GALATI | BLEK LLP

455 Capitol Mall Suite 350
Sacramento CA 95814
Tel· 916.441.6575
Fax· 916.441.6553



November 3, 2010

California Energy Commission
Docket Unit
1516 Ninth Street
Sacramento, CA 95814-5512

Subject: **OAKLEY GENERATING STATION MITIGATION STRATEGY**
**OAKLEY GENERATING STATION**
**DOCKET NO. (09-AFC-4)**

Enclosed for filing with the California Energy Commission is the original of **OAKLEY GENERATING STATION MITIGATION STRATEGY**, for the Oakley Generating Station Docket No. (09-AFC-4).

Sincerely,

Marie Mills

Marie Mills

**Oakley Generating Station Mitigation Strategy**

The Oakley Generating Station (OGS) project, pursuant to the BAAQMD NSR rule is required to purchase or acquire sufficient emission reduction credits to offset the proposed project emissions due to its proposed status as a major NSR source for NOx. Per the BAAQMD NSR rule provisions (2-2-215, 2-2-302, and 2-2-303), OGS will be required to mitigate emissions of NOx and POC. Additionally, the California Energy Commission (CEC) historically held that emissions reductions should be provided for all nonattainment pollutants and their precursors at a minimum ratio of 1:1. For the OGS project, district regulations would not require mitigation for emissions of $PM_{10}$ and SOx, but CEC standard practice would require mitigation or these two additional pollutants. The BAAQMD NSR rule and CEC required amounts of mitigation are delineated in Table 1, where the emissions listed are based on the first year of operation (potential to emit).

**Table 1 Cumulative emissions increases and required mitigation (offsets).**

| Pollutant | Cumulative Offset Threshold | Mitigation Ratio | Cumulative Increase Since April 5, 1991, tons | OGS PTE, tpy | Cumulative PTE Increase, tpy | Mitigation Required, tons (Agency) |
|---|---|---|---|---|---|---|
| POC | 10/35 tpy | >10 but < 35 1:1<br>=> 35 1.15:1 | 29.5 | 29.5 | 29.5 | 29.5<br>(BAAQMD) |
| $NO_x$ | 10/35 tpy | >10 but < 35 1:1<br>=> 35 1.15:1 | 98.8 | 98.8 | 98.8 | 113.6<br>(BAAQMD) |
| $PM_{10}$ | 100 tpy | If major and increase is > 1 tpy, then 1:1 | 76.3* | 76.3* | 76.3* | 76.3*<br>(CEC) |
| CO | 100 tpy | > 100 tpy increase<br>Modeling plus offsets to show attainment and maintenance of standard | 98.8 | 98.8 | 98.8 | 0 |
| $SO_2$ | 100 tpy | If major and increase is > 1 tpy, then 1:1 | 12.6 | 12.6 | 12.6 | 12.6<br>(CEC) |

*The tpy value for PM10 is based on the 9 lb/hr rate which is being revised to 7.5 lbs/hr, which results in a revised tpy value of 63.6.

## OGS Proposed Mitigation Program

BAAQMD regulations 2-2-215, 302 and 303 requires OGS to provide emission offsets (emissions reduction credits, or ERCs) when emissions exceed specified levels on a pollutant-specific basis. Section 2-2-302 requires POC and $NO_x$ emission reduction credits to be provided at an offset ratio of 1:1 or 1.15:1 dependent upon emissions levels. Because both POC and $NO_x$ contribute to the Bay Area Basin ozone levels, Section 2-2-302.2 allows emission reduction credits of POC's to be used to offset increased emissions of $NO_x$, at the required offset ratios as stated above. Section 2-2-303 requires emissions offsets for emissions increases at facilities that emit more than 100 tpy of $SO_2$ and $PM_{10}$. As facility emissions of $SO_2$ and $PM_{10}$ will be below 100 tpy, $SO_2$ and $PM_{10}$ offsets are not required per the BAAQMD regulations.

Sections 2-2-304 and 2-2-305 impose emissions offset requirements, or require project denial, if $SO_2$, $NO_2$, $PM_{10}$, or CO air quality modeling results indicate emissions will interfere with the attainment or maintenance of the applicable ambient air quality standards or will exceed PSD increments. For many of the pollutants and averaging periods, District regulations do not require OGS to conduct these analyses, since the modeled impacts of the proposed facility are not significant under District rules. However, modeling for these pollutants has been conducted to satisfy CEC requirements. The modeling analyses show that facility emissions will not interfere with the attainment or maintenance of the applicable air quality standards.

For mitigations in the form of banked or held ERCs (ERC certificates), the project Applicant will provide all necessary documentation to show control or ownership of the required emissions offsets prior to issuance of the facility Permit to Operate by the BAAQMD per AQMD regulation 2-2-410. Offsets may be acquired from the District bank or from other sources such as shutdowns, or non-traditional sources of emissions reductions credits.

The applicant is proposing to mitigate the increases in $NO_x$ and POC through the purchase of banked ERCs, per the BAAQMD rules and regulations. Because the BAAQMD offset trigger levels for $PM_{10/2.5}$ and $SO_2$ are at 100 tons per year per pollutant and the projects emissions are less than those levels, ERCs for these pollutants are not required at this time for mitigation per the BAAQMD rules.

Notwithstanding the above, in addition to providing offsets for $NO_x$ and POC through the BAAQMD emissions bank, OGS is committing to mitigate the $PM_{10/2.5}$ and $SO_2$ emissions from the proposed project. The commitment is consistent with recent CEC permitting cases that provide for the mitigation of the impacts of $PM_{10/2.5}$ and SOx emissions. (See the CEC decisions for the Pico Power Project, the Metcalf Energy Center, the Tracy Peaker, Tesla Power Project, Russell City Energy Center, and Chula Vista Peaker). To develop a $PM_{10/2.5}$ and SOx mitigation program that both addresses the project impacts and the environmental and public health concerns of the affected communities, the following programs were considered:

- High-efficiency street-sweeping of traffic lanes on high traffic streets. OGS could provide funding to the city of Oakley for the purchase and operation of high efficiency street sweepers. This method would directly benefit the communities in the project area.

- Replacing wood fireplaces and wood stoves. Funding could be provided to and administered through the BAAQMD where up to $300 per fireplace and up to $500 per wood stove refunds would be provided. The program would replace wood burning fireplaces with natural gas inserts with the wood stoves being replaced with current EPA certified clean pellet stoves. This program is purely voluntary for those who wish to participate.

- Providing funding to the Carl Moyer Program (CMP) on a dollar/ton basis that would be made available to the BAAQMD. The Carl Moyer program provides incentive grants for cleaner-than-required engines, equipment and other sources of pollution providing early or extra emission reductions. Eligible projects include, but are not limited to, engine replacements, elimination and/or reduction of engine use, engine control system retrofits, and other engine replacement projects. The program achieves near-term reductions in emissions of NOx, $PM_{10/2.5}$, SOx, and reactive organic gas (ROG). Funding would be provided on a dollar per ton basis at a rate that is consistent with the funding values noted in the current version of the CMP guidelines, i.e., *The Carl Moyer Program Guidelines, Air Resources Board, Cal EPA, Approved Revision 2008, 4-22-08*. The current funding value (cost effectiveness cap) is $16,000 per weighted ton of emissions. The funding would be directed towards local projects for a period of time, after which the funding would be open to projects in the general project impact region (which may, in the future, extend beyond the boundaries of Contra Costa County and the BAAQMD).

Background on the Carl Moyer Program

The Carl Moyer Program provides grant funding to encourage the voluntary purchase of cleaner-than-required engines, equipment, and emission reduction technologies. While regulations continue to be the primary means to reduce air pollution emissions, the Carl Moyer Program plays a complementary role to California's regulatory program by funding emission reductions that are surplus, i.e., early and/or in excess of what is required by regulation. The Carl Moyer Program accelerates the turnover of old highly polluting engines, reduces the costs to the regulated community, speeds the commercialization of advanced emission controls, and reduces air pollution impacts to communities in and beyond the project region. Emission reductions achieved through the Carl Moyer Program are an important component of the California State Implementation Plan, the State's federally-required plan aimed at meeting clean air goals.

Over its first seven years, the Carl Moyer Program provided $170 million to clean up approximately 7,500 engines throughout California. This achieved emission reductions of about 24 tons per day of oxides of nitrogen and one ton per day of toxic diesel particulate matter. Legislative changes in 2004 provided continued funding for the Carl Moyer Program up to $141 million per year Statewide through 2015. While the legislative focus of the Carl Moyer Program has been on achieving reductions of criteria and toxic pollutants, the program has a beneficial impact on greenhouse gas emissions as well - especially by funding hybrid and electric projects.

The Carl Moyer Program is implemented through the cooperative efforts of the California Air Resources Board (ARB) and local California air pollution control/air quality management districts. Every year, ARB distributes State funds to participating districts. Such districts follow ARB Carl Moyer Program Guidelines to select, fund, and monitor specific clean air projects in their areas. The Carl Moyer Program Guidelines spell out basic requirements for administrative procedures, eligibility criteria for projects in different source categories, cost-effectiveness criteria, and reporting practices. The Guidelines also include guidelines for administering the Agricultural Assistance Program. While the Guidelines incorporate criteria specified in State law and provide basic standards for program implementation, districts may impose additional and/or more stringent criteria in order to tailor their programs to meet local needs. This affords districts with considerable flexibility in Carl Moyer Program implementation while ensuring the proper and responsible use of State funds.

The Carl Moyer Program continues to be immensely popular, with the demand for grants typically outstripping available funds in spite of a large expansion in funding in recent years. Part of the Carl Moyer Program's success has been its ability to change and adapt, meeting a variety of new challenges as they arise. The 2008 Guidelines (referenced above) address a number of challenges, e.g., balancing a desire for program simplicity with the need for accountability, and identifying possibilities for surplus emission reductions while new regulations decrease the opportunities for achieving such reductions.

CMP Funding

The applicant has assumed the following in establishing the overall CMP funding level on a weighted ton basis:

- Base CMP cost effectiveness fee = $16,000 (CMP Guidelines, 2008, Chapter 1, Part F, Pg 19.)
- An additional 20% to account for administration costs
- Revised base fee = $19,200 weighted ton

The maximum total annual emission of $PM_{10/2.5}$ is 63.6 tpy, plus SOx at 12.6 tpy, equals 76.2 tons (per Table 1).

Air Quality Considerations Which May Affect Mitigation Values

Presently, the project regional area is attainment for $SO_2$ and nonattainment for $PM_{10/2.5}$. A review of air monitoring data for $PM_{10/2.5}$ from the Bethel Island and Pittsburg monitoring sites for the period 2007 through 2009 indicates that the 1st through the 4th high 24 hour monitored values occurred within the period from September through February, while the period from March through August is not the significant period for $PM_{10/2.5}$ concentrations.

**Table 2** shows the seasonal data and proposed mitigation levels.

**Table 2 Seasonal $PM_{10/2.5}$ Data**

| Month | PM10/2.5 Significant Periods | PM10/2.5 Avg Emissions, tons/month |
|---|---|---|
| January | Yes | 5.3 |
| February | Yes | 5.3 |
| March | No | 5.3 |
| April | No | 5.3 |
| May | No | 5.3 |
| June | No | 5.3 |
| July | No | 5.3 |

| | | |
|---|---|---|
| August | No | 5.3 |
| September | Yes | 5.3 |
| October | Yes | 5.3 |
| November | Yes | 5.3 |
| December | Yes | 5.3 |
| Seasonal Mitigation Level | | 31.8 tpy |

Similar to the seasonal analysis prepared for the Russell City Energy Center (AFC Amendment), the amounts of $PM_{10/2.5}$ can be reduced as mitigation for the entire annual period, for each pollutant, is not realistically needed. As such the revised mitigation levels for $SO_2$ and $PM_{10/2.5}$ are calculated to be 12.6 and 31.8 tons respectively, for a total of 44.4 tons. The seasonal CMP mitigation fee based on the data above would be approximately $974,592. Using the current ERC prices in the BAAQMD for PM10 and SOx of $55,000 and $15,000 per ton respectively, yields a potential ERC cost of $1,938,000. OGS is proposing to fund the mitigation program at a level of $1,938,000.

Additionally, OGS notes that a number of the proposed emissions reduction scenarios under the CMP or similar programs will result in significant decreases in NOx emissions. OGS is already offsetting its NOX emissions via the District ERC Bank program. As such, a significant amount of NOx, over and above the ERC offsets will be provided. Since NOx is a precursor to PM10/PM2.5, OGS is proposing to use the additional NOx reductions, at some agreed upon ratio, to offset PM10/PM2.5. OGS will work with the District to set the final NOx/PM10-2.5 ratio. OGS notes that previous mitigation programs have used the following NOx/PM10-2.5 ratios.

- SJVUAPCD (Sweet 2005) Study, NOx:PM10 Ratio = 3 or 4:1
- SAI Applications International, Trade-Off Ratios for Shell Martinez Refinery, NOx;PM10 Ratio = 6:1

Preliminary Cost Estimation

In an effort to provide a reasonable estimation of what can be achieved under the CMP through the payment of the above noted fee, we present the following. According to data delineated by CARB in the *Diesel Risk Reduction Plan, Appendix II, October 2000*, control technology costs for diesel PM (and other pollutants) are as follows (see Table 3-next page).

**Table 3 Engine Control Technology Cost Data**

| Control Technology | Pollutant Controlled | Control Efficiency | 40 HP | 100 HP | 275 HP | 400 HP | 1400 HP |
|---|---|---|---|---|---|---|---|
| | | | **$ per Engine** | | | | |
| CCTS | PM | Low-Mod | na | $670-810 | $1270-1660 | $1770-2300 | $5500-6700 |
| Ecotip Injector | PM | Low | na | $96-100 | $330-360 | $480-510 | $1840-1940 |
| ITG Bi-Fuel | PM | Low-Mod | $1030-1120 | $1210-1300 | na | $1530-1630 | $2080-2180 |
| DOC | CO, HCn | Low | $210-1160 | $270-1360 | $580-1660 | $730-1930 | $2260-5970 |
| Catalyzed DPF | PM, NO | High* | $990-1640 | $1410-2230 | $1960-2700 | $2840-3120 | $8300-11150 |
| CDT FBC+DPF | CO, PM, HCn | High* | $600-1700 | $850-2130 | $1490-3400 | $2450-4800 | $9140-15040 |
| Electric DPF | PM | High | $1220-1670 | $1490-1940 | $2740-3190 | $3300-3750 | $9490-9940 |
| NOxTech | CO, PM, HCn, NOx | Mod | $1580-3530 | $1870-4180 | $2750-6110 | $3370-7480 | $8410-18520 |
| SINOx | NOx, PM | Low | na | na | $4030-5570 | $5470-7290 | $16970-20920 |
| Repower | CO, NOx, PM, HCn, SOx | Variable | $1420 | $2420-4960 | $3400-8180 | $6720-12120 | $44900 |
| Electric Replacement | CO, NOx, PM, HCn, SOx | High | Average Motor Cost is $65/hp (range is $43-$100/HP) (HP range is 100 to 400) | | | | |

*when combined with very low sulfur diesel.
Original $ values are based on year 2000 (500 hours/year operation, 10 year equipment life, 9% rate of return).
Values above revised based on cost escalation per CE Cost Index (2000-2009), 1.37.

Table B-2 (in the above noted reference) presents data on the estimated control measure cost analysis for the various engine categories (based upon the average HP rating per category). This data is presented in Table 4 below (as adjusted per the CE Cost Index as noted in Table 3).

**Table 4 Control Measure Cost Data**

| Engine Category | Avg HP | 2010 Inventory | Control Cost Range, $ (Low | to High) |
|---|---|---|---|---|
| New Engine | 400 | 1352 | $2450 | $4800 |
| Stationary-Backup* | 550 | 11344 | $3330 | $6340 |
| Stationary-Prime* | 480 | 1025 | $2920 | $5620 |
| Portable* | 110 | 49860 | $890 | $2290 |
| Agricultural | 120 | 6380 | $930 | $2360 |

*percent of population controlled =90

The new engine replacement costs most likely do not apply to engines used in buses, locomotives, and marine applications (see Table 4).

Table 5 presents summary data on the cost of engine replacement only for the categories comprised of buses, locomotives, and marine craft.

**Table 5 Engine Replacement Costs**

| Engine Category/Use | HP Range | Engine Replacement Cost, $[1] |
|---|---|---|
| Buses-Diesel | 220-320 | ND[4] |
| Buses-Natural Gas | 250-325 | ND[4] |
| Locomotives | 1500-2000 | $825,000 - $1,450,000 |
| Marine Vessels[3] | All | $150-$200/HP |
| **Other Cost Data** | | |
| **Engine Category/Use** | **HP Range** | **Engine Retrofit Cost, $** |
| Locomotive-Switch Engine Idle Control Technology[2] | 1500-3000 | $27,000-$40,000 |
| Engine Replacement w/Electric Motor | <=400 | $65/HP |

[1] applies only to engine replacement, not to replacement of entire device or process.

[2] EPA estimates the installation of this technology on one (1) switchyard engine could reduce engine PM emissions 0.1 tpy, and 3 tpy of NOx. Fuel savings would be on the order of 20,500 gals/year. If fuel sulfur is assumed to average 0.05% S wt., the SOx emissions would be reduced by approximately 0.072 tpy.

[3] Santa Barbara APCD study, $150-200/hp repower costs.

[4] Engines typically rebuilt, not replaced.

Data presented in Tables 3 through 5 establish a reasonable range of engine replacement costs for most of the categories of engines delineated in the CMP guidelines. The following discussion presents data on the estimated emissions reductions for engine replacements, and in some cases the use of add-on controls, for the categories of engines delineated in the CMP guidelines. Combining this data will allow the applicant to estimate the costs of CMP strategies as well as the emissions reductions achieved. The caveats to this are that; (1) the combinations of engine replacement or add-on control schemes is almost limitless, and (2) the applicant has little control over the dollars once they are provided to the local air district.

<u>Mitigation Program Categories and Discussion</u>

The following sections briefly describe a number of potential emissions mitigation strategies, including those noted above, that could be implemented in the project area (and potentially expanded to a larger area which may encompass areas outside of the BAAQMD), to achieve, in some instances, significant emissions reductions and health related benefits. The goal of implementation and funding of these various programs by OGS is to generate emissions offsets that can be credited to the OGS project. Several caveats should be noted concerning the assumptions and data used in the strategies delineated below. These are;

- The emissions factors and resultant reductions predicted for the various strategies are best estimates only. They are based on average emissions factors, average or known in-service use rates, and cost values generated from data sources generally applicable to the specific source category.
- The emissions reductions and associated costs are not meant to be exact for a specific engine class or category, but rather they are meant to be indicative of the anticipated emissions reductions and costs for the overall broad variety of sources included in each category.
- The primary purpose of this initial analysis was to present OGS and District staff with an overall picture of which categories of sources may present the best available opportunity to achieve creditable emissions reductions, in the most cost effective manner considering the potential funding available.

In addition, a large majority of the strategies presented herein are targeted at reductions in emissions for diesel compression-ignition engines. Emissions reductions from diesel engines will also result in a decrease in diesel engine exhaust (diesel particulate) associated health risks. For some of the categories discussed below, the level of DPM is significant, and would result in an overall decrease of DPM related risk with the air district.

Secondly, reductions of other pollutants such as NOx, VOCs, and SOx can be significant in some cases. These reductions, which represent precursors to PM10/PM2.5 formation, will also be an added benefit in the effort to reduce "particulate" pollution and health impacts. The discussion below does not attempt to establish any inter-pollutant ratios for NOx to PM, VOCs to PM, or SOx to PM. These ratios would have to be established pursuant to other studies before inter-pollutant crediting could occur for PM10/PM2.5.

Appendix A presents the spreadsheet based calculations, assumptions, and references for the various engine classes and categories listed below, as well as the preliminary costs and cost benefit calculations.

<u>Off-Road Engine Replacement</u>

The strategy of replacing old, higher polluting off-road existing in-use engines, with new engines which meet or exceed the EPA/CARB tiered emissions standards is a viable and proven strategy to achieve significant emissions reductions, as well as reduced health impacts. Engines in these categories are typically classified as stationary backup engines, stationary prime use engines, portable or mobile equipment engines, and agricultural use engines (primarily irrigation pump systems). In a number of stationary engine uses, the reciprocating engine can be replaced by electric motors to achieve an even higher level of emissions reductions.

Engine replacement (repowering) has been implemented at numerous locations, by numerous air districts, under programs such as Carl Moyer. A significant number of California's air districts are regular participants in the Carl Moyer program.

The emission reductions achievable are highly dependent on the use category of engine, use rates, engine HP, etc. Engine replacement costs for these types of units generally range from $30-$40/hp. Engine replacement with electric motors typically cost about $65/hp, and the electric motor costs are a small fraction of the overall lifetime costs to operate the electric motor, i.e., usually about 2-3%.

Emissions reductions anticipated by replacing engines with electric motors are as follows: (all categories, all HP ranges)

NOx reduction = 1.351 tpy per engine
PM reduction = 0.08 tpy per engine
ROG reduction = 0.254 tpy per engine
Average cost per engine = $8,000

Emissions reductions anticipated by replacing existing engines with Tier 4 engines are as follows: (all categories, all HP ranges)

NOx reduction = 0.89 tpy per engine
PM reduction = 0.061 tpy per engine
ROG reduction = 0.232 tpy per engine
Average cost per engine = $12,000

Emissions reductions anticipated by replacing existing engines with Tier 3 engines are as follows: (all categories, all HP ranges)

NOx reduction = 1.05 tpy per engine
PM reduction = 0.078 tpy per engine
ROG reduction = 0.239 tpy per engine
Average cost per engine = $12,000

Urban Bus Replacement

Replacement of old and aging urban transit buses is another emissions reduction strategy that can produce significant emissions reductions as well as health related benefits. Although information on the differential costs of bus replacement, i.e., replacement of diesel buses with natural gas or hydrid powered buses were available, the actual cost of new buses were not readily available. As a result, costs for this strategy category are not available.

Several of the larger metropolitan air districts, including the SCAQMD, have been actively involved in school bus replacement programs, but no information on the Districts involvement in urban transit bus replacement programs could be obtained. The school bus program requires that school districts provide matching funds for new CNG buses, and the District will provide additional funding for the CNG infrastructure, up to $14,000 for each bus replaced. We would assume that the District would consider implementing a similar program for urban transit buses if the opportunity presented itself.

This strategy can also be applied to; (1) the replacement of diesel powered garbage trucks, i.e., replacement with LNG or CNG fueled trucks, and (2) the replacement of gasoline powered vehicles such as police cars and city staff vehicles with low or zero emission type vehicles.

Emissions reductions anticipated by replacing existing bus engines with 2010 compliant engines, or NG engines, are as follows:

NOx reduction = 1.663 tpy per engine
PM reduction = unknown tpy per engine
ROG reduction = unknown tpy per engine
Average cost per engine = not determined

Locomotive Repowering

The repowering or engine replacement of existing old, high use, locomotive engines is another viable emissions reduction strategy. The program consists of identifying candidate locomotive engines (primarily switch engines) and implementing an engine replacement that relies upon new engine technology which meets the existing EPA/CARB tiered emissions standards for locomotives. Typically, such projects involve more than a simple engine replacement, i.e., a complete repowering with new engine technology can affect the locomotive mechanical and electrical systems. Several such repowering projects have been accomplished in the states of Illinois and New York. The range of costs for repowers is approximately $1.2 to $1.6 million, with an average cost of $1.4 million. Typical emissions reductions achieved from repowering are on the order of 80-90 tpy of NOx, 4-5 tpy of hydrocarbons (HCn), and 2-3 tpy PM10.

An alternative strategy to repowering is the complete replacement of the entire locomotive unit. Costs to replace an existing locomotive unit with an entirely new unit which meets or exceeds the EPA/CARB tiered emissions standards for locomotives ranges from $1.7 to $2.3 million.

Emissions reductions anticipated by replacing existing locomotive engines with Tier 3 engines are as follows:

NOx reduction = 89.77 tpy per engine
PM reduction = 2.57 tpy per engine
ROG reduction = 4.72 tpy per engine
Average cost per engine = $1,400,000

Emissions reductions anticipated by replacing existing locomotive units with new locomotive units with engines meeting Tier 3 standards are the same as the values presented above, except that the total cost per locomotive unit would be in the range of $2,000,000.

Marine Engine Repowering

Marine use engines are typically classified as either propulsion or auxiliary. Engine uses in marine applications are generally broken down by the following categories; tug boats, ferry craft, work boats, crew boats, and tow boats. Due to the size and use rates of these engines and the environment in which they are used, repowering/replacement costs are very high. CARB estimates that the costs to repower/replace a propulsion engine at approximately $270/hp, while the costs to repower/replace an auxiliary engine are on the order of $233/hp. Data obtained from the Santa Barabra APCD marine vessel study indicates a repowering cost of $160/hp. The Santa Barbara APCD cost data is thought to only represent the engine costs, i.e., installation and retrofit costs are not included. Emissions reductions from propulsion engine repowering vary considerably, while reductions from auxiliary engines are more consistent between the various engine use categories.

The SCAQMD is involved in a multi-faceted program targeting emissions reductions at the Ports of Los Angeles and Long Beach. A key component of the program at the ports is the reduction of emissions (and health based impacts) from marine in-use engines (primarily diesel engines), as well as "hoteling" emissions from large on-board ship engines and boilers. We would assume that the District would also be open to such a program if funding could be provided.

Emissions reductions anticipated by replacing existing marine (tugboat) propulsion engines with Tier 3 engines are as follows:

NOx reduction = 0.466 tpy per engine
PM reduction = 0.549 tpy per engine
ROG reduction = 13.298 tpy per engine
Average cost per engine = $3,439,800

Emissions reductions anticipated by replacing existing marine (tugboat) auxiliary engines with Tier 3 engines are as follows:

NOx reduction = 0.591 tpy per engine
PM reduction = 0.025 tpy per engine
ROG reduction = unknown tpy per engine
Average cost per engine = $258,630

Locomotive Switch Engine Idling Control Technology Retrofit

Idling locomotives emit significant amounts of air pollution due to the duty cycles involved in their use. Switch engines are powered by diesel engines that are frequently left idling when not in use, wasting fuel and polluting the air. Idling occurs for several reasons, including but not limited to; ensuring the engine is ready for use, avoiding difficult engine starts due to a cold engine or weak battery, and preventing freezing inside the engine (since locomotive engines do not use anti-freeze). Idling control technologies are now available that can maintain the necessary engine temperatures more efficiently and eliminate the need for idling. These technologies allow the main locomotive engine to be shut down when not in use, relying upon a much smaller engine (called an auxiliary power unit-APU) to maintain the system at proper temperatures for anticipated operations. The APU's are generally rated at 20-40 hp, in comparison to the main engine hp which can range from 1500-3000 hp.

Idling control technology is being implemented and considered at numerous locations within the SCAQMD, most notably the Ports of Los Angles and Long Beach. The use of the technology results in significant reductions in NOx, SOx, and PM10, as well as significant savings in fuel costs. PM10 reductions are in all cases reductions of DPM, which can result in the lowering of DPM health impacts to receptors both in the near-field as well as the regional affected environment. The following rail yards (Table 6) were identified within or adjacent to the BAAQMD for inclusion in any idling or locomotive control programs.

**Table 6 Rail Yard Location Data**

| Rail Yard Name/Location | Operating Railroad |
|---|---|
| Richmond/Richmond, Ca | BNSF |
| Oakland/Oakland, Ca. | UPRR |
| Martinez/Martinez, Ca. | UPRR |
| Milpitas/Milpitas, Ca. | UPRR |
| Pittsburg/Pittsburg, Ca. | BNSF |

(per the ARB/Railroad Statewide Agreement-Particulate Emissions Reduction Program at California Rail Yards, June 2005)

Emissions reductions (per EPA) anticipated by retrofitting existing locomotives with idling control technology are as follows:

NOx reduction = 3.0 tpy per engine
PM reduction = 0.1 tpy per engine
SOx reduction = 0.072 tpy per engine
Average cost per engine = $33,500

<u>Truck Stop Electrification</u>

One of the more promising areas noted in this preliminary study was the strategy of truck stop electrification (TSE).

Large diesel truck idling is the continuous operation of the truck's main drive engine while it is stopped. Since diesel trucks operate differently than cars, i.e., they are designed to carry large loads over long distances and may idle overnight or while waiting to load and unload, idling become a significant percentage of total operations, potentially on the order of 40% of total operations. Due to regulations requiring truck drivers to rest a certain number of hours per day, many drivers spend their rest periods at established truck stops or truck plaza's. many of these truck stops or plaza's can accommodate literally hundreds of trucks at a time. Studies indicate that truck drivers idle their engines from 6-8 hours per rest stop over a typical driving year of 300 days.

TSE is simply a stand-alone system that negates the need for the truck to idle during these periods by supplying basic, and in some cases, enhanced services to the truck from either lot level or overhead systems. Services typically include electrical, heating, air conditioning, phone, cable, movies, and internet. Most systems include electrical circuits for refrigeration unit power.

Per stall installation costs fluctuate between $12000 to $15000. For a full service stall, utilized at an average rate of 60% per year the emissions reductions are as follows; NOx at 0.781 tpy, CO at 0.33 tpy, VOC at 0.0396 tpy, PM10 at 0.0154 tpy, and CO2 at 60 tpy. The cost for a 100 stall installation would be approximately $1.5 million, and could be as much as $1.8 million once construction, layout, and site design aspects are accounted for. Current estimates indicate that the cost to the driver to utilize the system is offset by the non-idling fuel savings cost.

The I-5 corridor which runs from northern California through the South Coast Air Basin, and on to the San Diego regional area, is one of the primary corridors identified by EPA as a prime candidate for TSE applications. The I-80 corridor in the Bay Area, as well as a number of other BAAQMD major freeway routes would also seem to be prime targets for TSE programs. Table 7 lists the truck stops in or adjacent to the BAAQMD that were identified as possible candidates for TSE study.

**Table 7 Truck Stop Location Data**

| County | City | Company | Address | # of Existing Spaces |
|---|---|---|---|---|
| Alameda | Oakland | S.F. Oakland Auto Truck Plaza | 8255 San Leandro St | 50 |
| San Joaquin | Tracy | Country Mart Diesel & Gas | 34243 S Chrisman Road | 22 |
| San Mateo | South San Francisco | Golden Gate Petroleum/Shell | 114 Harbor Way | 10 |
| Solano | Suisun City | Terminal Station | 100 Suisun Valley Rd | 350 |
| Stanislaus | Westley | Westley Triangle Truck Stop | 7051 S McCracken Rd | 100 |

Emissions reductions anticipated by installing and operating each TSE stall are as follows:

NOx reduction = 0.781 tpy per stall
PM reduction = 0.0154 tpy per stall
ROG reduction = 0.0396 tpy per stall
Average cost per stall = $15,000

Lawnmower Exchange Program

The lawnmower exchange program is simply a program whereby residents within the BAAQMD can exchange their gasoline powered (2 or 4 stroke) lawnmowers for new electric mowers. The recipient typically pays part of the new mower costs, which seems to be in the range of 40-50% of the retail cost of the new mower. The SCAQMD has operated an exchange program for quite some time, and expects to fund the program for 2010 at a level of approximately $1.63 million. Emissions reductions achieved are small, but the program seems to be very popular, with exchanges in 2009 (total of 4800) selling out in 5 days.

Emissions reductions anticipated by replacing existing lawnmowers (gas 2 stroke) with electric versions are as follows:

NOx reduction = 0.000045 tpy per engine
PM reduction = 0.00119 tpy per engine
SOx reduction = 0.000018 tpy per engine
ROG reduction = 0.0321 tpy per engine
Average cost per engine = $290

Emissions reductions anticipated by replacing existing lawnmowers (gas 4 stroke) with electric versions are as follows:

NOx reduction = 0.00031 tpy per engine
PM reduction = 0.000009 tpy per engine
SOx reduction = 0.000059 tpy per engine
ROG reduction = 0.006 tpy per engine
Average cost per engine = $290

Leafblower Exchange Program

The leafblower exchange program provides an incentive to professional gardeners and landscapers within the BAAQMD to exchange old gasoline powered leafblowers and purchase new lower polluting (and less noisy) blowers for about one-half the retail cost. Like the lawnmower program, the exchange program is popular, with about 1500 units exchanged in 2009 at a cost of approximately $270,000. Like the lawnmower category, the individual emissions reductions are small, but the SCAQMD estimates that exchanges of 1500 units will reduce smog-forming pollutants (NOx and VOCs) by about 14 tpy.

Emissions reductions anticipated by replacing existing leafblowers (gas 2 stroke) with electric versions are as follows:

NOx reduction = 0.000072 tpy per engine
PM reduction = 0.000594 tpy per engine
SOx reduction = 0.000018 tpy per engine
ROG reduction = 0.0201 tpy per engine
Average cost per engine = $67

Diesel Particulate Filter Retrofit

The installation and/or retrofit of existing diesel engines, in most use categories, with diesel particulate filters (or similar technologies) has been shown to be an effective emissions reduction technique, as well as providing positive health related benefits by lowering ambient concentrations of DPM. DPFs are typically sized and costed based upon the horsepower category of the engine. Smaller engines generally represent the higher cost to purchase and install, and as the engine size increases, the costs are reduced. Engines in the range of 100 hp experience DPF costs on the order of $75/hp, while large engines above 400 hp and up to 1400 hp show costs on the order of $23-$26/hp. DPF technology is being employed on multiple fronts by the SCAQMD, i.e., school bus retrofit "trap" program, locomotive DPFs at the Ports of Los Angeles and Long Beach, etc.

DPF technology is typically not utilized in marine applications due to the salt water environment to which the engines are exposed.

Table 8 presents the average DPF costs for the various engine use categories and HP sizes.

**Table 8    DPF emissions and costs.**

| Engine Cat | Avg HP | Avg Hrs/Yr | Hp-Hrs/Yr | DPF Cost | Annual PM Reduced, tpy |
|---|---|---|---|---|---|
| New | 400 | 500 | 200000 | $10,400 | 0.121 |
| Stationary Backup | 550 | 75 | 41250 | $14,300 | 0.025 |
| Stationary Prime | 480 | 600 | 288000 | $12,480 | 0.174 |
| Portable | 110 | 500 | 55000 | $8,250 | 0.033 |
| Ag | 120 | 840 | 100800 | $9,000 | 0.061 |

In addition, it should be noted that numerous other diesel engine retrofit technologies exist. Table 9 summarizes these basic technologies and estimated costs.

| Table 9 Other Diesel Engine Control Technology Cost Data | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Control Technology** | **Pollutant Controlled** | **Control Efficiency** | **40 HP** | **100 HP** | **275 HP** | **400 HP** | **1400 HP** |
| | | | **$ per Engine** | | | | |
| CCTS | PM | Low-Mod | na | $670-810 | $1270-1660 | $1770-2300 | $5500-6700 |
| Ecotip Injector | PM | Low | na | $96-100 | $330-360 | $480-510 | $1840-1940 |
| ITG Bi-Fuel | PM | Low-Mod | $1030-1120 | $1210-1300 | na | $1530-1630 | $2080-2180 |
| DOC | CO, HCn | Low | $210-1160 | $270-1360 | $580-1660 | $730-1930 | $2260-5970 |
| Catalyzed DPF | PM, NO | High* | $990-1640 | $1410-2230 | $1960-2700 | $2840-3120 | $8300-11150 |
| CDT FBC+DPF | CO, PM, HCn | High* | $600-1700 | $850-2130 | $1490-3400 | $2450-4800 | $9140-15040 |
| Electric DPF | PM | High | $1220-1670 | $1490-1940 | $2740-3190 | $3300-3750 | $9490-9940 |
| NOxTech | CO, PM, HCn, NOx | Mod | $1580-3530 | $1870-4180 | $2750-6110 | $3370-7480 | $8410-18520 |
| SINOx | NOx, PM | Low | na | na | $4030-5570 | $5470-7290 | $16970-20920 |
| Repower | CO, NOx, PM, HCn, SOx | Variable | $1420 | $2420-4960 | $3400-8180 | $6720-12120 | $44900 |
| Electric Replacement | CO, NOx, PM, HCn, SOx | High | Average Motor Cost is $65/hp (range is $43-$100/HP) (HP range is 100 to 400) | | | | |

*when combined with very low sulfur diesel.
Original $ values are based on year 2000 (500 hours/year operation, 10 year equipment life, 9% rate of return).
Values above revised based on cost escalation per CE Cost Index (2000-2009), 1.37.

School Filtration Retrofit Program

Presently, there is very little data that can be relied upon to analyze the emissions reduction benefits and costs of applying high efficiency filter systems on existing school heating, ventilation and air conditioning (HVAC) systems. The program has been implemented in the SCAQMD as a pilot program to provide air filtration systems for schools in the Wilmington area in the vicinity of the Valero Refinery. The program was funded as a result of an enforcement settlement between Valero and the SCAQMD. Early data on the pilot program indicates that the costs can range from as little as $100 for high efficiency filter replacement, to over $8500 for stand-alone filtration systems. No data was available that indicated if these costs were applied on a per school basis or a per-school room basis. Although this program is certainly beneficial for the schools and students impacted by it, quantification of actual emissions reductions would be very resource intensive, the amounts reduced would be minimal at best, and in all likelihood would represent a cost to achieve the reductions that would prove to be not cost effective in terms of the amounts of creditable offsets needed by OGS under the seasonal mitigation strategy.

**BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA**
**1516 NINTH STREET, SACRAMENTO, CA 95814**
**1-800-822-6228 – WWW.ENERGY.CA.GOV**

**APPLICATION FOR CERTIFICATION FOR THE *OAKLEY GENERATING STATION***

**Docket No. 09-AFC-4**
***PROOF OF SERVICE***
**(Revised 8/13/2010)**

APPLICANT

Greg Lamberg, Sr. Vice President
RADBACK ENERGY
145 Town & Country Drive, #107
Danville, CA 94526
Greg.Lamberg@Radback.com

APPLICANT'S CONSULTANTS

Douglas Davy
CH2M HILL
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833
ddavy@ch2m.com

COUNSEL FOR APPLICANT

Scott Galati
*Marie Mills
Galati & Blek, LLP
455 Capitol Mall, Suite 350
Sacramento, CA 95814
sgalati@gb-llp.com
mmills@gb-llp.com

INTERESTED AGENCIES

California ISO
*E-mail Preferred*
e-recipient@caiso.com

INTERVENORS

Robert Sarvey
501 W. Grantline Road
Tracy, CA 95376
Sarveybob@aol.com

ENERGY COMMISSION

JAMES D. BOYD
Vice Chair and Presiding Member
jboyd@energy.state.ca.us

ROBERT B. WEISENMILLER
Commissioner and Associate Member
rweisenm@energy.state.ca.us

Kourtney Vaccaro
Hearing Officer
kvaccaro@energy.state.ca.us

*Pierre Martinez
Siting Project Manager
pmartine@energy.state.ca.us

Kevin Bell
Staff Counsel
kbell@energy.state.ca.us

*Jennifer Jennings
Public Adviser
E-mail preferred
publicadviser@energy.state.ca.us

*indicates change

## DECLARATION OF SERVICE

I, Marie Mills, declare that on November 3, 2010, I served and filed copies of the attached OAKLEY GENERATING STATION MITIGATION STRATEGY, dated November 3, 2010. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at:

[http://www.energy.ca.gov/sitingcases/contracosta/index.html]. The documents have been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

(*Check all that Apply*)

FOR SERVICE TO ALL OTHER PARTIES:

__X__ sent electronically to all email addresses on the Proof of Service list;

_____ by personal delivery;

__X__ by delivering on this date, for mailing with the United States Postal Service with first-class postage thereon fully prepaid, to the name and address of the person served, for mailing that same day in the ordinary course of business; that the envelope was sealed and placed for collection and mailing on that date to those addresses NOT marked "email preferred."

*AND*

FOR FILING WITH THE ENERGY COMMISSION:

__X__ sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below (*preferred method*);

*OR*

_____ depositing in the mail an original and 12 paper copies, as follows:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 09-AFC-4
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct, that I am employed in the county where this mailing occurred, and that I am over the age of 18 years and not a party to the proceeding.

Marie Mills

____________________
Marie Mills

*indicates change