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December 26, 2019

California Air Resources Board
Fuels Evaluation Section
Attn: Mr. Anil Prabhu
P.O. Box 2815
Sacramento, CA 95812

RE: **Tier 2 Pathway Application B0037; SMUD (S338): Low-CI Electricity from Dairy Manure Biogas Digester Genset System in Van Warmerdam Dairy Farm; Electricity use to charge electric vehicles in Sacramento County, California.**

Dear Mr. Prabhu,

The Association of Irritated Residents, Central California Asthma Collaborative, and Leadership Counsel for Justice and Accountability ("Commenters") submitted four comments regarding the Tier 2 Pathway Application (No. B0037; SMUD (S3338)) for Low-CI Electricity from Dairy Manure Biogas Digester Genset System in Van Warmerdam Dairy Farm for electricity production to charge electric vehicles within SMUD's service territory in Sacramento County, California. This letter addresses those comments.

In accordance with the Low Carbon Fuel Standard, Section 95488.7(d)(5)(A): "Only comments related to potential factual or methodological errors will require responses from the fuel pathway applicant."

Sacramento Municipal Utility District ("SMUD"), as the fuel pathway applicant, offers the following responses to such potential factual and methodological errors identified by Commenters.

Comment No. 1. Lack of Available Information and Data Transparency

The applicants and / or the California Air Resources Control Board (CARB) withheld and redacted information regarding both dairy operations (including herd size, amount of manure managed) and energy generation (including biogas conditioning, and kilowatts produced) such that it is impossible to determine both the air quality and water quality impacts that the project will produce, as well as the energy conversion and energy production rates which, along with information regarding dairy operations, is necessary to assess the veracity of the claimed project benefits and the carbon intensity value. In short, based on the public's review of the available documents there is no way to comment in any informed way on the proposed project or assess the accuracy and value of the justification presented.

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The materials available for review also leave out critical information regarding the demand for generated electricity for vehicles taking into consideration other sources of electricity.

Additionally, CARB withheld the following information, alleging that they contain confidential business information: Attestation Letter, Utilities Invoices and Electricity Bills, Facility Process Flow Diagram, and Monthly Data and Calculation for GREET Input Values.

Without access to data critical to allow an independent analysis of truly monumental carbon intensity values or environmental and ecological impacts of the proposed project, the application must not be approved.

Response:

Information about dairy operations, including herd size, energy generation, biogas conditioning, kilowatts usage, kilowatts production and carbon intensity value are shown in Attachment A of this letter. The information redacted from and/or unavailable in the publicly

posted version of the Application includes personal information or competitive trade data that is appropriately maintained as confidential in accordance with the California Air Resources Board's (ARB's) practices. The Application together with carbon intensity (CI) calculator as submitted provides sufficient data to ensure that necessary calculation and analysis can be performed. Commenters do not identify any factual or methodological error in the Application.

Comment No. 2. Air and Water Quality Impact

This project will threaten environmental degradation in the local community and throughout the region due to increased air pollution and groundwater contamination. This project, by generating methane and then combusting methane to produce electricity will create NOx. Furthermore, due to the information redacted in the application and supporting paperwork, it is impossible to understand the scope and severity of the air quality impacts of this project. NOx is key to ozone formation in the warm months and similarly catalytic in the formation of PM2.5 in the cooler months. Reducing NOx emissions in the Sacramento Valley is key to the Valley reaching compliance with the federal clean air standards and protecting the health of the region. Additionally, studies find that manure exiting a digester emits as much as 81% more ammonia than raw manure. Increased ammonia together with increases in NOx creates an even more intensive ammonium nitrate PM 2.5 impact.

This project, because it will worsen local air quality, is in conflict with the language of AB32 which, in summary, says that efforts to reduce GHG emissions should not compromise or conflict with efforts to reduce air pollution. Additionally, this project and similar projects undermines the state's efforts to make truly clean, zero emissions electricity available to the public. We have access – and can increase access – to zero emission electricity sources, including wind and solar for electric. There is simply no need to generate polluting electricity when other sources are available and expanding.

Large scale dairies are a primary contributor to groundwater contamination crisis communities throughout the Central Valley are facing. Cow manure, and in particular liquefied manure applied to cropland, contributes nitrate to groundwater, which impacts the health and economic well-being of residents and communities in nearby towns and cities. Digesters, like the digester at issue in this application, rely on manufactured, liquefied manure that is so deleterious to the environment and nearby communities to generate profits through energy production. As no information is available with respect to herd size, volume of liquefied manure produced, or application of manure applied to land, it is impossible to know the extent to which this project could exacerbate the quality of already very polluted water.

Response:

The dairy farm, animals, manure lagoon, land application of manure, and all the other practices whose environmental impacts the commenters are concerned about are existing agriculture operations that predate the dairy digester project. These facilities and practices are permitted by the applicable regulatory authorities and their impacts (if any) occur with or without the presence of the digester. The digester proposed by the LCFS Electricity Pathway Application captures existing air emissions from an existing uncovered lagoon or pond. This results in a negative Carbon Intensity (CI) as demonstrated in the calculations reflected in the Application and described on Attachment A to this letter. Thus, the project will reduce methane emissions reported in $CO_{2equivalent}$ from existing pond.

The digester does create one new emissions source—a lean-burn internal combustion engine with selective catalytic reduction emissions control technology. This system includes the most current air emission reduction technology and is fully permitted by the Sacramento County Air Quality Management District. It has successfully met various inspection, reporting, and testing requirements, and the jurisdictional regulator has determined it satisfies air quality requirements.

The Commenters appear to disagree with the presence of dairy farms or the policies of Sacramento County and the Regional Water Quality Control Board in allowing dairy farming,

but do not provide details to any inaccuracies in the pathway calculations or other factual or methodological errors in the Application.

Notwithstanding the foregoing, SMUD provides additional information in Attachment B to this letter demonstrating that the proposed pathway provides reduction of CO_2e, NOx, PM10 and PM2.5. While this additional information is outside the scope of the LCFS Pathway review requirements it is illustrative of the beneficial impact from the proposed pathway.

Comments on water quality and groundwater contamination do not pertain to factual or methodological errors of the pathway application.

Comment No 3. Incomplete GHG Analysis

Similarly, the calculation of GHG emissions and alleged reductions ignore the GHG emissions of manure production. The GHG emissions from the dairy —including methane released from manure, enteric emissions, and other dairy operations—are not regulated. Therefore, these emissions must be calculated and applied to the lifecycle GHG analysis for this project.

Response:
The pathway is designed to calculate the voluntary reduction in emissions compared to the baseline conditions on the dairy. These baseline conditions are governed by applicable regulations that are not a part of the LCFS program. All emissions reductions claimed must be "additional to any legal requirement for the capture and destruction of biomethane" according to the LCFS regulation. The data presented demonstrates the digester's voluntary reductions below the dairy's legal baseline conditions, meeting the requirements of the LCFS rule. If Commenters disagree with the methodology of LCFS regulation or believe that dairy farms should be more stringently regulated, there are other resources for them to pursue. However, the concerns they identify in their comments are not germane to the calculations of CI in the pathway under consideration in the Application and do not identify any factual or methodological errors.

The calculations of GHG emissions and CI reduction provided in the Application meet all LCFS Regulation requirements. Calculation of enteric fermentation is not included in the protocol as it can be easily manipulated by changing the animal diets.

Commenters express concern that all related GHG emissions of manure production, were ignored. This concern is unfounded. A complete life-cycle GHG emission or CI was calculated and a life cycle assessment report (LCA Report) describing the Van Warmerdam digester and associated electric generation was completed following the requirements of LCFS Regulation as identified in section 95488.7(a)(2). The GREET 3 model calculates the CI or life-cycle GHG emissions associated with the manure in great details with all inputs and variables. Computational algorithms were drawn from ARB's Compliance Offset Protocol Livestock Projects, which has been in use since 2011 in partial fulfillment of the Global Warming Solutions Act of 2006 (AB32) that CARB reviewed and provided Applicants with a state-approved computation tool applying them to the case of LCFS electricity generated from dairy manure.

Comment No.4 Incentivized Production of Methane

This project and similar projects do not just undermine California's climate and environmental justice goals, but actually

incentivize increased production of methane (and the concomitant pollution that accompanies methane production). To the extent that dairies are making manure and waste management decisions to increase methane production – such as increasing herd size to increase manure production, opting out of solid separation to increase methane, taking in food wastes for digestion, and even opting for liquefied manure management instead of methods that prevent production of methane in the first place – Van Warmerdam Dairy should not reap the benefits of the LFCS program, designed to reduce greenhouse gases, instead of incentivize production thereof.

In conclusion, this project should be denied because it will harm local air quality, threaten water quality, and fails to consider the full lifecycle emissions of methane production from dairies. Furthermore, there is inadequate data to determine the extent to which the project will reduce greenhouse gas emissions and fails to take into consideration how the project will incentivize production and emission of greenhouse gases. Unless and until there is publicly available and verifiable data demonstrating that this project will not produce negative local air and water impacts, and the extent to which this project will actually reduce, this project will reduce greenhouse gas emissions that could not otherwise be reduced, CARB must deny this application.

Response:

Under the LCFS Regulation Dairy farms are not rewarded for increasing methane, but only for reducing methane emissions that would have occurred in the absence of the digester project. In addition, as discussed above, the dairy farm must implement voluntary reductions of methane emissions over and above the legal requirements already placed upon their dairies. Commenters have not identified any factual or methodological errors in the Application or process.

The life-cycle CI calculation described in the LCA Report is a comparative life-cycle assessment, meaning it reports differences between the LCFS pathway (the Van Warmerdam electricity generation to charge EVs) and a counterfactual baseline that would have likely occurred without the fuel pathway. The Van Warmerdam Dairy digester project simply adds a cover to the conventional lagoon allowing the methane to be captured rather than released to the atmosphere.

Conclusion:

SMUD appreciates the opportunity to respond to the comments pertaining to factual or methodological issues with the pathway Application for the Van Warmerdam Dairy Digester project. The Pathway Application meets the requirements of the LCFS Regulations and SMUD requests that the Executive Officer certify the pathway.

If the Executive Officer would like any further input or supporting information regarding these issues, please contact me and SMUD will promptly supplement this response. Thank you.

Sincerely,

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Attachment A. Some Information for Van Warmerdam Dairy Digester GREET Pathway to Produce Electricity to Charge Electric Vehicles in SMUD Region

Result Summary

The full life cycle carbon intensity (CI) result for Van Warmerdam dairy digester to produce electricity and charge electric vehicle pathway (Tier 2 Electricity Pathway) is **-592.68 gCO2/MJ** .

Figure 1 shows the discrete components that form the Van Warmerdam dairy digester to produce electricity and charge electric vehicle pathway.

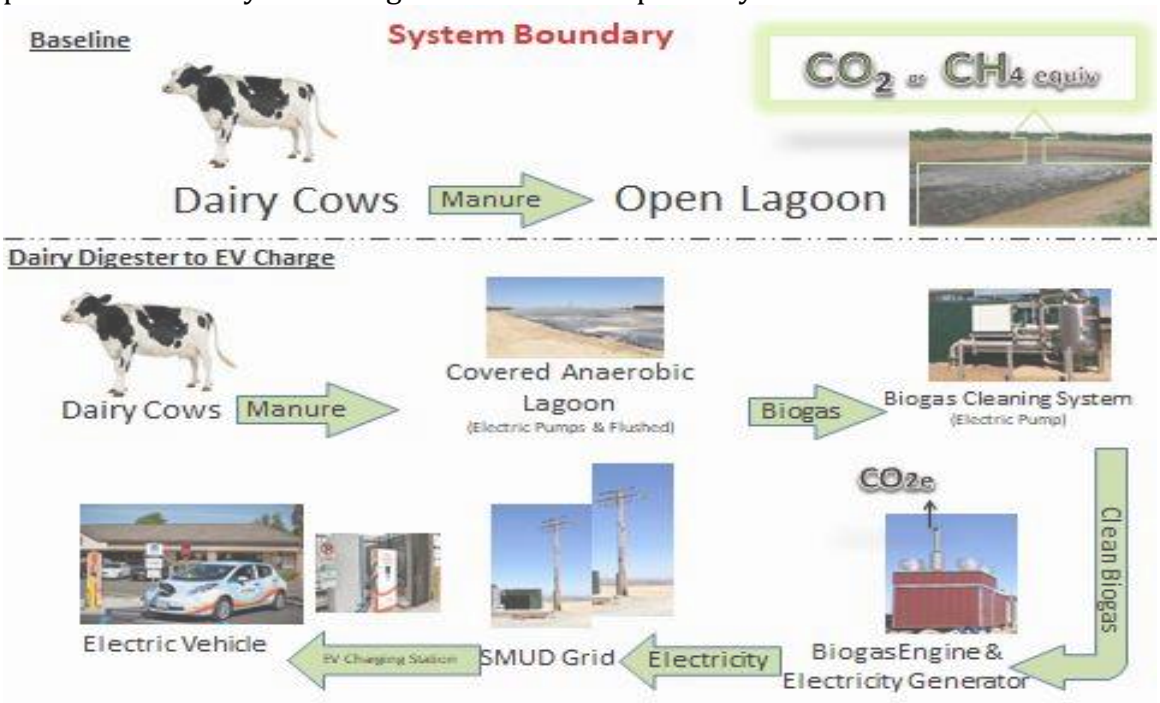

Figure 1: System Boundary Diagram for Van Warmerdam Dairy Digester to EV Pathway

1. Feedstock Phase (Biogas Production)

The feedstock for this pathway is biogas produced from anaerobic digestion of dairy manure or dairy waste using covered lagoon at Van Warmerdam dairy farm located in Sacramento County, California . Van Warmerdam dairy farm has a total 1,297 cows (including milking cows, non-milking cows and heifers) for November 2017 to October 2019 reporting period of 24 months. The third-party owner/developer of Van Warmerdam dairy digester system is Maas Energy Works (MEW). Van Warmerdam dairy owners receive monthly lease payments from MEW from the use of dairy manures and the site. MEW has a power purchase agreement with SMUD. Components of the feedstock or biogas production are described below that include covered lagoon digester and biogas clean-up (or upgrading system) for electricity generation.

Covered lagoon digester description: The covered lagoon digester at Van Warmerdam employs an earthen pond approximately 525 ft. by 125 ft., with a total operational fluid volume of about 8,000,000 gallons. The pond is covered with 80/1000-inch-high density poly-ethylene (HDPE) membrane to contain the biogas. The cover is designed to allow directional flow through the digester to ensure retention time and using mixers in the digester to help improve biogas production. The digester operates at ambient temperatures and is supplemented by waste heat recovered from the engine. The collected manure is retained in the digester for approximately 30 days and recirculated several times. As the manure decomposes, biogas is produced and accumulates under the cover. The digester's flexible cover enables biogas storage, allowing the engine to run during peak power periods when prices paid for electricity are highest, and store gas during lower prices. The effluent from the digester is used as a liquid fertilizer via irrigating forage crops at Van Warmerdam farm.

Biogas cleaning or treatment description: Biogas clean-up at Van Warmerdam dairy digester uses two systems to remove hydrogen sulfide (H_2S) from the biogas. First, a small amount of air is injected under the cover at multiple points. This very small injection of air, spread across the cover, induces naturally-occurring bacteria to grow on the slurry surface and digester cover. Via a process known as biological fixation, these bacteria metabolize H_2S back into elemental sulfur, which collects on the surface rather than entering the biogas stream. The biological fixation system reduces H_2S significantly but may not consistently meet the project's air permit's 50 parts per million (ppm) limits on H_2S. For this reason, the biogas can be routed through a canister containing approximately 80 gallons of activated carbon media. This media (which must be replaced on a periodic basis) absorbs the remaining sulfur and ensures continuous permit compliance.

The total volumetric flow in standard cubic feet (SCF) of biogas combusted was recorded each day using a Sage SIP-05-10-DC24-DIG GAS (Model 35934) biogas flow meter installed in the biogas feed pipe upstream of the genset. The biogas is conveyed underground from the covered lagoon digester to fuel the engine generator system to generate electricity (as fuel for GREET 3.0 Model), as described below.

Engine-Generator Description: The engine generator chosen for Warmerdam is a Guascor SFGLD-560 1,800 RMP, 12-cylinder internal combustion engine rated at over 900 horsepower (> 600 kW) and operating on biogas fuel with Selective Catalytic Reduction as nitrogen oxides (NOx) control technology including an oxidation catalyst capable of meeting the permit limitations. The engine is coupled to a Stamford HCI 534F with 600 kW synchronous generator, generating at 480 V, which is connected to SMUD's distribution feeder via a 750-kVA interconnection transformer.

Heat Recovery Description: The genset recovers heat from three sources at Warmerdam dairy digester system. The engine block's jacket water is pumped out via the engine water pump. Additionally, the exhaust from the engine is routed through a series of parallel pipes where a heat exchanger extracts energy from the exhaust in the form of more hot water. Finally, the engine's intercooler loop coolant is pumped out to catch more hot water.

Together, these three sources allow the system to recover hot water for a total well in excess of 40% of the engine's energy input. After collection, the hot water is transferred to a pipe-in-pipe heat exchanger where the heat is transferred to manure pumped from the covered lagoon. With its large volume, the lagoon can supply essentially unlimited cooling potential to the engine. The heated manure in the heat exchanger is then dumped back into the lagoon to increase the overall lagoon temperature and thus help improve biogas production by about 10%.

Grid Interconnection: The facility is directly connected to a SMUD's 12.47 kV distribution feeder, which also serves the host dairy farm. Interconnection improvements included the installation of a pad mounted Delta-Y 750 kVA transformer and two new poles, one of which included a new broken delta bank with lockable 800 amp disconnect and a Beckwith M3520 protective relay on the project's site of the transformer.

Process Configuration: Figure 2 shows the process configuration of Van Warmerdam dairy digester to produce electricity and charge electric vehicle pathway.

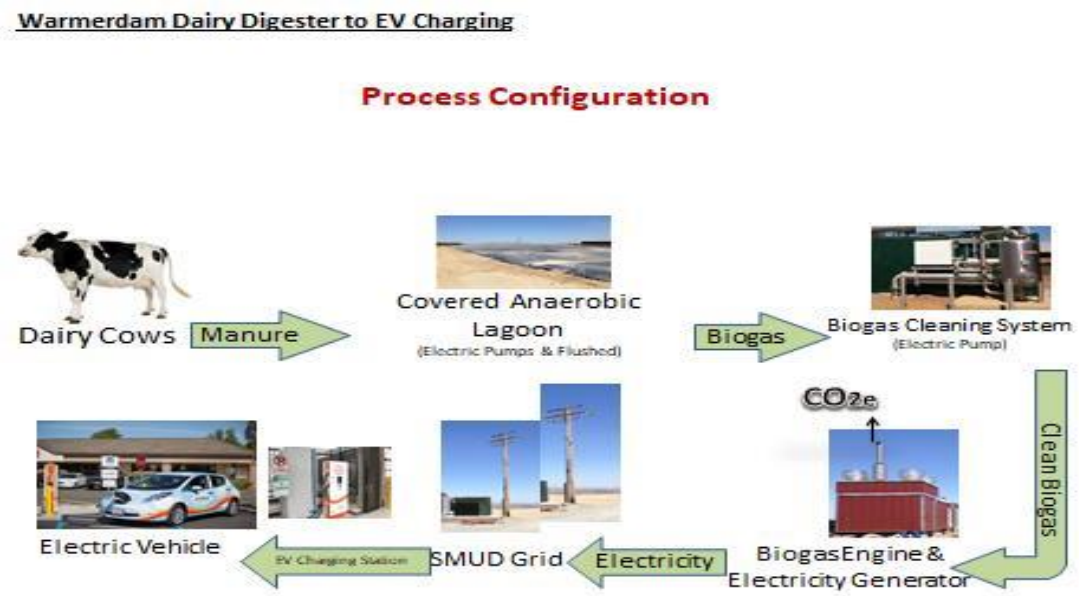

Figure 2: Van Warmerdam Dairy Digester to Produce Electricity and Charge EV Pathway

2. Data Sources and Pathway Inputs

Biogas Production

Biogas production for period of November 1, 2017 to October 31, 2017 (or period of 24 months) were recorded with **CH_4** content data and used as inputs in the CI calculator. The raw biogas and cleaned biogas are assumed as the same flow and CH4 concentration were measured. Then, the cleaned or conditioned biogas is conveyed underground to fuel

the engine generator system with rated output of 600 kW manufactured by Martin Machinery.

The inputs for baseline methane emissions (without covered lagoon) for the GREET 3.0 model using the "Livestock Protocol" are shown included in the Application and CI calculation using Livestock Protocol. All data inputs can be found in the Climate Action Reserve (CAR) tool for the reporting period but cannot be viewed publicly.

A fugitive methane emission or loss of 2% is assumed, as indicated in GREET 3.0. This loss was taken into consideration in calculating the biogas input for conversion efficiency determination of the reciprocating engine.

Conversion Efficiency of Van Warmerdam Dairy Digester Engine Genset

The conversion efficiency of Van Warmerdam Dairy Digester Engine Genset is calculated based on 2-year or 24-month metered data for electricity and biogas production, as shown below.

$$Engine\ Efficiency = \frac{kWh\ production\ x\ 3.6/1055.056}{Biogas\ Production\ x\ Lower\ Heating\ Value\ of\ Biogas}$$

The total electricity production for 2-year reporting period was 3,515,877 kWh.

Using the total kWh production and the total biogas production with corresponding lower heating value (LHV) of biogas as indicated in GREET 3.0 Reference Table, the resulting efficiency of Van Warmerdam Dairy Digester Engine Genset was calculated. Efficiency using higher heating value (HHV) was also calculated. For the proposed pathway, this efficiency was used as input in the GREET 3.0 model to calculate CI. Adjustment factor was also used as prescribed by CARB.

Electricity Usage

The electricity usages for all auxiliary or parasitic loads (like pumps, lights, motors, thermal load, etc.) have a separate meter and were recorded at Van Warmerdam digester facility. The total electricity usage was 80,761 kWh for the reporting period.

Indirect Land Use Change

The digester facility is located at Van Warmerdam dairy farm and accordingly in the site of agricultural land use. So, there is no indirect land use change or zero gCO_2/MJ.

Attachment B: Supplemental Response for the Review Process

The scope of an LCFS pathway applicant's duty to respond to comments is established by Low Carbon Fuel Standard Section 95488.7(d)(5)(A): "Only comments related to potential factual or methodological errors will require responses from the fuel pathway applicant."

SMUD recognizes air and water quality concerns are of vital importance not only to Sacramento County but to the entire State of California and local communities. The comments about air quality and water issues are outside the scope of the pathway review. The following supplemental response is therefore provided on these issues.

This Van Warmerdam dairy digester project is mitigating emissions from the dairy farm operation by utilizing the **very negative carbon intensity** (-592.68 gCO2/MJ) electricity source from biogas (produced from anaerobic digestion of dairy manure) towards charging electric vehicles in SMUD Service Territory. This project provides myriad benefits to the community and the local economy.

With regards to air quality impacts, the Dairy Digester Emissions Matrix (see https://ww3.arb.ca.gov/cc/dairy/dsg2/dairy-emissions-matrix-113018.pdf) which was developed by a diverse group of stakeholders including representatives from Central Valley Air Quality Coalition, Central California Asthma Collaborative, and the American Lung Association, as well as other stakeholders in collaboration with CARB pursuant to SB 1383 has indicated that the destruction of methane in a stationary reciprocating engine to produce electricity for an for EV charging produces less NOx and PM2.5 than the alternative method of methane destruction within mobile natural gas engines. Uncovered lagoon has the worst emission profile as shown in the matrix.

The summary net benefits of onsite or stationary reciprocating engine to charge EVs is shown below.

	Net Benefits							
Scenario	**CO_2e (20-yr GWP)**	**CO_2e (100-yr GWP)**	**NOx**	**PM_{10}**	**$^{PM}2.5$**	**CO**	**SOx**	**VOCs**
Onsite Reciprocating Engine to Grid and EVs	-60,934	-24,356	-4.9	-0.9	-0.4	3.2	-2.3	-3.4
Pipeline Injection to NG Vehicles	-54,491	-19,402	-4.1	-0.2	<0.1	52.1	-1.0	-14.1
Pipeline Injection to Power Plant, Grid and EVs	-63,190	-26,853	-7.1	-1.5	-0.8	-5.8	-3.1	-4.0
Pipeline Injection to Hydrogen Vehicles	-56,702	-21,066	-1.3	-0.4	0.1	-1.7	0.3	-3.2
Pipeline Injection to Fuel Cell, Grid and Evs	-64,565	-28,073	-7.8	-1.7	-0.9	-6.6	-3.6	-4.2
Uncovered Lagoon	70,581	24,519	0.1	0.1	0.1	0.1	0.1	3.0

The electricity from biogas to charge EVs and Renewable Natural Gas or biomethane to be used in compressed natural gas (CNG) engines show net NOx and PM benefits to local communities and residents. The criteria pollutant emissions are less than in diesel-fueled vehicles.

The comments made on water quality do not pertain to factual or methodological errors, so SMUD has no response.