SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Draft White Paper:

Key Issues Relative to Proposed Amendments to Regulation XX – Regional Clean Air Incentives Market (RECLAIM)

BARCT Determinations; Cost-Effectiveness; Method, Amount, and Timing of Emission Reductions; and Other Key Issues

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PREFACE

This White Paper includes staff's technical analysis to date. The information is subject to change pending further review and input from stakeholders. The White Paper documents the technical analysis, lays out concepts for the RECLAIM amendments, discusses viewpoints that have been expressed, and describes how different issues are being addressed. Additional technical information is available on AQMD's web site at:

www.aqmd.gov/RECLAIM/RECLAIM_meetings.htm.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

The AQMD Governing Board adopted the Regional Clean Air Incentives Market (RECLAIM) program in 1993. The purpose of the RECLAIM program is to reduce NOx and SOx emissions through a market-based program. It is designed to provide facilities with the flexibility to seek the most cost-effective solution to reduce their emissions. The program replaced a series of existing command-and-control rules and control measures specified in the 1991 Air Quality Management Plan (AQMP).

AQMD staff is proposing amendments to Regulation XX –RECLAIM to achieve additional NOx reductions pursuant to the 2003 AQMP Control Measure #2003CMB-10. The proposed amendments also address requirements for Best Available Retrofit Control Technology (BARCT) in accordance with California Health and Safety (H&S) Code §40440, which is applicable to market-based incentive programs. Reductions in NOx will help the Basin attain ozone and PM2.5 standards. Other rule amendments include clarifications and changes to the protocols.

The reductions from the current staff proposal are 7.8 tons per day. In addition to staff's proposal, industry provided proposals. Figure ES-1 shows the reductions resulting from the staff proposal, industry proposals, current allocations, and the projected actual emissions based on the most recent reported emissions. The staff proposal calls for a reduction of 7.8 tons per day in two phases. Four tons per day would be reduced in 2007 and the remainder would be reduced in equal increments from 2006 to 2010. Under the staff proposal the power producers do not return to full trading market until 2007. Industry proposal 1 reduces 3 tons per day on a straight line rate over 3 years from 2007 to 2010. Industry proposal 2 reduces 4 tons total, with 2 tons being reduced in 2008 and 2 tons in 2009. Currently, there is a difference of about 5 tons per day between total RTCs and actual emission as described in this white paper. Power plants have substantially reduced their emissions as a result of Rule 2009 and currently hold approximately 3 to 4 tons per day of RTCs above their actual emissions. In addition, there are technologically feasible and cost effective reductions from many types of equipment in RECLAIM. The California Air Resources Board (CARB) endorses AQMD's approach.

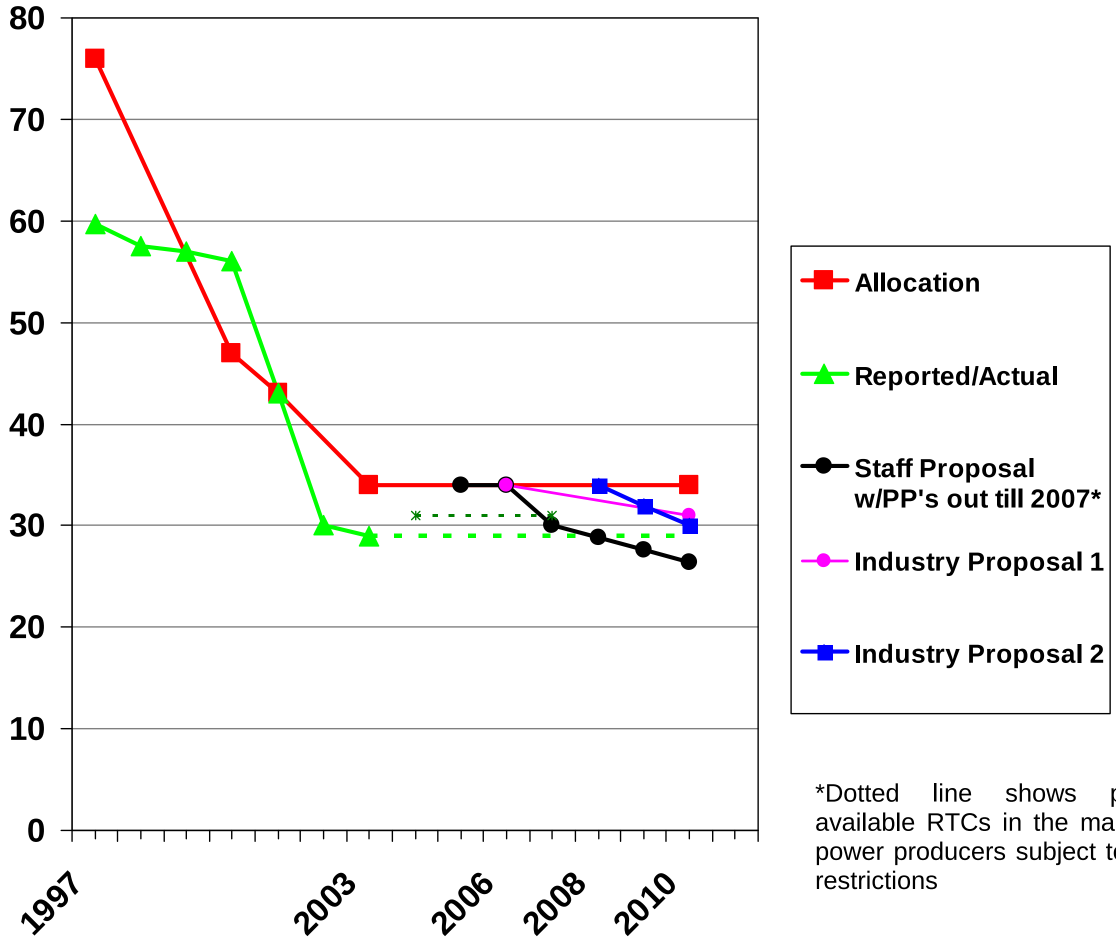
This White Paper includes technical information related to BARCT and cost-effectiveness, describes some of the key policy issues, describes different viewpoints, and makes preliminary staff recommendations.

Key issues discussed in the white paper include:

- BARCT determinations;
- Cost-effectiveness;
- Method of determining reductions;
- Amount of NOx RTC reductions;
- Timing of reductions;
- Method of applying reductions (program wide vs. industry specific); and
- Exemption from reductions.

This White Paper is developed in preparation for an informational hearing for the October 1 Governing Board meeting, where staff will highlight key issues and the public will have the opportunity to testify before the board regarding their suggestions for the program. The Board will not take action in October. The public hearing for adoption of the rule amendments would occur later this year.

Figure ES-1
NOx RTC Reductions
(Tons per Day)



*Dotted line shows projected available RTCs in the market with power producers subject to trading restrictions

INTRODUCTION

This White Paper includes technical information related to BARCT and cost-effectiveness, describes some of the key policy issues, describes different viewpoints, and makes preliminary staff recommendations.

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Background

The AQMD Governing Board adopted the Regional Clean Air Incentives Market (RECLAIM) program in 1993. The purpose of the RECLAIM program is to reduce NOx and SOx emissions through a market-based program. It is designed to provide facilities with the flexibility to seek the most cost-effective solutions to reduce their emissions. The program replaced a series of existing command-and-control rules and control measures specified in the 1991 Air Quality Management Plan (AQMP).

AQMD staff is proposing amendments to Regulation XX –RECLAIM to achieve additional NOx reductions pursuant to the 2003 AQMP Control Measure #2003CMB-10. This control measure addresses the requirement for Best Available Retrofit Control Technology (BARCT) in accordance with California Health and Safety (H&S) Code §40440, which is applicable to market-based incentive programs. Reductions in NOx will help the Basin attain ozone and PM2.5 standards. Other rule changes include clarifications and changes to the rules and protocols.

Requirements

The following sections describe three requirements that the AQMD must meet in adopting this rule amendment: the AQMP, state California H&S Code requirements §40440 regarding all feasible measures and BARCT, and California H&S Code §39616 applicable to market incentive programs.

Air Quality Management Plan (AQMP)

The 2003 AQMP was adopted by the Governing Board in August 2003. The plan was designed to demonstrate attainment with the state and national ambient air quality standards for ozone and PM10. Subsequently, the AQMP was approved by the CARB and submitted to EPA to update the State Implementation Plan (SIP). The 2003 AQMP contains a control measure calling for additional NOx emission reductions from RECLAIM sources. The control measure identified an approximate three (3) tons per day reduction of NOx from the program by the end of the 2010 compliance year. Beginning with the 2003 AQMP, BARCT will be evaluated every three years with future AQMP updates.

All Feasible Measures and BARCT

The California Clean Air Act (CCAA) requires districts to achieve and maintain state standards by the earliest practicable date and for extreme non-attainment areas, to include all feasible measures Health and Safety (H&S) Code (H&S §§40913, 40914, and 40920.5). The term "feasible" is defined in the 14 California Code of Regulations, section 15364, as a measure "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors." The required use of BARCT for existing stationary sources is one of the specified feasible measures. H&S Code §40440 (b)(1) requires AQMD to adopt rules requiring best available retrofit control technology for existing sources. H&S Code §40406 specifically defines BARCT as "…best available retrofit technology means an emission limitation that is based on the maximum degree of reduction achievable taking into account environmental, energy, and economic impacts by each class or category of source."

In RECLAIM, these emission limits were converted into mass emission limitations utilizing activity levels. Staff has examined the emission limits of other air pollution control district rules and other requirements for equipment categories in the RECLAIM program in an effort to determine the appropriate mass emission reductions to reflect BARCT, and, thus, all feasible measures for the sources. New BARCT limits would then be reflected as a reduction in the allowable mass emissions. Staff also examined what retrofit technologies had been achieved in practice. Staff also reviewed the technology and emission limits applied to all categories of equipment in the RECLAIM program. (For a list of RECLAIM equipment, the reader is referred to the tables at the conclusion of Rule 2002). As a result, staff has identified new BARCT levels for specific categories of equipment. The proposed BARCT for each category takes into account the range of types and size of equipment in each category. A more detailed discussion on BARCT as applicable to the proposed rule amendments is presented in Section I.

H&S Code 39616

As required in the California H&S Code §39616, which is applicable to market-based incentive programs, RECLAIM must result in an equivalent or greater level of emission reductions at an equivalent or lower cost as would have been achieved under a command-and-control regulatory structure. This equivalency demonstration was made when the RECLAIM program was adopted in October 1993 and again seven years after rule adoption (October 2000). In addition to making these demonstrations, the District found in its October 2000 report that the program met the BARCT requirements of H&S Code §40440 for all facilities, including power plants.

H&S Code Section 39616(c) - Market-Based Incentive Programs, requires the AQMD Governing Board to make findings that the program, as compared to command and control regulations, to which these sources would be subject: (1) achieves equivalent or greater emission reductions at equivalent or less cost; (2) has comparable enforcement and monitoring; (3) will not result in greater job loss or shift to lower skilled jobs; (4) promotes privatization of compliance and electronic availability of data; (5) does not delay compliance with the California Clean Air Act Amendments regarding the California ambient air quality standards; and (6) will not result in disproportionate impacts on sources in the program, in the aggregate. Equivalency to command and control encompasses not only BARCT, as discussed above, but also New Source Review and other programs.

These findings were made for the original program adoption and have not changed for any of the subsequent rule amendments. The Health and Safety Code also requires that these findings be ratified no later than seven years after program adoption. This ratification occurred in October 2000. Findings will be made relative to the current proposed amendments.

Rule 2007 and Power Producers Trading Restrictions

In May 2001, Regulation XX was amended to address the RTC price spike due to California's energy crisis. At the time, power plants were required to install BARCT, temporary mitigation programs were established to offset excess emissions from power plants, and trading restrictions were placed on power producing facilities. The goal of the May 2001 amendments was to implement realistic, effective solutions to reduce and stabilize the prices of NOx RTCs. Power producing facilities could fully rejoin the trading market in the 2004 compliance year, provided that the Governing Board determined prior to July 2003 that their re-entry would not result in any negative effect on the remainder of the RECLAIM facilities or on California's energy security needs. These findings were made at the June 2003 public hearing.

The Governing Board adopted proposed changes to Rule 2007 at the December 5, 2003 public hearing, which would have removed most of the trading restrictions. However, CARB expressed concerns regarding reentry of power plants into the full market before the BARCT analysis and allocation adjustments were implemented. Consequently, as part of the amendments, the Governing Board approved a provision to allow power producers to trade among themselves and set a future effective date of September 1, 2004 when power producers would have unrestricted trading of RTCs. At that time, it was anticipated that rule amendments to implement BARCT and adjust allocations would be completed prior to September 2004.

Rule 2007 is currently proposed for amendment at the September 3, 2004 Governing Board meeting to extend current trading restrictions. The current version of Rule 2007 limits power producing facilities from reconciling emissions using NOx RTCs that were purchased on or after January 12, 2001 and ending August 31, 2004, unless certain criteria are met. Under the current rule, effective September 1, 2004, the power producers will have unrestricted use of RTCs. However, to address CARB concerns regarding reintroducing power plants to the trading market before the program is adjusted for BARCT, the proposal would continue the existing use restrictions until other RECLAIM rule amendments occur that will decrease allocations to reflect BARCT as required under state law. Therefore, under the proposed amendment, current Rule 2007 provisions will continue until RECLAIM rules are amended and the specific date to remove trading restrictions specified. Power producing facilities will continue to be able to:

- sell NOx RTCs to the District; and
- sell RTCs above the facility's original allocation for each compliance year.

The proposed amendments would delay the September 1, 2004 removal of trading restrictions until adoption of the rule amendments implementing the 2003 AQMP control measure and BARCT equivalency.

Current Staff Proposal for NOx Reductions

The current staff proposal was developed using the AQMP method to calculate BARCT and equivalency to command and control. Based on the 2003 AQMP baseline inventory and growth projection, this method results in a projection of future actual emissions. Results from the application of this methodology reflect the most recent benchmark for command and control equivalency determination. More detailed information on the AQMP method is provided in Section III of this paper. The proposal includes adding a 10% adjustment to remaining emissions to account for inaccessible RTCs due to imperfect market conditions and RTCs held by facilities to ensure compliance with annual audits.

Previously, staff proposed an across-the-board reduction in RTC holdings for the RECLAIM program. The reductions would be implemented in equal increments beginning in compliance year 2006 and continuing through compliance year 2010, on a straight-line rate of reduction. Also considered under the proposal was a provision to allow the RTC reductions during the last year to become tradable in the event the price exceeded $15,000 per ton. The $15,000 per ton trigger for program evaluation would be retained as a program backstop measure. It should be noted that the $15,000 per ton is the threshold specified in paragraph (b)(6) in Rule 2015 – Backstop Provisions. According to this rule requirement, exceeding an RTC price of $15,000 would result in a RECLAM program evaluation. Staff also proposed criteria by which a facility would be exempt from RTC holding reductions. These criteria were only applicable to original RTCs, not additional holdings, as follows:

- 1994 allocations equal 2000 allocations; and
- End factors for all equipment categories for compliance year 2000 less than or equal to new BARCT.

Staff originally proposed that RTC reductions be submitted to the SIP for compliance years 2006 through 2009. The additional reductions for compliance year 2010, however, would not be submitted to the SIP due to the potential for some or all of them to be temporarily used in the event RTC prices rise beyond $15,000 per ton and the program is subject to review pursuant to Rule 2015.

Based on a concern that the actual emissions from the program would not equal the RTC allocations until 2008, the Staff has revised its proposal. Under the revised proposal reductions would be 7.8 tons per day (this number is a preliminary number and subject to final verification). The reductions would be implemented in phases: 4 tons per day of reductions in compliance year 2007 and the remaining 3.8 tons per day of reductions would be implemented in equal increments beginning in compliance year 2008 and continuing through compliance year 2010, on a straight-line rate of reduction. Current trading restrictions on power producers would remain in effect until 2007. The $15,000 per ton trigger for program evaluation would be retained as a program backstop measure. The last year RTC reductions would be held back from the SIP submittal if the price of RTCs exceeds $15,000 per ton.

Staff also proposes to further clarify the criteria by which a facility would be exempt from RTC holding reductions. These criteria are only applicable to original RTCs, not additional holdings, as follows:

- that are in the RECLAIM program since 1994 and have 1994 allocations equivalent to 2000 allocations;
- where all equipment, except those exempt under Rule 219, are at or below the proposed new BARCT; and
- that have not sold their RTCs post 2004.

Staff currently proposes that the RTC reductions (6.5 tpd) be submitted to the SIP for compliance years 2006 through 2009. The additional 1.3 tpd reductions, however, would not be submitted to the SIP due to the potential for some or all of them to be temporarily used in the event RTC prices rise beyond $15,000 per ton and the program is subject to review pursuant to Rule 2015.

Staff held numerous briefing sessions with CARB staff in the last several months regarding staff approaches/methodologies, and technological and policy issues. To date, CARB staff endorses AQMD staff's approach.

CEQA and socioeconomic analyses for the project are currently in progress. Rule development is ongoing and staff is committed to working with all stakeholders throughout the process.

Report Format

This White Paper is formatted to highlight key issues relating to the proposed RECLAIM amendments. The key issues regarding the amendments are addressed in four sections, as follows:

I. BARCT and Cost-Effectiveness;
II. BARCT Technology Evaluation;
III. Method, Amount, and Timing of RTC Reductions; and
IV. General Discussion Topics.

Supporting information regarding each issue is provided in the appendices to this document.

I. BARCT AND COST-EFFECTIVENESS

Best Available Retrofit Control Technology (BARCT)

Issue

As described previously, BARCT is defined in state law as "an emission limitation that is based on the maximum degree of reduction available taking into account environmental, energy, and economic impacts by each class or category of sources" (§ 40406). Thus, there are a number of factors to consider when evaluating BARCT for the RECLAIM program such as technical feasibility, cost-effectiveness, and how a BARCT concentration limit is translated to mass emission limits under RECLAIM. The following information provides background, highlights different viewpoints, and provides technical information relative to each equipment category and staff recommendations.

Background

When RECLAIM was adopted the applicable command and control rules and control measures that represent BARCT were converted into mass emission limits for facilities, expressed in allocations. The ending factors in Tier I Ending Emission Factors in Rule 2002 represented, for each category of equipment, the level of emission control required by the applicable rule and/or near-term control measures. Additional reductions in facility emission allocations from 2000 to 2003 incorporated technology forcing control measures.

RECLAIM allows flexibility in how a facility meets programmatic reductions; therefore, facilities generally are not required to add BARCT to any equipment. An exception to this generality came during the California energy crisis. At that time the power producers were required to reduce NOx emissions by adding controls. Programmatic reductions may be met by a variety of options, including control beyond BARCT, changes to other equipment, efficiency improvements, or equipment replacements.

Criteria & Methodology

BARCT is established when technology is identified that can reduce emissions from existing equipment. Among the criteria considered when evaluating BARCT were:

- Does another air pollution control district or agency have BARCT that we have not identified or have a more stringent BARCT level than the SCAQMD?
- Is the proposed BARCT level achieved in practice as retrofits?
- Is technology available and feasible for retrofits?
- Do manufacturers offer guarantees for achieving proposed emission levels?
- Is retrofit technology cost effective?
- Based on the above criteria, could a command and control BARCT rule have been proposed in the absence of the RECLAIM program?

To determine new BARCT for RECLAIM, several steps were employed. First, adopted AQMD BARCT rules for non-RECLAIM facilities were compared to current Rule 2002 Tier 1 factors for the various types of RECLAIM equipment. The Tier I factors were developed based on the subsumed rules and control measures at the time RECLAIM began. Many of the rules have not changed, but some, like Rule 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters have been amended since the original RECLAIM program was adopted to make emission limits more stringent for non-RECLAIM sources. Second, other districts' rules were reviewed to determine if any exist that AQMD does not have or are more stringent than those of the AQMD. In most cases, other districts' rules are either less stringent or equivalent to those implemented by the AQMD. Some district rules had more stringent limits and these were considered when evaluating new BARCT. AQMD staff also conducted a literature search for other regulations nationwide. Based on this survey, California was found to have more stringent limits. Third, technology for NOx control was considered. For example, the control efficiency of low NOx burner technology has improved since the beginning of RECLAIM. As part of the technology review, manufacturers of controls were consulted on technological feasibility and, if applicable, to determine emission levels guaranteed for various types of equipment. Recent permits were also evaluated to determine achieved in practice emission limits for retrofit controls. Fourth, a cost analysis was performed to determine if the proposed controls were cost effective.

This analysis included the extent of emission reductions beyond the Tier I emissions limits and the incremental cost effectiveness for various levels of controls, with two exceptions. For Rule 2009, the level of controls spanned pre-Rule 2009 emissions to proposed BARCT and for FCCUs, actual emissions from four facilities were compared to proposed BARCT. A final consideration was the reasonableness to write a command and control BARCT rule in the absence of the RECLAIM program.

Cost Effectiveness

Introduction

Cost effectiveness is defined as dollars per ton of pollutant reduced. Criteria pollutants and their precursors subject to the cost effectiveness assessment include volatile organic compounds (VOC), oxides of nitrogen (NOx), oxides of sulfur (SOx), particulate matter (PM), and oxides of carbon (CO). The major parameters in cost-effectiveness include capital and installation costs, operating and maintenance costs, interest rates, and project life.

Cost effectiveness calculations have been performed for control measures in the Air Quality Management Plan (AQMP) and proposed rules. The cost effectiveness assessment is often used in a relative sense, i.e., to compare the effectiveness of control measures, rules, and their alternatives.

RECLAIM Cost Effectiveness Calculations

Cost effectiveness for BARCT was completed using the equipment inventory in the AQMD database, and the emission reductions that were determined by the difference between the Tier I emission factor and the proposed new BARCT and the peak activity level used in deriving the year 2000 allocation. Rule 2009 and FCCU cost effectiveness were calculated differently, as previously noted. Peak year activity was the same as what each facility used in determining original allocations. Each facility chose a single year from 1987 to 1992. The same throughput data at source category levels (e.g., boilers, heaters) was used for this analysis. Device level data (i.e., by individual units) is unavailable under the current RECLAIM reporting scheme.

It should be noted that emission reductions used for the cost-effectiveness evaluation of the various equipment categories with new BARCT are not the same as those reductions calculated under the AQMP method to derive programmatic RTC holding reductions. This was done because the AQMP method incorporates projected emission growth that varies from year to year. The allocation method, on the other hand, relies on an inventory that was used to establish initial year 2000 allocations by equipment type. Therefore, the emissions reduced in the cost effectiveness calculations are consistent with the initial RTCs allocated to the facilities.

Equation for determining emission reductions for cost effectiveness:

(Peak year activity x Tier I end factor) – (Peak year activity x proposed new BARCT)

The AQMD routinely conducts cost-effective analyses regarding proposed rules and regulations that result in the reduction of criteria pollutants (NOx, SOx, VOC, PM, and CO). The analysis is used as a measure of relative effectiveness of a proposal. It is generally used to compare and rank rules, control measures, or alternative means of emissions control relating to the cost of purchasing, installing, and operating control equipment in order to achieve the projected emission reductions. Cost-effectiveness is a key element to the BARCT criteria for economic feasibility. The AQMD has historically used the Discounted Cash Flow (DCF) method for evaluating cost-effectiveness. The following equation illustrates the DCF approach:

$$\text{DCF} = \frac{\text{One-time Cost} + (\text{Recurring Cost x Present Value Factor})}{\text{Emission Reductions over Project Life}}$$

The total capital investment, and operation and maintenance costs are based on the total number of equipment with Tier I ending emission factor greater than the proposed new BARCT.

Several issues were raised by stakeholders regarding the cost effectiveness analysis, including equipment life, cost threshold, and which method should be used. These are discussed below.

Equipment Life

Issue

Cost effectiveness is determined by dividing the cost of controls by the amount of emission reductions expected over a given period of time. Typically this is based on an equipment life of 10 years since most industrial equipment lasts about 10 years prior to replacement. While this is appropriate for many types of equipment, certain types of equipment and controls under consideration for new BARCT in the RECLAIM program have a much longer life expectancy. Using a longer life expectancy lowers the cost effectiveness. Stakeholders have asked to standardize equipment life as 10 years for all equipment. The issue is the appropriateness of using a longer equipment life when calculating cost effectiveness.

Background

Historically, since 1989, a 10-year equipment life is most typical for cost-effectiveness because 10 years is a representative length of life expectancy for many types of equipment. In a recently adopted SCAQMD rule for controlling particulate matter from fluid catalytic cracking units (i.e., Rule 1105.1), a 25 year equipment life was used to derive the cost effectiveness. Also, a 20-year life was used for some of the control options in Rule 1178 when calculating cost effectiveness. A 10 year equipment life was used for non-refinery boilers and process heaters, metal melting and heat treating, and miscellaneous combustion sources. A 25-year life was used on for fluid catalytic cracking units and refinery boilers and process heaters.

Discussion

Due to advancements in emission control technologies, a 10-year equipment life is no longer appropriate under all circumstances. For example, SCR equipment manufacturers design the reactor for a 25 year life, with a minimum maintenance schedule of 5 years for catalyst replacement. Refinery stakeholders have commented that in evaluating costs for large boilers and heaters that a 20-year life is considered.

Industry Comments

- Equipment life greater than 10 years (e.g., 25 years) should not be used to derive the cost-effectiveness of emission reductions. If greater than 10 years is appropriate, then no further reductions from the equipment should be sought for the same period where facilities have installed the controls to comply with the RECLAIM RTC reductions.

Environmental Organization Comments

- Equipment life should be based on the actual life expectancy of the control equipment.

Staff Recommendations

Based on information gathered from industry and control equipment manufacturers, staff recommends varying equipment life depending on the type of equipment. If a 10-year life was used as the norm since the beginning of the RECLAIM program, beginning in 2005, all RECLAIM equipment would be replaced with new equipment. Many types of equipment, such as large boilers and refinery FCCUs typically last 20 to 40 years. In addition, any further control would need to be proven cost-effective for the next increment of emission reductions. Furthermore, if a piece of control equipment is replaced while having additional useful life due to AQMD rulemaking, a sunk cost (assuming no salvage value) can be added to the next increment of cost-effective analysis. Staff believes using a longer equipment life for some equipment categories is more realistic than 10 years.

Incremental Cost-Effectiveness

California Health and Safety Code 40920.6 requires an analysis of cost-effectiveness and incremental cost-effectiveness prior to adopting rules or regulations that are proposed to meet BARCT. Incremental cost effectiveness is used to measure the difference dollars per ton difference between two or more control options. It is calculated by dividing the difference in the dollar costs by the difference in the emission reduction potentials between the two control technologies. Incremental cost effectiveness does not reflect potential emission reductions and is not comparable to other methods of determining cost-effectiveness. Incremental cost effectiveness analysis for each source category is presented in Section II of this report. The equation used for this calculation follows.

Incremental cost-effectiveness equation:

$$(PV_1 - PV_2) \div (ER_1 - ER_2) = \$/\text{ton}$$

Where:
PV_1 = Present Value of control technology 1
PV_2 = Present Value of control technology 2
ER_1 = Emission Reductions from control technology 1
ER_2 = Emission Reductions from control technology 2

Taking all the factors into consideration, the analysis resulted in recommendations for new BARCT for some categories and none for others, as described below.

<u>New BARCT</u>
New BARCT was recommended for some types of equipment, including:

- Rule 1146 and 1146.1 boilers and heaters;
- Rule 1109 refinery boilers and heaters;
- Fluid catalytic cracking units;
- Metal melting and heating processes; and
- Miscellaneous combustion equipment including ovens, kilns, calciners, dryers, and furnaces.

<u>Implementation Schedule</u>
Unlike command and control rules, RECLAIM allows facilities flexibility to comply with their allocations. This includes what, if any, controls will be added and on what schedule. Installation of low NOx burners requires less planning, designing, and construction time than SCR. Therefore, the equipment which can be controlled with low NOx burners would be retrofit before equipment that can be controlled with SCR. It is likely that Rule 1146/1146.1 boilers/heaters, metal melting, heat treating, and miscellaneous combustion equipment could be retrofit with low NOx burners within the first year or two of the proposed reductions. SCR retrofits require significantly more lead time and resources. Due to turnaround schedules at refineries, construction for SCR retrofits on refinery boilers and heaters would begin in 2 to 3 years and be staggered over a period of 3 or 4 years. Turnaround schedules for FCCUs are generally every 4 to 5 years. Therefore, SCR retrofits for FCCUs could not be expected to take place until 2009 or 2010.

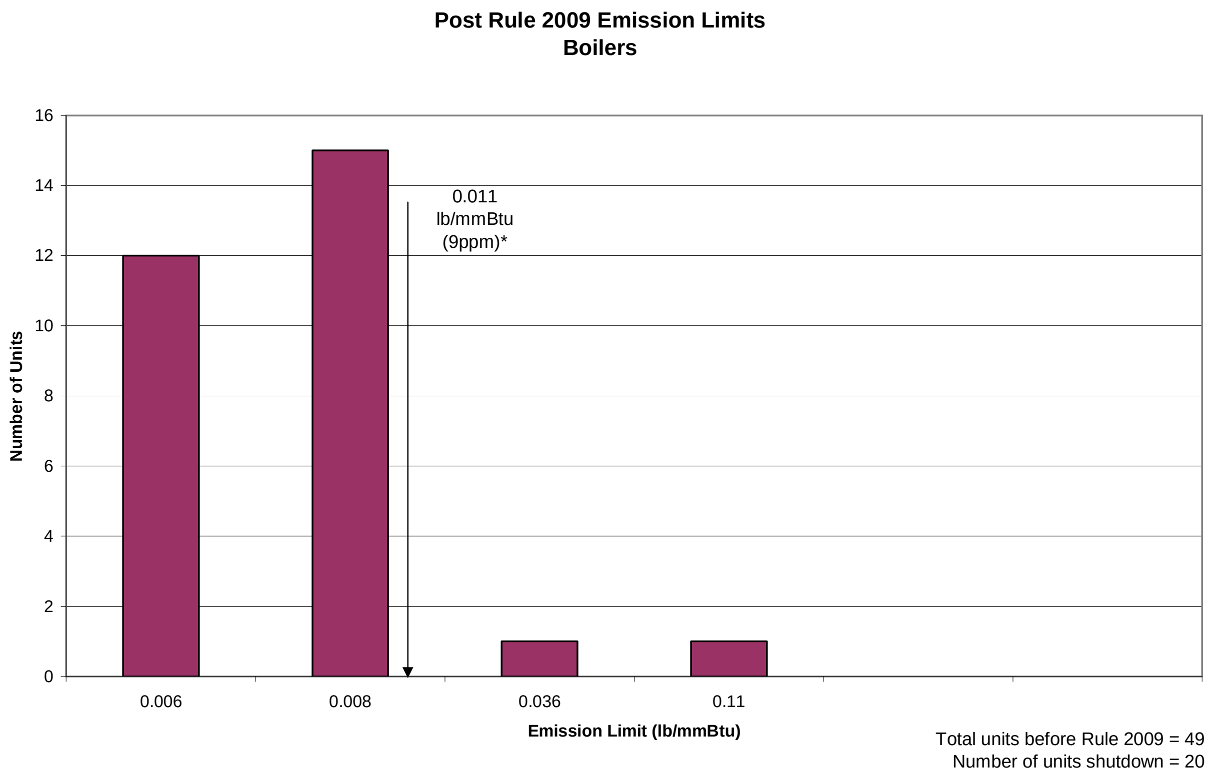
<u>No New BARCT</u>
No new BARCT was recommended for the following categories of equipment:

- Gas turbines;
- Cement kilns;
- Internal combustion engines;
- Glass melting furnaces; and
- Curing and drying ovens.

Rule 2009 BARCT Completed Already

BARCT for equipment at power producing facilities subject to Rule 2009 was considered separately as part of the year 2001 RECLAIM amendments and subsequent rule implementation. Consequently, much of the analysis was done at the time these facilities filed applications for modifications of their equipment. Under Rule 2009, a case-by-case technical and cost-effectiveness evaluation was performed for each boiler or turbine unit to determine BARCT. Permit information shows that BARCT for the majority of equipment under Rule 2009 ranges from 5 to 9 ppm. To comply with Rule 2009, some units were (1) taken out of service, (2) replaced by more efficient equipment, or (3) retrofit with controls. However, for the purpose of current BARCT determinations, an average concentration limit was developed for the boiler and turbine source categories based on the throughput used for the year 2000 allocation. Figures 1 and 2 illustrate the current emission limits for power plant boilers and turbines.

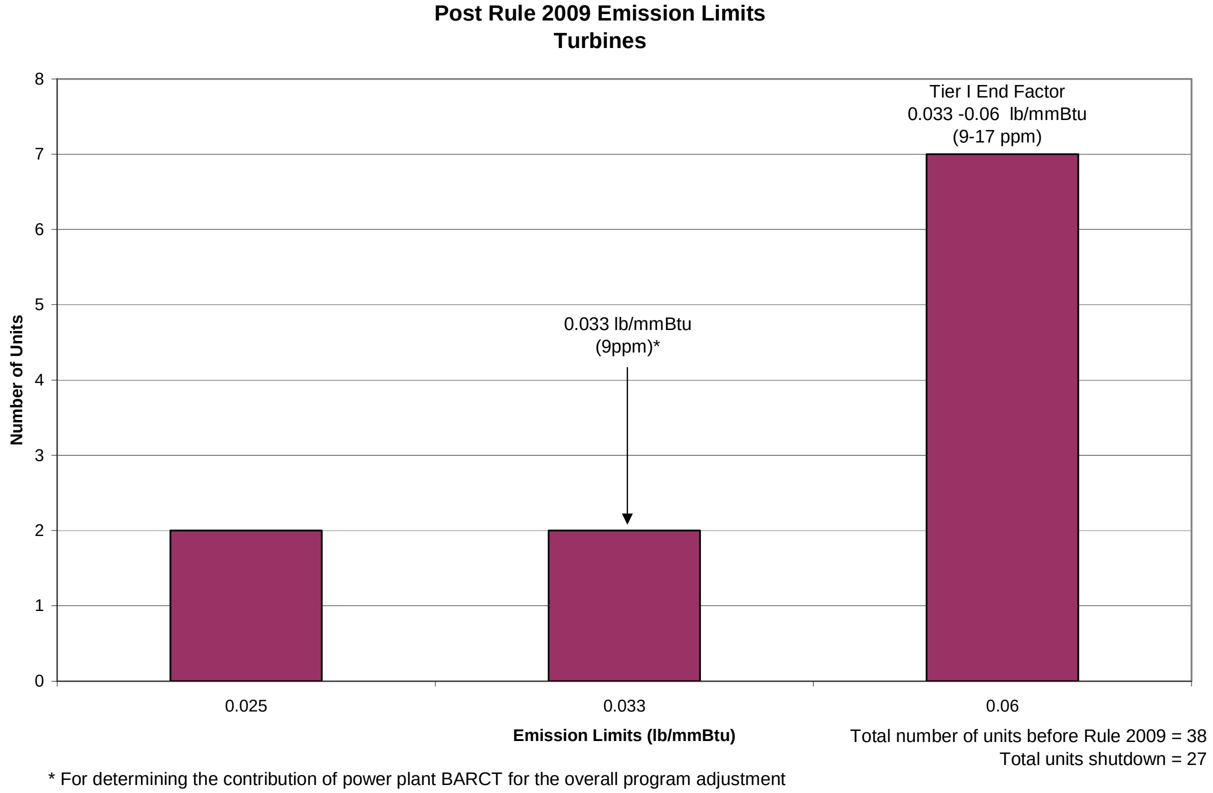
Figure 1



* For determing the contribution of power plant BARCT for the overall program adjustment

Note: The Tier I End Factor is unique for each utility ranging from 0.010 - 0.018 lb/mmBtu.

Figure 2



Section II contains a detailed description of the BARCT technology evaluation for each source category. Table 2 summarizes the BARCT analysis including, rule analysis, control technology, cost effectiveness and recommendation for new BARCT.

Table 2
Proposed BARCT and Cost Effectiveness

Subsumed Rule/CM	Rule-CM Description	Tier 1 Emission Factor	Tier 1 Control Technology	Basis for BARCT	New Proposed BARCT (lb/mmBtu)	New Control Technology	Cost Effectiveness ($/ton)	Other District Rule More Stringent?
90A-C-5	Misc. Combustion (Ovens, Kilns, Calciners, Dryers, Furnaces)	0.062 lb/mmBtu	Lo NOx Burner, Combust. Modif.	Manufacturer Information, Permit Data for Retrofit (70 units currently at or below 30 ppm)	0.036 (30 ppm)	Ultra Lo NOx Burner	$9,500 (10 yr)	No
90P-B-2	Petroleum Refinery FCC Units	70% reduction	SCR	Permit Data for Retrofit	80% reduction	SCR	$19,700 (10 yr) $15,500 (15 yr) **$11,400 (25 yr)**[1]	No
90P-C-5	Metal Melting Furnaces	0.062 to 0.162 lb/mmBtu	Lo NOx Burner	Manufacturer Information, Permit Data (60 units currently at or below 45 ppm)	0.055 (45 ppm)	Ultra Lo NOx Burner	$8,500 (10 yr)	No
	Heat Treating Furnaces						$4,000 (10 yr)	No
R1109	Refinery Boilers and Heaters > 110 mmBtu/hr	0.030 lb/mmBtu	Lo NOx Burner, FGR	Manufacturer Information, SJVUAPCD, Permit Data for Retrofit	0.006 (5 ppm)	SCR	$32,000 (10 yr) $24,000 (15 yr) **$17,500 (25 yr)**[1]	No
R1146	Boilers and Heaters ≥ 5 MM Btu/hr	0.045 lb/mmBtu	Lo NOx Burner, FGR	Manufacturer Information, SJVUAPCD, Permit Data for Retrofit	0.010 (9 ppm)	Ultra Lo NOx Burner	$9,000 -$10,000 (10 yr)[2]	San Joaquin Valley Unified APCD
R1146-1	Boilers and Heaters 2-5 MM Btu/hr	0.038 lb/mmBtu			0.015 (12 ppm)			
R2009	Utility Boilers	Differs by facility	Facility Cap, repower, Combust. Modif., FGR, SNCR, SCR	Permit Data for Retrofit	0.0109 (9 ppm)[7]	SCR	$3,100 (10 yr) $2,300 (15 yr)[3]	No

Subsumed Rule/CM	Rule-CM Description	Tier 1 Emission Factor	Tier 1 Control Technology	Basis for BARCT	New Proposed BARCT (lb/mmBtu)	New Control Technology	Cost Effectiveness ($/ton)	Other District Rule More Stringent?
1134	Gas Turbines	0.06 lb/mmBtu	Various, SCR, Water or Steam Injection		None	SCR	No	San Joaquin Valley Unified APCD
1112	Cement Kilns	Various	Lo NOx Burner, Comb. Modif.		None[4&6]			No
1110.2	Internal Combustion Engines	Various	Various depending on engine use: electrification, SCR, turbo-charger, after-cooler, comb. modif.		None[6]			No
1117	Glass Melting Furnaces	4 lb/tons product	Lo NOx burner, Combustion modif.		None[5]			No
90P-C-6	Curing & Drying Ovens	0.03 lb/mmBtu	Lo NOx burner, Combustion modif.		None[5]			No

[1]This value reflects the staff recommended equipment life and corresponding cost effectiveness.
[2]Control costs were obtained from 3 manufacturers. Cost effectiveness calculations for two of the manufacturers yielded numbers in the range of $9,000 to $10,000 per ton while the third was much higher. The third manufacturer gave costs only for burners rated at ≥ 20 mmBtu/hr.
[3]Rule 2009 utility boiler cost effectiveness is based on pre-Rule 2009 emissions.
[4]Controls not achieved in practice
[5]Further reductions not technically feasible
[6]Further reductions not economically feasible
[7]For determining the power plant BARCT contribution to the overall program adjustment

II. BARCT EVALUATION BY SOURCE CATEGORY

Introduction

Following is a discussion of each RECLAIM equipment category evaluated for new BARCT levels. Each section highlights stakeholder comments, technical evaluation, equipment life, and cost effectiveness.

Table 2 contains a summary of the BARCT determinations for each of the equipment categories that were found to have technically and economically feasible emission reductions.

Fluid Catalytic Cracking Units

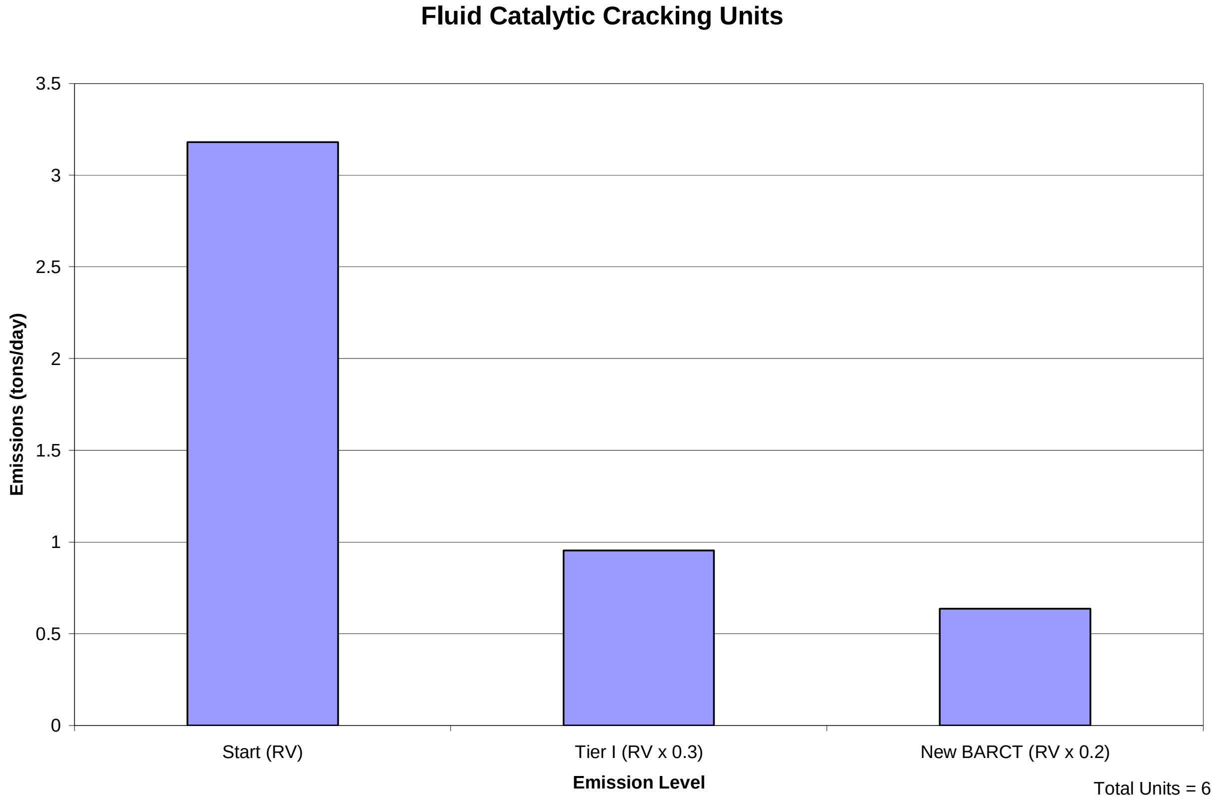
Technology Evaluation

There was a control measure for fluid catalytic cracking units (FCCUs) that was subsumed under RECLAIM when the program was initiated. The control measure would have reduced emissions through installation of SCR. SCR technology has improved in the last decade. There are no other district rules for this type of equipment, and none were found nationwide.

There are six FCCUs in the SCAQMD. Two units have been retrofit with SCR, demonstrating that this technology is achieved in practice. The new BARCT limit for this equipment category was set at a control efficiency of 80 percent. The technology has been achieved in practice and has manufacturer guarantees. 1991 AQMP Control Measure 90P-B-2 specified 70% reduction based on SCR. SCR technology has improved in recent years. It is likely that, in the absence of RECLAIM, a command and control rule would have been written for this category. Therefore, SCR has been determined to be the proposed BARCT.

Figure 3 is a graph of the emissions based on uncontrolled, Tier 1, and new BARCT levels. Due to the small number of units and to protect the confidentiality of the facilities, the bar chart for the FCCUs shows total emissions for the 6 units based on actual emission data. Charts for most other categories, where there are large numbers of equipment, are histograms. Two units have already achieved the new BARCT emission level. The other 4 units have not yet achieved Tier I levels.

Figure 3



Note: No established BACT limit
RV = reported value
Cost effectiveness (25 year life) = $11,400 per ton

Equipment Life

In a recently adopted SCAQMD rule for controlling particulate matter from fluid catalytic cracking units (i.e., Rule 1105.1), an equipment life of 25 years was used to derive the cost effectiveness. Due to advancements in emission control technologies, a 10-year equipment life is not appropriate for this equipment. SCR equipment manufacturers design the reactor for a 25 year life, with a minimum maintenance schedule for catalyst replacement. Refinery stakeholders have commented that in evaluating costs for large boilers and heaters that a 20-year life is considered. However, based on manufacture data and efforts under Rule 1105.1 rule development, an equipment life of 25 years is recommended. Also, a 20-year life for some of the control options was used in Rule 1178 when calculating cost effectiveness.

Cost Effectiveness

The cost-effectiveness, based on the range of costs associated with installation of BARCT on this equipment and an equipment life of 25 years, is expected to be approximately $11,400 per ton NOx reduced. If based on a life of 15 years, cost-effectiveness would be $15,500 per ton. For a 10 year life, the cost effectiveness would be $19,700. Incremental cost-effectiveness is based on varying control efficiency from 70% to 80% and is $12,500 per ton for a 10 year life, $10,000 per ton for a 15 year life, and $7,000 per ton for a 25 year life.

Industry Comments

- SCR as BARCT is incorrect, it is BACT/LAER. SCR is not easily transferable to all FCCUs, as they are unique. De NOx catalyst technology for BARCT should be considered for this category of equipment.

- The AQMD's assessment shows that there are only two FCC units that are uncontrolled. Due to the few number of units, a facility-specific analysis should be conducted for this equipment category. An independent analysis conducted on the equipment shows BARCT not to be cost-effective, based on a 10-year equipment life.

Environmental Organization Comments

- Actual life of the control equipment should be used in determining cost effectiveness.

Refinery Boilers and Process Heaters

Technology Evaluation

Rule 1109 – Emissions of Oxides of Nitrogen from Boilers and Process Heaters in Petroleum Refineries, applies to boilers and heaters at refineries with a heat input rating of greater than 40 mmBtu/hr and was subsumed into RECLAIM when the program was initiated. Rule 1109 limits these units to 25 ppm or approximately 0.030 pound of NOx per mmBtu. The 2000 (Tier I) Ending Emission factor for refinery boilers was based on the 25 ppm limit, so reduction to this level has already been accounted for in the allocations for the year 2000.

San Joaquin Valley Unified APCD has a more stringent limit than AQMD rules for a subcategory of refinery boilers/heaters. Their Rule 4306 limits units with greater than 110 mmBtu/hr input rating to 5 ppm. The SJVUAPCD requirements for refinery boilers/heaters rated at < 110 mmBtu/hr are less stringent than SCAQMD Rule 1109. SJVUAPCD has not yet implemented their rule, so no units have been retrofit there.

Staff consulted with burner manufacturers and refineries in studying the technology available to reduce NOx from refinery boilers and heaters. Ultra low NOx burners are only capable of reducing NOx levels in refinery boilers/heaters to approximately 25 ppm due to the size and design of the equipment and the combustion characteristics of refinery gas. Selective catalytic reduction is capable of reaching 5 ppm NOx limits and is an achieved-in-practice retrofit technology. This technology has improved in recent years, as seen with the SCR retrofits for utility boilers which achieved limits as low as 2.5 ppm. Based on actual installations at refineries, reductions of 95% have been achieved. SCR was determined to be cost effective for refinery boilers/heaters rated at greater than 110 mmBtu/hr, but not for the 40 to 110 mmBtu/hr units. In view of SJVUAPCD's more stringent emission limits and improvements in SCR, it is likely that Rule 1109 would have been amended from the Tier I 25 ppm level to include more stringent limits for large refinery boilers/heaters in the absence of RECLAIM.

The RECLAIM inventory for refinery boilers and heaters includes approximately 140 boilers and heaters. Of those, 75 are rated at greater than 110 mmBtu/hr. Approximately a third of those 75 are already equipped with SCR. No new BARCT was set for units between 40 and 110 mmBtu/hr since SCR is not cost effective based on 25 ppm, the level achievable with ultra low NOx burners. A new BARCT level of 5 ppm was determined for refinery boilers/heaters rated at greater than 110 mmBtu/hr based on the SJVUAPCD rule and the cost effectiveness and feasibility of control with SCR.

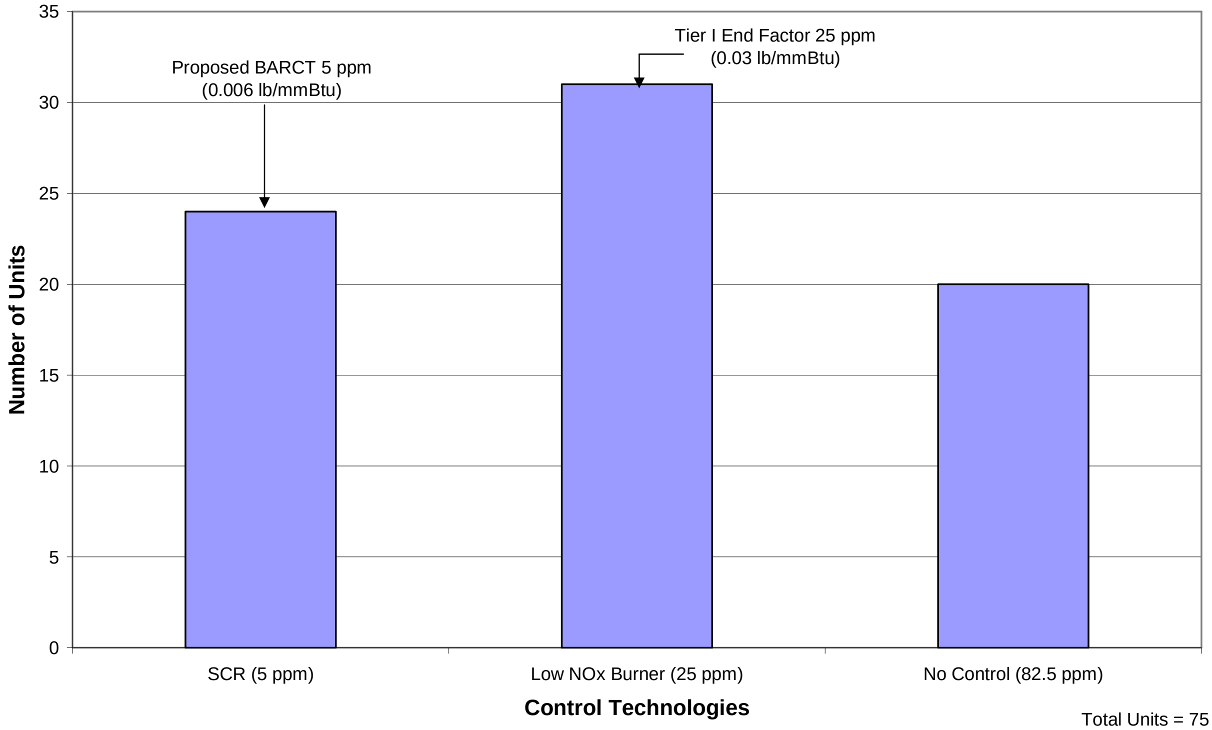
Figures 4 and 5 represent the population of Rule 1109 boilers and heaters in the RECLAIM universe and their current type of control equipment. For the purposes of these charts, boilers and heaters that are uncontrolled were assumed to be at the starting emission factor of 82.5 ppm. Those equipped with low NOx burners were assumed to be at Tier 1 ending emission factor of 25 ppm and those with SCR were assumed to meet the new BARCT level of 5 ppm based on 95% reduction from the uncontrolled level. The charts are not histograms like those for the remaining categories because most of these units do not have NOx permit limits.

Figure 4

Note: BACT is 5 ppm

Figure 5

Rule 1109 Boilers/Heaters > 110 mmBtu



Note: BACT is 5 ppm
Cost effectiveness (25 year life) = $17,500 per ton

Equipment Life

For this equipment, a life of 25 years was used to derive the cost effectiveness. Due to advancements in emission control technologies, a 10-year equipment life is not appropriate for this application. SCR equipment manufacturers design the reactor for a 25 year life, with a minimum maintenance schedule for catalyst replacement (i.e., every five years). Refinery stakeholders have commented that in evaluating costs for large boilers and heaters that a 20-year life is considered. However, based on manufacturer data, an equipment life of 25 years is recommended.

Cost Effectiveness

The cost-effectiveness, based on the range of costs associated with installation of BARCT to reduce emissions from 25 ppm to 5 ppm on this equipment and an equipment life of 25 years, is expected to approximately be $17,500 per ton NOx reduced. If based on a life of 15 years, BARCT is anticipated to cost about $24,000 per ton and 10 years about $32,000. It should also be noted that for about 20 units that have not implemented the original Rule 1109 requirement of 25 ppm, the cost-effectiveness to reach 5 ppm would be approximately $4,300 per ton for a 260 mmBtu boiler operating at 75% capacity and based on a control equipment life of 25 years.

Incremental cost-effectiveness was not calculated for this category. Industry had raised a concern that some units have already been retrofit with low NOx burners. The cost effectiveness for the large Rule 1109 boilers/heaters was calculated using emission reductions based on Tier I limits in Rule 2002 which are based on low NOx burner technology. The cost effectiveness for this category already accounts for reductions achieved by low NOx burners. The only candidate for control is SCR, therefore, there is no incremental cost effectiveness.

Industry Comments

- BARCT is currently proposed for all refinery heaters and boilers greater than 110 mmbtu/hr. The AQMD's cost-effectiveness for refinery heaters and boilers ranges from $17,400 per ton for a 25-year life to $31,500 per ton for 10-year life. AQMD has deemed this category to be cost-effective in total. However, there is a spectrum of costs depending on the circumstances surrounding a particular unit. Staff's analysis of BARCT should acknowledge that many refinery boilers and heaters over 110 mmbtu/hr already have some level of control. The threshold for BARCT controls should be raised to 250 mmbtu/hr, which should be the basis for additional NOx reductions from this equipment category. This will reduce the overall cost-effectiveness below $15,000 based on a 10 year equipment life.

Environmental Organization Comments

- Actual life of the control equipment should be used in determining cost effectiveness.

Industrial Boilers and Process Heaters (non-Refinery)

Technology Evaluation

Several factors went into determining the BARCT level for RECLAIM boilers and heaters. Current BARCT for non-RECLAIM facilities for this equipment is governed by SCAQMD Rules 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters and 1146.1 - Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters. Rules 1146 and 1146.1 basically apply to all other boilers and heaters greater than 2 mmBtu/hr heat input rating, with the exception of those used to generate electricity and refinery boilers and heaters rated at greater than 40 mmBtu/hr which are covered by other rules and described in the next section.

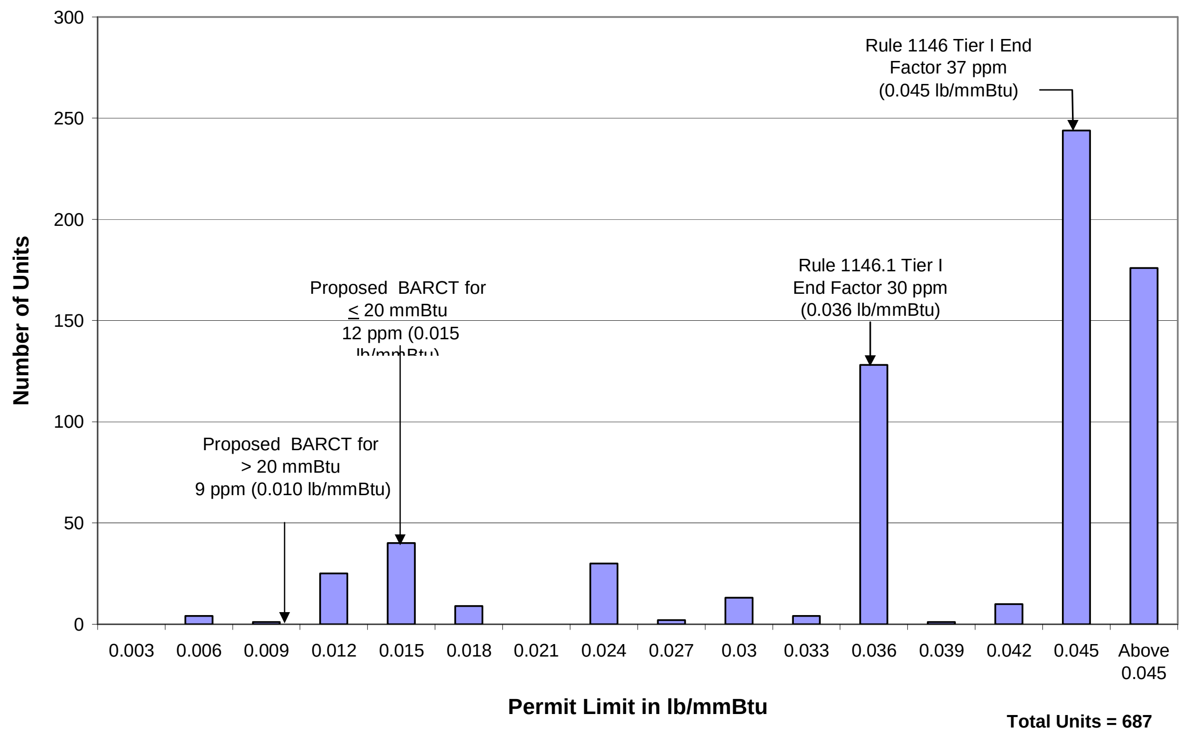
San Joaquin Valley Unified Air Pollution Control District's (SJVUAPCD) Rule 4306 – Boilers, Steam Generators, Heaters, and Process Heaters, is more stringent than the AQMD's rules for some classifications of boilers/heaters. Gaseous fueled units rated at less than or equal to 20 mmBtu/hr are limited to 12 ppm and those rated at greater than 20 mmBtu/hr are limited to 9 ppm. In addition to these two categories, the rule specifies other categories and limits. For gaseous-fueled oilfield and load following boilers/heaters, the limit is 15 ppm. For all liquid fueled units, regardless of size or usage, the limit is 40 ppm. SJVUAPCD Rule 4306 also allows a weighted average based on annual fuel usage for units that operate on both gaseous and liquid fuels. SJVUAPCD has not yet implemented their rule, so it is unknown how many units have achieved the new limits in that district.

Other considerations in the BARCT analysis were the existing technologies for NOx control. Selective catalytic reduction, while able to reach low NOx limits and achieved in practice, was determined not to be technologically feasible for this source category, particularly the smaller units. Unlike low-NOx burners, SCR installations require additional space for the controls and ammonia tanks. Due to space constraints and the toxicity issues of ammonia, SCR is typically not feasible for smaller units. Low NOx burners and ultra low NOx burners are capable of achieving NOx emission limits of 12 ppm for natural gas units rated at less than or equal to 20 mmBtu/hr and 9 ppm for units rated at greater than 20 mmBtu/hr. In view of SJVUAPCD's more stringent emission limits and improvements in burner technology, it is likely that Rules 1146 and 1146.1 would have been amended to include more stringent limits for non-refinery boilers/heaters in the absence of RECLAIM.

The RECLAIM inventory includes approximately 700 boilers and heaters in the Rule 1146/1146.1 category. The category encompasses units from many different industries used for various processes, including approximately 100 refinery units (non-Rule 1109). Most of the boilers/heaters are fired on natural gas only, however there are some units permitted for use with other fuels, including liquid fuels, process gas, and refinery gas. A histogram of the boiler inventory was prepared based on permitted emission limits (see Figure 6). Some of the units with the lowest permit limits may be units installed at BACT. New BARCT levels of 12 ppm for units less than or equal to 20 mmBtu/hr and 9 ppm for units greater than 20 mmBtu/hr were determined for the Rule 1146 and 1146.1 boilers/heaters based on the evaluation of other district's rules, analysis of retrofit technology, and consideration of the mix of equipment types and fuels in the RECLAIM inventory. The new BARCT level is the same as the level SJVUAPCD has set for natural gas units in their Rule 4306.

Figure 6

Rule 1146 & 1146.1 Boilers/Heaters



Notes: BACT for ≤ 20 mmBtu/hr is 12 ppm
BACT for > 20 mmBtu/hr is 9 ppm
Cost effectiveness (10 year life) = $9,000 - $10,000 per ton

Equipment Life

For this equipment, a life of 10 years is appropriate and was used to derive the cost effectiveness.

Cost Effectiveness

The cost-effectiveness, based on the range of costs associated with installation of BARCT on this equipment and an equipment life of 10 years, is expected to range from $9,000 to $10,000 per ton NOx reduced from the Tier I control levels. An incremental cost-effectiveness analysis as performed for this equipment category. The incremental cost-effectiveness was determined to be approximately $55,000 - $74,000/ton. This was based on Low-NOx burners and SCR control technologies.

Metal Melting and Metal Heat Treating

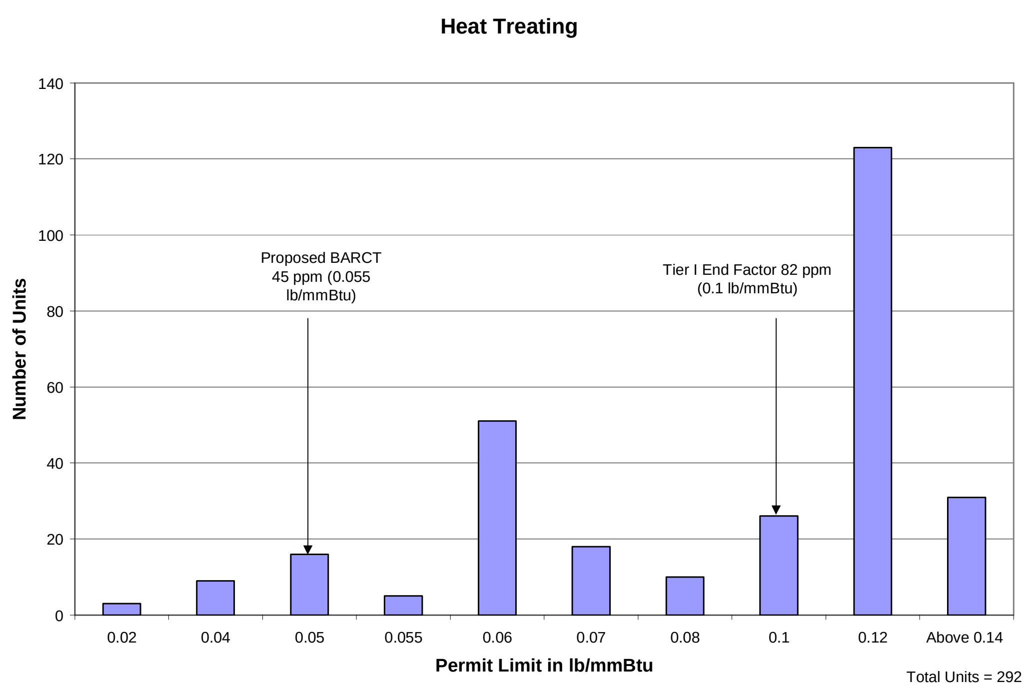
Technology Evaluation

Current BARCT in RECLAIM for heat treating and metal melting furnaces was based on a subsumed 1991 AQMP control measure (90P-C-5). These types of equipment are subject to an end factor in Rule 2002 of approximately 50 ppm or 0.062 pounds of NOx per mmBtu of heat input.

A review of South Coast and other districts' rules showed no specific rules for these two types of equipment other than rules regarding toxic emissions. Based on discussions with and information provided by equipment vendors, burner and combustion technology has improved since RECLAIM was initiated (1993/1994). Low NOx burners and ultra low NOx burners have been used to achieve NOx limits at or below 45 ppm for this type of equipment in retrofit applications. Due to the wide variety of equipment designs, the attainable NOx emission level varies on a case-by-case basis.

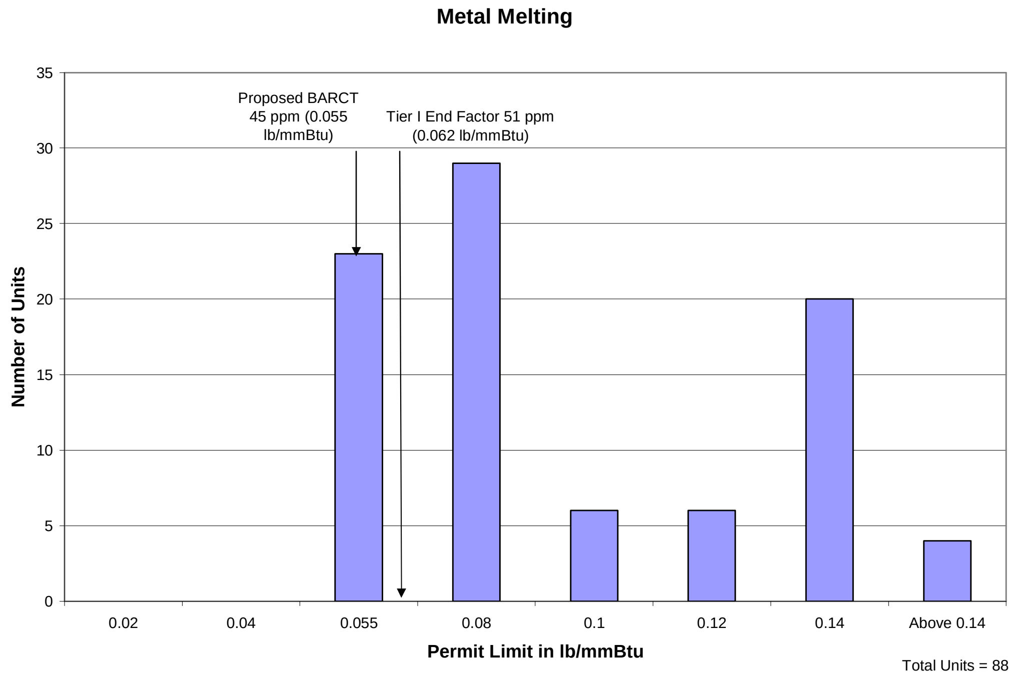
The RECLAIM inventory includes approximately 300 heat treating furnaces. Based on permit limits for NOx, more than 30 of the units are at or below 45 ppm. A histogram of the heat treating equipment is shown in Figure 7 based on the permitted NOx limits for the units. Some of the units with the lowest permit limits may be units installed at BACT. There are approximately 90 metal melting furnaces in the RECLAIM inventory with over one-fourth of the units currently at or below 45 ppm based on permit limits (see Figure 8). Many of the heat treating and metal melting furnaces are uncontrolled, however a review of units with burner retrofits showed that NOx levels at or below 45 ppm are achievable. Based on improvements in burner and combustion technology, discussions with burner manufacturers, and a review of existing retrofits, a new average BARCT level of 45 ppm or 0.055 pounds of NOx per mmBtu of heat input was determined to be feasible for this equipment. 1991 AQMP Control Measure 90P-C-5 specified 50% reduction based on low NOx burners. Burner technology has improved in recent years. It is likely that, in the absence of RECLAIM, a command and control rule would have been written for this category.

Figure 7



Note: BACT is natural gas with low NOx burner
Cost effectiveness (10 year life) = $4,000 per ton

Figure 8



Note: BACT is natural gas with low NOx burner
Cost effectiveness (10 year life) = $8,500 per ton

Equipment Life

For this equipment, a life of 10 years is appropriate and was used to derive the cost effectiveness.

Cost Effectiveness

The cost-effectiveness, based on the range of costs associated with installation of BARCT on this equipment and an equipment life of 10 years, is expected to be approximately $8,500 per ton for metal melting furnaces and $4,000 per ton NOx reduced for heat treating furnaces. An incremental cost-effectiveness analysis as performed for metal melting and heat treating. The incremental cost-effectiveness was determined to be approximately $46,000 and $60,000 per ton, respectively. This was based on the difference between Low NOx burners and SCR control technologies.

Miscellaneous Combustion Equipment

Technology Evaluation

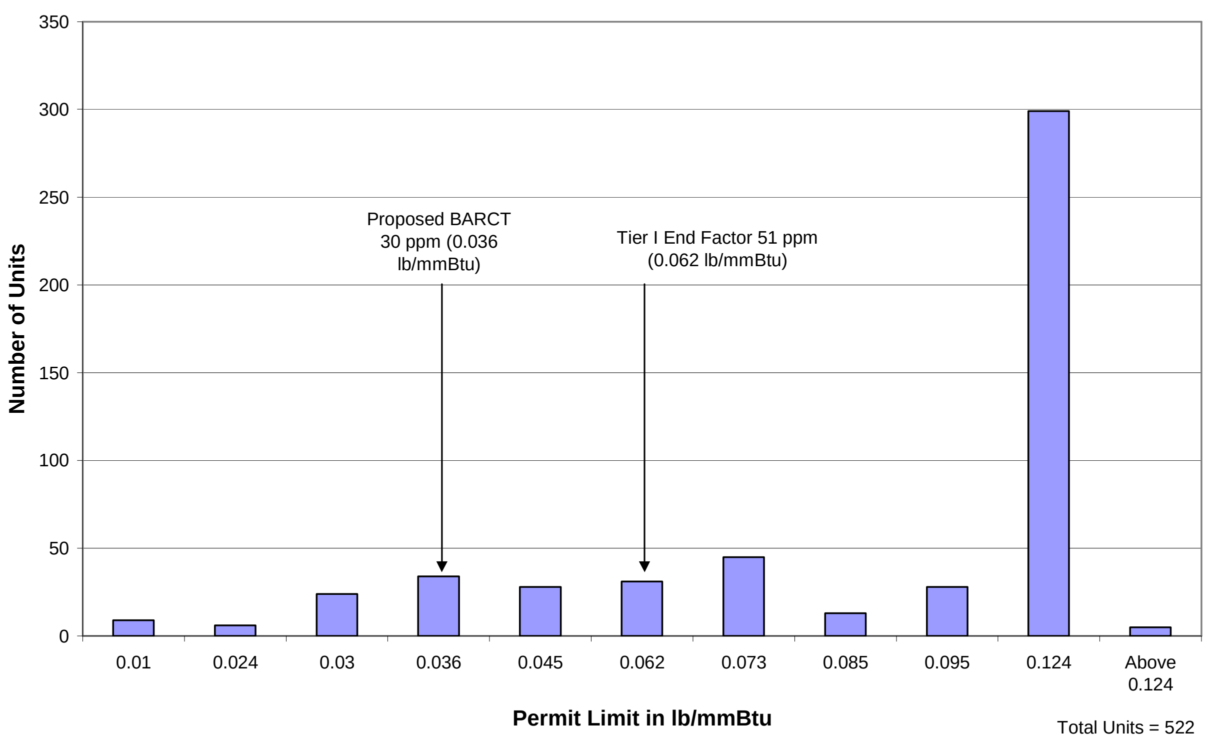
The miscellaneous equipment category includes ovens, kilns, calciners, dryers, and furnaces. It does not, however, include ceramic, clay, cement, or brick kilns or metal melting, heat treating, or glass melting furnaces. Current BARCT in RECLAIM for miscellaneous combustion equipment was based on a subsumed 1991 AQMP control measure (90A-C-5). These types of equipment are subject to an end factor in Rule 2002 of approximately 50 ppm or 0.062 pounds of NOx per mmBtu of heat input.

A review of South Coast and other districts' rules showed no specific rules for this type of equipment. However, burner and combustion technology has improved and ultra low NOx burners have been used to achieve NOx limits at or below 30 ppm for all these types of equipment in retrofit applications. There is a wide variety of equipment designs so NOx emission levels are typically determined on a case-by-case basis.

The RECLAIM inventory includes approximately 500 miscellaneous combustion sources in this category. Figure 9 is a histogram showing the distribution of the miscellaneous combustion units based on permit limits. Some of the units with the lowest permit limits may be units installed at BACT. More than 70 units are currently permitted for NOx levels at or below 30 ppm. A review of units with burner retrofits showed that NOx levels at or below 30 ppm are achievable. Based on improvements in burner and combustion technology, discussions with burner manufacturers, and a review of existing retrofits, a new average BARCT level of 30 ppm or 0.036 pounds of NOx per mmBtu of heat input was determined to be feasible for this equipment. 1991 AQMP Control Measure 90A-C-5 specified 50% reduction based on low NOx burners. Burner technology has improved in recent years. It is likely that, in the absence of RECLAIM, a command and control rule would have been written for this category.

Figure 9

Miscellaneous Combustion Equipment



Note: BACT is natural gas with low NOx burner
Cost effectivenss (10 year life) = $9,500 per ton

Equipment Life

For this equipment, a life of 10 years is appropriate and was used to derive the cost effectiveness.

Cost Effectiveness

The cost-effectiveness, based on the range of costs associated with installation of BARCT on this equipment and an equipment life of 10 years, is expected to be approximately $9,500 per ton NOx reduced from the Tier I level. An incremental cost-effectiveness analysis was not done for miscellaneous combustion equipment at this time. Currently Lo-NOx burner technology is the most practical, available option to meet the BARCT limit. While it is technically feasible to use SCR to control NOx emissions from this type of equipment, it would require additional equipment to raise the exhaust temperature since this equipment operates at too low of temperatures for the SCR to operate efficiently.

Equipment Categories with No Proposed BARCT

Other categories of equipment in RECLAIM were evaluated to determine if new BARCT is feasible. Among the criteria considered when evaluating whether there was a need for new BARCT or not were:

- Does another air pollution control district or agency have a more stringent BARCT level than the SCAQMD?
- Is the proposed BARCT level achieved in practice with retrofits?
- Is technology available and feasible for retrofits?
- Do manufacturers offer guarantees for achieving proposed emission levels?
- Is retrofit technology cost effective?
- Based on the above criteria, could a command and control BARCT rule have been proposed in the absence of the RECLAIM program?

Other categories of equipment evaluated for new BARCT included afterburners, curing and drying ovens, glass melting furnaces, cement kilns, gas turbines, non-emergency internal combustion engines, and refinery boilers and heaters rated between 40 and 110 mmBtu per hour. We have not identified new, more stringent, BARCT for this equipment to date. New BARCT was not established for these categories for various reasons. In some cases, current BARCT NOx emission levels are already the most stringent. In other cases, the available retrofit technology was not cost effective. Appendix A contains a detailed listing of the BARCT findings for each of these categories. RECLAIM facilities have the option of choosing to retrofit some of these sources in lieu of the sources where new BARCT is proposed. Although retrofits were deemed not cost effective for a category, retrofits on individual pieces of equipment may be cost effective. This allows RECLAIM participants other possibilities for flexibility to decide the best way to meet their reduced NOx RTC allocations and/or to generate additional reductions for the rest of the market.

Of the aforementioned categories evaluated for BARCT, only gas turbines were found to have a control level more stringent than that previously subsumed under the RECLAIM program.

However, upon review of the cost associated with the use of SCR, the controls were not found to be cost effective based on the activity levels used for estimating the year 2000 allocations.

Staff Recommendation

The following categories of equipment have been identified as capable of further emission reductions beyond the Tier I emission factors (i.e., Rule 2002 Table 1 factors): industrial and refinery boilers and heaters; metal melting furnaces; metal heat treating; fluid catalytic cracking units (FCCU); and miscellaneous combustion sources (i.e., ovens, kilns, calciners, dryers, and furnaces). Utility boilers can also achieve further reductions beyond Tier I controls; however, since they have previously installed BARCT pursuant to Rule 2009, these reductions have already been achieved and need to be reflected in program allocations.

III. METHOD, AMOUNT, AND TIMING OF RTC REDUCTIONS

Issues

Key issues regarding implementation of the 2003 AQMP control measure and state BARCT requirements are the:

- Method for determining reductions of RTC holdings;
- Facilities seeking exemption from the programmatic RTC reductions; and
- Rate at which RTC holdings are reduced, and how reductions are applied.

Background

At the time the RECLAIM program was created, the universe of facilities was based, in general and with some exclusion, on facility-wide emissions of 4 tons per year or greater. Each facility received a starting allocation (1994 compliance year), an ending or Tier I allocation (compliance year 2000), and a 2003 compliance year allocation meant to represent technology forcing BARCT (i.e., Tier II emission reductions called for in the 1991 AQMP) as well as the 1991 plan's growth and control scenario that was used as the basis for determining equivalency with command and control.

Allocations for 1994 were based on each facility's peak activity year from 1989 to 1992 multiplied by emission factors listed in Rule 2002, whereas the year 2000 ending allocations were based on peak year activity from 1987 to 1992 multiplied by Tier I ending emission factors, also listed in Rule 2002. The final ending allocation for 2000 and 2003 levels were based on an across-the-board reduction for all facilities equivalent to the 1991 AQMP growth and control scenario including Tier II emission reductions for the universe of sources, in aggregate.

A market driven method was suggested by industry representatives of the Working Group using small, incremental reductions as a surrogate to determine when BARCT has been met. Specifically, the method would achieve 2 tons per day reduction in 2008 and an additional 2 tons per day in 2009 or 1 ton per day additional reduction each in 2009 and 2010. Beginning reductions in 2008 is intended to allow the time needed to plan, permit, construct, and implement retrofit controls. With each AQMP update, a review of the previous two years RTC prices would be examined to determine if the average RTC price remained below $15,000 per ton to see what further reductions may be appropriate, such as an additional 1 ton per day would be reduced from RTC holdings with a one-year lead time. This is intended to examine how the market would react so as to not reduce any more than the market can bear with RTC costs not exceeding $15,000 per ton. If the average price exceeds $15,000 per ton, no reductions would be implemented. With this method, industry representatives would like a commitment that AQMD would seek to extend current area and mobile source credit programs and an AQIP type program where AQMD would be responsible to generate reduction credits.

Method for Determining Reductions of RTC Holdings

Methodologies

In assessing the necessary RTC reductions to meet the state law requirements, staff examined several methodologies that would best reflect the implementation of the current BARCT in a timely manner achieving equivalent emission reductions to command and control. Two primary methods used in the initial RECLAIM program design were evaluated. One approach, called "AQMP method", was used for establishing the 2003 ending allocations by calculating the growth and control scenario anticipated under the 1991 AQMP, including Tier II technology forcing reductions. The other method, termed "allocation method", was used for the 1994 and the 2000 allocations by using the peak year activity selected by the facility for its equipment under the RECLAIM program multiplied by the emissions factors established by staff to reflect various levels of BARCT controls for the respective milestone years. A third method was suggested by the RECLAIM Working Group. This method, termed the "market-driven method," uses RTC price levels as a surrogate to indicate if BARCT is achieved. Essentially, under this method a pre-determined amount of RTCs (e.g., 2 or 3 tons per day) would be reduced by the RECLAIM facilities. Prior to the next AQMP, the RECLAIM program would be subject to an RTC price evaluation. The RTC price would indicate if an additional ton per day should be reduced by the RECLAIM facilities over the subsequent 3 years. After careful evaluation of the three methods, staff is proposing to rely on the AQMP method to derive the amount of RTC reductions needed for the following reasons:

- The 2003 AQMP baseline inventory and growth projection provide the most recent benchmark for command and control equivalency determination.
- The 1997 baseline inventory reported by the facilities provides a more recent equipment profile in the RECLAIM universe and captures the NSR activities since 1994. This is similar to the original RECLAIM program that used 1991 AQMP which used 1987 as the base year.
- If a more recent base year were to be used, a new set of growth factors needs to be developed to maintain data integrity. Similarly, control factors need to be revised to reflect controls already installed. This approach would create a different emission currency from the one used in the 2003 AQMP.
- The growth projections developed for the 2003 AQMP provide a more balanced view of the regional economy as compared to the allocation method that used the peak year activities selected by individual facilities that tend to overestimate the growth assumptions, since it is unlikely that all facilities would operate at their high throughput year at any given time.
- CARB requires that the RECLAIM program be evaluated periodically as part of AQMP revisions. The AQMP method would allow consistency in its approach for future program evaluation and be more amenable to future revisions to emissions inventory and growth forecast.

<u>AQMP Method</u>

The AQMP method was based on the use of 1997 reported emissions for all RECLAIM facilities. The 1997 emissions inventory was created using RECLAIM facilities reported CO emissions as a surrogate to disaggregate total NOx emissions. Compared to other non-RECLAIM pollutants, such as VOC and PM, CO emissions are used for apportioning the RECLAIM NOx and SOx emission since CO is a better surrogate for combustion (i.e., direct product of combustion) and is reported on all combustion forms. In addition, since the reporting of CO emissions is primarily based on default emission factors and the corresponding fuel usage reported on various combustion forms, this approach will ensure that the total RECLAIM emissions for each facility are distributed proportionally among various combustion equipment within each facility. Although reported NOx emissions are facility totals, RECLAIM facilities report their CO, PM, and VOC emissions from combustion processes based on type of equipment/combustion process (e.g., ICEs, boilers, heaters, etc.). The facility total NO_X emissions are apportioned to the combustion categories using the reported CO emissions.[1] Total facility NO_X emissions reported are thus allocated to corresponding combustion types. Each is then assigned a unique equipment description based on SIC, fuel type, and fuel usage provided in the emission reports.

The data on the combustion equipment can be associated with multiple devices.[2] The emission inventory process used for the 2003 AQMP disaggregates the emissions to the device level by using:

- facility device IDs and the corresponding Source Category Codes (SCCs) from AQMD's Facility Permit System for RECLAIM and Title V facilities and
- reported device-level emissions on AQMD's Facility Reporting System for RECLAIM facilities.

This information is then used to disaggregate the reported emissions to specific devices for any matched SCCs. The emissions were then grown based on SCAG growth factors from the 2003 AQMP and reduced by control factors based on the new BARCT determinations, as follows:

Projected Emissions = 1997 Baseline x SCAG Growth Factors x New BARCT Control Factors

The AQMP method results in a projection of future actual emissions based on baseline emissions, and growth and control levels. This methodology yielded projected emissions in the year 2010 of 24.1 tons per day.

<u>Growth Factors</u>
Growth factors are by industry and by county. The overall growth from 1997 to 2010 for all RECLAIM facilities, including power plants, is 20 percent. The average annual growth rate for all RECLAIM facilities is 1.55 percent. It should be noted that the electrical generation industry has a projected growth of 2.5 percent and petroleum refining, which is considered at capacity production, has a no growth projection. Table 4 shows the growth factors used in the 2003 AQMP by Standard Industrial Classification Code and by county and 2-digit SICs. The factors used in the analysis are the same as those used for the AQMP and are based on demographic growth forecasts for various socioeconomic categories (e.g., population, housing, employment by industries), developed by the Southern California Council of Governments (SCAG).

<u>Control Factors</u>
In addition to growth factors, the AQMP method applied control factors to the 1997 NOx emissions levels. The application of these factors demonstrated the effect of traditional

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[1] First calculate total CO emissions from all combustion types. Then, apportion the NO_X emissions using the ratio of the CO emissions in each row of the combustion form by the total CO emissions from all combustion types.

[2] Annual Emission Reporting allows the aggregation of emissions from like equipment (e.g. boilers) burning the same fuel.

command and control rules in conjunction with new BARCT levels. These control factors were based on the rules or control measures for each equipment category subsumed by the RECLAIM program with adjustments to account for equipment at or below BARCT or exempt from the rule. The control factor represents the percent of emissions that would remain after the rule/control measure implementation. For example, if a rule was determined to reduce emissions by 75%, after control the remaining emissions would be 25%. In this case the control factor would be 0.25. That factor would then be multiplied by the 1997 emissions for the category to show the remaining emissions. For example, if the 1997 emissions were 800 tons per year and the control factor was 0.25, the remaining emissions would be 0.25 x 800 = 200 tons per year. The control factors applied to each equipment category are described below.

Equipment with no subsumed rules or control strategies with no new BARCT

Equipment was categorized based on equipment types. There were no subsumed rules or control measures for some of the equipment types and no new BARCT under the analysis. For example, tail gas units at refineries had no associated rule or control measure. For this type of equipment category a control factor of 1.0 was applied.

Miscellaneous Combustion Equipment

Initially a control factor of 0.29 was derived by dividing the new BARCT level (0.036 lb/mmBtu) by the starting emission factor of 0.124 lb/mmBtu (0.036 ÷ 0.124 = 0.29). This value was then weighted to account for approximately 2.9% of the equipment being at or below BARCT as of 1997. The final weighted factor applied to category was 0.311 (2.9% x 1.00 + 97.1% x 0.29 = 0.311).

Fluid Catalytic Cracking Units

The control factor for fluid catalytic cracking units at refineries was based on an achieved in practice use of SCR at an efficiency rate of 80 percent. Therefore, the control factor is 0.2.

Metal Melting and Heat Treating Equipment

The control factor for this category was calculated by dividing the new BARCT level (0.055 lb/mmBtu) by the starting emission factor (0.124 lb/mmBtu). The resulting control factor is then 0.444 (i.e., 0.055 ÷ 0.124 = 0.444).

Refinery Boilers/Heaters

Rule 1109 – Emissions of Oxides of Nitrogen from Boilers and Process Heaters in Petroleum Refineries, applies to refinery boilers and heaters with input ratings greater than 40 mmBtu/hr. Approximately 80 percent of the emissions from Rule 1109 boilers and heaters are from units greater than 110 mmBtu/hr and 20 percent are from units between 40 and 110 mmBtu/hr. At a new BARCT level of 5 ppm (0.006 lb/mmBtu), the control factor for the larger units is 0.06 (i.e., 0.006 ÷ start factor of 0.100). The control factor for the smaller units is 0.300 based on the original Rule 1109 limit of 25 ppm or 0.030 lb/mmBtu (i.e., 0.030 ÷ 0.100). These two control factors were weighted based on the 80 percent/20 percent emissions ratio to develop the weighted control factor of 0.108 that was applied to the 1997 emissions for this category (i.e., 80% x 0.060 + 20% x 0.300).

Internal Combustion Engines

The original control factor for Rule 1110.2 – Emissions from Gaseous- and Liquid-fueled engines, was 0.235. This was weighted to take into consideration exemptions from Rule 1110.2, diesel or non-diesel fuel, and engines at or below BARCT. Non-exempt engines were given a control factor of 0.235 based on Rule 1110.2. Exempt non-diesel engines and engines at or below BARCT were assigned a control factor of 1.0 since no further reductions are required under command and control rules. Exempt diesel engines were assigned a control factor of 0.92 based on the expected NOx reduction under Rule 1470 – Requirements for Stationary Diesel-Fueled Internal Combustion and Other Compression Ignition Engines. A weighted average was used to determine the final control factor of 0.42 for this category (i.e. 74% x 0.235 + 8% x 1.00 + 18% x 0.920).

Cement Kilns

The control factors for cement kilns are facility-specific and ranged from 0.242 to 0.800 depending upon the equipment types. The factors were based on starting factors and Rule 2002 end factors since no new BARCT was proposed for this equipment category.

Gas Turbines

Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines applies to stationary gas turbines rated at 0.3 megawatt (MW) and larger. The control factor was determined by dividing the Rule 2002 Tier I factor, 0.060 lb/mmBtu, by the start factor of 0.184, resulting in a control factor of 0.326 (i.e., 0.060 ÷ 0.184). This factor was then adjusted because 4 percent of the emissions were from peaking turbines which are exempt from Rule 1134 resulting in a new factor of 0.353 (i.e., 4% x 1.00 + 96% x 0.326). It was determined from the equipment inventory that approximately 37% of the emissions in 1997 came from units at or below BARCT. Taking this into account, the resulting in a final control factor of 0.592 (i.e., 0.37 x 1.00 + 0.63 x 0.353).

Utility Boilers

Based on the Rule 1135 staff report, the total reductions of 19.4 tons per day (76%) were from a baseline of 25.6 tons per day. The remaining emissions, 6.2 tons per day divided by the baseline results in a control factor of 0.242. The control level of Rule 1135 is 0.25 lbs NOx/MW-hr which is equivalent to a unit limit of 0.025 lbs NOx/mmBtu or 20.6 ppm. The control factor going from 20.6 ppm to 9 ppm (Rule 2009 factor) is 0.437. Therefore the composite factor from uncontrolled to 9 ppm is 0.106. The 0.106 factor was adjusted slightly due to 1 per cent of the equipment being controlled in 1997. The weighted factor for the category was 0.107 (i.e., 1% x 1.00 + 99% x 0.106).

Other Boilers/Heaters

Rule 1146 – Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters and Rule 1146.1 – Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters apply to all boilers greater than 2 mmBtu/hr with the exception of those used to generate electricity, Rule 1109 units, and sulfur plant reaction boilers. The control factor for this category was determined based on a starting factor of 0.045 lb/mmBtu for Rule 1146 units (greater than 5 mmBtu/hr) and 0.124 lb/mmBtu for Rule 1146.1 units (2 to 5 mmBtu/hr). The proposed BARCT is 12 ppm or 0.015 lb/mmBtu for units rated less than or equal to 20 mmBtu/hr and 9 ppm for units greater than 20 mmBtu/hr. A composite new BARCT level of

10.5 ppm or 0.012 lb/mmBtu, based on the emissions from the two size categories, was used to determine a weighted average control factor for Rules 1146 and 1146.1. The control factor for Rule 1146 was the new BARCT 0.012 divided by the starting factor 0.045 or 0.2667. The control factor for Rule 1146.1 was the new BARCT 1.012 divided by the starting factor of 0.124 or 0.0967. Weighting the two factors based on approximately 85% of the emissions from Rule 1146 units and 15% from Rule 1146.1 units, the weighted control factor is 0.2412 (i.e., 85% x 0.2267 + 15% x 0.0967). The weighted control factor was then adjusted slightly based on 5 percent of the units being at or below BARCT. After this adjustment, the weighted average for this category becomes 0.2791 (i.e., 5% x 1 + 95% x 0.2412).

10 Percent Adjustment

The AQMP projections are based on actual emissions in 1997 and assumptions for growth. Staff believes that a certain level of compliance margin needs to be explicitly considered in a market based program, because not all excess/unused RTCs are for sale in the market to meet the buyers' needs. The reasoning is two-fold based on observations of the market activities in the last decade of program implementation. First, there are some companies that made corporate decisions not to sell unused RTCs; therefore, excess/unused credits were retired to benefit the environment, and were not available in the market. Staff performed an analysis to identify companies that have never sold any RTCs for the past 10 years and the amount of RTCs retired in each compliance year. The analysis indicated that there are about 67 RECLAIM facilities (many of them joined the program after 1994) that have never sold their RTCs and have retired, on average, 1% of total RTCs in the market annually.

Second, facilities typically retain extra RTCs in a given compliance year, should the audit results show more emissions than reported. This would prevent facilities from being subjected to non-compliance findings, penalties, and potential reductions for future year RTC deductions. In order to estimate the amount of compliance margin, staff selected compliance year (CY) 2002 to be representative of a typical compliance year. CY 2002 was chosen because the program has passed its initial stage for a long enough period of time that one would not expect a significant amount of unused RTCs due to recessionary impacts in the early 1990's or uncertainty in missing data provisions. Meanwhile, there were ongoing applications for control equipment, resulting in RTCs available for compliance. In addition, compliance year 2002 is the first year after the energy crisis, representing market behavior that demonstrates how facilities would maximize RTC use. For example, due to the shortage of RTCs during compliance years 2000 and 2001, where, of necessity, some 2002 cycle 1 RTCs were used for year 2001 cycle 2 compliance. On the other hand, since the market did not experience unusually high demand in 2002, portions of CY 2002 cycle 2 RTCs were transferred for use in CY 2003 by cycle 1 facilities. This cross-cycle trading illustrates how facilities can maximize use of their RTCs unless there is a need to retain such RTCs for their own compliance purposes or where no suitable buyers can be found in the market. Although it is impossible to quantify the latter, based on reasons stated earlier regarding the selection of CY 2002 for this analysis, it is believed that the contribution by the latter to the overall unused/excess RTCs in 2002 would be small. Therefore, the remaining RTCs unused in CY 2002 would closely resemble what the facilities would hold back as compliance margin. Staff analysis indicates that there were about 9 % of total 2002 RTCs unused by the end of compliance year 2002 potentially held back by facilities as compliance margin or because suitable buyers could not be identified in the market.

Furthermore, the AQMP method relies on an overall control efficiency for a source category, which may generate some technical uncertainty in emission quantification. Finally, setting the emission target based on the AQMP methodology is, in essence, setting allowable emissions based on projected actual emissions. It also justifies some adjustment to the market to reflect compliance margins facilities typically strive to achieve.

Based on the discussions above, staff recommends adding 10% to the RTC demand calculation in deriving the 2010 emission reduction target for the RECLAIM program to account for compliance margin as well as imperfect market interactions between buyers and sellers.

Results

The AQMP methodology results in a 7.8 ton per day reduction, derived as follows:

RTC Reductions = Current RTC Holdings - [AQMP Projected Emissions x 10% Adjustment Factor]

= 34.2 tpd - [24.0 x 1.10]

= 7.8 tpd

The following table summarizes for each major equipment category, the 1997 baseline emissions, the baseline in 2010 assuming growth as in the 2003 AQMP, the control factor for each subsumed rule or control measure, and the calculated remaining emissions in 2010. To calculate total reductions for the programmatic BARCT adjustment, the total remaining emissions (24.0 tpd) is adjusted upward by 10 percent, and subtracted from the total RTC holdings (34.2 tpd).

Table 3
RECLAIM BARCT NOx Emissions and Control Factors

Control Measure	1997 Baseline (tpd)	2010 Baseline (tpd)	Tier I Control Factor	Tier I Reductions (tpd)	Tier I Remaining (tpd)	New BARCT Control Factor	New BARCT Reductions (tpd)	New BARCT Remaining (tpd)	Incremental Reduction Beyond Tier I	% Contribution to Incremental Reduction
Non-Power Plants										
Miscellaneous Combustion 90A-C-5	5.9	8.2	0.515	4.0	4.2	0.311	5.7	2.5	1.7	20%
FCCU 90P-B-2	6.3	6.6	0.300	4.6	2.0	0.200	5.3	1.3	0.7	8%
Metal Melting & Heat Treating 90P-C-5	0.9	1.7	0.500	0.9	0.8	0.444	1.0	0.7	0.1	1%
Refinery Boilers/Heaters Rule 1109	10.9	11.4	0.300	8.0	3.4	0.108	10.1	1.3	2.1	24%
Cement Kiln Rule 1112	5.2	6.4	0.242-0.800	3.6	2.8	0.242-0.800	3.6	2.8	0	0%
Gas Turbines Rule 1134	6.9	8.2	0.592	3.4	4.8	0.592	3.4	4.8	0	0%
Boilers/Heaters Rules 1146/1146.1	4.2	5.0	0.737	1.3	3.7	0.279	3.6	1.4	2.3	27%
Internal Combustion Engines Rule 1110.2	10.7	12.1	0.420	7.0	5.1	0.420	7.0	5.1	0	0%
Others	1.4	2.2	---	0.0	2.2	---	0.0	2.2	0	0%
TOTAL	**52.4**	**61.8**		**32.8**	**29.0**		**39.7**	**22.1**	**6.9**	**80%**
Rule 2009 Power Plants										
Utility Boilers Rule 1135	8.6	11.4	0.250	8.5	2.9	0.107	10.2	1.2	1.7	20%
Internal Combustion Engines Rule 1110.2	0.5	0.6	0.420	0.4	0.2	0.420	0.4	0.2	0	0%
Gas Turbines Rule 1134	0.6	0.8	0.592	0.3	0.5	0.592	0.3	0.5	0	0%
TOTAL	**9.7**	**12.8**		**9.2**	**3.6**		**10.9**	**1.9**	**1.7**	**20%**
GRAND TOTAL										
	62.1	**74.6**		**42.0**	**32.6**		**50.6**	**24.0**	**8.6**	**100%**

Note: The AQMP method reflects control factors for more equipment than just those with new BARCT in order to account for rules or control measures for each equipment category subsumed by RECLAIM.

Table 4

SIC Code Growth Factors by County for the Year 2010					
SIC Sector	**SIC Code**	**Los Angeles**	**Orange**	**Riverside**	**San Bernardino**
Agriculture	1-9	0.868	0.986	1.019	0.703
Mining	10-12,14	0.910	0.680	1.200	0.260
Oil & Gas Extr.	13	1.000	1.000	1.000	1.000
Construction	15-17	1.354	1.436	2.575	1.602
Food/Tobacco	20	1.090	1.290	1.470	1.500
Textile Mill	22	1.430	1.380	1.670	1.660
Apparel/Other Text.	23	1.390	1.650	1.510	1.450
Lumber/Wood	24	0.890	1.210	1.360	1.500
Furniture/Fixtures	25	0.950	1.150	1.520	1.780
Paper	26	1.270	1.640	1.940	1.510
Printing	27	1.030	1.630	1.710	2.750
Chemicals	28	1.280	1.480	1.630	1.880
Petroleum Products	29	1.000	1.000	1.000	1.000
Rubber & Plastic	30	1.390	2.130	1.900	2.310
Leather	31	0.630	0.640	0.860	0.660
Stone,Clay & Glass	32	1.200	1.110	1.490	1.210
Primary Metals	33	1.730	1.390	1.760	1.830
Fabricated Metals	34	1.030	1.420	1.960	1.900
Machinery	35	2.910	3.840	5.230	7.110
Electronic Equip.	36	2.430	2.510	4.660	4.120
Trans. Equip.	37	1.090	1.270	1.850	1.470
Instruments	38	1.440	2.050	3.620	2.600
Misc. Mfg.	39	0.902	1.130	1.434	1.477
Railroads	40	1.530	1.970	1.320	1.550
Local Transits	41	1.049	1.441	1.167	1.182
Trucking	42	1.436	1.536	1.970	1.815
Water Transport	44	1.083	1.111	0.000	0.000
Air Transport	45	1.100	1.797	2.000	1.243
Pipelines Trans.	46	1.140	1.360	0.000	1.350
Travel Services	47	1.754	1.925	0.857	1.000
Communications	48	1.070	1.830	1.850	2.400
Utilities	49	1.293	1.579	4.200	2.083
Wholesales	50-51	1.034	1.413	1.669	1.648
Retails	52-59	1.023	1.404	1.863	1.531
Finance	60-62,67	0.923	1.569	1.780	1.557
Insurance	63-64	1.030	1.656	1.636	1.417
Real Estate	65,67	1.263	1.529	1.543	1.441
Hotels	70	1.163	1.350	1.182	1.387
Personal Services	72	1.282	1.667	1.920	1.590
Business Services	73	1.549	1.477	2.559	2.093
Auto Repairs	75-76	1.025	1.758	2.289	1.843
Motion Pictures	78	1.164	1.500	1.636	1.133
Amusements	79	1.112	1.554	1.631	1.286
Health Services	80	1.091	1.151	2.183	1.791
Legal Services	81	1.245	1.807	1.923	1.476
Educational Services	82	1.146	1.321	2.300	1.600
Non-Profit Org.	83,84,86	1.304	1.829	2.188	1.745
Professional Services	87,89	1.250	1.443	1.923	1.722
Government	91-97	1.138	1.205	1.563	1.390
Note: SCAG projections relative to 1997 base year.					

Source: Table 2-6 of Appendix III of the 2003 AQMP
For SIC = 4911, CEC forecast was used in the 2003 AQMP to be about 2.5% per year.

Allocation Method

Although not recommended by staff, calculations were performed to estimate the emissions and what emission reductions would have been if the allocation method is used. Under this approach, the equipment profile and the peak year activity (1987 - 1992) was used to establish the 2000 allocations. For the same source categories, instead of the year 2000 ending emission factors, the proposed new BARCT emission factors were used unless no new BARCT was proposed. The year 2000 ending emission factors are the lower of the Rule 2002, Table 1 emission factors or reported emission factors at the start of the RECLAIM program (i.e., 1993). The total resulting emissions based on the method are 28.3 tons per day, about 18 percent higher than the AQMP method without the 10% adjustment, or about 7 percent higher than the AQMP method with the 10% adjustment. This outcome is expected, because using the individual peak year activity as a growth surrogate is likely to over-predict emissions growth, resulting in less emission reductions.

Market-Driven Method

Industry representatives have suggested using a market-driven method using RTC price levels as a surrogate to determine when BARCT has been met. The method suggests small, incremental reductions in allocations allowing adequate time for the market to react. This would be reviewed every three years and adjusted either upward or downward depending on the RTC price. For example, it is recommended by some stakeholders to reduce 3 tons per day by 2010, between 2007 and 2010. If prices remain below $15,000 per ton for the previous two years, an additional one ton reduction would be taken, after a one-year lead time. This would repeat with each AQMP revision.

Another industry proposal is to reduce 2 tons per day by 2008 and another 2 tons per day by 2009. This proposal is intended to address the concern about market impacts if too large a reduction is taken too quickly.

It would be difficult to demonstrate BARCT and equivalency with command and control using a market-driven method and BARCT equivalency because this method does not factor in a date by which controls may be achieved. With each AQMP, an evaluation would occur. By allowing the market to settle each time an adjustment is made, the program would always be attempting to catch up to BARCT.

Industry Comments

- Determination of RTC holding reductions should consider growth and job impacts.
- Representatives of the power producing industry have raised concerns that use of 1997 actual emissions as the basis for RTC holding reductions will result in an under-prediction of power plant emissions, as 1997 was the last year of operating under a regulated electricity generation market. This concern on the impact of future holdings was also shared by other industrial sectors.
- In order to retain program integrity and reduce the possibility for unintended impacts, the RTC holding reduction methodology should be based on the peak-year/new-BARCT methodology. Use of the AQMP, which depends on control and growth factors, can be inaccurate and emissions based on an average year would be inappropriate. It also uses

"base year" and forecasted growth rates that appear to underestimate regional production and industrial competitiveness needs. The peak-year method provides high production year compliance flexibility. However, if the AQMP method is used, consideration should be given to all facilities to carryover surpluses to the next year.

- The three ton per day reductions is generally supported by all industry sectors.
- A general concern has been raised that reductions beyond three tons per day could be damaging to the market and could result in a shortage of RTCs.
- A facility that is at BARCT pursuant to its Rule 2009.1 compliance plan should not be subject to further reductions. Any future reductions should be based on a determination of new BARCT at the facility.
- Municipal power producing utilities should be exempt from the proposed RTC holding reductions, provided the facility:
    - operates all NOx emitting equipment (excluding Rule 219 exempt equipment) at BACT or BARCT; and
    - has not sold RTCs in the private market.
- AQMD should monitor the RTC price for two years and introduce the next round of reductions gradually over a period of 3 years to ensure market stability. The technology-based BARCT determination is not necessary and inappropriate for a market program. A $10,000 per ton or $15,000 per ton RTC price can be used as a surrogate to indicate if BARCT is achieved.
- Can a more recent year than 1997 be used as a base year for the AQMP method?

Environmental Organization Comments

- The reductions should begin earlier.
- Reductions should occur over a shorter period of time.
- The 10% adjustment gives too much of a cushion and may keep RTC prices too low to spur the implementation of controls.
- The environmental community has stated that RTC holding reductions are supported and that AQMD should seek the greatest reductions possible beyond the 3 tons per day in the 2003 AQMP.

Staff Recommendations

Staff recommends the AQMP approach with the 10% adjustment for determining the total reductions for the RECLAIM program. While both methods have precedence for use in setting allocations, the allocation approach has some disadvantages. Using a peak year from 1987 – 1992 as a surrogate for growth relies on data that is 12- 17 years old, whereas the AQMP approach uses 1997 actual emissions and more recently developed growth projections. 1997 actual emissions were used for the baseline for the 2003 AQMP. Choosing a different year would require development of new growth factors from SCAG and revised control factors to reflect controls implemented by the base year chosen. Emissions in later years would most likely be lower than emissions in 1997 to reflect more controls added by RECLAIM facilities and turnover of equipment which would be at BACT levels. Using the 1997 base year for the 2003 AQMP is consistent with the original 1994 program design, which used 1987 as the baseline for the 1991 AQMP.

The allocation method approach uses old peak year activity applied to the facility's year 1993 equipment list, which may not be representative over time. Using peak year activity results in an overestimation of the remaining emissions since it is unlikely all facilities will be operating at their peak level at the same time. As such, the allocation method cannot be a stand alone methodology and it needs another reference point to demonstrate equivalency to the command-and-control program. In the initial design of the RECLAIM program, both 2000 and 2003 ending allocations were reduced to match the 1991 AQMP controls. Calculations for each type of equipment at each facility 10 years after the program implementation would be extremely difficult, if not impossible. For example, there would be new or replaced equipment that do not have a historical peak year activity prior to 1994. After 1994, major sources report their emissions through CEMs that usage data for individual equipment is not readily available. Furthermore, this approach does not address RTC holdings versus calculated emissions and are less repeatable than the AQMP method. Staff does not recommend use of this method for calculating remaining emissions.

As previously mentioned, the market-driven method would rely upon an incremental removal of RTCs from the program in three year intervals. Under this method it is assumed that a RECLAIM program evaluation of RTC prices in conjunction with future AQMPs would provide adequate information for any additional reduction in RTCs. This method would have merit if BARCT was the only variable that impacted the price of RTCs. In fact there are multiple factors that influence RTC price. For example, during the energy crisis in 2000-2001, the RTC prices went up to $40 to $60 per pound, which was more a result of delay in installing controls and increased power plant demand, rather than the true reflection of control costs. On this basis, the market-driven approach is not recommended due to the difficulty of demonstrating equivalency to command and control and BARCT.

Potential Exemptions

Throughout the public process to amend RECLAIM, including numerous Working Group and stakeholder meetings, concerns were raised regarding facilities already at BARCT or BACT that whether further reductions from facility's RTCs would be equitable. Several options have been discussed regarding whether it is appropriate to exempt certain facilities from further reductions under RECLAIM. The exemption(s) could either be in the form of exclusion from: 1) RTC reductions only or 2) the program altogether. As shown below, each exemption could be based on these criteria.

<u>1) RTC Reductions</u>
Facilities:

- that are in the RECLAIM program since 1994 and have 1994 allocations equivalent to 2000 allocations;
- where all equipment, except those exempt under Rule 219, are at or below the proposed new BARCT;
- that have not sold their RTCs post 2004;
- holdings would become non-tradable; and
- holdings above initial allocations are not exempt from further reductions and are tradable.

2) Out of Program
Facilities:

- where all equipment, except those exempt under Rule 219, are at or below BARCT;
- that are willing to take an annual emissions cap based on the amount of RTCs retired from the program and subject to equipment concentration limits at current BARCT or BACT and command-and-control for all future permitting actions; and
- holdings above initial allocations are not exempt from further reductions.

Discussion

In a market system, it is difficult to develop equitable criteria for exclusion from the reductions, while maintaining market integrity. If given an option, each facility would choose what is best for them which could result in less environmental benefit. Facilities at BARCT include many power plants and some very large RECLAIM facilities. However, there are facilities that were brought into the RECLAIM program from the start to be buyers with their emissions at BACT levels. Further reduction of RTCs would force facilities to purchase more credits. Many stakeholders appear to understand that some consideration shall be given to these facilities without compromising environmental objectives.

Allowing facilities out of RECLAIM would require changes to RECLAIM and command and control rules to deal with how to treat their RTCs, whether they would be eligible for ERCs in the future. Over time, as more facilities get to BARCT, there would be a diminished number of participants and eventually there would be no RECLAIM program.

Facilities, in many cases, have enjoyed benefits of the program which include 1-to-1 offsets per year for NSR rather than 1.2-to-1 in perpetuity under command and control. They have the ability to sell credits if production is low and more flexibility and time to add controls than under command and control rules.

Industry Comments

- For facilities that have already done BARCT or better, it is more equitable to have no reductions or allow them out of the program.
- Some companies may need protection if they cannot afford to purchase credits and have already spent money to control facility NOx emissions.
- If reductions are required from these facilities, there should be an AQIP program.
- Some of these companies have benefited from previous sales of credits; no special consideration shall be given.
- In a market system there would be less demand (less sellers) if such facilities were allowed out of the program or exempted from the across-the-board reductions.
- Less buyers in the market would mean less need for other reductions or innovation.
- The “out-of-program” concept changes the fundamental design of the RECLAIM program.

Staff Recommendation

Staff recommends exemption from emission reductions for facilities which have their 1994 starting emission factors equal to their 2000 ending emission factors and all equipment at the facility is at or below proposed new BARCT. Staff analysis indicates that there are potentially 3 facilities that would qualify for the exemption, resulting in about 0.02 tons per day of reductions foregone. This is still under consideration. In summary, staff is contemplating some limited exemption. If the scope of exempting is broadened, it may need to shift the reduction burden to the rest of the universe to meet the state law requirements. If facilities can opt out of the program, staff needs to develop a more detailed plan to transition the program into a command-and-control program. Staff will continue to evaluate this and work with stakeholders.

Rate of NOx RTC Reductions and How Reductions are Applied

Introduction

A key requirement is that BARCT be implemented and reductions achieved on a timely basis reflecting the availability of BARCT controls. There are several policy options for how reductions are obtained from RECLAIM, including the slope of the reduction line, the time allowed for reductions to occur and whether reductions are applied equally to all RTC holders or by differential rates of reduction by industry or by facility.

Just as the 1991 AQMP reductions from compliance year 2000 to 2003 were applied programmatically across all facilities, regardless of equipment type and size, staff proposes to utilize the same approach for achieving additional emission reductions under the program. Factors for analyzing the appropriate reduction schedule include the time necessary for planning, design, financing, engineering, and construction.

Discussion

Rate of NOx RTC Reductions

Under the current RECLAIM regulation, RTCs have remained at the same level since 2003. Total actual emissions from all RECLAIM facilities for the year 2002 were 30 tons per day, approximately 8.5 tons per day less than the available RTCs in the market. Projected actual emissions for the year 2003 are one ton less than 2002 levels, and are expected to be 5.2 tons per day lower than available RTCs in the program. Annual audits for RECLAIM show that, except for the energy crisis in 2000 and 2001, there are generally 15 to 20 percent unused RTCs at the end of the compliance year. While not all unused RTCs are available in the market, the current very low prices during the reconciliation period (less than $1.00 per pound, and as low as $0.40 per pound), indicate that the market as a whole has excess RTCs and can be further reduced in a relatively short time frame. Specifically, Rule 2009 power plants have implemented BARCT (and beyond BARCT for the purpose of this proposal) since 2003. The most recent compliance year 2003 power plant quarterly reports indicate that power plants had 2.6 tons per day excess RTCs in 2003.

However, some equipment categories, such as FCCUs, may need until 2010 to achieve these reductions due to the factors discussed earlier. Concerns were raised that although the market as a whole has excess RTCs, adequate time (i.e., 2 to 3 years) should be given to individual facilities should they choose to install controls instead of purchasing credits form the market.

RTC Reduction Options

Regardless of the years in which RTC holding reductions occur, there are two options for the application of those reductions: an “across-the-board” reduction; and equipment-/industry-specific reduction. Each approach has advantages and disadvantages.

<u>Across-the-Board</u>
Under this approach, each facility or RTC holder would have an equal percentage reduction from their current RTC holdings for each individual year. For example, if the reductions were 20 percent by 2010, all RTC holdings will be reduced by the same percentage. This approach, from a market aspect, is believed to be the most appropriate as it achieves reductions on a programmatic basis and allows the market forces of supply and demand to dictate where the most cost effective reductions will come from. Furthermore, this approach would have minimal interruption to the ongoing trading activities, because regardless who holds the credits, the rate of reductions would be the same.

<u>Equipment-/Industry-Specific</u>
This approach would apply reductions to only those facilities that have equipment where a new BARCT level has been determined. The reductions to RTC holdings would be facility-specific based on the level of control achieved at the facility. The reduction would be derived based on the allocation method discussed earlier. This approach, from an equity standpoint, does not penalize (in the form of RTC holding reductions) those facilities that have already made efforts to achieve BARCT at their facility or are already at BACT. Difficulties include: selection of appropriate activity levels for the facilities in question; how to demonstrate programmatic equivalency to command and control; based on a snapshot of holdings, certain amount of RTCs would always be held by brokers who do not own or operate any equipment; and facilities could transfer RTCs to another facility or third party if that would result in a lower rate of reduction. This approach also fails to recognize the trading activities that have taken place since the inception of the program.

<u>Price Trigger for Temporary Relief</u>
Industry expressed concerns regarding the potential for increased RTC prices and the amount of time it takes to conduct a Rule 2015 evaluation in the event prices exceed $15,000 per ton. One possible solution is to track RTC market price to provide a temporary relief mechanism. An advantage of this approach is the assurance of a quick response to stabilize the market. However, the industry stakeholders claimed that they cannot effectively rely on this strategy, because they need to plan their compliance options several years ahead. Environmental representatives have commented that this relief removes the incentive to install control equipment and raises the potential for market manipulation. Staff’s response, however, is that the relief is not designed to delay controls, but to serve as a temporary solution when there is a significant mismatch between and demand and supply while giving staff time to perform a program evaluation.

Industry Comments

- Some industry representatives have stated that RTC holding reductions for the RECLAIM program should be implemented evenly across all RECLAIM sources. Other industry representatives advocate equipment- or industry-specific reductions, stating that across-the-board reductions are not fair to facilities that have installed control equipment and accomplished their commensurate command-and-control reductions.
- Industry representatives have recommended that programmatic reductions begin in 2007 instead of 2006 to allow time for installing air pollution controls, to allow adequate time for planning, design, permitting, construction, and implementation of control equipment.
- Access to restricted RTCs in the event prices exceed $15,000 per ton should be based on a one-month or three-month period, not a 12-month rolling average.
- Restricted RTCs should be transferable to facilities under common ownership in the event the average RTC prices threshold of $15,000 is exceeded.

Environmental Organization Comments

- The reductions should begin earlier.
- Reductions should occur over a shorter period of time.

Staff Recommendation

Staff proposes that a decrease in RTC holdings would be implemented on a two-phase programmatic basis between compliance years 2007 and 2010 reflecting the total reduction of 7.8 tons per day (or 22.8 percent) for the current program. The first phase is 4 tons per day in 2007 and 3.8 tons between 2008 and 2010 in equal increments. As a companion piece to this recommendation, power plants would not rejoin the full market until 2007. Reductions in 2007 through 2009, 6.5 tons per day, would be credited toward the California SIP. Reductions for 2010 would be retained by facilities as restricted credits for use only if the average RTC price, based on a 12-month rolling average, exceeds $15,000 per ton during 2010 or later years. In the event this occurs, the incremental reductions would no longer be restricted and the holders of the credits could use or sell the RTCs for compliance purposes pursuant to Rule 2004. When prices exceed $15,000 per ton, a program evaluation is also required under Rule 2015 and upon completion of the evaluation, staff will recommend appropriate adjustments and/or other necessary corrections to the program. Staff, therefore, believes the relief would be a temporary delay in achieving the targeted reductions.

Staff is proposing a 12-month rolling average in determining if the average RTC price exceeds $15,000 per ton. This time-frame is chosen to avoid potential price manipulation. Staff has observed that most of the trading activities occur during the cycle-end reconciliation. A 12-month period provides an average price of 2 trading cycles, which would eliminate isolated abnormalities. $15,000 per ton is selected because it is consistent with the threshold in Rule 2015 for program evaluation.

This two-phase approach is designed to address two seemingly conflicting objectives. First, industry stakeholders requested sufficient lead time be given to facilities who want to install controls in lieu of purchasing RTCs. A two-year lead time (2005-2006) for design, budgeting, permitting, and installation of low-NOx burners is more than adequate. Second, since power plants have already implemented BARCT, immediate reductions from the program can be taken to reflect BARCT. Delaying the start of reductions until 2007 and restricting power plant trading would in essence retain the environmental benefit from power plant reductions in the interim while allowing other facilities to install controls if electing to do so. The price trigger provides a safety valve for the market without compromising long-term environmental objectives.

Due to the large size and complexity of many facilities, such as refineries, reductions were assumed to occur over several years. In addition, for such large facilities, it was necessary to take into consideration turn-around times for equipment turnover and maintenance. For example, the schedule for refinery FCCU turn-arounds would not be completed by all refineries until after 2008. Therefore, staff is proposing reductions to be spread out from 2007 to 2010. This would provide the additional reductions necessary to achieve the command-and-control equivalent emission reductions and allow for the necessary lead time to implement the reductions at the facilities.

The staff proposal is based on cost effective control technologies implemented under a schedule if command and control rules were implemented. However, in a market program, the decision to purchase RTCs or install controls and the implementation schedule is decided by the individual facility operators. In a relatively small market like RECLAIM, there is a potential to have a mismatch between demand and supply. Therefore, staff recommends a price trigger to monitor the market by providing temporary relief. The reason why only the 2010 reductions beyond 2009 (1.3 tons per day) are subject to price trigger is explained as follows. When applying the AQMP methodology in estimating the total reductions for the RECLAIM program, growth assumptions developed by SCAG based on 2 digit-industrial SIC codes were used. This set of growth assumptions was also used in the 2003 AQMP for attainment demonstration. Issues were raised regarding the uncertainty in growth projections, specifically what if the growth rates for the next several years in the region exceeded the SCAG projections, which could create greater demand of RTCs in the market, resulting in significantly higher credit price. In order to address this concern, staff examined the key demographic growth indicators developed by SCAG for the last four major AQMP revisions. Since the facilities in the RECLAIM program are mostly in the industrial or manufacturing sector, it was determined that the total employment data is an appropriate indicator for the overall growth projections for the program. As can be seen in Table 5, employee data varied slightly between planning cycles for the same year 2010. The highest upward fluctuation in employment data is between 1997 and 2003 AQMPs by approximately 6%.

Table 5

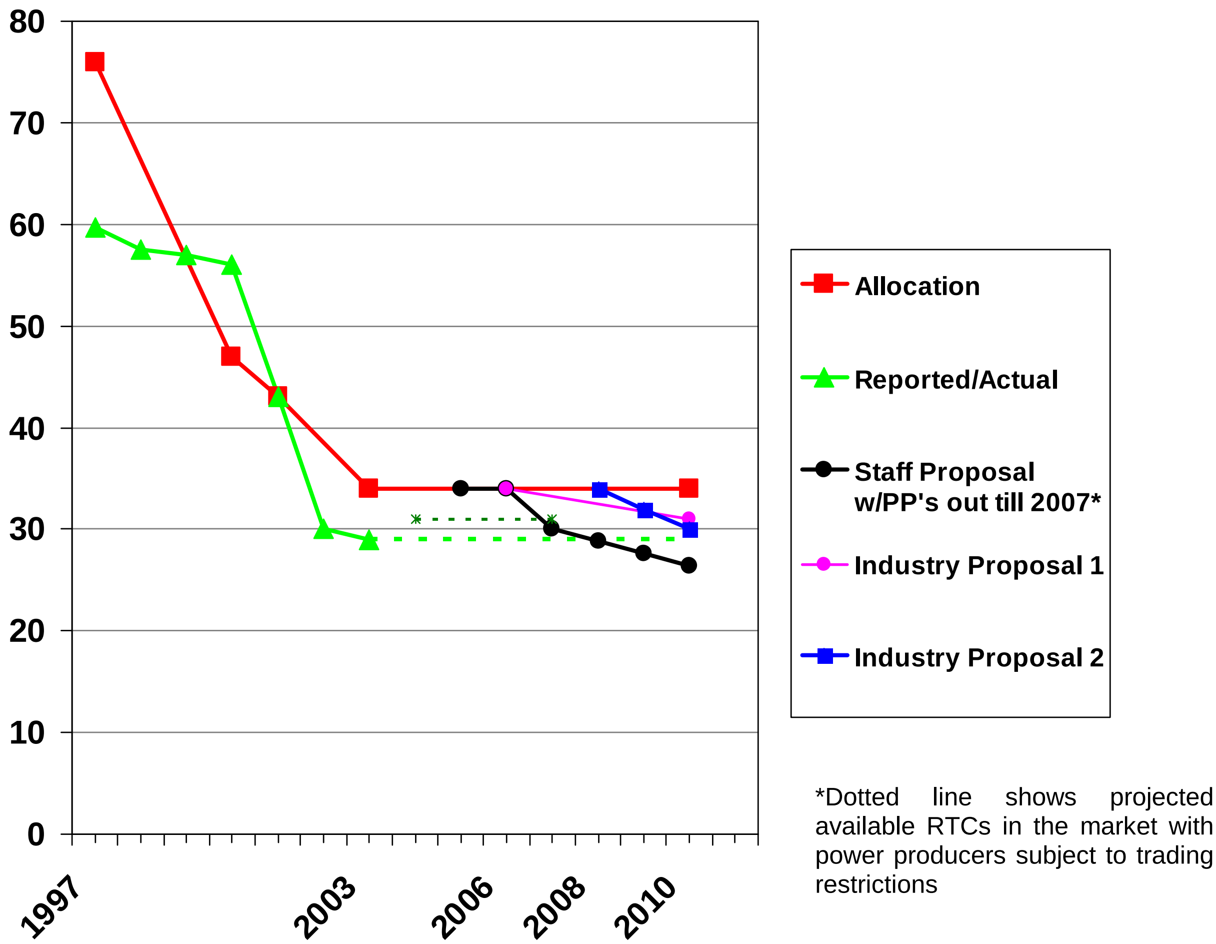
Baseline Socioeconomic Forecasts for the South Coast Air Basin for 2010

Socioeconomic Category	1991 AQMP	1994 AQMP	1997 AQMP	2003 AQMP
Population (millions)	15.7	17.3	16.7	18.2
Housing Units (millions)	6.1	6.0	5.7	5.9
Total Employment (millions)	8.2	8.6	8.0	8.5
Daily VMT (millions)	387.6	413.9	377.9	454.7

Source: Chap. 3 of 1991, 1994, 1997 & 2003 AQMPs

Total program RTCs for each compliance year after 2010 will be the same as the RTC holdings in 2010. If the average credit prices do not exceed $15,000 per ton, then the reductions achieved for the 2010 compliance year would be counted as part of the overall region's progress towards attainment and submitted for inclusion in the SIP. Figure 10 illustrates the staff and industry proposals relative to the current RTCs and reported actual emissions. The dotted line for the staff proposal represents the projected available RTCs in the market with power plants continue to be subject to trading restrictions. The 2010 emissions under the staff proposal would be 2.5 tons per day below the projected 2003 emissions, while the industry proposal would be 1 to 2 tons above the 2003 levels.

Figure 10
NOx RTC Reductions
(Tons per Day)



IV. GENERAL DISCUSSION TOPICS

Throughout the rule development process, other issues that have not been discussed previously in this white paper have been raised. These issues are described below, with discussion and staff recommendations, where appropriate.

Cost Threshold

Issue

This issue involves: (1) the appropriateness of a threshold, and (2) if appropriate, the value of the threshold.

Background

The Governing Board has not set an upper limit for cost effectiveness. Cost effectiveness for command and control rules for NOx BARCT is looked at on a rule-by-rule basis rather than having a single dollar per ton number. When a rule is brought to the Governing Board, the Board determines the cost, affordability to the industry, etc. and determines the cost effectiveness number for the controls. The RECLAIM program combines many types of industries. Therefore a mixture of more and less cost effective controls is appropriate.

Cost effectiveness is used as a criteria for analyzing controls for new equipment for non-major sources. Under the Best Available Control Technology (BACT) guidelines, the current maximum cost effectiveness is $19,100 per ton for NOx controls and the incremental cost effectiveness maximum is $57,200 per ton.

Under the RECLAIM rules, a program evaluation is required if the cost of RTCs reaches $15,000 per ton. It should be noted that control cost is only one factor affecting RTC prices, however it is not the only one.

Discussion

Neither BARCT nor the RECLAIM program requires that only the least cost control alternatives are considered. Theoretically, the most cost effective controls are put on first, followed by more costly controls. RECLAIM is designed to encourage the development of more cost effective controls.

An analysis of previous NOx rules and control measures was done to help quantify cost effectiveness. The following weighted cost-effectiveness includes stationary source AQMD rules and 2003 AQMP control measures. This analysis ascertained the ranking of the $15,000 per ton level in relation to the statistically significant parameters of these rules and control measures. All results are in 2003 dollars.

Table 6
Cost Effectiveness of AQMD Rules and 2003 AQMP Measures

Cost Effectiveness	
$9,900	Average
$6,600	Standard Deviation
$12,900	60 Percentile
$14,300	75 Percentile
$17,800	90 Percentile
$20,200	95 Percentile

As shown above, the PAR 2002 $15,000 per ton can be tied to the 75^{th} percentile or even lower. Theoretically speaking, RTCs should reflect both control costs and transaction costs. A market price of $15,000 per ton would mean the control cost is actually less. Statistically, an upper percentile would be appropriate in establishing an upper limit.

H&S Code §39616(f) requires the AQMD to set a market price for RTCs above which a reassessment of the program is triggered. It should be noted that if the $15,000 program evaluation trigger level of Rule 2015, which was adopted as part of the original program design, were converted to current dollars, the program evaluation level would be approximately $17,400. Affordability and overall costs are critical factors in rule development. Setting one universal cost effectiveness threshold may take away the flexibility in industry-by-industry consideration. Cost effectiveness and affordability are critical to small business. Also, one should not underestimate the technology advancement potential that tends to lower control costs over time. For example, when Rule 1135 was first adopted the SCR cost then was $9,700 and now is $3,100.

Relative to a BARCT cost threshold, some industry participants have argued that a limit, suggested in a July 1997 Presidential (Clinton) policy memo regarding implementation of revised air quality standards for ozone and PM, should be used. The intent of the memo was to demonstrate that there was a "strong desire to drive the development of new technologies with the potential of greater emission reduction at less cost." Specifically, the memo states, "$10,000 per ton of emission reduction is the high end of the range of reasonable cost to impose on sources." The memo did not provide the basis for this cost threshold figure, but was intended to be used not only for strategies to attain the PM and ozone standards, but for market-based strategies as well to reduce compliance costs. This included concepts such as a Clean Air Investment Fund, which would allow sources facing control costs higher than $10,000 a ton for any of these pollutants to pay a set annual amount per ton to fund cost-effective emissions reductions from non-traditional and small sources. However, the final EIP (January 2001) stated that the $10,000 per ton threshold be used "as a guide," but that state and local agencies may set "required per ton threshold for payment into a fund higher or lower than $10,000, based on local and regional circumstances and the purposes designated for the fund..." Circumstances in this region are such that significant additional reductions are needed to attain national ambient air quality standards, such that a low threshold of $10,000 is inappropriate because it would not result in enough reductions. In addition, the concept of a $10,000 cost threshold was initially conceptualized at a time in which the EPA was proposing a more expeditious attainment schedule relative to the new ozone and PM standards. The proposed schedule never materialized and attainment dates were set beyond 2020. Therefore, this level was not set as a regulatory requirement, rather it was a policy objective of President Clinton's administration.

In the evaluation of BARCT, not all equipment categories have a new BARCT level proposed. However, incremental cost-effectiveness was a consideration when a new BARCT level was identified for certain categories. For example, for boilers subject to Rule 1146, SCR was not accepted as BARCT due to the incremental cost of control (i.e., from 30 ppm to 5 ppm). Based on the incremental cost-effectiveness, the level of control for this category was then identified as ultra-low NOx burners. This is not to say that if a boiler is currently uncontrolled, SCR would not be considered cost effective. For refinery heaters and boilers a 5 ppm emission concentration from SCR control led to a bifurcation by equipment size. That is, SCR was not found cost-effective for units between 40 and 110 mmbtu/hr. For the larger than 110 mmbtu/hr units, SCR was identified to be cost-effective and therefore proposed as BARCT. In another example, a new BARCT level was determined for gas turbines. However, the reductions by SCR were found not to be cost effective and the reductions were therefore not included in the programmatic reductions.

Table 7
Cost Effectiveness Ranking

Equipment	$/ton	BARCT Concentration	Control Technology
Utility Boilers[1]	3,100	9 ppm	SCR
Heat Treating	4,000	45 ppm	LoNOx
FCCU[2]	11,400	80% reduction	SCR
Metal Melting	8,500	45 ppm	LoNOx
R1146, R1146.1 Boilers/Heaters	9,000 – 10,000	9 and 12 ppm	LoNOx
Misc	9,500	30 ppm	LoNOx
R1109 Boilers/Heaters > 110 mmBtu[2]	17,500	5 ppm	SCR

[1] Rule 2009 Utility boiler cost effectiveness is based on pre-Rule 2009 emissions.
[2] Cost effectiveness based on 25 year life, others based on 10 year life.

Industry Comments

- Allowable cost effectiveness should not exceed $15,000 per ton of reduction, based on a 10-year equipment life. Any control equipment with a higher cost-effectiveness should not be considered when determining the level of RTC reductions sought as a result of this process.
- A BARCT cost-effectiveness threshold needs to be established.
- BARCT cost-effectiveness should be based on $10,000 per ton NOx threshold given by EPA as ceiling for BARCT. If not, then BARCT cost-effectiveness should be set at $15,000 per ton, consistent with the program evaluation criteria of Rule 2015.

- Cost-effectiveness should not exceed that noted in the 2003 AQMP control measure for further RECLAIM reductions.

Environmental Organization Comments

- A cost threshold prevents the market from performing as a free market.
- If a cost threshold is set to prevent credit prices from rising too high, then a low end threshold should be set to prevent prices from going too low. When credit prices drop there is a disincentive for facilities to add controls.

Staff Recommendation

Adopting one cost-effectiveness threshold for BARCT rules for all industries does not take into consideration differences in size and available resources. For example if an industry is made up primarily of small businesses affordability may become an issue, whereas large industry may have no problem with that same threshold. Staff recommends considering cost-effectiveness on equipment category basis.

LCF and DCF Cost-Effectiveness Methods

Issue

The AQMD routinely conducts cost-effective analyses regarding proposed rules and regulations that result in the reduction of criteria pollutants (NOx, SOx, VOC, PM, and CO). The analysis is used as a measure of relative effectiveness of a proposal. It is generally used to compare and rank rules, control measures, or alternative means of emissions control relating to the cost of purchasing, installing, and operating control equipment in order to achieve the projected emission reductions. Cost-effectiveness is a key element to the BARCT criteria for economic feasibility. There are two primary methods for evaluating cost-effectiveness: Discounted Cash Flow (DCF); and Levelized Cash Flow (LCF). DCF is the AQMD's chosen method of analyzing costs. However, comments have been received suggesting that the LCF method of cost-effectiveness should be used in support of AQMD rulemaking.

Background

The major parameters in cost-effectiveness include capital and installation costs, operating and maintenance costs, interest rates, and project life. DCF is based on a conversion of future expenditures (including annual costs) to a present value basis using a present value factor. LCF is different in that fixed capital expenditures are converted into an equivalent annual amount using a capital recovery factor. Under the same interest rate and project life, the present value factor is a reciprocal of the capital recovery factor. LCF generally yields numbers that are 20 to 30% higher that DCF. Appendix B provides a more detailed discussion of each method and includes examples of each.

Discussion

DCF is more versatile than LCF in that DCF can easily deal with non-constant annual operating and maintenance costs and those costs occurring longer than the standard one-year interval (e.g., catalyst replacement every five years). Second, DCF allows non-uniform emission reductions over the project life. Finally, DCF is neutral on how a project is financed by individual businesses, which is very much tied to the well-being of these businesses.

In addition, the most important criteria in applying a cost-effectiveness methodology is to maintain consistency. That is, if past rulemaking projects are based on DCF, then it would be prudent to continue using DCF for future projects. Using the LCF method for this analysis would result in the inability to compare cost effectiveness for new BARCT with past rules.

Other Potential Supply of RTCs

The BARCT analysis indicates which equipment category additional NOx emission reductions are feasible from beyond the rules and control measures subsumed by RECLAIM. In addition to the BARCT reductions that are cost effective and feasible for several categories of RECLAIM equipment, there are other potential reductions in the program. For example, even though as a category, no reductions are proposed programmatically for internal combustion engines, but there are many pieces of equipment that are not yet controlled to Tier I levels and may be able to reduce emissions very cost effectively. Some oil and gas facilities have electrified their engines. In addition, RECLAIM facilities have the ability to utilize combustion optimization technology or changes in throughput to generate credits when they are not at production levels that need all of their annual allocations. Another consideration is the supply of credits resulting from new source review. When equipment in RECLAIM is replaced, BACT is required. This normal progression of equipment replacement upon the end of its useful life results in additional credits that are no longer needed by the facility to retire against the higher emissions from the equipment that was replaced. These three factors have not been quantified or accounted for in the overall program reductions, and will help provide room for growth of all sources, including supply for new power plants.

Industry Comments

- LCF is more appropriate than DCF for cost-effectiveness.
- In comparing control technologies relied upon by other air districts, consistent cost-effectiveness methodologies should be used to make the appropriate comparison.

The stakeholder comments have been addressed in the discussion above.

General Industry Comments

- The proposed RECLAIM amendments and the agreement with CARB alters the fundamental principals in the design of the program by redefining BARCT equivalency every three years.

Discussion: AQMD staff worked closely with CARB staff regarding the appropriate interval for the BARCT review required by H&S Code § 40440. The agreement was to review BARCT every three years in conjunction with AQMP revisions. This allows a systematic review over a reasonable period of time, rather than utilizing the most conservative approach of requiring a BARCT every time any of the RECLAIM rules are amended. The program design concept of meeting equivalent reductions from the sources in the program as what would have occurred under command and control remains unchanged. Staff recommends that a BARCT analysis be conducted every three years, in conjunction with AQMP revisions.

- The current proposal does not adequately factor the need for credits as a result of NSR. An example is the potential need for increased electric power generation over the next ten years. The proposal fails to recognize the significance of this industry's expected growth.

Discussion: The method used to calculate emission reductions possible for the BARCT relied on the new control factors for select categories of equipment and the growth factors from the 2003 AQMP. New source growth is accounted for in the category and county projections of growth. For power plants, the CEC forecast of 2.5 percent per year was used to estimate growth for this sector.

- RTC reductions should be recognized as a "take-away" of credits that have real, significant financial cost to companies. This represents a financial loss since many companies bought such credits to ensure compliance. This is a write-off that publicly-traded companies will have to show in their financial statements. The replacement or opportunity cost of the RTC reduction is larger than the anticipated financial loss. The RTC reductions will significantly increase the cost of future compliance, as these credits were not surplus to operational needs.

Discussion: At the onset of RECLAIM, RTCs were allocated to RECLAIM facilities free of additional charge. These RTCs have become assets to RECLAIM facilities and their values depend on the price and number of RTCs held by a facility. The values of these assets are realized as they are not sold.

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 facility as the District 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. The associated expenditure is the compliance cost of RECLAIM, which is no different from the compliance cost of any command-and-control rule. Yet, RECLAIM facilities have choices that are not afforded to those under the command-and-control rules.

- The proposal does not address the unique situation associated with the power industry. For example, increased in-Basin generation may be necessary in the event a problem occurs with one of the transmission lines bringing in power. Such a disruption could trigger an order by Cal-ISO for a significant and unexpected ramp-up of electricity production. Such an event could be disruptive to the RECLAIM market and put a strong and unanticipated upward pressure on the price of RTCs.

Discussion: Current power plant holdings are approximately 30 percent above recent actual emissions (compliance year 2002). Power plants, due to Rule 2009, have installed BARCT and BACT on all generation equipment. Even if the generation demands of the 2000/2001 energy crisis were repeated, emissions from power plants are expected to be significantly below current RTC holdings. In June 2003, staff has concluded that current RTCs held by the facilities are sufficient to cover the emissions resulting from an electrical generation demand at the level seen in the 2000-2001 timeframe.