.us/assets/public/comm_exec/pubs/rg/rg360/rg-360-06/techsupp_2.pdf).

[2] Texas Commission on Environmental Quality, "Sampling Procedures Manual, Appendix P: Cooling Tower Monitoring," Revision 1, January 2003 (http://www.tceq.state.tx.us/assets/public/implementation/air/sip/sipdocs/2002-12-HGB/02046sipapp_ado.pdf).

[3] Texas Commission on Environmental Quality, "Current Best Available Control Technology (BACT) Requirements: Cooling Towers," August 1, 2011 http://www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/bact/bact_cooltow.pdf).

RBLC Summary for Cooling Towers

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
7/12/2013	IA-0106	CF Industries Nitrogen, LLC	CF Industries Nitrogen, LLC - Port Neal Nitrogen Complex	PN 13-037	Cooling Towers	VOC	Limit the amount of VOC in treatment chemicals and a drift eliminator	Not listed	There is not a numerical limit. Instead there is a work practice being put in place to limit the amount of VOC in the treatment chemicals.
12/23/2010	FL-0322	Southeast Renewable Fuels (SRF), LLC	Sweet Sorghum-to-Ethanol Advanced Biorefinery	PSD-FL-412 (0510032-001-AC)	Cooling Water Tower	VOC	Not listed	Not listed	The permittee shall control VOC emissions by promptly repairing any leaking components in accordance with the approved LDAR plan. The permittee shall collect a sample of cooling water on a weekly basis from cooling towers No. 1 and No. 3 and analyze it for VOCs to enable the early detection of leaking heat exchangers and thereby minimizing VOC emissions from the cooling towers. These work practice standards are established as BACT for VOC emissions from the cooling towers.
12/10/2009	FL-0318	Verenium	Highlands Ethanol Facility	PSD-FL-406 (0550061-001-AC)	Cooling Tower	VOC	The cooling tower shall be constructed to achieve the specified drift rate of no more than 0.0005% of the circulating water flow rate.	Not listed	VOC emissions can occur from cooling towers used in chemical plants, where the circulating water is used to cool down hydrocarbon process streams. While the process heat exchangers will be designed to prevent contact of the cooling water with the process streams, leaks in the process heat exchangers can occur. The VOCs that would consequently enter the cooling water would ultimately be stripped out by the cooling tower's air flow. Therefore, the permittee shall control VOC emissions by promptly repairing any leaking components in accordance with the approved LDAR plan. The permittee shall collect a sample of cooling water on a weekly basis and analyze it for VOCs to enable the early detection of leaking heat exchangers and thereby minimizing VOC emissions from the cooling tower.
11/17/2009	LA-0213	Valero Refining - New Orleans, LLC	St. Charles Refinery	PSD-LA-619 (M5)	Cooling Towers (13-81, 2004-6, 2005-42, 2005-43, 2008-35)	VOC	Monitoring process side of the heat exchangers for leaks 2008-35: VOC monitoring program meets 40 CFR 63 Subpart F	Not listed	No emission limits
12/27/2006	LA-0211	Marathon Petroleum Co LLC	Garyville Refinery	PSD-LA-719	Cooling Tower Nos. 1 & 2 (24-08 & 32-08) & Hydrogen Plant Cooling Tower (53-08)	VOC	Monthly monitoring of the heat exchanger/cooling tower under LDAR program	Not listed	There are no emission limits
1/21/2004	WI-0207	Ace Ethanol, LLC	Ace Ethanol - Stanley	03-DCF-184	Cooling Towers, F06	VOC	Mist eliminators	Not listed	0.005% circulation drift rate, 300 ppm VOC content
8/14/2003	WI-0204	United Wisconsin Grain Producers	UWGP - Fuel Grade Ethanol Plant	03-DCF-048	Cooling Towers, P80	VOC	0.005% max. drift rate, 124 ppm VOCs, max. flow of 22,000 gpm	Not listed	None
7/10/2003	OH-0256	British Petroleum Chemicals, Inc.	Lima Chemicals Complex	03-11250	Cooling Tower	VOC	Drift eliminators + LDAR program	Not listed	None

C3P searched the EPA RACT/BACT/LAER Clearinghouse (RBLC) database to assist in the identification of potential GHG and/or VOC emission control technologies from analyzer vents. One analyzer vent was found in the RBLC search, but no controls were specified. The results of the RBLC search are attached.

BACT for Analyzer Vents

Approximately 30 process analyzers are expected to be used by the PDH process. Of these analyzers, approximately ½ of them vent back to the process. The remaining process analyzers vent to the flare. Of the analyzers that vent to the flare, 4 are hydrogen sulfide analyzers, 4 are hydrogen-hydrocarbon detectors, and 7 are gas chromatographs.

Step 1: Identify All Available Control Technologies

The primary VOC/GHG control options available for analyzer vents are as follows:

- Return analyzer vent to the process
- Minimize the quantity of process gas vented from each analyzer
- Utilize control device to reduce VOC emissions from the analyzer vents

Step 2: Eliminate Technically Infeasible Options

All of the options in Step 1 are considered technically feasible for controlling VOC and GHG emissions from the process analyzers.

Step 3: Rank Remaining Control Technologies

No BACT options are being eliminated by this step.

Step 4: Evaluate Economic, Energy and Environmental Impacts

No BACT options are being eliminated by this step.

Step 5: Select BACT

C3P was unable to identify any BACT guidance, SIP provisions, NSPS requirements, or new source NESHAP requirements for the control of process analyzer vent gas. If it is not technically feasible to vent the stream back to the process, C3P believes that the most stringent control achieved in practice is to vent the process analyzers to a thermal control device, such as the flare.

For the purpose of estimating GHG emissions from the venting of these process analyzers to the flare, C3P conservatively assumed that each analyzer vents at a rate of 1,000 cc/hour. This flow rate resulted in a GHG emission rate of 0.6 tons/year of CO_2e when venting these analyzer vents to the flare. This emission rate from the analyzer vents represents 0.00007% of the total proposed CO_2e emissions from the PDH plant.

C3P will utilize all of the technologies listed in Step 1. This will include:

- Where technically feasible, return analyzer vent to the process
- Minimize the quantity of process gas vented from each analyzer to a maximum of 1000 cc/hr
- Utilize PDH flare to reduce VOC emissions from the analyzer vents

RBLC Summary for Analyzer Vents

Date	RBLC ID	Company	Facility	Permit Number	Process Name	Pollutant	Control Method	Control Efficiency	Pollutant Notes
4/3/2004	TX-0449	Union Carbide Corporation - A Subsidiary of Dow CC	UCC Seadrift Operations	P118M4	Analyzer Vents	VOC	Not listed	Not listed	None

Greenhouse Gas Emission Calculations - Flare Emissions During Barge Loading

EPN	Description	Flow (scf/yr)	Annual GHG Emissions (tpy)			
			CO_2	CH_4	N_2O	Total GHG (CO_2e)
DOCK - FLARE	Barge Loading Emissions from Flare	17,512,236	324.8	1.0	0.001	345.4
TOTAL		17,512,236	**324.8**	**1.0**	**0.001**	**345.4**

Gas Vented to Flare During Barge Loading

Component	Weight Percent (%)	MW (kg/kgmol)	Carbon Atoms/mole	Carbon Content
Natural Gas	20.43%	16.00	1	0.751
Nitrogen	79.57%	28.00	0	0.000
Total		25.55		0.153

Conversions & Emission Factors

8760	hr/yr
2000	lb/ton
0.0001	kg/MMBTU N_2O, from 40 CFR 98 Subpart C, Table C-2
0.001	kg/MMBTU CH_4, from 40 CFR 98 Subpart C, Table C-2
310	GWP for N_2O
21	GWP for CH_4
1	GWP for CO_2
0.001	conversion factor from kilograms to metric tons
1.1023	short tons/metric ton