



# **Quality Assurance Guidance**

**PAMS Required  
Quality Assurance Implementation Plan**

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**Quality Assurance Guidance Document**

**PAMS Required**

**Quality Assurance Implementation Plan**

U.S. Environmental Protection Agency  
Office of Air Quality Planning and Standards  
Air Quality Assessment Division  
Research Triangle Park, NC 27711

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### *Acronyms and Abbreviations*

AMMS	Air Monitoring and Methods Subcommittee
AMTIC	Ambient Monitoring Technical Information Center
AQS	Air Quality System
CAA	Clean Air Act
CAP	Corrective Action Plan
CAPS	cavity attenuated phase shift
CASAC	Clean Air Science Advisory Committee
CBSA	Core-Based Statistical Area
DART	Data Analysis and Reporting Tool
DNPH	2,4-dinitrophenylhydrazine
DQI	data quality indicator
DQO	data quality objective
EMP	Enhanced Monitoring Plan
EPA	Environmental Protection Agency
GC	gas chromatograph
GLP	good laboratory practice
MQO	measurement quality objective
MSC	Monitoring Steering Committee
NAAMC	National Ambient Air Monitoring Conference
NAAQS	National Ambient Air Quality Standards
NACAA	National Association of Clean Air Agencies
NAS	National Academy of Sciences
NATTS	National Air Toxics Trends Stations
NIST	National Institute of Standards and Technology
NPAP	National Performance Audit Program
OAQPS	Office of Air Quality Planning and Standards
OTR	Ozone Transport Region
PAMS	Photochemical Assessment Monitoring Stations
ppm	part per million
PQAO	primary quality assurance organization
PT	proficiency test
QA	quality assurance
QC	quality control
QAIP	quality assurance implementation plan
QAPP	quality assurance project plan
QMP	quality management plan
QS	quality system
SLAMS	state and local air monitoring stations
SOP	standard operating procedure
STAG	State and Tribal Assistance Grant
TAD	technical assistance document
TSA	technical systems audit
UV	ultraviolet
VOC	volatile organic compound

## **1.0 Introduction**

The scope of this document is to address the implementation of the quality assurance (QA) program for the reengineering of the Photochemical Assessment and Monitoring Stations (PAMS) ambient air monitoring network, and specifically pertains to the quality system needed for the implementation of the “Required”<sup>1</sup> PAMS program. Implementing such a QA program requires awareness of timelines to execute the PAMS network in its entirety. As a result, there is natural overlap of timelines for implementing the QA program and the other technical aspects of the network. Timelines related to network implementation listed in this quality assurance implementation plan (QAIP) are estimates based on having all sites fully operational at the start of the PAMS season in June 2019. A separate document will more formally address the timelines and actions necessary to implement the technical portions of the PAMS Required network.

### **1.1 PAMS Program**

Section 182 (c)(1) of the Clean Air Act (CAA) required the Environmental Protection Agency (EPA) to promulgate rules for enhanced monitoring of O<sub>3</sub>, NO<sub>x</sub>, and volatile organic compounds (VOCs) for O<sub>3</sub> nonattainment areas classified as serious (or above) to obtain more comprehensive and representative data on O<sub>3</sub> air pollution. In addition, Section 185B of the CAA required the EPA to work with the National Academy of Sciences (NAS) to conduct a study on the role of O<sub>3</sub> precursors in tropospheric O<sub>3</sub> formation and control. As a result of this study, the NAS issued the report titled, “Rethinking the Ozone Problem in Urban and Regional Air Pollution”.<sup>2</sup>

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 PAMS in each O<sub>3</sub> nonattainment area classified as serious, severe, or extreme (“PAMS areas”). The first PAMS sites began operation in 1994 and have been in operation for over 20 years. Since the start of the program, there have been many changes to the nature and scope of the O<sub>3</sub> problem in the U.S., and of our understanding of it. The O<sub>3</sub> standard has been revised multiple times since the PAMS program was first implemented. On July 18, 1997, the EPA revised the O<sub>3</sub> National Ambient Air Quality Standards (NAAQS) to a level of 0.08 parts per million (ppm), with a form based on the 3-year average of the annual fourth-highest daily maximum 8-hour average O<sub>3</sub> concentration. On March 28, 2008 (73 FR 16436), the EPA revised the O<sub>3</sub> standards to a level of 0.075 ppm, with a form based on the 3-year average of the annual fourth-highest daily maximum 8-hour average O<sub>3</sub> concentration. On October 1, 2015 the EPA revised the O<sub>3</sub> NAAQS to a level of 0.070 ppm (effective Dec. 28, 2015), with a form based on the 3-year average of the annual fourth-highest daily maximum 8-hour average O<sub>3</sub> concentration. These changes in the level of the O<sub>3</sub> NAAQS, along with notable decreases in O<sub>3</sub> levels in most parts of the U.S. have changed the landscape of O<sub>3</sub> NAAQS violations in the U.S. At the time of the first round of designations for the 8-hour standards (June 15, 2005), only five areas were classified as serious or above against the 8-hour standards as compared to 22 areas that were

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<sup>1</sup> The document will use the term “Required” to indicate the 40 sites for which this document is being written.

<sup>2</sup> <https://www.nap.edu/read/1889/chapter/1>

classified as serious or above against the 1-hour standards (the latter removed in 1997). While the number of serious and above areas decreased, the number of nonattainment areas remained nearly the same. In addition to the change in the landscape of O<sub>3</sub> nonattainment issues, much of the equipment used at PAMS sites is outdated and in need of replacement. New technologies have been developed since the inception of the PAMS program that should be considered for use in the network to simplify procedures and improve data quality. EPA in 2006 permitted PAMS to be more customized and aligned with the needs of the responsible air quality organizations. Yet program needs continued to evolve and EPA determined that it would be appropriate to again re-evaluate the PAMS program.

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, including changes to required measurements and associated network design requirements. The EPA also requested advice on appropriate technology, sampling frequency, and overall program objectives in the context of the most recently revised O<sub>3</sub> NAAQS and changes to atmospheric chemistry that have occurred over the previous 10 to 15 years in the significantly impacted areas. The CASAC AMMS met on May 16 and May 17, 2011, and provided a report with their advice on the PAMS program on September 28, 2011 (U.S. EPA, 2011f).<sup>3</sup> In addition, the EPA met multiple times with the National Association of Clean Air Agencies (NACAA) Monitoring Steering Committee (MSC) to seek advice on the PAMS program. The MSC includes monitoring experts from various State and local agencies actively engaged in ambient air monitoring and many members of the MSC have direct experience with running PAMS sites.

Based on the findings of the PAMS evaluation and the consultations with the CASAC AMMS and NACAA MSC, the EPA proposed to revise several aspects of the PAMS monitoring requirements. The current objective of the PAMS air monitoring program is to provide data to evaluate and support the development of air quality models and track trends in ozone precursor concentrations so as to aid ongoing efforts to attain the ozone NAAQS. The final rule, promulgated on October 1, 2015, may be found in its entirety elsewhere.<sup>4</sup> The following are the highlights of the changes that occurred to the PAMS program as a result of the new regulations, which include: 1) network design, 2) VOC sampling, 3) carbonyl sampling, 4) nitrogen oxides sampling, and 5) meteorology measurements.

- **Network Design** - The first part of the network design change involved EPA requiring PAMS measurements minimally during the PAMS (summer) sampling season, which is June 1 through August 31, at all NCore sites in Core-Based Statistical Areas (CBSAs) with a population of 1,000,000 people or more. The final network design will result in approximately 40 “Required” PAMS sites, 14 of which are existing PAMS sites (see Table 1-1 and Figure 1-1 for detailed site information). The final requirements have waiver provisions which allow monitoring organizations to make PAMS measurements at

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<sup>3</sup> EPA-CASAC-11-010 [https://yosemite.epa.gov/sab/sabproduct.nsf/8412C8765AE2BC80852579190072D70A/\\$File/EPA-CASAC-11-010-unsigned-final.pdf](https://yosemite.epa.gov/sab/sabproduct.nsf/8412C8765AE2BC80852579190072D70A/$File/EPA-CASAC-11-010-unsigned-final.pdf)

<sup>4</sup> <http://www.noticeandcomment.com/EPA-HQ-OAR-2008-0699-fdt-33820.aspx>

alternative locations such as existing PAMS sites or existing National Air Toxics Trends Stations sites (NATTS) and to avoid being required to make PAMS measurements in areas with historically low O<sub>3</sub> concentrations. Therefore, the final site locations and network size may differ from what is shown in Table 1-1 and Figure 1-1. The second part of the network design requires states with moderate or above ozone nonattainment areas and states in the Ozone Transport Region (OTR)<sup>5</sup> to develop and implement Enhanced Monitoring Plans (EMPs). These EMPs are intended to provide monitoring organizations with the flexibility to implement additional monitoring to suit the needs of their area. EMPs will be addressed in the monitoring organization Implementation Plan (discussed in Section 2) and will not be further described within this document. Additional information may be found elsewhere.<sup>6,7</sup>

- The new regulations specify that the following parameters will be measured at PAMS Required sites:
  - **Volatile organic compounds (VOCs)** – It is strongly suggested that all Required PAMS sites take hourly speciated VOC measurements with auto-gas chromatographs (GCs). A complete list of the targeted compounds may be found in Table 1-2<sup>8</sup>. There is a waiver option to allow three 8-hour samples every third day (as an alternative to hourly speciated VOC measurements) at locations where auto-GCs may not be appropriate (e.g., where VOC concentrations are too low or where the predominant VOCs may not be measureable by the auto-GC technique). Based on EPA's evaluations of auto-GCs, some species in Table 1-2 may be removed from the final target list. Decisions on the final compound list will be made prior to decisions on the auto-GC purchases or canister sampling waivers. A national contract will be available for canister analysis.
  - **Carbonyls** - All Required PAMS sites will conduct carbonyl sampling with a frequency of three 8-hour samples on a one-in-three-day basis (~90 samples per PAMS sampling season). A complete list of the target carbonyl compounds may be found in Table 1-2. The TO-11A method, as used in the NATTS program<sup>9</sup> will be used for PAMS Required sites. Episodic carbonyl measurements are not a requirement for the Required sites, but such could be included in an EMP as it would be useful for air quality modelling. A national contract will be available for carbonyl analysis.
  - **Nitrogen Oxides** - All Required PAMS sites must monitor for NO and NO<sub>y</sub> (total oxides of nitrogen) in addition to true NO<sub>2</sub>, where the latter must be measured with a cavity attenuated phase shift (CAPS) spectroscopy direct-reading NO<sub>2</sub> instrument or a photolytic-converter NO<sub>x</sub> analyzer.

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<sup>5</sup> OTR includes Connecticut, Delaware, the District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Virginia.

<sup>6</sup> Summary of Final Photochemical Assessment Monitoring Stations (PAMS) Network Designs. September 25, 2015  
<http://www3.epa.gov/ttn/naaqs/standards/ozone/data/20150925cavender.pdf>

<sup>7</sup> Federal Register. Environmental Protection Agency. October 26, 2015. 40 CFR Parts 50, 51, 52, 53, and 58; [EPA-HQ-OAR-2008-0699; FRL-9933-18-OAR]; RIN 2060-AP38 National Ambient Air Quality Standards for Ozone (see footnote 4).

<sup>8</sup> The target list is still being reviewed and was not yet finalized at the time this document was written.

<sup>9</sup> See NATTS Technical Assistance Document for TO-11A method. Revision 3 of the TAD was not yet finalized at the time this document was written.

- **Meteorology Measurements** - All Required PAMS sites must measure wind speed and direction, temperature, humidity, atmospheric pressure, precipitation, solar radiation, ultraviolet radiation, and mixing height. Although EPA is suggesting the use of ceilometers for mixing height, other types of meteorological equipment that provide for an indication of mixing height can be proposed in the monitoring organization Implementation Plan (see Section 4.3.1). Sites may apply for a waiver to allow meteorological measurements to be obtained from other nearby sites (e.g., National Oceanic and Atmospheric Administration Automated Surface Observing System sites).<sup>10</sup>

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<sup>10</sup> There is a possibility that EPA may not have access to data from these sites.

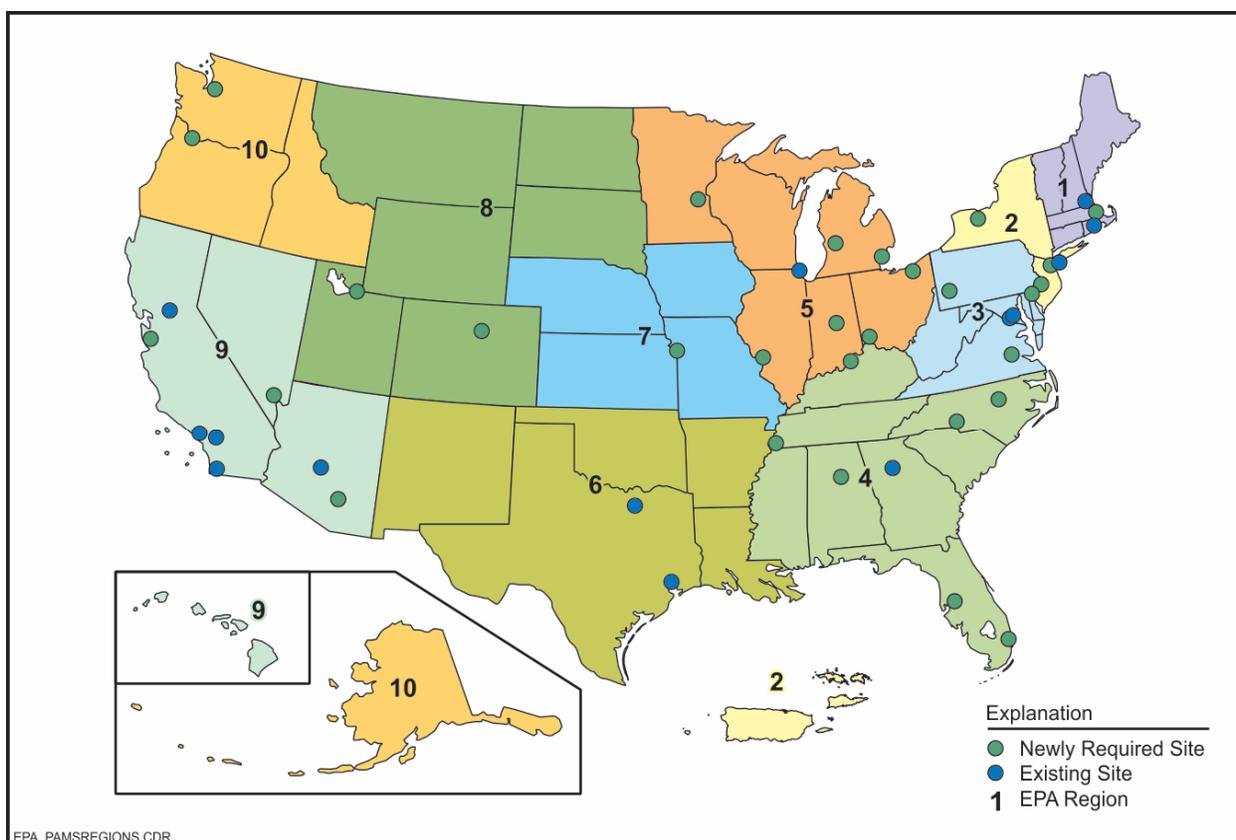
**Table 1-1. Required Sites in CBSAs with a Population Greater than 1,000,000<sup>11</sup>**

Region	State	PQAO	AQS ID	CBSA	Population	Existing PAMS?
1	MA	0660	25-025-0042	Boston-Cambridge-Newton, MA-NH	4,732,161	No
1	NH	0762	33-015-0018	Boston-Cambridge-Newton, MA-NH	4,732,161	Yes
1	RI	0907	44-007-1010	Providence-Warwick, RI-MA	1,609,367	Yes
2	NJ	0764	34-013-0003	New York-Newark-Jersey City, NY-NJ-PA	20,092,883	No
2	NY	0768	36-081-0124	New York-Newark-Jersey City, NY-NJ-PA	20,092,883	Yes
2	NY	0768	36-055-1007	Rochester, NY	1,083,393	No
3	DE	0294	10-003-2004	Philadelphia-Camden-Wilmington, PA-NJ-DE	6,051,170	No
3	DC	0350	11-001-0043	Washington-Arlington-Alexandria, DC-VA-MD	6,033,737	Yes
3	MD	1002	24-033-0030	Washington-Arlington-Alexandria, DC-VA-MD	6,033,737	Yes
3	PA	0861	42-101-0048	Philadelphia-Camden-Wilmington, PA-NJ-DE	6,051,170	No
3	PA	0021	42-003-0008	Pittsburgh, PA	2,355,968	No
3	VA	1127	51-087-0014	Richmond, VA	1,260,029	Yes
4	AL	0013	01-073-0023	Birmingham-Hoover, AL	1,143,772	No
4	FL	1328	12-011-0034	Miami-Fort Lauderdale-West Palm Beach, FL	5,929,819	No
4	FL	1328	12-057-3002	Tampa-St. Petersburg-Clearwater, FL	2,915,582	No
4	GA	0437	13-089-0002	Atlanta-Sandy Springs-Roswell, GA	5,614,323	Yes
4	KY	0584	21-111-0067	Louisville/Jefferson County, KY-IN	1,269,702	No
4	NC	0669	37-119-0041	Charlotte-Concord-Gastonia, NC-SC	2,380,314	No
4	NC	0776	37-183-0014	Raleigh, NC	1,242,974	No
4	TN	0673	47-157-0075	Memphis, TN-MS-AR	1,343,230	No
5	IL	0513	17-031-4201	Chicago-Naperville-Elgin, IL-IN-WI	9,554,598	Yes
5	IN	0520	18-097-0078	Indianapolis-Carmel-Anderson, IN	1,971,274	No
5	MI	0685	26-163-0001	Detroit-Warren-Dearborn, MI	4,296,611	No
5	MI	0685	26-081-0020	Grand Rapids-Wyoming, MI	1,027,703	No
5	MN	0700	27-003-1002	Minneapolis-St. Paul-Bloomington, MN-WI	3,495,176	No
5	OH	1259	39-061-0040	Cincinnati, OH-KY-IN	2,149,449	No
5	OH	0229	39-035-0060	Cleveland-Elyria, OH	2,063,598	No
6	TX	1035	48-113-0069	Dallas-Fort Worth-Arlington, TX	6,954,330	Yes
6	TX	1035	48-201-1039	Houston-The Woodlands-Sugar Land, TX	6,490,180	Yes
7	KS	0563	20-209-0021	Kansas City, MO-KS	2,071,133	No
7	MO	0588	29-510-0085	St. Louis, MO-IL	2,806,207	No
8	CO	0240	08-031-0025	Denver-Aurora-Lakewood, CO	2,754,258	No
8	UT	1113	49-035-3006	Salt Lake City, UT	1,153,340	No
9	AZ	0053	04-013-9997	Phoenix-Mesa-Scottsdale, AZ	4,489,109	Yes
9	AZ	0864	04-019-1028	Tucson, AZ	1,004,516	No
9	CA	0972	06-037-1103	Los Angeles-Long Beach-Anaheim, CA	13,262,220	Yes

<sup>11</sup> <http://www3.epa.gov/ttn/naaqs/standards/ozone/data/20150925cavender.pdf>

**Table 1-1. Required Sites in CBSAs with a Population Greater than 1,000,000 (Continued)**

Region	State	PQAO	AQS ID	CBSA	Population	Existing PAMS?
9	CA	0972	06-065-8001	Riverside-San Bernardino-Ontario, CA	4,441,890	Yes
9	CA	0942	06-073-0003	San Diego-Carlsbad, CA	3,263,431	Yes
9	CA	0145	06-067-0006	Sacramento-Roseville-Arden-Arcade, CA	2,244,397	Yes
9	CA	0086	06-085-0005	San Jose-Sunnyvale-Santa Clara, CA	1,952,872	No
9	NV	0226	32-003-0540	Las Vegas-Henderson-Paradise, NV	2,069,681	No
10	OR	0821	41-051-0080	Portland-Vancouver-Hillsboro, OR-WA	2,348,247	No
10	WA	1136	53-033-0080	Seattle-Tacoma-Bellevue, WA	3,671,478	No



**Figure 1-1. Estimated Locations of Required PAMS Sites per EPA Region Based on Final Network Design Requirements<sup>12</sup>**

<sup>12</sup> Source: <http://www3.epa.gov/ttn/naaqs/standards/ozone/data/20150925cavender.pdf>

**Table 1-2. PAMS Target Compound List**

Priority Compounds				Optional Compounds			
1	1,2,3-trimethylbenzene <sup>a</sup>	19	n-hexane <sup>b</sup>	1	1,3,5-trimethylbenzene	19	m-diethylbenzene
2	1,2,4-trimethylbenzene <sup>a</sup>	20	n-pentane	2	1-pentene	20	methylcyclohexane
3	1-butene	21	o-ethyltoluene <sup>a</sup>	3	2,2-dimethylbutane	21	methylcyclopentane
4	2,2,4-trimethylpentane <sup>b</sup>	22	o-xylene <sup>a,b</sup>	4	2,3,4-trimethylpentane	22	n-decane
5	acetaldehyde <sup>b,c</sup>	23	p-ethyltoluene <sup>a</sup>	5	2,3-dimethylbutane	23	n-heptane
6	acetone <sup>c,d</sup>	24	propane	6	2,3-dimethylpentane	24	n-nonane
7	benzene <sup>a,b</sup>	25	propylene	7	2,4-dimethylpentane	25	n-octane
8	c-2-butene	26	styrene <sup>a,b</sup>	8	2-methylheptane	26	n-propylbenzene <sup>a</sup>
9	ethane <sup>d</sup>	27	toluene <sup>a,b</sup>	9	2-methylhexane	27	n-undecane
10	ethylbenzene <sup>a,b</sup>	28	t-2-butene	10	2-methylpentane	28	p-diethylbenzene
11	ethylene			11	3-methylheptane	29	trans-2-pentene
12	formaldehyde <sup>b,c</sup>			12	3-methylhexane	30	$\alpha/\beta$ -pinene
13	isobutane			13	3-methylpentane	31	1,3 butadiene <sup>b</sup>
14	isopentane			14	acetylene	32	benzaldehyde <sup>c</sup>
15	isoprene			15	cis-2-pentene	33	carbon tetrachloride <sup>b</sup>
16	m&p-xylenes <sup>a,b</sup>			16	cyclohexane	34	ethanol
17	m-ethyltoluene <sup>a</sup>			17	cyclopentane	35	tetrachloroethylene <sup>b</sup>
18	n-butane			18	isopropylbenzene <sup>b</sup>		

Source: Revisions to the Photochemical Assessment Monitoring Stations Compound Target List. U.S. EPA, November 20, 2013

<sup>a</sup> Important SOAP (Secondary Organic Aerosols Precursor) Compounds

<sup>b</sup> HAP (Hazardous Air Pollutant) Compounds

<sup>c</sup> Carbonyl compounds

<sup>d</sup> Non-reactive compounds, not considered to be VOC for regulatory purposes

## 1.2 PAMS Field and Laboratory Activities

Since data for the PAMS network are used to aid in the evaluation of attainment of the ozone NAAQS, these data must be of known and acceptable quality. Therefore, a quality system will be developed to evaluate and control the quality of the PAMS data in order to make meaningful decisions with an acceptable level of confidence.

The PAMS monitoring program can be divided into a field and laboratory component. Below is a brief description of these field and laboratory activities.

**Field Activities:** All Required PAMS sites will make the following measurements, unless waiver options are granted by the EPA Regions by July 2017<sup>13</sup>: (1) hourly speciated VOC measurements with auto-GCs, (2) carbonyl sampling (three 8-hour samples on a one-in-three-day sampling frequency), (3) NO, true NO<sub>2</sub>, and NO<sub>y</sub> measurements, and (4) surface meteorology measurements including mixing height.

The following steps must be taken to ensure the quality of the data:

<sup>13</sup> The official due date for the annual network plan for PAMS, including any waivers is July 1, 2018. However, based on the activities needed to implement the program by June 2019, EPA suggests that monitoring organizations submit any waivers to EPA Regions by July 2017.

- Adhere to the PAMS regulations and standards, principles, and practices outlined in the national- and monitoring organization-developed PAMS Quality Assurance Project Plan (QAPP).

In addition, the following are recommended in order for data to be comparable across all required PAMS sites:

- Adherence to vendor operation manuals and national and monitoring organization developed field standard operating procedures (SOPs)
- Adherence to the national PAMS Technical Assistance Document (TAD) and monitoring organization laboratory SOPs
- Completion of training and initial readiness review for PAMS operators working with instrumentation as well as establishing training programs in out years due to monitoring staff turnover. Readiness reviews are described in Section 4.2.4.

The nationally developed QAPP and SOPs are discussed in Sections 2 and 4.

**Laboratory Activities:** Carbonyl samples will be analyzed in the laboratory by EPA Method TO-11A unless a continuous analyzer<sup>14</sup> is employed at the PAMS Required site for carbonyl measurements. Laboratory activities include sample receiving, sample handling, sample extraction and analysis, data entry/management, and archival activities. Specific detailed instructions will be found in the PAMS QAPP and SOPs which are described in Sections 2 and 4.

Similar to the field activities the laboratory activities must:

- Adhere to PAMS regulations and standards, principles, and practices outlined in the national- and monitoring organization-PAMS QAPP and/or monitoring organization QAPP.

In order for data to be comparable across all required PAMS sites, the following are recommended:

- Adherence to the vendor's operation manual for the proper operation of the analytical equipment
- Adherence to the national PAMS TAD and monitoring organization laboratory SOPs
- Completion of a training program for PAMS laboratories, if necessary.

**Data Quality Indicators and Measurement Quality Objectives:** PAMS monitoring leads met with the EPA modeling community in May 2016 to discuss the quality of the data required for model evaluation. This discussion led to technical compromise with what might be achievable to

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<sup>14</sup> At present continuous carbonyl analyzers are being developed but are expensive research-grade instruments not suitable for routine monitoring applications.

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what is considered more practicable for monitoring situations. For example, VOC canister sampling with laboratory analysis may produce lower detection limits and reduce bias and imprecision but would have a downside in that the sampling frequency would be lower (three 8-hour samples every 3 days). On the other hand, hourly VOC results from auto-GCs might be more biased or imprecise and have a higher detection limit but in the long run will likely be better able to evaluate models. With this in mind Table 1-3 provides the data quality indicators (DQIs) and measurement quality objectives (MQOs) for the parameters described in Section 1.1. Monitors and methods should be selected to meet the MQOs.

NOTE: This section will also briefly include the types of samples against which the MQOs will be evaluated but additional details will be included in the TAD and National QAPP.

**Table 1-3. PAMS Data Quality Indicators and Measurement Quality Objectives**

Method or Parameter	DQI				Source
	Bias (%)	Precision (%)	Detection Limit	Completeness (%)	
Auto-GC target compounds	25	15-25 <sup>15</sup>	0.5 ppbC	80	Completeness: Presentation Carol Meyer, ORSAT, August 10, 2016, NAAMC
True NO <sub>2</sub> and NO/NO <sub>y</sub>	10	10	0.001 ppm	75	Quality Assurance Handbook for Air Pollution Measurement Systems. Volume II. Ambient Air Quality Monitoring Program. May, 2013. <a href="http://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf">http://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf</a> Detection limit for low level NO <sub>2</sub> per 40 CFR Part 58 Appendix A indicates audit levels of 0.3 to 3 ppbv
Ozone	7	7	0.002 ppm	> 90% (avg) daily max available in O <sub>3</sub> season with min of 75% in any 1 year.	Quality Assurance Handbook for Air Pollution Measurement Systems. Volume II. Ambient Air Quality Monitoring Program. May, 2013. <a href="http://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf">http://www3.epa.gov/ttn/amtic/files/ambient/pm25/qa/QA-Handbook-Vol-II.pdf</a>
TO-11A (carbonyls)	25	15	0.1 µg/m <sup>3</sup>	85	Technical Assistance Document for the National Ambient Air Toxics Trends Stations Programs. October 12, 2015.
Meteorology	Accuracy		Resolution	Completeness (%)	Source
Ambient Temperature	±0.5 °C		0.1 °C	75	Quality Assurance Handbook for Air Pollution Measurement Systems. Volume IV: Meteorological Measurements Version 2.0 (Final). March 2008. <a href="http://www3.epa.gov/ttn/amtic/files/ambient/met/Volume_IV_Meteorological_Measurements.pdf">http://www3.epa.gov/ttn/amtic/files/ambient/met/Volume_IV_Meteorological_Measurements.pdf</a>
Relative Humidity	±5 %RH		0.5% RH		
Barometric Pressure	±1 hPa		0.1 hPa		
Wind Speed	±0.2 m/s + 5%		0.1 m/s		
Wind Direction	±5 degrees		1 degree		
Solar Radiation	±5%		1 Watt/m <sup>2</sup>		
UV Radiation	±5%		0.01 Watt/m <sup>2</sup>		
Precipitation	±10%		0.25 mm/hr		
Mixing Height	TBD		5 m	CL31 Ceilometer for Cloud Height Detection. Vaisala. <a href="http://www.vaisala.com/Vaisala/%20Documents/Brochures%20and%20Datasheets/CL31-Datasheet-B210415EN.pdf">http://www.vaisala.com/Vaisala/%20Documents/Brochures%20and%20Datasheets/CL31-Datasheet-B210415EN.pdf</a>	

<sup>15</sup> Type of check and acceptance criteria still under evaluation

### **1.3 Purpose of PAMS QA Implementation Plan**

Following the promulgated changes described in Section 1, EPA felt that it was necessary to review the PAMS QA program and tailor it to the needs of the Required network. Since the network will be required to be fully implemented at the start of the PAMS season in 2019, it was advantageous to develop a QAIP, this document, early in the process so as to increase the likelihood of attaining the implementation goal. This QAIP describes the monitoring requirements; the PAMS quality system (QS); the necessary QS actions; the schedule for these actions; and the individuals/parties responsible for implementing the QS for the PAMS Required sites.

More specifically, this QAIP:

- Provides summary information on the PAMS program
- Identifies each important phase of the QA program and explains how it will be implemented, including the various guidance documents to be written
- Identifies the roles and responsibilities of the stakeholder organizations
- Outlines the specific lines of communication between EPA, the monitoring organizations, and potential support contractors
- Establishes the pertinent milestones involved with the QA program
- Defines the resources needed for successful implementation of the QA program
- Identifies the logistical elements required for the QA program
- Describes assessments, including data evaluation and reporting components.

## 2.0 Roles and Responsibilities

The degree of complexity and the number of organizations involved with the PAMS monitoring program require that the flow of information and associated communication be structured to optimize the collective resources. The only realistic perspective on implementing this program is one that recognizes that deployment and operation of this network is a shared responsibility among all involved organizations. The purpose of this section is to describe the roles across the PAMS program, to define desirable communication pathways, and to outline basic responsibilities for all stakeholders.

To aid in the understanding of the roles and responsibilities, the various QS and technical documents that will be generated to guide the implementation and execution of the PAMS program are described below:

### **National Quality System Development for the PAMS Required Network:**

- **PAMS QAIP:** The PAMS QAIP is this document. The purpose of this QAIP is to describe the changes to the PAMS program monitoring requirements; the changes to the PAMS quality system; and the needed actions, schedule, and parties responsible for implementing the PAMS QA program for the PAMS Required Network.
- **PAMS TAD:** The TAD will present best practices and provide requirements for site placement, chemical and meteorological measurements, and reporting of PAMS network data, and is intended as an aid to the monitoring organizations responsible for implementing the PAMS program.
- **National PAMS QAPP:** The national QAPP will include information on data generation and acquisition, including sampling process design, sampling methods, sample handling, analytical methods, quality control (QC), and instrument testing, inspection, and maintenance. It will also include data validation and usability guidelines. The national QAPP is intended as an aid to the monitoring organizations. More details of this document will be provided in Section 4.
- **National PAMS SOPs (auto-GCs, carbonyls sampling and cartridge analysis, Ceilometer, true NO<sub>2</sub>):** The national SOPs will also be an aid to the monitoring organizations. They will describe general step-by-step instructions on how to collect PAMS data with ceilometers, true NO<sub>2</sub> instruments, auto-GCs, and with carbonyls samplers, and how to extract and analyze the 2,4-dinitrophenylhydrazine (DNPH) cartridges. More details of these SOP documents are provided in Section 4.
- **PAMS Technical Systems Audit (TSA) and Proficiency Test (PT) Programs:** The TSA program will outline the process for on-site reviews and inspections of a monitoring organization's PAMS network monitoring program to assess its compliance with established regulations and guidance governing the collection, analysis, validation, and reporting of PAMS data. The PT program will provide objective, quantitative assessments of data quality. More details of these programs are provided in Section 4.

## **Monitoring Organization Quality System Development for the PAMS Required Network:**

- **Monitoring organization PAMS Implementation Plan:** The monitoring organization Implementation Plan document will specify how the monitoring organization will perform the measurements for the Required Network. The plan will include details on activities such as monitoring site location, costs, and schedule of events, among other information. The plan will also include any waivers to siting or monitoring methods.
- **Monitoring organization PAMS QAPP:** The monitoring organization QAPP will include similar information as the national QAPP, but it should be more specific, detailed and focused on that monitoring organization's approach. Monitoring organizations may alternatively adopt the national QAPP and prepare an addendum detailing any deviations or exceptions to the national QAPP.
- **Monitoring organization PAMS SOPs:** The monitoring organization SOPs for its auto-GC, ceilometer, true NO<sub>2</sub> monitor, and meteorology instruments can include similar information as the national SOPs, but they should be more specific, detailed and focused to its selected instrumentation. SOPs for NO<sub>2</sub> measurements may be modified from the national SOP or state and local monitoring stations (SLAMS) SOPs; carbonyl SOPs may be adapted from the NATTS program. SOPs for other instrumentation not included for national development are intended to be developed by the monitoring organizations.

### **2.1 PAMS Required Network Workgroup**

A PAMS Required Network Workgroup will be formed to address the QA aspects of the PAMS Required Network. Members of the group will include personnel from the Office of Air Quality Planning and Standards (OAQPS), EPA Regions, and the monitoring organizations that will be implementing Required sites. The Required Network Workgroup will convene around May 2016 to start a dialogue on the aspects of the QAIP and the steps necessary to ensure a national QS is in place by the June 2019 implementation date. The Workgroup will meet approximately every month (to be decided) to discuss various QA issues.

The PAMS Required Network Workgroup will have the following responsibilities:

- Reviewing the draft PAMS QAIP and providing input, suggestions, comments, and questions
- Participating in the development and review of the draft PAMS TAD, national QAPP, and national SOPs
- Participating in the development and review of the PAMS TSA and PT programs
- Assisting in the development of training and readiness reviews.

During implementation of the PAMS Required program, the Workgroup will continue to meet to work through quality and technical issues that may arise, as appropriate. As the Required site

issues are addressed, the Workgroup can expand to include those monitoring organizations that will be developing EMPs.

## **2.2 EPA Office of Air Quality Planning and Standards (OAQPS)**

OAQPS has the overall responsibility for ensuring the quality of the nation's ambient air data including PAMS data. OAQPS has the following responsibilities:

- Providing for an overall monitoring lead and QA lead for the PAMS Required Network
- Finalizing the auto-GC comparison study and providing DQI results to EPA Regions and PAMS Required Network organizations
- Developing national contracts for auto-GCs, ceilometers, and true NO<sub>2</sub> instruments<sup>16</sup>
- Maintaining national contracts for VOC and carbonyl analysis
- Revising the PAMS target compound list (Table 1-2) based on auto-GC comparison data
- Providing individual or group discussions with EPA Regions and monitoring organizations to help them determine and/or select instrumentation
- Developing and finalizing the PAMS QAIP
- Developing and finalizing the PAMS TAD, national QAPP, and national SOPs
- Organizing and conducting training course(s) for auto-GC, ceilometers, and other equipment and technical activities, as needed
- Identifying necessary AQS reporting features for PAMS routine data and QC data
- Developing and implementing the PAMS TSA and PT Programs
- Setting TSA expectations and enforcing compliance.

## **2.3 EPA Regional Offices**

The EPA Regional Offices are the major communication link with both monitoring organizations and QAQPS. This role is absolutely necessary for the development of effective policies and programs. The Regional offices have the following specific responsibilities:

- Identifying a Regional PAMS QA Lead
- Participating in the PAMS Required Network Workgroup
- Reviewing and approving monitoring organization PAMS Required Network Implementation Plans and waiver requests
- Providing input, comments, review, and approval of the national PAMS Required Network QAPP, monitoring organization specific QAPPs, and reporting approval to AQS

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<sup>16</sup> EPA is looking into the option of developing national contracts.

- Distribution of funds and reallocating any remaining funding for other ozone-related work
- Implementing TSAs or participating in contractor supported TSAs
  - Identifying and communicating findings
  - Ensuring that corrective action plans (CAPs) are written and implemented (that findings are addressed)
  - Reporting TSA activity (not findings) to AQS

## **2.4 State, Local, and Tribal PAMS Required Network Monitoring Organizations**

State, local, and tribal monitoring organizations bear the majority of the responsibility for developing, implementing, and tracking the PAMS Required Network program. It is imperative that the monitoring organizations work with the EPA Regional Offices throughout this process to identify problems as early as possible, and to help find solutions to these issues. The monitoring organizations have the following specific responsibilities:

- Participating in the PAMS Required Network Workgroup
- Reviewing the PAMS QAIP and providing input, suggestions, and comments
- Developing and submitting their PAMS Required Network Implementation Plan
- Reviewing and providing input to the national PAMS QAPP, SOPs, and TAD
- Operating the sites in accordance with Code of Federal Regulations (CFR), and approved National QAPPs and SOPs.
- Preparing and submitting waivers, as needed
- Selecting and purchasing instruments to measure PAMS parameters off of national contracts<sup>17</sup>
- Developing their PAMS QAPP and submitting for EPA Regional review and approval
- Developing specific PAMS SOPs
- Attending field training courses, as necessary
- Performing internal audits in between national TSAs
- Developing and implementing CAPs based on TSA findings and internal/external audits
- Completing field implementation by June 2019.

It is realized that the above list is not definitive and that others activities, such as coordinating regular maintenance of the site and installed equipment, ongoing training, conducting and reporting the results of performance evaluation samples, developing QC programs to name a few, will be required to fully implement the PAMS monitoring program and should be described in the QAPP.

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<sup>17</sup> This would be for auto-GCs, ceilometers, and true NO<sub>2</sub> only.

## 2.5 PAMS Support Contractors

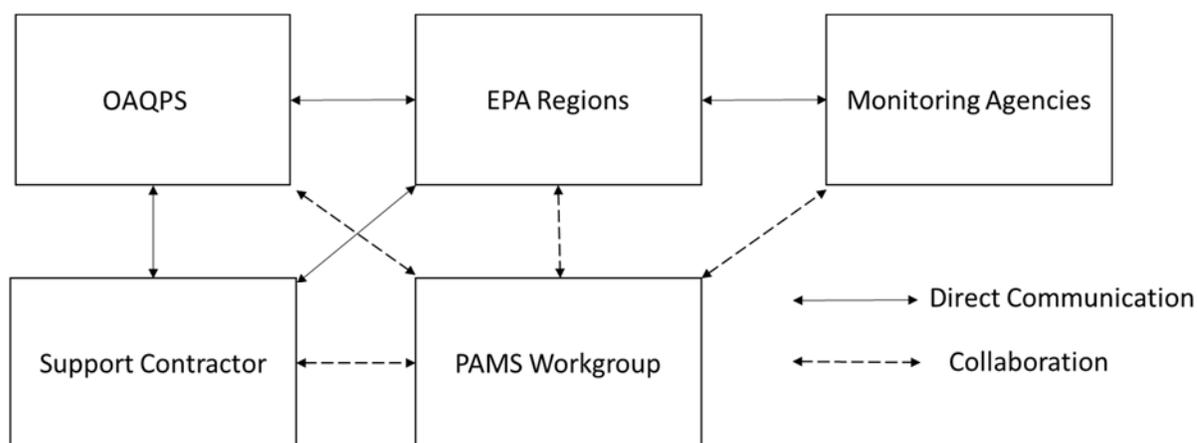
EPA will have support contractors to perform specific tasks associated with the PAMS Required Site Network program. Their responsibilities include, but are not limited to:

- Completing the auto-GC comparison
- Assisting in the development of the PAMS QAIP
- Facilitating PAMS Required Network Workgroup conference calls
  - Developing agendas
  - Summarizing conference call notes and identifying action items
- Assisting in the development of national PAMS guidance documents
  - Developing a draft PAMS TAD, national QAPP, and national SOPs
  - Submitting draft documents for review to PAMS Required Network Workgroup
  - Incorporating PAMS Required Network Workgroup comments and finalizing national documents
- Developing training modules for field, lab, and audit activities
- Developing nationwide PAMS TSA and PT Programs
  - Submitting draft programs to PAMS Required Network Workgroup
  - Incorporating PAMS Required Network Workgroup comments
  - Submitting final documents
- Executing and participating in TSAs with EPA Regions
  - Providing a yearly schedule of site evaluations for the EPA Regions
  - Providing technical oversight of the field activities by performing TSAs and ensuring national consistency in the audit process
  - Facilitating TSA follow-up
  - Working with Regional PAMS monitoring leads to review, evaluate, and closeout CAPs resulting from TSAs
  - Assisting monitoring organizations that need help implementing their CAPs
- Facilitating and executing the PT program
  - Informing monitoring organizations of upcoming PTs
  - Generating and distributing PT samples
  - Collecting and reporting results to EPA and monitoring organizations
  - Reporting results to AQS.

## 3.0 Communications

An organized communications framework is needed to facilitate the flow of information among the parties discussed in Section 2.0 as well as other users of the information produced by the PAMS network. Figure 3-1 represents the principal communications pathways. In general, OAQPS will be responsible for developing the program based on the regulation promulgated for the PAMS Required Network. OAQPS, through normal communication channels (solid arrows),

will communicate with the EPA Regional PAMS monitoring leads who will then communicate to their respective PAMS Required Network monitoring organizations. The EPA Regional PAMS monitoring leads will be responsible for informing OAQPS on QA issues that require attention. A second line of communication will be developed using the PAMS Required Network Workgroup. The Workgroup will collaborate on the implementation aspects of the PAMS Required Network QA program. The Workgroup may review and comment on the major QA implementation documents as well as discuss technical issues associated with the parameters to be measured. OAQPS will direct and monitor the work of the support contractor(s). The support contractors will facilitate PAMS Required Network Workgroup meetings, track technical issues, assist in the development of PAMS documentation and develop and implement the PT and TSA programs. In those efforts, there will be some communication between the support contractor and the EPA Regions and monitoring organizations. During the development and implementation of the program, EPA may provide funding for support contractors to communicate directly with monitoring organization and troubleshoot and consult on technical issues. The communication network will be described as it relates to planning, implementation, assessment, and reporting stages.



**Figure 3.1 Communication Pathways**

### **3.1 Planning (October 2015 through June 2019)**

During the planning stages, the PAMS Required Network Workgroup will be a major avenue of communication for the development of QA materials for the PAMS Required Network QA program. Technical discussions on the QA implementation aspects will take place on a regular basis in order to review and concur on the products developed by support contractors, monitoring organizations, EPA Regions, and OAQPS. A shared site (e.g., Dropbox or SharePoint) will be developed to allow PAMS Required Network stakeholders to review products being developed and to provide comments and revisions to those documents. On monthly PAMS Required Network Workgroup calls, comments made on documents the prior month will be discussed and issues resolved. The support contractors will take the lead in the development of the site and

develop a set of issues to be discussed on each call. Agendas for the call will be developed and e-mailed to Workgroup members one week prior to the call. The support contractor will also take notes and document issues discussed and resolved on the calls within one week of the call.

**Regional Communication with Monitoring Organizations** - Regional Offices have normal communication with monitoring organizations. This QAIP will not go into any detail on this level of communication. However, for the PAMS Required Network program, the monitoring organizations should have their final PAMS Required Site Network Implementation Plans finalized by July 2017,<sup>18</sup> inclusive of any waivers regarding siting, instrumentation/methods, and/or sampling frequencies, as applicable. Regions should approve monitoring organization final PAMS Required Site Network Implementation Plans by October 2017.

### **3.2 Implementation (beginning in June 2019)**

**National Communication** - During implementation, the PAMS Required Network Workgroup will remain the primary mode of national communication with participants in the program. EPA will continue monthly PAMS Required Network Workgroup calls to support the program until they are no longer needed. Call frequencies may be reduced based on input from the Workgroup. The support contractor will play the same roles as identified in the planning phase. Since program documentation will be completed, the contractor will elicit agenda items from the Workgroup for each call; topics of discussion may include updates, progress reports, and issue resolution. Any issues discussed that result in a change in how the PAMS program will be implemented will be posted on the Ambient Monitoring Technical Information Center (AMTIC) website and changed in program documentation, as necessary.

**Regional Communication** - Prior to implementation of the PAMS program, the EPA Regions will have worked with the monitoring organizations to develop an implementation schedule for their respective region.

### **3.3 Assessments (Beginning April 2018)**

During the assessment of the PAMS measurements data, the following communication avenues will be developed.

**National Communication** – OAQPS will communicate PT results to EPA Regions and monitoring organizations as well as post results to AMTIC and the shared site. QAQPS, the EPA Regional PAMS monitoring lead, and monitoring organizations will review PT results. During PAMS Required Network Workgroup conference calls, the data will be discussed as they relate to any observed trends (i.e., overall bias, bias of particular instruments), corrective action needed, or additional assessments, as applicable. PT results will be posted to AQS by the support contractor.

In addition, there is a need to assess the implementation of the QS of the PAMS Required Network Program. Although PAMS Required Network Workgroup calls may be reduced or

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<sup>18</sup> Plan is required to be submitted by July 1, 2018, but earlier submission is strongly encouraged.

possibly eliminated, OAQPS will devote one call annually to an assessment of the PAMS QS and ask for feedback from the EPA Regions and monitoring organizations. This feedback, as well as a summary of PT and TSA results, will be included in the Annual QA Summary Report. It is anticipated that OAQPS will convene a National Ambient Air Monitoring Conference (NAAMC) every two years. During this meeting, a session will be devoted to assessing the implementation of the PAMS program as well as the implementation of the PAMS Required Network QS.

**Regional Communication** - Detailed reviews and discussions of the PAMS PT data will occur at the EPA Regional/monitoring organization level. If data do not meet acceptance criteria, the Regions and monitoring organizations may decide to perform additional PTs as part of their root cause analysis and demonstration of return to conformance. Information on root causes and corrective actions will be forwarded back to OAQPS so that the PAMS program may be continuously improved.

Regions will store TSAs on an internal EPA SharePoint site for review and use by other EPA Regions and by OAQPS for program assessment and improvement. Monitoring organizations will also be asked to provide any internal assessments they have performed on the PAMS program to the Regions and to OAQPS.

**Support Contractors** - The support contractors will have communication with Regional PAMS monitoring leads on the implementation and conduct of PT programs and TSAs. Details of these activities are presented in Section 4. Findings during TSAs may involve support contractor communication with the monitoring organizations. Resolution of these issues should take place at the EPA Regions unless it affects the implementation of the program at a national level, which will then be discussed and resolved through OAQPS and EPA Regional communication.

### **3.4 Reporting (Beginning June 2019)**

It is critical to the success of the program that pertinent information is reported in a timely manner so as to drive improvements in the quality of routine PAMS data as well as to improve the implementation of the PAMS PT and TSA programs.

**National Reporting** – As discussed in Section 3.3, every year OAQPS will develop an Annual QA Summary Report that will provide a data summary of the QA activities performed during the calendar year and will include information that can be retrieved and assessed through AQS as well as overall assessments of the QS. The PT data, and high-level summary of important TSA results, will be included in this report. The PAMS Required Network Workgroup will have input to the content and structure of the report and will have the opportunity for internal peer review prior to distribution on AMTIC.

Every three years OAQPS will develop a QA report assessing three years' worth of QC data. This report differs in the yearly report in that it will be more interpretive and will integrate all facets of the QA program. The PAMS Required Network Workgroup will have input to the

content and structure of the report and will have the opportunity for internal peer review prior to distribution on AMTIC.

**Regional and Monitoring Organization Reporting** - Reporting at the Regional and monitoring organization level will reflect the current reporting policy or regulation established for the PAMS Network.

### **3.5 Ambient Monitoring Technology Information Center**

Another important avenue of communications on QA activities is AMTIC. AMTIC presently has an area devoted to PAMS monitoring and an area devoted to the PAMS PT program. Important information and guidance documents, once completed,<sup>19</sup> will be posted in these areas. EPA will utilize AMTIC extensively throughout the planning, implementation, assessment, and reporting processes.

### **3.6 Air Quality System**

AQS contains ambient air pollution data collected by EPA, state, local, and tribal air pollution control organizations from thousands of monitors. AQS also contains meteorological data, descriptive information about each monitoring station, quality control data, and TSA information. Support contractors and PAMS Required Network monitoring organizations will upload PT and routine/QA data, respectively, to AQS.

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<sup>19</sup> Documents at draft stages will be posted to a SharePoint site where PAMS Workgroup members can review and comment. Once finalized the documents can be uploaded to AMTIC.

## **4.0 Timelines and Milestones**

### **4.1 Planning/Implementation/Assessment/Reporting Time Lines**

In order to ensure that the PAMS program is implemented in 2019, it is expected that program milestones are reached in a timely and efficient manner. Figure 4-1 provides the key planning aspects of the Required Network program that must be completed to meet the required June 1, 2019 implementation date. Figures 4-1, 4-2 and 4-3 are color-coded to distinguish the entities primarily responsible for the activity or product:

- Green - EPA OAQPS and/or the EPA Regions
- Yellow - PAMS Required Network Monitoring Organizations
- Blue - PAMS Required Network Workgroup
- Orange - Support Contractor

Note that the complete Gantt chart in Figure 4-1 is split into two sub-charts; Figure 4-2 is specific to EPA OAQPS and Regions, Required Network Workgroup, and support contractor(s) responsibilities and Figure 4-3 is specific monitoring organization responsibilities. The major milestones include the following items:

- OAQPS will develop the national PAMS QAIP by October 2016
- OAQPS will write the PAMS TAD and the Auto-GC SOPs by July 2017
- OAQPS will write the PAMS national QAPP and remainder of the national SOPs by January 2018
- The EPA QA support contractor will develop the PAMS TSA and PT by April 2018
- Monitoring organizations should have their PAMS waivers and Required Network Implementation Plans finalized by July 2017 and must have them completed by the end of October 2017<sup>20</sup>
- Monitoring organizations should have their PAMS quality systems (QAPPs and SOPs) finalized by March 2019
- Monitoring organizations should have all field equipment installed and operational by October 2018
- Field, laboratory, and audit training will be complete by March 2019
- Readiness reviews (in preparation of PT and TSAs) will be conducted from April 2018 through March 2019 (depending on readiness of monitoring organizations)
- Each PAMS Required Network site should have analyzed at least one set of PT samples by June 2019
- Field implementation of routine monitoring will start by June 2019.

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<sup>20</sup> The regulation requires that monitoring organization Required Network IPs be developed in their Annual Network Plans due July 2018. However, in order to be operational by June 2019, it would be beneficial to have plans finalized by the end of October 2017.

A description of the major activities included in the timeline are provided below. Although development of many of the activities and products listed in Figure 4-1 are collaborative, those that are primarily the responsibility of EPA and QA support contractors will be included in Section 4.2 and those that are primarily the responsibility of the monitoring organizations will be located in Section 4.3. In addition, for each title of a subsection, the following indicator(s) are included:

- **EPA** - indicates EPA has primary responsibility
- **EPA-C** - indicates that EPA's support contractor has primary responsibility
- **MO** - indicates the monitoring organization has primary responsibility.

## **4.2 EPA Activities**

### **4.2.1 PAMS Quality Assurance Implementation Plan Due October 2016 - EPA**

This plan has been described in previous sections. It is developed as a succinct document describing what needs to take place, who needs to do it, and by when in order to meet the overall goal of network implementation by June 2019. It is also intended to describe EPA commitments to ensure adequate resources are available to achieve this goal. The document will be finalized by October 2016 and the timeline contained herein utilized to keep the program on track.

### **4.2.2 PAMS TAD and Auto-GC SOPs Due July 2017 - EPA**

The TAD will present best practices and detail requirements for the siting, sample collection, QA/QC procedures and samples, and reporting of PAMS network data. It is intended to be an aid to the monitoring organizations responsible for implementing the PAMS program. The delivery of the TAD will be the responsibility of the OAQPS PAMS Monitoring Lead. It will include a general description of the PAMS QS, the data quality objectives (DQOs), DQIs, and MQOs of the required measurements. It will be complemented by a more detailed national QAPP and SOPs (described below). It is realized that monitoring organizations will be making decisions on whether to implement auto-GCs or request a waiver for canister sampling. Therefore, SOPs for auto-GCs will be developed before any other SOPs or the national QAPP described below in order to provide monitoring organizations more time for review and decision making. OAQPS will provide SOPs for auto-GCs for vendors that have participated in the auto-GC comparison study, have achieved the MQOs (Table 1-3), and are participating in the national contract. The EPA QA support contractor will develop these SOPs in the EPA QA/G-6 SOP format. The TAD and auto-GC SOPs will follow the schedule below:

- The EPA Support contractor will submit a draft PAMS TAD and Auto-GC SOPs to OAQPS by February 2017
- The PAMS Required Network Workgroup and QAQPS will have three months to review the documents (review by May 2017)
- The EPA support contractor will finalize the documents and OAQPS will distribute them by July 2017.

### 4.2.3 PAMS National QAPP/Additional SOPs Due December 2017 - EPA

**National QAPP** - Similar to the Chemical Speciation Network, OAQPS will develop a generic QAPP for the implementation of the “major aspects” of the PAMS Required Network QS. The delivery of the QAPP will be the responsibility of the OAQPS PAMS QA Lead. This national QAPP will not explain all facets of the QA program since the monitoring organizations have established QSs to suit their monitoring needs which are unique to their programs. Table 4-1 provides a list of the QAPP elements that will be provided in the national QAPP. EPA will address all elements but focus primarily on those in black font. Monitoring organizations will add detail to those elements highlighted in red.

**Table 4-1. PAMS National QAPP Elements<sup>21</sup>**

QAPP Element	
A1	Title and Approval Sheet
A2	Table of Contents
A3	<b>Distribution List</b>
A4	Project/Task Organization
A5	Problem Definition/Background
A6	Project/Task Description
A7	Quality Objectives and Criteria for Measurement Data
A8	<b>Special Training Requirements/Certification</b>
A9	<b>Documentation and Records</b>
B1	Sample Process (Network) Design
B2	Sampling Methods Requirements
B3	<b>Sample Handling and Custody Requirements</b>
B4	Analytical Methods Requirements
B5	Quality Control Requirements
B6	<b>Instrument/Equipment Testing, Inspection &amp; Maintenance</b>
B7	Instrument Calibration and Frequency
B8	<b>Inspection/Acceptance Requirements for Supplies and Consumables</b>
B9	Data Acquisition Requirements for Non-direct Measurements
B10	<b>Data Management</b>
C1	Assessments and Response Actions
C2	Reports to Management
D1	Data Review, Validation, and Verification Requirements
D2	Validation and Verification Methods
D3	Reconciliation and User Requirements

With the inclusion of SOPs (either within the QAPP or by reference), EPA will consider this QAPP “approvable” if the monitoring organization signs the QAPP approval page affirming that it will implement the national QAPP and SOPs as written and submitted. Items unique to the monitoring organization that are not addressed within the national QAPP will need to be addressed by addendum. If the monitoring organization does not plan on signing the national QAPP it should submit its own QAPP to the EPA Regions by July 31, 2018.<sup>22</sup> In addition, the monitoring organization QAPP should identify what elements of the national QAPP it is not intending to follow and the suggested alternative procedure(s). The EPA QA support contractor

<sup>21</sup> The National QAPP will focus on the items listed in black font.

<sup>22</sup> Monitoring Organization QAPP must be submitted and approved prior to June 1, 2019 Implementation.

will contribute to and facilitate the QAPP development process. The creation of the national QAPP will follow the schedule shown below.

- The PAMS Required Network Workgroup will convene in January 2017 to start the development of national QAPP sections
- EPA and its support contractor will complete a draft by July 2017
- The PAMS Required Network Workgroup will have three months to review and provide comment on the draft QAPP (review by October 2017)
- EPA and its support contractor will revise the draft document and OAQPS will distribute the final QAPP by the end of December 2017.

**National SOPs** - SOPs for ceilometers, true NO<sub>2</sub> instruments, carbonyl samplers, and carbonyl extraction and analysis by Compendium Method TO-11A will also be generated. These national SOPs will follow the development schedule below.

- EPA and its support contractor will draft the SOPs by July 2017
- The PAMS Required Network Workgroup and QAQPS will have three months to review and provide comment on the SOPs (review by October 2017)
- EPA and its support contractor will revise the draft SOPs and OAQPS will distribute final SOPs by the end of December 2017.

#### **4.2.4 PAMS TSA and PT Programs Due April 2018 - EPA-C**

Similar to the NATTS program, the support contractor will develop a TSA program and a PT program.

A TSA is an on-site review and inspection of a monitoring organization's ambient air monitoring program to assess its compliance with established requirements governing the collection, analysis, validation, and reporting of ambient air quality data.

To increase the uniformity of TSAs, the support contractor will develop checklists for field site and laboratory audits for inclusion in the national PAMS QAPP. The checklists will incorporate elements from the PAMS Required Network TAD and national QAPP and SOPs. TSAs of sites will focus on siting criteria, Qs, compliance with QS documents, and interviews of staff responsible for data generation, equipment calibration, day-to-day operations including sample collection (handling and custody), meteorology, and data management. Laboratory audits will focus on Qs, compliance with QS documents, performance of analytical methods, sample handling and custody, and data reporting. Similar to the NATTS program, it is expected that the EPA Regions and the EPA support contractor will perform TSAs of the PAMS Required Network sites and supporting laboratories.

The TSA program will formally begin in June 2019 once sites are online and monitoring has begun. To assist sites to complete implementation and to assess sites' readiness prior to the implementation deadline, the support contractor, along with the Regions, will conduct readiness

reviews at 20 of the 40 PAMS Required Network sites prior to program implementation. These readiness reviews are intended to serve as a technical assistance audit, and are not meant to be a formal TSA with audit findings. Rather, these reviews will identify areas which are not yet in compliance with the PAMS TAD, QAPP, and/or SOPs, and will provide an opportunity for process improvements and will help to identify the actions required and resources needed so that sites are fully operational by June 1, 2019. Following program implementation, each site will be audited every three years. Since not every site will have its own laboratory, laboratories supporting multiple PAMS sites will be subject to audit in the calendar year that the supported PAMS sites are audited but will not be audited more than once every three years unless major audit findings suggest more frequent auditing is necessary.

The PT program will evaluate the PAMS Required Network sites and/or laboratories for measurement bias, specifically for VOCs and carbonyls. Assessment of measurement bias for nitrogen oxides will be covered via the National Performance Audit Program (NPAP).

The EPA support contractor will execute the PT program. The contractor will prepare VOCs and carbonyls samples for shipment to either the field site (VOCs) or to the support laboratory (carbonyls) on an annual basis. VOC PT samples will be prepared in an electropolished or fused silica-lined canister at a known concentration that is blind to the site. Carbonyl PT samples will be prepared by spiking DNPH cartridges with known amounts of target analytes that are blind to the support laboratory. Sites or support laboratories will analyze the PT sample(s) on the auto-GC (VOCs) or via their TO-11A method (carbonyls) and will report the concentrations to EPA's support contractor who will compile the reported concentrations for evaluation against the nominal spiked value and against the overall PAMS Required Network average (with outliers removed). Sites or laboratories not meeting the acceptance criterion for bias (to be defined in the national PAMS TAD and/or QAPP) are expected to take corrective action to address the nonconformance.

Below is a general outline of the actions and timeline for the PAMS TSA and PT programs.

- The EPA support contractor will develop the nationwide PAMS TSA and PT programs by November 2017
- The PAMS Required Network Workgroup will have three months to review the PAMS TSA and PT programs (review by February 2018)
- The EPA support contractor will finalize the TSA and PT programs by April 2018
- The EPA support contractor will provide PT samples to operational labs and sites starting April 2018
- The EPA support contractor and EPA Regions will conduct readiness reviews at 20 of the 40 PAMS Required Network sites between April 2018 and March 2019
- The EPA support contractor and EPA Regions will conduct TSAs at each site once every three years starting June 2019

#### **4.2.5 Field, Lab, and TSA Audit Training - Implemented February 2017 through March 2019 - EPA & EPA-C**

Training will focus on the updated aspects of the PAMS Required Network program, which include the auto-GCs, true NO<sub>2</sub> instruments, ceilometers, and on the meteorological measurements not currently required at NCore sites, including atmospheric pressure, precipitation, solar radiation, and ultraviolet (UV) radiation. Due to the complexity involved in selecting, setting up, and operating auto-GCs, EPA will conduct auto-GC informational training in early 2017 to aid monitoring organizations in the auto-GC selection process. EPA will solicit advice from the PAMS Required Network Workgroup to help define the training needs for the PAMS Required Network program. An objective discussion of the current PAMS program implementation and data quality issues, and what is needed to improve the program, is key to developing the training activities that will help to achieve the DQOs for the Required Network program. In addition to field and laboratory training, EPA will include some level of TSA training. Monitoring organizations can use the TSA training to develop their own internal auditing capability. The training will inform the monitoring organizations on aspects evaluated during a TSA and what might be considered major findings requiring immediate corrective action. The TSA audit training will also benefit EPA Regional staff who may have limited technical expertise in the PAMS parameters. EPA currently is considering three (east coast, middle, and west coast) 4-day training sessions with the agenda to be developed by the PAMS Required Network Workgroup. The following steps will be followed to implement the training activities:

- The PAMS Required Network Workgroup will discuss training topics June 2016 through October 2017
- EPA will conduct auto-GC informational training between February and May 2017
- Monitoring organizations should have decided on monitoring equipment by October 2017. In November 2017 the EPA support contractor will collect information on the types of field equipment and laboratory methods used in the PAMS Required Network program to determine training needs for development
- The PAMS Required Network Workgroup will generate a final list of training topics by December 2017
- EPA and its support contractor will develop training materials by September 2018
- EPA and its support contractor will conduct field and laboratory training from October 2018 through March 2019
- EPA and its support contractor will conduct TSA training from October 2018 through March 2019

#### **4.2.6 Data Quality Assessments and Reporting Due June 2019 - EPA & EPA-C**

**Automated data quality indicator report** - As part of the PAMS QA program, EPA will work with the PAMS Required Network Workgroup to develop an automated QA report for VOCs and carbonyls similar to the DQI reports (e.g., AMP-256) used for the SLAMS criteria pollutants.

Although the Data Analysis and Reporting Tool (DART) is being revised and is expected to include some automated data quality evaluations, EPA will need to mimic those evaluations in AQS and/or develop new evaluations.

In addition to the automated report, as the Required Network PAMS program gets underway it is important to be evaluating data early in the program to determine the quality of data among the Required Network sites. As an example: as new auto-GCs are being deployed it will be important to evaluate the DQIs of each instrument at each site. Therefore, an annual PAMS QA Report will be developed that evaluates the DQIs by site, method, monitoring organization, and primary QA organization (PQAO). The report will also include a list of TSAs accomplished for the year, general findings, pertinent program revisions, and important discussion and action items by the PAMS Required Network Workgroup. The following steps will occur in order to develop the appropriate assessments and reports:

- The PAMS Required Network Workgroup will discuss assessment and reporting topics from October 2017 through September 2018
- EPA and its support contractor will develop a “mock” annual QA report for PAMS Required Network Workgroup review by December 2018
- The PAMS Required Network Workgroup will review the DART application and determine what assessments are “transferrable” to AQS by January 2019
- EPA and its support contractor will work with the AQS team to develop QA transactions for PT results and confirm QA transactions for other quality control samples by March 2019
- EPA and its support contractor will ensure that AQS reports will be available for use by April 2019
- EPA and its support contractor will revise the annual QA report by June 2019. First use would be for calendar year 2019 data.

## **4.3 Monitoring Organization Implementation Responsibilities**

### **4.3.1 Required Network Implementation Plans and PAMS Waivers Due July 2017<sup>23</sup> – MO**

Each monitoring organization will develop a brief implementation plan of the Required Network PAMS site that the monitoring organization may choose to include in its annual monitoring network plan. This Required Network IP must include the final site location, the types of instruments to be installed, and frequency of measurements that will be made at the site. The Required Network Implementation Plans will state the methods and procedures that are being followed as stipulated in the final PAMS rule, national PAMS QAPP, and the PAMS TAD. If any deviations or procedural differences are desired, a waiver must be developed to discuss said differences. The waivers will be in the form of a one or two-page technical memo that describes the need for the waiver, the proposed alternative procedure, and the rationale defending the waiver. It will be submitted to the EPA Regional Administrator for review and approval. Waivers may be submitted with the Required Network Implementation Plan or as standalone documents.

The final PAMS rule has waiver provisions which allow monitoring organizations to make PAMS measurements at alternative locations such as existing PAMS sites or existing NATTS sites and to avoid being required to make PAMS measurements in areas with historically low O<sub>3</sub> concentrations. In addition, it is expected that auto-GCs will be used for VOC measurements in order to report hourly measurements. One alternative to auto-GCs will be to collect three sequential 8-hour canister samples, once every three days. Monitoring organizations must request a waiver from use of auto-GCs along with appropriate rationale. Auto-GC monitoring systems will entail work and require a level of expertise which may not be currently available to monitoring agencies so development of this implementation plan two years before 2019 monitoring will provide time to address the technical needs for this monitoring. Table 1-3 provides the MQOs for the VOCs. It may be useful to determine the VOC concentration at the site with canister sampling prior to auto-GC decision making to determine if the auto-GC will be sensitive enough to detect the site concentrations. Such information can help justify the waiver.

- Monitoring organizations will submit the draft Required Network IP and any waivers to EPA Regional offices by May 2017. Note that the regulation requires that the draft IPs be submitted by July 2018; however, in order to be operational by June 2019, the organizations should plan to submit their implementation plans by May 2017
- The EPA Regions will have one month to review the waivers and draft Implementation Plans (May 2017 through June 2017)
- The monitoring organizations will have an additional one month (June 2017 through July 2017) to revise and finalize the Implementation Plans before submitting them for final approval.

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<sup>23</sup> As mentioned earlier, the regulatory requirement for the Implementation Plan is July 1, 2018, but it is strongly encouraged that these plans be submitted by July of 2017.

- The EPA Regions will have three months to approve the final waivers and Implementation Plans (July 2017 through October 2017)

#### **4.3.2 Monitoring Organization Quality Systems QMPs, QAPPs, and SOPs Due March 2019 – MO**

Monitoring organizations must have proper QS documentation in place prior to the implementation of new or revised monitoring activities. The three documents discussed in this section include quality management plans (QMPs), QAPPs, and SOPs.

**QMP** - describes the QS in terms of the organizational structure, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, and assessing activities involving environmental data collection. The QMP is not specific to any particular project, but related to how the monitoring organization implements its QS. Usually monitoring organizations performing ambient air monitoring have a QMP in place and will not require modification for the PAMS Required Network monitoring activity. However, EPA will require that QMP approval dates be included in AQS to document that the monitoring organization has an approved QMP.

**QAPP** - a formal document describing, in comprehensive detail, the necessary QA/QC and other technical activities that must be implemented to ensure that the results of work performed will satisfy the stated performance criteria, which may be in the form of a DQO. The QAPP is specific to a particular monitoring project. SOPs are part of the QAPP development process and are vital to the quality of any monitoring program. The QAPP must be detailed enough to provide a clear description of every aspect of the project and include information for every member of the project staff, including field scientists, lab staff, QA staff, and data reviewers. The QAPP facilitates communication among clients, data users, project staff, management, and external reviewers. As indicated in Section 4.2.3, EPA will develop a national PAMS Required Network QAPP for this activity. However, there will be some sections that will be specific to each monitoring organization that cannot be addressed by the national Required Network QAPP. Therefore, some material will need to be augmented by the monitoring organization.

**SOPs** - written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps, and are the officially approved method for performing certain routine or repetitive tasks. As indicated in Sections 4.2.2 and 4.2.3, EPA will develop national PAMS Required Network SOPs for auto-GCs which have been shown to meet the MQOs of the program, in addition to SOPs for ceilometers, some meteorological parameters, true NO<sub>2</sub> analyzer, and carbonyl sampling and analysis. Other field and laboratory SOPs will be the responsibility of the monitoring organizations.

- Monitoring organizations should submit QMPs (if necessary), and draft PAMS QAPP/SOPs to EPA Regions by August 2018
- Regions will review the monitoring organization QAPPs by November 2018
- Monitoring organizations' QMPs and QAPPs will be finalized and fully approved by March 2019

- Monitoring organizations should develop their SOPs for existing and new equipment by August 2018 and finalize them by March 2019

#### **4.3.3 Field Equipment - Installed and Operating by March 2019 – MO**

It is expected that all field related equipment, samplers/monitors will be installed by October 2018 for shakedown, testing, and training in order to be ready for full implementation by June 2019. The following action items may assist in meeting that goal:

- Monitoring organizations should complete the equipment inventory on the PAMS Required Network SharePoint site by October 1, 2016. This inventory will inform OAQPS of equipment needs in the Required Network and where resources are best allocated to acquire new equipment.
- Monitoring organizations should gather existing PAMS instrumentation from May 2017 through April 2018 and evaluate their usefulness for the Required Network. As instruments are gathered, monitoring organizations are encouraged to update the inventory on the Required Network SharePoint.
- EPA will set up meetings with monitoring organizations to discuss results of the PAMS auto-GC comparison from October 2016 through February 2017 to help monitoring organizations in their decision making. Some of the auto-GCs in the comparison will meet to MQOs described in Table 1-3 and national contracts will be developed for monitoring organization selection (if so desired). However, monitoring organizations should be familiar with the typical ambient concentrations at their particular site to determine if the auto-GCs will be sufficiently sensitive. Therefore, some canister sampling may need to occur to get an idea of concentrations at the required site.
- Monitoring organizations should purchase new capital equipment (e.g., auto-GCs, true NO<sub>2</sub> monitors, and ceilometers) during the May 2017 through April 2018 period. National contracts should be available by November 2017. It is strongly suggested that equipment setup, calibration, and training be included in any new acquisition of equipment particularly for auto-GCs and ceilometers.<sup>24</sup>
- Monitoring organizations should install existing and new instrumentation in the field from April 2018 through October 2018.
- Monitoring organizations should conduct instrument performance shakedowns from October 2018 through May 2019.

#### **4.3.4 Monitoring Organization Internal Technical Systems Audit - Completed by May 30, 2019 - MO**

It is suggested that monitoring organizations conduct a TSA of the monitoring process prior to full implementation to ensure that the June 2019 implementation date is met. This audit could be performed in coordination with the readiness reviews performed by the EPA support contractor

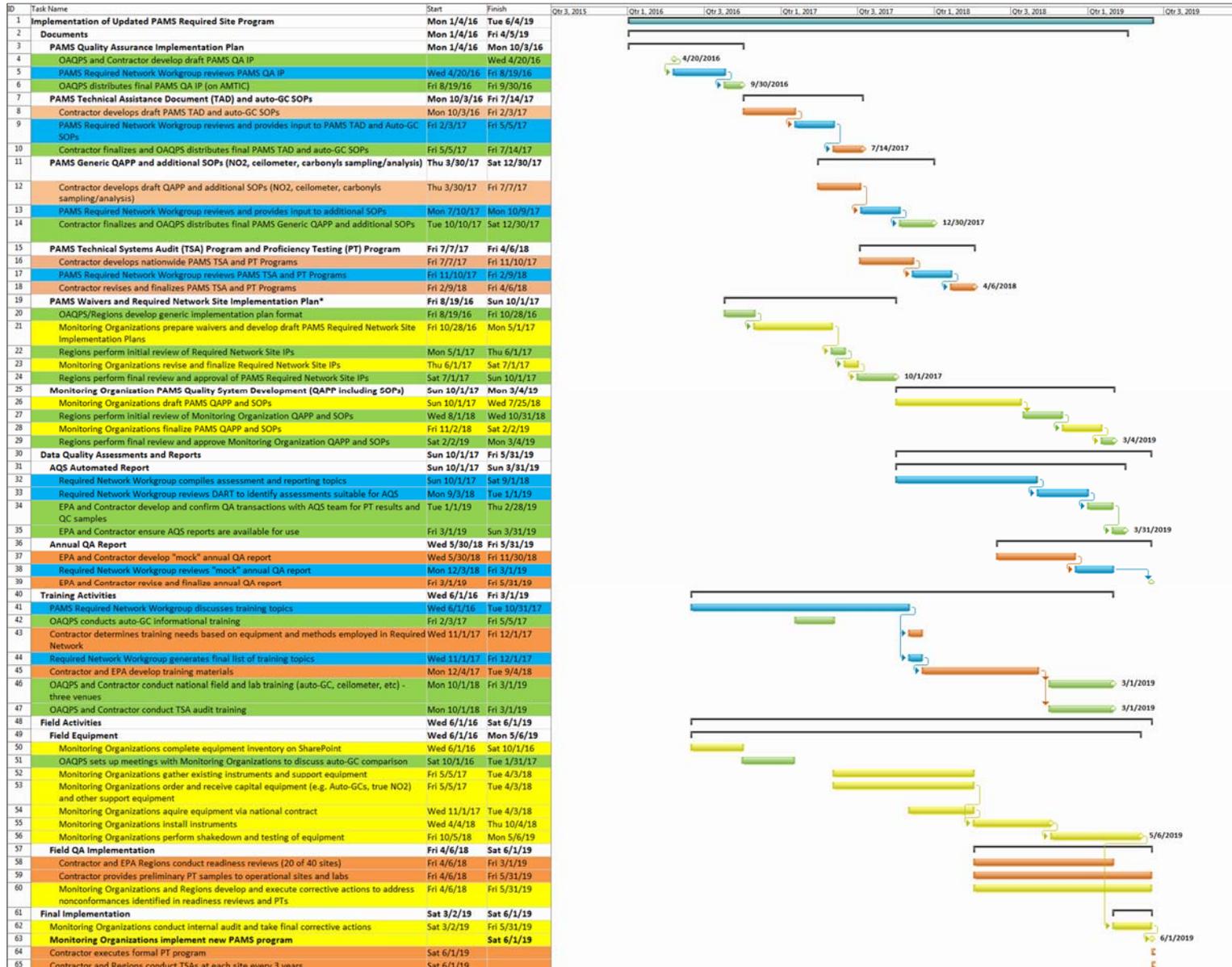
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<sup>24</sup> If national contracts are developed, EPA will include these activities in the purchase prices.

and the regions. Monitoring organizations should prepare an audit report that should be submitted to the Region.

#### **4.3.5 PAMS Implementation - at Required Network Sites by June 1, 2019 - MO**

Monitoring shall begin on June 1, 2019.



\*The regulation requires that monitoring organization Required Network Implementation Plans be developed in their Annual Network Plans due July 2018. However, in order to be operational by June 2019, it would be beneficial to have the plans finalized by October 2017 as proposed in this Gantt chart.

Figure 4-1. Planning Timeline – EPA, Monitoring Organizations, Workgroup, and EPA Contractors

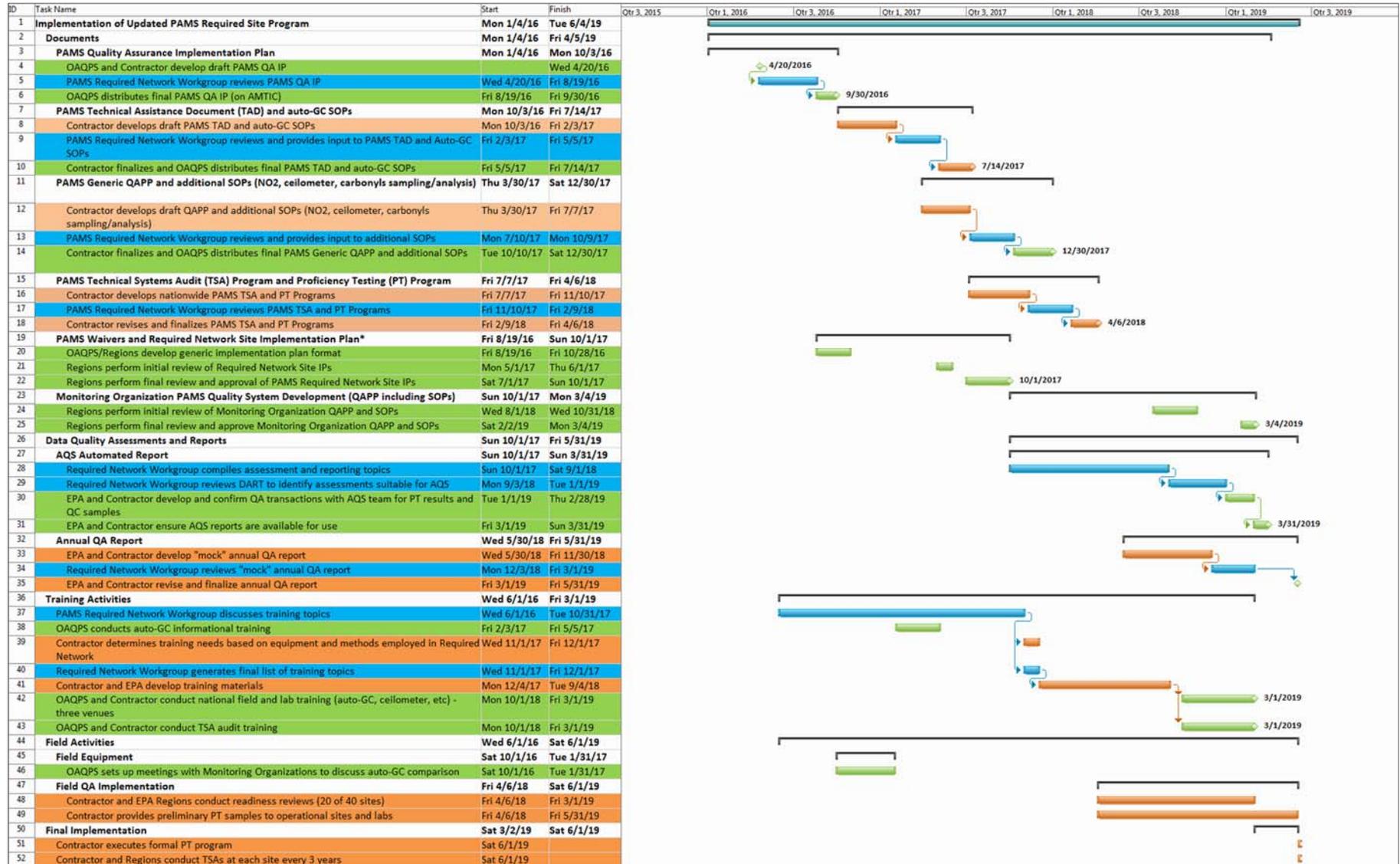


Figure 4-2. Planning Timeline – EPA, Workgroup, and EPA Contractors

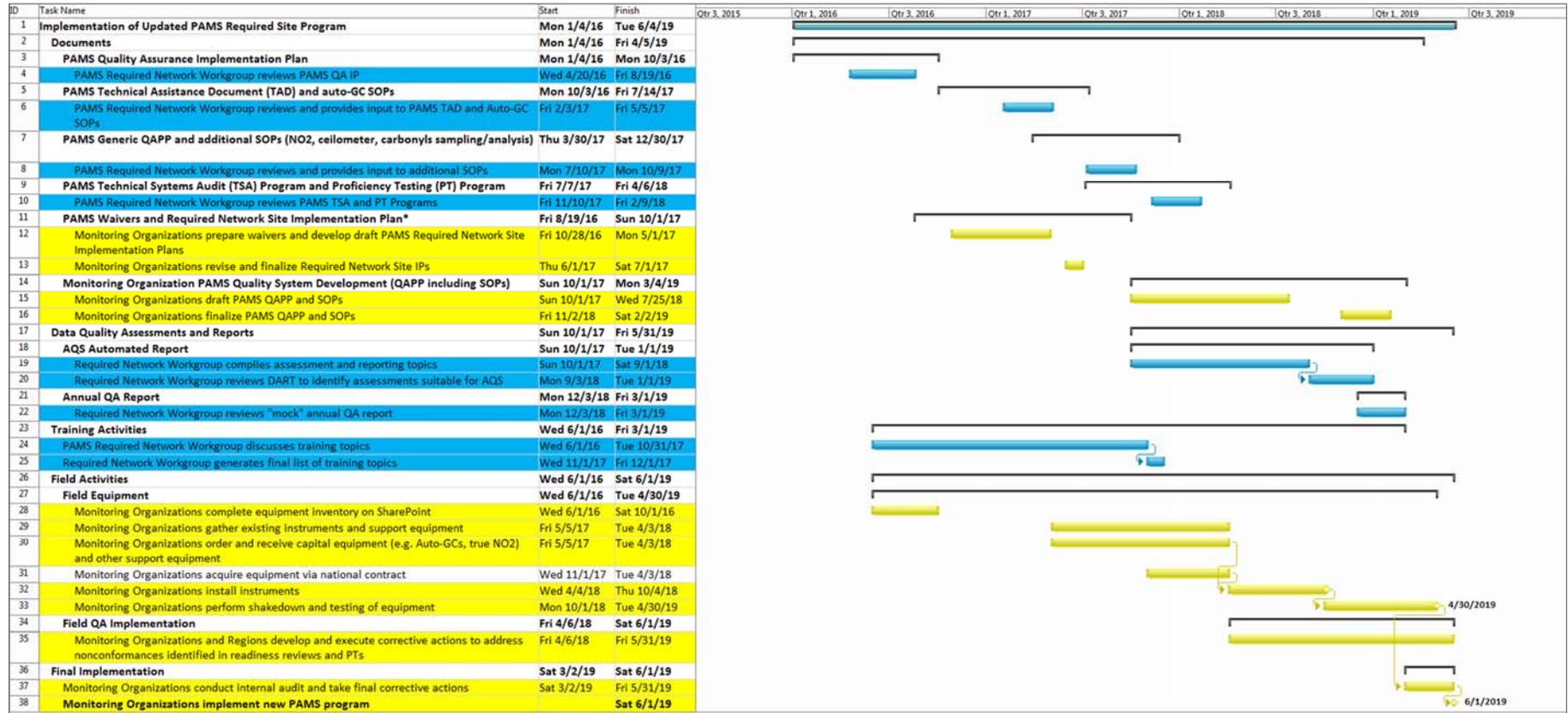


Figure 4-3. Planning Timeline – Monitoring Organizations and Network Workgroup

## **5.0 Resources to Implement External QA Program**

Presented in this section are estimates of the resources necessary to execute only the PAMS QA program and the majority of the discussion is focused on resources needed by the EPA QA contractor to provide the products and training needed from 2016 until June of 2019. It is not intended to provide a full discussion on the resources needed to implement the entire PAMS Required Network. The majority of the QA program will be implemented by the monitoring organizations and the resources need by the monitoring organizations are not discussed in this section. It is noted that any cost identified in this section is EPA's best estimate at the time of development of this document.

### **5.1 QA Activities Requiring Resources**

The following planning, implementation and reporting activities will require resources:

#### **Planning**

- Development of the PAMS QAIP
- Development of a national QAPP and SOPs
- Development of the PAMS TAD
- Facilitation of PAMS Required Network Workgroup calls
- Development of field, lab, and TSA training modules
- Development of PT program
- Development of TSA checklists
- Conduct of readiness reviews, shakedown audits, and initial PTs

#### **Implementation**

- Distribution of PTs
- Implementation of TSAs
- Facilitation of Required Network Workgroup calls
- Revision of Required Network program documents

#### **Reporting**

- Annual QA reports
- Triennial QA reports
- Quality control evaluation reports (AQS AMP reports or DART)

### **5.2 Source of Funds**

There will be two sources of funds used for the PAMS Required Network QA program:

- State and Tribal Assistance Grant (STAG) Funds (105) - The majority of the resources needed to fund the QA program will come out of STAG funds since EPA will require the assistance of support contractors to develop and implement the QA activities and products described in Section 4. EPA will work with the EPA Regions to provide

estimates of the resource needs to EPA management on an annual basis. Such estimates will then be reflected in the EPA Annual Program Plan.

- EPA Environmental Program Funds - These are internal EPA funds that will be used to fund travel for EPA Regions or OAQPS to travel to sites for training or to conduct TSAs.

### 5.3 Resource Estimates

Table 5-1 provides an estimate for the development of the QA activities and products described in Section 5.1. The hours are only estimates of support contractor time and do not include efforts by EPA and the PAMS Required Network Workgroup.

**Table 5-1. Resource Estimates for PAMS Required Network QA Program 2016 - 2019**

Activity/Product	Hours	\$/year/site	One Year	Recurring
<b>Planning</b>				
PAMS QAIP	300		X	
National QAPP	200		X	
National SOPs (auto-GC, ceilometer, meteorology) <sup>1</sup>	200		X	
QA portion of PAMS TAD	100		X	
Facilitation of PAMS QA Workgroup calls	40			X
Develop TSA program (including checklists)	120		X	
Develop PT program	160		X	
Training modules (field, lab, TSA) <sup>2</sup>	300		X	
Training session (field, lab) - 3 one-week classes + preparation <sup>3</sup>	320		X	
<b>Implementation</b>				
VOCs and carbonyls PTs		\$2,000		X
TSAs <sup>4</sup>	1500			X
<b>Reporting</b>				
Annual report	200			X
Production of QC reports	300		X	
Triennial report	250			X

<sup>1</sup> Estimate based on preparing SOPs for three auto-GCs, one ceilometer, and meteorology

<sup>2</sup> Estimate based on training for auto-GCs, ceilometer, meteorology, and TSA conduct

<sup>3</sup> Training on out years as requested

<sup>4</sup> Hours to conduct TSAs at 1/3 of the PAMS Required Network sites each year (~120 hours per site)

One time annual costs for program development are estimated at approximately \$350,000 with costs distributed across 2016 through June 2019 (approximately 2000 hours per the table above, plus another 60 h per readiness review audit for 20 audits is a total of 3200 hours @ \$100/h plus travel costs). Recurring costs (starting after 2019 implementation) would be about \$250,000 for

facilitating QA Workgroup calls, TSAs, the implementation of the PT program, and the annual and triennial summary reports.

## **5.4 QA Program Equipment and Standards**

This section will describe any QA resources needed to implement the external QA program. Additional details will be given in the PAMS Required Network TAD.

**Gaseous Standards** – Gas standards will be required to prepare the VOC PT samples. These will be purchased from a reputable supplier and will be accompanied by a certificate of analysis indicating the concentrations of the individual target analytes. Such gas standards should be traceable to National Institute of Standards and Technology (NIST) standards.

**Meteorological Standards for TSAs** – Separate instruments against which meteorological measurements could be compared will include those for wind speed, wind direction, temperature, relative humidity, solar radiation (including ultraviolet radiation), and barometric pressure.

**Flow Transfer Standards for TSAs** – Flow transfer standards will be required to independently verify the flow rates of the carbonyls sampling units. Such transfer standards will have a calibrated flow range covering flow rates utilized in carbonyls sampling in the PAMS Required Network.

## **5.5 Training Resources**

Prior to implementation in June 2019, personnel involved in the field, lab, and audit aspects of the PAMS program will have an opportunity to receive training. National training is scheduled from October 2018 through March 2019. Resource estimates are for three training courses (east coast, middle country, west coast), each lasting four full days. Since training will be implemented after monitoring organizations have selected their auto-GCs, training could be set up based strictly on distance to the training site, or it could be set up by the use of one particular model of auto-GC. The PAMS Required Network Workgroup will provide input on the best process to implement the training sessions.

As mentioned in previous sections, national training activities will primarily be focused on the implementation of auto-GCs, true NO<sub>2</sub> instruments, ceilometers, and TSAs. The PAMS Required Network Workgroup will provide additional input on training needs. Training resources will include:

- **Instrument Vendors** - The following provide opportunities for vendor implemented training:
  - **National Ambient Air Monitoring Conference (NAAMC)** - EPA expects that many of the instrument vendors for PAMS programs will attend these biannual meetings and EPA anticipates that hands-on training may be available. This training would be no cost to the monitoring organization other than the cost to travel to the conference.

- **National Training** (see Section 4.2.5) - depending how the training is organized; vendors may attend the three national training sessions intended to train monitoring organizations on their instrument(s). Vendor costs may be associated with this training which are not reflected in Table 5-1.
- **Monitoring Organizations** - Depending on how the auto-GC and ceilometer instruments are purchased (national contract versus individual monitoring organization purchase) it is advantageous to include vendor-provided instrument setup and training in the purchase price (not reflected in Table 5-1).
- **Support Contractor** - The EPA support contractor(s) will become familiar with the current PAMS program and will become familiar with the auto-GCs, true NO<sub>2</sub> instruments, ceilometers, and meteorological parameters since they will be charged with developing national SOPs. They are also expected to participate in the training and their costs are included in Table 5-1.

### **Additional Out Year Training**

It is expected that there will be turnover in PAMS implementation personnel and the need for additional training beyond the pre-implementation training. The PAMS Required Network Workgroup will determine whether training is needed for the following year in time to develop training materials and determine the resources required to implement the training.

### **Additional Out Year Resource Needs**

As part of reporting and annual network reviews, capital equipment should be reviewed and put on replacement schedule (replacements approximately every 7 years) to ensure equipment remains viable.

## **5.6 Technical Systems Audit Resources**

Once the program is implemented, TSAs will take place during the PAMS sampling season, nominally between the months of June and September. As much as possible, PAMS TSAs will be scheduled in concert with NCore, NATTS, or other program audits at the site or laboratory to reduce the burden on monitoring organizations, reduce contractor costs (if NATTS and PAMS TSAs can occur within the same week), and to leverage EPA Regional staff time such that TSAs for multiple programs can be covered concurrently.

The bulk of the recurring costs is the estimate of 120 hours for each TSA (40 hours/audit including travel to and from the site and 80 hours of preparation/summary reporting/follow-up/close out) for the QA contractor to conduct one-third of the TSAs (40 sites/3 = ~13 TSAs/year) each year. In some cases, the EPA Regions will conduct these TSAs without EPA contractor support so this estimate is conservative and reflects the contractor performing all 13 annual audits. As the program planning progresses, these estimates may change.

### **5.6.1 TSA Site Selection**

Required Network PAMS sites that are anticipated to be up and running by June 2019 will comprise the pool of sites from which the initial one-third of the entire PAMS network will be selected for TSA in the first year of implementation. From this pool of sites, those that have or are expected to have ozone concentrations around the NAAQS will be prioritized for TSA in the first year.

For each site, a site data sheet may be developed that contains information such as:

AQS site ID	PAMS equipment at site
Site GPS coordinates	Monitoring organization contact
Monitoring organization	Safety concerns
Street address	Closest hospital (address)
Additional equipment needed	Important free form notes
Closest PAMS site	Second closest PAMS site

### **5.6.2 TSA Visit Schedule**

As the site implementation activities progress toward the June 2019 deadline to begin monitoring, it is anticipated that sites which are online and ready to begin monitoring and data collection activities will be identified and will populate the list of the initial 33% of the network selected for TSA. For subsequent years, the next 33% of the PAMS network sites subject to TSAs will be determined no later than December of the preceding year TSAs are to occur. The Regional PAMS monitoring lead and the support contractor(s) will attempt to determine the most efficient site visit schedule so as to maximize EPA Region staff time to conduct site TSAs or site visits for other monitoring programs such as NATTS, NCore, etc. concurrently with the PAMS TSA.

The list of the selected third of the PAMS network to be audited will be disseminated to each participating monitoring organization at the beginning of the calendar year and posted on AMTIC. Conducting TSAs at 13 sites scattered across the country over the course of the three-month sampling season demands that the TSA schedule maximize efficiency for auditor travel. It is anticipated that TSAs for sites and/or supporting laboratories close in proximity will be scheduled such that travel time is minimized.

During PAMS implementation, the support contractor and EPA PAMS monitoring and QA leads will meet regularly to discuss progress as it relates to the site TSA schedule. The schedule will be updated as required and monitoring organizations will be contacted if the schedule changes.

One month and then one week prior to an evaluation visit, the field scientist and/or PAMS monitoring lead will contact the monitoring organization as a reminder and ensure the monitors are operating on schedule and inquire about any particular site access problems where special equipment will be needed. Details of the audit, such as where and when to meet the routine operator, will be discussed.

### **5.6.3 Initial Readiness Review Audit**

As PAMS sites begin to come online (as soon as October 2017 for some pre-existing PAMS sites), such sites will be visited by the support contractor and/or the EPA Region to review the QS documentation, operator training, equipment, and siting to make sure the sites are on track to be in compliance for the June 2019 implementation date.

### **5.6.4 Routine TSAs**

Audits performed after the June 1, 2019 implementation will include review of the following activities: planning, field operations, QA/QC, data management, and reporting. Audit reports will present and describe nonconformances and will rank them in order of their potential impact on data quality. For findings having an impact on data quality, monitoring organizations are expected to implement corrective actions. EPA Regions will provide the final TSA reports to the monitoring organizations. More details on this activity will be included in the PAMS Required Network National QAPP.

The monitoring organizations are expected to create CAPs as an outcome of the TSA for nonconformances noted. The EPA support contractor and/or EPA Region may assist in development of the CAP; however, the responsibility of implementing the corrective action lies with the monitoring organization. The support contractor will facilitate TSA follow-up and aid monitoring organizations that require assistance with compliance. The support contractor (or EPA Regions if audit conducted by EPA) will report to AQS the occurrence of an audit one week after the audit. The EPA Region will follow up on corrective action.

## **5.7 Reporting Resources**

Section 4.2.6 provides a discussion of the three types of reports that will be developed at the national level.

**Automated AQS Report** - For the automated report, it is expected that one-time resources of about 300 hours would be necessary to program this report capability. Any additional modification and improvements would be implemented by the EPA National Air Data Group and not require additional resources.

**Annual QA Report** - The annual QA report will aggregate the QC data available in AQS and provide a national assessment of data quality. Although the PAMS Required Network Workgroup will assist on the details of the report, it is expected to be brief (10-15 pages), interpretative, and somewhat similar from one year to the next in order to simplify data comparisons. Therefore, it is expected that development of the report would require resources of no more than 200 hours per year.

**Triennial QA Report** - Every three years OAQPS will develop a QA report assessing three years' worth of data. This report differs from the annual report in that it will be more interpretive and will integrate all facets of the QA program including internal QC, PTs, TSAs,

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and lessons learned over the years of implementing the program. The report will be very similar to the three-year PM<sub>2.5</sub> report<sup>25</sup> and will compare data quality across monitoring organizations, as well as methods used in the program. Since this report will build off the annual reports, it is expected that development of the report would require resources of no more than 250 hours every three years.

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<sup>25</sup> <https://www3.epa.gov/ttn/amtic/anlqa.html>