ORDER FOR SUPPLIES OR SERVICES

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1. DATE OF ORDER: 09/16/2014

2. CONTRACT NO. (If any): EP-C-11-036

3. ORDER NO.: 0022

4. REQUISITION/REFERENCE NO.: See Schedule

5. ISSUING OFFICE (Address correspondence to):
CPOD
US Environmental Protection Agency
26 West Martin Luther King Drive
Mail Code: NWD
Cincinnati OH 45268

6. SHIP TO:
a. NAME OF CONSIGNEE: NERL ERD ATHENS
b. STREET ADDRESS: US Environmental Protection Agency
National Exposure Research Lab
Ecosystems Research Division
960 College Station Road
c. CITY: Athens
d. STATE: GA
e. ZIP CODE: 30605-2700
f. SHIP VIA:

7. TO:
a. NAME OF CONTRACTOR: R T I INTERNATIONAL
b. COMPANY NAME:
c. STREET ADDRESS: PO BOX 12194
d. CITY: RESEARCH TRIANGLE PARK
e. STATE: NC
f. ZIP CODE: 277092194

8. TYPE OF ORDER
☐ a. PURCHASE
REFERENCE YOUR:
Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated.
☒ b. DELIVERY
Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.

9. ACCOUNTING AND APPROPRIATION DATA: See Schedule

10. REQUISITIONING OFFICE: CPOD

11. BUSINESS CLASSIFICATION (Check appropriate box(es))
☐ a. SMALL ☒ b. OTHER THAN SMALL ☐ c. DISADVANTAGED ☐ d. WOMEN-OWNED ☐ e. HUBZone
☐ f. SERVICE-DISABLED VETERAN-OWNED ☐ g. WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOSB PROGRAM ☐ h. EDWOSB

12. F.O.B. POINT:

13. PLACE OF
a. INSPECTION: Destination
b. ACCEPTANCE: Destination

14. GOVERNMENT B/L NO.:

15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date):

16. DISCOUNT TERMS:

17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Tax ID Number: (b)(4) DUNS Number: Technical Support for Integrated Environmental Modeling Technologies (iemTechnologies) TOPO: Justin Babendreier Continued ...					

18. SHIPPING POINT:

19. GROSS SHIPPING WEIGHT:

20. INVOICE NO.:

17(h) TOTAL (Cont. pages): $360,000.00

21. MAIL INVOICE TO:
a. NAME: RTP Finance Center
b. STREET ADDRESS (or P.O. Box): US Environmental Protection Agency
RTP-Finance Center
Mail Drop D143-02
109 TW Alexander Drive
c. CITY: Durham
d. STATE: NC
e. ZIP CODE: 27711

SEE BILLING INSTRUCTIONS ON REVERSE

17(i) GRAND TOTAL: $869,275.00

22. UNITED STATES OF AMERICA BY (Signature): 09/16/2014 Camille W. Davis ELECTRONIC SIGNATURE

23. NAME (Typed): Camille W. Davis
TITLE: CONTRACTING/ORDERING OFFICER

ORDER FOR SUPPLIES OR SERVICES
SCHEDULE - CONTINUATION

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

DATE OF ORDER	CONTRACT NO.	ORDER NO.
09/16/2014	EP-C-11-036	0022

ITEM NO. (a)	SUPPLIES/SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	Admin Office: CPOD US Environmental Protection Agency 26 West Martin Luther King Drive Mail Code: NWD Cincinnati OH 45268 Period of Performance: 09/16/2014 to 09/16/2015					
0001	Technical Support for Integrated Environmental Modeling Technologies (iemTechnologies) Requisition No: PR-ORD-14-02055, PR-ORD-14-02530 Accounting Info: 13-14-C-26CL000-301FK8-2532-26A6A-1426 CLE034-001 BFY: 13 EFY: 14 Fund: C Budget Org: 26CL000 Program (PRC): 301FK8 Budget (BOC): 2532 Cost: 26A6A DCN - Line ID: 1426CLE034-001 Funding Flag: Partial Funded: $150,000.00 Accounting Info: 14-15-C-26UK000-301FK8-2532-26A6A-1426 UKE086-001 BFY: 14 EFY: 15 Fund: C Budget Org: 26UK000 Program (PRC): 301FK8 Budget (BOC): 2532 Cost: 26A6A DCN - Line ID: 1426UKE086-001 Funding Flag: Partial Funded: $160,000.00 Accounting Info: 14-15-C-26UK000-301FK8XPW-2532-26A6A-1426UKE086-002 BFY: 14 EFY: 15 Fund: C Budget Org: 26UK000 Program (PRC): 301FK8XPW Budget (BOC): 2532 Cost: 26A6A DCN - Line ID: 1426UKE086-002 Funding Flag: Partial Funded: $50,000.00 The obligated amount of award: $360,000.00. The total for this award is shown in box 17(i).				360,000.00	
	TOTAL CARRIED FORWARD TO 1ST PAGE (ITEM 17(H))				$360,000.00	

PERFORMANCE WORK STATEMENT
STREAMS II
Task Order 0022, RTI EP-C-11-036

TITLE: Technical Support for Integrated Environmental Modeling Technologies (iemTechnologies)

Task Order COR (TOCOR)	**Alternate Task Order COR (ATOCOR)**
Name: Justin Babendreier	**Name:** Rajbir Parmar
Office: USEPA ORD/NERL/ERD/RSB 960 College Station Road Athens, GA 30605	**Office:** ORD/NERL/ERD/RSB 960 College Station Road Athens, GA 30605
Phone: (706) 355-8344	**Phone:** (706) 355-8344
Fax: (706) 355-8302	**Fax:** (706) 355-8302
E-mail: Babendreier.Justin@epa.gov	**E-mail:** Parmar.Rajbir@epa.gov

PERIOD OF PERFORMANCE: September 16, 2014 through September 16, 2015
A 1-year Option Period may be ordered at a later date.

BACKGROUND

Research Program for Integrated Environmental Modeling (IEM)

EPA's primary aim of this work is to continue to extend development of effective, integrated, place-based source-to-outcome integrated modeling strategies for quality assured exposure and risk assessment of land use activities. Environmental systems studied are often rainfall-driven, watershed-based. EPA needs to assess impacts to water quantity and quality across various "source-terms" imparting toxic and non-toxicological stress, for example. Iterating on kernel analysis of "unit" systems, the project seeks to develop abstracted science-software technologies that can evaluate single stressor outcomes (e.g., a single source of stress; landfill, mine, impoundment, wastewater treatment plant, etc.), as a base effort. As well, the design seeks, in a systems context, to deliver abilities to evaluate concurrent impact from multiple stressors (e.g., those also dealing with toxicants, nutrients, sedimentation, etc) across multiple scales.

The HE2RMES system is designed, for example, such that many "units" (sites in this case) can be assessed at and across multiple locations (e.g., study the country). This can all be achieved seamlessly, as one study, within the iemTechnologies integrated modeling platform. Similarly, one can recursively and/or repeatedly assess various stressors, each having different character and behavior in a systems context. Focused on in this Task Order, one of EPA's science and technology strategies for achieving interoperable, cumulative exposure and risk assessment work flows, ***iemTechnologies***, is broken down as a series of six independent, complementing interoperable software systems. See Figures 1 and 2 in Appendix C *in* (Babendreier, 2014b).

See Appendix B *in* (Babendreier, 2104b) for information on installation the base interoperable, integrated software "system of systems" being enhanced, ***iemTechnologies.***

Glossary of iemTechnologies and Related Software Terms Used in this PWS

iemTechnologies' components and their relationship and layout of associated key work flows are shown in Figure 1 in Appendix C *in* (Babendreier, 2014b), and each are also discussed below as an overview. RIMM or *Risk Informed Materials Management* is a "decision analysis process" supported by a collection of methods, tools, models, and databases, and other information the user community brings to it. It is more fully described in Babendreier (2014b). Highlighting ORD's RIMM Research focus, its broad capabilities and goals include:

- **RIMM** - Risk Informed Materials Management.
  - A Decision Analysis PROCESS supported by models databases, tools (e.g., HE2RMES)
  - Helps discover the community problem-solution "option space" for management of a material, as a valued-set of constraints inherently evolved from the community's context.
  - Addresses the inherent exposure/risk question: is the material safe as we intend to use it?

The following list of key iemTechnologies-related components supporting RIMM assessors and assessments, and their associated acronyms used in this PWS, include:

- **iemTechnologies** - Integrated Environmental Modeling (IEM) Technologies
  - A system of independent modeling component systems that, together, facilitate a user's ability to integrally manage science-based work flows encountered in model-supported environmental decision-analysis and decision-making.

- **OpenTERRAworks** - An open, dotspatial 2D/3D GIS landscape design tool set.
  - Get baseline data, and modify and set future landscapes' design RIMM sites/facilities.
  - Ideal for use in both 2D and 2D/3D design modes (as a substitution pattern for D4EM).

- **D4EM** - Data for Environmental Modeling
  - A library of data acquisition routines supporting web-based, served data.

- **FRAMESv2** - Framework for Risk Analysis in Multimedia Environmental Systems
  - A windows-based, model-independent, integrated plug-and-play modeling framework.
  - Used for connecting and integrally executing models, databases, and tools.

- **HE2RMES** - Human and Ecological Exposure and Risk for Multimedia Environmental Systems
  - A FRAMESv2 modeling domain; a collection of models databases, tools.

- **SDPProjectBuilder** - a D4EM-4-HE2RMES application.
  - Used to quickly and easily build input data sets for one or more sites (Anywhere, USA).

- **SDP** - Site Definition Processor; a HE2RMES pre-processor that reads site data
  - Consumes the SDPProjectBuilder's intermediate MySQL-based output site databases.

PROJECT DESCRIPTION

The purpose of this task order is to extend the existing capabilities and functionality of the HE2RMES modeling domain in FRAMESv2. This effort will be add new models and/or enhance existing models now in HE2RMES. The work also seeks to complete a partially developed site-specific data acquisition system (SDPProjectBuilder) that will support parameterization of the HE2RMES modeling system for any site/facility in the U.S., This transferability idea is referred to here as *D4EM-4-HE2RMES for "Anywhere USA" application.*

The product line to be delivered to USEPA by the successful Bidder will be formed as various upgraded and new software subcomponents (i.e., file systems) that remain interoperable within iemTechnologies. All new and enhanced software systems delivered will be fully documented, tested, and delivered in reproducible, testable form by others. This work will follow a formal process of quality assurance using ORD Level III "Verification" procedures for software development projects (defined explicitly herein under Task 1).

The target audience is EPA personnel developing, prototyping, and evaluating iemTechnologies for in-house uses supporting RIMM-type assessments, and, ultimately, all future iemTechnologies system users who will benefit from: a) improved HE2RMES models; b) options to integrate models, and c) improved site selection and model input data acquisition capabilities supporting use of HE2RMES at any site and/or across multiple sites in the U.S.

TASK ORDER OBJECTIVES

The purpose of this Task Order is to work with and improve upon the current state of USEPA's iemTechnolgies software system. This work will extend the current functionality of the HE2RMES modeling system and tools, with applications intended for general support of assessments for Risk Informed Materials Management (RIMM) (Babendreier, 2014b).

The work is broken down across several Tasks, and focuses on two primary objectives:

Objective #1: *Completing an existing, partially completed D4EM application interface for HE2RMES v1.0; the associated software application name is SDPProjectBuilder, and*

Objective #2: *Extending capabilities of the HE2RMES v1.0 modeling domain in FRAMESv2 via addition and/or enhancement of select science models and associated processors.*

Tasking Summary *(8 Tasks; Tasks 2, 4, 5, and 6 are delineated further in Tables 1 & 2)*:

- Task 1 is to develop a QAPP to insure the integrity and quality all products produced.
- Task 2 is to develop SDPProjectBuilder for the existing HE2RMES modeling system.

- Task 3 develops a 10-to-20 node beta software testing environment for RIMM tools.
- Task 4 is to enhance the existing basis of hydrogeologic model science in HE2RMES, bringing it up to date with more recent versions of EPA's CMTP groundwater model.
- Task 5 is to develop new source-term models in HE2RMES to implement new solvers associated with the General Environmental Model (GEM), and to address recent advances in vapor transport and operational management routines for the landfill model.
- Task 6 is to develop SDPProjectBuilder for new or enhanced HE2RMES models.
- Task 7 is to develop an SDPProjectBuilder User Manual and Help System.
- Task 8 is to provide for a RIMM Webinar-Workshop Series for product line roll-outs.

Key Elements of Work Expected By the Contractor's Team(s)

To provide for clarity prior to describing detailed descriptions per Task and/or Subtask, Table 1 lists the relevant work, across the Task Order, associated with the first project objective (#1), denoted here as ***SDPProjectBuilder,*** described under this Task Order's Objectives. Table 2 similarly defines related Tasks and/or Subtasks associated with the second project objective (#2), also described and denoted here as ***Enhanced and New HE2RMES Science Modules***.

D4EM-4-All (Existing and New HE2RMES Science Modules)

Shown in Table 1, comparing similar system objects across Table 2, all new source-term models will also achieve counterpart D4EM functionality by the end of the project; for these efforts, the science model work must largely proceed related D4EM development. Products are identified in detailed descriptions accordingly by associated Task ID and Subtask ID.

D4EM-4-HE2RMES Help System and Technology Transfer

Task 7 ensures an expanded SDPProjectBuilder help system is delivered. Task 8 works across the project timeline (mid-way to end of project) to assist in RIMM-based technology transfer. The latter Task, specifically, is designed to engage OSWER, other key EPA staff, and the public, near to the end of the build process, as EPA concludes with technology roll-out.

Intermediate iemTechnologies-Based RIMM Bench-Testing by EPA Staff

In-house EPA review efforts and in-house system- and unit-level testing of early prototypes, by both ORD and OSWER staff, are also planned as integral elements of QA. These will use parallel computing experimentation, inside EPA, to additionally support the project. This will also help keep EPA's review stages on track. While designed specifically to give timely feedback on shortcomings (e.g., nuisance bugs, bugs, etc), cross-team testing is also designed to engage intended users of the HE2RMES modeling system, for RIMM assessments, as early on as possible. These complementary QA/QC efforts are expected to help EPA deliver and assure the highest quality possible in RIMM tools developed under this Task Order. As part of this effort, for example, separate from this order, EPA may pursue initial beta applications in RIMM, while

the project is underway (e.g., beneficial reuse applications, helping ORD to build a track for delivery and client use, on schedule and on time. Work is essentially targeted for immediate delivery (i.e., as soon as possible/practical) to OSWER staff and the communities they serve.

Table 1. D4EM-4-HE2RMES Software Development and Enhancement Products to Be Delivered by the Successful Bidder (Products are Identified Accordingly by Associated Task ID and Subtask ID and Follow Incremental QA/QC Staging Listed)

Task Order Applicable Task ID and/or Subtask ID	Lists Subcomponents of the System-Level D4EM Application: **SDPProjectBuilder** *All Subtasks are targeted for delivery as tested, certified **ORD QA Level III RDST software.*** *For the wildcard characters:* 1. *(*) indicates replace with string **-RDST.docx**;* primary tag shown indicates the target FRAMESv2 module. 2. (†) indicates that the **"RDST"** for the targeted delivery does not yet exist. ***Test plans do not yet exist for the RDST documents listed here.*** *Deliveries shall include all source code and documentation per QAPP specifications.*	Model or Module Class	FRAMES Module Assimilation Method	Delivery Schedule(*) For Incremental Software Build Review and Approval Stages. Finalize Requirements (R) (i.e., Stage ID = A) for each Subtask is established in the Work Plan that each Subtask is approved under. *Due dates shown are days from each Subtask's associated Work Plan approval date.* Contractor Delivery Date - to TOCOR for Review					
				B	C	D1	D2	E1	E2
				Finalize Design (D) & Specifications (S)	Develop Draft Testing Plan (T)	Deliver the As-Is Beta Software System and Documentation		Deliver the As-Is Final Software File System & QA Summary	
				@ < %20 Total Subtask LOE	@ < %60 Total Subtask LOE	@ ~%60 Total Subtask LOE	@ ~%85 Total Subtask LOE	@ < 95% Total Subtask LOE	@ < 100% Total Subtask LOE
EPA Review/Approval Sub-stage (Days after Contractor delivers to the TOCOR)				15	15	N/A	N/A	30	30

(*) Deliverable E1 shows literal date EPA has scheduled initial priorities for as TD #1 ≡ Subtasks 2.1 to 2.18, along with Subtasks 4.1, 4.2, 5.1, 5.2, 6.1, and 6.2.				Contractor Delivery Dates below are "total days from" associated work plan approval date.					
2.1	LAU*.docx *(Land Application Unit v1.0)*	Existing Source	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.2	Airshed*.docx	Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.3	Aquifer*.docx	Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.4	SurfaceWater*.docx	Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.5	Vadose*.docx	Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.6	Watershed*.docx	Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.7	D4EM-4-ISC3-RDST.docx	Fate/Transport	Standalone Version	23	69	69	98	110 12/31*	170 3/1/15
2.8	Airshed_F2UIWrapper*.docx	Fate/Transport	F2UIWrapper I/O	23	69	69	98	110 12/31*	170 3/1/15
2.9	D4EM-4-EXAMS-RDST.docx	Fate/Transport	Standalone Version	23	69	69	98	110 12/31*	170 3/1/15
2.10	EXAMS_F2UIWrapper*.docx	Fate/Transport	F2UIWrapper I/O	23	69	69	98	110 12/31*	170 3/1/15
2.11	AquaticFoodWeb*.docx	Foodweb	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15

2.12	TerrestrialFoodWeb*.docx	Foodweb	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.13	FarmFoodChain*.docx	Foodweb	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.14	EcoExposure*.docx	Exposure	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.15	HumanExposure*.docx	Exposure	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.16	EcoRisk*.docx	Risk	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.17	HumanRisk*.docx	Risk	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.18	WP*.docx *(Waste Pile)*	Existing Source	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
2.19	AT*.docx *(Aerated Tank)*	Existing Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15
2.20	LF*.docx *(Landfill)*	Existing Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15
2.21	SI*.docx *(Surface Impoundment)*	Existing Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15
6.1	LAU_GEM*. xxxx (Land Application Unit v2.0)	Enhanced Source	F2-API Direct I/O	23	69	69	98	110 12/31*	150

6.2	WP_GEM*. xxxx (Waste Pile v2.0)	Enhanced Source	F2-API Direct I/O	23	69	69	98	110 12/31*	150
6.3	LF_RW*.xxxx (Landfill v2.0) .... Rags & Wipes Rule LF model	Enhanced Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15
6.4	Roadway_GEM*.xxxx (a *line-source model* ; Roadway v1.0)	New Source	F2-API Direct I/O	66	158	158	216	240 9/21/15	270 10/21/15
6.5	LF_GEM*. xxxx (Landfill v3.0)	Enhanced Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15
6.6	LAU_GEMGA*. xxxx (Land Application Unit v3.0; see Appendix C *in* Babendreier, 2014b)	Enhanced Source	F2-API Direct I/O	66	158	158	216	240 9/21/15	270 10/21/15

Table 1 - Note 1A: For D4EM-related efforts, all existing HE2RMES science modules have fully specified draft RDST documents available (less test plans), presumed by EPA to be ready for immediate building.

Table 1 - Note 1B: For D4EM-related efforts, enhanced and new science models and associated RDSTs will build largely from the related, existing D4EM use-cases. In general, similar patterns of I/O exchange via SDPProjectBuilder and the SDP (a key pre-processor in HE2RMES) are expected.

Table 1 - Note 1C: The main effort here to establish D4EM-4-HE2RMES comparable functionality for the new and enhanced source-terms is expected to largely focus on:

- Possible unique, new dictionary management requirements (e.g., new variables and/or new, differently named dictionaries needed to represent extended or new datasets;, and
- Related SDP changes needed to accommodate both:
  - The overall increased number of models managed in the FRAMESv2 domain, and/or

- Differences among similar source-class patterns, accounting for the associated efforts needed to handle added use cases, and associated data I/O flow into and through the SDP code (and through all science models in the HE2RMES modeling domain).

Notes under **Addendum Table Notes** identified as Note_1&2A, Note_1&2B, and Note_1&2C apply to this table also - as if listed here directly.

Table 2. HE2RMES Science-Model Development and Enhancement Products to Be Delivered by the Successful Bidder (Products are Identified Accordingly by Associated Task ID and Subtask ID and Follow Incremental QA/QC Staging Listed)

Task Order Applicable Task ID and/or Subtask ID	Lists Subcomponents of the System-Level HE2RMES Modeling System in FRAMESv2 **Enhanced and New HE2RMES Models** *All Subtasks are targeted for delivery as tested, certified **ORD QA Level III RDST software.*** *For the wildcard characters:* 3. *(*) indicates replace with string "-**RDST**"*; primary tag shown indicates the intended new FRAMESv2 module name to be used. 4. (†) indicates that the **"RDST"** for the targeted delivery does not yet exist. ***Test plans do not yet exist for the software products listed here.*** *Deliveries shall include all source code and documentation per QAPP specifications.*	Model or Module Class	FRAMES Module Assimilation Method	Delivery Schedule(*) For Incremental Software Build Review and Approval Stages Finalize Requirements (R) (i.e., Stage ID = A) for each Subtask is established in the Work Plan that each Subtask is approved under. *Due dates shown are days from each Subtask's associated Work Plan approval date.*					
				Stage ID for TOCOR's Review and Approval					
				B	C	D1	D2	E1	E2
				Finalize Design (D) & Specifications (S)	Develop Draft Testing Plan (T)	Deliver the As-Is Beta Software System and Documentation		Deliver the As-Is Final Software File System & QA Summary	
				@ < %20 Total Subtask LOE	@ < %60 Total Subtask LOE	@ ~%60 Total Subtask LOE	@ ~%85 Total Subtask LOE	@ < 95% Total Subtask LOE	@ < 100% Total Subtask LOE
EPA Review/Approval Sub-stage (Days after Contractor delivers to the TOCOR)				15	15	N/A	N/A	30	30

(*) Deliverable E1 shows literal date EPA has scheduled initial priorities for as TD #1 ≡ Subtasks 2.1 to 2.18, along with Subtasks 4.1, 4.2, 5.1, 5.2, 6.1, and 6.2.				Contractor Delivery Dates below are "total days from" associated work plan approval date.					
4.1	Vadose2* (VadoseZone v2.0)† Migrate all related science enhancements in EPA's CMTP v2.1 and CMTP v2.2 into HE2RMES existing vadose zone model code set, developing a new model.	Enhanced Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
4.2	Aquifer2*.xxxx (Aquifer v2.0) Migrate all related science enhancements in EPA's CMTP v2.1 and CMTP v2.2 into HE2RMES existing aquifer model code set, developing a new model. To include addition of optioned use of newly available "stream plume" interceptor module.	Fate/Transport	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
5.1	LAU_GEM*. xxxx (Land Application Unit v2.0)	Enhanced Source	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
5.2	WP_GEM*. xxxx (Waste Pile v2.0)	Enhanced Source	F2-API Direct I/O	23	69	69	98	110 12/31*	170 3/1/15
5.3	LF_RW*.xxxx (Landfill v2.0) While use of pattern established via LF*.docx (Landfill v1.0) is expected, method. and eqn. solution will replicate related, non-FRAMES Rags & Wipes model basis.	Enhanced Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15

5.4	Roadway_GEM*.xxxx (Roadway v1.0)	New Source	F2-API Direct I/O	66	158	158	216	240 9/21/15	270 10/21/15
5.5	LF_GEM*. xxxx (Landfill v3.0)	Enhanced Source	F2-API Direct I/O	46	138	138	196	220 9/1/15	250 10/1/15
5.6	LAU_GEMGA*. xxxx; LAU_GEM /w Green-Ampt solver for inter-compartmental water flows. (Land Application Unit v3.0; see Appendix C *in* Babendreier, 2014b)	Enhanced Source	F2-API Direct I/O	66	158	158	216	240 9/21/15	270 10/21/15

Table 2 Note_2A: For HE2RMES-related efforts, enhanced aquifer and vadose zone models, and associated RDST, will build directly from, and extend from, the associated existing science model bases in HE2RMES v1.0.

Table 2 Note_2B: For HE2RMES-related efforts, for source-term models, associated new Requirements (R) are expected to largely reflect the existing science model's requirements, aside from a handful of "standardized" requirements statements that may need to be added to establish:

a) The new mathematical basis for solvers designated, and

b) Associated solution of the underlying governing equation set. Compared to parent derivative RDSTs, elements for (D) and (T) are expected to have to be completely recast, and to some degree, possibly (S).

Notes under **Addendum Table Notes** identified as Note_1&2A, Note_1&2B, and Note_1&2C apply to this table also - as if listed here directly.

Addendum Notes: Applicable to Tasks 2, 4, 5, & 6, Accordingly Indentified in Tables 1 & 2

Applicable generally to all associated Task IDs and Subtask IDs identified accordingly in Table 1 and Table 2 of this Task Order.

(*) Scheduling here assumes the most expedited case where large portions of Tasks 2, 4, 5, and 6 are issued under one Work Plan at the start, requested by EPA 1 week after award of the Task Order. Remaining tasking would be ordered roughly at the conclusion of this first round of work. Approval times for stages may be extended by the TOCOR if previous stages incur additional time needed to reach acceptance and TOCOR approval. Delivery dates must be maintained unless extended by the TOCOR during QA/QC reviews. Failure of quality control checks at one or more designated stages does not alter the successful bidder's responsibility to maintain overall delivery schedules stated for each Subtask ID.

For these products in Tables 1 and 2 with RDST status marked as (xxxx), draft software module **Introduction** and "R" - **Requirements** document sections, along with an initial straw layout of conceptual **Design** and **Specifications** (stated as to how the Contractor intends to achieve each effort), will be provided by the Contractor for each Subtask associated with a specific request for work plan from the TOCOR (e.g., provide a stated list of requirements that will be used test overall module functionality).

Table 1 & 2 Note_1&2A: Reference descriptions for categories shown are adopted from Section 5.0 Cost-Basis Controls Guiding Incremental Oversight of Work Plan Execution in Summary of Guiding Principles and Best Practices for Quality Assurance in Modeling (Babendreier, 2014a)[1]; these describe QA Level III RDST-based QAPP standards required for all Subtasks in Tables 1 & 2 (i.e. developer-based software verification).

Tables 1 & 2 - Note_1&2B: HE2RMES' existing pre- and post-processor software modules (SDP, CDP, and CPP) are not targeted directly for enhancement, other than in adjusting to new or redefined roles in servicing either new HE2RMES science modules to be created under this Task Order, and/or existing modules modified/enhanced as part of the overall software development effort described in this Task Order.

Tables 1 & 2 - Note_1&2C: On handling of legacy 3MRA document systems: there is no expectation by EPA, or need anticipated, to modify legacy 3MRA document systems, nor associated peer review support materials, unless materials are carried forward, to be reused in new deliverables due under this Task Order. The Contractor must nonetheless maintain the 3MRA legacy documentation system that has been captured, as it is now completely, within the HERMES v1.0 documentation and help system. Representing a documentation base spanning 15 years, the base is material to HE2RMES QA, and is seen also as critical to preserving the public's knowledge of that development effort.

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[1] Babendreier (2014a). *Summary of Guiding Principles and Best Practices for Quality Assurance in Modeling*. QA/QC Management Protocols adopted for ERD iemTechnologies Software Development. Amendment #2, August 1, 2014. USEPA, Office of Research and Development, Athens GA.

Outside this Task Order's scope but underpinning the high importance the Agency places on quality assured software development activities being undertaken in this project, the iemTechnologies RIMM-based product line, as final outcomes and bundled file systems for its installer, are expected to also undergo additional peer review and Agency clearance. The final build is geared for eventual clearance and distribution through EPA's servers which handle public offerings (e.g. ORD's CEAM website; OSWER's various public website offerings, etc).

DETAILED TASK DESCRIPTIONS

Task Enumeration Nomenclature and Standards Applicable to Tasks 2, 4, 5, and 6

All drafts and final reports shall be approved by the TOCOR according to the schedule for each Task and/or Subtask in Table 1 and Table 2, covering Tasks 2, 4, 5, and 6, or as otherwise specified in Task 1, 3, 7, and 8. The contractor shall incorporate the TOCOR's and QA Officer's comments into subsequent revisions of each draft ***software*** delivery; the term ***software*** is to be explicitly defined under the QAPP and shall include all critical file systems. Based on standards imposed under Task 1[2], standard *tagging* will be used in delivering Table 1 and 2 product lines, to distinguish deliverables expected across the approved effort per Subtask.

For purposes of tagging these staged product deliveries for each Task and/or Subtask ID, one of 7 suffixes (**A**, **B**, **C**, **D1**, **D2**, **E1**, or **E2**) will be applied, each representing one of the expected RDST-driven intermediate or final deliveries. Approval by EPA is omitted as a review step in processing stages ***D1*** and ***D2*** shown in Tables 1 and 2. A development status of *beta* is associated with all deliveries except Stages ***E2*** shown. As indicated, final ***requirements*** must be formulated (i.e., written out in enumerated lists, in prose format), prior to work plan approval. Requirements for each Subtask represent the expected outcome of the software product ordered, where the test plan assures all requirements have been met (adequately testing each requirement). Examples of interpretation of the "staged-development" nomenclature adopted here are:

- Subtask 2.16 deliverables statements identified as "Subtask 2.16 Deliverable *A*" indicates the deliverable associated with "***Finalize Requirements (R)***" for the EcoRisk module.

- "Subtask 2.3 Deliverable ***D1***" indicates the deliverable associated with "***Deliver the As-Is Beta Software System and Documentation***" for the Aquifer module, for the related sub-condition "***@ ~60% total Task and/or Subtask LOE***".

- Similarly, indicating the final product expected, "Subtask 2.6 Deliverable ***E2***" indicates the deliverable associated with "***Deliver the As-Is Final Software File System and QA" Summary*** for the Watershed module, for the related sub-condition "***@ < 100% total Task and/or Subtask LOE***".

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[2] Appendix C *in* Babendreier (2014a); see Section 5.0: *Cost-Basis Controls Guiding Incremental Oversight of Work Plan Execution*.

The software activity stages involve incremental review. This imposes that the Contractor's development team, and the TOCOR, towards the midway and closing marks, assess overall progress on development goals for each Task and Subtask effort. The structured approach ensures that the Contractor's team is moving the product line into deliverable, testable file system format. Also, that this is all being done according to expected final delivery standards, expected file and/or compiler formats, and product line delivery schedules. These are explicated by stages for Tasks 2, 4, 5, and 6, as shown in Tables 1 and 2, given relative to work plan approval dates. Delivery and schedule details are specifically set in prose for Tasks 1, 3, 7, and 8.

Relaxed Benchmark Schedules Allowed for Existing and New Source-Term Modules

An added provision is made here for allowance of possibly needed additional time for reaching final ***Design*** and ***Specifications*** for existing and new ***source-term*** modules being developed under this Task Order. This is also provided for to allow for collaborative design discussions inclusive of OSWER\ORCR technical staff. To this end, deliverables designated by suffix ***B*** (Babendreier, 2014a; see Appendix C Section 5.0) are provided allowance to incur up to 40% of total Task and/or Subtask LOE, instead of the default value goal of 20%. This relates to meeting the schedule for delivery, indicating when the contractor's draft "final" ***Design*** and ***Specifications*** document sections, of the related RDST document, must be delivered to the TOCOR. The Contractor shall, nonetheless, still make every reasonable attempt to achieve the stated performance criteria as actually shown in Tables 1 and 2 (i.e., as possible attain defaults).

Software System Starting Point - iemTechnologies File System

The existing code and document basis for HE2RMES v1.0, and the partially completed SDPProjectBuilder used to develop the *10K U.S. Lifestyle Farms database*, will serve as starting points for the work. See Appendix B *in* - *USEPA's iemTechInstaller Tool Getting Started* and Appendix A *in* (Babendreier, 2014b). Files will be delivered by EPA, to each bidder for evaluation, using the latest iemTechnolgies build available at time of bid. The software file system will be acquired by the Contractor from EPA's science FTP2 server, and installed by the Contractor on their own PCs via iemTechInstaller. iemTechnologies can be placed on bidder's desktops, and then explored via the iemTechnologies' Gateway Browser Tool.

For downloading from the FTP2 ftp site address, use 134.67.20.10 (port 21), along with a collaborator UserID and password you will need to obtain directly from EPA. The following instructions should be followed for acquiring iemTechnologies as needed to assist bidders in pre-award evaluations. A user account and password needs to be obtained first, and subsequently, then, the iemTechnologies software file system can be downloaded (est. download time: ~ 30 minutes). The first two documents are provided as electronic files accessible in the bid package:

1. iemTechnologies FTP General Instructions_STREAMSBuild.docx,
2. SettingUpFTPZillaClient.JPG, and
3. USEPA's iemTechInstaller Tool Getting Started in (Babendreier, 2104b).

Across the entire Task Order and its associated period of performance, the contractor shall, perform the following Tasks, numbered 1 through 8.

Task 1: Develop QAPP

All work conducted under this Task Order shall be performed pursuant to an EPA-approved Quality Assurance Project Plan (QAPP). The QAPP shall outline the approach and measures the Contractor will implement to ensure the highest standard of quality in data, models, tools, and associated software systems produced under this order. The QAPP will be submitted by the contractor with care to ensure minimum requirements are captured from the standards referenced here, needed to establish a sound software development process and measurement system for software product line outcomes.

The Quality Assurance Project Plan is subject to review and approval by the TOCOR and the EPA QA Officer. Work on Tasks 2 to Tasks 8 inclusive, including all associated Subtasks, cannot proceed until the following two conditions are met on a Task- and/or Subtask-level basis:

(1) The contractor receives notification of the QAPP approval from the TOCOR; and
(2) A Technical Directive has been issued by TOCOR, and an associated Work Plan has been approved by the TOCOR, which explicitly identifies by Task and/or Subtask level as appropriate, approved work, approved LOE, and approved costs.

Guidance and Related Specifications for Development of QAPP

The contractor shall prepare a software-development-oriented Category III Quality Assurance Project Plan (QAPP) in accordance with applicable sections of "EPA Requirements for Quality Assurance Project Plans for Modeling." The QAPP shall describe the project's specific quality assurance project plans to achieve the objectives of the Task Order, ensuring overall consistency and compliance with the QMP for this contract. The QAPP shall also be developed to specifically adopt *QAPP-managed software activity categories* and associated descriptions[3]. These RDSTs guidelines were specifically developed for ORD Category III Modeling QAPPs, and are adopted here to support this work effort.

Guidance for ***ORD QA Category*** (sometimes referred to an ***ORD QA Level***) references and associated definitions at each level are summarized in Exhibit 2[4]. Excerpts here provide an overriding guidance in place for modeling projects that this Task Order's QAPP shall generally be developed in accordance with (Babendreier, 2014a). In developing the QAPP, it shall comply with applicable EPA standards and guidance, shown in Exhibit 2 by Babendreier (2014a), which derives, summarizes, and collates key referenced guidance and standards across available literature. To that end, the following specific standard of compliance will be established and achieved across Tasks 2 through Tasks 8, unless otherwise indicated in approved work plans:

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[3]Appendix C *in* Babendreier (2014a); *RDST-based QA/QC Standards for ORD Category Level III QAPPs Software Development Projects.*

[4] Babendreier (2014a). *Exhibit 2 Guidance for Interpretation of QA Level Requirements for Modeling Projects.*

- **Best Practice Type** ≡ [Software] ***Development***, and
- **Example Model Evaluation Tasking** ≡ [Software] ***Verification***.
  a.k.a. QAPP needed for Task Order: Software Development - Verification.

Where the above standard is expected to be applied across this Task Order, either this standard, or as appropriate, an alternative standard will be explicitly sub-specified at Task and Subtask levels by the TOCOR, during the work plan approval for each Technical Directive issued (identifies one of four primary software "activities" that dominate each task).

Software Development Support Activities and Associated QAPP Work Flows

This work statement covers scope for development, assimilation, maintenance and enhancement of models, data, and tools, and the various associated software systems related to EPA's strategic, modular iemTechnologies development approach.

In addressing defined tasks found in Tasks 2 through Tasks 8, work will be implemented by the contractor through execution of key software support activities, covering ***maintenance***, ***development***, ***enhancement***, and/or ***miscellaneous tasking***, and which generally include all inherent work associated with software system(s) testing and integrated system(s) reference implementation(s). Each task-type indicates a specific work flow associated with common steps expected to be carried-out by the contractor to document associated QAPP management outcomes, and manage individual responses in general to Technical Directives.

A given Task or Subtask here may often retain a mixture of some or all of these activities; each is handled and measured by the most appropriate, dominant attributable work flow designation (set here, a priori, by EPA, by Task and/or subtask during work plan approval). M***iscellaneous tasking*** activities are, by reference, incorporated generally as part of common activities for the other three software support activity designations. For each of Tasks 2, 4, 5, and 6, a single, dominant category is assigned, by Task ID and/or Subtask ID. Example specification of ***work flows*** to be managed for each of the four categories of ***software state*** are delineated in Babendreier (2014a; *see* App. C - see Section 2.0).

QAPP Software Development Work Flow Diagram:

Assisting the team in managing software code development related Tasks 2, 4, 5, and 6, and to be included and referenced within the contractors work plans and the QAPP, a Technical Directive Workflow diagram[5] (single figure) shall be furnished by the contractor constituting the simple basic steps (work flows) associated with each of the four primary software development activities that might need to be managed during project execution. Applied to each Technical Directive issued by the Task Order COR (TOCOR), and where noted to be applicable across the three non-miscellaneous activities, this diagram shall capture and organize the key, salient steps that organize development team "key software support activities" in going from:

[5] Appendix C *in* Babendreier (2014a); see Figure 2 *Example Technical Directive Workflow Diagram*

1. Receipt of a Technical Directive

2. Final Work Plan approval,

3. Establishment of final R, D, S elements,

4. Software coding, testing, evaluation, and contractor QA testing certification,

5. Delivery of completed ***software*** to EPA for its evaluation and acceptance.

6. Final acceptance of completed unit efforts and products established under the Task

7. Summary technical report (WORD) across relevant Task and/or Subtask groups, tabulating outcomes of all associated unit and integrated system efforts ordered, including an overall QA systems analysis of the final product sub-line.

    a. This builds eventually to a single report across all Tasks.

    b. If using a cross-TD format, it shall be intermediately updated and re-issued to the TOCOR concomitantly with Task-level any completion state reaching the "@ < 100%" completion state for a given Task and/or Subtask[6]; to be submitted to the TOCOR for use in certification of product acceptance by EPA.

QASP Acceptance Criteria

EPA's acceptance criteria shown in this Task Order's Quality Assurance Surveillance Plan (QASP) are guided by QA Category III QAPP sub-specifications for software development (Babendreier, 2014a). The sub-specification ***RDSTs*** n these cases track tangible software unit deliverables, across each Subtask ID accordingly indentified in Tables 1 and 2 (each ***software unit*** is tracked by a unit's RDST). The workflow diagram shall address intermediate and final repository actions expected by the Contractor for each Task and Subtask ID. All electronic ***Final*** deliverables shall be placed in the repository by the Contractor.

All four software development activities, in Table 1 of Appendix C in (Babendreier, 2014a), are expected to be possibly utilized across the Period of Performance of this Task Order. The work flow diagram shall also indicate the general needs for final project-level summary reporting, addressing: (1) QA outcomes; and (2) software bugs across all Task and Subtask IDs.

Each Bidder's proposal, and equally the case for the successful Bidder's ***Final*** QAPP to be approved by the TOCOR, must explicitly address software design approaches and standards

[6] Appendix C *in* Babendreier (2014a); see Section 3.0 *Work Flows and Related Aspects of Schedule, Deliverables, and Acceptance Criteria.*

that will be utilized in addressing elements in both project Objectives (#1 and #2) associated with primary and secondary data standards (Babendreier, 2014a; e.g., I/O flow through D4EM)[7].

Software File System Delivery Mechanisms (Supporting Two-Way File Exchange)

The Contractor will deliver all intermediate *Draft* products due to the EPA's FTP2 science server (i.e., stages **A, B, C, D1, D2, E1**), and all final products ordered to the *Final* repository mechanism designated (i.e.; stage *E2* possibly using USDA's Colab website); see App. C Section 5.0 *in* Babendreier (2014a) and Tables 1 and 2. The Contractor will maintain compliance with general conduct rules established by EPA and associated technical system administrators for these systems. The Contractor will use FTP and final repository accounts, and associated directory structures established by the TOCOR for these server systems. FTP accounts and a project-level directory structure for all Tasks will be initialized by the TOCOR post-award.

The TOCOR will use these same storage and transfer systems, generally, and/or email, to deliver EPA responses back to the Contractor, for all EPA review and approval steps established specifically in detailed task descriptions, for each of Tasks 1 through 8.

Task 1 Deliverable A: *Draft* QAPP submitted to the TOCOR for review. Due 15 days maximum from award of contract.

Task 1 Deliverable B: A revised *Final* QAPP addressing TOCOR's and QA officer's comments. Due one (1) week after receiving associated comments from the TOCOR. Allow one (1) week for response and/or approval by the TOCOR.

Task 2: SDPProjectBuilder for the Existing HE2RMES v1.0 Modeling System

The designated software support activity for this work is ***Software Enhancement***, except for Subtask 6.4, which, since it's new, is designated as ***Software Development***, as described in Table 1 of Appendix C *in* (Babendreier, 2014a).

The purpose of Task 2 is to complete the existing SDPProjectBuilder application for ***Anywhere USA*** functionality, supporting LAU-based RIMM assessments (existing form model first, then GEM-LAU) as the initial, first "system" priorities, across Task 2 efforts. Subsequently, Task 2 progresses to establish similar functionality for the other four existing HE2RMES source-term models, as well as all new source-term models being developed under Task 5 and Task 6.

As the standard for all efforts to complete the integrated SDPProjectBuilder application, the final routines shall provide *full-service* parameterization across HE2RMES' existing source-to-outcome modeling domain. As a general system-wide requirement, the SDPProjectBuilder shall support uses of HE2RMES' existing full source-term model suite, including integrated uses

[7] Appendix C *in* Babendreier (2014a); see Section 6.1 *Assuring Primary and Secondary Data Standards in Software Design.*

of all existing and/or enhanced F/T, foodweb, exposure, and risk models supported in the HE2RMES v1.0, including HE2RMES pre/post-processors (SDP through ELP2 function sets).

The work entails development of RDST-type quality assurance documentation patterns, using the same structured design, delivery, and review processes in place used to build the HE2RMES v1.0 modeling system, and partially completed SDPProjectBuilder. See Appendix C and D *in* (Babendreier, 2014a), and discussions under Task 1, for detailed expectations for all ***RDST*** deliveries. Generally, facets of new RDSTs will mimic existing RDST *starting points*.

Existing SDPProjectBuilder RDSTs - Available for Review Pre-Award

Shown in Table 1, EPA and its Federal partners, under previous work efforts, have developed **RDST** documents (less test plans), for each of HE2RMES existing science models (See Subtasks 2.1 through 2.21, inclusive). In addition, these efforts developed two added RDSTs, as separate standalone SDPProjectBuilder modules. EPA developed these "standalone" counterparts to support immediate, extended use of SDPProjectBuilder for use with EXAMS and ISCST, outside of FRAMESv2 (the other two complements are for wrappers used inside FRAMESv2). The draft RDSTs will be delivered via iemTechnologies and will be found under *...\iemTechnologies\FRAMESv2\HE2RMES\Documentation\SDPProjectBuilder\DraftRDSTs.*

These RDST documents, referenced in Table 1, establish the expected draft requirements that these routines, once built, will meet. In their proposal, each bidder may address any proposed changes that differ from these requirements (for Task 2), and should indicate how proposed changes contribute more effectively to the design goals and project objectives.

Key Assumptions for LOE and Subtask-Level Cost Estimation

The iemTechInstaller bundle set will contain the 19 RDST-based SDPProjectBuilder "use case" documents referenced in this Task. Test plans in most of these cases have not yet been described or explicitly defined, but all requirements have been established for each module. Substantial detail in proposed design and specifications has also been provided. For purposes of Technical Direction, the 19 new RDSTs and associated software laid out in Table 1 are designated here for treatment as explicit Subtasks, <u>where proposed costs for completing each D4EM-4-HE2RMES module shall be provided by each bidder, for each Subtask designated</u>.

Proposed costs shall also address, by Subtask ID, associated assimilation costs for integrating each individual D4EM-4-HE2RMES routine into the collective, integrated system-level SDPProjectBuilder application (i.e., that users will launch and run to setup sites, and/or sets of sampled sites for study and analysis via the HE2RMES modeling system). This generally excludes help systems for SDPProjectBuilder, handled under Task 7, but shall include:

1. Handling all software development and enhancement aspects associated with both the GUI and runtime side routines comprising the SDPProjectBuilder software system, and

2. All software development and enhancement aspects associated with the expected use and/or leverage of GUI and/or runtime side routines comprising the OpenTERRAworks v1.0 software system (e.g., 2D/3D landscape design-assisted source-term specification).

The Contractor's proposed costs shall also include all efforts needed to incorporate and merge all new file systems into the existing iemTechInstaller bundled system, including meeting all standards in place for directory structures and package deliver formats contained therein.

Subtask 2# Deliverable ***A_Draft*** **,** ***B_Draft*****,** ***C_Draft*****,** ***E1_Draft*****,** ***E2_Draft*****:**
Draft RDST submitted by the indicated Table 1 delivery date to the TOCOR for review of the associated SDPProjectBuilder Subtask's use case; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Allow for time indicated in Table 1 for TOCOR's response.

Subtask 2# Deliverable ***A_Final*****,** ***B_Final*****,** ***C_Final*****,** ***D1*****,** ***D2*****,** ***E1_Final*****,** ***E2_Final*****:**
A revised ***Final RDST*** addressing TOCOR's and QA officer's comments for the associated SDPProjectBuilder Subtask's use case (see Table 1); includes all associated stage ***as-it's-built software*** for deliverables ***D1***, ***D2***, ***E1***, and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Due one week after receiving associated comments from the TOCOR. Allow for time indicated in Table 1 for TOCOR's response and/or approval.

To distinguish the state of each document's stage, deliveries listed in Table 1 shall be tagged for each deliverable using suffixes of ***Draft*** and ***Final*** for planned two-way file server exchanges, as designated under approved work plans for intermediate and final product lines. In all cases, ***Draft*** sub-designation tags used in this nomenclature map 1:1 to the associated designation for ***Final***, also listed here as an expected deliverable, accordingly indentified.

Revisiting General Deliverables Notation Used in This PWS

For each Subtask identified in Table 1 and Table 2, the above notation will be used to define expected deliverables and schedule. The "staged deliverables set" represents a schedule itself (i.e. series) of deliverables that lead eventually to and conclude with a single, final software package/module. It leads generally to a final, updated RDST quality assurance (QA) document, along with executed and certified test plans. For deliverable notations and descriptions, see the QA document's "deliverables" schedule[8].

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[8] Appendix C *in* Babendreier (2014a); see Section 5.0: *Cost-Basis Controls Guiding Incremental Oversight of Work Plan Execution*.

Establishing Requirements for Tasks and Subtask Associated with Software Activities

Notation adopted in Table 1and assumed here sets expectations that ***A_Draft*** is delivered at the time of bid proposal, by each vendor, in at least conceptual form for each Subtask ID. If currently without a straw or detailed "near-final" set of draft requirements statements, a straw set should be developed with the bid (see Tables 1 and 2). For legacy enhancements and extensions, straw requirements can include the full set or subset of existing requirements by reference to existing RDST, and as applicable, enumerated subsets of requirements, if all are not to be included. Set during the work plan negotiation and approval process, the deliverable ***A_Final*** indicates simply that final requirements for each Subtask ID, identified in Tables 1 and 2, have been established and put in place for these software development and/or enhancement activities[9].

Revisiting General Deliverables Notation Used in This PWS

Allowed for non-functional changes only, in handling any finalized grammar and/or language specification coordination changes amongst system components, related minor updates to requirements statement sets will be tracked in each RDST draft submitted by either the Contractor (*as **Draft** or **Final***) and/or the TOCOR (*in response*). Edits to all sections on each stage may typically occur as the RDST matures across various steps associated with software activities described in Table 1 of Appendix C *in* (Babendreier, 2014a).

Deliverables ***D1*** and ***D2*** represent intermediate EPA-conducted QC system check-ins, where these deliverables have no required expectation of subsequent formal TOCOR response to the Contractor. As such, these two deliverables are not labeled ***Final***.

Until the RDST and software associated with ***E1_Draft*** is delivered to the TOCOR, there are no formal EPA review steps after ***C_Final***. Using current ***as-it's-built software*** (e.g., ***D1***, ***D2***), the TOCOR, and through the TOCOR, other EPA review staff, will, as practical and duties allow, test the system, and send intermediate analysis, comments and bug descriptions back to the Contractor for resolution. These will be sent as they become known, documented, and available for transmittal, per outcomes of the ***Cross-Team Extreme Testing*** approach. All EPA transmittals to the Contractor will be coordinated through the TOCOR, for all deliverable stages identified in Tables 1 and 2, for all Subtask IDs accordingly identified.

Outcomes Serve as an the Effective, Extended Starting Point for Other Tasks

By reference here, associated SDPProjectBuilder development work and costs for new or enhanced science modules described in other Tasks or Subtasks are to be handled separately. The general ordered assumption is that the new D4EM routines produced under Task 2 will be available as new, intermediate (i.e., extended) starting points for all other Tasks below, as well as

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[9] See Table 1 - *QAPP-Managed Software Activity Categories* *in* Appendix C *in* Babendreier (2014a).

subsequent Subtasks that may follow in completing the rest of Task 2. To minimize development costs, the TOCOR likely order efficient-sequenced Subtasks in Technical Directives to be issued.

Task 3: Establish Windows-based PC-Cluster and Conduct Extreme-Testing

This tasks requires that the Contractor establish their own development team testing apparatus, in-house, for running tests on software systems being produced under this Task Order. The Contractor, post-award, should attempt to initiate its ***MiniMUSE*** testing capability as soon as practical, as described in Task 3.1, and begin heavily testing HE2RMES experiments installed with iemTechnologies. This is a critical element of effort needed to for the development team to gain familiarity with the iemTechnologies system, its operations, and its capabilities.

As-It's-Built: Cross-Team Extreme Testing, Evaluation, and Debugging

Using both serial and parallel computing testing regimes (SuperMUSE and/or ORDsMUSE), EPA staff will also concomitantly work to evaluate the SDPProjectBuilder and HE2RMES modeling systems. This will be done, as one course, to develop in-house operational capacity for the target client (at OSWER via ORDsMUSE). ORD also plans to use SuperMUSE to support testing for software developed under this Order. OSWER's and ORD's efforts will improve quality assurance of intermediate and final deliverables, and during the course of the project, will be done, where practical, to aid the Contractor in bug identification. These early efforts will also help to keep EPA's technical reviews of the design-build process on track.

Bugs Detected in Unit Software Not Currently Covered Under Active Work Plans

Per the QAPP, if bugs are encountered that appear to be possibly outside currently approved scope (i.e., approved active work plans), the Contractor shall notify the TOCOR within 5 days, or earlier as soon as practical. The TOCOR will determine if the bug will be fixed by the Contractor or EPA, or otherwise handled by the TOCOR. Prior to approving any efforts to debug the errant software, the TOCOR will first assess if additional Technical Direction: a) is needed; b) can be issued under currently approved work; and/or c) if a Task Order modification is first necessary to establish model support activities necessary to achieve full resolution of the bug(s).

Subtask 3.1: Establish a 10-to-20 node PC-Cluster Capability (Windows 7)

Establishing a Mini-PC-Cluster Capability at the Contractor's Location

Complementing the EPA development team approaches for *extreme unit- and system-level testing*, the Contractor shall similarly establish and conduct initial demo testing and subsequent HE2RMES system simulation. Within 30 days of QAPP approval, a parallel cluster operation for testing, with 10-to-20 Microsoft® Windows (Version 7+) nodes shall be established for the Contractor's development team's testing regime; the cluster can be virtual on a server blade split on 10 nodes, for example, or physically defined by 10 standalone PCs in a

small networked office cluster. The overall goal is to conduct *extreme system testing* earlier, and often, by a cross-section of project team members spanning design, build, and "new user" roles.

Demonstrate Serial & Parallel FRAMESv2 Simulation Fluency via iemTechnologies

The PC-cluster demonstration associated with Subtask 3.1 shall include initial test runs of ***canned demos*** installed with iemTechnologies bundles:

1. ***CO2_serial*** (see CO2 *domain in FRAMESv2; ..FRAMESv2\Simulations\CO2);*
2. ***CO2 parallel*** (also see CO2 *domain* in FRAMES*);*
3. ***HE2RMES LAU_Serial (***see ***...****\FRAMESv2\Simulations\HE2RMES); and*
4. ***HE2RMES LAU_Parallel.*** (also see the HE2RMES *domain in* FRAMES*);*

Total costs shall include subsequent Contractor efforts needed for the first month for focused learning, running, and testing of the existing HE2RMES v1.0 modeling system in FRAMESv2. Include costs in working with FRAMESv2 tools, SuperMUSE's parallel computing routines, and SuperMUSE serial and parallel experiments using one to 20 PCs (e.g., as useful, emulate 1 PC clusters for typical desktop testing purposes by individual developers). The estimated costs for setting up and operating the cluster (Subtask 3.1; first month) shall be set apart from efforts to continually run the ***extreme-testing*** system for one month increments afterwards (see Subtask 3.2; for subsequent simulation testing efforts to ne conducted by month).

Subtask 3.1 Deliverable A: *Draft PC-Cluster Setup and Initial Testing Report* shall be developed by the Contactor and submitted to the TOCOR within 40 days of QAPP approval, summarizing: a) the date the Contractor achieved operational status for the initial 10-to-20 node PC-cluster - showing successfully run CO2 and HE2RMES demos; b) efforts to conduct initial iemTechnologies CO2 and HE2RMES demos and testing as specified; and 3) ongoing simulation work with HE2RMES v1.0 domain. Allow one (1) week for the TOCOR's response.

Subtask 3.1 Deliverable B: A revised *Final PC-Cluster Setup and Initial Testing Report* addressing the TOCOR's and QA officer's comments for the associated onetime QA start-up effort. Due one (1) week after receiving associated comments from the TOCOR. Due one (1) week after receiving associated comments from the TOCOR. Allow one (1) week for response and/or approval by the TOCOR.

Subtask 3.2: Conduct Periodic Extreme-Testing on the Contractor's Cluster

Multiple units of Subtask 3.2 may be ordered monthly, across the Period of Performance. Beginning 30 days after the QAPP is approved, for purposes of this Task Order, the level of simulation-testing expected of the Contractor throughout the rest of the Period of Performance shall be estimated and performed monthly, to comply with the default standard adopted here of

operating at > 85% utilization on a monthly basis[10]. See Task 7 for related SDPProjectBuilder requirements for also carrying out coordinated ***system-level*** testing and ***batch-site*** testing on that system of tools. Work under Subtask 3.2 would be expected to utilize datasets generated under systems-level testing in Task 7 for the SDPProjectBuilder tool.

The Contractor shall estimate the cost to maintain and summarize compliance with this ***extreme-testing*** standard adopted here, on a monthly basis The Contractor shall set and adopt a Task-Order-wide bug tracking inventory report EXCEL-spreadsheet called for under the QAPP, and begin using it for these purposes. This shall provide a series of monthly summaries that lead to a final, updated current bug report at the conclusion of associated work plan efforts (e.g., indexed on bugID, system, module, etc.)[11].

Reporting Pattern Should Mimic QAPP's Required Master Bug Tracking Inventory

The effort in Subtask 3.2 should include costs for developer analysis to archive error patterns detected in extreme-testing efforts (i.e. list of bugs, test-beds; status, resolution etc). These costs shall provide for error summary and reporting of general malfunctions, associated conditions, and, if known or identifiable quickly, reasons for the failed or undesirable behaviors detected (many are easily identified). Extreme-testing results and bugs shall be tracked, combined and summarized, using a single, system-wide unit software bug tracking inventory.

Debugging Costs Associated with All Software Activities are Handled at the Unit-Level

Task 3 efforts described here are exclusive of significant system analysis needed to identify causes and needed fixes for complex bug patterns. Estimates for Task 3.2 costs should not include software debugging activities for failed software units indentified during this testing. Associated costs for bug analysis and associated software debugging activities shall be accounted for by the Contractor as a typical effort that will be predictably encountered in quality assuring software units under development, and/or enhancement activities approved under other tasks in this Task Order (i.e., debugging costs shall be estimated and provisioned in Tasks 2, 4, 5, or 6).

As part of the Subtask 3.2 work effort, the Contractor shall briefly document and summarize outcomes of their monthly extreme-testing efforts and results. Specifically indicating whether or not utilization of the testing platform was maintained at > 85%utilization (yes/no). As part of the periodic monthly reporting of the Task Order, the Contractor shall also briefly document and summarize outcomes of their monthly extreme-testing efforts and results there.

Subtask 3.2 Deliverable A: A *Draft* EXCEL-based, system-wide Bug Tracking Inventory Report shall be submitted to the TOCOR within 10 days of concluding the associated month's testing effort. Allow one (1) week for response and/or approval by the TOCOR.

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[10] Appendix C *in* Babendreier (2014a); see Section 6.2.2: *Example Specification For Use in Setting Requirements for Cluster Testing*

[11] App. C *in* Babendreier (2014a); Sect. 1.0: *General Tasking to be Performed as Part of Quality Control Work Flow*

Subtask 3.2 Deliverable B: A revised *Final* EXCEL-based system-wide Bug Tracking Inventory Report addressing the TOCOR's and QA officer's comments for the month's report. Due one (1) week after receiving associated comments from the TOCOR. Allow one (1) week for response and/or approval by the TOCOR.

Task 4: Hydrogeologic Model Enhancements for HE2RMES

The designated software support activity for this work is ***Software Enhancement***, as described in Table 1 of Appendix C *in* (Babendreier, 2014a). Refer to Table 2 for Subtask IDs.

Enhance Vadose Zone and Aquifer Modules in HE2RMES

EPA's CMTP (comprised essentially of 3MRA's vadose and saturated zone models) has had both computational and database updates since 2003. Future OSWER risk assessments need to reflect these updates. Covering various decadal improvements in fate and transport science and related support databases and datasets, the Contractor will migrate EPA's CMTP model science enhancements (as EPA CMTP v2.1 and v2.2), in one effort, into HE2RMES vadose and aquifer codes, and as needed across the rest of the source-to-outcome model domain set. The Contractor will maintain the legacy system and enumerate the new modules as shown in Table 2.

Address Collaterally-Affected Modules in HE2RMES

Each Bidder will address in their proposal the expected list of ***affected modules*** across this Task. Proposed costs must include all associated efforts expected to be incurred in order for the Contractor to complete and deliver updated software and QA documentation for each of the ***affected modules*** also. The Bidder's proposed cost in handling ***affected modules*** should address minimization of work effort across all Subtasks in the Task to the degree feasible. The Bidder shall evaluate and address possible effects that may arise in final design and specifications, indicating what changes will be needed for any affected science modules, system modules, and/or pre/post-processors across the HE2RMES v1.0$^+$ modeling domain, and SDPProjectBuilder v1.0$^+$ routines.

Deliverables for this Task must also include comparable numbering, as listed, for similar deliverables ***E1_Draft*** and ***E2_Draft***, that will update <u>all</u> effected unit module's documentation and software (i.e., for other HE2RMES science modules and pre/post-processors that were affected by the targeted work). Developed together with the Contractor as key information becomes certain in final design stages, the specific final list of ***affected modules***, for this Task, for each Subtask, will be specified by the TOCOR in responding to deliverable ***C_Draft***.

If costs are not included under related deliverables stated for ***affected modules***, delivered in conjunction with Subtask 5.1 and Subtask 5.2, the Bidder must include associated cost estimates within this Task (Task 4). Apportion all ***affected modules*** work needed, as accurate as possible, when providing this estimate across both Subtask 4.1 and Subtask 4.2. The Bidder may assume that both Subtasks 4.1 and 4.2 are issued together within the same Technical Directive.

Update HE2RMES RDST and Help System, and iemTechnologies Assimilation

Modified, updated RDSTs will be required for each Subtask in Task 4, as indicated in Table 2, but should largely be derivable from the legacy model pattern, aside from specifications associated with inclusion of an optioned use of the EPACMTP's newest "stream plume" interceptor module. The Contractor's proposed effort and costs shall address all associated help system development/changes that will be needed to update the existing help system in HE2RMES v1.0, including existing unit- and system-level ORD QA Level III RDST documentation, video help system, and miscellaneous system documentation. The Contractor shall account for supporting all model versions, legacy and new, in all final documentation needs described here, for target enhanced models (vadose and aquifer) and all other ***affected modules***.

The Contractor's estimated costs shall include all efforts needed to incorporate all new file systems into the iemTechInstaller bundle system, generally maintaining concordance with all existing standards in place for directory structures (i.e., iemTechnologies *starting point*).

Subtask 4# Deliverable ***A_Draft*** **,** ***B_Draft*****,** ***C_Draft*****,** ***E1_Draft*****,** ***E2_Draft*****:**
Draft RDST submitted by the indicated Table 2 delivery date to the TOCOR for review of the associated Subtask's HE2RMES module identified; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Allow for time indicated in Table 2 for TOCOR's response.

Subtask 4# Deliverable ***A_Final*****,** ***B_Final*****,** ***C_Final*****,** ***D1*****,** ***D2*****,** ***E1_Final*****,** ***E2_Final*****:**
A revised ***Final RDST*** addressing TOCOR's and QA officer's comments for the associated Subtask's HE2RMES module identified (see Table 2); includes all associated stage ***as-it's-built software*** for deliverables ***D1***, ***D2***, ***E1***, and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Due one (1) week after receiving associated comments from the TOCOR. Allow for time indicated in Table 2 for TOCOR's response and/or approval.

Subtask 4#_AffectedMod# Deliverable ***E1_Draft*****,** ***E2_Draft*****:**
Draft RDST for the ***affected module*** submitted to the TOCOR for review by the indicated Table 2 delivery date of the associated Subtask's HE2RMES module identified as the ***affecting module***; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***. Allow for time indicated in Table 2 for TOCOR's response.

Subtask 4#_AffectedMod# Deliverable ***E1_Final*****,** ***E2_Final*****:**
A revised ***Final RDST*** for the ***affected module*** addressing TOCOR's and QA officer's comments; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***. Due one (1) week after receiving associated comments from the TOCOR. Allow for time indicated in Table 2 for TOCOR's response and/or approval.

Task 5: Develop New Source-Term Models for HE2RMES

The designated software support activity for this work is ***Software Enhancement***, except for Subtask 5.4, which, since it's new, is designated as ***Software Development***, as described in Table 1 of Appendix C *in* (Babendreier, 2014a).

Overview of New and Enhanced "Source-Term" Science Models in HE2RMES

This work focuses on extending new source-terms in HE2RMES related to improvements in modeling approaches recently made available via advances in the Generalized Environmental Model or GEM (Little, 2012), for example. GEM is expected to improve accuracy for constituent flux solvers compared to solvers originally used in the 3MRA system (at least for ***daily*** and ***sub-daily*** time steps). The Contractor will create new models that substitute GEM solvers within HE2RMES' existing models, where the work described for extending existing models and adding one new model is broken down explicitly in Subtask IDs 5.1 through 5.6, as shown in Table 2.

For LAU, LF, and WP models, this work will substitute GEM for the original legacy solver approaches, replacing the Generalized Soil Column Model or GSCM. Appendix C *in* (Babendreier, 2014b), *RIMM-Prioritized Targets for HE2RMES Science Model Enhancement*, provides an overview and reference with background information on the GEM solver system, as well as other science model description aspects associated with work descriptions across Task 5.

1. **GEM (Generalized Environmental Model):** A general form 1D-to-3D compartment model that includes decadal advances in soil and water hydrology sciences since the 3MRA soil column model. GEM, as to be applied in cases here, is expected to form along a 2D object-oriented implementation of this mass-transfer ***compartmental*** approach. The models ordered here by Subtask ID shall provide for generalized time-space solutions for soil chemistry handling, with a maintained assumption of interflow transfers still to be provided by other, existing solvers (water balance). All model forms will be updated, with consistently maintained dimensional-representation.

    a. **[Subtask 5.1, 5.2] - GEM-Based Waste-Pile and Land Application Unit Model Upgrades:** Provide a new model form that replaces the 3MRA's legacy Generalized Soil Column Model (GSCM), used in these two source-terms. The Contractor shall implement a GEM compartmental soil column approach.

    b. **[Subtask 5.5] - Enhancement Landfill Model (GEM):** Used by OSWER in its more recent Rags & Wipes Rulemaking[12], provide a new model that will incorporate the newer GEM solver methodology. Do so for both the existing landfill model and the newer one optioned for GEM, for both, adding improvements for explicit *in-situ* vapor handling and treatment of time-variant facility construction practices/approaches. This work will pivot from and extend two (2) antecedent forms of the landfill model:

[12] Conditional Exclusions From Solid Waste and Hazardous Waste for Solvent-Contaminated Wipes; Final Rule; Environmental Protection Agency; 07/31/2013 (FR Doc. 2013-18285; Filed 7-30-13)

1. The original landfill model now in HE2RMES v1.0 (beta)
2. The Rags & Wipes landfill model to be developed under Subtask 5.3.

c. **[Subtask 5.4] - New Roadway Model, GEM-Based:** Leveraging work done in OSWER's IWEM, develop a new GEM-based ***line-source*** module to model contaminant releases from multi-layered roadway and surface construction volumes. Representing effective draft requirements statements for this RDST, the new ***roadway*** model features must include:
   - Development of a GEM-based model to represent roadway designs;
   - Handling of any number of layers with depth with each layer having a unique composition as to materials, constituent composition, etc.;
   - Handling of lateral flow between compartments (road to boundary, boundary to road);
   - Ditches, berms, etc. will be handled as compartments next to the road;
   - Handling also air, water, and vapor fluid phase aspects in all calculations;
   - Assumptions:
     - Inter-compartmental flows will be based on a separate water balance algorithm that estimates daily-varying flows from rainfall/runoff/ infiltration estimates, combined with lateral steady flows from a regional flow field.
     - Will maintain an overall water balance and include daily-varying flows, but simulation of transient flows is not required to be conducted within days, similar to the IWEM modeling approach.
   - Imports D4EM routines/data directly from existing D4EM source code (LAU/LF), also leverages use of existing OpenTERRAworks roadway spatial design routines.

2. **[Subtask 5.3] - Enhance Landfill Model (Used in OSWER Rags & Wipes Rule:** References final rule (FR Doc. 2013-18285) and historical risk assessment docket**:** Incorporate the rule's final landfill model used for the risk assessment, into HE2RMES:
   - Assimilates the existing, non-GEM-based technical form of the model.
   - Extends science of existing 3MRA landfill model - adds advective transport for mass constituents in vapor phase.
   - Also enhances the treatment of time-variant facility construction and operation practices during "open" phase of landfill life.

3. **[Subtask 5.6] - Enhance Water Balance for LAU_GEM (as LAU_GEMGA)**
   - Discussed in analysis found in Appendix C *in* (Babendreier, 2014b), an investigatory conversion of the newest LAU_GEM's legacy *water balance approach;* converting this one test routine to the Green-Ampt solver will be pursued, with a desired outcomes of:
     - At a minimum, providing useful model evaluation information on ***structural uncertainty*** in the final HE2RMES' source-term model set for solids and semi-solids material management; and
     - Provide for improved accuracy at all-time steps, and/or at least at shorter time step management (e.g., sub-daily);
     - Significantly extend the utility of the HE2RMES systems to a wider array of RIMM problem statements (e.g., moving towards ***acute*** service).

For purposes here, each model enhancement development effort shall result in a new, separate source-term model/module for use in the HE2RMES domain. These FRAMESv2-compliant ***model*** class objects will all allow for direct, complete, and consistent substitution, in place of their existing counterpart source-term (or analogies to these, in the case of the roadway model). All existing source-terms shall also be maintained as separate modules, as is, for continued uses; a new LF or old LF model can be selected by the user, for example, without impact to their ability to conduct full experimentally-robust simulation designs, across the entire HE2RMES source-to-outcome modeling domain (i.e. maintain flexibility of legacy module schemes; provision for new ones; and provision for smart-processor technology to handle cases).

Address Collaterally-Affected Modules in HE2RMES

Each Bidder will also address in their proposal the expected list of **affected modules** across this Task. Proposed costs must include all associated efforts expected to be incurred in order for the Contractor to also complete and deliver updated software and QA documentation for each of the ***affected modules***. The Bidder's proposed cost in this regard should address minimization of work efforts across all Subtasks in this Task, and others. The Bidder shall evaluate and address possible effects that may arise in final design and specifications, indicating what changes will be needed for any affected science modules, system modules, or pre/post-processors across the HE2RMES v1.0$^+$ modeling domain and SDPProjectBuilder routines.

Deliverables for this Task must also include comparable numbering, as listed, for similar deliverables ***E1_Draft*** and ***E2_Draft***, that will update <u>all</u> effected unit module's documentation and software (i.e., for other HE2RMES science modules and pre/post-processors that were affected by the targeted work). Developed together with the Contractor as key information becomes certain in final design stages, the specific final list of ***affected modules***, for this Task, for each Subtask, will be specified by the TOCOR in responding to deliverable ***C_Draft***.

Update HE2RMES RDST and Help System, and iemTechnologies Assimilation

A new RDST will be required for each Subtask in Task 5, as indicated in Table 2, but should largely be derivable from the existing documents, aside from specifications for solvers and specific requirements listed by module herein. One exception may be added complications associated with the new LF_RW (Landfill model for Rags & Wipes Rule) which covers markedly different enhancement strategies associated with that model's construction.

The Contractor's proposed effort and costs shall also address all associated help system development/changes that will be needed to update the existing help system, to accommodate each new source-term model, into the HE2RMES v1.0$^+$ modeling domain, including existing unit- and system-level ORD QA Level III RDST documentation, video help system, and miscellaneous system documentation. The Contractor shall account for supporting all model

versions, legacy and new, in all final documentation needs described here, for target enhanced models (vadose and aquifer) and all other affected modules.

The Contractor's estimated costs shall include all efforts needed to incorporate all new file systems into the iemTechInstaller bundle system, generally maintaining concordance with all existing standards in place for directory structures (i.e., iemTechnologies *starting point*).

Subtask 5# Deliverable ***A_Draft*** **,** ***B_Draft*****,** ***C_Draft*****,** ***E1_Draft*****,** ***E2_Draft*****:**
Draft ***RDST*** submitted by the indicated Table 2 delivery date to the TOCOR for review of the associated Subtask's HE2RMES module identified; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Allow for time indicated in Table 2 for TOCOR's response.

Subtask 5# Deliverable ***A_Final*****,** ***B_Final*****,** ***C_Final*****,** ***D1*****,** ***D2*****,** ***E1_Final*****,** ***E2_Final*****:**
A revised *Final* ***RDST*** addressing TOCOR's and QA officer's comments for the associated Subtask's HE2RMES module identified (see Table 2); includes all associated stage ***as-it's-built software*** for deliverables ***D1***, ***D2***, ***E1***, and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Due one (1) week after receiving associated comments from the TOCOR. Allow for time indicated in Table 2 for TOCOR's response and/or approval.

Subtask 5#_AffectedMod# Deliverable ***E1_Draft*****,** ***E2_Draft*****:**
Draft ***RDST*** for the ***affected module*** submitted to the TOCOR for review by the indicated Table 2 delivery date of the associated Subtask's HE2RMES module identified as the ***affecting module***; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***. Allow for time indicated in Table 2 for TOCOR's response.

Subtask 5#_AffectedMod# Deliverable ***E1_Final*****,** ***E2_Final*****:**
A revised *Final* ***RDST*** for the ***affected module*** addressing TOCOR's and QA officer's comments; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***. Due one (1) week after receiving associated comments from the TOCOR. Allow for time indicated in Table 2 for TOCOR's response and/or approval.

Task 6: SDPProjectBuilder for New and Enhanced HE2RMES Source-Terms

The designated software support activity for this work is ***Software Enhancement***, except for Subtask 6.4, which, since it's new, is designated as ***Software Development,*** as described in Table 1 of Appendix C *in* (Babendreier, 2014a).

In this Task, listed in Table 1, for each of Subtasks 6.1 through 6.6, the Contractor will develop new D4EM-4-HE2RMES ***use cases***, and related, new unit module software and RDST documentation. These are being developed to support each new and/or enhanced source-term model developed under Task 5, listed in Table 2 as Subtask 5.1 through Subtask 5.6. Note in the case of landfill, there are two antecedent cases in moving to GEM (Subtask 6.5 and Subtask 6.6),

both from the original 3MRA-based model, as well as from the newer Rags & Wipes Rule landfill model that will also be built. Per discussions in Appendix C *in* (Babendreier, 2014b), a third form will be created for LAU-GEMGA (LAU_GEM w/ a Green-Ampt solver).

The term ***use cases*** refers to the 1:1 map (typical in most regards anyway) between a set of methods called in batch that map web-acquired input data to a full representation of the module inside FRAMES. There are generally two case: direct recording and/or handled via a "standalone-to-wrapper" approach to record set. Record sets are formed first and stored in HE2RMES' ***site-specific*** database(s) (of choice), as intermediate database record sets produced by the use case routine. The stored record set is later recalled from the site-specific database(s) by HE2RMES' pre-processor set (i.e., during a simulation "run" in FRAMESv2's simulation editor).

Update SDPProjectBuilder RDSTs, Help System, and iemTechnologies Assimilation

Proposed costs shall also address, by Subtask ID, associated assimilation costs for integrating each new individual D4EM-4-HE2RMES use case into the collective, integrated system-level SDPProjectBuilder application (i.e., that users will launch and run to setup sites, and/or sets of sampled sites for study and analysis via the HE2RMES modeling system). This generally excludes help systems for SDPProjectBuilder (handled under Task 7), but includes:

1. Handling all software development and enhancement aspects associated with both the GUI and runtime side routines comprising the SDPProjectBuilder software system, and

2. All software development and enhancement aspects associated with the expected use and/or leverage of GUI and/or runtime side routines comprising the OpenTERRAworks v1.0 software system (e.g., 2D/3D landscape design-assisted source-term specification).

3. The Contractor's proposed costs shall also include all efforts needed to incorporate all new file systems into the iemTechInstaller bundle system, including complying with all existing standards for directory structures and package deliver formats contained therein.

Subtask 6# Deliverable ***A_Draft, B_Draft, C_Draft, E1_Draft, E2_Draft*:**
Draft RDST submitted by the indicated Table 1 delivery date to the TOCOR for review of the associated SDPProjectBuilder Subtask's use case; includes all associated stage ***as-it's-built software*** for deliverables ***E1*** and ***E2***; includes only the RDST document for ***A***, ***B***, and ***C***. Allow for time indicated in Table 1 for TOCOR's response.

Subtask 6# Deliverable ***A_Final, B_Final, C_Final, D1, D2, E1_Final, E2_Final*:**
A revised ***Final RDST*** addressing TOCOR's and QA officer's comments for the associated SDPProjectBuilder Subtask's use case (see Table 1); includes all associated stage ***as-it's-built software*** for deliverables ***D1***, ***D2***, ***E1***, and ***E2***; includes only the RDST document for ***A***, ***B***, and

C. Due one (1) week after receiving associated comments from the TOCOR. Allow for time indicated in Table 1 for TOCOR's response and/or approval.

Task 7: SDPProjectBuilder User Manual and Extended Help System

The designated software support activity is ***Miscellaneous Tasks***, as described in Table 1 of Appendix C *in* (Babendreier, 2014a).

Associated with the deliverable specifications below, the Contractor will develop an application-wide help system for the SDPProjectBuilder, and all its updated routines arising from all work in Tasks 2, 4, 5, and 6, covering all use case modules listed in Table 1. This will derive from the ***starting point***, and all work to be completed to assimilate Task 2 and Task 6 ***use cases***. The overall documentation specified here for the D4EM-4-HE2RMES system components is expected to develop similarly. This will be delivered by the Contractor in two serial stages, representing the SDPProjectBuilder's state associated with completion of Task 2 and Task 6 additions. The two, phased-delivered help systems are represented here as Subtask 7.1, and Subtask 7.2, where Subtask 7.1 combine's also a partially completed, mixed outcome for Task 6.

Phased Approach for SDPProjectBuilder Help System and RDST QA Documents

The first deliverable set of the new help system will cover all SDPProjectBuilder modules in Table 1, except those identified with Subtask 6.3, Subtask 6.4, Subtask 6.5, and Subtask 6.6. Model development and upgrades enumerated for the second set (Subtasks 6.3, 6.4, 6.5, and 6.6) would then complete the total effort desired, accommodating and adding these four new modules to a single, overall help system for the SDPProjectBuilder application.

For each of the delivery phases specified here, as Subtask 7.1 and 7.2, the Contractor will specifically develop and deliver:

1. A **User Manual** spanning functionality of the entire system; the manual will also include at least one (1) didactic example per HE2RMES module, illustrating its role, use, and specification in the GUI as needed to generate site data that allows for HE2RMES simulation and analysis across multiple sites.

2. **An integrative electronic help system** and, for each FRAMES v2 module in HE2RMES' domain, develop a **1-page tutorial document,** to be coordinated at the system level within the electronic help system which will handle and guide all relevant information the domain set (e.g., at the system level, handling collation of unit RDSTs, tutorials, etc).

3. **Demo SDPProjectBuilder Projects and Related FRAMES v2 Simulations**. To be coordinated with developing and executing test plans needed for unit and system-wide testing of SDPProjectBuilder modules, develop and create demo materials:
    a. Capture generated, sampled sites and their associated MySQL record sets using SDPProjectBuilder, supporting designs to handle single site and batch modes, and
    b. To provide for select, real-world examples, showing quality assured linkages at the unit and system levels, also provide targeted demonstration simulations in

FRAMES that consume the newly created input "sites", providing example output of the analyzed system via the HE2RMES ELP1 and ELP2 post-processor tools.

4. **Video help system** that shows users how to navigate the GUI, and generally work across the various SDPProjectBuilder routines to: a) select sites, b) design source-terms, and c) capture associated input datasets needed for HE2RMES simulation and analysis, etc. In all, provide 12 "vignette" videos of 5 - 10 minutes length, each covering key dimensions of the RIMM tools systems (semi) auto-data-acquisition system, and general uses within iemTechnologies. Example help systems like this are available within iemTechnologies for OpenTERRAworks and HE2RMES v1.0 (beta).
    a. To minimize project costs, this effort will be split in two phases, each to be delivered under either Subtask 7.1 or 7.2. The Contractor will judiciously parse the set in two, so that videos are only cast once throughout all efforts in Task 7.

The Contractor will manage all files produced in this effort as a single integrated help system, representing a single deliverable product target for EPA, at each delivery stage. Thus, the Contractor shall deliver two incremental versions of the SDPProjectBuilder's help and RDST documentation system. The Contractor's proposed costs shall include all efforts needed to incorporate all new file systems into the iemTechInstaller bundle system, including meeting all existing standards in place for directory structures and package deliver formats contained therein.

Subtask 7.1 SDPProjectBuilder User Manual and Help System - Phase 1

The Contractor will developed a User Manual and extended help system described in Task 7. The first deliverable set of the new system will cover all SDPProjectBuilder modules in Table 1, except those accordingly identified as Subtask 6.3, Subtask 6.4, Subtask 6.5, and Subtask 6.6.

Subtask 7.1 Deliverable A: *Draft* Integrated SDPProjectBuilder Help System (Version 1.0) submitted to the TOCOR for review by the delivery date specified in the associated work plan. Allow two (2) weeks for response and/or approval by the TOCOR.

Subtask 7.1 Deliverable B: A revised *Final* Integrated SDPProjectBuilder Help System (Version 1.0) addressing the TOCOR's and QA officer's comments. Due two (2) weeks after receiving associated comments from the TOCOR. Allow two (2) weeks for the TOCOR's response and/or approval.

Subtask 7.2 SDPProjectBuilder User Manual and Help System - Phase 2

The Contractor will developed an enhanced User Manual and extended help system described in Task 7. This second deliverable set of the new system will cover all SDPProjectBuilder modules in Table 1 accordingly identified as Subtask 6.3, Subtask 6.4, Subtask 6.5, and Subtask 6.6.

Subtask 7.2 Deliverable A: *Draft* Integrated SDPProjectBuilder Help System (Version 2.0) submitted to the TOCOR for review by the delivery date specified in the associated work plan;

Subtask 7.2 Deliverable B: A revised *Final* Integrated SDPProjectBuilder Help System (Version 2.0) addressing the TOCOR's and QA officer's comments. Due two (2) weeks after receiving associated comments from the TOCOR. Allow for two (2) weeks for the TOCOR's response and/or approval.

Task 8: Develop and Implement Webinar-Workshop Series for RIMM

The designated software support activity for this work is ***Miscellaneous Tasks***, as described in Table 1 of Appendix C *in* (Babendreier, 2014a).

Subtask 8.1 Develop RIMM Webinar Series Presentation Materials

The Contractor will assist the TOCOR in developing technical slideshow materials supporting EPA's development of two (2) webinar presentations (plan for: one (1) @ 30 minute and one (1) @ 60 minute length; one (1) slide/minute rate). The longer slideshow shall make select excerpted use, for example, of the HE2RMES and SDPProjectBuilder systems' videos. The presentations will highlight this collective RIMM system capability set, developed across the Task Order. Task 8 efforts will focus primarily on documenting the ***as-it's-built software*** development state, marked at the time of work plan issuance for each of Subtasks 8.1 and 8.2.

EPA will finalize the two presentations and clear them for public uses and distribution, for general use in providing debriefings and/or educational materials on the RIMM system. These will be used by EPA and others for a variety of project dissemination purposes. The Contractor will provide an estimate of all costs needed to finalize the Webinar presentation materials defined here.

Subtask 8.1 Deliverable A: Two (2) *Draft* presentations submitted to the TOCOR for review. Due 30 days maximum from approval of the associated work plan. Allow one (1) week for response and/or approval by the TOCOR.

Subtask 8.1 Deliverable B: Two (2) revised *Final* presentations addressing the TOCOR's and TOCOR's QA officer's comments. Due one (1) week after receiving associated comments from the TOCOR. Allow two (2) weeks for the TOCOR's response and/or approval.

Subtask 8.2 Conduct Single RIMM Webinar Event and Co-Present with EPA

Cost estimates shall be provided that provision for two to three (2-3) technical expert (senior) staff from the Contractor to attend and co-present with EPA, for each webinar presentation ordered. Assume the Contractor's staff interface for this webinar series will be arranged via remote access to assist in presentation and/or address audience questions. No travel expenses are provisioned for in this Subtask. Travel will be not be required for Subtask 8.2.

Contractor Setups, Manages, Attends, Co-Presents and Documents Webinar Events

Actual dates of webinars will be set and planned at time of work plan approval. The Contractor shall provide and include cost estimates for managing a webinar event associated with presentation of materials developed and delivered as ***Subtask 8.1 Deliverable B***. Efforts for Subtask 8.2 shall include: set-up and logistics for the event (e.g., GoTo Meeting webinar), recording various aspects of participation (i.e. who/what institutions registered for the webinar), and recording the actual event's presentation portions (provide the original recording as well as one intended for reuse which does not contain general proceedings and extraneous discussion).

Recordings and presented materials will be archived to document the record, and for possible recasting. The TOCOR will determine for each event, the target audience, where some events are expected to be open to the public, and some will be set-up for EPA staff only (e.g., OSWER staff only event, joining one event to ORD Webinar series, etc).

Subtask 8.2 Deliverable A: Setup, manage, and attend, co-present and document a single webinar presentation with TOCOR and TOCOR's staff. The TOCOR will determine the target audience and proposed event date at time of work plan approval for each event. Each target date will be allowed to be mutually re-rescheduled, as needed to account for event planning constraints that arise, until actual events are successfully set-up and conducted.

Subtask 8.2 Deliverable B: *Draft* Webinar Event Proceeding Summary Document, and associated electronic files underpinning proceedings, submitted to the TOCOR for review. Due two (2) weeks after the event date. Allow two (2) weeks for the TOCOR's response and/or approval.

Subtask 8.2 Deliverable C: Revised *Final* Webinar Event Proceeding Summary Document and associated electronic files addressing the TOCOR's and TOCOR's QA officer's comments. Due one (1) week after receiving associated comments from the TOCOR. Allow one (1) week for the TOCOR's response and/or approval.

Subtask 8.3 Develop RIMM Workshop Series Agenda and Materials

Contractor Creates and Delivers an Electronic File System of Workshop Materials

The Contractor will assist the TOCOR in developing technical educational materials supporting EPA's development of a single 1-day workshop (9:00 am to 4:00 pm EST; 1 hour lunch break; 60 minutes of additional break time). The workshop will offer a mix of lectured-presentation, demonstration, and hands on training, with 5.5 hours of a total time for audience engagement with the workshop materials. The materials constituting the full presentation scheme

will be delivered in electronic files. The first step in this work will be to develop an Agenda around which to design the workshop materials needed.

Contractor Creates and Delivers a 3-Ring Binder Workshop Handout

Select materials from the information constituting the *Electronic File System of Workshop Materials* will be used in development of a handout binder. The Contractor will develop the key product deliverable of Subtask 8.3, a single color-printed copy of select relevant materials placed into a 3-Ring binder and delivered to EPA. Its primary purpose, the binder will be suitable for a workshop participants, as a handout, to take home after the event, for continued uses and learning on the subjects of: RIMM, HE2RMES, SDPProjectBuilder, and generally, iemTechnologies, including uses of the former three, vis-a-vis iemTechnologies.

Each Bidder will provide an estimate of all costs needed to develop and finalize the workshop presentation materials. Assume EPA will finalize and approve the materials to be presented, and will also clear these for public uses and distribution. These are intended to serve also general uses in providing added educational events on the RIMM system, to be used likely by EPA for a variety of project dissemination and educational purposes.

Subtask 8.3 Deliverable A: *Draft straw agenda* for workshop submitted to the TOCOR for review. Due 30 days maximum from approval of the associated work plan. Allow one (1) week for the TOCOR's response and/or approval.

Subtask 8.3 Deliverable B: Revised *Final agenda* for workshop addressing the TOCOR's and TOCOR's QA officer's comments. Due one (1) week after receiving associated comments from the TOCOR. Allow two (2) weeks for the TOCOR's response and/or approval.

Subtask 8.3 Deliverable C: *Draft* workshop materials submitted to the TOCOR for review. Due 60 days after receiving approval of the workshop agenda from the TOCOR. Allow two (2) weeks for the TOCOR's response and/or approval.

Subtask 8.3 Deliverable D: Revised **Final** workshop materials addressing the TOCOR's and TOCOR's QA officer's comments. Due 60 days after receiving associated comments from the TOCOR. Allow two (2) weeks for the TOCOR's response and/or approval.

Subtask 8.4 Attend Single RIMM Workshop Event and Co-Present with EPA

The workshop will highlight the RIMM system capabilities developed to date and across the Task Order (for completed development marked at the time of work plan issuance for this Task). The workshop will be attended by the Contractor's technical team (as visitors) in collaboration with EPA. EPA and its staff will generally be responsible for all venue and associated logistics and aspects of these events. EPA will handle all printing, collation, and binding costs associated with each workshop event. EPA will handle non *de minims* document

reproduction costs associated with Subtask 8.4, where EPA will be responsible, for example, for duplication of the hard-copy 3-ring binder handouts to provide to workshop participants.

The TOCOR will determine the target audience and proposed event date at time of work plan approval for each event. The workshop date will be set at the time of work plan approval, for each unit of Subtask 8.4 unit ordered. Each target date will be allowed to be mutually re-rescheduled, as needed to account for event planning constraints that may arise, until actual event dates are successfully conducted by the TOCOR and the Contractor's staff. Cost estimates shall provision for travel expenses and participation of two senior technical expert staff from the Contractor to attend the workshops, and collaborate with EPA in carrying the event out. The Contractor's staff in attendance will generally be assisting EPA in making select presentations at the workshop, throughout the day event.

For purposes of estimating pre-ward costs, the Contractor shall provide two estimates for Subtask 8.4 total expected costs, assuming each of two events will be hosted singularly by EPA, at least a month apart, at the one of the two following EPA facilities:

1. Workshop #1 - Washington DC (ORCR Offices @ Potomac Yards); and
2. Workshop #2 - RTP, NC (EPA ORD/NERL Laboratory Facilities).

Subtask 8.4 Deliverable A: Travel to the designated venue and attend the workshop, for the workshop event date set during work plan approval. Participate throughout the day, along with EPA staff, to co-present materials developed under Task 8.3 to the targeted audience.

KEY REFERENCES

Babendreier (2014a). *Summary of Guiding Principles and Best Practices for Quality Assurance in Modeling*. QA/QC Management Protocols adopted for ERD iemTechnologies Software Development. Amendment #2, August 2014. USEPA, ORD, Athens GA.

Babendreier (2014b). *Risk Informed Materials Management (RIMM) Research Plan and Overview*. A Safe and Healthy Communities Research Program Focus under the Sustainable Materials Management Theme. August 2014. USEPA, ORD, Athens GA.

ATTACHMENTS

Attachment 1: Appendix A: RDST-based QA/QC Standards for ORD Category Level III QAPPs Software Development Projects

Attachment 2: Appendix B: Quality Assurance Project Planning - Background Document Reference

Attachment 3: Appendix C: General Environmental Model - Background Information

Attachment 4: Guiding Principles and Best Practices for Quality Assurance in Modeling Evaluation Research Program

Attachment 5: RIMM Research Plan Overview Document

Attachment 6: iemTechnologies FTP General Instructions

Attachment 7: Setting up FTP Zilla Client

QUALITY ASSURANCE SURVEILLANCE PLAN (QASP)
STREAMS II
Task Order 0022, RTI EP-C-11-036

TITLE: Technical Support for Integrated Environmental Modeling Technologies

TASK ORDER MANAGER: Justin Babendreier

Task	Activities	Deliverables	Performance Requirement
Task 1: Develop QAPP	Develop QAPP outlining the approaches to be implemented ensuring a high standard of quality in secondary data, data analysis, and written deliverables.	Draft QAPP Revised QAPP	Management and Communications Technical Effort Timeliness
Task 2: Develop SDPProjectBuilder for the existing HE2RMES modeling system	Individual Subtask unit software modules will be developed as required documented and testing and delivered.	Per QAPP RDSTs: A_Draft , B_Draft, C_Draft, E1_Draft, E2_Draft A_Final, B_Final, C_Final, D1, D2, E1_Final, E2_Final	Cost Management and Control Technical Effort Timeliness
Task 3: Develop and use a 10-to-20 node beta software testing environ for testing RIMM tools.	Establish a Mini-PC-Cluster Capability at the Contractor's Location and demonstrate proficiency in running systems.	Draft PC-Cluster Setup and Initial Testing Report Final PC-Cluster Setup and Initial Testing Report	Management and Communications Technical Effort Timeliness
	Conduct Periodic Extreme-Testing on the Contractor's Cluster	Draft EXCEL-based, system-wide Bug Tracking Inventory Report Final EXCEL-based, system-wide Bug Tracking Inventory Report	Technical Effort Timeliness

Task	Activities	Deliverables	Performance Requirement
Task 4: Enhance the existing basis of hydrogeologic model science in HE2RMES	Individual Subtask unit software modules will be developed as required documented and testing and delivered.	Per QAPP RDSTs: A_Draft , B_Draft, C_Draft, E1_Draft*, E2_Draft * A_Final, B_Final, C_Final, D1, D2, E1_Final*, E2_Final*	Cost Management and Control Technical Effort Timeliness
Task 5: Develop new GEM-based source-term models in HE2RMES w/ new solvers for GEM where indicated. Also develop new HE2RMES Rags & Wipes Landfill model	Individual Subtask unit software modules will be developed as required documented and testing and delivered.	Per QAPP RDSTs: A_Draft , B_Draft, C_Draft, E1_Draft*, E2_Draft * A_Final, B_Final, C_Final, D1, D2, E1_Final*, E2_Final*	Cost Management and Control Technical Effort Timeliness
Task 6: Develop/enhance SDPProjectBuilder adding in functions for the newest HE2RMES models developed in other Tasks.	Individual Subtask unit software modules will be developed as required documented and testing and delivered.	Per QAPP RDSTs: A_Draft , B_Draft, C_Draft, E1_Draft, E2_Draft A_Final, B_Final, C_Final, D1, D2, E1_Final, E2_Final	Cost Management and Control Technical Effort Timeliness
Task 7: Develop an SDPProjectBuilder User Manual and Help System	Individual Subtask unit software modules will be developed as required documented and testing and delivered.	Draft Integrated SDPProjectBuilder Help System (V1.0) Final Integrated SDPProjectBuilder Help System (V1.0) Draft Integrated SDPProjectBuilder Help System (V2.0)	Cost Management and Control Technical Effort Timeliness

Task	Activities	Deliverables	Performance Requirement
		Final Integrated SDPProjectBuilder Help System (V2.0)	
Task 8: Develop and Implement Webinar and Workshop Series for RIMM	Develop RIMM Webinar Series Presentation Materials	Two Draft presentations. Two Final presentations.	Management and Communications Technical Effort Timeliness
	Conduct Single RIMM Webinar Event and Co-Present with EPA	Setup, manage, and attend, co-present and document webinar pres. Draft Webinar Event Proceeding Summary Document Final Webinar Event Proceeding Summary Document	Management and Communications Technical Effort Timeliness
	Creates and Delivers an Electronic File System of Workshop Materials	Draft straw agenda for workshop. Final *agenda* for workshop Draft workshop materials Final workshop materials	Management and Communications Technical Effort Timeliness
	Attend and Conduct Single RIMM Workshop Event and Co-Present with EPA	Travel to the designated venue and attend the workshop.	Management and Communications Technical Effort Timeliness

(*) indicates deliverable for each associated "Affected Module" as set out in each specific Task description.

General Management and Administration			
Performance Requirement	**Measurable Performance Standards**	**Surveillance Methods**	**Incentives/Disincentives**
Management and Communications: The Contractor shall maintain contact with the EPA CO, PO and TOM throughout the performance of the contract and shall immediately bring potential problems to the attention of the appropriate EPA TOM. In cases where issues have a direct impact on project schedules or cost, the contractor shall provide options for EPA's consideration on resolving or mitigating the impacts.	Any issues that impact project schedules or cost shall be brought to the attention of the appropriate EPA TOM within 3 business days of occurrence.	100% of active work assignments under the contract will be reviewed by the EPA TOM monthly (via monthly progress report) to identify unreported issues. The EPA TOM will report any issues to the EPA PO who will bring the issue(s) to the Contractor's attention through the CO.	**Unsatisfactory** rating under the category of Business Relations in the NIH Performance Evaluation System if two or more incidents occur during an applicable period of performance when the contractor does not meet the measurable performance standards for a given contract period.

General Management and Administration			
Performance Requirement	**Measurable Performance Standards**	**Surveillance Methods**	**Incentives/Disincentives**
Timeliness: Services and deliverables shall be in accordance with schedules stated in each work assignment or tasking document, unless amended or modified by an approved EPA action.	During any period of performance, 90% of all submitted deliverables shall be submitted no later than 5 business days past the due date.	100% of active work assignments under the contract will be reviewed by the EPA TOM monthly (via monthly progress report & milestones established for each deliverable) to compare actual delivery dates against those approved. The EPA TOM will report any issues to the EPA PO who will bring the issue(s) to the Contractor's attention through the CO.	**Unsatisfactory** rating under the category of Timeliness in the NIH Performance Evaluation System when the contractor does not meet the measurable performance standards during an applicable period of performance.

Cost Management and Control: The Contractor shall monitor, track and accurately report level of effort, labor cost, other direct cost and fee expenditures to EPA through progress reports and approved special reporting requirements. The Contractor shall assign appropriately leveled and skilled personnel to all tasks, practice and encourage time management, and ensure accurate and appropriate time keeping.	The contractor shall manage costs to the level of approved ceiling on the work assignment. The contractor shall notify the TOM/PO when 75% of the approved funding ceiling for the work assignment is reached.	The EPA PO will routinely meet with the Contractor's Project Manager to discuss the work progress and contract and individual work assignment expenditures. The EPA PO shall review the Contractor's monthly progress reports and request the TOMs verification of expenditures and technical progress before authorizing invoice payments.	**Unsatisfactory** rating under the category of Cost Control in the NIH Performance Evaluation System when the contractor does not meet the measurable performance standards during an applicable period of performance.

Technical Effort: The analyses or products developed by the contractor shall be factual and defensible and based on sound science and engineering. All data shall be collected from reputable sources and quality assurance measures shall be conducted in accordance with contract, agency requirements and any additional requirements outlined in individual work assignments or technical directives. Any work requiring the contractor to provide options or recommendations shall include the rationale used in selecting the option/recommendation and all other options and recommendations considered.	All analyses conducted for EPA by the Contractor must be factual and based on sound science and engineering. All analyses and products (initial and final drafts) shall conform in format and content to requirements specified by the TOM in written technical direction, and should meet the objectives stated in the work assignment. All initial draft documents shall be clearly written at a level appropriate to the targeted audience. All information shall be factual, technically sound, and accurate, with data sources identified. Draft versions of a document shall require no more than two editorial revisions.	EPA will review all analyses and work products conducted by the Contractor and will independently consider the merit. EPA may opt to peer review analyses to further validate merit. The EPA TOM will review initial drafts to assess technical accuracy and editorial quality. The TOM will identify all inaccuracies and needed edits and corrections to the contractor in the initial review of draft documents.	**Unsatisfactory** rating under the category of **QUALITY OF PRODUCT OR SERVICE** in the NIH Performance Evaluation System when the contractor does not meet the measurable performance standards during an applicable period of performance, even after review input and follow up discussion by Agency personnel.