**I. Title of Task Order:** Integrated Assessment Modeling (IAM) Tools Development

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

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**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 concludes on when all work is completed in accordance with the SOW and the terms and conditions of the Task Order.

**IV. Background:**

1. **Project Summary:**

The purpose of this Task Order (TO) is to assist EPA in developing and improving a series of Integrated Assessment Modeling (IAM) tools for supporting regulatory modeling work. This “IAM” project is an expansion and extension of the previous “Air Benefit and Cost and Attainment Assessment System” (ABaCAS) development project to provide an integrated assessment of air emissions control cost and its associated air quality attainment and health benefits for domestic and international applications. A list of key tasks will be performed under this TO:

1. Develop/improve the regulatory modeling support tools such as (1) “SMAT-CE” attainment tool, (2) model visualization and analysis tool (Model-VAT), (3) Data Fusion Tool (DFT), and (4) ABaCAS system and its components. Develop/improve their training materials, including “on-line User’s Manuals” and “Quick Start Guides”, as well as debugging, managing the codes and delivering the installation packages to EPA and user community;
2. Develop/upgrade the Response Surface Model (RSM) methodology and applications, particularly the new “polynomial functions RSM” (pf-RSM) and “machine learning” “indicator RSM” (i-RSM). Assist EPA in developing the USA and international applications of pf-RSM and i-RSM. Develop and include pf-RSM and i-RSM functions into the RSM-VAT tool; Develop/improve online User’s Guides for the upgraded RSM-VAT as well as debugging, managing the codes and delivering the installation packages to EPA and user community;
3. Develop/improve 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 installation packages to EPA and user community;
4. Develop/improve 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 installation packages to EPA and user community.
5. **Background Information:**

Over the last decade, EPA has engaged in the development of a series of integrated assessment modeling (IAM) tools to support air quality management and regulatory policy analysis, including Modeled Attainment Test Software (MATS) ([*http://www.epa.gov/ttn/scram/modelingapps\_mats.htm*](http://www.epa.gov/ttn/scram/modelingapps_mats.htm)), environmental Benefits Mapping and Analysis Program (BenMAP) *(*[*http://www.epa.gov/air/benmap/ce.html*](http://www.epa.gov/air/benmap/ce.html)*)*, and an integrated decision support system, “Air Benefit and Cost and Attainment Assessment System” (ABaCAS) ([*http://www.abacas-dss.com/*](http://www.abacas-dss.com/)*)*.

EPA has recently developed an updated version of SMAT-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) 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 an integrated assess,emt system, the “Air Benefit and Control and Attainment Assessment System” (ABaCAS), by linking these cost and benefit modeling assessment tools for international and domestic applications. The “ABaCAS” system is aimed at providing policy makers and research scientists a user-friendly framework for conducting integrated assessments of emissions control cost and their associated air quality attainment and health benefits. The “ABaCAS” includes six components: (1) an international emissions control and cost estimate tool (ICET), (2) an air quality attainment assessment tool (SMAT-CE), (3) a health and economic benefit tool (BenMAP-CE), (4) a real-time emissions control and air quality response tool (RSM-VAT), (5) a streamlined edition of ABaCAS (ABaCAS-SE), and (6) an optimized edition of ABaCAS (ABaCAS-OE) ([*http://www.abacas-dss.com/*](http://www.abacas-dss.com/)*)*.

EPA has also developed several 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, and (2) a standalone “Data Fusion” Tool (DFT) to provide spatial field interpolation for fusing scattered monitoring data and gridded model data spatially together.

EPA also plans to develop new integrated assessment tools for supporting effective air quality assessment and management. Under this TO, EPA plans to initiate efforts to develop new modeling assessment tools, including (1) new RSM-VAT functions and applications, particularly the new “polynomial functions RSM” (pf-RSM) and “machine learning” “indicator RSM” (i-RSM), (2) the “Flexible Air quality Scenario Tool – Community Edition” (FAST-CE), and (3) the NEXUS Multi-Pollutant Analysis Tool.

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. The conceptual framework will initially be focused on examining three type of pollutants: ozone, PM2.5 and air toxics. Further analyses may be extended to include other air quality issues such as regional haze and deposition issues.

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 weekly or 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. Delivery of work plan and cost estimate – 20th day after receiving EPA’s WA
2. Monthly report and project summary report – each month and 12 months after project starts

**Task #2: Develop/improve integrated assessment modeling (IAM) tools, including RSM-VAT, Data Fusion Tool, SMAT-CE, Model-VAT, and ABaCAS**

The Contractor shall support EPA in developing and improving EPA’s IAM system and tools, including new and/or upgraded modules for RSM-VAT, SMAT-CE, Data Fusion tool (DFT), Model-VAT and ABaCAS system. The Contractor shall assist EPA in developing online User’s Guides for new or upgraded modules in RSM-VAT, DFT, SMAT-CE, Model-VAT tools and ABaCAS as well as debugging, managing the codes and delivering the installation packages to EPA and user community.

**Subtasks:**

1. Develop/enhance the “polynomial function” RSM (pf-RSM) and new machine-learning “indicator RSM” (i-RSM) module in RSM-VAT; Conduct pilot pf-RSM and i-RSM case studies for USA and international applications as instructed by EPA;
2. Develop new and/or upgraded modules and methodologies in DFT, SMAT-CE, Model-VAT and ABaCAS system as instructed by EPA;
3. Develop/improve draft User’s Guides for new and upgraded modules for RSM-VAT, DFT, SMAT-CE, Model-VAT tools and ABaCAS system as instructed by EPA;

**Deliverables/Schedule:**

1. Delivery of RSM-VAT with new and upgraded modules and installation package to EPA and user community - 12 months after project starts
2. Delivery of DFT, SMAT-CE, Model-VAT tools and ABaCAS system with new and/or improved modules and installation package to EPA and user community - 12 months after project starts
3. Delivery of updated on-line User’s Guide of upgraded RSM-VAT, SMAT-CE, DFT and Model-VAT tools and ABaCAS system to EPA and user community – 12 months after project starts

**Task #3: Develop/improve “Flexible Air quality Scenario Tool – Community Edition” (FAST-CE) and NEXUS Multi-Pollutant Analysis Tool (NEXUS)**

The Contractor shall assist EPA in developing and upgrading the prototypes of user-friendly “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 Guides for FAST-CE and NEXUS as well as debugging, managing the codes and delivering the installation 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. Many of the described features are similar to the RSM-VAT tool, which could serve as the basis for the new functionality desired as part of this work.

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-phase of data query and visualization functions over national and regional/metropolitan area levels. In Phase 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 Phase 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 will be initially used, and the dataset for this case study will be provided by EPA as the base for this NEXUS multi-pollutant analysis tool development.

**Subtasks:**

1. Develop/improve the FAST-CE prototype with user-friendly GUI and upgraded functions; Extend the FAST-CE tool to include DDM and RSM techniques and QA/Validation module for evaluating a suite of Source Apportionment (SA), DDM, and RSM methodologies under a common platform;
2. Develop/improve the NEXUS prototype with user-friendly GUI to provide upgraded data query and visualization functions; Extend NEXUS analysis and report functions of air quality and emissions information over the selected (or combined) regions or metropolitan areas of interest for PM2.5, O3, and air toxics as instructed by EPA;
3. Develop on-line User’s Guides for FAST-CE and NEXUS as instructed by EPA

**Deliverables/Schedule:**

1. Delivery of upgraded version of FAST-CE and NEXUS to EPA and user community – 9 months after project starts
2. Delivery of extended version of FAST-CE and NEXUS to EPA and user community – 12 months after project starts
3. Delivery of draft on-line User’s Guide of FAST-CE and NEXUS to EPA and user community - 12 months after project starts

**VI. QA Requirements:**

The contractor shall prepare a Quality Assurance Project Plan (QAPP). Attachment 1 to the Statement of Work (SOW) provides information regarding the NHSRC QA Requirements/Definitions List.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality. A draft QAPP shall be delivered to TOCOR within 4 weeks of award. The TOCOR will review the Draft QAPP and provide comments back to Contractor within 4 weeks. A revised QAPP shall be submitted to the TOCOR within 10 working days after receipt of the EPA’s comments.

**VII. Deliverables:**

The Contractor shall adhere to the following schedule:

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

1 Work Plan 20 days after effective date of WA

2 Deliverables 12 months after project starts

3 Deliverables 12 months after project starts

**VIII. Reporting Requirements:**

1. If any problems arise that would impede performance, the 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.

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