

# SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

## **Revised Draft Socioeconomic Report For Proposed Amendments to Regulation XX – Regional Clean Air Incentive Market (RECLAIM) NO<sub>x</sub> RECLAIM**

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## TABLE OF CONTENTS

PREFACE.....	ES-1
1. EXECUTIVE SUMMARY .....	1
2. INTRODUCTION .....	1
3. METHODOLOGY FOR SOCIOECONOMIC ASSESSMENT .....	3
4. REGULATORY HISTORY .....	4
4.1 Legislative Mandates.....	5
4.2 SCAQMD Governing Board Resolutions .....	5
4.3 Health & Safety Code Requirements .....	6
5. SHORT-TERM ECONOMIC OUTLOOK.....	6
6. AFFECTED FACILITIES.....	8
6.1 Small Businesses .....	10
7. COST OF BARCT INSTALLATION .....	10
7.1 BARCT Cost Estimates for Refinery Sector.....	18
7.1.1 Refinery FCCUs .....	18
7.1.2 Refinery Process Heaters and Boilers.....	20
7.1.3 Refinery Gas Turbines.....	21
7.1.4 Sulfur Recovery Units and Tail Gas Units (SRU/TGUs) .....	22
7.1.5 Petroleum Coke Calciner .....	23
7.2 BARCT Cost Estimates for Non-Refinery Sector.....	24
7.2.1 Container Glass Melting Furnaces.....	24
7.2.2 Sodium Silicate Furnace.....	24
7.2.3 Metal Heat Treating Furnaces .....	25
7.2.4 Gas Turbines (Non-Refinery/Non-Power Plant) .....	25
7.2.5 Internal Combustion Engines (Non-Refinery/Non-Power Plant) .....	26
8. MACROECONOMIC IMPACTS ON REGIONAL ECONOMY .....	27
8.1 Impact of Proposed Amendments .....	27
8.1.1 Potential Health Benefits.....	32
8.1.2 Competitiveness .....	33
8.1.3 Rule Adoption Relative to the Cost Effectiveness Schedule.....	34
8.1.4 Incremental Cost Effectiveness .....	34
8.2 Impact of CEQA Alternatives .....	35
8.2.1 Alternative 1 – Across the Board Shave of NOx RTCs.....	36
8.2.2 Alternative 2 – Most Stringent Shave of NOx RTCs.....	37
8.2.3 Alternative 3 – Industry Approach .....	37
8.2.4 Alternative 4 – No Project .....	38

8.2.5	Alternative 5 – Weighted by BARCT Reduction Contribution .....	38
9.	MARKET ANALYSIS.....	39
9.1	Assumptions for Price Analysis .....	41
9.2	Understanding the Impact of the First 4 tpd Shave .....	43
9.3	Potential Compliance Cost for Net Buyers: 45 Affected Facilities .....	44
9.4	Potential Compliance Cost for Net Buyers: 210 Facilities .....	47
9.5	Value of Shaved Excess RTCs.....	49
10.	COSTS OF COMMAND AND CONTROL (CAC) COMPARED TO RECLAIM 49	
11.	REFERENCES .....	54
12.	APPENDIX A: RESPONSE TO STAKEHOLDER COMMENTS.....	56

**PREFACE**

The draft socioeconomic analysis herein was based on the version of the rules presented at the July 22, 2015 Public Workshop and may not fully reflect the changes made to the rules as of the 30-day Set Hearing Package. Specifically, the present worth value (PWV) of the total costs associated with installing controls identified in the 2015 Best Available Retrofit Control Technology (BARCT) analysis was revised slightly to the range of \$0.73-1.10 billion from the range of \$0.62-1.09 billion.<sup>1</sup> These changes are relatively minor and expected to result in negligible differences to annualized cost and job impacts, especially given that the socioeconomic analysis utilizes the high-end cost estimate.

**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.

<p><b>Key Elements of the Proposed Amendments</b></p>	<p>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.</p> <p>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 &gt;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 &gt;150 mmBtu/hr, gas turbines and Internal Combustion Engines (ICEs) not located on the outer continental shelf (OCS).</p> <p>The proposed NOx shave of 14 tpd would be distributed as a 66 percent shave for 9 refineries and investors, a 47 percent shave for 30 electrical generating facilities, a 47 percent shave for 26 non-major facilities, and no shave for the 210 remaining facilities. By 2023, it would result in 12.5 tpd of remaining RTCs (26.5 tpd – 14 tpd = 12.5 tpd). This amount is expected to sufficiently account for the needs of all RECLAIM facilities, including growth and a compliance margin.</p>
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<sup>1</sup> As reported in the Draft Staff Report Tables 4.3 and 4.4.

<p><b>Affected Facilities and Industries</b></p>	<p>The proposed amendments would affect the current RTC holdings for 65 out of 275 RECLAIM facilities. The 65 affected facilities would include 9 major refineries, 30 electrical 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 30 electrical generating plants belong to sector of utility (NAICS 221), the remaining 26 facilities belong to the sectors of oil and gas extraction (NAICS 211), utility (NAICS 221), chemical manufacturing (NAICS 325), primary metal manufacturing (NAICS 331), non-metallic mineral manufacturing (NAICS 327), airport operation (NAICS 488), and paper manufacturing (NAICS 322).</p>
<p><b>Assumptions for the Analysis</b></p>	<p>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.</p> <p>The 9 refineries currently have the following equipment/source categories that have BARCT determinations for this rule amendment: 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™) with Wet Gas Scrubbers (WGS).</p> <p>The 11 non-refinery facilities currently have the following equipment/source categories that have BARCT determinations for this rule amendment: container glass melting furnaces, glass melting furnace facilities, sodium silicate furnaces, metal heat treating furnaces (rated less than mmBtu/hour), stationary ICEs and non-electrical 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.</p> <p>In total, the proposed rule amendments are assumed to result in the installation of the following new NOx air pollution control equipment:</p>

	<p>117 SCRs, 8 LoTOx™ with WGSs, 1 LoTOx™ without WGS, and 3 UltraCat DGSs.</p> <p>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™ technology.</p>
<p><b>Cost Impacts</b></p>	<p>The annualized compliance cost is estimated to be approximately \$72 million when evaluated at a 4 percent discount rate, or \$59 million when evaluated at a 1 percent discount rate from year 2022 onwards when all controls are assumed to have been installed. More than 80 percent of the annualized compliance cost is expected to occur in the refinery sector, and more than 40 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.</p> <p>Under the proposed shave, up to 15 out of 45 facilities subject to the shave but for which no BARCT has been identified would need to purchase up to 0.78 tpd of NOx RTCs annually from the market, up from 0.37 tpd that are currently needed. These potential compliance costs could represent up to 9 percent of the overall annual compliance cost associated with control installation (if RTC prices rise to just below the Proposed Amended Rule 2002 price trigger of \$22,500 per ton). Although the 210 facilities would not be shaved, some of them could potentially need to pay higher prices for RTCs. These potential compliance costs could represent up to 13 percent of the overall annual compliance cost associated with control installation (if RTC prices rise to just below the Proposed Amended Rule 2002 price trigger of \$22,500 per ton). However, since costs to RTC buyers are also gains to RTC sellers, the net effect of these projected RTC transactions would not result in additional cost for the RECLAIM universe.</p>
<p><b>Job Impacts</b></p>	<p>Job impacts due to the proposed amendments are projected for the maximum compliance cost of full BARCT installation, and are not related to the redistribution of wealth within the RECLAIM universe as a result of RTC transactions. It is projected that the proposed amendments would result in 13 net jobs created on an annual average between 2018 and 2035, and about 150 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. (Note that jobs foregone may include either losses of existing jobs or projected additional jobs not created. Projected job impact related to wealth redistribution is expected to be very minor largely due to the high level of industry aggregation in REMI.)</p>

	<p>In earlier years, the positive job impact from expenditures made by refineries, container glass, sodium silicate plants, and sulfur acid plants would more than offset the jobs forgone from the additional cost of doing business. The positive job impact would trickle down to the sectors of fabricated metal products (NAICS 332) and machinery manufacturing (NAICS 331) due to purchase of various types of control equipment (SCR, LoTOx™, UltraCat DGS, etc.) by the affected facilities. Likewise, the sector of construction (NAICS 23) would gain jobs in the local economy due to installation of the control equipment. In addition, the sector of professional and technical services (NAICS 541) is projected to gain jobs in earlier years from additional demand for equipment installation and maintenance. Operating and maintenance expenditures will benefit the industries of chemical products (NAICS 325) for additional sales of ammonia and public utilities (NAICS 22) for electricity.</p> <p>Between 2018 and 2035, the oil and gas extraction sector will incur 30 jobs forgone on an annual average 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 (10 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.</p>
<p><b>Health Benefits</b></p>	<p>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.</p> <p>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.</p>



<p><b>Impact of CEQA Alternatives</b></p>	<p>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.</p> <p>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 cost (\$8.20 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 result in an average of 30 jobs foregone on an annual average.</p> <p>Alternatives 1 and 2 would cost less than the proposed amendments, yet would experience more negative job impacts (approximately 70 and 100 jobs forgone on an annual average, respectively). 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.</p>
<p><b>Market Analysis</b></p>	<p>The proposed shave of 14 tpd of NOx RTCs for the top 65 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) to reduce actual emissions. In addition to the potential compliance cost of control equipment installation and operation for these facilities, the proposed amendments may potentially result in incremental compliance costs for other RECLAIM facilities as discussed in the cost impact section above.</p> <p>The total compliance costs associated with RTC purchases over the course of 25 years would amount to \$14 million to \$356 million (expressed in 2014 dollars), depending on the price scenario.</p>
<p><b>Costs of Command and Control Compared to RECLAIM</b></p>	<p>RECLAIM allows facilities to use the least cost 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. Therefore, by design, total costs to install controls under the RECLAIM</p>

	<p>program since its adoption will always be equal to or less than under command and control. 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-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.</p>
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## 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 the facilities and investors holding the top 90 percent of NO<sub>x</sub> RTCs, as weighted by a Best Available Retrofit Control Technology (BARCT) reduction contribution to achieve an overall reduction of 14 tons of NO<sub>x</sub> per day by 2023 according to the following implementation schedule as summarized below:

**Table 1: Implementation Schedule for NO<sub>x</sub> RTC Reductions**

<b>Implementation Year</b>	<b>Amount of NO<sub>x</sub> RTC Reductions (tons/day)</b>
2016	4
2018	2
2019	2
2020	2
2021	2
2022	2
<b>TOTAL</b>	<b>14</b>

The proposed shave of 14 tpd of NO<sub>x</sub> RTCs for the top 65 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) to reduce actual emissions.

At the beginning of the RECLAIM program in 1994, a total of 392 NO<sub>x</sub> 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 NO<sub>x</sub> program in 2013, with a total of 26.5 tpd RTC holdings. Over the past decade, however, actual emissions have consistently been less than total RTC holdings. 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 NO<sub>x</sub> 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.)

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 NO<sub>x</sub> RECLAIM amendments. Despite 7.7 tpd of NO<sub>x</sub> RTC shave from the 2005 amendments being implemented over the period of 2007-2011, only 4 tpd of actual NO<sub>x</sub> 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**

<b>Facility</b>	<b>2006 Audited NO<sub>x</sub> emissions (lbs)</b>	<b>2012 Audited NO<sub>x</sub> emissions (lbs)</b>	<b>Difference (tpd)</b>
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
<b>Total</b>			<b>2.62</b>

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 California Health and Safety Code (H&SC), SCAQMD staff conducted a BARCT assessment of the NO<sub>x</sub> 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 NO<sub>x</sub> 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<sup>2</sup>, 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 (except electrical 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 PM<sub>2.5</sub> standards by 2019 and 2024 and the ozone standards by 2024 and 2032, staff proposes reductions (or a “shave”) of NO<sub>x</sub> 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 26.5 tpd of NO<sub>x</sub> RTCs in total, among which the refinery sector holds 51 percent of the RTCs, electrical generating plants 21 percent, investors 4 percent and other RECLAIM facilities 24 percent. The proposed shave of 14 tpd would result in 12.5 tpd of remaining RTCs (26.5 tpd – 14 tpd = 12.5 tpd). This amount is expected to sufficiently account for:

- The projected 2022 emissions by RECLAIM facilities at the proposed 2015 BARCT levels<sup>3</sup>, which would be 10.18 tpd (2.71 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 2022 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 NO<sub>x</sub> RTC reductions would be distributed as a 66 percent shave for 9 refineries and investors, a 47 percent shave for 30 electrical generating plants, a 47 percent shave for 26 non-major facilities, and no shave for the 210 remaining facilities. As a result, the shave would directly affect a total of 65 facilities plus investors that together hold 90 percent of the 26.5 tpd of the NO<sub>x</sub> RTCs. Other facilities that would not be shaved may also be indirectly impacted by potential changes in RTC price due to the proposed NO<sub>x</sub> RTC reductions.

### 3. METHODOLOGY FOR SOCIOECONOMIC ASSESSMENT

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<sup>2</sup> Except for power producing 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 power producing facilities because this activity level better represents this sector’s energy consumption.

<sup>3</sup> To account for projected industry growth, the growth factor assumptions are: 1) 1.0 for the refinery sector; 2) 0.89 for power plants; and 3) 1.1 -1.3 for the non-refinery sector.

For the purpose of the socioeconomic analysis of the proposed amendments and CEQA alternatives for the NO<sub>x</sub> RECLAIM program, staff has assumed three compliance costs categories:<sup>4</sup> (1) costs of control equipment implementation for 9 refineries and 11 non-refineries that would be shaved, assuming all control equipment identified in the 2015 BARCT analysis would be 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 45 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 210 exempt 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 resulting from the shave for a fraction of the 45 facilities and the 210 exempt 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 NO<sub>x</sub> and SO<sub>x</sub> 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 NO<sub>x</sub> RTCs were relatively stable between \$1,500 and \$3,000 an annual ton per day. In 2000, prices of NO<sub>x</sub> RTCs rose very quickly to over \$45,000 a ton due to the increased demand for RTCs from electrical generating plants in response to

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<sup>4</sup> Note that the current socioeconomic analysis uses the high-end cost estimate specified in the Preliminary Draft Staff Report. Cost estimates based on Norton Engineering Consultants (NEC)’s analysis for the refinery FCCUs lie between the low- and high-end of the range provided in the staff report.

the deregulated electrical generation market and limited installation of air pollution controls. In order to address the issues in the RECLAIM market, the Board removed large electrical generating plants from the market in May 2001. These electrical generating plants were required to file compliance plans for the installation of BARCT and restrictions were placed on the use and trade of their NO<sub>x</sub> RTCs. Other amendments to RECLAIM in 2001 included filing of compliance plans and forecast reports by large (at least 50 tons of NO<sub>x</sub> emissions) and medium (between 25 and 50 tons of NO<sub>x</sub> emissions) non-electrical generating plant facilities and the access to RECLAIM Air Quality Investment Program (AQIP), Mitigation Fee Program, and state Emission Credit Bank by 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 electrical generating plants was projected to be \$9 million. The annualized cost for the level 1 controls (known technologies at the time) on non-electrical generating plant facilities was estimated to be \$26 million.<sup>5</sup> 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 NO<sub>x</sub> emission reductions, and the creation of mobile and area source credit rules.

In 2005, Regulation XX – RECLAIM was amended to achieve additional NO<sub>x</sub> 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 electrical 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 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

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<sup>5</sup> Specifically, Level 1 technologies included selective catalytic reduction (SCR) and low-NO<sub>x</sub> burner (LNB) controls on non-power plant 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).

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:

- Type of affected industries
- Impact on employment and the economy of the district
- Range of probable costs, including those to industries
- 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 (SO<sub>x</sub>), oxides of nitrogen (NO<sub>x</sub>), 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 ECONOMIC OUTLOOK**

According to the Wells Fargo Economic Forecast 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 of 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. The Southern California 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.

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 Model (REMI, 2014). Most of the affected RECLAIM facilities belong to manufacturing and utility 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%

Sector	Los Angeles			Orange			Riverside & San Bernardino			Southern California		
	2014	2015f	2016f	2014	2015f	2016f	2014	2015f	2016f	2014	2015f	2016f
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

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).

**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%

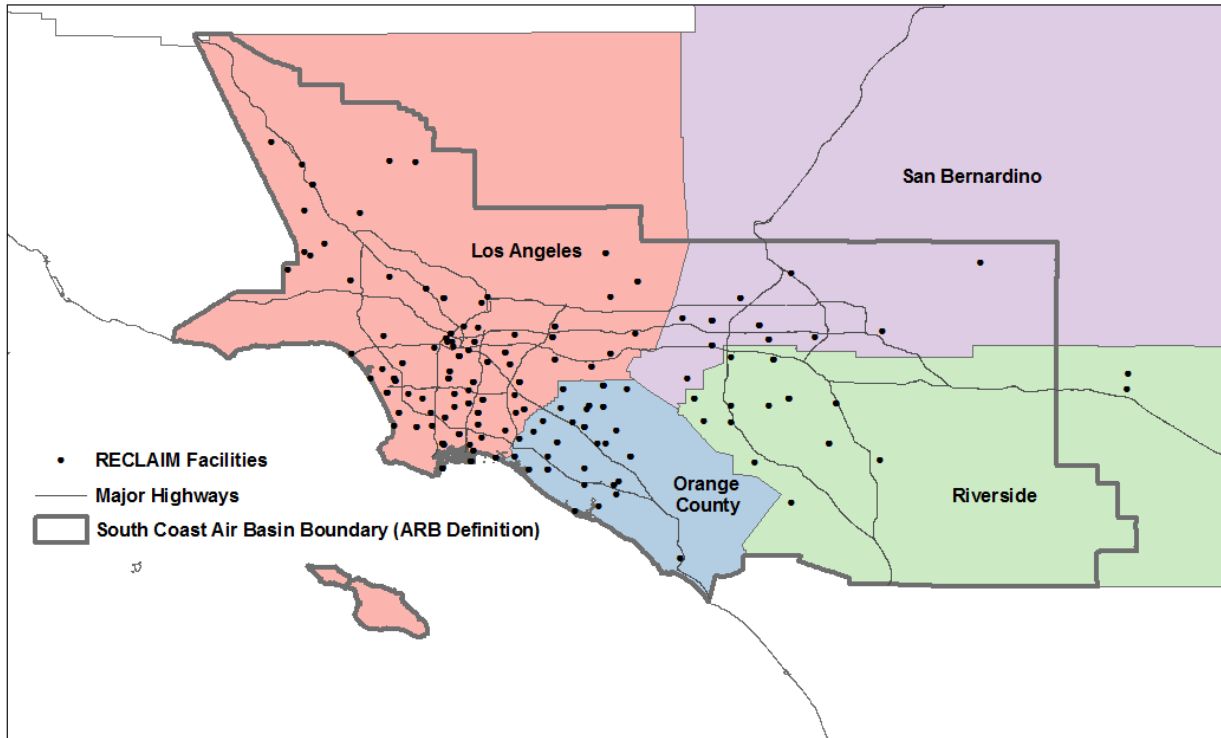
\*CSUF 2015 Economic Forecast

## 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.<sup>6</sup>

<sup>6</sup> 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 NO<sub>x</sub> RECLAIM program, the 14 tpd of NO<sub>x</sub> RTC reductions will only directly affect 65 facilities plus the investors that currently hold 90 percent of the NO<sub>x</sub> RTC credits. Out of the 65 facilities, 68 percent are in Los Angeles County, 6 percent in Orange County, 12 percent in Riverside County, and 14 percent in San Bernardino County.

They include 9 major refineries, 30 electrical generating plants, and 26 other top-emitting non-refinery facilities. The 9 affected refineries belong to the sector of petroleum product manufacturing (NAICS 324), the 30 electrical generating plants belong to sector of utility (NAICS 221), the remaining 26 facilities belong to the sectors of oil and gas extraction (NAICS 211), utility (NAICS 221), chemical manufacturing (NAICS 325), primary metal manufacturing (NAICS 331), non-metallic mineral manufacturing (NAICS 327), airport operation (NAICS 488), and paper manufacturing (NAICS 322).

For the remaining 210 facilities, no NO<sub>x</sub> RTC shave is proposed.

## 6.1 Small Businesses

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 NO<sub>x</sub>, 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.<sup>7</sup> 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.<sup>8</sup> For the 65 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.<sup>9</sup>

## 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

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<sup>7</sup> 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>.

<sup>8</sup> In order to reconcile discrepancies in Dunn & Bradstreet employment figures, estimates were acquired from SCAQMD Engineering & Compliance (RECLAIM Audit) permit data where applicable.

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 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 Preliminary Draft Staff Report, the total compliance cost of 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 (LoTOx™) 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-electrical generating plant 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: 117 SCRs, 8 LoTOx™ with WGSs, 1 LoTOx™ without WGS, and 3 UltraCat DGSs.

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

<b>Sector</b>	<b>Equipment/Source Category</b>	<b>Number of Affected Facilities</b>	<b>Estimated Number of Control Devices</b>
Refinery	Fluid Catalytic Cracking Units (FCCUs)	5	3 SCRs 2 LoTOx™ with WGSs

Sector	Equipment/Source Category	Number of Affected Facilities	Estimated Number of Control Devices
			1 LoTOx™ without WGS
Refinery	Refinery Process Heaters and Boilers	8	74 SCR
Refinery	Refinery Gas Turbines	5	7 SCR + Add Catalysts to 4 SCR
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
Non-Refinery	Metal Heat Treating Furnaces	1	1 SCR
Non-Refinery	Internal Combustion Engines (Non-Refinery/Non-Electrical generating Plant)	3	16 SCR
Non-Refinery	Turbines (Non-Refinery/Non-Electrical generating Plant)	7	13 SCR and 1 SCR replacement
		<b>TOTAL</b>	<b>117 SCR</b> <b>8 LoTOx™ with WGS</b> <b>1 LoTOx™ without WGS</b> <b>3 UltraCat DGS</b>

\* While the total number of affected facilities for the refinery sector is 9, there is an overlap for all of the equipment/source categories except the petroleum coke calciner

\*\* Even though both SCR and LoTOx™/scrubber are feasible technologies, LoTOx™ with WGS is considered in the socioeconomic report because they have higher costs for SRU/TGUs

\*\*\* Even though both UltraCat DGS and LoTOx™ with WGS are feasible technologies, UltraCat DGS is analyzed in the socioeconomic report because it has higher costs for petroleum coke calciner

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**

<b>Non-Refinery</b>		
<b>Source Category</b>	<b>Control Equipment</b>	<b>Required Time</b>
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
<b>Refinery</b>		
<b>Source Category</b>	<b>Control Equipment</b>	<b>Required Time</b>
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.<sup>10</sup> 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.

<sup>10</sup>Cost estimates are based on vendor-supplied information and assumptions resulted from staff engineering analysis. Staff cost estimates for refinery FCCUs, as reported in the staff report, range from \$152 to \$391 million. The corresponding NEC cost estimates range from \$163 to \$211 million. In order to be conservative, the Socioeconomic Analysis used the cost estimate of \$391 million. Additionally, in a comment letter dated August 21, 2015, Western States Petroleum Association (WSPA) states “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 stated in a working group meeting that their cost estimates were 2 to 3 times higher than those estimated in the Staff Report. As of October 6, 2015, the District has received no cost estimates from WSPA to analyze.

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

<b>Equipment Category</b>	<b>Average DCF \$/ton</b>	<b>Average LCF \$/ton</b>
Refinery Gas Turbine	\$1,900	\$3,300
Metal Heat Treating Furnace >150mmBtu/hr	\$3,400	\$5,500
Sodium Silicate Furnace	\$4,800	\$7,600
Glass Melting Furnace	\$4,900	\$7,600
Non-Refinery ICE Engine	\$6,000	\$9,600
Cement Kiln**	\$8,200	\$13,100
Refinery FCCU	\$10,500	\$18,000
Non-Refinery Gas Turbine	\$20,300	\$32,500
Coke Calciner	\$23,000	\$38,000
Refinery Boiler/Heater	\$28,000	\$45,000
SRU/TG	\$34,000	\$56,000
<b>Average</b>	<b>\$13,200</b>	<b>\$21,500</b>

\*DCF stands for Discounted Cash Flow and LCF stands for Levelized Cash Flow

\*\* The facility that uses cement kilns was shut-down in 2011 and therefore this source category does not appear in other tables.



Table 8: Distribution of Control Equipment Categories by Installation Schedules

Categories	2016		2018		2019		2020		2021		2022		Total Equip	Total tpd emi reductions
	# 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		
<b>Refinery Sector</b>														
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				
<b>Subtotal</b>		<b>0.04</b>		<b>2.40</b>		0.46		0.84		1.60		0.68		6.00
<b>Non-Refinery Sector</b>														
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
<b>Subtotal</b>				<b>0.09</b>		<b>1.64</b>		<b>1.04</b>						<b>2.77</b>
<b>Total Emission Red.</b>		<b>0.04</b>		<b>2.49</b>		<b>2.10</b>		<b>1.88</b>		<b>1.60</b>		<b>0.68</b>		<b>8.77</b>
<b>Proposed RTC Red.</b>		<b>4</b>		<b>2</b>		<b>2</b>		<b>2</b>		<b>2</b>		<b>2</b>		<b>14</b>

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.<sup>11</sup>

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

	2018		2019		2022		2035		Average Annual (2018-2035)	
	<b>Discount Rate Applied</b>									
	4%	1%	4%	1%	4%	1%	4%	1%	4%	1%
<b>Source Category Refinery</b>										
Refinery FCCU	0.00	0.00	9.40	7.79	25.24	20.95	25.24	20.95	21.86	18.11
Coke Calciner	0.00	0.00	5.83	4.89	5.83	4.89	5.83	4.89	5.51	4.62
Boilers/Heaters	0.00	0.00	0.00	0.00	17.58	13.12	17.58	13.12	15.12	11.29
Gas Turbines	0.30	0.29	0.76	0.73	3.08	2.95	3.08	2.95	2.70	2.58
SRU/TGs	0.00	0.00	0.00	0.00	7.97	5.84	7.97	5.84	6.50	4.72
<b>Total Refinery</b>	<b>0.30</b>	<b>0.29</b>	<b>16.00</b>	<b>13.41</b>	<b>59.73</b>	<b>47.77</b>	<b>59.73</b>	<b>47.77</b>	<b>51.85</b>	<b>41.48</b>
<b>Source Category Non-Refinery</b>										
Sodium Silicate Furnace	0.29	0.25	0.29	0.25	0.29	0.25	0.29	0.25	0.29	0.25
ICE Engines	0.00	0.00	2.38	1.98	2.38	1.98	2.38	1.98	2.25	1.87
Container Glass Furnace	0.00	0.00	1.03	0.82	1.03	0.82	1.03	0.82	0.97	0.78
Gas Turbines	0.00	0.00	0.00	0.00	8.34	7.63	8.34	7.63	7.41	6.78

<sup>11</sup> 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/](https://www.whitehouse.gov/omb/circulars_a094/a94_appx-c/)).

Metal Heat Furnace >150 mmBtu/hr	0.00	0.00	0.62	0.56	0.62	0.56	0.62	0.56	0.59	0.53
<b>Total Non-Refinery</b>	<b>0.29</b>	<b>0.26</b>	<b>4.32</b>	<b>3.63</b>	<b>12.66</b>	<b>11.26</b>	<b>12.66</b>	<b>11.26</b>	<b>11.50</b>	<b>10.22</b>
<b>Grand Total</b>	<b>0.590</b>	<b>0.550</b>	<b>20.32</b>	<b>17.04</b>	<b>72.39</b>	<b>59.03</b>	<b>72.39</b>	<b>59.03</b>	<b>63.36</b>	<b>51.70</b>

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 \$72 million (at 4 percent discount rate) or \$59 million (at 1 percent discount rate) from year 2022 onwards when all controls are assumed to have been installed. More than 80 percent of the annualized compliance cost is expected to occur in the refinery sector, and more than 40 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 utility sector (NAICS 221).

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

Industry (NAICS)	2018		2019		2022		2035		Average Annual (2018-2035)	
	Discount Rate Applied									
	4%	1%	4%	1%	4%	1%	4%	1%	4%	1%
Refineries (324)	0.30	0.29	16.00	13.41	59.73	47.77	59.73	47.77	51.85	41.48
Utility (221)	0.00	0.00	2.38	1.98	6.28	5.57	6.28	5.57	5.72	5.00
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	3.34	3.05	3.34	3.05	2.97	2.71
Nonmetallic Mineral Product Mfg. (327)	0.00	0.00	1.03	0.82	1.03	0.82	1.03	0.82	0.97	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
<b>Grand Total</b>	<b>0.59</b>	<b>0.55</b>	<b>20.32</b>	<b>17.04</b>	<b>72.39</b>	<b>59.03</b>	<b>72.39</b>	<b>59.03</b>	<b>63.36</b>	<b>51.70</b>

## 7.1 BARCT Cost Estimates for Refinery Sector

There are 9 refinery facilities subject to the NO<sub>x</sub> RECLAIM rules whose operators may choose to install NO<sub>x</sub> 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 NO<sub>x</sub> 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 LoTOx<sup>TM</sup> with WGSs, 1 LoTOx<sup>TM</sup> 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 NO<sub>x</sub> 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 NO<sub>x</sub> 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 NO<sub>x</sub> emissions from a FCCU (beyond what is currently being achieved through the use of NO<sub>x</sub> reducing additives), the potential available control technologies are either: 1) SCR; or, 2) LoTOx<sup>TM</sup> with WGS.

Two out of the 5 affected refineries are assumed to install SCRs and the remaining 3 are assumed to install LoTOx<sup>TM</sup> 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 LoTOx<sup>TM</sup> 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 LoTOx<sup>TM</sup> with WGSs are

estimated at \$33.47, \$54.89, and \$60.62 million, respectively. Assuming a 25-year life<sup>12</sup> 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 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 LoTOx™ with WGS portion of the system. The annual operating costs for the 3 LoTOx™ with WGSs units include utilities (electricity), ammonia/caustic, waste water, and other periodic maintenance. The annual operating cost for each LoTOx™ 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 3LoTOx™ with WGS units would sum up to about \$10.7 million.<sup>13</sup> Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the FCCU units would amount to \$25.2 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)**

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

\*Total value every 5 years

<sup>12</sup> 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.

<sup>13</sup> The total O&M cost in Table 11 is the sum of annual electricity/water, ammonia/caustic and annualized cost of the catalyst.

### 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 NO<sub>x</sub> 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 NO<sub>x</sub> emissions from refinery boilers and process heaters was assumed to be accomplished with SCR technology. It was assumed that 8 refineries would install 74 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 74 SCR installations for the refinery boilers and heaters is estimated at \$15.36 million. The total annual operating and maintenance costs for the 74 SCR units are estimated at \$2.45 million.<sup>14</sup> Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the boilers and heaters would amount to \$17.79 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 Cost	Electricity/ Water	Ammonia /Caustic	Catalyst	Other Maintenances
1	\$7.36	\$25.80	\$0.34	\$0.10	\$0.13	\$0.07	\$0.03
3	\$0.44	\$1.54	\$0.02	\$0.01	\$0.01	\$0.00	\$0.00
4	\$4.51	\$15.79	\$0.21	\$0.06	\$0.08	\$0.04	\$0.02
5	\$11.98	\$41.98	\$0.55	\$0.16	\$0.22	\$0.11	\$0.06
6	\$11.32	\$39.67	\$0.52	\$0.16	\$0.21	\$0.10	\$0.05

<sup>14</sup> 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.

Refinery	Equipment Cost	Installation Cost	Total O&M Cost	Electricity/Water	Ammonia /Caustic	Catalyst	Other Maintenances
7	\$7.80	\$27.34	\$0.36	\$0.11	\$0.14	\$0.07	\$0.04
8	\$3.85	\$13.48	\$0.18	\$0.05	\$0.07	\$0.04	\$0.02
9	\$5.93	\$20.80	\$0.27	\$0.08	\$0.11	\$0.05	\$0.03
<b>Total</b>	<b>\$53.19</b>	<b>\$186.4</b>	<b>\$2.45</b>	<b>\$0.729</b>	<b>\$0.968</b>	<b>\$0.484</b>	<b>\$0.245</b>

### 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 NO<sub>x</sub> sources at the refineries in the SCAQMD. Collectively, the 21 gas turbines/duct burners emitted about 1.33 tpd of NO<sub>x</sub> in 2011.

For the purpose of the analysis, controlling NO<sub>x</sub> 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 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.<sup>15</sup> Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the gas turbines would amount to \$6.25 million using a 4 percent discount rate.<sup>16</sup> Table 13 presents the detailed costs per refinery.

<sup>15</sup> 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.

<sup>16</sup> The total annualized cost of \$6.25 million is different from the \$3.15 million that was reported in the draft released on September 9, 2015, due to the correction of a previous compilation error. The revised annualized cost now matches the estimated total cost of control installation (\$0.62-1.09 billion) reported in the Preliminary Draft Staff Report. The revision has negligible job impacts; therefore, no corresponding revisions were made in Table 10, nor in Section 8.

**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
<b>Total</b>	<b>\$3.91</b>	<b>\$11.73</b>	<b>\$5.25</b>	<b>\$1.58</b>	<b>\$2.09</b>	<b>\$1.06</b>	<b>\$0.52</b>

#### *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 NO<sub>x</sub> and SO<sub>x</sub> 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 NO<sub>x</sub> control option to be utilized in response to this portion of the proposed project is assumed to be LoTOx<sup>TM</sup> technology with a WGS or SCR. Three refineries are assumed to install 1 LoTox<sup>TM</sup> with WGS each and 1 refinery is assumed to install 2 LoTOx<sup>TM</sup> 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 LoTOx<sup>TM</sup> 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 LoTOx<sup>TM</sup> with WGS and SCR installations for the refinery SRU/TGUs is estimated at \$7.33 million. The total annual operating and maintenance costs are estimated at \$0.64 million.<sup>17</sup> Summing up the capital, operating, and maintenance costs, total annualized cost of compliance for the gas turbines would amount to \$7.98 million using a 4 percent discount rate. Table 14 presents the detailed costs per refinery.

<sup>17</sup> The total O&M cost in Table 14 is the sum of annual electricity/water, ammonia/caustic, waste water, and other maintenances.



**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	\$11.86	\$41.52	\$0.21	\$0.11	\$0.08	0.013*	\$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
<b>Total</b>	<b>\$25.47</b>	<b>\$89.15</b>	<b>\$0.64</b>	<b>\$0.32</b>	<b>\$0.24</b>	<b>\$0.03</b>	<b>\$0.04</b>

\*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 NO<sub>x</sub> emissions from the coke calciner: 1) LoTO<sub>x</sub><sup>TM</sup> with scrubber; and, 2) UltraCat DGS. The type of NO<sub>x</sub> 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 NO<sub>x</sub> 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 LoTO<sub>x</sub><sup>TM</sup> 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 \$5.84 million using a 4 percent discount rate.

## 7.2 BARCT Cost Estimates for 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 NO<sub>x</sub> RECLAIM program there is 1 facility among the top NO<sub>x</sub> 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 NO<sub>x</sub> 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 annual 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 NO<sub>x</sub> RECLAIM program, there is only 1 facility that produces sodium silicate in a melting furnace. NO<sub>x</sub> emissions are also created from combusting fuel needed to heat the furnace. To effectively achieve the largest reduction of NO<sub>x</sub> emissions, it was assumed that the affected facility would chose 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 \$0.29 million 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 and into a liquid molten consistency and to maintain the metal in a liquid state until it is ready for later use. Among the top NO<sub>x</sub> emitting facilities in the NO<sub>x</sub> 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 NO<sub>x</sub> reduction from these metal heat treating furnaces, SCR is the technology that is best suited for the flue gas treatment of NO<sub>x</sub>. 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 \$0.62 million using a 4 percent discount rate.

### **7.2.4 Gas Turbines (Non-Refinery/Non-Electrical generating Plant)**

Stationary gas turbines are used primarily to drive compressors or to generate electrical generating. Among the top non-electrical generating plant NO<sub>x</sub> 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 NO<sub>x</sub> emissions from the 4 non-refinery/non electrical generating plant 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 \$2.42 million. The total annual operating cost of these 14 SCRs is estimated at \$5.92 million.<sup>18</sup> Summing up the

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<sup>18</sup> The total O&M cost in Table 15 is the sum of annual electricity, ammonia/urea, and annual cost of catalyst.

capital, operating, and maintenance costs, total annualized cost of compliance for the gas turbines would amount to \$8.34 million using a 4 percent discount rate. Table 15 presents the detailed costs per facility.

**Table 15: Total Capital, Installation, and Annual Operating Cost of SCRs for Non-Electrical generating plants 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	\$3.48	\$6.97	\$1.57	\$0.55	\$0.57	\$0.45
<b>Total</b>	<b>\$12.59</b>	<b>\$25.21</b>	<b>\$5.92</b>	<b>\$1.39</b>	<b>\$3.11</b>	<b>\$1.41</b>

### 7.2.5 Internal Combustion Engines (Non-Refinery/Non-Electrical generating Plant)

Stationary Internal Combustion Engines (ICEs) are used primarily to drive pumps, compressors, or to generate electrical generating. 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.<sup>19</sup> Summing up

<sup>19</sup> The total O&M cost in Table 16 is the sum of annual electricity, ammonia/urea, annual cost of catalyst, and other maintenances.

the capital, operating, and maintenance costs, total annualized cost of compliance for the ICEs would amount to \$2.37 million using a 4-percent discount rate. Table 16 presents the detailed costs per facility.

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

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

## 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.<sup>20</sup>

### 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 \$72 million when evaluated at a 4 percent discount rate, or \$59 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

<sup>20</sup> 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>.)

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 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, LoTOx™, 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	Industries Incurring Compliance Costs (NAICS)	Industries Benefitting from Compliance Spending (NAICS)
Installation of SCR, LoTOx™, UltraCat DGS	Refinery (NAICS 324), Manufacturing (NAICS 331), Utility (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)	<i>One-time-Capital:</i> Machinery Manufacturing (NAICS 333)
Installation of SCR, LoTOx™, UltraCat DGS	Refinery (NAICS 324), Manufacturing (NAICS 331), Utility (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)	<i>One-time-Capital:</i> Construction (236)
Operating and Maintenance Cost of SCR, LoTOx™, UltraCat	Refinery (NAICS 324), Manufacturing (NAICS 331), Utility (NAICS 221), Chemical Manufacturing (NAICS 325),	<i>Recurring:</i> Professional, Scientific, and Technical Services (541)

Source of Compliance Costs	Industries Incurring Compliance Costs (NAICS)	Industries Benefiting from Compliance Spending (NAICS)
DGS	Nonmetallic Mineral Product Manufacturing (NAICS 327), Oil and Gas Extraction (NAICS 211), and Support Activities for Transportation (NAICS 488)	
Other Operating and Maintenance Costs: Electricity, Water	Refinery (NAICS 324), Manufacturing (NAICS 331), Utility (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)	<i>Recurring:</i> Utility (221)
Other Operating and Maintenance Costs: Ammonia/Urea, Caustic, Oxygen	Refinery (NAICS 324), Manufacturing (NAICS 331), Utility (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)	<i>Recurring:</i> Chemical Manufacturing (NAICS 325)
Other Operating and Maintenance Costs: Solid Waste Disposal & Waste Water	Refinery (NAICS 324)	<i>Recurring:</i> 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 13 net jobs could be created annually from 2018 to 2035, and about 150 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 NO<sub>x</sub> 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 2,300 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 (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, LoTOx<sup>TM</sup>, 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

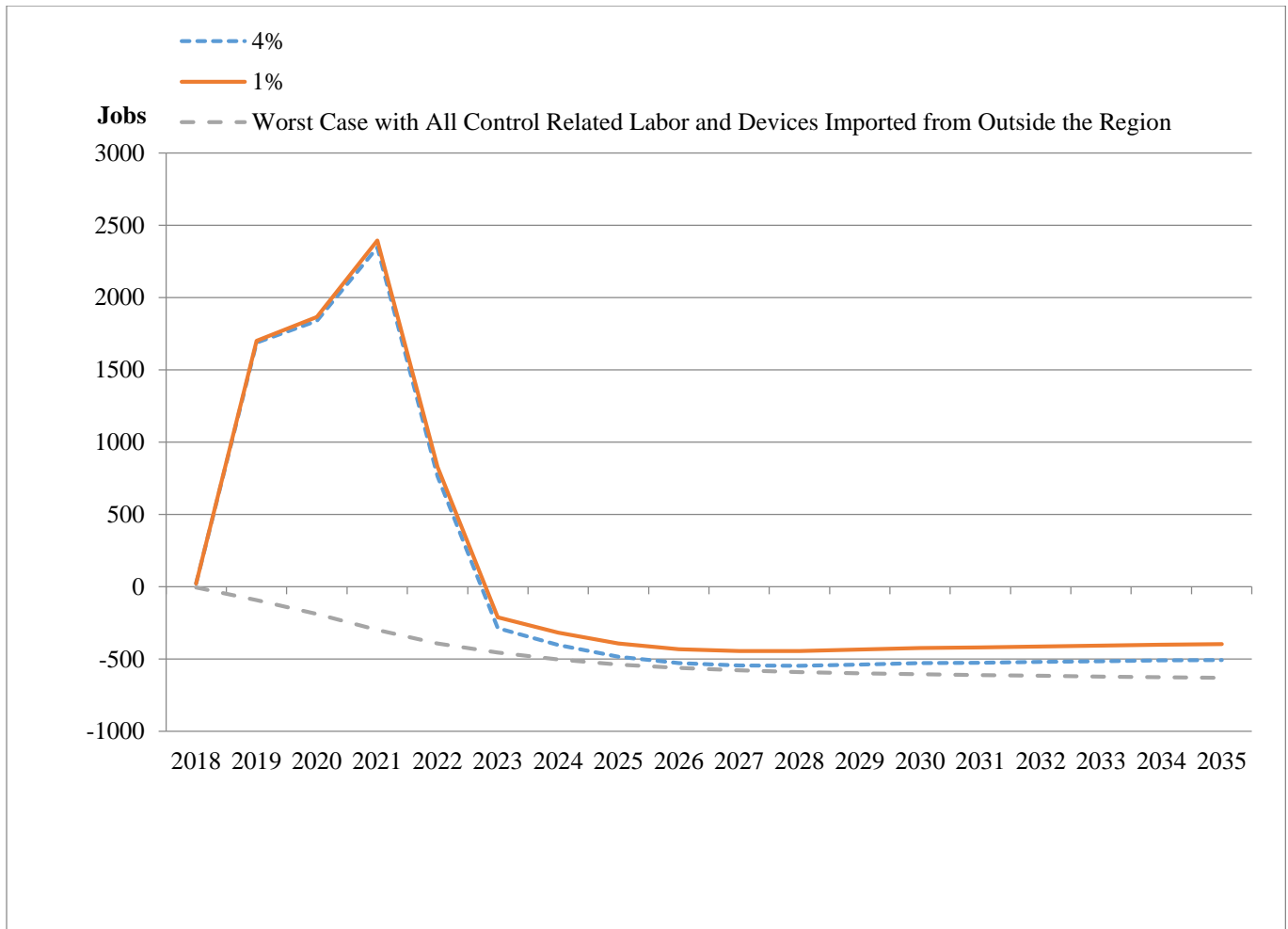
Industry	NAICS	Year					Average Annual (2018-2035)
		2018	2021	2022	2030	2035	
Oil and gas extraction	211	0	-11	-20	-46	-48	-33
Utilities	22	0	5	4	1	0	2
Construction	23	11	1264	468	-120	-88	117
Nonmetallic mineral product mfg.	327	0	10	3	-3	-2	0
Fabricated metal product mfg.	332	0	22	7	-4	-4	1
Machinery mfg.	331	1	47	21	2	1	9
Petroleum and coal product mfg.	324	0	-4	-7	-13	-13	-10
Chemical mfg.	325	0	5	3	1	1	2
Rest of Manufacturing	31-33	0	25	-3	-13	-11	-7
Wholesale trade	42	1	61	23	-5	-5	7
Retail trade	44-45	1	101	3	-62	-60	-28
Truck transportation and couriers	484,492	0	14	3	-5	-5	-1
Monetary authorities	521,522,525	0	15	4	-3	-2	1
Securities, and commodity contracts	523	0	33	4	-7	-4	-1
Insurance carriers and related activities	524	0	10	2	-3	-3	0
Real estate	531	0	45	12	-20	-20	-6
Professional and technical services	54	2	130	52	-2	-44	-1
Management of companies and enterprises	55	0	10	2	-34	-2	-1
Administrative and support services	561	1	92	27	-3	-28	-4
Waste management and remediation services	562	0	3	2	-27	-2	0
Educational services	61	0	26	7	-2	-8	-1
Ambulatory health care services	621	1	68	17	-8	-20	-3
Hospitals	622	0	15	5	-19	-8	-2
Nursing and residential care facilities	623	0	12	3	-6	-5	-1
Social assistance	624	0	38	10	-5	-13	-2
Performing arts and spectator sports	711	0	10	0	-12	0	0
Amusement, gambling, and recreation	713	0	7	2	-2	-1	0
Accommodation	721	0	12	3	-1	-3	0
Food services and drinking places	722	1	63	21	-3	-27	-5
Repair and maintenance	811	0	26	7	-23	-4	1
Personal and laundry services	812	0	38	7	-5	-8	0
Membership associations and organization	813	0	22	5	-9	-4	0
Private households	814	0	11	2	-5	-2	0
Other Industries		0	39	5	-2	-14	-6
Government		1	85	57	-15	-50	-12
<b>Total</b>		<b>22</b>	<b>2347</b>	<b>763</b>	<b>-527</b>	<b>-506</b>	<b>13</b>

\*The job impacts are projected for the regional economy, which include 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, utility expenditures are paid to local utility 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 470 jobs forgone. The approximately 500 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 (NO<sub>x</sub>) 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.<sup>21</sup> 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 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 PM<sub>2.5</sub> standards. NO<sub>x</sub> is also a precursor to PM<sub>2.5</sub>. Exposure to high levels of PM<sub>2.5</sub> 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 PM<sub>2.5</sub> is associated with premature deaths. According to recent estimates by the California Air Resources Board, elevated ambient PM<sub>2.5</sub> levels result in approximately 4,100 premature deaths annually in the South Coast Air Basin.

The reductions in ozone and PM<sub>2.5</sub> associated with the proposed rule amendments have the potential to reduce the mortality and morbidity incidences associated with NO<sub>x</sub> emissions.

### **8.1.2 Competitiveness**

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.

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<sup>21</sup> 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](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.

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.

The proposed amendments are not expected to impose discernable impacts relative to the cost of services or delivered prices of the affected facilities. Based on the 2014 annual financial reports, the total gross annual revenue of the corporations which own the 9 affected refineries was about \$963 billion. Based on this estimate, the total annualized cost for the 9 refineries (\$41 to \$52 million) represents approximately 0.004 to 0.005 percent of their estimated corporate gross annual sales. 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.<sup>22</sup> 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.

### ***8.1.3 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 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.

### ***8.1.4 Incremental Cost Effectiveness***

Please refer to the Draft Staff Report.

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<sup>22</sup> 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.

## 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 NO<sub>x</sub> BARCT emission limits would be achieved. After further analysis, staff determined Alternatives 3 and 4 do not comply with state law.

**Table 19: Proposed Amendments and CEQA Alternatives**

	<b>Proposed Amendments</b>	<b>Major Refineries/ Investors</b>	<b>Non-Major Facilities</b>	<b>Electrical generating Plants</b>	<b>Remaining Facilities</b>
<b>Staff Proposal</b>	<b>Shave Applied to Facilities and Investors Holding the Top 90% of RTCs (Weighted by BARCT Reduction Contribution)</b> <i>65 total facilities, plus investors</i>	<b>66%</b> <i>(9 Facilities)</i>	<b>47%</b> <i>(26 Facilities)</i>	<b>47%</b> <i>(30 Facilities)</i>	<b>0%</b> <i>(210 Facilities)</i>
<b>CEQA Alternatives</b>					
<b>CEQA Alternative #1</b>	<b>Across the Board</b> <i>Affects all facilities and investors</i>	<b>53%</b>	<b>53%</b>	<b>53%</b>	<b>53%</b>
<b>CEQA Alternative #2</b>	<b>Most Stringent Approach</b> <i>Across the Board without 10% Compliance Margin</i>	<b>60%</b>	<b>60%</b>	<b>60%</b>	<b>60%</b>
<b>CEQA Alternative #3</b>	<b>Industry Approach</b> <i>Across the Board: Difference between previous BARCT and new BARCT</i>	<b>33%</b>	<b>33%</b>	<b>33%</b>	<b>33%</b>

<b>CEQA Alternative #4</b>	<b>No Project</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>	<b>0%</b>
<b>CEQA Alternative #5</b>	<b>Weighted by BARCT Reduction Contribution</b> <i>Affects all facilities and investors</i>	<b>66%</b>	<b>36%</b>	<b>36%</b>	<b>36%</b>

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. 47 percent, or 3.12 vs. 2.77 tpd). Since these facilities will have their holdings reduced by 53 percent rather than the 47 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. 47 percent or 3.54 vs. 2.77 tpd). Since these facilities will have their holdings reduced by 60 percent rather than the 47 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 0.77 tpd of RTCs at a price of \$22,499 per ton, irrespective of the projected demand and supply of NOx RTC 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 assumed 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 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 NO<sub>x</sub> 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 NO<sub>x</sub> RECLAIM program

Under Alternative 4, existing Regulation XX would remain as currently written. Additional NO<sub>x</sub> reductions are not anticipated because the current level of NO<sub>x</sub> allocations is projected to exceed NO<sub>x</sub> 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 NO<sub>x</sub> RTC reduction of 14 tpd that would affect all NO<sub>x</sub> RECLAIM facilities and investors. Although the total amount of shave is identical to the proposed project, the NO<sub>x</sub> 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, NO<sub>x</sub> RTC holdings for major refineries and investors would be shaved by 66 percent and the NO<sub>x</sub> 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 20 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 20: 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	\$63.36	+13	14
Alternative 1	\$44.50	-72	14
Alternative 2	\$54.85	-98	15.87
Alternative 3	\$8.20	-29	8.77
Alternative 4	\$0	0	0
Alternative 5	\$60.78	+21	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 (\$8.20 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 (approximately 70 and 100 annual jobs forgone, respectively). 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 45 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 NO<sub>x</sub> 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 45 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 210 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 210 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 NO<sub>x</sub> 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. Because the RTC price scenarios were set 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.<sup>23</sup> Projected job impact related to wealth redistribution is expected to be very minor largely due to the high level of industry aggregation in REMI.

Finally, the monetary value of the shaved RTC holdings, which would be removed from the 65 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 49.

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<sup>23</sup> Stakeholders have mentioned in various meetings that the redistribution of wealth among buyers and sellers is not completely contained within the RECLAIM universe as brokers may take profits from the selling of RTCs outside the Basin. It should be noted that the few brokers within the RECLAIM universe may have helped reduce friction in the market by bringing down the "search costs" for both buyers and sellers. As such, any gains realized outside the market could be more than offset by the potential reduction in search costs that the brokers provide to the market.

## 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.<sup>24</sup> 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 21 summarizes the results below.

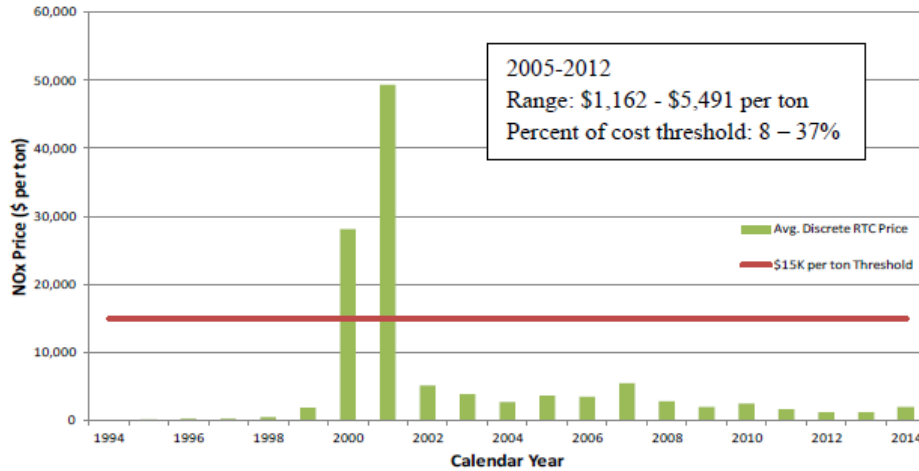
**Table 21: Estimates of RTC price increases**

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 NO<sub>x</sub> in 2005. As a result of the January 2005 amendment, NO<sub>x</sub> 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 NO<sub>x</sub> reductions specified by the January 2005 amendment did not cause major RTC price spikes.

<sup>24</sup> 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>

Figure 3: NOx Discrete Prices vs. Threshold

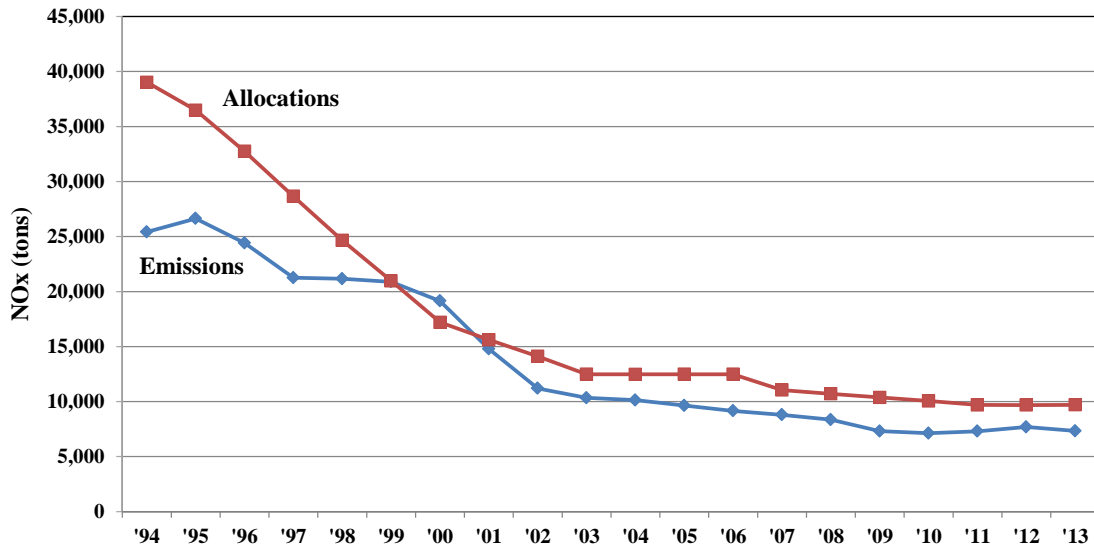


Additionally, since the RECLAIM program began in 1994, actual NOx emissions have consistently been well below total RTC holdings (except during California’s energy crisis in 2001). Figure 4 shows how, despite past changes in the market’s structure, there were sufficient amounts of NOx RTCs available 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 is 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 electrical generating plants for which their 2012 emissions were used as in the Preliminary 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 electrical generating plants. 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.

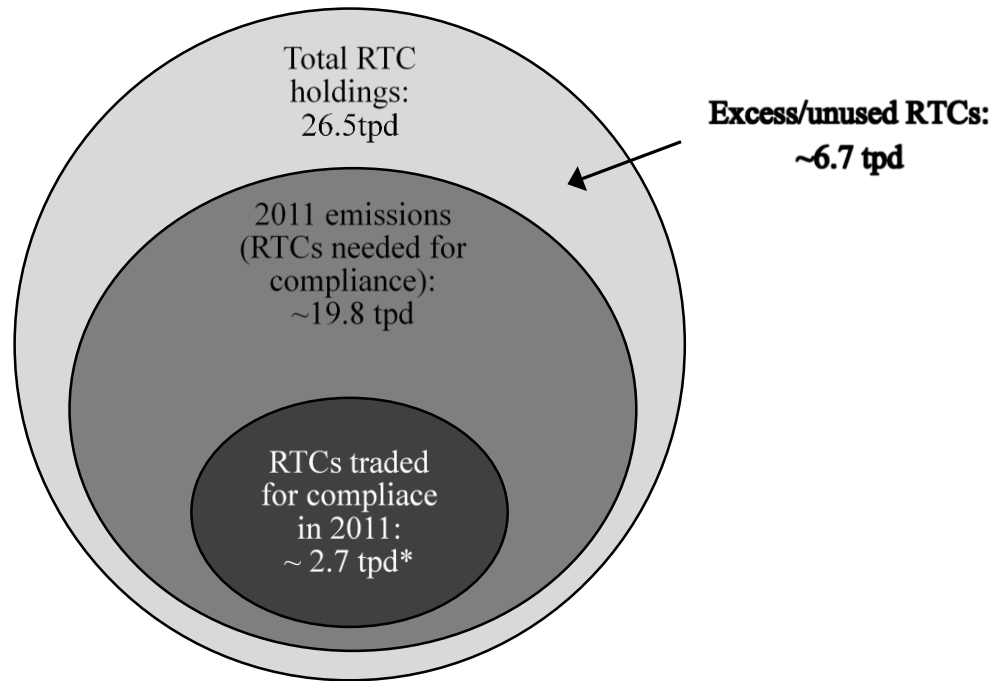
**Figure 4: Audited Emissions and RTC Holdings**



**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: 45 Affected Facilities**

For the first shave of 4 tpd in 2016, up to 15 of the 45 shaved facilities (6 existing net buyers and 9 new net buyers) could have their emissions exceed their RTC holdings, based on 2011 emission data. These 15 facilities are expected to purchase up to 0.46 tpd of NOx RTCs annually from the market, up from 0.39 that are currently needed. If RTC price remains constant following the shave, the facilities would incur costs of about \$100,000 for the additional 0.07 tpd of NOx credits needed (0.46 tpd - 0.39 tpd = 0.07 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 \$740,000/\$1.4 million/\$2 million/\$3.3 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 0.39 tpd already needed before the shave.<sup>25</sup>

As a result of the 14 tpd shave fully phased-in in 2022, up to 15 of the 45 facilities (7 existing net buyers plus 8 new net buyers) are expected to have their 2023 emissions exceed

<sup>25</sup> 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.

their projected RTC holdings, unless they make operational changes at their facility or purchase RTCs.<sup>26</sup> When CEQA alternatives are considered, the number of facilities that fall into this group of net buyers ranges from 11 to 20.

Under the proposed shave, these 15 facilities are expected to need to purchase up to 0.78 tpd of NO<sub>x</sub> RTCs annually from the market, up from 0.37 tpd that are currently needed. If RTC price remains constant following the shave, the facilities would incur costs of a little over half a million dollars for the additional 0.41 tpd of NO<sub>x</sub> RTCs needed (0.78 tpd – 0.37 tpd = 0.41 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 \$1.6/\$2.7/\$3.8/\$5.9 million respectively, not only for the cost of additional RTCs needed due to the shave but also for the higher price of 0.37 tpd already needed before the shave. By comparison, these potential compliance costs could represent up to 9 percent of the overall annual compliance cost associated with control installation.<sup>27</sup> 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 45 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 45 facilities would range between over \$300,000 to about \$8 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 22 summarizes the potential compliance cost for the proposed rule amendment and the CEQA alternatives for this group of facilities under different price scenarios.

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<sup>26</sup> 2023 emissions are calculated by applying a growth factor of 0.87 to the 30 electrical generating facilities' 2011 actual emissions and 1.10 growth factor to the remaining 15 facilities' 2011 actual emissions. In the Preliminary Draft Staff Report, however, staff projected the 2023 NO<sub>x</sub> emissions by electrical generating facilities based on the 2012 emissions. The resulting discrepancy is 0.4 tpd less of overall 2023 NO<sub>x</sub> emissions in this analysis, which erroneously applied the 2012-2023 growth factor of 0.87 for electrical generating facilities to a base year of 2011. However, about half of the 30 electrical generating facilities would have surplus RTCs to offset any minor increase in the projected emission increase. For the remaining half of electrical generating facilities (net buyers), up to \$1.7 million would be added to the cost of \$3.8 million (300% price increase scenario) for the proposed rule amendments in Table 22.

<sup>27</sup> 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 22: Annual Price Increases for Net Buyers for 45 Facilities from 2023 onwards

45 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	0.78	\$570	\$1,650	\$2,730	\$3,770	\$5,910
Alternative 1	18	0.88	\$700	\$1,920	\$3,130	\$4,310	\$6,720
Alternative 2	20	1.06	\$950	\$2,410	\$3,870	\$5,280	\$8,180
Alternative 3	11	0.61	\$330	\$1,170	\$2,000	\$2,820	\$4,480
Alternative 4	7	0.37	\$0	\$0	\$0	\$0	\$0
Alternative 5	11	0.64	\$370	\$1,240	\$2,120	\$2,970	\$4,710



#### 9.4 Potential Compliance Cost for Net Buyers: 210 Facilities

Among the 210 facilities that would be exempt from the proposed shave, approximately 100 facilities purchase NO<sub>x</sub> RTCs to remain in compliance according to the 2011 audited emissions and RTC holdings data. These 100 facilities represent 13 different industries with half belonging to the manufacturing sector (NAICS 31-33). In 2011, this group's NO<sub>x</sub> RTC holdings fell short of its actual NO<sub>x</sub> emissions by roughly 1 tpd, and this gap is expected to widen to 1.24 tpd in 2023 due to industry growth.<sup>28</sup> 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 210 facilities would not be shaved. If the price of NO<sub>x</sub> 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 \$1.7/\$3.4/\$5.1/\$8.5 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.<sup>29</sup> 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 210 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 \$600,000 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 23 summarizes the potential compliance cost for the proposed rule amendment and the CEQA alternatives for this group of facilities, under different price scenarios.

Overall, the total compliance costs associated with RTC purchases among the 255 facilities with no identified BARCT would amount to \$14 million to \$356 million (expressed in 2014 dollars) over the course of 25 years, depending on the price scenario.

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<sup>28</sup> 2023 emissions are calculated by applying a growth factor of 1.3 to each of the 210 facilities' 2011 actual emissions.

<sup>29</sup> See Footnote 19.

Table 23: Annual Price Increases for Net Buyers in 210 Facilities Group from 2023 onwards

210 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	103	1.24	\$0	\$1,720	\$3,430	\$5,090	\$8,500
Alternative 1	149	2.08	\$1,150	\$4,020	\$6,890	\$9,670	\$15,360
Alternative 2	153	2.22	\$1,340	\$4,410	\$7,470	\$10,430	\$16,500
Alternative 3	128	1.70	\$630	\$2,980	\$5,330	\$7,610	\$12,270
Alternative 4	103	1.24	\$0	\$0	\$0	\$0	\$0
Alternative 5	132	1.75	\$700	\$3,120	\$5,540	\$7,880	\$12,680

### 9.5 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 8.77 tpd of a BARCT shave and 5.21 tpd of an excess RTC shave. Staff does not agree with this division because 14 tpd of NO<sub>x</sub> RTC shave is necessary to induce a BARCT-equivalent level of *actual* NO<sub>x</sub> emission reductions. However, if a value is estimated for the 5.21 tpd excess RTC shave, it is \$7 million annually, applying the base price of \$3,779 per ton.

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.

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

RECLAIM allows facilities to use the least cost 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 NO<sub>x</sub> RTCs is needed to induce actual emission reductions equivalent to BARCT. The 2015 BARCT analysis demonstrated that there would be an actual NO<sub>x</sub> 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 NO<sub>x</sub> RTC holdings had closely matched the total amount of actual NO<sub>x</sub> emissions from the NO<sub>x</sub> universe, the removal of 8.77 tpd of NO<sub>x</sub> RTCs would likely induce an equivalent amount of actual NO<sub>x</sub> emission reductions. However, over the past five years, actual NO<sub>x</sub> emissions from RECLAIM facilities fell below the overall NO<sub>x</sub> RTC holdings by 21-30%, resulting in approximately 5.45-8.41 tpd of unused NO<sub>x</sub> RTCs (unused for compliance purposes). Therefore, the removal of 8.77 tpd of NO<sub>x</sub> RTCs would first eliminate some, if not all, of these excess NO<sub>x</sub> 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 NO<sub>x</sub> emission reductions.

The problem of excess unused RTCs is illustrated by the fact that the 2005 NO<sub>x</sub> shave did not achieve 2005 BARCT levels for the RECLAIM universe. The 7.7 tpd of NO<sub>x</sub> shave adopted in the 2005 RECLAIM amendments was phased in over the period of 2007-2011; however, only about 4 tpd of actual NO<sub>x</sub> emission reductions occurred between 2006 (the year before the 2005 shave began) and 2012 (the year after the 2005 shave was fully phased in).<sup>30</sup> 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 NO<sub>x</sub> emissions from the RECLAIM universe in 2023 would be consistent with the projected NO<sub>x</sub> emissions in 2023 at the 2015 BARCT levels. (Please see the Staff Report for the shave methodology.)

As discussed in the Preliminary 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 NO<sub>x</sub> RECLAIM universe. The total cost of full BARCT installation was estimated to be between \$0.62 billion and \$1.09 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;

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<sup>30</sup> 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.

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 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". 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 NO<sub>x</sub> 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-saving 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 NO<sub>x</sub> 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 SCR's.<sup>31</sup> The cost-savings would continue to accumulate as long as refineries are able to further delay the installation of SCR's 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 SCR's 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.

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. 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.

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<sup>31</sup> The total capital and installation cost for 47 SCR's 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.,  $\$460 \text{ million} \times (1.05)^{-8} - \$460 \text{ million}$ , in 2015 dollars), by the end of 2015. Meanwhile, the affected facilities purchased 1.7 tpd of RTCs in lieu of installing 47 SCR's. The cost of purchasing these RTCs over the past 8 years is estimated to be about \$15 million (i.e.,  $1.7 \text{ tpd} \times 365 \text{ days} \times \$3,000 \text{ per discrete ton of RTCs} \times 8 \text{ years}$ ). 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.)

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).<sup>32</sup>
- 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 are not 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.

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

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<sup>32</sup> Rule 2005—New Source Review for RECLAIM.

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## 12. APPENDIX A: 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.<sup>1</sup> 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

<sup>1</sup> 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”).

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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,<sup>2</sup> 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<sup>3</sup> 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).<sup>4</sup>
- 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).<sup>5</sup>
- 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.<sup>6</sup>

1-3

<sup>2</sup> ABT Associates, Review of the SCAQMD Socioeconomic Assessments, Documentation, Task 1-4 Final, 14 August 2014.

<sup>3</sup> Norton Engineering Consultants, Inc., SCAQMD NOx RECLAIM - BARCT Feasibility and Analysis Review, Non-Confidential Final Report No. 14-045-4, 26 November 2014.

<sup>4</sup> 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).

<sup>5</sup> Comparison of data presented in Norton Report (p. 21) to AQMD Staff data presented to the NOx RECLAIM WGM, 31 July 2014.

<sup>6</sup> Comparison of data presented in Norton Report (p. 24) to AQMD Staff data presented to the NOx RECLAIM WGM, 31 July 2014.

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.<sup>7</sup> 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.<sup>8</sup>

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,




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***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 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.

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 new BARCT is speculative, and should be addressed at the time of any rulemaking that actually results in stranded assets.

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, the socioeconomic analysis typically includes results estimated based on the costs provided by staff as well as WSPA and the refineries. For example, the socioeconomic analysis of the SO<sub>x</sub> RECLAIM rule amendment addressed a scenario where the costs estimated by WSPA for FCCUs and SRU/TGs were three times higher than staff's and consultants' estimates, which were also presented to the Board. In a recent 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. As of October 6, 2015, the District has received no cost estimates from WSPA to analyze.

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



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.

2-1

This "Industry RECLAIM Coalition" formally offers the following scoping comments on Socioeconomic Analysis for Proposed Amended Regulation XX.<sup>1</sup>

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

2-2

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

<sup>1</sup> 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").

<sup>2</sup> ABT Associates, Review of the SCAQMD Socioeconomic Assessments, Documentation, Task 1-4 Final, 14 August 2014.

<sup>3</sup> 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<sup>7</sup> 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"),<sup>4</sup> 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 Cheng, SCAQMD  
30 January 2015

While the BARCT technical analysis being conducted by AQMD Staff is being based on incremental cost effectiveness,<sup>5</sup> 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.<sup>6</sup> 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.

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,



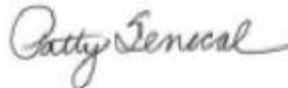
Bill Quinn  
California Council for Environmental and Economic Balance



Michael Carroll  
Regulatory Flexibility Group



Curtis Coleman  
Southern California Air Quality Alliance



Patty Senecal  
Western States Petroleum Association

<sup>5</sup> 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.

<sup>6</sup> AQMD NOx RECLAIM Working Group Meetings, 7 January 2015 and 31 July 2014.

2-5

**2- 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, staff report presented 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 for installation and some of the 210 facilities that are not shaved but would need to purchase RTCs for compliance purposes. These incremental costs would be the result of both additional units of RTCs needed to be bought 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 NO<sub>x</sub> 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 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 NO<sub>x</sub> emissions in 2023, which staff analysis shows can be achieved with 2015 BARCT, after making allowances for growth, a compliance margin, and uncertainties that arose in the BARCT analysis. Therefore, staff disagrees with WSPA and holds the opinion that the 14 tpd of proposed NO<sub>x</sub> RTC shave are entirely attributable to the 2015 BARCT. Moreover, 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 additional 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 current 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.