DRAFT SUGGESTED LIST OF MEASURES TO REDUCE OZONE IN THE MARICOPA NONATTAINMENT AREA

A Draft Suggested List of Measures to Reduce Ozone in the Maricopa Nonattainment Area has been developed to meet Clean Air Act requirements related to the 2015 ozone standard. The Draft Suggested List of Measures is an important part of the process used to meet Reasonably Available Control Measures (RACM) requirements, contingency measure requirements, and to demonstrate attainment of the 2015 ozone standard within the Maricopa nonattainment area. Following approval of the Draft Suggested List of Measures by the MAG Regional Council, the measures are then considered for implementation by the implementing entities.

BACKGROUND INFORMATION

On October 7, 2022, EPA published a final rule in the Federal Register to determine that the Maricopa Eight-Hour Ozone Nonattainment Area did not attain the 2015 ozone standard (0.070 parts per million) by the August 3, 2021 attainment date and will be reclassified to a Moderate Area. The attainment date for Moderate Areas is August 3, 2024. The final rule indicates that a new plan to address Moderate Area requirements will be due to EPA by January 1, 2023.

Preliminary ozone modeling indicates that additional ozone precursor control measures will be needed to demonstrate attainment of the 2015 ozone standard in the nonattainment area by August 3, 2024. MAG contracted with Ramboll US Consulting to identify and evaluate new and available ozone precursor emission control measures. Ramboll finalized their report, *Evaluating New and Available Ozone Precursor Control Measures in the Maricopa Nonattainment Area*, on March 6, 2023. The measures contained in the Ramboll report have been included in the Draft Suggested List of Measures. Where available, the Draft Suggested List includes estimates of 2023 ozone-season emissions reductions of ozone precursors, as well as cost data associated with adoption and implementation of the suggested measures.

The MAG Air Quality Technical Advisory Committee and MAG Management Committee recommends the Draft Suggested List of Measures, and the MAG Regional Council approves the Draft Suggested List of Measures for consideration by each implementing agency. Each implementing entity then determines which measures are available and feasible for implementation by that entity. The Environmental Protection Agency indicates that it is expected that the suggested measures will be evaluated for technological and economic feasibility. If an entity decides that a measure on the Suggested List is not available or feasible for implementation, the entity will provide a justification for why the measure is not available or feasible.

Draft Suggested List of Measures to Reduce Ozone in the Maricopa Nonattainment Area

These measures may or may not be feasible and available to the implementing entities.

The ordering of measures on the Suggested List does not indicate the relative importance or priority of any particular measure.

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
MEASURES FOR ONROAD MOBILE SOURCES				
OM-1	**Optional Reduced NOx Standards for Heavy-Duty Vehicles:** Adopt optional low-NOx emission standards for onroad heavy-duty engines similar to the California Air Resources Board's (CARB) 2013 program. In 2013, CARB adopted optional low NOX emission standards in California for on-road heavy-duty engines, which encourages engine manufacturers to introduce new technologies to reduce NOX emissions below the current mandatory on-road heavy-duty diesel engine emission standards for model years 2010 and later. This reduction program aims to encourage fleet owners to convert their fleets to use ultra-low NOx engines that reduce NOx emission below mandated standards. This measure could be paired with incentive programs to encourage fleet adoption of low-NOx heavy-duty engines.	1,265 lbs of NOx	$12,659 per ton of NOx	State
OM-2	**Clean Vehicle Rebate Project/Clean Air Vehicle Decal for Light-Duty Vehicles:** Adopt a rebate and incentive program similar to California's "Clean Vehicle Rebate Project" which encourages the accelerated adoption of clean light-duty vehicles. This measure would achieve emission reductions as part of an incentive program such as a rebate program for new electric vehicle buyers and High-Occupancy-Vehicle (HOV) access incentives.	612 lbs of NOx and 1,047 lbs of VOC	$36,160 per ton of NOx $21,133 per ton of VOC	State, County, Local
OM-3	**Goods Movement Emission Reduction Program:** Adopt an incentive program similar to California Proposition 1B to reduce emissions from the movement of goods, including highway trucks. This measure would target emission reductions from diesel-fueled single-unit short-haul trucks and combination unit short-haul trucks. Under this program the purchase of eligible low- and zero-emission heavy-duty vehicles would be subsidized.	1,113 lbs of NOx	$41,044 per ton of NOx	State

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
OM-4	**Heavy-Duty Vehicles Diesel Retrofit:** Adopt a program or incentives to encourage the retrofit of heavy-duty onroad diesel engines. This control measure would entail installation of diesel retrofit systems to reduce tailpipe NOx emissions from diesel engines. Retrofit devices applicable to the reduction of NOx emissions include selective catalytic reduction systems and engine upgrade kits.	384 lbs of NOx and 51 lbs of VOC	$7,932 per ton of NOx	State, County
OM-5	**Public and Workplace Electric Vehicle Charging Infrastructure:** Adopt programs to encourage accelerated access to public and workplace electric vehicle charging infrastructure for light-duty electric vehicles. Implementing public and workplace charging infrastructure will make it more accessible and convenient for individuals to own electric vehicles and in turn reduce vehicle emissions.	377 lbs of NOx and 645 lbs of VOC	Not Estimated	State, County, Local
OM-6	**Eliminate Long Duration Idling from Heavy-Duty Vehicles:** Adopt regulations and/or programs to eliminate or reduce long duration idling (hoteling) from heavy-duty vehicles. Potential means of compliance include idle reduction technology to provide cab comfort services during periods of sleep and rest, including battery-powered systems, thermal energy storage systems, and truck-stop electrification systems.	385 lbs of NOx and 32 lbs of VOC	Not Estimated	State, County, Local
OM-7	**Alternative Fuel Programs – Replacement of Diesel-Fueled Heavy-Duty Vehicles with Natural Gas-Fueled Vehicles:** Adopt a voucher or incentive program similar to California Air Resource Board's (CARB) On-Road Heavy-Duty Voucher Incentive Program that provides financial incentives to heavy-duty diesel vehicle owners for vehicle replacement. The CARB program provides vouchers for natural gas vehicles certified to meet California optional low NOx standards or zero emission vehicles.	918 lbs of NOx	Not Estimated	State, County
OM-8	**CARB Phase III Reformulated Gasoline:** Require the use of California Air Resources Board (CARB) Phase III reformulated gasoline during the ozone season (April-September) in the nonattainment area.	979 lbs of NOx	Not Estimated	State
OM-9	**Accelerated Retirement of Older Light-Duty and Medium-Duty Vehicles:** Adopt a vehicle scrappage incentive program similar to the South Coast Air Quality Management District "Replace Your Ride" program. This program would target vehicles that have been operated for over 20 years (i.e., model year 2003 or older) and could retire up to 2,000 light- and medium-duty vehicles annually, based on an existing program in Southern California.	121 lbs on NOx and 150 lbs of VOC	Not Estimated	State, County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
OM-10	**Accelerated Deployment of Near-Zero and Zero-Emission Heavy-Duty Trucks:** Adopt a rebate program targeting the replacement of diesel heavy-duty vehicles (gross-vehicle weight rating of 14,001 lb and greater) with hybrid-electric and full-electric models similar to the program in the South Coast Air Quality Management District 2016 Air Quality Management Plan.	217 lbs of NOx and 10 lbs of VOC	Not Estimated	State, County
OM-11	**Aerodynamic Devices and Low-Rolling Resistance Tires for Heavy-Duty Trucks:** Adopt an incentive program to subsidize the use of aerodynamic devices and low-rolling resistance tires (e.g., EPA SmartWay Technologies) on heavy-duty trucks.	151 lbs of NOx and 9 lbs of VOC	Not Estimated	State, County
OM-12	**Idling Reduction Technologies for Diesel School Buses:** Adopt the use of idling reduction technologies for school buses similar to those described by EPA and in the North American Council for Freight efficiency report. There are five verified idling reduction technologies listed on the EPA website that can reduce diesel school bus idle emissions. Maricopa County Air Quality Department Ordinance P-21 already restricts diesel idling. Additional school bus idle emissions reductions may be achieved by a program intended to limit diesel school bus idling to only manufacturer prescribed warm-up periods.	25 lbs of NOx and 2 lbs of VOC	Not Estimated	County, Local
OM-13	**Alternative Fuel or Less-Polluting Sweepers:** Require or adopt the use of alternative fuel or less-polluting sweepers similar to South Coast Air Quality Management District (SCAQMD) Rule 1186.1. Under this measure old, higher emitting, street sweeper trucks will be replaced with newer models that have lower emissions.	3 lbs of NOx and <1 lb of VOC	Not Estimated	State, County, Local
OM-14	**Alternative Fuel or Low-Emitting Public Fleet Requirements:** Require or adopt the use of alternative fuel or low-emitting public light-duty and medium-duty vehicle fleet requirements similar to South Coast Air Quality Management District (SCAQMD) Rule 1191. This rule requires public fleets to acquire alternative fuel or low-emitting vehicles when procuring these vehicles.	12 lbs of NOx and 20 lbs of VOC	Not Estimated	State, County, Local
OM-15	**Alternative Fuel Public Transit Fleet Requirements:** Require or adopt the use of alternative fuel public transit fleet requirements similar to South Coast Air Quality Management District (SCAQMD) Rule 1192. This rule requires public transit fleets to acquire alternative fuel vehicles when procuring these vehicles.	7 lbs of NOx and 1 lb of VOC	Not Estimated	State, County, Local
OM-16	**Alternative Fuel Residential and Commercial Refuse Collection Vehicle Requirements:** Require or adopt the use of alternative fuel refuse fleet requirements similar to South Coast Air Quality Management District (SCAQMD) Rule 1193. This rule requires private and public solid waste collection fleets to acquire alternative fuel vehicles when procuring these vehicles.	48 lbs of NOx and 3 lbs of VOC	Not Estimated	State, County, Local

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
OM-17	**Clean Heavy-Duty Public Fleet Requirements:** Require or adopt the use of alternative fuel, dual-fuel, or dedicated gasoline public heavy-duty fleet requirements similar to South Coast Air Quality Management District (SCAQMD) Rule 1196. This rule requires public heavy-duty fleets to acquire alternative fuel, dual-fuel, or dedicated gasoline vehicles when procuring these vehicles.	36 lbs of NOx and 5 lbs of VOC	Not Estimated	State, County, Local
OM-18	**Last Mile Delivery:** Adopt or promote a program to encourage the use of clean/zero emission heavy-duty vehicles to make short-distance deliveries within urban centers similar to a California Air Resources Board (CARB) 2016 State Implementation Plan strategy. Last-mile delivery is particularly suited for partial- and zero-emissions technology such as electric and hybrid-electric because of travel that is typically constrained geographically and duty cycles requiring substantial time in start/stop mode.	311 lbs of NOx and 43 lbs of VOC	Not Estimated	State, County, Local
OM-19	**Lower-Emission School Bus Program:** Adopt an incentive program to replace older school buses with alternative fuel or zero-emission buses similar to the incentive program described in the South Coast Air Quality Management District 2022 Air Quality Management plan.	9 lbs of NOx and 1 lb of VOC	Not Estimated	State, County, Local
OM-20	**Promote Co-Working Space:** Adopt a program to encourage co-working. Co-working spaces are located in a centralized and public transportation dense portions of cities and therefore have the potential to eliminate or reduce unnecessary vehicle trips.	8 lbs of NOx and 15 lbs of VOC	Not Estimated	State, County, Local
OM-21	**Accelerated Penetration of Partial Zero-Emission and Zero-Emission Light-Duty Vehicles:** Adopt a program that would establish incentives and provide vehicle purchase rebates for new partial zero- and zero-emission vehicle buyers to accelerate the commercial deployment of plug-in hybrid-electric, battery electric, and fuel cell passenger vehicles, light duty trucks, and sport utility vehicles. California's Clean Vehicle Rebate Project is an example program which offers rebates of $1,000 to $7,500 for the purchase or lease of qualified vehicles.	28 lbs of NOx and 68 lbs of VOC	Not Estimated	State, County, Local
OM-22	**Accelerated Penetration of Partial Zero-Emission and Zero-Emission Light Heavy-Duty and Medium Heavy-Duty Vehicles:** Adopt a program that would establish incentives and provide vehicle purchase rebates for new partial zero and zero-emission light heavy-duty and medium heavy-duty vehicle buyers to accelerate the commercial deployment of such vehicles.	273 lbs of NOx and 36 lbs of VOC	Not Estimated	State, County, Local

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
OM-23	**Enhanced Heavy-Duty Vehicle Inspection and Maintenance Regulation:** Adopt a heavy-duty vehicle inspection and maintenance program similar to the one implemented by the California Air Resources Board (CARB). CARB's program includes elements that do not exist in the nonattainment area such as roadside remote sensing to identify potential high-emitters for follow-up testing and emissions-related repairs, if needed.	Not Estimated – emission reductions from this measure are not expected until after 2023	Not Estimated	State
OM-24	**Accelerated Fleet Turnover for Trucks and Buses:** Adopt a program or regulation similar to the California Air Resources Board (CARB) Truck and Bus Regulation which sets fleet replacement schedules for private and public trucks and buses. Under the CARB rule, all heavier trucks and buses with 1996 or newer model year engines should have a PM filter (OEM or retrofit). Vehicles with 1995 model year and older engines should have been replaced by January 1, 2015. By January 1, 2023, all trucks and buses must have 2010 model year engines with few exceptions.	Not Estimated – emission reductions from this measure are not expected until after 2023	Not Estimated	State
OM-25	**Grant Fund for Cleaner-Than-Required Engines and Equipment:** Adopt a grant program similar to the California Air Resources Board (CARB) Carl Moyer Memorial Air Quality Standards Attainment Program. Under the CARB program, the grant funds the replacement of old, high-polluting vehicles, engines, and equipment, with new technologies that are cleaner than required, or earlier than required by, rules and regulations. Grant amounts are based on the cost-effectiveness of harmful pollutants that will be reduced by the project and may also fund the installation of charging and fueling infrastructure.	Not Estimated – emission reductions from this measure are not expected until after 2023	Not Estimated	State
OM-26	**Advanced Clean Cars Program:** Adopt a program or regulation similar to the California Air Resources Board (CARB) Advanced Clean Cars II regulations. Under the CARB regulation, by 2035 all new light-duty cars, trucks and SUVs sold in California are required to be zero emissions.	Not Estimated – emission reductions from this measure are not expected until 2026 at the earliest	Not Estimated	State
OM-27	**Advanced Clean Transit Program:** Adopt a program or regulation similar to the California Air Resources Board (CARB) Innovative Clean Transit regulation. Under the CARB regulation, beginning in 2029, 100% of new purchases by transit agencies must be zero-emission buses, with a goal for full transition by 2040. It applies to all transit agencies that own, operate, or lease buses with a gross vehicle weight rating (GVWR) greater than 14,000 lbs. It includes standard, articulated, over-the-road, double-decker, and cutaway buses.	Not Estimated – emission reductions from this measure are not expected until 2029 at the earliest	Not Estimated	State

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
OM-28	**Advanced Clean Fleets Regulation:** Adopt a program or regulation similar to the California Air Resources Board (CARB) proposed Advanced Clean Fleets regulation. Under the proposed regulation, CARB is developing a medium and heavy-duty zero-emission fleet regulation with the goal of achieving a zero-emission truck and bus California fleet by 2045 everywhere feasible and significantly earlier for certain market segments such as last mile delivery and drayage applications. The initial focus would be on high-priority fleets with vehicles that are suitable for early electrification, their subhaulers, and entities that hire them.	Not Estimated – emission reductions from this measure are not expected until 2026 at the earliest	Not Estimated	State
OM-29	**Onroad Motorcycles New Emission Standards:** Adopt emission standards similar to California Air Resources Board (CARB) proposed onroad motorcycles emission standards. In the CARB 2022 State SIP Strategy, CARB proposed a strategy to develop new exhaust emissions standards for hydrocarbons (HC), NOx, CO and nonmethane HC (NMHC) that achieve a large degree of harmonization with more aggressive current European motorcycle emissions standards. CARB will also propose significant ZEM sales thresholds beginning in 2028 and increasing gradually through 2035.	Not Estimated – emission reductions from this measure are not expected until 2026 at the earliest	Not Estimated	State
MEASURES FOR NONROAD MOBILE SOURCES				
NM-1	**Diesel Engine Repower:** Adopt a scrappage program to replace older diesel nonroad engines with Tier 4 or newer engines. All types of diesel-fueled non-road equipment in the Maricopa nonattainment area that have older engines are considered as candidates for replacement. Replacing older engines with newer lower-emitting engines or replacing the entire piece of equipment with equipment that has a lower-emitting diesel engine is the most widely employed method for reducing emissions from non-road diesel engines.	4,872 lbs of NOx and 306 lbs of VOC	$19,652 per ton of NOx	State, County
NM-2	**Diesel Engine Retrofit:** Adopt a program to retrofit diesel nonroad engines with Selective Catalytic Reduction (SCR) devices. SCR devices are advanced emissions control technology systems which use a reducing agent within the catalyst system to induce a reduction reaction for NOx and VOC tailpipe emissions.	4,727 lbs of NOx and 360 lbs of VOC	$7,994 per ton of NOx	State, County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NM-3	**Alternative Fuel - Renewable Diesel:** Adopt a program or requirement to replace diesel fuel with renewable diesel (biodiesel) in nonroad equipment, similar to recommendations as described in the EPA document, "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment". Renewable diesel is a biomass-derived transportation fuel for use in diesel engines which meet American Society for Testing and Materials (ASTM) D795 specifications for petroleum in the United States.	1,010 lbs of NOx and 50 lbs of VOC	Not Estimated	State
NM-4	**Public Contract Agreements Specifications:** Adopt a program or requirement to write air quality requirements into public contract agreements for contracts that use nonroad equipment such as construction and mining equipment. Such air quality requirements could specify off-road equipment fleet fuel requirements, off-road equipment tier 4 requirements, use specifications and low-idle requirements, etc.	3,954 lbs of NOx and 262 lbs of VOC	$8,746 per ton of NOx	State, County, Local
NM-5	**Ban the Use of 2-Stroke Lawn and Garden Equipment on High Pollution Advisory Days:** Require the adoption of a regulation that would ban the use of 2-stroke lawn and garden equipment on days forecast to exceed the 2015 ozone standard – High Pollution Advisory Days. This measure, or similar versions, is being considered in several states and nonattainment areas. California also has measures to ban the sale of certain gasoline powered lawn and garden equipment.	162 lbs of NOx and 4,691 lbs of VOC	Not Estimated	State, County
NM-6	**Heavy-Duty Equipment Usage Restrictions:** Require the adoption of a regulation that would restrict, limit or ban the use of older, higher-emitting heavy-duty nonroad equipment on days forecast to exceed the 2015 ozone standard – High Pollution Advisory Days.	17,836 lbs of NOx and 1,768 lbs of VOC	Not Estimated	State, County
NM-7	**Motorized Boating Restrictions:** Require the adoption of a regulation that would restrict, limit or ban the use of pleasure craft boating activities on days forecast to exceed the 2015 ozone standard – High Pollution Advisory Days.	293 lbs of NOx and 619 lbs of VOC	Not Estimated	State, County
NM-8	**Idling Reduction and Control:** Adopt a program or requirement to restrict or limit idling in nonroad equipment, similar to recommendations as described in the EPA document, "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment". Idle reduction is achieved by technologies (on-board idle reduction technologies) or practices (training and tracking of idling time) which reduce the time an engine spends in idle mode, thereby reducing idling emissions.	489 lbs of NOx And 48 lbs of VOC	Not Estimated	State, County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NM-9	**Equipment Operator Training:** Adopt a program or requirement to train nonroad equipment operators, similar to recommendations as described in the EPA document, "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment". Equipment operator training would provide benefits including improved workplace safety and downtime by reducing operator errors, increased equipment lifespan, and reduced idling time.	489 lbs of NOx and 48 lbs of VOC	Not Estimated	State, County
NM-10	**Advance Electrification of Recreational Vehicles:** Adopt an incentive or voucher program to encourage the replacement of gasoline powered recreation vehicles (all-terrain vehicles) with electric models, similar to San Joaquin Valley Air Pollution Control District "Zero-Emission Ag Utility Terrain Vehicle Voucher Program.".	12 lbs of NOx and 99 lbs of VOC	Not Estimated	State, County
NM-11	**Electrification of Transport Refrigeration Units:** Adopt a program or requirement to accelerate the turnover of diesel-powered transport refrigeration units (TRU) to newer, low-emitting or zero-emission technologies, similar to the California Air Resources Board (CARB) TRU Air Toxic Control Measure. CARB's 2022 Amendments to the California TRU Air Toxic Control Measure requires annual turnover of 15% of truck mounted TRUs to electric models beginning in 2022. Electrification technology for trailer-mounted TRUs is less advanced; therefore, CARB has yet to include a requirement for trailer-mounted TRU electrification.	98 lbs of NOx and 3 lbs of VOC	Not Estimated	State, County
NM-12	**Regulation of Emergency Engines and Generators:** Require the adoption of a regulation that would regulate emergency or back-up nonroad engines and generators (gen sets). As an example, in California, a combination of California Air Resources Board (CARB) programs (e.g., Portable Engine Air Toxic Control Measure, Portable Equipment Registration Program (PERP)) establish requirements for the use of backup generators greater than 50 rated horsepower, including limiting use to only during Public Safety Power Shutoff and fleet requirements for engine standards (e.g., tier level).	Not Estimated – data not readily available on amount of units in-use	Not Estimated	State, County
NM-13	**Regulation of Portable Nonroad Engines:** Require the adoption of a regulation that would regulate portable nonroad engines. Portable equipment generally has wheels, skids, carrying handles, dolly, trailer, or platform which can be used to transport the equipment. Portable equipment applications include equipment types such as generator sets, pumps, air compressors, gas compressors, welders, pressure washers, and chipper/stump grinders. In California, similar to emergency generators, a combination of California Air Resources Board (CARB) programs (e.g., Portable Engine Air Toxic Control Measure, Portable Equipment Registration Program) establish requirements for portable equipment greater than 50 rated horsepower.	Not Estimated – data not readily available on amount of units in-use	Not Estimated	State, County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NM-14	**Diesel Equipment Replacement with Electric or Hybrid-Electric Models:** Adopt an incentive, grant, or voucher program to encourage the replacement of older, diesel nonroad equipment with electric or hybrid-electric equipment similar to the Colorado Clean Diesel Program. The current Colorado Clean Diesel Program covers electric construction equipment (i.e., material handlers, mini-excavators, and backhoes), TRUs, airport ground support equipment, lawn mowers, farm tractors, bucket trucks, snow groomers, idle-reduction technology, and infrastructure associated with electric fleets.	782 lbs of NOx and 77 lbs of VOC	Not Estimated	State, County
NM-15	**Electrification of Construction Equipment:** Adopt a program to encourage the use of electric construction equipment. While a somewhat dated guidance, EPA's "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment" document provides some examples of available equipment that may be electrified at construction sites.	315 lbs of NOx and 41 lbs of VOC	Not Estimated	State, County
NM-16	**Diesel Engine Preventative Maintenance Requirements:** Adopt guidance or requirements that specifies regular preventative engine maintenance for diesel nonroad equipment, similar to requirements described in EPA's "Cleaner Diesels: Low Cost Ways to Reduce Emissions from Construction Equipment" document.	527 lbs of NOx	Not Estimated	State, County
NM-17	**Accelerated Replacement of Existing Passenger Locomotive Engines to Tier 4 Emission Standards:** Adopt a program or requirement to promote the earlier and cleaner replacement or upgrade of existing passenger locomotive engines to meet Tier 4 emission standards, similar to those described in the South Coast Air Quality Management District 2016 Air Quality Management Plan.	20 lbs of NOX and 1 lb of VOC	Not Estimated	State, County
NM-18	**Idling Reduction from Line-Haul Locomotives:** Adopt a program or requirement to limit the idling from line-haul locomotives. EPA has identified four types of devices that can reduce idling in locomotives.	32 lbs of NOx and 1 lb of VOC	Not Estimated	State, County
NM-19	**Upgrade Switcher Locomotive Engines to Diesel-Electric Hybrids:** Adopt a program or requirement to upgrade switcher locomotive engines to diesel-electric hybrid engines as suggested by EPA's Menu of Control Measures. Switching locomotives are used in rail yards or to pull several rail cars to local customers and could have engines ranging from 1000 to 3000 hp.	213 lbs of NOx and 13 lbs of VOC	Not Estimated	State, County
NM-20	**Idling Reduction from Switcher Locomotives:** Adopt a program or requirement to limit the idling from switcher locomotives. EPA has identified four types of devices that can reduce idling in locomotives.	150 lbs of NOx and 10 lbs of VOC	Not Estimated	State, County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NM-21	**Engine Repowering, Retrofitting and New Engines for Line Haul Locomotives:** Adopt a program or requirement to upgrade existing diesel-powered line-haul locomotive engines by repowering, retrofitting or replacing with new engines similar to those described in the South Coast Air Quality Management District 2016 Air Quality Management Plan.	431 lbs of NOx and 17 lbs of VOC	Not Estimated	State, County
NM-22	**Electrification of Airport Ground Support Equipment:** Adopt a program or requirement to encourage the electrification of airport ground support equipment as recommended by EPA's Menu of Control Measures. Airport ground support equipment is well suited for electrification because of centralized fleet operations at individual airports and airport ground support equipment needs are often low-end torque, have frequent start/stops, substantial idle time, and short required ranges. There are electric options available for commonly used airport ground support equipment, including pushbacks, belt loaders, container loaders, luggage tugs, lavatory trucks, and water trucks.	86 lbs of NOx and 31 lbs of VOC	Not Estimated	State, County, Local
NM-23	**Infrastructure and Operations Improvements at Airports:** Adopt a program to encourage the implementation of efficiency improvements in the infrastructure and operations at airports. Possible strategies include: • Passenger and overall system efficiency increases • Gate electrification • Underground hydrant refueling systems • Design airside layout to reduce aircraft delay and surface vehicle congestion • Longer runways to reduce the use of reverse thrust • Promote public transit to airports	Not Estimated – emission reductions from these programs would be expected in years beyond 2023	Not Estimated	State, County, Local
NM-24	**CARB Tier 5 New Compression-Ignition Standards:** Adopt emission standards similar to California Air Resources Board (CARB) Tier 5 nonroad equipment emission standards. In the CARB 2022 State SIP Strategy, CARB adopted a strategy to develop new Tier 5 emission standards for nonroad equipment. Tier 5 standards would be stricter than currently in place Tier 4 standards for new nonroad engines.	Not Estimated – emission reductions from this measure are not expected until 2029	Not Estimated	State

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NM-25	**Amendments to CARB's In-Use Off-Road Diesel-Fueled Fleets Regulation:** Adopt in-use off-road diesel-fueled fleet regulations similar to California Air Resources Board (CARB) regulations. The in-use off-road equipment sector includes equipment used in industries such as construction, mining, industrial, oil drilling, and similar industries, and covers mobile diesel vehicles 25 horsepower or greater. Common examples are loaders, backhoes, excavators, forklifts, workover rigs, and other off-road equipment. In the 2022 CARB State SIP Strategy, CARB adopted fleet regulations strategies that include the phase-out of Tier 0-2 nonroad engines between 2024-2032, among other requirements.	Not Estimated – emission reductions from this measure are not expected until 2024 at the earliest	Not Estimated	State
NM-26	**CARB Off-Road Zero-Emission Targeted Manufacturer Rule:** Adopt an off-road zero-emission targeted manufacture rule similar to California Air Resources Board (CARB) rule. In the 2022 CARB State SIP Strategy, CARB state the goal of the rule is to achieve criteria pollutant reductions by accelerating the development and production of zero-emission off0road equipment and powertrains. CARB proposes to develop a regulatory measure that would require manufacturers of off-road equipment and/or engines to produce for sale zero-emission equipment and/or powertrains as a percentage of their annual statewide sales volume to ensure these globally emerging zero-emissions products and related innovations come to California.	Not Estimated – emission reductions from this measure are not expected until 2031	Not Estimated	State
MEASURES FOR EMISSION SOURCES AT STATIONARY NONPOINT (AREA) SOURCES				
NP-1	**Advanced Emission Reduction Options for Boiler, Steam Generators and Process Heaters:** Require the adoption of NOx emission limits similar to San Joaquin Valley Air Pollution Control District (SJVAPCD) Rules 4306 and 4320. The emission limits would apply to gaseous fuel or liquid fuel-fired boilers, steam generators, or process heaters with a total rated heat input greater than 5 million British thermal units per hour (MMBtu/hr). A variety of facilities with units could be subject to the rules, for example, electrical utilities, cogeneration, and manufacturing and industrial processes. The NOx limit set by Rule 4306 and 4320 may be achieved by using selective catalytic reduction (SCR) or a combination of SCR and low NOx burners. The San Joaquin Valley 2016 Plan for the 2008 8-hour Ozone Standard estimated a control efficiency of 96% for NOx emissions under these rules.	1,120 lbs of NOx	$2,518 to $33,527 per ton of NOx, depending on control technology selected	County
NP-2	**Solvent Degreasing VOC Content Limits:** Require the adoption of VOC content limits similar to South Coast Air Quality Management District (SCAQMD) Rule 1122 for solvent degreasers. Solvent degreasers include batch-loaded cold cleaners, open-top vapor degreasers, all types of conveyorized degreasers, and air-tight and airless cleaning systems; these systems typically remove contaminants from parts, products, tools, machinery, and equipment.	1,564 lbs of VOC	$1,652 per ton of VOC	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NP-3	**Consumer Products - OTC Model Rules:** Require the adoption of a rule(s) similar to the Ozone Transport Commission (OTC) model rules limiting the VOC content of consumer products sold within the Maricopa nonattainment area. Consumer products are items sold to retail customers for personal, household, or automotive use, including adhesives and sealants, personal care products, household cleaning and maintenance products, etc.	6,302 to 13,184 lbs of VOC	$1,263 to $2,778 per ton of VOC	County
NP-4	**Enhanced Underground Storage Tank (UST) Breathing Emission Controls at Gasoline Dispensing Facilities (GDF):** Require the use of pressure control systems on underground storage tanks at gasoline dispensing facilities that can achieve at least a 95% effective control efficiency on breathing emissions. Breathing emissions refer to emissions that escape through the UST vent pipe as a result of gasoline evaporation and barometric pressure changes. This measure would reduce UST breathing emissions by implementing pressure control systems to reduce emissions by maintaining UST pressures close to ambient conditions.	1,761 lbs of VOC	$12,384 to $16,196 per ton of VOC	State, County
NP-5	**Enhanced Stage I Vapor Recovery at Gasoline Dispensing Facilities (GDF):** Require the use of enhanced Stage I emission control equipment that can achieve at least a 98% effective control efficiency on Stage I emissions; similar to California Air Resources Board Stage I controls. Stage I refers to the emissions source category associated with the transfer of gasoline from tanker trucks to underground storage tanks.	1,426 lbs of VOC	$2,753 per ton of VOC	State, County
NP-6	**Greenwaste Composting Operations:** Require the adoption of greenwaste composting operating requirements similar to South Coast Air Quality Management District (SCAQMD) Rule 1133.3. Greenwaste means any organic waste material generated from gardening, agriculture, or landscaping activities. Greenwaste composting means composting of greenwaste by itself or a mixture with foodwaste, or with up to 20 percent manure, per pile volume basis. SCAQMD Rule 1133.3 states that the operator of greenwaste composting operations processing greater than 5,000 tons per year of foodwaste throughput shall use an emission control device and achieve an overall system control efficiency of at least 80%, by weight, for VOC emissions. Operations with up to 5,000 tons per year of foodwaste throughput shall demonstrate VOC emission reductions of at least 40%, by weight.	1,593 lbs of VOC	Varies dependent on control technology selected. Representative estimates not available.	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NP-7	**Wood Flat Stock VOC Coating Content Limits:** Require the adoption of VOC coating content limits for wood flat stock similar to South Coast Air Quality Management District (SCAQMD) Rule 1104. Wood flat stock is defined as interior wood panels and exterior wood siding, which include, redwood, cedar or plywood stocks, plywood panels, particle boards, composition hard boards, and any other panels or siding constructed of solid wood or a wood-containing product. This control measure achieves VOC emissions reductions through product reformulation and product substitution for wood flat stock coatings, inks, and adhesives.	Up to 1,794 lbs of VOC	$1,900 per ton of VOC	County
NP-8	**Architectural and Industrial Maintenance Coatings – OTC Model Rules:** Require the adoption of a rule(s) similar to the Ozone Transport Commission (OTC) model rules limiting the VOC content of architectural and industrial maintenance (AIM) coatings. AIM coatings consist of surface coatings such as paint, primers, varnishes, or lacquers, as well as solvents used as thinners and for cleanup.	Up to 3,392 lbs of VOC	$7,139 to $10,268 per ton of VOC	County
NP-9	**Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations – OTC Model Rule:** Require the adoption of a rule similar to the Ozone Transport Commission (OTC) model rule limiting the VOC content of coatings and cleaning solvents used in motor vehicle and mobile equipment non-assembly line coating operations.	1,847 lbs of VOC	$3,602 per ton of VOC	County
NP-10	**Low NOx Burners for Industrial Oil Combustion:** Require the installation of low NOx burners on industrial boilers and engines fueled by oil (distillate/diesel) with the potential to emit 25 tons per year of NOx. EPA's Menu of Control Measures (2022) estimates a control efficiency of 36% for NOx emissions.	22 lbs of NOx	Not Estimated	County
NP-11	**Low NOx Burners for Industrial Natural Gas Combustion:** Require the installation of low NOx burners on industrial boilers and engines fueled by natural gas with the potential to emit 25 tons per year of NOx. EPA's Menu of Control Measures (2022) estimates a control efficiency of 31% for NOx emissions.	118 lbs of NOx	Not Estimated	County
NP-12	**Low NOx Burners for Residential/Commercial/Institutional Water Heaters and/or Space Heaters:** Require the installation of low-NOx water heaters and space heaters in residential/commercial/institutional facilities. EPA's Menu of Control Measures (2022) estimates a control efficiency of up to 75% for NOx emissions.	733 lbs of NOX	Not Estimated	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NP-13	**Zero and Near-Zero NOx Emission Burners and Incentives for Commercial/Residential Heaters and Boilers:** Require the adoption of rules and incentives similar to those proposed by the South Coast Air Quality Management District that would phase in the replacement of existing older heaters and boilers with zero or near-zero emitting units. This control measure achieves NOx emission reductions from unregulated residential and commercial appliances through a regulatory approach and incentives to replace existing older NOx appliances with zero emission units or lower NOx technologies.	396 lbs of NOx	Not Estimated	County
NP-14	**Low Emissions Burners and Incentives for Commercial and Residential Cooking Appliances:** Require the adoption of rules and incentives similar to those proposed by the South Coast Air Quality Management District that would phase in the replacement of existing older cooking appliances with zero-emission and low NOx units. This control measure achieves NOx emission reductions from unregulated restaurant and residential charbroilers, fryers, ranges, and ovens by replacing conventional gas-fired cooking appliances with zero-emission and low NOx emission devices such as electric cooking devices, induction cooktops, and low NOx burner technologies.	4 lbs of NOx	Not Estimated	County
NP-15	**Bakery Products - Catalytic Incineration:** Require the adoption of VOC emission limits from commercial bakeries similar to South Coast Air Quality Management District (SCAQMD) Rule 1153. This would require the installation of emission control systems, such as catalytic incinerators, on bakery ovens to limit VOC emissions. This rule applies to commercial bakery ovens with a rated heat input capacity of 2 million BTU per hour or more and with average daily emissions of 50 pounds or more of VOCs.	Up to 163 lbs of VOC	Not Estimated	County
NP-16	**Adopt Rule Similar to San Joaquin Valley Air Pollution Control District (SJVAPCD) Open Burning Rule 4103:** Require the adoption of a rule similar SJVAPCD Rule 4103 to further control NOx and VOC emissions from open burning. Maricopa County currently regulates emissions from open burning with Maricopa County Air Quality Department Rule 314, which is very similar to SJVAPCD Rule 4103 but does not include alternatives to open burning. Alternatives listed in the San Joaquin Valley rule include biomass power plants, pyrolysis, biochar, bio-oil, high solids anaerobic digestion, composting, fiberboard, mulch/land applications/soil incorporation, and cellulosic ethanol production. These alternatives specifically address open burning emissions from biogenic waste such as agricultural waste. The only alternative that has readily quantifiable emissions reductions is the diversion of waste to biomass power plants.	Up to 35 lbs of NOx and 155 lbs of VOC	Not Estimated	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NP-17	**Graphic Arts VOC Coating Content Limits:** Require the adoption of VOC coating content limits for graphic arts operations similar to South Coast Air Quality Management District (SCAQMD) Rule 1130. Graphic arts are the four basic processes involved in the printing industry: web offset lithography, web letterpress, rotogravure, and flexography. High-solvent-content material may be applied to the surface of a moving web or film as part of the graphic arts process. VOCs are released when the solvent is evaporated by the movement of heated air across the wet surface.	862 lbs of VOC	Not Estimated	County
NP-18	**Pesticide Application and Reformulation:** Require the adoption of rules and/or incentives to limit VOC emissions from pesticide application by switching to and/or encouraging the use of low-VOC pesticides and better Integrated Pest Management (IPM) practices. IPM practices focus on pest prevention, reduction, and elimination without the overuse of hazardous chemicals. Low-VOC pesticide products are readily available on the market. EPA's Menu of Control Measures (2022) estimates a control efficiency of 20% for VOC emissions when using reformulated low-VOC pesticides and better IPM practices.	150 lbs of VOC	Not Estimated	State, County
NP-19	**Household Solvents, Personal Products - Cleaner Product Certification Program:** Require the adoption or promotion of a VOC emission reduction program similar to South Coast Air Quality Management Districts (SCAQMD) "Clean Air Choices Cleaners". This program is a voluntary certification program which is designed to increase the market share of ultra-low-polluting commercial cleaning products. Common products are, for example, all-purpose cleaners and degreasers, air fresheners, and floor care products. A product must meet environmentally preferable qualifications including a VOC limit of 10 grams per liter or less to become certified.	Voluntary Program, Not Estimated	Not Estimated	County
NP-20	**Metal Parts and Products VOC Coating Content Limits:** Require the adoption of VOC content limits on coatings for metal parts and products similar to South Coast Air Quality Management District (SCAQMD) Rule 1107. This rule sets stringent VOC coating limits and has requirements for operating equipment and cleaning procedures.	168 lbs of VOC	Not Estimated	County
NP-21	**Paper, Fabric and Film VOC Coating Content Limits:** Require the adoption of VOC content limits on coatings for paper, fabric and film similar to South Coast Air Quality Management District (SCAQMD) Rule 1128. The applicable 2023 VOC emissions in the Maricopa nonattainment area are from paper coatings. Paper coatings applications include, but are not limited to, post cards, adhesive tapes and labels, and book covers.	22 lbs of VOC	Not Estimated	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
NP-22	**Storage Tanks at Petroleum Facilities - SCAQMD Rule 1178:** Require the adoption of control measure requirements for fixed roof petroleum storage tanks similar to South Coast Air Quality Management District (SCAQMD) Rule 1178. Adopting SCAQMD Rule 1178 could potentially regulate more fixed roof tanks in the Maricopa nonattainment area.	174 lbs of VOC	Not Estimated	County
NP-23	**Organic Waste Processing Technology and Restriction on the use of Uncomposed Greenwaste:** Require the use of emerging organic waste processing technology (e.g., Regreen Technologies) and the restricted use of chipped and ground uncomposted greenwaste (mulch), similar to a control measure described in the 2016 South Coast Air Quality Management District 2016 Air Quality Management Plan. Uncomposted and untreated mulched greenwaste has a high potential to emit VOCs. This measure is proposing controls above and beyond those described in measure NP-6.	159 lbs of VOC	Not Estimated	County
NP-24	**Require the Use of Leak-Free, Non-Permeable Hoses and Nozzles at Gasoline Dispensing Facilities:** Require the use of Leak-Free, Non-Permeable Hoses and Nozzles at Gasoline Dispensing Facilities. This requirement would be applicable to available hoses and nozzles certified to be leak-free and non-permeable and would be distinct from revoked Stage II requirements.	754 lbs of VOC	Not Estimated	County
NP-25	**Zero-Emission Standard for Space and Water Heaters:** Adopt a program or regulation similar to the California Air Resources Board (CARB) proposed zero-emission standard for space and water heaters. Under this program, beginning in 2030, 100 percent of new space and water heaters sold in California would need to meet the zero-emission standard.	Not Estimated – emission reductions from this measure are not expected until 2030 at the earliest	Not Estimated	State, County
NP-26	**Reduce BACT Trigger Limit from 40 tons to 25 tons for New and Existing Facilities:** Adopt a regulation that would require the application of Best Available Control Technologies (BACT) for NOx and VOC emissions at sources with the potential to emit 25 tons per year of either pollutant. This measure reduces the current BACT trigger from 40 tons to 25 tons.	Not Estimated – data not readily available on how many emission sources and process would be impacted	Not Estimated	County
NP-27	**Require Low-NOx Burners on Boilers at Small, Minor Sources:** Require the use of low-NOx burners on smaller boilers that currently are not subject to controls based upon applicable boiler size or potential emissions.	Not Estimated – data not readily available on how many boilers would be impacted	Not Estimated	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
MEASURES FOR EMISSION SOURCES AT MAJOR STATIONARY FACILITIES (POINT SOURCES)				
INDUSTRIAL COMBUSTION CONTROLS FOR MAJOR STATIONARY SOURCE BOILERS AND ENGINES				
IC-1	**EMx and Dry Low-NOx Combustion:** Require the use of EMx in combination with low-NOx burners for natural gas-fired boilers and engines. EMx is a specific type of post-combustion catalytic oxidation and absorption technology. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	537 lbs of NOx	$2,580 per ton of NOx	County
IC-2	**EMX and Water Injection:** Require the use of EMx in combination with water injection for natural gas-fired boilers and engines. EMx is a specific type of post-combustion catalytic oxidation and absorption technology.	537 lbs of NOx	$3,725 per ton of NOx	County
IC-3	**Catalytic Combustion:** Require the use of catalytic combustion for natural gas-fired boilers and engines. Catalytic combustion refers to combustion occurring in close proximity to a solid surface that has a special catalyst coating.	415 lbs of NOx	$602 per ton of NOx	County
IC-4	**Low-NOx Burner and Selective Catalytic Reduction:** Require the use of post-combustion selective catalytic reduction in combination with low-NOx burners for natural gas-fired boilers and engines. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases.	67 lbs of NOx (Industrial Boiler) 17 lbs of NOx (Comm. Boiler)	$33,527 per ton of NOx	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
IC-5	**Selective Catalytic Reduction:** Require the use of post-combustion selective catalytic reduction for natural gas-fired and oil-fired boilers and engines. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases.	62 lbs of NOx (Industrial Nat. Gas Boiler) 16 lbs of NOx (Comm. Nat. Gas Boiler) 32 lbs of NOx (Industrial Diesel Boiler/Engine) 59 lbs of NOx (Comm. Diesel Boiler/Engine) 19 lbs of NOx (Metals Process Boiler)	$11,472 per ton of NOx $11,472 per ton of NOx $9,114 per ton of NOx $4,851 per ton of NOx $11,472 per ton of NOx	County
IC-6	**Low-NOx Burner:** Require the use of low-NOx burners for natural gas-fired boilers and engines. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	55 lbs of NOx (Industrial Nat. Gas Boiler) 14 lbs of NOx (Comm. Nat. Gas Boiler)	$9,248 per ton of NOx $9,248 per ton of NOx	County
IC-7	**Regenerative Selective Catalytic Reduction:** Require the use of post-combustion regenerative selective catalytic reduction for natural gas-fired boilers and engines. Regenerative selective catalytic reduction (RSCR) is a form of clean-side SCR technology. The RSCR system is located after the particulate control device, which minimizes impact on the SCR catalyst. Ammonia is added to the flue gas stream in order to reduce NOx to nitrogen and water. A regenerative heater is used in the RSCR, which uses beds of ceramic media to achieve thermal efficiencies of >95%.	51 lbs of NOx (Industrial Nat. Gas Boiler) 13 lbs of NOx (Comm. Nat. Gas Boiler) 13 lbs of NOx (Metals Process Boiler)	$4,059 per ton of NOx $4,059 per ton of NOx $4,059 per ton of NOx	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
IC-8	**Low-NOx Burner and Selective Non-Catalytic Reduction:** Require the use of post-combustion selective non-catalytic reduction in combination with low-NOx burners for natural gas-fired boilers and engines. Selective non-catalytic reduction involves injecting ammonia or urea into a properly determined location. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	51 lbs of NOx (Industrial Nat. Gas Boiler) 13 lbs of NOx (Comm. Nat. Gas Boiler) 15 lbs of NOx (Metals Process Boiler)	$23,456 per ton of NOx $23,456 per ton of NOx $4,961 per ton of NOx	County
IC-9	**Selective Catalytic Reduction and Steam Injection:** Require the use of post-combustion selective catalytic reduction in combination with steam injection in the combustion zone for natural gas-fired boilers and engines. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases.	49 lbs of NOx	$927 per ton of NOx	County
IC-10	**EMx:** Require the use of EMx for natural gas-fired boilers and engines. EMx is a specific type of post-combustion catalytic oxidation and absorption technology.	49 lbs of NOx	$2,580 per ton of NOx	County
IC-11	**Low-NOx Burner and Flue Gas Recirculation:** Require the use of low-NOx burners in combination with flue gas recirculation for natural gas-fired boilers and engines. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion. Flue gas recirculation is a process in which a portion of the flue gas is captured and re-routed back into the boiler as a means of reducing the peak flame temperatures in the boiler and modifying oxygen content.	45 lbs of NOx (Industrial Nat. Gas Boiler) 12 lbs of NOx (Comm, Nat. Gas Boiler) 7 lbs of NOx (Metals Process Boiler)	$27,692 per ton of NOx $27,692 per ton of NOx $9,061 per ton of NOx	County
IC-12	**Low-NOx Burner, Over-Fired Air, and Natural Gas Reburn:** Require the use of low-NOx burners in combination with over-fired air and natural gas reburn for natural-gas boilers and engines. Over-fired air involves the injection of air into the burner above the main combustion zone. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion. Reburning is a technique that uses separate burning zones in a boiler to minimize NOx formation.	44 lbs of NOx (Industrial Nat. Gas Boiler) 12 lbs of NOx (Comm. Nat. Gas Boiler)	$2,135 per ton of NOx $2,135 per ton of NOx	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
IC-13	**Low-NOx Burner and Over-Fired Air:** Require the use of low-NOx burners in combination with over-fired air for natural-gas boilers and engines. Over-fired air involves the injection of air into the burner above the main combustion zone. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	44 lbs of NOx (Industrial Nat. Gas Boiler) 12 lbs of NOx (Comm. Nat. Gas Boiler)	$10,172 per ton of NOx $10,172 per ton of NOx	County
IC-14	**Selective Non-Catalytic Reduction:** Require the use of post-combustion selective non-catalytic reduction for natural gas-fired boilers and engines. Selective non-catalytic reduction involves injecting ammonia or urea into a properly determined location.	33 lbs of NOx (Industrial Nat. Gas Boiler) 9 lbs of NOx (Comm. Nat. Gas Boiler) 3 lbs of NOx (Metals Process Boiler)	$10,720 per ton of NOx $10,720 per ton of NOx $10,720 per ton of NOx	County
IC-15	**Flue Gas Recirculation:** Require the use of flue gas recirculation for natural gas-fired boilers and engines. Flue gas recirculation is a process in which a portion of the flue gas is captured and re-routed back into the boiler as a means of reducing the peak flame temperatures in the boiler and modifying oxygen content.	29 lbs of NOx (Industrial Nat. Gas Boiler) 8 lbs of NOx (Comm. Nat. Gas Boiler)	$25,029 per ton of NOx $25,029 per ton of NOx	County
IC-16	**Ignition Retard:** Require the use of ignition retard in oil-fired engines. Ignition Retard is a NOx control technique that is applicable to internal combustion (IC) engines. Ignition in a normally adjusted IC engine is set to occur shortly before the piston reaches its uppermost position (top dead center, or TDC). At TDC, the air or air-fuel mixture is at maximum compression and power output and fuel consumption are optimum. Retarding causes more of the combustion to occur during the expansion stroke, thus lowering peak temperature, pressure, and residence time.	9 lbs of NOx (Industrial Diesel Boiler/Engine) 37 lbs of NOx Comm. Diesel Boiler/Engine	$1,596 per ton of NOx $1,596 per ton of NOx	County
INDUSTRIAL COMBUSTION CONTROLS FOR NATURAL GAS-FIRED ELECTRIC GENERATING UNITS				
EGU-1	**Selective Catalytic Reduction and Steam Injection:** Require the use of post-combustion selective catalytic reduction in combination with steam injection in the combustion zone for natural gas-fired electric generating utility boilers. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases.	8,550 lbs of NOx	$2,686 per ton of NOx	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
EGU-2	**Selective Catalytic Reduction and Dry Low NOx Combustion:** Require the use of post-combustion selective catalytic reduction in combination with low-NOx burners for natural gas-fired electric generating utility boilers. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	8,132 lbs of NOx	$1,932 per ton of NOx	County
EGU-3	**Selective Catalytic Reduction and Water Injection:** Require the use of post-combustion selective catalytic reduction in combination with water injection in the combustion zone for natural gas-fired electric generating utility boilers. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases.	7,756 lbs of NOx	$3,262 per ton of NOx	County
EGU-4	**Low-NOx Burner:** Require the use of low-NOx burners for natural gas-fired electric generating utility boilers. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	3,619 lbs of NOx	$1,016 per ton of NOx SRP estimates for Advanced Dry Low NOx: $3,310-$4,880 per ton of NOx in 2020	County
EGU-5	**Steam Injection:** Require the use of steam injection in the combustion zone for natural gas-fired electric generating utility boilers.	3,447 lbs of NOx	$2,631 per ton on NOx SRP estimates: $3,700-$3,870 per ton of NOx in 2020	County
EGU-6	**Selective Catalytic Reduction:** Require the use of post-combustion selective catalytic reduction for natural gas-fired electric generating utility boilers. A selective catalytic reduction emission control system uses a reductant, typically ammonia or urea, in reaction with a catalyst (oxides of base metals) to selectively reduce NOx emissions from exhaust gases.	3,181 lbs of NOx	$1,735 per ton of NOx SRP estimates: $6,440-$6,540 per ton of NOx in 2020	County

Measure Number	Measure Title	2023 Potential Emission Reductions (lbs/day)	Cost-Effectiveness ($/ton)	Potential Implementing Entity
EGU-7	**Water Injection:** Require the use of water injection in the combustion zone for natural gas-fired electric generating utility boilers.	3,102 lbs of NOx	$2,806 per ton of NOx SRP estimates: $3,450-$3,770 per ton of NOx in 2020	County
EGU-8	**Low NOx Burner, Over-Fired Air and Selective Non-Catalytic Reduction:** Require the use of post-combustion selective non-catalytic reduction in combination with low-NOx burners and over-fired air in the combustion zone for natural-gas fired electric generating utility boilers. Selective non-catalytic reduction involves injecting ammonia or urea into a properly determined location. Over-fired air involves the injection of air into the burner above the main combustion zone. A low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion.	2,903 lbs of NOx	$2,582 per ton of NOx	County
EGU-9	**Natural Gas Reburn:** Require the use of natural gas reburning for natural gas-fired electric generating utility boilers. Reburning is a technique that uses separate burning zones in a boiler to minimize NOx formation.	1,988 lbs of NOx	$3,173 per ton of NOx	County
EGU-10	**Low-NOx Burner (Nozzles) with Separated Over-Fired Air:** Require the use of low-NOx burners (nozzles) in combination with over-fired air for natural gas-fired electric generating utility boilers. A Low-NOx burner is a combustion modification control technology that reduces NOx emissions by reducing flame turbulence, delaying fuel/air mixing, and establishing fuel-rich zones for initial combustion. Over-fired air involves the injection of air into the burner above the main combustion zone.	1,869 lbs of NOx	$588 per ton of NOx	County