

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 set emissions requirements for portable engines to reduce exposure to toxic diesel particulate matter (PM) and protect public health. The ATCM works in concert with the Portable Equipment Registration Program (PERP) to allow fleets to voluntarily register portable equipment used across California with the State rather than permitting or registering the equipment with each local air district individually. As a technology-forcing regulation, the ATCM was designed to force the development of retrofit emissions control technologies and new engine technologies to meet regulatory requirements. Some of these technologies materialized, though not as early as anticipated. This increased the cost to regulated parties compared to the estimates at the time of ATCM adoption. The purpose of the proposed amendments to the PERP and ATCM (together referred to as Portable Regulatory Amendments) is to provide relief from the technologically and financially challenging 2017 and 2020 fleet average emission standards set by the current ATCM, while also safeguarding public health benefits by ensuring the emissions reductions envisioned in the original ATCM will be met. The emission levels required under the current ATCM in 2020 will still be achieved, but will be delayed by seven years as demonstrated in Figures 1 and 2 (Section B. Non-Monetary Impacts).

Portable engines (and associated equipment) and non-combustion equipment units are regulated by the California Air Resources Board (ARB) and by the 35 local air districts in California. Examples of portable engines include those used in well drilling, service or work-over rigs, power generation (excluding cogeneration), pumps, compressors, diesel pile-driving hammers, welding, cranes, wood chippers, dredges, and military tactical support equipment applications. Equipment units are pieces of portable equipment that emit non-combustion related particulate matter less than 10 microns in diameter (PM₁₀) and are used in activities that include, but are not limited to, 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 equipment units vary among the air districts.

In 1995, the California legislature mandated that ARB establish a fee-based, voluntary, uniform, and statewide registration program for portable equipment. This statewide program would provide an alternative path to registration to portable equipment owners that operate in multiple air districts. Absent a uniform statewide program, equipment owners must obtain an operating permit from each air district in which the engine or equipment unit operates, potentially leading to multiple permits for one piece of equipment. As a result of the California legislature's mandate, ARB adopted the PERP regulation in 1997, which defined the equipment allowed to register in PERP, set operational limits for registered equipment, established registration procedures, and set registration fees. A portion of the registration fees is distributed to the local air districts that perform inspections and enforce the operational conditions of PERP registrations.

ARB adopted the ATCM in 2004 as part of a broad initiative, called the Diesel Risk Reduction Plan, to control diesel particulate emissions from many diesel engines and equipment to protect public health. The ATCM prohibits operating older portable engines that emit higher levels of air pollutants than newer engines, sets strict engine eligibility for portable engines registering in PERP, limits districts to permitting only engines certified to meet federal emission standards, and requires all fleets to meet fleet emission standards.

When ARB adopted the ATCM in 2004 the rulemaking relied on several assumptions about developing new technologies as the basis for establishing stringent fleet emission standards. The costs presumed an abundance of Tier 4 engines would be available for fleet owners to purchase at competitive prices and that these purchases could be made well before the emissions standards were required. The rulemaking also assumed that where Tier 4 engines were not yet available, engines could be retrofit to comply with the standards. In reality, the costs were much higher than anticipated, Tier 4 engines were not available as early as anticipated, and retrofits were not available for all engine categories.

1. Statement of the Need of the Portable Regulatory Amendments

a) Goal of the Portable Regulatory Amendments

The goal of the PERP and ATCM is to provide diesel particulate matter (PM) emissions reductions to protect public health. Because the original rules assumed emissions control technologies would come to market more quickly than they did, compliance costs are compressed, resulting in extremely high annual costs. The goal of the Portable Regulatory Amendments is to extend the time frame of compliance such that fleets can achieve fleet standards to reduce toxic air emission as envisioned in the original PERP and ATCM regulations, though at a later date. To accomplish this goal, and ensure that the 1995 legislative mandates are achieved, the Portable Regulatory Amendments:

- Maintain a uniform statewide registration program for portable equipment,
- Simplify fleet emission requirements for small fleets,
- 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

This section contains a brief discussion outlining the need for the Portable Regulatory Amendments, while a more extensive description will be presented in the Initial Statement of Reasons.

At the time of the 2004 ATCM adoption, it was assumed that equipment owners would comply using a combination of the following compliance options: replacement of retired equipment with new, compliant equipment; retrofit of existing engines, particularly those with several years of useful life, with after-treatment devices; or repower existing equipment by replacing retired engines with new, compliant engines. In reality, deployment of Tier 4 engines in the portable

equipment market was delayed, retrofits were not made widely available for portable use, and repower was technologically not possible in most cases due to a significantly larger footprint of new engines. Fleets are now in the position to replace both the engine and the equipment simultaneously in order to achieve compliance, and must replace both in a compressed timeframe compared to timeline envisioned under the 2004 ATCM regulation. Due to delayed availability into the portable market, fleets are required to replace about 90 percent of their equipment with new equipment housing Tier 4 engines by 2020.

In the 2004 Portable Engine ATCM Initial Statement of Reasons, ARB compliance assumptions relied on new emissions control devices, known as Verified Diesel Emission Control Strategies (VDECS), becoming available for portable engines to meet the ATCM standards in 2017.¹ VDECS were expected to provide a cost-effective emissions control retrofit option for older engines. Manufacturers of VDECS found diesel particulate filters difficult to manufacture and certify for the portable sector due to: the large number of different applications (chippers, generators, pumps, compressors, crushers, etc.); the number of different engine manufacturers and models; the varying duty cycles of each application; and the economic uncertainty of entering a relatively small and diverse market. Therefore, VDECS did not make their way to the portable engine sector as expected. This fact is demonstrated through analysis of PERP engine registration data. To date, only 7 of 30,000 registered engines have been retrofitted with emission control devices.

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. However, repowering existing equipment with Tier 4 technology is not possible because Tier 4 engines are much larger in size per horsepower than older engines due to the emission control technologies required to comply with Tier 4 emission standards. This size difference was not envisioned in 2004, since the compliant engine technology had not yet been developed. Equipment owners have found it necessary to purchase entire new pieces of portable equipment equipped with new engines to comply with the current rule. It is possible that many fleets would need to turnover 90 percent of their existing equipment by 2020 in order to meet the current standards, a timeframe that has been deemed unrealistic by many fleet owners, as short-term financing options are limited and can result in extremely high compliance costs.

The ATCM also assumed that fleets would comply in part by purchasing compliant equipment housing Tier 4 engines. 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. In reality, the availability of Tier 4 engines was delayed by at least a year. Equipment manufacturers 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 a

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

doubling of the cost of new equipment with Tier 4 compliant engines. To address these issues, ARB extended the six-month eligibility of the previous tier engines to 18 months after each subsequent Tier 4 certification went into effect under the compliance flexibility provisions of the ATCM. However this flexibility is not sufficient to fully address the delay in engine availability.

The Transitional Program for Equipment Manufacturers (TPEM), a federal program designed to provide flexibility to equipment manufacturers as they transition to building equipment with only the newest tier engines,² contains provisions which allow equipment manufacturers to sell up to 80 percent of their equipment with engines certified to the previous tier after a new tier requirement becomes effective. The engines produced under these provisions are known as flex engines. Because of the flex provisions, a large volume of flex engines were produced and flooded the portable engine market, particularly Tier 3 flex engines rated less than or equal to 750 brake horsepower and Tier 2 flex engines rated greater than 750 brake horsepower. Flex engines have higher emissions rates than Tier 4, and alone do not meet the 2017 or 2020 ATCM emissions for most engine horsepower categories. Because engine manufacturers could legally produce flex engines (under the TPEM), they produced Tier 3 category engines. These engines were integrated into portable equipment because of the high cost of re-engineering low sales volume equipment with larger footprint tier 4 engines. As fleets needed to purchase new equipment in accordance with their normal turnover schedules, many purchased the Tier 3 flex engines available under the TPEM because Tier 4 engines were not readily available. Unfortunately, new Tier 3 flex engines did not drive down fleet diesel PM emissions to the degree necessary to comply with the 2017 fleet standards. In many cases, meeting the current 2017 ATCM standards would require fleets that purchased Tier 3 flex engines to replace them after only three to five years of use (when the expected service life of the equipment is at least 20 years).

In summary, retrofit technologies and repower options, which represent the most cost-effective compliance options to meet ATCM requirements, have not developed as anticipated in the 2004 ATCM. To meet regulatory requirements, fleets must purchase new equipment with Tier 4 engines installed, which is much more costly. The higher than anticipated costs would occur over a more condensed time frame than originally anticipated and could require capital investments and loans that would be difficult for fleets to secure in the necessary timeframe. Specific cost comparisons are discussed in the next section. The result is only 10 percent of fleets are likely to meet regulatory requirements by 2020. Based on stakeholder discussions, meeting the 2004 ATCM requirements would result in significant cost burdens to fleets. While we cannot predict the fleet response to these high costs, stakeholders suggest it could lead to significant increases in consumer prices and potentially drive fleets to exit the California market, specifically small businesses. However, stakeholders believe that distributing the costs over the longer timeframe proposed in the Portable Regulatory Amendments will alleviate the concerns regarding compliance costs and timing. The Portable Regulatory Amendments will also achieve the emission levels required under the current ATCM in 2020 with a delay of seven years.

² 40 CFR 1039.625, <https://www.gpo.gov/fdsys/granule/CFR-2014-title40-vol33/CFR-2014-title40-vol33-sec1039-625>

2. Identification of the Baseline (Referred to as Business As Usual)

The business as usual scenario (BAU) used as a baseline for this economic analysis assumes the current ATCM is fully enforced and all fleets meet existing fleet average standards to control the diesel particulates they emit. Costs (or cost-savings) of the Portable Regulatory Amendments are calculated relative to this baseline.

ARB performed an engineering analysis to estimate the composition of the fleet in the BAU scenario by tabulating the non-road diesel engine emission standards for Tiers 1, 2, 3, and 4 under 40 CFR 89.102³ and 40 CFR 1039.102⁴ and the 2017 and 2020 fleet standards for the existing ATCM shown in Table 3. Equation 1 below was used to calculate what percent of a fleet must be Tier 4 to be compliant with each fleet standard.

$$x = \frac{\text{standard} - (\text{Tier 1 or 2 or 3 standard})}{\text{Tier 4 std} - (\text{Tier 1 or 2 or 3 standard})} \quad \text{Eq. 1}$$

Where x is the percent of Tier 4 engines required for a fleet to be compliant with an ATCM standard for a certain percent of Tier 1, 2, or 3 engines.

$$y = 1 - x \quad \text{Eq. 2}$$

The variable y in Equation 2 shows what percent of that same fleet must be Tier 1, Tier 2, or Tier 3, depending on which Tier standard is used. For example, to calculate what percent Tier 4s and Tier 2s would be required to meet the 2017 standard for engines 175-750 horsepower, *standard* = 0.08, *Tier 2 standard* = 0.15, and *Tier 4 standard* = 0.01 which yields x=50 percent, or 50 percent of the fleet must be Tier 4 for fleet to comply with the 0.08 standard. This equation was used for each Tier standard and each ATCM fleet standard for each horsepower category then averaged to calculate the average fleet compositions above.

Because retrofit and repower are not feasible compliance options, equipment replacement is the only viable option for operators to reduce their fleet average emissions. Equipment replacement is the highest cost compliance option and was never intended to be the sole compliance option to meet regulatory requirements.

The cost to comply with the current 2004 ATCM (the cost of the BAU in this analysis) was analyzed to reflect updated data not available at the time of the original adoption of the regulation. The new projected equipment replacement cost used to characterize the BAU is 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 between \$100 and \$450 per horsepower. For engines greater than 175 horsepower the modeled cost for engines is between \$100 and \$300 per horsepower. These cost model inputs are discussed in further detail in the Direct Cost section (D).

³ 40 CFR 89.102, <https://www.law.cornell.edu/cfr/text/40/89.102>

⁴ 40 CFR 1039.102, <https://www.law.cornell.edu/cfr/text/40/1039.102>

3. Major Regulation Determination

The Portable Regulatory Amendments are a major regulation because the estimated direct cost savings of the proposal exceeds \$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 \$60 million every year through 2024 in response to delayed purchase requirements. The direct cost savings are explained in more detail in the Direct Cost section (D) of this document.

4. 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 the association of air pollution control officers from all 35 local air quality agencies located throughout California. To support the development of the Portable Regulatory Amendments, CAPCOA formed a subcommittee of seven CAPCOA member districts which actively participated in the regulatory 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 website⁵ and distributed through a list serve⁶ 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 Portable Regulatory 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 five Workgroup meetings were conducted on April 19, May 4, June 9, August 17, and October 26, 2016. The Portable Regulatory Amendments, including alternatives, were directly shaped by stakeholder comments and suggestions.

⁵ <https://www.arb.ca.gov/portable/perpact/portable-activity.htm>

⁶ https://www.arb.ca.gov/listserv/listserv_ind.php?listname=portable

5. Description of the Portable Regulatory Amendments

The Portable Regulatory Amendments contains requirements for 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 lower-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 compared to the existing PERP and ATCM regulations and allow for automatic compliance management through the PERP registration process. This approach not only reduces compliance costs for small fleets as compared with the original rule, but also simplifies implementation and enforcement.

Large fleets are those that exceed 750 total combined break horsepower (bhp). Large fleets 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 percent Tier 4 and 10 percent Tier 1, 2, or 3 engines by 2027. The Portable Regulatory Amendments represent a seven-year delay in equipment phase-out relative to the current regulation. The Portable Regulatory Amendments would thus spread out compliance costs over an additional seven years, while still achieving emissions reductions and technology goals when the Portable Regulatory Amendments are fully implemented.

The established tier phase-out schedule for all fleets requires a complete turnover to Tier 4 engines by 2029 with the exception of flex engines, as shown in Table 1. Large fleets will also have the option of meeting fleet average emissions standards instead of tier phase-out requirements. Proposed fleet average emissions standards in grams per brake horsepower hour (g/bhp-hr) are shown in Table 2, and can be compared to current fleet average requirements in Table 3.

Table 1: Proposed Engine Tier Phase-Out Schedule

<i>Engine Certification</i>	<i>Engines rated 50 to 750 bhp</i>		<i>Engines rated >750 bhp</i>
	<i>Large Fleet</i>	<i>Small Fleet</i>	
Tier 1	1/1/2020	1/1/2020	1/1/2022
Tier 2 built prior to 1/1/2009	1/1/2022	1/1/2023	1/1/2025
Tier 2 built on or after 1/1/2009	N/A	N/A	1/1/2027
Tier 3 built prior to 1/1/2009	1/1/2025	1/1/2027	NA
Tier 3 built on or after 1/1/2009	1/1/2027	1/1/2029	NA
Flexibility engines (Tier 1,2, and 3)	December 31 of the year 17 years after the date of manufacture		

Table 2: Proposed Fleet Average Option for Large Fleets

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

Table 3: Existing Fleet Average Standards for All Fleets

<i>Fleet Standard Compliance Date</i>	<i>Engines <175 hp (g/bhp-hr)</i>	<i>Engines 175-750 hp (g/bhp-hr)</i>	<i>Engines >750 hp (g/bhp-hr)</i>
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 primary change that arises from the Portable Regulatory Amendments is the proposed change to the fleet requirements. The main change that results from the Portable Regulatory Amendments is a delay in fleet emissions standards which delays the removal of older engines from the fleet. These older engines, with higher PM and NOx emissions compared to newer Tier 4 engines, will remain in operation longer than originally allowed under the current regulation (the BAU in this economic analysis). The addition of a tier phase-out schedule will promote greater compliance with the ATCM and PERP engine standards and will lead to the emission reductions envisioned by this 2004 ATCM regulation over an elongated timeframe. As explained above, ARB staff determined the existing fleet standards are financially and technologically unrealistic, primarily due to the lack of verified retrofits and the delayed availability and high cost of Tier 4 engines. Comparing the anticipated reductions that would have been achieved under the current standards in 2020, identified as the BAU, we see an overall delay of seven years in the rate of achieving PM and NOx reductions shown on Figures 1 and 2 below. Adoption of the proposed Portable Regulatory Amendments does not cause any degradation to current air quality, only a delay in the accrual of projected air quality benefits for the near term. Eventually the Portable Regulatory Amendments achieve the same reductions originally expected the ATCM and PERP regulations.

ARB calculated the change in the rate of emission reductions (in tons per day or tpd) caused by the change in compliance schedules. ARB estimates a delay of the original rate of emission reductions by seven years. ARB calculated and compared the projected emission reductions for 2020 and 2023 under the BAU to the projected emission reductions under the Portable Regulatory Amendments for the same two years. In 2020, ARB estimates fewer emission reductions by 0.38 tpd of PM and 9.0 tpd of NOx under the Portable Regulatory Amendments compared to what was projected for 2020 under the BAU. In the key year of

2023 for attaining the National Ambient Air Quality Standard (NAAQS) for ozone in the South Coast air basin, ARB estimates fewer emission reductions by 0.14 tpd of PM and 3.8 tpd of NO_x, which is a contributor to ozone formation, compared to the BAU. By 2027 the Portable Regulatory Amendments will achieve the same tons per day of emissions reductions as projected for the BAU. This will work to achieve the ozone NAAQS as initially projected in the 2004 ATCM regulation.

To illustrate this change in rates of emission reductions, Figures 1 and 2 plot the emission reductions of NO_x and PM from portable engines under both the BAU and Portable Regulatory Amendments. If the existing ATCM standards are implemented, the fleet would turn over more quickly and emissions would decline faster than under the Portable Regulatory Amendments. In 2027, the rates of emission reductions under the Portable Regulatory Amendments catch up to rate of reductions under the BAU, shown by the blue and red lines converging.

Figure 1: Annual Statewide PM (tpd)

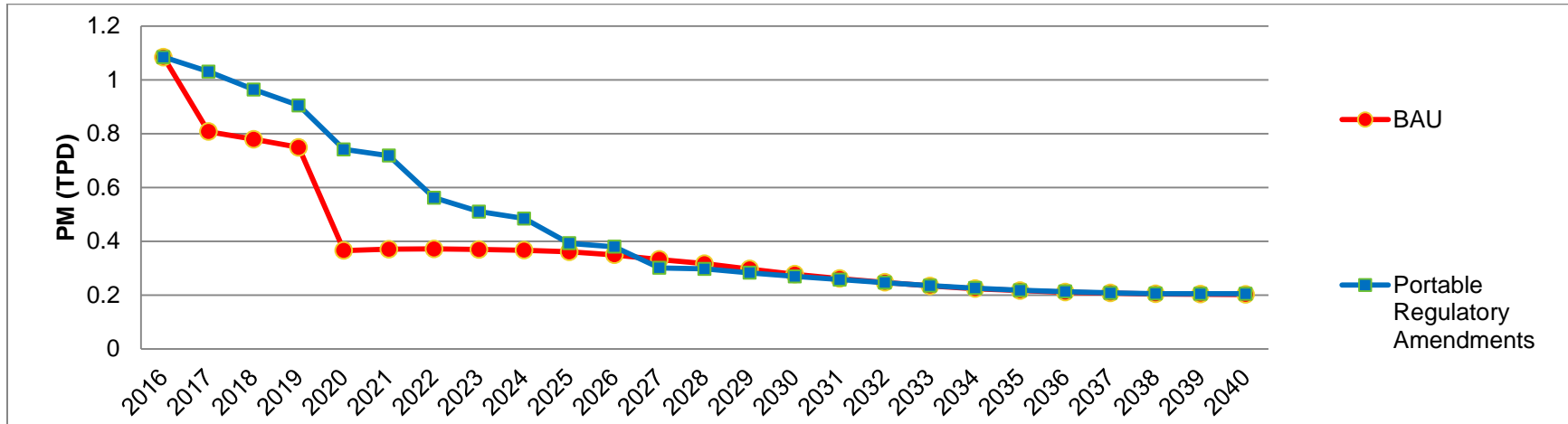
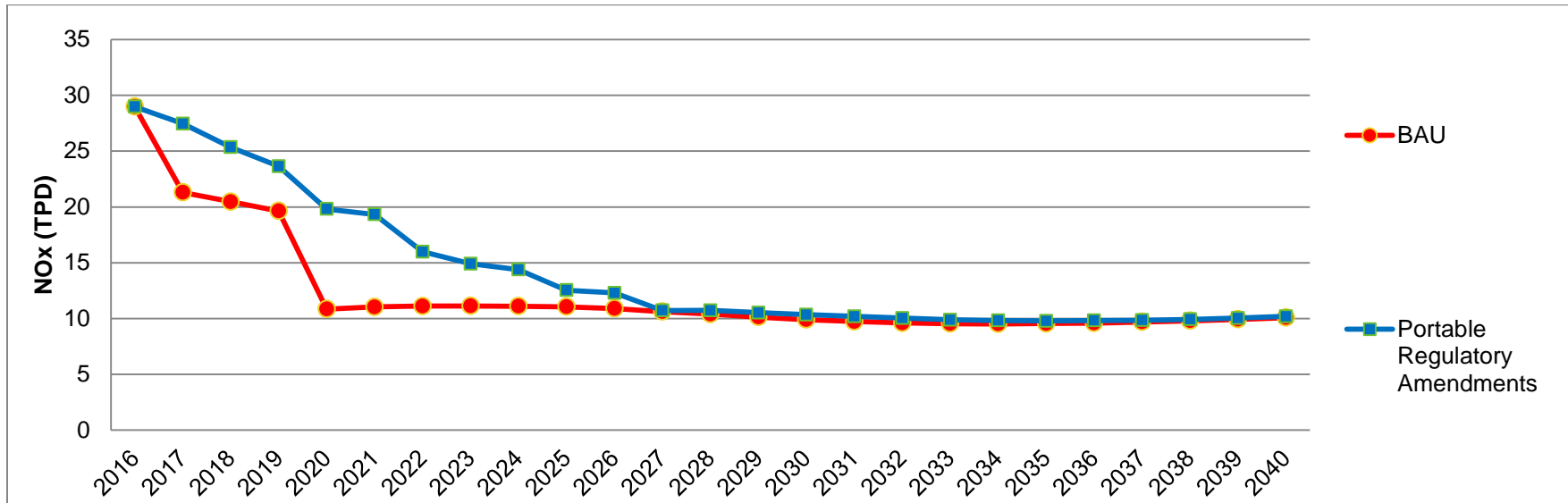


Figure 2: Annual Statewide NOx (tpd)



To estimate the potential health risk associated with the delay in emissions reductions under the Portable Regulatory Amendments, ARB estimated the cancer risk from the diesel PM emissions of portable equipment. This was determined by identifying the cancer risk from ambient concentrations of diesel PM multiplied by the proportion of diesel PM that can be attributed to portable engines. Most major sources of diesel PM emissions are often located near highly populated areas. Because of this, elevated PM levels are mainly an urban problem, with large numbers of people exposed to higher PM concentrations, resulting in greater health consequences compared to rural areas. The South Coast Air Basin has the greatest number of diesel PM sources and, therefore, represents an upper bound to the potential cancer risk state-wide. Table 4 outlines the cancer risk associated with estimated PM emissions from portable equipment in the South Coast Air Basin under the current regulation (or BAU), based on the rate of emissions projected when the regulation was adopted and the projected emissions from the Portable Regulatory Amendments over time.

Table 4. Projected South Coast Air Basin-Wide Cancer Risk from Portable Equipment Diesel PM (Chances per Million)

Year	BAU	Portable Regulatory Amendments
2012	48	48
2017	28	35
2020	13	25
2021	13	24
2023	13	18
2027	11	11
2030	10	9
2031	9	9

Table 4 shows that the projected exposure rate and associated cancer risk from portable equipment under the current regulation (or BAU) and the Portable Regulatory Amendments. The rates of exposure and cancer risk under these two scenarios will converge in 2027. However, there is a slightly higher remaining rate of exposure and associated elevated cancer risk from 2017 through 2027 under the projections for the Portable Regulatory Amendments compared to the projected rate of exposure for the current regulation. To put the excess cancer risk in perspective, a recent study found the basin-wide cancer risk in Southern California from all sources to be 897 cases per million people.⁷

⁷ <http://www.aqmd.gov/docs/default-source/air-quality/air-toxic-studies/mates-iv/mates-iv-final-draft-report-4-1-15.pdf?sfvrsn=7>; page ES-3

C. Benefits

The Portable Regulatory Amendments 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 will be discussed 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.

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

The cost-savings will be discussed in more detail under the Direct Costs section, while additional discussion of the indirect and induced impacts on businesses will be discussed in the Macroeconomic Impact section.

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 Typical Businesses and Small Businesses

For most years under the Portable Regulatory Amendments, as compared with the BAU, fleets see an increase in registration fees, decreases in equipment and engines replacement costs, and decreases in costs for the diesel exhaust fluid (DEF) used to reduce emissions on Tier 4 engines. The largest direct costs to businesses are engine and equipment replacement costs. Direct costs and cost-savings to businesses are calculated on a fleet-by-fleet basis.

The engine and equipment replacement costs to businesses are calculated by projecting annual fleet engine purchases under the Portable Regulatory Amendments and taking the difference of those expenditures relative to the engine expenditures anticipated in the BAU. Engine and equipment expenditures are estimated using an equipment turnover model which simulates fleet-level annual engine and equipment purchases. The model relies on reported PERP data (discussed in Sections (a)(iii) and (a)(iv)) to estimate fleet purchasing habits and compliance requirements. A cost is assigned to each newly purchased engine and a residual value is assigned to each retired engine. With these values the model calculates the cost of engine and equipment replacement for each fleet in each calendar year. These costs are then amortized over a 5-year period at an 8 percent interest rate based on stakeholder feedback of typical financing conditions. Registration fees and DEF costs are added to calculate the total costs on businesses.

a. Inputs

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

i. Equipment Cost

Equipment replacement represents the majority of costs of the Portable Regulatory Amendments. 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. A cost curve was developed based on data from more than 230 pieces of portable equipment equipped with various engine tiers, horsepower, and age, representing generators, compressors, and pumps. The cost curve was then used in ARB's equipment turnover 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 the compliance path chosen by large fleets (either tier phase-out or fleet averaging), individual fleets were evaluated on the characteristics of the engines in their fleet. Fleets with one or more engine at least twelve years old and with a relatively low fleet emission average are predicted to follow the fleet average schedule. A low fleet emission average already puts these fleets on track to comply with the first fleet average standard in 2020 while allowing these large fleets the ability to retain older, potentially specialized, pieces of equipment that cannot be replaced due to technological or economic constraints.

ARB expects large fleets with relatively high fleet average emissions would likely follow the tier phase-out schedule, due to the later compliance dates for the tier phase-out relative to the fleet average option, as shown in Tables 1 and 2. Under the phase-out schedule, large fleets may extend the life of their equipment while staying compliant. This may be attractive to fleets with a high proportion of Tier 3 engines that are certified to a PM emission standard higher 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 2025, 2027 or 2029, depending on the fleet size and year of engine manufacture.

ARB analyzed each fleet and categorized them by compliance path. The analysis indicated about 67 percent of large fleets will follow the tier phase-out schedule and 33 percent of large fleets are anticipated to follow the fleet average schedule.

iii. Fleet Purchasing Habits

ARB assumes each fleet will keep the average age of their equipment steady across all years unless compliance with a standard forces them to accelerate turnover, bringing the average equipment age down for that year. If a fleet must remove and replace equipment to become compliant with an upcoming fleet standard, this analysis assumes a fleet will 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. In most cases, removing the oldest engine in a fleet also means removing the highest emitting engine in that fleet.

iv. Fleet Decision-Making Process

Assumptions regarding fleet decision making were developed using eleven years of PERP registration data that contains detailed information on approximately 4,400 fleets in California. This data includes years when the current fleet standards became effective, providing insight on historic fleet response to meeting standards similar to the Portable Regulatory Amendments. Based on this data, ARB assumes that fleets will replace equipment in order to maintain a constant total horsepower throughout the Portable Regulatory Amendments. In addition, PERP data from 2005 through 2016 was used to estimate each fleet's average engine age and horsepower.

v. Direct Cost Estimation Results

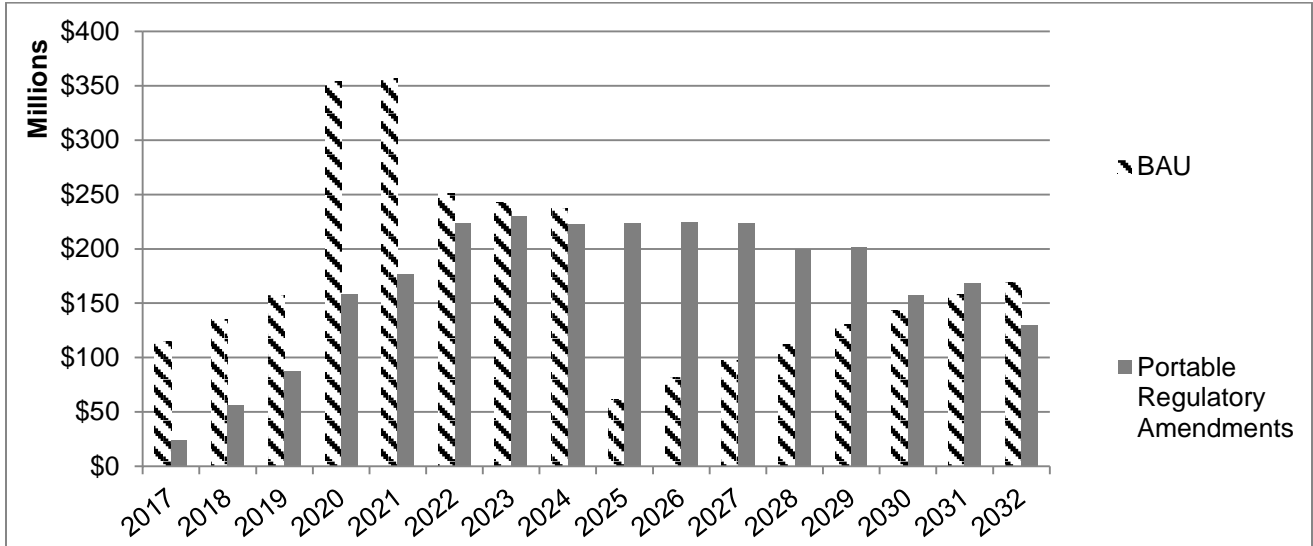
The historical PERP data discussed above was used to inform an equipment turnover simulation model designed by ARB’s emissions modeling team. The model predicts when engines are replaced by newer engines for a fleet to become compliant with a given compliance scenario. In this analysis two scenarios were run, the BAU and the Portable Regulatory Amendments.

To illustrate the change in costs for equipment owners, the annualized equipment replacement cost is calculated under the BAU and under the Portable Regulatory Amendments from 2017 through 2020. The average annual amortized equipment replacement cost under the BAU is \$190,236,334 from 2017 until 2020 (the final compliance date under the BAU). The average annual amortized cost under the Portable Regulatory Amendments is \$81,676,965 between 2017 and 2020, assuming 67 percent of fleets use the phase-out option, and 33 percent use the fleet average. Looking at the incremental cost of the Portable Regulatory Amendments, there is an average annual equipment cost-savings (across about 4,400 fleets) of approximately \$109 million dollars per year or 57 percent lower than the BAU, as shown in Equation 3 below.

$$\begin{aligned} \Delta \text{ Annual Equipment Cost} &= \$81,676,965 - 190,236,334 \\ &= - \frac{108,559,369}{\text{year}} \quad \text{Eq. 3} \end{aligned}$$

Figure 3 shows the estimated annual amortized 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, 2029. Figure 3 illustrates the significantly higher annual equipment costs under the BAU relative to the Portable Regulatory Amendments in the near-term. Stakeholders report that high annual equipment costs, for example in 2020 and 2021, represent a significant burden to businesses, especially small businesses.

Figure 3: Annual Equipment Replacement Cost for BAU and Portable Regulatory Amendments



vi. Registration Costs

The Portable Regulatory Amendments include a registration fee increase that will impose a direct, on-going 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 on-going cost to the regulated industry is estimated by multiplying the total registration fee increase by the estimated numbers of equipment for both initial and renewal registrations (which renew every three years). Table 5 outlines the current registration fees under the BAU and proposed registration fees under the Portable Regulatory Amendments. The fiscal impacts for state and local air districts are described in more detail in the Fiscal Impact section.

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, Equation 4, was used to calculate the number of renewals, in any given year:

$$R = \frac{TNE - IR}{3} \quad Eq. 4$$

Table 5: Changes to On-Going Registration Costs

Initial Registration (3 year registration)			
Cost Type	BAU	Portable Regulatory Amendments	Change in Cost
Total for New Registration	\$620	\$805	\$185
Registration Renewal (3 year registration)			
Cost Type	BAU	Portable Regulatory Amendments	Change in Cost
Total for Renewal	\$575	\$740	\$165

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. Aside from registration and renewal costs, there are additional registration action costs that are estimated to increase by 46 percent under the Portable Regulatory Amendments. Additional registration actions include document replacement requests, sticker replacement requests, and document correction requests. The frequency of registration actions will not be affected by the Portable Regulatory Amendments.

The equipment turnover simulation model estimates the PERP registration costs in each year given the equipment initially registered, or re-registered. Registration costs peak in 2020 for the both the BAU and Portable Regulatory Amendments at just under \$11 million each. Under the Portable Regulatory Amendments, 2020 is predicted to be a peak year for registration fees due to the first set of compliance standards in both the phase-out and fleet average schedules. The projected annual numbers of initial registrations and renewals under the BAU and the Portable Regulatory Amendments are presented in Table 6. To find the total change in fees in each year, the difference in renewals between the Portable Regulatory Amendments and the BAU is estimated and multiplied by the corresponding change in registration fees. The districts will receive \$60 of the registration increase for each new three-year renewal and newly registered engine. The remaining registration funds are distributed to ARB. The total increase in registration fees for the industry in 2017 through 2030 is estimated at \$26,446,932, or approximately \$1.9 million per year.

Table 6: Projected Number of Renewals and Initial Registrations by Year

Year	BAU		Portable Regulatory Amendments		Difference (Portable Regulatory Amendments – BAU)	
	# Newly Registered Engines	Renewals	# Newly Registered Engines	Renewals	# Newly Registered Engines	Renewals
2017	6,789	7,757	1,733	9,442	-5,056	1,685
2018	1,459	9,534	2,358	9,234	899	-300
2019	1,457	9,534	1,884	9,392	427	-142
2020	11,950	6,037	6,195	7,955	-5,755	1,918
2021	275	9,928	848	9,737	573	-191
2022	241	9,940	3,599	8,820	3,358	-1,120
2023	440	9,873	2,599	9,154	2,159	-719
2024	483	9,859	941	9,706	458	-153
2025	619	9,814	2,176	9,295	1,557	-519
2026	515	9,848	637	9,808	122	-40
2027	650	9,803	2,022	9,346	1,372	-457
2028	635	9,808	328	9,911	-307	103
2029	674	9,795	678	9,794	4	-1
2030	556	9,835	431	9,876	-125	41

vii. Diesel Exhaust Fluid Costs

The Portable Regulatory Amendments are anticipated to result in lower on-going costs due to the reduced need for Diesel Exhaust Fluid (DEF) as a result of the delay in equipment turnover requirements. Currently, all Tier 4 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 to reduce NOx emissions. DEF is a urea-water mixture that is consumed by the SCR at a rate proportional to the consumption rate of diesel fuel. In order to calculate how much DEF will be consumed in any given year under the BAU and Portable Regulatory Amendments, ARB calculated the amount of diesel fuel annually consumed by Tier 4 engines. The equipment turnover model projects the number of Tier 4 engines operating in California for each year starting in 2016 under the BAU scenario and under the Portable Regulatory Amendments scenario.

The amount of DEF required under the BAU and the Portable Regulatory Amendments is a based on the dosing rate, the DEF to diesel consumption ratio. The top three engine manufacturers' websites⁸⁹ show an average dosing rate between 1 and 5 percent. To estimate the highest cost impact, 5 percent is used as the dosing rate. The annual DEF

⁸<https://www.cdc.gov/niosh/mining/UserFiles/workshops/dieselaerosols2012/NIOSHMVS2012Tier4TechnologyReview.pdf>

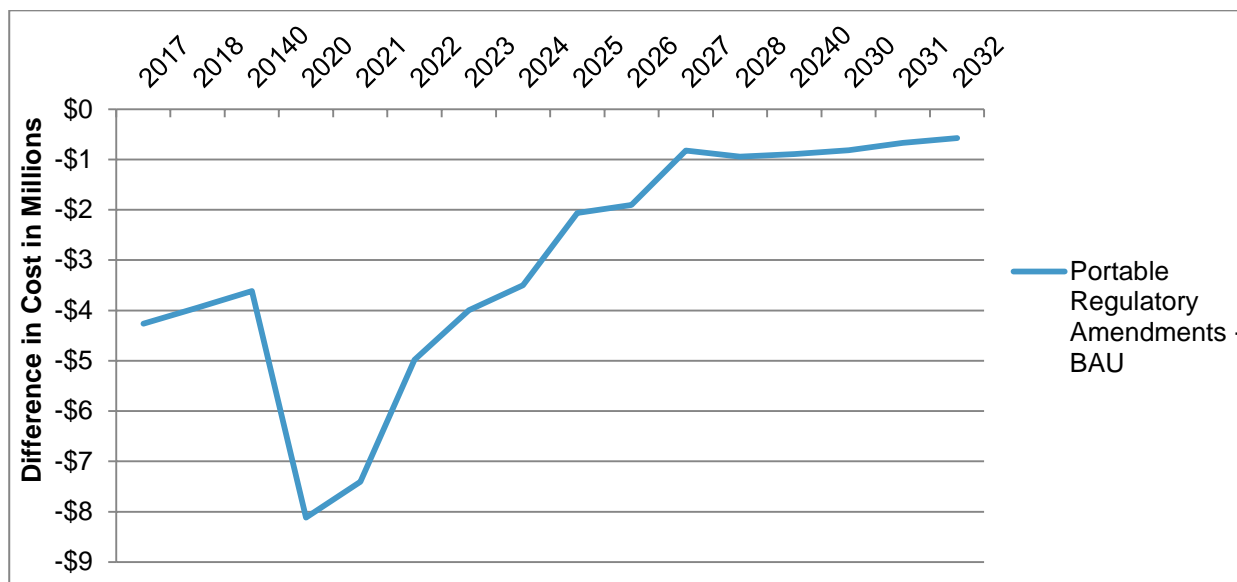
⁹https://www.deere.com/common/docs/products/equipment/industrial_and_agricultural_engines/interim_tier_4_stage_3_b/brochure/it4_brochure.pdf

consumption rate is calculated by multiplying the annual fuel consumption rate by the 5 percent dosing rate.

The cost of DEF in dollars per gallon is used to calculate the annual cost to all fleets as a result of the Portable Regulatory Amendments. Most equipment manufacturers purchase DEF in 55 gallon drums, for which the cost is estimated at \$2.88 per gallon.¹⁰ It is assumed that this cost remains constant (in 2015\$) for the timeframe of this analysis.

Figure 3 shows slower engine turnover under the Portable Regulatory Amendments than under the BAU which 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. This change in annual DEF costs between the BAU scenario and the Portable Regulatory Amendments scenario is outlined in Figure 4. The figure shows that relative to the BAU, the Portable Regulatory Amendments result in cumulative cost savings of \$19.9 million spread among all regulated businesses through 2020. Between 2017 and 2020, this cost savings represents about \$0.4 million per year spread among all small fleets (8 percent of engine horsepower registered in PERP) and \$4.6 million per year spread among all large fleets (92 percent of engine horsepower registered in PERP).

Figure 4: Difference in DEF Costs: Portable Regulatory Amendments - BAU



vi. Total Costs

The annual total cost or cost-saving to industry of the Portable Regulatory Amendments is the sum of the costs or cost savings of one-time equipment and engine replacements, as well as on-going costs and cost-savings from DEF consumption required for Tier 4 engines and equipment registration fees. The annual costs or savings can be summed over the life of the Portable Regulatory Amendments to calculate total costs. Summing the incremental cost of

¹⁰<https://www.google.com/search?q=def+55+gallon+drum&ie=utf-8&oe=utf-8#q=def+55+gallon+drum&tbm=shop>

the Portable Regulatory Amendments (relative to the BAU) results in a cost-savings to industry of almost \$630 million between 2017 and 2030.

E. Macroeconomic 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, meeting the requirements of the Administrative Procedure Act and its implementing regulations.¹¹ ARB uses the REMI single-region, 160-sector model with the model Reference case.

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. The years of analysis are 2017 through 2030. 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 a delayed requirement to purchase more expensive and lower emission equipment compared with the BAU. Fleets use existing engines longer which results in lower equipment capital and DEF costs through 2024 for many fleets.

The analysis begins with the equipment replacement costs, which are one-time capital costs that are amortized for five years, as outlined in the cost section and Table 7 and described below.

1. Production Cost Changes:

- a. Changes in costs for portable equipment are represented as a production cost increase or decrease to an industry depending upon the year.
- b. Changes in costs for DEF for Tier 4 engines are represented as a production cost increase or decrease to an industry depending upon the year.

¹¹ Gov. Code, §§ 11346.3, 11346.36; 1 Cal. Code Regs., tit. 1 §§ 2000-2004; see also: http://dof.ca.gov/Forecasting/Economics/Major_Regulations/SB_617_Rulemaking_Documents/documents/Order_of_Adoption-1.pdf

the employment values shown in Table 8 and employment changes 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 years when previously equipment would have been retired, but due to the delay can continue using the equipment given it still has 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 as compared to the BAU year-over-year. The impacts shown in Table 10 reflect the growth in output, categorized by industry, for businesses located in California. According to the REMI modeling results approximately 90 percent 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. Thus, GDP (output being one major component of GDP) should follow a similar pattern to changes in the output of the primary industries.

Table 10: Change in California Output Growth Relative to the Baseline

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Primary Industries															
Commercial & industrial machinery and equipment rental and leasing (NAICS 5324)	Change (%)	0.0%	0.1%	0.1%	0.1%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%
	Change (M\$2015)	\$2.0	\$3.0	\$3.0	\$7.0	\$9.0	\$8.0	\$8.0	\$7.0	\$4.0	\$2.0	\$0.0	-\$1.0	-\$2.0	-\$2.0
Construction (NAICS 23)	Change (%)	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Change (M\$2015)	\$34.0	\$51.0	\$56.0	\$116.0	\$142.0	\$112.0	\$88.0	\$67.0	-\$9.0	-\$49.0	-\$66.0	-\$72.0	-\$67.0	-\$58.0
Secondary Industries															
Agriculture, construction, and mining machinery manufacturing (NAICS 3331)	Change (%)	-5.2%	0.7%	0.5%	-6.9%	0.8%	3.3%	1.4%	0.4%	2.6%	-0.1%	2.1%	-0.6%	-0.4%	-0.3%
	Change (M\$2015)	\$40.0	\$5.0	\$4.0	-\$53.0	\$6.0	\$26.0	\$11.0	\$3.0	\$21.0	-\$1.0	\$19.0	-\$5.0	-\$4.0	-\$3.0

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. Percentages are rounded to the nearest tenth.

c) Impacts on Investments in California

As modeled, the Portable Regulatory Amendments would produce very small impacts on private business investments in California, relative to the BAU scenario. 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. However in the REMI model estimates, approximately 90 percent of that portable equipment sector is located outside of California. The REMI modeling results suggest that PERP 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 11 shows

the change in California private investments from 2017 to 2030, ranging from a 0.20 percent increase in growth in 2021 and a decline of 0.09 percent in 2027. The slowed growth in private investment is indiscernible from BAU given the size of California's \$2.2 trillion economy.¹²

Table 11: Change in Gross Domestic Private Investment Growth in California

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Change (%)	0.06%	0.08%	0.08%	0.18%	0.20%	0.15%	0.12%	0.08%	-0.02%	-0.07%	-0.09%	-0.09%	-0.08%	-0.06%
Change (M\$2015)	\$52.0	\$78.0	\$85.0	\$178.0	\$218.0	\$176.0	\$142.0	\$113.0	-\$1.0	-\$63.0	-\$88.0	-\$99.0	-\$93.0	-\$81.0

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 2030, relative the BAU scenario. Table 12 shows that the greatest annual change in growth of personal income is 0.02 percent in 2021. The Portable Regulatory Amendments are anticipated to increase employment in most sectors in California, with only small decreases in growth beginning in 2025, as seen in Table 8. The increased employment results in increased growth of personal income. The growth in personal income follows in the same pattern as employment with a one year lag, and the growth in personal income makes a slight decline after 2026 as a result of increased compliance requirements and corresponding decrease in employment in the portable engine sector as seen in Tables 8 and 9.

¹² 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 12: Change in Personal Income Growth in California

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Change (%)	0.00%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Change (M\$2015)	\$64.0	\$125.0	\$138.0	\$269.0	\$361.0	\$307.0	\$271.0	\$235.0	\$62.0	-\$26.0	-\$51.0	-\$92.0	-\$93.0	-\$87.0

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) Impact on California Gross Domestic Product (GDP)

As presented in Table 13, the Portable Regulatory Amendments are estimated to slightly accelerate the growth of California GDP in the early years, relative to the BAU scenario. 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 2025 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 produce lower compliance costs in early years for industries that use portable equipment. As a result, these companies increase employment, other capital purchases, and output in their industry. 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 13 indicates. Overall, the changes in growth of GDP are indiscernible from BAU given the size of California's \$2.2 trillion economy.¹³

¹³ 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 13: Change in California’s Gross State Product Growth

	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Change (%)	0.01%	0.01%	0.01%	0.02%	0.02%	0.02%	0.01%	0.01%	0.00%	0.00%	0.00%	-0.01%	0.00%	0.00%
Change (M\$2015)	\$134.0	\$207.0	\$216.0	\$467.0	\$572.0	\$436.0	\$375.0	\$317.0	\$1.0	-\$109.0	-\$129.0	-\$172.0	-\$155.0	-\$135.0

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 more 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

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 Regulatory Amendments, but instead this industry will face more favorable economic conditions. Those companies that have already complied will be able to use their engines for compliance and have already incurred the costs to comply. Thus, in compliance years, their spending will be lower than that of other business and may give them a slight advantage in compliance years. In future years, as new businesses are beginning to meet the requirements, those with Tier 4 engines already will face lower cost to offer the same service.

h) Creation, or Elimination, of Businesses

Due to the Portable Regulatory Amendments, there is anticipated to be growth in industries using portable equipment, as described in the previous sections, which may expand businesses in early years relative to the BAU scenario. 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 percent 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. 18 Year Equipment Life with Relaxed Fleet Average Standards
2. Tiers 1-3 Phase-Out by 2025

Alternative 1 considers a scenario with delayed tier phase-out dates and relaxed fleet average option standards which will allow older engines to operate longer, especially large fleets that opt-in to the fleet average standards.

Alternative 2 considers a scenario in with accelerated tier phase-out and fleet average schedules compared to the Portable Regulatory Amendments and would result in higher emission reductions with additional costs to affected businesses.

A comparison of emissions impacts for the BAU, Portable Regulatory Amendments, and each alternative is presented in Figure 5 and Figure 6.

Figure 5: Statewide PM: All Scenarios

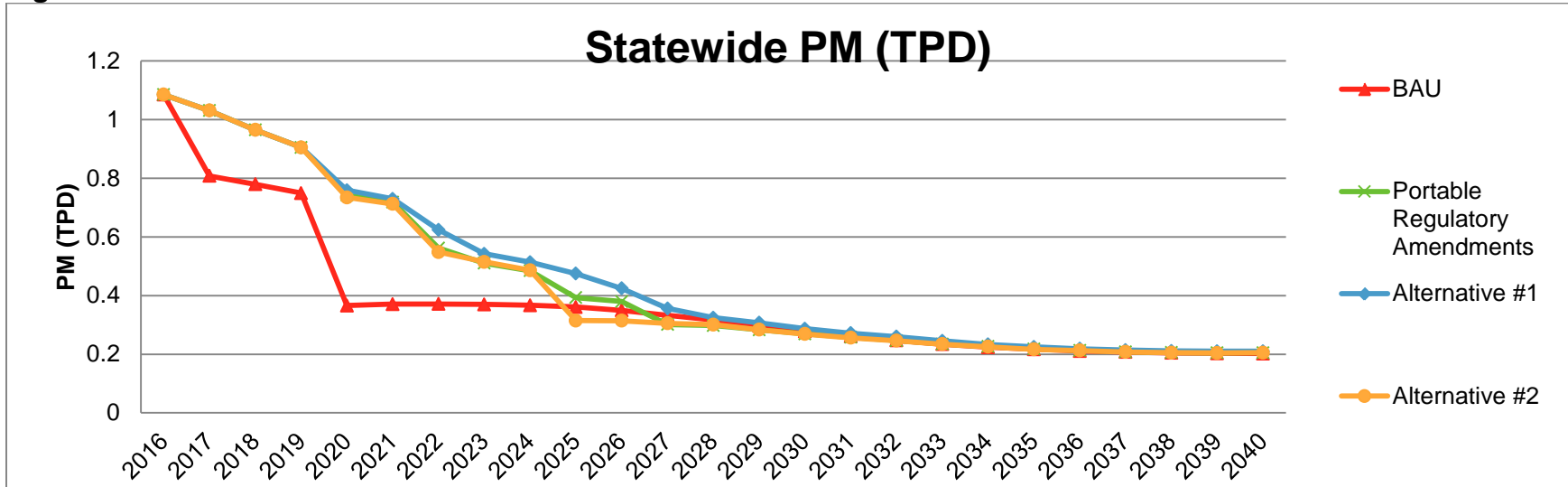
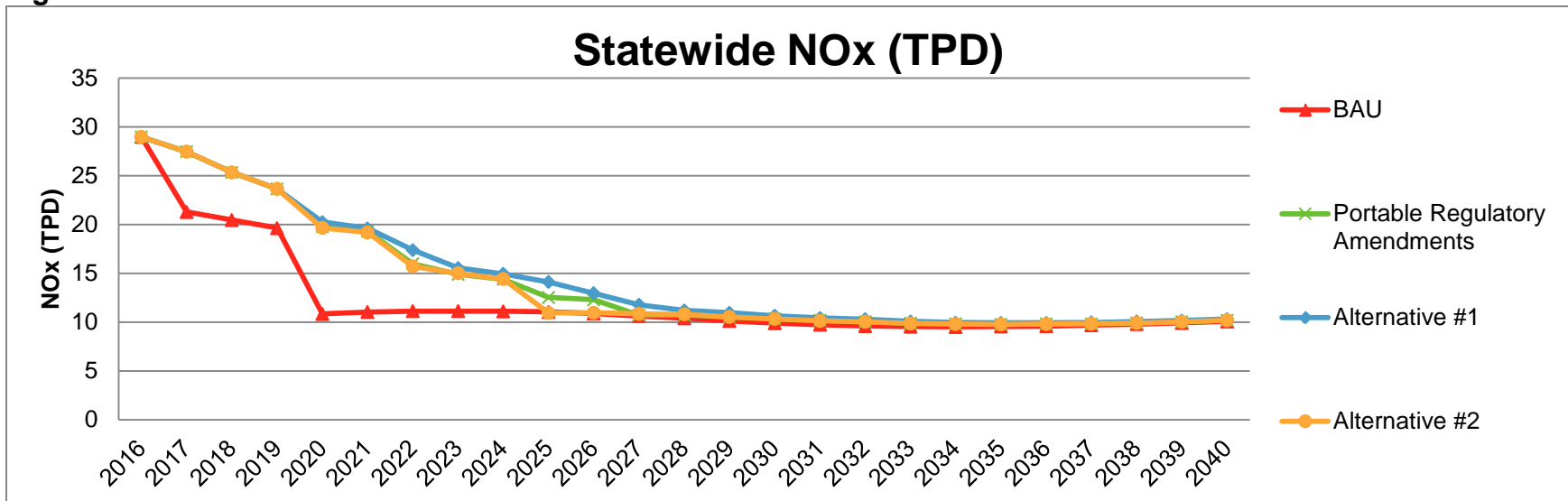


Figure 6: Statewide NOx: All Scenarios



1. Alternative 1: 18 Year Equipment Life with Relaxed Fleet Average Standards

a. Costs and Benefits

Alternative 1 is less stringent than the Proposed Regulatory Amendments because it allows older engines to operate longer. This alternative is not as costly for fleets but results in fewer emission reductions compared to the Portable Regulatory Amendments. Figures 5 and 6 show the PM and NO_x respectively for this alternative.

Alternative 1 would provide additional 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 1, 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 percent Tier 4 and 35 percent 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 using methods similar to that of the Portable Regulatory Amendments outlined in the Direct Cost section. However, because the fleet option for Alternative 1 is more attractive (less restrictive) than for the Portable Regulatory Amendments ARB predicts that 50 percent of the large fleets will choose the fleet average option while the rest will choose the Tier phase-out option.

The costs and cost savings of the Portable Regulatory Amendments and Alternative 1 are compared from 2017 to 2027, which corresponds with the timeframe of the implementation of the Alternative. Using the same inputs used to estimate the change in average annual cost as the Portable Regulatory Amendments this alternative would require a change in the fleet purchasing habits as estimated using the equipment turnover model. The average annual equipment cost savings of Amendment 1 from 2017 to 2027 is \$34.9 million, while the average annual equipment cost savings under the Portable Regulatory Amendments is estimated at \$21.4 million over the same time frame.

b. Economic Impacts

Alternative 1 is less stringent than the Portable Regulatory Amendments, resulting in more growth in early years compared with both the BAU and the Portable Regulatory Amendments. Compared to the BAU, there would be small changes in GDP, personal income, private investment, or other economic indicators as shown in Table 14. The results for the alternative are not significantly different than the regulation in percentage terms.

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 less costly for businesses on an annual basis while achieving fewer reductions through 2027, and those reductions are achieved later. Alternative 1 is a less cost-effective alternative compared to the Portable Regulatory Amendments.

d. Reason for Rejection

This alternative was rejected because the Portable Regulatory Amendments will result in higher emission reductions while remaining economically feasible. The lower cost to businesses offered by Alternative 1 comes with higher statewide emission rates between 2020 and 2027. Additionally, air districts with the most serious air quality issues nationwide have State and federal emission goals in 2025 and Alternative 1 would result in a 1.1 tpd of NOx and 0.06 tpd of PM statewide increase compared to the Portable Regulatory Amendments for that year.

Table 14: Change in Growth of Economic Indicators for Alternative 1 Compared to the Baseline

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
GDP	Change (%)	0.01%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
	Change (M\$2015)	133.9	207.6	215.7	401.1	513.2	335.8	252.1	193.2	-90.7	-190.7	-238.5	-242.4	-230.3	-190.6
Personal Income	Change (%)	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%	-0.01%	-0.01%	0.00%
	Change (M\$2015)	64.5	125.2	138.0	231.9	324.4	243.2	194.5	153.5	-8.3	-83.3	-127.4	-144.3	-148.7	-130.7
Employment	Change (%)	0.01%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
	Change in Jobs	1150	1850	1850	3275	4200	2600	1825	1300	-950	-1650	-1925	-1875	-1725	-1375
Investment	Change (%)	0.06%	0.08%	0.08%	0.16%	0.18%	0.12%	0.07%	0.05%	-0.04%	-0.10%	-0.11%	-0.10%	-0.09%	-0.08%
	Change (M\$2015)	52.2	77.7	85.4	157.2	193.2	140.5	94.7	63.8	-35.9	-95.4	-123.6	-126.5	-116.2	-97.3

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.

2. Alternative 2: Tiers 1-3 Phased-out by 2025

In Alternative 2 the final compliance date is two years earlier for large fleets and four years earlier for small fleets than in the Portable Regulatory Amendments resulting in a compressed timeframe for compliance and higher compliance costs in those years. The Portable Regulatory Amendments phase-out most Tier 1-3 engines by 2025 while Alternative 2 phases out all Tier 1-3 engines by 2025.

Alternative 2 would utilize the same fleet standards as the Portable Regulatory Amendments, but would require these fleet standards to be met earlier as shown in Table 15 below. This alternative would also use a different Tier Phase-out schedule, as shown in Table 16 below. This option achieves higher emission reductions by 2025, while the Portable Regulatory Amendments will achieve the same emissions reductions as Alternative 2 in 2029, though at a lower cost to industry.

Table 15: Alternative #2 Fleet Average Option for Large Fleets

<i>Proposed Compliance Date</i>	<i>Proposed Fleet PM Standard (g/bhp-hr)</i>
1/1/2020	0.10
1/1/2023	0.06
1/1/2025	0.03

Table 16: Alternative #2 Tier Phase-Out Schedule

<i>Engine Certification</i>	<i>Engines rated 50 to 750 bhp</i>		<i>Engines rated >750 bhp</i>
	<i>Large Fleet</i>	<i>Small Fleet</i>	
Tier 1	1/1/2020	1/1/2020	1/1/2022
Tier 2	1/1/2022	1/1/2022	1/1/2025
Tier 3 built prior to 1/1/2009	1/1/2025	1/1/2025	NA
Flex engines (Tier 1,2, and 3)	Treated as the Tier the engine was built to.		

a. Costs and Benefits

Alternative 2 is a more costly alternative compared with the Portable Regulatory Amendments. It requires that all engines lower than Tier 4 phase-out in 2025 instead of 2029 as required under the Portable Regulatory Amendments. The costs and cost savings of the Portable Regulatory Amendments and Alternative 2 are compared from 2017 to 2027, which corresponds with the timeframe of the implementation of the Alternative. The Portable Regulatory Amendments provide four more years to purchase Tier 4 engines, thus spreading the capital costs to ensure the businesses can comply. Alternative 2 results in slightly lower statewide emission rates, but also results in a higher cost to business. Figures 5 and 6 show

the PM and NOx respectively for this alternative. The average annual equipment cost savings of Alternative 2 from 2017 to 2027 is \$14.6 million while the average annual equipment cost savings under the Proposed Regulatory Amendments is estimated at \$21.4 million over the same time frame.

b. Economic Impacts

Alternative 2 would result in a \$6.8 million per year average annual cost savings to the primary industry when compared to the Portable Regulatory Amendments over the life of the amendment. The cost would be imposed on both large fleets and small fleets since the tier phase-out and fleet average schedules are accelerated relative to the Portable Regulatory Amendments. Table 17 compares the BAU with Alternative 2, and shows that estimated changes in California GDP, personal income, and employment are very similar to the economic impacts of the Portable Regulatory Amendments. Through 2021, most of the economic indicators are relatively the same; in 2025 the alternative results in lower growth that persists through 2030. This result is primarily due to the Tier 2 phase-out (for engines rated 50-750 bhp) and tier 1 phase-out (for engines rated >750 bhp) in 2022. While this alternative is more costly and the growth of GDP, employment, investment and personal income are all lower than the Portable Regulatory Amendments, these changes are very small compared to the size of the California economy.

c. Cost-Effectiveness

Alternative 2 would result in a higher compliance costs but would also result in slightly lower statewide emissions than the Portable Regulatory Amendments in early years. Fleets would be required to obtain more Tier 4 engines to stay in compliance with Alternative 2, which would lead to direct decreases in NOx and PM between 2017 and 2027.

d. Reason for Rejection

Alternative 2 achieves larger emissions reductions than the Portable Regulatory Amendments but these reductions are achieved with a higher cost to California businesses. Annual costs to businesses in some years would be higher than the costs to businesses under the BAU which stakeholders believe is economically unrealistic and could potentially result businesses leaving California.

Table 17: Change in Growth of Economic Indicators for Alternative 2 Compared to the Baseline

		2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
GDP	Change (%)	0.01%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (M\$2015)	133.9	207.5	215.6	386.8	492.3	273.1	192.4	141.3	-228.1	-361.1	-315.3	-296.0	-260.3	-78.7
Personal Income	Change (%)	0.00%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change (M\$2015)	64.5	125.2	138.0	225.0	311.6	209.8	154.2	118.8	-82.6	-193.9	-190.5	-190.5	-176.8	-78.8
Employment	Change (%)	0.01%	0.01%	0.01%	0.01%	0.02%	0.01%	0.01%	0.00%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	0.00%
	Change in Jobs	1150	1850	1850	3175	4025	21225	1350	900	-1925	-2925	-2450	-2225	-1875	-525
Investment	Change (%)	0.06%	0.08%	0.08%	0.16%	0.17%	0.10%	0.05%	0.02%	-0.10%	-0.14%	-0.14%	-0.12%	-0.09%	-0.04%
	Change (M\$2015)	52.2	77.7	85.4	151.7	185.5	116.1	72.5	42.6	-91.1	-157.6	-156.9	-144.6	-124.6	-56.5

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

Local government agencies have two separate roles under the Portable Regulatory Amendments. Many local government agencies register their portable equipment units in PERP and will see lower equipment and DEF costs and higher registration fees under the Portable Regulatory Amendments compared to the BAU scenario. In the second role, the 35 California air districts regulate portable equipment and enforce the PERP registrations. A portion of the higher registration fees in the Portable Regulatory Amendments will be distributed to the local air districts representing increased revenue to local government.

The net cost or savings to PERP registrants, including local government, will vary annually depending on the age of the portable engines, fleet composition, and other factors. Local governments comprise about 4.8 percent of total portable equipment (by horsepower) and the Portable Regulatory Amendments are estimated to result in an annual cost-savings of \$492 million to all regulated entities between 2017 and 2020 (see Table 7 for additional detail). This cost savings includes lower expenditures on equipment and DEF and increased registration fees. The estimated annual cost savings to local government agencies is approximately \$23.6 million each year between 2017 and 2020.

Increased registration fees (for all fleets including those owned by local agencies) will provide increased revenue to local air districts. 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). In total, the air districts are expected to see an increase in revenue of approximately \$672,000 per year on average between 2017 and 2030. The amount allotted to each district will vary depending upon the number of renewals or new registrations annually in each district. As indicated in the Cost Section (D)(2)(a)(vi.), to find the total increase in fees in each year, the difference between the renewals or newly registered engines in any given year for the Portable Regulatory Amendments and the BAU is obtained (see Table 6), then these values are multiplied by their corresponding increase in fees. The districts will receive \$60 of the increase for each new renewal and newly registered engine and the remaining funds are distributed to ARB. This increase in revenue is expected to cover any additional staffing or training needs at local air districts.

2. State Government

State government comprises about 1 percent of the total registered horsepower in PERP and is anticipated to have an average net annual cost savings of approximately \$4.9 million (1 percent of the total cost of \$492 million which is outlined in Table 7) between 2017 and 2020. This cost savings includes lower expenditures on equipment and DEF and increased registration fees. Thus, the Portable Regulatory Amendments are expected to represent a net savings to State government agencies who register PERP equipment of approximately \$4.9 million each year from 2017 to 2020.

3. ARB

As outlined in the cost section, the increase in registration costs will increase the revenue to support the PERP by \$185 for each new registration and \$165 for a renewal of each registration (see Table 5). ARB is expected to retain approximately \$1.2 million per year on average between 2017 and 2030, after accounting for fees to local government. This is calculated by multiplying the annual new registration numbers (presented in Table 6) by \$185, and the registration renewals (also presented in Table 6) by \$165, summing these numbers and subtracting the portion of registration fees apportioned to local government.

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 will require changes to the DMS for amendment implementation. These staffing 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. Once the proposed fee increases are in place, ARB will submit a budget change proposal to address any staffing shortages, IT resource needs, and other implementation resources as deemed necessary.