



NOx Control Measures

Presentation to the
Regional Air Quality Council
and North Front Range MPO

June 25, 2008



Air Pollution Control Division



Overview

- NOx emissions inventories
- Review of NOx control strategy development for Regional Haze
- NOx emissions controls "On the Books"
- Potential new NOx strategies
- Modeling of NOx control options
- Process and timeline for NOx control strategy development and implementation



NOx Emissions Inventories

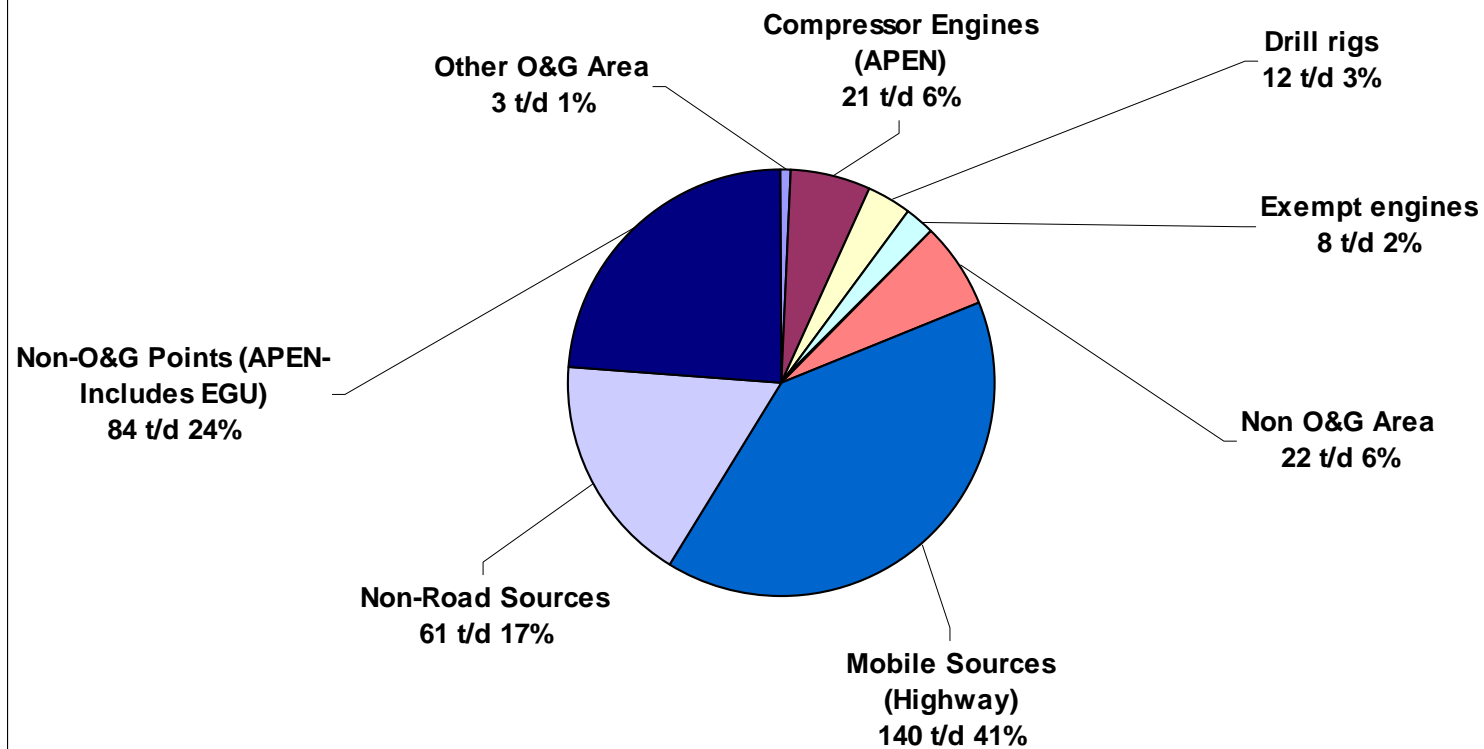




Front Range NAA NOx Emissions – 2010

(7% reduction since 2006)

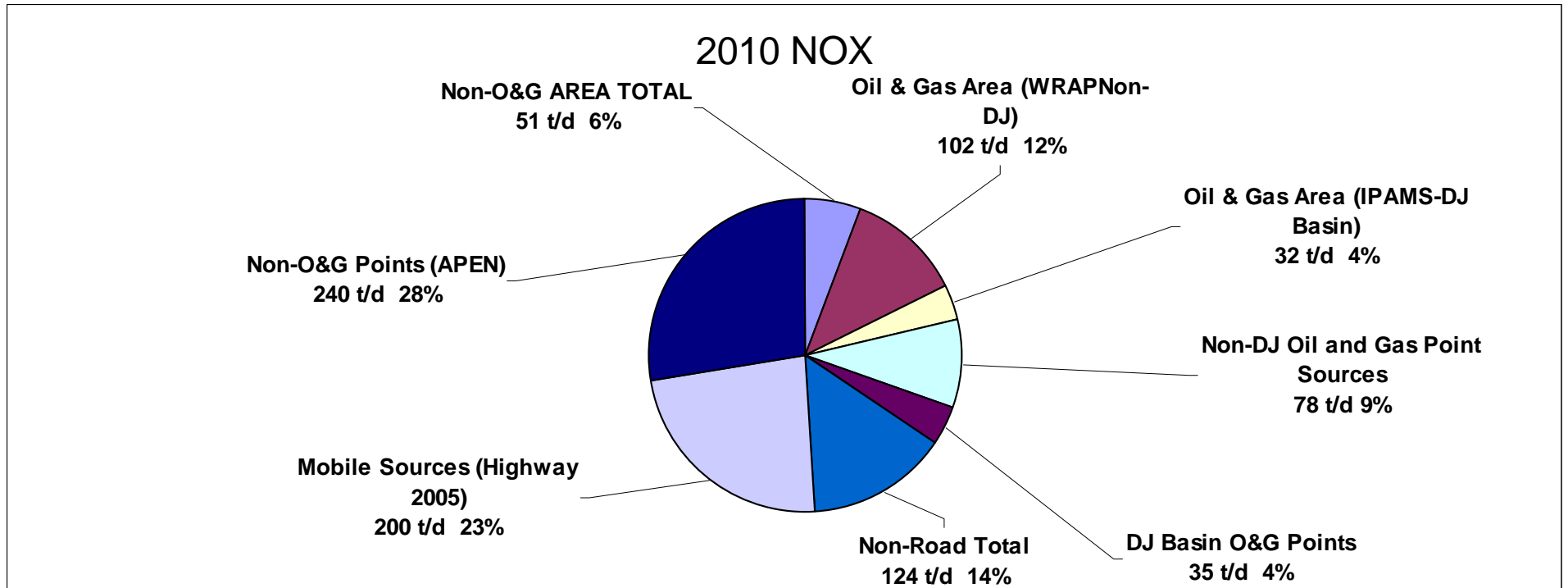
2010 NAA NOx





Statewide NOx Emissions – 2010

(2% increase since 2006)





NOx Emissions Trends

- 7% reduction from 2006 to 2010
 - Fueled by reductions from mobile and non-road
 - Stationary NOx emissions increase
- 23% reduction by 2012 along the Front Range
 - Fueled by 50% reduction from mobile sources
 - Stationary NOx emissions remain flat due to engine controls
 - Area source NOx emission will increase
 - Off-road NOx emissions decline
- 28% reduction by 2022 for metro Denver
 - Fueled by 71% reduction from mobile sources
 - Area source NOx emission will also increase
- 30% reduction by 2018 for the Western U.S.
 - We can expect additional reduction from the BART program and any additional strategies adopted by the states



Review of NO_x Control Strategy Development for Regional Haze



Regional Haze NOx Control Strategy Development

- AQCC adopted NOx BART limits for sources in December 2008
- Public Hearing on the Reasonable Progress portion of SIP was deferred until January 2008, and then vacated
- Reasonable progress stakeholder process ensued



Summary of BART Results

Facility	New SO2 Controls Added	New NOx Controls Added
Pawnee	SO2 - Lime Spray Dryers	NOx - Upgrade Low NOx Burners
Craig - Units 1 & 2		
Hayden - Units 1 & 2		NOx - Upgrade Low NOx Burners
Cherokee - Unit 4		NOx - Upgrade Low NOx Burners
Comanche - Units 1 & 2		
Valmont - Unit 5		NOx - Upgrade Low NOx Burners
CENC - Units 4 & 5		NOx - Upgrade Low NOx Burners w/Overfire Air



Reasonable Progress Process - Proposal

- Presumptive approach for significant NO_x stationary sources
- Individual Sources and NO_x >1,546 tpy
 - Coal-Fired Electric Generating Units (EGUs)
 - Portland Cement Plants
- Source categories greater than 20,000 tpy NO_x
 - RICE: >20,000 tpy NO_x
 - Drill rigs: >5,000 tpy NO_x in DJ basin
 - 20% of the rigs are in the DJ
 - Awaiting data for the rest of the State



Potential Sources Identified for Reasonable Progress Process

2018 PRP Emission Inventory - Criteria Thresholds (Revised):		SO ₂ > 380 tpy	
		NO _x > 1,546 tpy	
	Source	SO ₂ [tpy]	NO _x [tpy]
1	PUBLIC SERVICE CO CHEROKEE PLT	6,964	10,315
2	PUBLIC SERVICE CO COMANCHE PLT	6,478	7,138
3	COLORADO SPRINGS UTILITIES - NIXON PLT	4,073	2,331
4	TRI STATE GENERATION CRAIG	3,940	16,799
5	PUBLIC SERVICE CO - ARAPAHOE	3,119	3,340
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9	TRIGEN - COLORADO ENERGY CORPORATION	2,624	1,185
10	SUNCOR ENERGY - DENVER REFINERY	2,253	524
11	PUBLIC SERVICE CO PAWNEE PLT	2,225	3,942
12	TRI STATE GENERATION NUCLA	1,325	1,753
13	AQUILA, INC. - W.N. CLARK STATION	1,322	1,090
14	PLATTE RIVER POWER AUTHORITY - RAWHIDE	927	3,912
15	PUBLIC SERVICE CO - VALMONT	879	2,279
16	ROCKY MOUNTAIN BOTTLE CO	542	524
17	HOLCIM (US) INC. PORTLAND PLANT	393	1,859
18	CEMEX, INC. - LYONS CEMENT PLANT	84	2,903
Highlighted Totals:		46,002	68,385



Reasonable Progress Process - Proposal

- Division would specify control technology with \$/ton off-ramps for each subject-to-RP source category, such as:
 - Best level of control – if not reasonable, then:
 - Next best level of control – if not reasonable, then:
 - Moderate level of control – if not reasonable, then:
 - No control required
- VERA's provide protection for the life of the VERA
 - Once expires, the presumptive applies within 2 years
- Reasonable \$/ton threshold under development
- \$/ton threshold begins at pre-BART control level
 - Unless facility agrees to BART implementation by 1/1/2015



Potential NO_x Controls for RP Eligible Source Categories

Table 4: Summary of Key NO_x Control Options for Coal-Fired Boilers	
NO _x Control Technology	Control Efficiency [%]
Selective Catalytic Reduction (SCR)	90% or more, 0.07 lb/MMBtu
Selective Non-Catalytic Reduction (SNCR)	20% to 55%
Ultra Low-NO _x Burners (ULNBs)	Additional 20% or more beyond LNBS
Low-NO _x Burners (LNBS)	30 - 60%, 0.25 - 0.65 lb/MMBtu
Over-Fire Air (OFA)	Up to 60% or more in certain boilers

Table 5: NO_x Control Options for Portland Cement Plants (Rotary Kiln)	
NO _x Control Technology	Control Efficiency [%]
SCR	85-95%
Selective Non-Catalytic Reduction (SNCR) -Biosolids Injection	50%
SNCR (NO _x OUT [®])	40%
Tire Derived Fuel (at Precaliner)	35%
Mid Kiln Firing	33-41%
Chemstar	~33%
Low-NO _x Burners (indirect-fired)	~27%



Continuing RP Process

- Continued research and possible stakeholder dialogue on certain key RP issues as time permits in 2008
 - Mechanics of presumptive approach
 - Off ramps
 - Economic analyses of control options
 - Feasibility
 - VERA's

Continuing RP Process

- NOx stakeholder process/evaluation continuing for ozone and visibility
 - Important sources/categories to be determined
 - Costs/benefits of controls to be explored
 - Timing for reductions needs to be determined
 - Determinations of important geographic regions
 - NOx/ozone interplay being explored



NO_x Emissions Controls "On the Books"



State and Federal Control Measures that Reduce NOx Emissions

- o Diesel I/M (PM, SO₂, NOx)
- o Gasoline I/M (NOx, PM, VOCs, CO)
- o State permitting requirements - NSPS, PSD, permit limits and standards (SO₂, NOx, PM)
- o BART limits (NOx, SO₂)
- o Repair your air program (NOx, PM, VOCs, CO)
- o Diesel school bus retrofits (PM, SO₂, NOx)
- o Summertime low RVP gasoline (NOx, VOCs)
- o Alternative fuels programs (PM, SO₂, NOx, VOCs, CO)
- o Public information/outreach (PM, SO₂, NOx, VOCs, CO)
- o Rideshare/transit programs (PM, SO₂, NOx, VOCs, CO)
- o State tax credits for hybrids/alternative fuels use (PM, SO₂, NOx, VOCs, CO)
- o Xcel's Voluntary Agreement for power plants (SO₂, NOx)
- o Craig, Hayden, Comanche reductions (SO₂, NOx)
- o O&G engine controls (NOx, VOCs CO)
- o Low sulfur diesel (NOx, SO₂, PM)
- o Low Sulfur gasoline (NOx, SO₂, PM)
- o Off-road engine standards (NOx, SO₂, PM)
- o Diesel engine standards - TIER I, II, III (NOx, SO₂, PM)
- o Gasoline engine standards (TIER I&II) (NOx, PM, VOCs, CO)
- o Small engine standards (NOx, PM, VOCs, CO)
- o Alternative fuels programs (PM, SO₂, NOx, VOCs, CO)
- o Federal tax credits for hybrids/alternative fuels use (PM, SO₂, NOx, VOCs, CO)
- o Clean Air Interstate Rule (SO₂, NOx)
- o NOx SIP Call (NOx)
- o Regional Haze programs (SO₂, NOx)



Potential New NO_x Control Strategies





Existing Engines Controls

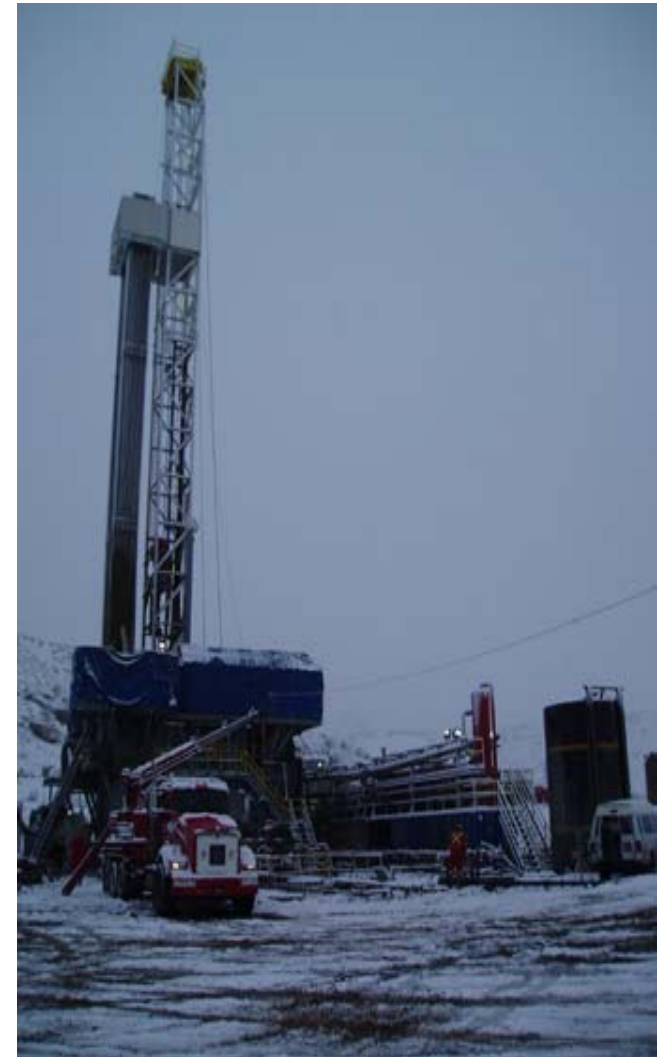
- Reduce emissions from existing natural gas-fired reciprocating internal combustion engines by applying Reg. 7 retrofit requirements Statewide
 - Engines greater than 500 horsepower
 - Rich burn RICE: non-selective catalyst reduction (NSCR) and air fuel controllers (NO_x, VOCs, CO)
- Some portion of the 28,000 tpy of NO_x
- Implement by 5/2010





Drill Rigs Control Options

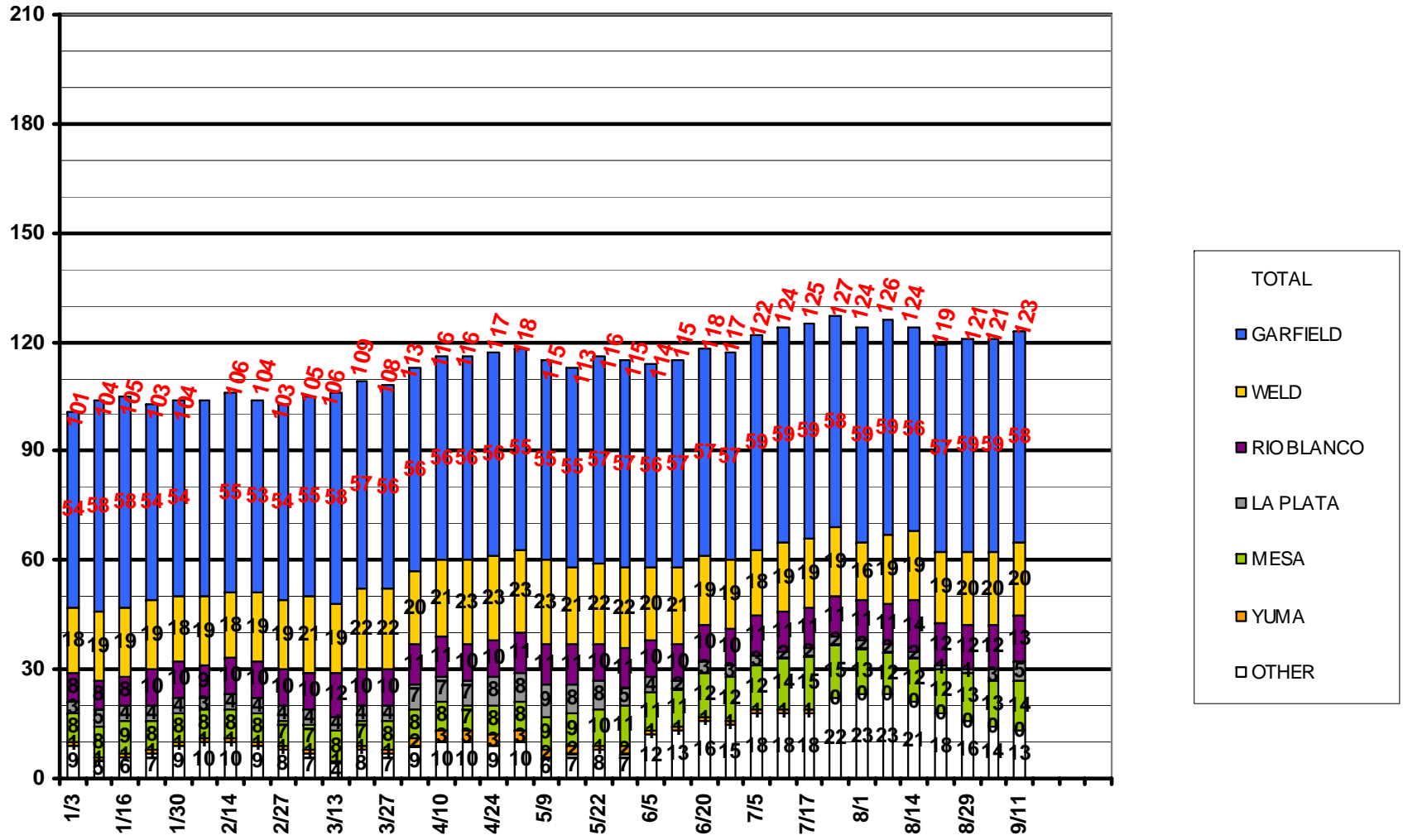
- Investigate Drill Rig Controls – Possibilities:
 - Determine emissions (5,000 tpy in the DJ; ~25,000 tpy Statewide??)
 - Determine authorities
 - Develop registration/APEN system
 - Only the cleanest engines on new rigs into the state
 - Retrofits on existing pre-TIER 2 engines
 - Biodiesel/natural gas vs. diesel



DRILLING RIGS RUNNING IN COLORADO BY COUNTY EACH WEEK IN 2007

(Based on Data in Anderson Reports Weekly Rig Status Report)

Weekly # of Rigs (Labels on bars indicate # of rigs by county.)





Stationary Sources Control Options

- BART for Martin Drake and CEMEX will advance in 2008
- Potential shut-down of Arapahoe 3&4 and Cameo by 2011-2013 (>2,000 tpy in reductions)
- Individual source evaluations

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Modeling of NO_x Control Options



2010 8-Hour Ozone Projections with Growth and Current Controls (Preliminary)

Site	Design Value (current)	Design Value (future)	
Welby-----	70-----	70.5	↑
USAF Academy-----	73-----	71.9	↓
Weld Tower-----	73-----	72.7	↓
Fort Collins South-----	74-----	73.3	↓
Manitou-----	74-----	73.7	↓
Carriage-----	74-----	74.4	↑
Welch-----	75-----	74.9	↓
RMNP-----	76-----	75.1	↓
Highland-----	78-----	77.5	↓
Arvada-----	79-----	79.4	↑
South Boulder-----	81-----	80.9	↓
NREL-----	82-----	82.5	↑
Chatfield-----	84-----	83.7	↓
Ft Collins West-----	86-----	85.1	↓
Rocky Flats North-----	85-----	85.1	↑





Modeling for NO_x for Ozone

1. 20% NO_x Reduction from Point and O&G in NAA
2. 20% NO_x Reduction from Point and O&G in Colorado
3. 20% NO_x Reduction from Point and O&G in NAA and
20% NO_x Reduction from Pawnee and Rawhide
4. 20% VOC & NO_x Reduction from Point and O&G in
Colorado
5. 20% across the board VOC reduction (approx. 90 tpd)
plus 43% NO_x reduction (approx. 90 tpd) in Point, O&G,
Non-road and Area Sources in NAA



Process and Timeline for NO_x Control Strategy Development and Implementation





Investigating NO_x Controls

- Evaluate significant sources/categories for NO_x controls
 - The work began in the Regional Haze process will inform the process
 - The presumptive approach information and detailed economic analyses is establishing a starting point
 - Technical and administrative issues need to be fleshed out
 - Sensitivity modeling will further inform the importance of NO_x controls
- Detailed NO_x proposals will likely be finalized in 2009 through the RH process for both ozone and visibility
 - 2010 implementation will be a challenge
 - Certain NO_x controls for specific sources/categories could be part of the 2008 ozone plan
 - Continue the dialogue