Regional Haze Planning Review + Brief TSS Demo

IMPROVE Steering Committee Meeting

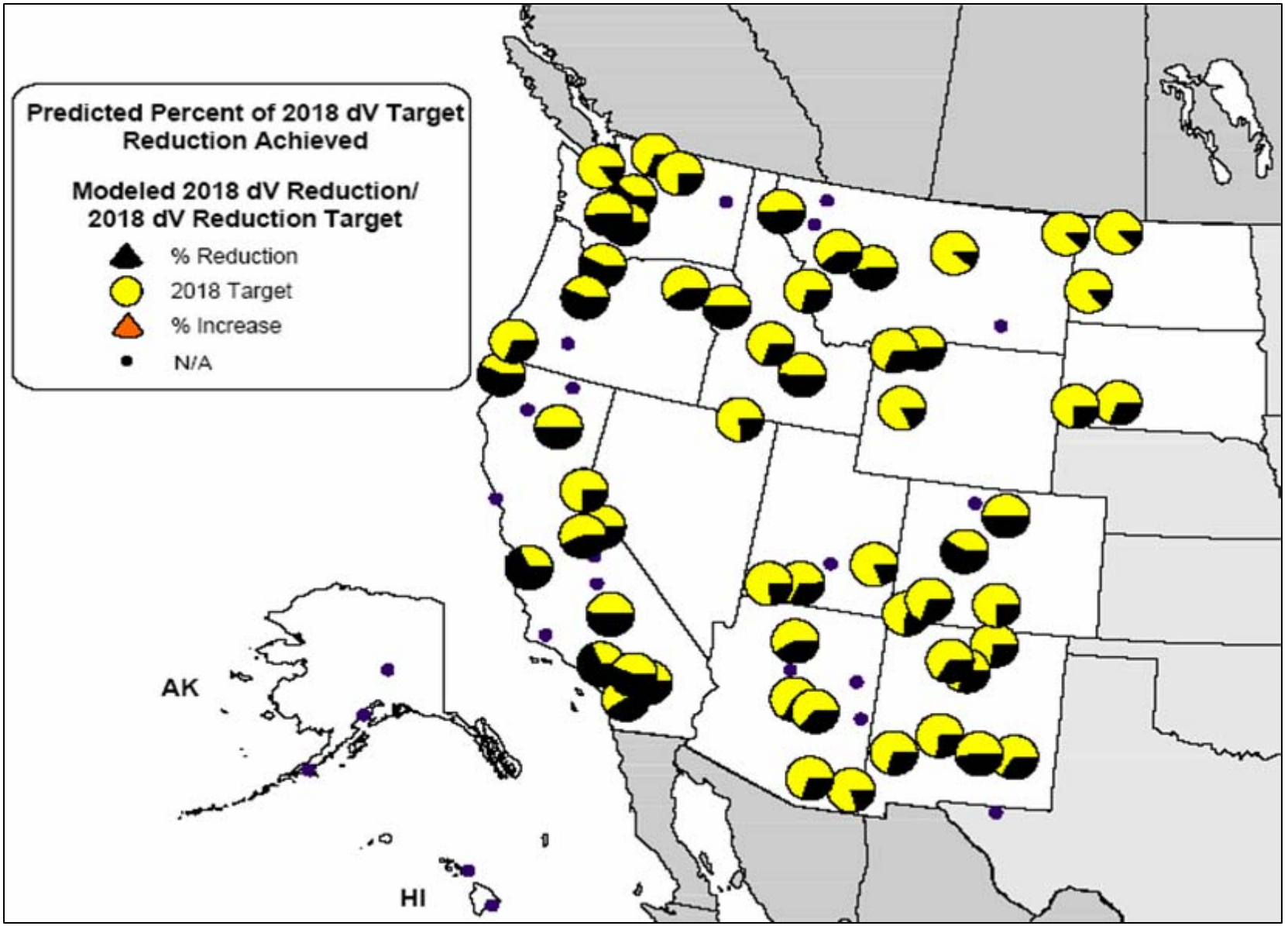
September 5-6, 2007

Technical Analysis Results

- WRAP analyses:
  - Comprehensive & complete emissions inventories
  - Monitoring data analysis for all western Class I areas
  - Regional photochemical aerosol modeling
  - Multiple source apportionment methods
  - Results summarized & available for planning

2018 visibility projections of visibility improvement from 2018 base case emissions/modeling scenarios are significantly shy of the “Uniform Rate of Progress”

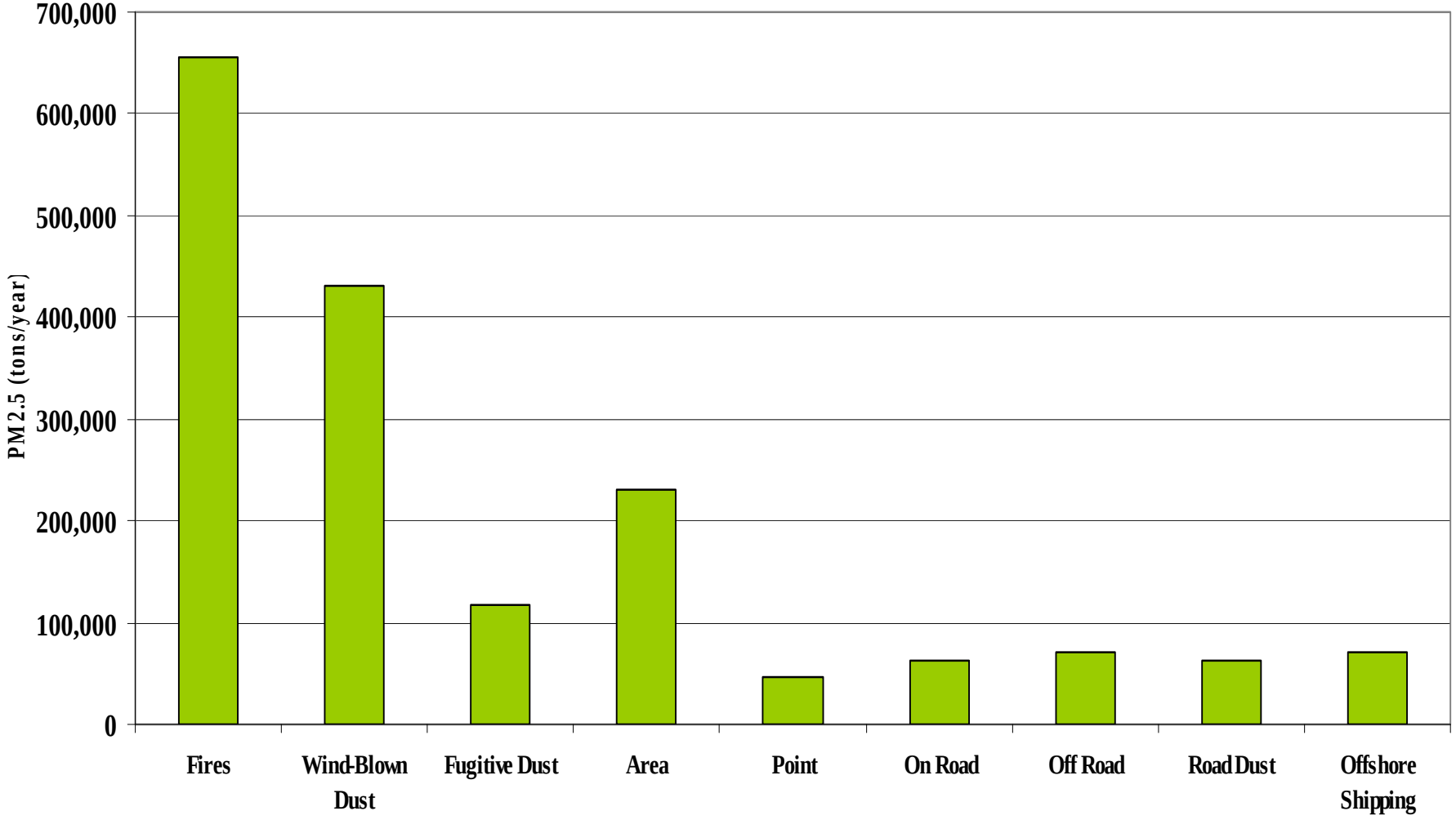
2018 Base Case Visibility Projections (deciviews)



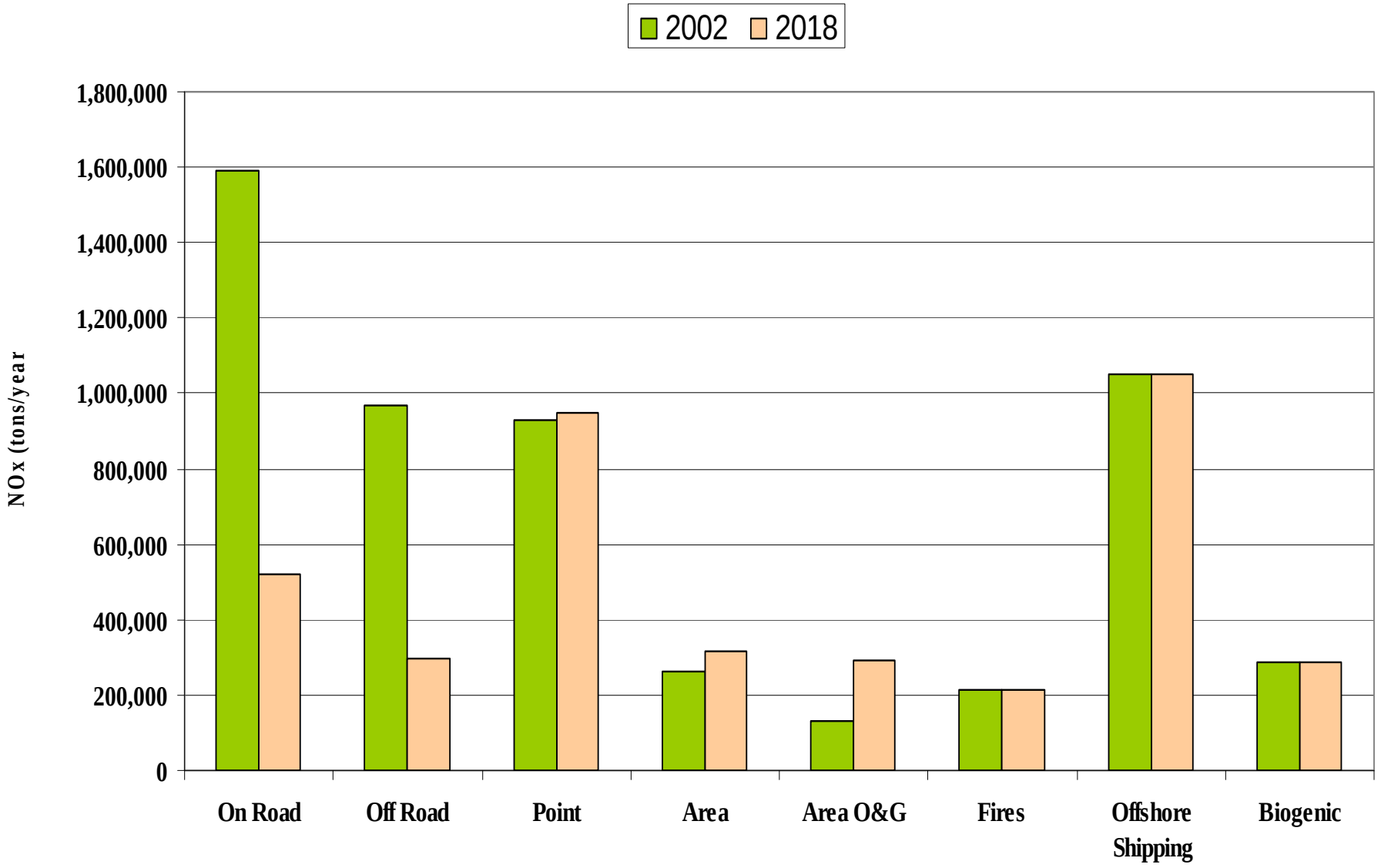
Note: Federal mobile source rules included, Fire & Dust emissions held constant, no BART controls

2000-04 Annual Average WRAP Region $PM_{2.5}$ Emissions (13 States)

(Does not include out-of-region sources)

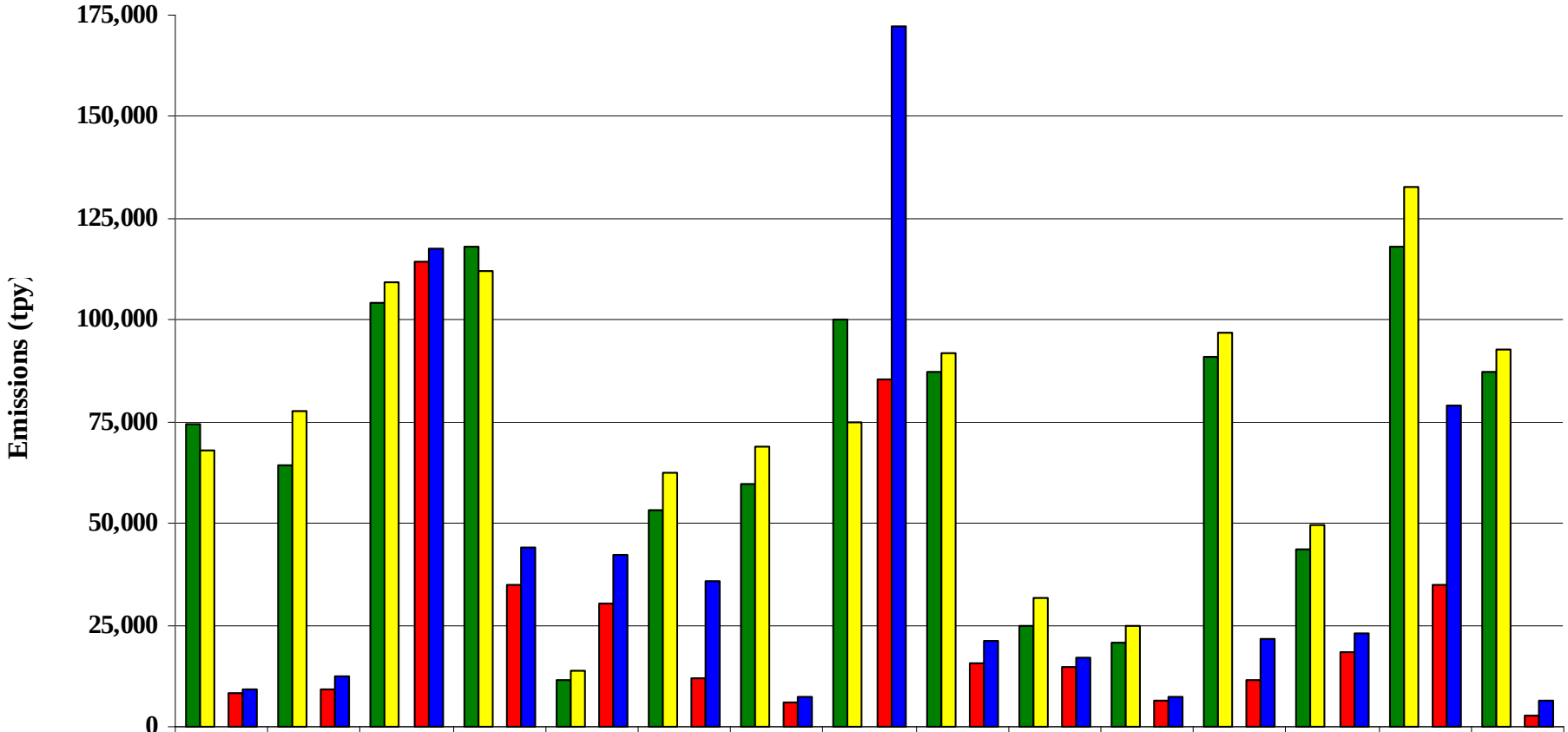


WRAP region 2000-04 average and 2018 base case NO_x emissions by source category



Note: No BART controls included for 2018 - Data Sources: WRAP Forums' emissions inventories and biogenics from BEIS model

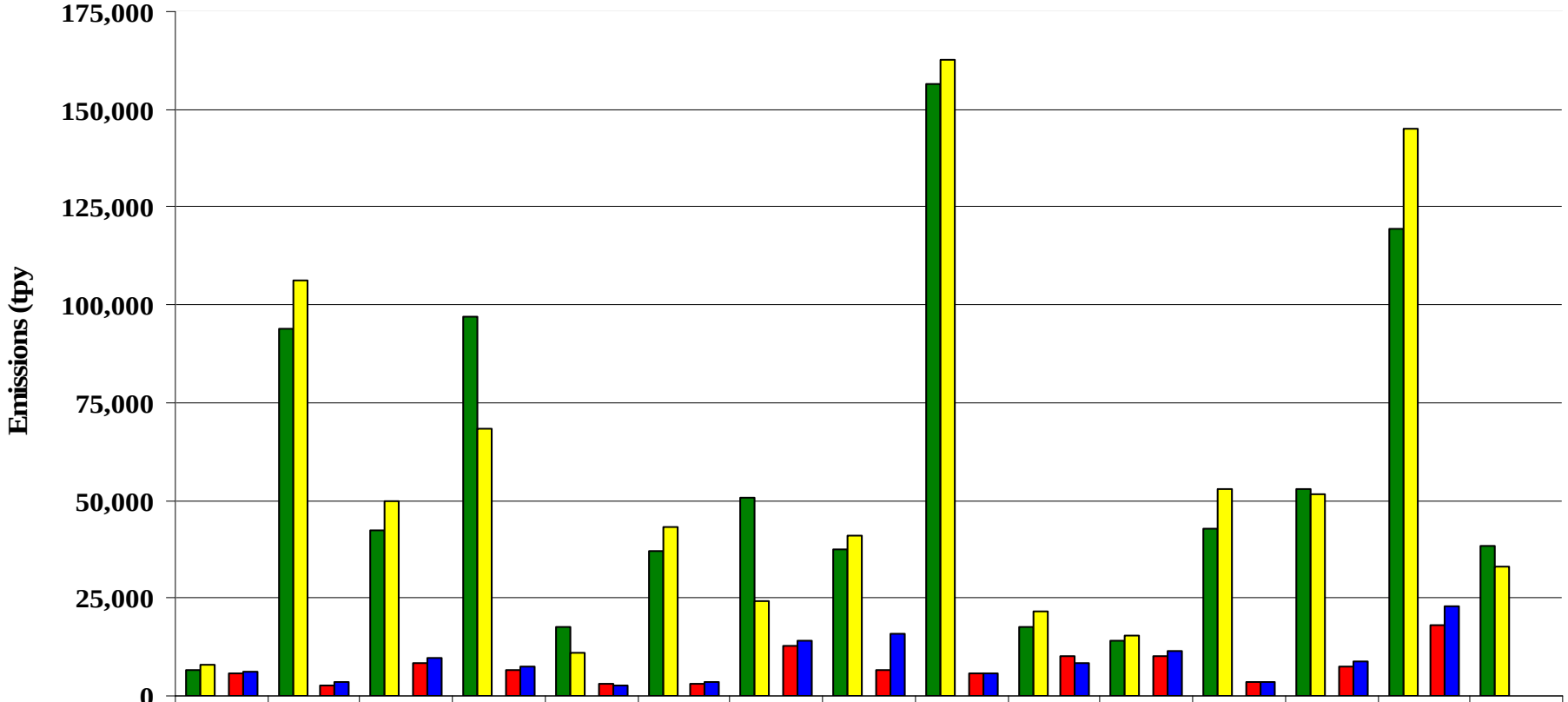
Point and Area Source 2002 and 2018 NOx Emissions



	AK	AZ	CA	CO	ID	MT	NV	NM	ND	OR	SD	UT	WA	WY	Tribes
2002-Point	74,472	64,084	104,435	117,869	11,487	53,415	59,775	100,352	87,425	24,959	20,698	91,044	43,631	117,883	87,215
2018-Point	67,959	77,737	109,515	112,153	13,946	62,583	69,016	74,874	91,895	31,761	24,726	96,974	49,397	132,591	92,580
2002-Area	8,488	9,049	114,471	34,846	30,318	12,072	5,787	85,576	15,457	14,825	6,345	11,335	18,355	34,891	2,932
2018-Area	9,293	12,559	117,717	44,041	42,068	36,053	7,488	172,319	21,129	17,027	7,207	21,636	22,746	79,196	6,639

Note: No BART controls included for 2018

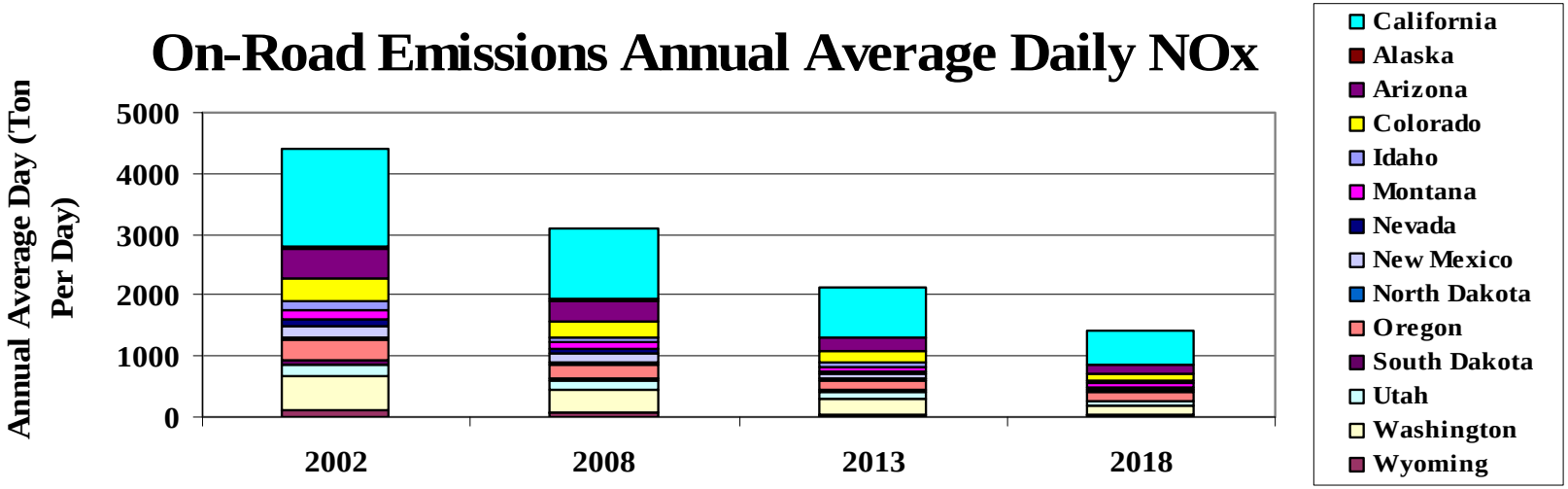
Point and Area Source 2002 and 2018 SO2 Emissions

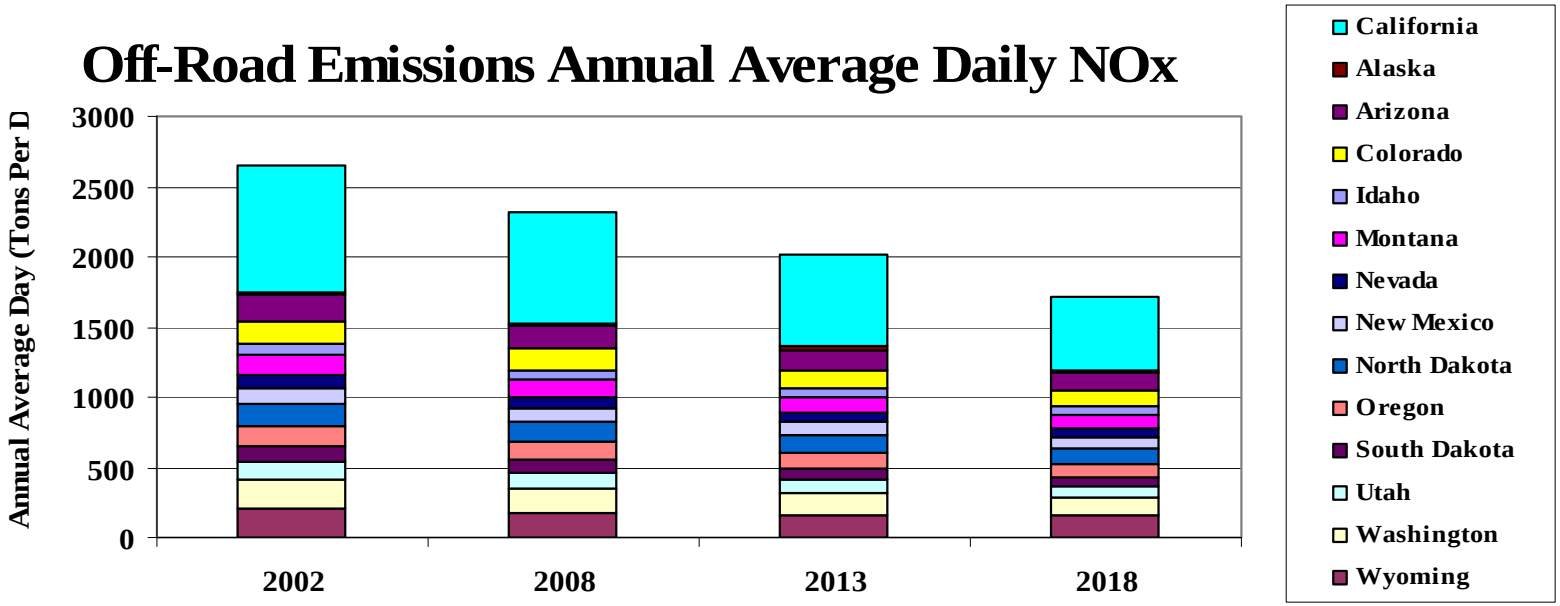


	AK	AZ	CA	CO	ID	MT	NV	NM	ND	OR	SD	UT	WA	WY	Tribes
2002-Point	6,809	93,752	42,120	97,011	17,597	36,879	50,722	37,436	156,668	17,587	14,021	42,838	52,969	119,645	38,208
2018-Point	7,777	106,113	49,632	68,476	10,813	43,055	24,041	40,825	162,705	21,687	15,268	52,953	51,355	145,100	32,895
2002-Area	5,531	2,677	8,314	6,559	2,916	3,299	12,954	6,559	5,748	9,932	10,167	3,581	7,388	17,902	49
2018-Area	6,044	3,410	9,772	7,499	2,721	3,432	14,194	15,753	5,856	8,422	11,667	3,587	8,667	23,109	2

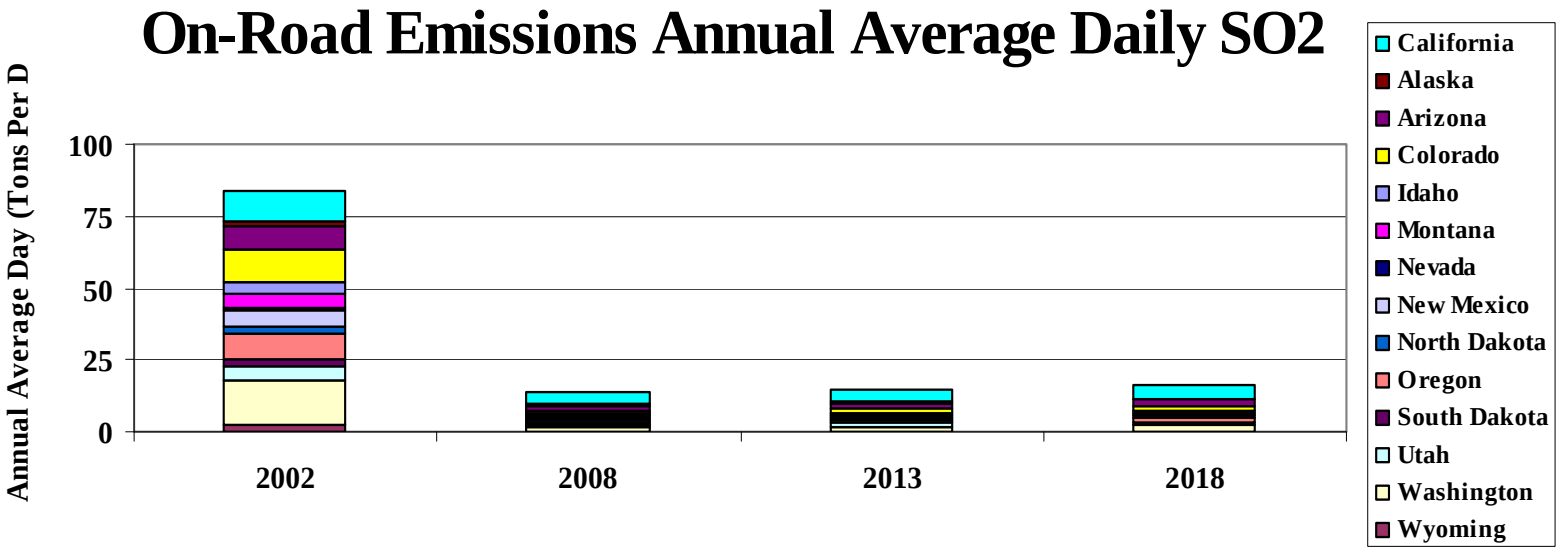
Note: No BART controls included for 2018

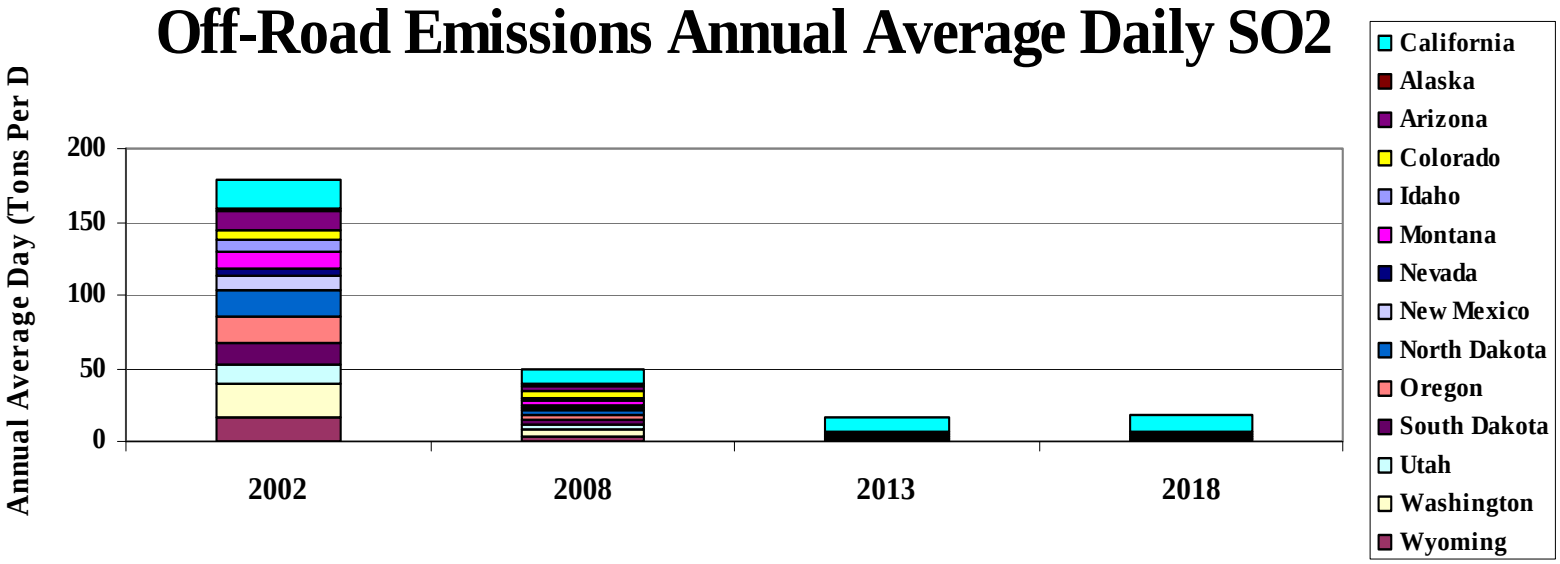
Mobile Emissions



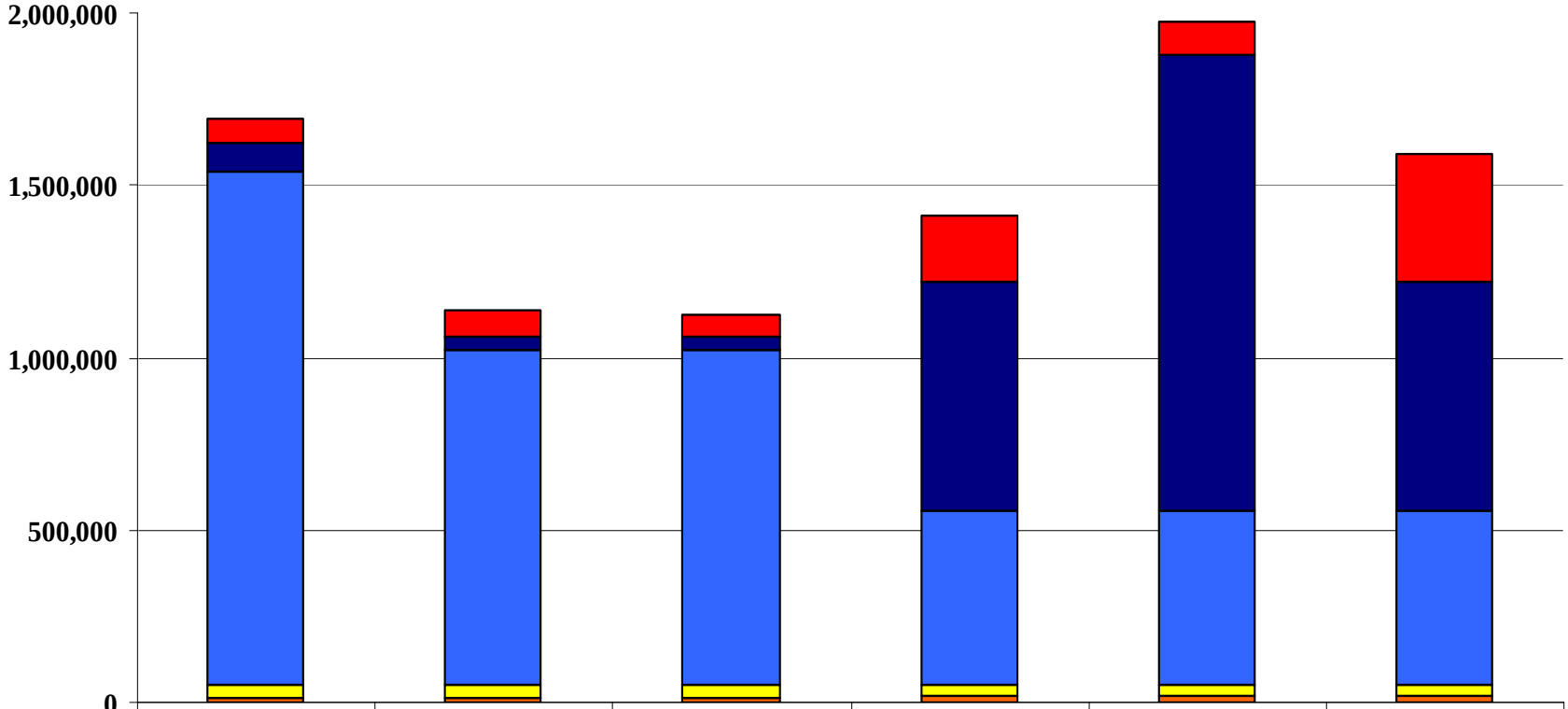


Mobile Emissions





WRAP Region Fire PM2.5 Emissions Scenarios (tpy)



	2002 Actual	2000-04 Baseline Average	2018 Planning - Baseline Average with ERTs	2018 Projection A - FLM-proposed activities	2018 Projection B - Climate conditions/ resource limited	2018 Projection C - Max. application of Prescribed Fire
Prescribed Fire	71,421	72,218	64,170	195,020	97,347	376,206
Wildland Fire Use	81,505	41,171	41,171	659,594	1,319,189	659,594
Wildfire	1,489,886	971,453	971,453	504,654	504,654	504,654
Agricultural Fire	34,571	34,590	34,590	34,590	34,590	34,590
N-F Rangeland Fire	15,454	15,454	15,454	18,643	18,643	18,643

Why A Species-Based Approach to understanding PM & Regional Haze Planning?

- Species differ significantly from one another:
  - Contribution to visibility impairment
  - Spatial and seasonal distributions
  - Source types
  - Contribution from natural & international sources
  - Emissions data quality & completeness
  - Atmospheric science quality
  - Tools available for assessment and projection

WRAP Region Emissions/Air Quality Projections Data for Haze Planning

	SO2	NOx	OC/EC	Fine Soil/CM
Emission Sources	**Almost entirely anthropogenic.** *Mostly point sources*	**Mostly anthropogenic.** *Mix of combustion sources*	**Diverse.** *Mix of anthropogenic, fire, and biogenic VOC sources*	**Diverse.** *Very difficult to partition windblown dust into natural vs. anthropogenic*
Emissions Data Quality	**Very good overall.** *Activity data less good for area sources*	**Good.** *Activity data less good, some coding concerns w/ smaller point, area, and O&G sources*	**Fair.** *Good activity data & confidence in $PM_{2.5}$ emissions, but uncertain chemistry of $PM_{2.5}$ & biogenic VOCs*	**Poor, except for some locales.** *Categorically complete but accuracy very uncertain*
Emission Projections	**Very good.** *Uncertain about area sources*	**Good.** *Uncertain about offshore and O&G*	**Fair.** *What to expect from fire?*	**Fair.** *What to expect from windblown dust?*
Atmospheric Science Quality	**Very good.** *Meteorology probably largest uncertainty*	**Fair.** *Chemistry more complex, but meteorology too*	**Fair.** *Most complex, least understood, but model performance okay*	**Fair.** *No major chemistry, but model resolution & meteorology insufficient*
WRAP Technical Tools for Haze Planning	**Emission Inventories** **Modeling Projections** **Modeled Source Apportionment**	**Emission Inventories** **Modeling Projections** **Modeled Source Apportionment**	**Emission Inventories** **Modeling Projections** **Receptor Modeling** **Weighted Emissions Potential**	**Emission Inventories** **Weighted Emissions Potential** **Causes of Dust Analysis**

State programs are already managing emissions

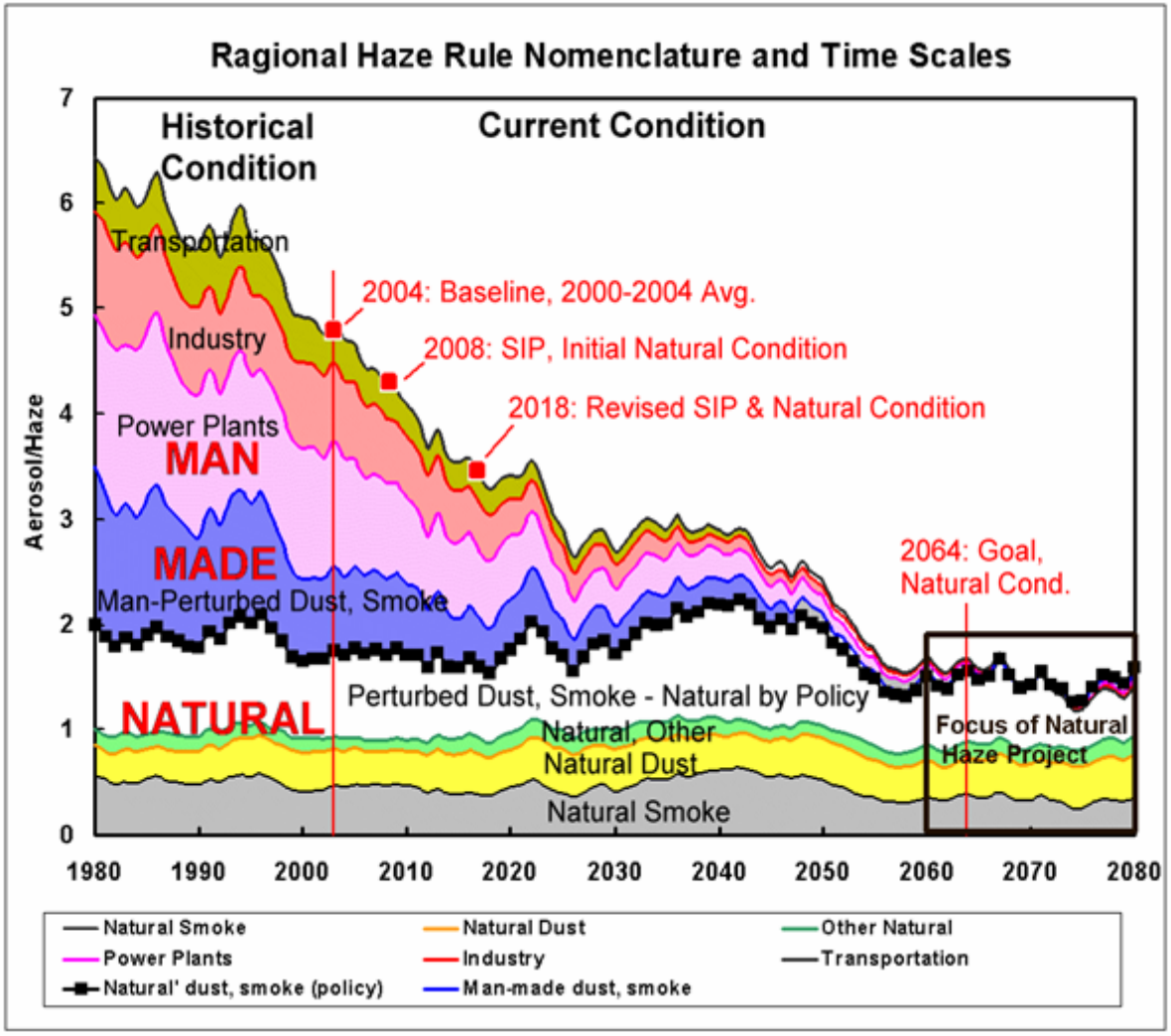
- **BART in process**
- **Title V permits (approved/delegated by EPA)**
- **PSD/NSR (that other visibility protection program)**
- **Smoke management**

- **Reasonable controls and control programs are in place for meaningful sources contributing to visibility impairment**

A complete haze plan in the WRAP region: an integration

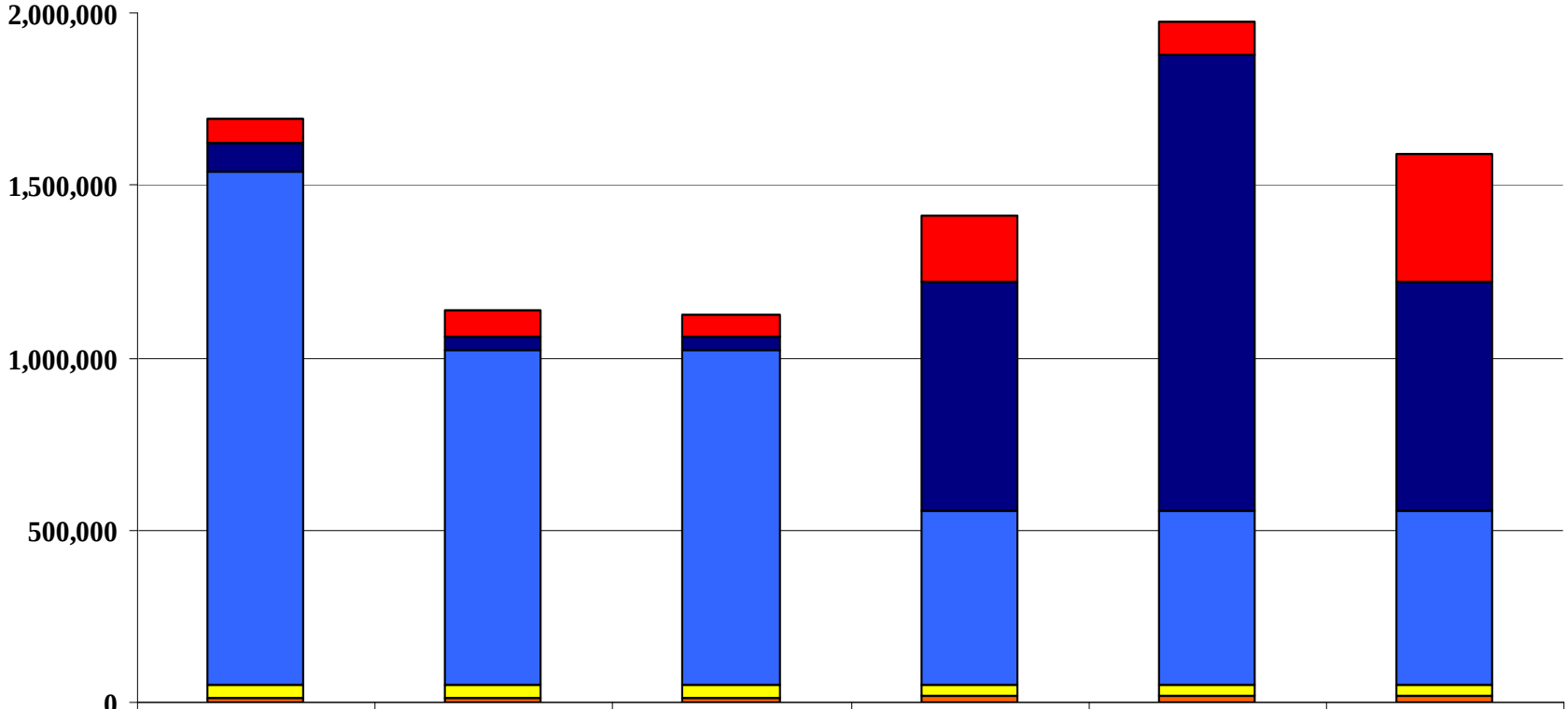
- **BART controls and §309 SO_2 program**
- **Manage controllable fire emissions and track emissions;**
- **Account for growth;**
- **Identify natural and uncontrollable emissions and their impacts;**
- **Set reasonable progress goals for 2018; and**
- **Adopt stable IMPROVE monitoring network for tracking visibility**

Likely actual western glide path



Fire Emissions

WRAP Region Fire PM2.5 Emissions Scenarios (tpy)



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2018 Planning - Seasonal Suites of Emissions Reduction Techniques (ERTs)

- **List common combinations of ERTs applied during each season for the four vegetation types (Grass, Brush, Timber, Crop).**
- **From available Emission Reduction Factor (ERF) information, assign a single ERF to each seasonal suite of ERTs.**
  - **Input from Regional Experts**
    - **SW – Fitch/Lahm, USDA FS**
    - **NW – Russell, USDA FS/USDOI BLM**
    - **IMW – Paintner, USDoI NPS**
- **Prepare the Seasonal Suite table for each sub-region.**

2018 Planning - Seasonal ERT Suites

Northwest [1]

	Grass	Ref	Brush	Ref	Timber	Ref	Crop (ag)	Ref
Seasonal ERT Suites:								
Spring	55%	5,6,7,9,10,11,14,18	70%	3,8,9,12,13,	40%	1,12,15,16,18,19,22	0%	
Summer	65%	18,6	45%	6,7,10,11,18	45%	1,2,3,4,22	20-40%	1,2,3,10
Fall	65%	9,10,11	65%	3,10,11,13,18	40-65%	1,2,4,12,13,17,18,21,22	60-80%	20,21,22
Winter	10%	5,9,12	70%	15,9	10-40%	12,13,15,16,17,20,21,22	70-80%	20,21,22

Southwest [2]

	Grass	Ref	Brush	Ref	Timber	Ref	Crop (ag)	Ref
Seasonal ERT Suites:								
Spring	55%	5,6,9,10,11,18	45%	3,5,6,8,9,10	45%	1,7,8,9,10,12,13,15,16,18,19	50%	3,10,11,21
Summer	55%	5,6,9,10,11	40%	5,6,7,8,18	30%	1,10,12,17,19	50%	3,10,11,21
Fall	55%	5,6,7,10,11,12,13,18	45%	3,5,10,11,13,18	45%	1,2,3,4,10,11,12,13,16,17,18,19	70%	3,10,11,21
Winter	55%	5,6,10,11,13,18	45%	3,5,10,11,13,18	60%	1,10,11,12,13,19,21	70%	3,10,11,21

Intermountain West [3]

	Grass	Ref	Brush	Ref	Timber	Ref	Crop (ag)	Ref
Seasonal ERT Suites:								
Spring	55%	5,6,7,9,10,11,14,18	40%	3,5,6,9,13	40%	1,9,10,12,13,15,16,18,19,21	50%	10,11
Summer	60%	5,6,10,11,18	40%	5,6,7,10,11,13,18	45%	1,2,3,4,10,12,19	40%	1,3,10,11
Fall	65%	5,6,7,10,11,18	60%	3,5,10,11,13,18	60%	1,2,4,10,12,13,17,18,19,21	70%	10,20,21,22
Winter	25%	5,6,9,10,11,18	50%	3,5,9,13,15,17,18	20%	10,12,13,15,16,19,20,21	0%	

Example ERT Suite

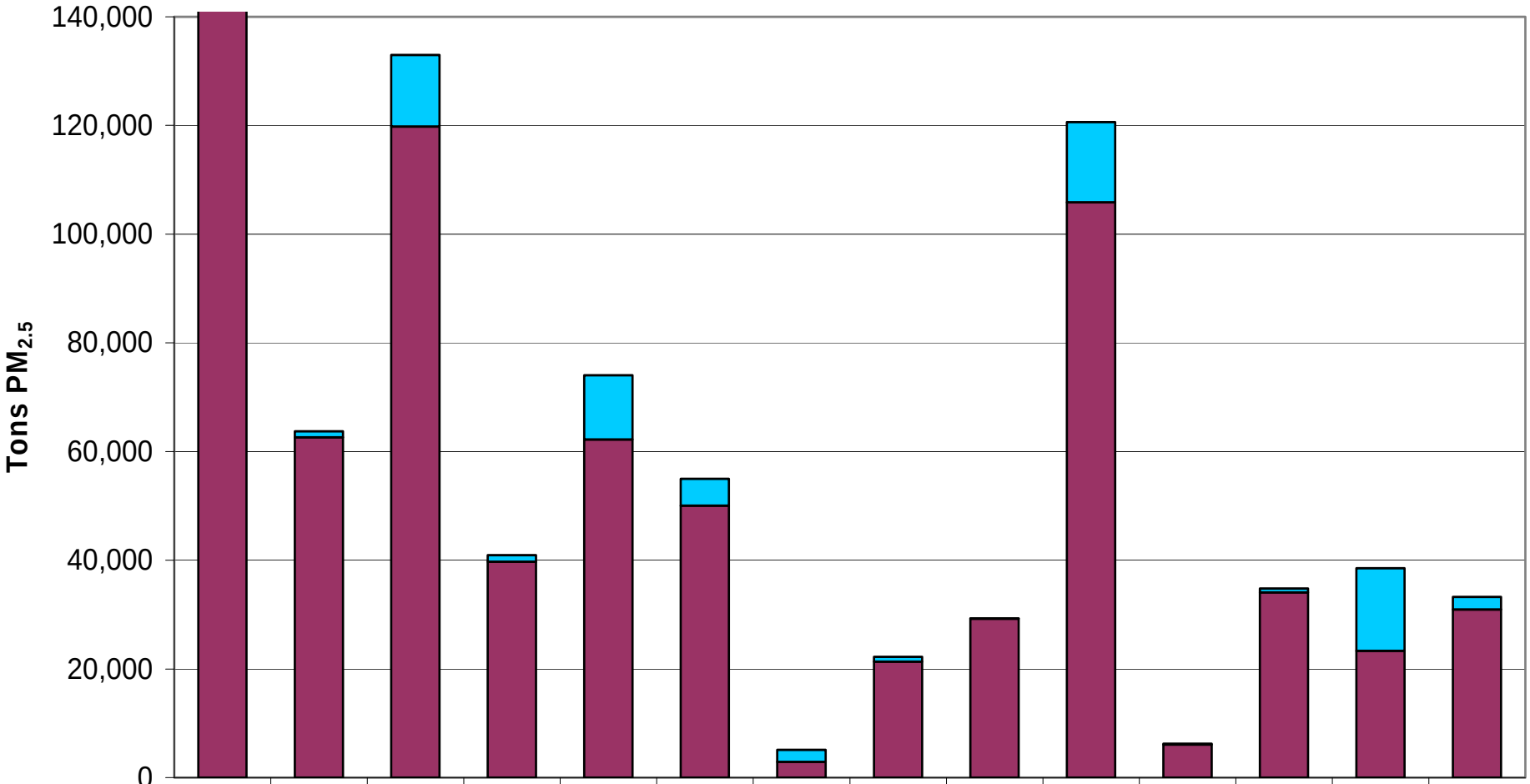
Northwest [1]

Timber

Fall	40-65%	1,2,4,12,13,17,18,21,22

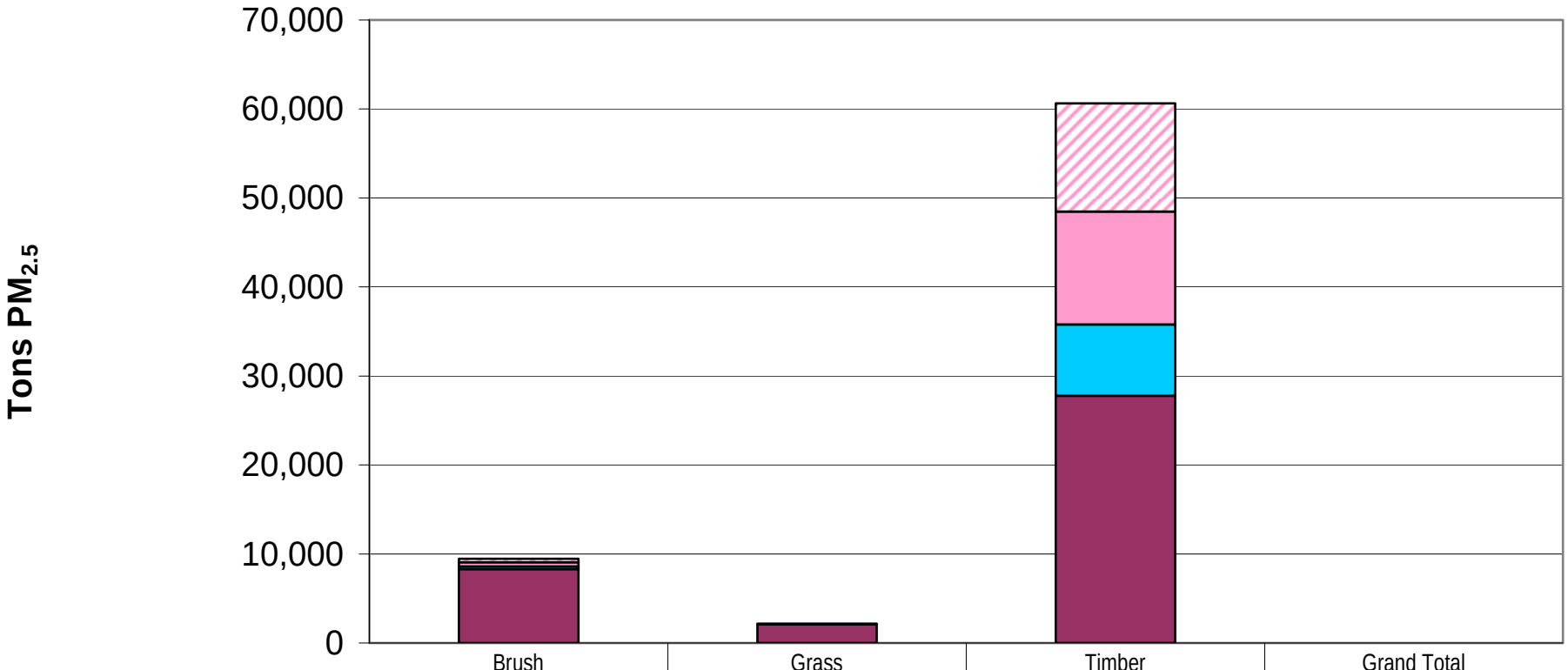
	Emissions Reduction Method	ERT Cat	Definition
1	Pre-Burn Fuel Removal	2	(Mechanical removal.) Includes mechanical removal of logging debirs from clearcuts, onsite chipping of woody material and/or brush for offsite utilization, and mechanical removal of fuels which may or may not be followed by offsite burning in a more controlled environment.
2	Firewood Sales	2	Removal of woody debris using firewood
4	Biomass Utilization (exept for Elect Gen)	2	
12	Isolating Fuels	1	
13	Concentration Burning	1	
17	Burn Before Large Activity Fuels Cure	4	Burning activity-generated fuels within 3-4 drying months of timber harvests to reduce the consumption of large fuels due to residual live fuel moisture.
18	Aerial Ignition/Mass Ignition	6	Ignition techniques to shorten the duration of the smoldering fire and reduce the total amount of fuel consumed.
21	Pile Burning	6	Fuels concentrated into clean and dry piles generate greater heat and burn more efficiently. A greater amount of consumption occurs in the flaming phase and the emission factor is lower. (brush; forest)
22	Air Curtain Incinerators	6	Burning fuels in a large metal container or pit with the aid of powerful fan-like device to force additional oxygen in to the combustion process.

2018 Planning - Baseline Average with ERTs
Baseline Emission Inventory: Natural vs. Anthropogenic $PM_{2.5}$ Emissions



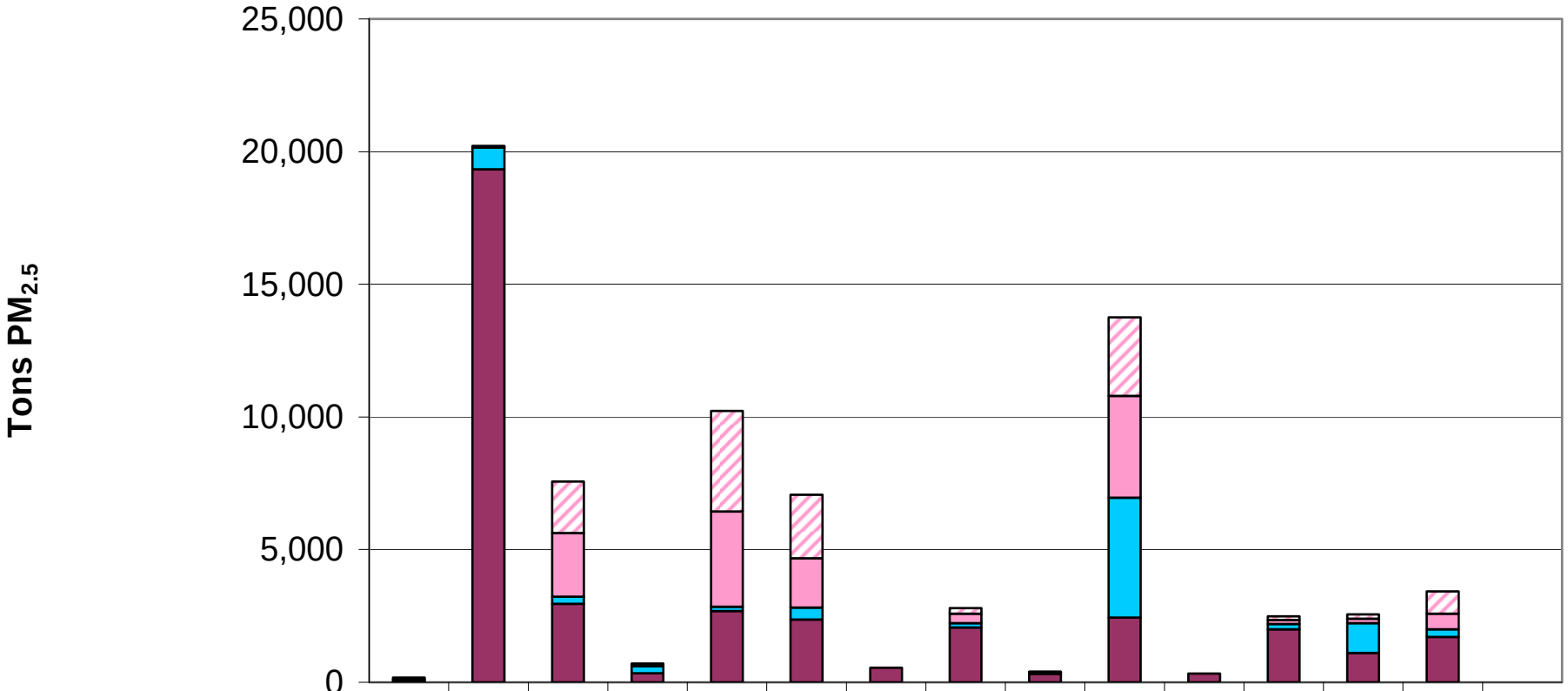
	AK	AZ	CA	CO	ID	MT	ND	NM	NV	OR	SD	UT	WA	WY
Anth PM2.5	172	1,090	13,157	1,220	11,842	4,900	2,155	923	98	14,713	136	697	15,250	2,298
Natural PM2.5	478,057	62,620	119,806	39,740	62,212	50,072	2,927	21,329	29,226	105,890	6,119	34,103	23,301	30,936
Acres	1,124,577	591,509	1,358,937	249,834	955,301	735,393	310,262	341,054	299,837	919,592	289,711	276,463	858,071	236,491

2018 Planning - Baseline Average with ERTs
Prescribed Burning by Fuel Type: Emissions Averted



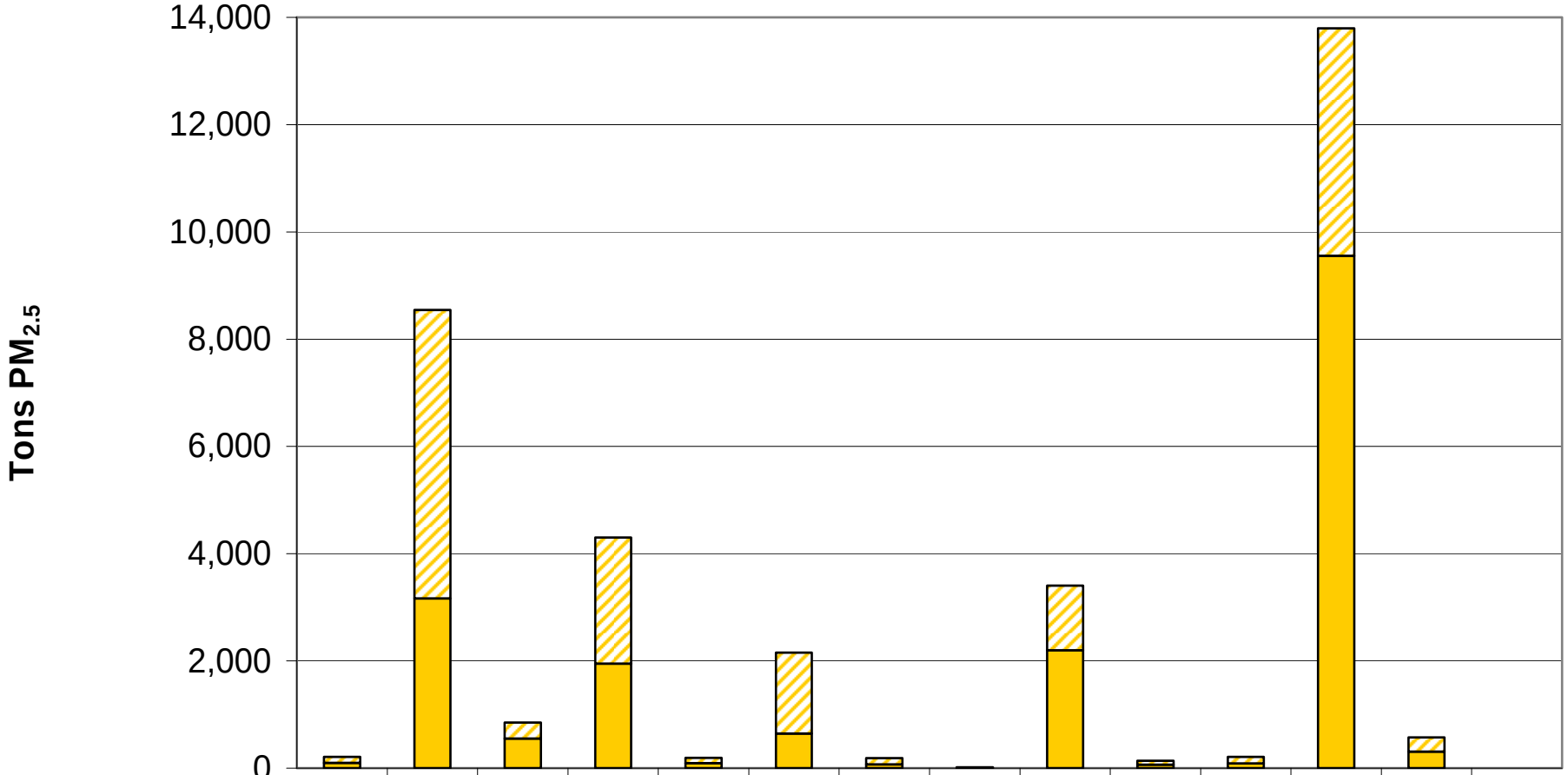
	Brush	Grass	Timber	Grand Total
Averted (ERTs on Broad-ANTH)	413	0	12,182	12,595
Broadcast - ANTH	459	0	12,688	13,148
Piled - ANTH	286	34	7,997	8,318
Broadcast - NAT	8,314	2,125	27,782	38,221
Acres	110,105	59,641	499,602	669,348

2018 Planning - Baseline Average with ERTs
Prescribed Burning by State: Emissions Averted

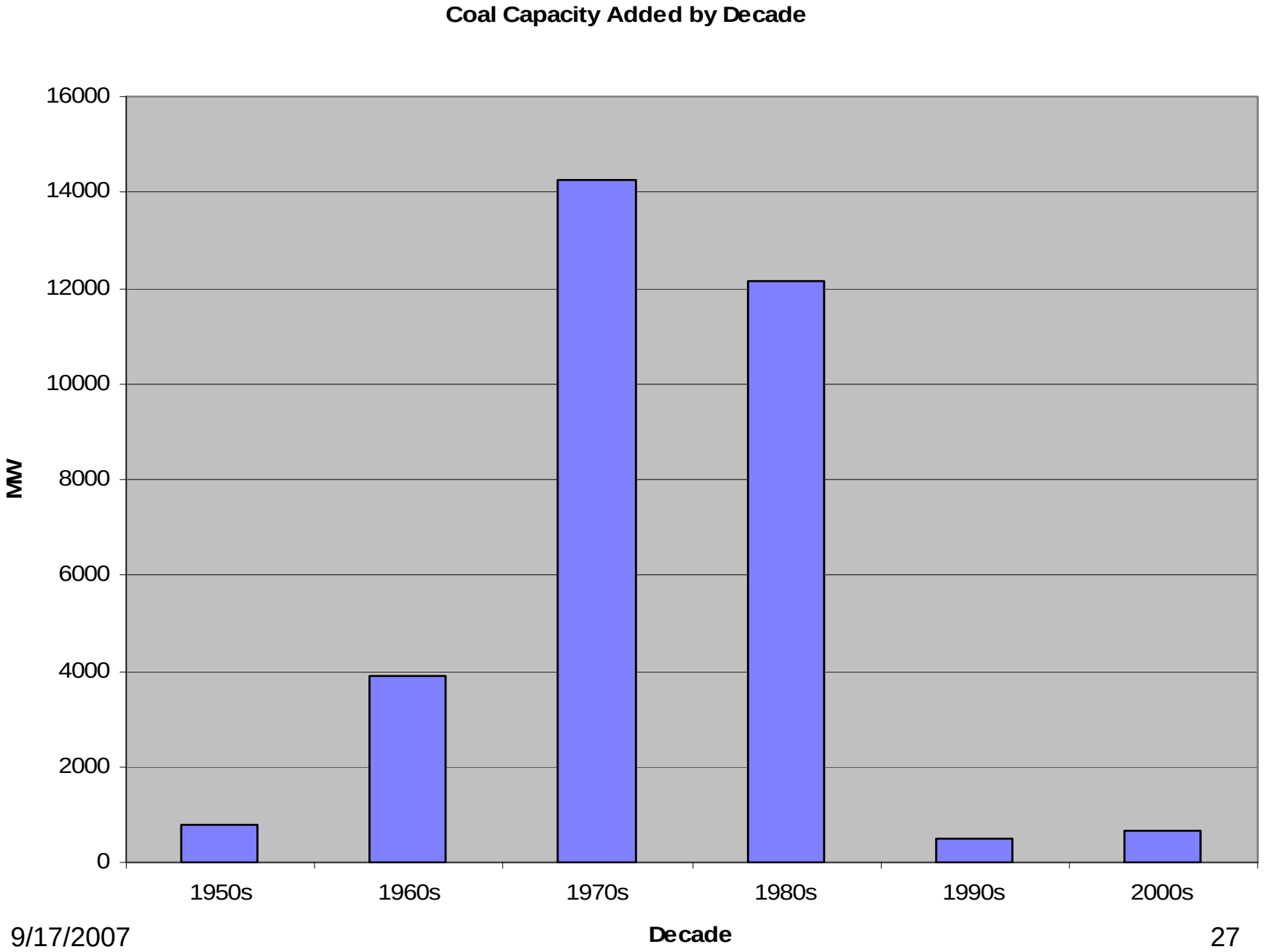


	AK	AZ	CA	CO	ID	MT	ND	NM	NV	OR	SD	UT	WA	WY	Grand Total
Averted (ERTs on Broad-ANTH)	79	30	1,944	39	3,784	2,395	0	214	16	2,955	0	136	163	840	12,595
Broadcast - ANTH	88	37	2,395	56	3,594	1,857	0	353	19	3,840	0	155	167	587	13,148
Piled - ANTH	4	814	276	273	162	453	0	166	44	4,512	0	195	1,123	296	8,318
Broadcast - NAT	8	19,337	2,955	339	2,688	2,361	556	2,064	319	2,447	333	2,003	1,105	1,708	38,221

2018 Planning - Baseline Average with ERTs
Agricultural Burning by State: Emissions Averted



	AZ	CA	CO	ID	MT	ND	NM	NV	OR	SD	UT	WA	WY	Grand Total
Emissions Averted	110	5,378	298	2,350	101	1,509	118	13	1,207	68	121	4,238	264	15,774
Baseline Control PM2.5	99	3,164	554	1,952	94	647	72	6	2,200	68	89	9,559	312	18,816


Coal Capacity Added by Decade
16000
14000
12000
10000
8000
6000
4000
2000
0
MW
1950s
1960s
1970s
1980s
1990s
2000s
Decade