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U.S. EPA Region 9
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Email: R9AirPermits@epa.gov
Docket ID No. EPA-R09-OAR-2017-0473 http://www.regulations.gov

Re: Comments on Proposed Clean Air Act Prevention of Significant Deterioration Permit for the Palmdale Energy Project, PSD Permit No. SE 17-01

Dear EPA Region 9 and Ms Beckham,

These comments are submitted on behalf of the Center for Biological Diversity ("Center"), California Communities Against Toxics, Desert Citizens Against Pollution ("DCAP") and Sierra Club, National Air Team (collectively "conservation groups") regarding the Proposed Clean Air Act Prevention of Significant Deterioration Permit for the Palmdale Energy Project, PSD Permit No. SE 17-01. The conservation groups have serious concerns about the proposed permit terms and the lack of adequate analysis of the proposed permit in the fact sheet and accompanying documents. Our detailed comments follow.

I. The Facility Definition Is Unclear and Unstable.

The application describes the project as:

> The Palmdale Energy Project (PEP) is proposing to construct and operate a fast start (Flex Plant) 645 MW (nominal average annual rated) natural gas-fired combined-cycle power plant. The Flex Plant design project will operate up to approximately 8,000 hours per year, with an expected facility capacity factor at 60 to 80 percent. *However, the dispatch profile may change as market conditions evolve.* As a result of the potential dispatch profiles, and to permit the possible worst case operational scenarios, *two (2) additional operational profiles were considered beyond the base load case which are based on more of a cycling or peaking type of project.*

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(PEP PSD Application October 2015 at 2-1; emphasis added; see also *Id*. at 2-6 to 2-7 describing 3 different operational scenarios.) In the Fact Sheet for the draft permit EPA describes the project as:

> The Project is designed to provide flexible capacity from natural gas to the California Independent Systems Operator (CAISO) with an expected capacity factor of 60 to 80 percent. Flexible capacity natural gas resources typically operate *to meet the ramping and peak load requirements* in the morning and late afternoon, helping to integrate the ramp up and ramp down of solar generation provided by other facilities.
> . . .
> The Project is designed to act as a load following unit with an expected facility capacity factor of 60 to 80 percent. However, as noted above, the Project is intended to provide flexible capacity to the CAISO, thus the Project's actual dispatch profile must adapt to market conditions, which will result in different operational scenarios at different times. That is, *as needed, the plant may act like a peaking plant (approximately 4,320 hours a year) or a baseload plant (approximately 8,000 hours a year), or on an intermediate basis (approximately 5,000 hours a year), to meet the shifting demands of the electric grid*.

(August 2017 Fact Sheet at 4, 6 *citing* page 2-1 and 2-6 of the October 2015 Application; emphasis added.)

Because the BACT analysis is limited and EPA will not consider a proposed alternative that would "redefine the design of the source," it is critical that the definition is clear, stable and not so tied to the proponent's preferences that no BACT can be applied.

> In Step 1 of the BACT analysis, the EPA generally consider the capabilities of add-on air pollution control technologies, inherently lower-emitting processes/practices/designs, and combinations of the two that are potentially available and applicable for use at the proposed facility. *See id*. at 24-25 & n.66; *NSR Manual* at B.10. Add-on controls typically filter and remove pollutants from facility exhaust streams, while inherently lower-emitting processes/practices/designs generate fewer air contaminants in production processes. EPA encourages permit issuers to "cast a wide net" at this stage of the BACT analysis, thereby compiling a "broad array" of potential emissions control options that they can examine more closely in subsequent steps of the analysis. *GHG Guidance* at 26.
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> But Step 1's broad look is "not without limits." *Id*. Consideration of fundamentally different facility types than those proposed by permit applicants generally is not required. Indeed, EPA guidance and Board precedent, affirmed by the U.S. Court of Appeals for the Seventh Circuit, give permitting authorities the discretion to exclude a proposed control alternative from consideration in the BACT analysis, if that proposed alternative would "redefine the design of the source." *NSR Manual* at B.13; *see Sierra Club v. EPA*, 499 F.3d 653, 654-57 (7th

> Cir. 2007), *aff'g In re Prairie State Generating Co.*, 13 E.A.D. 1 (EAB 2006); *see also Util. Air Regulatory Group v. EPA*, 134 S. Ct. 2427, 2448 (2014); *In re Sierra Pac. Indus.*, PSD Appeal Nos. 13-01 to -04, slip op. at 59-60 (EAB July 18, 2013), 16 E.A.D. ___; *In re City of Palmdale*, 15 E.A.D. 700, 729-30 (EAB 2012); *GHG Guidance* at 26-27. If a permitting authority decides that a proposed alternative would constitute a redefinition of the source, it will not list the alternative as a potential control option in Step 1 of its BACT analysis, and it will not consider that option further. *NSR Manual* at B.13.

(Az. Public Services Company at 5-6 (citations omitted). However, there must be some stability in how the source is defined or no meaningful analysis can occur. Here, the PEP facility is variously framed as a baseload project, a peaker project and a load following project. This is an unstable description and is so closely tied to the proposed facility and the varying ways it could be utilized that it unlawfully narrows the field of "inherently lower-emitting processes/practices/designs" by definition. As such, in essence only the PEP facility as designed could fit the description.

For example, here, at Step 1 of the GHG analysis EPA rejected the solar hybrid alternative that would reduce GHG emissions because they would "redefine the design of the source" because the project is described as "intermediate load following" or "flexible capacity" and *not baseload*. (Fact Sheet at 26), although as explained above EPA itself describes the project as possibly also being used for baseload elsewhere (*id*. at 6). In this way, the overly broad and unstable definition is used to undermine meaningful BACT analysis and public review of the draft permit.

The project definition is so unstable that EPA cannot fairly conduct a BACT analysis of alternatives. As courts have explained in the NEPA context where purpose and need defined by the agency is used to develop alternatives, agencies cannot narrow the purpose and need statement to fit only the proposed project and then shape their findings to approve that project without a "hard look" at the environmental consequences. As the Ninth Circuit has explained an "agency cannot define its objectives in unreasonably narrow terms" and the statement of purpose and alternatives are closely linked since "the stated goal of a project necessarily dictates the range of 'reasonable' alternatives." (*City of Carmel-by-the-Sea v. U.S. Dept. of Transportation*, 123 F.3d 1142, 1155 (9th Cir. 1997); *Muckleshoot Indian Tribe v. U.S. Forest Service*, 177 F. 3d 900, 812 (9th Cir. 1999).) The Ninth Circuit reaffirmed this point in *National Parks Conservation Assn v. BLM*, 586 F.3d 735, 746-48 (9th Cir. 2009), holding that "[a]s a result of [an] unreasonably narrow purpose and need statement, the BLM necessarily considered an unreasonably narrow range of alternatives" in violation of NEPA.

It is well established that the public review process cannot be "used to rationalize or justify decisions already made." (40 C.F.R. § 1502.5; *Metcalf v. Daley*, 214 F.3d 1135, 1141-42 (9th Cir. 2000) ["the comprehensive 'hard look' mandated by Congress and required by the statute must be timely, and it must be taken objectively and in good faith, not as an exercise in form over substance, and not as a subterfuge designed to rationalize a decision already made."]) To do so would allow an agency to circumvent meaningful review by simply "going-through-the-motions." The agency cannot camouflage its analysis or avoid robust public input, because "the very purpose of a draft and the ensuing comment period is to elicit suggestions and criticisms to enhance the proposed project." (*City of Carmel-by-the-Sea*, 123 F.3d at 1156.) The agency cannot circumvent relevant public input by framing the purpose and need so that no alternatives can be meaningfully explored or by failing to review a reasonable range of alternatives.

Furthermore, even if EPA's definition of the source as "load following" or "intermediate" is accepted as the purpose of the facility, other alternatives, including a hybrid battery plant, could meet those needs with lower emissions.

II. EPA'S BACT LIMITS ARE INADEQUATE AND ARE BASED ON AN INADEQUATE BACT ANALYSIS

A. NOx AND CO BACT FOR GEN1 AND GEN1

In step 1 of the NOx BACT analysis for emission units Gen 1 and Gen 2, EPA failed to consider using batteries rather than duct burners for meeting peak demand. Batteries would reduce both CO and NOx as well as GHG, which is discussed elsewhere. Therefore, when EPA does the cost effectively analysis in Step 4, EPA needs to consider the cost per ton by combining the tons of NOx, CO, and GHG.

Turning to why batteries need to be considered in step 1 of the NOx and CO BACT analysis for Gen1 and Gen2, batteries are technological feasible to replace the duct burners. In fact, they are the preferred technology for pairing with renewable energy generation, which PEP claims is its purpose. EPA does not provide a heat rate for the duct burners in the Fact Sheet but we assume both duct burners are in the range of providing 40 megawatts (MW) total of additional energy and are limited to 1500 hours per year. Thus, PEP would need approximately 60,000 megawatt hours (MW-h) annually of storage.

Batteries of this size are commercially available. The world's largest lithium-ion battery system is 100 MW, which is significantly larger than what PEP would need. (*See* Ex. 5.) EPA failed to consider this system. The system is commercially available because Tesla has already signed a contract for such a system. (*Id.*) As of the end of September 2017, the system is already half in place. (*Id.*) The 100 MW Tesla system is designed to meet PEP's stated business purpose, that is smooth out volatility caused by wind and solar generation. (*Id.*) This system is so large that even if PEP was concerned about "extended peaks" the battery system could be sized to accommodate that need. But EPA should not accept unsupported assertions from PEP. PEP would have to show that they will have an uninterruptable supply of natural gas at all times to serve the duct burners for extended peaks to the extent that EPA requires the same functionality from a battery system.

In addition, just between January and July of this year, that is 2017, 12 MW of utility scale batteries were installed in the U.S. (Ex. 2.) Furthermore, it is likely that the 30 MW battery at Blue Summit Storage is also already operational. Although it is listed in the planned project table, the U.S. Energy Information Administration (EIA) tables are a few months behind the times and the EIA lists the project as coming on line in August of 2017. (Ex. 3 at line 18.)

There are also approximately 147 MW of batteries that EIA has said are planned for the U.S. (Ex. 3.) This includes a 25 MW battery paired with a 275 mw natural gas fired combustion turbine at the Mission Rock Energy Center in California. (Ex. 3 at line 1076 and 1077.) It also includes a 40 MW battery system at the Fallbrook Energy Storage facility in California. (Ex. 3 at 1107.) It is important to consider that EIA may not be capturing all projects. EIA relies on self-reporting of projects.

Nor is this redefining the source to evaluate a battery system to replace the duct burners, even considering EPA's incorrect statement of the business purpose of this source. EPA originally states the purpose of PEP as the following:

> the PEP is designed as an "intermediate load following" facility. This could also be referred to as a "flexible capacity" facility. This type of facility primarily operates to meet the energy market's ramping and peak load requirements in the morning and late afternoon, helping to integrate the ramp up and ramp down of solar generation. The purpose of the PEP is to be able to respond to changes in demand from the electric grid, making this the fundamental business purpose of the facility.

(Fact Sheet at 26.) In other words, the grid needs to balance generation and demand. The business purpose of the PEP is to help keep the gird in balanced. PEP will be paid to provide this help.

However, to avoid considering battery storage, EPA itself redefines the purpose of this source in a nonsensical manner. EPA defines the project as having a purpose of burning nature gas in combined cycle units. (Fact Sheet at ftnt. 49.) But no one is in business to buy combustion turbines and burn natural gas. No business gets paid to buy combustion turbines. Rather, the combustion turbines cost the business money. Similar, no one's business purpose is to burn natural gas as no one is paid to do that. Rather, as EPA previously explained the business purpose of this facility is to provide intermediate load following or flexible capacity. In any event, in this section we are only taking about replacing the duct burners with batteries. This would not infer with EPA's incorrect statement of the purpose of this project of buying combustion turbines. It would reduce the amount of natural gas PEP burns but again, burning a certain amount of natural gas is not the business purpose of PEP. Furthermore, with a limit of 1,500 hours per year, the duct burners are to meet peak need.

EPA acknowledges that the duct burners have higher NOx and CO emission rates than the combustion turbines. Therefore, by eliminating the duct burners and replacing their abilities with those of batteries which are changed from the combustion turbines, the facility can meet lower BACT emission limits.

In addition, batteries could be used to allow the source to better service its stated business need if the source so chose. Batteries add at least one additional function that duct burners cannot. That is duct burners cannot absorb electricity, they can only produce it. Batteries can absorb electricity from the grid, allowing the gird to better deal with rapid ramping which can be caused by solar and wind. At times, various grids in the U.S. have experienced negative wholesale prices because the grid operator has too much electricity on the grid. (*See e.g.* https://qz.com/953614/california-produced-so-much-power-from-solar-energy-this-spring-that-wholesale-electricity-prices-turned-negative/.) Other authorities, like ERCOT and BPA have had to curtail zero NOx and CO emission wind and solar power generation at various times because of excess generation. (*See e.g.* https://www.nrel.gov/docs/fy14osti/60983.pdf)

The duct burners provide no solution to these situations. However, if PEP was using batteries rather than duct burners to meet peak load needs, then during periods of excess generation, PEP could actually absorb electricity from the grid. This would increase PEP's ability to meet its stated business purpose. Helping a source to better meet its stated business purpose is not redefining the source.

Batteries may add additional abilities to the facility, such as providing other ancillary support services to the grid, that the duct burners are not capable of. EPA must consider these in step 4 of its BACT analysis by considering additional income that PEP could generate by providing additional ancillary support services as well as the environmental benefit of the reduction of curtailment of zero emission sources like solar and wind.

B. AMMONIA SLIP RATE BACT EMISSION LIMIT

The draft permit does not have an ammonia slip BACT emission rate. Ammonia is now considered a precursor to PM2.5. Thus, the permit needs an ammonia slip rate emission limit based on the Region's BACT analysis. AVAQMD's determination of a 5 ppm limit is not an acceptable substitute for the Region doing its own BACT analysis. However, AVAQMD's inclusion of an ammonia slip emission rate does establish that ammonia is a significant precursor to PM2.5 in the Antelope Valley. Furthermore, the significant emission rate for any other pollutant is zero. Thus, the permit needs an ammonia emission limit based on the Region's BACT analysis.

C. BACT EMISSION RATES FOR CO, NOX, PM, PM10 AND PM2.5 FOR UNITS D2 AND D3

BACT is an emission limit. (40 CFR 52.21(b)(12).) Units D2 and D3 do not have any BACT emission limits for NOx, CO, PM, PM10 and PM2.5. These sources have stacks and thus are easily subject to source testing. Therefore, there is no excuse for not include BACT emission limits for these sources.

D. CO BACT FOR CTs

The Fact Sheet rejects EMx as a control technology for CO emissions from the CTs at step 2 of the BACT analysis. This is an error.

The Fact Sheet rejects EMx because EPA could only find its use on a 1.4 MW combustion turbine. However, EPA failed to conduct a proper technology transfer analysis to see if EMx could be applied to CTs similar in size to what PEP is proposing. Technology transfer is a well-established principle in BACT analysis. EPA's rejection of a technology at step 2 because it is not currently in use at a large size turbine is based on a misapplication of BACT, its technology forcing nature and its technology transfer principle. The fact that there is at least one BACT analysis that chose EMx further supports the conclusion that it is technically feasible. BACT is an emission limit. The fact that a large CT with a BACT limit based on EMx chose not to install EMx, by itself, is not relevant to a BACT analysis. Again, BACT is an emission limit. Sources are free to meet their BACT emission limit in any manner they choose. Therefore, EPA must redo the Fact Sheet to include a technology transfer analysis for EMx.

E. PM BACT FOR CTs

In selecting the BACT emission limits for GEN1 and GEN2, the Fact Sheet states: "These emission limits are based on available PM emissions data for this turbine model, and are generally in the range of other recent BACT limits for similar units, as shown in Table 9." (Fact Sheet at 23.) This sentence evidences two errors in this BACT analysis.

The first is BACT is the "best" available control technology. It is not the "around as good as" available control technology. Put another way, BACT requires the <u>maximum</u> degree of reduction. (40 CFR 52.21(b)(12).) The Fact Sheet itself explains that step 4 requires an evaluation of the <u>most effective</u> control alternative. (Fact Sheet at 12.)

The Fact Sheet goes on to list the Moundsville Combined Cycle Power Plant in West Virginia as having an emission limit of 8.9 lb/hr and 0.0037 lb/MMBtu. (Fact Sheet at 24) This permit also required inlet air filtration in addition to GCP and natural gas. (*Id.*) Therefore, step 4 of the BACT analysis for PM/PM10/PM2.5 needs to list 8.9 lb/hr and 0.0037 lb/MMBtu as the first choice as this represents the maximum degree of reduction and the most effective control alternative. EPA also needs to evaluate inlet air filtration.

The other problem with this BACT analysis is EPA based it on the turbine model which PEP claims it will use. But again, BACT is the most effective control technology. A polluter does not get to choose a less protective BACT limit but choosing a higher polluting turbine. Rather, if there is a cleaner turbine that can perform the same basic function as the polluter's preferred turbine, EPA is required to consider that clearer turbine. As EPA failed to do that for the PM/PM10/PM2.5 BACT analysis, EPA must redo the analysis.

F. NOx BACT for the Auxiliary Boiler

EPA acknowledges that there is one BACT determination for an auxiliary boiler of 5 ppm NOx. However, EPA rejects this because it claims this emission rate is not demonstrated in practice. This is a misapplication of BACT for two reasons. One is that the Fact sheet does not document what auxiliary boilers are achieving in practice, regardless of their NOx emission limits. The other is that the fact alone that a source has not been built yet does not mean that EPA is free to ignore this. EPA's approach would be the opposite of the technology forcing nature of BACT. Not only would EPA's approach make it impossible for emission limits to get more stringent absent a polluter asking of a more stringent limit, it would allow for BACT limits to get less stringent over time between the time a source gets a limit and "demonstrates in practice" that the limit is achievable. If EPA believes that demonstrates in practice requires the lifetime of the facility, this could take 30 years. Therefore, EPA must redo the BACT analysis with 5 ppmvd as the top choice in step 4 of the BACT analysis.

Furthermore, Table 15 states that there are two other facilities in California, AES Huntington Beach Energy Center and AES Alamitos Energy Center, which have 5 ppm NOx limits based on the use of SCR. EPA fails to provide an analysis of why it rejected these two examples in refusing to set a NOx BACT of 5 ppm.

G. CO BACT FOR THE AUXILIARY BOILER

Once again, EPA fails to consider technology transfer of a low temperate oxidation catalyst to set CO BACT for the auxiliary boiler. EPA states: "While there may be developing technologies for low temperature oxidation catalysts,[] we are not aware of any such available application for natural gas boilers of this type." (Fact Sheet at 38; footnote omitted.) EPA fails to undertake an analysis of whether these low temperature oxidation catalysts can be applied to the type of natural gas boiler at PEP. Ironically, the evidence EPA cites to is on NASA's "technology transfer" web page.

Furthermore, as with NOx, EPA eliminates the lowest CO emission rate it is aware of because the facility with that limit is not yet in operation. This is error for the same reasons explained above. Therefore, EPA must redo the BACT analysis starting with 25 ppm CO in step 4.

A. The BACT Analysis For GHG Emissions Is Inadequate

The conservation groups understand that the BACT analyses for controlling greenhouse gas emissions is to be conducted in the same manner as for any other regulated pollutant. Because EPA in its Step 1 BACT analysis fails to accurately and clearly describe the project it unfairly limits the consideration of hybrid solar thermal, and at Step 2 battery storage. As a result, EPA's rejection of various BACT for GHGs at Step 1 and 2 are in error. And, as described more fully below, EPA never even considers other solar components or a combination of solar and battery technologies as alternatives that could be used to reduce GHG emissions. Because additional feasible and available technologies should have been fully considered in the BACT for GHGs but were not, the analysis is in error.

1. Step 1: Rejection of Hybrid Solar Thermal was in error

EPA's rejection of a hybrid solar thermal design to reduce emissions was in error. First, as explained above, at Step 1 of the GHG analysis EPA rejected the solar hybrid alternative that would reduce GHG emissions because they would "redefine the design of the source" because the project is now described as "intermediate load following" or "flexible capacity" and not baseload (Fact Sheet at 26), although EPA itself describes the project as possibly also being used for baseload (*id*. at 6). As a result EPA's reason for rejecting this alternative is not supported.

Further, the EPA's "determination" that the proposed facility design (without the solar hybrid component) was derived for reasons independent of air quality (*id*. at 26-27) is wrong. The discussion is *premised* on the fact that renewable generation has increase in order to reduce GHGs, and the argument that this allegedly creates a need for additional gas-fired units to integrate more of these resources into the energy system.[1] (*Id*.) And clearly the entire point of shifting to renewable energy is to reduce air quality impacts from GHGs. Therefore, for EPA to argue that the design of this facility is somehow "independent of air quality" is nonsensical. If the project may be used for baseload, as the applicant has stated, then the solar hybrid should be considered as BACT.

2. Step 1: Other Potential Alternative Technologies to Reduce GHGs Should Have Been Considered.

If the real goal is to balance solar and other renewable energy with load, as the applicant states, then the EPA should look at other technologies that would accomplish this goal with far fewer GHG emissions. As a recent study explains:

> Kauai Island Utility Cooperative (KIUC), a public utility with 30,000 customers and peak load and annual energy demand of 78 MW and 430 million MWh, respectively,[] has taken the lead in transitioning from a fossil fuel-based grid to a model built on solar combined with battery storage. KIUC will replace about 40 percent of overall demand provided by fossil fuels with renewables in the 2015 to 2025 timeframe, increasing the percentage of renewables to 76 percent in 2025. KIUC has two major projects combining solar and battery storage: the SolarCity project consisting of 20 MW of solar and 52 MWh of battery storage (operational as of April 2017) and the AES project consisting of 28 MW of solar and 100 MWh of battery storage (under construction as of June 2017).

(Ex. 13 at 25; footnotes omitted.) To the extent there is a need for "load following" capacity to integrate the world-class solar resources in the Palmdale area into the grid, battery storage could be implemented. Further, these battery storage solutions are technologically feasible and cost competitive.

> Utility-scale battery storage has been identified by investor-owned utilities as cost-competitive with combustion turbines for peaking power since 2014. Southern California Edison (SCE), in its November 2014 procurement application

[1] The conservation groups do not agree with these assertions that there is a need for additional fossil fuel energy projects and discusses these issues further below.

> to the California Public Utilities Commission (CPUC), stated that its least-cost, best-fit resource modeling indicated the acquisition of utility-scale battery storage would be the most economic scenario relative to combustion turbines or other non-fossil resources. The CPUC ultimately approved 100 MW of utility-scale battery storage and 130 MW of behind-the-meter battery storage in response to SCE's November 2014 application.
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> Separate from the SCE authorization described above, over 100 MW of battery storage (with 400 MWh of storage capacity) was added in Southern California in only nine months from the time the CPUC notified the Southern California utilities to seek additional storage capacity in June 2016. That capacity reached operational status in late 2016 and early 2017. This large-scale, fast-track battery deployment process demonstrated that the long lead time procurement cycles typical of conventional gas-fired generation, based on long-term utility growth forecasts that may never become reality, are not necessary for battery storage procurement.
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> The lowest published cost for large-scale solar PV with batteries, less than $0.045/kWh, is from Tucson Electric in May 2017. This production cost is substantially below the production cost of $0.059/kWh estimated by EIA for a new gas-fired combined cycle power plant. The solar component of the project is 100 MW. The battery component is 30 MW rated capacity and 120 MWh of energy storage. Prior to the Tucson Electric announcement, the lowest published cost figures had been for two Kauai Island Utility Cooperative (KIUC) solar with battery projects, by AES and SolarCity. The contract power cost for the 28 MW solar with 20 MW battery facility by AES, contracted in December 2016 at $0.11/kilowatt-hr (kWh), is comparable to that of new peaking gas-fired power plants.iv In 2015, KIUC signed a similar contract with Solar City for $0.145/kWh. The Solar City project became operational in March 2017.

(*Id*. at 54, footnotes omitted.) Moreover, batteries can be constructed and installed in a timely way, Tesla recently installed 50 MW in just 2 months to help balance wind and solar resources in Australia. (Ex. 5.)

3. Step 2: Rejection of Hybrid Battery Storage is in Error

EPA rejects the hybrid battery storage with the gas turbine as BACT for GHGs because it has not been demonstrated as feasible, although EPA identifies an operating plant with this technology. (Fact Sheet at 29-30.) This is in error.

First, once again, EPA's short hand description of the project the analysis as "load following" or intermediate capacity ignores the possible use as baseline and the peaking function is in error. Second, even taking that definition, EPA's that it is "not technically feasible" is unsupported and simply relies on "concerns" raised by the applicant. (Fact Sheet at 30.) EPA describes one project operating in Southern California with this technology with a GE turbine, and admits that both GE and Siemens (the turbine manufacturer proposed for PEP), "claim to be able to apply this type of hybrid battery design to a wide range of turbines. (*Id*. at 30.) Indeed, Siemens is marketing such a system for combined cycle gas turbines. (Ex. 14.)

If the vendors say they can design and build battery hybrid systems for combined cycle gas plants, that should be sufficient to show this is a BACT, which is intended to be a technology forcing standard.

4. Step 3: EPA Failed to Consider Use of More Efficient Turbines to Control GHG

The EPA should have considered more advanced turbines for GHG BACT. The PEP proposes to use Siemens SGT6-5000F, however other turbines may be more efficient and reduce GHGs. For example, the G class turbine, SGT6-8000 says it has "world class fast cold start and hot restart capability,[2] and 61% net efficiency.[3] Similarly, the H class turbines have 61% efficiency and fast start capability.[4] In contrast, the F class which Palmdale would use only has a 59.3% efficiency.[5] Thus, using the G or H class turbine for GHG BACT would mean almost a 2% reduction in GHG emissions which EPA should have considered.

In sum, EPA should have considered using an H or G class turbine as BACT to lower GHG emissions, as there would be nearly equivalent start times[6] and they could provide the same load following function.

5. The Performance Degradation Rate Used To Set the GHG BACT is Not Supported

The Fact Sheet states that the applicant included a "performance" compliance margin or degradation rate of 6 percent for anticipated degradation of the equipment over time. (Fact Sheet at 31-32.) Degradation is an important factor to be considered, as the heat rate of the facility may gradually deteriorate slightly between overhauls. However, the EPA's estimate is far too high. To begin with, in setting the new source performance standard (NSPS) for combined cycle combustion turbines, EPA used a 5 percent anticipated degradation factor. Region 9 does not

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[2] https://www.siemens.com/global/en/home/products/energy/power-generation/gas-turbines/sgt6-8000h.html#!/

[3] *Id*. (https://www.siemens.com/global/en/home/products/energy/power-generation/gas-turbines/sgt6-8000h.html#!/)

[4] H class turbine also gets 61% efficiency and the 1x1 configuration is 665 MW which is about the same as Palmdale's 2x1 configuration. https://www.siemens.com/global/en/home/products/energy/power-generation/gas-turbines/sgt5-8000h.html#!/ The H class turbine also has world class cold start and hot restartcapabilityand these plants can operate from part load simply cycle up to full-load combined cycle. (*Id*.) And has "excellent peaking capability". (*Id*.)

[5] https://www.siemens.com/global/en/home/products/energy/power-generation/gas-turbines/sgt6-5000f.html#!/

[6] "Minimum emissions compliant loads and start times are now nearly equivalent between F-class and advanced class units." http://www.power-eng.com/articles/print/volume-119/issue-8/features/the-fall-of-the-f-class-turbine.html

explain why it is deviating from EPA headquarters. Moreover, EPA in setting the NSPS actually acknowledges that the loss is more like 3%; but that they are "being conservative". Note that this assumes that the manufacturer's recommendation for overhaul & maintenance are occurring. This then would be what is called the non-recoverable degradation factor. If Region 9 does not actually believe that degradation will be 6 percent but they are including some sort of safety fact, the record needs to include a justification for a particular safety factor if one exists.

A review of the literature indicates that 6 percent is a significant overestimate given maintenance practices that are widely used and known to improve output (and revenue). Even 3 percent is likely to be too high for newly designed and constructed units that employ efficient designs.[7] Published industry information asserts that good maintenance practices, including frequent offline water washing, reduce both the amount of performance degradation and the rate of performance degradation. Detailed testing by Siemens and other manufacturers demonstrates that with advanced cleaning systems, degradation in performance between major overhauls due to compressor fouling can be reduced to negligible levels of less than one percent. One such test shows a reduction in turbine efficiency from 35.3 percent to just 35.2 percent in over 47,000 hours of operation.[8] In addition regulators need to require adequate maintenance and not just rely on operators who have multiple goals.[9]

If the EPA includes a degradation factor, then it must justify that factor. At a minimum, this means that the EPA needs to consider far more detailed information, than it has provided in the Fact Sheet to date and ascertain the extent to which top-performing units – including units with better initial designs and units that employ appropriate maintenance practices –experience the assigned degradation factor. The EPA must make a record demonstrating that a degradation factor is necessary and that the degradation factor used in the permit appropriately represents the reasonable and unavoidable degradation of the facility.

Kehlhofer, et al., 3d edition, 2009, Pennwell Corporation (Ex 15), Figure 9-10 shows that the "recoverable" (through blade washing, filter cleaning, etc) is much larger than the non-recoverable losses This unit was cleaned about once a week. If cleaned twice a week the decay would be less and presumably, if only cleaned once a month the degradation would be much

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[7] *See, e.g.,* I.S. Diakunchak, Performance Deterioration in Industrial Gas Turbines, Journal of Engineering for Gas Turbines and Power, v. 114, April 1992, pp. 161-168 (1%); S. Can Gulen and Sal Paolucci, Real-time On-line Performance Diagnostics of Heavy-duty Industrial-gas Turbines, Transactions of the ASME (2%), Available at: http://www.thermoflow.com/WALK_GTEYE/ASME_2000-GT-312_ThermoflowGTEYE.pdf ; J. Petek and P. Hamilton, Performance Monitoring for Gas Turbines, Orbit, v. 25, no. 1, 2005; Emerson Process Management, Gas Turbine Engine Performance, January 2005.
[8] Leusden, C, Sorgenfrey, C and Dummel, L Performance Benefits Using Siemens Advanced Compressor Cleaning Systems, ASME Paper 2003-GT-38184, Journal of Engineering for Gas Turbines and Power, pp 763-769 Vol 126, Oct, 2004 (available at: http://www.scribd.com/doc/76381599/compressor-washing).
[9] *See* https://st-www.gepower.com/content/dam/gepower-pgdp/global/en_US/documents/technical/ger/ger-3695e-ge-aero-gas-turbine-design-op-features.pdf
http://www.ewp.rpi.edu/hartford/~roberk/IS_Climate/Papers/Gas%20Turbine%20Compressor%20Washing%20State%20of%20the%20Art%20-%20Field%20Experiences.pdf
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.460.3253&rep=rep1&type=pdf (explaining the benefits of maintenance to improve performance)

more. This supports the argument that an aggressive "routine maintenance" program should be part of any PSD GHG permit.

But EPA has not done this. Rather, EPA simply accepted the 48,000 hour recommendation for major overhauls as a given. EPA failed to consider require routine maintenance or more frequent major overhauls as a way to lower the degredation and thus require a more protective GHG BACT emission limit.

Yet, EPA has acknowledged that mandating maintenance work can be the basis for a GHG BACT limit. In PEP's draft permit, the GHG BACT for the auxiliary boiler is based on yearly tuneups.

6. The EPA Did Not Address Fugitive Emission Leak Detection and Repair (LDAR) and Remote Sensing For Natural Gas

While the Fact Sheet discusses SF6 leak prevention it does not discuss natural gas leak prevention from the combustion turbines, auxiliary boiler, duct burners and natural piping and metering equipment. Methane, which is what natural gas mainly is, is a NSR regulated pollutant. Any emissions of methane triggers PSD review for methane. PEP will invariably emit a non-zero amount of methane through leaks in the piping and other equipment. However, EPA did not conduct a BACT analysis of methane from leaks at PEP.

Leak detection and repair (LDAR) can be achieved in various ways including handheld analyzers and remote sensing technologies, as-observed audio, visual, and olfactory (AVO). At minimum, the EPA needs to address how implementation of these technologies could reduce methane leaks in its GHG BACT analysis.

III. THE AMBIENT AIR QUALITY IMPACTS ANALYSIS IS INADAEQUATE

A. EPA IMPROPERLY FAILED TO CONDUCT A CUMULATIVE IMPACT ANALYSIS BY USING SIGNIFICANT IMPACT LEVELS

EPA claims that if a source by itself does not exceed a significant impact level (SIL) which EPA has decided to use, EPA may allow the permittee to avoid doing a cumulative impact analysis if EPA feels like that is appropriate, on a case by case basis, based on the record. (Fact Sheet at 51.) EPA is incorrect. The statute and regulations require that sources demonstrate that they will not cause or contribute to a violation of the NAAQS and increments. This demonstration requires consideration of nearby sources as well as the permittee's source.

For PEP, EPA proposes that because the project itself has impacts below the CO 1-hour and 8-hour SIL, a cumulative impact analysis is not required for CO. (Fact Sheet at 57.) EPA cites to 40 CFR 51.165(b)(2) as authority for these SILs. (Fact Sheet at 57.) But 40 CFR 51.165 does not apply to this permit. Rather, 40 CFR 51.165 prescribes what must be in state permitting programs.

The Fact Sheet also states that a cumulative analysis is not going to be required because project only impacts and background concentrations are very small in comparison to the relevant CO NAAQS. The Fact Sheet ignores the fact that PEP is right next to airport runways which are mainly used by military aircraft. (Fact Sheet at 53; Ex. 12.) Military jets, such as the B-2 bomber which uses this runway, are unregulated for CO, NOx and PM/PM10/PM2.5 emissions (77 Fed. Reg. 36,342, 36,343 (June 18, 2012)), which can be massive. There are also major industrial facilities right next to the PEP which again can have substantial CO emissions.

The statute and regulation prohibit PEP from contributing to violations of the CO NAAQS. The statute and regulation do not use the term "significantly" contribute. Rather, they say contribute. Thus, if the existing sources such as the jet engines and the manufacturing facilities at Plant 42 are causing CO NAAQS violations and PEP contributes to these violations at all, EPA must deny the permit. Therefore, EPA's must require a cumulative impact analysis for CO.

EPA's decision to not require the source to demonstrate that will not cause or contribute to violations of the annual NO2 NAAQS or increment is also flawed. As to the NAAQS, jet engine NOx emissions during takeoff can be substantial. For example, NOx emissions from a B777, which is subject to regulation unlike the military jets at Plant 42, is approximately 18 kg or approximately 40 lbs. (Ex. 4 at figure 3.) This compares to the startup emission limit for Gen 1 and Gen 2 of 51.48 lb. The difference is that the startup emissions for Gen 1 and Gen 2 are spread out over up to 39 minutes. In comparison, the 40 lbs of NOx from a commercial jet is spread out over only less than a minute. (Ex. 4 at figure 2.) Thus, on an annual basis, many more takeoffs are possible than startups and thus, the jet engines NOx may swamp PEP. The Palmdale airport has an average of 175 operations per day with 141 of those being military. (Ex. 12.) If half the military flights are large planes and have those actions are take takeoffs, that is 35 takeoffs per day. That equals 255 tons per year of NOx being emitted at close to ground level and very near where EPA's modeling predicted the maximum impact from the stationary sources. This is not meant to be a substitute for a modeling analysis. It is just meant to show that it is arbitrary for EPA to leave the aircraft emissions out of the modeling analysis. Furthermore, because the monitor EPA is using for background is miles away and in an urban area, it may not be picking up any of the NOx from the jet engines which again are released very close to ground height with almost no vertical exit velocity.

As to the annual NOx increment, without EPA figuring out how much of the NOx increment is currently consumed, EPA is simply guessing that PEP will not cause or contribute to a violation of increment. EPA is not allowed to make this permitting decision based on guess work. Therefore, EPA needs to require the applicant to conduct a cumulative annual NOx analysis.

B. HOUR LIMITS ON D2 AND D3

The emergency generator engine and emergency fire pump engine have restrictions on their hours of operations but the limit is based on a calendar year. In contrast, the fuel usage limit for the auxiliary boiler is based on a 12-month rolling total. All three of these limits should have been used in the modeling to support the conclusion that the source does not cause or contribute to increment or NAAQS violations although it is not clear if EPA actually did this. In any event, using calendar year limits for the engines, D2 and D3, allows the engines to operate for significantly more hours than represented in the modeling. This is particularly true during the first year of operations if the facility does not commence operations during January. The permit must be changed to use monthly limits of 2 hours per month for the emergency generator engine and 1 hour per month for the emergency fire pump engine to more closely reflect the modeling. In the alternative, it EPA wishes to leave the emission limits as calendar year, the modeling must be revised to reflect that these sources operating more than 1 and 2 hours per month.

C. EPA FAILED TO CONSIDER WHETHER A STARTUP SCENARIO WILL VIOLATE THE PM2.5 AND PM10 INCREMENT AND NAAQS INCREMENT

EPA evaluated a startup scenario for NO2 but not for PM10 or PM2.5. (Fact Sheet at 58.) EPA provides no justification nor is there one. PM10 and PM2.5 impacts are often highest for sources like the auxiliary boiler which has a relatively low stack height and exit velocity and temperature.

D. THE CUMULATIVE IMPACTS ANALYSIS MUST INCLUDE EMISSIONS FROM AIRCRAFT USING THE PLANT 42 RUNWAY AS WELL AS PALMDALE REGIONAL AIRPORT

Air Force Plant 42 and the Palmdale Regional Airport share a common runway. (*See* https://en.wikipedia.org/wiki/United_States_Air_Force_Plant_42.) Part of its mission is maintenance and modification of the B-2 Spirit bomber. While we do not have access to emission data for this particular plane, the B-2 bomber is not subject to a NOx, CO or PM/PM10/PM2.5 emission limit and uses a jet design from the 1980s, which does not bode well for low emissions. (*See* https://en.wikipedia.org/wiki/General_Electric_F118#Performance)

All of the modeling did not include emissions from airplanes at the airport. (October 2015 Application, Table 7-5.) Yet, one hour NOx concentrations from the PEP physically overlap with the runways and manufacturing facilities at Plant 42. (Fact Sheet at 53, Figure 4.)

Current modeling showed values very close to the NAAQS right next the runway. (Fact Sheet Appendix 6.) As explained above in Section IIA, while Palmdale may have less flights than O'Hare, it has 175 operations on average per day. Therefore, EPA must include the aircraft emissions in all its cumulative NAAQS modeling exercises.

E. EPA FAILED TO INCLUDE RECEPTORS IN PLANT 42 FOR THE CUMULATIVE ANALYSIS

Figures 8, 9, and 10 in the Fact Sheet appears to demonstrate that those modeling exercises failed to include modeling receptors within the Plant 42 border. Figure 11, however, indicates receptors inside of Plant 42's borders. The Fact Sheet does not provide a basis for the decision to exclude receptors inside Plant 42 for some of the modeling. Nor does it provide a reference to the administrative record in support of this decision. PEP does not own Plant 42 and therefore Plant 42 is ambient air which must have receptors in it for all of the modeling. Therefore, EPA must redo the modeling and issue a new Fact Sheet and hold a new public comment period.

This is especially concerning because Figure 8 seems to indicate the maximum impact was on the border of Plant 42. Thus, it appears that violations were modeled and then receptors removed to "erase" the violation.

In addition, EPA admits that the cumulative impact analysis for PM10 and PM2.5 excluded Plant 42 sources' impacts inside Plant 42's fence line. (Fact Sheet at 74) There is no justification for this because as explained above, PEP does not own Plant 42. In other words, EPA's long standing interpretation of ambient air allows a company to poison its own workers but not someone else's workers on an adjacent property. Therefore, EPA needs to rerun the cumulative impact analysis for PM10 and PM2.5 considering all sources impacts on all receptors outside of PEP's fence line.

F. EPA IMPREMISSIBLY RELIED ON SILS FOR ITS CLASS 1 ANALYSIS

Fact Sheet at 63 shows that EPA impermissibly relied on SILs in its Class 1 impact analysis. Even if this is harmless error for PM2.5 because PEP established the minor source baseline date and is the only increment consuming source at this time, that is not true for NOx. As explained above SILs are not permissible. Furthermore, using SILs from a proposed rule is contrary to the Clean Air Act and is a due process violation.

F. EPA MUST MODEL THE EMERGENCY ENGINES

We agree that it is appropriate to not include emergency engines in startup and shutdown scenarios because there is a permit condition which prohibits that. However, the emissions from the emergency engines must be included in other scenarios.

G. EPA MUST INCLUDE DUCT BURNING IN ANNUAL ANALYSIS

It appears that EPA did not include emissions from the duct burners in the annual NOx and PM2.5 analysis. There is no basis for excluding these emissions so the modeling must be redone to include them.

IV. THE DRAFT PERMIT IS NOT ENFORCEABLE AS A PRACTICAL MATTER

PSD permits must be enforceable as a practical matter. Below we identify numerous permit conditions which are not enforceable as a practical matter.

Condition 4 says that determination of compliance with this requirement will be based on "information available to EPA". This violates the Credible Evidence Rule and renders this condition not enforceable as a practical matter because members of the public or the state and local air agencies would need to determine what information EPA has and would not be able to enforce this condition based on information they have which EPA does not have. Therefore, this condition must be changed to delete the entire last sentence of the condition so that any credible evidence can be used to enforce this condition.

Condition 13 must be deleted and Condition 27's allowance of CEMS to not be certified by the end of shakedown must also be deleted. NAAQS and increments apply at all times. This is especially important with NAAQS with short averaging times. PSD regulations require that permit applicants establish that they will not cause or contribute to a violation of a NAAQS or increment. However, the applicant has not demonstrated that it will not cause or contribute to a violation of a NAAQS or increment during "shakedown" when the emission limits of Condition 18, 19, and 22 do not apply and the NOx and CO CEMS are not certified. Therefore, Condition 13 must be deleted or EPA must deny the permit.

Condition 14 should define "regular, seasonal closures" because the restarting of a facility can constitution a major modification triggering PSD review.

Conditions 18.a.iv, 18.b.v and 22.c need to specify that these limits include both filterable and condensable PM10 and PM2.5. BACT applies to both types of PM10 and PM2.5 regardless of whether the new source performance standard and/or national emission standard for hazardous air pollutions apply to both.

Conditions 18.b.i and ii need to specify the methodology for determining compliance when the duct burners are used for part of an hour. It should specify that the emission limit should be pro rated in relationship to the amount of time the duct burners were used.

Condition 19.b needs to define "normal operating mode" to be enforceable as a practical matter.

The draft permit must have BACT emission limits for GEN1 and 2 for PM/PM10/PM2.5 during startup and shutdown which are enforceable as a practical matter. Because the stack test will not be performed during startup and shutdown, the current permit limits do not apply during startup and shutdown as a practical matter. This PM/PM10/PM2.5 startup and shutdown emission limit needs to be enforceable as a practical matter and needs to include both filterable and condensable PM10 and PM2.5. Once EPA sets a practically enforceable PM/PM10/PM2.5 emission limit during startup and shutdown, EPA needs to model this emission rate to determine is the source will cause or contribute to NAAQS or increment violations based on this emission rate. During this modeling, EPA must use stack parameters, such as exit temperature and velocity, which reflect actual parameters during startup and shutdown. This is critical as low exit temperature and velocity tend to result in higher ambient concentrations. EPA also needs to ensure that all of the stacks are modeled at the exact location where they actually will be.

Similarly, the permit must have BACT emission limits for the auxiliary boiler, the emergency generator engine, and the emergency fire pump engine during startup and shutdown which are enforceable as a practical matter. Emissions during startup and shutdown of these types of units can be exponentially higher than during the stack test and with their relatively low stacks and almost always operating in startup and shutdown mode, they can easily cause or contribute to violations of increments or NAAQS. Once BACT emission limits for the auxiliary boiler, emergency generator engine and emergency fire pump engine are established, EPA must model these emission rates using stack parameters which reflect actual conditions during startup and shutdown of this equipment.

The permit must also have monitoring, testing and reporting for the emission limits for the auxiliary boiler, emergency generator engine and emergency fire pump engine during normal operations. In the draft permit, there is no testing to ensure compliance with any of the emission limits in Conditions 22.

The permit must also include BACT emission limits for NOx, CO, PM, PM10 and PM2.5 (front and back half) for the emergency generator engine and emergency fire pump engine during normal operations. These sources are capable of being tested and so a work practice is not an acceptable substitute for actual emission limits. The permit must also have testing, monitoring and reporting to determine compliance with these BACT emission limits.

Conditions 24.e and 25.e must specify that the engines shall only burn diesel fuel with 15 parts per million sulfur or less. Without this condition, the determination of potential to emit and resultant determination of which pollutants are above the significant emission rate are not valid.

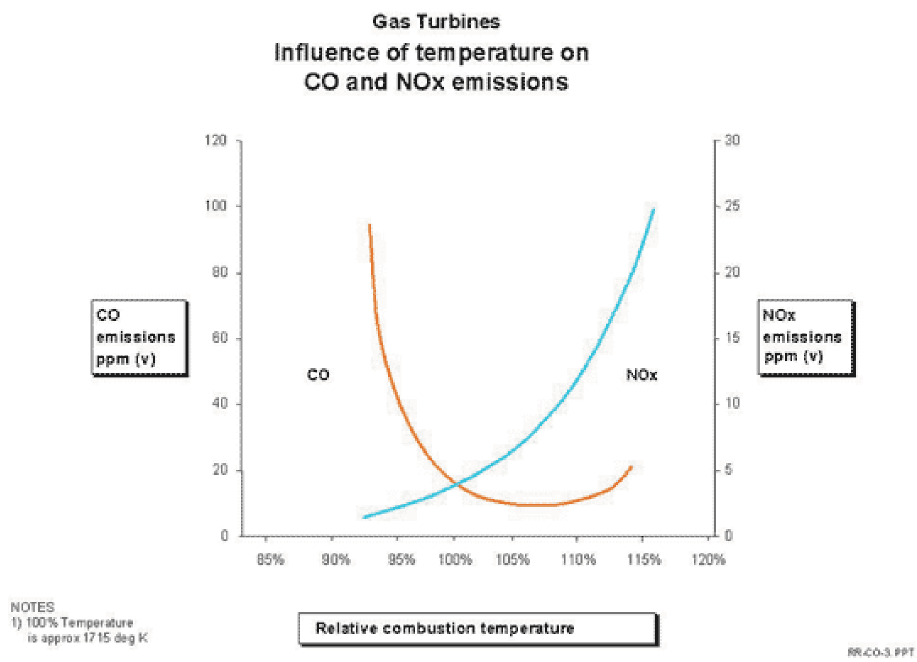
For the same reason, Conditions 24 and 25 must also require testing of the sulfur content of the diesel fuel to ensure compliance with this 15 ppm S requirement. It is not true that diesel with more than 15 ppm S is not available. EPA's regulations allow the use of 500 ppm sulfur fuel in a certain type of diesel which is referred to as diesel transmix. (*See* Ex. 1.) Furthermore, the 15 ppm S standard does not apply downstream of the refinery for nonroad, locomotive and marine fuel. (40 CFR § 80.524.) That means that nonroad diesel has to average 15 ppm S when it leaves the refinery or importer but that average does not guarantee that the diesel burned at PEP will be 15 ppm S or below. In addition, there are numerous exceptions to the 15 ppm S standard. For example, motor vehicle diesel fuel can be downgraded to 15 ppm S. (40 CFR § 80.527) Refiners can use credits rather than actually producing 15 ppm S nonroad diesel. (40 CFR §§ 80.536) Small refiners can also get exemptions from the 15 ppm S standard. (40 CFR §§ 80.550 – 80.555.)

With regard to the circuit breakers, they have a 0.5% by weight (calendar year basis) emission limit which appears to be the Region's GHG BACT emission limit for this emission unit. (*See* Condition 26.a.) However, the leak detection system is a 10% by weight leak detection system. (*See* Condition 26.c.) It does not seem possible for a 10% leak detection system to enforce as a practical matter a 0.5% annual leak rate. Therefore, the permit must have another method to practically ensure compliance with the 0.5% annual leak BACT limit.

Condition 27.b should prohibit CEMS repairs, calibration checks, and zero and span adjustments during periods of startup, shutdown and malfunction of GEN1 and GEN2. This will ensure that periods when emissions from GEN1 and GEN may be highest are not unmonitored.

Similarly, Condition 32.d should require a span value of significantly higher than 125 percent of the maximum estimated hourly potential CO emissions of GEN1 and GEN2. As mentioned before, CO emissions can be exponentially higher during startup, shutdown and malfunction. See below sample chart. Limiting span to 125 percent makes the CO BACT limit not practically enforceable because the CEMS will not be capturing high values.

Condition 18.a.v includes the MWh contribution from the steam turbine generator in the GHG BACT limit. Therefore, in order for this condition to be enforceable as a practical matter, Condition 35 needs to require a wattmeter for the steam turbine generator in addition to for each CTG.



Condition 33 must specify that nothing in the monitoring plan can be inconsistent with requirements in the permit. For example, the performance evaluation procedures and acceptance criteria cannot be less stringent than the applicable performance standards and other requirements in the permit. Without this clarification, not only is condition 33 not enforceable as a practical matter, it also violated the PSD public participation requirements because the public will not have an opportunity review and comment on the monitoring plans. The monitoring plan could also constitute a modification of the PSD permit without obtaining approval for the modification.

Similarly, Condition 40.e must be removed. This provision makes the emission limits not subject to CEMS not enforceable as a practical matter and also violates the public participation provisions.

V. THE FACT SHEET IS INADEQUATE

40 C.F.R. § 124.8(b)(4) requires that fact sheets include a brief summary of the basis for the draft permit conditions including references to the administrative record. The PEP Fact Sheet states that PEP is below the significance threshold for sulfuric acid mist, hydrogen sulfide, sulfur dioxide, total reduces sulfur, and reduced sulfur compounds. However, the Fact Sheet does not provide any references to the administrative record or any other basis for this determination. Thus, the Fact Sheet's conclusion, and resultant lack of BACT emission limits for these sulfur containing pollutants, are without any support and violate 40 C.F.R. § 124.8(b)(4).

The 60 foot stack height for such a small device as the auxiliary boiler does not appear consistent with GEP. The Fact Sheet must reference where in the administrative record the GEP analysis is.

Condition 28 provides: "Data reported to meet the requirements of Condition 51 shall not include data substituted using the missing data procedures in subpart D of 40 CFR part 75, nor shall the data have been bias adjusted according to the procedures of 40 CFR part 75." Condition 29.b contains a similar provision. The Fact Sheet does not provide an explanation of the basis for these provisions or any reference to the administrative record supporting these provisions.

VI. THE NPHA ANALYSIS IS INADEQUATE

EPA's National Historic Preservation Act (NHPA) analysis is inadequate because EPA only considered impacts within the physical footprint of PEP and supporting structures and only impacts caused by land disturbance activities. (Fact Sheet at 81.) EPA completely failed to address the issue of air pollution from the proposed PEP impacting historical properties. Yet, the "destructive effect of air pollution on our built heritage has long been apparent." (The Effects of Air Pollution on the Built Environment, Air Pollution Reviews Vol. 2, Ed. Peter Brimblecombe (Effects of Air Pollution) at xvii.) "We find ourselves in an age where the links between environment, its pollution and culture seem more obvious than ever." (*Id.*) "The damage done by air pollution [] is real, measurable, and in many cases obvious." (The Effects of Air Pollution on Cultural Heritage, John Watt, Johan Tidblad, Vladimir Kucera & Ron Hamilton, Eds.,(2009) at v.) "[P]eople have pointed out that materials may be more sensitive than plants and animals since they have no healing capacity." (*Id.* at viii.) As far back as the 17th century, architects were aware that the sulfur content of coal smoke damaged buildings. (C. Saiz-Jimenez, Ed., Air Pollution and Cultural Heritage (2004) at 97.)

A brief description of the different forms of deterioration associated with atmospheric pollution is given below.

Stone

- Surface erosion and loss of detail
- Soiling and blackening
- Biological colonization
- Formation of "crust"

Metals
- Surface corrosion
- Development of stable patina
- Pitting and perforation
- Deterioration/loss of coating (paint, galvanizing, etc.)

Timber
- Biological decay
- Deterioration/loss of coating (paint)

Glass
- Corrosion of medieval potash glass
- Soiling of modern soda glass

Other materials
- Concrete
- Mortars
- Brickwork

Structural
- Cracking of walls
- Water penetration

(The Effects of Air Pollution on Cultural Heritage at 2-3.) "In principle historic materials are deteriorated by means of three mechanisms, which in many cases interact together, simultaneously or in a time sequence." (*Id.* at 2.) These three mechanisms are (1) physical damage; (2) chemical and biological damage; and (3) soiling.

Furthermore, while PEP will not directly release ground level ozone, the NOx and volatile organic compounds ("VOCs") that it will release will contribute to the formation of ground level ozone. The fact that ozone is not regulated by PEP's PSD permit does not excuse EPA from having to consider under the NHPA ozone impacts to historical properties caused by PEP. PEP will also emit hydrochloric acid and millions of tons of carbon dioxide per year and a lesser quantity of nitrous oxide.

The primary and secondary PM/PM10 and PM2.5, as well as the NOx, SO2, ground level ozone, carbon dioxide, nitrous oxide, hydrochloric acid and possibly other pollutants that PEP will cause in the ambient air will adversely impact historical properties. In particular, it is well understood that acid deposition can adversely impact historic structures such as gravestones, statues and buildings which are entitled to protection on the NHPA. (*See e.g.* Ex. 6 at 13 [EPA explaining acid deposition impacts to historic properties to 6 – 8 graders. Furthermore, the "emissions of nitrogen oxides (NOx), sulphur and carbon dioxide (SO2 and CO2) and particulate matter (PM) leads to the decay of building materials." C. Saiz-Jimenez, Ed., Air Pollution and Cultural Heritage (2004) at 225].) Researchers have explained that "over the years, research has shown growing evidence of the impact of air pollution not only on human health and the natural environment, but also on the built environment." (C. Saiz-Jimenez, Ed., Air Pollution and Cultural Heritage (2004) at ix.) They have explained that "[l]ocal authorities need to raise the awareness of the public of what damage air pollution, driven by wasteful use of non-renewable energy, is causing to our most precious environment. Authorities also need to create the right enabling environment, ensuring that the market gives business and industry the right price signals, encouraging them to adopt pollution avoiding behaviors." (*Id.* at ix.)

SO2 and NOx contribute to acid rain. Acid rain's damage to buildings and other historic properties is well known. "Sulphur dioxide (SO2) and nitrogen oxides (NOx) released from power stations and other sources form acids where the weather is wet, which all to the Earth as precipitation and damage both heritage materials and human health. In dry areas, the acid chemicals may become incorporated into dust or smoke, which can deposit on buildings and cause corrosion when later wetted. Atmospheric chemistry is, of course, far more complex than this and a variety of reactions occur that may form secondary pollutants that also attack materials. One further gas, ozone (O3) has also been shown to be important. .. . It is the major component of photochemical smog and this ground-level ozone is a product of reactions amoung the chemicals produced by burning coal[.]" (The Effects of Air Pollution on Cultural Heritage at 1.) "The predominant environmental damage effect on the carbonate rocks used in ancient masonry and monuments is the transformation of calcium carbonate into gypsum (CaSO4 * 2H2O) caused by wet and dry deposition of SO2 (Canuffo et al. 1983)." "SO2 plays the most important role as a precursor of acid rain when relative humidity is high (>50%)." (Air Pollution and Cultural Heritage at 171.)

Grey-to-black crust formation is produced by gypsum crystals and atmospheric deposition, including carbonaceous particles." (C. Saiz-Jimenez, Ed., Air Pollution and Cultural Heritage (2004) at 32.) Carbonate rocks include limestone and marble which are in many historical properties. NOx also contributes to black crust. (*Id.* at 84.) Black crust formation is a process affecting not only stones, but also terracotta, plaster and alabaster pedestals. (*Id.* at 93.)

"Total carbon (TC) detected in damage layers sampled on the surface of outdoor exposed carbonate building materials [] is composed of two main fractions, carbonate (CC) and non-carbonate carbon (NCC): . . . The NCC fraction includes two different components, organic carbon (OC), of biogenic and anthropogenic origin, and elemental carbon (EC), which is mainly a product of combustion processes." (*Id.* at 32.) In other words, "[i]t is known that surface blackening is caused by carbonaceous particles embedded in the black crusts, which are emitted into [the] atmosphere by combustion processes." (*Id.* at 39.)

Outdoor air pollution can also lead to indoor air pollution that can damage historically significant properties such as textiles, pigments and paper. (*Id.* at 63, 66, 69.)

Ozone has a strong effect on the corrosion of copper and can damage stone. (*Id.* at 89, 98, 100.) Ozone can also degrade materials such as rubber, dyes and books. (The Effects of Air Pollution on Cultural Heritage at 23.) SO2 can damage mortar, which in turn may damage paints and masonry units as well as the mortar itself. (Air Pollution and Cultural Heritage at 111.) SO2 can also damage bricks, especially when particulate matter is also present. (*Id.* at 144.) SO2 and particulates can also damage sandstone buildings. (*Id.* at 158-159.) Total carbon, nitrates, sulphates, calcium and sodium soil glass. (*Id.* at 213.) Air pollution also damages granite. (*Id.* at 227.)

Tools are available for EPA to meet its NHPA obligation with regard to air pollution impacts on historic properties. One of the first studies to look comprehensively at the synergistic effects of various air pollutants on culturally significant structures, the MULIT-ASSESS study, developed multi-pollutant deterioration and soiling models of wet and dry deposition of gases and particulates on materials. More recently, the CULTSTRAT study researched threshold levels of pollution for different materials used in historic structures. One of the goals of the CULTSTRAT project was to contribute towards public policy that protected historic structures in Europe.

In Europe, "EIA [Environmental Impact Assessment] makes considerable steps towards recognizing the cultural heritage as a mainstream environmental issue without overplaying its role." (C. Saiz-Jimenez, Ed., Air Pollution and Cultural Heritage (2004) at 253.)

Non-zero air pollution impacts, including acidifying NOx and soiling PM2.5 impacts, were modeled by EPA for up to 127 miles away from PEP. Fact Sheet at 63, 65. Within that distance, there are many historic properties which are susceptible to adverse impacts from PEP's air pollution. (*See e.g.* Ex. 7, 8, 9, 10, 11; *see also* https://architecturaltrust.org/easements/about-the-trust/trust-protected-communities/shady-point/.) This is far from an exhaustive list of historic properties which may be adversely impacted by PEP's air pollution. EPA must obtain a complete list of relevant historical properties to conduct a proper NHPA analysis.

In conclusion, we hope and expect that EPA will consider these comments and revise the proposed permit, the fact sheet, and the cultural resources NHPA report and hold a new public comment period so public can review and comment on the numerous wholly new analyses required by the comments above. Please do not hesitate to contact us if you have any questions about these comments.

Sincerely,

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National Air Team
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Exhibits (attached):

Ex. 1: EPA, Amendments to the Renewable Fuel Standard and Diesel Sulfur Programs. EPA-420-F-12-061, September 2012

Ex. 2: US EIA Electric Power Monthly, Table 6.3. New Utility Scale Generating Units by Operating Company, Plant, and Month, 2017

Ex. 3: US EIA Electric Power Monthly, Table 6.5. Planned U.S. Electric Generating Unit Additions

Ex. 4: Yashovardhan S. Chati and Hamsa Balakrishnan, Analysis of Aircraft Fuel Burn and Emissions in the Landing and Take Off Cycle using Operational Data, 6th International Conference on Research in Air Transportation (ICRAT 2014)

Ex. 5: EENews Energywire, October 2, 2017, "Storage: Tesla's Australia battery system half-done — Musk"

Ex. 6: EPA, Learning About Acid Rain, Teachers Guide, EPA 430-F-08-002, April 2008

Ex. 7: National Register of Historic Places, Supplementary Listing Record, Errea House, NRIS Reference Number: 97000809

Ex. 8: National Register of Historic Places, Supplementary Listing Record, Tehachapi Railroad Depot, NRIS Reference Number: 99001263

Ex. 9: National Register of Historic Places, Inventory- Nomination Form, Antelope Valley Indian Museum, Entered February 26, 1987

Ex. 10: National Register of Historic Places, Registration Form, Cedar Avenue Complex, File No. 1024-0018

Ex. 11: National Register of Historic Places, Inventory- Nomination Form, Harvey House Depot, Entered April 3, 1975

Ex. 12: Palmdale Regional Airport KPMD Overview, available at https://flightaware.com/resources/airport/KPMD/summary

Ex. 13: Bill Powers, P.E., Powers Engineering, North Carolina Clean Path 2025, Achieving an Economical Clean Energy Future, August 2017. available at http://www.ncwarn.org/cp25/

Ex. 14: Siemens, Enhancing gas turbine power generation with battery storage

Ex. 15: Kehlhofer et al., 3d edition, 2009, Pennwell Corporation, Combined Cycle Gas Stem Turbine Power Plants (excerpt)