apcd air pollution control district
SANTA BARBARA COUNTY

H.B. Case No.:	2025-09-M1
Petitioner:	County of Santa Barbara, Public Works Department
Permit No.:	ATC 14500-10 and PT 70/PTO 14500 (upon issuance)
Date Rec'd:	5/4/2026
Time Rec'd:	1353 hours
Filing Fee Paid:	$977.00

PETITION FOR VARIANCE

Type of Variance Requested:

Emergency _____ Interim[1] X 90-Day _____ Regular X

Length of Variance Requested: Start Date 5/28/2026

End Date 5/28/2027

[1] A 90-Day or Regular Variance must be filed concurrently with an Interim Variance

1. PETITIONER INFORMATION

A. Please provide the name, address and phone number of the Petitioner.

Name: County of Santa Barbara Public Works
Address: 130 E Victoria St
Santa Barbara, CA 93101
Phone Number: 805-882-3600

B. Please provide the name, address and phone number of the person authorized to receive correspondence regarding this Petition if different from response in 1.A.

Name: Lindsay Cokeley
Address: 130 E Victoria St
Santa Barbara, CA 93101
Phone Number: 805-698-0742

C. The Petitioner is (please check one):

1) An Individual ( )
2) Partnership ( )
3) Corporation ( )
4) Public Agency (X)
5) Other Entity (please describe)

2. Location of equipment for which the variance is requested if different from response in 1.A.

14470 Calle Real, Goleta, CA 93117

3. List any District permits that are applicable to the equipment subject to this variance request.

ATC 14500-10

4. Briefly describe the equipment that is the subject of this Petition.

Materials Recovery Facility (MRF) and Anaerobic Digestion Facility (ADF) combined heat and power (CHP) engines (Device IDs: 388360, 389006, 393170, 393171); MRF and ADF Selective Catalytic Reduction and Oxidation Catalysts (Device IDs: 388361, 389007, 393172, 393173), ADF Enclosed Flare (Device ID: 388364), MRF Enclosed Flare (DID: 393175), CHP engine Continuous Emissions Monitoring Systems (CEMS), Compost Piles (DID 388367), Gore Covers (398523), Compost Aeration (398524), Tipping Area (388338), ADF (DIDs: 388347, 388348), CMU Trommel Screen (388369), and Biogas Treatment System (388358)

5. **FINDINGS REQUIRED FOR THE GRANTING OF A VARIANCE**

In order for the Hearing Board to grant a variance to a Petitioner authorizing the operation of a source in violation of any rule, regulation or order of the District, the Hearing Board is required to make "findings" in accordance with the requirements specified in California Health and Safety Code §42352, et. seq. and District rules and regulations. The Hearing Board's variance decision will take into consideration information you provide in this Petition. Please ensure your responses are complete and thorough. Please use additional pages as necessary.

A. Please state 1) what District rule, regulation or order you either are or will be in violation of, and 2) the date said violation will or did occur. Include as appropriate the applicable permit conditions for which variance relief is being sought.

See Attachment B

B. Please describe how compliance with the District rule, regulation or order listed in Section A above is beyond your reasonable control. In addition to any other relevant factors, please include in your discussion 1) what actions you have taken to comply or seek a variance, which were timely and reasonable under the circumstances.

See Attachment B

C. Please describe how you would be impacted if you were required to immediately comply with the District rule, regulation or order the subject of this variance request. In addition to any other relevant factors, please discuss why such impacts would result in 1) an arbitrary or unreasonable taking of property, or 2) the practical closing and elimination of a lawful business.

See Attachment B

D. If you were required to immediately comply with the District rule, regulation or order the subject of this variance request, please describe what impact, if any, that would have on air contaminants.

See Attachment B

E. Please describe what consideration you have given to curtailing operations in lieu of obtaining a variance.

See Attachment B

F. Please describe what steps and measures you will take to reduce excess pollutant emissions the maximum extent feasible during the requested variance period.

See Attachment B

G. If requested to do so by the District, please describe how you will monitor or otherwise quantify and report to the District any pollutant emissions associated with the granting of your variance.

See Attachment B

6. **SUPPLEMENTAL FINDINGS IF APPLYING FOR AN EMERGENCY VARIANCE PURSUANT TO RULE 506 (EMERGENCY VARIANCE FOR BREAKDOWNS)**

A. Please provide the date and time the breakdown was reported to the District

Date: N/A Time: N/A

B. Breakdown number (as provided by the District): N/A

C. Please provide a description of the "breakdown condition", including equipment involved and the cause to the extent it is known.

N/A

D. Please describe why the continued operation of your facility in a "breakdown condition" is not likely to cause an immediate threat or hazard to public health or safety and will not interfere with the attainment or maintenance of any primary national ambient air quality standard.

N/A

7. Will the operation of the equipment subject to this variance result in violation of District Rule 303, Nuisance?

No

8. Please state whether or not any civil or criminal case involving the equipment subject to this variance is pending any court.

N/A

The undersigned is authorized to submit the above Petition on behalf of the Petitioner and further states under penalty of perjury that the above Petition, including any attachments and the items therein set forth, are true and correct.

DATE: 4/29/2026 SIGNATURE: DocuSigned by: Travis Spier 0CB7F7833BB84D8...

TITLE: Engineering Manager

PRINT NAME: Travis Spier

Variance Filing Fees: All variance Petitions must be accompanied by the requisite filing fee at the time of filing or include a letter from the Petitioner on company letterhead authorizing the District to debit the filing fee from the company's reimbursable account. You may also pay your filing fees by credit card using the attached form. Current variance filing fees may be found under Rule 210, schedule F, Sections 12a and 12b at http://www.sbcapcd.org/fees.htm

Credit Card Payment: The Variance Filing Fee may be paid with a credit card. Please use APCD Form -01C to pay via credit card. The form may be downloaded at: http://www.sbcapcd.org/eng/dl/dl01.htm

Attachment B
Variance Petition Supporting Documentation

1. *Section 5.A. Please state 1) what District rule, regulation or order you either are or will be in violation of, and 2) the date said violation will or did occur. Include as appropriate the applicable permit conditions for which variance relief is being sought.*

   District Rules 328.C.2, C.4, G, H and I.1 and Rule 206, ATC 14500-Mod 10, Conditions 9.B.12, 9.C.1.b.i, 9.C.1.b.iii., 9.C.2.b.ii., 9.C.3.b.i,, 9.C.3.b.ii,, 9.C.3.b.iii,, 9.C.3.b.iv., 9.C.3.c.i., 9.C.3.c.ii., 9.C.3.d.i, 9.C.3.d.ii., 9.C.5.a.ii., 9.C.5.b.i., 9.C.6.a.iii, 9.C.6.a.iv., 9.C.7.a.i, 9.C.7.a.iv, 9.C.9.a.i, 9.C.9.a.iv., 9.C.9.b.iii., 9.C.9.b.iv.1.a., 9.C.9.b.iv.2.a., 9.C.9.b.xvi., 9.C.9.c.xiii (ADF CHP IC engines only), 9.C.10.b.i., 9.C.10.b.iii., 9.C.10.b.v., 9.C.10.b.xvi., 9.C.10.b.xvii., 9.C.10.c.iv., 9.C.10.d.i, 9.C.11.a.i., 9.C.11.a.ii., 9.C.11.b.i., 9.C.11.b.iv., 9.C.11.b.v., 9.C.11.b.viii., 9.C.11.b.ix., 9.C.11.b.x., 9.C.11.b.xi., 9.C.11.c.viii, 9.C.11.c.ix., 9.C.11.c.x., 9.C.11.c.xi., 9.C.11.c.xii, 9.C.19, 9.C.21 (ADF and MRF CHP IC engines only) and 9.C.22.

2. *Section 5.B. Please describe how compliance with the District rule, regulation or order listed in Section A above is beyond your reasonable control. In addition to any other relevant factors, please include in your discussion 1) what actions you have taken to comply or seek a variance, which were timely and reasonable under the circumstances.*

   Compliance with the permit conditions identified in Section 5.A has been beyond the County's reasonable control because the noncompliance stems from technical and permitting issues that could not be fully identified or resolved until after the facility was designed, constructed, and operated, and because resolution depends on specialized third-party engineering, manufacturer information, revised emissions analysis, District review, and permit amendments that cannot be completed immediately by County staff alone. The County has taken timely and reasonable actions to comply and seek regulatory relief while these issues are being resolved, and is further described in this Attachment.

   On May 30, 2025 the County of Santa Barbara Public Works Resource Recovery and Waste Management Division (RRWMD) applied for a regular variance which would allow the facility to operate out of compliance with permit conditions while permit amendments were being processed. That same month, the County executed a contract with AECOM, the consultant that had previously assisted with this permit to help determine the correct path for a permit revision and to prepare revised emission calculations and modeling. County staff submitted applications and responses to incomplete applications in August 2025. Incomplete letters were received from the District in October 2025 and March 2026 which required revised emission calculations and manufacturer's literature to change equipment operating parameters. A complete response has been delayed for multiple reasons that are beyond the County's reasonable control.

   Facility operational changes were conveyed to AECOM in July of 2025. Due to the complexity of the permitted equipment operating scenarios, changes to the stationary source emissions as a part of the Tajiguas Landfill Capacity Increase Project, new emission factors, and AECOM staff turnover, draft emission calculations were not finalized by AECOM until February 2026.

RRWMD staff took additional steps to comply. We reviewed original application materials dating back to 2013, thoroughly evaluated the root causes of the equipment operating-parameter discrepancies, invested additional funds into repairs and technology upgrades and reached out to manufacturers that are located across the globe to obtain the information requested. Due to the age of this permit, many of the staff at the District and RRWMD are no longer employed and there are many unanswered questions regarding assumptions made during the design and permitting phase. As of April, all available materials have been reviewed and submitted to the District. District engineering staff needs to review and deem the permit modifications complete and then amend the permit to address the corrected assumptions found through this process. This will not occur by the time the current variance ends in May.

The facility is currently experiencing NOx exceedances caused by the presence of siloxanes in the biogas, a factor that was not anticipated in the conceptual design established over 10 years ago. At the time of the original design, siloxanes were not expected to be a significant constituent of the MSW-derived organic feedstock processed at the facility. In response, the County initiated the ADF Biogas Treatment System Upgrade Project, which included evaluating current infrastructure with the engineering firm Tetra Tech and specialized media vendors. These technical evaluations confirmed that the existing biogas H2S treatment vessels are undersized and lack the specific humidity controls required for effective siloxane removal in addition to their current H2S Treatment.

Consequently, the County was forced to pivot to a redesigned treatment path, as detailed in Section 5.F of this attachment. This necessity is supported by the SCS Engineers Technical Update by Jeffrey L. Pierce, which notes that siloxanes, typically originating from consumer products such as cosmetics and detergents, oxidize into Silicon Dioxide (SiO2) during combustion. This process creates a microcrystalline glass-like fouling on the Selective Catalytic Reduction (SCR) catalyst bricks, effectively poisoning the catalyst and rendering the SCR system non-functional. This degradation of the SCR components directly limits the system's effectiveness in reducing nitrogen oxides, thereby causing the identified NOx exceedances.

To effectively address the changes that will occur to the Biogas Treatment System in the permit amendment, the emission calculations that were finalized in February 2026 will need to be amended, and stationary source air modeling will need to be done after all the source emissions are quantified. Parts for engine upgrades were ordered in June 2025, and due to delays outside of the County's control, all the parts needed to complete these upgrades will not arrive until approximately late summer/early fall of 2026.

As soon as staff discovered parts could not be sourced in time and a new design was needed, a variance extension was discussed with District staff. District staff recommended submitting a variance application to be heard in May. RRWMD staff decided to take additional time to review all the conditions previously applied for under variance to ensure that all conditions that need variance coverage are out of staff's control. To this end, RRWMD staff made schedule changes and corrections to operational flows, at the risk of increased costs due to overtime and decreased movement of waste through the facility to comply with as many operational limits as possible. RRWMD intends to comply with these conditions until such time the permit can be finally approved and amended.

3. *Section 5.C, Findings Required for the Granting of a Variance, Impacts*

Please describe how you would be impacted if you were required to immediately comply with the District rule, regulation or order the subject of this variance request. In addition to any other relevant factors, please discuss why such impacts would result in 1) an arbitrary or unreasonable taking of property, or 2) the practical closing and elimination of a lawful business.

Immediate compliance would require a shutdown of the MRF and/or ADF and put the ReSource Center in non-compliance with its Material Delivery Agreements (with cities of Santa Barbara, Goleta, Solvang, and Buellton), its energy financing agreements (i.e. Power Purchase Agreement and Net Energy Metering Agreement), and other State regulations, such as Senate Bill 1383.

If the facility were required to immediately comply by shutting down the biogas engines and flare, the County would be forced to stop processing organics in the ADF and unlikely able to meet the required 90 percent recovery of organic waste at the ADF and Composting Management Unit (CMU) in accordance with Senate Bill 1383. In addition, shutdown of the ADF engines would cause a breach of the Guaranteed Energy Production rate in the County of Santa Barbara's Power Purchase Agreement with Southern California Edison, a financial mechanism partially funding operations at the ReSource Center, and result in liquidated damages assessed to the County. Due to financial constraints for costly hauling and disposal of waste, the County may be forced to bury the organic waste at the Tajiguas Landfill, exhausting its current capacity ahead of the projected 2038 closure date, with closure occurring approximately four years earlier in late 2034.

Closure of the Tajiguas Landfill prior to 2038 would burden the ratepayer of paying for debt service for the ReSource Center alongside costs for transportation and disposal of waste at alternative landfills. RRWMD is aware that in-County waste disposal at alternative landfills are limited, with the City of Lompoc landfill and the City of Santa Maria Regional Landfill estimated to close in 2034. Increased haul distances, vehicle miles travelled and associated air pollutant and greenhouse gas (GHG) emissions are expected when exporting waste to out-of-County landfills and is considered financially infeasible. Tipping fees would likely need to increase by approximately 46 percent to offset the approximately 13.4 million dollars in annual costs for hauling waste out of the County and to maintain debt service obligations for the ReSource Center.

Section 4.3.D of the County's Material Delivery Agreements with the cities of Goleta, Santa Barbara, Solvang, and MarBorg (for the City of Buellton) contains a protocol to address the scenario that the County has to increase its tipping fee at the ReSource Center greater than 7.5 percent in a single year or 15 percent in the past three consecutive years. This protocol requires an operating committee to be convened, and a two-thirds vote (representation based on the quantity of material delivered to the ReSource Center by each public participant) to approve a proposed tipping fee. Therefore, the County's ability to increase the tipping fee by 46 percent is uncertain and its ability to meet the bond financing obligations could be jeopardized. In summary, [this scenario] is considered financially infeasible as the annual cost would be over eight times ($13.4 million/$1.6 million) that of the proposed project and increases in tipping fees to offset this cost are unlikely to be approved.

Lastly, Health & Safety Code § 42352 states "in making those findings where the petitioner is a public agency, the hearing board shall consider whether or not requiring immediate compliance would impose an unreasonable burden upon an essential public service". This section further defines "essential public service" as "a landfill gas control or processing facility, if owned and operated by a public agency". The RRWMD of the Public Works Department is the operator of the Tajiguas Landfill and ReSource Center, and its responsible official is the Director of Public Works, which is a "public agency" as defined in this Section.

4. *Section 5.D, Findings Required for the Granting of a Variance, Immediate Compliance*

If you were required to immediately comply with the District rule, regulation or order the subject of this variance request, please describe what impact, if any, that would have on air contaminants.

The original EIR for this project indicated a Class IV impact on GHG emissions with an annual reduction of 117,000 metric tons of carbon dioxide equivalent (MTCO2e). This is accomplished by digesting the organics at the ADF as opposed to allowing for the less controlled anaerobic decomposition in the landfill (with most effecting landfill gas collection systems only able to capture 75% of emissions as opposed to nearly 100% at ADFs). Additional GHG reductions also occur from the generation of renewable energy and the use of compost displacing petrochemical derived soil amendments. The ReSource Center is a significant mitigation of environmental impacts of the waste generated by Santa Barbara County residents. Immediate compliance would require a shutdown of the ADF and MRF as well as subsequent burial of more waste, primarily organic waste. This would result in a loss of all environmental benefits derived from the project. Consequences include increased methane surface emissions and accelerating the reduction of available landfill air space.

Diversion of waste to an off-site facility in Los Angeles County is no longer an option, and noncompliance with Senate Bill 1383 organic waste diversion requirements with Cal Recycle are in effect. Should the division need to divert waste outside of the County after landfill capacity is reached, there would be a net increase in GHG emissions from the increased truck trips to facilities hundreds of miles away. Additionally, the combustion of the methane rich biogas (i.e. ADF option) is more environmentally friendly than letting the biogas vent to the atmosphere (i.e. landfilling option) from a greenhouse gas standpoint. For reference, methane has 28 to 100 times more global warming potential compared to carbon dioxide.

Processing organics in the controlled environment of the ADF allows for nearly 100% emission capture, whereas landfilling these materials results in fugitive methane emissions that are far more damaging to the environment. Maintaining operations while the biogas treatment project is completed is the most environmentally protective path for the community.

Section 5.E, Findings Required for the Granting of a Variance, Reasonable Control and Actions Taken. Please describe what consideration you have given to curtailing operations in lieu of obtaining a variance.

When the County first took over operation of the ReSource Center, staff completed extensive work to repair and diagnose systemic problems. The first line of actions that were completed in 2024 included the replacement of all the CHP engine SCR systems, all gas treatment media, and catch up on preventative maintenance, which allowed our division to start fresh. This effort concluded in March 2025, when all engines passed source testing. The source tests gave us key information that we did not already have, which indicated that the systems can function properly when new. We then had to take time to address the root cause of each issue that came up throughout the calendar year in 2025. It was at this point that additional variance coverage was sought.

During the Regular Variance 2025-09-R, staff determined that the root cause of many emissions exceedances was due to the organic feedstock quality and inaccurate permit assumptions. Staff started executing corrective action to address emissions exceedances by conducting a forensic evaluation of the systems. We began testing biogas for multiple types of siloxanes, increased dosing within the ADF to try to bring down H2S levels prior to treatment, adjusted ADF operations to try to comply with hours of operation limits, continuously monitored methane content in the fuel, and evaluated dynamic dosing of Urea to better control criteria pollutant emissions from the engines. After completing this forensic evaluation, it was determined that the CHP engine controllers and the Biogas Treatment system needed substantial upgrades to continue to function properly.

Prior to the Regular Variance 2024-06-R, the County evaluated shutting down the ADF engines intermittently while processing biogas through the ADF Flare. However, this requires an alternative means for supplying hot water that is supplied by the ADF engines' water jacket system to heat the ADF and percolate tanks. There are safety concerns with bringing a portable boiler onsite for this purpose. This additional equipment would also result in greater energy consumption and greater carbon footprint. For further clarification, heat from the ADF CHP engines is needed to keep the percolate microorganisms alive and metabolizing the organic matter in the ADF digesters, and additional flare usage would cause more excess emissions. Curtailing operations at the Resource Center would require more waste to be diverted to the landfill, which at this point is simply not an option. It should be noted that the generation of methane from organics in the community's waste is a zero-sum game. Reducing biogas production at the ADF would require burying organic material in the landfill, shifting methane emissions to a less controlled environment. Landfill-generated methane is more difficult to capture effectively and typically results in higher GHG emissions, undermining the County's climate goals.

Furthermore, the County is required to generate a minimum amount of renewable energy from its biogas production through its Power Purchase Agreement with Southern California Edison. A reduction in biogas production could result in failure to meet the Guaranteed Energy Production, triggering liquidated damage and causing lost revenue. These financial consequences would ultimately be borne by the community's ratepayers, compounding the environmental cost with economic impacts.

5. *Section 5.F, Steps Taken*

Please describe what steps and measures you will take to reduce excess pollutant emissions to the maximum extent feasible during the requested variance period.

During the requested variance period, RRWMD staff will continue taking all feasible measures to minimize excess pollutant emissions from facility operations. At the MRF, staff will continue to monitor indoor air quality to ensure that increased throughput at the MRF does not cause excess emissions. Staff will also increase the frequency of the biogas H2S treatment system carbon media changeouts, and fast track repairs and upgrades to the CHP engine control and SCR systems. Additionally, staff have adjusted operational hours to come into compliance with operational limits that are tied to air modeling. This decreases the number of conditions that need additional variance coverage while revised emission calculations, air modeling, and CEQA determinations are completed.

The County has engaged consultants including Tetra Tech to evaluate several solutions for biogas treatment, including a fixed-bed media system, a new standalone regenerative system, and a piping system to route gas to existing treatment infrastructure. The County has selected the piping solution due to its shorter lead time and ease of construction.

This project includes the installation of two separate HDPE pipelines: a supply line to carry untreated biogas to the landfill gas treatment system (a combination of the existing H_2S scrubber and siloxane removal system) and a return line to bring treated mixed gas back to the ADF for combustion in the engines or flare. Untreated biogas sent over to the landfill gas treatment system will utilize the existing H_2S treatment system that is currently configured in lead-lag. RRWMD has verified the existing landfill gas H_2S scrubber and siloxane removal system can handle the increased quantity and constituent load of the biogas. While the installation is occurring, RRWMD staff has proposed a Biogas Treatment System Corrective Action Plan to ensure additional monitoring takes place when breakthrough is anticipated in the current activated carbon vessels.

Once the dual-pipe gas treatment infrastructure is commissioned and siloxane levels are reduced, the County will replace the poisoned SCR catalyst bricks in both ADF biogas engines. The County expects to have the pipe systems installed, the SCR components restored, and the facility back in full compliance by approximately May 2027.

Staff will continue adjusting CMU operations to reduce moisture content and increase aeration within the Gore heaps to better control ROC and ammonia. Staff will work with the manufacturer to replace ineffective parts so the Gore system can operate as designed and achieve improved emissions control. Staff is also continuing to work with the District to determine the correct permit assumptions and emission factors using operational data and comparisons of other composting operations that use similar technology globally.

6. *Section 5.G, Monitor and Quantify*

RRWMD would rely on the CEMS data for NOx and CO emissions, fuel meter data, and hour meter data available to quantify pollutant emissions from the engines and the ADF Flare. Staff will continue to monitor pursuant to the monitoring and recordkeeping requirements listed within ATC 14500-10. Staff will work with the District to fine-tune the Biogas Treatment System Corrective Action plan to ensure excess emissions of ammonia or H2S is limited to the maximum extent possible.

Additionally, our engineering staff are working to design a site-specific odor study, similar to the South Bay Odor Attribution Study implemented in 2020-2021 by the Bay Area Air Quality Management District. This will be implemented to find solutions to monitor and characterize odors that are generated at the Tajiguas Landfill and ReSource Center. This study will help RRWMD staff effectively respond to odor complaints and adjust operations to reduce or eliminate any offsite impacts.

To:	Travis Spier, Lindsay Cokeley, Benjamin Forest
Cc:	Sami H. Ayass, P.E., Paul Stout, P.E.
From:	Juan M. Carbajal, E.I.T.
Date:	March 13, 2026
Subject:	Tajiguas Landfill – Anaerobic Digestion Facility (ADF) Biogas Treatment Upgrade Memorandum

1.0 INTRODUCTION, PURPOSE, AND OBJECTIVES

Tajiguas Landfill (Landfill/Site) is located at 14470 Calle Real in Goleta, California, approximately 26 miles west of the City of Santa Barbara (City). The Landfill is owned and operated by the County of Santa Barbara (County). It is located in a canyon known as Cañada de la Pila. The Landfill began receiving refuse in 1967 to serve the County, City of Goleta, unincorporated areas of Montecito and Summerland, rural areas of southern Santa Barbara County, the Santa Ynez Valley and Cuyama Valley.

On May 21, 2024, the Santa Barbara County Air Pollution District (SBCAPD) issued Authority to Construct (ATC) No. 14500-10 to the County for modifications to the anaerobic digestion project at the Landfill. The purpose of this memorandum (memo) is threefold. First, to describe the existing biogas treatment equipment and its current limitations in meeting hydrogen sulfide (H_2S), volatile organic compounds (VOCs), and siloxane limits per current industry standards. Second, explain what additional or alternative equipment, media, and operating procedures would be required if the existing equipment is inadequate. Third, explain and explore options to achieve biogas upgrading for the biogas from the Anaerobic Digestion Facility (ADF).

2.0 EXISTING CONDITIONS

Organic waste sorted at the Landfill's Materials Recovery Facility (MRF) are placed in anaerobic digesters to generate biogas in the ADF. The biogas is routed through a cooler and air chiller to remove condensate. Biogas condensate is sent to a condensate sump located in the hallway of the ADF. The biogas is compressed and sent through three (3) activated carbon vessels. These vessels are filled with Darco BG-1 (potassium iodide-impregnated carbon) media which is a media used to specifically remove hydrogen sulfide from the biogas stream. These 790-gallon (gal) vessels are filled with 1,764 pounds (lbs) of carbon media impregnated with potassium iodide to reduce the biogas' sulfur concentration to 20 parts per million by volume (ppmv). The treated biogas is combusted in two (2) spark-ignited GE/Jenbacher JMS 416 GS-L/N.L B82 combined heat and power (CHP) engines rated at 1,573 brake horsepower (bhp) and located at the ADF. Each cogeneration unit can produce up to 1,137 kilowatts (kW).

The maximum biogas permitted flow to the two (2) engines is 550 standard cubic feet per minute (scfm). The average flow for raw untreated biogas was 419 scfm which was calculated from February 1, 2025, to September 30, 2025. The data was provided to Tetra Tech by the County via Microsoft Excel files.

Table 1 below presents the lab analysis on the raw untreated biogas at the Landfill. The biogas compositions of oxygen, nitrogen, carbon dioxide, methane, and hydrogen were averaged from June 26, 2025, through September 10, 2025. Two (2) lab reports were provided to Tetra Tech by the County as PDF files. Tetra Tech averaged the values from the reports to populate the table below. Additional laboratory reports dated June 10, 2025, and June 18, 2025, were provided to Tetra Tech and indicated that untreated biogas contained between 2,794 and 12,918 parts per billion by volume (ppbv) of siloxanes, which is the highest siloxane value among the data provided by the County.

Table 1 – Lab Analysis of Raw Untreated Biogas Samples at Tajiguas Landfill from June 26, 2025 to September 10, 2025.

Constituent	Concentration
Oxygen (percent vol.)	**1.5**
Nitrogen percent vol.)	**13.9**
Carbon Dioxide (percent vol.)	**35.7**
Methane (percent vol.)	**46.2**
Hydrogen (percent vol.)	**< 1**
Total Reduced Sulfur as Hydrogen Sulfide (ppmv)	**23.7**
Total Volatile Organic Compounds (ppbv)	**33,382**
Total Organosiloxanes as Silicon (ppbv) from June 26, 2025, and September 10, 2025, reports	**553-1,186**
Total Organosiloxanes as Silicon (ppbv) from June 10, 2025, and June 18, 2025, reports	**2,794-12,918***
Ammonia (ppmv)	**0 (field)** **< 0.86 (lab)**

*A second data set was provided upon final client review of this memorandum. As this data has much higher siloxane concentrations than the prior data, this would lead to higher costs for Options 1 and 2, which are the fixed media option and regenerative media option discussed later in this memorandum. We have not revised the costs for Options 1 or 2 within the memorandum since it will not change the final memorandum conclusion, which is to utilize Option 3, which includes piping the ADF biogas to the LFG treatment facilities for upgrading.

Table 2 below presents the regulatory and performance requirements of the treated biogas.

Table 2 – Regulatory and Performance Requirements of Treated Biogas

Constituent	Concentration
Hydrogen Sulfide (ppmv)	**< 20 at standard conditions (60 °F, 14.7 psia)**
Ammonia (ppmv)	**< 15 at 15 percent oxygen**
Siloxane (ppbv)	**< 500**
Volatile Organic Compounds (ppbv)	**20,000**

The ATC issued by SBCAPD requires carbon vessels to be operated in "lead/lag" (series) at all times except during media change-out or maintenance. The three (3) existing carbon vessels at the ADF are all currently online and in parallel operation. Tetra Tech was awarded a contract to redesign the piping and associated equipment so the existing vessels can operate in series and to add VOCs and siloxane treatment capabilities to the system. However, Tetra Tech determined that the proposed redesign approach will not work due to the following limitations:

1) Existing Carbon Vessel Media Capacity Limitations;
   a) There is not sufficient media capacity in the existing vessels to remove the required concentrations of H_2S, VOCs, and siloxane (see Tables 2 and 3). The current media, Darco BG-1 (potassium iodide-impregnated carbon), targets H_2S only.
2) Existing Vessel Size Limitations; and
   a) The three (3) existing carbon vessels each have dimensions of 51-inch diameter and 60-inch height. When piped in series, the biogas velocity through the vessels will be approximately 30 feet per minute, which does not provide sufficient contact time with the media because of the high velocity and the relatively short packed-bed depth.
3) Siloxane Removal Limitations.
   a) The biogas entering the existing chiller is not saturated. The heat exchanger cools down the incoming biogas and lowers its humidity to about 50 percent. The gas exiting the chiller is warmed up through the recuperator in counter-flow with warm biogas. This allows for a warmer biogas with a lower relative humidity to flow through the activated carbon.
   b) The two (2) CHP engines that use ADF biogas as the primary fuel have selective catalytic reduction (SCR) bricks installed to meet the stringent emissions limits set by the SBCAPD. The design of a siloxane removal system for engines with SCR typically includes three dedicated vessels in series, with at least 12 feet in height and 5.5 feet in diameter of media per bed. Given the current dimensional limitations of the ADF biogas

treatment room and the limited number of existing vessels, there is insufficient capacity to effectively treat VOCs and siloxanes in addition to H2S treatment.

3.0 INDUSTRY-STANDARD BIOGAS TREATMENT PROCESSES

There are several technologies available for the cleanup of biogas for beneficial use. Generally, the process will involve:

1) Removal of H_2S;
2) Initial pressurization;
3) Moisture removal;
4) Particulate matter removal; and
5) Removal of VOCs and siloxanes.

3.1 REMOVAL OF H_2S

H_2S removal can be a media-based system (Ferosorb, SULFATREAT, MV Technologies, or equal) or, if final H_2S levels are high enough, the owners can employ a skid-based system using biological or other means of removal. While media-based systems, large vessels with media design to remove H_2S, are cheaper from a capital perspective, at higher incoming H_2S concentrations the media consumption and costs start to dominate the life cycle costs of such systems. Thus, if higher H_2S concentrations are indicated in the inlet gas quality to be used as the design basis, project owners can employ a more regenerative system that uses a liquid solution and either biological or chemical regeneration.

3.2 INITIAL PRESSURIZATION, MOISTURE REMOVAL, AND PARTICULATE MATTER REMOVAL

Initial pressurization, moisture removal, and particulate matter removal can be completed with a skid with compressors (Vilter or equal) in an N plus 1 design. During pressurization, the biogas will be heated through compression; therefore, a heat exchanger (HX) is utilized to cool the biogas. The HX will use glycol and an adjacent glycol-to-air cooling fan system to allow the glycol to recirculate. The cooling of the biogas will be completed to take the biogas below its dewpoint, about 35 degrees Fahrenheit (°F), forcing most of the moisture in the biogas stream to condense out. The pressurized biogas will then pass through a series of particulate filters with the smallest being two (2) to four (4) microns in size.

3.3 REMOVAL OF VOCS AND SILOXANES

Removal of VOCs and siloxanes can be completed with a fixed media or a regenerative system. Fixed-media systems use a bed of sorbent or catalytic material (e.g., activated carbon, zeolites, or catalytic filters) through which biogas flows; contaminants such as VOCs and siloxanes are adsorbed or reacted and the unit is typically replaced or chemically regenerated offline when capacity is spent. Regenerative systems cycle the sorbent or adsorbent through an active in-place regeneration step (thermal, vacuum, or steam) that desorbs the contaminants and restores capacity, allowing continuous operation with periodic regeneration rather than full bed replacement. Fixed-media units are generally simpler, lower-cost up front, and easier to operate for smaller or intermittent flows, but they require more frequent media change-outs and generate spent media waste or off-site regeneration needs. Regenerative systems have higher capital and operating complexity (energy for regeneration, process controls), but they reduce solid waste, lower ongoing media costs for high-throughput or continuous plants and can achieve more consistent contaminant removal over time.

4.0 PROPOSED DESIGN APPROACH

Per discussion with the County, Tetra Tech investigated three options to treat the ADF biogas for VOCs and siloxane prior to biogas being used to produce heat and energy at the ADF CHP engines. The three (3) treatment options that the County requested Tetra Tech explore include:

1) Fixed media VOCs and siloxane treatment system;
2) Regenerative VOCs and siloxane treatment system; and
3) Treating biogas using existing H_2S, VOCs, and siloxane treatment system at MRF that currently treats landfill gas (LFG) only.

For Option 1 and 2, Tetra Tech proposes to design a supplemental skid to augment the existing H_2S removal system to meet permit and downstream equipment operational limits for H_2S, VOCs, and siloxane. In general, the biogas treatment equipment will clean and upgrade the biogas to operate the two (2) existing CHP engines.

Based on discussions with the County, three (3) options for the VOCs and siloxane removal are proposed: (1) installing a new fixed-bed non-regenerative siloxane removal system; (2) installing a new siloxane removal regenerative system; and (3) tying into the existing siloxane removal regenerative system at the MRF. These are discussed in more detail in the following subsections.

4.1 NEW FIXED BED, NON-REGENERATIVE GAS CONDITIONING SYSTEM

A fixed-bed siloxane removal system removes VOCs and siloxanes by allowing constituents of biogas to contact a stationary bed of solid sorbent. Siloxanes are captured by adsorption onto the media; cleaned biogas exits the bed while the sorbent retains the contaminants until the media is exhausted. Fixed media require changeouts, typically multiple times per year depending on the concentration of VOCs and siloxanes and the size of the media vessels.

Tetra Tech sized a fixed-bed Gas Conditioning System and ancillary components to treat biogas from the ADF with an average flow of approximately 419 scfm and a maximum flow of 550 scfm, at inlet pressures of zero (0) to 7.5 inches of water column (" WC) and inlet temperatures in the 80 to 100 degrees Fahrenheit (°F) range. The measured raw biogas composition used for design approximately 46 percent methane, 36 percent carbon dioxide, 14 percent nitrogen, and 1.5 percent oxygen and design contaminants including H_2S (approximately 23.7 ppmv measured) and siloxanes measured during the September 2025 lab testing run. The system will be designed to deliver conditioned biogas at roughly 60 to 80" WC discharge pressure, with a discharge temperature near 80 °F, a target dew point of 40 °F, H_2S reduced to less than 20 ppmv, and siloxanes controlled to below 500 ppbv as directed by the County due to the siloxane limitation of the SCR installed on the CHP engines.

The primary gas handling and moisture-management train will be composed of a gas blower and an upstream moisture/particulate filter assembly. The inlet filter is a 304L stainless-steel housing with a cleanable polypropylene structured-mesh element, designed for 99 percent removal of greater than three (3) micron (µm) particulates and liquid droplets and including sight glass, level switches, condensate drains, and a condensate pump arrangement. The blower specified will be a rotary-lobe positive-displacement unit, belt-driven by a 480 volt / three (3) phase / 60 hertz motor with a variable frequency drive (VFD) speed control; blower provisions include inlet and discharge flex connectors, discharge silencer, discharge check valve and pressure safety valve, belt guard, and internally corrosion-resistant-coated surfaces.

Thermal management and gas cooling are handled with a dual-core HX: stage 1 is a gas-to-gas plate/fin core (aluminum plate and fins) and stage 2 is a gas-to-glycol fin/tube core.

For contaminant removal, the existing H_2S system will remain for an overall performance objective of reducing H_2S to less than 20 ppmv. The VOCs and siloxane removal system will be a media or adsorbent-based polishing to meet the 500 ppbv siloxane CHP engine limit.

The proposed fixed-bed, non-regenerative system will contain three (3) siloxane/VOCs removal media vessels, each 5.5 feet in diameter and 16 feet height. The proposed system will require electrical service availability (480 volt / three (3) phase / 60 hertz). The system will include four (4) separate but interconnected skids.

Gas blower / moisture removal system and siloxane removal system will include:

1) The blower/compressor is skid-mounted with the HX and could potentially be installed inside the building if access allows. Alternatively, the blower could be supplied as a separate, smaller skid to be placed at the location of the existing blower inside the ADF biogas treatment building;
   a) Approximate dimensions: 6 feet in length, 3 feet in width, and 8 feet in height.
2) The glycol system, control panel, and siloxane vessels are separate skids;
   a) Glycol chiller dimensions: 7.5 feet in length, 0.375 feet in width, and 8.2 feet in height; and
   b) This skid will need to be mounted outdoors only.
3) Moisture removal / HX skid; and
   a) Approximate dimensions: 6.7 feet in width, 5 feet in depth, and 7 feet in height; and
   b) This skid may be located either outside or inside.
4) Siloxane and VOCs removal skid.
   a) Approximate dimensions (fixed bed, non-regenerative system): 24 feet in length, 13 feet in width, and 22 feet in height; and
   b) To be installed outdoors.

4.2 NEW REGENERATIVE SILOXANE REMOVAL SYSTEM

The removal of siloxanes is achieved by flowing the contaminated biogas upwards through three of the vessels where the siloxane molecules adhere to the surface of the regenerative media beads through adsorption until saturated. Meanwhile, backup vessels that are off-line are regenerated. After an adjustable period of time the vessels switch. The off-line (now regenerated) vessel is brought on-line, and most contaminated on-line vessel is taken off-line to be regenerated. A minimum of three (3) vessels is always on-line treating the biogas stream while one is off-line being regenerated or waiting in standby.

Regeneration is achieved using a Thermal Swing Adsorption (TSA) process. Heated ambient air provided by a blower and heater flows downwards through the vessel heating the beads of media. The heat breaks the bond between the surface of the beads and the siloxane molecules. The released siloxane molecules are then carried out of the vessel by the air stream.

In addition to siloxanes, the adsorption–regeneration process will collect many other VOCs present in the biogas. Therefore, the purge/regeneration air cannot be released to the atmosphere; it must be incinerated in an enclosed thermal oxidizer (TOX).

Regeneration process control and integration with a TOX or an existing flare is critical to prevent flame outs, and to ensure that all combustibles are removed from the media in a slow, controlled manner. The velocity of the regeneration air is therefore carefully controlled with a VFD, and temperature of the air is carefully controlled using a silicon-controlled-rectifier. This ensures that CO_2, non-methanogenic organic compounds (NMOCs), and other collected compounds desorb from the bed slowly without negatively impacting TOX combustion.

Furthermore, the type of media must be carefully selected based on the amount and type of NMOCs present in the biogas stream, with consideration for how they will react to the introduction of a heated air stream. Finally, down-flow regeneration is always utilized to ensure contaminants always migrate towards the TOX, even in the event that the regeneration process is interrupted.

A return line will be installed from the regenerative siloxane removal system to the enclosed TOX to destroy biogas that cannot be routed to the engines during maintenance or as part of startup procedures. It requires approximately 300 scfm of biogas to maintain operating temperature and has a higher fuel demand than a standard TOX (roughly four times the fuel consumption for heat maintenance, per vendor information). The system parasitic loads are estimated at 25 horsepower (hp) for the blower and 90 kW for the heater. For planning, it is assumed the heater will operate 12 hours and the blower 16 hours on alternating days; on each operation the blower consumes approximately 25 hp (18.7 kW) for 16 hours and the heater consumes 90 kW for 12 hours, yielding an energy use per run of about 1,378 kilowatt-hour (kWh) and an average daily energy use (with runs every other day) of about 689 kWh. The California Air Resources Board and local California air districts have recently required Low Nitrogen Oxide (NOx) TOX for this application; this regulatory requirement and the TOX fuel-use multiplier should be verified with the district and equipment vendors during design.

The system will include four separate but interconnected skids. Gas blower / moisture removal system and siloxane removal system will include:

1) The blower/compressor is skid-mounted with the HX and could potentially be installed inside the building if access allows. Alternatively, the blower could be supplied as a separate, smaller skid to be placed at the location of the existing blower inside the ADF biogas treatment building;
    a) Approximate dimensions: 6 feet in length, 3 feet in width, and 8 feet in height.
2) The glycol system, control panel, and siloxane vessels are separate skids;
    a) Glycol chiller dimensions: 7.5 feet in length, 0.375 feet in width, and 8.2 feet in height; and
    b) This skid will need to be mounted outdoors only.

3) Moisture removal / HX skid;
   a) Approximate dimensions: 6.7 feet in width, 5 feet in depth, and 7 feet in height; and
   b) This skid may be located either outside or inside.
4) Regenerative media Siloxane and VOCs removal skid; and
   a) Approximate dimensions (regenerative system): 28 feet in length, 26 feet in width with maintenance clearance; and
   b) To be installed outdoors.
5) TOX stack and skid.
   a) Approximate skid dimensions: 32 feet in length and 9.3 feet in width; and
   b) Approximate flare stack height: 30.3 feet in length.

4.3 EXISTING REGENERATIVE SILOXANE REMOVAL SYSTEM

As a third option, Tetra Tech is proposing to use the proposed H_2S and existing regenerative siloxane removal system located in the MRF on the west side of the landfill to treat both the LFG and biogas from the ADF area on the east side. The existing regenerative system has a rated capacity of 2,000 scfm and currently treats LFG generated by the waste mass for combustion in the MRF CHP engines; any excess LFG is routed to the MRF flare for destruction. The regenerative system comprises two siloxane media vessels (seven (7) feet in diameter and eight (8) feet straight side), one (1) regeneration blower, and one (1) regeneration heater. Downstream of the regenerative vessels, two polishing vessels (eight (8) feet in diameter and six (6) feet in length) provide additional siloxane removal prior to combustion. Table 3 presents the design inlet operating conditions for the regenerative system and the media specifications for both the regenerative and polishing vessels, respectively. This data was obtained from the siloxane removal system operating and maintenance manual provided by the County.

Table 3 – Existing Siloxane Removal System Design Inlet Operating Conditions

Operating Condition	Minimum	Maximum
Inlet Gas Flow (scfm)	0	2000
Inlet Gas Pressure (psig)	10	14
Inlet Gas Temperature (°F)	33	240
Inlet Total Siloxane Level (mg/m^3)	0	10
Inlet Total H2S Level (ppmv)	0	40
Inlet Total VOCs Level (mg/m^3)	0	500
Inlet Total Oil Level (ppmv)	0	5
Ambient Temperatures (°F)	35	100

The proposed design approach is to convey biogas from the ADF via a new dedicated header line that will tie into the main 20-inch LFG header upstream of the future location of the new LFG H_2S removal system and downstream of the existing H_2S removal system. The new H_2S removal system is currently under design and scheduled to be constructed in late 2026. The biogas will first be treated by the new H_2S removal system and then by the existing siloxane removal system at the MRF.

An eight-inch HDPE SDR-17 pipeline will be installed between the ADF and the MRF's H_2S, VOCs, and siloxane treatment systems. The dedicated header will be routed to follow the landfill's natural slopes, allowing condensate to drain to strategically located condensate sumps. Approximately 450 to 550 scfm of additional biogas will be added to the existing LFG system. After treatment, a clean combination of biogas and LFG will be routed back to the MRF CHP engines, MRF enclosed ground flare, and back across the landfill to ADF CHP engines and the ADF enclosed ground flare via a new dedicated return line. The clean and conditioned comingled LFG and biogas will be conveyed across the landfill via a new dedicated eight-inch HDPE SDR-17 pipeline approximately 2,830 feet long. The return line will follow the same alignment as the conveyance line and will be equipped with condensate sumps as required.

5.0 CONCEPTUAL SITE PLANS

Tetra Tech prepared conceptual site plans for the three (3) options for the proposed biogas conditioning system options. Tetra Tech developed the footprints for the equipment based on previously completed, comparable projects.

5.1 NEW FIXED BED, NON-REGENERATIVE SILOXANE REMOVAL SYSTEM

The proposed gas conditioning system includes a new blower skid, moisture removal/HX, glycol chiller, and three (3) vessels for the fixed bed, non-regenerative siloxane removal system. Tetra Tech recommends installing the new blower inside the blower building in place of the existing centrifugal blowers. The moisture removal/HX and glycol chiller may be installed indoors or outdoors, while the VOCs and siloxane removal system will be installed outdoors. Locations for the proposed system were selected based on proximity to the ADF, available space, and discussions with the County. See Appendix A for the conceptual site plans.

5.2 NEW REGENERATIVE SILOXANE REMOVAL SYSTEM

The proposed gas conditioning system includes a new blower skid, moisture removal/HX, glycol chiller, four (4) vessels for the regenerative siloxane removal system, and a TOX. A return line will be installed from the siloxane removal system to the flare station to destroy biogas that cannot be sent to the engines for either maintenance or as part of the startup procedure. Tetra

Tech recommends installing the new blower inside the blower building in place of the existing centrifugal blowers. The moisture removal/HX and glycol chiller may be installed indoors or outdoors, while the regenerative VOCs and siloxane removal system will be installed outdoors along with the TOX. Locations for the proposed system were selected based on proximity to the ADF, available space, and discussions with the County. See Appendix A for the conceptual site plans.

5.3 EXISTING REGENERATIVE SILOXANE REMOVAL SYSTEM

This proposed approach will utilize the existing H_2S treatment and regenerative siloxane removal systems at the MRF. Two (2) eight-inch HDPE SDR-17 lines will be run between the ADF and the MRF. One line will convey biogas from the ADF to the MRF H_2S, VOCs, and siloxane removal systems. The second line will return the conditioned, comingled LFG and biogas to the ADF CHP engines. See Appendix A for a draft layout of the proposed lines.

6.0 PROPOSED GAS CONDITIONING SYSTEM COST ESTIMATE

Tetra Tech developed high-level cost estimates to procure, install, construct, and maintain the proposed gas conditioning systems for the ADF biogas. This estimate was prepared based on knowledge of the Landfill's ADF, existing MRF LFG treatment systems, and Tetra Tech's experience with biogas treatment design, operations, compliance, and construction. However, these costs have been prepared at a high level without any design and largely based on vendor quotes and past cost estimate for similar projects. Equipment and maintenance costs were provided by Tetra Tech using typical pricing. Please note the cost tables in this section do not include insurance fees and contingencies. The cost tables also do not include operations, maintenance, and monitoring costs that may be required to meet operational standards and meet all SBCAPCD permit conditions.

6.1 NEW FIXED BED, NON-REGENERATIVE SILOXANE REMOVAL SYSTEM

The table below shows a high-level cost estimate to procure, install, construct, and maintain the proposed gas conditioning system with a new fixed bed, non-regenerative siloxane removal system at the ADF.

Table 4 – Cost Estimate for the Proposed Gas Conditioning System with a Fixed Bed, Non-Regenerative Siloxane Removal System

Equipment Cost	
Description of Work	**Cost**
Gas Blower/Moisture Removal System	$703,200 (1)
Fixed Bed, Non-Regenerative Siloxane Removal System	$622,800 (1)
Shipping Estimate to Santa Barbara, CA	$30,000 (1)
Start-up and Commissioning Services	$36,000 (1)
Total Equipment Cost	**$1,392,000**
Construction Cost	
Description of Work	**Cost**
Engineering Design, Building Permitting, and Engineering Through Construction	$500,000 (2)
Site Asphalt & Concrete Demo & General Clean-up	$76,138 (2)
Foundations & General Site Prep Work	$254,172 (2)
Equipment/ Piping & Mechanical Work	$172,691 (2)
Electrical Work	$491,648 (2)
Pipe Fitting and Welding	$371,647 (2)
Total Construction Cost	**$1,866,296**
Total for Equipment and Construction (6)	**$3,258,296**
Maintenance Cost	
Description of Work	**Cost**
Siloxane Removal Media Changeout (per year)	$634,000 (3)(4)
Skid Maintenance (per year)	$2,500 (2)
Parasitic Load Cost (Approx. per year)	$155,010 (5)
Total Maintenance Cost (per year)	**$791,510**

(1) Vendor supplied pricing.
(2) Cost estimated from previously completed projects.
(3) Cost from vendor.
(4) Does not include shipping, labor, or disposal of new/spent media.
(5) Tetra Tech assumed an electrical cost of $0.37/kWh to calculate parasitic load cost calculations.
(6) A second data set was provided upon final client review of this memorandum. As this data has much higher siloxane concentrations than the prior data, this would lead to higher costs for Option 1. We have not revised the costs for Option 1 since it will not change the final memorandum conclusion, which is to utilize Option 3, which includes piping the ADF biogas to the LFG treatment facilities for upgrading.

6.2 NEW REGENERATIVE SILOXANE REMOVAL SYSTEM

The table below shows a high-level cost estimate to procure, install, construct, and maintain the proposed gas conditioning system with a new regenerative siloxane removal system at the ADF. The regenerative system requires a Low NOx TOX which is also included in the cost estimate.

Table 5 – Cost Estimate for the Proposed Gas Conditioning System with a Regenerative Siloxane Removal System

Equipment Cost	
Description of Work	**Cost**
Gas Blower/Moisture Removal System	$703,200 (1)
Regenerative Siloxane Removal System (1)	$1,560,000 (1)
Low NOx Thermal Oxidizer (1)	$500,000 (2)
Shipping Estimate to Santa Barbara, CA	$80,000 (3)
Start-up and Commissioning Services	$45,000 (3)
Total Equipment Cost	**$2,888,200**
Construction Cost	
Description of Work	**Cost**
Engineering Design, Building Permitting, and Engineering Through Construction	$600,000 (4)
Site Asphalt & Concrete Demo & General Clean-up	$141,391 (4)
Foundations & General Site Prep Work	$267,739 (4)
Equipment/ Piping & Mechanical Work	$400,120 (4)
Electrical Work	$913,000 (4)
Pipe Fitting and Welding	$690,156 (4)
Total Construction Cost	**$2,928,406**
Total for Equipment and Construction (7)	**$5,816,606**
Maintenance Cost	
Description of Work	**Cost**
Siloxane Removal Media Changeout (per year) (1)	$50,000 (5)
Skid Maintenance (per year)	$2,500 (2)
Parasitic Load Cost (Approx. Per year)	$242,500 (6)
Total Maintenance Cost (per year)	**$295,220**

(1) Vendor supplied pricing.
(2) Cost provided by vendor.
(3) Cost from vendor increased to account for additional equipment for the regenerative system.
(4) Cost estimated from previously completed projects.
(5) Does not include shipping, labor, or disposal of new/spent media.
(6) Tetra Tech assumed an electrical cost of $0.37/kWh to calculate parasitic load cost calculations.
(7) A second data set was provided upon final client review of this memorandum. As this data has much higher siloxane concentrations than the prior data, this would lead to higher costs for Option 2. We have not revised the costs for Option 2 within the memorandum since it will not

change the final memorandum conclusion, which is to utilize Option 3, which includes piping the ADF biogas to the LFG treatment facilities for upgrading.

6.3 EXISTING REGENERATIVE SILOXANE REMOVAL SYSTEM

The table below shows a high-level cost estimate to procure, install, construct, and maintain the proposed gas conditioning system while utilizing the existing regenerative siloxane removal system at the MRF.

Table 6 – Cost Estimate for the Proposed Gas Conditioning System with an Existing Regenerative Siloxane Removal System

Equipment Cost	
Description of Work	**Cost**
Total Equipment Cost	**Assume No New Major Equipment**
Construction Cost	
Description of Work	**Cost**
Engineering Design, Building Permitting, and Engineering Through Construction	$100,000 (1)
Site Asphalt & Concrete Demo & General Clean-up	$27,256 (1)
Equipment/ Piping & Mechanical Work	$148,240 (1)
Pipe Fitting and Welding	$102,340 (1)
8-inch HDPE Solid Piping and Fittings (approximately 5,660 ft)	$229,796 (1)
2-inch HDPE Air Line and Condensate Force Main	$57,449 (1)
8-inch Butterfly Valves (Qty. 4)	$8,600 (1)
Condensate Sumps (Qty. 4)	$60,000 (1)
12-Inch Corrugated Metal Pipe Road Crossings (Qty. 2)	$24,500 (1)
Total Construction Cost	**$758,181**
Total for Equipment and Construction	**$758,181**
Maintenance Cost	
Description of Work	**Cost**
Total Maintenance Cost (per year)	**Assume No New Equipment to Maintain**

(1) Cost estimated from previously completed projects.

7.0 CLOSING

Tetra Tech investigated the existing conditions of the ADF treatment system and the operational requirements of the ATC in conjunction with the County. Based on the findings discussed in this memorandum, a new system must be designed to treat not only H_2S but also VOCs and

siloxanes to meet the emissions and operational requirements of the CHP engines, since the original approach of redesigning the piping is not possible.

Tetra Tech evaluated three options for ADF biogas VOC and siloxane removal: (1) installing a new fixed-bed, non-regenerative siloxane removal system; (2) installing a new regenerative siloxane removal system; and (3) tying into the existing regenerative siloxane removal system at the MRF. The first two options require designing a supplemental skid to augment the existing H_2S removal system so that permit limits and downstream equipment operational limits for H_2S, VOCs, and siloxanes are met.

After analyzing the estimated capital and operating costs including equipment procurement, design and engineering, construction, and ongoing operations, the preferred option is to utilize the existing siloxane removal system at the MRF. Tetra Tech recommends this approach to reduce overall capital and long-term operational costs. Before proceeding, the County must review any net energy metering (NEM) arrangements and power purchase agreements (PPA) with utility providers to confirm that use of biogas and LFG complies with those agreements.

This memorandum includes additional siloxane data provided upon final client review from June 10, 2025, and June 18, 2025, reports showing much higher siloxane concentrations than the prior data. Because these values are substantially higher than previously reported samples, Options 1 and 2 could incur materially higher capital and/or annual media/regeneration costs than shown in Tables 4 and 5, respectively. Costs for Options 1 and 2 were not revised since Tetra Tech recommended tying into the existing regenerative siloxane removal system at the MRF (Option 3).

Should the County choose to install a new siloxane removal system, a fixed media bed instead of a regenerative VOCs and siloxane removal system is not recommended for the following reasons:

1) A regenerable siloxane reduction system requires electricity to regenerate the media and a thermal oxidizer (TOX) to destroy the VOCs and siloxanes in the regeneration airstream.
    a) Because the regeneration airstream has a very low energy input, the TOX requires supplemental fuel (natural gas or biogas) to maintain temperature while burning the regeneration airstream. From previous projects, the amount of biogas required for the scale of this project is approximately 300 scfm, which represents a significant fraction of the available biogas; and
        i) Also, since the project is in California, the California Air Resources Board may require a new Low NOx TOX; and
        ii) The Low NOx TOX uses around four (4) times the fuel to maintain heat versus a standard TOX.

b) For this reason, we do not recommend regenerable siloxane reduction systems (SRS) for applications with lower biogas flow.

Tetra Tech is available to answer any questions or concerns stakeholders may have regarding this memorandum. We appreciate the opportunity to continue providing engineering services at the Tajiguas Landfill.

APPENDIX A – CONCEPTUAL SITE PLANS FOR THE TAJIGUAS LANDFILL ADF BIOGAS TREATMENT UPGRADE