

Proposed Portable Equipment Regulation and ATCM Amendments Standardized Regulatory Impact Assessment (SRIA)

A. Summary

The Portable Engine Airborne Toxic Control Measure (ATCM) is a regulation adopted in 2004 that sets emissions requirements for portable equipment to reduce exposure to toxic diesel particulate matter and protect public health. The ATCM works in concert with the Portable Equipment Registration Program (PERP) which allows fleets to voluntarily register portable equipment used across California with the State rather than with each local air district individually. As a technology forcing regulation, the ATCM is intended to force the development of retrofit emissions control technologies and new engine technologies which meet regulatory requirements. These technologies have not materialized as quickly as anticipated, which has dramatically increased costs of the ATCM regulation. The purpose of the PERP and ATCM amendments (together referred to as Portable Regulatory Amendments) is to provide relief from the financially and, in some cases, technologically un-attainable 2017 and 2020 fleet average emission standards set by the current ATCM, while also ensuring public health protection by ensuring the technological goals of the regulation will be met. For the purposes of this document, both the current ATCM and the PERP regulation are referred to as the business as usual (BAU) scenario.

The operation of portable engines and their associated equipment units is regulated by the California Air Resources Board (ARB) and by the 35 local air districts in California. Examples include portable engines used in well drilling, service or work-over rigs, power generation (excluding cogeneration), pumps, compressors, diesel pile-driving hammers, welding, cranes, wood chippers, dredges, equipment necessary for the operation of portable engines and associated equipment, and military tactical support equipment applications. Associated equipment units include confined and unconfined abrasive blasting, concrete batch plants, sand and gravel screening, rock crushing, and unheated pavement recycling and crushing. Permitting requirements for portable engines and their associated equipment units vary among the districts.

In 1995 the California legislature mandated ARB establish a fee-based, voluntary, uniform, and statewide registration program for portable equipment. This statewide program would provide an alternative to portable equipment owners that otherwise were required to obtain an operating permit from each air district in which the engine and/or equipment unit was to operate. In 1997 ARB adopted the PERP regulation, which defines the type of equipment allowed to register in PERP, sets operational limits for registered equipment, establishes registration procedures, and sets registration fees. A portion of the registration fees is distributed to the local air districts which perform inspections and enforce conditions of PERP registered equipment.

ARB adopted the ATCM in 2004 as part of a broad initiative, called the Diesel Risk Reduction Plan, to control diesel particulate emissions from all types of diesel engines and equipment to protect public health. The ATCM prohibits older uncertified portable engines and sets strict engine eligibility for portable engines registering in PERP, limiting districts to permitting only certified engines, and requiring all fleets to meet a series of fleet emission standards.

Because portable equipment may be registered with ARB through PERP, or permitted by local air districts, both ARB and districts implement the ATCM. At the state level, the PERP and ATCM regulations work together, operating as one uniform statewide program. ARB is amending both regulations to harmonize regulatory requirements.

When ARB adopted the ATCM in 2004 the rulemaking relied on several assumptions about the development of new technologies as the basis for establishing stringent fleet emission standards. Staff assumed new emissions control devices, called Verified Diesel Emission Control Strategies (VDECS) would become available as a retrofit to existing engines to meet regulatory requirements in a cost-effective manner. While VDECS were developed in a wide array of applications, such as trucks, VDECS were not manufactured for the portable engine market as envisioned in the regulation. Fleets which otherwise might have purchased VDECS were now faced with needing to replace engines and/or equipment to meet regulatory requirements.

ARB also assumed that Tier 4 technology would become available six months after the Tier 4 non-road certification became effective. Instead the introduction of Tier 4 technologies that meet ATCM requirements has been delayed in the portable equipment sector. As a result, fleets needing to purchase new equipment to meet regulatory requirements were unable to do so quickly enough to meet ATCM requirements. These issues are discussed further in the Statement of the Need for the Portable Regulatory Amendments section of this document.

The result of these factors is that portable fleets currently operate around 10,000 registered Tier 1 and Tier 2 engines, which represents about 38% of the total statewide inventory. Under the current ATCM these engines must be retrofit or replaced with Tier 4 engines by December 31, 2016 in order to meet the existing 2017 ATCM fleet average standards. These engines cannot be retrofitted because VDECS are not being sold for portable applications. Portable equipment consists of complex, expensive machines intended to be operated for decades. The cost to replace these engines within one year is prohibitively high not only because of the number of equipment required to be replaced, but also because the supply of compliant engines is limited, and as a result the cost of portable equipment with a Tier 4 compliant engine is twice that of a lower tier, higher emitting engine which is not compliant with ATCM requirements. ARB projects that only 10% of regulated fleets would be able to meet 2020 emissions standards in the current ATCM.

Statement of the Need of the Portable Regulatory Amendments

a) Goal of the Portable Regulatory Amendments

The goal of the Portable Equipment Registration Program and ATCM is to provide diesel particulate matter (PM) emissions reductions to protect public health. Because the rule assumed emissions control technologies would materialize more quickly than they actually did, most regulated fleets can no longer afford to comply with the regulations as fleet turn over would be required to occur in an expedited timeframe. The goal of the Portable Regulatory Amendments is to ensure those reductions can be achieved, by reducing

compliance costs so that fleets can afford to comply. To accomplish this goal the Portable Regulatory Amendments:

- Maintain a uniform statewide registration program for portable equipment,
- Simplify fleet emission requirements for small fleets,
- Improve enforceability of the fleet emission requirements,
- Recognize and reward fleet owners that made early investments to comply with the 2017 ATCM fleet requirements, and
- Provide incentives, where possible, for early compliance.

b) Statement of Need for the Portable Regulatory Amendments

A brief discussion outlining the need for the Portable Regulatory Amendments is discussed here, while a more extensive description will be presented in the Initial Statement of Reasons.

The Portable Regulatory Amendments address unanticipated high compliance costs required to meet 2017 and 2020 emissions standards caused by the lack of available retrofit technologies and the delay in manufacture of Tier 4 engines in the portable equipment sector.

In the 2004 Portable Engine ATCM Initial Statement of Reasons ARB relied on VDECS becoming available for portable engines to meet the ATCM standards in 2017.¹ VDECS were to provide a cost-effective emissions control method for older engines to meet regulatory requirements. However, the market for VDECS did not materialize in the portable equipment sector. VDECS manufacturers found diesel particulate filters difficult to verify and manufacture for the portable sector due to: 1) the large number of different applications (chippers, generators, pumps, compressors, crushers, etc.); 2) the number of different engine manufacturers and models; and 3) the varying duty cycles of each application. To this day, only 7 of 30,000 registered engines in PERP have been retrofitted with emission control devices, and retrofit technologies are not available on the market for nearly all portable applications.

Portable equipment includes expensive machines meant to be operated for decades after purchase. The current ATCM assumes older machines could be repowered with compliant engines to meet regulatory requirements. The idea behind repowering was that an older tier engine would be simply removed from its existing chassis and a newer tiered engine would be placed in its existing configuration within the equipment unit package. Unfortunately, repowering existing equipment with Tier 4 technology is not an option because Tier 4 engines are much larger in size per horsepower than previous tier engines. This size difference of Tier 4 engines was not considered in 2004 since the compliant engine technology had not yet been developed. Given that the Tier 4 engines do not fit in the equipment, repowering is technologically and economically infeasible.

¹<https://www.arb.ca.gov/regact/porteng/isor.pdf>

The ATCM assumed that fleets would comply in part by purchasing compliant equipment. Staff anticipated the first Tier 4 engines would be available on June 30, 2011, six months after the interim Tier 4 certification standard became effective for 175 and greater horsepower engines. During this six month period, the previous tier engines would continue to be eligible for initial registration in PERP but on July 1, 2011 only Tier 4 engines (and flex engines described further below) would be eligible. In reality, the availability of Tier 4 engines was delayed by at least a year after each Tier 4 certification went into effect. Moreover, equipment manufacturers also experienced delays receiving the test engines and once received found the engines to be larger than previous engine generations. The larger engines forced redesign of the equipment chassis to accommodate the larger Tier 4 footprint, which caused further delay in the availability of compliant equipment to the market, and led to doubling of the cost of new equipment with Tier 4 compliant engines. As a result, ARB extended the six-month eligibility of the previous tier engines to 18 months after each subsequent Tier 4 certification went into effect.

Tier 4 certification standards contain provisions which allow engine manufacturers to continue manufacturing a certain amount of engines to the previous tier after a new tier becomes effective. The engines produced under these provisions are known as flex engines. In recognizing the flex provisions, the ATCM allows for flex engines to be eligible for initial registration in PERP, even though they are not certified to the latest tier. As a result of the flex provisions, a large volume of flex engines was produced and flooded the portable engine market, particularly Tier 3 flex engines. Flex engines have higher emissions than Tier 4, and do not meet ATCM emissions standards. Because many fleets purchased higher emitting Tier 3 flex engines when Tier 4 engines were not available, their fleet emissions do not meet the 2017 fleet standards. In some applications, equipment with Tier 4 engines in the greater than 750 horsepower category is still not available today.

In summary, retrofit technologies and repower options, which represent the cheapest compliance options to meet ATCM requirements are not available. To meet regulatory requirements fleets must purchase new equipment, but in some cases compliant equipment are not yet available in the market, and in most applications compliant equipment became available in the market only recently. The result is only 10% of fleets are likely to meet regulatory requirements by 2020, and requiring fleets to meet 2020 ATCM emissions standards would require capital investments that would not be affordable for most fleets and could drive many fleets to exit the California market.

1. Major Regulation Determination

The Portable Regulatory Amendments are a major regulation because estimated direct cost impacts of the proposal exceed \$50 million within a 12-month period after full implementation. Postponing the turnover of older tiered engines, as proposed in the Portable Regulatory Amendments, would result in direct cost savings to all fleets registered in PERP of over \$350 million and almost \$500 million dollar savings in 2017 and 2020, respectively. These cost savings would be spread over subsequent years to allow fleets more time to replace equipment as explained in the Direct Cost section (D) of this document.

2. Information Used to Compare Economic Impacts of Alternatives

The business as usual scenario requires all fleets to meet a series of fleet average standards to control the amount of diesel particulates they emit. Typically, older tiered engines have higher emissions. Compliance with the January 1, 2017 standards requires fleets to have an average composition of 50% Tier 4 and 50% Tier 2, or Tier 3 engines. Compliance with the January 1, 2020 standards requires an average fleet composition of 90% Tier 4 and 10% Tier 1, 2, or 3 engines. As described above, because retrofit and repower are generally not feasible compliance options, equipment replacement is the only viable option for operators to reduce their fleet average emissions.

The Portable Regulatory Amendments will establish small and large fleets based on each individual fleet's cumulative horsepower. Small fleets will be those with less than or equal to 750 total combined horsepower. They will be required to follow a tier phase-out schedule, where specific tiered engines must be removed from service by certain years. The small fleet tier phase out schedule will provide additional time to meet regulatory requirements and allow for automatic compliance management through the PERP registration process. This approach not only reduces compliance costs for small fleets but also simplifies implementation and enforcement.

Large fleets exceed 750 total combined horsepower and will have the option to follow a tier phase-out schedule, or comply with a set of fleet average standards. Proposed fleet average standards would require an average fleet composition of 90% Tier 4 and 10% Tier 1, 2, or 3 engines by 2027. The delay of requirements from 2017 and 2020 in the current regulation to 2027 with the Portable Regulatory Amendments would spread out compliance costs over an additional seven years, while still achieving emissions and technology goals when the regulation is fully implemented.

Under the BAU (the current regulation), the cost to replace, or repower, a portable engine was expected to range between \$135 through \$220 per horsepower. The \$135 dollars per horsepower was used to represent replacement and installation of the engine, and the \$220 dollars per horsepower was used to represent the cost of replacing an entire unit, such as a generator set. These assumptions were updated for this analysis. The new projected equipment replacement cost used to characterize the Portable Regulatory Amendments is now split into two horsepower categories because data analysis suggested a significant difference in costs between the two horsepower ranges. For engines in the 50 to 175 horsepower range the modeled cost is now between \$100 and \$450 per horsepower. For engines greater than 175 horsepower the modeled cost for engines is now between \$100 and

\$300 per horsepower. These cost model inputs are discussed in further detail in the Direct Cost section (D) of this document.

3. Public Outreach and Input

The Portable Regulatory Amendments have been developed through a robust public process involving government and industry stakeholders. ARB solicited participation from CAPCOA (California Air Pollution Control Officers Association), which is an association of air pollution control officers from all 35 local air quality agencies located throughout California. To support the development of amendments, CAPCOA formed a subcommittee of seven CAPCOA member districts which actively participated in the development process. ARB also participated in separate meetings with the California Department of Transportation (CalTrans) which has a large fleet of portable engines registered in PERP and was concerned about meeting the 2017 fleet requirements.

ARB conducted eight public workshops on the Portable Regulatory Amendments. The workshops included affected industry stakeholders, members of the CAPCOA subcommittee, and the public. The workshops were held throughout the state on March 3, March 8, March 10, June 30, September 13, September 15, September 20, and November 10, 2016. Workshops were webcast to encourage participation by stakeholders who could not attend in person. Following each workshop, and throughout the regulatory development process, ARB received input from and worked with stakeholders on a variety of changes in the Portable Regulatory Amendments. Announcements and materials related to the workshops were publically posted on the ARB website² and distributed through a list serve³ to over 14,000 recipients.

At the first series of workshops in March, ARB invited the public to join a workgroup of interested stakeholders that would help shape the amendments. The resulting workgroup consisted of 48 industry representatives and CAPCOA subcommittee members. ARB held five formal workgroup meetings and many smaller meetings at the request of individual workgroup members. The Portable Regulatory Amendments, including alternatives, were directly shaped by stakeholder comments and suggestions.

4. Description of the Portable Regulatory Amendments

The Portable Regulatory Amendments establish a tier phase-out schedule for small and large fleets, as shown in Table 1, and establish complete turnover to Tier 4 equipment by 2030.

² <https://www.arb.ca.gov/portable/perpact/portable-activity.htm>

³ https://www.arb.ca.gov/listserv/listserv_ind.php?listname=portable

Table 1: Proposed Tier Phase-Out Schedule

Engine Certification	Engines rated 50 to 750 bhp		Engines rated >750 bhp
	Large Fleet	Small Fleet	
Tier 1	1/1/2020	1/1/2020	1/1/2022
Tier 2	1/1/2023	1/1/2025	1/1/2027
Tier 3 built prior to 1/1/2009	1/1/2026	1/1/2028	NA
Tier 3 built on or after 1/1/2009	1/1/2028	1/1/2030	NA
Flexibility engines (Tier 1,2, and 3)	December 31 of the year 18 years after the date of manufacture		

Large fleets will also have the option of meeting fleet average emissions standards instead of tier phase-out requirements. Proposed fleet average emissions standards are shown in Table 2, and can be compared to current fleet average requirements in Table 3.

Table 2: Proposed Fleet Average Option for Large Fleets

Proposed Compliance Date	Proposed Fleet PM Standard (g/bhp-hr)
1/1/2020	0.10
1/1/2023	0.06
1/1/2027	0.03

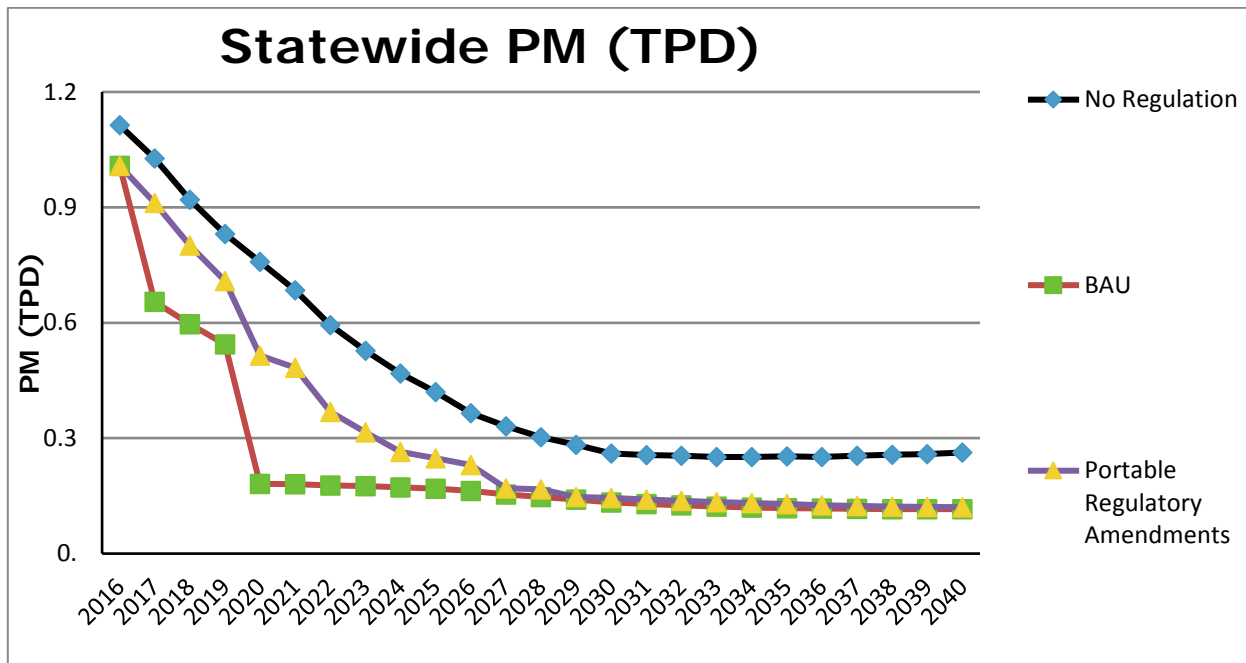
Table 3: Existing Fleet Average Standards for All Fleets

Fleet Standard Compliance Date	Engines <175 hp (g/bhp-hr)	Engines 175-750 hp (g/bhp-hr)	Engines >750 hp (g/bhp-hr)
1/1/2013	0.30	0.15	0.25
1/1/2017	0.18	0.08	0.08
1/1/2020	0.04	0.02	0.02

B. Non-Monetary Impacts

The proposed Portable Regulatory Amendments provide additional time for fleets to make the necessary investments to achieve compliance and therefore ensures the emissions reductions envisioned by the regulation will be achieved. Figures 1 and 2 show diesel particulate matter and oxides of nitrogen (NOx) emissions, from portable equipment, under three scenarios: no regulation in place (no regulation), the current regulation (BAU), and with the Portable Regulatory Amendments.

Figure 1: Statewide PM TPD vs. Year

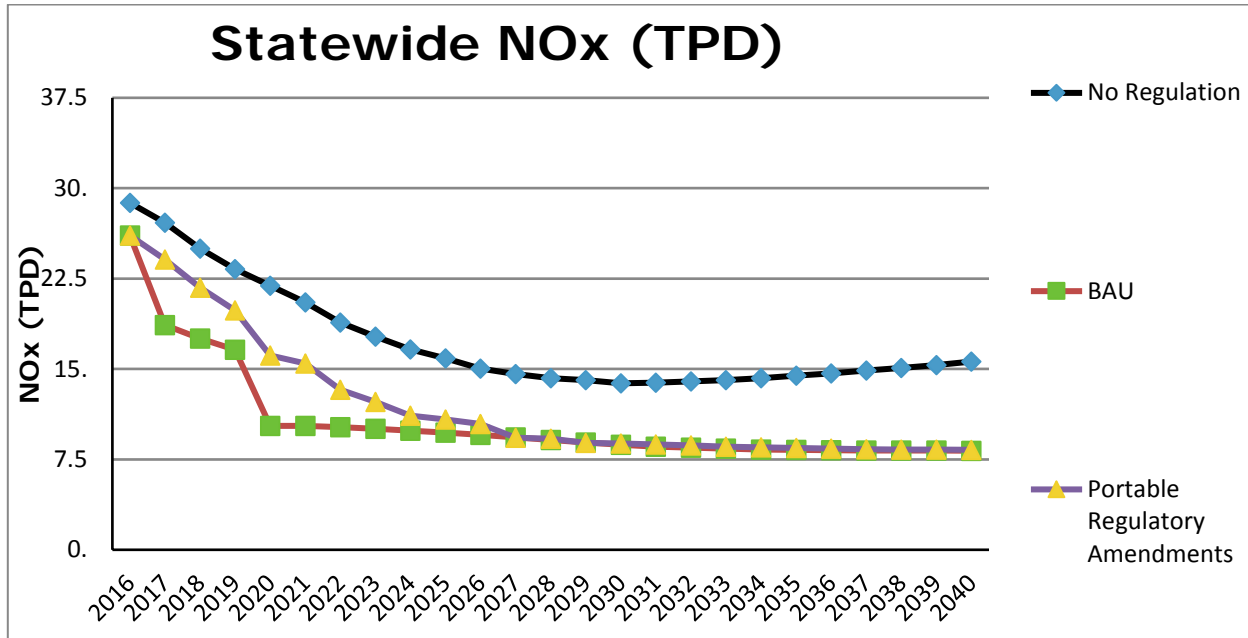


Results show the Portable Regulatory Amendments would continue to provide substantial emissions reductions that would not be achieved if there was no regulation, and that the emissions reductions envisioned by the current regulation will ultimately be achieved when the Portable Regulatory Amendments are fully implemented by 2030. At all times the proposed amendments result in lower emissions from today's levels, and lower emissions from projected future emissions levels in the no regulation scenario. As a result, the proposed amendments do not involve new significant environmental effects or lead to a substantial increase in the severity of previously identified effects and so there is no adverse impact to air quality associated with the amendments.

Both figures show the current business as usual scenario would in theory provide more emissions reductions, more quickly, than under the Portable Regulatory Amendments. For example, the current regulation was forecast to provide an additional 0.33 tons per day (tpd) of PM and 5.8 tpd of NOx statewide in 2020. In 2023, a key attainment year for California, the current regulation was forecast to provide an additional 0.15 tpd of PM and 2.5 tpd of NOx compared to the proposed amendments. However, the current regulation, for the reasons discussed above, is not technologically feasible. Therefore these

additional reductions cannot be achieved. The Portable Regulatory Amendments provide additional time necessary to upgrade equipment, which ensures long-term emissions reductions are achieved.

Figure 2: Statewide NOx TPD vs. Year



C. Benefits:

The Portable Regulatory Amendments benefit public health by reducing toxic diesel particulate matter and smog forming NOx emissions and by improving enforceability of regulatory requirements, and benefit regulated businesses by spreading out compliance costs and rewarding fleets that were able to make the investments necessary to meet current regulatory requirements.

1. Benefits to Individuals

There are no direct benefits to individuals as a result of the Portable Regulatory Amendments. Any indirect or induced impacts on individuals will be discussed further in the Macroeconomic Impact section.

2. Benefits to Typical Businesses and Small Businesses

The Portable Regulatory Amendments directly benefit a wide-range of businesses that vary in size, revenue, and type of equipment such as rental companies, construction businesses, landscaping companies, and government agencies. For example, landscaping companies register portable engines that power wood processing equipment such as chippers and grinders. Construction companies register engines that power generators, compressors, pumps, pavement grinders, and conveyors. PERP registered engines that power compressors, generators, chippers, pumps are also owned by various government agencies and municipalities including county, city, state and federal

departments. Some of these agencies include local sanitation departments, water districts, state prisons, universities, the United States Military and many more. The Portable Regulatory Amendments provide economic relief to all regulated fleets by spreading out costs and providing the time to finance fleet upgrades to meet regulatory requirements.

78% of all portable fleets are small fleets as designed in the current regulation, but these fleets represent only about 10% of total horsepower and emissions from all PERP equipment. The Portable Regulatory Amendments provide these 3,000 small fleets additional time to meet regulatory requirements, and the tier phase-out requirements in the Portable Regulatory Amendments greatly simplify fleet management and therefore reduce compliance costs for implementation.

D. Direct Costs

This section begins with the identification of the entities that are directly affected by the Portable Regulatory Amendments. Next, the methodology for estimating direct cost is outlined, including a discussion of the underlying assumptions.

1. Direct Costs on Individuals

There are no direct costs to individuals as a result of the Portable Regulatory Amendments. Any indirect or induced impacts on individuals will be discussed further in the Macroeconomic Impact section.

2. Direct Costs on Businesses and Small Businesses

Direct costs to businesses are calculated on a fleet by fleet basis, and reflect the sum of three factors: the cost of replacement engines, the cost of equipment registration, and the cost of diesel exhaust fluid (DEF) which is a new expenditure required for Tier 4 final engines. The primary direct cost and cost-savings to businesses is expenditures for engines and equipment. Under the Portable Regulatory Amendments, while fleets see an increase in registration fees, this increase is more than offset by cost reductions caused by the compliance deadline extension and reduction in DEF usage.

The engine and equipment cost changes for businesses are calculated by projecting annual fleet engine purchases for the Portable Regulatory Amendments and taking the difference of those expenditures with the engine expenditures anticipated in the BAU. These expenditures are estimated using a fleet turnover model which simulates annual engine and equipment purchases. A cost is assigned to each newly purchased engine and a value is assigned to each retired engine. With these values the model calculates the cost of new engine and equipment purchases for each fleet in each calendar year. Registration fees and other miscellaneous costs are also added.

a. Inputs

The inputs to the direct cost estimation are outlined in the following section.

i. Equipment Cost

Equipment replacement represents the vast majority of costs of this regulation. The equipment cost is the dollar value of a portable engine and its equipment package sold in the open market for engines of various tier, horsepower, age, and equipment type. During the Portable Regulatory Amendments process, ARB collected data on recently sold, or listed for sale, new and used portable equipment using cost data for equipment provided by stakeholders, as well as a variety of online sources. In total, more than 230 equipment units of various engine tiers, horsepower, and age, representing generators, compressors, and pumps were used to develop a cost curve. The cost curve was then used in ARB's equipment replacement model to calculate equipment replacement cost on a per unit basis by taking the cost of newly purchased equipment required and subtracting it from the existing equipment's resale value.

ii. Fleet Compliance Path Selection

To determine which compliance path large fleets would choose (either the tier phase-out, or fleet averaging), individual fleets were compared on the characteristics of the equipment in their fleet. Fleets with one or more engines at least twelve years old with a relatively low fleet average are predicted to follow the fleet average schedule. A low fleet average would already put those fleets on track to comply with the first fleet average standard in 2020 while being able to retain an older, potentially specialized, piece of equipment that cannot be replaced due to technological or economic constraints.

ARB envisioned that the large fleets with relatively high fleet average emissions would be most likely to follow the tier phase-out schedule as the compliance dates are later for tier phase-out compared with the fleet average, as shown in Tables 1 and 2. Thus large fleets may extend the life of their equipment while staying compliant, especially if their fleet has a high proportion of Tier 3 engines, which are certified to a higher PM emission standard than the proposed fleet average compliance standard in 2020. The tier phase-out schedule allows these Tier 3 engines to be operated in California until 2026, or 2028, depending on the year of engine manufacture.

ARB analyzed each fleet and categorized them by compliance path. The analysis assumes that about 67% of large fleets will follow the tier phase-out schedule and 33% of large fleets will follow the fleet average schedule.

iii. Fleet Purchasing Habits

ARB assumes each fleet will keep the average age of their equipment constant across all years. If a fleet must remove and replace equipment to become compliant with an upcoming fleet standard, the fleet will likely remove from service, or sell, the oldest piece of equipment and replace it with a newer engine of equal horsepower and equipment type. It is important to note the tier of the engine is strongly correlated to the age of the engine, so by removing the oldest engine in a fleet, they are, in most cases, also removing the highest emitting engine in that fleet.

iv. Fleet Decision-making Process

ARB assumes that fleets will maintain a constant total horsepower for the life of the Portable Regulatory Amendments through replacement instead of changing use of engines or shrinking or increasing fleet size. These assumptions are consistent with the eleven years of PERP registration data which contains detailed information on close to 4,000 fleets. These assumptions are further consistent with examples of fleet decision-making processes in response to the current fleet standards that became effective in 2013 that appear to follow this pattern.

v. Direct Cost Estimation Results

The inputs discussed above were programmed into an equipment turnover simulation model designed by ARB's emissions modeling team. The model predicts when engines would be replaced by newer engines for a fleet to become compliant with a given compliance scenario. In this analysis two simulations were run: the BAU scenario, and the Portable Regulatory Amendments. All figures below are outputs of the equipment turnover simulation model.

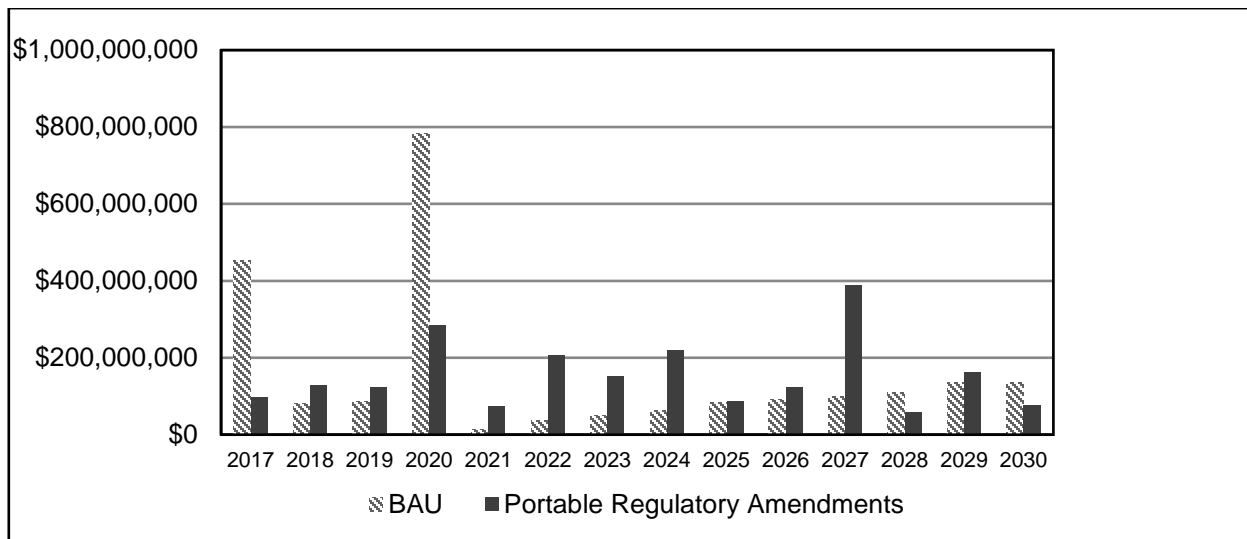
To illustrate the change in costs for equipment owners, the average annual equipment cost is calculated over the life of the regulation and compared with the BAU. The average annual cost to comply with the regulations in the BAU is \$233,207,054 from today until the final compliance date (four years). The average annual cost for the fleet average is \$26,463,548, and \$26,748,061 for the tier phase-out from today until the final compliance date (fourteen years). Assuming 67% use the phase-out option, and 33% use the fleet average, the average annual equipment cost savings over the life of each regulatory scenario for all 3,800 fleets resulting from the Portable Regulatory Amendments is a \$206 million dollars per year, as shown in Equation 1 below.

$$\Delta = [(67\%) * 26,748,061 + (33\%) * 26,463,548] - 233,207,054$$

$$= - \frac{\$206,552,882}{year} \quad \text{Eq. 1}$$

Figure 3 shows the estimated change in annual equipment replacement cost under the BAU scenario with a final compliance date of January 1, 2020, and under the Portable Regulatory Amendments with a final compliance date of January 1, 2030. Results demonstrate the Portable Regulatory Amendments spread out regulatory costs over a 14-year period, rather than front-loading costs in the first three years as under the BAU scenario. As estimated, the Portable Regulatory Amendments will reduce the cost of compliance by 50 percent and will spread that cost over a longer time frame.

Figure 3: Annual Equipment Replacement Cost for 3 Scenarios



The figure above shows that the Portable Regulatory Amendments in 2017 will result in direct cost savings to the regulated businesses of \$350M (the cost of Portable Regulatory Amendments subtracted from the cost of BAU for 2017). In 2020, the Portable Regulatory Amendments will result in cost savings of \$480M (the cost of Portable Regulatory Amendments subtracted from the cost of BAU for 2020). 2027 is the year with the highest cost associated with the last fleet average standard becoming effective where the direct cost to the regulated businesses is projected to be \$390M.

vi. Registration Costs

The Portable Regulatory Amendments include a registration fee increase that will impose a direct cost to businesses that register engines in PERP. The proposed fees will also result in additional revenue to all 35 air districts who receive a portion of the registration fees. The increased cost to the regulated industry is estimated by multiplying the total permit fee increase (which is incurred every three years) by the estimated numbers of equipment for both initial and renewal registrations. Table 4 outlines the current and proposed registration fees. The fiscal impacts for state and local air districts are described in more detail in the Fiscal Impact section.

Table 4: Changes to Registration Costs

Initial Registration (3 year registration)			
Cost Type	PERP Regulation Cost	PERP Amendment Cost	Change in Cost
Total for New Registration	\$620	\$805	\$185
Registration Renewal (3 year registration)			
Cost Type	PERP Regulation Cost	PERP Amendment Cost	Change in Cost
Total for Renewal	\$575	\$740	\$165

The equipment turnover model forecasts the number of engines that will be newly registered or renewed each year as a result of the Portable Regulatory Amendments. The cost to industry for initial registrations was calculated by multiplying the initial registration fee by the estimated number of initial registration applications processed in a given year. The cost to industry for renewals was calculated by multiplying the renewal cost by the number of registration renewals projected in a given year. The following equation was used to calculate the number of renewals, in any given year:

$$R = \frac{TNE - IR}{3} \quad \text{Eq. 2}$$

Where R represents the total number of renewals in a given year, TNE represents the total number of engines in PERP, which the model holds constant, and IR represents the number of initial registrations in a given year as estimated by the equipment turnover model. To determine the number of renewals each year, the annual initial registrations (IR) are subtracted from TNE and divided by three to account for the three-year registration cycle. It is important to calculate the number of initial registrations and renewals since their fees differ from one another, which ultimately will affect the annual cost to industry.

The equipment turnover simulation model predicts the initial PERP registration cost to peak in 2024 at about \$10,668,074 at the increased fees rate versus about \$4,874,768 at the current fees rate. 2024 is predicted to be a peak year for registration fees due to an assumed engine life between 8 to 10 years. The projected number of initial registrations and renewals is presented in Table 5 below.

Table 5: Projected Number of Renewals and Initial Registrations by Year

Proposed Regulatory Amendments		
Year	Number of Newly Registered Engines	Renewals
2017	3,197	8,954
2018	5,210	8,283
2019	3,633	8,809
2020	7,656	7,468
2021	3,218	8,947
2022	3,688	8,791
2023	3,627	8,811
2024	5,827	8,078
2025	3,137	8,974
2026	2,385	9,225
2027	5,731	8,110
2028	1,921	9,380
2029	5,180	8,293
2030	1,672	9,463

Aside from registration and renewal costs, additional registration actions costs will increase by 46%. Additional registration actions include document replacement requests, sticker replacement requests, document correction requests, and other requests whose frequency will not be affected by the Portable Regulatory Amendments. The resulting cost of additional registration actions is estimated to increase by \$223,953 in any given year after the amendments become adopted. This number was calculated by taking 2014 and 2015 data for additional registration actions costs, \$588,800, and multiplying it by the proposed 38% fee increase in the Portable Regulatory Amendments.

vi. Diesel Exhaust Fluid (DEF) Costs

The Portable Regulatory Amendments are anticipated to result in cost savings due to the reduced need for Diesel Exhaust Fluid (DEF) as a result of the delayed equipment turnover requirements. Currently, all engine manufacturers have opted to use Selective Catalytic Reduction (SCR) which requires DEF to be sprayed on a catalyst to break apart NOx into inert nitrogen and water. DEF is a urea-water mixture that is consumed by the SCR at a rate proportional to the consumption rate of diesel. This DEF to diesel consumption ratio is called the dosing rate. Only Tier 4 engines use DEF. In order to

calculate how much DEF will be consumed in any given year under the BAU scenario, we calculated the amount of diesel fuel consumed yearly by Tier 4 engines in Equation 4 below. The equipment turnover model projects the number of Tier 4 engines operating in California for each year starting in 2016 and ending in 2030 under the BAU scenario and under the Portable Regulatory Amendments scenario.

BAU: To become compliant with the 2020 fleet standards under the BAU scenario, a typical fleet would consist of about 90% Tier 4 (interim or final) engines and about 10% Tier 1, Tier 2, or Tier 3 engines. The equipment turnover model projected the amount of Tier 4 engines (and their horsepower) that would be registered in PERP under the BAU from 2016 through 2030.

Portable Regulatory Amendments: The equipment turnover model was used to estimate the number of Tier 4 engines registered in PERP for compliance with both the proposed fleet average schedule and the proposed tier phase-out schedule under the Portable Regulatory Amendments scenario.

Given the yearly number of Tier 4 engines and their associated horsepower required for compliance for both scenarios, the amount of DEF fluid for these Tier 4 engines depends on the dosing rate. The top three engine manufacturers' websites^{4,5} show an average dosing rate between 1-5%. To estimate the highest cost impact, 5% was used as the dosing rate. The annual DEF consumption rate is calculated by multiplying the annual fuel consumption rate with the 5% dosing rate.

The cost of DEF in \$/gallon was used to calculate the annual cost to all fleets as a result of the Proposed Regulatory Amendments. Most equipment manufacturers purchase DEF in 55 gallon drums, for which the cost was found online⁶ to be at about \$2.88/gallon. It was assumed that this cost remained constant (in 2015\$) for the timeframe of this analysis.

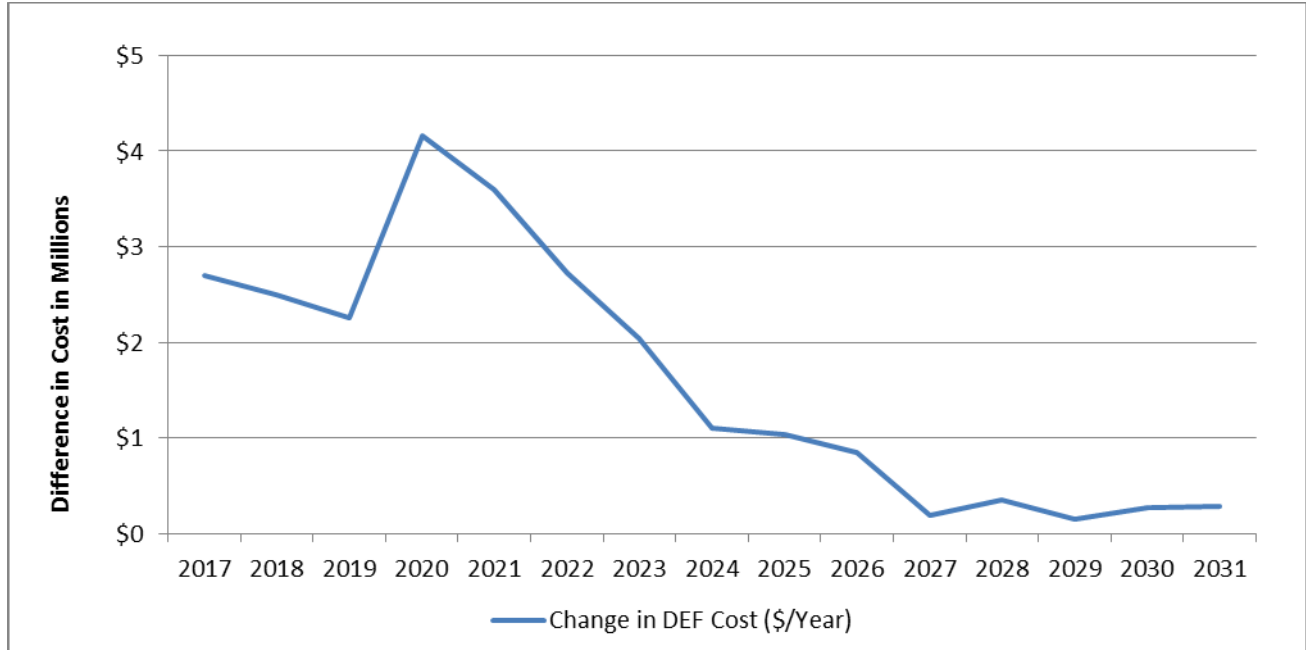
Figure 3 shows that slower engine turnover under the Portable Regulatory Amendments results in fewer Tier 4 engines operating in California between 2017 and 2027. Because only Tier 4 engines use DEF, this will result in lower DEF costs until fleets purchase Tier 4 equipment. In 2028, fleets following the tier phase-out schedule under the Portable Regulatory Amendments will have more Tier 4 equipment in service than those under the BAU scenario. This change in annual DEF costs between the BAU scenario and the Portable Regulatory Amendments scenario is shown in Figure 4 below. The figure shows that relative to the BAU, the Portable Regulatory Amendments result in cumulative cost savings of \$4 million spread among all regulated businesses in 2020. This relative savings subsequently subsides until 2027 when the Portable Regulatory Amendments have the same DEF costs as the BAU. This cost savings represents about \$0.3 million spread among all small fleets (8% of engine horsepower registered in PERP fall under the small fleet definition) and \$3.7 million spread among all large fleets (92% of engine horsepower registered in PERP fall under the large fleet definition).

⁴<https://www.cdc.gov/niosh/mining/UserFiles/workshops/dieselaerosols2012/NIOSHMVS2012Tier4TechnologyReview.pdf>

⁵https://www.deere.com/common/docs/products/equipment/industrial_and_agricultural_engines/interim_tier_4_stage_3_b/brochure/it4_brochure.pdf

⁶<https://www.google.com/search?q=def+55+gallon+drum&ie=utf-8&oe=utf-8#q=def+55+gallon+drum&tbm=shop>

Figure 4: Difference in DEF Costs: BAU vs. Portable Regulatory Amendments



vii. Total Costs

The total cost to industry of the Portable Regulatory Amendments each year is the sum of equipment purchase costs, DEF consumption costs for Tier 4 equipment, and registration costs. These costs can be summed over the life of the regulation to calculate total costs.

The total cost of the business as usual scenario is \$997,724,130 over the remaining life of that regulation – a four-year period from today until 2020. The proposed amendments would reduce the total cost of the regulation by half to \$497,042,354, and spread these costs out over the 14 year duration of amendments.

For a typical small fleet, the proposed regulatory amendments will reduce annual incremental equipment costs over the four year period between now and 2020 from \$20,919 per year to \$2,380 per year.

D. Economic Impacts

1. Methods for determining economic impacts

Regional Economic Models, Inc. (REMI), Policy Insight Plus Version 1.7.2 is used to estimate the macroeconomic economic impacts of the Portable Regulatory Amendments on the California economy. REMI is a structural macro-economic forecasting and policy analysis model that integrates input-output, computable general equilibrium, econometric and economic geography methodologies.

REMI provides year-by-year estimates of the total impacts of the Portable Engine Amendments, pursuant to the requirements of SB 617 and the California Department of Finance.⁷ ARB uses the REMI single-region, 160-sector model with the model Reference case adjusted to reflect the Department of Finance Conforming Forecast dated December 2015.

The Portable Regulatory Amendments are simulated in REMI by adjusting production costs for covered sectors to reflect the change in purchases of portable equipment, the increase in registration costs (adjusted for increased program costs), and the change in costs due to the maintenance of the portable equipment. Additionally, the impact of increased registration costs on State and local air district budgets is modeled through changes in REMI's State and local spending variables. The years of analysis are 2018 through 2031; these years are used to simulate the Portable Regulatory Amendments through 12 months post full implementation.

2. Inputs of the assessment

Under the Portable Regulatory Amendments, fleets using portable equipment face delays in the compliance dates for the purchase of more expensive and lower emission equipment. In early years of implementation, the fleet owners face lower equipment costs relative to the BAU scenario. In later years of the analysis, fleets increase turnover as the new compliance dates approach and they will switch to the Tier 4 engines, which results in higher equipment capital and DEF costs.

The analysis begins with the equipment replacement costs as outlined in the cost section previously, and translated into REMI inputs as illustrated in Table 6, and described below:

1. Production Cost Changes:
 - a. Changes in costs for portable equipment are represented as production cost increases or decreases. Relative to equipment purchases under BAU, delayed purchases of equipment as a result of the Portable Regulatory Amendments are represented as decreases in production costs, while purchase requirements are translated in REMI as increases in production costs.
 - b. Changes in costs for DEF for Tier 4 engines are represented as production cost increases or decreases.
 - c. Increases in production costs are included in all years due to increases in new registration and renewal registration costs.
2. Exogenous Final Demand Changes (changes in the demand faced by final product manufacturers as a result of changes in equipment and maintenance costs):
 - a. The manufacturers of portable equipment face changing levels of demand as a result of the delay in the compliance date relative to the BAU.
 - b. The manufacturers of DEF will face changes in demand as a result of altered compliance schedule and introduction of Tier 4 engines due to the Portable Regulatory Amendments.

⁷http://dof.ca.gov/Forecasting/Economics/Major_Regulations/SB_617_Rulemaking_Documents/documents/Order_of_Adoption-1.pdf

3. State spending
 - a. There are anticipated to be increases in State spending in response to the increased registration costs faced by portable engine owners. These fees are outlined in Table 6. A portion of the PERP fee is afforded to the State to process and register portable engines and a portion is afforded to the local air districts to implement and enforce the applicable requirements.
4. Local spending
 - a. There are anticipated to be increases in local spending in response to the increased registration costs faced by portable engine owners. These fees are outlined in Table 6.

The production cost changes for businesses are calculated by projecting fleet engine purchases for the Portable Regulatory Amendments and taking the difference of those expenditures with the engine expenditures in the BAU. The compliance dates for the BAU are in 2017 and 2020 as outlined in Table 3. Given the delayed compliance for engine purchases, businesses will spend less on equipment and DEF in those years. Instead of retiring some engines early as required under the BAU, these businesses will purchase new engines based upon business need. Table 1 outlines the new compliance dates based upon engine year and Tier. As shown in Table 6, affected businesses will increase their engine purchases to comply with the engine requirements.

Table 6: REMI Inputs

			2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Primary Industries	Explanation	REMI Category															
Commercial and industrial machinery & equipment rental and leasing (NAICS 5324)	Equipment costs, DEF, registration	Production Cost (2015M\$)	-169.2	22.4	17.6	-236.8	28.5	80.3	47.7	75.3	1.6	15.2	138.2	-23.9	13.8	-27.5	-19.2
Construction (NAICS 23)		Production Cost (2015M\$)	-169.2	22.4	17.6	-236.8	28.5	80.3	47.7	75.3	1.6	15.2	138.2	-23.9	13.8	-27.5	-19.2
State Government	Increased fees for ARB	State Spending (2015M\$)	0.6	2.0	1.6	0.4	1.7	1.9	1.9	2.6	1.7	1.5	2.5	1.3	2.2	1.1	1.2
Local Government	Increased fees for Air Districts	Local Spending (2015M\$)	-0.3	1.3	0.9	-0.9	1.0	1.2	1.3	1.9	1.0	0.8	1.8	0.7	1.5	0.4	0.5
Secondary Industries	Explanation	REMI Category															
Agriculture, construction, and mining machinery manufacturing (NAICS 3331)	Equipment sales	Exogenous Final Demand (2015M\$)	-356.7	47.2	37.4	-498.0	61.6	170.4	100.6	156.9	2.0	31.1	289.7	-52.1	26.1	-59.5	-41.8
Petroleum and petroleum products merchant wholesalers (NAICS 4247)	DEF sales	Exogenous Final Demand (2015M\$)	-2.7	-2.5	-2.3	-4.2	-3.6	-2.7	-2.0	-1.1	-1.0	-0.8	-0.2	-0.4	-0.2	-0.3	-0.3

The input values are rounded to the nearest \$100,000.

3. Assumptions and Limitations of the Model

The estimated economic impacts of the Portable Regulatory Amendments are sensitive to assumptions made by ARB in the modeling of the regulatory change. The list below outlines the key assumptions made in estimating the economic impacts for the purposes of modeling the Portable Regulatory Amendments in REMI.

1. The primary impacted industry is broken into the following categories using the North American Industry Classification System (NAICS):
 - a. NAICS 5324 (Commercial and industrial machinery and equipment rental and leasing): This NAICS is used for the rental companies that offer portable equipment for rental by individuals and businesses. For this analysis, this portion of the industry is assumed to represent approximately 47% of the total equipment.
 - b. NAICS 23 (Construction): The non-governmental and non-rental companies are grouped in the construction category. For this analysis, construction is assumed to represent approximately 47% of the total equipment.
 - b. State Government: Less than 1% of currently registered fleets in the PERP database are State government entities.
 - c. Local Government: Less than 5% of the currently registered fleets in the PERP database are local government entities.
 - c. Federal Government: A portion of the currently registered fleets in the PERP database are federal government entities, such as military bases. These costs are not entered into the model as an increase in spending or production cost because the spending originates from outside of California. Portable equipment owned by the federal government represents approximately less than 0.5% of the total equipment.
2. The secondary industries, that manufacture PERP equipment or sell DEF, are broken down into:
 - a. NAICS 3331 (Agriculture, construction, and mining machinery manufacturing): As fleet specific NAICS code information was not available, for simplicity it is assumed that all of the exogenous final demand is associated with the NAICS code representing agriculture, construction, and mining machinery manufacturing.
 - b. NAICS 4247 (Petroleum and petroleum products merchant wholesalers): This NAICS represents DEF sales relative to the BAU.
3. The fleet turnover is estimated by keeping the average age of each fleet stable using data from the PERP database for the years 2003 to 2016 as the basis for the estimation.
4. All equipment purchased is paid in full at time of the purchase and no equipment is financed over time. While stakeholders identified varied financing depending upon the equipment type and business size, no financing is modeled, thus simplifying the analysis.
5. Equipment purchases by State and local government are not modeled in REMI. State and local government represents less than 6% of portable equipment in California and any in equipment purchases will be offset by increase in fees.

4. Results of the Assessment

a) California Employment Impacts

As modeled, the Portable Regulatory Amendments would have a small impact on employment growth relative to the BAU. Fleets are estimated to spend less on equipment in early years and use the increased profit as expenditures on labor and other capital - growing employment in California. Table 7 shows growth in early years when the Portable Regulatory Amendments delay equipment purchase requirements compared with the BAU. The REMI model responds to decreases in production costs by increasing output and thus increasing both capital and labor purchases. The delayed purchase requirements will thus increase employment for businesses that use portable equipment, while decreasing employment for the engine manufacturers that face a lowered demand. Though some of the purchase requirements are delayed only until 2020 for most fleets (those using the fleet averaging option may not have to purchase equipment until later years), the growth in employment in early years offsets the slowing of growth in 2020 and 2021, yielding a slight decline not beginning until 2022. However this slowing of growth represents as most less than 0.01% of California employment.

Employment impacts are predominantly concentrated in the portable equipment industries, with large increased growth in the commercial and industrial machinery and equipment rental and leasing companies and construction in response to decreased costs to operate their businesses. The growth of employment follows the delayed compliance dates, and decreases when the highest changes in expenditures result from the new compliance dates. Those industries see the largest positive impacts in 2017 and 2020 at 0.19% and 0.09% respectively. The decrease in growth is largest in 2027 at -0.09% and -0.05% respectively, only lasting through 2029. The portable engine manufacturers face the largest impacts in 2017 and 2020 when the demand for their products is decreased. The impact is a 4.8% decline in 2017 and 3.1% decrease in growth in 2020. However, the increased demand for secondary industries in other years results in positive employment growth in most years.

Table 7: Change in Employment Growth

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Change (%)	0.02%	0.00%	0.00%	0.03%	0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
Change in Jobs	5,500	900	425	6,925	1,300	-850	-1100	-2175	-875	-950	-3,400	-700	-900	75	250

The value in each year is interpreted as the reference year value less the BAU value in that same year. The change in jobs is rounded to the nearest 25.

b) California Business

The Portable Regulatory Amendments are anticipated to have a small impact on the growth in final product output, referred here as output growth, relative to the BAU. As modeled, fleets would spend less on portable equipment in early years. Facing lower input costs, relative to the BAU, assuming no change in demand, these companies would, in theory, increase their output. Businesses that use portable equipment would be able to provide more services using the portable equipment given that the cost of using the equipment is cheaper. Table 7 shows growth in output for primary industries in early years when the Portable Engine Amendments delay equipment purchase requirements, and a slowing in the growth of output in beginning in 2022 compared with the BAU. Though the purchase requirements are delayed to 2020 for most fleets (those using the fleet averaging option may not have to purchase equipment until later years), the growth in output in early years offsets the slowing of growth in 2020 and 2021, yielding a slight decline beginning in 2022 for construction and 2024 for rental companies. These results suggest that the construction sector is more responsive to changes in production costs than the rental industry. This output growth follows a similar pattern to that of the employment values shown in Table 7, which follow the same pattern as construction and are likely driven by the increased output growth in early years, and slight declines in growth in later years.

For manufacturers of portable engines, the largest declines in output growth are anticipated in 2017 and 2020, the years when under the previous regulation increased purchases of Tier 4 engines would have been required, leading to an increase in demand in quantity and quality of portable engines. This decline occurs in later years when previous equipment would have been retired, but were replaced later due to the delay and thus still have useful life. However, these industries face sustained growth in most of the interim years as a result of the spread of equipment purchases to later compliance dates, which lead to increased demand for the manufacturers. The impacts shown in Table 8 reflect the growth in output, categorized by industry, for businesses located in California. According to the REMI modeling results approximately 90% of the portable equipment manufacturing sector is located outside of California. Given the low concentration of manufacturing

in California, the negative output effects are masked by the cost-savings to the portable equipment users that face lower input costs and as a result increase both their capital and labor purchases.

Table 8: Change in Output Growth Relative to the BAU

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Primary Industries																
Commercial & industrial machinery and equipment rental and leasing (NAICS 5324)	Change (%)	0.1%	0.1%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	-0.1%	-0.1%	0.0%	0.0%
	Change (2015M\$)	\$5.9	\$3.5	\$2.2	\$9.9	\$6.3	\$2.4	\$0.4	-\$2.1	-\$1.5	-\$1.7	-\$5.9	-\$3.6	-\$3.3	-\$1.7	-\$0.8
Construction (NAICS 23)	Change (%)	0.1%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	-0.1%	0.0%	0.0%	0.0%	0.0%
	Change (2015M\$)	\$129.8	\$53.8	\$19.3	\$174.2	\$70.8	-\$16.5	-\$47.1	-\$83.8	-\$55.5	-\$47.9	-\$118.5	-\$52.9	-\$40.4	-\$4.7	\$11.1
Secondary Industries																
Agriculture, construction, and mining machinery manufacturing (NAICS 3331)	Change (%)	-4.8%	0.6%	0.5%	-6.3%	0.8%	2.1%	1.2%	1.8%	0.0%	0.3%	3.1%	-0.5%	0.3%	-0.6%	-0.4%
	Change (2015M\$)	-\$36.5	\$4.8	\$3.7	-\$48.6	\$6.0	\$16.3	\$9.5	\$14.9	\$0.1	\$2.9	\$28.0	-\$5.1	\$2.5	-\$5.9	-\$4.1

The value in each year is interpreted as the reference year value less the BAU value in that same year. The values presented above are rounded to the nearest \$100,000. The %ages are rounded to the tenth.

c) Impacts on Investments in California

As modeled, the Portable Regulatory Amendments would produce very small impacts on private business investments in California. There will be reductions in equipment purchases in early years, which will slow the growth in investments in the portable equipment manufacturing sector in early years. In the REMI model estimates, approximately 90% of that portable equipment sector is located outside of California. Impacts on California investment are driven predominantly by companies

that rely on portable equipment and are able to spread their purchases over a longer time frame - potentially leverage funds towards other investments in early years. The REMI modeling results suggest that equipment fleets have additional leverage to make other investments in early years. The availability of investment leverage for these fleets slows in later years when the new compliance dates shift spending back to new capital equipment. Table 9 shows the change in California private investments from 2017 to 2031. The slowed growth in private investment is indiscernible from BAU given the size of California’s \$2.2 trillion economy.⁸

Table 9: Change in Gross Domestic Private Investment Growth

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Change (%)	0.25%	0.09%	0.03%	0.27%	0.09%	-0.03%	-0.07%	-0.12%	-0.07%	-0.05%	-0.14%	-0.06%	-0.04%	0.00%	0.02%
Change (2015M\$)	\$199.8	\$82.8	\$30.7	\$266.6	\$111.6	-\$19.2	-\$65.1	-\$121.2	-\$78.9	-\$68.6	-\$178.0	-\$80.1	-\$62.9	-\$9.3	\$14.1

The value in each year is interpreted as the reference year value less the BAU value in that same year. The values presented above are rounded to the nearest \$100,000.

d) Impacts on Individuals in California

The Portable Regulatory Amendments are estimated to produce a negligible change in personal income growth from 2017 through 2031. Table 10 shows that the greatest annual change in growth of personal income is 0.02% in 2017 and 2020. The Portable Regulatory Amendments are anticipated to increase employment in most sectors in California, with only decreases in 2024 and 2027, as seen in Table 7. The increased employment results in increased growth of personal income. The growth in personal income follows in the same pattern as employment, and the growth in personal income makes a slight decline after 2021 as a result of decreased output in the portable engine sector as seen in Table 8.

⁸ Source: California Department of Finance Gross State Product in CA – Annual from 1963: http://www.dof.ca.gov/Forecasting/Economics/Indicators/Gross_State_Product/

Table 10: Change in Personal Income Growth

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Change (%)	0.02%	0.00%	0.00%	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
Change (2015M\$)	\$328.5	\$99.0	\$60.9	\$465.1	\$162.5	\$7.0	-\$37.4	-\$129.7	-\$63.7	-\$72.2	-\$256.6	-\$89.0	-\$96.9	-\$22.4	\$1.9

The value in each year is interpreted as the reference year value less the BAU value in that same year. The values presented above are rounded to the nearest \$100,000.

e) Impacts on California Gross Domestic Product (GDP)

As presented in Table 9, the Portable Regulatory Amendments are estimated to slightly accelerate the growth of California GDP in the early years. The growth in California GDP increases in most years analyzed, following closely with the California economic indicators described in the previous tables. The estimated increase in GDP growth from 2017 to 2021 is a result of increased employment, personal income, and output growth in the portable equipment sector, along with the indirect and induced benefits resulting from those primary sector impacts. These changes are a result of delayed compliance requirements that result in lower compliance costs in early years for industries that use portable equipment. As a result, these companies increase employment, capital purchases, and output in their industry. Additionally, given lower compliance costs, these businesses are able to better compete with businesses outside of California as compared with the BAU. Given that consumption (which will increase given increased California employment) and output are drivers for GDP, growth is anticipated to follow directly with those results as Table 11 indicates. Overall, the changes in growth of GDP are indiscernible from BAU given the size of California's \$2.2 trillion economy.⁹

Table 11: Change in Gross State Product Growth

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Change (%)	0.02%	0.00%	0.00%	0.03%	0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
Change	\$608.3	\$103.5	\$56.5	\$826.4	\$171.7	-\$82.6	-\$115.9	-\$259.3	-\$100.4	-\$117.2	-\$460.6	-\$96.5	-\$134.2	\$3.4	\$29.5

⁹ Source: California Department of Finance Gross State Product in CA – Annual from 1963:
http://www.dof.ca.gov/Forecasting/Economics/Indicators/Gross_State_Product/

(2015M\$)															
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The value in each year is interpreted as the reference year value less the BAU value in that same year. The values presented above are rounded to the nearest \$100,000.

f) Incentives for Innovation

The Portable Regulatory Amendments are designed to encourage innovation in the manufacturing of cleaner portable engines. Currently, the engine manufacturers are working with portable equipment companies to design Tier 4 engines that will fit on the footprints of more types of equipment. However, more time is needed for research and development for some pieces of equipment, especially specialized equipment that is often the oldest equipment in the fleet. Delaying the compliance date will afford manufacturers the time needed to manufacture additional Tier 4 engines and find additional opportunities for emissions reductions, economies of scale, and efficiencies to lower the cost of Tier 4 engines. Delayed compliance under the Portable Regulatory Amendments will ensure adequate time for innovation to occur.

g) Competitive Advantage or Disadvantage

Based on the direct cost estimation, the Portable Regulatory Amendments would not change the competitiveness of directly regulated entities. Portable engine owners would have additional time to comply with the Tier 4 requirements as compared with the BAU. The Portable Regulatory Amendments will postpone emission related requirements for both permitted and non-permitted engines regardless of permit requirements.

The Portable Regulatory Amendments will postpone the requirements for all businesses that are required to permit their equipment and will thus reduce equipment costs in early years compared to the BAU. Where permitting is required for California-based companies, out of state portable equipment used in California are also required to be permitted, resulting in a comparable increase in costs for both Californian and non-Californian companies. Thus, portable engine owners are not expected to face competitive disadvantages as a result of the Portable Engine Amendments, but instead this industry will face more favorable economic conditions.

h) Creation, or Elimination, of Businesses

Due to the Portable Regulatory Amendments, there is anticipated to be growth in industries using portable equipment that is estimated to increase in the economic indicators described previously which may expand businesses in early years. However, any expansion of the portable equipment sector would likely be minor given that the purchase requirement of Tier 4 engines is not eliminated, but instead delayed. For instance, a business operating a large fleet of portable equipment including a Tier 2 wood-chipper would be required to meet a 2020 compliance date under the BAU. The Portable Regulatory Amendments would give the entity until 2023 (see Table 1) to retire the Tier 2 engine. This would provide them more time to become compliant, but is unlikely to drastically change their business model such that new businesses would be incentivized to enter the market. The manufacturers of portable equipment who face lower demand in early years as a result of delayed compliance may scale back their operations slightly, but may invest in the new Tier 4 technology which yields higher revenues. Though as indicated previously, the REMI model indicates that only about 10% of the agriculture, construction, and mining machinery manufacturing industry is located in California, thus the impact of the decreased demand faced by this industry is largely concentrated outside of California and is not likely to have a significant impact on businesses in California. Given the small impact on the industry, it is unlikely that there will be any creation or elimination of new businesses.

5. Summary and Agency Interpretation of the Results of the Economic Impact Assessment

The Portable Regulatory Amendments ensure the stability of the portable engine industry in California. Facing a shortfall in supply of the necessary engines to comply with the original compliance dates, the lengthened compliance timelines provide manufacturers the necessary time to make investments towards the creation of Tier 4 engines on multiple footprints, and provides fleet operators additional time to invest in newer, compliant equipment.

As modeled, the Portable Regulatory Amendments are unlikely to have significant impacts on the California economy. The estimated cost impacts of the Portable Regulatory Amendments represent a simulation of the potential effect on the directly affected industry that operates portable equipment, though actual fleet choices may vary.

F. Alternatives

In addition to the Portable Regulatory Amendments, ARB also evaluated several alternatives, as is required by the California Code of Regulations (CCR), Title 1, §2003(e). To solicit alternatives from stakeholders, ARB presented a preliminary draft of the Portable Regulatory Amendments at the first series of public workshops on March 3, 8, and 10, 2016. Stakeholders submitted alternative proposals the following month, which ARB considered and incorporated into the current version of the Portable Regulatory Amendments. ARB continued to solicit alternatives at subsequent workshops held in June and September and at the workgroup meetings held in April, May, June, August, and October. Stakeholders responded with input, most of which included minor variations of the current Portable Regulatory Amendments. As a result of the public process, the following are the finalized alternatives:

1. No action.
2. Increase the fleet compliance standards while retaining the same compliance dates.

Alternative 1 assumes there are no changes to the current fleet standards, which would result in no cost savings to the affected businesses. This alternative was suggested by some stakeholders who either were going to be in compliance in 2017, or who did not want the standards to be delayed.

Alternative 2 considers a scenario in which the fleet average standards under the Portable Regulatory Amendments would be higher resulting in less emission reductions and additional cost savings for the affected businesses.

Alternative 1: No Action.

a. Costs and Benefits

This alternative would be costly and technologically difficult to achieve. Alternative 1 would impose no additional costs to the affected businesses beyond what they are currently facing, and would result in no cost savings or delays, relative to the Portable Regulatory Amendments. The scenario would allow the BAU to continue as it was adopted in 2004 given the projected

compliance costs as estimated using equipment turnover simulation model (described in Direct Cost section) with current fleet equipment levels.

b. Economic Impacts

Since Alternative 1 does not impose any additional costs to the affected businesses, there would be no economic impacts relative to the business as usual scenario. Compared to the business as usual scenario, there would be no changes in GDP, personal income, private investment, or other economic indicators. Additionally, because of the lack of availability for equipment with Tier 4 engines in the greater than 750 horsepower category, it is possible that many fleet owners would be unable to obtain the proper equipment that would meet the compliance requirements. This could potentially lead to increases in prices for Tier 4 engines given the limited supply and the stringency of the current ATCM standards. If this were to occur, it is likely that potentially half of all businesses registered in PERP would no longer be sustainable and may have to shut down. Additionally, the emissions reductions previously claimed in the Portable Engine ATCM may not be achieved if the Tier 4 engines are in insufficient supply, thus closing the gap between the Portable Regulatory Amendments and the Alternative as discussed in Section (B).

c. Cost-Effectiveness

Cost-effectiveness is defined as the cost to achieve a ton of emissions reduction. In the case of Alternative 1, it is more costly for businesses on an annual basis while achieving the same cumulative emissions reductions through 2030, though those reductions are achieved earlier. Alternative 1 is a less cost-effective alternative compared to the Portable Regulatory Amendments. It imposes high direct costs to typical businesses subject to the BAU, and indirect costs to individuals seeking services from those businesses. Additionally, the chance of the emissions reductions being achieved in this Alternative is low given the technology constraints. ARB estimates Alternative 1 would cost businesses almost nine times more on average in equipment costs annually to comply relative to the Portable Regulatory Amendments.

d. Reason for Rejection

Alternative 1 imposes an unreasonably high cost to fleets subject to the current rule. It is also unclear, from a technology standpoint, if there are enough Tier 4 engines being produced and sold to meet the demand of the affected businesses in order to stay compliant with the current rule. Fleet owners have indicated that they have been unable to comply given the equipment options provided by manufacturers. Additionally, many businesses have been, and still are, purchasing Tier 3 flex engines as those engines have flooded the portable engine market and are priced at about half the cost of a Tier 4 engine. Because Tier 3 engines have higher emission factors than Tier 4 engines, about half of the businesses that recently invested in them would not be compliant with the 2017 standards under BAU. This would potentially lead to those businesses shutting down. Therefore, the alternative is not preferred over the Portable Regulatory Amendments.

1. Alternative 2: Increase the Fleet Compliance Standards While Retaining the Fleet Compliance Dates.

Alternative 2 would utilize the same tier phase-out dates as the Portable Regulatory Amendments but would use a different set of fleet standards for large fleets opting into the fleet average option. This alternative would not achieve the same level of emission reductions as the Portable Regulatory Amendments, but would further decrease the costs to fleets. The Portable Regulatory Amendments standards are shown in Table 12 below and alternative 2 fleet standards are shown in Table 13:

Table 12: Proposed Fleet Standards

<i>Compliance Date:</i>	<i>Fleet Compliance Standard (g/hp-hr)</i>
1/1/2020	0.10
1/1/2023	0.06
1/1/2027	0.03

Table 13: Alternative 2 Fleet Standards

<i>Compliance Date:</i>	<i>Fleet Compliance Standard (g/hp-hr)</i>
1/1/2020	0.12
1/1/2023	0.09
1/1/2027	0.06

a. Costs and Benefits

Alternative 2 would provide direct cost savings to the businesses choosing to follow the fleet average option compared with the Portable Regulatory Amendments. The fleet emission standards would be higher than those following the fleet averaging schedule in the Portable Regulatory Amendments with a maximum difference in 2027 where a 0.06 g/bhp-hr fleet emission standard is required versus the proposed 0.03 g/bhp-hr fleet emission standard. Under Alternative 2, it is assumed that an increased number of fleets would choose the fleet average option. This change would require a fleet to have an average fleet composition of 65% Tier 4 and 35% Tier 2 or 3 engines, which would result in lower total cost over the life of the rule and, consequently, a lower annual cost of compliance to the affected businesses. Based on the assumptions in the equipment turnover model, the direct cost can be estimated similar to that of the Portable Regulatory Amendments, as outlined in the Direct Cost section. However, the fleet option for Alternative 2 is more attractive. To estimate the costs, ARB predicts that 50% of the large fleets will choose the fleet average option while the rest will choose the Tier Phase-Out option.

Using the same inputs used to estimate the change in average annual cost relative to the Portable Regulatory Amendments this alternative would require a change in the fleet purchasing habits as estimated using the equipment turnover model:

$$\Delta = \$163,043,966 - \$170,624,248 = \frac{-\$7,580,282}{year} \quad \text{Eq. 3}$$

b. Economic Impacts

As shown in Equation 3, Alternative 2 would result in a \$7.5 million per year average annual cost savings (or a 4.4% lower cost) to the primary industry when compared to the Portable Regulatory Amendments over the life of the rule. The savings would directly benefit large fleets only because the only difference between Alternative 2 and the Proposed Regulatory Amendments is to the fleet average schedule which is only offered to large fleets. Table 14 compares the Portable Regulatory Amendments with Alternative 2, and shows that estimated changes in California GDP, personal income, and employment are very similar to the economic impacts of the proposed amendments. In early years, the alternative will result in more investment likely due to the fleets choosing the fleet average option shifting investments from equipment that is predominantly manufactured outside of California to investments in industries that have a higher percentage of companies located in California. These changes are very small compared to the size of the California economy.

c. Cost-Effectiveness

Alternative 2 would result in a lower compliance cost but would also result in higher statewide emissions. Fleets would not be required to obtain as many Tier 4 engines to stay in compliance, which would lead to direct increases of 1,110 tons of NO_x and 64.5 tons of PM 2.5 between 2017 and 2030. These excess emissions would primarily affect the districts that are in extreme non-attainment for ozone and serious non-attainment PM 2.5 which are where about 60% of the statewide portable engines operate.

2. Reason for Rejection

While Alternative 2 would provide a lower cost solution to the current rule, it does not achieve as many emission reductions as the Portable Regulatory Amendments. Therefore, Alternative 2 does not achieve the maximum emissions reductions with the available technology and is thus not preferred over the Portable Regulatory Amendments.

Table 14: Change in Growth of Economic Indicators for Alternative 2 Compared to the BAU

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
GDP	Change (%)	0.02%	0.00%	0.00%	0.03%	0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
	Change (2015M\$)	608.3	103.5	56.6	872.3	224.5	-32.1	-76.8	-206.9	-96.6	-115.6	-345.2	-96.1	-116.2	-13.1	14.7
Personal Income	Change (%)	0.02%	0.00%	0.00%	0.02%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
	Change (2015M\$)	328.5	99.0	61.0	489.8	194	39.3	-10.2	-95.5	-54.6	-67.1	-192.3	-79	-81.9	-26.7	-4.3
Employment	Change (%)	0.02%	0.00%	0.00%	0.03%	0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	-0.01%	0.00%	0.00%	0.00%	0.00%
	Change in Jobs	5508	901	421	7302	1721	-461	-813	-1784	-874	-964	-2595	-719.0	-812.0	-73.0	125
Investment	Change (%)	0.25%	0.09%	0.03%	0.28%	0.11%	-0.01%	-0.06%	-0.10%	-0.07%	-0.07%	-0.12%	-0.05%	-0.04%	-0.01%	0.00%
	Change (2015M\$)	199.8	82.8	30.7	281.5	132.4	1.7	-48.6	-102	-75.4	-70.2	-142.8	-73.9	-59.0	-17.6	3.5

The value in each year is interpreted as the reference year value less the BAU value in that same year. The change in jobs is rounded to the nearest 25, while the dollar values are rounded to the nearest \$100,000.

G. Fiscal Impacts

1. Local government

There are two separate roles local government agencies assume in PERP. Many local government agencies register their portable equipment units in PERP. In this role they are acting as the registrants being affected by the high replacement cost of Tier 4 engines and the increased registration fees. In the second role, local government is represented by the 35 local air districts that also regulate portable equipment and enforce the PERP registrations. A portion of the registration fees in PERP is distributed to the local air districts and represents the district inspection fee.

The effect of being a PERP registrant leads to a change in the spending on portable equipment by local government. This will vary annually and by government agency depending on the age of their portable engines, the make-up of their fleets, and other unknown factors. It is likely that the Portable Regulatory Amendments would have a positive effect on local government budgets. Given that local governments comprise about 4.8% of the total portable equipment (by horsepower) and that the portable Regulatory Amendments are estimated to result in total annual savings of \$206 million to all regulated entities between 2017 and 2020 it is estimated the local government agencies would experience direct average annual cost savings of approximately \$10 million ($\$206 \text{ million} \times 0.048$) between 2017 and 2020. There will be additional savings for DEF costs that are negligible for each entity. This was calculated by multiplying the overall annual savings calculated in section (D)(2)(a)(v) with the proportion of horsepower registered by local agencies in PERP.

The effect on air districts as a result of the increased registration fees, as outlined in Table 4, in the cost section, is an increase in district revenue. This increase will be approximately 18% of the revenue districts received in 2015 under either scenario and will be reflected in the 2017 district revenue distribution. This revenue increase is based on applying the Consumer Price Index from 2006 to 2016 to the district portion of the PERP registration fees. Currently, the district portion of the fee is \$345 for both a renewal and an initial registration. Under the Portable Regulatory Amendments the fee would increase to \$405 (\$60 increase per engine). The number of initial registrations and renewals in PERP in any year across California is estimated to be between 10,000 and 15,000 depending on how many new engines must be added to fleets to become compliant with the fleet emission standards. In total, the air districts may see an increase in revenue of approximately \$690,000 per year on average.

1. State Government

The Portable Regulatory Amendments would have a positive effect on state government budgets as well, through delayed purchase requirements of higher cost Tier 4 engines. This would result in cost savings similar to that of a typical business. State government comprises about 1 percent of the total government registered horsepower in PERP, thus should face an average annual cost savings of approximately \$2.1 million ($\$206 \text{ million} \times .01$) across all state agencies.

2. ARB

As outlined in the cost section, the increase in registration costs will increase the revenue to support the PERP by \$125 for each new registration and \$105 for a renewal of each registration (see Table 4). The estimated impact of the registration fee increase is discussed in section (D)(2)(a)(vi).

PERP was established as a self-funded program. However, in recent years, it became apparent that the program is both understaffed and underfunded. The proposed fee increases would pay for additional full-time staff to manage and support the program, and for additional information technology (IT) resources to support program implementation. The implementation of the Portable Regulatory Amendments increases resource needs for IT to accommodate changes to the DMS for amendment implementation. Additionally, these changes will ensure the program will be able to handle the additional registrations that will be processed for large fleets choosing the fleet average option since they will now need to register all their portable engines in PERP. Notwithstanding, these resource increases are small relative to the current understaffing. Once the proposed fee increases are in place, ARB will be proposing a budget change proposal to address any staffing shortages, IT resource needs, and other implementation resources as deemed necessary.