Recommendations for Redesigning the Speciation Monitoring Network

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Monitoring, Analysis, and Modeling Team

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Agenda

- The Team's charge
- Brief overview of NAAMS
- Summary of review
- Re-design of speciation network
- Next steps
- Demonstration of decision matrix and GIS tools

The Team's Charge

MQAG has been developing a National Ambient Air Monitoring Strategy (NAAMS) that will shape the future of US air monitoring

- While the NAAMS has received significant review and input from external reviewers (CASAC, STAPPA/ALAPCO), it had not been reviewed by many of the monitoring data users within EPA

Our Goal:

- Facilitate review and input from monitoring data users within EPA
- Raise awareness of upcoming changes in monitoring networks within EPA

NAAMS Overview – Why?

Compliance Driven Networks → **Multi-pollutant Multi-purpose Networks**

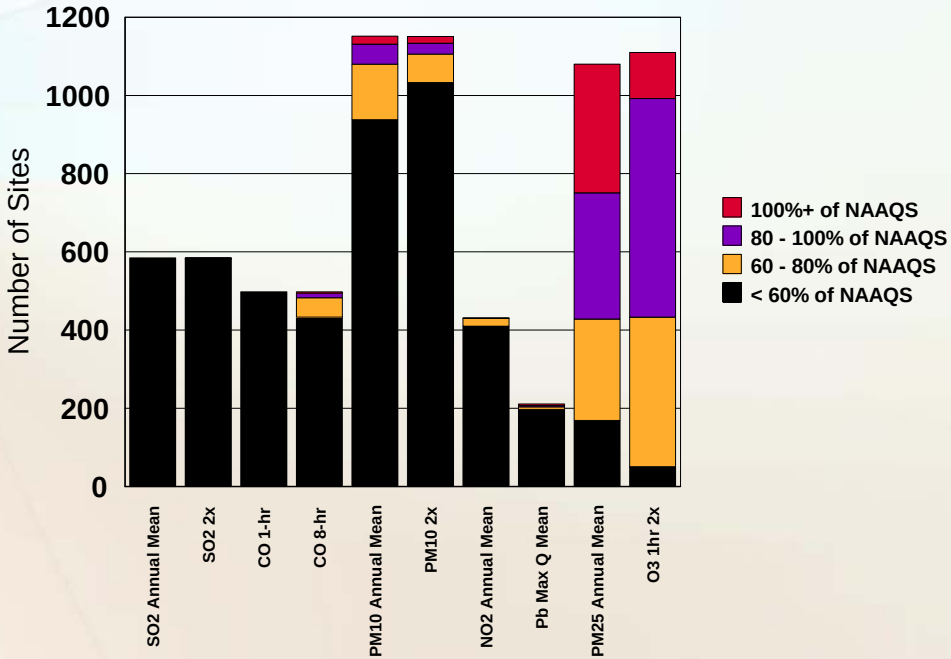
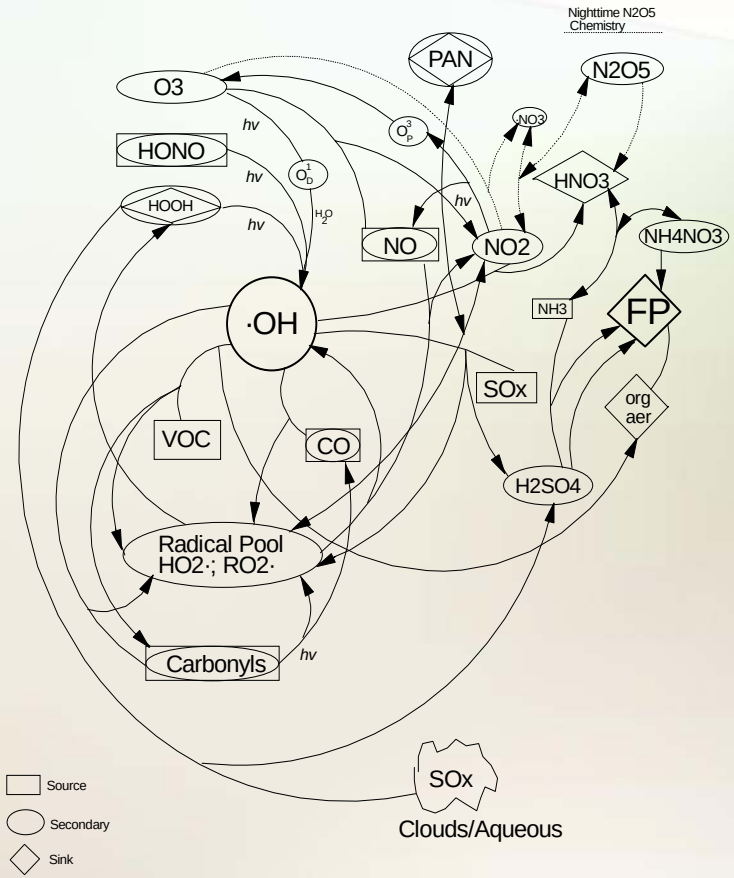
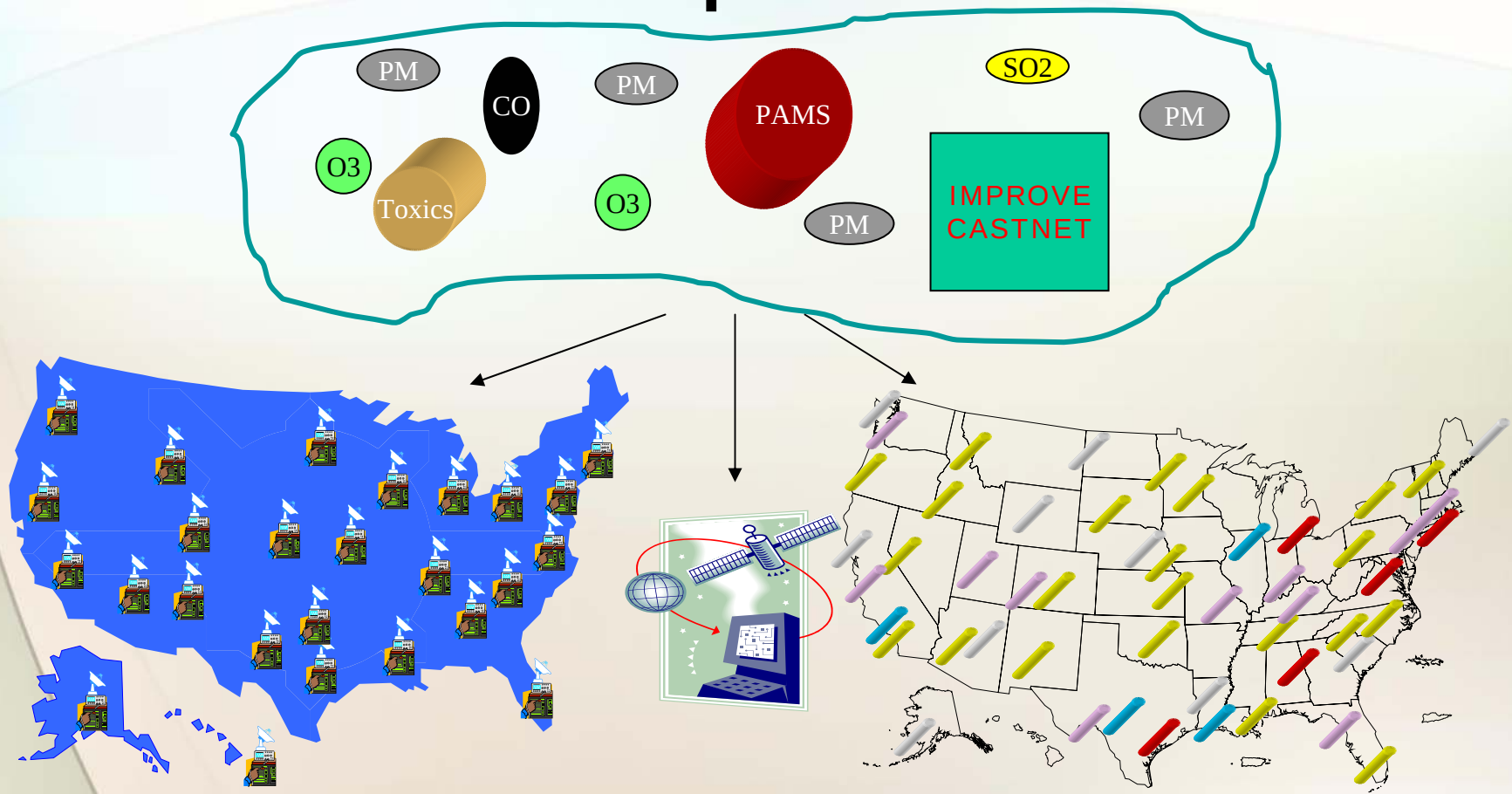


Figure 4. Linkage between oxidant chemistry and fine particle (FP) formation.



Overview of NAAMS

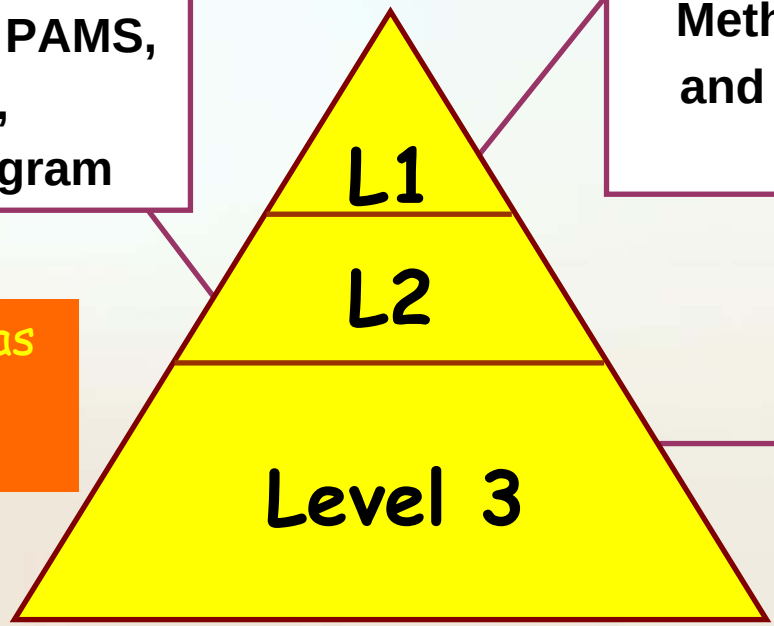
Move from single-pollutant/purpose networks to multi-pollutant networks



NAAMS Overview – NCore Levels

NCore 2: ~ 75 Multi-pollutant Sites for "Core Species" Plus Leveraging from PAMS, Air Toxics, Speciation Program

NCore 1: 3-10 Sites for Comprehensive Measurements, Advanced Methods Serving Science and Technology Transfer Needs



Gray areas between levels

NCore 3: Single Criteria Pollutant Sites

Minimum "Core" Level 2 Measurements

NOy,TLSO2,TLCO, PM2.5, PM10-2.5, O3, Continuous PM2.5, NH3, HNO3, PM2.5 Speciation, Meteorology (T,RH,WS,WD)

NAAMS Overview - Funding Implications

Zero Sum Strategy

INVESTMENTS

Additional measurements – NH3, HNO3, NOy, trace level SO2, trace level CO

More continuous measurements – PM2.5, PM2.5 speciation

Faster data reporting

Improved QA

DIVESTMENTS

Reduction in compliance monitoring for SO2,PM10, NO2, Pb

Reduction in PM2.5 speciation monitoring

Reduction in PAMS monitoring

Review of NAAMS

- **The team facilitated the review of the NAAMS by the Atmospheric Modeling Division (AMD) of EPA ORD**
  - **They recommended the following species measurements at NCORE level 2 sites:**
    - **SO2, HNO3, NH3, NOx, NOy, CO, O3, H2O2, PM2.5 species (including trace elements), and speciated organics**
  - **They also recommended to increase the number of rural sites and to better coordinate site locations and measurements between the CASTNet and speciation networks (e.g. some rural NCORE level 2 sites could be located at existing CASTNet sites)**

Review of NAAMS (continued)

- **The project team reviewed the NAAMS**
- **We identified two areas where the team should provide support**
  - **Re-design of PM2.5 speciation network**
  - **Design of NCore Level 2 network**

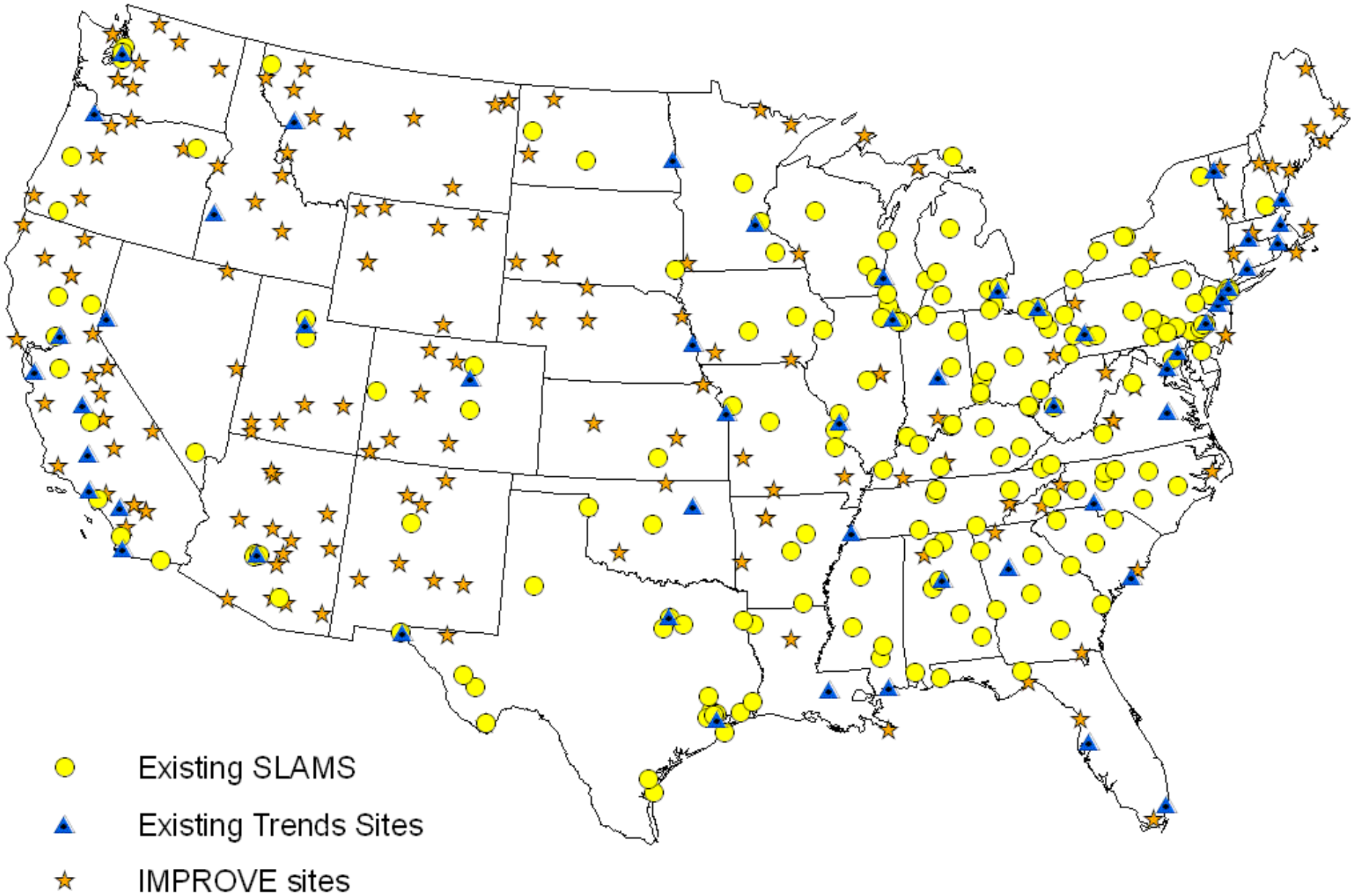
Speciation Network Re-Design Assumptions

- **50% reduction in number of supplemental speciation sites (SLAMS)**
  - **Based on NAAMS and 2005 grant budgets**
  - **186 existing SLAMS**
- **Little to no changes to Trends sites**
  - **54 existing Trends sites**
- **No changes to Improve network**
  - **188 improve sites**

Speciation Network Re-Design Approach

- **Identify and map existing sites**
- **Objectively rank sites using a "Decision Matrix"**
- **Subjective review of exiting sites**
- **Add new sites to meet needs**

Existing PM2.5 Speciation Networks



Ranking of Existing Sites

- **Used a "Decision Matrix" to rank existing sites**
  - **A decision matrix is a tool used to rank alternatives, in this case site locations.**
  - **Step 1. Identify and weight criteria that add value to a site**
  - **Step 2. Score each site for each criteria**
  - **Step 3. Rank each site based on the total score for all criteria**

Ranking of Existing Sites (continued)

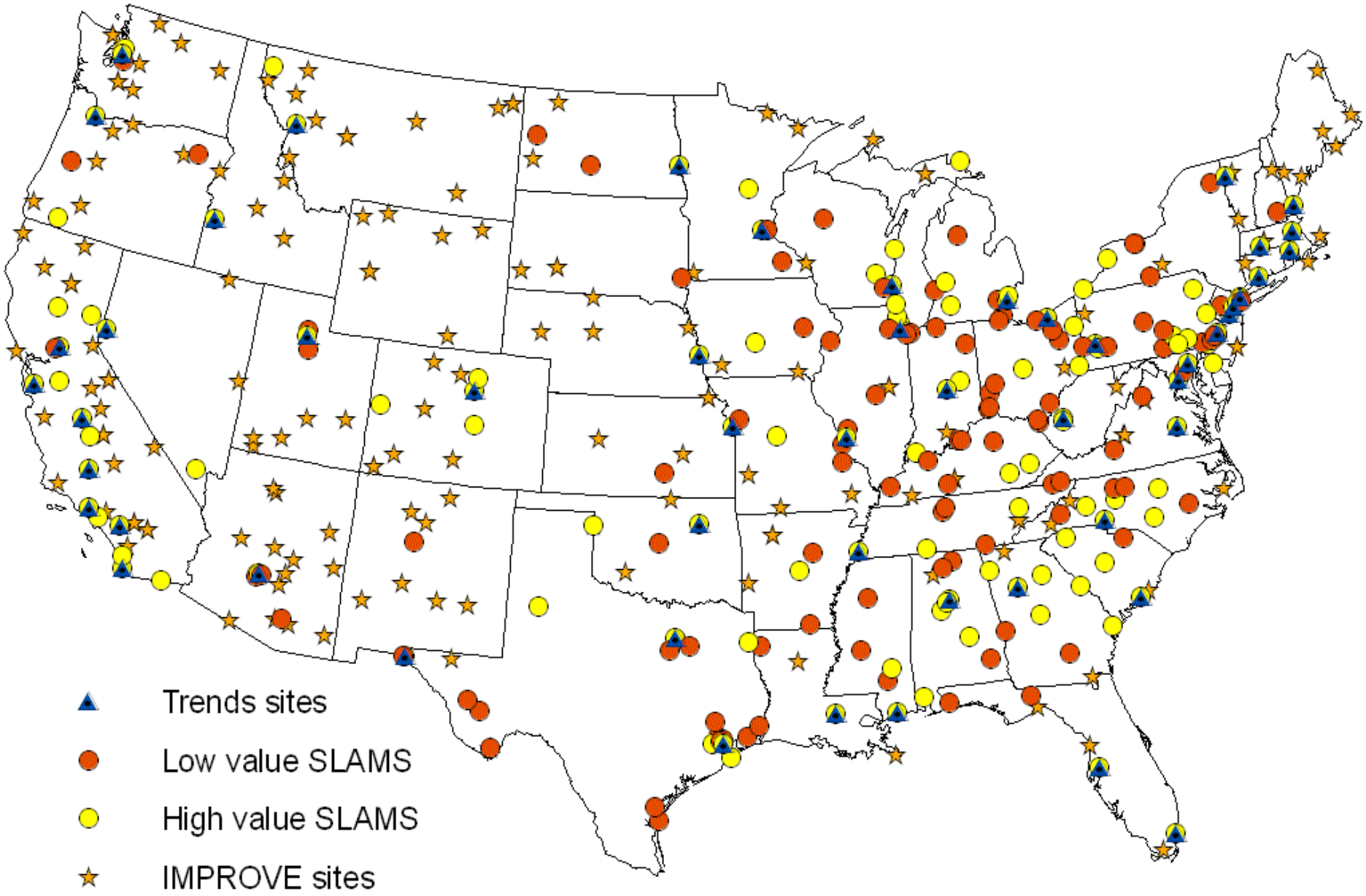
- **What criteria were used?**
  - **Error in estimating PM2.5 concentration if monitor removed (25%)**
  - **Distance to nearest site (25%)**
  - **3-year PM2.5 design value (15%)**
  - **Rate of change in monitored values (15%)**
  - **Population density near monitor (10%)**
  - **Collocation with PAMS and NATS (5% each)**
  - **2010 residual non-attainment areas after CAIR (protected sites)**
  - **Trend site (protected)**

Ranking of Existing Sites (continued)

Excerpt of Decision Matrix

AIRS	Minimum Distance		Trends Site?		FRM Site?		PAMS Site?		NATS Site?		Error		Rate of Change		Population Density		Avg. Conc.		Total	Rank	Percentile
060658001	1.7	0.17	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	36.7	0.19	654.8	0.15	317,926	0.02	27.8	0.15	100.97	1	100.0
060190008	1.8	0.18	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	26.4	0.13	537.5	0.12	292,638	0.01	19.7	0.15	100.81	2	99.6
060371103	1.5	0.15	No	0.00	Yes	0.00	Yes	0.05	No	0.00	17.1	0.09	548.2	0.12	1,153,946	0.06	22.0	0.15	100.76	3	99.2
061072002	1.7	0.16	No	0.00	Yes	0.00	No	0.00	No	0.00	35.4	0.18	511.6	0.12	69,965	0.00	21.3	0.15	100.76	4	98.7
300530018	1.7	0.17	No	0.00	Yes	0.00	No	0.00	No	0.00	49.4	0.25	90.5	0.02	7,665	0.00	16.2	0.12	100.70	5	98.3
060290014	1.9	0.20	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	23.9	0.12	196.9	0.04	191,213	0.01	20.3	0.15	100.68	6	97.9
060730003	1.6	0.16	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	13.2	0.07	300.6	0.07	254,568	0.01	15.7	0.12	100.62	7	97.5
040139997	0.7	0.05	Yes	0.00	Yes	0.00	Yes	0.05	Yes	0.05	34.8	0.18	276.1	0.06	573,574	0.03	10.7	0.05	100.61	8	97.1
061112002	1.7	0.17	Yes	0.00	Yes	0.00	No	0.00	No	0.00	13.1	0.07	496.2	0.11	133,888	0.01	14.5	0.08	100.58	9	96.7
220330009	2.3	0.24	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	9.8	0.05	70.0	0.01	35,054	0.00	13.1	0.08	100.58	10	96.2
420030064	1.2	0.12	No	0.00	Yes	0.00	No	0.00	No	0.00	24.7	0.12	147.2	0.03	51,442	0.00	21.2	0.15	100.57	11	95.8
060731002	1.6	0.16	No	0.00	Yes	0.00	No	0.00	No	0.00	5.8	0.03	452.5	0.10	168,636	0.01	15.9	0.12	100.57	12	95.4
060990005	1.9	0.20	No	0.00	Yes	0.00	Yes	0.05	No	0.00	24.3	0.12	212.7	0.04	145,599	0.01	16.2	0.12	100.56	13	95.0
160270004	2.2	0.22	Yes	0.00	Yes	0.00	No	0.00	No	0.00	24.7	0.13	59.8	0.01	60,967	0.00	9.2	0.05	100.56	14	94.6
720610005	2.1	0.22	Yes	0.00	Yes	0.00	No	0.00	No	0.00	22.9	0.12	63.6	0.01	159,088	0.01	9.3	0.05	100.55	15	94.1
130210007	1.9	0.20	No	0.00	Yes	0.00	No	0.00	No	0.00	7.7	0.04	156.4	0.03	62,135	0.00	15.2	0.12	100.54	16	93.7
010730023	1.1	0.10	Yes	0.00	Yes	0.00	No	0.00	No	0.00	21.5	0.11	70.0	0.01	144,093	0.01	18.0	0.15	100.52	17	93.3
440070022	1.7	0.17	Yes	0.00	Yes	0.00	No	0.00	Yes	0.05	10.3	0.05	160.1	0.03	362,349	0.02	11.6	0.05	100.52	18	92.9
320310016	1.8	0.18	Yes	0.00	Yes	0.00	No	0.00	No	0.00	30.0	0.15	115.2	0.02	186,698	0.01	9.0	0.00	100.52	19	92.5
421010004	1.0	0.09	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	7.1	0.04	197.8	0.04	574,410	0.03	15.2	0.12	100.51	20	92.1
270953051	2.2	0.22	No	0.00	Yes	0.00	No	0.00	No	0.00	22.0	0.11	138.2	0.03	1,369	0.00	7.1	0.00	100.51	21	91.6
120571075	1.9	0.19	Yes	0.00	Yes	0.00	No	0.00	Yes	0.05	10.3	0.05	55.7	0.01	263,232	0.01	11.0	0.05	100.51	22	91.2
340390004	1.3	0.12	Yes	0.00	Yes	0.00	No	0.00	No	0.00	13.3	0.07	170.0	0.03	326,857	0.02	15.7	0.12	100.51	23	90.8
110010043	0.7	0.06	Yes	0.00	Yes	0.00	Yes	0.05	Yes	0.05	8.1	0.04	101.2	0.02	494,632	0.02	15.2	0.12	100.51	24	90.4
180970078	1.7	0.17	Yes	0.00	Yes	0.00	No	0.00	No	0.00	7.5	0.04	88.4	0.02	232,350	0.01	16.2	0.12	100.51	25	90.0
060850005	1.9	0.20	Yes	0.00	Yes	0.00	No	0.00	No	0.00	8.3	0.04	101.3	0.02	402,567	0.02	14.6	0.08	100.50	26	89.5
471570047	2.1	0.22	Yes	0.00	Yes	0.00	No	0.00	No	0.00	9.1	0.05	48.2	0.01	108,527	0.01	14.0	0.08	100.50	27	89.1
360050083	0.8	0.06	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	0.6	0.00	275.6	0.06	2,012,638	0.10	13.9	0.08	100.50	28	88.7
240053001	1.5	0.15	Yes	0.00	Yes	0.00	Yes	0.05	No	0.00	2.4	0.01	85.7	0.01	93,024	0.00	15.2	0.12	100.50	29	88.3
080010006	1.6	0.16	Yes	0.00	Yes	0.00	No	0.00	No	0.00	23.6	0.12	87.6	0.02	125,342	0.01	10.4	0.05	100.50	30	87.9
401431127	2.1	0.21	Yes	0.00	Yes	0.00	No	0.00	No	0.00	6.3	0.03	86.9	0.02	190,351	0.01	12.0	0.08	100.50	31	87.4

Objective Ranking of Sites Using Decision Matrix



Subjective Review of Sites

- **“Low value” sites were the primary removal targets**
  - **We removed all low value sites**
  - **We further removed apparent “redundant” sites (where numerous low or high value sites are close together)**
  - **We also removed some trends sites which appeared to be superfluous**

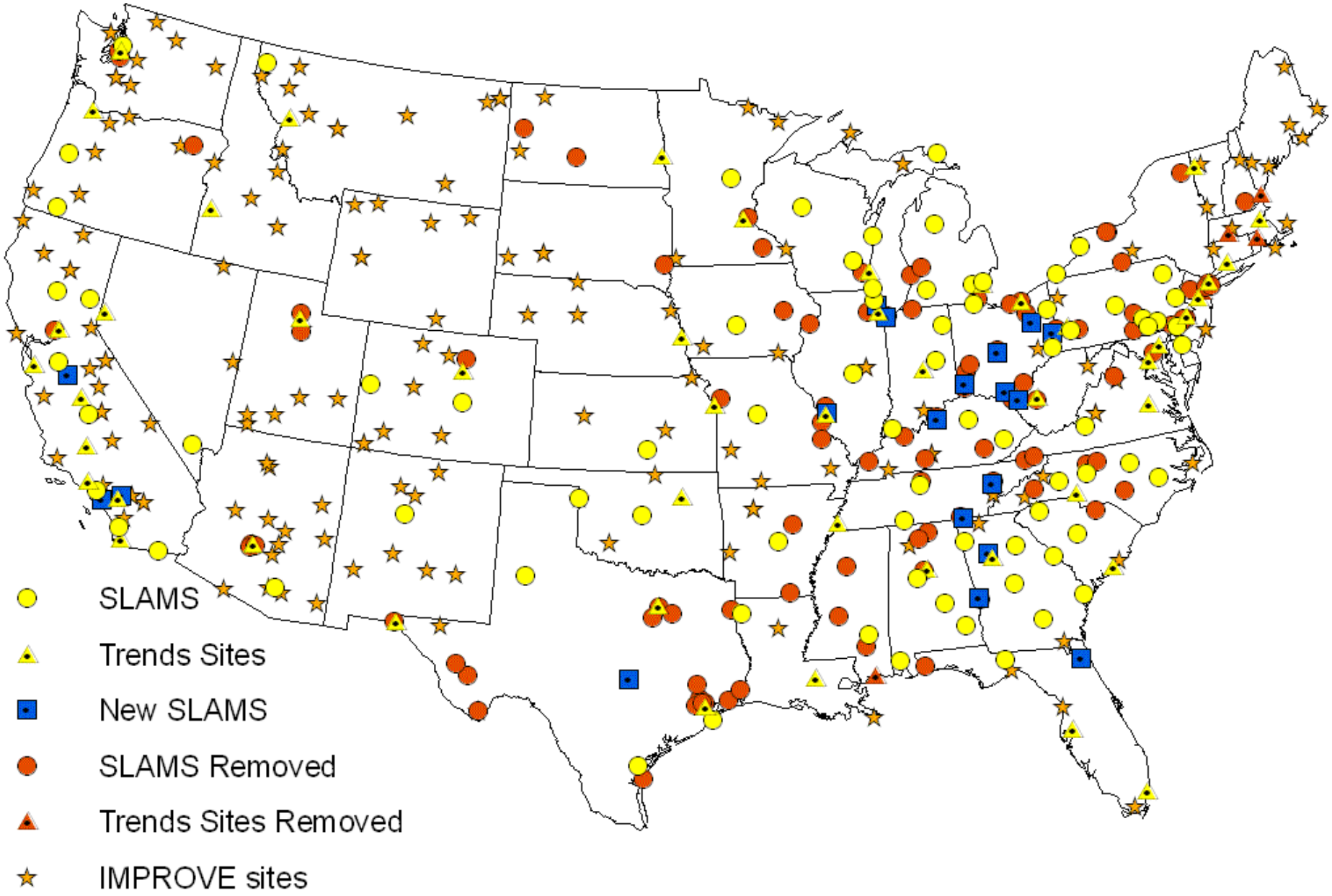
Subjective Review
Adding New Sites to the Network

- **New sites were added to the network based on the following criteria:**
  - **Remaining PM2.5 nonattainment in 2010 after CAIR (based on final CAIR modeling)**
    - **This was done on a monitor by monitor basis**
    - **We made sure that each predicted future year nonattainment county had at least one speciation monitor nearby (some have more than one)**
  - **Large cities**
    - **We identified a few large cites that did not have a speciation monitor**

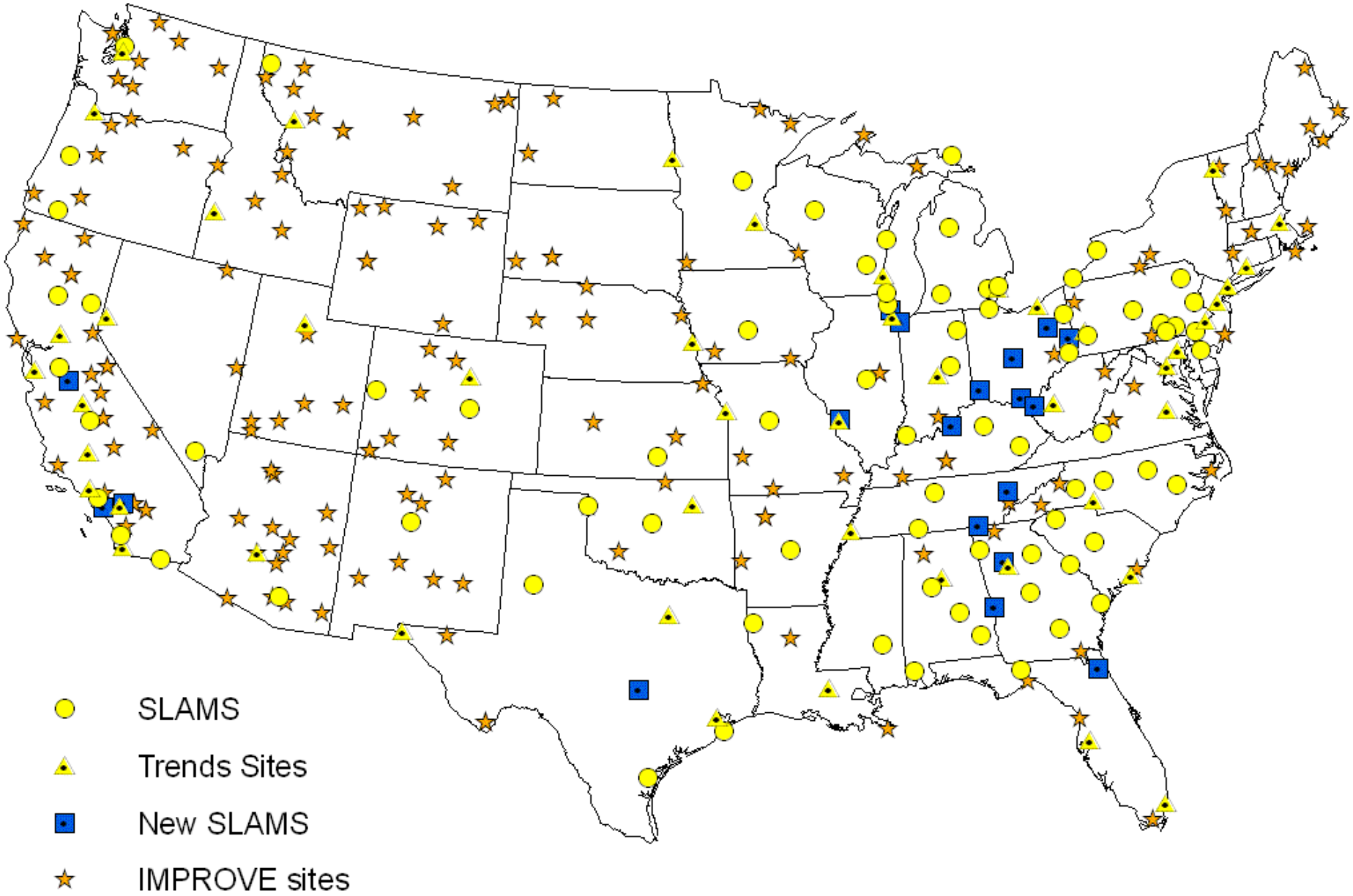
Subjective Review
Adding Existing Sites Back

- **Low value sites were added back into the network based on the following criteria**
  - **Large cities - We tried to keep a speciation monitor in most cities with >250,000 population**
- **Fill Holes**
  - **Removing some low value sites left large gaps in the network**
    - **We tried to balance the need to have some low concentration rural sites with the need to keep high concentration urban sites**
- **Keep certain rural sites that were deployed based on EPA recommendations when the network was designed in 2001**
  - **These were mostly “hole filling” sites**

Final Ranking of Sites



Final Network Design Recommendation



Final Speciation Network Design

- **SLAMS sites**
  - **79 existing sites remain**
  - **19 new sites added**
  - **107 existing sites removed**
- **Trends sites**
  - **49 existing sites remain**
  - **5 existing sites removed**
- **Improve sites**
  - **188 sites (no change)**

Team Recommendations

- **The teams recommended network design should be used as a starting point for redesigning the speciation network**
  - **Which sites are cut and added will depend on additional input from EMAD, EPA regions, and the States**
- **Final network of ~150 speciation sites should operate on a 1 in 3 day schedule**
  - **For budget considerations, rural and low concentration sites could operate on a 1 in 6 schedule**
- **The final list of sites should serve as a starting point for the identification of the NCore Level 2 network**
  - **Should consist of a subset of the speciation sites plus additional rural sites (possibly existing CASTNet sites)**

Next Steps

- **The recommended sites need to be further refined by EMAD, EPA regions, and the States**
  - **Our recommended network design is a first cut**
  - **We need to have a communication strategy because not everyone is going to be happy (especially Texas)**
  - **We need to be willing to add and subtract a certain number of sites to accommodate the needs and desires of the regions and States**
- **Further discussion is needed to refine the list of measurements at NCORE level 2 sites**
  - **The NAAMS and the ORD recommendations are a good place to start**
  - **Many of the final decisions will be dependant on the budget**
- **A follow-up team should work to recommend NCore Level 2 site locations**
- **A follow-up team should work to identify the final NCore network configuration and set of measurements**

Demonstration of Decision Matrix and GIS Tools