**I. Title of Task Order:** Air Quality Modeling Assessment Tools (**AQMAT**) Development

**II. Task Order Contracting Officer’s Representative (TOCOR):**

Carey Jang

EPA/OAR/OAQPS/AQAD/AQMG

MC: C439-01, 109 T.W. Alexander Drive

RTP, NC 27711

Tel: (919) 541-5638

**III. Period of Performance:**

The Period of Performance for this Task Order begins on the date the Contracting Officer signs the approved Task Order. The Period of Performance will include a 12-month base period and two 12-month option periods. The Period of Performance concludes on the termination date of the contract, in accordance with this task order and any subsequent call order modifications.

**IV. Background:**

1. **Overview:**

Over the last decade, EPA has engaged in the development of a series of air quality modeling assessment tools (AQMAT) to support air quality management and regulatory policy analysis, for example, the Modeled Attainment Test Software (MATS) and environmental Benefits Mapping and Analysis Program (BenMAP).EPA has recently developed an enhanced and upgraded version of Software for Modeled Attainment Test-Community Edition (SMAT-CE) ([*https://www.epa.gov/scram/photochemical-modeling-tools*](https://www.epa.gov/scram/photochemical-modeling-tools)) in replacing the legacy MATS. EPA has also developed and released a new version of BenMAP-Community Edition (BenMAP-CE) *(*[*http://www.epa.gov/air/benmap-ce.html*](http://www.epa.gov/air/benmap-ce.html)*)* in replacing the legacy BenMAP. The software development team re-designed the legacy MATS and BenMAP into open-source and public community-owned tools, using a modern software language (C#) and geographic information system (GIS) under a user-friendly Graphical User Interface (GUI). The targeted users of SMAT-CE and BenMAP-CE include decision makers, policy analysts, and scientists among the Federal, State, and local air quality community as well as international community. The EPA will continue to update and improve the current versions of SMAT-CE and BenMAP-CE which will be released to the public community periodically.

Built upon the successful development of BenMAP-CE and SMAT-CE, EPA has also developed a series of modeling assessment tools to enhance its functions and strength for providing regulatory modeling support, including (1) a state-of-the-art model visualization and analysis tool (Model-VAT) to provide multi-scale and multi-model data graphical and statistical analysis capabilities, (2) a standalone “Data Fusion” Tool (DFT) to provide spatial field interpolation for fusing scattered monitoring data and gridded model data spatially together, and (3) an Response Surface Modeling – Visualization and Analysis Tool (RSM-VAT) to provide a near real-time assessment of air quality changes to emissions control. EPA also plans to develop new integrated air quality modeling assessment tools for supporting effective air quality assessment and management.

1. **Purpose:**

The purpose of this Task Order (TO) is to assist EPA in developing and upgrading a suite of Air Quality Modeling Assessment Tools (**AQMAT**) for supporting regulatory modeling efforts. This “AQMAT” development effort is an expansion and extension of the previous assessment tools development project to provide an integrated assessment of air emissions control cost and its associated air quality attainment and health benefits. Under this TO, EPA plans to initiate efforts to develop new and upgrade existing modeling assessment tools, including (1) the “Flexible Air quality Scenario Tool – Community Edition” (FAST-CE), (2) the NEXUS Multi-Pollutant Analysis Tool, (3) updates of existing modeling assessment tools, such as the Data Fusion Tool (DFT), Model-VAT, and the RSM-VAT to equip with new “deep” “machine learning” functions to Response Surface Modeling (DeepRSM).

The FAST-CE development project is intended to develop and upgrade the standalone reduced-complexity tool that provides greater flexibility and transparency in the estimation of monetized benefits for O3 and PM2.5 reductions. A user-friendly system is needed to provide a fast turnaround for benefits estimation where time does not allow for the application of a specific control strategy to be modeled with a photochemical transport model. EPA reviewed existing multiple reduced-complexity tools and identified techniques that can integrate source-receptor relationships generated by photochemical transport models provide the most promise to meet regulatory demonstration needs that range in terms of complexity. The predicted air quality surfaces and benefit-per-ton estimates will support upcoming proposed & final sector-based rules and provide a flexible framework for integrating more complex air quality surfaces generated by photochemical models applied with instrumented techniques including source apportionment (e.g., PSAT/OSAT/APCA in CAMx and ISAM in CMAQ), Decoupled Direct Method (DDM), and RSM.

The NEXUS tool development project is intended to develop a new standalone data query and visualization tool to assist EPA and States to readily identify areas with multi-pollutant issues and understand general nature of air quality issues across PM2.5, O3, and air toxics. This NEXUS tool provides two levels of data query and visualization functions over national and regional/metropolitan area levels. In “Level 1”, the NEXUS tool allows the user to input publicly available air quality, monitoring, and emissions data and provide query and visualization functions to identify potential multi-pollutant air quality issues across PM2.5, O3, and air toxics at a national level. In “Level 2”, the tool allows the user to flexibly select one or more regions or metropolitan areas of interest and provide in-depth air quality and emissions information to dissect the nature of multi-pollutant issues over the selected (or combined) regions or areas. The conceptual framework was initially focused on examining three type of pollutants: ozone, PM2.5 and air toxics. Under this TO, further analyses will be extended to include issues associated with environmental justice (EJ) and climate risks as well as update to most recent emissions, air quality, and health risk data.

A list of key tasks will be performed under this TO:

1. Develop and enhance the user-friendly “Flexible Air quality Scenario Tool – Community Edition” (FAST-CE). Develop online User’s Guides for the FAST-CE as well as debugging, managing the codes and delivering the software packages to EPA and user community,
2. Develop and enhance the NEXUS Multi-Pollutant Analysis Tool. Develop online User’s Guides for the NEXUS tool as well as debugging, managing the codes and delivering the software packages to EPA and user community,
3. Update existing modeling assessment tools, such as the SMAT-CE, Data Fusion Tool (DFT), Model-VAT, and RSM-VAT; Upgrade the Response Surface Model (RSM) methodology with the new “deep machine learning” (DeepRSM) capabilities into the RSM-VAT tool; Update online User’s Guides for these upgraded tools as well as debugging, managing the codes and delivering the software packages to EPA and user community.

Specific tasks and activities required by this TO are described below, along with the project deliverables. In accordance with the contract and as through technical direction by the TOCOR.

**V. Description and Tasks:**

The Contractor shall begin to work on this task order when authorized through technical direction by the TOCOR. Note that the proposed work and cost estimates for the tasks below should be submitted and authorized separately. Contractor shall perform the following key tasks as directed by EPA through routine communication.

Specific tasks and activities are outlined below. The Contractor shall provide a proposed schedule of work that will be accomplished over the course of the period of performance.

**Task #1: Task Order Administration**

The Contractor shall have conference calls with the TOCOR on a monthly or bi-monthly basis after approval of the task order to plan and review progress of this TO. The contractor will provide status updates on each task and the EPA TOCOR will discuss any technical issues related to completing each task. The EPA TOCOR will provide the contractor with technical direction regarding the priority of the items for each task, including those that should be addressed by the next conference call. During the calls, the contractor shall provide status updates on the progress of active work items. Upon request, the contractor shall provide level-of-effort (LOE) estimates for implementing specific proposed work items.

The Contractor shall submit monthly progress reports (see “Reporting Requirements” section below), provide labor category estimates of resources for each task and subtask in any provided cost estimate, review and quality assure all work products, and keep the TOCOR informed of any problems that may impede project performance or delivery dates, along with any corrective actions needed by the Contractor or the TOCOR to solve such problems. The contractor shall include a description of the work performed on each task in each monthly report.

**Deliverables/Schedule:**

1. Monthly report and project summary report – monthly after task order award

**Task #2: Support the development and improvements of EPA’s “Flexible Air quality Scenario Tool – Community Edition” (FAST-CE) Tool**

The Contractor shall assist EPA in developing and upgrading EPA’s air quality modeling assessment tool, the “Flexible Air quality Scenario Tool – Community Edition” (FAST-CE) and NEXUS Multi-Pollutant Analysis Tool. The Contractor shall support EPA in developing and improving online User’s Guide for FAST-CE as well as debugging, managing the codes and delivering the software packages to EPA and user community.

This user-friendly FAST-CE tool should allow the user to input gridded photochemical model source apportionment surfaces, photochemical model DDM sensitivity coefficients, and RSM outputs, and provide functionalities to modulate these concentration or response surfaces to generate a new air quality surface, visualize the changes in the air quality surface, and provide connectivity to other downstream tools, such as SMAT-CE and BenMAP-CE, to estimate a fused surface, attainment, and monetized health benefits. This connectivity could simply be generating input files for SMAT-CE and BenMAP-CE based on the newly generated air quality surface. The tool should provide a simple option to estimate non-linear air quality surfaces from linear changes in emissions. This type of functionality could simply be a separate input file with pollutant-specific nonlinear curve functions.

**Subtasks:**

1. Develop a beta version of FAST-CE with upgraded GUI and functions and online user’s guide to be ready for public release; Build in a “meta data” function for identifying and organizing the FAST-CE cases and datasets,
2. Develop capabilities under FAST-CE to project the O3 and PM2.5 Design Values (DVs) based on monitor data (e.g., SMAT-CE’s “point” data) in addition to the current grid-based data,
3. Develop EJ impact screening capabilities under FAST-CE to include and display population-weighted and demographic data and deliver such information by sector/source,
4. Develop capabilities to allow the FAST-CE to link to the Global Climate Assessment Model (GCAM) energy scenarios (e.g., "GCAM scenario builder" module) and the Hemispheric-CMAQ (H-CMAQ) applications,
5. Extend the FAST-CE tool to include RSM and/or DDM techniques for better characterizing nonlinearity issues and evaluating Source Apportionment, DDM, and RSM methodologies under a common platform.

**Deliverables/Schedule:**

1. Delivery of upgraded versions of FAST-CE to EPA and user community – 12 months after task order award and as instructed by EPA
2. Delivery of new and updated on-line FAST-CE User’s Guides of EPA’s air quality modeling assessment tools to EPA and user community – 12 months after project starts

**Task #3: Support the development and improvements of EPA’s NEXUS Multi-Pollutant Analysis Tool**

The Contractor shall assist EPA in developing and upgrading EPA’s air quality modeling assessment tool, the NEXUS Multi-Pollutant Analysis Tool. The Contractor shall support EPA in developing and improving online User’s Guide for NEXUS as well as debugging, managing the codes and delivering the installation packages to EPA and user community.

This purpose of this NEXUS project is to develop and improve a user-friendly software tool to allow users to explore multi-pollutant air quality issues across the U.S. as well as regions and metropolitan areas. This NEXUS tool should provide two-level of data query and visualization functions over national and regional/metropolitan area levels. In Level 1, the NEXUS tool will allow the user to input publicly available air quality, monitoring, and emissions data and provide query and visualization functions to identify potential multi-pollutant air quality issues across PM2.5, O3, and air toxics at a national level. In Level 2, the tool will be extended to allow the user to flexibly select one or more regions or metropolitan areas of interest and provide in-depth air quality and emissions information to dissect the nature of multi-pollutant issues over the selected (or combined) regions or areas. A pilot 2014 multi-pollutant case has been used initially, and the emissions, air quality, risk dataset will be updated to 2017 provided by EPA as the base for this upgraded NEXUS tool development.

**Subtasks:**

1. Develop a beta version of NEXUS with upgraded GUI and functions and online user’s guide to be ready for public release,
2. Develop capacities to include and display EJ/demographic metrics and tribal areas
3. Update the emissions data and the PM2.5, O3 air toxics data and their health risk data used in NEXUS from 2014 to 2017,
4. Develop air quality impact and EJ screening capabilities in NEXUS to include and display population-weighted and demographic data,
5. Develop sector emissions and source category emissions summary and spatial analysis capabilities,
6. Develop a prototype of “Proximity-based Source/Sector Multi-Pollutant and Climate Risk and EJ Analysis” module; Allow to identify individual sources/facilities within a specific region/area and extend to their sector groups at the national level (“zoom-out” to nationwide).

**Deliverables/Schedule:**

1. Delivery of upgraded versions of NEXUS tool to EPA and user community – 12 months after task order award and as instructed by EPA
2. Delivery of new and updated on-line NEXUS User’s Guides of EPA’s air quality modeling assessment tools to EPA and user community – 12 months after project starts

**Task #4: Support the development and improvements of EPA’s Existing Air Quality Modeling Assessment Tool**

The Contractor shall assist EPA in updating EPA’s existing air quality modeling assessment tools, including the Data Fusion Tool (DFT), “SMAT-CE” attainment tool, model visualization and analysis tool (Model-VAT), and RSM-VAT. The Contractor shall support EPA in updating online User’s Guide for these existing tools as well as debugging, managing the codes and delivering the software packages to EPA and user community.

EPA plans to continue to support and update the existing air quality modeling assessment tools, including the RSM-VAT, DFT, Model-VAT, SMAT-CE. Particularly, EPA plans to upgrade the Response Surface Model (RSM) methodologies with the new “deep machine learning” (DeepRSM) capabilities into the RSM-VAT tool.

**Subtasks:**

1. Develop the new “deep machine-learning” RSM (DeepRSM) capabilities under RSM-VAT; Conduct pilot DeepRSM case studies for USA and international applications as instructed by EPA;
2. Update and improve DFT, SMAT-CE, Model-VAT as instructed by EPA;
3. Develop/improve on-line User’s Guides for RSM-VAT, DFT, SMAT-CE, Model-VAT as instructed by EPA;

**Deliverables/Schedule:**

1. Delivery of upgraded versions of existing air quality modeling assessment tools to EPA and user community – 12 months after task order award and as instructed by EPA
2. Delivery of updated on-line User’s Guides of EPA’s existing air quality modeling assessment tools to EPA and user community – 12 months after project starts

**VI. QA Requirements:**

Quality assurance activities shall be conducted to assure environmental data generated, processed, or used to support this task order shall be of known quality and shall achieve prescribed data quality objectives. Furthermore, the data shall be adequate and sufficient for their intended use. The Contractor shall be in compliance with the requirements of CIO 2105.0, *Policy and Program Requirements for the Mandatory Agency Wide Quality System* and the *American National Standard-Specifications and Guidelines for Environmental Data Collection and Environmental Technology Programs* (ANSI/ASQC-E4-2014). Consistent with these requirements, the Contractor shall develop a task order Quality Assurance Project Plan.

1. **Quality Assurance Project Plans (QAPP).** The Contractor shall develop a task order QAPP to provide a plan for obtaining, using, storing, and retrieving the type and quality of environmental data needed for EPA’s effort to develop and enhance the air quality modeling assessment tools for supporting regulatory analysis. The QAPP should document how quality assurance (QA) and quality control (QC) activities are applied to environmental data operations to assure that the results obtained are of the type and quality needed and expected.
2. Within one month of the effective date of the TO, the Contractor shall submit a draft QAPP in Microsoft Word format, divided by sections that describe the policies, organization, objectives, functional guidelines, and specific QA/QC activities designed to achieve the data quality requirements of the task order. The QAPP shall provide a level of detail and organization that is consistent with EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans* which can found at <https://www.epa.gov/quality/epa-qar-5-epa-requirements-quality-assurance-project-plans>. Specific QA/QC related tasks to be addressed by the QAPP are described in Task 1 of this task order. These are not necessarily inclusive; the Contractor shall include any other tasks or implementable measures that are not mentioned but are necessary to optimize the quality or assess the uncertainty of the information that is produced. Additional guidance on developing the QAPP is available in EPA’s *Guidance for Quality Assurance Project Plans EPA QA/G-5* which can be found at <https://www.epa.gov/sites/production/files/2015-06/documents/g5-final.pdf>.
3. With consultation from the Quality Assurance Manager (QAM) or the Delegated Quality Assurance Officer (DQAO), the work required in this Task Order has been preliminarily determined to be classified as Category 2 by the TOCOR.
4. The TOCOR will review the quality documentation and provide comments to the contractor in writing within 2 weeks. EPA will provide comments to the submitted draft QAPP in writing or directly on a digital file. The Contractor shall revise the QAPP and resubmit it to the EPA for approval within one week. The revised QAPP will be the official QAPP for the task order.
5. Incorporation of Standard Operating Procedures (SOPs) - When addressing the data acquisition elements in the task order QAPP, detailed copies of quality assurance methods and/or SOPs can be either included directly in the discussion, provided as attachments to the QAPP, or, if easily obtained and readily available to all project participants (e.g., American Society for Testing and Materials (ASTM) methods), cited within the discussion and included in the reference list. Detailed copies of the methods and/or SOPs must accompany the QAPP either in the text or as attachments. All SOPs referenced in each activity performed by the Contractor shall be submitted as part of the applicable QAPP. The SOPs shall be written to be consistent with EPA QA/G-6 titled *Guidance for Preparing Standard Operating procedures (SOPs)*, which can found at <https://www.epa.gov/quality/guidance-preparing-standard-operating-procedures-epa-qag-6-march-2001>.
6. QAPP Amendments – During the term of the contract, the Contractor shall revise and maintain on file, with all previous revisions, an amended QAPP within 30 days of the following circumstances:
7. The Agency modifies the contract.
8. The Agency notifies the Contractor of deficiencies in the QAPP document resulting from the Agency's review of the Contractor's performance.
9. The Contractor identifies deficiencies resulting from their internal review of the QAPP document.
10. The Contractor's organization, personnel, facility, equipment, policies, or procedures change.
11. The Contractor identifies deficiencies resulting from the internal review of their organization personnel, facility, equipment, policies or procedures.
12. Document Control - When the QAPP or any SOP is amended, all changes shall be clearly marked with a bar in the margin indicating where the change is found in the document, or by highlighting the change by underlining, bold printing, or using a different print font. The amended section pages shall have the date on which the changes were implemented. Any changes in the QAPP shall be submitted to the EPA Project Officer for approval before implementation.
13. QAPP and SOP Archival ‑ The Contractor shall maintain a master QAPP which incorporates the original QAPP and all subsequent amendments. The Contractor shall provide a copy of the master QAPP (including the SOPs) and any of its attachments to the designated recipients within 14 days of a request.

**VII. Deliverables:**

The Contractor shall adhere to the following schedule:

**Task** **Deliverable** **Delivery Schedule**

1 Deliverable Monthly report after task order award and project summary report at the end of project

2 Deliverable 12-month after task order award and as instructed by EPA

3 Deliverable 12-month after task order award and as instructed by EPA

4 Deliverable 12-month after task order award and as instructed by EPA

**VIII. Reporting Requirements:**

1. If any problems arise that would impede performance, Contractor shall inform the EPA TOCOR immediately (by phone or email) and provide information needed to resolve the problem(s).

# 2. The Contractor shall submit monthly progress reports to the EPA TOCOR in accordance with the terms and conditions of the contract and advise the TOCOR about problems in a timely manner, but at a minimum, via the monthly progress reports.

# 3. The Contractor shall deliver all draft and final work products in accordance with the contract. In addition, the Contractor shall deliver to the TOCOR each draft and final deliverable in an electronic format that is compatible with EPA-installed application software which includes word processing software Microsoft Word, spreadsheet software Microsoft Excel, and database management software Microsoft Access. Final deliverables that will be posted online or otherwise available to the public shall be 508 compliant.

# 4. The Contractor shall ensure that all electronic work products are free of computer viruses, malware, or spyware.