



Results from Colorado's Regional Haze SIP Development Process

February 4, 2011

Presentation to the Regional Air Quality Council

Colorado Air Pollution Control Division

Rocky Mountain National Park

Emission Control Strategies for Ozone

| 2008 Ozone Action Plan <i>(All strategies apply to the entire Denver/North Front Range nonattainment area (NAA) unless otherwise noted)</i> | | | | | Potential Strategies Requiring Additional Evaluation for Near-Term Plan/SIP Amendment | | |
|---|--|---|---|---|---|--|------------------------------------|
| Measures Adopted for Federally-Enforceable State Implementation Plan (SIP) | | Potential Emission Reduction | Measures Adopted and Enforced as State- only Measures | | Potential Emission Reduction | | Potential Emission Reduction |
| | | | <ul style="list-style-type: none"> ➤ Inspection/maintenance program in North Front Range – eff. July 1, 2010 ➤ More stringent Reg. 11 I/M cut-points (Denver area) – adopted, effective May 1, 2008 ➤ Mandatory high-emitter pilot program (Denver area) – began January 1, 2008 ➤ Tighten up collector plate requirements for older vehicles (statewide)-legislation being pursued | <p>~ 1 tpd VOC, ~1 tpd NOx, ~17 tpd CO</p> <p>~ 1 tpd VOC, ~3 tpd NOx, ~13 tpd CO</p> <p><i>Pilot program results are not available</i></p> <p>~ 1 tpd VOC ~ 7 tpd CO</p> | <p>Ozone Fuels Strategies:</p> <ul style="list-style-type: none"> ➤ 7.0 RVP gasoline ➤ Federal Reformulated Gasoline ➤ Eliminate ethanol waiver | <p>~ 10 tpd VOC</p> <p>~ 18 tpd VOC</p> <p>~ 10 tpd VOC + 360 tpd CO</p> | |
| <ul style="list-style-type: none"> ➤ Increase system-wide condensate tank control requirements to 85% in 2010 and 90% in 2011 for all tanks greater than or equal to 2 tpy | <p><i>Total from 2010 base ~ 34 tpd (2010)/ 49 tpd (2011) VOC</i></p> | <ul style="list-style-type: none"> ➤ Statewide Oil & Gas regulations -- Controls on existing reciprocating internal combustion engines | <p>~4 tpd VOC ~16 tpd NOx</p> | <ul style="list-style-type: none"> ➤ Statewide Oil & Gas regulations – control requirements for new condensate tanks and pneumatic valves | <p><i>Scope of the potential controls has not been determined</i></p> | | |
| | | <ul style="list-style-type: none"> ➤ Pneumatic valves controls - require low/no bleed valves on all new and existing valves by 2009 | <p>~ 23 tpd VOC</p> | <ul style="list-style-type: none"> ➤ Increase system-wide condensate tank control requirements to 95% for all tanks | <p><i>Total from 2010 base ~61 tpd VOC</i></p> | | |
| <ul style="list-style-type: none"> ➤ Remove current exemptions in Reg. 3 for selected small sources required to file air pollution emission notices and obtain permits ➤ Require Reasonably Available Control Technology (RACT) for minor sources in NAA (Reg. 3) | <p><i>Emission reductions are difficult to quantify at this time, but are expected to be small in the short-term</i></p> | <ul style="list-style-type: none"> ➤ Expand Reg. 7 (VOC control requirements) to entire NAA | <p><i>Emission reductions are difficult to quantify at this time, but are expected to be small in the short-term</i></p> | <ul style="list-style-type: none"> ➤ Emission controls on large NOx sources <ul style="list-style-type: none"> ▪ power plants ▪ boilers ▪ cement kilns | <p>~ 30-45 tpd NOx</p> | | |
| | | | | <ul style="list-style-type: none"> ➤ California Paints/Solvents/ Consumer Products Rule | <p>~ 8 tpd VOC</p> | | |
| TOTAL EMISSION REDUCTIONS | | <p>VOC NOx CO</p> | <p>~34 tpd(2010) 49 tpd (2011)</p> | <p>VOC NOx CO</p> | <p>~30 tpd ~20 tpd >37 tpd</p> | | |

Overview

- EPA pressed Colorado to take action in 2010 to address deficiencies in the state's 2007/2008 Regional Haze SIP
- HB10-1365 was passed – emission reduction plans for subject units to address Reasonably Foreseeable Requirements, including Regional Haze and Ozone
- APCD developed and brought forward to the Air Quality Control Commission Regional Haze proposals for BART (Aug. 2010) and Reasonable Progress (Sept. 2010)

Great Sand Dunes National Park & Preserve

The National Visibility Goal

Congress... *“declares as a national goal the prevention of any future and remedying of any existing impairment of visibility in any mandatory Class I Federal areas which impairment results from man-made air pollution”*

(1977 Clean Air Act, §169A)

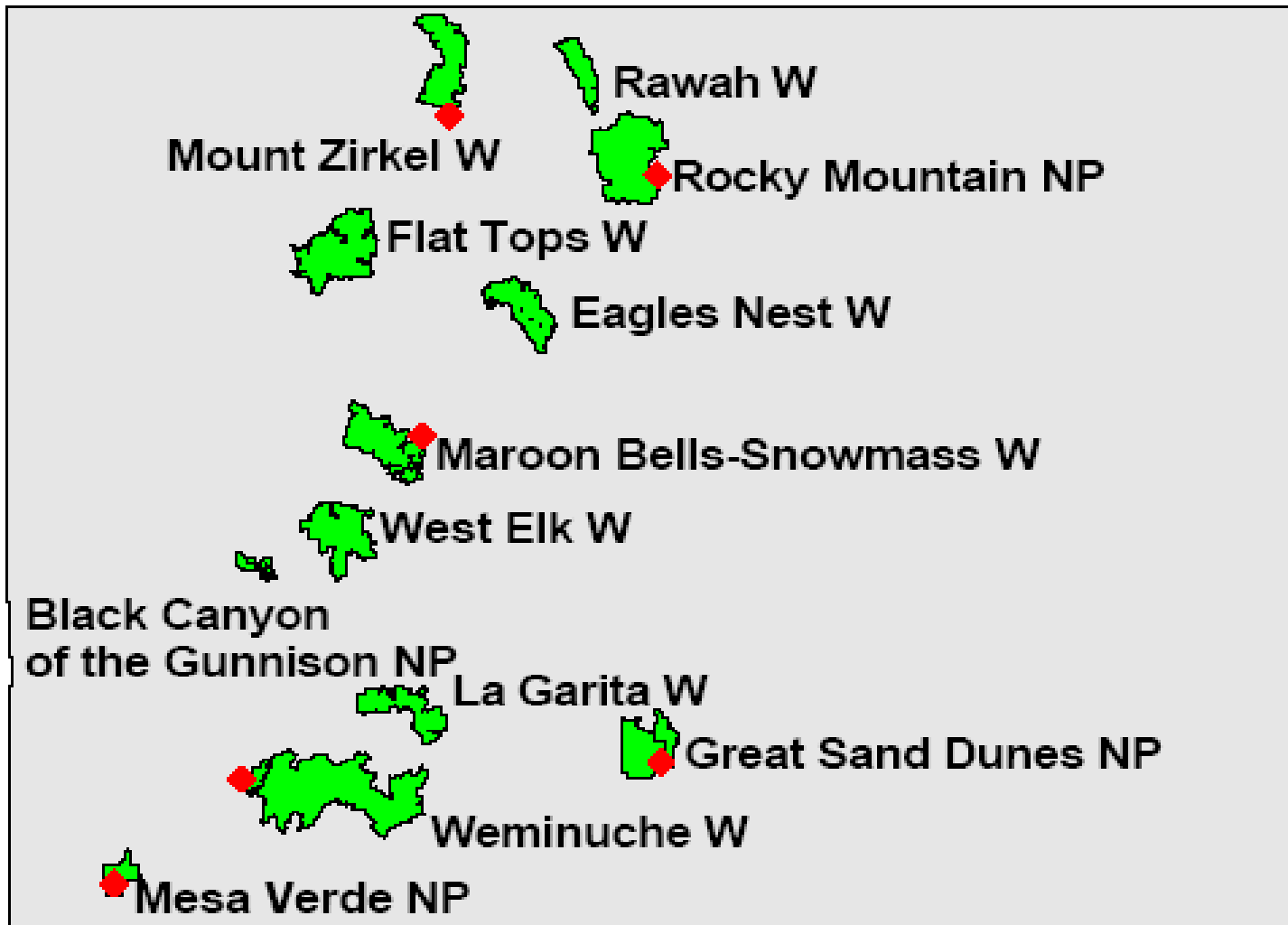
**Maroon Bells-Snowmass
Wilderness Area**

HB10-1365

“A coordinated plan of emission reductions from these coal-fired power plants will enable Colorado rate-regulated utilities to meet the requirements of the federal Clean Air Act and protect public health and the environment at a lower cost than a piecemeal approach.”

“The air quality provisions of this emissions reduction plan...are intended to fulfill the requirements of the state and federal acts and shall be proposed...to the Air Quality Control Commission...for incorporation into the Regional Haze element of the State Implementation Plan”

Colorado Class I Areas



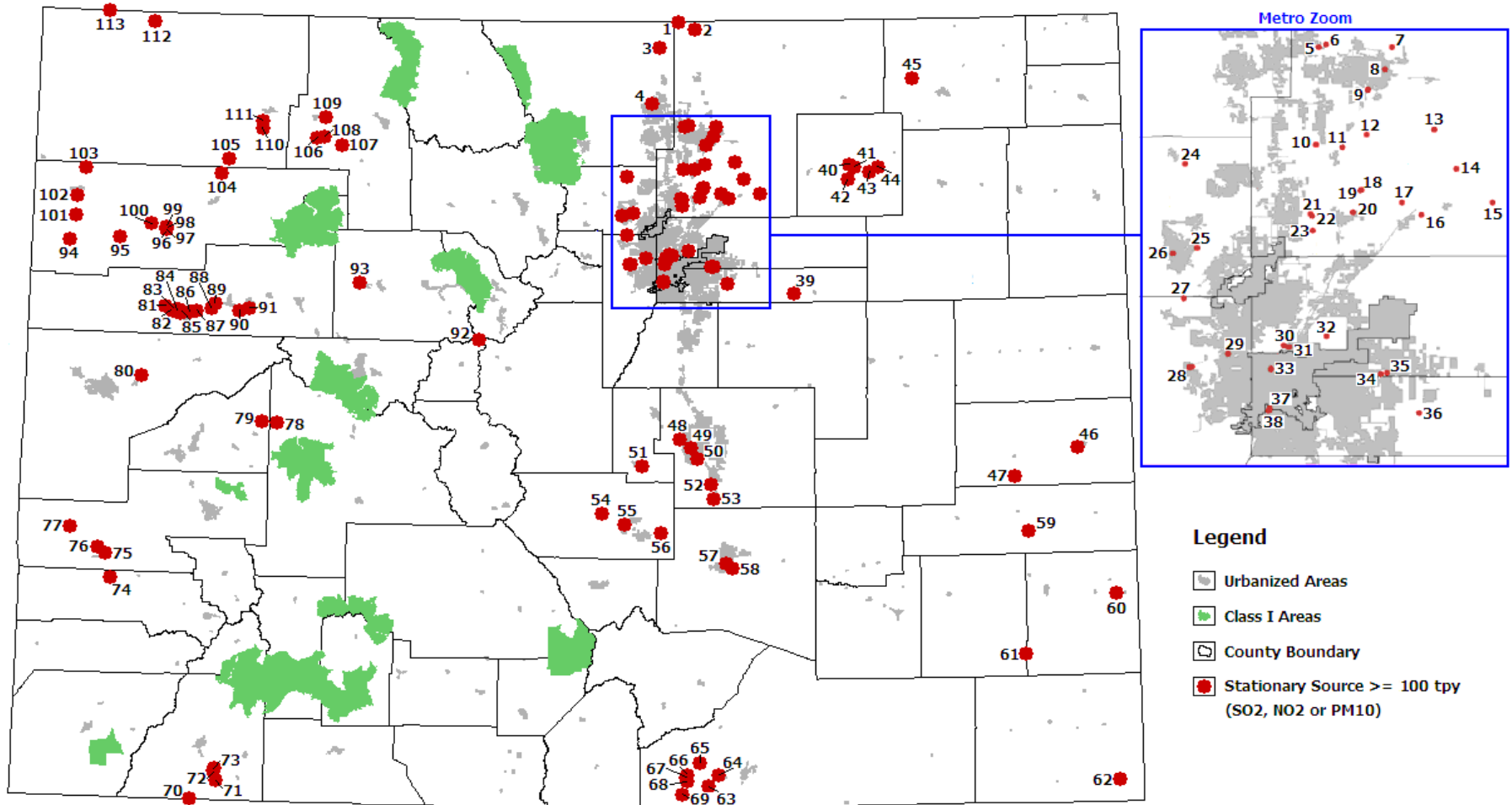
Overview

- From August 2010 to early January 2011, the AQCC considered numerous proposals and adopted an updated Regional Haze SIP
 - Emission controls for numerous large stationary sources were adopted along with the accompanying technical support information (30 units at 16 facilities)
 - Includes the HB1365 emissions reduction plans for PSCo and Black Hills approved by the PUC in December 2010
- The plan is now undergoing legislative review prior to being submitted to the EPA

*Black Canyon of the Gunnison
National Park*

The state began evaluating these sources for emissions reductions...

Site Emission \geq 100 tpy for SO₂, NO₂ or PM₁₀
Number of Sources = 113



...and these controls were adopted:

- **NOx control upgrades: 15 units**
- **SO2 control upgrades: 5 units**
 - **Gas operation: 2 units**
 - **Shut down: 9 units**

| NOx Reductions (tons/year) | SO2 Reductions (tons/year) | PM Reductions (tons/year) | Total Emissions Reductions (tons/year) |
|---|---------------------------------------|--------------------------------------|---|
| 34,774 | 35,776 | 532 | 71,082 |
| (95.3 tons/day) | (98.0 tons/day) | (1.5 tons/day) | (194.8 tons/day) |

...by the year 2018.

Emission Reductions Resulting from the Regional Haze Program

| Facility or Unit | Location | Emissions Control Approach | | | NOx Reductions (tons/year) | SO2 Reductions (tons/year) | PM Reductions (tons/year) | Total Emissions Reductions (tons/year) |
|----------------------------|----------------|----------------------------|-------------|-----------------|----------------------------|----------------------------|---------------------------|--|
| Black Hills Clark Station* | Canon City | Shut Down | | | 861 | 1,457 | 72 | 2,390 |
| PSCo Cherokee-Unit 1* | Denver Metro | Shut Down | | | 1,556 | 2,221 | 37 | 3,814 |
| PSCo Cherokee-Unit 2* | Denver Metro | Shut Down | | | 2,895 | 1,888 | 35 | 4,818 |
| PSCo Cherokee-Unit 3* | Denver Metro | Shut Down | | | 1,866 | 743 | 65 | 2,674 |
| PSCo Cherokee-Unit 4* | Denver Metro | Natural Gas Operation | | | 2,211 | 2,127 | 0 | 4,338 |
| PSCo Arapahoe-Unit 3* | Denver Metro | Shut Down | | | 1,770 | 925 | 56 | 2,751 |
| PSCo Arapahoe-Unit 4* | Denver Metro | Natural Gas Operation | | | 248 | 1,764 | 0 | 2,012 |
| PSCo Valmont-Unit 5* | Denver Metro | Shut Down | | | 2,314 | 758 | 42 | 3,114 |
| PSCo Pawnee Station* | E Colorado | NOx - SCR | SO2 - LSD | PM - baghouse** | 3,135 | 11,066 | 0 | 14,201 |
| PSCo Comanche-Unit 1 | Pueblo | NOx - LNB** | SO2 - LSD** | PM - baghouse** | 0 | 0 | 0 | 0 |
| PSCo Comanche-Unit 2 | Pueblo | NOx - LNB** | SO2 - LSD** | PM - baghouse** | 0 | 0 | 0 | 0 |
| PSCo Hayden-Unit 1 | NW Colorado | NOx - SCR | SO2 - LSD** | PM - baghouse** | 3,032 | 61 | 0 | 3,093 |
| PSCo Hayden-Unit 2 | NW Colorado | NOx - SCR | SO2 - LSD** | PM - baghouse** | 3,120 | 39 | 0 | 3,159 |
| PSCo Cameo Station | W Colorado | Shut Down | | | 1,140 | 2,618 | 225 | 3,983 |
| TriState Craig-Unit 1 | NW Colorado | NOx - SNCR | SO2 - WS** | PM - baghouse** | 727 | 0 | 0 | 727 |
| TriState Craig-Unit 2 | NW Colorado | NOx - SCR | SO2 - WS** | PM - baghouse** | 3,975 | 0 | 0 | 3,975 |
| TriState Craig-Unit 3 | NW Colorado | NOx - SNCR | SO2 - LSD** | PM - baghouse** | 854 | 0 | 0 | 854 |
| TriState Nucla | W Colorado | NOx - SNCR** | SO2 - LI** | PM - baghouse** | 0 | 0 | 0 | 0 |
| PRP Rawhide-Unit 101 | Larimer County | NOx - ECC | SO2 - LSD** | PM - baghouse** | 448 | 0 | 0 | 448 |
| CSU Drake-Unit 5 | Colo. Springs | NOx - ULNB+OFA | SO2 - DSI | PM - baghouse** | 215 | 762 | 0 | 977 |
| CSU Drake-Unit 6 | Colo. Springs | NOx - ULNB+OFA | SO2 - LSD | PM - baghouse** | 509 | 2,368 | 0 | 2,877 |
| CSU Drake-Unit 7 | Colo. Springs | NOx - ULNB+OFA | SO2 - LSD | PM - baghouse** | 749 | 3,764 | 0 | 4,513 |
| CSU Nixon | Fountain | NOx - ULNB+OFA | SO2 - LSD | PM - baghouse** | 707 | 3,215 | 0 | 3,922 |
| Holcim Cement Plant | Florence | NOx - SNCR | SO2 - WLS** | PM - baghouse** | 1,028 | 0 | 0 | 1,028 |
| Cemex Cement Plant | Denver Metro | NOx - SNCR | SO2 - none | PM - baghouse** | 846 | 0 | 0 | 846 |
| CENC-Boiler 3 | Denver Metro | NOx - none | SO2 - none | PM - baghouse** | 0 | 0 | 0 | 0 |
| CENC-Boiler 4 | Denver Metro | NOx - LNB+SOFA | SO2 - none | PM - baghouse** | 214 | 0 | 0 | 214 |
| CENC-Boiler 5 | Denver Metro | NOx - LNB+SOFA+SNCR | SO2 - none | PM - baghouse** | 354 | 0 | 0 | 354 |

* HB 10-1365 Source

** existing controls

| | | | | |
|---|---------------|---------------|------------|---------------|
| Total Emissions Reductions (by 2018) | 34,774 | 35,776 | 532 | 71,082 |
|---|---------------|---------------|------------|---------------|

| | | | | |
|---|----------------|---------------|----------------|--|
| 2009 Statewide Emissions (all sources) | 284,037 | 61,229 | 293,738 | |
|---|----------------|---------------|----------------|--|

| | | | | |
|---|---------------|---------------|--------------|--|
| Benefit of RH Emission Reductions - Percentage Reduction from 2009 Statewide Emissions | -12.2% | -58.4% | -0.2% | |
|---|---------------|---------------|--------------|--|

Abbreviation Key

| | | | |
|-----------------------------------|-------------------------------------|--|-------------------------|
| DSI = dry sorbent injection | LSD = lime spray dryers | SNCR = selective non-catalytic reduction | WLS = wet lime scrubber |
| ECC = enhanced combustion control | NOx = Nitrogen Oxides | SOFA = separated overfire air | WS = wet scrubbers |
| LI = limestone injection | PM = Particulate Matter | SO2 = Sulfur Dioxide | |
| LNB = low NOx burners | SCR = selective catalytic reduction | ULNB+OFA = ultra LNB plus overfire air | |

Of these reductions, roughly half are achieved by PSCo through the HB-1365 process.

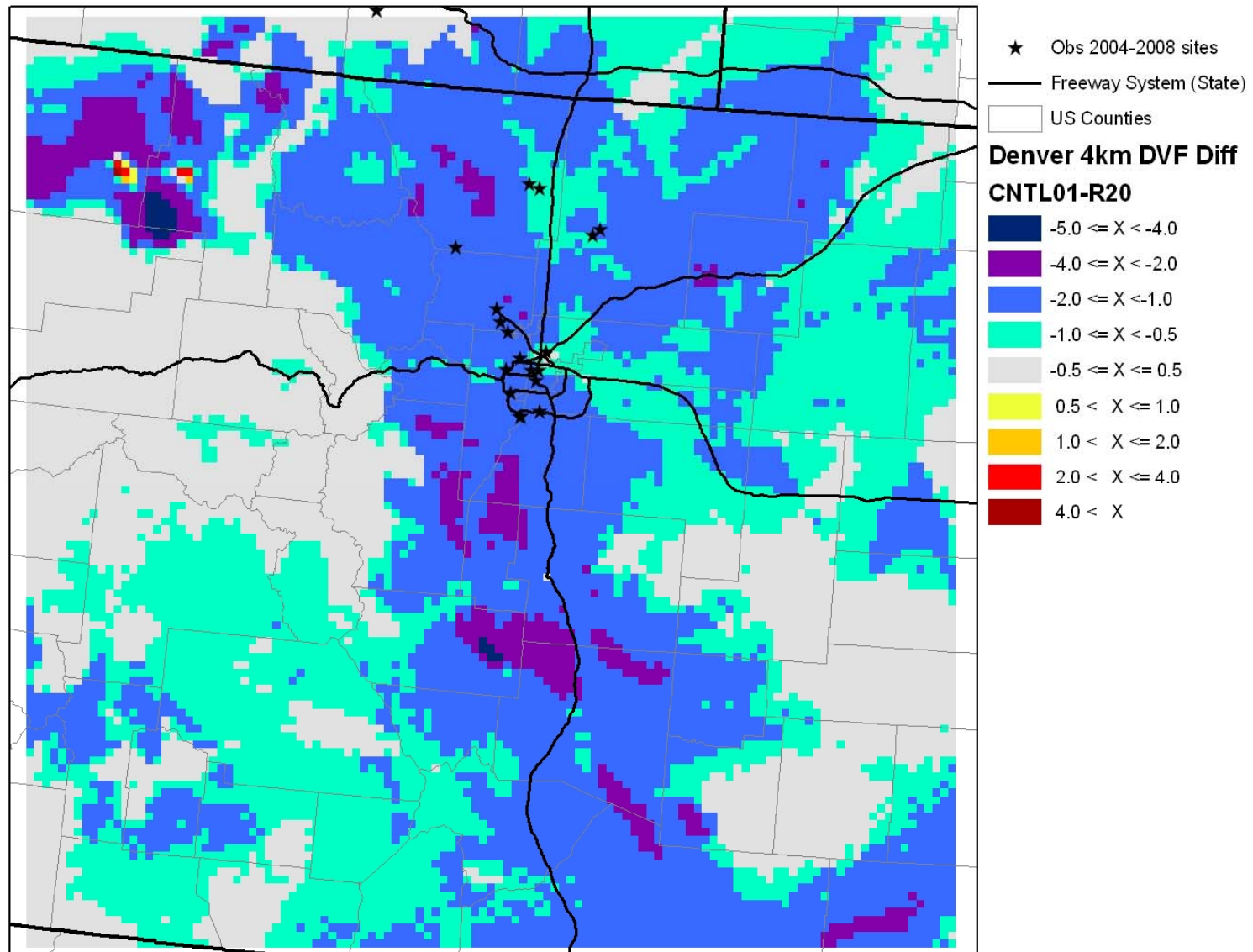
- **Arapahoe Unit 3:**
- **Arapahoe Unit 4:**
- **Cherokee Unit 1:**
- **Cherokee Unit 2:**
- **Cherokee Unit 3:**
- **Cherokee Unit 4:**
- **Pawnee NOx:**
- **SO2:**
- **Valmont Unit 5:**

SO2: 21,493 tons per year
NOx: 15,995 tons per year



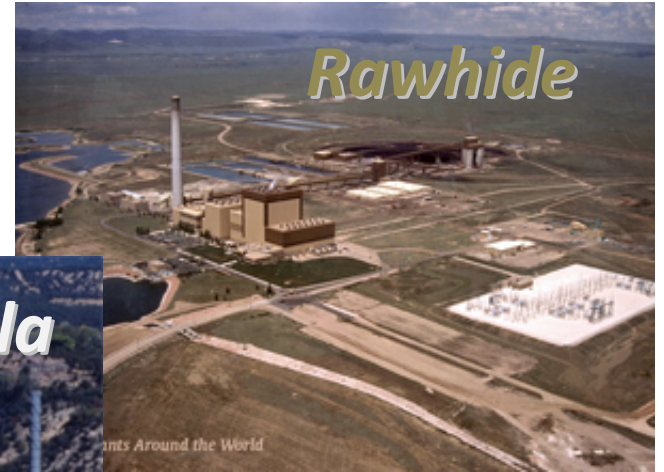
Shutdown by 12/31/2013
Natural Gas Operation by 12/31/2014
Shutdown by 7/1/2012
Shutdown by 12/31/2011
Shutdown by 12/31/2016
Natural Gas Operation by 12/31/2017
0.07 lb/MMBtu (SCR) by 12/31/2014
0.12 lb/MMBtu (LSD) by 12/31/2014
Shutdown by 12/31/2017

“What if” Scenario for 2020: Ozone Benefits of Controlling Large NO_x Sources





CENC



Rawhide



Nucla



Holcim



Craig



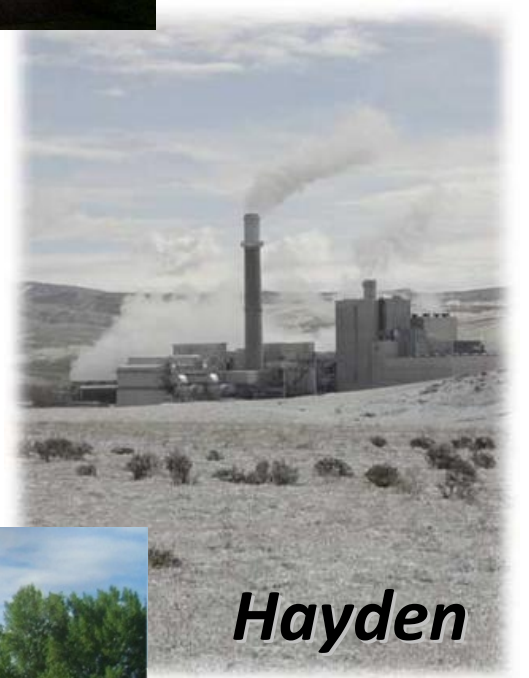
Nixon



Drake



Comanche



Hayden



Cameo



Cemex

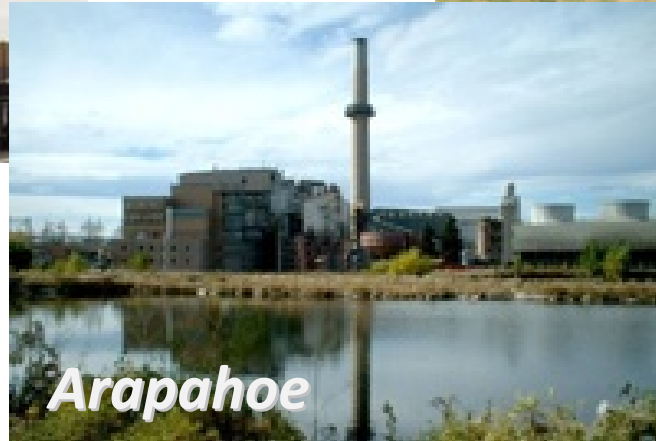


Cherokee

Illustrations "Power Plants Around the World"



Pawnee



Arapahoe



Valmont

Power Plants Around the World



Clark