

technical brief

Mobile Emission Reduction Credits

One Company's Experience With the Application Process in Sacramento, CA

Electric Transportation Program

Summary

In November 2003, the Sacramento Municipal Utility District (SMUD) filed an application with the Sacramento Metropolitan Air Quality Management District (SMAQMD) for Mobile Emission Reduction Credits (MERC's) for the emission reductions resulting from SMUD's electric forklift incentive pilot program. This program helps eligible SMUD customers purchase electric forklifts, instead of Internal Combustion Engine (ICE) powered models. As of this date (December 2005), no credits have been received, although the application was approved in December 2004. This paper provides an overview of the application process, as well as a chronology of events during the past 2 years. SMUD had previously attempted to obtain credits in the early 1990's for a natural gas bus replacement program, using a similar process, but also came up empty after expending significant resources.

What are MERC's?

To quote from reference 1, "Mobile source emission reduction credits are created when reductions in emissions from cars, buses, or other mobile sources exceed the reductions required by federal, state and local laws. In addition, mobile source emission reduction credits must exceed the requirements of district rules and regulations as well as the requirements of the district's air quality attainment plans." Further, "The four criteria that all emission reduction credits (regardless of their source) must meet are:

1. The reductions are not required by law, regulation, or otherwise assumed to occur as part of a regional air quality plan. These reductions must be surplus.
2. The reductions are real and quantified to an acceptable degree of certainty.
3. The actions that produce the credits are enforceable and legally binding.
4. The life of the reduction must be reasonably established and commensurate with the proposed use of the credit."

CA's Air Quality Regulatory Framework

California's (CA) air quality regulatory framework is complex. The CA Air Resources Board (CARB or ARB) is the agency which governs the states air resources, with the authority to ensure that local districts are meeting their legal responsibilities. This authority oversees the State Implementation Plan (SIP), which is derived from federal and state air quality standards. In general, local districts (SMAQMD is one) have the primary responsibility to regulate emissions from stationary sources, and the ARB has the responsibility to regulate emissions from mobile sources. With respect to MERC's, the ARB issues guidance for the development and implementation of programs to generate credits (CARB-Link to MERC program info: <http://www.arb.ca.gov/msprog/mserc/mserc.htm>). Although the ARB encourages districts to use these guidelines wherever possible, they

are not formal regulations, and local districts may develop alternate approaches.

SMUD's Electric Forklift Incentive Program

SMUD is the electric utility which serves Sacramento county and a small portion of Placer county in northern California. Over the years, SMUD has sponsored, or supported, programs to improve air quality in its service territory. One such program is the electric forklift incentive program. Initiated as a pilot program in 2002, SMUD provides financial incentives to customers to purchase electric forklifts instead of conventionally fueled forklifts. This program was developed based on the requirements of CARB's Carl Moyer Air Quality Program (CARB-Link to Carl Moyer Program info: <http://www.arb.ca.gov/msprog/moyer/moyer.htm>), which provides grant funds to local air districts for the incremental cost of "cleaner than required" engines (Mobile Source Emission Reduction Credits", CA Air Resources Board, Feb. 1996). Although the SMUD program is modeled after the Moyer program, SMUD chose to provide the pilot program's incentives using internal funds. With this approach, SMUD could later apply for MERC's, as the incentive funds were not provided by any state or federal agency.

The SMUD program provides incentives for the purchase of electric powered forklifts, in place of internal combustion engine (ICE) powered forklifts, under 3 scenario's:

- Replace an existing ICE forklift (old ICE unit must be destroyed)
- Support the expansion of an existing business by at least 25%
- Outfit a new business—must certify that electric unit(s) will replace the planned purchase of ICE unit(s)

Consistent with Carl Moyer Program guidelines, the SMUD program requires that participating customers sign a detailed agreement, which includes:

- Operation of the equipment solely in Sacramento County
- A participation duration of 5 years, minimum
- A quarterly report of forklift operating hours & energy consumption from a dedicated meter
- Customer must agree to a bi-annual on-site verification by SMUD personnel
- Customer relinquishes any claims for emission reduction credits
- For ICE forklifts which have been replaced, written verification is required that the ICE forklift's engine has been destroyed
- The purchase of a charger for each forklift is required

MERC Application Decision

As the incentive program was being designed in late 2001, SMUD staff initiated conversations with SMAQMD staff regarding the MERC application process. However, these and subsequent discussions were less than encouraging. We were informed that:

- The process is normally lengthy, and since the SMAQMD hadn't processed an application in several years, it could further complicate the process
- Unless the applicant has a specific use for the credits, it probably doesn't make sense to proceed
- There will be a fee for the 20 to 40 labor hours required to process the application, at approximately \$110/hr
- The application cannot include emissions reductions realized more than 60 days prior to submittal of the application which meant that some of the early forklifts in our program would not be eligible
- The life of the credits is limited, and begins at the time of application, regardless of when/if the credits are granted

Nevertheless, in the fall of 2003, SMUD decided to submit a MERC application.

At the time of filing, SMUD had no specific use in mind for the credits, however it was felt that:

- a) There may be a future use for the credits
- b) It may be possible to sell the credits
- c) It is valuable to understand the application process

MERC Application Chronology (See Table 1 for summary)

SMUD submitted its application under SMAQMD Rule 206 (SMAQMD-Link to Rule 206: <http://www.arb.ca.gov/drdb/sac/curhtml/r206.htm>) on November 25, 2003. Since the application does not require any specific format, SMUD followed the format of SMAQMD Rule 206, inserting the specifics for the forklift incentive program, in the applicable paragraph. In late December 2003, SMUD was informed that the application fee was \$4,520 (40 hrs at \$113/hr), which was mailed January 6, 2004. SMUD maintained regular contact with AQMD staff and preliminary approval was received in a letter dated May 26, 2004.

The approval was contingent on minor updates, supplying answers to additional questions, and SMUD acceptance of the terms and conditions for obtaining and using credits. SMUD was also notified that there would be a 1 month public comment period, but that in general, the public does not comment although CARB or the EPA may. At that time, we were also informed that even if no comments were received during this period, it is still possible that agencies could file objections at some future date if SMUD tried to use the credits.

Following the public comment period, which ended July 9, 2004, SMUD submitted Revision A of the application, which incorporated the requested changes (See Appendix I). During the review period, SMUD was informed that SMAQMD had received verbal comments from the EPA, and would be receiving written comments shortly. However, the EPA's written comments were not sent to AQMD until Sept 29, 2004. In their letter, the EPA (Region IX) stated that the credits could not be approved because they fail to meet the requirements of real, enforceable, quantifiable, permanent and surplus. On December 6, 2004, the AQMD sent a rebuttal letter to the EPA disagreeing with

their assessment, and informing EPA that SMAQMD would be issuing a decision to grant the credits. SMUD received a letter from the AQMD, dated December 13, 2004, stating that they had made a final decision to certify the credits. However, as of December 2005, 1 year after we received notification that the credits were approved, and 2 years after the application was submitted, no credits have been granted (However, we were recently informed that the application was still "alive" and that the final issues were being resolved). Given that the life of the credits is 5 years, and the clock starts when the application is submitted, 40% of the life is already gone.

In conversations with AQMD staff in early 2005, we were informed that additional open issues related to enforcement had surfaced. We believe the issue relates to AQMD staff having "march in nights" to our customer's facilities for inspections and possible enforcement actions. However, SMUD refuses to subject our customers to these conditions, since this was not part of the participation agreement. At least part of the problem seems to relate to AQMD's normal process for credits of this type, whereby program participants agree to specified emission reduction levels at the outset. Credits are then issued for those reductions, and enforcement actions could result if the contracted reduction levels are not achieved.

For the SMUD program, no minimum usage levels are specified, but usage data is recorded. Consequently, SMUD believes that this program delivers every reasonable assurance that the data we're providing is accurate and non-fraudulent. Our customers have nothing to gain by "gaming" the system, since there are no minimum usage requirements, and they don't receive the credits.

The mechanics of the program are as follows:

- Forklift operating hours and energy consumption, via a dedicated watt-hr meter, are recorded on a quarterly basis
- This data is analyzed for "normalcy" using "typical" usage patterns
- The agreement includes provisions for semi-annual, on-site visits by SMUD personnel
- An automatic emission reduction credit "pad" is built in because the program resulted in the destruction of uncontrolled emissions forklifts (12 to 13 g/bHP-hr

Table 1. MERC Application Chronology

Date	Event
Late 2001	SMUD initiates discussions with SMAQMD re: MERC application process
7/1/02	First forklift incentive program contract signed
11/03	SMUD re-initiates discussions with SMAQMD re: MERC application process
11/25/03	SMUD submits MERC application under SMAQMD Rule 206
1/6/04	SMUD submits required application fee
5/26/04	SMUD receives conditional approval of application pending minor updates and acceptance of the terms and conditions
7/9/04	End of public comment period—SMAQMD notifies SMUD that they have received verbal comments from EPA but needs written comments before final assessment is prepared
7/13/04	SMUD submits Revision A of the application incorporating all requested changes
9/29/04	EPA submits written comments to SMAQMD, disapproving MERC application
12/6/04	SMAQMD sends letter to EPA disagreeing with their assessment, and stating that they will issue a final decision to grant credits
12/13/04	SMAQMD sends letter to SMUD stating that they have made a final decision to grant the credits
12/04	Final forklift incentive program contract signed (total of 24 lifts)—SMUD decides to end program because new CARB regulations force the use of electrics, or retrofit kits, to reduce emissions
3/05	Draft Memorandum of Understanding (MOU) received from SMAQMD
4/05	SMUD is informed that issues have arisen with respect to "enforceability"
4/05–6/05	Periodic contact with SMAQMD indicate that reviews are still ongoing with respect to an "enforceability" issue
12/05	SMUD is informed that the application is still active, and some final issues are being resolved.

NO_x) & the calculation methodology only allows credits for the difference between an electric (considered 0 emissions) and the emissions of a new (post 2002) ICE machine (2.4 to 3 g/bHP-hr NO_x for this time period)

- At this point, an additional 24 months of emissions reduction credit "pad" has also been built in due to the fact that no credits have, or will be, issued for the reductions achieved during the application period
- Another emissions reduction credit "pad" was put in place per agreement with SMAQMD, in that credits would only be issued for 90% of the predicted emissions reductions, in case operational fluctuations caused temporary usage to be less than the predicted levels

Prior MERC Applications

The only other attempt by SMUD to obtain mobile emission reduction credits involved 2 applications related to obtaining offset credits for a cogeneration facility SMUD was proposing to build. These projects were part of a Regional Transit (RT) modernization program. The first project was for the purchase of 95, compressed natural gas (CNG) powered buses and the second was for an electric trolley system. Both projects started in early 1992, and following multiple meetings with CEC, CARB, SMAQMD and the EPA, preliminary MERC applications were submitted in mid 1993. The application methodology was the same as the current effort, following SMAQMD Rule 206. In November 1993, SMUD submitted its final application for the CNG bus project (due to RT commitment issues to the trolley project,

this part of the MERC application was dropped). In May 1994, CEC staff released its preliminary assessment, documenting many unresolved issues. At this point, SMUD dropped the MERC application.

Conclusions

The SMAQMD process for obtaining MERC's is difficult. After multiple attempts, spanning many years, SMUD has been unable to meet the requirements for obtaining credits despite heavy up front coordination with the local, state and federal air quality organizations. In the most recent case, SMUD even received a letter certifying the credits, and yet 1 year has passed without credits being issued. SMUD's observations can be summarized as follows:

- The SMAQMD MERC application process is complex, time consuming and

it should be simplified. For example, the ERC application for the South Coast and Bay Area AQMD's (SCAQMD, BAAQMD) consists of a 2 page, "fill in the blanks", form.

- At least part of the problem is the infrequency with which SMAQMD processes MERC applications. We were told that they had not processed an application in several years, and ours was kind of the "ground-breaker".
- SMAQMD has been somewhat supportive of our effort, given their rebuttal to the EPA comments.
- SMUD's contract with program participants ensures every reasonable level of compliance, but still appears to be insufficient.
- SMUD could possibly receive credits, but is unwilling to subject its customers to enforcement actions, as this was not part of our deal with them. The contract between SMUD and AQMD should provide the necessary compliance and verification requirements.
- There are significant differences between local, state and federal air quality agencies, as to what constitutes real, enforceable, surplus, quantifiable and permanent as evidenced by SMAQMD's approval of SMUD's application following the EPA's disapproval.
- An option should be developed for programs like SMUD's, that issues credits "after the fact", based on the actual emissions reductions achieved—this would eliminate the enforceability issue, and is consistent with the SCAQMD approach.

Appendix I

Completed SMUD MERC Application for the Electric Forklift Incentive Pilot Program SMUD MERC Application Under Rule 206, Rev A—July 2004

Introduction: The Sacramento Municipal Utility District (SMUD) has developed a program which provides financial incentives to commercial customers who purchase new electric forklifts, instead of internal combustion engine (ICE) forklifts. The SMUD program has been developed using the Carl Moyer Program guidelines as a basis and provides incentives for electric forklift purchases which:

1. Replace an existing ICE forklift (old ICE unit must be destroyed)
2. Support the expansion of an existing business by at least 25%
3. Outfit a new business—must certify that electric unit will replace planned purchase of ICE unit

SMUD proposes to generate mobile emission reduction credits (MERCs) through the use of these forklifts by its customers. The emission reductions are derived from elimination of the NO_x that would have been generated had the customer purchased new ICE powered forklifts instead of zero emission electric forklifts. To assure verification of the emission reductions, SMUD will monitor the operation of each electric forklift, which are expected to operate an average of 1,650 hours per year, for a minimum of 5 years. SMUD's goal is to provide incentives for 10 to 20 electric forklifts, per year, between Sept 2002 and Dec 2004. It is anticipated that approximately 65% of the lifts in the SMUD program, will be deployed in AB 1390 (Environmental Justice) designated areas.

Following the submittal of this initial application, SMUD will submit documentation in accordance with SMAQMD requirements, for each forklift in the program.

401. Initial Plan: The purpose of this Initial Plan is to demonstrate that emission reductions are real, surplus, quantifiable, enforceable, and permanent and to include the methods for quantifying the actual emission reductions. This plan/application will include details regarding the deployment of each new electric forklift, the new ICE forklift which was considered for purchase and the ICE forklift replaced.

402. Compliance Plan: The Compliance Plan herein details the process for confirming the actual emission reductions, including procedures for maintaining records, regular audits, and the contractual agreement with the pollution source owner, including the consequences for non-compliance.

403. New Vehicles: For the purpose of compliance with Sections 401 and 402 for actual emission reductions by purchasing new zero emission electric vehicles (forklifts) instead of new ICE forklifts. The Initial and Compliance Plans are the same as those in section 404.

404. Replacement Vehicles: For the purpose of compliance with Sections 401 and 402 for actual emission reductions by replacing existing fleet vehicles (forklifts) with zero emission electric forklifts, the Initial and Compliance Plans are described below:

404.1 Initial Plan: The following outline will be used to apply for MERCs for the participating forklifts under this program:

- a) Forklifts are defined as an off-road vehicle per the California Air Resources Board (CARB). There is estimated to be 1050 smooth terrain ICE forklifts in the Sacramento air basin, generating 1.25 tons per day (tpd) NO_x (Ref SMAQMD Electric Material Handling Workshop presentation dated 9-16-03). For existing businesses, the SMUD forklift program provides incentives for replacing those ICE machines with new electric machines instead of new ICE machines. For existing/expanding businesses, the program provides incentives to purchase new electric forklifts, instead of new ICE forklifts. The program will include qualified SMUD commercial customers who typically use between 5 and 50 lifts in each of their operations. Since the filing of the initial application, sixteen (16) forklifts have been approved for the program. A total of two (2) more forklifts could enter the program during the remainder of calendar year 2004.
- b) Emission rate for all affected pollutants and the corresponding emission standard for the retired and base vehicles (forklifts) are as follows:

Class 4/5 (ICE)—Propane, Diesel or Gasoline

- The ICE units to be retired are typically pre 2000 models with emission rates per Table 2, herein.
- Emission rates for the base ICE units which would have been purchased if the electric units weren't, are model years 2003 and 2004 LPG powered with emission rates per Table 2, herein (Note: All ICE powered machines in the lift range of > 3000 lbs use engines that displace more than one (1) liter with a (NO_x + NMHC) emissions rate of 3.0 g/bhp-hr, maximum. Per the Carl Moyer guidelines, 80% of this total is NO_x or 2.4 g/bhp-hr). To date, our customers have all indicated that they would have purchased new, propane powered ICE lifts, if not for the incentive program.

c) Emission rate for all affected pollutants and the corresponding emission standard for the new vehicle (forklift) are as follows:

All forklifts eligible for the SMUD program are classified as Class 1 electric models, with lift capacities of 3000 lb, minimum. Electric forklifts are considered to emit zero pounds of NO_x per hour.

d) Quarterly NO_x emission projections for the **new electric vehicles (forklifts) is zero pounds of NO_x, per quarter, per lift.**

Quarterly NO_x emission projections for the **base vehicles (forklifts) is 30 pounds of NO_x, per quarter, per lift** using the following inputs for the equation in (i), below:

$$\begin{aligned} \text{Power} &= 46 \text{ HP, LF} = 30\%, \\ \text{NO}_x &= 2.4 \text{ g/bhp-hr,} \\ \text{average hours/yr} &= 1650 \text{ (413 hrs/qtr)} \end{aligned}$$

Average quarterly NO_x emission projections for the **retired vehicles (forklifts) is 164 pounds of NO_x, per quarter, per lift** using the following inputs for the equation in (i), below:

$$\begin{aligned} \text{Power} &= 46 \text{ HP, LF} = 30\%, \\ \text{NO}_x &= 13 \text{ g/bhp-hr,} \\ \text{average hours/yr} &= 1650 \text{ (413 hrs/qtr)} \end{aligned}$$

- e) Average hourly usage projections for each new zero emission electric forklift in the SMUD program, is 413 hours per quarter. This estimate is based on actual and projected usage.
- f) kWh usage to recharge the electric forklifts (using 413 engine hours/quarter), is between 800 and 2500 kWh per quarter, per forklift, depending on the exact model purchased and the method of recharging.
- g) The average age of existing vehicle (forklift) fleet is approximately 10 years, and the projection for the new electric vehicle (forklift) life is 5 years, minimum. There is no projected increase in emission over the vehicle life due to depreciation, engine wear, degradation of controls or other causes for electric forklifts.
- h) SMUD is aware of current CARB efforts to improve air quality by retrofitting existing forklifts, and/or mandating cleaner engines and/or requiring the purchase of electric forklifts. However, the exact requirements which may result from these efforts, are unknown at the present time.
- i) Estimation of actual emission reductions, utilizing the aforementioned assumptions, is as follows:

$$\begin{aligned} \text{NO}_x \text{ emissions (lbs/yr)} &= \\ &= \frac{(\text{Operating hours/yr}) * \text{horsepower} * \text{load factor} *}{454 \text{ (g/lb)}} \\ &\quad \text{emission rate (g/bhp-hr)} \end{aligned}$$

where the "emission rate" is from Table 2, herein.

j) There is no California DMV vehicle registration assigned for the class of off-road vehicle being replaced.

404.2 Compliance Plan: The following activities will be performed for each of the forklifts participating in this program:

- a. All forklifts in the SMUD program must be operated within SMUD's service territory. However, only those forklifts operated in Sacramento County will be eligible for ERC's under this application. SMUD has required that for each forklift in the program, the customer provide quarterly records of kWh usage, forklift operating hours and vehicle maintenance records for a period of 1 year followed by annual reports for the next 4 years. However, in accordance with SMAQMD reporting requirements, the SMUD program requirements will be modified to require quarterly reporting for the full 5 years. The installation of a SMUD provided electric meter, is required to measure kWh usage. The meter must be on an independent circuit so that it only measures the power to the forklift(s). In addition, the electric forklift operating hours must be recorded using the totalizing, non-resetting hours meter included with each forklift. As part of the application process, SMUD has required specific data on the new electric forklift, the ICE that would have been purchased instead of the electric lift and the old ICE unit to be destroyed (if applicable).

- b. SMUD will perform audits of customer sites on a bi-annual basis (twice a year), to verify forklift hour meter records, kWh meter records, driver logs, and maintenance records. It is not necessary to perform actual vehicle emission testing for electric forklifts, since they have zero emissions. SMUD will prepare and submit an audit report to SMAQMD summarizing the results.
- c. For forklifts which are replaced, SMUD requires that the old ICE forklift be destroyed. SMUD will provide certification of the destruction of the ICE powered forklift and that it was drivable at the time of removal.
- d. SMUD has entered into a contractual agreement with each participating commercial customer, which states all the requirements of the Initial and Compliance Plans, and the consequences for non-compliance.

Compliance With Rules and Regulations

Based on the arrangements made between SMUD and its customers, emission reductions are determined to be real, surplus, enforceable, quantifiable, and permanent. Emission reductions will be generated since zero emission electric forklifts were purchased in lieu of conventionally fueled forklifts.

Real: Gasoline, propane, and diesel-powered forklifts all produce pollutants in their exhaust gases, including oxides of nitrogen (NO_x), hydrocarbons (HC), carbon monoxide (CO), and particulate matter (PM), when they are operated. In addition, gasoline models produce evaporative hydrocarbon emissions, and propane models, even though their fuel systems are closed, typically generate evaporative emissions when they are refueled. Replacing these “conventionally-fueled” units with electric models eliminates these evaporative and refueling emissions. To insure that these are real emission reductions, SMUD will screen the customers using the following parameters:

- Equipment type: Electric forklift purchase or replacement in lieu of an ICE unit
- Load capacity: Projects that replace forklifts with over 6,000 pound capacity are most likely replacing conventionally fueled forklifts.
- Work location: Projects that operate mostly outdoors or indoor/outdoor locations are most likely replacing conventionally fueled forklifts.
- Charger availability: If no charger is currently available at the project site, electric forklifts have not been used.
- Mix of electric and conventionally fuels forklifts—a customer who has all electric forklifts, would most likely continue to buy electrics

In addition to initial screening, SMUD will visit the customer site and make an assessment. To further insure that the customer is replacing conventionally fueled forklifts:

- The customer will be required to state such in the SMUD contract.
- For replacement purchases, SMUD will require destruction of the conventionally fueled forklift as evidenced by certification of destruction of the old forklift by a qualified recycler.

Surplus: The SMUD Electric Forklift Incentive Program provides “surplus” emission reductions by incentivizing the purchase of electric forklifts which are not required by any law, rule or regulation. Some sectors do require that electric forklifts be used:

- Occupational Safety and Health Administration (OSHA) requirements for air quality in closed spaces, requires that the exposure limit for CO be no more than 50 parts per million based on an eight-hour time-weighted average. Electric forklifts permit these standards to be met without improved air circulations.
- Fire codes may require the use of electric forklifts in dealing with hazardous or flammable materials because electric forklifts reduce risk of fire.
- Electric forklifts are required in some segments of the food industry.

SMUD requires a site inspection as well as a completed application and signed contract which specify that electric forklifts are not required by law.

Another requirement of this program, is verification that the purchase of electric forklifts would not have occurred as the result of “business-as-usual.” In other words, if a business always purchased electric forklifts, or if a business with many branch operations has made a decision to convert all of their facilities to electric, purchase of electric forklifts would be considered “business-as-usual”.

Enforceable: The SMUD Electric Forklift Incentive Program is designed to provide enforcement of the emission reductions at the levels prescribed and for the specified terms in two ways:

- Customers will be required to sign a detailed contract with the SMUD to guarantee five years worth of emission reductions and to certify that they are not replacing old electric forklifts with new ones.
- Customers must sign a contract with SMUD agreeing to keep records of operating hours and to allow bi-annual site inspections by SMUD. Results of these inspections and data collection will be included in the SMUD reports to SMAQMD.

Quantifiable: The actual emission reductions are quantified using the data in the Sept 30, 2003 Air Resources Board (ARB) publication titled: “The Carl Moyer Memorial Quality Standards Attainment Program Guidelines, Table 7.5”. This table has been included herein as Table 2.

The actual NO_x reductions will be calculated using the characteristics of the ICE forklift which would have been purchased, the Table I emission rates and the average operating hours. The formula used for the calculation is from the ARB Off-road model, as follows:

$$\text{NO}_x \text{ emissions (lbs/yr)} = \frac{(\text{Operating hours/yr}) * \text{horsepower} * \text{load factor} * \text{emission rate (g/bhp-hr)}}{454 \text{ (g/lb)}}$$

Permanent: Electric forklifts have been assigned a life of five (5) years by the Carl Moyer Memorial Air Quality Advancement Program (Moyer Program). However, according to the Air Resources Board Off-road Model, electric forklifts operate for an average of 11.7 years. For the purpose of the SMUD Electric Forklift Incentive Program, a life of 5 years is assumed. Contracts between SMUD and the customer will be written for five years and a program of monitoring will be enforced for that period. It is requested that a minimum five-year credit be granted for every forklift replaced under this program.

Recommendation: Based on the data and calculation methodology defined herein, the following MERC's for NO_x are expected to result from SMUD's forklift incentive program (see Table 3).

SMUD requests MERC's, with a life of 5 years, be granted as the actual reductions are achieved. SMUD is aware that proposed/pending legislation, may affect the actual NO_x reductions in the out years.

Table 2. Baseline Emission Rates for Forklift Engines by Model Year¹

Rated Power (horsepower)	Type of Engine	Model Year	Emission Standards/Rates (g/bhp-hr)	
			NO _x	NMHC +NO _x
25 < hp < 50	Compression ignition (diesel)	2000–2003	--	7.1
		2004 +	--	5.6
50 < hp < 100	Compression ignition (diesel)	Pre-2000	8.75 ²	--
		2000–2003	6.9	--
		2004 +	--	5.6
		2008 +	--	3.5
100 < hp < 175	Compression ignition (diesel)	Pre-2000	8.17 ³	--
		2000-2002	6.9	--
		2003 +	--	4.9
		2007 +	--	3.0
25 < hp < 50	Large Spark-ignited (propane) Uncontrolled	Pre-2002	13.0 ⁴	--
		2002 +	--	9.0 ⁵
> 50 hp	Large Spark-ignited (propane) Uncontrolled	Pre-2001	10.5 ⁶	--
		2001-2006	--	3.0 ⁷
		2007 +	--	2.0 ⁹
25 < hp < 50	Large Spark-ignited (gasoline) Uncontrolled	Pre-2002	8.0 ⁸	--
		2002 +	--	9.0 ⁹
50 < hp < 120	Large Spark-ignited (gasoline) Uncontrolled	Pre-2001	11.8 ¹⁰	--
		2001-2006	--	3.0 ⁹
		2007 +	--	2.0 ⁹
> 120 hp	Large Spark-ignited (gasoline) Uncontrolled	Pre-2001	12.9 ¹¹	--
		2001-2006	--	3.0 ⁹
		2007 +	--	2.0 ⁹

¹ Emission standards are provided where uncontrolled emission rates are not available.
² Emission rate for uncontrolled off-road heavy-duty diesel engines of 50 to 120 horsepower.
³ Emission rate for uncontrolled off-road heavy-duty diesel engines of 120 or more horsepower.
⁴ Emission rate for uncontrolled off-road heavy-duty propane engines of 25 to 50 horsepower.
⁵ This emission standard is for propane or gasoline LSI engines with a displacement of 1.0 liter or less.
⁶ Emission rate for uncontrolled off-road heavy-duty propane engines of 50 or more horsepower.
⁷ This emission standard is for propane or gasoline LSI engines with a displacement of more than 1.0 liter.
⁸ Emission rate for uncontrolled off-road heavy-duty gasoline engines of 25 to 50 horsepower.
⁹ This emission standard is for propane or gasoline LSI engines with a displacement of 1.0 liter or less.
¹⁰ Emission rate for uncontrolled off-road heavy-duty gasoline engines of 50 to 120 horsepower.
¹¹ Emission rate for uncontrolled off-road heavy-duty gasoline engines of 120 or more horsepower.
Reference: California Off-Road Large Spark-Ignited Emissions Inventory (October 19989)

For More Information

A. Rogers, EPRI Project Manager, phone: 650.855.2101, email: arogers@epri.com

Contractors

SMUD—Electric Transportation Group, Principal Investigator: B. Vincent

The Electric Power Research Institute (EPRI)

The Electric Power Research Institute (EPRI), with major locations in Palo Alto, California, and Charlotte, North Carolina, was established in 1973 as an independent, nonprofit center for public interest energy and environmental research. EPRI brings together member organizations, the Institute's scientists and engineers, and other leading experts to work collaboratively on solutions to the challenges of electric power. These solutions span nearly every area of power generation, delivery, and use, including health, safety, and environment. EPRI's members represent over 90% of the electricity generated in the United States. International participation represents nearly 15% of EPRI's total R&D program.

Together...Shaping the Future of Electricity

Table 3. NO_x Reduction Summary

Calendar Year	Quarterly NO _x Reductions (lbs)			
	1 st Quarter	2 nd Quarter	3 rd Quarter	4 th Quarter
2003	----	----	----	10 (1 lift)
2004	61 (5 lifts)	89 (5 lifts)	391 (16 lifts)	504 (17 lifts)
2005	504 (17 lifts)	504 (17 lifts)	504 (17 lifts)	504 (17 lifts)
2006	504 (17 lifts)	504 (17 lifts)	504 (17 lifts)	504 (17 lifts)
2007	504 (17 lifts)	504 (17 lifts)	504 (17 lifts)	504 (17 lifts)

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