SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Final Socioeconomic Report For Proposed Amendments to Regulation XX – Regional Clean Air Incentive Market (RECLAIM) NOx RECLAIM

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Authors: Shah Dabirian, Ph.D. – Program Supervisor
Priscilla Hamilton – Air Quality Specialist
Elaine Shen, Ph.D. – Program Supervisor

Technical Assistance: Minh Pham, P.E. – Air Quality Specialist
Kevin Orellana – Air Quality Specialist
Susan Tsai – Air Quality Engineer II
Bob Sanford – Senior Air Quality Engineer
Mitch Haimov – Air Quality Analysis & Compliance Supervisor
Fortune Chen – Air Quality Specialist

Reviewed By: Gary Quinn, P.E. – Program Supervisor
Danny Luong, P.E. – Senior Enforcement Manager
Barbara Radlein – Program Supervisor
William Wong – Principal Deputy District Counsel
Barbara Baird – Chief Deputy Counsel

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Table of Contents

1. EXECUTIVE SUMMARY

A socioeconomic analysis has been conducted to assess the impacts of the proposed amendments to Regulation XX – RECLAIM. The same level of analysis has also been performed on the California Environmental Quality Act (CEQA) alternatives. A summary of the analysis and findings are presented below.

Key Elements of the Proposed Amendments	The proposed amendments would reduce (or "shave") 14 tons per day (tpd) of NOx RECLAIM Trading Credits (RTCs) by the year 2023, of which 4 tpd would occur in 2016, and the remaining 10 tpd would be distributed evenly over the period of 2018–2022 at the rate of 2 tpd per year. These reductions will help the region attain federal ozone and PM2.5 standards. The amount and distribution of the proposed shave was determined based on the Best Available Retrofit Control Technology (BARCT) analysis. A new level of BARCT is proposed for Fluid Catalytic Cracking Units (FCCUs), boilers/heaters >40 mmBtu/hr, gas turbines, coke calciners, and sulfur recovery and tail gas incinerators used in the refinery sector. For the non-refinery sector a new BARCT level is proposed for container glass melting furnaces, sodium silicate furnaces, metal melting furnaces >150 mmBtu/hr, gas turbines and Internal Combustion Engines (ICEs) not located on the outer continental shelf (OCS). The proposed NOx shave of 14 tpd would be distributed as a 66 percent shave for 9 refineries and investors, a 49 percent shave for 21 electricity generating facilities, a 49 percent shave for 26 non-major facilities, and no shave for the 219 remaining facilities. By 2023, it would result in 12.51 tpd of remaining RTCs (26.51 tpd – 14 tpd = 12.51 tpd). This amount is expected to sufficiently account for the needs of all RECLAIM facilities, including growth and a compliance margin.
Affected Facilities and Industries	The proposed amendments would affect the current RTC holdings for 56 out of 275 RECLAIM facilities. The 56 affected facilities would include 9 major refineries, 21 electricity generating facilities, and 26 other top emitting non-refinery facilities. The nine affected refineries belong to the sector of petroleum product manufacturing (NAICS 324), the 21 electricity generating facilities belong to the sector of utilities (NAICS 221), the remaining 26 facilities belong to the sectors of manufacturing (NAICS 31-33), mining, oil and gas exploration (NAICS 211), utilities (NAICS 221), amusement and recreation industries (NAICS 713), and a military facility. Facilities in the 219 group represent a range of industries, but are largely comprised of manufacturing (NAICS 31-33), mining, oil and gas

	exploration (NAICS 211), and utilities (NAICS 221) industries.
Assumptions for the Analysis	The proposed amendments are assumed to induce full BARCT installation by 2023 at the 9 refineries and 11 non-refinery facilities where the 2015 BARCT analysis identified cost-effective controls for their major NOx emission sources. This assumption is made to arrive at the most conservative (i.e., maximum) compliance cost estimates. In reality, the RECLAIM program affords facilities with compliance flexibility so that the actual costs may be lower if a facility identifies any other more cost-effective alternatives to remain in compliance, such as RTC purchases and operational changes. The 9 refineries currently have the following equipment/source categories that have BARCT determinations for the proposed rule amendments: FCCUs, Sulfur Recovery Units/Tail Gas Incinerators (SRU/TGUs), coke calciners, refinery boilers and heaters, and refinery gas turbines. In response to the proposed rule amendments, operators of these refineries are assumed to install Selective Catalytic Reduction (SCR) technology, UltraCat Dry Gas Scrubbers (DGS), and Low Temperature Oxidation (LoTOx^{TM}) with Wet Gas Scrubbers (WGS). The 11 non-refinery facilities currently have the following equipment/source categories that have BARCT determinations for the proposed rule amendments: container glass melting furnaces, glass melting furnace facilities, sodium silicate furnaces, metal heat treating furnaces rated >150 mmBtu/hour, stationary ICEs and non-electricity generating plant stationary gas turbines. In response to the proposed rule amendments, operators of these facilities are assumed to install SCR technology or UltraCat DGS. For the purpose of conducting a worst-case analysis, 34 SCR units and 1 UltraCat DGS are assumed to be installed at the 11 non-refinery affected facilities. It is possible that another UltraCat DGS may also be installed in lieu of 1 of the 34 SCR units. In total, the proposed rule amendments are assumed to result in the installation of the following new NOx air pollution control equipment: 116 SCRs, 8 LoTOx^{TM} with WGSs, 1 LoTOx^{TM} without WGS, and 3 UltraCat DGSs. The annualization factor used for capital costs is based on a discount rate of 1 or 4 percent and a 25-year equipment life for all control equipment including SCRs, UltraCat DGS, and LoTOx^{TM} technology.

Cost Impacts	Total compliance cost associated with control equipment installation by 9 refineries and 11 non-refinery facilities would range from $728 million to $1.1 billion in present worth values (expressed in 2014 dollars). Using the high-end cost estimates, the annualized compliance cost is estimated to be approximately $70 million when evaluated at a 4 percent discount rate, or $60 million when evaluated at a 1 percent discount rate from year 2022 onwards when all controls are assumed to have been installed. More than 73 percent of the annualized compliance cost is expected to occur in the refinery sector, and more than 43 percent of the sector's annualized compliance cost would be associated with FCCU installation. Among the non-refinery sectors, gas turbines would account for more than 60 percent of the sector's annualized compliance cost. It should be noted that these cost estimates do not consider the possibility that these 20 facilities could potentially sell surplus NOx RTCs, if any, resulting from control installation. This would then offset some of the control installation costs. The proposed shave could potentially affect facilities with no identified cost-effective controls in two ways. First, 36 of these facilities would be subject to the proposed shave, and some of them would need to buy additional NOx RTCs to reconcile actual emissions. Second, all facilities could potentially pay a higher price for NOx RTCs that they purchase each year for compliance. Additionally, higher NOx RTC prices could be potentially induced by the opt-out of any electricity generating facilities that regularly sell their surplus discrete credits or by removing from the market NOx RTCs resulting from the shut-down of RECLAIM facilities. Furthermore, under the proposed amendments, the 12-month rolling average price trigger would be raised to $22,500 per ton (discrete credits), thus potentially allowing NOx RTC prices to increase further before non-tradable/non-usable NOx RTCs are converted to tradable/usable NOx RTCs; however, the proposed addition of a 3-month rolling average price trigger of $35,000 per ton (discrete credits) would institute another safeguard. Total incremental compliance cost (expressed in 2014 dollars) associated with RTC purchases over the course of 25 years is estimated to range from $19 million—if discrete NOx RTC prices remain the same—to $500 million—if the average annual discrete NOx RTC prices increase to $22,499/ton for a total of 25 years and none of the affected facilities pursue any other more cost-effective compliance options.
Job Impacts	Assuming that the proposed amendments would induce full BARCT installation by 2023 and the 9 refineries and 11 non-refinery facilities would incur the high-end estimated costs, it is projected that about 20 jobs on the net would be created on an annual average between 2018 and 2035, and about 140 net jobs would be foregone when the

	analysis horizon is extended to 2043. (Note that jobs foregone may include either losses of existing jobs or projected additional jobs not created.) The difference is because the majority of jobs, mostly in the construction sector, would be created at the beginning of the analysis period (2018-2022) when control installation is assumed to take place. Despite having a large share of the total compliance cost, the refinery industry is projected to have fewer jobs forgone relative to other industries with similar magnitude of cost impact due to the fact that the industry is the most capital-intensive. As such, less labor would be required to produce the same amount of products or services. Note that the projected job impact would be more positive (i.e., fewer jobs foregone) if facilities sell any surplus NOx RTCs that result from installing control equipment, to offset control installation costs. Regarding the incremental compliance cost that could be potentially incurred by the rest of NOx RECLAIM facilities, the associated job impacts have been estimated under various scenarios of discrete NOx RTC prices. If prices remain the same, little job impact is expected due to the proposed amendments. If the average annual discrete NOx RTC prices increase to $22,499/ton and none of the affected facilities pursue any other more cost-effective compliance options, then about 40 jobs on the net would be foregone annually between 2023 and 2035. However, this latter price scenario is unlikely to occur, particularly if the 9 refineries and 11 non-refinery facilities install identified cost-effective controls, which would then either decrease the market demand or increase the market supply of NOx RTCs by these facilities.
Impact of CEQA Alternatives	Five alternatives to the proposed amendments were developed for the CEQA analysis associated with this proposal: Alternative 1 (Across the Board), Alternative 2 (Most Stringent), Alternative 3 (Industry Approach), Alternative 4 (No Project), and Alternative 5 (Weighted by BARCT Reduction Contribution for all Facilities and Investors). After further analysis, staff determined Alternatives 3 and 4 do not comply with state law. Regarding cost-effective control installation, the proposed rule amendments have the highest cost but the second to highest positive job impact, due to increased labor demand for the full, instead of partial, installation of control equipment. Alternative 4 would maintain the status quo and serves as a benchmark against which other alternatives were evaluated; however, it does not comply with state law. Of the four remaining alternatives, Alternative 3, which also does not comply with state law, has the lowest annualized cost ($9.40 million) because it is expected to induce the lowest number of control equipment to be installed; for the same reason, however, it

	would not create as many jobs and would result in an average of 30 jobs foregone on an annual average. Alternatives 1 and 2 would cost less than the proposed amendments, yet would experience more negative job impacts (approximately 80 jobs forgone on an annual average basis). This is due to less control equipment installation spending in the refinery sector relative to the 11 non-refinery facilities and would result in negative net job impacts. For the incremental costs associated with NOx RTC purchases that could potentially be incurred by some of the facilities without identified cost-effective controls, Alternative 2 has the highest estimated costs (up to $31 million in total), as it would result in the largest amount of NOx RTC shave. In terms of job impacts, all CEQA alternatives except Alternative 4 (No Project) would result in a more negative job impact—up to about 60 jobs foregone on an average annual basis if the average annual discrete NOx RTC prices increase to $22,499/ton and none of the affected facilities pursue any other more cost-effective compliance options—than the proposed amendments. This is mainly because, unlike the proposed amendments, Alternatives 1, 2, 3 and 5 would not exempt from the shave the 219 facilities that tend to be smaller and use more labor-intensive production technologies than, for example, those used by the refineries.
Health Benefits	The South Coast Air Basin is one of only two "extreme" non-attainment areas in the nation that have not reached the federal 8-hour ozone standard. The amount of pollutants produced by modern urban life and industrial activities, combined with Southern California's year- round sunny weather, all contribute to the high concentrations of ground-level ozone in the area. Ozone exposure can cause immediate, adverse effects on the respiratory system. Long-term impacts of frequent exposure to ozone may lead to permanent lung damage and increase the risk of premature death. In addition, the South Coast Air Basin remains a non-attainment area for the federal 24-hour and annual PM2.5 standards. Exposure to high levels of PM2.5 have been shown to cause and aggravate cardiopulmonary illnesses. NOx is a precursor of PM2.5. These outcomes result in increased absences from school and work, hospitalization, and other medical expenses. Exposure to PM2.5 is associated with premature deaths. According to recent estimates by the California Air Resources Board, elevated ambient PM2.5 levels result in approximately 4,100 premature deaths annually in the South Coast Air Basin.

Costs of Command and Control Compared to RECLAIM	RECLAIM allows facilities to use the least costly option to remain in compliance. Unlike command-and-control rules where every source has to be controlled to the same emission standard, RECLAIM facilities can pursue operational changes or purchase RTCs from investors or other facilities with surplus credits in lieu of upgrading existing control equipment, installing new control equipment or making other changes. Therefore, by design, total costs to install controls under the RECLAIM program since its adoption will always be equal to or less than total costs under command and control. The stream of cost-savings for any RECLAIM facility would only be reduced when, at a point in time, it becomes more economical for the facility to install the control equipment that would have been required under command-and-control. However, the future cost-savings may not be completely eliminated by control installation as long as the facility is able to sell surplus RTCs to offset some of the control installation costs. For example, following the 2005 NOx RECLAIM amendments, none of the 51 SCRs identified in the BARCT analysis for refineries have been installed because of RECLAIM, and 4 SCRs were installed only due to orders for abatement. As a result, refineries have saved approximately $205 million since 2007 by delaying installation of 47 SCRs. The cost-savings would continue to accumulate as long as refineries are able to further delay the installation of SCRs and still remain in compliance under RECLAIM. This continuous stream of cost-savings would only be reduced or even ceased if the currently proposed shave could eventually induce at least some of the 47 SCRs to be installed.

2. INTRODUCTION

RECLAIM allows facilities to use the most cost-effective approach to meet their obligation to surrender RTCs to match their quarterly and annual emissions, while helping the region attain clean air goals. This is possible, because unlike command-and-control regulations where every source is controlled to the same emission standard, a RECLAIM facility with more emissions than its actual RTC holdings has the option to install pollution control equipment, change operations, or purchase additional RTCs to offset its total emissions. Facilities are expected to choose whichever option is more economical for their business.

The proposed rule amendments consist of applying a shave to investors and to the facilities holding the top 90 percent of NOx RTCs, as weighted by a Best Available Retrofit Control Technology (BARCT) reduction contribution to achieve an overall reduction of 14 tons of NOx per day by 2023 according to the following implementation schedule as summarized below:

Table 1: Implementation Schedule for NOx RTC Reductions

Implementation Year	Amount of NOx RTC Reductions (tons/day)
2016	4
2018	2
2019	2
2020	2
2021	2
2022	2
TOTAL	**14**

The proposed shave of 14 tpd of NOx RTCs for the top 56 emitters is expected to assist in achieving clean air goals and meeting the requirements of state law by inducing the 20 facilities (9 refineries and 11 non-refineries[1]) to reduce actual emissions.

At the beginning of the RECLAIM program in 1994, a total of 392 NOx facilities were allocated RTC holdings at no cost. As a net outcome of facility shutdowns and new facilities joining the universe, there were 275 facilities in the NOx program in 2013, with a total of 26.51 tpd RTC holdings. Over the past decade, facilities have met their emission-reduction obligations under RECLAIM by purchasing unused "excess" RTCs and, only to a lesser extent, by reducing actual NOx emissions. Some of these unused "excess" credits can be attributed to facility shutdowns and the subsequent selling of credits. Regardless of why there are excess credits, their existence exerts downward pressure on the RTC market price and may have dis-incentivized RECLAIM facilities to install many of the already identified cost-effective control measures. For example, in the 2005 NOx RECLAIM amendments, the BARCT analysis included the potential installation of 51 SCR units at refineries. However, not one has been installed due to the RECLAIM program (4 SCR units were installed only due to orders for abatement).

[1] Two of the 11 non-refineries would not have their NOx RTC holdings shaved because they are not among the top 90 percent holders of NOx RTCs.

According to staff analysis of the RECLAIM transaction records, many of the unused RTCs were sold, as Infinite-Year-Blocks (IYBs), to operating RECLAIM facilities by some of the now-closed facilities prior to facility closure. These excess RTCs have been artificially depressing RTC prices and have induced RECLAIM facilities to delay the installation of cost-effective controls. A case in point is the 2005 NOx RECLAIM amendments. Despite 7.7 tpd of NOx RTC shave from the 2005 amendments being implemented over the period of 2007-2011, only 4 tpd of actual NOx emission reductions had occurred by the end of the 2012 Compliance Year. Some of the 4 tpd of actual reductions came from operational changes at refineries, which chose to run gas turbines instead of higher-emitting boilers at various points in time. However, just less than two thirds of the 4 tpd actual reductions were due to facility shut-downs (Table 2) and not measures taken to reduce actual emissions by facilities in the program. This outcome is not optimal for achieving clean air goals in the Basin.

Table 2: RECLAIM Facility Shutdowns from 2006 to 2012

Facility	2006 Audited NOx emissions (lbs)	2012 Audited NOx emissions (lbs)	Difference (tpd)
A	1,582,879	9,372	2.16
B	136,876	655	0.19
C	125,778	0	0.17
D	80,669	0	0.11
Total			**2.62**

Excess RTC holdings have ranged between 5.45-8.41 tpd over the past five years. Removing at least a portion of these excess credits from the market would relieve the downward pressure on the RTC market price and would be more likely to make control equipment installation a more cost-effective option than purchasing RTCs, particularly for the 20 facilities with newly identified control equipment.

In accordance with the requirements of the California Health and Safety Code (H&SC), SCAQMD staff conducted a BARCT assessment of the NOx RECLAIM program to: 1) assess advancements in control technology; 2) to ensure that RECLAIM facilities achieve the same emissions reductions as the implementation of BARCT; 3) to ensure that emission reductions from the NOx RECLAIM program contribute towards achieving the federal National Ambient Air Quality Standards (NAAQS); and, 4) to assure that the participating facilities will continue to achieve emission reductions as expeditiously as possible to carry out the commitments in the 2012 Air Quality Management Plan (AQMP).

Based on the BARCT analysis[2], a new level of BARCT is proposed for Fluid Catalytic Cracking

[2] Except for electricity generating facilities, the proposed RTC shave reduction will be based on compliance year 2011 activity levels for all other affected facilities. The 2012 activity levels will be used for RTC reductions from electricity generating facilities because this activity level better represents this sector's energy consumption.

Units (FCCUs), boilers/heaters >40 mmBtu/hr, gas turbines, coke calciners, and sulfur recovery and tail gas incinerators used in the refinery sector. For the non-refinery sector (except electricity generating plants), a new BARCT level is proposed for container glass melting furnaces, sodium silicate furnaces, metal melting furnaces >150 mmBtu/hr, gas turbines and ICEs not located on the outer continental shelf (OCS).

To realize the emission reduction potential of 2015 BARCT and help the Basin achieve the PM2.5 standards by 2019 and 2024 and the ozone standards by 2024 and 2032, staff proposes reductions (or a "shave") of NOx RECLAIM Trading Credits (RTCs) by a total of 14 tpd to be implemented over a seven-year period from 2016 to 2022. This number includes shaving unused RTCs as well as assuming programmatic BARCT equivalency. See the Staff Report for the rationale for this approach. Currently, there are 275 RECLAIM facilities holding 26.51 tpd of NOx RTCs in total, among which the refinery sector holds 51 percent of the RTCs, electricity generating plants 21 percent, investors 4 percent and other RECLAIM facilities 24 percent. The proposed shave of 14 tpd would result in 12.51 tpd of remaining RTCs (26.51 tpd – 14 tpd = 12.51 tpd). This amount is expected to sufficiently account for:

- The projected 2023 emissions by RECLAIM facilities at the proposed 2015 BARCT levels[3], which would be 10.23 tpd (2.76 tpd for the refinery sector plus 7.47 tpd for the non-refinery sector).
- A 10 percent compliance margin that has been added to the projected 2023 emissions
- An adjustment to account for other uncertainties (e.g. uncertainties in BARCT analysis, and base year activity level adjustments)

Under the proposed amendments, the 14 tpd of NOx RTC reductions would be distributed as a 66 percent shave for 9 refineries and investors, a 49 percent shave for 21 electricity generating facilities, a 49 percent shave for 26 non-major facilities, and no shave for the 219 remaining facilities. As a result, the shave would directly affect a total of 56 facilities plus investors that together hold 90 percent of the 26.51 tpd of the NOx RTCs. Other facilities that would not be shaved may also be indirectly impacted by potential changes in RTC price due to the proposed NOx RTC reductions.

3. METHODOLOGY FOR SOCIOECONOMIC ASSESSMENT

For the purpose of the socioeconomic analysis of the proposed amendments and CEQA alternatives for the NOx RECLAIM program, staff has assumed three compliance cost categories: (1) costs of control equipment implementation for 9 refineries and 11 non- refineries that would be shaved,[4] assuming all control equipment identified in the 2015 BARCT analysis would be

[3] To account for projected industry growth, the growth factor assumptions are: 1) 1.0 for the refinery sector; 2) 0.89 for electricity generating facilities; and 3) 1.1 -1.3 for the non-refinery sector. These growth factors are based on those in the Draft Final Staff Report, which are based on growth factors for point sources in 2012 AQMP made by SCAG. The only exception is for EGFs, whose growth factors were based on the 2014 Gas Fuel Report.

[4] Note that the current socioeconomic analysis uses the high-end cost estimate specified in the Revised Draft Staff Report. Cost estimates based on Norton Engineering Consultants (NEC)'s analysis for the refinery FCCUs lie between

installed by 2023 in lieu of other compliance options such as RTC purchases or operational changes, (2) incremental costs for a fraction of the remaining 36[5] shaved facilities to purchase RTCs to remain in compliance, due to both additional credits potentially needed and any potential increase in RTC price, and (3) incremental costs of purchasing RTCs at potentially higher prices for a fraction of the 219 non-shaved facilities that historically purchase credits from the market to reconcile actual emissions with RTCs. The costs associated with control equipment implementation are described in the cost section and then used as inputs to simulate and assess the regional macroeconomic impact of the proposed amendments and CEQA alternatives. The costs and job impacts resulting from the shave for a fraction of the 36 facilities and the 219 non-shaved facilities are discussed further in the Market Analysis section.

4. REGULATORY HISTORY

In 1993, SCAQMD adopted an emissions trading program (RECLAIM) for stationary sources as a market incentive system to cost-effectively achieve emission reductions. RECLAIM establishes facility mass emission limits for NOx and SOx and allows sources the flexibility to achieve regional prescribed emission reduction targets through process changes, installation of control equipment, and emissions trading. H&SC §39616 (c)(1) and (c)(4) required that findings be made that a market-based incentive program would result in "equivalent or less cost" and "not result in greater loss of jobs or more significant shifts from higher to lower skilled jobs than" the counterpart command-and-control regulation, at the time of adoption and 5 years later. Staff does not expect a shift from high- pay to low-pay jobs as a result of the proposed rule amendments.

A socioeconomic analysis of RECLAIM was conducted at the time of its adoption. The cost of RECLAIM was estimated to be $80.8 million annually, on average, compared with the $138.7 million cost of the corresponding command-and-control system (which included rules and control measures in the 1991 AQMP that were subsumed by RECLAIM). RECLAIM was predicted to result in an average of 866 jobs forgone annually, compared with 2,013 jobs forgone under the command-and-control system. Based on the five occupational categories from the lowest-paid to the highest-paid, RECLAIM was projected to result in increased employment opportunities for nearly every category relative to the command-and-control system.

Until the year 2000, prices of NOx RTCs were relatively stable between $1,500 and $3,000 an annual ton per day. In 2000, prices of NOx RTCs rose very quickly to over $45,000 a ton due to the increased demand for RTCs from electricity generating plants in response to the deregulated electricity generation market and limited installation of air pollution controls. In order to address the issues in the RECLAIM market, the Board removed large electricity generating plants from the market in May 2001. These electricity generating plants were required to file compliance plans for the installation of BARCT and restrictions were placed on the use and trade of their NOx RTCs. Other amendments to RECLAIM in 2001 included filing of compliance plans and forecast reports by large (at least 50 tons of NOx emissions) and medium (between 25 and 50 tons of NOx emissions) non-electricity generating facilities and the access to RECLAIM Air Quality Investment Program (AQIP), Mitigation Fee Program, and state Emission Credit Bank by

the low- and high-end of the range provided in the staff report.

[5] Inland Empire Energy Center and General Electric are considered as one facility, as the latter serves as a holding account for the former.

designated facilities. At the time, the Board also adopted several mobile and area source emission reduction credit rules whose credits could be used by RECLAIM facilities to comply with their allocations.

The annualized cost for installing controls on electricity generating facilities was projected to be $9 million. The annualized cost for the level 1 controls (known technologies at the time) on non-electricity generating facilities was estimated to be $26 million.[6] It was projected that 640 jobs would be forgone annually from the proposed controls, filing of compliance plans and forecast reports, the access to a reserve of NOx emission reductions, and the creation of mobile and area source credit rules.

In 2005, Regulation XX – RECLAIM was amended to achieve additional NOx reductions pursuant to the 2003 AQMP Control Measure #2003CMB-10. The proposed amendments also addressed requirements for demonstrating BARCT equivalency in accordance with H&SC §40440. In addition, trading restrictions for electricity generating producing facilities were removed.

4.1 Legislative Mandates

The socioeconomic assessments at the SCAQMD have evolved over time to reflect the benefits and costs of regulations. The legal mandates directly related to the assessment of the proposed rule include the SCAQMD Governing Board resolutions and various sections of the H&SC.

4.2 SCAQMD Governing Board Resolutions

On March 17, 1989 the SCAQMD Governing Board adopted a resolution that calls for an economic analysis of regulatory impacts that includes the following elements:

- Affected industries
- Range of control costs
- Cost effectiveness
- Public health benefits

On October 14, 1994, the Board passed a resolution which directed staff to address whether the rules or amendments brought to the Board for adoption are in the order of cost effectiveness as defined in the AQMP. The intent was to bring forth those rules that are most cost-effective first.

4.3 Health & Safety Code Requirements

The state legislature adopted legislation that reinforces and expands the Governing Board resolutions for socioeconomic assessments. H&SC §40440.8(a) and (b), which became effective on January 1, 1991, require that a socioeconomic analysis be prepared for any proposed rule or rule amendment that "will significantly affect air quality or emissions limitations." Specifically, the scope of the analysis should include:

[6] Specifically, Level 1 technologies included selective catalytic reduction (SCR) and low-NOx burner (LNB) controls on non-electricity generating turbines (SCR), internal combustion engines (SCR), boilers (LNB), heaters (ultra LNB), dryers (ultra LNB or LNB), ovens (LNB), furnaces (LNB or oxy-fuel), and afterburners (LNB).

- Type of affected industries
- Impact on employment and the economy of the district
- Emission reduction potential
- Necessity of adopting, amending or repealing the rule in order to attain state and federal ambient air quality standards
- Availability and cost effectiveness of alternatives to the rule

Additionally, the SCAQMD is required to actively consider the socioeconomic impacts of regulations and make a good faith effort to minimize adverse socioeconomic impacts. H&SC §40728.5, which became effective on January 1, 1992, requires the SCAQMD to:

- Examine the type of industries affected, including small businesses; and
- Consider socioeconomic impacts in rule adoption

Finally, H&SC §40920.6, which became effective on January 1, 1996, requires that incremental cost effectiveness be performed for a proposed rule or amendment that imposes BARCT or "all feasible measures" requirements relating to ozone, carbon monoxide (CO), oxides of sulfur (SOx), oxides of nitrogen (NOx), and their precursors.

Furthermore, H&SC §39616 (c)(1) and (c)(4) requires that at adoption, a market-based incentive program result in equivalent or less cost and not result in greater job losses or more significant shifts from high- to low-skilled jobs as compared with command-and- control measures. This finding was made in 1993 when RECLAIM was adopted and in 2000 when the findings were ratified.

Finally, H&SC §40440.5 requires that social, economic, and public health analyses of proposed rules be available to the public by at least 30 days prior to the hearing.

5. SHORT-TERM/LONG-TERM ECONOMIC OUTLOOK

According to the Wells Fargo Economic Forecast released on June 3, 2015, "California's economy should continue to outperform the national average over the next couple of years, led by continued gains in the state's technology sector and stronger growth in residential and commercial construction." Despite a whole host of challenges ranging from the drought to labor strikes at its major ports, California's economy has maintained strong momentum through the first part of 2015.

According to the 2015-2016 Economic Forecast and Industry Outlook from Los Angeles Economic Development Corporation (LAEDC), Southern California will continue employment gains and experience a decline in local unemployment rates. Southern California's leading industries are:

- Healthcare and Social Assistance
- Construction
- Professional, Scientific and Technical Services

- Administrative Support
- Waste Services

The lagging industries are other services, nondurable goods manufacturing, and financial activities.[7]

The economy of the four counties falling under the SCAQMD's jurisdiction is comprised of a large non-manufacturing sector and a much smaller manufacturing sector. The service sector and the retail and wholesale trade sector combined constituted over 52 percent of the region's employment in 2014 Regional Economic Models (REMI, 2014). Most of the affected RECLAIM facilities belong to manufacturing and utilities sectors. For these sectors, the California State University, Fullerton (CSUF) projected steady and positive employment growth in 2015 and 2016 for the counties of Orange, Riverside, and San Bernardino. Table 3 presents the projected annual percentage employment growth by sector for 2015 and 2016.

Table 3: Annual Percentage Employment Growth by Sector

Sector	Los Angeles			Orange			Riverside & San Bernardino			Southern California		
	2014	2015f	2016f	2014	2015f	2016f	2014	2015f	2016f	2014	2015f	2016f
Mining and logging	3.4%	-1.4%	-0.4%	1.1%	3.2%	2.8%	0.9%	6.0%	3.0%	7.0%	1.1%	-0.6%
Construction	10.5%	7.7%	5.7%	9.6%	6.4%	9.1%	5.3%	0.5%	4.6%	8.6%	5.6%	6.6%
Total Manufacturing	-4.1%	1.1%	-1.0%	-0.3%	2.1%	2.1%	1.6%	10.8%	6.7%	-2.2%	2.9%	1.0%
Durable Manufacturing	-2.1%	5.2%	-0.7%	0.9%	2.6%	2.3%	2.3%	13.8%	8.3%	-0.5%	5.8%	1.7%
Nondurable Manufacturing	-6.6%	-4.3%	-1.6%	-3.5%	0.9%	1.5%	0.4%	4.9%	3.3%	-4.8%	-1.9%	-0.2%
Transportation, Commun. & Utilities	2.2%	4.0%	3.3%	1.0%	1.4%	1.3%	3.8%	4.0%	4.6%	2.3%	3.5%	3.2%
Transportation, Warehousing & Utilit.	0.2%	4.3%	3.6%	1.2%	2.6%	2.9%	3.4%	3.9%	5.3%	1.0%	3.9%	3.9%
Wholesale Trade	3.3%	4.5%	2.7%	1.0%	0.7%	0.3%	3.6%	3.3%	3.3%	2.9%	3.4%	2.3%
Retail Trade	0.7%	4.3%	2.4%	-2.9%	-0.7%	-0.5%	2.2%	2.2%	-2.7%	-0.4%	2.2%	0.6%
Finance, Activities	2.7%	2.2%	2.5%	1.9%	1.9%	2.0%	3.7%	3.9%	4.5%	2.7%	2.4%	2.7%
Services	0.4%	1.8%	0.9%	1.2%	0.2%	0.3%	1.9%	1.8%	2.1%	0.8%	1.4%	1.1%
Total Government	2.3%	2.3%	2.3%	2.0%	2.2%	2.4%	3.7%	4.2%	4.7%	2.5%	2.6%	2.7%
Total Employment	3.4%	-1.4%	-0.4%	1.1%	3.2%	2.8%	0.9%	6.0%	3.0%	7.0%	1.1%	-0.6%

Note: "f" means forecast. Source: California State University, Fullerton
Source: http://business.fullerton.edu/Center/EconomicAnalysisAndForecasting/#Default.

In addition, the CSUF forecast projects lower unemployment rates in 2015 and 2016 for all the four counties and, Southern California as a whole. Table 4 presents the annual percentage change in unemployment. (CSUF 2015 Economic Forecast).

[7] http://laedc.org/2015/02/18/2015-2016-economic-forecast-published/.

Table 4: Annual Percentage Unemployment Rate Outlook

	2012	2013	2014	2015F	2016F
Southern California	10.2%	8.6%	7.4%	6.9%	6.5%
Los Angeles	10.9%	9.9%	8.7%	7.6%	7.0%
Orange County	7.6%	6.2%	5.3%	4.8%	4.5%
Riverside & San Bernardino	12.0%	10.2%	8.8%	8.4%	8.3%

Source: CSUF 2015 Economic Forecast.

For the long-term economic outlook, all sectors of the local economy, except manufacturing, will experience a positive job growth.[8] The long-term growth is robust in construction, mining, transportation, and utilities sectors. The manufacturing sector is projected to incur a modest negative job growth from 2012-2022. Please see Appendix A for 10-year industry employment projections for the 4-county area.

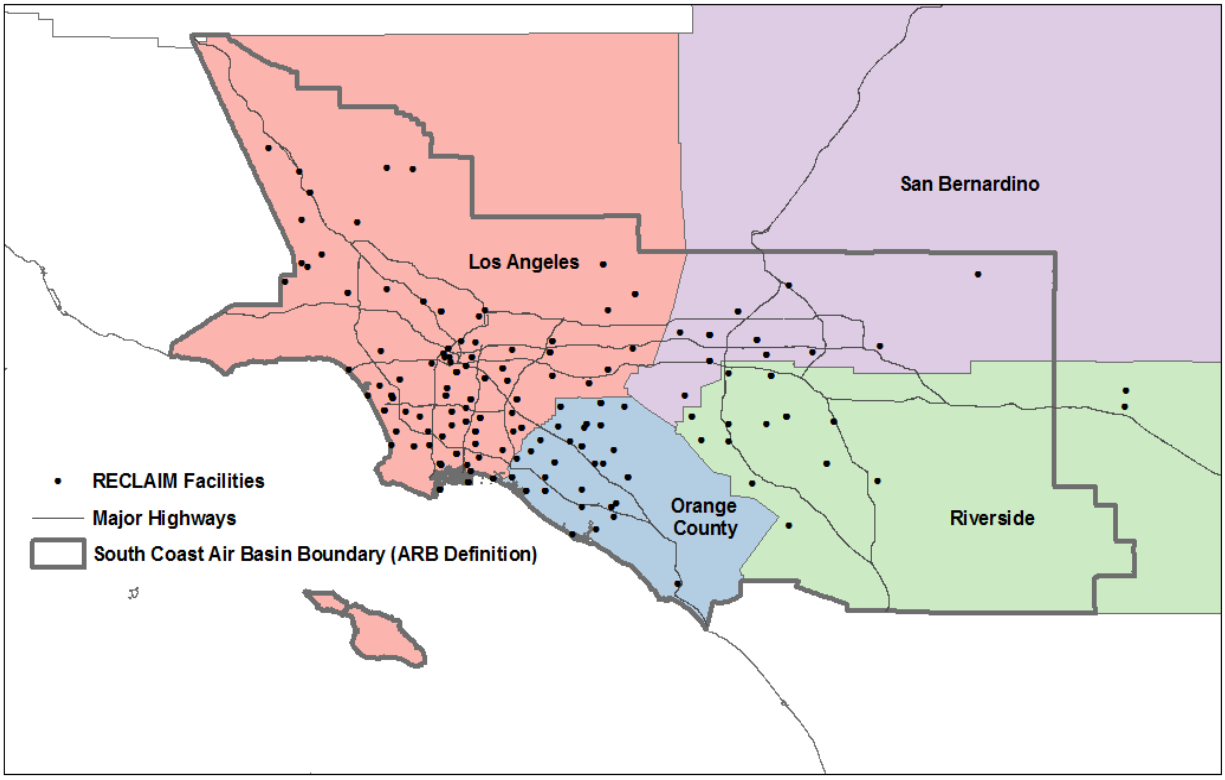
6. AFFECTED FACILITIES

The RECLAIM universe of facilities evolves due to shutdowns and the entry of new facilities. The RECLAIM program started with 392 NOx facilities in 1994 when RECLAIM went into effect. By the end of compliance year 2013, there were about 275 facilities in the NOx RECLAIM universe. Most of the RECLAIM facilities are relatively large emitting businesses (greater than 4 tons of NOx) with respect to their cohort in the same industry. These facilities are spread across all industries in the four-county economy. Of the 275 facilities, 66 percent were in Los Angeles County, 18 percent in Orange County, and 8 percent in both Riverside and San Bernardino Counties. Figure 1 shows the location of these facilities within the SCAQMD jurisdiction.[9]

[8] http://www.labormarketinfo.edd.ca.gov/data/employment-projections.html.

[9] While two facilities located in Desert Hot Springs fall outside the South Coast Air Basin Boundary as defined by the California Air Resources Board, Desert Hot Springs falls within the SCAQMD's jurisdiction for Riverside County. For more information see: http://www.aqmd.gov/home/about/jurisdiction.

Figure 1: Location of RECLAIM Facilities as of 2013



For the 275 facilities that are in the NOx RECLAIM program, the 14 tpd of NOx RTC reductions will only directly affect 56 facilities plus the investors that currently hold 90 percent of the NOx RTC credits. Out of the 56 facilities, 76 percent are in Los Angeles County, 4 percent in Orange County, 9 percent in Riverside County, and 11 percent in San Bernardino County.

They include 9 major refineries, 21 electricity generating facilities, and 26 other top-emitting non-refinery facilities. The 9 affected refineries belong to the sector of petroleum product manufacturing (NAICS 324), the 21 electricity generating facilities belong to the sector of utilities (NAICS 221), the remaining 26 facilities belong to the sectors of manufacturing (NAICS 31-33), mining, oil and gas exploration (NAICS 211), utilities (NAICS 221), amusement and recreation industries (NAICS 713), and a military facility.

For the remaining 219 facilities, no NOx RTC shave is proposed. Facilities in this group represent a range of industries, but are largely comprised of manufacturing (NAICS 31-33), mining, oil and gas exploration (NAICS 211), and utilities (NAICS 221) industries. Cost impacts on these facilities individually are expected to be small (if not zero). Any cost impacts that could potentially occur would be the result of any NOx RTC price increases due to the proposed amendments, and they are expected to be proportional to the amount of NOx RTCs currently needing to be purchased by these facilities.

6.1 Small Business

The SCAQMD defines a "small business" in Rule 102 for purposes of fees as one which employs 10 or fewer persons and which earns less than $500,000 in gross annual receipts. The SCAQMD also defines "small business" for the purpose of qualifying for access to services from the SCAQMD's Small Business Assistance Office (SBAO) as a business with an annual receipt of $5 million or less, or with 100 or fewer employees. In addition to the SCAQMD's definition of a small business, the federal Small Business Administration (SBA) and the federal 1990 Clean Air Act Amendments (1990 CAAA) also provide definitions of a small business.

The 1990 CAAA classifies a business as a "small business stationary source" if it: (1) employs 100 or fewer employees, (2) does not emit more than 10 tons per year of either VOC or NOx, and (3) is a small business as defined by SBA. The SBA definitions of small businesses vary by six-digit NAICS codes. In general terms, a small business must have no more than 500 employees for most manufacturing and mining industries, and no more than $7 million in average annual receipts for most nonmanufacturing industries. For instance, the sector of petroleum refineries (NAICS 324110) has 1,500 employees as the threshold below which a business is considered small. The sector of utilities (NAICS 221111) has 500 to 1,000 employees as a threshold and non-metallic mineral products (NAICS 327213) which includes glass plants, has fewer than 750 employees as a threshold below which a business is considered small.

The 2015 Dun and Bradstreet data includes employment or gross revenue information for about half of the 275 facilities in the RECLAIM universe. According to the SCAQMD (Rule 102) definition of a small business, 11 facilities would be classified as small businesses. Under the 1990 CAAA definition, 26 facilities are considered small businesses. Based on SBA's definition of a small business, 85 facilities would be small businesses.[10] For the 56 facilities affected by the shave and for which Dun and Bradstreet data is available, none are considered small businesses under either the SCAQMD or 1990 CAAA definitions. Twenty-two are considered small businesses under the SBA definition.[11]

7. COST OF BARCT INSTALLATION

This section estimates the total cost of BARCT installation. However, it should be noted that a RECLAIM facility is expected to retrofit an emission source only when it meets both of the following conditions: first, it does not hold sufficient RTCs to offset facility-wide emissions at the end of the compliance period; second, the cost of control installation per ton of emission reduction is lower than the expected average RTC price over the life of the control equipment. Even if a facility finds it more cost-effective to install pollution control equipment, it still would not incur the full cost of control installation if control installation results in surplus RTCs that the facility eventually sells to offset the control installation cost. Therefore, the compliance cost estimated in this section should be considered as the most conservative (i.e., maximum) estimate of the overall

[10] See the SBA website (http://www.sba.gov/community/blogs/community-blogs/small-business- matters/what-small-business-what-you-need-know-and-wh).The latest SBA definition of small businesses by industry can be found at http://www.sba.gov/content/table-small-business-size-standards.

[11] In order to reconcile discrepancies in Dunn & Bradstreet employment figures, estimates were acquired from SCAQMD Engineering & Compliance (RECLAIM Audit) permit data where applicable.

compliance cost for the proposed shave that will be needed to achieve the BARCT-equivalent level of NOx emission reductions.

Based on the BARCT analysis detailed in the Revised Draft Staff Report, the total compliance cost for BARCT installation would be potentially incurred by the 9 refineries and 11 non-refineries that have sources/equipment that can be upgraded to the 2015 BARCT level (for more detailed information on methodology and assumptions used, please see the Staff Report).Table 5 presents the estimated number of upgradable control devices at the 20 facilities per equipment/source category.

Under the proposed amendments, the 9 refineries would have the flexibility of changing operations, holding sufficient RTCs, or installing Selective Catalytic Reduction (SCR) technology, UltraCat Dry Gas Scrubbers (DGS), and Low Temperature Oxidation (LoTOxTM) with Wet Gas Scrubbers (WGS) to reduce NOx emissions coming from FCCUs, Sulfur Recovery Units/Tail Gas Incinerators (SRU/TGUs), coke calciner, refinery boilers and heaters, and refinery gas turbines.

The 11 non-refinery facilities currently have the following equipment/source categories: container glass melting furnaces, glass melting furnace facilities, sodium silicate furnaces, metal heat treating furnaces (rated greater than 150 mmBtu/hour), stationary ICEs and non- electricity generating facility stationary gas turbines. Under the proposed amendments, operators of these facilities would have the flexibility of changing operations, holding sufficient RTCs, or installing SCR technology or UltraCat DGS to reduce NOx emissions. For the purpose of conducting a worst-case analysis, 34 SCR units and 1 UltraCat DGS are assumed to be installed at the 11 non-refinery affected facilities. It is possible that another UltraCat DGS may also be installed in lieu of 1 of the 34 SCR units.

In total, the proposed project is assumed to result in the installation of the following new NOx air pollution control equipment: 116 SCRs, 8 LoTOxTM with WGSs, 1 LoTOxTM without WGS, and 3 UltraCat DGSs.

Table 5: Estimated Number of NOx Control Devices per Sector and Equipment/Source Category

Sector	Equipment/Source Category	Number of Affected Facilities	Estimated Number of Control Devices
Refinery	Fluid Catalytic Cracking Units (FCCUs)	5	3 SCRs 2 LoTOx™ with WGSs 1 LoTOx™ without WGS
Refinery	Refinery Process Heaters and Boilers	8	73 SCRs
Refinery	Refinery Gas Turbines	5	7 SCRs + Add Catalysts to 4 SCRs
Refinery	Sulfur Recovery Unit / Tail Gas Units (SRU/TGUs)	4	5 LoTOx™ with WGSs and 1 SCR**
Refinery	Petroleum Coke Calciner	1	1 UltraCat DGS or LoTOx™ ***
Non-Refinery	Container Glass Melting Furnaces	1	2 SCR or 1 UltraCat DGS
Non-Refinery	Sodium Silicate Furnaces	1	1 SCR or 1 UltraCat DGS

Sector	Equipment/Source Category	Number of Affected Facilities	Estimated Number of Control Devices
Non-Refinery	Metal Heat Treating Furnaces	1	1 SCR
Non-Refinery	Internal Combustion Engines (Non-Refinery/Non-Electricity Generating)	3	16 SCRs
Non-Refinery	Turbines (Non-Refinery/ Non-Electricity Generating)	7	13 SCRs and 1 SCR replacement
		TOTAL	**116 SCRs** **8 LoTOx™ with WGSs** **1 LoTOx™ without WGS** **3 UltraCat DGSs**

Under the assumption that all BARCT control devices listed above would be installed, an assumed implementation schedule was developed based on the required construction time (Table 6) and cost-effectiveness of control equipment (Table 7), which would ensure the achievement of projected emission reductions in 2018 and 2022. To the extent possible, it was assumed that the most cost-effective NOx control equipment would be installed or modified first, taking into account unit turnaround schedule information available to staff at this time. Table 8 summarizes the assumed implementation schedule.

Table 6: Construction Time by Source Category and Control Equipment

Non-Refinery		
Source Category	**Control Equipment**	**Required Time**
Sodium Silicate Furnace	SCR	2 years
ICE Engines	SCR	2 years
Container Glass Furnace	SCR/UltraCat DGS	2 years
Gas Turbines	SCR	2 years
Metal Heat Treating Furnace >150mmBtu/hr	SCR	2 years
Refinery		
Source Category	**Control Equipment**	**Required Time**
Refinery FCCU	SCR/ LoTOx™	3 Years
Coke Calciner	LoTOx™ /UltraCat DGS	3 Years
Boilers/Heaters	SCR	3 Years
Gas Turbines	SCR	2-3 years
SRU/TGs	SCR/ LoTOx™	3 Years

The cost estimates in this analysis are based on the combined estimates provided by SCAQMD consultants and staff for each affected facility. In addition, when applicable, the assumptions applied in the previous CEQA documents were used which analyzed similar equipment in both the 2005 amendments to NOx RECLAIM and the 2010 amendments to SOx RECLAIM.[12] Further, if a particular technology was identified as having a cost that exceeds $50,000 per ton for a particular facility, staff did not include that equipment as having feasible BARCT controls or emission reduction potential in the analysis. This is consistent with past practice for proposed RECLAIM amendments.

Table 7: Distribution of Control Equipment by Equipment Category and by Cost-Effectiveness

Equipment Category	Average DCF $/ton	Average LCF $/ton
Refinery Gas Turbine	$2,046	$3,250
Metal Heat Treating Furnace >150mmBtu/hr	$3,400	$5,500
Sodium Silicate Furnace	$4,750	$7,600
Glass Melting Furnace	$5,950	$9,450
Non-Refinery ICE Engine	$6,000	$9,600
Refinery FCCU	$8,200	$14,300
Non-Refinery Gas Turbine	$20,300	$32,500
Coke Calciner	$23,500	$38,000
Refinery Boiler/Heater	$28,000	$45,000
SRU/TG	$34,000	$56,000
Average	**$13,615**	**$22,120**

* DCF stands for Discounted Cash Flow and LCF stands for Levelized Cash Flow.
** Each of the cost-effective values in this table corresponds to the midpoint of the cost-effectiveness ranges reported in the Revised Draft Staff Report.

[12] Staff has met with three refineries who provided varying levels of detail regarding their projected costs that would occur for these facilities to comply with the proposed amendments. There is not sufficient information for staff to verify the WSPA cost estimates. Some of the difference related to staff using an incremental cost-effectiveness calculation, which assumes that 2005 BARCT levels are in place, which may or may not be the case for individual facilities, but is needed for a programmatic evaluation. The individual facilities include total costs, and often include full costs for additional equipment such as substations that may support the new control equipment, as well as other operations at the facility.

Table 8: Distribution of Control Equipment Categories by Installation Schedules														
	2016		2018		2019		2020		2021		2022		Total Equip	Total tpd emi reductions
Categories	**# of Equip**	**tpd emi red**	**# of Equip**	**tpd emi red**	**# of Equip**	**tpd emi red**	**# of Equip**	**tpd emi red**	**# of Equip**	**tpd emi red**	**# of Equip**	**tpd emi red**		
Refinery Sector														
Ref Gas Turbines	0	0.04	add cat	2.4	1 SCR	0.13	1 SCR	0.21	3 SCR	0.96	2 SCR	0.39	7 SCR	4.14
FCCUs					1 SCR	0.07	1 SCR	0.06	1 LoTOxTM	0.06	1 LoTOxTM	0.15	2 SCR 3 LoTOxTM	0.43
					1 LoTOxTM	0.09								
Coke Calciners					1 LoTOxTM UltraCat DGS	0.17							LoTOxTM UltraCat DGS	0.17
Boilers/Heaters							7 SCR	0.10	9 SCR	0.10	9 SCR	0.08	74 SCR	0.94
							14 SCR	0.17	14 SCR	0.14	2 SCR	0.01		
							13 SCR	0.24	6 SCR	0.13				
SRU/TGs							1 LoTOxTM	0.06	1 LoTOxTM	0.06	1 LoTOxTM	0.05	5 LoTOxTM 1 SCR	0.32
									2 LoTOxTM & 1 SCR	0.15				
Subtotal		**0.04**		**2.40**		0.46		0.84		1.60		0.68		6.00
Non-Refinery Sector														
Sodium Silicate Furnace			1 SCR or UltraCat DGS	0.09									1 SCR or UltraCat DGS	0.09
ICE					16 SCR	0.84							16 SCR	0.84
Container Glass Furnace					1 SCR or 2 UltraCat DGS	0.24							1 SCR or 2 UltraCat DGS	0.24
Gas Turbines							14 SCR	1.04					14 SCR	1.04
Metal H. Furnace >150mmBtu/hr					1 SCR	0.56								0.56
Subtotal				**0.09**		**1.64**		**1.04**						**2.77**
Total Emission Red.		**0.04**		**2.49**		**2.10**		**1.88**		**1.60**		**0.68**		**8.77**
Proposed RTC Red.		**4**		**2**		**2**		**2**		**2**		**2**		**14**

Table 9 presents the total average annual compliance cost of the proposed amendments by source/equipment category. The detailed cost assumptions will be discussed in the following subsections. Only estimates using a 4 percent discount rate will be reported in those subsections.[13]

Table 9: Average Annualized Control Installation Cost Estimates by Equipment Category (Millions of 2014 dollars)

	2018		2019		2022		2035		Average Annual (2018-2035)	
	Discount Rate Applied									
	4%	1%	4%	1%	4%	1%	4%	1%	4%	1%
Source Category Refinery										
Refinery FCCU	0	0	9.4	7.82	25.25	21.03	25.25	21.03	21.86	18.18
Coke Calciner	0	0	5.83	4.89	5.83	4.89	5.83	4.89	5.51	4.62
Boilers/Heaters	0	0	0	0	15.17	11.06	15.17	11.06	13.03	9.5
Gas Turbines	1.23	1.17	1.69	1.61	6.12	5.87	6.12	5.87	5.35	5.13
SRU/TGs	0	0	0	0	6.77	4.97	6.77	4.97	5.64	4.14
Total Refinery	**1.23**	**1.17**	**16.92**	**14.32**	**59.14**	**47.81**	**59.14**	**47.81**	**51.39**	**41.57**
Source Category Non-Refinery										
Sodium Silicate Furnace	0.3	0.26	0.3	0.26	0.3	0.26	0.3	0.26	0.3	0.26
ICE Engines	0	0	2.38	1.98	2.38	1.98	2.38	1.98	2.25	1.87
Container Glass Furnace	0	0	0.93	0.82	0.93	0.82	0.93	0.82	0.88	0.78
Gas Turbines	0	0	0	0	6.96	6.38	6.96	6.38	6.19	5.67
Total Non-Refinery	**0.30**	**0.26**	**4.23**	**3.63**	**11.19**	**10.00**	**11.19**	**10.00**	**10.20**	**9.11**
Grand Total	**1.53**	**1.43**	**21.15**	**17.95**	**70.32**	**57.81**	**70.32**	**57.81**	**61.59**	**50.68**

[13] In 1987, SCAQMD staff began to calculate cost-effectiveness of control measures and rules using the Discounted Cash Flow method with a discount rate of 4 percent. Although not formally documented, the discount rate is based on the 1987 real interest rate on 10-year Treasury Notes and Bonds, which was 3.8 percent. The maturity of 10 years was chosen because a typical control equipment life is 10 years; however, a longer equipment life would not have corresponded to a much higher rate-- the 1987 real interest rate on 30-year Treasury Notes and Bonds was 4.4 percent. Since 1987, the 4 percent discount rate has been used by SCAQMD staff for all cost-effectiveness calculations, including BACT analysis, for the purpose of consistency. The compliance cost reported in this assessment was thus annualized using a real interest rate of 4 percent. As a sensitivity test, a real interest rate of 1 percent was also used, which is closer to the prevailing real interest rate (see https://www.whitehouse.gov/omb/circulars_a094/a94_appx-c/).

As shown in Table 9, more expensive controls would not be installed until the 2019- 2022 timeframe. Based on this schedule and facility-specific estimates, the average annualized cost of the proposed amendments is estimated to be approximately $70 million (at 4 percent discount rate) or $60 million (at 1 percent discount rate) from year 2022 onwards when all controls are assumed to have been installed. More than 73 percent of the annualized compliance cost is expected to occur in the refinery sector, and more than 43 percent of the sector's annualized compliance cost would be associated with FCCU installation. Among the non-refinery sectors, gas turbines would account for more than 60 percent of the sector's annualized compliance cost.

Table 10 presents the annual compliance cost of full BARCT implementation by industry. Refineries (NAICS 324) would incur the majority of the compliance costs. Among the non- refinery sectors, glass melting furnaces, sodium silicate furnaces and metal heat treating furnaces belong to nonmetallic mineral product manufacturing (NAICS 327), chemical manufacturing (NAICS 325), and primary metal manufacturing (NAICS 311) sectors. Gas turbines were used in airport operations (NAICS 488), oil and gas extraction (NAICS 211), and paper manufacturing (NAICS 322) sectors. Internal Combustion Engines (ICE) engines were used in the utilities sector (NAICS 221).

Table 10: Average Annualized Control Installation Cost Estimates by Industry (Millions of 2014 dollars)

	2018		2019		2022		2035		Average Annual (2018-2035)	
	Discount Rate Applied									
	4%	1%	4%	1%	4%	1%	4%	1%	4%	1%
Refineries (324)	1.23	1.17	16.92	14.32	59.14	47.81	59.14	47.81	51.39	41.57
Utility (221)	0.00	0.00	2.38	1.98	6.27	5.57	6.27	5.57	5.72	5.06
Air Port Operation (488)	0.00	0.00	0.36	0.30	0.36	0.30	0.36	0.30	0.32	0.27
Paper Manufacturing (322)	0.00	0.00	0.00	0.00	0.73	0.68	0.73	0.68	0.65	0.60
Oil and Gas Extraction (211)	0.00	0.00	0.00	0.00	1.97	1.80	1.97	1.80	1.75	1.60
Nonmetallic Mineral Product Mfg. (327)	0.00	0.00	0.93	0.82	0.93	0.82	0.93	0.82	0.88	0.78
Chemical Manufacturing (325)	0.30	0.26	0.30	0.26	0.30	0.26	0.30	0.26	0.30	0.26
Primary Metal Manufacturing (311)	0.00	0.00	0.62	0.57	0.62	0.57	0.62	0.57	0.59	0.54
Grand Total	**1.53**	**1.43**	**21.15**	**17.95**	**70.32**	**57.81**	**70.32**	**57.81**	**61.59**	**50.68**

7.1 BARCT Cost Estimates for the Refinery Sector

There are 9 refinery facilities subject to the NOx RECLAIM rules whose operators may choose to install NOx air pollution control equipment in response to the proposed RTC shave. These facilities include the 6 refineries owned by 5 companies operating FCCUs, refinery boilers and heaters, refinery gas turbines, and SRU/TGUs.

As discussed previously, the 9 refineries may choose among changing operations, obtaining

sufficient RTC holdings, and installing NOx control devices, presumably based on which option would be more economical. The analysis herein assumes that the 9 refineries would install BARCT controls under the proposed amendments, a scenario representing the maximum potential cost.

As a conservative approach to cost estimation, the most stringent controls with the high- end cost (worst case scenarios) are assumed for the proposed amendments as well as for the CEQA alternatives. In total, 84 SCR units, 6 LoTOxTM with WGSs, 1 LoTOxTM without WGS, and 1 UltraCat DGS are assumed to be installed at the 9 refinery sector facilities. In order to operate SCR and UltraCat DGS, ammonia is necessary and, as such, tanks to store ammonia would also need to be installed. The size of each ammonia tank needed to operate the SCR units and 1 UltraCat DGS have been estimated to range between 2,000 and 11,000 gallons in capacity. For a full description of the control technologies, please see the CEQA NOx Control Technologies section.

7.1.1 Refinery FCCUs

The purpose of an FCCU at a refinery is to convert or "crack" heavy oils (hydrocarbons), with the assistance of a catalyst, into gasoline and lighter petroleum products. Each FCCU consists of three main components: a reaction chamber, a catalyst regenerator and a fractionator. There are 5 refineries that operate 6 FCCUs in the SCAQMD. The FCCUs are classified as major sources of emissions in RECLAIM, and as such, the NOx emissions from FCCUs are required to be monitored with a continuous emission monitoring system (CEMS), and reported on a daily basis electronically to the SCAQMD.

To further reduce NOx emissions from a FCCU (beyond what is currently being achieved through the use of NOx reducing additives), the potential available control technologies are either: 1) SCR; or, 2) LoTOxTM with WGS.

Two out of the 5 affected refineries are assumed to install SCRs and the remaining 3 are assumed to install LoTOxTM with WGS. The total compliance cost of the proposed amendments for refinery FCCUs includes one-time cost and recurring cost. The one-time cost includes the capital cost of SCRs and LoTOxTM with WGS and their installations (demolition, concrete, structural, piping, electrical, contractors, contingencies).

The capital cost and installation of the 2 SCRs are estimated at $30 and $48.3 million, respectively. Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the capital cost and installation of the 3 LoTOxTM with WGSs are estimated at $33.47, $54.89, and $60.62 million, respectively. Assuming a 25-year life[14] for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of compliance for the refinery FCCUs would sum up to $14.53 million.

The annual operating costs for the 2 SCR units include utilities (electricity), ammonia, catalyst

[14] Although the Bay Area AQMD and EPA OAQPS assume an SCR lifespan of 20 years, staff assumed a 25-year equipment life for SCRs to be installed based on the profiles of SCRs used by refineries in the Basin. Nearly 30 percent of the refinery combustion equipment in the Basin has SCRs that were installed more than 25 years ago, and more than 60 percent of the refinery combustion equipment has SCRs that were installed more than 20 years ago. These units are still in operation and thus support the assumption of a 25-year useful life in the cost analysis.

replacement (every 5 years), and other periodic maintenance. The annual operating cost for each SCR unit is estimated at $0.12 and $0.19 million, respectively. The catalyst replacement costs for each SCR unit is estimated at $1.5 million and $2.4 million, respectively. Staff used data provided in the 2005 SOx RECLAIM amendments for the annual costs associated with the WGS and manufacturer's data for the annual costs associated with the LoTOxTM with WGS portion of the system. The annual operating costs for the 3 LoTOxTM with WGSs units include utilities (electricity), ammonia/caustic, waste water, and other periodic maintenance. The annual operating cost for each LoTOxTM with WGS unit is estimated at $2.4 and $3.5, and $3.9 million, respectively. The total annualized operating and maintenance costs for the 2 SCRs and 3LoTOxTM with WGS units would sum up to about $10.7 million.[15] Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the FCCU units would amount to $25 million using a 4 percent discount rate.

Table 11: Total Capital, Installation, and Annual Operating Cost of SCRs/LoTOx™ for Refineries FCCUs (Millions of 2014 dollars, present value)

Refinery	Equipment Cost	Installation Cost	Total O&M Cost	Electricity/ Water	Ammonia/ Caustic	Catalyst*
5	$7.5	$22.5	$0.12	$0.036	$0.084	$1.5
6	$12.0	$36.0	$0.192	$0.058	$0.134	$2.4
7	$9.6	$23.9	$2.14	$0.64	$1.49	0.0
4	$15.6	$39.0	$3.51	$1.05	$2.45	0.0
9	$17.3	$43.3	$3.88	$1.16	$2.7	0.0
Total	**$62.00**	**$164.70**	**$9.84**	**$2.94**	**$6.86**	**$3.90**

*Total cost recurring every 5 years

7.1.2 Refinery Process Heaters and Boilers

Refinery process heaters and boilers are used extensively throughout various processes in refinery operations such as distillation, hydrotreating, fluid catalytic cracking, alkylation, reforming, and delayed coking. There are 23 boilers and 189 heaters in the refineries classified as major or large NOx sources. The refinery heaters and boilers primarily burn refinery gas which is generated at the refinery. Most of these boilers and heaters use natural gas as back-up or supplemental fuel.

For the purpose of the analysis, controlling NOx emissions from refinery boilers and process heaters was assumed to be accomplished with SCR technology. It was assumed that 8 refineries would

[15] The total O&M cost in Table 11 is the sum of annual electricity/water, ammonia/caustic and annualized cost of the catalyst.

install 73 SCR units. Based on the vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital, installation, and operating costs of each SCR is presented in the table below. It should be noted that the annual operating costs were distributed among electricity, ammonia, annual catalyst replacement, and other annual maintenance.

Assuming a 25-year life for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of compliance of 73 SCR installations for the refinery boilers and heaters is estimated at $15.02 million. The total annual operating and maintenance costs for the 73 SCR units are estimated at $0.15 million.[16] Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the boilers and heaters would amount to $15 million using a 4 percent discount rate. Table 12 presents the detailed costs per refinery.

Table 12: Total Capital, Installation, and Annual Operating Cost of SCRs for Refineries Process Heaters and Boilers (Millions of 2014 dollars, present value)

Refinery	Equipment Cost	Installation Cost	Total O&M in $1,000	Electricity/Water	Ammonia/Caustic	Catalyst	Other Maintenance
1	$7.36	$25.80	$21.44	$6.43	$8.58	$4.29	$2.14
3	$0.44	$1.54	$1.28	$0.38	$0.51	$0.26	$0.13
4	$4.51	$15.79	$13.12	$3.94	$5.25	$2.62	$1.31
5	$10.87	$38.12	$31.69	$9.51	$12.67	$6.34	$3.17
6	$11.32	$39.67	$32.97	$9.89	$13.19	$6.59	$3.30
7	$7.80	$27.34	$22.72	$6.82	$9.09	$4.54	$2.27
8	$3.85	$13.48	$11.20	$3.36	$4.48	$2.24	$1.12
9	$5.93	$20.80	$17.28	$5.18	$6.91	$3.46	$1.73
Total	**$52.08**	**$182.54**	**$151**	**$45.51**	**$60.68**	**$30.34**	**$15.17**

7.1.3 Refinery Gas Turbines

Gas turbines are used in refineries to produce both electricity and steam. Refinery gas turbines are typically combined cycle units that use 2 work cycles from the same shift operation. There are a total of 21 gas turbines/duct burners classified as major NOx sources at the refineries in the SCAQMD. Collectively, the 21 gas turbines/duct burners emitted about 1.33 tpd of NOx in 2011.

For the purpose of the analysis, controlling NOx emissions from refinery gas turbines was assumed to be accomplished with SCR technology. A total of 5 refineries are affected in this category. Refinery 1 is assumed to add catalyst to existing SCRs and the remaining 4 refineries are assumed to install SCRs: Refinery 4 (2 SCRs), Refinery 3 (3 SCRs), Refinery 6 and 7 each to install 1 SCR.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital, installation, and operating costs of each SCR is presented in the table below. It should be

[16] The total O&M cost in Table 12 is the sum of annual electricity/water, ammonia/caustic, annual cost of the catalyst, and other maintenances.

noted that the annual operating costs were distributed among electricity, ammonia, annual catalyst replacement, and other annual maintenance. Assuming a 25-year life for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of compliance of the SCRs installations for the refinery gas turbines is estimated at $1 million. The total annual operating and maintenance costs of SCR units are estimated at $5.25 million.[17] Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the gas turbines would amount to $6 million using a 4 percent discount rate. Table 13 presents the detailed costs per refinery.

Table 13: Total Capital, Installation, and Annual Operating Cost of SCRs for Refineries Gas Turbines (Millions of 2014 dollars, present value)

Refinery	Equipment Cost	Installation Cost	Total O&M Cost	Electricity/ Water	Ammonia /Caustic	Catalyst	Other Maintenances
1	$0.77	$2.30	$1.03	$0.31	$0.41	$0.21	$0.10
4	$0.71	$2.14	$0.96	$0.29	$0.38	$0.19	$0.09
5	$1.51	$4.54	$2.03	$0.61	$0.81	$0.41	$0.20
6	$0.29	$0.86	$0.39	$0.12	$0.15	$0.08	$0.04
7	$0.63	$1.89	$0.85	$0.25	$0.34	$0.17	$0.09
Total	**$3.91**	**$11.73**	**$5.25**	**$1.58**	**$2.09**	**$1.06**	**$0.52**

7.1.4 Sulfur Recovery Units and Tail Gas Units (SRU/TGUs)

Refinery SRU/TGUs, including their incinerators, are classified as major sources of both NOx and SOx emissions. Because sulfur is a naturally occurring and undesirable component of crude oil, refineries employ a sulfur recovery system to maximize sulfur removal. The type of NOx control option to be utilized in response to this portion of the proposed project is assumed to be LoTOxTM technology with a WGS or SCR. Three refineries are assumed to install 1 LoToxTM with WGS each and 1refinery is assumed to install 2 LoTOxTM with WGS and 1 SCR.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital, installation, and operating costs of LoTOxTM with WGS and SCR are presented in the table below. It should be noted that the annual operating costs were distributed among electricity, ammonia/caustic, waste water, annual catalyst replacement, and other annual maintenance.

Assuming a 25-year life for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of compliance of the LoTOxTM with WGS and SCR installations for the refinery SRU/TGUs is estimated at $6.2 million. The total annual operating and maintenance costs

[17] The total O&M cost in Table 13 is the sum of annual electricity/water, ammonia/caustic, annual cost of the catalyst, and other maintenances.

are estimated at $0.57 million.[18] Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the gas turbines would amount to $7 million using a 4 percent discount rate. Table 14 presents the detailed costs per refinery.

Table 14: Total Capital, Installation, and Annual Operating Cost of Sulfur Recovery Units and Tail Gas Units (SRU/TGUs) (Millions of 2014 dollars, present value)

Refinery	Equipment Cost	Installation Cost	Total O&M Cost	Electricity/ Water	Ammonia/ Caustic	Waste Water	Other Maintenance
1	$4.52	$15.82	$0.15	$0.07	$0.06	$0.01	$0.01
5	$7.91	$27.68	$0.14	$0.07	$0.05	$0.01*	$0.01
6	$4.57	$15.99	$0.13	$0.07	$0.05	$0.01	$0.01
8	$4.52	$15.82	$0.15	$0.07	$0.06	$0.01	$0.01
Total	**$21.52**	**$75.31**	**$0.57**	**$0.28**	**$0.21**	**$0.04**	**$0.04**

***** Refinery 5 cost estimates for annual cost of catalyst

7.1.5 Petroleum Coke Calciner

Petroleum coke is the heaviest portion of crude oil which cannot be recovered in the normal oil refining process. Instead, it is processed in a delayed coker unit to generate a carbonaceous solid referred to as "green coke," a commodity. To improve the quality of the product, it is sent to a calciner to make calcined petroleum coke.

There are two commercially available multi-pollutant control technologies for the low temperature removal of NOx emissions from the coke calciner: 1) LoTOxTM with scrubber; and, 2) UltraCat DGS. The type of NOx control option to be utilized for the coke calciner in response to the proposed amendments would depend on the facility's individual operations and the current control technologies and techniques in place. For the purpose of the socioeconomic analysis, 1 refinery is assumed to control NOx emissions from a coke calciner with UltraCat DGS. It should be noted that the annual operating costs were distributed among electricity, ammonia, waste water, annual catalyst replacement, and other annual maintenance.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital and installation of LoTOxTM with UltraCat DGS is estimated at $50.84 million. Assuming a 25-year life for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of compliance of 1 UltraCat DGS is estimated at $3.25 million. The total annual operating and maintenance costs are estimated at $2.58 million. Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the coke calciner would amount to

[18] The total O&M cost in Table 14 is the sum of annual electricity/water, ammonia/caustic, waste water, and other maintenances.

$6 million using a 4 percent discount rate.

7.2 BARCT Cost Estimates for the Non-Refinery Sector

In addition to the 9 refineries, 11 non-refinery facilities also operate with equipment that can be further controlled to meet 2015 BARCT levels. They include 1 container glass manufacturing plant, 1 sodium silicate manufacturing plant, 1 steel plant operating 2 metal heat treating furnaces rated greater than 150 mmBtu/hr, 7 facilities operating gas turbines, and 3 facilities operating ICEs. The analysis herein assumes that the 11 non-refinery facilities would choose to install BARCT controls under the proposed amendments, the maximum potential compliance cost scenario.

As a conservative approach to cost estimation, the most stringent controls with the high- end cost (worst case scenarios) are assumed for the proposed amendments as well as for the CEQA alternatives. In total, 34 SCR units and 1 UltraCat DGS are assumed to be installed at these facilities.

7.2.1 Container Glass Melting Furnaces

A container glass melting furnace is the main equipment used for manufacturing glass products, such as bottles, glassware, pressed and blown glass, tempered glass, and safety glass. In the NOx RECLAIM program there is 1 facility among the top NOx emitting facilities that operates glass melting furnaces. This facility produces container glass from dry, solid raw materials that are melted in the furnaces and then formed into glass container bottles.

To effectively reduce NOx emissions from this category, staff assumed the affected facility would chose to install 2 Tri-Mer UltraCat Systems for treating the flue gas of glass melting furnaces. Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital and installation of 2 Tri-Mer UltraCat Systems is estimated at
$5.68 million. Assuming a 25-year life for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of compliance of 2 UltraCat DGS is estimated at $0.36 million. The total annual operating and maintenance costs are estimated at $0.67 million. The annual operating costs were distributed among electricity, ammonia and sorbent, waste water, waste disposal, annual catalyst replacement, and other annul maintenance. The total annualized cost of compliance for the container glass melting furnace including capital, operating, and maintenance, is estimated to be $1.03 million.

7.2.2 Sodium Silicate Furnace

In the NOx RECLAIM program, there is only 1 facility that produces sodium silicate in a melting furnace. NOx emissions are also created from combusting fuel needed to heat the furnace. To effectively achieve the largest reduction of NOx emissions, it was assumed that the affected facility would choose to install 1 UltraCat DGS.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital and installation costs of 1 UltraCat DGS is estimated at $2 million. Assuming a 25-year life for equipment and installation, and a real interest rate of 4 percent, the total one-time annualized cost of 1 UltraCat DGS is estimated at $0.13 million. The total annual operating and

maintenance costs are estimated at $0.17 million. The annual operating costs were distributed among electricity, ammonia, waste water, waste disposal, annual catalyst replacement, and other annual maintenance. Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the container glass melting furnace would amount to $300,000 using a 4 percent discount rate.

7.2.3 Metal Heat Treating Furnaces

A metal melting furnace burns liquid or gaseous fuel to generate enough pre-heated air at a temperature high enough to melt solid metal into a liquid molten consistency and to maintain the metal in a liquid state until it is ready for later use. Among the top NOx emitting facilities in the NOx RECLAIM program, there is only 1 facility that processes steel in 2 metal heat furnaces with individual heat ratings above 150 mmBtu/hr. To effectively achieve a substantial NOx reduction from these metal heat treating furnaces, SCR is the technology that is best suited for the flue gas treatment of NOx. As a result, it was assumed that the operator of the affected facility would chose to install 1 SCR system.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital and installation of 1 SCR is estimated at $2.80 million. Assuming a 25- year life for equipment and installation, and a real interest rate of 4 percent, the total one- time annualized compliance cost is estimated at $0.18 million. The total annual operating and maintenance costs are estimated at $0.44 million. The annual operating costs were distributed among electricity, ammonia, annual catalyst replacement, and other annual maintenance. Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the metal melting furnace would amount to $600,000 using a 4 percent discount rate.

7.2.4 Gas Turbines (Non-Refinery/Non-Electricity Generating Plant)

Stationary gas turbines are used primarily to drive compressors or to generate electricity. Among the top non-electricity generating facility NOx emitting facilities in the RECLAIM universe, there are 20 gas turbines that are either major or large source units. For the purpose of the analysis, controlling NOx emissions from the 4 non-refinery/non-electricity generating facility gas turbines is assumed to be accomplished with SCR technology.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital, installation, and operating costs of 14 SCRs for the 7 affected facilities are presented in the table below. It should be noted that the annual operating costs were distributed among electricity, ammonia and annual catalyst replacement. Assuming a 25- year life for equipment and installation, and a real interest rate of 4 percent, the total one- time annualized cost of compliance of 14 SCRs is estimated at $2.02 million. The total annual operating cost of these 14 SCRs is estimated at $4.94 million.[19] Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the gas turbines would amount to $7 million using a 4 percent discount rate. Table 15 presents the detailed costs per facility.

[19] The total O&M cost in Table 15 is the sum of annual electricity, ammonia/urea, and annual cost of catalyst.

Table 15: Total Capital, Installation, and Annual Operating Cost of SCRs for Non-Electricity generating facilities Gas Turbines (Millions of 2014 dollars, present value)

Facility	Equipment Cost	Installation Cost	Total O&M Cost	Electricity	Ammonia /Urea	Catalyst
1	$2.81	$5.62	$2.12	$0.41	$1.34	$0.37
2	$2.03	$4.06	$0.27	$0.08	$0.15	$0.03
3	$0.77	$1.55	$0.44	$0.02	$0.32	$0.10
4	$0.96	$1.92	$0.17	$0.04	$0.09	$0.04
5	$0.92	$1.84	$0.56	$0.02	$0.35	$0.19
6	$1.62	$3.25	$0.79	$0.27	$0.29	$0.23
7	$1.40	$2.81	$0.6	$0.2	$0.2	$0.2
Total	**$10.51**	**$21.05**	**$4.95**	**$1.04**	**$2.74**	**$1.16**

7.2.5 Internal Combustion Engines (Non-Refinery/Non-Electricity Generating Facility)

Stationary Internal Combustion Engines (ICEs) are used primarily to drive pumps, compressors, or to generate electricity. For the purpose of the analysis, controlling NOx emissions from this category is assumed to be accomplished with SCR technology.

Based on vendor–supplied costs and the assumptions made in staff's engineering analyses, the total capital, installation, and operating costs of 16 SCRs for the 3 affected facilities are presented in the table below. It should be noted that the annual operating costs were distributed among electricity, ammonia and annual catalyst replacement. Assuming a 25- year life for equipment and installation, and a real interest rate of 4 percent, the total one- time annualized cost of compliance of 16 SCRs is estimated at $1.38 million. The total annual and operating costs of these 16 SCRs is estimated at $0.99 million.[20] Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the ICEs would amount to $2 million using a 4-percent discount rate. Table 16 presents the detailed costs per facility.

[20] The total O&M cost in Table 16 is the sum of annual electricity, ammonia/urea, annual cost of catalyst, and other maintenances.

Table 16: Total Capital, Installation, and Annual Operating Cost of SCRs for Non- Electricity generating facilities ICE Engines (Millions of 2014 dollars, present value)

Facility	Equipment Cost	Installation Cost	Total O&M Cost	Electricity	Ammonia /Urea	Catalyst	Other Maintenances
1	$0.53	$3.93	$0.18	$0.005	$0.08	$0.08	$0.02
2	$0.68	$4.78	$0.31	$0.004	$0.07	$0.22	$0.02
3	$0.80	$10.80	$0.50	$0.01	$0.21	$0.22	$0.06
Total	**$2.01**	**$19.51**	**$0.99**	**$0.02**	**$0.36**	**$0.52**	**$0.10**

8. MACROECONOMIC IMPACTS ON REGIONAL ECONOMY

The Regional Economic Model (REMI, PI+ v1.7.2) (PI+ v1.7.2) was used to assess the total socioeconomic impacts of a policy change (i.e., the proposed rule). The model links the economic activities in the counties of Los Angeles, Orange, Riverside, and San Bernardino, and for each county, it is comprised of five interrelated blocks: (1) output and demand, (2) labor and capital, (3) population and labor force, (4) wages, prices and costs, and (5) market shares.[21]

8.1 Impact of Proposed Amendments

The assessment herein is performed relative to a baseline ("business as usual") where the proposed amendments would not be implemented. The proposed amendments are assumed to induce full BARCT installation at the 9 refineries and 11 non-refinery facilities, which would create a policy scenario under which the affected facilities would incur a total annual compliance cost of approximately $70 million when evaluated at a 4 percent discount rate, or $60 million when evaluated at a 1 percent discount rate from year 2022 onwards when all controls are assumed to have been installed. It is assumed that the 20 facilities would finance the capital and installation costs of control equipment, or more specifically, these one-time costs are assumed to be amortized and incurred over the equipment life.

Direct effects of the proposed amendments are used as inputs to the REMI model in order for the model to assess secondary and induced impacts for all the industries in the four- county economy on an annual basis and across a user-defined horizon: 2018 (first year of assumed BARCT implementation) to 2035, and a sensitivity analysis was conducted that extends the horizon to

[21] Within each county, producers are made up of 66 private non-farm industries, three government sectors, and a farm sector. Trade flows are captured between sectors as well as across the four counties and the rest of U.S. Market shares of industries are dependent upon their product prices, access to production inputs, and local infrastructure. The demographic/migration component has 160 age/gender/race/ethnicity cohorts and captures population changes in births, deaths, and migration. (For details, please refer to REMI online documentation at http://www.remi.com/products/pi.)

2043. Direct effects of the proposed amendments include additional costs to the 20 facilities that would install control equipment and additional sales, by local vendors, of equipment, devices, or services that would meet the proposed requirements. Whereas all the compliance expenditures that are incurred by the affected facilities would increase their cost of doing business, the purchase of additional control equipment such as SCR, LoTOxTM, UltraCat DGS, and equipment installation would increase the spending and sales of businesses in various sectors, some of which may be located in the SCAQMD region. Table 17 lists the industry sectors modeled in REMI that would either incur cost or benefit from the compliance expenditures.

Table 17: Industries Incurring *vs.* Benefitting from Compliance Costs/Spending

Source of Compliance Costs	REMI Industries Incurring Compliance Costs (NAICS)	REMI Industries Benefitting from Compliance Spending (NAICS)
Installation of SCR, LoTOx™, UltraCat DGS	Refinery (NAICS 324), Manufacturing (NAICS 331), Utilities (NAICS 221), Chemical Manufacturing (NAICS 325), Nonmetallic Mineral Product Manufacturing (NAICS 327), Oil and Gas Extraction (NAICS 211), and Support Activities for Transportation (NAICS 488)	*One-time-Capital:* Machinery Manufacturing (NAICS 333)
Installation of SCR, LoTOx™, UltraCat DGS	Refinery (NAICS 324), Manufacturing (NAICS 331), Utilities (NAICS 221), Chemical Manufacturing (NAICS 325), Nonmetallic Mineral Product Manufacturing (NAICS 327), Oil and Gas Extraction (NAICS 211), and Support Activities for Transportation (NAICS 488)	*One-time-Capital:* Construction (236)
Operating and Maintenance Cost of SCR, LoTOx™, UltraCat DGS	Refinery (NAICS 324), Manufacturing (NAICS 331), Utilities (NAICS 221), Chemical Manufacturing (NAICS 325), Nonmetallic Mineral Product Manufacturing (NAICS 327), Oil and Gas Extraction (NAICS 211), and Support Activities for Transportation (NAICS 488)	*Recurring:* Professional, Scientific, and Technical Services (541)
Other Operating and Maintenance Costs: Electricity, Water	Refinery (NAICS 324), Manufacturing (NAICS 331), Utilities (NAICS 221), Chemical Manufacturing (NAICS 325), Nonmetallic Mineral Product Manufacturing (NAICS 327), Oil and	*Recurring:* Utilities (221)

Source of Compliance Costs	REMI Industries Incurring Compliance Costs (NAICS)	REMI Industries Benefitting from Compliance Spending (NAICS)
	Gas Extraction (NAICS 211), and Support Activities for Transportation (NAICS 488)	
Other Operating and Maintenance Costs: Ammonia, Caustic, Oxygen	Refinery (NAICS 324), Manufacturing (NAICS 331), Utilities (NAICS 221), Chemical Manufacturing (NAICS 325), Nonmetallic Mineral Product Manufacturing (NAICS 327), Oil and Gas Extraction (NAICS 211), and Support Activities for Transportation (NAICS 488)	*Recurring:* Chemical Manufacturing (NAICS 325)
Other Operating and Maintenance Costs: Solid Waste Disposal & Waste Water	Refinery (NAICS 324)	*Recurring:* Waste Management (NAICS 562)

It should be noted that the REMI model is not designed to assess impacts on individual operations. The model was used to assess the impacts of the proposed amendments on various industries that make up the local economy. Cost impacts on individual operations were assessed outside of the REMI model and used as inputs into the REMI model.

When the compliance cost annualized at a 4 percent interest rate is used, it is projected that an average of 20 net jobs could be created annually from 2018 to 2035, and about 140 net jobs foregone when the analysis horizon is extended to 2043. The difference is because the majority of jobs would be created at the beginning of the analysis period (2018-2022) when control installation is assumed to take place, as shown in Figure 2. (Note that jobs foregone may include either losses of existing jobs or projected additional jobs not created). The projected job impact becomes slightly more positive when the compliance cost annualized at a 1 percent interest rate is used. This analysis only considers the potential compliance cost of full BARCT installation at the 20 facilities, and it does not take into account the monetary benefits for facilities that potentially will have more RTCs available for sale as a result of NOx emission reductions due to BARCT installation. (Please see next section for an RTC market analysis.)

In earlier years of the implementation of these amendments, the positive job impacts from the compliance expenditures made by refineries, container glass, sodium silicate plant, and sulfur acid plants would more than offset the jobs forgone from the additional cost of doing business (Table 18). In 2021, where most of the spending is expected to occur, about 2,000 additional jobs are projected in the regional economy. The positive job impact would trickle down to the sectors of construction, miscellaneous professional services, retail, wholesale, and business services. However, as refineries, glass, sulfur acid plant, and other non-major facilities continue to incur the

amortized capital expenditures, reductions in job growth would set in, resulting in jobs forgone in later years.

The oil and gas extraction sector is projected to have about 30 average annual jobs forgone, due to additional spending on SCRs required on gas turbines. Despite having a large share of the total compliance cost, the refinery industry is projected to have fewer jobs forgone (about 10) relative to other industries with a similar magnitude of cost impacts. This is due to the fact that the industry is the most capital-intensive. As such, less labor would be required to produce the same amount of products or services.

In earlier years, positive job impacts are projected in the sectors of fabricated metal products (NAICS 332) and machinery manufacturing (NAICS 331), due to purchase of various types of control equipment (including SCR, LoTOxTM, and UltraCat DGS) by the affected facilities (as presented in Table 17). Likewise, the sector of construction is projected to gain many jobs during the beginning period, due to the installation of control equipment. In addition, the sector of professional and technical services (NAICS 541) is projected to also gain jobs in earlier years from additional demand for equipment installation and maintenance. Operating and maintenance expenditures would benefit the industries of chemical products (NAICS 325) for additional sales of ammonia and public utilities (NAICS 22) for electricity.

The projected reduction in disposable income from the overall jobs forgone in the later years would dampen the demand for goods and services in the local economy, thus contributing to jobs forgone in sectors such as the rest of manufacturing, retail trade, wholesale, and accommodation and food services. As presented in Table 18, many major sectors of the regional economy would experience negative, albeit minor, job impacts in later years from the secondary and induced effects of BARCT implementation.

Table 18: Projected Job Impacts of Full BARCT Implementation by Industry and Year

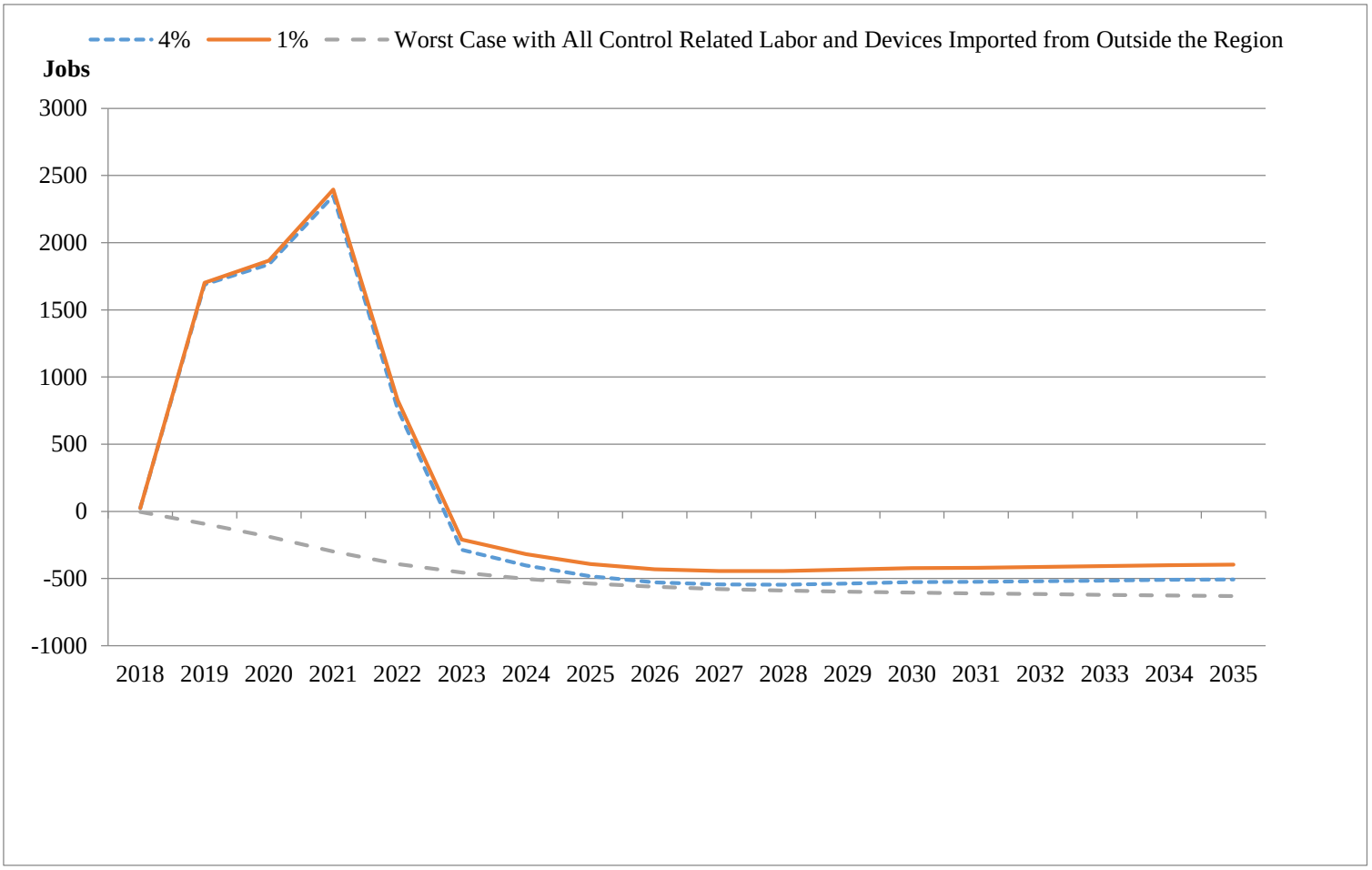
Industry	NAICS	Year					Average Annual (2018-2035)
		2018	2021	2022	2030	2035	
Oil and gas extraction	211	0	-10	-19	-43	-45	-31
Utilities	22	0	5	5	1	1	2
Construction	23	23	1193	476	-114	-84	116
Nonmetallic mineral product mfg.	327	0	9	3	-2	-2	0
Fabricated metal product mfg.	332	1	21	8	-4	-3	1
Machinery mfg.	331	2	44	22	2	1	9
Petroleum and coal product mfg.	324	0	-4	-7	-13	-12	-9
Chemical mfg.	325	0	5	4	2	1	2
Rest of Manufacturing	31-33	0	24	1	-13	-11	-7
Wholesale trade	42	1	56	22	-5	-6	6
Retail trade	44-45	2	95	6	-59	-57	-27
Truck transportation and couriers	484,492	0	13	3	-5	-4	-1
Monetary authorities	521,522,5255	0	14	5	-2	-2	1
Securities, and commodity contracts	523	1	31	5	-6	-4	0
Insurance carriers and related activities	524	0	10	3	-3	-3	0
Real estate	531	1	43	13	-19	-19	-6
Professional and technical services	54	4	125	54	-30	-39	2

Industry	NAICS	Year					Average Annual (2018-2035)
		2018	2021	2022	2030	2035	
Management of companies and enterprises	55	0	9	2	-3	-2	-1
Administrative and support services	561	2	87	28	-26	-26	-4
Waste management and remediation services	562	0	3	2	-1	-2	0
Educational services	61	1	24	8	-8	-8	-1
Ambulatory health care services	621	1	64	18	-17	-19	-2
Hospitals	622	0	14	5	-6	-7	-2
Nursing and residential care facilities	623	0	11	3	-4	-5	-1
Social assistance	624	1	36	11	-11	-13	-2
Performing arts and spectator sports	711	0	9	0	-1	0	0
Amusement, gambling, and recreation	713	0	6	2	-1	-1	0
Accommodation	721	0	11	3	-3	-3	0
Food services and drinking places	722	1	60	22	-22	-26	-4
Repair and maintenance	811	1	25	8	-4	-4	1
Personal and laundry services	812	1	35	8	-8	-8	0
Membership associations and organization	813	0	21	6	-5	-4	0
Private households	814	0	11	2	-2	-2	0
Other Industries		0	38	5	-16	-14	-6
Government		1	81	56	-44	-48	-11
Total		**44**	**2219**	**793**	**-495**	**-480**	**23**

*The job impacts are projected for the regional economy, which includes jobs at all businesses, whether directly affected by full BARCT implementation or not.

Figure 2 presents a projected time series of job impacts over the 2018-2035 time period. Based on Abt Associate's 2014 recommendation to enhance socioeconomic analysis by conducting scenario analysis on major assumptions, staff has analyzed an alternative scenario (worst case) where the affected facilities would not purchase any control equipment or services from providers within the Basin. This is a highly hypothetical scenario in order to test the sensitivity of the previously discussed scenarios where the analyses rely on REMI's embedded assumptions about how the capital and O&M spending would be distributed inside and outside the region. In reality, utilities expenditures are paid to local utilities producers. Moreover, construction jobs related to control installation are likely to increase hiring from the local labor force. This worst-case scenario would result in an annual average of approximately 450 jobs forgone. The approximately 480 jobs forgone in 2035 represent less than 0.01 percent of total jobs in the region. It is not expected that the proposed rule amendments will create a shift from high-to-low skill jobs.

Figure 2: Projected Regional Job Impact, 2018-2035



8.1.1 Potential Health Benefits

The South Coast Air Basin is one of only two "extreme" non-attainment areas in the nation that have not reached the federal 8-hour ozone standard. Ground-level ozone, or smog, forms when volatile organic compounds (VOC) photochemically react with nitrogen oxides (NOx) in the presence of sunlight. Encompassing a major swath of Southern California, the South Coast Air Basin is among the most densely populated areas nationwide, with about 13 million cars, trucks, and other vehicles operating on its extensive network of highways and roads.[22] The amount of pollutants produced by modern urban life and industrial activities, combined with Southern California's year-round sunny weather, all contribute to the high concentrations of ground-level

[22] According to estimates provided by the California Department of Motor Vehicles, there were a total of 13.7 million registered vehicles in Los Angeles, Orange, Riverside, and San Bernardino counties for the period of January 1 to December 31, 2013. (https://www.dmv.ca.gov/portal/wcm/connect/add5eb07-c676-40b4-98b5-8011b059260a/est_fees_pd_by_county.pdf?MOD=AJPERES, accessed February 18, 2015.) The South Coast Air Basin covers all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties; therefore, the total number of vehicles would have been somewhat smaller.

ozone in the area. Ozone exposure can cause immediate, adverse effects on the respiratory system and result in various symptoms such as coughing, throat irritation, chest pain, and shortness of breath. It can also inflame the lining of the lungs, and for asthma patients, it may increase the number and severity of attacks. Long-term impacts of frequent exposure to ozone may lead to permanent lung damage and increase the risk of premature death.

In addition, the South Coast Air Basin remains a non-attainment area for the federal 24- hour and annual PM2.5 standards. NOx is also a precursor to PM2.5. Exposure to high levels of PM2.5 have been shown to cause and aggravate cardiopulmonary illnesses, including heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms, such as irritation of the airways, coughing or difficult breathing. These outcomes result in increased absences from school and work, hospitalization, and other medical expenses. Exposure to PM2.5 is associated with premature deaths. According to recent estimates by the California Air Resources Board, elevated ambient PM2.5 levels result in approximately 4,100 premature deaths annually in the South Coast Air Basin.

The reductions in ozone and PM2.5 associated with the proposed rule amendments have the potential to reduce the mortality and morbidity incidences associated with NOx emissions.

8.1.2 Competiveness

The additional cost for the proposed rule would increase the cost of services rendered by the affected industries in the region. The magnitude of the impact depends on the size and diversification of, and infrastructure in, a local economy as well as interactions among industries. A large, diversified, and resourceful economy would absorb the impact described above with relative ease.

Changes in production/service costs would affect prices of goods produced locally. The relative delivered price of a good is based on its production cost and the transportation cost of delivering the good to where it is consumed or used. The average price of a good at the place of use reflects prices of the good produced locally and imported elsewhere.

It is projected that the manufacturing sector, where most of the affected RECLAIM facilities belong, would experience a rise in its relative cost of services by about 0.013 percent and a rise in its delivered price by less than 0.001 percent in 2022 from the implementation of the proposed amendments.

8.1.3 Job Impact by Occupation

Occupations can be grouped into five categories according to median weekly earnings (See Table A in Appendix B for more details). Group 1 has the lowest-paid occupations while Group 5 has the highest-paid occupations. Table X shows the job impact as a percentage of the baseline jobs under the proposed amendments for each occupational wage group. Median weekly U.S. wage rates for 95 occupations are obtained from the 2013 BLS Employment and Earnings. The wage rates are ranked in ascending order, and then divided into five groups. The range of occupational wage rates as listed in the Appendix B.

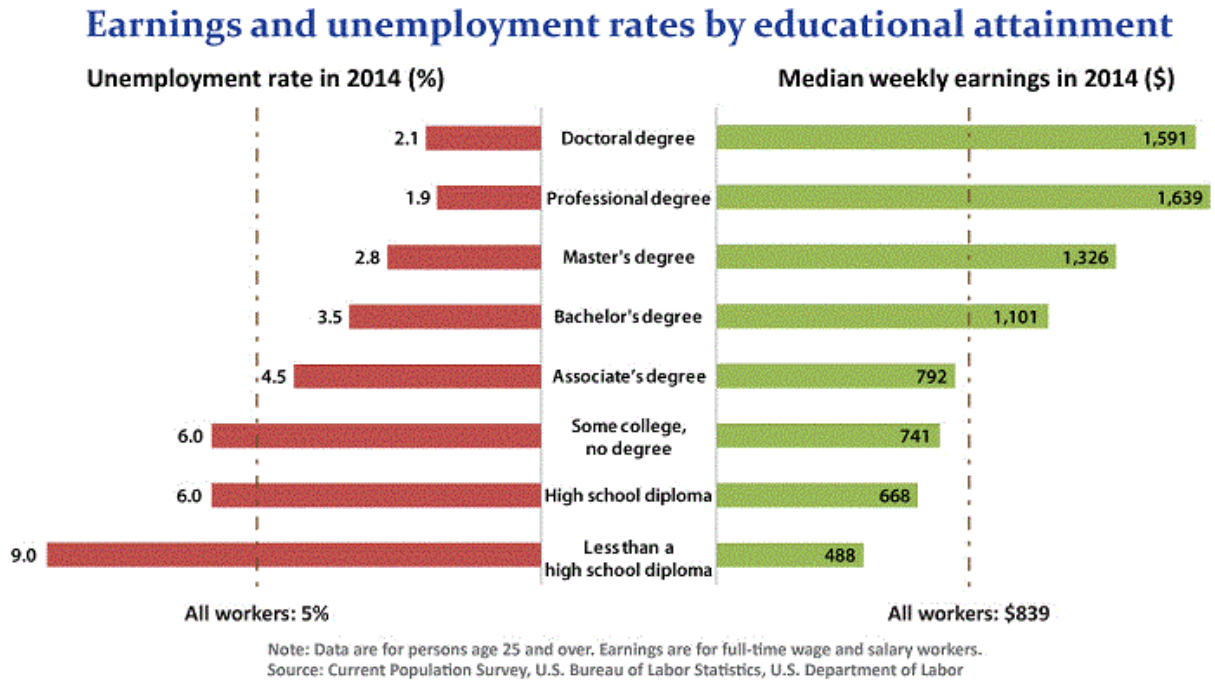
A positive figure indicates that the proposed amendments create more jobs and a negative figure means the opposite. In earlier years of the implementation of these amendments, the positive job impacts from the compliance expenditures made by affected facilities would more than offset the jobs proportionally forgone from the additional cost of doing business. However, as affected facilities continue to incur the amortized capital expenditures, reductions in job growth would set in, resulting in jobs forgone in later years.

For example, in 2018 through 2022, the full installation of BARCT controls is projected to result in more jobs created with respect to the baseline for all occupational groups. As shown in Table 19, however, proportionately fewer jobs would be foregone (e.g., in 2030 and 2035) for lower skilled than higher skilled jobs. For the purpose of this analysis, staff assumed lower skilled jobs as those jobs that do not require a bachelor's degree which according to the 2014 Bureau of Labor Statistics would have weekly earnings of about $1,100 per week. Similar job impacts by occupational group would have occurred under command-and-control regulations as they would also require the full installation of BARCT controls.

Table 19:
Job Impact of the Proposed Amendments by Occupational Wage Group by Year

Group	Median Weekly Earnings*	% Impact from Baseline					No. of Occupations
		2018	2021	2022	2030	2035	
1	$236 - $480	0.0002%	0.0104%	0.0033%	-0.0032%	-0.0032%	19
2	$481 - $619	0.0003%	0.0152%	0.0046%	-0.0051%	-0.0049%	19
3	$620 - $767	0.0009%	0.0453%	0.0173%	-0.0065%	-0.0054%	19
4	$768 - $980	0.0003%	0.0119%	0.0045%	-0.0040%	-0.0040%	19
5	$990 - $1738	0.0004%	0.0193%	0.0069%	-0.0049%	-0.0047%	19

*Source: Employment and Earnings. Bureau of Labor Statistics. (See http://www.bls.gov/emp/ep_chart_001.htm.)



According to the 2014 California State Board of Equalization, total gasoline sales in California were 14.57 billion gallons, of which the region's share is estimated to be 46 percent. The annual compliance cost of refineries due the proposed amendments, if fully passed on to gasoline consumers, would result in a gasoline price increase of up to 0.8 cents per gallon in the four-county area.[23] Gasoline produced by refineries within SCAQMD is also consumed in a larger region including other parts of California and areas in neighboring states (e.g. Nevada and Arizona), therefore, the actual added cost is expected to be lower than the stated amount. It should be noted that due to possible outside competition in the gasoline market, refineries may not be able to pass on the full cost of the proposed amendments to consumers. However, it should be noted that due to clean air regulations, the gasoline blends sold in this region are different from those permitted in other parts of the country. Therefore, any outside competition, if any, is expected to be very limited.

8.1.4 Rule Adoption Relative to the Cost Effectiveness Schedule

On October 14, 1994, the Governing Board adopted a resolution that requires staff to address whether rules being proposed for adoption are considered in the order of cost- effectiveness. The 2012 AQMP ranked, in the order of cost-effectiveness, all of the control measures for which costs were quantified. It is generally recommended that the most cost- effective actions be taken first.

The proposed amended rules implement control measure CMB-01 (Additional Reductions for

[23] The rate of 46 percent was applied to the state's total of 14.57 billion gallons sold to get the Basin's share of 6,702 million gallons sold. Dividing the average annual cost of the proposed amendments ($52 million) by 6,702 million gallons will result in $0.008 or (0.8 cents/gallon) increase in gasoline price.

NOx RECLAIM) in the 2012 AQMP. The cost effectiveness of this measure (Phase II) was estimated to be $16,000 per ton of NOx reduced. This measure was ranked 8th among all the SCAQMD control measures for stationary sources in terms of cost-effectiveness in the 2012 AQMP.

8.1.5 Incremental Cost Effectiveness

The annualized BARCT costs for the Proposed Rule Amendments and Alternative 3—Industry Proposal—are shown in Table 21 below. Alternative 3 will result in 5.23 less emissions reductions than the Proposed Rule Amendments (8.77 tpd vs. 14 tpd). The incremental cost of achieving the additional 5.23 tpd is taken as the difference in cost between the Proposal and Alternative 3, which is calculated by converting annualized BARCT costs into PWV 2014 dollars. The incremental cost-effectiveness for achieving the additional 5.23 tpd of NOx reductions is therefore $17,000/ton.

8.2 Impact of CEQA Alternatives

Five alternatives to the proposed amendments were developed for the CEQA analysis associated with this proposal. This section provides an assessment of the possible different socioeconomic impacts resulting from these alternatives. Table 19 below summarizes the proposed shave for each affected source category. Alternative 1 (Across the Board), Alternative 2 (Most Stringent), Alternative 3 (Industry Approach), Alternative 4 (No Project), and Alternative 5 (Weighted by BARCT Reduction Contribution for all Facilities and Investors). The primary components of the proposed alternatives that have been modified are the source categories that may be affected, and the manner in which compliance with the proposed NOx BARCT emission limits would be achieved. After further analysis, staff determined Alternatives 3 and 4 do not comply with state law.

Table 20: Proposed Amendments and CEQA Alternatives

	Proposed Amendments	Major Refineries/ Investors	Non-Major Faciliti	Electricity generating Facilities	Remaining Facilities
Staff Proposal	**Shave Applied to Facilities and Investors Holding the Top 90% of RTCs (Weighted by BARCT Reduction Contribution)** *56 total facilities, plus investors*	**66%** ***(9 Facilities)***	**49%** ***(26 Facilities)***	**49%** ***(21 Facilities)***	**0%** ***(219 Facilities)***
CEQA Alternatives					
CEQA Alternative #1	**Across the Board** *Affects all facilities and investors*	**53%**	**53%**	**53%**	**53%**

CEQA Alternative #2	**Most Stringent Approach** *Across the Board without 10% Compliance Margin*	**60%**	**60%**	**60%**	**60%**
CEQA Alternative #3	**Industry Approach** *Across the Board: Difference between previous BARCT and new BARCT*	**33%**	**33%**	**33%**	**33%**
CEQA Alternative #4	**No Project**	**0%**	**0%**	**0%**	**0%**
CEQA Alternative #5	**Weighted by BARCT Reduction Contribution** *Affects all facilities and investors*	**66%**	**36%**	**36%**	**36%**

To analyze the worst case scenarios, the CEQA analysis assumes that all other components of the project alternatives are identical to the components of the proposed project (i.e., the same control equipment); therefore, the corresponding impacts would also occur under all the alternatives except the 'no project' alternative. However, for the purpose of conducting socioeconomic analyses and comparing costs and job impacts under different CEQA alternatives, staff assumed that a different set of source categories would be affected under each CEQA alternative.

The analysis conducted in the ensuing subsection focuses on the 9 refineries and 11 non- refinery facilities with identified 2015 BARCT.

8.2.1 Alternative 1 – Across the Board Shave of NOx RTCs

Alternative 1 consists of an across-the-board NOx RTC shave of 14 tpd that would affect all NOx RECLAIM facilities and investors. Although the total amount of the shave is identical to the proposed project, the NOx RTC holdings would be shaved by 53 percent overall.

For the purpose of the socioeconomic analysis of the CEQA alternatives, staff assumed fewer control equipment to be installed by refineries since less reduction (53 percent vs. 66 percent) is required. To meet the proposed 53 percent shave, refinery sector needs to only reduce 4.76 out of 6.00 tpd required under the proposed project. To meet the 4.76 tpd reductions and based on the cost-effectiveness schedule, only control costs for the refinery FCCUs, gas turbines, and coke calciners are considered for the cost estimates.

On the other hand, the remaining 11 non-major facilities would need to reduce more of their current holdings relative to the proposed project (53 percent vs. 49 percent, or 3.12 vs. 2.77 tpd). Since these facilities will have their holdings reduced by 53 percent rather than the 49 percent in the proposed project, these facilities are assumed to need to purchase RTCs to meet the difference. While these facilities may purchase some RTCs, this would not be an additional cost of the

program since the sellers would be paid for these RTCs. For the purpose of worst-case analysis, staff assumed these facilities will purchase 0.35 (3.12 tpd - 2.77 tpd = 0.35 tpd) tpd of RTCs at a price of $22,499 per ton (i.e. the Proposed Amended Rule 2002 trigger), irrespective of the projected demand and supply of NOx RTC and how the market would behave under this alternative shave.

8.2.2 Alternative 2—Most Stringent Shave of NOx RTCs

Alternative 2 consists of the most stringent approach by applying an across-the-board NOx RTC shave of 15.87 tpd. Alternative 2 would affect all RECLAIM facilities and investors, but without including the 10 percent compliance margin or the BARCT adjustment for refinery equipment. Under Alternative 2, the NOx RTC holdings would be shaved by 60 percent overall. Under Alternative 2, the total shave of 15.87 tpd is greater than the 14 tpd shave that is contemplated by the proposed project. In addition, the distribution of the shave under Alternative 2 would reduce the NOx RTC holdings differently than the proposed amendments: 60 percent reduction would be applied to all 275 NOx RECLAIM facilities and investors.

For the purpose of the socioeconomic analysis of the CEQA alternatives, staff assumed less control equipment to be installed by refineries since less reduction (60 percent vs. 66 percent) is required. To meet the proposed 60 percent shave, the refinery sector needs to only reduce 5.34 tons out of 6.00 tons required under the proposed project. To meet the 5.34 tons reductions and based on the cost-effectiveness schedule, only control costs for the refinery FCCUs, gas turbines, coke calciners, and boilers/heaters are considered for the cost estimates.

On the other hand, the remaining 11 non-major facilities need to reduce more relative to the proposed project (60 percent vs. 49 percent or 3.39 vs. 2.77 tpd). Since these facilities will have their holdings reduced by 60 percent rather than the 49 percent in the proposed project, these facilities are assumed to need to purchase RTCs to meet the difference. For the purpose of the worst-case analysis, staff assumed these facilities to purchase 0.62 tpd of RTCs at a price of $22,499 per ton, irrespective of the projected demand and supply of NOx RTCs and how the market would behave under this alternative shave.

8.2.3 Alternative 3 – Industry Approach

Alternative 3, an approach that has been proposed by industry representatives does not comply with state law because it does not meet the definition of BARCT as the maximum degree of reductions achievable, taking into account economic and other impacts (HS&C 40406). This proposal consists of an across the board NOx RTC shave of 8.77 tpd that would affect all RECLAIM facilities and investors. The total amount of shave would be lower than the 14 tpd shave that is contemplated by the proposed project. Under Alternative 3, the NOx RTCs held by all RECLAIM facilities and investors would be shaved by 33 percent. Since there are unused RTCs in the system, it is very likely that facilities would first give up most of their unused credits and install additional controls as needed to reach the total 8.77 tons. However, the analysis assumes that facilities would install controls to reach the required 33 percent reduction to provide a conservative estimate of costs.

For the purpose of the socioeconomic analysis of the CEQA alternatives, staff assumed less control equipment to be installed by refineries since less reduction (33 percent vs. 66 percent) is required. To meet the proposed 33 percent shave the refinery sector needs to only reduce 2.97 tons out of 6.00 tons required under the proposed project. To meet the 2.97 tons reductions and based on the cost-effectiveness schedule, only control costs for the refinery gas turbines are included for the cost estimates.

As in the refinery sector, the remaining 11 non-major facilities would have fewer holding reductions relative to the proposed project (36 percent vs. 47 percent or 1.94 vs. 2.77 tons/day). To meet the 1.94 tons reductions and based on the cost-effectiveness schedule, only control costs for the sodium silicate furnace, ICE engines, container glass furnace, and metal heat furnaces are considered for the cost estimates.

8.2.4 Alternative 4—No Project

Alternative 4 is the "No Project" approach such that no NOx RTC reductions would be applied to any RECLAIM facility or investor. CEQA requires the specific alternative of No Project to be evaluated even though it also does not comply with state law for the same reason as Alternative 3. A No Project Alternative consists of what would occur if the proposed amendments were not approved. The net effect of not amending Regulation XX to reduce the available RTCs on the market would be a continuation of the 2005 amendments to the NOx RECLAIM program

Under Alternative 4, existing Regulation XX would remain as currently written. Additional NOx reductions are not anticipated because the current level of NOx allocations is projected to exceed NOx emissions. Consequently, no additional cost is expected from Alternative 4 and no other socioeconomic impacts are foreseen.

8.2.5 Alternative 5—Weighted by BARCT Reduction Contribution

Alternative 5 consists of an across the board NOx RTC reduction of 14 tpd that would affect all NOx RECLAIM facilities and investors. Although the total amount of shave is identical to the proposed project, the NOx RTC reductions under this alternative would be weighted by the BARCT reduction contribution for major refineries and all other facilities, with investors grouped with the major refineries. As such, NOx RTC holdings for major refineries and investors would be shaved by 66 percent and the NOx RTC holdings for non-major refineries and all other facilities would be shaved by 36 percent.

For the purpose of the socioeconomic analysis of the CEQA alternatives, staff assumed the same control equipment to be installed by refineries as the proposed project since the same reduction (66 percent) is required. To meet the proposed 36 percent shave, the remaining 11 non-major facilities need to reduce less relative to the proposed project (36 percent vs. 47 percent or 2.12 vs. 2.77 tpd). Based on the cost-effectiveness schedule, only control costs for the sodium silicate furnace, ICE engines, container glass furnace, and gas turbines are considered for the cost estimates.

Table 21 presents a comparison of the alternatives in terms of annual average cost and jobs

forgone. This table assumes that, under Alternatives 1 and 2, facilities would buy unused RTCs at a greater rate than in the proposed project in lieu of installing more expensive controls. Therefore, costs are lower but actual emission reductions are also lower than from the proposed project.

Table 21: Average Annual Costs and Job Impacts by CEQA Alternative For 9 Refineries and 11 Non-Major Facilities

CEQA Alternatives	BARCT Cost In $ Millions (annualized using a 4 percent discount rate)	Jobs	Amount of RTC Credits Removed from Market (Tons/day)
Proposed Amendments	$61.59	+23	14
Alternative 1	$45.83	-76	14
Alternative 2	$55.00	-83	15.87
Alternative 3	$9.40	-30	8.77
Alternative 4	$0	0	0
Alternative 5	$60.23	+34	14

The proposed project has the highest cost but the second to highest positive job impact, due to increased labor demand for the full, instead of partial, installation of BARCT equipment. Alternative 4 serves as a benchmark against which other alternatives were evaluated. Of the four remaining alternatives, Alternative 3, which does not comply with state law, has the lowest cost ($9.40 million) because it is expected to induce the least number of BARCT equipment to be installed; however, it would result in an average of about 30 jobs foregone annually. This alternative excludes controls on FCCU and SRU/TGUs, boilers/heaters, and coke calciner units at refineries and hence would avoid potential costs, but also the jobs that could be potentially created due to additional expenditure on these controls. In addition, this alternative would achieve fewer emission reductions from the 20 BARCT facilities.

Alternatives 1 and 2 would cost less than the proposed amendments, yet would experience much more negative job impacts (about 80 annual jobs forgone). This is due to less BARCT installation spending in the refinery sector relative to the 11 non-refinery facilities and would result into negative net job impacts.

9. MARKET ANALYSIS

In addition to the potential compliance cost of control equipment installation and operation for these 20 facilities, the proposed amendments may potentially result in new or additional compliance costs for some of the 36 facilities where no control equipment was identified for installation. New costs would be the result of some facilities finding that their emissions exceed their RTC holdings post-shave. These facilities with negative balances would become net buyers and face the costs of purchasing additional RTCs to remain compliant. Additional costs would be incurred by facilities that were net buyers before the shave and would see their holdings further

reduced under the proposed shave.

Along with the cost of additional credits that would need to be purchased, every unit of traded NOx RTCs could potentially become more expensive as a result of the proposed shave. In the short term, these net buyers are expected to purchase RTCs at a higher price, although RTC costs may go down in the long-term, if some (or all) of the 20 facilities with identified control equipment chose to install controls and offer surplus RTCs for sale. In addition to the potential compliance cost that would be incurred by the 36 shaved facilities with no identified control equipment, compliance costs could also be incurred by the net buyers who already exist within the remaining group of 219 facilities that are exempt from the RTC shave under the proposed rule. These facilities are expected to buy RTCs every year and would also face possibly higher RTC prices as the potential market supply decreases (at least in the short term). Under CEQA alternatives, these 219 facilities may incur even more costs from varying degrees of RTC shaves.

In order to estimate the magnitude of these market impacts, a price analysis has been conducted. To estimate the potential impact of price increases on the projected net buyers, a sensitivity analysis was conducted where prices grew from 100, 200, 300 percent, and up to $22,499/ton, which is just below the proposed amended price exceeding which the non- tradable/non-usable credits will be converted to tradable/usable NOx RTCs upon Governing Board concurrence. It should be noted that the compliance costs incurred by these projected net buyers would at the same time create monetary benefits to other RECLAIM facilities and/or investors who would be the sellers of these credits.

Finally, the monetary value of the shaved RTC holdings, which would be removed from the 56 facilities, has also been estimated. However, it should be noted that this estimated value is not considered a compliance cost as RTCs were originally allocated to RECLAIM facilities at zero cost and are not legally considered a facility's property. The results of this "value" analysis are set forth below on page 47.

9.1 Assumptions for Price Analysis

Two types of credits exist within the RECLAIM market: Discrete-year credits which are valid within the year of issuance and Infinite-Year Blocks (IYB) which are bundles that extend into perpetuity after the initial purchase year. Given that prices for discrete-year are the most reflective of actual market behavior, they form the basis of this analysis. Over the past 5 years, prices for discrete RTCs begin at about $3,000 to $4,000 per ton and eventually drop to around $1,000 per ton as the end of the year approaches. RTCs are much less expensive near the end of the year when the RTC expiration date approaches.

The base price of $3,779 per ton for discrete RTCs from January in compliance year 2015 was used for this analysis.[24] In order to capture a realistic range of increases up to the $22,500 per ton trigger, an increase of 100 percent, 200 percent, and 300 percent was applied to the base price of $3,779 per ton. These values were then aggregated into their yearly totals. Table 22 summarizes

[24] This price represents a 12-month rolling average which is calculated to smooth out short-term fluctuations and present long-term trends. For more information see: http://www.aqmd.gov/docs/default- source/reclaim/nox-rolling-average-reports/12-mo-rolling-avg-price-comp-yrs-2014-15-nox-rtcs---july- 2015.pdf?sfvrsn=6

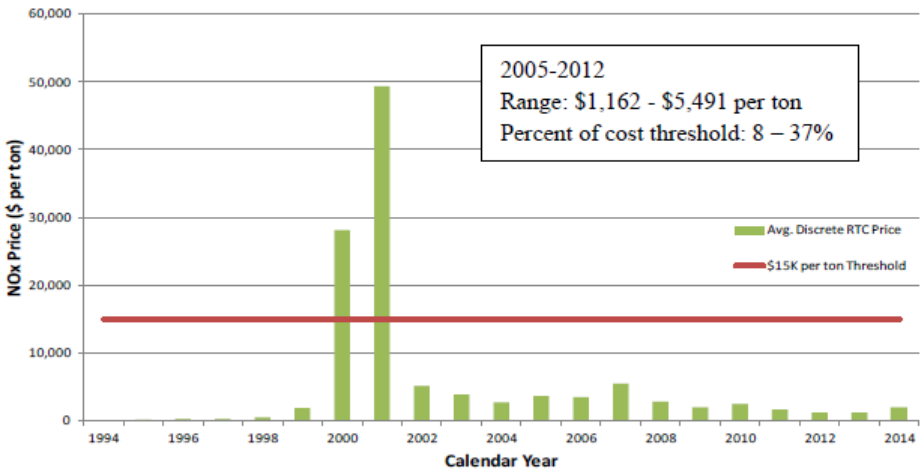
the results below.

Table 22: Estimates of RTC price increase

Type	Market price	100 percent Increase	200 percent Increase	300 percent Increase	Proposed Amended Rule 2002 Price Trigger
Discrete Ton	$3,779	$7,558	$11,337	$14,999	$22,499

These cost assumptions are conservative given historical trends in the marketplace. Since the adoption of Regulation XX, there have been a number of amendments to the RECLAIM rules, including BARCT reassessments for NOx in 2005. As a result of the January 2005 amendment, NOx RTCs were reduced by 7.7 tpd (accounting for approximately 22.5 percent of the total RTC holdings at that time) uniformly across the then 281 RECLAIM facilities. This reduction was implemented in phases: 4 tpd in 2007 and an additional 0.925 tpd in each of the following 4 years. Figure 3 shows discrete RTC prices for compliance years 1994 to 2013, reflecting the fact that the NOx reductions specified by the January 2005 amendment did not cause major RTC price spikes.

Figure 3: NOx Discrete Prices vs. Threshold

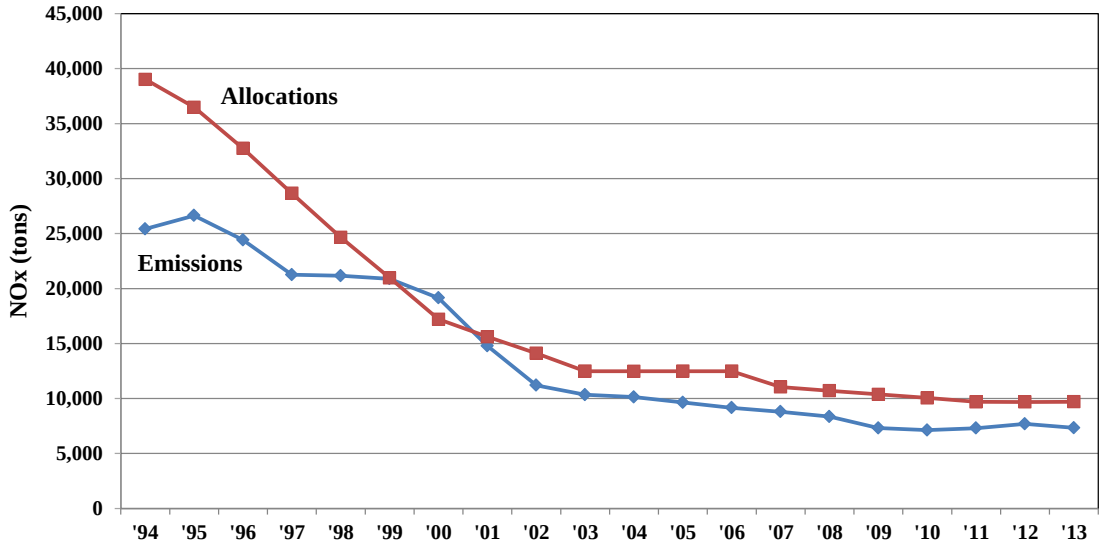


Additionally, since the RECLAIM program began in 1994, actual NOx emissions have consistently been well below total RTC holdings (except during California's energy crisis in 2001). Figure 4 shows how, despite past changes in the market's structure, there were sufficient amounts of NOx RTCs available to allow for expansion and modification by RECLAIM facilities. In drafting the proposed rule, staff added a 10 percent compliance margin to the projected 2023 emissions by RECLAIM facilities at the proposed 2015 BARCT levels and an additional 0.85 tpd to account for uncertainties in the BARCT analysis and base year activity level adjustments. Given this historical trend and staff's efforts to structure the rule effectively, the remaining NOx RTC holdings after the proposed shave is fully phased in are not expected to drop below actual total NOx emissions, even with less than the full implementation of control equipment. Large price spikes are not expected unless some

facilities hoard large quantities of RTCs, thus constricting the supply such that prices are not set competitively.

In order to identify the potential buyers of NOx RTCs in 2023 and subsequent years, staff assumed that the only change in RTC allocations would be the proposed shave. Regarding future emissions, staff started with the actual 2011 NOx emissions among existing emission sources, except electricity generating facilities for which their 2012 emissions were used as in the Revised Draft Staff Report. Sector-specific growth factors were then applied to project NOx emissions at each facility in 2023. By doing so, staff assumes in the analysis that emissions at each facility would grow at the same rate; however, it is possible that emissions would grow more at facilities with surplus NOx RTC holdings and less at facilities who already need to purchase NOx RTCs annually from the market. Therefore, the projected incremental compliance cost reported in this section can be considered as a conservative estimate. In the meantime, potential increases in compliance cost due to higher RTC prices was not explicitly considered for new and modified sources, nor for the required holdings beyond actual emissions for the electricity generating facilities. Staff did not explicitly consider increases due to higher RTC prices for facilities with new and modified sources, given that staff cannot predict the number of new and modified sources and the amount of RTCs needed for them. However, they are implicitly taken into account when growth factors were applied to project future growth by industry. These projected future emissions by industry-wide growth factors may be able to capture at least a portion of the incremental compliance costs potentially incurred by these facilities.

Figure 4: Audited Emissions and RTC Holdings

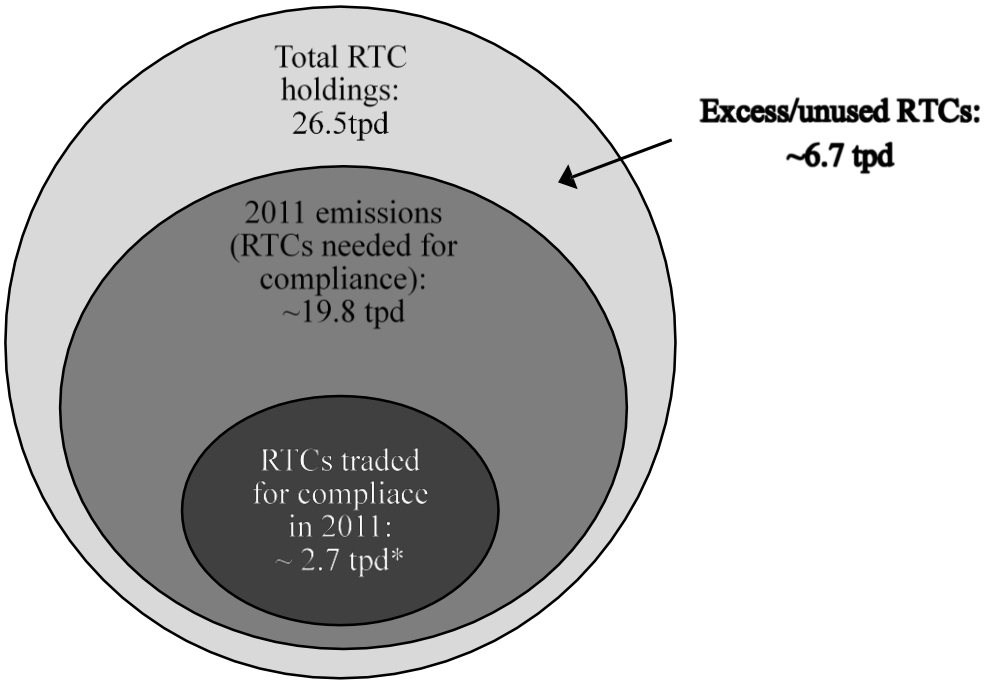


9.2 Understanding the Impact of the First 4 tpd Shave

Under the proposed rule amendments, 4 tpd of NOx RTCs would be removed from the NOx RECLAIM program in 2016, and this analysis assumed that no new BARCT control equipment would be installed in that year. Based on 2011 data, there existed a wide margin between the overall NOx RTC holdings and actual emissions. As illustrated in Figure 5, a total of about 6.7 tpd

were unused and considered as excess NOx RTC credits. Moreover, in 2011, only 2.7 tpd of NOx RTCs were traded in the market directly for the purpose of regulatory compliance, while 6.7 tpd of excess RTCs remained unused. Therefore, even with no assumed BARCT installation in 2016 (thus, no additional credits expected to be released into the market for trading), it would be unlikely that NOx RTC prices would skyrocket after the first 4 tpd of NOx RTCs are shaved. To be conservative, however, the following analysis will examine different price scenarios to evaluate the potential cost impact in the first year of the proposed shave.

Figure 5: Distribution of RTCs in NOx RECLAIM Market, 2011



*RTCs traded for compliance was calculated for each NOx RECLAIM facility by: 1) subtracting 2011 RTC holdings from 2011 NOx emissions and 2) summing up the negative balance, which is equivalent to the amount of facility emissions that a facility did not have RTC holdings for. Among the approximately 2.7 tpd RTCs traded for compliance in 2011, close to 60 percent was purchased by the 9 refineries and 11 non-refinery facilities with identified control equipment.

9.3 Potential Compliance Cost for Net Buyers: 36 Affected Facilities

For the first shave of 4 tpd in 2016, up to 7 of the 36 shaved facilities (3 existing net buyers and 4 new net buyers) could have their emissions exceed their RTC holdings, based on 2013 emission data. These 7 facilities are expected to purchase up to 0.45 tpd of NOx RTCs annually from the market, up from 0.32 that are currently needed. If RTC price remains constant following the shave, the facilities would incur costs of about $0.18 million for the additional 0.13 tpd of NOx credits needed (0.45 tpd - 0.32 tpd = 0.13 tpd). If the price increases by 100 percent, 200 percent, 300 percent or up to $22,499/ton, then these facilities would incur a higher cost of $0.81 million/$1.43 million/$2.04 million/$3.27 million respectively, not only for the cost of additional RTCs needed due to the initial 4 tpd shave but also for the higher price of the 0.32 tpd already needed before the shave.[25]

As a result of the 14 tpd shave fully phased-in in 2022, up to 15 of the 36 facilities (6 existing net buyers plus 9 new net buyers) are expected to have their 2023 emissions exceed their projected RTC holdings, unless they make operational changes at their facility or purchase RTCs.[26] When CEQA alternatives are considered, the number of facilities that fall into this group of net buyers ranges from 6 to 17.

Under the proposed shave, these 15 facilities are expected to need to purchase up to 1.52 tpd of NOx RTCs annually from the market, up from 0.97 tpd that are currently needed. If RTC price remains constant following the shave, the facilities would incur costs of $0.76 million for the additional 0.55 tpd of NOx RTCs needed (1.52 tpd –0.97 tpd = 0.55 tpd). If the price increases by 100 percent, 200 percent, 300 percent and up to $22,499/ton trigger, then these facilities would incur a higher cost of $2.85/$4.94/$6.97/$11.13 million respectively, not only for the cost of additional RTCs needed due to the shave but also for the higher price of 0.97 tpd already needed before the shave. By comparison, these potential compliance costs could represent up to 16 percent of the overall annual compliance cost associated with control installation.[27] However, these costs are not additional to the overall cost of the proposed shave because increased costs to RTC buyers are canceled out by increased gains to RTC sellers.

Under the CEQA alternatives, these 36 facilities would be subject to different shaves and result in different projected amounts of RTCs that would needed to be purchased. Under the CEQA alternatives, the potential compliance costs for some of these 36 facilities would range between $0 and $14 million, depending on the price differential assumed. It is assumed these funds would remain in the local economy as they flow to other RECLAIM holders who are selling RTCs. Table 23 summarizes the potential compliance cost for the proposed rule amendment and the CEQA alternatives for this group of facilities under different price scenarios.

[25] The formula used for calculating this cost is: [pre-shave RTC purchase necessary for compliance*(post- shave RTC price – pre-shave RTC price) + (post-shave RTC purchase necessary for compliance - pre-shave RTC purchase necessary for compliance)*post-shave price]*365 days.

[26] 2023 emissions are calculated by applying a growth factor of 0.87 to the 21 electricity generating facilities' 2012 actual emissions and 1.10 growth factor to the remaining 16 facilities' 2011 actual emissions. See Revised Staff Report for emissions projections.

[27] To arrive at this percent increase, the total compliance cost of full BARCT installation was converted to 2015Q1 dollars using the Marshall & Swift Indices.

Table 23: Annual Price Increases for Net Buyers for 36 Facilities from 2023 onwards

36 Facilities	Number of Net Buyers	Amount of RTCs to be purchased (TPD)	Estimated Incremental Increases in Cost				
			Current Market Price (Thousands)	100 percent differential (Thousands)	200 percent differential (Thousands)	300 percent differential (Thousands)	$22,499 (Thousands)
Proposed Rule Amendments	15	1.52	$760	$2,850	$4,940	$6,970	$11,130
Alternative 1	17	1.63	$910	$3,160	$5,410	$7,580	$12,040
Alternative 2	17	1.82	$1170	$3,690	$6,200	$8,630	$13,620
Alternative 3	11	1.25	$380	$2,110	$3,830	$5,500	$8,920
Alternative 4	6	0.97	$0	$0	$0	$0	$0
Alternative 5	12	1.30	$460	$2,260	$4,060	$5,800	$9,370

9.4 Potential Compliance Cost for Net Buyers: 219 Facilities

Among the 219 facilities that would be exempt from the proposed shave, 102 facilities were estimated to have purchased NOx RTCs to remain in compliance according to the projected 2023 emissions and the projected RTC holdings in 2023. These 102 facilities represent 13 different industries with half belonging to the manufacturing sector (NAICS 31-33). In 2013, this group's NOx RTC holdings fell short of its actual NOx emissions by roughly 0.81 tpd, and this gap is expected to widen to 1.33 tpd in 2023 due to industry growth.[28] Therefore, some facilities have needed and will continue to need to purchase RTCs from the market to ensure they have sufficient RTCs to cover their emissions.

Under the proposed rule amendments, the 219 facilities would not be shaved. If the price of NOx RTCs remains unchanged from the current market price, no additional compliance cost would be incurred. If, however, the price increases by 100 percent, 200 percent, or 300 percent and up to $22,499/ton trigger, then these facilities would have to pay an additional $1.84/$3.67/$5.45/$9.6 million respectively in order to be compliant. By comparison, these potential compliance costs could represent up to 13 percent of the overall annual compliance cost associated with control installation.[29] However, these costs are not additional to the overall cost of the proposed shave because increased costs to RTC buyers are canceled out by increased gains to RTC sellers.

Under the CEQA alternatives, these 219 facilities would be subject to different shaves and the projected amount of RTCs needed to be purchased would increase as a result. The potential compliance cost under these alternatives would range between $0 and $17 million annually, depending on the price differential assumed. It is assumed these funds would remain in the local economy as they flow to other RECLAIM holders who are selling RTCs. Table 24 below summarizes the potential compliance cost for the proposed rule amendment and the CEQA alternatives for this group of facilities, under different price scenarios.

[28] 2023 emissions are calculated by applying a growth factor of 1.3 to each of the 210 facilities' 2011 actual emissions.
[29] See footnote 25.

Table 24: Annual Price Increases for Net Buyers in 219 Facilities Group from 2023 onwards

219 Facilities	Number of Net Buyers	Amount of RTCs to be purchased (TPD)	Estimated Incremental Increases in Cost				
			Current Market Price (Thousands)	100 percent differential (Thousands)	200 percent differential (Thousands)	300 percent differential (Thousands)	$22,499 (Thousands)
Proposed Rule Amendments	102	1.33	$0	$1,840	$3,670	$5,450	$9,100
Alternative 1	146	2.19	$1,190	$4,210	$7,240	$10,170	$16,170
Alternative 2	150	2.34	$1,390	$4,610	$7,830	$10,960	$17,350
Alternative 3	127	1.80	$650	$3,140	$5,620	$8,030	$12,960
Alternative 4	102	1.33	$0	$0	$0	$0	$0
Alternative 5	133	1.87	$740	$3,330	$5,910	$8,410	$13,530

9.5 REMI Job Impacts of RTC Purchases

Regarding the incremental compliance cost that could potentially be incurred by the NOx RECLAIM facilities that do not have cost-effective controls identified by the 2015 BARCT analysis, the associated job impacts in the regional economy have been estimated under various scenarios of discrete NOx RTC prices. In addition to the incremental costs incurred by RTC buying facilities, the transactions will at the same time create financial gains for the RTC sellers. In order to project future NOx RTC sales by industry, staff used the 2010-2014 NOx RTC transaction data to arrive at an average percent distribution of sales by industry.

If prices remain the same, little job impact is expected due to the proposed amendments. If the average annual discrete NOx RTC prices increase to $22,499/ton and none of the affected facilities pursue any other more cost-effective compliance options, then about 40 jobs on the net would be foregone annually between 2023 and 2035. However, this latter price scenario is unlikely to occur, particularly if the 9 refineries and 11 non-refinery facilities install identified cost-effective controls, which would then either decrease the market demand or increase the market supply of NOx RTCs by these facilities.

It should be noted that all CEQA alternatives except Alternative 4 (No Project) would result in a more negative job impact—up to about 60 jobs foregone on an average annual basis if the average annual discrete NOx RTC prices increase to $22,499/ton and none of the affected facilities pursue any other more cost-effective compliance options—than the proposed amendments. This is mainly because, unlike the proposed amendments, Alternatives 2, 3 and 5 would not exempt from the shave the 219 facilities that tend to be smaller and use more labor-intensive production technologies than, for example, those used by the refineries.

The table below illustrates the job impacts on all facilities needing to purchase additional RTCs.

Table 25: Average Annual Jobs Foregone as a Result of RTC Purchases

All Facilities	**Average Annual Job Impact (2023-2035)**				
	Current Market Price	**100 percent increase**	**200 percent increase**	**300 percent increase**	**$22,499**
Proposed Rule Amendments	+1	-6	-14	-21	-36
Alternative 1	-2	-13	-25	-36	-58
Alternative 2	-2	-13	-24	-35	-57
Alternative 3	-2	-13	-24	-35	-57
Alternative 4	0	0	0	0	0
Alternative 5	-2	-13	-24	-35	-57

9.6 Value of Shaved Excess RTCs

SCAQMD staff believes the proposed shave of 14 tpd is necessary in order to induce the 20 facilities with identified control equipment to upgrade their control equipment and achieve programmatic BARCT equivalency. This is especially likely given that about 60 percent of the 2.7 tpd of RTCs traded for compliance in Compliance Year 2011 were made by the 20 affected facilities.

Some stakeholders commented that the shave should be divided into 8.79 tpd[30] of a BARCT shave and 5.21 tpd of an excess RTC shave. Staff does not agree with this division because 14 tpd of NOx RTC shave is necessary to induce a BARCT-equivalent level of *actual* NOx emission reductions. Moreover, at the outset of RECLAIM, RTCs were allocated to RECLAIM facilities free of charge, yet they now have value to the facilities as a commodity that can be bought and sold. While RTCs have value, they are not a property right. The proposed amendments to RECLAIM will reduce the number of RTCs. Since there was no cost associated with allocated RTCs for a facility, there should be no financial loss to the RECLAIM universe as the SCAQMD retires them. Staff's analysis of the RECLAIM data revealed that only 3.33 tpd out of the proposed 14 tpd shave would affect additional acquisitions of NOx RTCs that were used to expand a facility's NOx RTC holdings beyond the original free-of-charge allocations. These 3.33 tpd of NOx RTCs are spread across 24 RECLAIM facilities, and more than three quarters of these shaved credits would be concentrated in the refinery sector. If a value is estimated for the 3.33 tpd of shaved credits, it is $4.6 million annually, applying the base price of $3,779 per ton.

However, the choice between additional RTC purchase and emission control installation is solely a business decision to comply with RECLAIM requirements, and the decision to purchase RTCs in lieu of installing emission controls is most likely made to minimize overall compliance cost. Therefore, it is expected to generate an expected stream of cost-savings afforded only by the RECLAIM program and not available under command-and-control. Therefore, any RTC investment loss should not be considered as a compliance cost to be compared to the compliance cost under command-and-control regulations (Section 11 includes further explanations on this topic). Moreover, this loss may be offset by any potential increase in RTC price due to a decreased RTC supply, which would subsequently raise the market value of a facility's remaining RTC holdings. Finally, any loss of "value" of shaved RTCs cannot be compared to command and control, because in that case, there are no RTCs and thus no similar "value" was ever created.

10. NEW REVISIONS TO THE PROPOSED RULE AMENDMENTS

The Revised Draft Socioeconomic Report (released on October 6, 2015) was based on the version of the rules presented at the July 22, 2015 Public Workshop. Since then, there have been revisions made to the Proposed Rule Amendments. The revisions that were already incorporated in the Revised Draft Staff Report (released on October 6, 2015) have been reflected in the analysis presented in the previous sections. The potential socioeconomic impacts of the newer revisions are discussed below.

[30] As of the Revised Draft Staff Report released on November 5th, this number is now 8.77.

10.1 Option to Exit for Electricity Generating Facilities

Under the Proposed Amendments to Rule 2001, an electricity generating facility (EGF)—excluding cogeneration plants—would be allowed to exit the RECLAIM program, provided that at least 99 percent of the facility's NOx emissions for the most recent three full compliance years are from equipment that meets current BACT or BARCT for NOx. If an EGF decides to opt out from RECLAIM, it would need to surrender a pre-defined amount of NOx RTCs to be retired from the NOx RTC market. For existing EGF RECLAIM facilities as defined by the rule, the amount to be surrendered would be equivalent to the amount of NOx RTC holdings as of September 22, 2015, as adjusted by the proposed shaves; for other EGFs, the amount would be equivalent to the quantity required to be held by the facility pursuant to Rule 2005 – New Source Review.

Since the ability to exit RECLAIM is an option, it will be a business decision made by an EGF to exit RECLAIM, and therefore, it can be reasonably assumed that the business decision to exit the program would generate potential cost-savings for the facility; therefore, such a facility is not expected to experience any adverse economic impact due to this proposed rule amendment. However, due to the proposed provisions that a pre-defined amount of NOx RTCs shall be surrendered and retired from the market, this proposed rule amendment could potentially reduce the market supply of NOx RTCs. It should be noted that, while the 21 EGFs together hold more than 20 percent of the current NOx RTCs (or 5.63 tpd as of September 22, 2015), only a very small percentage of these holdings are sold on the NOx RECLAIM market, either as IYB or Discrete NOx RTCs.

To assess the potential impact on both the IYB and Discrete NOx RTC market, staff analyzed the NOx RTC transactions occurring during the period from 2010-2014. To begin, staff eliminated any transaction that did not have a positive market value (which could be due to a business's internal transfers or equal-value swap trades), and therefore might not have reflected real market supply and demand. Infinite-Year-Block (IYB) NOx RTCs sold by any operating EGFs over the five-year period represented less than 0.00001 percent of total IYB NOx RTCs traded in this market. As a result, little impact from EGF opt-out is expected for the IYB market.

Less than half of the EGFs have consistently sold RTCs in the discrete credit market over the past five years. As shown in the table below, during 2010-2014, these EGFs sold an annual average of nearly 1.4 tpd of NOx RTCs to help satisfy the market demand for discrete year NOx RTCs. Many of these facilities would be subject to a 49% shave under the proposed rule amendments and will no longer have that much surplus NOx RTCs for sale on the market. Therefore, in the worst-case scenario if all EGFs decide to exit RECLAIM, the post-shave market supply of NOx RTCs would be decreased by 0.216 tpd, once they have all opted out.[31] The decrease per se may exert an upward pressure on the discrete NOx RTC prices. (The estimated incremental compliance cost associated with market price increases of discrete NOx RTCs can be found in Section 9.) It is also possible that these EGFs choose to opt out during the 2016-2022 period, thus removing more NOx RTCs from the market than would occur after full shave implementation in 2022. Note that EGFs opting-out may also decrease demand for RTCs. Nonetheless, if that happens and credit prices increase

[31] The total projected surplus NOx RTCs for all operating EGFs in 2023 are estimated to be up to 1.5 tpd. However, staff does not expect this full amount of surplus credits would be offered for sale in the NOx RTC market, as a large share of these credits are held by EGFs that typically do not sell their surplus NOx RTCs.

to the level as specified by the Rule 2002 price trigger, the non-tradable/non-usable credits would then be converted to tradable/usable credits, which would be sufficient to temporarily offset the decrease in NOx RTC supply due to any EGF opt-out. (As shown above, the decrease resulting from EGFs opting out is expected to be less than 1.4 tpd while the amount of potential credit conversion would be at least 2 tpd.)

Table 26: Potential Decrease in the Market Supply of Discrete NOx RTCs due to EGF Opt-Out

Electricity Generating Facility Selling NOx RTCs during 2010-2014 (excl. Cogeneration)	Average Annual NOx RTC Sale (tpd)	Proposed Total Shave (tpd)	Estimated Post-Shave Market Supply (tpd) = Min (0, Average Annual NOx RTC Sale - Proposed Total Shave)
A	0.353	0.363	0.000
B	0.347	0.176	0.171
C	0.264	0.330	0.000
D	0.219	0.196	0.023
E	0.087	0.160	0.000
F	0.049	0.077	0.000
G	0.044	0.120	0.000
H	0.017	0	0.017
I	0.006	0	0.006
Total	**1.385**		**0.216**

In a letter dated November 17, 2015, WSPA stated that the Socioeconomic Assessment "does not consider whether such a supply constriction [from EGF opt-out] might actually impair regional economic activity due to a lack of available RTCs. Rather, it assumes that RTC supply will be available at some (presumably higher) cost without providing any evidence to support that assumption." In another letter dated November 17, 2015, Southern California Air Quality Alliance on behalf of the NOx RECLAIM Industry Coalition stated that the Socioeconomic Assessment did not consider the effect of EGF opt-out on the IYB market. Staff believes that these comments are a result of misunderstandings. The analysis presented in the paragraphs above, which is a refinement of the analysis conducted in the Draft Final Socioeconomic Report, clearly represents staff's assessment of the effects of EGF opt-out on the discrete year and IYB NOx RTC market.

The WSPA comment letter dated November 17, 2015 incorrectly claimed that the Socioeconomic Report released on November 4, 2015 acknowledged that "EGFs have been significant sellers of surplus RTCs in the discrete credit market over the past five years to meet market demand; […]." While the 21 EGFs together hold more than 20 percent of the current NOx RTCs (or 5.63 tpd as of September 22, 2015), they rarely offered any IYB RTCs for sale, and are not expected to do so in the future given their NSR holding requirements and/or grid stability considerations. Less than half of the EGFs were regular net sellers of discrete NOx RTCs over the past five years, and they supplied an annual average of 1.4 tpd in total, which is about only 5 percent of the current total NOx RTC holdings. In the post-shave market (i.e., 2023 and beyond.), the estimated 0.216 tpd of remaining market supply among these facilities would account for less than 2 percent of total post-shave market holdings.

10.2 NOx RTC Price Triggers

Under the Proposed Amendments to Rule 2002, the price threshold beyond which the non-tradable/non-usable NOx RTCs would be converted to tradable/usable NOx RTCs is raised to $22,500 from $15,000, on the basis of 12-month rolling average of discrete NOx RTC prices. In order to further ensure price stability during the proposed phased-in period of 2016-2022, an additional stabilization mechanism would be put in place, which constitutes an additional price trigger of $35,000, on the basis of 3-month rolling average of discrete NOx RTC prices. This additional price trigger would assist with shortening the duration of any potential price spikes and containing the magnitude of any potential adverse economic impact on NOx RTC buyers. The estimated incremental compliance cost associated with market price increases of discrete NOx RTCs can be found in Section 9, which contains the price scenario where buyers would need to pay $22,500 per discrete ton of NOx RTC to reconcile their annual NOx emissions.

Proposed Amended Rule 2002 also contains another price trigger—$200,000 per ton (Infinite Year Block) based on the 12-month rolling average—below which the Executive Officer will report the determination to the Governing Board. As the determination is yet to be made and the provision would not be effective until 2019, it is speculative to assess any potentially resultant socioeconomic impact. Moreover, following the 2005 NOx RECLAIM amendments, none of the 51 SCRs identified in the BARCT analysis for refineries have been installed because of RECLAIM, not even in 2008 when the average IYB prices went above $200,000 (in 2008 dollars) per ton of NOx. This suggests that NOx RTC prices could have been historically too low to induce cost-effective control installation, and the 200,000 price trigger floor is conservative.

10.3 Facility Shutdowns

Since the adoption of RECLAIM, facilities which planned to shut down were not restricted from selling off their RTCs prior to facility closures. RTCs resulting from shutdowns are not subject to the best available control technology (BACT) discount that is applicable to non-RECLAIM sources.

As a consequence, staff estimated that a significant portion of the unused RTCs can be traced to the sale of pre-closure RTCs. As shown in Table 2 of this report, facility shutdowns amounted to 2.62 tpd of actual NOx emission reductions between 2006 and 2012, which was just less than two thirds of the 4 tpd actual total reductions over the same period. However, NOx RTCs that were previously held by these shutdown facilities were never removed from the market, thus exerting a downward pressure on the RTC market prices. This, in turn, has dis-incentivized the remaining NOx RECLAIM facilities from installing cost-effective control equipment or making other changes at their facilities.

Under the Proposed Amended Rule 2002, any major NOx-emitting facility (i.e., those listed in Table 7 or 8) permanently shutting down some or all equipment with emissions greater than or equal to 25 percent of the facility emissions for any quarter within the previous 2 compliance years would need to surrender NOx RTCs to be retired from the market. The amount of NOx RTCs to be surrendered would be determined by the maximum quarterly ratio of the average NOx emissions emanating from the shutdown equipment over facility-wide NOx emissions, multiplied

by the facility's NOx RTC allocations.

In the Southern California Air Quality Alliance comment letter dated November 17, 2015, it was stated that an analysis should have been conducted to assess the impact of removing RTCs from the market relating to shutdowns. Also in the WSPA comment letter dated November 17, 2015, it was stated that there was no technical analysis in the Draft Final Socioeconomic Report in this topic. Since staff cannot predict which facilities may choose to shut down some or all of their permitted equipment, it would be speculative to predict the magnitude of any impact on the NOx RTC market resulting from future shutdowns. The shut-down provision would not allow large influxes of credits into the RECLAIM market because of shutdowns. However, as discussed previously, staff acknowledges that the provision of surrendering and retiring NOx RTCs from the market could potentially affect the credit market and prices. The magnitude of the potential impact would depend heavily on the usual market behavior of each facility before it decides to shut down. On the one hand, for facilities that regularly sell their surplus NOx RTCs, the provision would exert an upward pressure on NOx RTC prices. On the other hand, if the shutdown facility is a regular buyer on the NOx RTC market or does not participate in the market at all, the retirement of their NOx RTCs would have little, if any, impact on the RTC market supply. In any event, District analyses show that the unrestrained flow of RTCs from shut downs have resulted in an oversupply of RTCs so that BARCT equivalent controls are avoided.

11. COSTS OF COMMAND AND CONTROL (CAC) COMPARED TO RECLAIM

RECLAIM allows facilities to use the least costly option to remain in compliance. Unlike the command-and-control regulations where every source has to be controlled to the same emission standard, RECLAIM facilities can pursue operational changes or purchase RTCs from investors and other facilities with surplus credits in lieu of upgrading existing control equipment or installing new control equipment. This flexibility notwithstanding, RECLAIM ultimately must achieve emissions reductions equivalent to or greater than what would have been achieved under command-and-control regulations. A BARCT assessment is required by H&SC §40440 and BARCT requires actual emission reductions. Based on staff analysis, a reduction of 14 tpd of NOx RTCs is needed to induce actual emission reductions equivalent to BARCT. The 2015 BARCT analysis demonstrated that there would be an actual NOx emission reduction of 8.77 tpd from the 2011-2012 activity levels at 2015 BARCT compared to the same activity levels at 2005 BARCT. This represents 8.77 tpd reductions in actual emissions. If the overall NOx RTC holdings had closely matched the total amount of actual NOx emissions from the NOx universe, the removal of 8.77 tpd of NOx RTCs would likely induce an equivalent amount of actual NOx emission reductions. However, over the past five years, actual NOx emissions from RECLAIM facilities fell below the overall NOx RTC holdings by 21-30%, resulting in approximately 5.45-8.41 tpd of unused NOx RTCs (unused for compliance purposes). Therefore, the removal of 8.77 tpd of NOx RTCs would first eliminate some, if not all, of these excess NOx RTCs from the market and only thereafter result in actual emissions reductions. As a result, total emission reductions would be less than the BARCT-equivalent level of actual NOx emission reductions.

The problem of excess unused RTCs is illustrated by the fact that the 2005 NOx shave did not achieve 2005 BARCT levels for the RECLAIM universe. The 7.7 tpd of NOx shave adopted in

the 2005 RECLAIM amendments was phased in over the period of 2007-2011; however, only about 4 tpd of actual NOx emission reductions occurred between 2006 (the year before the 2005 shave began) and 2012 (the year after the 2005 shave was fully phased in).[32] Almost two-thirds of the actual emission reductions resulted from facility shutdowns, not installation of controls or other changes at RECLAIM facilities. Therefore, as long as there are persistently unused RTCs available in the market, the RTC shave would need to be larger than the tons of emission reductions calculated for the BARCT analysis to induce an equivalent level of actual emission reductions.

The proposed phased-in shave of 14 tpd is anticipated to be able to induce sufficient emission reductions by 2023 so that the expected total NOx emissions from the RECLAIM universe in 2023 would be consistent with the projected NOx emissions in 2023 at the 2015 BARCT levels. (Please see the Staff Report for the shave methodology.)

As discussed in the Revised Draft Staff Report, staff has identified and demonstrated that technologically feasible and cost-effective control equipment are commercially available if any of the 20 facilities with identified BARCT chooses to install controls in response to the proposed shave from the NOx RECLAIM universe. The total cost of full BARCT installation was estimated to be between $728 million and $1.1 billion (present worth value in 2014 dollars). However, a RECLAIM facility is expected to retrofit an emission source only when it meets both of the following conditions: first, it does not hold sufficient RTCs to offset facility-wide emissions at the end of the compliance period; second, the cost of control installation per ton of emission reduction is lower than the expected average RTC price over the life of the control equipment.

Even if a facility finds it more cost-effective to install pollution control equipment, it still would not incur the full cost of control installation if control installation results in surplus RTCs that the facility eventually sells to offset the control installation cost. In comparison, command-and-control regulations would require, under all circumstances, that this same facility install the control equipment and incur the full cost of control installation. As a result, total costs to install controls under RECLAIM will always be equal to or less than under command and control. Under command and control, each facility must install the required controls, whereas under RECLAIM, the highest cost option is where each facility installs BARCT controls, because the total actual costs may be lower if a facility identifies any other more cost-effective alternative to remain in compliance. Looking at the RECLAIM program as a whole, the major source of cost-savings potential is precisely the differential in each facility's ability to cost effectively reduce emissions at different points in time. This cost-savings has been studied and quantified in economic research of cap- and-trade market mechanism since the 1970s, and the range of cost-savings was estimated to be between 15% and 90 % of command-and-control costs (Chan et al. 2012).

H&SC §39616 (c) specifies that: "In adopting rules and regulations to implement a market- based

[32] Some of the 4 tpd of actual reductions came from operational changes at refineries, which chose to run gas turbines instead of higher-emitting at various points in time. However, just less than two-thirds of the 4 tpd actual reductions were due to facility shut-downs and not measures taken to reduce actual emissions by facilities in the program. In 2005, the installation of 51 SCR units at refineries. However, not one has been installed due to the RECLAIM program. (Four SCR units were installed only due to orders for abatement.) While that choice did not violate RECLAIM, it resulted in facilities not achieving the level of emissions they would have achieved had they applied BARCT. As a result, there is a need to ensure that the currently proposed shave is sufficient to induce emissions reductions equivalent to 2015 BARCT levels, accounting for growth to 2023.

incentive program, a district board shall, at the time that the rules and regulations are adopted, make express findings." One of those findings pursuant to H&SC §39616 (c)(1) is that emission reduction benefits and the costs of the program shall be compared with those of "current command and control regulations and future air quality measures that would otherwise have been adopted as part of the district's plan for attainment." H&SC §39616 (c) does not refer to "amendments," and therefore, it does not apply to the proposed rule amendments *per se*. Nevertheless, assuming that the finding needed to continue to be made upon amendment of the rules, it makes sense to make that finding with respect to the entirety of the RECLAIM program since its adoption, because the statute repeatedly refers to "the program" in specifying findings that need to be made. Thus, the structure of H&SC §39616 is directed to the program as a whole, which includes the entirety of the program since its adoption. With the exception of the 2000-2001 period when the California energy crisis took place, the historical discrete NOx RTC prices ($5,500 or lower per ton) have consistently been at the lower end of or below the cost- effectiveness range of pollution controls. As a result, many RECLAIM facilities have accrued substantial cost-savings over the years by being able to delay or forego the installation of pollution control equipment that would have been required at different points in time by command-and-control regulations. And even if the H&SC §39616 (c)(1) finding needs to be made for this proposed shave alone, the proposed shave is expected to only reduce the future stream of this cost-savings. Even so, a reduced cost-savings is still a cost- savings compared to command-and-control regulations. Thus, this amendment will clearly not cost more than the projected cost of command and control.

For example, following the 2005 NOx RECLAIM amendments, not one of the 51 SCRs identified in the BARCT analysis for refineries have been installed because of RECLAIM, and 4 SCRs were installed only due to orders for abatement. As a result, refineries have saved approximately $205 million since 2007 by delaying installation of 47 SCRs.[33] The cost-savings would continue to accumulate as long as refineries are able to further delay the installation of SCRs and still remain in compliance under RECLAIM. This continuous stream of cost-saving would only be reduced or even ceased if the currently proposed shave could eventually induce at least some of the 47 SCRs to be installed.

Staff acknowledges that, for a portion of the smaller emitters that have no cost-effective controls identified so far, they may have been affected by past RTC price spikes and could potentially be impacted by future price fluctuations, either due to their RTC holdings or their limited financial capacity to hedge against price volatilities. However, their potential losses would be at the same time economic gains for the RTC sellers; therefore, the resulting net cost, if any, is expected to be zero or negligible to the entire RECLAIM program, particularly compared with the program's cost savings. While individual facilities may experience different costs and savings, H&SC §39616 applies to the RECLAIM universe as a whole.

[33] The total capital and installation cost for 47 SCRs was estimated to be $460 million in 2005 dollars in the 2005 amendments to the RECLAIM program (not counting the operating and maintenance costs). If the facilities invested this money at a 5 percent nominal rate of return over the 8 years, they would have saved a total of $220 million (i.e., $460 million*(1.05)^8 - $460 million, in 2015 dollars), by the end of 2015. Meanwhile, the affected facilities purchased 1.7 tpd of RTCs in lieu of installing 47 SCRs. The cost of purchasing these RTCs over the past 8 years is estimated to be about $15 million (i.e., 1.7 tpd * 365 days *
$3,000 per discrete ton of RTCs * 8 years). The total net cumulative benefits of the program for refineries only would have been about $205 million. (Based on further analysis using internal RECLAIM compliance data, the total cost of RTC purchases by refineries from 2005-2013 was estimated to be between $16 and $18 million.)

In the 2005 RECLAIM amendments, some stakeholders commented that the shaved RTCs would result in real, significant financial cost to companies and should be recognized as a cost. However, staff disagreed at the time RECLAIM was first adopted and still disagrees today that the cost of shaved RTCs should be recognized as a programmatic cost. Staff has never considered the "cost" of the shaved RTC's to be recognized as a "cost" for determining equivalency with command and control. At the outset of RECLAIM, RTCs were allocated to RECLAIM facilities free of charge, yet they now have value to the facilities as a commodity that can be bought and sold. While RTCs have value, they are not a property right. The proposed amendments to RECLAIM will reduce the number of RTCs. Since there was no cost associated with allocated RTCs for a facility, there should be no financial loss to the RECLAIM universe as the SCAQMD retires them. Any additional purchase of RTCs executed by a facility is made in lieu of emission control. The choice between the RTC purchase and emission control is solely a business decision that is made to generate an expected stream of cost-savings afforded only by the RECLAIM program and not available under command-and-control. Therefore, any RTC investment loss should not be considered as a compliance cost to be compared to the compliance cost under command-and-control regulations. Moreover, this loss may be offset by any potential increase in RTC price due to a decreased RTC supply, which would subsequently raise the market value of a facility's remaining RTC holdings. Finally, any loss of "value" of shaved RTCs cannot be compared to command and control, because in that case there are no RTCs and thus no similar "value" was ever created.

To sum up, many factors are in play that may lower the compliance cost of RECLAIM as compared to CAC. They include:

- RECLAIM facilities have many more options for compliance than facilities under traditional command and control rules, including adding control equipment, process changes, and purchasing RTCs.
- Sources subject to Rule 2005—New Source Review for RECLAIM—are not subject to the 1.2 offset factor that is applied to new and modified sources for non- RECLAIM facilities when using emission reduction credits (ERCs).[34]
- Rule 2005 facilities can sell excess RTC offset holdings at the end of each compliance year resulting from installing or modifying existing control equipment. This option is not available under CAC.
- RTCs resulting from shutdowns have not been subject to the best available control technology (BACT) discount that is applicable to non-RECLAIM sources.
- RECLAIM facilities can take advantage of facility or program emission averaging to implement the least cost controls. Cross-cycle trading under RECLAIM provides additional compliance flexibility.
- The non-RECLAIM facilities are subject to source specific standards (e.g. concentration limits or mass emission limits) that cannot be exceeded at any time whereas, for the most part, RECLAIM facilities can operate their equipment with flexibility and reconcile the emissions with the facility caps at the end of the compliance quarter and year.
- RECLAIM facilities have received monetary benefits from trading their RTCs through the past 22-year life of the RECLAIM program to reduce the costs of compliance.

[34] Rule 2005—New Source Review for RECLAIM.

Based on the aforementioned reasons, the compliance costs under RECLAIM are equivalent to or less than what would have occurred under CAC.

12. REFERENCES

Chan, Gabriel, Robert Stavins, Robert Stowe, and Richard Sweeney. 2012. "The SO2 Allowance Trading System and the Clean Air Act Amendments of 1990: Reflections of Twenty Years of Policy Innovation." Cambridge, Mass: Harvard Environmental Economics Program.

Chevron 2014 Annual Report. Downloaded August 26, 2014 from http://www.chevron.com/annualreport/2014/

Exxon-Mobile 2014 Annual Report. Downloaded August 26, 2014 from http://ir.exxonmobil.com/phoenix.zhtml?c=115024&p=irol-reportsAnnualDun& Bradstreet Enterprise Database. 2015.

Phillips66 2014 Annual Report. Downloaded August 26, 2014 from http://investor.phillips66.com/investors/financial-information/annual-reports/

Regional Economic Modeling Inc. (REMI). Policy Insight® for the South Coast Area (70 sector model). Version 1.7.2.

South Coast Air Quality Management District (SCAQMD). Revised Draft Staff Report: Proposed Amendments to Regulation XX – Regional Clean Air Incentive Market (RECLAIM). Diamond Bar, C.A. November 2015.

. (AQMD). RECLAIM 2013 Annual RECLAIM Audit Report for 2013 Compliance Year. March 2015.

. RECLAIM. Draft Environmental Assessments of Proposed amendments to NOx RECLAIM. Diamond Bar, C.A. August 2015.

. RECLAIM. Vol. III: Final Socioeconomic and Environmental Assessments of RECLAIM. Diamond Bar, C.A. October 1993.

. 2012 Air Quality Management Plan. Diamond Bar, C.A. August 2012.

. Socioeconomic Report for Proposed Amendments to Regulation XX – Regional Clean Air Incentive Market (RECLAIM). Diamond Bar, C.A. May 2001.

. Socioeconomic Report for Proposed Amendments to Regulation XX – Regional Clean Air Incentive Market (RECLAIM). Diamond Bar, C.A. January 2005.

. Socioeconomic Report for Proposed Amendments to Regulation XX – Regional Clean Air Incentive Market (SOx RECLAIM). Diamond Bar, C.A. January 2010.

State Board of Equalization, 2014. Gasoline Consumption Downloaded August 26, 2015 from http://www.boe.ca.gov/sptaxprog/reports/MVF_10_Year_Report.pdf

Tesoro 2014 Annual Report. Downloaded August 26, 2015 from http://www.marketwatch.com/story/tesoro-corporation-reports-2014-fourth-quarter-and- record-full-year-results-2015-02-11

U.S. Small Business Administration. Small Business Size Standards Matched to NAICS Codes. Washington, D.C. 2014. Downloaded August 12, 2015, from http://www.sba.gov/idc/groups/public/documents/sba_homepage/serv_sstd_tablepdf.pdf

Valero 2014 Financial Summary Report Downloaded August 26, 2015 from: http://www.valero.com/mwg-internal/de5fs23hu73ds/progress?id=IxbJVKQ0GdFHOoVWgjWLj_kkRRK-upCMYiQHDq_cIYs

13. APPENDIX A: 10-YEAR INDUSTRY EMPLOYMENT PROJECTIONS

2012-2022 Industry Employment Projections Los Angeles-Long Beach-Glendale Metropolitan Division (Los Angeles County)			Employment Development Department Labor Market Information Division Published: December 2014
NAICS Code*	**Industry Title**	**Percent Change 2012-2022**	**Annual Average Percent Change**
	Total Employment	**12.8%**	**1.3%**
1133,21	**Mining and Logging**	**9.3%**	**0.9%**
23	**Construction**	**30.2%**	**3.0%**
31-33	**Manufacturing**	**-14.2%**	**-1.4%**
	Durable Goods Manufacturing	**-14.6%**	**-1.5%**
	Nondurable Goods Manufacturing	**-13.6%**	**-1.4%**
22,42-49	**Trade, Transportation, and Utilities**	**12.7%**	**1.3%**
42	**Wholesale Trade**	**12.3%**	**1.2%**
44-45	**Retail Trade**	**13.7%**	**1.4%**
22,48-49	**Transportation, Warehousing, and Utilities**	**10.4%**	**1.0%**
48-49	**Transportation and Warehousing**	**10.7%**	**1.1%**
52-53	**Financial Activities**	**7.4%**	**0.7%**
	Government	**3.7%**	**0.4%**

2012-2022 Industry Employment Projections
Anaheim-Santa Ana-Irvine Metropolitan Division
(Orange County)

Employment Development Department

Labor Market Information Division
Published: December 2014

NAICS Code*	Industry Title	Percent Change 2012-2022	Annual Average Percent Change
	Total Employment	**17.4%**	**1.7%**
1133,21	**Mining and Logging**	**-20.0%**	**-2.0%**
23	**Construction**	**34.0%**	**3.4%**
31-33	**Manufacturing**	**-4.6%**	**-0.5%**
	Durable Goods Manufacturing	**-6.7%**	**-0.7%**
	Nondurable Goods Manufacturing	**0.7%**	**0.1%**
22,42-49	**Trade, Transportation, and Utilities**	**18.4%**	**1.8%**
42	**Wholesale Trade**	**24.8%**	**2.5%**
44-45	**Retail Trade**	**17.0%**	**1.7%**
22,48-49	**Transportation, Warehousing, and Utilities**	**7.5%**	**0.8%**
48-49	**Transportation and Warehousing**	**4.6%**	**0.5%**
52-53	**Financial Activities**	**22.4%**	**2.2%**
	Government	**3.8%**	**0.4%**

2012-2022 Industry Employment Projections
Riverside-San Bernardino-Ontario Metropolitan Statistical Area (Riverside and San Bernardino Counties)

Employment Development Department

Labor Market Information Division

Published: December 2014

NAICS Code*	Industry Title	Percent Change 2012-2022	Annual Average Percent Change
	Total Employment	**19.4%**	**1.9%**
1133,21	**Mining and Logging**	**33.3%**	**3.3%**
23	**Construction**	**58.0%**	**5.8%**
31-33	**Manufacturing**	**-3.3%**	**-0.3%**
	Durable Goods Manufacturing	**-2.5%**	**-0.2%**
	Nondurable Goods Manufacturing	**-5.0%**	**-0.5%**
22,42-49	**Trade, Transportation, and Utilities**	**20.7%**	**2.1%**
42	**Wholesale Trade**	**29.6%**	**3.0%**
44-45	**Retail Trade**	**18.5%**	**1.9%**
22,48-49	**Transportation, Warehousing, and Utilities**	**19.4%**	**1.9%**
48-49	**Transportation and Warehousing**	**20.4%**	**2.0%**
52-53	**Financial Activities**	**15.0%**	**1.5%**
	Government	**5.0%**	**0.5%**

14. APPENDIX B: WEEKLY EARNINGS BY OCCUPATIONAL WAGE GROUP BY MEDIAN WEEKLY EARNINGS

Table A

Quintile	Occupational Title	Median Weekly Earnings
1	Media and communication equipment workers	$398
1	Nursing, psychiatric, and home health aides	$457
1	Occupational therapy and physical therapist assistants and aides	$457
1	Other healthcare support occupations	$460
1	Cooks and food preparation workers	$398
1	Food and beverage serving workers	$424
1	Other food preparation and serving related workers	$385
1	Building cleaning and pest control workers	$467
1	Grounds maintenance workers	$445
1	Entertainment attendants and related workers	$361
1	Personal appearance workers	$480
1	Other personal care and service workers	$431
1	Supervisors of farming, fishing, and forestry workers	$448
1	Agricultural workers	$418
1	Fishing and hunting workers	$448
1	Forest, conservation, and logging workers	$448
1	Other construction and related workers	$461
1	Textile, apparel, and furnishings workers	$250
1	Other transportation workers	$236
2	Life, physical, and social science technicians	$571
2	Other education, training, and library occupations	$582
2	Other protective service workers	$534
2	Supervisors of food preparation and serving workers	$529
2	Animal care and service workers	$524
2	Funeral service workers	$481
2	Baggage porters, bellhops, and concierges; Tour and travel guides	$481
2	Retail sales workers	$516
2	Information and record clerks	$603
2	Other office and administrative support workers	$611
2	Helpers, construction trades	$566
2	Extraction workers	$596
2	Assemblers and fabricators	$525
2	Food processing workers	$509
2	Printing workers	$583
2	Plant and system operators	$573
2	Other production occupations	$555

Table A (Continued)

Quintile	Occupational Title	Median Weekly Earnings
2	Rail transportation workers	$619
2	Material moving workers	$486
3	Social scientists and related workers	$640
3	Religious workers	$767
3	Librarians, curators, and archivists	$685
3	Entertainers and performers, sports and related workers	$763
3	Supervisors of building and grounds cleaning, maintenance workers	$684
3	Supervisors of personal care and service workers	$687
3	Other sales and related workers	$659
3	Communications equipment operators	$638
3	Financial clerks	$624
3	Material recording, scheduling, dispatching, and distributing workers	$623
3	Secretaries and administrative assistants	$681
3	Construction trades workers	$680
3	Electrical and electronic equipment mechanics, installers, and repairers	$706
3	Vehicle and mobile equipment mechanics, installers, and repairers	$737
3	Other installation, maintenance, and repair occupations	$761
3	Metal workers and plastic workers	$645
3	Woodworkers	$623
3	Motor vehicle operators	$689
3	Water transportation workers	$620
4	Drafters, engineering technicians, and mapping technicians	$909
4	Life scientists	$960
4	Counselors and Social workers	$864
4	Miscellaneous community and social service specialists	$773
4	Legal support workers	$856
4	Preschool, primary, secondary, and special education school teachers	$935
4	Other teachers and instructors	$905
4	Art and design workers	$969
4	Health technologists and technicians	$768
4	Supervisors of protective service workers	$897
4	Fire fighting and prevention workers	$939
4	Law enforcement workers	$899
4	Supervisors of sales workers	$776
4	Sales representatives, services	$906
4	Supervisors of office and administrative support workers	$772
4	Supervisors of installation, maintenance, and repair workers	$980

Table A (Continued)

Quintile	Occupational Title	Median Weekly Earnings
4	79 Supervisors of production workers	$902
4	88 Supervisors of transportation and material moving workers	$882
4	Military	$904
5	Top executives	$1,729
5	Advertising, marketing, promotions	$1,384
5	Operations specialties managers	$1,320
5	Other management occupations	$1,141
5	Business operations specialists	$1,074
5	Financial specialists	$1,108
5	Computer occupations	$1,367
5	Mathematical science occupations	$1,244
5	Architects, surveyors, and cartographers	$1,016
5	Engineers	$1,384
5	Physical scientists	$1,261
5	Lawyers, judges, and related workers	$1,738
5	Postsecondary teachers	$1,172
5	Media and communication workers	$995
5	Health diagnosing and treating practitioners	$1,267
5	Other healthcare practitioners and technical occupations	$1,065
5	Sales representatives, wholesale and manufacturing	$1,042
5	Supervisors of construction and extraction workers	$990
5	Air transportation workers	$1,131

15. APPENDIX C: RESPONSE TO STAKEHOLDER COMMENTS

Comments Received at the January 8, 2015, CEQA and Socioeconomic Scoping
A combined CEQA and Socioeconomic Scoping was held on January 8, 2015. There were two specific comments regarding the yet to be completed draft socioeconomic analysis which are addressed below.

Comment #1:
Industry would like to request that the impact of an alternative incremental BARCT shave be analyzed in the socioeconomic assessment.

Response:
The draft socioeconomic document analyzed the impact of this proposed alternative in the Draft Socioeconomic Report released on September 9, 2015. This alternative is listed as CEQA alternative #3—Industry Proposal.

Comment #2:
There are at least a dozen facilities with boilers above 40 mmBtu/hr that will not have cost-effective control equipment to install. The cost-effectiveness of this control equipment is $200,000 per ton and higher, and, as a result, these facilities are only left with the option to buy credits at higher prices after the shave.

Response:
The proposed amendments used a cost effectiveness of $50,000 per ton to determine the quantity of equipment estimated to be cost effective and the amount of emission reductions for the program.

If this comment refers to the refinery sector, the incremental cost effectiveness is $28,000 for refinery boilers/heaters above 40 mmBtu/hr (see Table 4.3 of the staff report). Any controls with cost effectiveness above $50,000 were not considered in the BARCT analysis. If this comment refers to the non-refinery sector, the BARCT analysis indeed did not identify any cost-effective controls for boilers/heaters above 40 mmBtu/hr (see Table 4.2 of the staff report); however, there are cost-effective controls identified for other emission sources.

Under the proposed amendments, the proposed BARCT-based shave would be distributed in the fashion that facilities with identified BARCT would see their RTC holdings reduced by the highest percentages. A non-refinery facility with identified BARCT is expected to be able to reduce facility-wide emissions by installing cost- effective controls on emission sources other than boilers/heaters above 40 mmBtu/hr; however, this same facility would also have the flexibility to reconcile their facility-wide emissions by obtaining sufficient NOx RTCs.

The Draft Socioeconomic Report has analyzed the potential incremental costs of purchasing RTCs at higher prices for 45 facilities where no control equipment has been identified for installation, as well as for the 210 facilities exempt from the shave.

Western States Petroleum Association (WSPA) Comment Letter #1 Received January 30, 2015

Socioeconomic Comment Letter #1

Western States Petroleum Association
Credible Solutions • Responsive Service • Since 1907

Patty Senecal
Manager, Southern California Region and Infrastructure Issues

VIA ELECTRONIC MAIL

January 30, 2015

Dr. Elaine Chang
Deputy Executive Officer, Planning, Rule Development & Area Sources
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

SUBJECT: WESTERN STATES PETROLEUM ASSOCIATION (WSPA) COMMENTS ON THE SOCIOECONOMIC ASSESSMENT FOR PROPOSED AMENDED REGULATION XX – REGIONAL CLEAN AIR INCENTIVES MARKET (RECLAIM)

Dear Dr. Chang:

The Western States Petroleum Association ("WSPA") is a non-profit trade association representing twenty-five companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas and other energy supplies in California, Arizona, Nevada, Oregon, and Washington. WSPA-member companies operate petroleum refineries and other facilities in the South Coast Air Basin that are within the purview of the Regional Clean Air Incentives Market ("RECLAIM") program. 1-1

WSPA supports the scoping comments submitted by the Industry RECLAIM Coalition for the Socioeconomic Assessment for Proposed Amended Regulation XX.[1] WSPA formally offers the following additional comments:

1. *A ten-year useful equipment life would be more appropriate due to the frequency of District rulemakings. AQMD's 25-year useful equipment life assumption is not appropriate and results in an understated BARCT cost effectiveness analysis. Potential stranded asset costs should be considered in the socioeconomic assessment.* 1-2

[1] SCAQMD, Notice of Preparation (NOP) and Initial Study for a Draft Program Environmental Assessment for Proposed Amended Regulation XX – Regional Clean Air Incentives Market (RECLAIM), 4 December 2014 ("NOP/IS").

970 W. 190th Street, Suite 304, Torrance, California 90502
PHONE: (310) 678-7782 • FAX: (310) 324-9063 • PSenecal@wspa.org • www.wspa.org

For some time, South Coast Air Quality Management District ("AQMD" or "District") has been using a 25-year equipment life assumption to compute emission control cost effectiveness when conducting new Best Available Control Retrofit Control Technology ("BARCT") analyses. This equipment life assumption results in a systemic understatement of emission control costs because BARCT is typically redefined on much shorter terms. To that point, the District established BARCT for all of the source categories being considered under this Regulation XX rulemaking only ten years ago (i.e., 2005). Calculation of control costs of the 25-year term distorts the true cost associated with these rules.

1-2
Concluded

As recommended in ABT Associates' recent evaluation of the District's socioeconomic assessment process,[2] AQMD should ensure that the control costs used in the Regulation XX socioeconomic assessment include the full cost of retrofitting existing controls or installing new controls. This would include consideration of any stranded asset costs, such as when the proposed BARCT determination requires replacement of prior investments for emission control equipment or effectively mandates the replacement of basic equipment (e.g., gas turbines).

2. *The District's capital cost estimates are significantly lower than refiners' estimates; the socioeconomic assessment should consider a scenario based on these higher costs.*

As with past rulemakings, the District's emission control costs for refineries have been underestimated. Norton Engineering Consultants ("Norton") recently concluded a review of the District's BARCT analysis[3] and concluded that emission control costs for most refinery source categories would be significantly higher than those estimated by District staff. For example:

- FCCUs: Norton's Present Worth Value (PWV) estimates for FCCUs were >60% higher than the last PWV estimates presented by AQMD staff to the NOx RECLAIM Working Group (note: range of variance was between -19% and +138% depending on the unit)
- Refinery Heaters/Boilers: On average, Norton's PWV estimates were >90% higher than the last estimates presented by AQMD staff (note: range of variance was a function of size).[4]
- Coke Calciner: Norton concluded the PWV costs will be >75% higher than the most recent AQMD Staff estimates, and that for BARCT performance in the range of 5-10 ppmv NOx (i.e., not 2 ppmv).[5]
- Sulfur Recovery Units/Tail Gas Treatment Units: Norton concluded that PWV costs will be higher than the AQMD Staff with range of variances between +37% and +267% depending on the unit.[6]

1-3

[2] ABT Associates, Review of the SCAQMD Socioeconomic Assessments, Documentation, Task 1-4 Final, 14 August 2014.
[3] Norton Engineering Consultants, Inc., SCAQMD NOx RECLAIM - BARCT Feasibility and Analysis Review, Non-Confidential Final Report No. 14-045-4, 26 November 2014.
[4] Comparison of data presented in Norton Report and AQMD Staff data, presented to the NOx RECLAIM Working Group Meeting (WGM), 7 January 2015 (slide 25).
[5] Comparison of data presented in Norton Report (p. 21) to AQMD Staff data presented to the NOx RECLAIM WGM, 31 July 2014.
[6] Comparison of data presented in Norton Report (p. 24) to AQMD Staff data presented to the NOx RECLAIM WGM, 31 July 2014.

970 W. 190th Street, Suite 304, Torrance, California 90502
PHONE: (310) 678-7782 • FAX: (310) 324-9063 • PSeneca@wspa.org • www.wspa.org

Based on a confidential and blinded cost survey of WSPA members conducted last year, it appears that the Norton cost estimates may also significantly understate the refinery sector's overall cost of control for this Regulation XX rulemaking. Because RECLAIM is a market-based emission control program, the individual companies have the flexibility to develop their own strategies for complying with their facility-wide emission limits. These strategies can involve emissions control projects or RTC trading and the companies are incentivized under the program to seek the most cost-effective approach for their particular situation.

1-3
Concluded

WSPA, through a third party contractor, conducted a confidential cost survey of the Southern California refineries concerning total capital and operating costs for their compliance strategies for the District's proposed NOx RECLAIM shave.[7] This information is highly proprietary and refiners submitted this information on a confidential basis to the third-party contractor who de-identified and aggregated the compliance costs for the overall industry. The current refining industry forecast suggests the compliance costs of this rulemaking may be nearly twice the most recent cost estimate presented by AQMD staff.[8]

Given the magnitude of this cost variance, WSPA is willing to make its contractor, Stillwater Associates, available to District socioeconomic staff to discuss the aggregated findings of WSPA's confidential survey for the refining industry. In addition, our members, as individual refiners, are willing to discuss with the District staff, individual inputs to the confidential survey to substantiate the methodology and its findings. We respectfully request that the District's socioeconomic assessment consider this higher cost scenario as it would better inform the Governing Board and stakeholders of the true, potential socioeconomic impacts associated with the proposed rulemaking.

1-4

We appreciate your consideration of these comments in the scoping of the socioeconomic assessment for the Regulation XX rulemaking, and will continue working with AQMD staff towards the development of sensible proposal for the RECLAIM program.

Very truly yours,

Patty Senecal

Responses to WSPA – Socioeconomic Letter #1

1-1. Thank you for the comments provided.

1-2. Although the Bay Area AQMD and EPA OAQPS assume an SCR lifespan of 20 years, staff used a 25-year equipment life for SCRs to be installed based on the profiles of SCRs used by refineries in the Basin. Nearly 30 percent of the refinery combustion equipment in the Basin has SCRs that were installed more than 25 years ago, and more than 60 percent of the refinery combustion equipment has SCRs that were installed more than 20 years ago. These units are still in operation and thus support the assumption of a 25-year useful life in the cost analysis.

In addition, there is no demonstration that assets have been stranded as a result of advancements in BARCT, since such advancements may be based on improvements in the earlier air pollution control technology. Thus, to artificially reduce equipment life based on the potential for new BARCT requirements in the future is speculative, and will be addressed at the time of any rulemaking.

1-3. The cost estimates used in the staff report are what is used in the socioeconomic analysis. Please see the Staff Report for more information regarding the difference between staff estimates and NEC estimates.

1-4. As indicated in Response 1-3, please refer to the Staff Report for cost estimates and related assumptions. In a comment letter dated August 21, 2015, Western States Petroleum Association (WSPA) stated, "WSPA believes that the District's cost effectiveness calculations significantly understate the costs associated with achieving the proposed BARCT levels. We believe that even the Norton analysis underestimates actual costs. WSPA is currently developing additional information based on detailed engineering assessments that more accurately represent the costs associated with the proposed BARCT. We will submit this information to the record as it becomes available." WSPA also stated in a working group meeting that their cost estimates were 2 to 3 times higher than those estimated in the Staff Report. Staff has met with three refineries who provided varying levels of detail regarding their projected costs that would occur for these facilities to comply with the proposed amendments. There is not sufficient information for staff to verify the WSPA cost estimates. Some of the difference related to staff using an incremental cost-effectiveness calculation, which assumes that 2005 BARCT levels are in place, which may or may not be the case for individual facilities, but is needed for a programmatic evaluation. The individual facilities include total costs, and often include full costs for additional equipment such as substations that may support the new control equipment, as well as other operations at the facility.

Comment Letter #2 Received January 30, 2015
California Council for Environmental and Economic Balance (CCEEB), Southern California Air Quality Alliance (SCAQA), Regulatory Flexibility Group (RFG), and WSPA

Socioeconomic Comment Letter #2

California Council for Environmental and Economic Balance

Regulatory Flexibility Group

WSPA
Western States Petroleum Association

30 January 2015

Dr. Elaine Chang
Deputy Executive Officer, Planning, Rule Development & Area Sources
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

SUBJECT: INDUSTRY COMMENTS ON THE SOCIOECONOMIC ANALYSIS FOR PROPOSED AMENDED REGULATION XX – REGIONAL CLEAN AIR INCENTIVES MARKET (RECLAIM)

Dear Dr. Chang:

These comments are presented on behalf of the members of leading Southern California businesses represented by the California Council for Environmental and Economic Balance ("CCEEB"), the Regulatory Flexibility Group ("RegFlex"), the Southern California Air Quality Alliance ("SCAQA"), and Western States Petroleum Association ("WSPA"). The members of these business groups are major Southern California employers who own and operate facilities that comprise most of the Regional CLean Air Incentives Market ("RECLAIM") program.

This "Industry RECLAIM Coalition" formally offers the following scoping comments on Socioeconomic Analysis for Proposed Amended Regulation XX.[1] 2-1

1. *The socioeconomic analysis should incorporate the procedural improvements recommended under the ABT study;[2] these are important enhancements to the District's socioeconomic analysis process.*

The District recently commissioned ABT Associates to conduct an evaluation of the SCAQMD's socioeconomic assessment process.[2] ABT made a number of recommendations relevant to this rulemaking which SCAQMD committed to implement.[3] This included but was not limited to the following: 2-2

[1] SCAQMD, Notice of Preparation (NOP) and Initial Study for a Draft Program Environmental Assessment for Proposed Amended Regulation XX – Regional Clean Air Incentives Market (RECLAIM), 4 December 2014 ("NOP/IS").
[2] ABT Associates, Review of the SCAQMD Socioeconomic Assessments, Documentation, Task 1-4 Final, 14 August 2014.
[3] AQMD, Summary of ABT Recommendations & SCAQMD Staff Response, presented to Governing Board, 7 November 2014.

Dr. Elaine Chang, SCAQMD
30 January 2015

- Appropriately consider useful life of pollution control equipment; need to consider stranded costs where early replacement is required
- Present both DCF and LCF methods" with appropriate thresholds
- Ensure control costs of new regulations include complete estimate of retrofitting existing controls. Clearly cite and include all sources of control cost estimates.
- Improve transparency through external peer reviews

2-2 Concluded

While these recommendations were agreed to by AQMD Staff in the context of the 2016 Air Quality Management Plan ("AQMP"),[4] the Industry RECLAIM Coalition believes they are more broadly important than just for the AQMP. The proposed revisions to Regulation XX represent a significant rulemaking which could have significant socioeconomic impacts to the Southern California regional economy. We recommend that these process improvements recommended by ABT Associates should be fully incorporated into the socioeconomic analysis for the Regulation XX rulemaking.

2. *The socioeconomic analysis should fully consider the comparative economic impacts of project Alternatives presented in the Draft Program Environmental Assessment ("PEA") for Proposed Amended Regulation XX, including the Industry Coalition's alternative proposal.*

Under the 2012 AQMP, the Governing Board approved control measure CMB-01 which authorized further reductions from the NOx RECLAIM program. The control measure authorized by the Governing Board was based on a range of 3-5 tons per day ("TPD") of RECLAIM Trading Credits ("RTCs") being removed from the program. While stakeholders understood the eventual rulemaking could differ, the current Staff proposal as presented in the NOP/IS would be substantially larger at nearly 13 TPD.

2-3

This Industry RECLAIM Coalition has presented an alternative methodology for demonstrating command-and-control equivalency which would reduce the program's quantity of RTCs by an amount limited to only those reductions that can be directly attributed to the advancement of Best Available Retrofit Control Technology ("BARCT"). While the industry proposal could also result in RTC reductions greater than the approved AQMP control measure, it would be less than what has been presented by the AQMD Staff.

Given the significant differences between the Proposed Project and project Alternatives, we recommend that the socioeconomic analysis quantify the potential economic impacts of each policy option (i.e., the Proposed Project and all project Alternatives) for the Governing Board and stakeholders.

3. *The socioeconomic analysis should consider total costs associated with the Proposed Project and project Alternatives.*

2-4

Dr. Elaine Chang, SCAQMD
30 January 2015

While the BARCT technical analysis being conducted by AQMD Staff is being based on incremental cost effectiveness,[5] the actual economic impacts associated with this rulemaking will be based the total costs for compliance. To understand the potential economic impacts of this rulemaking, the socioeconomic analysis should consider the total capital cost and total increased operating costs as compared to the current baseline condition.

Furthermore, the socioeconomic analysis should consider the cost to RECLAIM program participants for RTC reductions which cannot be directly attributed to the advancement of technology (i.e., BARCT). The AQMD Staff proposal would appear to cause RTC reductions beyond those directly attributable to new BARCT.[6] RECLAIM program members will bear the costs for new capital and operating expenses associated with new BARCT, and they will also be collectively impacted by potential RTC reductions which are not tied to BARCT. These impacts may be regionally significant.

2-5

The socioeconomic analysis should fully quantify all these costs in assessing the potential economic impacts for the Proposed Project and each project Alternative to ensure the Governing Board and stakeholders are informed of the socioeconomic impacts associated with the different policy options.

The RECLAIM program remains vitally important to the health of Southern California's economy and environment. The members of this coalition have actively participated in this rulemaking through the NOx RECLAIM Working Group over these last two years, and we look forward to continuing to work with you and the District's Staff on the significant rulemaking.

Very truly yours,

Bill Quinn
California Council for Environmental and Economic Balance

Michael Carroll
Regulatory Flexibility Group

Curtis Coleman
Southern California Air Quality Alliance

Patty Senecal
Western States Petroleum Association

[5] For this rulemaking, incremental cost effectiveness is based on the cost and emissions benefit differences that would theoretically be observed between the new 2015 BARCT technology and emissions performance level as compared to the prior 2000/2005 BARCT technology and emissions performance level.
[6] AQMD NOx RECLAIM Working Group Meetings, 7 January 2015 and 31 July 2014.

Responses to CCEEB, RegFlex, SCAQA, and WSPA – Socioeconomic Letter #2

2-1. Thank you for the comments provided.

2-2. The Socioeconomic analysis of the proposed amendments to the NOx RECLAIM has implemented, to the extent possible, methodological and procedural improvements based on the recommendations put forward by Abt Associates in their 2014 report. These improvements include:

- Conducting Socioeconomic Scoping Session with CEQA Scoping on January 8, 2015
- Providing a more-than-45-day review period for the Draft Socioeconomic Report (Draft released on September 9, 2015)
- Identifying key socioeconomic issues and assumptions
- Analyzing the impacts of potential alternatives, including the Industry Proposal
- Providing a range of costs and job impacts to reflect different assumptions
- Clearly citing and including all sources of control cost estimates
- Conducting sensitivity analysis by analyzing a scenario in which no control installation spending occurs in the Basin
- Providing better documentation of assumptions and methodologies

Finally, although not included in the socioeconomic analysis, the staff report presents cost-effectiveness analysis results both LCF and DCF methodologies.

2-3. The Draft Socioeconomic Report has analyzed the potential economic impacts of four policy alternatives (and no impacts under the "No Project" alternative), including an Industry Proposal, which is represented as CEQA alternative #3.

2-4. The draft socioeconomic impact assessment estimated total compliance costs associated with the proposed rule amendments and CEQA alternatives. In addition to the potential compliance cost of control equipment installation and operation for these 20 facilities, the proposed amendments may potentially result in incremental costs for some of the 45 facilities where no BARCT was identified, and some of the 210 facilities that are not shaved but would need to continue purchase RTCs which may increase in price. These incremental costs would be the result of both additional RTCs that would be purchased from the market and due to potential RTC price increases after the shave. However, the total cost to RTC buyers is at the same time an economic gain for RTC buyers; therefore, the net compliance cost related to RTC transactions would cancel out.

2-5. As discussed in Response 2-4, the draft socioeconomic economic report considers the total compliance costs associated with the proposed NOx RECLAIM amendments and also with each CEQA alternatives. This is done by comparing the proposed amendments against a baseline of "business as usual".

Based on staff's analysis, a shave of 14 tpd from current RTC levels of 26.51 tpd is necessary to attain the 12.51 tpd (26.51 tpd – 14 tpd = 12.51 tpd) of remaining NOx emissions in 2023. This level includes installation of 2015 BARCT, an allowance for growth, a compliance margin, and adjustments to account for uncertainties in the BARCT analysis. The cost of full BARCT installation represents the most conservative (i.e., maximum) cost estimate because, under RECLAIM, the total actual costs may be lower if a facility identifies any other more cost-effective alternative to remain in compliance.

The draft socioeconomic report also included discussion of the value of shaved RTCs (Please see Section 9—Market Analysis for more details). At the outset of RECLAIM, RTCs were allocated to RECLAIM facilities free of charge, yet they now have value to the facilities as a commodity that can be bought and sold. While RTCs have value, they are not a property right. The proposed amendments to RECLAIM will reduce the number of RTCs. Since there was no cost associated with allocated RTCs for a facility, there should be no financial loss to the RECLAIM universe as the SCAQMD retires them. Any additional purchase of RTCs executed by a facility is made in lieu of emission control. The choice between the RTC purchase and emission control is solely a business decision that was made to generate an expected stream of cost-savings afforded only by the RECLAIM program and not available under command-and-control. Therefore, any RTC investment loss should not be considered as a compliance cost to be compared to the compliance cost under command-and- control regulations. Moreover, this loss may be offset by any potential increase in RTC price due to a decreased RTC supply, which would subsequently raise the market value of a facility's remaining RTC holdings. Finally, any loss of "value" of shaved RTCs cannot be compared to command and control, because in that case there are no RTCs and thus no similar "value" was ever created.

Socioeconomic Letter #3 Kavet, Rockler & Associates LLC (on behalf of WSPA)

Kavet, Rockler & Associates, LLC
Economic & Public Policy Consulting

Nicolas Rockler, Ph. D.
242 Payson Road
Belmont, Massachusetts 02478 U.S.A.
Telephone: (617) 395-8021 E-Mail:
nrockler@kavetrockler.com

October 16, 2015

Dr. Shah Dabirian
Program Supervisor, NO_x Reclaim
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

ELECTRONIC SUBMISSION

RE: Revised Draft Socioeconomic Report for Proposed Amendments to Regulation XX-Regional Clean Air Incentive Market (RECLAIM) NO_x RECLAIM

Dear Dr. Dabirian:

At the request of the Western States Petroleum Association (WSPA), we were asked to review the October, 2015 draft "Socioeconomic Report for Proposed Amendments to Regulation XX-Regional Clean Air Incentive Market (RECLAIM) NO_x RECLAIM" prepared by the South Coast Air Quality Management District (SCAQMD.) Specifically, we were asked to review the draft analysis as regards methodology, implementation of the economic model supplied by Regional Economic Models, Inc. (REMI), and to offer relevant comments that have a bearing on the adequacy or accuracy of the economic analysis given in the draft report. We note that we posed a number of questions during a teleconference on October 7, 2015 that included a number of the SCAQMD staff, as well as WSPA representatives. Some of what we learned during that discussion has carried through to comments we make here and there are a number of questions that remain unresolved. Below, we offer our questions and comments under each of the three categories.

I. METHODOLOGY

a. Omission of RTC Costs in Macroeconomic Impact Estimates

In the revised draft report, it is noted that the proposed best available retrofit control technology (BARCT) shave will produce annualized capital and operating cost changes of $72 million per year at a 4% discount rate (see ES-3 and later). These estimated BARCT costs are then used in estimating the macroeconomic impact on the regional economy. However, it appears as though compliance costs involving RTC allowances were excluded from the macroeconomic impact analysis. We note that firms with inadequate allowances after the shave will face higher production costs when securing *additional* RTCs. The argument that SCAQMD offers, if we understand it correctly, is that the RTC allowances were made available freely at the start of the program and that any subsequent trading of allowances merely represents a shift in asset values between seller and buyer with no economic gain or loss to the region. We agree with this view so long as the sole function of the RTC is limited to a bookkeeping store of value. However, RTC's are not merely abstract assets: Very much like certain metal commodities such as gold and silver, RTCs are at once both assets with a market-determined value and a critical production input in the manufacture of certain goods. When a firm decides to offset an excess of emissions at a particular level of output, there must be seller of RTCs that has surplus allowances at its own level of emissions to sell. Note that carrying surplus RTC allowances does not change the seller's production costs, but does represent an opportunity cost that affects its current net income if the market value of its RTCs is greater than zero. On the other hand, the buyer must pay the current market cost for each additional RTC that it requires, and this cost is *incremental* to all other costs in their production function. These costs will be incurred by any facilities when their RTC holding levels fall below their emissions levels, which can occur for a number of reasons, including mandated allowance reductions. This production cost increase is by design, intended to create an incentive to reduce emissions by investment in improved control or combustion technology or by reducing production volumes if this reduces emissions. Were it the case that the shave had no effect on operating costs, no incentive would exist to alter emitters' production technologies or output.

I-A

Kavet, Rockler and Associates, LLC Page 2

We note that you have already estimated the total RTC allowance cost changes for 255 facilities (see ES-5 "Market Analysis, para. 2) as ranging from $14 to $365 million. We do not see why the addition of the RTC costs to the production cost policy variable in the REMI model cannot be included to complete the total program cost macroeconomic impact. On p.40, you note that because actual RTC price changes cannot be accurately predicted, you cannot include market effects in the REMI macroeconomic simulation. We contend that a reasonable range of value could be applied to develop a range of total macroeconomic impact.

By ignoring the RTC price changes on production costs, this analysis implicitly sets the RTC price change to be zero, a value that seems unreasonable.

I-A

b. **Growth Assumptions**

For determining which firms will need to acquire additional RTC allowances in the future, it is stated on p. 42, paragraph 2 that you have applied an industry specific annual growth rate to the 2011 actual emissions to project when and by how much a facility will exceed its RTC holdings. These growth rate assumptions are fundamental to estimating the RTC market impact component. It was noted during the teleconference that three different growth rate assumptions were used and that these are shown in the footnotes found on p. 45 and 47 of the revised draft report. Also during the phone conference, it was noted that the industry projections used are mandated in State legislation. Could we please have a complete citation for the industry-level projections that were used? (We note that although the REMI model is not a forecasting model per se, its baseline economic projection is derived from known and credible macroeconomic forecasts and the implicit growth rates for each of the industries in the model could certainly function develop a medium-run economic outlook for SCAQMD's purposes.) We contend that a three-sector scheme for estimating future RTC allowance requirements is far too aggregate and may misrepresent the severity of the proposed regulatory change on industries that are important to the regional economy.

I-B

c. **Industry-Level Data**

When projecting future demand for RTC allowances, we suggest that it would be very useful for SCAQMD to aggregate facilities to a NAICS 6-digit industry-level or REMI 70 sector level for an appropriate time interval and produce data files of output, emissions, employment, and RTC holdings. Such information would allow the SCAQMD and public to directly identify which industries are more or less affected by the non-BARCT market effects and which are greater or lesser contributors to overall regional economic activity and emissions. This information is entirely missing in the analysis despite the need for such information being listed as a report requirement on pp. 5-6 of the draft. I-C

II. REMI IMPLEMENTATION QUESTIONS

a. Classification of BARCT Compliance Costs

In Table 17, we see both BARCT compliance costs and compliance spending listed as inputs to the REMI model. We do not see the specific REMI "policy variables" (as they are known in the model) listed or described in even a general context. However, we do see that one-time capital costs are entered into the REMI model as Machinery Manufacturing and installation costs entered as Construction costs. We would also expect that operating costs for the new capital equipment would be entered into the REMI model as changes in the production costs for the affected industry, and that the suppliers of the goods and services required to run the new capital equipment would see a change in appropriate industry sales values in the REMI model. Is this how compliance costs were entered into the model? What were the job and output impacts of the compliance costs? These can be presented separately from RTC allowance job and output impact. For the compliance spending, how were the machinery manufacturing and installation costs entered? II-A

b. BARCT Installation Costs as Construction Industry Spending

During the phone conference, one SCAQMD representative (apologies for not noting who the speaker was at the time) stated that the installation costs associated with the BARCT capital equipment entered into the REMI model as construction sector spending. We contend that this should have been entered using the wage payments policy variable for the construction sector or the employee compensation policy variable for construction sector (i.e., fully-loaded labor costs including wages, fringes, and benefits.) If entered as general construction sector spending, the REMI model will divide-up the spending over a multitude of inputs: Approximately 20 percent of the total amount will be classified as labor costs, 60 percent will assigned to materials and services expenditures (including amounts for lumber, gypsum board, glass and glazing products, lighting products, flooring products, concrete products, etc.) things unlikely to be purchased for installing refinery equipment, and the last 20 percent will be classified as overhead and profits which would have already been included in the equipment purchase. This appears to be incorrect to us.

II-B

c. **Production Location of BARCT Capital Equipment**

Also during the phone conference, we established that SCAQMD knows the manufacturer of capital goods and can determine location of manufacture for that equipment. In that case, it is always recommended that we use this knowledge and avoid use of the general regional purchase coefficient that is included in the REMI model. The regional purchase coefficients are, at best, an approximation of a general regional production pattern and if one knows the actual geographic source, there is no point in allowing large errors to reduce the impact estimation quality. The same can be said of the installation labor, if the manufacturer requires that its own labor be used.

II-C

d. **BARCT Equipment Purchases as Increment to the Regional Capital Stock**

We determined that SCAQMD did not increment the regional capital stock in the REMI model. This is not automatically done with investment expenditures in the REMI model, despite what one SCAQMD representative said during the phone conference. The user must specifically enter the value of the BARCT capital equipment and installation costs to the regional nonresidential capital stock policy variable. The consequence of omitting this step is having slightly overstated aggregate capital investment. The BARCT investment will offset implicit future investment, resulting in higher future net job-creation impact. II-D

e. **Review of REMI Input File**

To assure ourselves that the REMI model was correctly implemented, we submitted a public records request, at SCAQMD's suggestion, to obtain a copy of the relevant worksheets and REMI input files. We received these data on October 14th and will review to see specifically what direct impact data were entered into the model, and how they were entered in terms of specific policy variable categories. We will submit comments, if needed, at a later date to address any specific concerns. II-E

III. GENERAL QUESTIONS AND/OR COMMENTS

a. At no point in the draft analysis is there a figure that represents the total cost of the proposed regulatory change. It would be very helpful if SCAQMD can develop such a figure (or a value range) that allows the reader to know the potential total. III-A

b. The "Short-Term Economic Outlook" section (starting on p.6) offers no insights into the industries of the regulated facilities. It offers a two year forecast (of which ¾ of a year is now history and not outlook), which is of limited value in the context of 10 year projection period for emissions and economic activity. Since we are not given an economic outlook for markets that can change significantly over the next 10 years, we do not know how South Coast believes events will unfold and have no basis to assess the reasonability of the cost estimates for RTC allowances and effect on specific industries. III-B

c. We attempted to verify the short-run "outlook" figures using the cited sources, i.e., the California State University at Fullerton, Wells Fargo California Economic Outlook, and the Los Angeles Economic Development Corporation. We could not match- up table data from the draft with (several of) the cited sources. We suggest that a full citation of the source used for this section would be helpful. III-C

d. In the "Competitiveness: section, p. 34 it is stated, "The proposed amendments are not expected to impose discernable impacts relative to the cost of services or delivered prices of the affected facilities." Given the incomplete macroeconomic analysis with respect to RTC allowance pricing impacts, we think this conclusion is premature. If you add the allowance price effects into production cost estimates, REMI can solve for price and interregional trade changes that will inform us whether the effects are significant or not. These cannot be dismissed out-of-hand. III-D

e. Regarding ability to bear the costs of required investments, references are made on P. 34 to the refining industries gross revenues of the corporate owners of the facilities. This is an entirely inappropriate metric when conducting a regional economic evaluation as to whether the change in regulation is burdensome. The refineries do not operate in a national or international market reflected by total international corporate revenues. Rather, they operate in a regional market where the burden of the mandated and market changes should be measured against a figure such as regional refinery non-labor value added, which measures the value produced by capital net of depreciation, retained earnings, and earnings distributed to owners (i.e., shareholders), excluding raw material input costs and labor input. The change in non-labor value added will inform us as to whether the regulation change is burdensome. III-E

f. The second paragraph and footnote given on p. 34 offers an estimate for determining the cost-per-gallon of gasoline due to the proposed regulatory changes. Since, once again, these ignore RTC acquisition costs; the figures are likely to be low. Furthermore, it ignores the natural forces of the transportation fuel markets and it assumes that the region faces no outside competition from gasoline imports. This leads to the misleading conclusion that refineries can fully pass on all costs associated with the revised regulations. For example, the calculation ignores known gasoline imports to region via the Port of Los Angeles, which amounted to $2.9 billion in 2012, a relatively small amount compared to the $70 billion of regional refinery output[1], but proof that the market is not closed to competitors and that not all costs can be assumed to be passed on to consumers. III-F

Please let us know if you have questions regarding the specific points we have raised. We look forward to your reply and thank you for your assistance.

Sincerely,

cc: Dr. Phil Fine, SCAQMD
Sue Gornick, WSPA

[1] HIS Regional Economic Service county database, 2014.

I. METHODOLOGIES

Response to Comment I-A:

The commenter noted that, in the Revised Draft Socioeconomic Report released in October 2015, staff already estimated that potential incremental compliance cost for the projected NOx RTC buyers. The incremental cost for an affected facility is estimated as the difference in its current compliance cost and the projected higher compliance cost, which would be the result of either the proposed NOx RTC shave per se or any increase in NOx RTC prices due to a potentially decreased supply of NOx RTCs in the market.

Since any incremental compliance cost paid to obtain NOx RTCs would benefit NOx RTC sellers, the incremental compliance cost on the net for the entire RECLAIM universe would be by far lower than the gross compliance cost incurred by NOx RTC buyers. Any positive net compliance cost would be equivalent to the financial gains accrued to NOx RTC brokers. As the commenter noted, the Revised Draft Socioeconomic Report does state that, "[b]ecause the RTC price scenarios were set arbitrarily at various price points for illustrative purposes only, and any actual price increase cannot be accurately predicted, staff did not include the result of price analysis as an input for the REMI model to assess the macroeconomic impacts that could be potentially generated due to a redistribution of wealth within the RECLAIM universe as a result of RTC transactions." Staff did not assume the RTC price changes on production costs to be zero. In fact, in the Final Socioeconomic Report, job impacts have been estimated using REMI for the incremental compliance costs related to NOx RTC transactions. Please see Section 9.59.5 REMI Job Impacts of RTC Purchases for more details.

Response to Comment I-B:

The growth factors used in projecting the 2023 NOx emissions are the same set of growth factors used in the 2012 Air Quality Management Plan (AQMP), with the base year set in 2011. Nearly all of the growth factors were based on the growth projections made in the 2012 Regional Transportation Plan/Sustainable Community Strategies (RTP/SCS) prepared by the Southern California Association of Governments (SCAG). The only exception is for Electricity Generating Facilities (EGFs). EGF emissions were projected using 2012 as the base year and with updated growth factors based on the 2014 Gas Fuel Report published by the Southern California Gas Company. (See Appendix W of the October 6, 2015 Draft Staff Report for more details).

In order to project the overall 2023 NOx emissions among current NOx RECLAIM facilities, SCAQMD staff began by projecting the 2023 emissions for each facility, based on the aforementioned growth factors that vary by county and by 3-digit North American Industry Classification System (NAICS) code. The projected emissions at the facility level were then aggregated to the group level to arrive at the composite growth factors referenced in the Revised Socioeconomic Report (i.e., those noted by the commenter). Therefore, the projected total NOx emissions for any of the groups analyzed in the Report are consistent with the summation of projected NOx emissions across all facilities in a group.

When it comes to analyzing the potential buyers of NOx RTCs and the additional credits that will

be needed in the post-shave market, staff acknowledges that the use of the group-level composite growth factors can potentially generate somewhat different estimates than using the more disaggregate growth factors that vary by county and by 3-digit NAICS. The difference would be larger, with greater within-group variations of projected NOx emissions and RTC holdings; however, the magnitude and even the direction of this difference is a priori unclear. If, as reasonably expected, the projected NOx emissions mostly occur at facilities with higher levels of post-shave RTC holdings, then the projected total additional NOx RTCs that will need to be purchased, and thus the associated incremental compliance cost, will have been overestimated in the Report. In a letter from Kavet, Rockler & Associates dated November 19, 2015, it is stated that "it would be preferable to provide NAICS-3 estimates for industry growth accompanied by estimates for industry emissions and allowance balance at same NAICS-3 level." Staff continues to believe that presenting the potential incremental compliance cost for the two major groups of facilities that are distinguished by whether they would be shaved or not (and both without identified cost-effective controls) is a more appropriate method to illustrate overall impacts. Staff is working to compile this information and will respond to the commenter.

It should also be noted that, to be conservative about compliance cost estimates, staff assumes that all facilities with identified cost-effective controls would install such devices and incur the associated compliance costs. In reality, the installation of all cost-effective controls will not likely come true unless NOx RTC prices would rise to a sufficiently high level to make control installation a more economical compliance option. In fact, the estimated cost-effective values of several categories of cost-effective control equipment lie well above the proposed price trigger of $22,500 per ton (based on a 12-month rolling average of discrete NOx RTC prices), above which all non-usable/non-tradable NOx RTCs would be converted to usable/tradable RTCs to stabilize market prices.

Response to Comment I-C:

As mentioned in the previous response, the growth factors used to project the 2023 NOx emissions vary by county and by 3-digit NAICS. The REMI 70-sector model used by the SCAQMD staff has a similar level of industry aggregation and the same geographical breakdown.

The growth factors used for point sources in the 2012 AQMP are directly based on industry output, employment, or population growth projections made by SCAG. (The only exception is for EGFs, whose growth factors were based on the 2011 Gas Fuel Report. For details, please refer to the 2012 AQMP: Table III-2-5 in Appendix III available at http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2012-air-quality-management-plan/final-2012-aqmp-(february-2013)/appendix-iii-final-2012.pdf.) Therefore, it appears redundant to additionally report the underlying growth projections used to generate the growth factors. Moreover, the data files, which contain NOx emission and RTC holding projections and were used to generate estimates reported in Section 9: Market Analysis, can be requested via a public records request, similar to the commenter's previous request for REMI data files used in the Revised Draft Socioeconomic Report.

Furthermore, the socioeconomic assessment has met the legal requirements listed on pp. 5-6 of the Revised Draft Socioeconomic Report. Industry distribution was not included explicitly for the 219

facilities, because facilities in this group represent a range of industries, but are largely comprised of manufacturing, mining, oil and gas exploration, and utilities industries. Cost impacts on these facilities individually are expected to be small (if not zero). Any cost impacts that could potentially occur would be the result of any NOx RTC price increases due to the proposed amendments, and they are expected to be proportional to the amount of NOx RTCs currently needing to be purchased by these facilities. This information has now been included in Section 6: Affected Facilities.

II. REMI IMPLEMENTATION QUESTIONS

Response to Comment II-A:

Table 17 lists the industry sectors modeled in REMI that would either incur cost or benefit from the compliance expenditures. A full lists of policy variables are beyond level of detail needed for the average reader and thus are not presented in the report. (Policy variables are the channels through which the estimated economic changes due to the proposed amendments—for example, changes in production costs and market demand for goods or services—are inputted into REMI to generate macroeconomic impacts.) However, they are available to the public, and as requested by the commenter in his Public Records request, staff has prepared and sent REMI RWB files with a complete list of policy variables on October 14, 2015.

The operating and maintenance costs of the new capital equipment were modeled in REMI as a change in production cost for the RECLAIM facilities with identified cost-effective controls. The suppliers of the goods and services of these new equipment would receive additional spending, modeled as an increase in industry specific exogenous final demand. Please note that not all the additional spending would benefit the local economy, as the affected facilities may purchase the control equipment and the related goods and services from outside the region. The distribution of these additional spending within and outside the region is determined internally by the REMI model's Regional Purchase Coefficients. As a sensitivity test to this implicitly assumed spending distribution, staff also conducted a worst-case scenario where no additional spending would occur within the region.

As noted by the commenter, in the Draft Socioeconomic Report, staff did not enter into the REMI model the incremental compliance cost due to either additional RTC purchases or any increases in NOx RTC price. For the specific response to this comment, please see the response to Comment I-A.

Response to Comment II-B:

The installation costs associated with the BARCT capital equipment were entered into the REMI model as an increase in exogenous final demand in the construction sector. The commenter recommended that staff use the wage payments policy variable instead. However, it should be noted that, first, the increased exogenous final demand in the construction sector (the policy variable that staff used) automatically adds labor income based on the underlying Input-Output table and labor productivity. Second, after consultation with REMI staff and conducting several simulations, staff confirmed that the wage payments variable is an inappropriate policy variable to use. The most important reason is that it would inappropriately ignore the direct job creation impact

due to construction labor demands by control installation. As a result, an excessively small job impact would be observed in the construction sector, mainly due to indirect effects such as those working through increased labor income that would drive up residential construction labor demand. In fact, the largest impact of increased wage payments in the construction sector would be, literally, a higher average wage per worker in the construction sector. Staff does not consider this as the most appropriate modeled impact in the context of control installation.

Staff acknowledges that, when entered as an exogenous demand in the construction sector, the additional spending associated with control installation would result in increases in intermediate goods and services in the REMI model that, in reality, are remotely related to control installation. However, this result is largely related to the level of industry aggregation in the REMI model and, as advised by REMI staff, may be partially mitigated by choosing an appropriate translator policy variable that will constrain the direct effect to fewer, more disaggregate construction industries that are a subset of the broader construction sector. However, the use of this translator variable mitigates but does not completely resolve this issue. Moreover, the use of wage payments variable, as recommended by the commenter, would not be the solution to this problem.

In a comment letter sent by Kavet, Rockler & Associates on November 19, 2015, the commenter maintained the opinion that control installation cost should be entered into REMI as "Wage Bill-Construction" or "Compensation (amount)-Construction". Staff does not agree with this opinion as already explained in Response to Comment II-B. A simple exercise of entering the same amount of construction spending using the three different policy variables showed that the two policy variables suggested by the commenter generated an unreasonably low share of construction jobs among total jobs created. For example, in a simple exercise where a same amount of construction spending was increased in the region in one single year, more than 50 percent of total jobs projected to be created that year was concentrated in the construction sector when entered as "Exogenous Final Demand-Construction". In comparison, only 7-11 percent of jobs created was in the construction sector when entered as "Compensation (amount)-Construction" or "Wage Bill-Construction".

Response to Comment II-C:

Please see the response to Comment II-A.

Response to Comment II-D:

While the REMI model models capital investment using optimal capital stock theory, staff disagrees with its applicability for modeling the potential impact on current and future capital investment due to these proposed air pollution control amendments. Increments to capital investment, operating through the optimal capital stock mechanism, results in an appropriate modeled effect only when a facility is reasonably expected to lower its level of capital investment in the future by a similar amount spent on installing pollution control equipment. This can be the case in the situation where the affected facility has already planned on installing controls even without any policy interventions, and the effect of policy interventions would be to induce this investment made earlier in time. In terms of control installation under the RECLAIM program, staff does not consider this to be the appropriate situation, because absent clean air regulations and

programs, a facility is not expected to make capital investments on pollution abatement. Staff also consulted with REMI staff, who agreed with staff's assessment.

In a letter from Kavet, Rockler & Associates dated November 19, 2015, the commenter maintained the opinion that "the nonresidential capital stock requires that the incremental value be included." Staff has already responded with the reasons why this is not always the case, especially not when it comes to capital spending on pollution control. Staff did not claim that the effect is insignificant, as incorrectly suggested by the commenter, but that it is an inappropriate modeling approach based on the theoretical foundation of optimal capital stock.

Response to Comment II-E:

REMI input files as requested were delivered via public record request on October 14, 2015. Kavet, Rocker, and Associates, LLC followed-up on this data request with a letter dated November 19, 2015 that presented their cost estimates using the REMI data sheets requested.

According to staff's estimates, the present worth value of control installation under the proposed rule amendments would amount to $728 million to $1.1 billion (in 2014 dollars). The high-end cost estimate (i.e., $1.1 billion) was used to annualize compliance costs and project macroeconomic impacts using the REMI model. However, it was not clear to staff how the commenter arrived at the conclusion that the total cost for the 2018-2035 period would be as high as $2.1 billion (in 2009 dollars) under the proposed rule amendments, or the "Proposed Project". One plausible explanation was that the commenter may have inadvertently double counted the compliance cost by adding up the same values assigned to both "Production Cost" and "Exogenous Final Demand" variables, which is a usual modeling practice to reflect the fact that one industry's compliance cost spending will benefit other industries that either manufacture control equipment or provide control installation related services.

III. GENERAL QUESTIONS AND/OR COMMENTS

Response to Comment III-A:
Staff believes that the compliance cost of control installation and the incremental compliance cost due to the effect of the NOx RTCs shave on the credit market are not the same in nature and should not be simply added. For example, the incremental compliance cost of purchasing additional RTCs could result in financial gains to a facility that installs cost-effective controls and thus has surplus NOx RTCs for sale. The financial gains would then offset the compliance cost of control installation. Therefore, simply adding up both categories of compliance costs could result in double counting.

Response to Comment III-B:

The Short-Term Economic Outlook section was provided at the request of stakeholders in order to assess the current state and overall health of the regional economy. This section presents the latest and credible economic forecast available by local economic development agencies and universities. Staff has also included a 10-year employment forecast by industry in Section 5: Short-term/Long-term Economic Outlook.

Response to Comment III-C:

Please see the following link for the 2015-2016 Economic Forecast and Industry Outlook from the Los Angeles Economic Development Corporation (LAEDC).
http://laedc.org/2015/02/18/2015-2016-economic-forecast-published/

Please use the following link for the report published by the California State University, Fullerton. The commenter may need to contact the department to receive the full report.
http://business.fullerton.edu/Center/EconomicAnalysisAndForecasting/#Default

Response to Comment III-D:

Staff will present the impacts of the proposed amendments on the relative cost of production and relative delivered prices in the Final Socioeconomic Report. Regarding the macroeconomic impact associated with the projected NOx RTC transaction, please see the response to Comment I-A.

Response to Comment III-E:

Staff has removed the reference to the refineries' global revenue.

Response to Comment III-F:

Regarding the comment on RTC acquisition cost, please see the response to Comment III-A.

Staff has added a caveat, stating that refineries may not be able to pass on the full cost of the proposed amendment to consumers due to possible outside competition from gasoline imports. However, it should be noted that due to clean air regulations, the gasoline blends sold in this region are different from those permitted in other parts of the country. Therefore, any outside competition, if any, is expected to be very limited.