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## 1. INTRODUCTION

On 16 March 1995, President Clinton and Vice President Gore announced an initiative titled *Reinventing Environmental Regulations*, which proposed 10 principles on regulatory reform and directed U.S. Environmental Protection Agency (U.S. EPA) to implement 25 high priority actions. One of these was aimed at achieving regulatory reform within the Department of Defense (DoD) through a program called ENVVEST (Environmental Investment).

On 2 November 1995, the DoD and U.S. EPA signed a Memorandum of Agreement (MOA) on Regulatory Reinvention Pilot Projects, which formally established the ENVVEST program. The MOA established a framework for developing pilot programs at three to five selected DoD facilities. Vandenberg Air Force Base (AFB) has been selected as the prototype facility to pilot the ENVVEST program and implement common sense and cost effective environmental protection. The ENVVEST program emphasizes regulatory compliance through pollution prevention and provides an alternative strategy to prescriptive command-and-control regulatory requirements in the form of a performance based environmental management system designed to attain greater environmental results.

## 2. PROGRAM SUMMARY

On 3 November 1997, Vandenberg AFB, U.S. EPA, and the Santa Barbara County Air Pollution Control District (SBCAPCD) signed the first, and currently the only, ENVVEST Final Project Agreement (FPA) within the DoD. The FPA states the intentions of the aforementioned parties to carry out a pilot project pursuant to the 1995 MOA by testing innovative approaches to environmental protection. Under the FPA, the Vandenberg AFB Air Quality Project XI/ENVVEST Initiative is aimed at improving air quality beyond that achieved through federal, state, and local permit programs. This multi-year implementation strategy is aimed at generating a reduction of ozone precursors, i.e., oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOCs), by 10 tons or more by 30 November 2002. The initial focus has been controlling emissions from boilers, furnaces, or process heaters. Realizing the shortfall of emission reductions from boiler projects, Vandenberg AFB has evaluated numerous projects to support attainment of the 10-ton reduction goal. Details of these efforts are discussed in sections 2.1 through 2.7 with a summary of these initiatives listed below.

### 2.1 Zero or Low Emission Internal Combustion (IC) Engine Replacement

- 2.1.1 Portable IC Engines
- 2.1.2 Lawn Mower Electrification
- 2.1.3 Grounds Maintenance Equipment Electrification
- 2.1.4 Low NO<sub>x</sub> Booster Pump Installation;

### 2.2 Low NO<sub>x</sub> Boiler Retrofit or Replacement;

### 2.3 Zero VOC Paint and Coating Substitution;

### 2.4 Paint Booth Consolidation;

### 2.5 Wastewater Reclamation System at Space Launch Complex 2 (SLC 2);

### 2.6 Sustainable Housing/Energy Conservation; and

## 2.7 Electric Vehicle (EV) Fleet Integration.

Vandenberg AFB has identified several cost-effective opportunities that could have resulted in a reduction, by several tons of actual  $\text{NO}_x$  and VOC emissions, that were real, quantifiable, and enforceable. However, in most cases once the surplus tests were identified and applied, only a fraction of actual emission reductions were left that could be credited to the program. Due to the surplus standards, Vandenberg AFB has had to abandon its most cost-effective reduction opportunities and pursue less effective measures while striving to meet the goals of the program. The following provides a brief synopsis of each reduction opportunity evaluated by Vandenberg AFB.

### 2.1 IC Engine Replacement

Vandenberg AFB evaluated two categories of IC engines for replacement: portable IC engines and equipment used during facility maintenance, which included ground maintenance equipment and agriculture irrigation equipment. Results from these evaluations are described in the following paragraphs.

#### 2.1.1 Portable IC Engines

Vandenberg AFB has made significant progress in reducing air pollutant emissions; however, achieving the ENVVEST emission reduction goals and milestones requires an equally dedicated and vital effort. Recent studies have demonstrated the availability of IC engine control technology with sufficient  $\text{NO}_x$  emission reduction potential to be considered in the ENVVEST ozone precursor reduction effort. Specifically, studies by Battelle-Columbus Laboratory<sup>1</sup> have evaluated the ability of six technologies to control  $\text{NO}_x$  emissions from Air Force aerospace ground equipment (AGE). Results of this study, which used a mobile electric power generator (Model A/M32A-86), showed three of the control technologies were practical and achieved a 70 percent reduction in  $\text{NO}_x$  without any increase in carbon monoxide (CO), hydrocarbon (HC), or particulate emissions.

The source applicability to the ENVVEST program was based on equipment usage data presented in the 1995 and 1996 Comprehensive Emission Inventory and previous study data. Previous study data included data analysis by Battelle-Columbus Laboratory and a Science Applications International Corporation (SAIC) AGE operations study at March AFB<sup>2</sup>, in which control technology options for diesel generators (also known as -86) were evaluated. Engelhard, a manufacturer of control technology for diesel engines, was consulted for control technology strategies for IC engines as well. The applicability analysis incorporated the potential emission reductions from application of control technology and implementation of the ENVVEST IC Engine Retrofit or Replacement (R&R) Program.

The source applicability report describes the emission reduction implementation (ERI) and cost feasibility (CF) for using low emission IC engines at Vandenberg AFB. It includes data collection and assumption methodologies, data analysis, cost feasibility, and monitoring requirements.

#### Portable IC Engines Table 2.1.1 Summary

Program Planning Cost	Control Technology Cost	Annual Monitoring Cost (\$/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Actual Emissions (\$/ton)	Surplus Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Surplus Emissions (\$/ton)
\$18,856	\$135,000 (\$45K for each custom trailer mounted unit)	None (Electrification)	2.13 (Based on three IC engine replacements)	\$64,380	1.20	\$112,500

### Vandenberg AFB Concerns With Respect to Project

- Logistical and infrastructure issues are of concern. Electric load and system operations would need to be thoroughly investigated before replacing IC engines. Electric motors require proper shielding to protect against electromagnetic interference, and explosive and flammable hazards around the SLCs.
- Regulation of IC engines to Tier II standards further diminishes surplus emission reduction potential.
- Additional costs to build a trailer for each electric unit so it can function as a portable unit. This increases costs per unit by 20 percent.

#### 2.1.2 Lawn Mower Electrification

Several studies indicate that emissions from gas-powered lawnmowers contribute significantly to air pollution. The Vandenberg AFB Comprehensive Inventory Report (CIR) shows that 1994 Military Family Housing (MFH) lawnmower emissions were 84, 3, and 5.7 tons per year for CO, NO<sub>x</sub>, and VOCs, respectively. The U.S. EPA estimates that gardening equipment produces up to five percent of the nation's air pollution. Furthermore, it is estimated that operation of a lawnmower for the time required to mow an average lawn (about one hour) generates as much air pollution as 40 late model automobiles operated for the same time period. In addition, U.S. EPA estimates that there are significant VOC emissions from spillage during lawnmower fueling. Both U.S. EPA and the California Air Resources Board (CARB), acknowledging that garden equipment is a significant source of CO and hydrocarbon emissions, have promulgated emission standards for gas-powered lawn and garden equipment.

Several agencies have recognized that reduction of lawnmower emissions can contribute to improvement of air quality. For example, the South Coast Air Quality Management District (SCAQMD) has implemented a program under Rule 1623 that permits businesses to earn emission credits by replacing gas-powered mowers with battery-powered models. City officials, local businesses, and a lawnmower manufacturer have joined together in Phoenix, Arizona, to promote a program that provides rebates for exchanging gas-powered lawnmowers for battery-powered mowers.

Vandenberg AFB evaluated the ERI and CF for replacing residential lawn mowers at Vandenberg AFB Military Family Housing (MFH). It included data collection and assumption methodologies, data analysis, cost feasibility, and monitoring requirements to implement a lawn mower buyback and replacement program.

Preliminary data assessment collected at Vandenberg AFB in combination with supporting

technical data from The Center for Emission Research and Analysis, SCAQMD, CARB, and manufacturers' data showed tremendous potential. The applicability analysis incorporates the emission reduction potential from replacing conventional gasoline lawn mowers with cordless electric (zero emission) lawn mowers under an ENVVEST Lawn Mower Replacement Program.

**Lawn Mower Electrification Table 2.1.2 Summary**

Program Planning Cost	Control Technology Cost	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Actual Emissions (\$/ton)	Surplus Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Surplus Emissions (\$/ton)
\$16,477	\$595,000 (Based on average price of \$250 per electric mowers)	\$12,500 (Monitoring estimated @ 20 hours per month)	6,214	\$95,750	0.7	\$850,000

**Vandenberg AFB Concerns With Respect to Project**

- Project is not cost effective based on the surplus emission reduction potential.

**2.1.3 Grounds Maintenance Equipment Electrification**

In addition to lawn mower electrification, Vandenberg AFB assessed the feasibility of replacing ground maintenance equipment used at the Vandenberg AFB Golf Course and cantonment area. Results from this effort are presented in the Lawn Mower ERI and CF Study. In summary, equipment used at the Vandenberg AFB Golf Course is primarily diesel fueled. Consequently, the resulting surplus emissions are negligible when compared to the cost of replacing the equipment with electric or low NO<sub>x</sub> equipment. Based on preliminary results, this ENVVEST emission reduction option will not be investigated further.

**2.1.4 Low NO<sub>x</sub> Booster Pump Replacement**

SBCAPCD documented success stories with respect to a low NO<sub>x</sub> booster pump installation program in the May/June 1998 *Business Focus News Report*. As a result, Vandenberg AFB evaluated the emission reduction potential from replacing one of the agriculture booster pumps operated on Vandenberg AFB. The existing source specifications are as follows:

<b>Engine Make</b>	Allis Chambers
<b>Engine Model/Serial Number</b>	3500/3D-55526
<b>Engine Horse Power (Bhp)</b>	120
<b>Engine Age</b>	21 years
<b>Fuel Type</b>	Diesel
<b>Operating Hours (estimated)</b>	800
<b>Load Factor (estimated)</b>	75 percent

Vandenberg AFB proposed to replace the old unit with a new, fuel-efficient, low NO<sub>x</sub> diesel-powered IC engine. Emission reduction quantification proposed by Vandenberg AFB included establishing a pre-replacement emission concentration and fuel use rate. A baseline

emission rate would be established using baseline source test and fuel use data. The baseline would be established by monitoring pre- and post-replacement engine parameters (emission concentration, combustion efficiency, and fuel rate) for 3 years. The emission reduction would be based on the difference between actual emission reductions from the old unit and the new unit. SBCAPCD agreed to this application; however, rather than basing the emission reduction potential on the difference in actual emissions measured from source test data, Tier II standards for non-road diesel engines would need to be used.

**Low NO<sub>x</sub> Booster Pump Replacement Table 2.1.4 Summary**

Program Planning Cost	Control Technology Cost	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Actual Emissions (\$/ton)	Surplus Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Surplus Emissions (\$/ton)
\$4,000	\$13,368 (Cummins 4B 3.9 booster pump replacement)	<\$1,000 (Using an ENVVEST approved test protocol)	0.86 (Base on manufacturer emission specifications)	\$15,544	0.14	\$95,486

**Vandenberg AFB Concerns With Respect to Project**

- Project is not cost effective based on the surplus emission reduction potential.

**2.2 Low NO<sub>x</sub> Boiler Retrofit or Replacement**

Vandenberg AFB operates approximately 236 boilers base wide. Eleven of these have heat input rating between 5 and 10 million British thermal units per hour (MMBtu/hr). These units are subject to SBCAPCD permit and NO<sub>x</sub> control requirements down to 30 parts per million (ppm), leaving little opportunity for further reductions.

An ERI and CF study was conducted by Vandenberg AFB to assess the reduction opportunity and evaluate the cost feasibility of retrofitting or replacing boilers with low and ultra low NO<sub>x</sub> control technology for the next largest class of boilers with a heat input ranging between 2 and 5 MMBtu/hr. Ten boilers have been retrofitted or replaced under the ENVVEST program. In addition, 15 boilers were replaced under the Vandenberg AFB Capital Improvement Program (CIP). Boiler emission specifications were outlined prior to installation. Each retrofit or replacement project resulted in a fully integrated and functional low NO<sub>x</sub> boiler system. The emission reductions achieved through implementation of this program are projected at 4 tons NO<sub>x</sub> per year.

In addition to the technical approach, methodology, and rationale used to estimate emission rates and reduction potential by identifying the facility type, boiler use, operating capacity, and fuel usage identified in the ERI and CF Study, three protocols were developed to measure boiler emissions, actual fuel use, and calculate the emission baseline. The three protocols were approved by SBCAPCD. Based on the aforementioned protocols, the projected CY99 NO<sub>x</sub> emission reductions are presented below.

**Low NO<sub>x</sub> Boiler Retrofit or Replacement Table 2.2 Summary**

Program Planning Cost (dollars)	Control Technology Cost (dollars)	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Actual Emissions (\$/ton)	Surplus Emission Reduction Potential (ton/year)	Average Cost per Ton Reduced
\$60,000 (estimated)	\$72,985 (FA 78 = 3 boilers)	\$25,000	2.22 (10 ENVVEST Boilers)	\$116.552	2.22	\$116.552
	\$185,762 (WR 13 = 7 boilers)		1.39 (15 CIP Boilers)	N/A	1.39	N/A

**Vandenberg AFB Concerns With Respect to Project**

- Continued monitoring cost for sources that are typically not regulated;
- Less reliability from the application of innovative and new technologies;
- Specialized training on the maintenance and upkeep of low NO<sub>x</sub> technologies; and
- Emission performance over the firing range of low and ultra-low NO<sub>x</sub> boilers.

**2.3 Zero VOC Paint and Coating Substitution**

Vandenberg AFB is currently assessing the emission reduction potential for VOCs from corrosion control, industrial facility painting, and architectural interior and exterior coating operations. A top down approach is being taken to accomplish this task under the ENVVEST Program. This includes evaluating painting and coating operations performed at Vandenberg AFB, determining the greatest VOC emission reduction potential, ranking each painting and coating process for ease of product substitution and greatest reduction, and listing zero or near-zero VOC substitute products for the highest ranked processes.

Preliminary assessment findings include:

- Zero VOC paint can be used in most interior architectural painting activities;
- Exterior architectural painting activities can be eliminated if paint color is added to stucco exterior;
- Exterior architectural painting activities at old MFH will be reduced upon completion of MFH upgrade/renovation project;
- Low VOC paint for interior industrial coating has been identified; and
- Low and zero VOC paint has been identified for corrosion control, however, significant test and evaluation is needed before application at Vandenberg AFB.

Vandenberg AFB successfully implemented zero VOC interior architectural paint substitution program at newly constructed facilities and is looking to incorporate operational changes to paint maintenance procedures at existing facilities. As a result, it is estimated that VOC emissions from interior architectural painting activities would be 1.27 tons VOC per year for Phase VI MFH upgrade renovation project, and 5.15 tons VOC per year for interior painting during MFH maintenance. Vandenberg AFB developed an ENVVEST Zero VOC Paint Protocol that summarizes the technical approach, emission reduction calculation methodology, and paint procurement and tracking system.

**Zero VOC Paint and Coating Substitution Table 2.3 Summary**

Program Planning Cost (dollars)	Control Technology Cost (dollars)	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Surplus Emission Reduction Potential (ton/year)	Average Cost per Ton Reduced
\$66,370	(Overall increase to paint cost is approximately 50 percent)	minimal	1.27 (MFH Phase VI)	Not determined	\$30,000 (Based on average VOC content of 0.65 lb/gal, average cost increase of 2.4 times more)
			5.15 (Maintenance assuming 5,000 gallons primer and 10,000 gallons finish annual usage rate)		

**Vandenberg AFB Concerns With Respect to Project**

- MFH maintenance cost will increase by \$135,000 annually.
- MFH new construction cost will increase by \$50,000 per phase (based on 100 houses).
- District approval on the ENVVEST Zero VOC Paint Protocol.
- Lack of ability to sustain emission reductions since incremental cost is funded through ENVVEST funds that terminate in FY01.

**2.4 Paint Booth Consolidation**

The IRF paint booth was originally constructed to be a multi-purpose facility for painting and corrosion control of large rail-car equipment and missile components under the former Rail Garrison Peacekeeper Project. The paint booth facility, which is 24 feet wide by 26 feet high and 109 feet long, operates under SBCAPCD Permit to Operate (PTO) 9954). The paint booth is located in Building 1900 in the central zone of Vandenberg AFB.

The 576th Flight Test Squadron (576 FLTS) on Vandenberg AFB is implementing a consolidated paint and coating operation at the IRF paint booth to reduce the VOC emissions from corrosion control operations. By implementing the consolidated approach to paint and coating operations at the IRF, emissions resulting from painting and coating traditionally "out-of-booth" articles, are now controlled with 90 percent efficiency.

An ERI and CF study was conducted to evaluate the emission reduction credit potential. In addition, the study presents the technical approach used to determine ENVVEST emission reduction credits from implementing a consolidated approach to painting and coating by increasing the throughput at the IRF paint booth. The VOC emission reduction credit potential from implementing the IRF paint booth consolidation efforts is calculated at 0.50 tons of VOC per year. The ENVVEST IRF Protocol was developed to determine the emission reduction credits available from implementing a consolidated approach to painting and coating operations at the IRF. The protocol provides an estimated emission reduction potential based on equipment to be painted in the booth and associated paint volume used to paint the article.

**Paint Booth Consolidation Table 2.4 Summary**

Program Planning Cost (dollars)	Control Technology Cost (dollars)	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Surplus Emission Reduction Potential (ton/year)	Average Cost per Ton Reduced
\$10,709	\$0 (former investment by the Air Force)	\$0 (Part of SBCAPCD PTO-9954)	0.50	Not determined	\$0 Maintenance & operating costs incurred by operator

#### Vandenberg AFB Concerns With Respect to Project

- Maintenance and operating costs associated with paint booth are significant; and
- Lack of ability to sustain continued use of IRF by 576 FLTS.

### 2.5 Wastewater Reclamation System at SLC 2

Satellites are launched into polar orbit from SLC 2 at Vandenberg AFB. Each launch generates approximately 50,000 gallons of industrial wastewater from cooling and pulse suppression during launch. In accordance with the Industrial Wastewater Treatment Plan, 30 SW Plan 32-7041-C (u), the wastewater must be treated at the Industrial Wastewater Treatment Plant (IWTP).

Before the wastewater can be treated, it must be transported from SLC 2 to the IWTP. The wastewater is transported to the IWTP by tanker trucks that have a 5,000-gallon capacity. Because of the volume of water generated during a launch cycle and the number of trips to haul it to the IWTP, the tanker trucks must travel more than 420 miles. In addition, support IC engines are used to pump the wastewater into the tanker trucks and IWTP, increasing the amount of emissions.

Vandenberg AFB is implementing a wastewater reclamation system at SLC 2 to provide a practical approach to managing launch-generated wastewater. The system will reclaim launch wastewater from the retention basin, condition the water so that constituents are below hazardous levels, and store the water for subsequent launch operations. By implementing the wastewater reclamation system at SLC 2, on-road mobile source emissions from the heavy-duty vehicles and portable IC engines will be reduced at Vandenberg AFB.

An FRI and CF study was conducted to evaluate the emission reduction credit potential and provide the technical approach used to determine ENVVEST emission reduction credits from implementing the wastewater reclamation system at SLC 2. Emission reduction potential from implementing SLC 2 wastewater treatment system was selected as a candidate mobile source emission reduction program. If the wastewater reclamation system is successfully implemented at SLC 2, the application could be transferable to other SLCs and provide further emission reductions. Moreover, this study implements the first of many programs to reduce and quantify mobile source emissions at Vandenberg AFB. The NO<sub>x</sub> and VOC emission reduction credit potential from implementing the wastewater treatment system at SLC 2 is calculated at 0.15 ton of NO<sub>x</sub> and VOC per year. A protocol has been developed to determine the emission reduction credits available and provide the technical approach used to calculate heavy duty truck and portable IC engine emission reductions from implementing the SLC 2 wastewater reclamation system.

#### Wastewater Reclamation System at SLC 2 Table 2.5 Summary

Program Planning Cost (dollars)	Control Technology Cost (dollars)	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Surplus Emission Reduction Potential (ton/year)	Average Cost per Ton Reduced
\$12,317	\$0 (Cost incurred by wastewater reclamation project)	Minimal cost (Recordkeeping is required for wastewater hauling activities)	0.15	Not determined	\$0 (Ancillary benefit of the wastewater reclamation project)

**Vandenberg AFB Concerns With Respect to Project**

- Project is based on a "pilot" program. If results from the study are unfavorable, the program will be discontinued.

**2.6 Sustainable Housing/Energy Conservation**

Vandenberg AFB has identified the construction of sustainable military family housings (MFH) as a possible emission reduction measure. Emission saving/reduction could be realized from the reduced natural gas and energy consumption of the new housing units, compared to existing housing. Vandenberg AFB proposes determining the fuel rate usage for pre- and post-MFH projects by measuring natural gas consumption with gas meters on a representative group of pre- and post-renovation homes. Natural gas fuel usage at MFH will be measured to determine a use rate for pre- and post MFH upgrade projects. Depending on the square footage and MFH occupancy rate, a monthly fuel usage rate will be calculated for each type of MFH unit (scf/month/MFH unit). Each units' specific fuel rate will be applied to non-metered pre- and post- MFH upgrade projects to determine pre- and post- MFH upgrade project emission rates. Additionally, Vandenberg AFB proposed to use the Facility Energy Decision System (FEDS) model to quantify the energy and emission reductions generated from sustainable MFH construction. The emission reduction potential is not yet estimated. Additional information regarding fuel use at the "new" versus the "old" housing units is necessary to determine the emission reduction potential.

**Sustainable Housing/Energy Conservation Table 2.6 Summary**

Program Planning Cost (dollars)	Control Technology Cost (dollars)	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Surplus Emission Reduction Potential (ton/year)	Average Cost per Ton Reduced
\$15,000	\$5,000 (fuel meters)	<\$1,000	Not determined	Not determined	Not determined

**Vandenberg AFB Concerns With Respect to Project**

- District approval of ENVVEST Sustainable MFH protocol and FEDS model used to quantify emissions.

**2.7 Electric Vehicle Integration to Fleet Applications**

Vandenberg AFB is assessing the feasibility and cost to implement an electric vehicle (EV) fleet program to provide environmentally friendly modes of transportation while achieving the goals of many environmental regulations. By implementing an EV program, Vandenberg AFB is taking a proactive approach to managing air quality through mobile source reductions.

Vandenberg AFB has developed a three-prong approach to evaluating EV applications on base. Each task is being performed simultaneously. First, Vandenberg AFB identified the need to utilize existing EV loaner programs, which provide EVs and temporary infrastructure at no or minimal cost to the using organization. Participants in the program will test and evaluate selected EVs for a 2 to 4 week period. At the conclusion of the loaner program, each organization will assess whether the EVs meets the requirements of their daily operations. Second, Vandenberg AFB is obtaining a "pilot" scale fleet of EVs from a BRAC base. The fleet will be assigned and used by various organizations under the 30th Transportation Squadron. Infrastructure requirements will be planned and permanently installed for this "pilot" scale program prior to fleet arrival. The "pilot" fleet use on Vandenberg AFB will be evaluated using performance guidelines and use guidelines specific to the fleet. Third, Vandenberg AFB will assess the applicability of phasing in long-term EV use for base operations. This assessment will identify possible vehicle fleet substitute options (make and model), infrastructure requirements, and vehicle and infrastructure co-funding opportunities. If feasible, Vandenberg AFB will install necessary EV infrastructure and integrate EV procurement into the fleet. However, upon consultation with the CARB, emission reduction credits generated from EVs, also known as zero emission vehicles (ZEVs), are not surplus. This remains an issue concerning the feasibility of an EV Program for Vandenberg AFB.

Based on CARB implemented low emission vehicle (LEV)II requirements, OEM manufacturers are mandated to implement ZEVs and ZEV technology into the California marketplace. Each manufacturer is required to achieve 10 percent of total fleet sales in California with ZEVs by 2003. Consequently, the only way a source can obtain an emission reduction credit is if a ZEV manufacturer is willing to sell or transfer their rights to use ZEVs to meet CARB's LEV standards. To date, no manufacturer is willing to do so.

The following table provides the emission reduction potential and associated costs for deploying 20 EVs into the Vandenberg AFB vehicle fleet during FY00. The emission estimates are based on the CARB *Mobile Source Emission Reduction Credits* guidelines published February 1996.

**Electric Vehicle Fleet Integration Table 2.7 Summary**

Program Planning Cost	Control Technology Cost	Monitoring Cost (dollars/year)	Vandenberg AFB Actual Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Actual Emissions (\$/ton)	Surplus Emission Reduction Potential (ton/year)	Cost per Ton Reduction Based on Surplus Emissions (\$/ton)
\$98,000	\$384,000 (10 yr. Lease cost)	\$0 (Assuming CARB baseline emission factors are used)	1.23 (Limited life credit of 3 years based on term of lease)	\$390,244	0	No return on investment
	\$96,000 (EV infrastructure)					

**Vandenberg AFB Concerns With Respect to Project**

- Reliability of EV technology;
- Cost of EV infrastructure and lease cost;
- Specialized training for EV operation and maintenance;
- Limited life emission reduction credits;
- Availability of emission reduction credits from ZEV manufactures (surplus issue); and
- Return on investment.

**3. PROGRESS OF FPA MILESTONES**

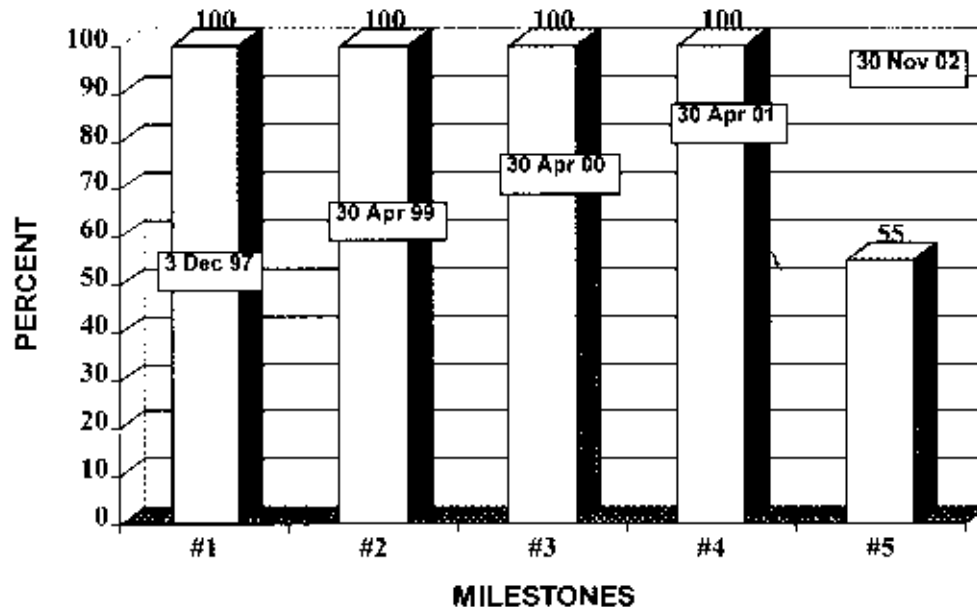
Through the process outlined in the FPA, Vandenberg AFB has agreed to the following milestones:

1. Within 30 days of execution of this Agreement, Vandenberg AFB shall complete the initial assessment and cost feasibility study.
2. By 30 April 1999, 30 percent of candidate boilers identified in milestone #1 are being retrofitted.<sup>3</sup>
3. By 30 April 2000, 2 tons per year of emission reductions shall have been accomplished.
4. By 30 April 2001, 70 percent of candidate boilers identified in milestone #1 are being retrofitted.
5. By 30 November 2002, Vandenberg AFB shall achieve a reduction in annual emissions of ozone precursors by 10 tons or more.

If any of the milestones are not met, the FPA will terminate and Vandenberg AFB will be required to comply with the requirements of Title V of the 1990 Clean Air Act Amendments. Table 3-1 shows Vandenberg AFB progress with respect to percent completion for each milestone.

**4. Conclusion**

**Table 3.1**  
**ENVVEST MILESTONE PROGRESS**



Vandenberg AFB has made admirable strides towards the program's final milestone by achieving 5.53 tons of real, quantifiable, surplus, and enforceable emission reduction credits. However, the program continues to be challenged with the issue of surplusability of emission reduction credits. Surplus standards, which are constantly evolving and changing, have a dramatic impact on the amount of emission reductions that can be credited to the ENVVEST Program. As shown in Tables 2.1 to 2.7, surplus standards have negated the cost effectiveness of pursuing a variety of innovative emission reduction projects. The amount of actual emission reductions that would result from each project initiative versus the amount of surplus emission reductions that may be credited to the program and their respective cost per ton. While the program continues to identify emission reduction opportunities, finding initiatives that support long-term emission reduction and financial goals is challenging. The only project successful to meet the emission reduction credit guidelines which maintains a cost effective approach to the program is the low NOx boiler retrofit and replacement program. Whereby, 100 percent of the emissions reduced are surplus and a typical boiler can have a life of 15 to 20 years prior to retirement. Realizing the surplus and financial limitations of the program, Vandenberg AFB has forecasted its best spent efforts to come short of the 10-ton reduction goal.

On 25 August 1999, Vandenberg AFB presented a proposal to the SBCAPCD that would still meet the goals and objectives of the program, while creating a win-win solution for all parties and fostering the commercialization of new and innovative technologies. Additionally, the proposal enables Vandenberg AFB to implement an EV program. The EV program would provide an environmentally friendly mode of transportation and meet the intent of the ENVVEST program.

In addition, many other environmental goals would be met. The SBCAPCD has conceptually agreed with the proposal and is currently consulting with EPA Region IX on its merits. The details of this proposal shall be discussed during the next progress report.

*Evaluation of Air Emissions-Reduction Technologies for Aerospace Ground Equipment (Phase II: Green AGE Initiative)*, Battelle Report to OC AL HSC/HRG, Wright-Patterson AFB, Ohio 45433, Contract No. F33657-92-D-2055, SAIC Task No. 12319, December 20, 1996.

<sup>1</sup> *Aerospace Ground Equipment (AGE)*, SAIC, Report to Headquarters, Air Force Reserve, Environmental Division HQ AFRES/CEV, March AFB, California, Contract No. F08635-93-C-0152, SAIC Task No. 152-5-01, January 1997.

<sup>2</sup> The term "being retrofitted" encompasses constructing, testing, and monitoring emission reductions.