Regulation for Reduction of Greenhouse Gas Emissions from Crude Oil and Natural Gas Operations
Standardized Regulatory Impact Assessment

A. Summary

All state agencies that propose major regulations must complete a Standardized Regulatory Impact Assessment (SRIA). This requirement is further described in Title 2, section 11346.36 of the California Government Code, and in Title 1 of the California Code of Regulation at sections 2000-2004. For the purposes of the SRIA, a major regulation is one that will result in either total costs or total benefits of more than $50 million in any given year of the proposed regulation's implementation.

The proposed Regulation for Reduction of Greenhouse Gas Emissions from Crude Oil and Natural Gas Operations (Oil and Gas Regulation) is aimed towards reducing greenhouse gas (GHG) emissions from oil and gas production, processing, storage and transmission compressor stations. The preliminary proposal (O&G Proposal) analyzed in this SRIA includes performance standards or control strategies for several sources (oil and water separators and storage tanks, well completion tanks, compressors, pneumatic devices, liquids unloading) as well as a comprehensive leak detection and repair (LDAR) program. The proposed Oil and Gas Regulation is expected to be effective January 1, 2017 with full implementation by December 31, 2018.

The proposed Oil and Gas Regulation was discussed at two workshops in August 2014 and December 2014, which provided stakeholders time to comment and propose alternatives, and allowed time to incorporate comments and alternatives into the SRIA analysis. ARB considers stakeholder feedback throughout the regulatory adoption process including up to the adoption of the final regulation. Thus, this SRIA is representative of a snapshot of this regulation (herein referred to as the O&G Proposal), where the costs and compliance requirements represent the best information we have at the time of SRIA submittal, and may differ from the proposed regulation that will be presented to the Air Resources Board in June 2015. The final proposed Oil & Gas Regulation will be informed by continued interactions with stakeholders, the public, external researchers, other regulatory agencies, as well as direction the Board may provide to staff at the hearings where it considers the proposal.

The economic impacts of the O&G Proposal on the California economy are negligible, considering the size and diversity of the California economy. However, the O&G Proposal increases costs on the complying industries (mainly oil and gas extraction with the natural gas distribution sector impacted at compressor stations only). These industries, referred to as primary industries, pay for control equipment and services from secondary industries but may also achieve operational cost savings through recovery of natural gas captured by the proposed control strategies.

The O&G Proposal requires full compliance by December 31, 2018. This SRIA spreads the compliance costs over several years for the primary industries because the analysis assumes these industries will have access to financing. In comparison, the secondary industries will face increased demand for their products resulting in an immediate

economic benefit beginning in 2017, with limited ongoing benefits for annual inspections and other ongoing costs for the primary industry (such as fuel demand). Thus, the primary industries see a small but negative impact in all years while the secondary industries see a benefit that is largest in 2017.

ARB estimates the O&G Proposal will result in slight reductions in the growth of California's Gross State Product (GSP) after 2017, with an increase in GSP growth of almost $54 million in 2017. The impacts are considered negligible for all years relative to the size of California's $2 trillion economy. The increase in 2017 is due to the bump in demand for secondary industries, mostly in 2017, with the cost spread across many years for the primary industry. The spread in costs for the primary industries results in a slight reduction in the growth of GSP over time, equaling less than $26 million in 2022; these results represent less than 0.00002% of GSP in 2017 and approximately 0.00001% growth reduction in GSP in 2022.[1] As discussed previously, ARB anticipates full implementation of the O&G Proposal by December 31, 2018; with all capital equipment acquired in 2017; however, the SRIA analysis amortizes those costs over the life of the capital. Though the full implementation- or time of full compliance- of the O&G Proposal will occur by December 31, 2018, we have provided results for a five-year period to provide a more thorough evaluation of the benefits and impacts of the O&G Proposal as the primary industries continue to comply with the requirements. The analysis utilizes the best information available and when necessary makes conservative assumptions that may underestimate emissions and reductions and overestimate costs; these estimated values may be revised as the proposed regulation is refined.

1. Statement of the Need of the Proposed Regulation

On September 27, 2006, Governor Schwarzenegger signed Assembly Bill 32 (AB 32), The California Global Warming Solutions Act of 2006 (Núñez, Statutes of 2006, chapter 488). AB 32 requires a reduction of greenhouse gas (GHG) emissions to 1990 levels by 2020 and designates the California Air Resources Board as the lead agency for implementing AB 32. As part of the strategy to meet the 2020 emission target, ARB identified the oil and gas sector as a large source of GHG emissions. Both the 2008 Climate Change Scoping Plan and the 2014 Update to the Climate Change Scoping Plan include the regulation of oil and gas operations as a potential GHG mitigation measure. With the emergence of SLCP, such as methane, as pollutants of concern, regulation of oil and gas operations have become even more important. As such, ARB is proposing a regulation to reduce vented and fugitive emissions from oil and gas sector production, processing, storage, and compressor stations along natural gas transmission lines. GHG emissions from oil and gas pipelines are being addressed in a separate regulatory effort in partnership with the California Public Utilities Commission.

The goal of the proposed Oil and Gas Regulation is to obtain maximum GHG reductions, primarily methane, from oil and gas production, processing, storage and transmission compressor stations in a technically feasible and cost-effective manner. The proposed Oil and Gas Regulation will promote statewide uniformity in methane emission controls, minimize the administrative burden on local air districts, harmonize state requirements with current and near-future local and federal requirements, achieve

[1] http://www.lao.ca.gov/reports/2014/calfacts/calfacts-2014.pdf. California's GDP is approximately $2.2 trillion dollars.

co-benefits that protect public health from toxic emissions from well stimulation or other sector sources, and support the State Implementation Plan (SIP) by designing a regulation that attends to criteria pollutant goals.

The O&G Proposal reduces GHG emissions through source-based requirements and a comprehensive leak detection and repair (LDAR) program. The source-based requirements are proposed for separators and oil and water tanks, compressors, pneumatic devices, well completion recirculation tanks, and liquids unloading. In general, the requirements include performance standards or control technologies based either on an emission threshold or time/usage criterions. The LDAR component is an annual monitoring and repair program that ensures leaks are repaired in a timely manner and has the benefit of detecting high emitting equipment that are not directly addressed by the control strategies. The strategies are described in more detail in Section C, Direct Costs.

2. Major Regulation Determination

The O&G Proposal was determined to be a major regulation because the modeling determined the estimated economic impact of compliance exceeds $50 million in 2017. While direct costs to the primary industries exceed $50 million in the first year of implementation, these industries achieve savings of almost $5 million annually from leakage prevention strategies within the O&G Proposal. Secondary industries also achieve benefits, as demand for their equipment, services, or other products such as natural gas increases yielding positive economic benefits. Californians will also benefit from reductions in GHGs and other air pollutants (such as volatile organic compounds (VOCs) and air toxics) due to the O&G Proposal.

3. Baseline Information

The baseline information provides an understanding of the current standards that industry must follow. These standards identify the business-as-usual case; the emissions estimates reflect the baseline case and emission reductions and costs used in this analysis will be above and beyond those incurred in the baseline.

The O&G Proposal has seven main control strategies, described in more detail in Section C. Some of these control strategies are already in use as several local air districts have been controlling emissions of VOCs and Nitrogen Oxides (NO_x) from the oil and gas sector for over 30 years. ARB's O&G Proposal would expand the coverage to additional emission sources and air districts without existing control programs. The estimated GHG emissions, GHG emission reductions, and costs described below for the O&G Proposal reflect only the increment above what is already being controlled by existing local air district VOC rules. That is, the baseline includes current local air district rules.

For example, the air districts within the major oil producing regions of the State have had LDAR programs, or Inspection and Maintenance (I&M) programs, for decades to reduce VOC emissions. However, current air district I&M programs do not cover components (such as valves, flanges, seals, etc.) with VOC concentrations of equal to or less than 10 percent by weight; consequently, components that are used in pipeline

quality natural gas service-which is approximately 95% methane and thus about 5% or less VOC-are not covered by district I&M programs. Therefore, the LDAR component of this O&G Proposal is primarily designed to address those components not covered by current district I&M programs such as components at dry natural gas production operations in northern California, underground natural gas storage facilities, and natural gas transmission compressor stations. ARB staff estimates that of all the components in the oil and gas sector, more than 80 percent are already covered by existing air district I&M programs to prevent the release of VOC emissions; the LDAR component of the O&G Proposal is aimed at the remaining 20 percent of components.

Other emission sources addressed in the O&G Proposal are also regulated by air districts. For example, air districts can regulate compressors as a stationary combustion source or through I&M rules for fugitive VOC leaks in oil fields. However, local air district rules do not require the control strategies described in the O&G Proposal such as rod packing replacements on reciprocating compressors or reduced emissions from seals from centrifugal compressors.

Most air districts within the major oil producing regions of the State also have rules to limit VOC emissions from tanks and separators, often requiring vapor recovery systems, although the stringency varies by air district and sometimes by tank size, throughput, and vapor pressure of the product stored. Air districts in dry natural gas producing areas typically do not have vapor recovery requirements for tanks. Local air district rules do not regulate recirculation tanks with limited usage (such as those used for well stimulation treatments), nor do they typically regulate pneumatic devices or pumps, or liquids unloading operations at dry natural gas wells, because the emissions are mostly comprised of methane.

In addition to local air district rules, US EPA put into place New Source Performance Standards (NSPS) for the oil and gas sector (Subpart OOOO). These standards directly achieve VOC reductions, with methane co-benefits, and apply only to new, modified, and reconstructed sources on or after August 2011. They include requirements for hydraulically fractured natural gas well sites; storage tanks throughout the sector; low or no bleed pneumatics at well sites, compressors and compressor seals in the field and natural gas processing plants; and strengthened LDAR at natural gas processing plants. Typically, local air districts adopt the NSPS requirements, and many local air districts' VOC rules already address the requirements described above.

The main differences between subpart OOOO and the O&G Proposal are that the O&G Proposal would: 1) apply also to existing sources; 2) be methane-based not VOC-based: and 3) apply to more of the sector, such as underground natural gas storage facilities and natural gas transmission compressors.

US EPA has recently announced plans to further explore approaches to reduce VOC and methane emissions from hydraulically fractured oil wells, compressors, pneumatic devices, liquids unloading from natural gas wells, and leaks. All of these sources are included in the O&G Proposal.

Table 1 below summarizes the estimated emissions and reductions from the categories being considered in this O&G Proposal. The emission estimates are based on a 2009 industry survey of 2007 emissions[2]. This survey is the most complete and detailed California-specific data available at the time of this analysis. While ARB also collects data through the Mandatory Greenhouse Gas Reporting Regulation (MRR), this data does not include facilities that emit less than 25,000 metric tonnes of carbon dioxide equivalent (MT CO_2e) annually which are almost exclusively the regulated parties for the O&G Proposal. In addition, not all MRR data is available at the level of detail necessary to evaluate each control option. Oil and gas production has decreased since 2007[3] but this could result in an increase or decrease of GHG emissions depending on infrastructure usage. For example, total emissions reported under MRR (including non-fugitive CO_2 emissions) have increased from 2008 to 2012 despite a decrease in production.[4] This SRIA analysis assumes 2007 is a representative year for current emissions. ARB has requested data from industry stakeholders to account for changes since 2007 and plans to consider updated information received in the final rulemaking.

Staff assumes operational practices and equipment, and thus emissions, are similar in present day as they were in 2007. Staff is currently comparing the information used in the SRIA analysis to more recent data reported to ARB and the U.S. Environmental Protection Agency (U.S. EPA), therefore emission estimates may change in the final rulemaking analysis. The following analysis includes a comparison of emissions, potential reductions, and cost-effectiveness using multiple global warming potentials (GWP) and accounting for the various air district rules across the state.

[2] http://www.arb.ca.gov/cc/oil-gas/FinalReportRevised.pdf

[3] Department Of Conservation, 2012 Preliminary Report of California Oil and Gas Production Statistics ftp://ftp.consrv.ca.gov/pub/oil/annual_reports/2012/PR03_PreAnnual_2012.pdf

[4] http://www.arb.ca.gov/cc/reporting/ghg-rep/reported-data/2008-2012-ghg-emissions-summary.pdf

Table 1: Summary of Annual Emissions and Reductions for O&G Proposal (2018-2022)[5]

Proposed Category For Control	Emissions before Regulation (tonnes CO_2e)	Reductions from Proposal (tonnes CO_2e)
Uncontrolled Oil and Water Separators and Tanks	265,000	252,000
Reciprocating Compressors	476,000	143,000
Centrifugal Compressors	20,000	10,700
Pneumatic Devices and Pumps	167,000	124,000
Recirculation Tanks For Well Stimulation Completions	25,700	24,400
Liquids Unloading	400	350
Components under New LDAR Program	2,900	1,200
Remaining Emissions (includes equipment controlled under existing district programs)	38,600	0
TOTAL	**996,000**	**556,000**

4. Public Outreach and Input

ARB has requested input from stakeholders and the public regarding the provisions in the proposed Oil and Gas Regulation. In 2014, ARB conducted informal meetings with stakeholders in addition to two public workshops, which were webcast and made available by teleconference, on the proposed regulatory provisions. Information regarding these workshops and any associated materials are posted on the ARB website and distributed through two public listserves that include over 3,000 recipients.[6] The August 2014 workshop was also posted to two additional ARB listserves[7] and distributed by the Department of Conservation.[8].

[5] Using Fourth Assessment Report 100 year GWPs. Annual emissions are based on 2007 data.

[6] The August 2014 workshop was posted to four ARB listserves including the climate change, fuels, oil and gas, and natural gas transmission and distribution list serves and distributed by the California Department of Conservation.

[7] http://www.arb.ca.gov/listserv/listserv_ind.php?listname=cc
http://www.arb.ca.gov/listserv/listserv_ind.php?listname=fuels

[8] http://www.conservation.ca.gov/index/Pages/Index.aspx

The public workshops at which ARB solicited comments and feedback from affected stakeholders regarding the O&G Proposal include:

- August 25, 2014: Public workshop to discuss proposed regulatory activities for oil and natural gas production, processing, and storage operations, including well stimulation.

- December 9, 2014: Second public workshop to discuss proposed regulatory activities for oil and natural gas production, processing, and storage operations, including well stimulation.

In addition to continued efforts to solicit feedback from stakeholders about alternatives to the O&G Proposal, a formal solicitation was made at the December 9, 2014 public workshop for stakeholders to provide regulatory alternatives for both the SRIA and the Environmental Analysis. Responses to the SRIA alternatives solicitation are addressed in Section E, Alternatives.

B. Benefits:

The O&G Proposal is anticipated to deliver environmental benefits that include an estimated annual reduction in GHG emissions, beginning in 2018, of about 556,000 MT CO_2e from oil and gas related emissions in California. In addition, the O&G Proposal is expected to save about 1.1 million standard cubic foot (Mscf) per year of industrial natural gas through reductions of leaks and through vapor recovery systems. Quantifying this benefit, assuming natural gas price is $4.10 per Mscf, the savings from the reduction in loss of natural gas would equal $4.8 million a year. The cost-effectiveness of the O&G Proposal is estimated to be approximately $40 per MT CO_2e reduced. To be consistent with ARB's GHG inventory, these estimates use the 100-year GWP for methane (i.e., 25) from the Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report (AR4). Table 2 shows the reductions and cost-effectiveness using the 20-year and 100-year GWP from the IPCC's most recent (Fifth) Assessment Report (AR5), in addition to the 100-year AR4 GWP, to reflect the latest science and the importance of short-lived climate pollutants (SLCP):

Table 2: Fifth Assessment GWP Reductions and Cost-Effectiveness

	100-year AR4 GWP	**100-year AR5 GWP**	**20-year AR5 GWP**
Emissions ($MTCO_2e$)	1.0	1.3	3.3
Reductions ($MTCO_2e$)	0.56	0.8	1.9
Cost-Effectiveness ($/tonne CO_2e)	$40	$30	$12
Cost-Effectiveness with gas savings ($/tonne CO_2e)	$32	$24	$10
GWP value	25	34	86

Cost-effectiveness is based on the natural gas savings price per Mscf for 2017 provided by the CEC.[9]

[9] http://www.energy.ca.gov/2014publications/CEC-200-2014-001/CEC-200-2014-001-SF.pdf. The value of the natural gas prices are based upon wholesale prices that are forecasted by the California Energy Commission using their NAMGas general equilibrium model.

The AR5 values reflect the impact of methane using the most recent scientific information. Using the 20-year GWP shows the impact of reducing methane in the short term when compared to carbon dioxide. One benefit of reducing methane, an SLCP, is that it has a much higher 20-year GWP compared to carbon dioxide as opposed to its already higher 100-year GWP. Reducing SLCPs, such as methane, can produce near term results that deliver immediate and tangible climate, air quality, economic, and health benefits while longer-term changes are being implemented.

The O&G Proposal is also expected to provide co-benefits of reductions in emissions of VOCs and toxic air contaminants that are emitted from uncontrolled oil and water storage tanks and released from well stimulation recirculation tanks. The estimated reduction in VOCs is approximately 5,000 tons per year, or about 14 tons per day, statewide. There is the potential for NO_x increases for vapor recovery units if the facility uses a flare instead of connecting to a sales line. ARB is investigating potential methods within the regulation for minimizing or eliminating any potential NO_x increases as part of continuing rule development

1. Benefits to Individuals

The O&G Proposal will not directly affect individual consumers; however, as a result of the anticipated decrease in GHG emissions, toxics, and VOCs, the O&G Proposal will provide health benefits. Emissions reductions of these pollutants have been correlated with a reduction in the risk of premature deaths, hospital visits, emergency room visits for asthma, and a variety of other health impacts, especially in sensitive receptors including children, elderly, and people with chronic heart or lung disease.

2. Benefits to California Businesses

The O&G Proposal requires the oil and gas industry to purchase, retrofit, and service capital equipment. The requirements of the regulation would increase the demand for these services and increase business opportunities for secondary industries both within and outside of California. Additionally, the O&G Proposal is designed to reduce industrial natural gas leakage, which will result in cost savings for the regulated parties. For example, many of the proposed control strategies are designed such that natural gas can be recovered and either used on site as energy or captured for sale. Conservative estimates of cost savings are presented in Table 4. While the primary industries are not small businesses, some of the secondary industries contain small businesses. If these businesses were able to meet the increased demand and provide the capital equipment and services to the primary industries for compliance, small businesses would see increased demand, output and, likely, employment.

C. Direct Costs

The individual control strategies of the O&G Proposal are designed to attain maximum GHG emission reductions using the best available data and developed with input from

air districts and industry stakeholders. The proposed control strategies require regulated entities to:

a) Install vapor recovery systems on crude oil and natural gas separators and tanks that currently have no vapor recovery installed on the primary or secondary vessels, if they exceed 6 metric tons per year of methane, as determined by a flash analysis test procedure. The vapor recovery system would have to reduce emissions by at least 95%.

b) Replace reciprocating natural gas compressor rod packings (within 3 years, without tracking usage, or, if usage is tracked, the replacement may be after 3 years but must be within 26,000 hours of operating time).

c) Replace centrifugal natural gas compressor wet seals with dry seals, or collect the wet seal vapors and route the gas to a vapor collection system to reduce the emissions by 95%.

d) Replace high bleed pneumatic devices with low-emitting devices that meet or exceed a specified leak rate of 6 standard cubic feet per hour, and replace pneumatic pumps with pumps that meet a zero leak rate standard.

e) Install a Plunger-Lift or similar equipment in natural gas wells to minimize the venting of natural gas to atmosphere when unloading liquid from the well bore.

f) Install 95% effective vapor recovery systems on recirculation tanks used to circulate fluids from a newly completed crude oil or natural gas well that was completed using a Well Stimulation Treatment, such as hydraulic fracturing.

g) Require an annual LDAR program that requires testing of components for leaks of methane at crude oil and natural gas facilities that aren't already covered by an existing LDAR program, and establish a requirement to repair leaks that are above a specified leak threshold of 1,000 parts per million (ppm).

To estimate the cost of the O&G Proposal, ARB collected cost data from a variety of sources including a study prepared by ICF International entitled "Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries"[10], documents obtained from U.S. EPA's Natural Gas Star program[11], and documented discussions with manufacturers of equipment and testing contractors. The ICF report is relied on heavily for the cost information because it is the most recent and complete cost analysis for this sector (released in 2014), and provides higher estimates than in other reports, thus providing more conservative estimates.

1. Direct Costs on Individuals

For 2017, the baseline projected outputs for oil and gas extraction and natural gas distribution industries are approximately $25 billion and $19 billion respectively. The

[10] https://www.edf.org/sites/default/files/methane_cost_curve_report.pdf
[11] http://www.epa.gov/gasstar/tools/recommended.html

ratio of compliance cost to total output is less than 0.5 percent for both industries, making pass-through of costs unnoticeable. However, to the extent that any potential costs are passed on to individual consumers, minor increases in the price of natural gas and electricity may occur.

2. Direct Costs on Typical Businesses

Based upon a 2009 survey, ARB estimates that the O&G Proposal will impact 325 businesses in California. ARB estimates direct cost to industry for the O&G Proposal to be approximately $115 million in 2017 which can be amortized by the industry; thus the realized cost by the primary industries in 2017 is approximately $19 million. ARB used high estimates throughout the SRIA for estimating emissions, costs, and reductions. ARB will continue to evaluate and revise our cost and benefit estimates as we further refine the proposed regulation. The typical businesses are not small because the primary industries are ineligible to be classified as small under government code.[12] Therefore the increased costs on industry do not directly impact small businesses.

D. Economic Impacts

1. Methodology for Determining Economic Impacts

While the direct regulatory costs of the O&G Proposal can be estimated using the anticipated cost of each control strategy multiplied by the number of units that will be affected, the indirect costs and economic impacts are modeled using a computational general equilibrium model of the California economy known as Regional Economic Models, Inc. (REMI). The REMI model generates year-by-year estimates of the total regional effects of a policy or set of policies. ARB used the REMI PI+ model for this analysis—a one-region, 160-sector model that has been modified by the Department of Finance to include California-specific data for population, demographics, and employment. [13]

2. Inputs of the Assessment

To estimate the economic impacts of the O&G Proposal, ARB has chosen one potential compliance scenario based upon estimates of costs and quantities of affected equipment from various reports, input from stakeholders, and survey information obtained by ARB staff.

The cost of compliance for the O&G Proposal is modeled in REMI as an increase in production cost for the affected primary industries and is calculated as the difference between the additional capital and maintenance cost required to comply with the O&G Proposal and the industries' business-as-usual (BAU) capital and maintenance costs. As modeled, the O&G Proposal will also result in more efficient business practices in the primary industries, generating additional revenue and partially offsetting the cost of compliance. By enhancing the leak detection, repair, and efficient replacement of

[12] http://www.leginfo.ca.gov/cgi-bin/displaycode?section=gov&group=14001-15000&file=14835-14843

[13] Information regarding the Department of Finance's affiliation with REMI and baseline scenario modifications is available at: http://www.dof.ca.gov/research/economic_research_unit/SB617_regulation/view.php

capital and its components, businesses will see previously unaccounted-for gas captured and utilized. This fuel may be used for operating the machinery within the facility or may be used as additional product for sale. The savings are estimated based upon calculations of the potential captured gas multiplied by the forecasted price of natural gas as provided by the California Energy Commission. This increase in revenue for the primary industries is modeled as a reduction in production costs. Changes in production costs, including increases due to compliance and reductions due to efficiencies, are input into the model as one net value. The change in production cost is disaggregated into direct costs and savings in Table 4.

Secondary industries see increases in demand in 2017 as they fulfill orders for the components and capital required for the primary industries to comply with the O&G Proposal (shown in Table 5).[14] The North American Industry Classification System (NAICS) codes for the primary and secondary industries affected by the O&G Proposal are listed in Table 3.

[14] The final demand variable in REMI is used to simulate additional demand due to the regulation for the secondary industries. This does not guarantee the purchases are fulfilled by California companies, but instead the increase in demand is distributed across industry based upon historic proportions of demand fulfillment in and out of the region.

Table 3: Primary and Secondary Industry NAICS Codes

Primary or Secondary	Regulatory Function	NAICS	NAICS Industry
Primary Industries	**Must meet all requirements**	2111	Oil and Gas Extraction
	Meets only rod-packing and pneumatic device requirements	2212	Natural Gas Distribution
Secondary Industries	**Ongoing fuel costs for flaring**	2212	Natural Gas Distribution
	Ongoing costs for operating capital	2211	Electricity Transmission
	Leak Detection and Repair	2389	Other Specialty Trade Contractors
	Installation and sale of liquid unloading and velocity tubing equipment	3331	Agriculture, Construction, and Mining Machinery Manufacturing
	Pumps and vapor recovery tanks	3339	Other General Purpose Machinery Manufacturing
	Installation and sale of pneumatic devices and rod packing	4238	Machinery, Equipment, and Supplies Merchant Wholesalers
	Leak detection and repair capital	3333	Commercial and Service Industry Machinery
	Trucks needed for leak detection and repair inspections	3361	Motor Vehicle Manufacturing

In Table 4, the positive values indicate the amortized compliance cost on the primary industries. Pneumatic devices offer one of the highest natural gas savings and the fastest recovery on capital investment. Businesses should expect to see the cost of implementation recovered within the first two years of usage. Due to the O&G Proposal, the natural gas distribution industry will be required to replace rod packing and upgrade to low bleed pneumatic devices. This results in cost savings that exceed the amortized costs of the capital investment, illustrated by the production costs and savings for the natural gas distribution industry in Table 4. Due to the high return on investment for pneumatic devices, many stakeholders have already begun to transition to low bleed devices. For instance, PG&E indicated in a comment letter from 2015 that a large proportion of their pneumatic devices have transitioned to low bleed pneumatics, and that they anticipate additional replacements in the future. The O&G Proposal would expedite the transition, accelerating emission reductions.

Table 4: Changes in Production Cost (Millions 2014$) for Primary Industries

REMI Category	Variable	2017	2018	2019	2020	2021	2022
Oil and Gas Extraction	Production Cost (for cost of compliance)	$18.67	$17.53	$17.53	$17.82	$17.53	$17.53
	Production Cost (for NG savings)	-$4.46	-$4.54	-$4.53	-$4.63	-$4.73	-$4.73
Natural Gas Distribution	Production Cost (for cost of compliance)	$0.15	$0.12	$0.12	$0.15	$0.12	$0.12
	Production Cost (for NG savings)	-$0.36	-$0.36	-$0.36	-$0.37	-$0.38	-$0.38

Table 5: Changes in Final Demand (Millions 2014$) for Secondary Industries

REMI Category	2017	2018	2019	2020	2021	2022
Other Specialty Trade Contractors	$2.43	$1.58	$1.58	$1.58	$1.58	$1.58
Other General Purpose Machinery Manufacturing	$90.15	$0.00	$0.00	$0.00	$0.00	$0.00
Electricity Transmission	$2.97	$2.97	$2.97	$2.97	$2.97	$2.97
Natural Gas Distribution*	$1.06	$1.06	$1.06	$1.06	$1.06	$1.06
Machinery, Equipment, and Supplies Merchant Wholesalers	$14.72	$0.00	$0.00	$1.95	$0.00	$0.00
Agriculture, Construction, and Mining Machinery Manufacturing	$3.41	$0.21	$0.21	$0.21	$0.21	$0.21
Commercial and Service Industry Machinery	$0.25	$0.00	$0.00	$0.00	$0.00	$0.00
Motor Vehicle Manufacturing	$0.24	$0.00	$0.00	$0.00	$0.00	$0.00

*The final demand change for the natural gas distribution industry reflects the increases from ongoing costs for natural gas for compliance and the decreases from the offset of the production cost savings from captured natural gas.

Table 5 shows the additional demand from the primary industries for the compliance equipment and services supplied by secondary industries. Therefore the additional production cost shown in Table 4 for the primary industries, that is distributed across multiple years, are positive impacts to the secondary industry and reflect the cost of compliance in the year that the equipment is purchased. Table 5 reflects annual compliance costs for LDAR monitoring plus capital costs for equipment. The predominant compliance pathway for the compressor requirement assumes a three-year rod packing replacement which results in an increase in costs every three years (e.g., in 2020) for both primary industries and an increase in benefit for the secondary industry (Machinery, Equipment, and Supplies Merchant Wholesalers).

ARB also simulated the administrative and enforcement costs of the O&G Proposal by increasing state and local government jobs by the equivalent of five positions throughout the state. This estimate likely overestimates the administrative and enforcement costs as many air districts are already implementing LDAR programs and have controls on equipment. The realized administrative and enforcement costs will be limited to implementation of a statewide program in addition to the incremental increase in costs for air districts with existing control programs.

3. Assumptions and Limitations of the Model

Highly aggregated expenditure categories may limit the degree to which the REMI model is able to fully represent nuanced changes within a sector.

The following assumptions are used in the modeling of the O&G Proposal:

- The value of the capital purchased in 2017 is amortized by the primary industries in the following way:
    - We assume that businesses are able to obtain financing, at a standard 5% interest rate, for the capital equipment costs required by the O&G Proposal.
    - The life of the capital differs based upon the replacement requirements of the O&G Proposal, and the standard life of the equipment.
    - When capital lifetime is longer than the time frame of the SRIA analysis (see Table 6), a 20 year amortization period is used for capital purchases.
    - Equipment purchases are calculated as the amortized costs of compliance (payments for the loans) to the primary industries that occur in each year.
- The amortization impacts the results in the following way:
    - There are large positive economic impacts in 2017 that dissipate over time. This result is due to the increase in the demand for the secondary industries' products that result in increased output for those industries.
    - Unlike the benefit to the secondary industry, the increased cost to the primary industry does not occur in one year; instead, these costs and negative economic impacts are spread over multiple years because the costs are assumed to be financed.
    - To the extent that some businesses are unable to obtain financing, we would expect higher capital costs in early years that would negatively impact the output of the primary industry as well as lead to lower economic impacts in 2017.
- Natural gas wholesale prices vary from $4.10 to $4.36 per Mscf from 2017 through 2022. The additional natural gas that is captured by the regulated parties may be of slightly lower quality than wholesale natural gas, but the value of this gas is not forecasted by energy agencies. Therefore, the price of wholesale natural gas is used to estimate the cost savings resulting from the captured gas.
- Natural gas savings are modeled as decreases in production costs.
- We assume all reciprocating compressors are not tracked; therefore are replaced every three years.

Table 6: Lifetime of Capital and Length of Amortization

Capital Amortization	Lifetime of Capital & Length of Amortization
Vapor recovery units	10 years
Flare capital	15 years
Rod packing	3 years
Centrifugal compressor	20 years
Dry seals	20 years
Pneumatic controllers	7 years
Pneumatic pumps	10 years
Plunger lifts	10 years
Velocity tubing	10 years
Foaming agent capital	10 years
Trucks for LDAR program	7 years

Lifetime estimates were obtained from Joel Bluestein of ICF International, co-author of the ICF report "Economic Analysis of Methane Emission Reduction Opportunities in the U.S. Onshore Oil and Natural Gas Industries".

4. Results of the Assessment

a) California Employment Impacts

As modeled, the O&G Proposal will have very small impact on employment growth each year, comparing the baseline scenario with the compliance scenario for the O&G Proposal. Table 7 shows the initial increase in employment growth estimated by the model as 500 more jobs. This result is primarily due to the increased demand for capital and components in 2017 for secondary industries, and increases in other employment due to the induced and indirect effects of the regulation. Facing higher costs, the primary industries will reduce their output slightly and therefore will need fewer employees for their operations. In 2017, the positive employment value is due to the increases in demand for capital and installation faced by secondary industries that outweigh any potential reductions in employment growth resulting in the primary industries from the additional production costs.

In 2018, the primary industries do not have large capital costs that increase the demand for primary industries. However, the primary industries continue to make payments on the amortized capital they purchased in 2017. Because the secondary industries do not face higher demand, but the primary industries still face higher costs, the initial employment increase is reduced in 2018, and continues to decrease through 2022. However, due to the level of employment in California and for the industries affected, these results are interpreted as negligible to both the economy and the affected industries.

Table 7: Changes in Employment Growth

	2017	2018	2019	2020	2021	2022
Change (percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Change in Jobs	500	-25	-75	-75	-150	-150

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead year-by-year changes. The change in jobs is rounded to the nearest 25.

b) California Business Impacts

As indicated in Table 8, the modeling results show that the O&G Proposal may produce a slight increase in output for secondary industries from 2017 through 2022, with the largest impact in 2017 when they are faced with higher demands from the primary industries. The higher demand in 2017 subsides once the initial replacement of equipment occurs, and the secondary industries reduce their output due to the curtailed capital demand and minimal labor needs of both primary industries (oil and gas extraction and natural gas distribution). The secondary industries that face higher demand due to new ongoing costs show increases in each year (for instance the Electric Power Generation, Transmission, and Distribution industry). The Machinery, Equipment, and Supplies Merchant Wholesalers industry faces a cyclical demand when the rod packing replacement requirement is met (every third year or 26,000 hours according to the O&G Proposal presented here); thus, this industry increases their output in 2017 and 2020.

For the primary industries (see Table 3), the compliance costs will yield slight reductions in output growth. Table 8 shows that the direct costs required by the O&G regulation produce a minor decrease in output in the primary industries that are required to comply. The slight change in output growth is a minor percentage change from their projected output levels absent the requirements from the O&G Proposal. Secondary industries receive the greatest benefit from this regulation, as the compliance requirements slightly increase the demand for capital and services supplied by these industries.

Output growth persists in the electric power generation, transmission and distribution industry, as the O&G regulation requires the installation and use of capital that incur ongoing electricity costs. Contractors are utilized during the initial testing of water storage vessels, and the ongoing LDAR programs. The majority of the capital is purchased in 2017, where machinery manufacturers and wholesalers see increased output, but curtail growth through the remainder of the regulation, with the exception of 2020 where some additional capital is required for compliance, and thus this industry faces a spur in demand similar to 2017. The commercial and service machinery industry provides the components needed in the LDAR program, these are ongoing

costs to primary industries and result in increased output growth for all years for this secondary industry. Finally, motor vehicle manufacturing supplies the consistent demand for trucks throughout the LDAR program, and thus output growth is positive for all years.

Some of the secondary industries see decreases in growth of output in later years compared to the BAU. These small, negligible changes from the baseline are due to the interaction between the secondary and primary industries: when the output of the primary industry decreases, they spend less on all inputs, some of which are produced by the secondary industries. For example, facing higher costs to production, oil and gas will likely scale back the production of natural gas; for 2022, the output reduction is -$9.09 million in 2022. This reduction in output causes the oil and gas industry to demand less of the products that are used as inputs to create the natural gas. One of those industries, called intermediate input industries, is specialty trade contractors. In 2022, this intermediate industry faces lower induced demand for their products (due to the lower production of natural gas by the primary industry), and therefore scales back their production as well.

Table 8: Changes in Output Growth

	Industry Name		2017	2018	2019	2020	2021	2022
Primary Industries	Oil and Gas Extraction	Change (percent)	-0.01%	-0.02%	-0.03%	-0.03%	-0.04%	-0.04%
		Change (2014 M$)	-$4.16	-$7.43	-$9.87	-$11.90	-$13.40	-$14.55
	Natural Gas Distribution	Change (percent)	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%	-0.01%
		Change (2014 M$)	-$3.12	-$3.52	-$3.66	-$3.87	-$4.06	-$4.13
Secondary Industries	Electric Power Generation, Transmission, and Distribution	Change (percent)	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
		Change (2014 M$)	$2.33	$1.86	$1.80	$1.75	$1.69	$1.64
	Other Specialty Trade Contractors	Change (percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Change (2014 M$)	$5.84	$1.38	-$0.62	-$2.11	-$3.50	-$4.24
	Other General Purpose Machinery Manufacturing	Change (percent)	0.61%	0.00%	0.00%	0.00%	0.00%	0.00%
		Change (2014 M$)	$30.71	$0.01	$0.01	$0.00	-$0.01	-$0.02
	Machinery, Equipment, and Supplies Merchant Wholesalers	Change (percent)	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
		Change (2014 M$)	$15.94	-$0.29	-$0.56	$0.93	-$0.99	-$0.99
	Agriculture, Construction, and Mining Machinery Manufacturing	Change (percent)	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%
		Change (2014 M$)	$0.48	$0.03	$0.02	$0.02	$0.02	$0.02
	Commercial and Service Industry Machinery	Change (percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Change (2014 M$)	$0.23	-$0.02	-$0.03	-$0.04	-$0.06	-$0.06
	Motor Vehicle Manufacturing	Change (percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
		Change (2014 M$)	$0.10	-$0.01	-$0.03	-$0.04	-$0.05	-$0.06

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year. The values presented above are rounded to the nearest 10,000.

c) Impacts on Investments in California

As modeled, the O&G Proposal would produce very small impacts on private business investment from 2017 through 2022. Table 9 shows that the annual change in the growth of investments in California is positive but negligible in 2017 and slightly negative in 2022, these results represent a zero-percent change in all years, representing a slight slowing of growth but not a discernable change from the baseline scenario. The change in these investments can be described as increases in spending by the primary and secondary industries on capital equipment (among other investments). Thus, as the compliance requirements are amortized by the primary industries, the production costs of the secondary industries lead to a reduction in output for that industry (as seen in Table 8) and thus reductions in their investment in capital equipment.

ARB interprets these results as not discernable given the size of California's $2 trillion economy.

Table 9: Change in Gross Domestic Private Investment Growth

		2017	2018	2019	2020	2021	2022
Private Investment	**Change (percent)**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$4.06	-$0.80	-$4.64	-$7.62	-$10.53	-$12.54

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year. The values presented above are rounded to the nearest $100,000.

d) Impacts on Individuals in California

The O&G Proposal would produce a negligible change in personal income for all years analyzed. Table 10 shows that the annual change in the growth of personal income in California does not represent a discernable change from the BAU. The results can be described as increases in spending by the secondary industries on additional labor to meet the new demand in 2017. Thus, as the compliance requirements are amortized, the production costs of the secondary industries lead to a reduction in output for that industry (as seen in Table 8) and thus reductions in their spending on labor. However, since the secondary industries are predominantly more labor-intensive, the employment increases seen by those industries outweigh the losses to the primary industries until 2020, and therefore the personal income consistently follows the same pattern as employment.

The changes in the growth of personal income are in line with the estimated changes in employment in California, which are negligible relative to the size of the California economy.

Table 10: Changes in Personal Income Growth

		2017	2018	2019	2020	2021	2022
Personal Income	**Change (percent)**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$33.79	$0.77	-$3.58	-$6.14	-$11.78	-$13.06

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year. The values presented above are rounded to the nearest 100,000.

e) Impacts on Gross State Product (GSP)

Table 11 shows that the annual change in the growth of GSP is positive but negligible in 2017 and slightly negative from 2018 through 2022. These results represent a slight slowing of GSP growth but not a discernable change from the baseline scenario. The increased demand faced by secondary industries in 2017 yields increases in output, employment and thus personal income that outweighs the small amortized costs borne by the primary industries in 2017. However, as the primary industries continue to make payments for the new capital and components purchased in 2017, the increased production cost yield slightly lower output and employment, thus bringing GSP down in 2018 and continuing this trend through 2022.

ARB interprets these results as small relative to the size of California's $2 trillion economy and the uncertainty regarding the potential cost and cost-savings that will be realized by the primary industries.

Table 11: Changes in Gross State Product Growth

		2017	2018	2019	2020	2021	2022
GSP	**Change (percent)**	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$54.27	-$6.66	-$12.80	-$16.64	-$23.55	-$26.11

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year. The values presented above are rounded to the nearest 100,000.

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

The O&G Proposal encourages the use of more efficient and potentially cost-saving technology to ensure maximum production of natural gas. Much of the capital equipment purchased, such as vapor recovery tanks, have lifetimes that far exceed the pay-off period. Though at some point the primary industries no longer are making payments for the capital required for compliance, they continue to enjoy the natural gas savings that are provided by that capital. Therefore the primary industries, oil and gas extraction and natural gas distribution, are required to make minor changes to their

production facilities, these modifications include increases in efficiency that may result in net benefits to regulated parties in the long-run. The requirement for improvements to production facilities will benefit secondary industries as displayed in Table 8. Secondary industries face increased product demand, resulting in increased output and employment in those industries.

The O&G Proposal was analyzed using conservative cost and GHG emission reduction estimates, thus the analysis may serve as an upper bound of anticipated impacts. To the extent there are greater cost savings due to increased product capture, the economic impacts of the O&G Proposal would be less negative in all years, and likely show a benefit to the economy. This result would persist in later years and the primary industries, having made a large initial investment in the capital necessary to prevent substantive leaks, would continue to see savings long after the payments for the capital are finished.[15]

As modeled, the O&G Proposal is unlikely to significantly impact California's economy, including the growth of employment, investment, personal income, output, and GSP does not represent a significant change from the BAU.

E. Alternatives

In addition to the O&G Proposal, ARB evaluated alternatives combining comments from stakeholders and staff's analysis of possible alternatives. Alternative 1 focuses on more stringent requirements for each sector, which results in more methane reductions. Meanwhile, alternative 2 considers more flexible or less stringent options.

Alternative 1: Additional Benefits Beyond the Proposal

The first alternative requires that existing continuous- and intermittent-bleed pneumatic devices to be replaced with no-bleed devices. It also requires an LDAR inspection program with quarterly inspections, and vapor recovery for all well completion recirculation tanks, in lieu of recirculation tanks employed only for completions using well stimulation. This alternative is based on comment letters received from the Natural Resource Defense Council (NRDC) and the Clean Air Task Force who each advocated more frequent LDAR inspections and no-bleed pneumatic devices.

a. Costs and Benefits

Alternative 1 results in higher compliance costs and only slightly increases the amount of GHG emission reductions relative to the O&G Proposal. The increase in compliance costs is due in large part to more frequent LDAR inspections required by this alternative. This first alternative also includes the replacement of existing pneumatic devices with no-bleed devices instead of low-bleed devices. Although this achieves additional GHG emission reductions, this replacement option is not feasible in all facilities, particularly

[15] Note that for amortization purposes, much of the capital equipment was assumed to have a 20 year life, but the equipment will likely last longer.

those that do not have access to electricity to operate the no-bleed devices. Staff estimates this alternative could reduce GHG emissions by 620,000 tonnes CO_2e as compared to 560,000 tonnes CO_2e in the Proposal, which is a difference of 60,000 tonnes CO_2e per year, statewide.

b. Economic Impacts

As modeled, Alternative 1 will have a very small impact on GSP, personal income, and private investment. Through 2018, there are increases in all three categories, while in later years there are reductions in the rate of growth across the three categories. These results largely mirror the results of the O&G Proposal. However, from 2020 onward, the growth of GSP slows under Alternative 1 relative to the O&G Proposal. The increase is growth of personal income persists longer in Alternative 1 relative to the O&G Proposal, which reflects a transfer from capital-intensive industries (the primary industries) to the labor-intensive industries (the secondary industries). This is primarily due to the increase in the frequency of LDAR inspections from annual to quarterly. This means more annual costs to the primary industry as well as benefits to the secondary industry.

Table 12: REMI Outputs (Alternative 1 Compared to Baseline)

		2017	2018	2019	2020	2021	2022
GSP	Change (Percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$48.64	-$2.82	-$10.75	-$16.64	-$24.58	-$28.67
Personal Income	Change (Percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$30.34	$3.58	-$1.28	-$4.35	-$10.50	-$12.03
Private Investment	Change (Percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$3.68	-$1.18	-$5.31	-$8.80	-$12.32	-$14.85

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year. The values presented above are rounded to the nearest 100,000.

c. Cost-Effectiveness

The cost effectiveness of Alternative 1 is estimated to be approximately $45 per tonne CO_2e reduced. The cost-effectiveness would be $33 per tonne or $13 per tonne using the 100-year and 20-year AR5 GWP respectively. These costs could be low as they do account for the fact that many facilities do not have access to electricity infrastructure and would require expensive and extensive improvements to their facilities in order to implement the pneumatic devices requirements of Alternative 1.

d. Reason for Rejection

Although Alternative 1 would achieve slightly greater GHG emission reductions than the O&G Proposal, some options are not feasible or cost effective or would not provide statewide uniformity.

Many facilities would not be able to meet the requirement to replace existing pneumatic devices with no-bleed devices if they do not have access to electricity. This requirement would thus cause costly improvements and the need to cease operations during upgrades. As presented in this SRIA, the O&G Proposal allows flexibility for the facilities to choose low-bleed or no-bleed. Given that pneumatic devices are comparably priced, it is likely that the businesses would choose no-bleed and achieve greater emissions reductions and larger cost savings than was presented in Section B.

The LDAR component would move from an annual to a quarterly LDAR inspection program, increasing the reduction amount from a 40 percent to 60 percent, but would increase costs by a factor of four. The increase in cost compared to emissions is one consideration but additionally, this option may not be consistent with current district programs and thus inconsistent with one of the overall goals of the program. Nonetheless, this may be appropriate for inclusion in the future, particularly if additional information on super-emitting devices becomes available.

Although ARB rejects Alternative 1 for full inclusion into the O&G Proposal at this time, there are components that will be examined further through the regulatory process, and may be incorporated into the final O&G Regulation.

Alternative 2: Lower Level of Benefits than the Proposal

The second alternative requires a number of items, including: a leak standard on rod packing for reciprocating compressors instead of requiring replacement after a period of time; eliminating standards for centrifugal compressors; replacing the liquids unloading equipment requirement in the current proposal with a reporting requirement; and eliminating the entire LDAR requirement listed in the current proposal. Alternative 2 addresses comment letters submitted by the Sierra Club, the Clean Air Task Force, and PG&E that discussed an LDAR approach for reciprocating compressors instead of a standard replacement based on time/use.

a. Costs and Benefits

The compliance costs associated with Alternative 2 would be less expensive for industry relative to the O&G Proposal; however the GHG emission reduction benefits would be reduced. ARB estimates this alternative would achieve about a 544,000 MT CO_2e reduction, relative to a 556,000 MT CO_2e reduction under the O&G Proposal.

b. Economic Impacts

As modeled, Alternative 2 would have a very small impact on GSP, personal income, and private investment. Through 2018, there are increases in the growth of all three categories, while from 2019 through 2020 there are reductions in the growth rate across

all three categories. These results are not largely different than the results of the estimated O&G Proposal.

Table 12: REMI Outputs (Alternative 2 Compared to Baseline)

		2017	2018	2019	2020	2021	2022
GSP	Change (Percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$36.86	-$6.91	-$12.80	-$15.10	-$21.76	-$24.06
Personal Income	Change (Percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$23.55	-$0.77	-$4.61	-$6.14	-$11.52	-$12.54
Private Investment	Change (Percent)	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Change (2014 M$)	$2.62	-$1.25	-$4.42	-$6.75	-$9.34	-$11.07

The value in each year is interpreted as the reference year value less the baseline value in that same year. Therefore these values should not be represented as cumulative values, but instead changes year-by-year. The values presented above are rounded to the nearest 100,000.

c. Cost-Effectiveness

The cost effectiveness of this alternative is estimated to be about $36/MT CO_2e reduced. The cost-effectiveness would be $26 per tonne or $10 per tonne using the 100-year and 20-year AR5 GWP respectively.

d. Reason for Rejection

ARB rejects this alternative because it does not include all feasible GHG reductions, and would not provide a statewide standard for key components. For example, the removal of the LDAR strategy would mean that almost a million components would not be subject to any methane standards. LDAR ensures that these components will be monitored for leaks, and that leaks exceeding a certain threshold are identified and fixed. Overall, the LDAR program will most likely achieve emission reductions greater than those estimated in the proposal, since it will reduce ultra-high leaking components that are not currently included in the GHG emission estimates. In addition, LDAR is required in several districts and this regulation would provide a statewide standard for all oil and gas producing regions. This alternative also eliminates the standards for controlling emissions from centrifugal compressors with wet seals. Although the wet seal replacement option is less cost effective than other strategies in this alternative, it would place restrictions on a potentially significant source of GHG emissions. ARB rejects Alternative 2 for full inclusion into the O&G Proposal at this time. However, there are aspects that will continue to be examined throughout the regulatory process for feasibility and cost-effectiveness.

F. Fiscal Impacts

1. Local Government

If local air districts enforce the LDAR portion of the regulation, they may need to purchase equipment if they do not already have an existing I&M program. Out of 13 air districts that have natural gas components that would be required to be inspected under the proposed regulation, 6 already have an existing I&M programs. For air districts with existing I&M programs, the additional incremental cost associated with the O&G Proposal is expected to be small compared to the costs of implementing the current I&M programs, in most cases. For example, ARB estimates that of all the components in the oil and gas sector, more than 80 percent are already covered by existing air district I&M programs, whereas the LDAR provision of the O&G Proposal is aimed at the remaining 20 percent of components. Ultimately, enforcement of the O&G Proposal's LDAR provision may be implemented by ARB, the districts, or a combination of the two.

2. ARB

The adoption of the O&G Proposal may result in increases to the ARB workload. It is anticipated that less than five person years will be needed for administrative and enforcement costs in each year. Many air districts are already implementing LDAR programs and have controls on equipment; therefore ARB costs will be limited to implementation of a statewide program and the incremental program expansion increase for areas with existing programs. In addition, there may be slight increases in staff hours required to monitor record-keeping and compliance requirements. These slight adjustments to ARB's workload are projected to be absorbed into the existing budget.

3. Other State Agencies

The proposed regulation does not affect other state agencies.