**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**
RESEARCH TRIANGLE PARK, NC 27711

November 19, 2014

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

MEMORANDUM

SUBJECT: Network Design Options for Photochemical Assessment Monitoring Stations Re-Engineering

FROM: Kevin A Cavender (EPA, OAQPS)

TO: Ozone NAAQS Review Docket (EPA-HQ-OAR-2008-0699)

The EPA is considering changes to the Photochemical Assessment Monitoring Stations (PAMS) requirements to improve the value of the data being generated as part of the Ozone National Ambient Air Quality Standard review (NAAQS). The following paragraphs provide a brief background on the PAMS program including the current network design requirements, a summary of the existing PAMS network including issues that have been identified that limit the value of the PAMS data, and options for improving the PAMS network design requirements to address the identified issues.

## BACKGROUND

Section 182 (c)(1) of the CAA required the EPA to promulgate rules for enhanced monitoring to obtain more comprehensive and representative data on $O_3$ air pollution. In addition, Section 185 (b) of the CAA required EPA to work with the National Academy of Sciences (NAS) to conduct a study on the role of $O_3$ precursors in tropospheric $O_3$ formation and control. In 1992, the NAS issued the report entitled "Rethinking the Ozone Problem in Urban and Regional Air Pollution" (National Academy of Sciences, 1992).

In response to the CAA requirements and the recommendations of the NAS report, on February 12, 1993 (58 FR 8452), the EPA revised the ambient air quality surveillance regulations to require Photochemical Assessment Monitoring Stations (PAMS) in each $O_3$ nonattainment area classified as serious, severe, or extreme ("PAMS areas"). The original PAMS requirements called for between two to five PAMS sites per PAMS area depending on the PAMS area's population. Four types of PAMS sites were identified including upwind (Type 1), maximum precursor emission rate (Type 2), maximum $O_3$ (Type 3), and extreme downwind (Type 4) sites.

In the 2006 monitoring rule (71 FR 61236), the EPA revised the PAMS requirements to only require two PAMS sites per PAMS area. The intent of the revision was to "allow PAMS monitoring to be more customized to local data needs rather than meeting so

many specific requirements common to all subject $O_3$ nonattainment areas; the PAMS changes would also give states the flexibility to reduce the overall size of their PAMS programs—within limits—and to use the associated resources for other types of monitoring they consider more useful."

In 2011, the EPA initiated an effort to re-evaluate the PAMS requirements in light of changes in the needs of PAMS data users and the improvements in monitoring technology. The EPA consulted with the Clean Air Science Advisory Committee (CASAC), Air Monitoring and Methods Subcommittee (AMMS) to seek advice on potential revisions to the technical and regulatory aspects of the PAMS program. Based on the findings of the PAMS evaluation and the consultations with the CASAC AMMS and National Association of Clean Air Agencies (NACAA) Monitoring Steering Committee (MSC), the EPA is considering revisions to the network design requirements for the PAMS network.

## SUMMARY OF EXISTING PAMS NETWORK

The current PAMS network design calls for a minimum of two sites (a Type 2, and either a Type 1 or Type 3) per PAMS area. Currently, 25 areas are subject to the PAMS requirements with a total of 75 sites. Figure 1 depicts the locations and types of the current PAMS sites. As can be seen in Figure 1, due to the locations of the current PAMS areas and the current network design, existing PAMS sites are clustered along the northeast and west coasts and in Texas leading to significant redundancy in these areas and very limited coverage throughout the remainder of the country.

As part of the PAMS evaluation, the EPA determined that at the national level the primary use of the PAMS data has been to evaluate photochemical model performance. The uneven spatial coverage noted above greatly limits the value of the PAMS data for evaluation of model performance. CASAC noted the spatial coverage issue and advised that EPA should consider requiring PAMS measurements in areas in addition to "areas classified as serious and above for the $O_3$ NAAQS to improve spatial coverage."

In their report, the CASAC AMMS found "that the existing uniform national network design model for PAMS is outdated and too resource intensive," and recommended "that greater flexibility for network design and implementation of the PAMS program be transferred to state and local monitoring agencies to allow monitoring, research and data analysis to be better tailored to the specific needs of each $O_3$ problem area." The NACAA MSC also advised the EPA that the existing PAMS requirements were too prescriptive and may hinder state efforts to collect other types of data that were more useful in understanding their local $O_3$ problems.

The EPA agrees with CASAC and NACAA that the PAMS requirements should be revised to provide monitoring agencies greater flexibility in meeting local objectives and to provide better spatial coverage for national and regional modeling efforts.

## OPTIONS FOR IMPROVING PAMS NETWORK DESIGN

The EPA is considering changes to the network design requirements that we believe will better serve both national and local objectives. The EPA is considering a two part network design. The first part of the design includes a network of fixed sites ("required PAMS sites") intended to support $O_3$ model development and the tracking of trends of important $O_3$ precursor concentrations. The second part of the network design includes monitoring agency directed "Enhanced Monitoring Plans" which allow monitoring agencies the needed flexibility to implement additional monitoring capabilities to suit the needs of their area.

Table 1 summarizes the estimated numbers of NCore sites that would be required to make PAMS measurements based on estimates of ozone design values for the years 2011-2013 for the various options discussed below.

*Option 1. Require PAMS Measurements at all NCore sites.* Under this option, all existing NCore sites would be required to collect PAMS measurements. The NCore network is a multi-pollutant monitoring network consisting of 80 sites (63 urban, 17 rural) and is intended to support multiple air quality objectives including the development and model evaluation of photochemical models (including both PM2.5 and $O_3$ models), and the tracking of regional precursor trends.

NCore sites are well suited for $O_3$ model development and evaluation. NCore sites are sited in typical neighborhood scale locations which are more suitable than source impacted locations for evaluation of grid models typical of current photochemical models and tracking of trends in pre-cursor concentrations.

In addition, by adding PAMS measurements to existing NCore sites, the PAMS network would be taking advantage of existing infrastructure and measurements currently being collected at NCore sites. NCore sites already have the larger, climate-controlled shelters that are necessary to operate the automated gas chromatographs ("auto-GCs") used to collect speciated VOCs. In addition, existing NCore sites currently collect data on many of the required PAMS measurements including $O_3$, carbon monoxide (CO), total reactive nitrogen (NOy), and meteorological measurements including wind speed and direction, temperature, and relative humidity.

However, it is noted that this option would place some PAMS measurements in areas with relatively low $O_3$ levels and would also result in a network of approximately 80 required sites, which would strain existing resources with a somewhat larger network than the current situation, and could make it difficult to also implement the desired state-directed Enhanced Monitoring Plans.

*Option 2 (Proposed). Require PAMS Measurements at NCore sites in Ozone Non-attainment Areas.* Under this option, only NCore sites in ozone non-attainment areas would be required to collect PAMS measurements. This option would provide the benefits discussed above for collecting PAMS measurements at existing NCore sites.

However, this option would reduce the total number of sites required. Based on estimates of ozone design values for the years 2011-2013, the number of NCore sites required to make PAMS measurements would range from 65 to 48 sites based potential ozone standards of 65 to 70 ppb, respectively. Figure 2 summarizes the locations of the potential NCore sites which would be required to make PAMS measurements under this option.

As can be seen in Figure 2 and Figure 3, the spatial coverage under this option would be improved while the total number of required sites would be reduced. Potential redundancy in the existing network would be reduced while important network coverage in the southeast and mid-west would be added.

However, the size of the network under this option is greatly impacted by the level of the ozone standard as well as the levels of ozone that will be present in the years leading up to the PAMS network deployment. Depending on the level of ozone standard finalized under this Ozone NAAQS review or future NAAQS reviews, this option may lead to more required PAMS sites than the current network design and could make it difficult to also implement the desired state-directed Enhanced Monitoring Plans.

*Option 3. Require PAMS Measurements at NCore sites in Ozone Non-attainment Areas with a Population Limit.* Under this option, only NCore sites in CBSAs with a population above a certain threshold that are in ozone non-attainment areas would be required to collect PAMS measurements. Figure 3 through Figure 5 represent the locations of required PAMS sites under this option with a population limit of 1 million, 750 thousand, and 500 thousand, respectively. This option would provide the benefits discussed above for collecting PAMS measurements at existing NCore sites and would further reduce the total number of sites required over Options 1 and 2. Limiting the applicability to those NCore sites in larger CBSAs would still provide the desired improvement in geographic distribution, as can be seen in figures 3 through 5, while reducing the number of required sites down to a level that would provide sufficient resources to provide the desired flexibility to states.

Table 1. Estimates of Number of Required PAMS Sites under Various Design Options

| Potential Ozone Standard (ppb) | Estimated Number of Required Sites | | | | | |
|---|---|---|---|---|---|---|
| | Current Design | Option 1 | Option 2[1] (Proposed) | Option 3[1] | | |
| | | | | 1 Mill | 750k | 500k |
| 70 | 50 | 80 | 48 | 31 | 40 | 42 |
| 65 | 50 | 80 | 65 | 37 | 48 | 52 |

[1] Using actual ozone data measured from 2011-2013. The estimated number of required sites would be smaller if ozone design values decreased compared with the 2011-2013 data, or greater if ozone levels increased.

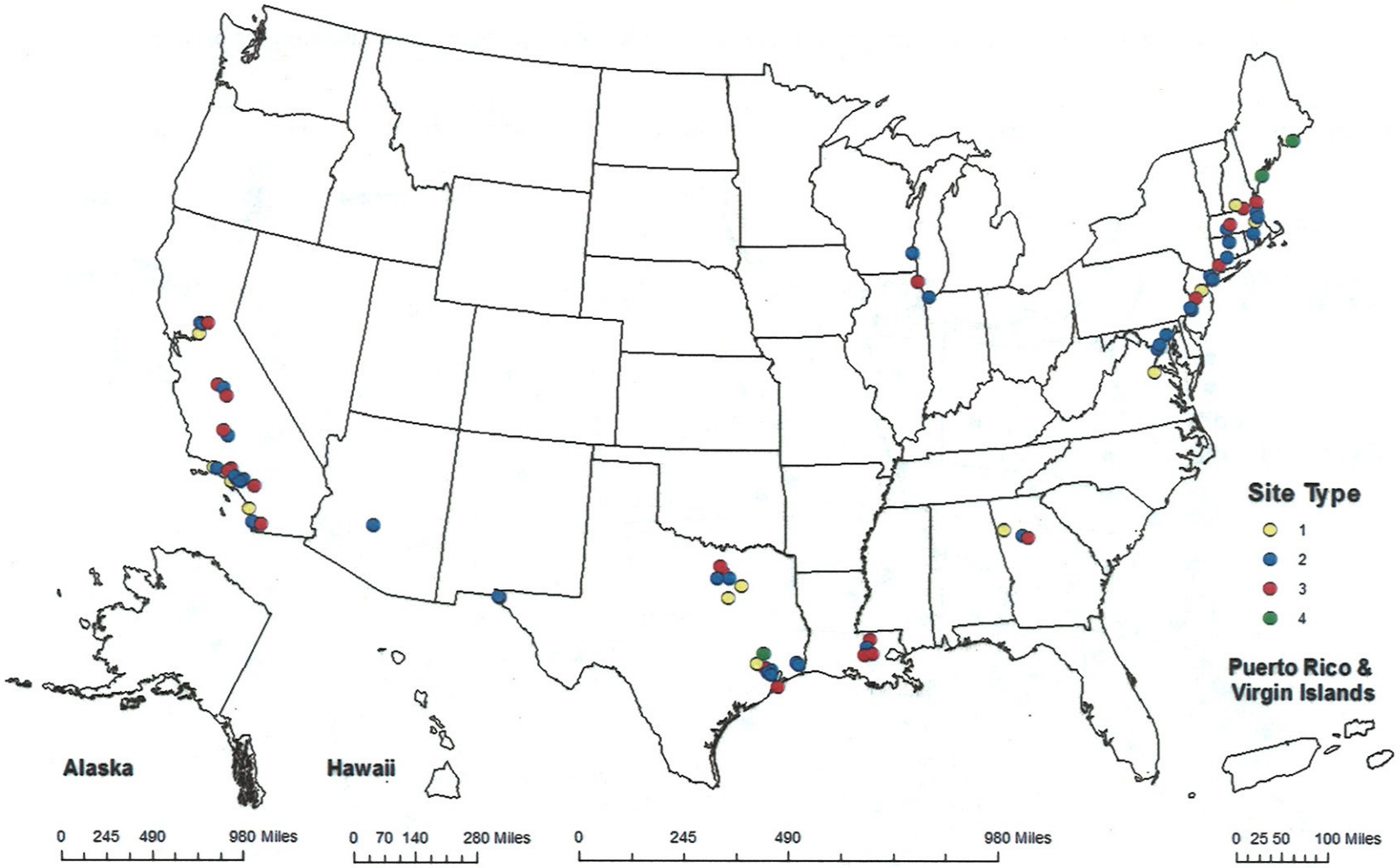


Figure 1. Summary of Existing PAMS Site Locations

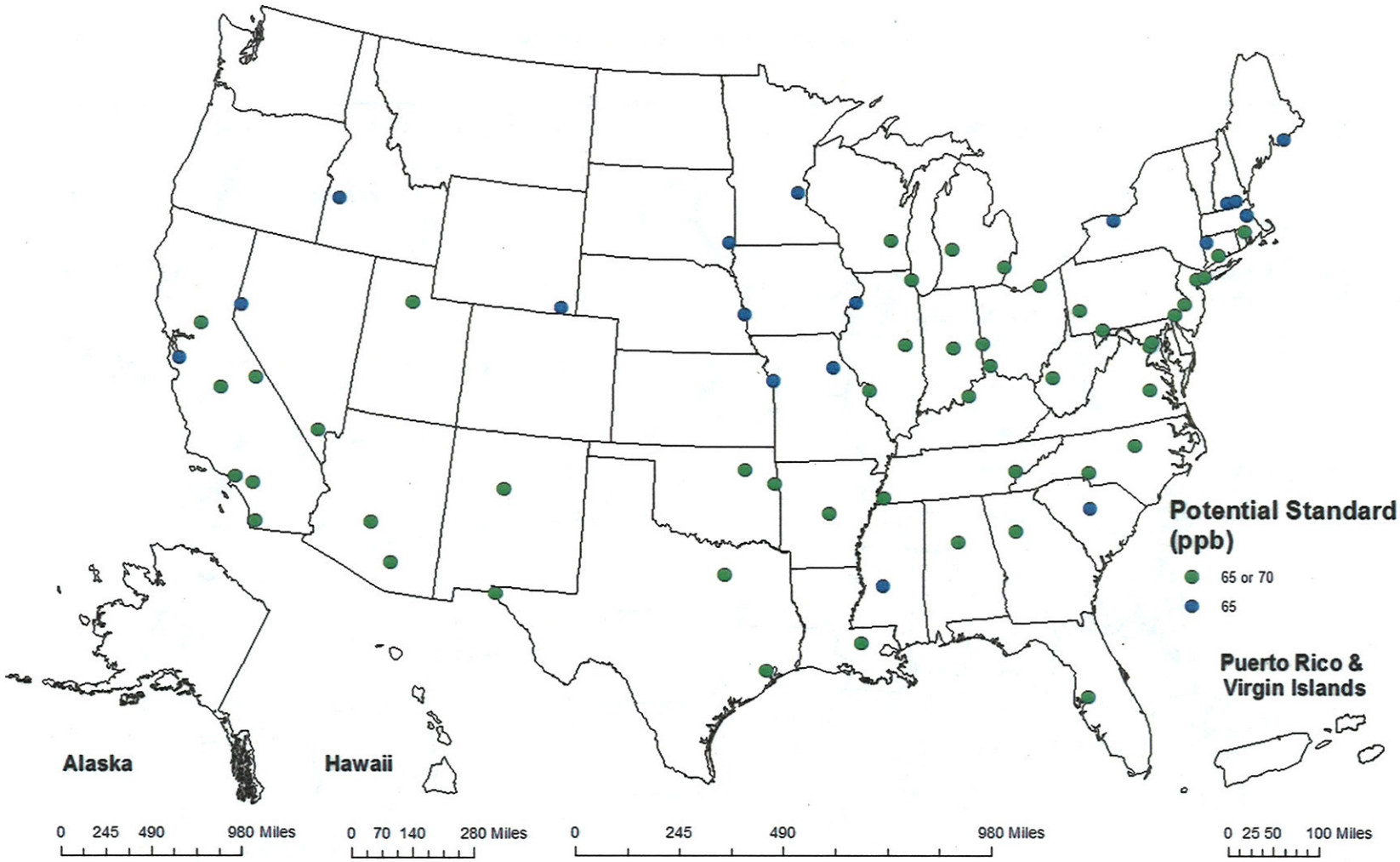


Figure 2. Summary of Potential PAMS Sites Under Option 2 (All NCore Sites in Non-attainment Areas)

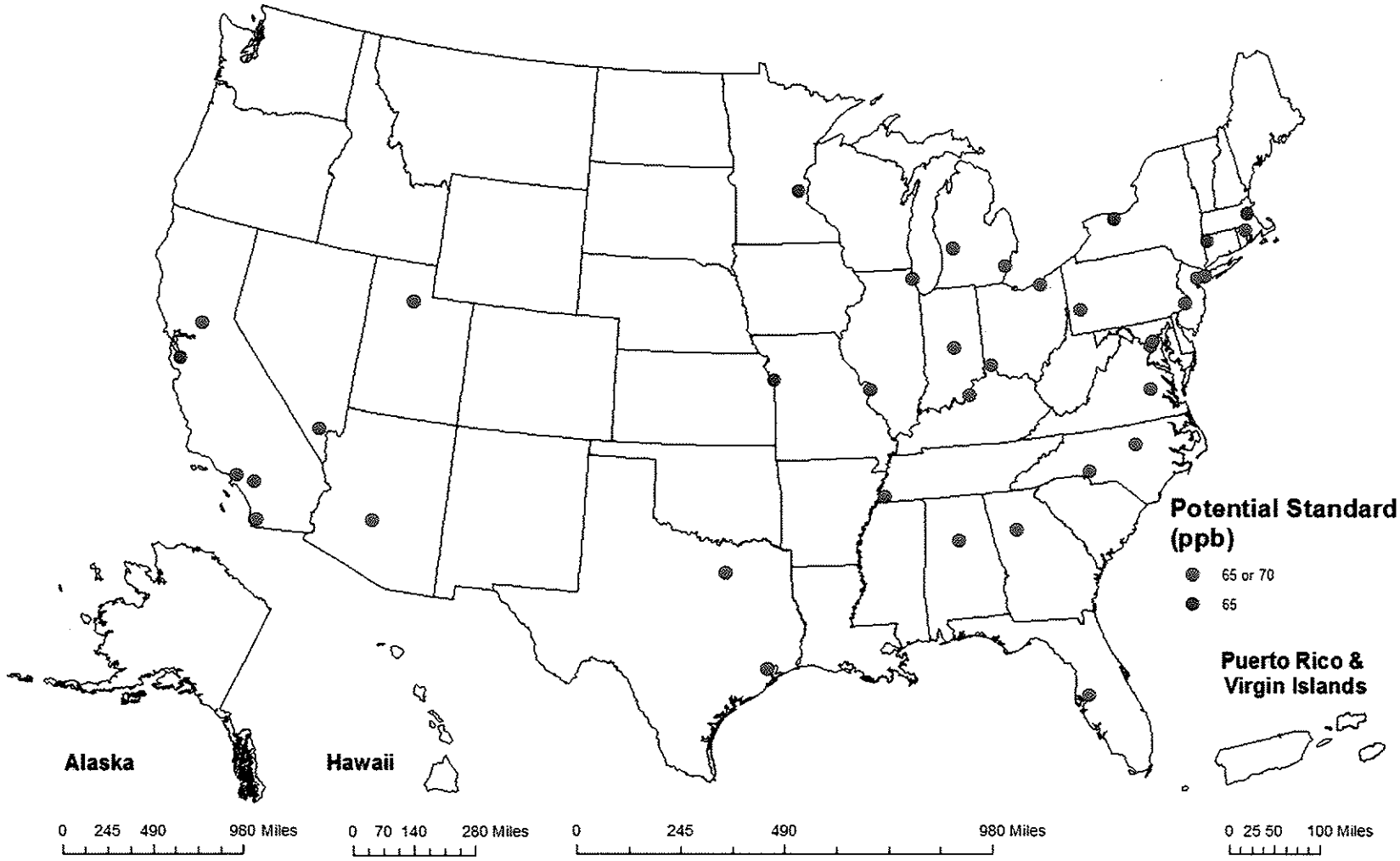


Figure 3. Summary of Potential PAMS Sites Under Option 3 (All NCore Sites in Non-attainment Areas with 1,000,000+ Population)

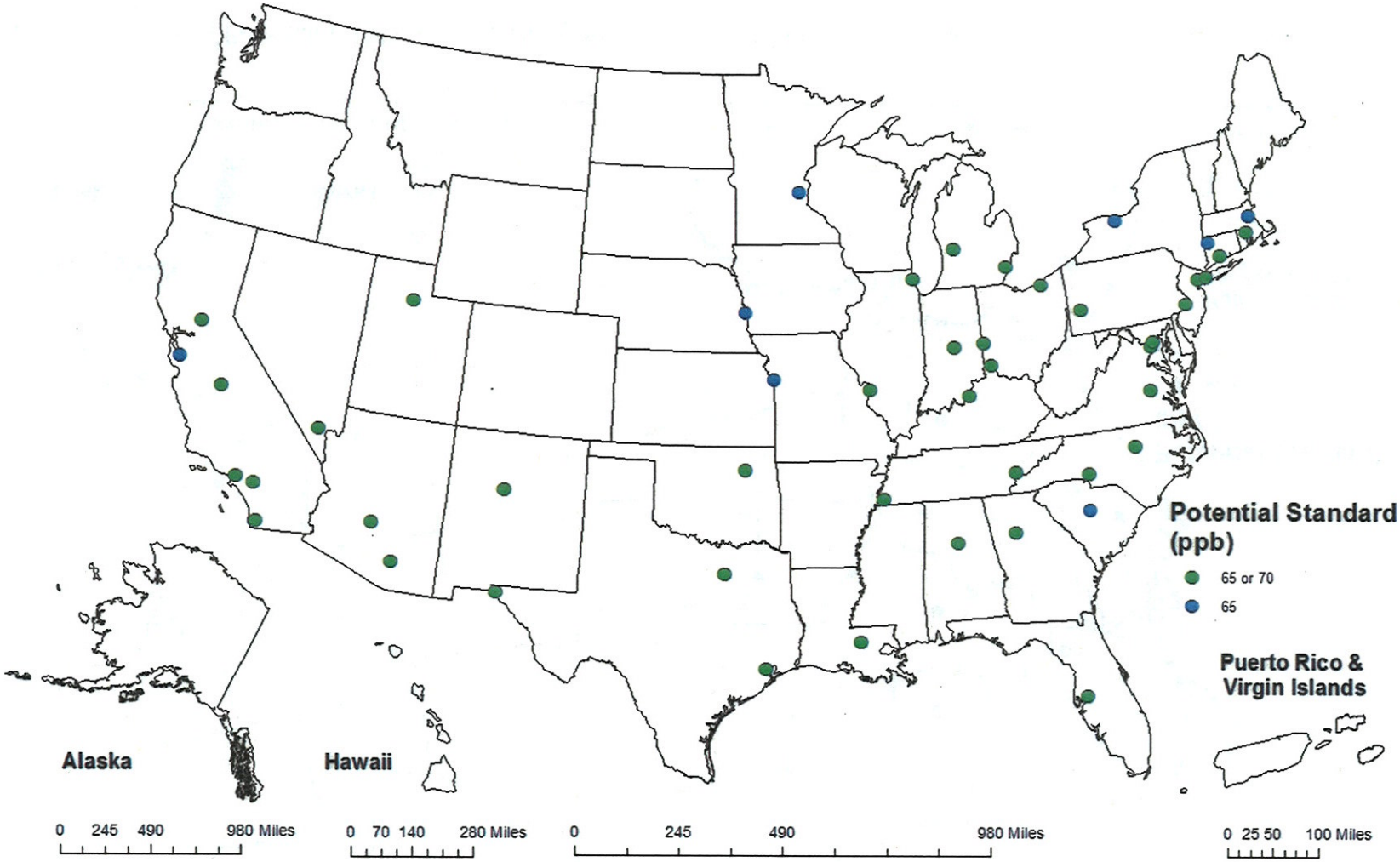


Figure 4. Summary of Potential PAMS Sites Under Option 3 (All NCore Sites in Non-attainment Areas with 750,000+ Population)

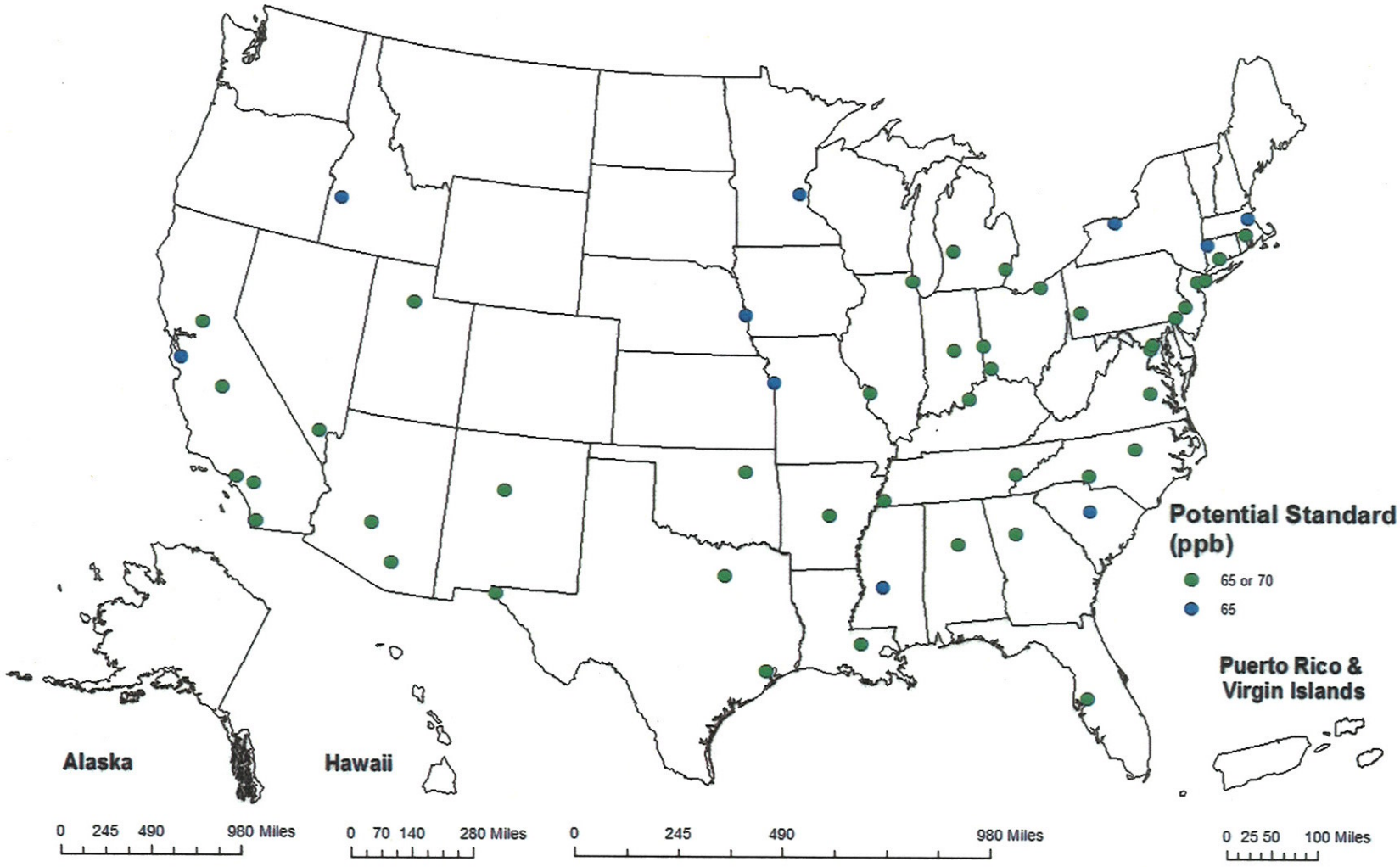


Figure 4. Summary of Potential PAMS Sites Under Option 3 (All NCore Sites in Non-attainment Areas with 500,000+ Population)