Analysis of a New Stationary Non-EGU Projection Methodology

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Purpose and Goals of the Project

To improve and update current emissions growth estimates for stationary non-EGU sources

Goal is to develop growth factors that are:

- Transparent;
- Scientifically based;
- Consistent with current knowledge;
- Easily updated for significant changes in future events; and
- Able to be altered to reflect different future year scenario assumptions

Key Considerations of New Projections

- Relevant for stationary non-EGU sources only
  - Mobile models used to forecast mobile emissions
  - IPM for EGU emissions
  - USDA for agriculture source emissions
  - 5-year average fires data
- Growth 2005 - 2030 in five-year increments (i.e., growth factors were developed for 2010, 2015, 2020, 2025, and 2030).
- Identified priority point and non-point sources to address individually for improvement based upon sources with highest CAP emissions

Background

The general emissions forecasting equation is:

$Emiss_{FY} = Emiss_{BY} \times GF \times [1 - [CE_{FY}/100][RE_{FY}/100][RP_{FY}/100]]$

Where:

$Emiss_{FY}$ = emissions in forecast year;

$Emiss_{BY}$ = emissions in base year;

GF = growth factor (ratio of forecast year to base year emission activity);

CE_{FY} = control efficiency (CE) for forecast year;

RE_{FY} = rule effectiveness (RE) for forecast year; and

RP_{FY} = rule penetration (RP) for forecast year.

Improvements

- **Combustion sources** – Used Department of Energy, Annual Energy Outlook 2009 reference case energy consumption /production forecasts (April AEO 2009 version that incorporates American Recovery and Reinvestment Act)
- **Non-Combustion sources**
  - **Non-point priority sources** – improved activity measures for 50 highest emitting stationary non-point SCCs (based on sums of CAP emissions…NO_X, SO_2, Primary $PM_{2.5}$, and VOC)
  - **Point priority sources** – 10 industries with highest CAP emissions (see slide 6 for list of industries)
    - Used a variety of approaches including:
      - Statistical relationship of historical (NEI) emissions to US census production & factor of production data
      - Consultation with EPA sector experts
      - Industry, AEO 2010, EMPAX-CGE, SRI and other available forecasts and key industry information
  - **Non-priority sources** -used DOE, AEO April 2009 reference case socioeconomic forecasts, but used same growth indicators that were developed for the priority sources where such use was appropriate (i.e., the non-priority represents essentially the same emissions activity as a priority source category)

Priority Point Source Industries Used in Analysis

Industry	NAICS
1. Pulp and Paper Manufacturing	322
2. Petroleum Refining	32411
3. Copper Production	331411
4. Cement Manufacturing	32731
5. Glass Manufacturing	3272
6. Primary Aluminum Manufacturing	331312
7. Secondary Aluminum Production	331314
8. Carbon Black Production	325182
9. Sulfuric Acid Production	325188
10. Iron and Steel Manufacturing	33111

Results

Analysis of Year 2020 Projections

- **Restricted to Stationary Non-EGU sectors**
  - Non-EGU Point and non-point
- **Focused on NO_X, SO2, and PM2.5**
  - Growth factors are not pollutant-specific but curious to see how significant source categories are impacted for each pollutant
- **Contiguous U.S. only**
  - Growth factors vary by region or state though some are national
- **Projected from year 2005 Emissions Modeling Platform**
  - http://www.epa.gov/ttn/chief/emch/index.html#2005
- **Comparison between year 2020 projected using our current "no-growth" methodology and this revised methodology**

Overall Non-EGU Summary

Pollutant	2005 Emissions	2020 Emissions EPA	2020 Emissions New	2005 % of Total	2020 EPA % of Total	2020 New % of Total	% Increase New minus EPA
NO_X	4,038,000	4,038,000	4,142,000	20%	33%	34%	3%
$PM_{2.5}$	1,529,000	1,454,000	1,719,000	43%	45%	49%	18%
SO_2	3,405,000	3,210,000	2,965,000	23%	37%	35%	-8%
VOC	8,843,000	8,537,000	9,152,000	60%	76%	77%	7%

Source Categories Undergoing Significant Changes from New Methodology

Pollutant	Tier 1 Description	2005 Emissions	2020 Emissions EPA	2020 Emissions New	% Increase New minus EPA	Difference New minus EPA
NO_X	FUEL COMB. ELEC. UTIL.	124,000	124,000	215,000	73%	91,000
NO_X	FUEL COMB. INDUSTRIAL	1,776,000	1,749,000	1,666,000	-5%	-83,000
NO_X	OTHER INDUSTRIAL PROCESSES	481,000	480,000	528,000	10%	48,000
NO_X	MISCELLANEOUS	66,000	66,000	88,000	33%	22,000
SO_2	FUEL COMB. INDUSTRIAL	1,714,000	1,611,000	1,375,000	-15%	-236,000
SO_2	FUEL COMB. OTHER	578,000	577,000	500,000	-13%	-77,000
SO_2	OTHER INDUSTRIAL PROCESSES	357,000	352,000	387,000	10%	36,000
SO_2	FUEL COMB. ELEC. UTIL.	70,000	70,000	94,000	34%	24,000
SO_2	METALS PROCESSING	175,000	175,000	190,000	9%	16,000
$PM_{2.5}$	FUEL COMB. OTHER	421,000	355,000	480,000	35%	126,000
$PM_{2.5}$	MISCELLANEOUS	229,000	229,000	297,000	30%	68,000
$PM_{2.5}$	OTHER INDUSTRIAL PROCESSES	261,000	260,000	305,000	17%	45,000
$PM_{2.5}$	FUEL COMB. ELEC. UTIL.	12,000	11,000	25,000	118%	13,000
$PM_{2.5}$	WASTE DISPOSAL & RECYCLING	265,000	264,000	277,000	5%	13,000
VOC	SOLVENT UTILIZATION	4,245,000	4,209,000	4,551,000	8%	342,000
VOC	FUEL COMB. OTHER	589,000	470,000	602,000	28%	132,000
VOC	OTHER INDUSTRIAL PROCESSES	457,000	425,000	498,000	17%	73,000
VOC	STORAGE & TRANSPORT	1,442,000	1,109,000	1,045,000	-6%	-63,000
VOC	MISCELLANEOUS	226,000	230,000	286,000	24%	56,000
VOC	PETROLEUM & RELATED INDUSTRIES	1,040,000	1,289,000	1,317,000	2%	28,000
VOC	CHEMICAL & ALLIED PRODUCT MFG	235,000	220,000	245,000	11%	25,000
VOC	WASTE DISPOSAL & RECYCLING	392,000	366,000	386,000	5%	19,000

Digging Deeper (Tier 2) into Non-EGUs

Pollutant	Tier 1 Description	Tier 2 Description	2005 Emissions	2020 Emissions EPA	2020 Emissions New	% Increase New minus EPA	Difference New minus EPA
NO_X	FUEL COMB. INDUSTRIAL	Coal	323,100	319,300	272,100	-15%	-47,200
NO_X	FUEL COMB. INDUSTRIAL	Oil	161,600	160,800	127,000	-21%	-33,700
NO_X	FUEL COMB. INDUSTRIAL	Gas	502,300	480,400	479,100	0%	-1,300
NO_X	FUEL COMB. INDUSTRIAL	Other	140,900	140,800	140,400	0%	-400
NO_X	FUEL COMB. INDUSTRIAL	Internal Combustion	648,300	647,800	647,400	0%	-400
SO_2	FUEL COMB. OTHER	Residential Other	167,900	167,900	127,500	-24%	-40,300
SO_2	FUEL COMB. OTHER	Commercial/Institutional Oil	266,900	266,800	232,800	-13%	-34,100
SO_2	FUEL COMB. OTHER	Commercial/Institutional Coal	128,900	128,500	125,400	-2%	-3,000
SO_2	FUEL COMB. OTHER	Residential Wood	5,300	4,600	6,900	44%	2,400
SO_2	OTHER INDUSTRIAL PROCESSES	Miscellaneous Industrial Processes	34,100	33,100	59,900	79%	26,800
SO_2	OTHER INDUSTRIAL PROCESSES	Mineral Products	252,100	248,100	255,700	3%	7,600
VOC	SOLVENT UTILIZATION	Nonindustrial	1,468,200	1,468,200	1,596,600	9%	128,400
VOC	SOLVENT UTILIZATION	Surface Coating	1,626,700	1,593,900	1,702,700	7%	108,900
VOC	SOLVENT UTILIZATION	Degreasing	346,900	346,200	417,900	21%	71,700
VOC	SOLVENT UTILIZATION	Other Industrial	385,600	382,900	432,200	13%	49,400
VOC	SOLVENT UTILIZATION	Solvent Utilization NEC	94,600	94,600	83,000	-12%	-11,600
$PM_{2.5}$	OTHER INDUSTRIAL PROCESSES	Agriculture, Food, & Kindred Products	93,600	93,500	118,600	27%	25,100
$PM_{2.5}$	OTHER INDUSTRIAL PROCESSES	Miscelllaneous Industrial Processes	44,400	43,600	58,500	34%	14,900

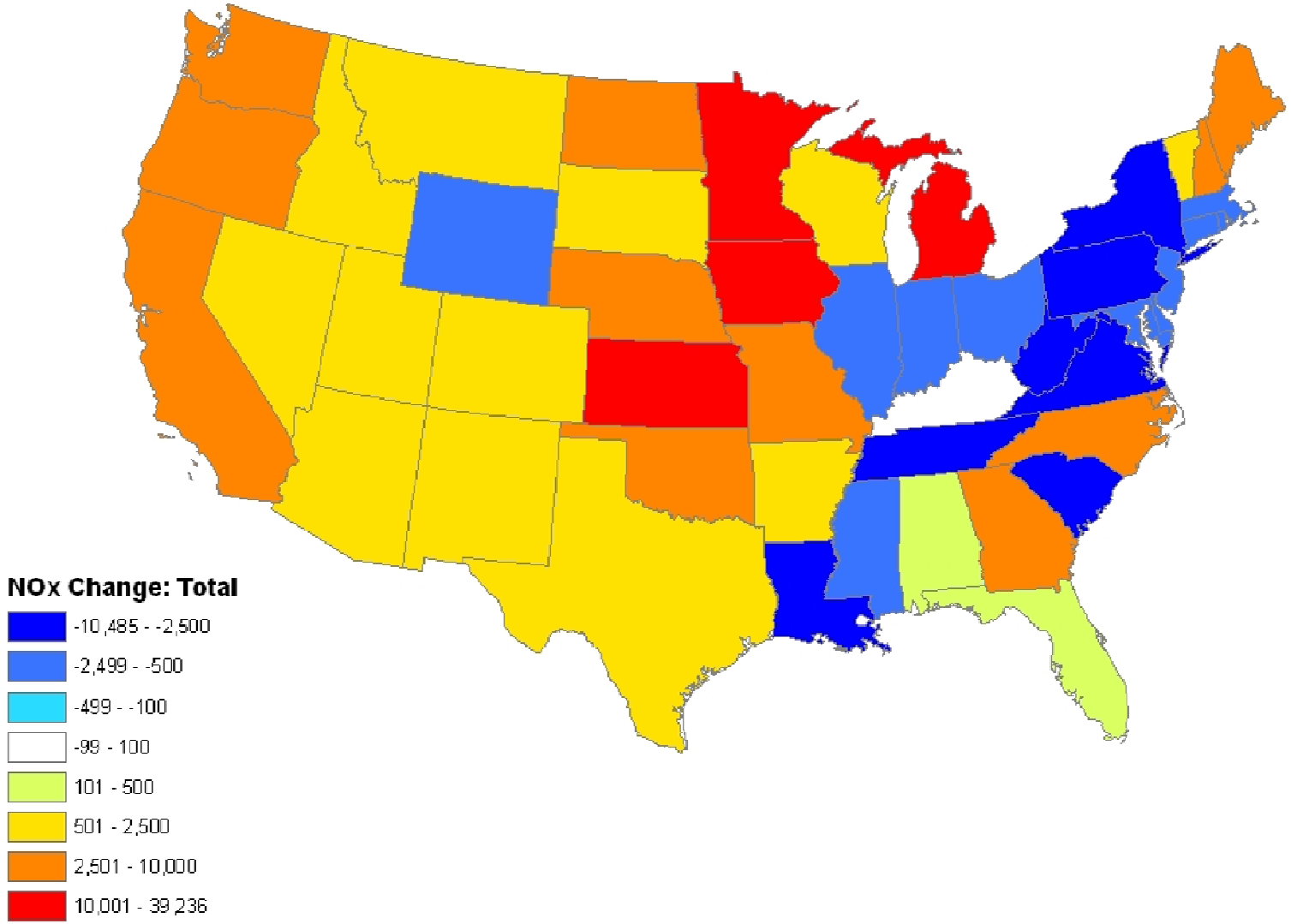
National Summaries can hide some interesting state-level changes

- **National Summaries useful but can hide some interesting state-level variance**
  - Example: NO_X Industrial Fuel Combustion IC engines
  - large increases >=2,500 tons central states (KS, MO, IO)
  - large decreases <= -2,500 tons CA and south (NM,TX, OK, LA)
  - Nationally offset to only ~400 tons difference
- **Tier 1 Fuel Combustion Electric Utility factors are huge**
  - Often increase 10x or more! Need to look at AEO 2010 estimates.
- **Usefulness for some source categories is a question**
  - Aircraft and RWC projections EPA already includes
  - Growth factors for RWC (general) as high as 28x in some states – did AEO 2009 estimate large increases in RWC because of assumed higher fossil fuel prices? Also need to check AEO 2010 estimates.

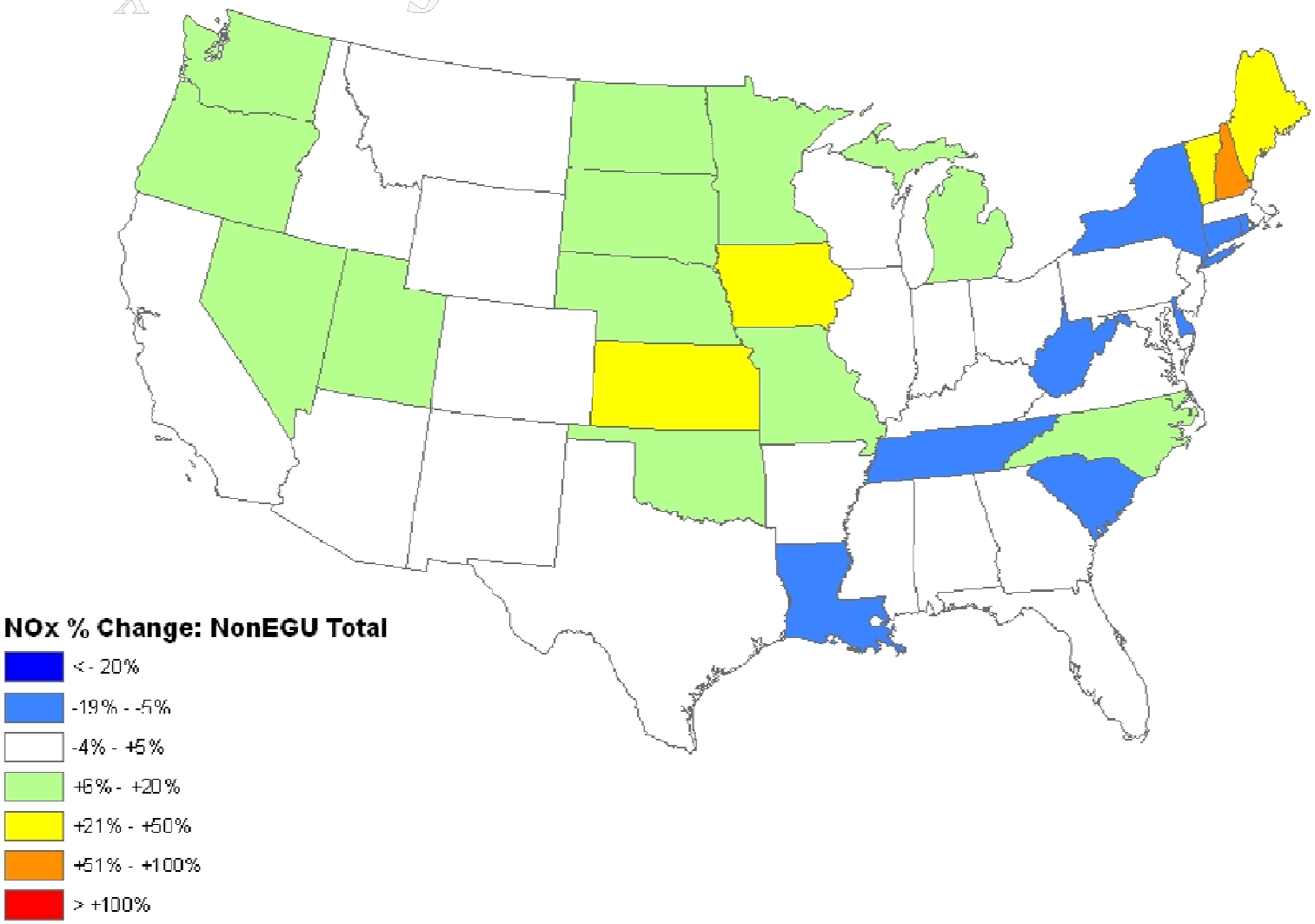
State-level Maps

- **Focused on NO_X, SO_2, and $PM_{2.5}$**
- **Started with "Tier 1" and drilled down to "Tier 2" for some categories**
  - NO_X: Industrial Fuel Combustion (coal, nat. gas, residual oil, IC engines)
  - SO_2: Other Industrial Processes (cement)
  - $PM_{2.5}$: Commercial Cooking, Ag Fires, RWC
- **Begin by showing state-level overall differences**
  - Not differences from 2005 to 2020, but rather EPA vs. this new methodology differences in year 2020
  - Warm colors represent increasing emissions compared to EPA (current) methodology
  - Cool colors represent decreasing emissions compared to EPA methodology

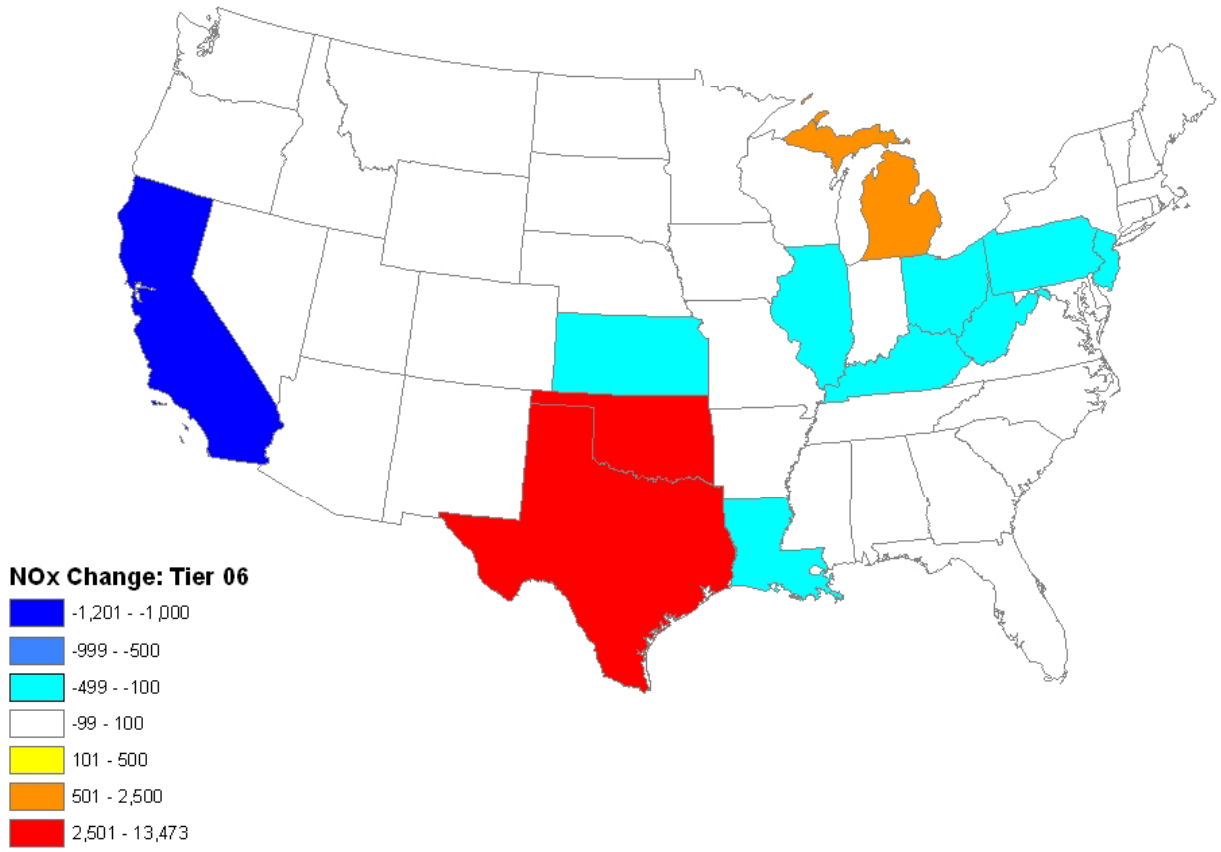
Total NO_X Change (New minus EPA)



NO_X % Change Non-EGUs

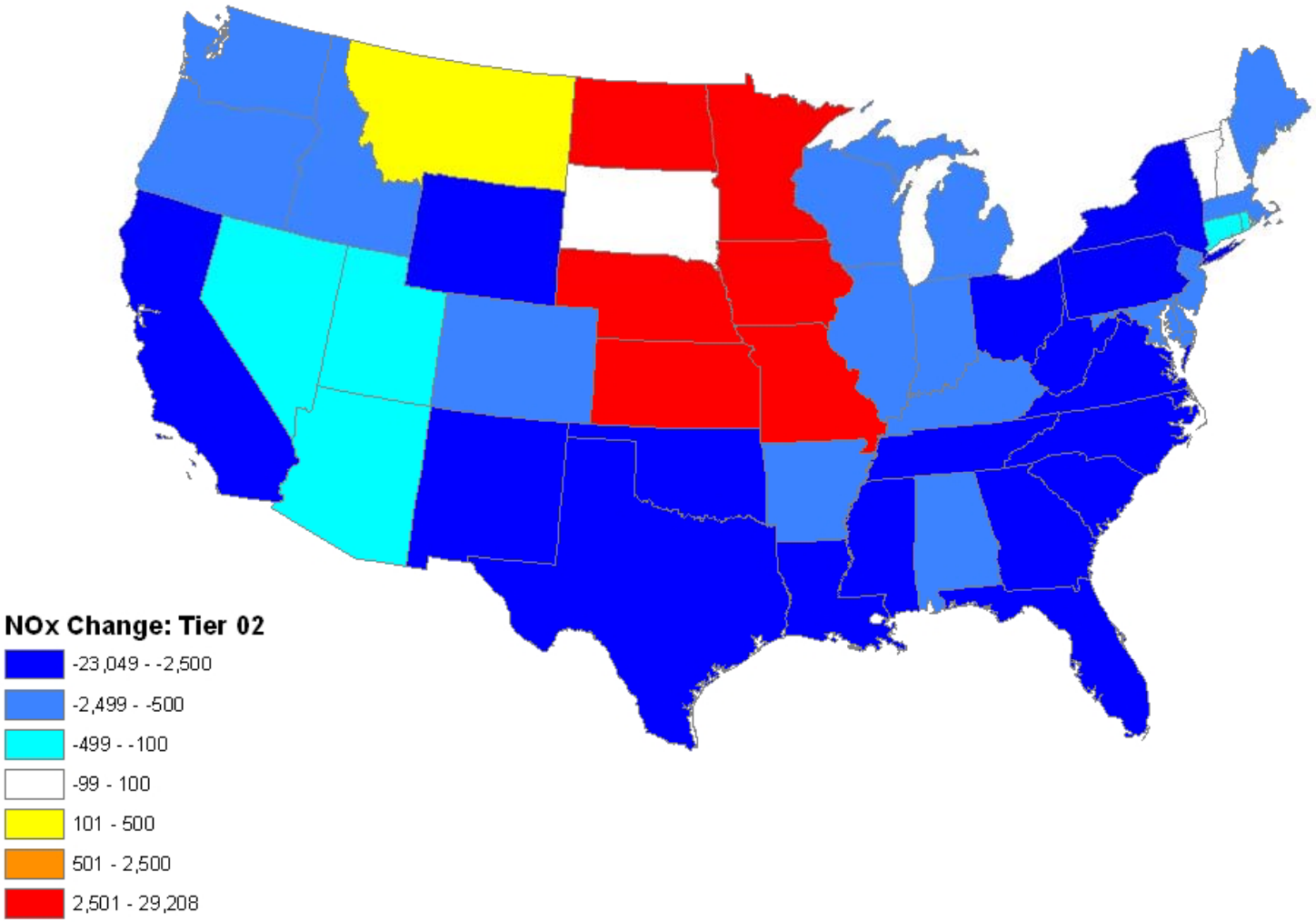


NO_X Change Oil and Gas Production*

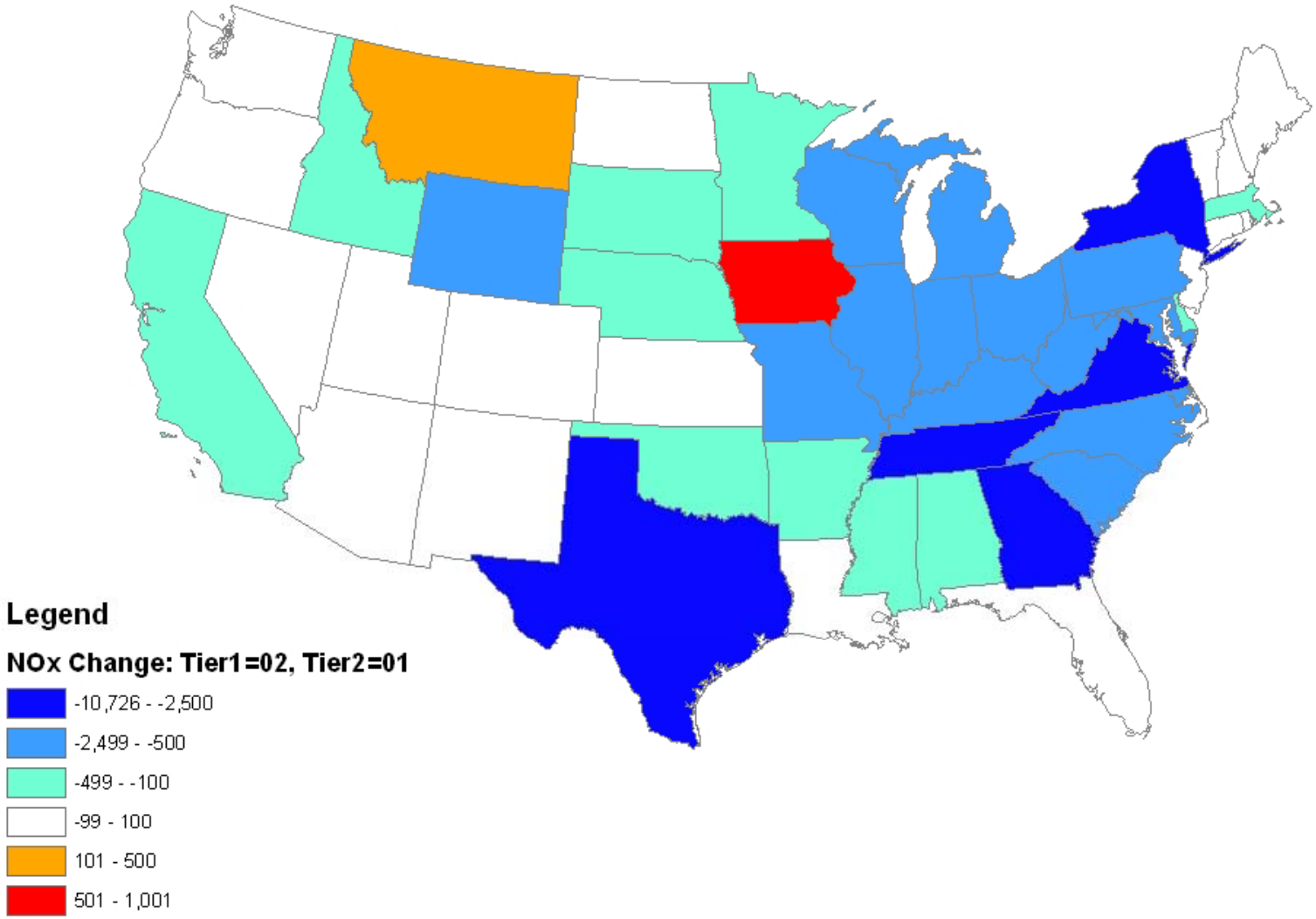


* EPA uses future year-specific inventory for oil and gas in non-California WRAP; otherwise, WRAP would also be lit up.

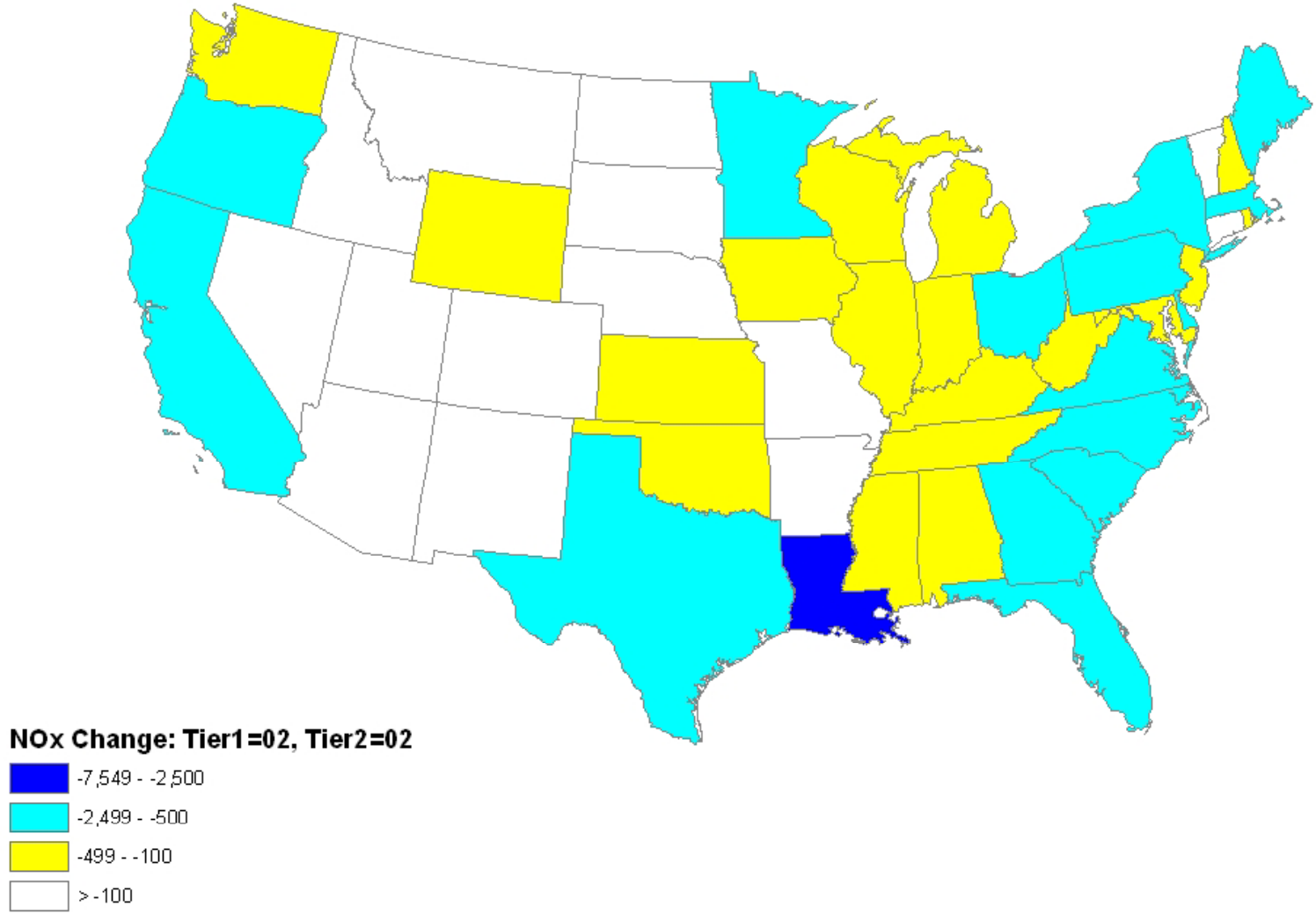
NO_X Change Industrial Fuel Combustion, All



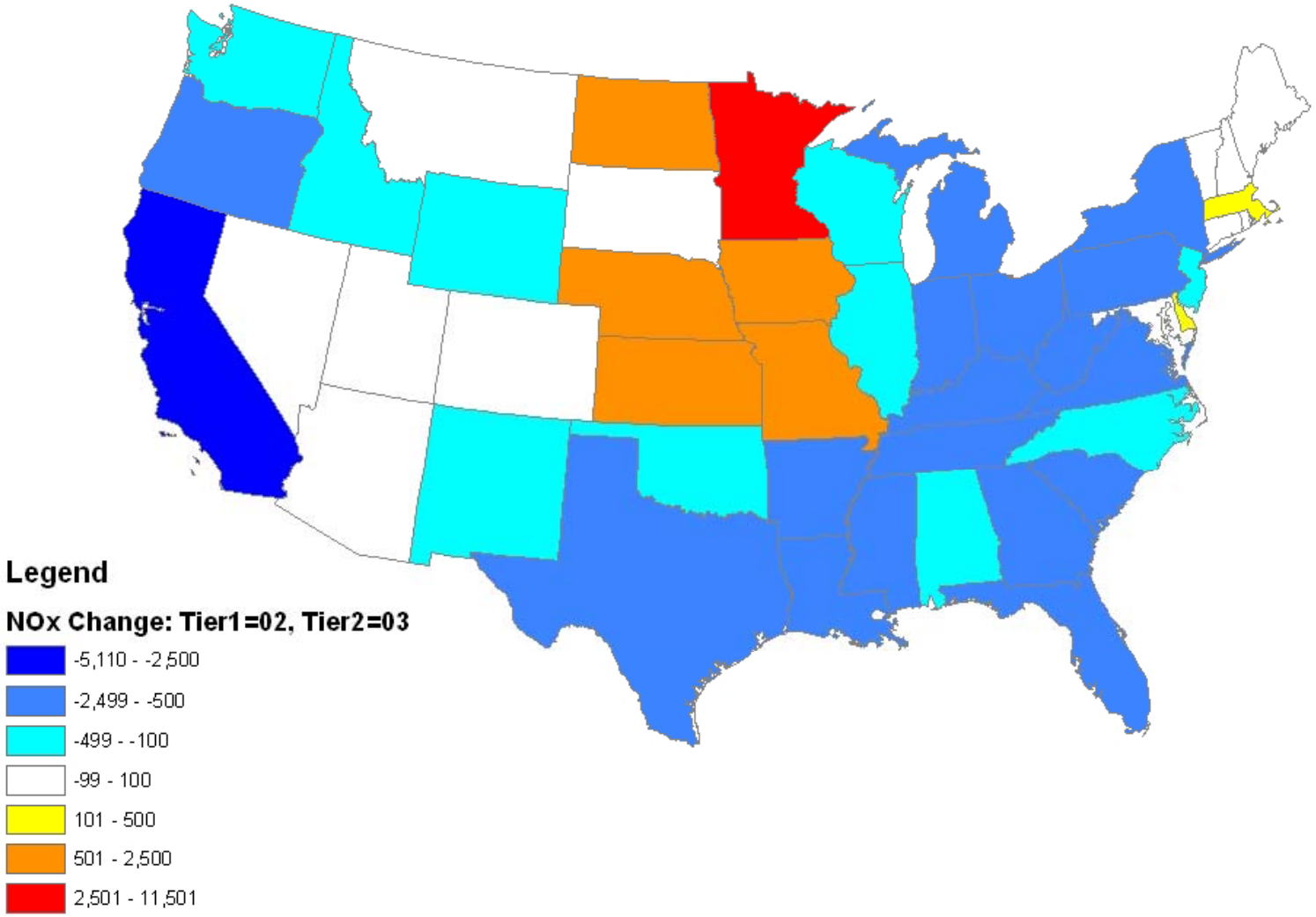
NO_X Change Industrial Fuel Combustion, Coal



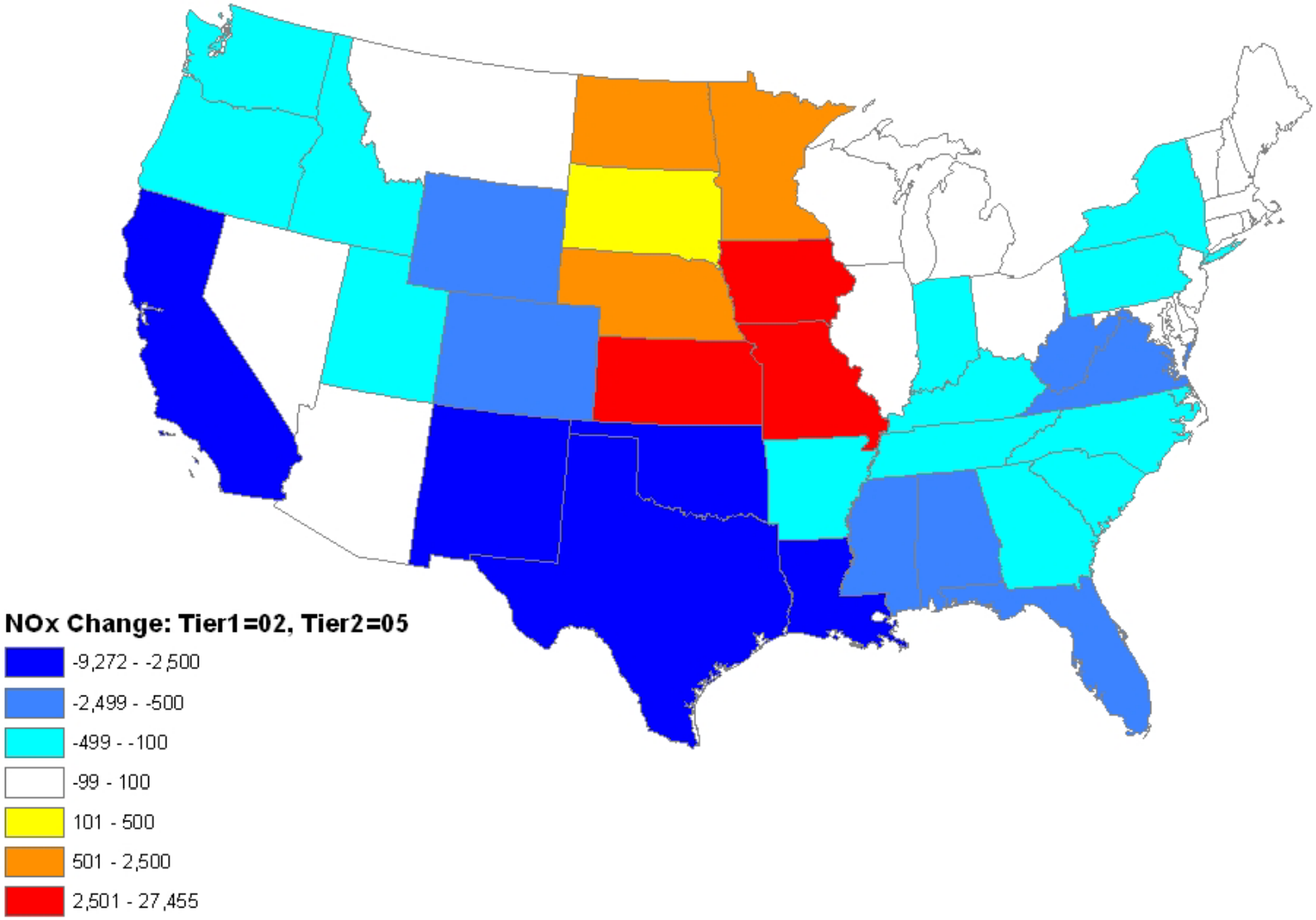
NO_X Change Industrial Fuel Combustion, Residual Oil



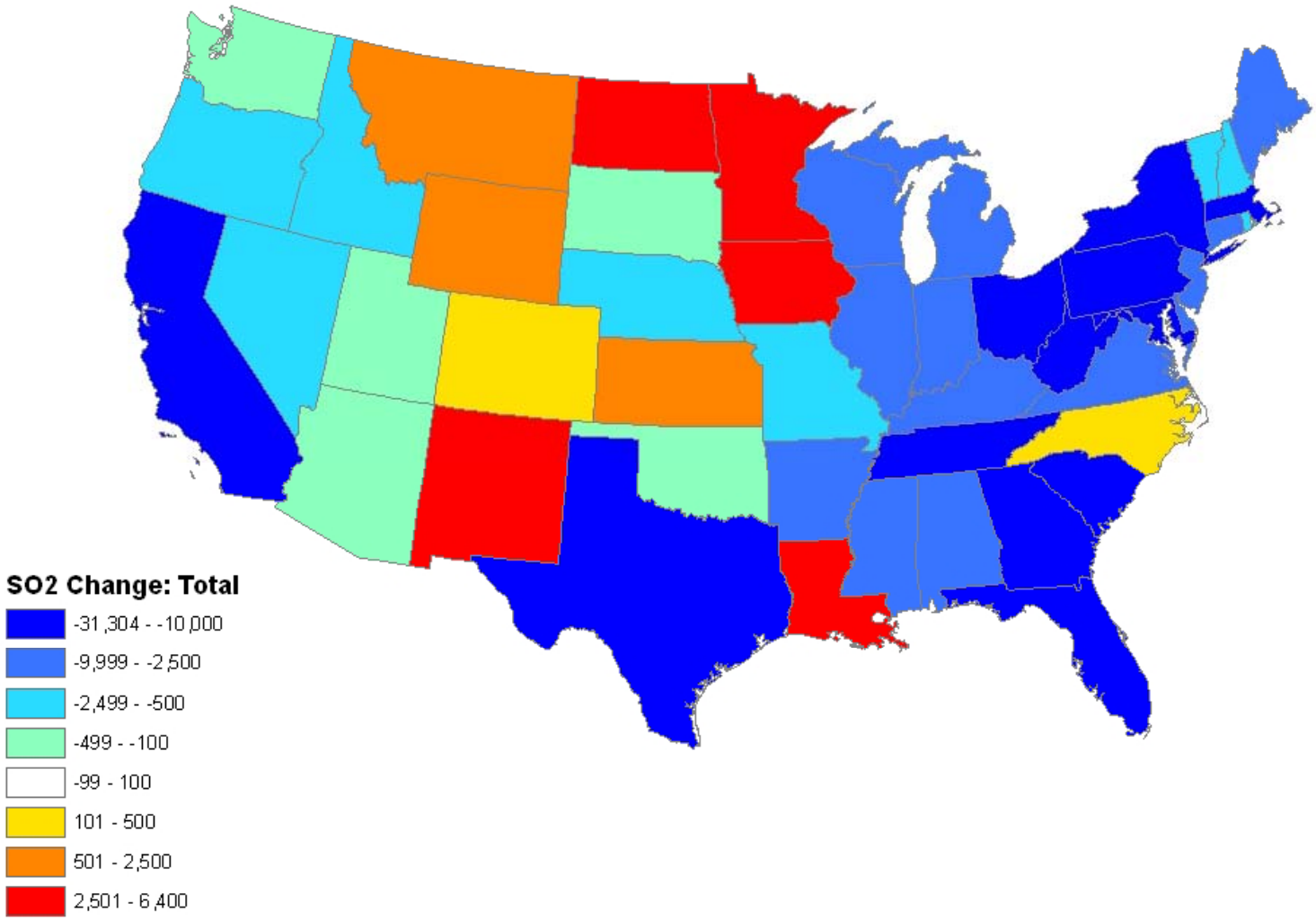
NO_X Change Industrial Fuel Combustion, Natural Gas



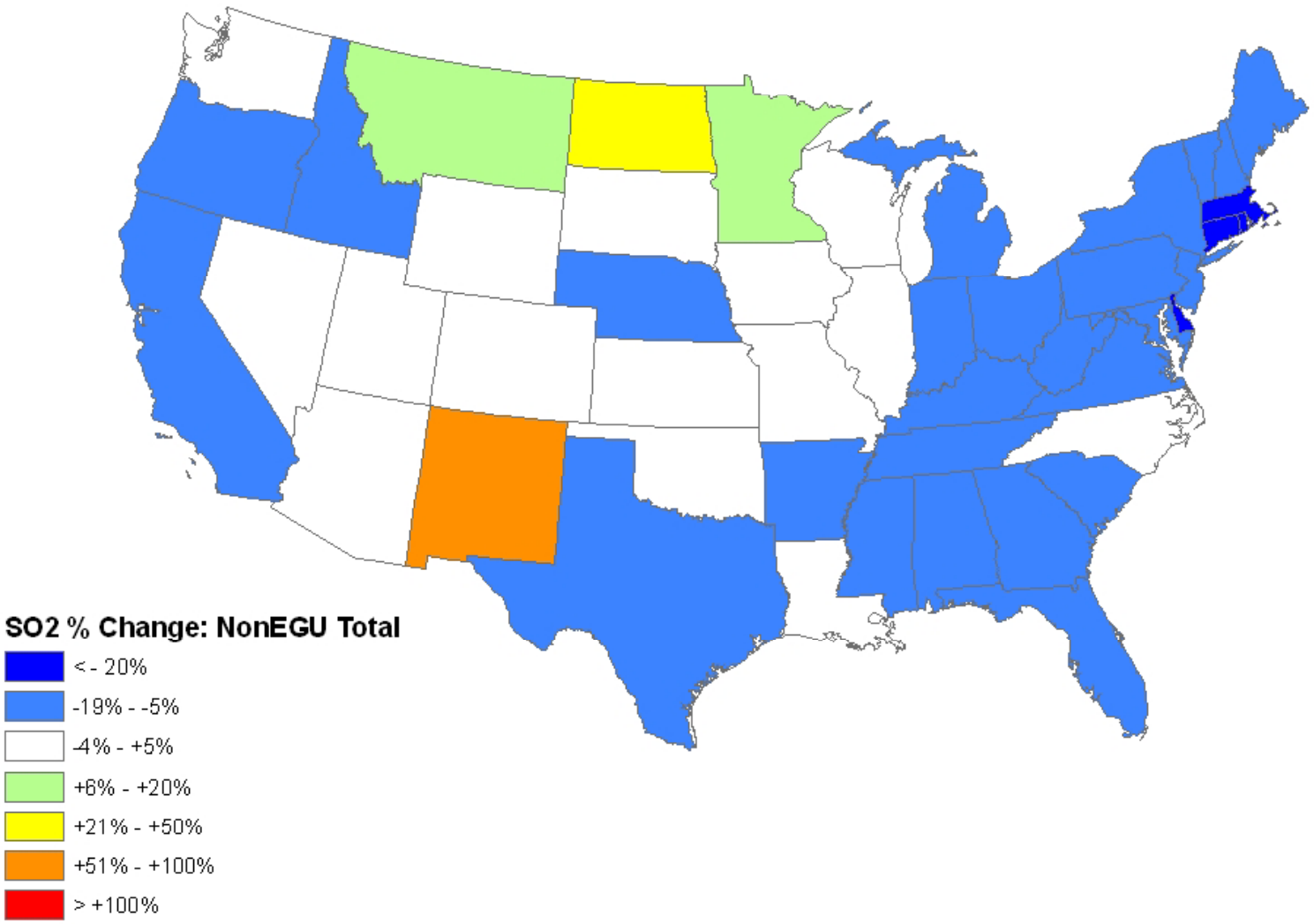
NO_X Change Industrial Fuel Combustion, IC Engines



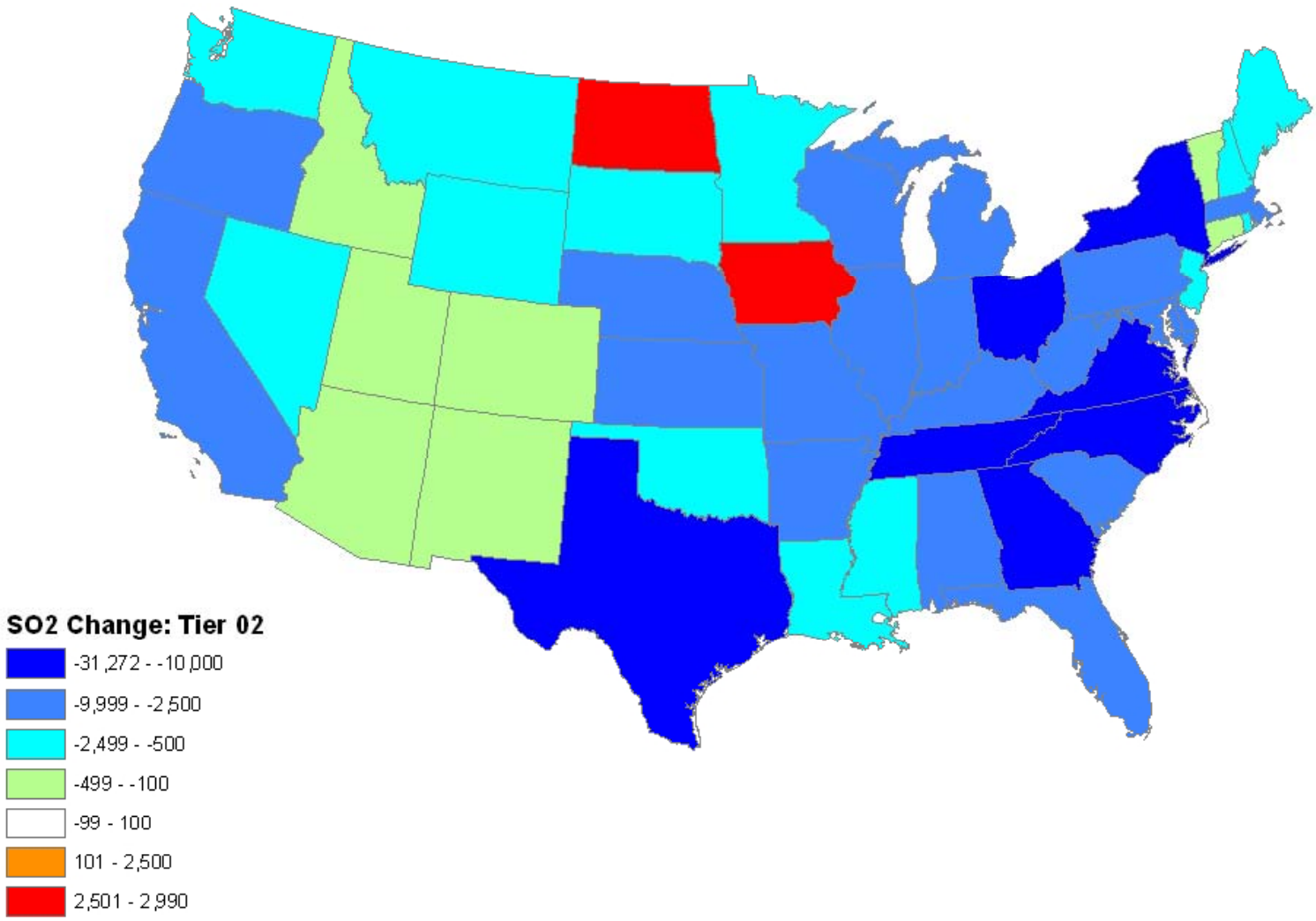
Total SO_2 Change (New minus EPA)



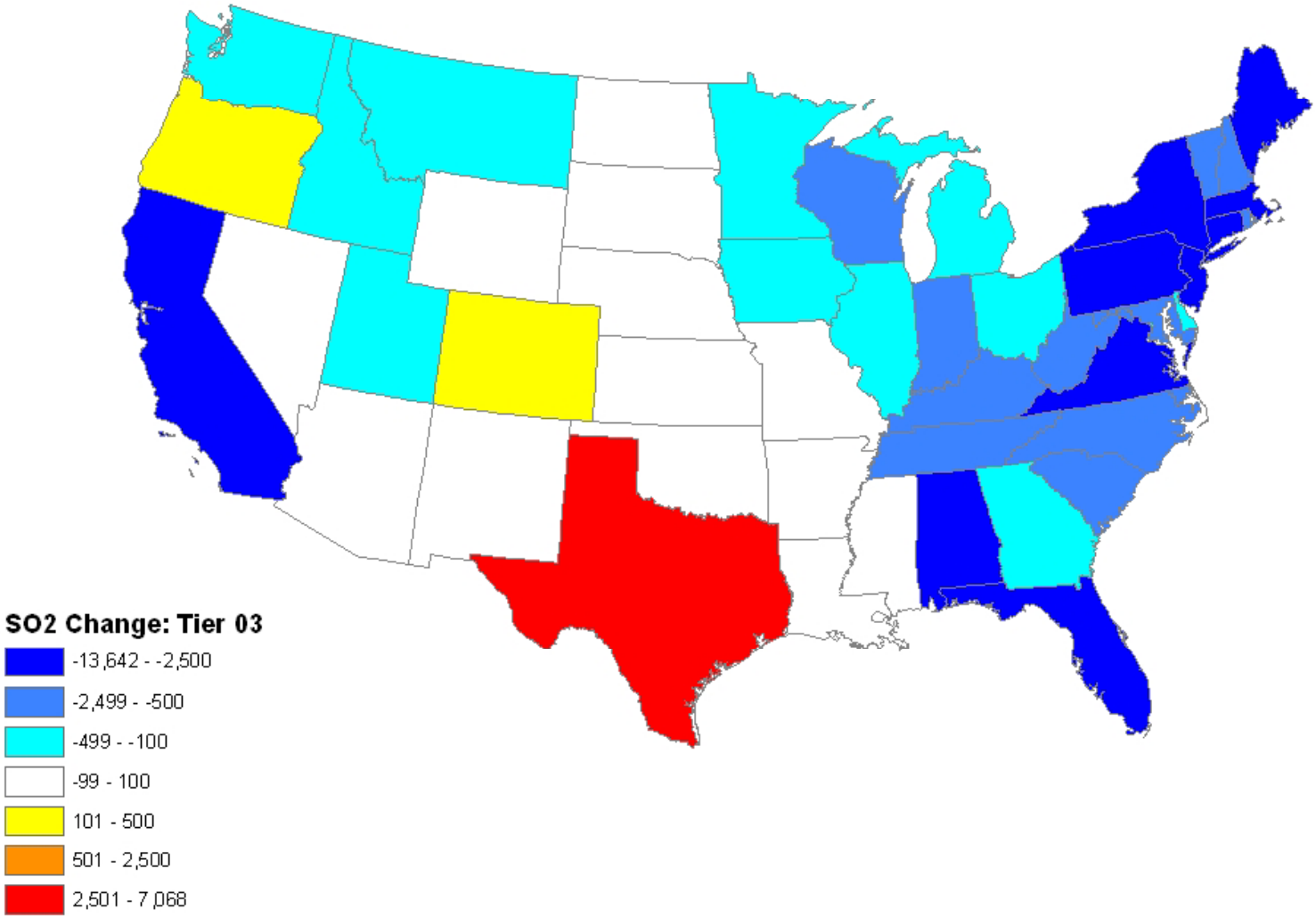
SO_2 % Change Non-EGUs



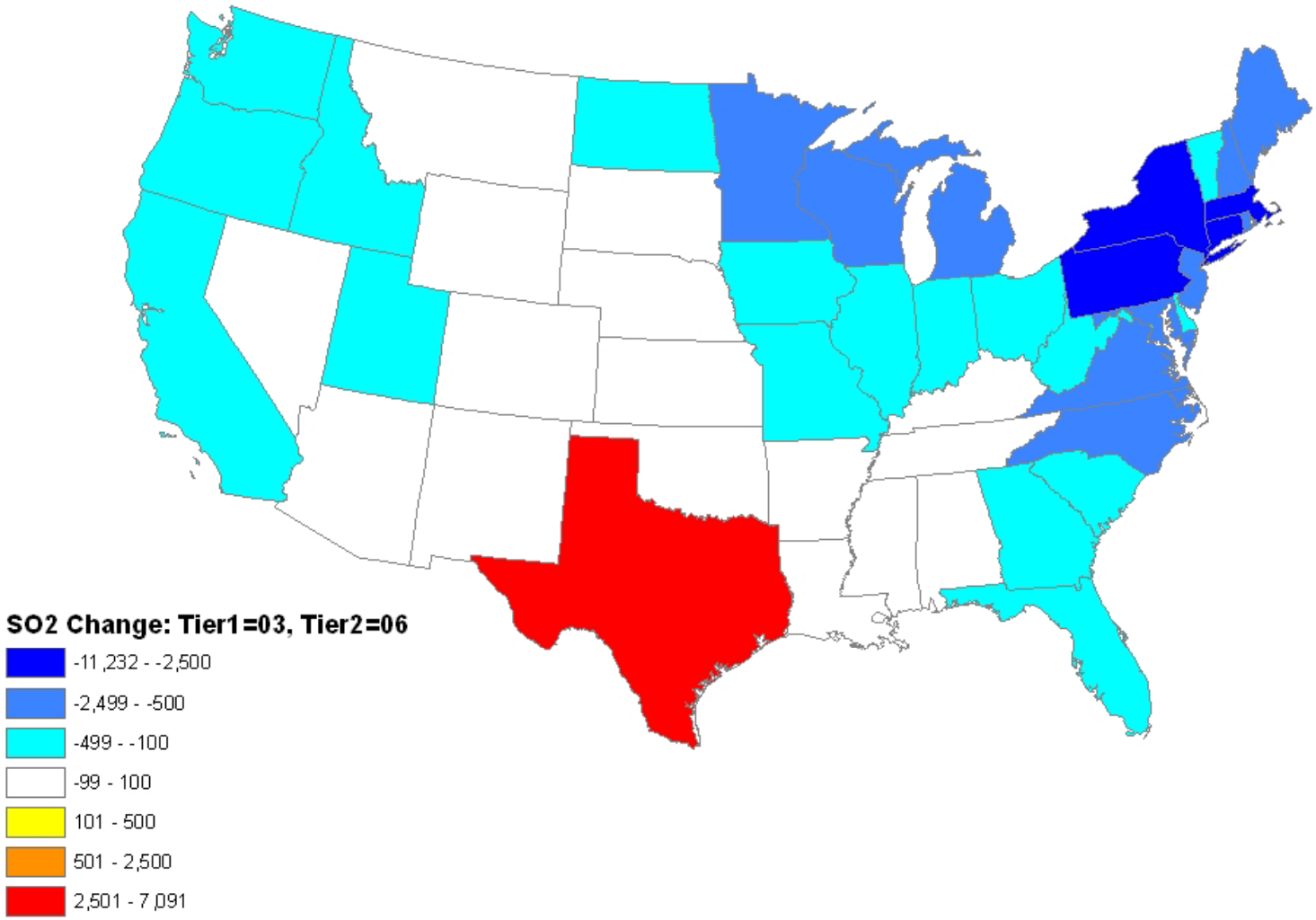
SO_2 Change Industrial Fuel Combustion, All



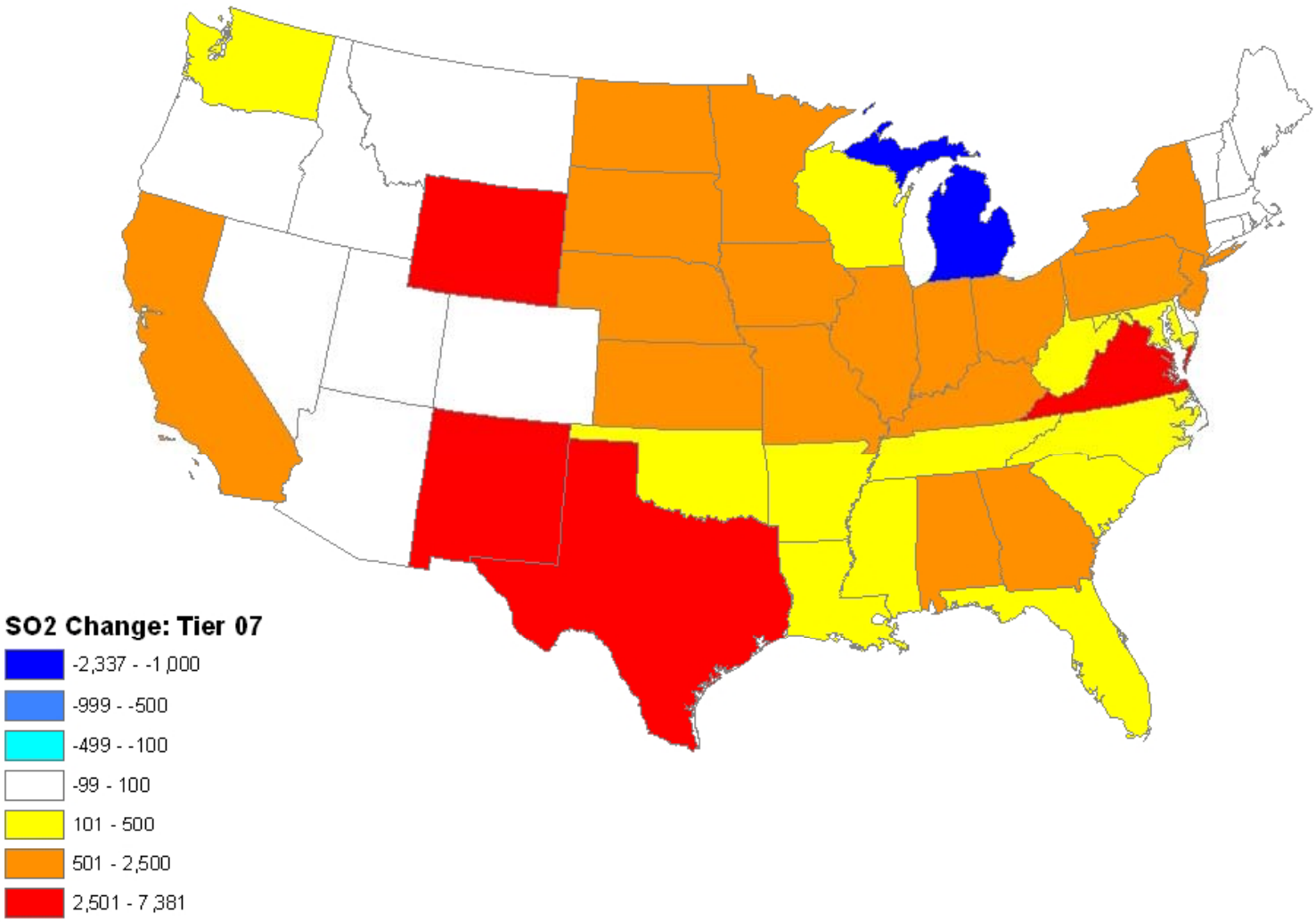
SO_2 Change Other Fuel Combustion, All



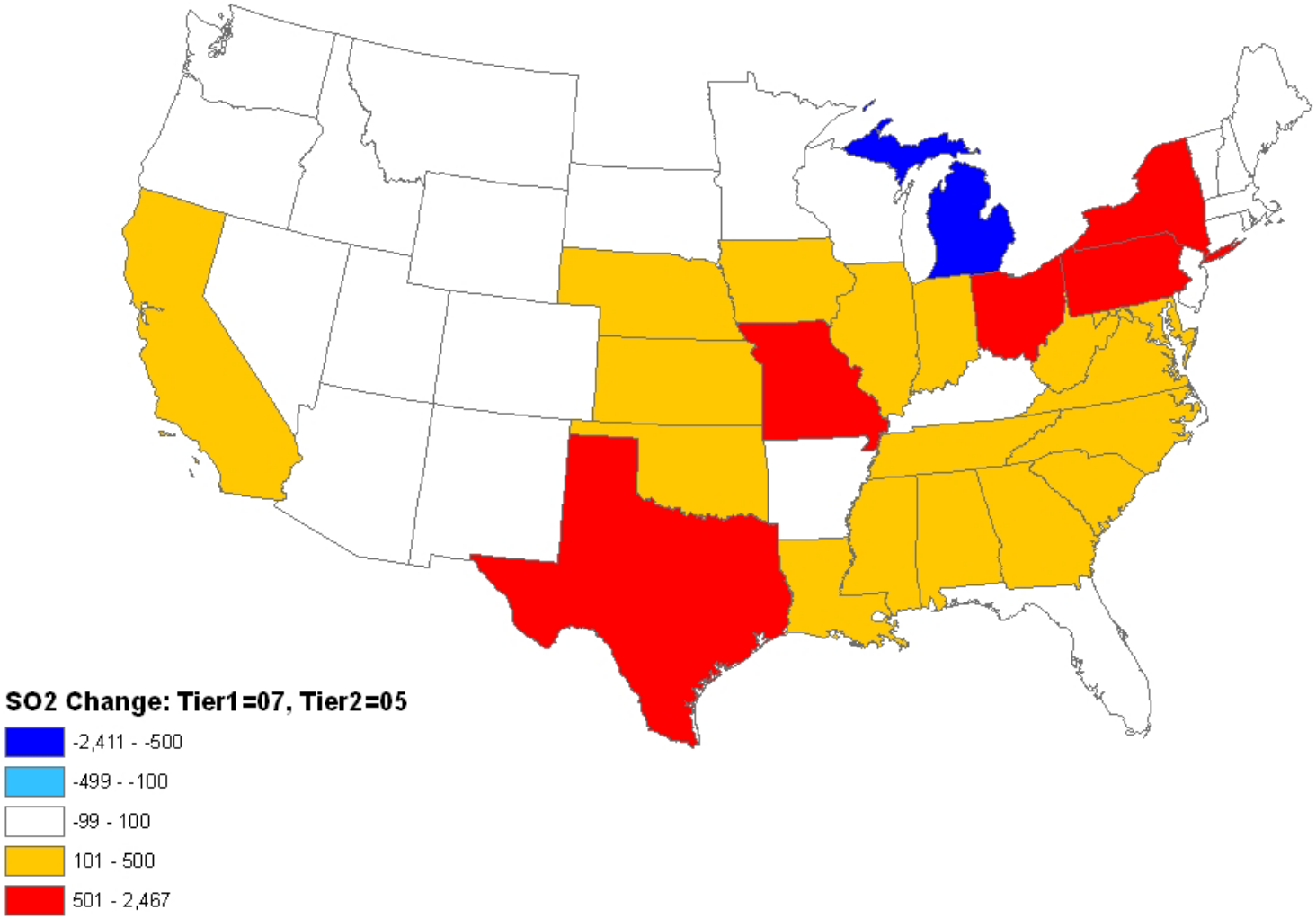
SO_2 Change Other Fuel Combustion, Distillate Oil



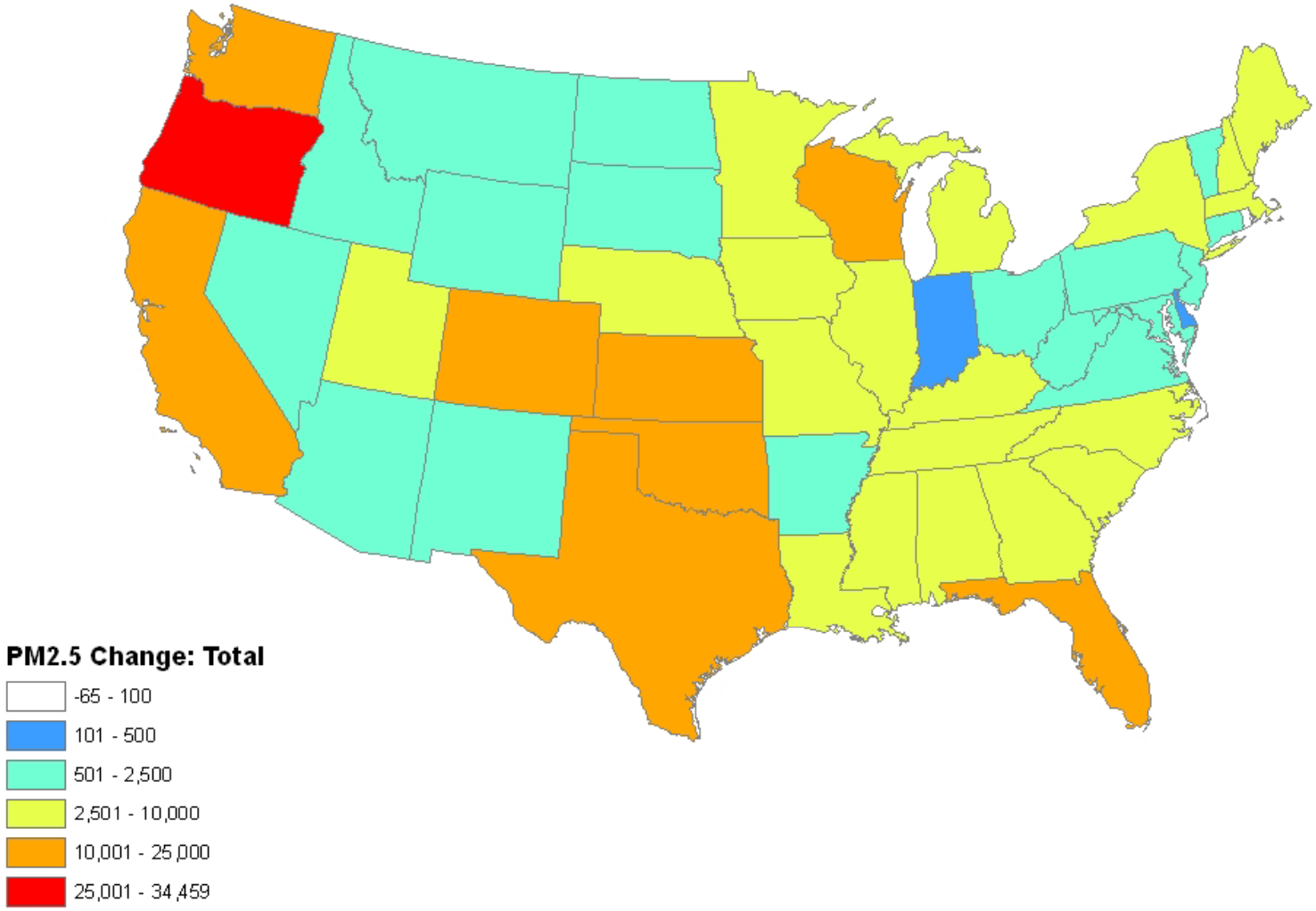
SO_2 Change Other Industrial Processes, All



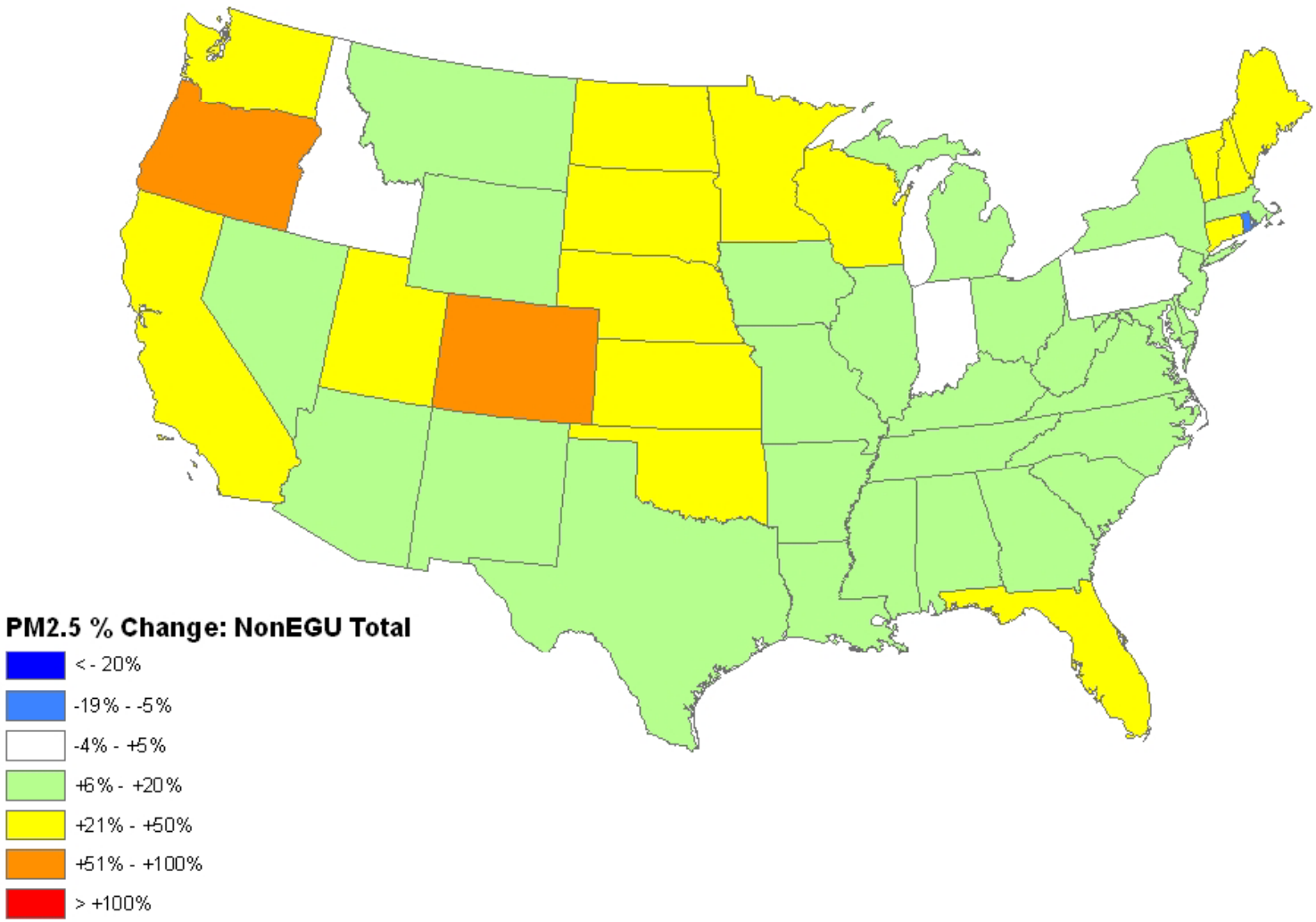
SO_2 Change Other Industrial Processes, Cement Manufacturing



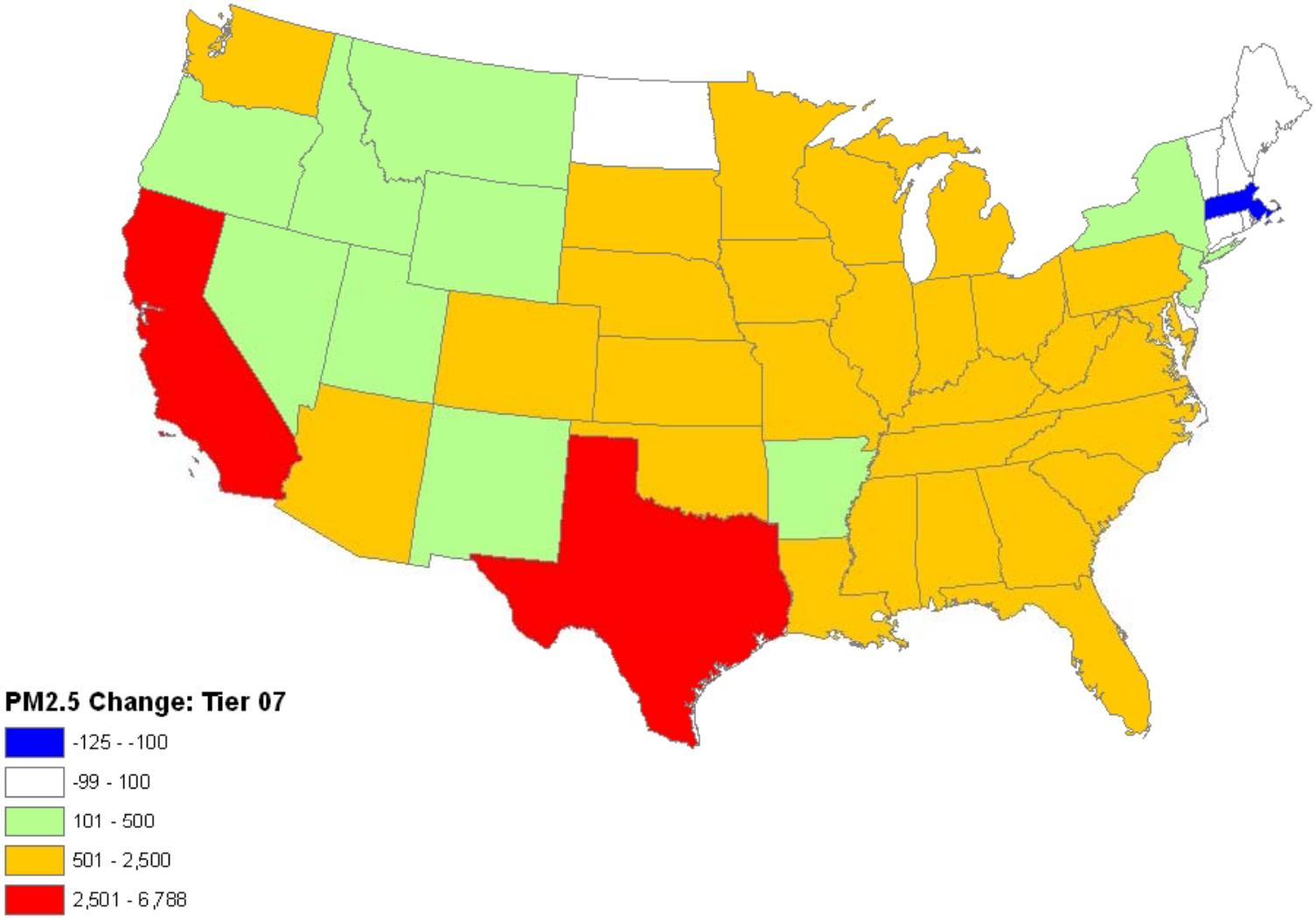
Total $PM_{2.5}$ Change (New minus EPA)



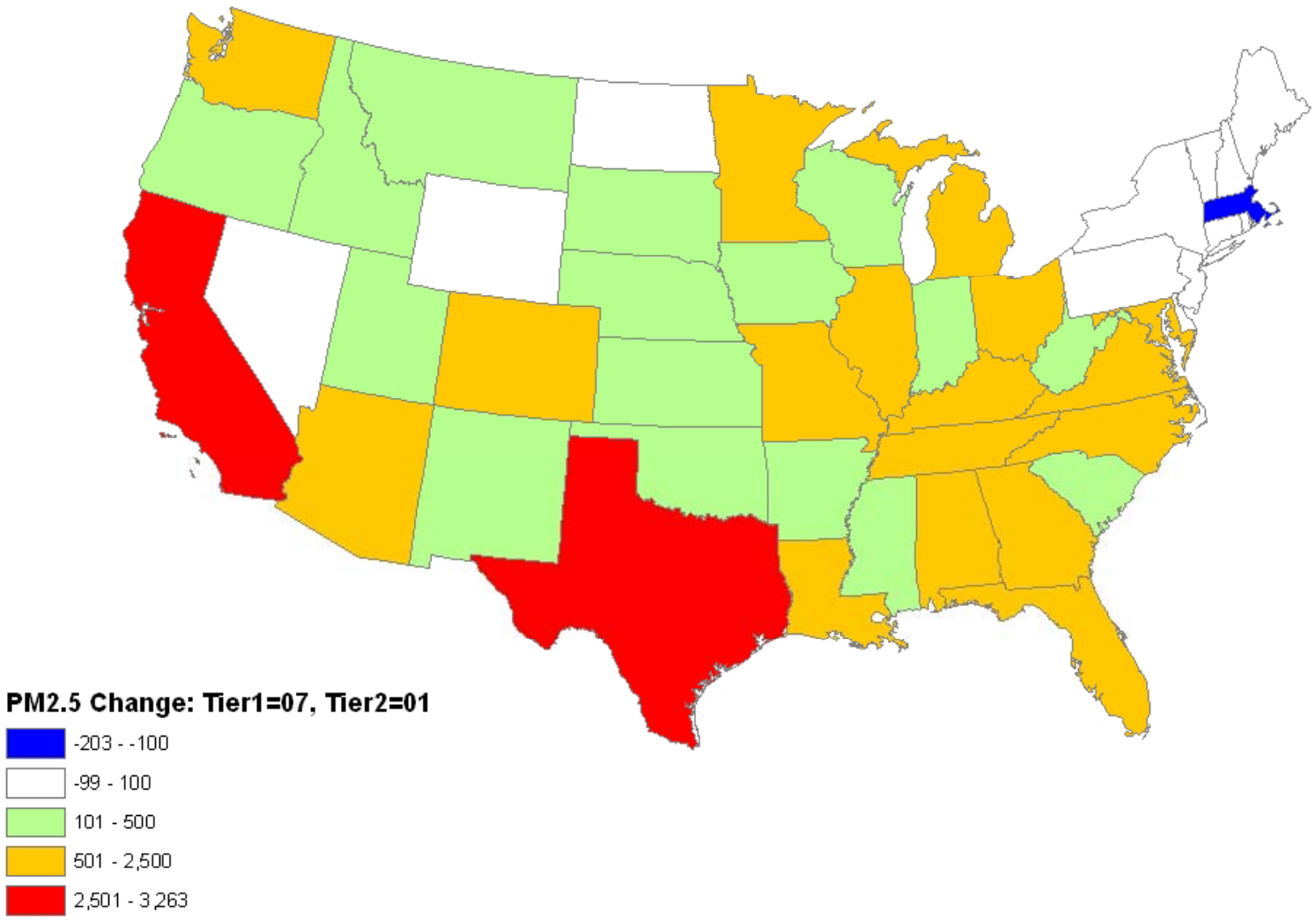
$PM_{2.5}$ % Change Non-EGUs



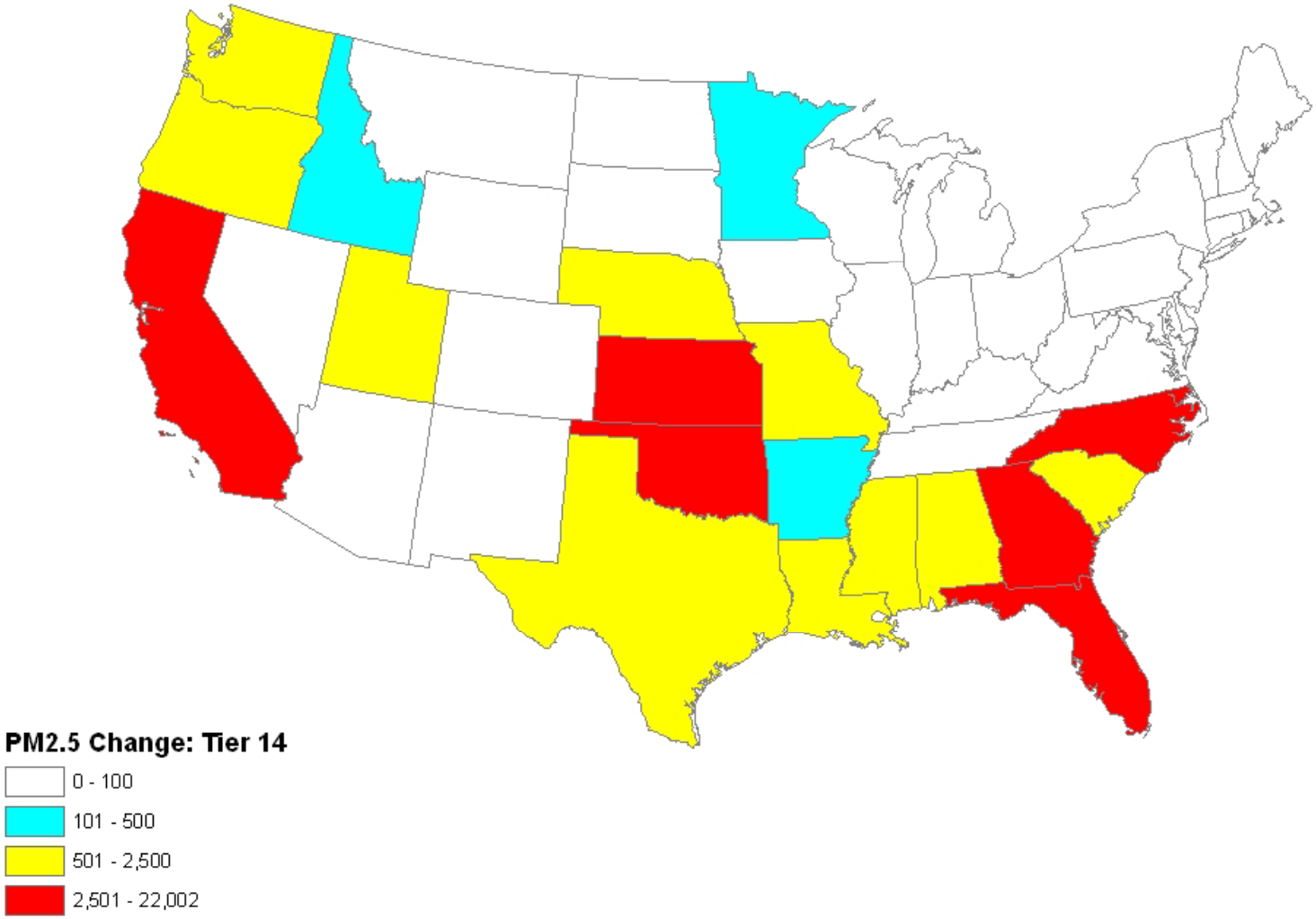
$PM_{2.5}$ Change Other Industrial Processes, All



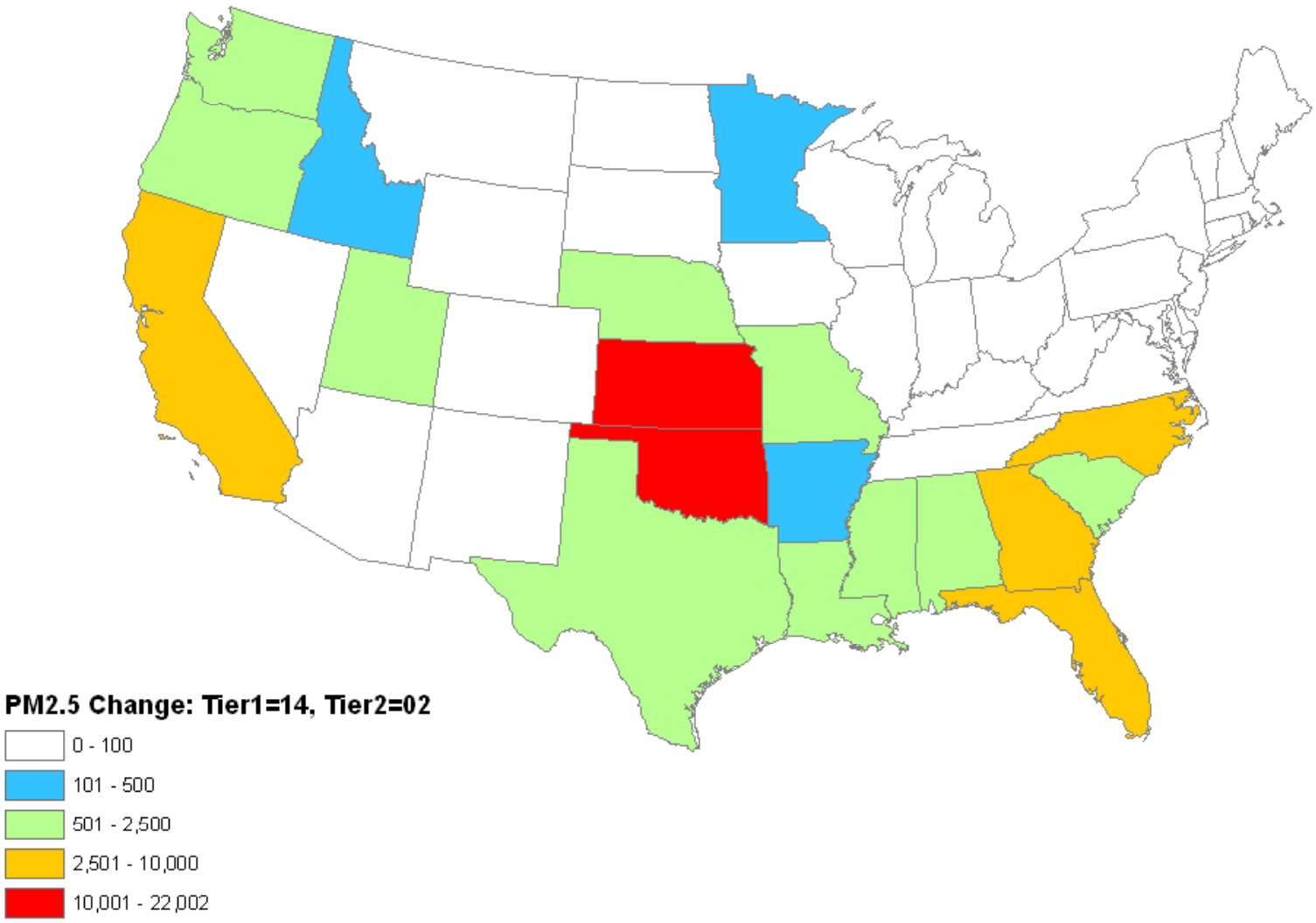
$PM_{2.5}$ Change Other Industrial Processes, Commercial Cooking



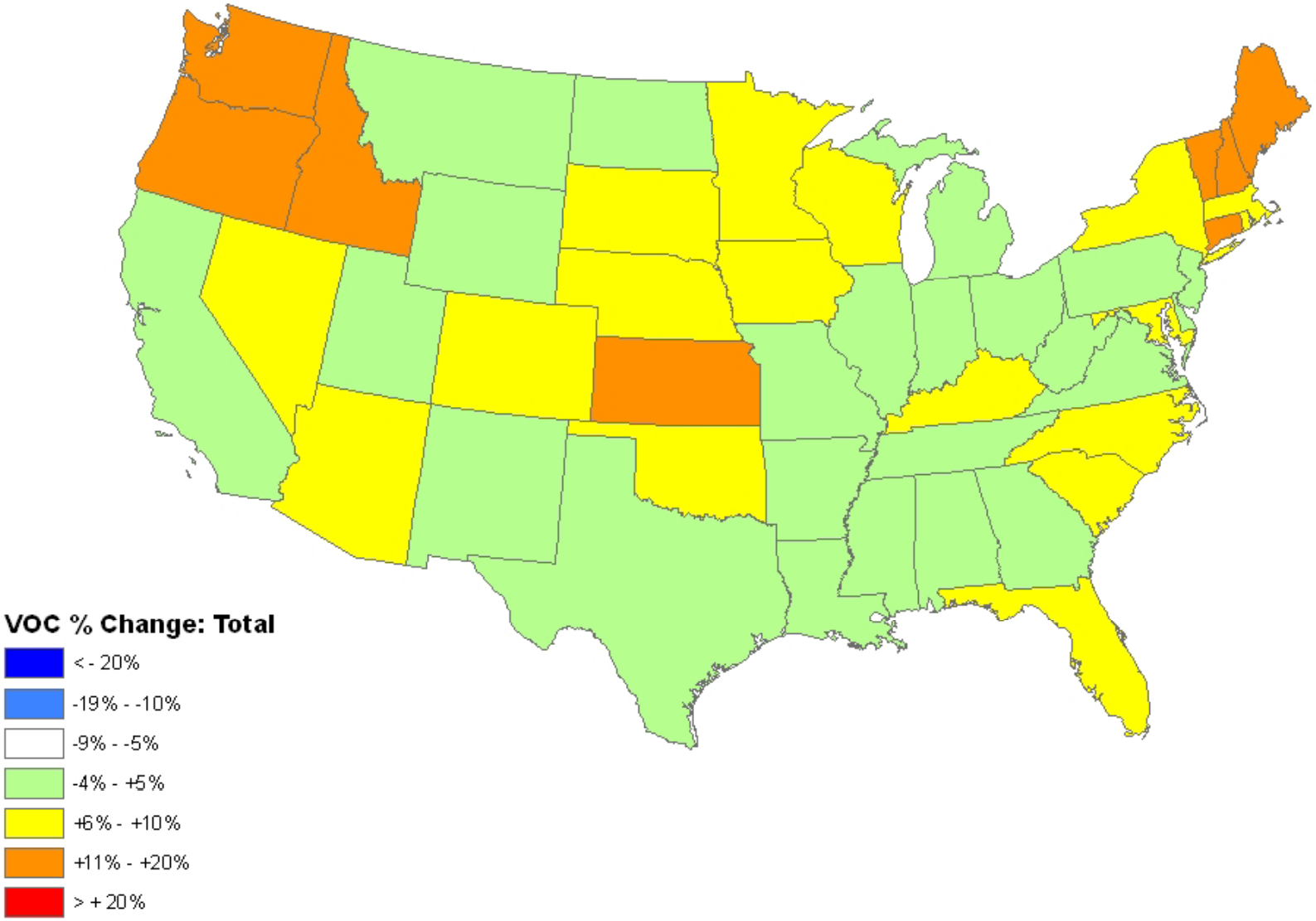
$PM_{2.5}$ Change Miscellaneous, All



$PM_{2.5}$ Change Miscellaneous, Ag Fires



Total VOC % Change (New minus EPA)



Next Steps

- Continue analyzing new growth estimates and have an internal EPA review of these estimates
- Publish a Notice of Data Availability with the new projection estimates and request comments from any interested party
- Incorporate improvements into the growth estimates based upon comments and reviews
- Include the revised improved estimates in future emission inventory forecasts that are used for regulatory and policy work at EPA

Disclaimer

- This paper has not been subject to EPA's required peer and policy review, and therefore does not necessarily reflect the views of the Agency. No official endorsement should be inferred.

Questions?