



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
REGION 4  
ATLANTA FEDERAL CENTER  
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ATLANTA, GEORGIA 30303-8960

August 8, 2016

Ms. Tracey Duncan  
Federal Facility Agreement Manager  
United States Department of Energy  
Portsmouth/Paducah Project Site Office  
5501 Hobbs Road  
Kevil, KY 42053

RE: **EPA Comments: C-400 Vapor Intrusion Study Work Plan to Support the Additional Actions for the Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, (DOE/LX/07-2403&D1)**, transmittal dated April 29, 2016 (PPPO-02-3455524-16B).

References:

- *EPA Comments (December 20, 2013) on the Five-Year Review for Remedial Actions at the Paducah Gaseous Diffusion Plant, Paducah, KY (DOE/LX/07-1289&D1).*
- *EPA Comments (July 3, 2014) on the 2013 CERCLA Five-Year Review for the Paducah Gaseous Diffusion Plant (DOE/LX/07-1289&D2/R1).*
- *EPA "Deferred Protectiveness" Determination (September 30, 2014), CERCLA Five-Year Review for the Paducah Gaseous Diffusion Plant (DOE/LX/07-1289&D2/R1).*
- *EPA Electronic Correspondence (July 22, 2015): Response to DOE Record of Conversation Concerning the Additional Action for the Five-Year Review (PPPO-02-3030987-15; July 16, 2015).*
- *EPA Electronic Correspondence (September 4, 2015): Vapor Intrusion – Sampling Results and C-400 – A few notes in support of scoping the VTC on 9/29.*
- *EPA Electronic Correspondence (September 29, 2015): Follow-up on the Tri-party C-400 Vapor Intrusion Video-teleconference held on September 29, 2015.*
- *EPA Acknowledgement of Receipt (December 29, 2015): Transmittal of the Path Forward for the Vapor Intrusion Study at the PGDP C-400 Building (PPPO-02-3308872-16; December 17, 2015).*
- *EPA Status Request (February 25, 2016) for the DOE Vapor Intrusion Study at the C-400 Maintenance Building.*
- *EPA Reply (March 22, 2016) to: Response to the U.S. EPA Status Request for the Vapor Intrusion Study at the C-400 Maintenance Building (PPPO-02-344502298-16).*

Dear Ms. Duncan,

The U. S. Environmental Protection Agency (EPA) Region 4 has reviewed the Department of Energy's (DOE) *C-400 Vapor Intrusion Study Work Plan to Support the Additional Actions for the Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*

Ms. Tracey Duncan

EPA comments: *C-400 Vapor Intrusion Study Work Plan to Support the Additional Actions for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, (DOE/LX/07-2403&D1)*

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(DOE/LX/07-2403&D1). The Work Plan was reviewed using the EPA document titled *OSWER Publication 9200.2-154 OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Sources to Indoor Air, June 2015* as the primary guidance document. Based on EPA's review, the draft Work Plan will require revision for consistency with the Guide and to meet the expectation of the EPA September 30, 2014, letter that DOE conduct a vapor intrusion study for the C-400 Building consistent with EPA protocol and based on current toxicity values and risk assessment methodology. A properly executed Vapor Intrusion (VI) Study will allow the parties to the Paducah Gaseous Diffusion Plant (PGDP) Federal Facility Agreement (FFA) to assess the potential risk of exposure people who work in and around the C-400 Building to migration of vapors (primarily TCE) to indoor air. General and Specific Comments are provided as an enclosure to this letter to support document revision and approval.

### *Background*

The C-400 Building is one of the earliest constructed buildings at PGDP and has been used for a wide variety of activities for over 5 decades, including activities that used degreasing solvents such as trichloroethylene (TCE). Interim response actions have been taken by DOE to address releases of TCE to soils and groundwater in the immediate vicinity of C-400. However, sampling has not yet been conducted to determine whether migration of vapors (from C-400 solvent releases to the environment) to C-400 indoor air pose a potential risk for C-400 current and future workers. Currently, and for an unspecified number of years into the future, DOE workers are conducting Deactivation activities in the C-400 Building. During an EPA tour of the C-400 Building in 2015, a laundry operation and an office space were active.

In a series of comments letters between December 2013 and September 2014, EPA provided review comments on various revisions of the DOE CERCLA Five Year Review (FYR) of the protectiveness of environmental media cleanup response actions implemented at the Paducah Gaseous Diffusion Plant Superfund Site. In our September 30, 2014 letter, EPA advised the DOE that the Agency did not concur with the DOE protectiveness statements for the (i) **C-400 Building** and the (ii) **Water Policy Box Groundwater Operable Units (OUs) response actions**. In that letter, EPA advised DOE of our independent protectiveness determination of "deferred protectiveness" and made recommendations for specific DOE actions to be completed 1.5 years from September 30, 2014 (i.e., March 2016).

For the C-400 Building remedy, EPA noted in the September 2014 letter that: "*Vapor intrusion into building C-400 is identified as an issue in the FYR with the recommendation that a vapor intrusion analysis be performed as part of any subsequent action and should be conducted in the near term to determine whether this potential pathway presents an*

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*unacceptable risk to human health such as workers that work in and around the C-400 Building.” EPA concluded: “Until a vapor intrusion study is conducted that is consistent with EPA protocol and based on current toxicity values and risk assessment methodology, the protectiveness statement should be “deferred” until the protectiveness of the remedy can be determined.”*

### *Path Forward*

As of August 2016, DOE has not yet conducted the vapor intrusion study identified by EPA in 2014 as necessary to determine whether the C-400 cleanup actions are protective of people who work in and around the C-400 Building. The DOE submittal that is the subject of this letter is a draft work plan to support a study in the near future. Based on our review, EPA has concluded that draft C-400 Vapor Intrusion Study Work Plan is not fully consistent with the Agency’s Vapor Intrusion Technical Guide or the expectation in EPA’s letter of September 30, 2014, that *“a vapor intrusion study (be) conducted that is consistent with EPA protocol and based on current toxicity values and risk assessment methodology”*. In the simplest terms, the plan of work proposed by DOE does not include the collection of any subslab gas samples; therefore, execution of the proposed work plan will not generate the data needed to perform a concurrent comparison of indoor air quality to subslab samples. The concurrent comparison of indoor air quality to subslab soil gas quality is necessary to the assessment of vapor intrusion risk by the EPA protocol laid out in the Agency’s Vapor Intrusion Technical Guide. General and Specific Comments generated during EPA’s review of the C-400 VI Work Plan are provided as an enclosure to this letter. Satisfactory resolution of the enclosed comments is necessary for EPA approval of the Work Plan.

EPA notes that DOE actions in response to EPA’s September 2014 “protectiveness deferred” determination and recommendations for DOE action for the **Water Policy Box Groundwater Operable Unit response action** have been reported to EPA and the Kentucky Department for Environmental Protection in a separate document (DOE/LX/07-1289&D2/R1/A2). EPA’s comments on that draft report of work have been addressed in separate correspondence (July 29, 2016). If you have any questions about the enclosed comments, please do not hesitate to contact me at (404) 562-8547 or via electronic mail at [corkran.julie@epa.gov](mailto:corkran.julie@epa.gov).

Sincerely,



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Federal Facility Agreement Manager  
Superfund Division

Ms. Tracey Duncan

EPA comments: *C-400 Vapor Intrusion Study Work Plan to Support the Additional Actions for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky, (DOE/LX/07-2403&D1)*

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Enclosure

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United States Environmental Protection Agency (U.S. EPA) Region 4  
Comments on:

**C-400 Vapor Intrusion Study Work Plan to Support the Additional Actions  
for the Comprehensive Environmental Response, Compensation, and Liability Act  
Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,  
(DOE/LX/07-2403&D1), April 29, 2016**

McCracken County, Paducah, KY  
U.S. EPA ID KY8890008982

**General Comments**

- 1) The General and Specific comments compare the submitted Work Plan elements to the requirements of a complete VI pathway and other considerations from the EPA Final Vapor Intrusion Technical Guide (hereafter, “the Guide”). Per the Guide, the vapor intrusion pathway is referred to as “complete” for a specific building or collection of buildings when the following five Conditions are met under *current* conditions:
  - i. A subsurface source of vapor-forming chemicals is present (e.g., in the soil or in groundwater) underneath or near the building(s);
  - ii. Vapors form and have a route along which to migrate (be transported) toward the building(s);
  - iii. The building(s) is(are) susceptible to soil gas entry, which means openings exist for the vapors to enter the building and driving ‘forces’ exist to draw the vapors from the subsurface through the openings into the building(s);
  - iv. One or more vapor-forming chemicals comprising the subsurface vapor source(s) is (or are) also present in the indoor environment; and
  - v. The building(s) is (or are) occupied by one or more individuals when the vapor-forming chemical(s) is (or are) present indoors.

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If one (or more) of these conditions is *currently* absent and is reasonably expected to be absent in the future (e.g., vapor migration is significantly and persistently impeded by natural geologic, hydrologic, or biochemical (e.g., biodegradation) processes and conditions), the vapor intrusion pathway is referred to as “incomplete.” General Comment 1 provides baseline information for understanding the General and Specific comments that follow.

- 2) Referencing General Comment 1, the first consideration is the requirement that the five Conditions are met “under current conditions”. The Work Plan provides an abundance of older data but by no means can the data be considered representative of *current* conditions for the purposes of a VI study. The only subsurface data presented on Pages 21 and 22 for the space under the C-400 building footprint are the results of two borings,

400-019 and 400-120, drilled through the slab of the building in 1997, nearly 20 years ago. This does not represent current conditions. No other data are presented which documents the current concentrations of volatile organic compounds (VOCs) in the soil gas volume beneath the slab of the C-400 Building down to top of the water table at approximately 30 – 35 feet below land surface (bls). Revise the Work Plan to propose the collection of sub-slab data to represent current conditions.

- 3) With reference to Condition i (General Comment 1) - *A subsurface source of vapor-forming chemicals is present (e.g., in the soil or in groundwater) underneath or near the building* - there are no current data documenting the current conditions of the shallow most groundwater, soil or soil gas concentrations of VOCs at the C-400 Building. There is anecdotal evidence of abundant use of VOCs in the C-400 Building, but no current data are presented supporting DOE's assumption of their presence below the slab of the C-400 Building. Revise the Work Plan to propose the collection of subslab data to represent current conditions.
- 4) With reference to Condition iv (General Comment 1)- *One or more vapor-forming chemicals comprising the subsurface vapor source(s) is (or are) also present in the indoor environment* – this Condition requires current chemical specific data collected from below the C-400 Building to be compared to current chemical specific data collected from within the C-400 Building. In February 2016 a tri-party scoping call was held in which DOE presented a draft concept for a vapor intrusion study that did not include the collection any subslab soil gas samples. EPA advised DOE during the February call that their proposed scope work would be useful only to DOE as an industrial hygiene study, but would not satisfy the requirement to conduct a vapor intrusion study for the C-400 building consistent with EPA protocol and based on current toxicity values and risk assessment methodology. The current Work Plan does propose collection of indoor and ambient outdoor air samples; however, despite EPA's feedback in February, the Work Plan does not propose the collection of soil gas samples from below the slab of the C-400 Building. Without these data the comparison of subslab to indoor chemical concentrations cannot be performed as envisioned by Condition iv. Revise the Work Plan to include the necessary subslab sampling.
- 5) Volatile compounds must be present at the top of the water table to be able to transfer from the liquid phase into the vapor phase. Analytical data from water table wells are most useful in evaluating the vapor intrusion potential for a structure. The Work Plan discusses that the water table is present 30-35 feet below land surface within the Upper Continental Recharge System (UCRS) aquifer and that the top of the Regional Gravel Aquifer (RGA) is between 45 and 50 feet below land surface. Discussions of concentrations of VOCs in the RGA are not helpful the understanding of the vapor

intrusion risk for Building C-400. Revise the Work Plan to provide a concise summary of the most current VOC analytical data for water table wells/UCRS monitoring wells in the immediate area of the C-400 Building.

- 6) The Work Plan acknowledges that TCE vapors “*have been present and may continue to be present in the indoor environment.*” On this basis, Condition iv for a complete pathway is met, contrary to the premise of the Work Plan: the Work Plan suggests that it is unknown whether the pathway has been or is complete. This comment is made to clarify the meaning and intent of Condition iv as expressed in the Guide. EPA endorses the DOE proposal to conduct additional indoor air sampling, concurrent with the ambient air samples, for purposes of characterizing current indoor exposures, consistent with the Guide. DOE response to this comment is not requested.
- 7) A conceptual site model (CSM) is a working hypothesis that identifies data gaps for which data are collected to support or discredit the elements of the model. For the vapor intrusion human health exposure pathway, there are five conditions to the pathway that need to be determined with current information or data (See General Comment 1). Conclusions should not be made until the hypothesis is tested with information or data that is confirmed to be current and valid. Revise the work plan to remove conclusions that DOE has reached using data that are not current or valid per the Guide.
- 8) The CSM (Section 6 of the Work Plan) warrants expansion to include further discussion of the building plenum, the potential role of the exhaust fans in inducing soil gas entry, the sumps as a potential on-going source of vapors, the extensive network of floor drains and sumps as conduits for soil gas entry, and site soils as potential sources of vapors in ambient air. The purported presence of two tunnels (one associated with the Test Loop Area and the other connected to the Control Building) is an important component of the CSM not addressed by the Work Plan. These structures, being below grade, could have a significant impact on the potential distribution of vapor forming chemicals in their portion of the C-400 Building. The investigatory aspects of the Work Plan (e.g., Section 7 of the Work Plan) and the proposed decision rules (Section 10) cannot be properly judged based upon an incomplete CSM. Revise the Work Plan to address the purported presence of the two tunnels.
- 9) Although the rationale for the Work Plan is positioned as primarily determining whether the vapor intrusion pathway is complete, the scope of the proposed decision logic goes well beyond that solitary determination. A broader and more complete range of response options, consistent with the Guide, should be identified since the scope of the decision logic is also intended to address risk management. Revise the Work Plan in include the *EPA Region 4 (Draft, 2015) Table 1: Tiered Response Actions for Indoor Air*

***Concentrations Determined to be Site Related*** (Attachment 1). This table was previously provided to DOE in support of scoping this Work Plan (C-400 VI) and the Water Policy Box Vapor Intrusion Screening Study Work Plan.

- 10) The Work Plan does not propose the collection of any subslab soil gas samples. This is a fatal flaw in the proposed plan of work. The Work Plan goes into considerable detail describing the historic uses of TCE in the inside of Building C-400, the collection of liquids via various drain systems routed to beyond the building and the various historical spills of TCE outside of the building. However, there are no current data that document the VOC contaminants below the slab. The collection of air samples from within the building, below the building, and from the ambient air outside the building is well supported by the Guide. (Figure 6-1, pg. 64, Section 6.3.5, pgs. 83 and 84, Section 6.4, pg. 88, Section 6.4.1, pg. 95). *Without subslab soil gas data there is no way to quantify the risk to indoor workers due to vapor intrusion of sub slab soil gas versus the risk due to indoor or ambient air sources from the same chemicals.* Not performing direct comparison of concurrent subslab and indoor air samples is in conflict with EPA vapor intrusion guidance and protocols and, therefore, the Work Plan does not meet the requirements of the EPA September 30, 2014, Five Year Review letter for DOE additional actions needed to support a revised protectiveness evaluation and determination for C-400 Building cleanup actions.
- 11) The Work Plan does not include standard operating procedures (SOPs) for the proposed work. For example, Section 8.0 (Sampling and Analysis Methods) indicates that sampling will be conducted in accordance with *Fluor Federal Services, Inc., Paducah Deactivation Project procedure CP4-ER-1035, Vapor Sampling* (i.e., Vapor Sampling SOP); however, this SOP is not provided in the C-400 VI WP. As a result, it is unclear if the sampling procedures provided in Section 8 are in accordance with the Vapor Sampling SOP. Additionally, it is unclear if the Vapor Sampling SOP includes purging of the intake tubing as it is not discussed in Bullet 3 of Section 8. Similarly, it is unclear if the Vapor Sampling SOP requires sufficient vacuum to be left in the Summa canister, which is typically required by the receiving laboratories, as it is not discussed in Bullet 5 of Section 8. Revise the Work Plan to include all SOPs.

### **Specific Comments**

- 1) Sec 1.0, pg.1 – In the second paragraph, revise the text that states “...characterization to be done in C-400 ...” to read “...characterization to be done in and under C-400...” as subslab characterization needs to be performed to provide a basis for comparing any indoor detections of VOCs to the detections of VOCs from below the slab.

- 2) Sec 4.2, pg. 3 – The text refers to a storm sewer receiving liquids from a basement sump and excavations along 11<sup>th</sup> Street. Revise the Work Plan to identify these items clearly on a figure.
- 3) Sec 5.1, pg. 5 – The first bullet lists the RGA groundwater contaminated with TCE as a source of VOCs that could contribute to VI for the C-400 building. As the RGA is below the UCRA aquifer, as shown on Figure 7 on page 19 of the Work Plan, it could not contribute VOCs directly to the vadose zone. Remove this bullet from this list of possible VOCs sources for VI. Additionally, discussion of contaminated RGA groundwater makes no contribution to the documentation of groundwater contamination at the water table in the UCRS and should be removed from this section.
- 4) Sec 5.2, pg. 6 – The text of the second paragraph that starts *Subsurface sources of vapor forming chemicals are present*. This summary statement states that subsurface sources of vapor forming chemicals are (currently) present when, in fact, the statements in the previous section refer to historic presence of TCE in the UCRS soils exterior to the C-400 Building and the historic use of TCE within the C-400 Building. There are no current data on the chemicals thought to be present in the subslab vadose zone volume below Building C-400. The introductory statement to the paragraph should be reworded to read: *Subsurface sources of vapor forming chemicals have been present, based upon historic data*.
- 5) Sec 5.2, pg. 6 – The text of the third paragraph that starts *Routes for vapor migration are likely* does not address the clay unit that appears to be continuous and extensive under the building, as shown in the Conceptual Site Model Figure 4, pg. 11, the cross section shown in Figure 7, pg. 19 and as discussed further in Comment 7 below. Revise the text to describe the clay unit and discuss how this element of the CSM has informed the proposed plan of work.
- 6) Sec 5.2, pg. 6 – The text of the fourth paragraph that starts *Building is susceptible to VI* does not address the continuous operation of one of the very large exhaust fans on the east side of the building. This fan likely sets up a pressure gradient between the indoor air and the subslab and the outside air. This pressure gradient would likely induce flow from below the slab. Measuring of the pressure gradient between the indoor air and the subslab should be included in this Work Plan as is recommended in Section 6.4.1, pg. 96, 97, 102 and 119 of the Guide.
- 7) Figure 3, pg. 9 – Revise this figure and the text to identify any other parts of the C-400 Building not represented by this figure. The question is specifically in reference to one or more tunnel systems on the north end of the building (associated with the Test Loop area; purported tunnel connection to the Control Building), but is meant to be inclusive of any

portion of the structure, including those structures that are below land surface. In the revised Work Plan, provide documentation and figures of all portions of the building so they may be used in planning the VI investigation.

- 8) Section 5.2, pg. 10 – EPA does not agree with the statement in paragraph 1 that “it is reasonable to conclude that TCE may be present in the indoor air of C-400 at concentrations above VISL values” because the statement is based upon historical descriptions and historical data (from 2003). The presence of TCE in indoor air at concentrations above the VISL values is a hypothesis that needs to be tested with *current* data. There are no current data presented with sufficiently low detection limits to evaluate the hypothesis regarding indoor air risk as part of a vapor intrusion investigation. The condition of the indoor air needs to be documented with *current* sampling and analysis of indoor air, ambient air and subslab soil gas. Revise paragraph 1 to address this issue.
- 9) Section 5.2, pg. 10 – EPA does not agree with the statement in paragraph 6 that Condition I (General Comment 1), *A subsurface source of vapor-forming chemicals is present (e.g., in the soil or in groundwater) underneath or near the building*, is demonstrated with current data. Revise the Work Plan to include collection of *current* subslab soil gas data during the investigation in order to test this hypothesis.
- 10) Fig 4, pg. 11 - The water table in Fig 4 is indicated below the second clay, presumably in the RGA. This is in conflict with the data presented in Fig 7 and elsewhere in the text which describe the water table at approximately 30 – 35 feet bls. Other important details are missing from the figure. For example, just how wide spread (laterally and horizontally) is the gravel below the building? Is the basement the correct proportions relative to the rest of the building? Is there a layer of piping and floor drains that connect to the storm water ditches that could be a target for this VI investigation? Revise this figure to answer these questions and provide more detail on the area specifically around and below the C-400 Building.
- 11) Sec 6.2, pg. 14 – A photograph of the Blakeslee degreaser in the *1995 C-400 Process and Structure Review* document shows that it is labeled ‘TRICHLOROETHANE’. Since TCA was used historically in this degreaser, TCA and 1,4-Dioxane should be added to the list of chemicals of interest to be sampled during the VI investigation. It is noted that Table 5.17 of the WAG 6 RI indicates the detection of 1,1,1-Trichloroethane at a concentration of 2,400 ug/Kg in Boring 400-200, off the southwest corner of Building C-400.
- 12) Sec 6.4, pg.15 – The text states that C-400 rests on a 16-inch on-grade slab in most places. However, technical drawing E4-6-S, Rev. 11 (noted as the as-built drawing) indicates that the slab is 8 inches. Evaluate this discrepancy and revise the Work Plan text and figures to

reconcile these conflicting descriptions and address any uncertainty DOE may have (if any) regarding the thickness of the slab across the C-400 Building footprint.

- 13) Sec 6.4, pg. 15 – The third paragraph refers to seep water in the sump. (i) This paragraph needs to be clarified to identify the source(s), or uncertainty in the source(s), of this water. Normally, a sump would collect indoor liquids in a low place for pumping up and/or out via some plumbing. If the seep water is groundwater coming into the building via the sump, then it is coming in a considerable distance above the stated depth of the water table (30-35 feet bls).

(ii) Additionally, if the groundwater seeping into the building is contaminated, this condition is a violation of one of the Remedial Action Objectives of the July 2005 Record of Decision which is to “Prevent exposure to contaminated groundwater by on-site industrial workers”. Revise the Work Plan to address the two (2) concerns identified in this comment.

- 14) Sec 6.4, pg. 18 – EPA does not agree with the statement on the top of page 18 that states “...identifying the specific locations of other potential VI conduits is not practicable. Instead, DOE assumes that both a subsurface source of TCE and preferential pathways for VI exist at C-400, and, for risk assessment and risk management purposes, assumes that any measured indoor air exceedances of the TCE VISL value are attributable to VI.”

First, whether practicable or impracticable is irrelevant: the migration of TCE along such drainage pathways as the building’s plumbing is a valid and necessary part of investigation for a VI investigation when the building’s infrastructure is known to have transported TCE. Secondly, the attribution of all TCE vapors detected in future indoor air samples is sourced from below the C-400 Building slab is not a reasonable assumption based upon the considerable documentation provided in this Work Plan and the *C-400 Process and Structure Review* document regarding the abundant use of TCE at the two degreasers, the Hand Tables and from buckets in other portions of the building not otherwise specified.

Please refer to Sec 6.5.2 of this Work Plan which describes “potential Indoor Air Sources” as this section is in direct conflict to this conclusion on page 18. Revise the work plan to eliminate DOE’s assumptions on page 18 and incorporate the *concurrent* subslab soil gas (with ambient and indoor air samples) that are a necessary component of the VI investigation of the C-400 Building. See, also, General Comment 7.

- 15) Sec 6.5.1.2, pg. 21 – The text in the first paragraph states that the lithologies in the vadose zone consist of silt and fine sand. This is in conflict with the cross section presented in Figure 7, pg. 19 which shows a continuous layer of clay as Hydrostratigraphic Unit 1. It is unclear which wells are represented: the line of the section is not indicated on the figure or the subsequent figure on the next page. MW175 is located on the west side of C-400, but none of

the other wells in the cross section are noted. Figure 3.14 from the WAG 6 RI report shows a continuous clay for Hydrostratigraphic Unit 3. The contouring is questionable as the data from 400-038 are not honored. One might consider the lithologic data provided in the boring logs for 400-019 and 400-020. Both logs show a shallower clayey silt shallow in approximately HU1 and a slit and clay and a clay at approximately HU3 depth. These data are not woven into the Work Plan's presentation of site conditions, but they do conflict with the silt and fine sand characterization of the UCRS. Also, as these sandy units would be more amenable to vapor migration, the silts and clays present (especially the continuous clayey silts of HU1) would not be amenable to vapor migration and would tend to attenuate the VOC concentrations. Revise the document to clarify the lithologies underneath the C-400 Building: the lithologies are a key part of the conceptual site model for the vapor intrusion study.

16) Figure 7, pg. 19 – Include a key insert which depicts the location of the line of the section for this figure.

17) Figure 8, pg. 20 – While the significant detections of TCE in the RGA depicted in the figure are interesting, they are not germane to the concentrations of TCE at the water table within the UCRS aquifer. Remove this figure and replace it with one that depicts the most recent detections of TCE in the UCRS aquifer.

18) Sec 6.5.1.1, pg. 22 – EPA does not agree with the conclusion stated at the top of page 22 that “these data support the conclusion that TCE is present in groundwater surrounding and potentially below C-400 at aqueous concentrations with the potential to result in TCE soil vapor concentrations under C-400 that are likely to exceed EPA's soil gas TCE VISL of 100  $\mu\text{g}/\text{m}^3$ .”

All of the data presented in this section deal with the TCE concentrations in the RGA which is not the water table aquifer and therefore is not pertinent for this VI investigation. Replace these several paragraphs with a discussion of any available, current, UCRS groundwater data for VOCs.

19) Sec 6.5.1.2, pg. 22 – The first paragraph goes through a discussion of soil gas from the WAG 6 RI which was submitted in 1999, 17 years ago. Without specificity, the discussion then goes on to refer to utility conduits as possible preferential vapor migration routes and explore whether or not this area was affected by the interim removal action on the south side of the building. Data from 17 years ago are not usable data to support the analysis that DOE has attempted in this paragraph and the text does not add any information to the understanding of *current conditions*. Revise the Work Plan to eliminate this discussion as it is misleading to the reader.

20) Sec 6.5.1.2, pg. 22 - The second paragraph states that “residual soil concentrations still exceed VISLs at some locations.” As the Vapor Intrusion Screening Level calculator does not provide risk-based screening levels for soil (mg/kg), but utilizes soil gas or groundwater concentration data instead, it is unclear how soil concentrations (mg/kg) were converted into equivalent vapor concentrations ( $\mu\text{g}/\text{m}^3$ ) for purposes of this Work Plan. Revise the work to provide the data and “show your work” for the conversion for a point by point consideration.

21) Sec 6.5.1.2, pg. 22 - The fourth paragraph describes some conversions of historical soil sample concentrations to soil gas concentrations. As currently presented in the Work Plan, EPA cannot agree with the conclusion that there is TCE present under Building C-400 based upon the lines of evidence (such as the conversion presented on page 22) in the Work Plan. The presence of TCE under the Building is a reasonable hypothesis based upon the CSM, but it needs to be verified with *current data*.

*If there are current soil sampling data from the below the C-400 slab*, revise the Work Plan to convert those current soil concentrations to soil gas concentrations, showing the work behind the conversion calculations and providing the DOE Paducah/C-400 site-specific factors such as fraction of organic carbon, fraction of water filled porosity, etc. Upon DOE provision of the data and analysis, EPA will review and evaluate that information in light of the DOE assumption that there is TCE present in the subsurface above the VISL modeled concentration of  $100 \mu\text{g}/\text{m}^3$ .

22) Sec 6.5.1.2, pg. 23 – EPA does not agree that “*it is reasonable to conclude that TCE is present under C-400*” in the Work Plan because no current and relevant data have been presented. It is a reasonable *hypothesis* that TCE is present under the C-400 Building: revise the Work Plan to test that hypothesis with the collection of subslab soil gas samples as part of a comprehensive vapor intrusion investigation according to EPA guidance and protocols.

23) Sec 6.5.1.2, pg. 23 – EPA notes DOE’s acknowledgement of TCE presence under the slab of the C-400 Building; however, *current data* are sought to evaluate the effectiveness of the interim remedial action(s) and to characterize VI potential under current conditions. Page 5 of the Work Plan states DOE “*concur with EPA’s determination that VOCs are present in high concentrations in the subsurface ... below C-400...*”. The arguments presented do not include any current data but rather anecdotal evidence of activities long ago that does not meet the requirements of EPA vapor intrusion investigation protocol as required by EPA’s September 20, 2014, letter. Revise the Work Plan to generate the data necessary to determine if people who work in and around the C-400 Building are at risk of exposure to contaminant vapors at levels that are not protective under CERCLA.

- 24) Sec 6.5.3, pg. 23 - EPA does not agree with the assertion in Paragraph 2 that there is TCE is present under the slab of the C-400 Building in excess of the VISL screening number of 100 ug/m<sup>3</sup>. This may be true, however, no current data are presented by DOE to test this hypothesis. The remedial actions at C-400 have all taken place approximately 200 feet away on the south end of this very large building. The extent of the gravel underneath the building is not documented. In addition, the soils of the UCRS are described in the boring logs and cross sections as having a considerable clay content that is not conducive to vapor migration. The only reliable way to estimate the risk posed by subslab vapors to the VI pathway is to perform a proper VI study with concurrent characterization of the subslab soil gas, and indoor and ambient air in around and underneath Building C-400, as per the EPA Guide. Revise the text to remove the assertion (not supported by current data) that there is TCE present under the slab of the C-400 Building in excess of the VISL screening number of 100 ug/m<sup>3</sup> and to propose collection of the appropriate subslab data.
- 25) Sec 6.5.4, pg. 24 – EPA does not agree with DOE’s assertion that the only data gap in the VI investigation of the C-400 Building is the quantification of the indoor air VOC concentrations. Further, EPA does not agree that the subsurface characterization data presented in the Work Plan are reliable: the data presented by DOE in the Work Plan are not current (in some cases 20 years old), or are not from the appropriate aquifer (the RGA vs the water table UCRS aquifer). As explained in the preceding comments, the subslab soil gas of the C-400 Building needs to be sampled and analyzed. Only then will there be quantified and current data to be compared with the indoor air and ambient air VOC concentrations that DOE proposes to collect. See, also, Specific Comment 22 above. Revise the Work Plan to correct the text regarding data gaps and also to include concurrent collection of air samples from within the building, below the building, and from the ambient air outside the building.
- 26) Sec 7, pg. 25 – The collection of subslab samples is considered a necessity to perform a VI investigation as envisioned by the EPA Guide. The collection of air samples from within the building, below the building, and from the ambient air outside the building is well supported by the Guide. (Figure 6-1, pg. 64, Section 6.3.5, pgs. 83 and 84, Section 6.4, pg. 88, Section 6.4.1, pg. 95) Without subslab soil gas data, there is no way to quantify the risk to indoor workers due to vapor intrusion versus the risk due to indoor air sources from the same chemicals. Revise the document to include collection of subslab soil gas data/
- 27) Section 7, pg. 25 – It is unclear from the text why DOE proposes that the exhaust fan remain on during the sampling period. The Work Plan does not explain whether “fan on” is the normal or required operating condition of this building. The operation of this very large exhaust fan likely induces a pressure gradient between the inside of the building and the subslab and outside air. It is EPA’s view that one set of samples should be collected with the exhaust fan off and one set of samples with the exhaust fan on. If DOE wants to collect a

third set of samples with two exhaust fans on to see if the additional air flow reduces the indoor air concentrations to below any levels of concern, that seems like a reasonable test of a potential interim action if current indoor air concentrations exceed the agreed upon screening value. It should be noted that an equally valid outcome of sampling with two fans on might be that it doubles the induced vapor intrusion into the C-400 Building of VOCs that may be present below the slab. As part of the evaluation of the effect of the exhaust fans, pressure gages should be installed in pairs at several locations throughout the building; paired as one below the slab and one measurement point adjacent to it, several locations as to mean proximal and distal to the fan at multiple locations throughout this very large building. Revise the work to include measurement of the pressure gradient between the indoor air and the subslab as is recommended in Section 6.4.1, pg. 96, 97, 102 and 119 of the Guide.

- 28) Sec 7, pg. 25 – Paired indoor air and subslab air samples should be collected at the locations of the several sources of TCE within the C-400 Building, and several other locations noted below, to verify the hypotheses presented in the CSM:
- i) Blakesley degreaser, apparently in the basement. This may be a duplicate with the sample suggested in ‘vii’ and if so, a duplicate sample is not necessary,
  - ii) Detrex Degreaser, on the west side,
  - iii) the Hand Tables, on the west side,
  - iv) the spray booths and their associated solvent storage tanks, located in the center of the building just south of the midpoint,
  - v) these locations are taken from the 1995 C-400 Building Process and Structure Review document, pages 49-51 of 100 of the pdf,
  - vi) the sump located near Column D4 as located on Drawing E4-1-S, Foundation Plan in the Compressor Pit,
  - vii) the sump located near Column F4 as located on Drawing E4-1-S, Foundation Plan in the Fan Room/Basement,
  - viii) the sump located near Column C14 as located on Drawing E4-1-S, Foundation Plan as the Emergency Fan Room,
  - ix) the two tunnel structures associated with Building C-400,
  - x) a location in the northeast portion of the building to provide a geographic distribution of sample locations, and
  - xi) additional locations (such as portions of the plumbing system) to be identified through tri-party discussions of the D1 Work Plan comments.
- 29) Sec. 7, Sampling Locations and Rationale, pg. 25: Revise this discussion and the associated Figure 9 [C-400 Map (with Approximate Sampling Locations for Vapor Intrusion)] and Table 4 (Proposed Locations and Rationale for VI Sampling) to assign a discrete number for each sampling location, along with its attendant description. For example, most of the locations on Figure 9 can be matched up with the text; however, a unique numbering system will support future discussion and differentiate between the fan room samples. In addition,

the text lists a sample location as “Basement furnace room on north end of C-400.” There is no sample location labeled as such on Figure 9. The location in the north end of C-400 is labelled “Fan Room Basement Area 700 sq. ft. [square feet].” Finally, the text lists two sampling locations from the C-400 basement fan room exhaust fan plenum, but only one location is shown on Figure 9. Review and correct any discrepancies between the text, Figure 9, and Table 4 and assign discrete sample location numbers to aid the future discussion of results.

30) Figure 9, pg. 26 – Is the *Fan Room Basement Area* on the north end of the building supposed to be labeled (i) *Basement Furnace Room* as described on the previous page or (ii) the *Emergency Fan Room* as it is labeled on Drawing E4-1-S, Foundation Plan, Rev.10 ? See Specific Comment 29. Evaluate and revise the Work Plan to correct the discrepancy as needed for accuracy and clarity.

31) Figure 9, pg. 26 - Figure 9 (*C-400 Map with Approximate Sampling Locations for VI*) does not include the lateral investigation boundaries of the VI evaluation. Based on Section 3 (Investigation Boundaries), the lateral boundaries include the areas in the immediate vicinity of C-400 “defined by 11<sup>th</sup> Street to the east, Tennessee Avenue to the south, 10<sup>th</sup> Street to the west, and Virginia Avenue to the north.” In addition, the approximate location and target proximity of the ambient air sample to the C-400 Building is not provided on Figure 9. Revise Figure 9 to indicate the lateral boundaries of the VI evaluation. In addition, revise Figure 9 to provide a refined indication of the ambient air sample location and target proximity to the C-400 Building.

32) Sec 7, pg. 27 – The text refers to four (4) days of sampling in the area of the exhaust fans. Revise the Work Plan to provide DOE’s rationale for the proposed additional days of samples in the area of the exhaust fans.

Also, it appears that all the other proposed samples will be for one 8 hour period. However, if the building operations are in excess of the standard 8 hour day, the sample collection time should match the building operations. In addition, the Guide calls for multiple rounds of sampling to assess the VI condition of a building: see page 125: “*EPA recommends that time-integrated measurements from multiple sampling events be used to estimate exposure concentrations appropriate for the exposure (occupancy) scenario being evaluated, ...when the risk assessment for an existing building would support a conclusion that the human health risk is acceptable (see Section 7.4.1).*” Revise the Work Plan sampling durations and numbers of rounds of sampling for consistency with page 125 and Section 7.4.1 of the Guide.

33) Sec 8, pg. 29, Third bullet – The text does not provide sufficient information to understand of the size and length of the crack. Nor is there any indication in the Work Plan of the size of the plastic covering or how it might be weighted to assure that it provides an adequate seal to

the indoor air. Revise the work plan to provide additional information about the condition of this area. Based on the information presented in the draft Work Plan, it is EPA's opinion that this sample does not represent a true subslab sample. The sample location is not sealed to ensure that the air is coming from below the slab. Also, the location of this crack is far from the main areas where TCE was used and would not be considered a valid point for determining if the several likely TCE release areas had contributed to the presence of TCE in the subslab environment. If this location is sampled and reported by DOE, EPA will not consider the data to be usable as a true subslab sample.

- 34) Sec 8, pg. 29, Seventh Bullet – There is a photograph of the Blakesley Degreaser labeled as containing trichloroethane (TCA) in the *C-400 Process and Structures Review* document. Assuming that this DOE photograph is historically accurate, TCA and 1,4 Dioxane warrant inclusion as site-related compounds of potential concern for this investigation. Revise the Work Plan to include evaluation of TCA and 1,4 Dioxane. See Specific Comment 11.
- 35) Section 9 (Results Evaluation) indicates that the air sample data collected from the floor crack (Main Floor) will be compared to EPA's soil gas vapor intrusion screening level (VISL) for default commercial scenarios. While this is not inherently incorrect, this sampling is more of an indicator of preferential pathways than a basis for assessing breathing zone exposure. As previously noted, neither is it truly reflective of subslab soil gas conditions. For example, the third bullet of Section 8 indicates that, "a layer of polyethylene sheeting will be placed over the crack to limit the potential dilution due to flow of indoor air into the sampling tube;" however, a layer of polyethylene sheet is not appropriate to limit the potential dilution due to flow of indoor air into the sampling tube. Recognizing that this sample's utility will be in identifying a preferential pathway, DOE should consider comparing results to the Industrial Air regional screening level (RSL) as the indoor air target concentration for the commercial VISLs. This adjustment is predominately ordered to ensure a sufficiently sensitive practical quantitation limit, where the indoor air target will require a more sensitive practical quantification limit (PQL). This will be helpful in assessing whether the data from the crack sample is above or below the indoor air target (regardless of mixing zone attenuation).
- 36) Sec. 9, pg. 30 - In Section 9 at the top of page 30, it is stated that the indoor air results will be compared to other benchmarks such as permissible exposure levels promulgated by the Occupational Safety and Health Administration (OSHA) and other reference values compiled by the American Conference of Governmental Industrial Hygienists (ACGIH). EPA notes that while these comparisons may be done for purposes needed by DOE as part of the PGDP industrial hygiene program, EPA risk evaluation and management decisions under CERCLA are not/will not be based on OSHA and ACGIH comparisons. EPA's toxicity values and the CERCLA risk range will be used for making risk evaluation and risk management decisions

using the data generated from an approved C-400 VI investigation Work Plan, the elements of which are consistent with the Guide.

- 37) Sec. 10, pg. 30: The text in *Investigation and Decision Rules* indicates that results will be compared to “site-specific benchmarks established for the types of workers present for the exposure durations that are representative of the types of workers;” however, the methodology that will be used to develop the site-specific evaluation basis is not provided and/or referenced. Revise the C-400 VI WP to provide the methodology that will be used to develop the site-specific evaluation basis.
- 38) Sec 10, pg. 30 & 31 – There is a fundamental disconnect between the approach for data evaluation described in the Guide and the procedure proposed by DOE in the Work Plan. The Guide recommends the comparison of groundwater and subslab soil gas to the VISL screening numbers. *In contrast, the draft Work Plan starts with the comparison of the indoor air data to various health screening values including VISL. If those indoor air data exceed the screening, then considerations will be given to additional action such as additional ventilation, personal protective equipment, building pressurization, or building evacuation.* The approach proposed by DOE in the Work Plan is the same as presented in a February 2016 tri-party Work Plan scoping conference call: DOE is proposing conduct of an industrial hygiene study on the indoor air taking into account the variable air flow induced by the exhaust fan(s) and variable exposure durations to the regular and temporary workers. EPA advised DOE during the February 2016 scoping call that an industrial hygiene study is not a substitute for a CERCLA study to evaluate the vapor intrusion risk for workers in and around the C-400 Building.

Revise this Section of the Work Plan, taking into consideration the need for concurrent evaluation of the subslab, indoor air and ambient air data collected from multiple rounds of sampling. This approach will allow the development of the multiple lines of evidence necessary in evaluating the vapor intrusion risk for the C-400 Building. To support document revision, see the Guide (Sec 6.5.4, page 134 of 267, fourth paragraph) for the specific language regarding the concurrent comparison of data from the different sampling locations; indoor, subslab and ambient. Following this EPA protocol is necessary to comply with the EPA September 2014 Five Year Review letter and to generate current data and lines of evidence sufficient for EPA to re-evaluate the C-400 Building “deferred protectiveness” statement in that letter (September 30, 2014).

- 39) Sec 10, pg. 31 - The first bullet states “*THEN the pathway is considered to be incomplete*”: This is not a correct statement: with only one round of data and no sub-slab data, this conclusion cannot be drawn. As stated in EPA’s VI Guide, seasonal data that matches sub-

slab, indoor air, and ambient air is needed to draw final conclusions. Revise the Work Plan to address this concern.

- 40) Sec. 10, pg. 31 - The second bullet that states "*THEN the pathway is considered to be complete*" may not be a correct statement. If sub-slab data are not collected, this conclusion cannot be drawn with any certainty. The detected concentrations could be associated with indoor air sources and/or the exhaust fan system actually pulling contaminated air into the building through cracks and crevices within the building. Revise the Work Plan to address this concern.
- 41) Sec.10, Investigation Decision Rules, pg. 31: Add the consideration of a sufficiently sensitive PQL to any decision criteria targeting nondetect analyses. Thus, the first sentence in the 1<sup>st</sup> bullet point will read: "**IF** indoor air concentrations for selected VOCs in both occupied and non-occupied areas are less than the VISL values or nondetect *at an appropriately sensitive PQL*, **THEN** the pathway ....".
- 42) Sec 11, pg. 32, fifth paragraph – The text states that "*The planned investigation is considered an appropriate investigation to fill the data gaps concerning the potential for VI at C-400.*" EPA does not agree with this statement. The investigation proposed by DOE focuses primarily on the collection of indoor air samples and triggers the consideration of collection of subslab samples (if warranted in DOE's opinion). This approach is not consistent with EPA's vapor intrusion guidance and protocol as referenced in General Comment 7 and the associated references to specific passages from the Guide. Revise the Work Plan to address this concern.
- 43) Sec 11, pg. 32 – As an additional reminder regarding pre-emptive mitigation, DOE should consider the guidance provided by the Guide (Sec. 7.8.1, pg. 136) where it is emphasized that "*EPA recommends that it (i.e., building mitigation) typically be used in conjunction with remediation of the subsurface source of vapor-forming chemicals (e.g., source removal or treatment), as discussed in Section 8.1.*" Pre-emptive mitigation entails immediate risk reduction while other actions of investigation, monitoring and remediation continue. This may be of extra importance if there are sensitive populations present in the C-400 Building given the likelihood that TCE may be present and it has an especially low screening number. Revise the Work Plan to describe the characteristics of the populations of workers currently in the C-400 Building, and those forecast to be in the building in the next two years; also, discuss whether sensitive populations are currently present or likely to be present in the immediate future.
- 44) Appendix A – The various sections of this appendix provide considerable detail regarding the *historical* detections of TCE and other VOCs in and around the C-400 Building. As they do not represent current conditions, they do not contribute to the understanding of current

conditions and the calculation of current risk due to vapor intrusion. Revise the Work Plan to link the presentation of historical (secondary) data to specific data quality objectives in this Work Plan and identify the use limitations on the historical data.

## **Appendix B: Quality Assurance Project Plan**

### **General Comments**

- 1) Appendix B references other documents including, but not limited to, the Work Plan and Standard Operating Procedures (SOPs) for much of the necessary information. While this may be acceptable, Appendix B does not include correct or complete references to where necessary information is located. For example, QAPP Worksheet #17 only states See Section 9, "Sampling Method". In addition, the referenced SOPs are not provided for review. Therefore, the adequacy of the referenced information and whether it meets the requirements for a QAPP cannot be verified. Revise Appendix B to provide complete references (i.e., document name, section title and number, subsection title and number) for all referenced information. Further, provide all referenced SOPs. Finally, in cases where documents other than the Work Plan and SOPs are referenced, revise Appendix B to specify where these documents can be located (e.g., provide a web link, or provide the document as a QAPP appendix).
- 2) According to QAPP Worksheet #9 (Project Scoping Session Participants Sheet) data quality objectives (DQOs) were developed for the vapor intrusion sampling and analysis project. However, neither the Work Plan nor Appendix B appear to fully document the DQOs. According to EPA QA/G-4, *Guidance on Systematic Planning using the Data Quality Objectives Process* (EPA/240/B-06/001) dated February 2006 (DQO guidance), the seven step DQO process should include 1) State the problem; 2) Identify the Goals of the Study; 3) identify Information Inputs; 4) define the Boundaries of the Study; 5) Develop the Analytical Approach; 6) Specify Performance or Acceptance Criteria; and 7) Develop the Plan for Obtaining Data. It appears some of the DQO information is contained in the Work Plan and QAPP, but neither provides a comprehensive list of DQOs that adequately demonstrate the entire planning process. Revise Appendix B or the Work Plan to include all seven steps of the DQO process in a consolidated list.
- 3) Appendix B presents inconsistent information on the number of field Quality Control (QC) samples that will be collected. For example, QAPP Worksheets #12 and #20 appear to indicate that no field QC samples will be collected. However, QAPP Worksheet #28 indicates a field duplicate will be collected. Revise Appendix B to consistently indicate the number and type of field QC samples that will be collected. If no field QC will be collected,

also revise Appendix B to discuss this including, but not limited to, why such samples were not deemed necessary for evaluating field accuracy and precision.

### **Specific Comments**

- 1) **Appendix B, QAPP Worksheet #3, Distribution List, Page B-14:** The Field Team Leader (FTL) for the project is not included on the distribution list. Since the FTL will be responsible for directing/overseeing field sampling activities, the person filling this position should be included on the distribution list. Additionally, the laboratory, validator, and any subcontractors should also be included on the distribution list. Revise QAPP Worksheet #3 to include the FTL, laboratory, data validator, and subcontractors.
- 2) **Appendix B, QAPP Worksheet #4, Project Personnel Sign-Off Sheet, Page B-16:** This worksheet is incomplete. For example, the project manager, personnel responsible for quality assurance (QA) and QC, FTL and analytical laboratory are not included on the sign-off sheet. Revise QAPP Worksheet #4 to include all key project personnel.
- 3) **Appendix B, QAPP Worksheet #5, Project Organizational Chart, Page B-15:** This worksheet is incomplete. For example, the Program Manager and the Environmental Monitoring Project Manager, which are included in QAPP Worksheet 7 (Personnel Responsibilities and Qualifications Table) are not included on the organizational chart. Revise the organizational chart to include all applicable project personnel.
- 4) **Appendix B, QAPP Worksheet #6, Communication Pathways, Pages B-19 and B-20:** This worksheet does not indicate that regulatory agencies will be notified of significant corrective actions or when changes to the Work Plan occur in the field. In addition, the communication procedures do not always specify the form of communication for the notifications. Revise the table to specify that the regulatory agencies will be notified of significant corrective actions and when changes to the Work Plan occur and include the timeframe for this notification. Also, revise QAPP Worksheet #6 to include the form of communication for all communication drivers.
- 5) **Appendix B, QAPP Worksheet #7, Personnel Responsibilities and Qualifications Table, Page B-17:** The FTL and personnel responsible for project QA/QC are not included in this worksheet. Revise QAPP Worksheet #7 to include this information.
- 6) **Appendix B, QAPP Worksheet #10, Problem Definition, Page B-27:** The text does not list the possible classes of contaminants and the affected matrices. Instead, the text states, "The primary contaminant of concern is TCE [trichloroethene]." Revise QAPP Worksheet #10 to provide a list of the possible classes of contaminants and the affected matrices.

- 7) **Appendix B, QAPP Worksheet #11, Project Quality Objectives/Systematic Planning Process Statements, Page B-28:** The text indicates that “meteorological data may be acquired from other sources, as needed;” however, the use/measurement of meteorological data is not discussed in the C-400 VI WP. For example, the C-400 VI WP does not discuss the measurement of barometric pressure during the VI evaluation. Revise the C-400 VI WP to discuss the use/measurement of meteorological data.
- 8) **Appendix B, QAPP Worksheet 12, Measurement Performance Criteria, Page B-29:** QAPP Worksheet #12 does not include specific measurement performance criteria (MPC) for evaluating sampling and analysis precision, accuracy and bias. Revise this worksheet to include specific performance criteria.
- 9) **Appendix B, QAPP Worksheet 15, Project Action Limits and Laboratory-Specific Detection/Quantitation Limits, Page B-33:** QAPP Worksheet #15 does not provide project action limits (PALs) for cis-1,2-dichloroethene and trans-1,2-dichloroethene, but these analytes are listed as site chemicals of potential concern (COPCs). As PALs do not appear to be available, Appendix B should discuss how these compounds will be evaluated. Revise Appendix B to discuss how compounds without PALs will be evaluated.
- 10) **Appendix B, QAPP Worksheet #16, Project Schedule\Timeline, Page B-32:** QAPP Worksheet #16 states that the project schedule has not yet been developed. Ensure a project schedule is developed and added to Appendix B prior to approval of Appendix B and initiation of field sampling activities. Also, ensure that the schedule\timeline identifies all required reports, records, data reports, quality assurance reports and documents pertinent to the data collection and analysis.
- 11) **Appendix B, QAPP Worksheet #17, Sampling Design and Rationale, Page B-34:** This worksheet references Section 9 (Sampling Method) for all information. However, the rationale appears to be discussed in Work Plan Section 7. Further, neither Section 7 nor Section 9 of the Work Plan presents sufficient rationale for the number and location of the samples, including but not limited to why the proposed number and location of the samples are sufficient to meet project DQOs. Further, the rationale for the proposed analyte list is not presented in these Work Plan sections or this worksheet. Revise this worksheet to present the rationale that demonstrates the numbers and locations of the proposed samples are sufficient to meet project DQOs. Also, revise this worksheet to provide the rationale for the proposed analyte list.
- 12) **Appendix B, QAPP Worksheet #18, Sampling Locations and Methods/SOP Requirements, Page B-35:** QAPP Worksheet #18 references Section 9 of the Work Plan for sampling locations. However, Sections 7 and 8 of the Work Plan contain most of this information, not Section 9. Further, while sample locations are discussed in the Work Plan, the information is not presented in a format consistent with the *Uniform Federal Policy Quality Assurance Project Plan* (EPA-505-B-04-900A) dated March 2005 (UFP-QAPP

Manual). Revise Appendix B to include a completed QAPP Worksheet #18 so that sample and analysis plan requirements are more clearly and completely communicated to the personnel implementing the plan.

- 13) **Appendix B, QAPP Worksheet #19, Analytical SOP Requirements:** QAPP Worksheet #19 does not include sample container requirements (including preparation requirements), holding time criteria, or other such information. Revise this worksheet to provide information about the summa canister preparation requirements, as well as any preservation, hold time, or other sample integrity precautions/requirements.
- 14) **Appendix B, QAPP Worksheet #20, Field Quality Control Sample Summary:** QAPP Worksheet #20 incorrectly references "SAP p. 21" the number of samples. Further, this worksheet indicates that ten field samples will be collected and not field QC samples, but the total number of samples is listed as 13. Revise this worksheet to correct the reference and clarify why the total number of samples differs from the number of field samples.
- 15) **Appendix B, QAPP Worksheet #22, Field Equipment Calibration, Maintenance, Testing, and Inspection, Page B-41:** QAPP Worksheet #22 does not identify the field instruments and equipment, or provide any technical criteria by which field sampling equipment is checked for acceptable performance (i.e. flow rate monitor). Additionally, this worksheet does not provide a listing of supplies, consumable items, instruments or equipment, or the location of spare parts needed to ensure all field sampling supplies and equipment are accessible and working properly. Revise QAPP Worksheet #22 to include this information.
- 16) **Appendix B, QAPP Worksheet #23, Analytical SOP Reference Table, Page B-42:** QAPP Worksheet #23 lists the analytical method number but not the laboratory specific SOP. Further, a copy of the referenced SOP is not included in Appendix B. Revise Appendix B to provide the SOP number in QAPP Worksheet #23, and to provide this SOP in a QAPP appendix.
- 17) **Appendix B, QAPP Worksheet #24, Analytical Instrument Calibration Table, Page B-43:** QAPP Worksheet #24 does not include the analytical instrument calibration and corrective action requirements. Revise this worksheet to include this information.
- 18) **Appendix B, QAPP Worksheet #28, QC Sample Table, Page B-47:** QAPP Worksheet #28 does not provide a complete list of laboratory QC parameters, or the laboratory specific QC acceptance criteria. Revise this worksheet to include this information.
- 19) **Appendix B, QAPP Worksheet #29, Project Documents and Records, Page B-48:** The data management, reduction and reporting discussion is insufficiently detailed. For example, it is unclear where hardcopy project documents will be stored and where the project database will be maintained. It is also unclear how long these documents and the database will be

stored before archival/disposal. Further, the documents listed do not include project report deliverables, laboratory data package deliverables, or what specifically is included in the laboratory data packages. Lastly, it is unclear how analytical data will be entered into the database, if the entry will be reviewed, and how data qualifiers will be added to the final reports. Revise Appendix B to provide greater detail regarding the data management, reduction and reporting tasks as per Section 3.5, Data Management Tasks, of the UFP QAPP Manual.

- 20) **Appendix B, QAPP Worksheet #31, Planned Project Assessment Table, Page B-49:** QAPP Worksheet 31 does not provide the approximate dates of the QA/QC assessments that will be implemented for this project, or list the individuals responsible for conducting these assessments. Ensure the next revision of Appendix B includes this information.
- 21) **Appendix B, QAPP Worksheet #35, Validation (Steps IIa and IIb) Process, Page B-53:** QAPP Worksheet #35 does not include a list of data flags or qualifiers that will be assigned and does not include a copy of data validation procedures used to evaluate Method TO-15 analyses. Revise Appendix B to include this information.
- 22) **Appendix B, QAPP Worksheet #36, Validation (Steps IIa and IIb) Summary Table, Page B-54:** QAPP Worksheet #36 states that TO-15 data will be evaluated against the National functional Guidelines and Worksheets #12, #15, and #28; however, Appendix B also references a data validation SOP in other worksheets. Revise Appendix B to consistently discuss how data will be validated and to include the data validation SOP(s).
- 23) **Appendix B, QAPP Worksheet #36, Validation (Steps IIa and IIb) Summary Table, Page B-54:** Appendix B does not indicate what will be included in the data validation reports. Revise the SAP to ensure that data validation reports will present a discussion of all QC parameters evaluated, the acceptance criteria used to evaluate each QC parameter, a list of all QC exceedances as well as the extent of the exceedance, the samples associated with each exceedance, and the qualifiers applied.
- 24) **Appendix B, QAPP Worksheet #37, Usability Assessment, Page B-55:** The discussion of the data assessment packages is insufficiently detailed. Revise this worksheet to provide further discussion on what will be included in the data assessment packages. This should include at minimum how DQOs were determined to be met, as well as how precision, accuracy, representativeness, comparability, completeness, sensitivity, trends, biases, and uncertainties were evaluated, along with sufficient information to support the data usability conclusions.
- 25) **Appendix B, QAPP Worksheet #37, Usability Assessment, Page B-55:** This worksheet indicates that statistical tests may be used to evaluate the data. However, it appears that the sampling design is not random, and therefore the use of statistics may not be appropriate. Revise Appendix B to clarify this apparent discrepancy and/or provide justification for the

EPA Region 4 Comments on:

*C-400 Vapor Intrusion Study Work Plan (DOE/LX/07-2403&D1, April 2016)*

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use of statistics in evaluating the data for this project. Also, if statistics will be used, revise Worksheet #37 to indicate that the data quality assessment packages will provide a discussion on why the statistical tests were deemed appropriate (e.g., the assumptions behind the statistical test, and whether the data met those assumptions), as well as sufficient information to verify any statistical calculations.

**Minor Comment**

1. The title of Appendix B on QAPP Worksheet #1, page B-10 states it is in Appendix A. Change the title to Appendix B (Quality Assurance Project Plan).

**Attachment 1 (1 page)**

EPA Region 4. Draft (2015). *Table 1. Tiered Response Actions for Indoor Air Concentrations Determined to be Site Related.*

**Attachment 2 (15 pages)**

Evaluation of - *Appendix B (Quality Assurance Project Plan) of C-400 Vapor Intrusion Study Work Plan to Support the Additional Actions for the CERCLA Five-Year Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky - with the USEPA Region 4 Superfund Division Final Uniform Federal Policy QAPP (EPA R4 UFP-QAPP) Checklist.*



**Before using this table, multiple lines of evidence would have been used to indicate the need for a VI Study which includes indoor, sub-slab/crawl space, and ambient air. This table is to be used when the data from the VI study is received. It should also be determined if detected analytes are site related or potential indoor sources before a final decision for action is made.**

**Table 1: Tiered Response Actions for Indoor Air Concentrations\* Determined to be Site Related**

	<b>Tier 1 Pathway Complete Unacceptable Risk or Hazard</b>  <b>Based on EPA RML Exceedance and VISL Calculator</b>	<b>Tier 2 Pathway Complete Unacceptable Risk or Hazard</b>  <b>RML not exceeded but Unacceptable Cumulative Risk or Hazard</b>	<b>Tier 3 Pathway Complete but Acceptable Risk or Hazard</b>  <b>EPA RSL Exceeded Acceptable Cumulative Risk and Hazard</b>	<b>Tier 4 Initial Assessment Incomplete Pathway</b>  <b>No Exceedances of EPA RSL</b>
<b>Analyte</b>	For any individual analyte where the concentration is > RML: >10 <sup>-4</sup> or HQ >3 based on indoor air risk calculation using the VISL calculator	Cumulative risk >10 <sup>-4</sup> or HI >1 for a specific target organ	The first or second round analyte concentration is > RSL  (RSL based on 1x10 <sup>-6</sup> or HQ = 0.1 residential risk)	ALL first and second round analyte concentrations are < RSL.  (RSL based on 1x10 <sup>-6</sup> or HQ = 0.1 residential risk)
<b>Response</b>	<b>Potential relocation if temporary engineering controls not available and mitigation recommended</b>	<b>Estimate Cumulative Risk:</b> If first round - Cumulative Risk is >1x10 <sup>-4</sup> or HI >1 for a specific target organ  <b>Re-evaluate with 2<sup>nd</sup> round sampling or mitigate.</b>  If first and second round data: >1x10 <sup>-4</sup> or HI >1 for a specific target organ <b>Mitigation Recommended</b> If first and second round data indicate different Tier levels, then additional monitoring will be needed or early mitigation can be done	If first round data are >RSL and <RML, cumulative risk should be evaluated  <b>Re-evaluate with 2<sup>nd</sup> round sampling</b>  If second round data are >RSL and <RML, cumulative risk should be evaluated.  If Cumulative Risk from both rounds are <1x10 <sup>-4</sup> and HI < 1  <b>No unacceptable risk therefore no action may be warranted, but further evaluation may be necessary.</b>  If first and second round data indicate different Tier levels, then additional monitoring may be needed or early mitigation can be done	If first round data are <RSL  <b>Re-evaluate with 2<sup>nd</sup> round of sampling.</b>  If ALL 1 <sup>st</sup> and 2 <sup>nd</sup> round analyte concentrations are <RSL based on 1x10 <sup>-6</sup> or HQ = 0.1  <b>Vapor intrusion pathway may be considered incomplete.</b>  <b>No unacceptable risk therefore no action necessary.</b>

\*May use for Residential and Industrial assessments.

**Notes:**

1. EPA RSL - Regional Screening Level, used for screening indoor air. [http://www.epa.gov/reg3hwmd/risk/human/rb-concentration\\_table/](http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/)
2. EPA RML – Regional Removal Management Level <http://www.epa.gov/region04/superfund/programs/riskassess/rml/rml.html>
3. For TCE, for sensitive subpopulations, the RML is 2 µg/m<sup>3</sup> and is based on a hazard quotient of 1 due to potential short-term non-cancer effects to sensitive subpopulations. For non-sensitive subpopulations, the target hazard index is 3 and the RML is 6 µg/m<sup>3</sup>.
4. VISL Calculator <http://www.epa.gov/oswer/vaporintrusion/guidance.html>

**Evaluation of:**  
**Appendix B (Quality Assurance Project Plan) of C-400 Vapor Intrusion Study**  
**Work Plan to Support the Additional Actions for the CERCLA Five-Year**  
**Review at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky**  
**[C-400 VI WP]**  
**With the USEPA Region 4 Superfund Division**  
**Final Uniform Federal Policy QAPP (EPA R4 UFP-QAPP) Checklist**

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
Title and Approval Page <b>Worksheet 1</b>		
Title of QAPP Worksheet 1	Y	
Organization's Name: The name of the Lead organization, the name of the organization preparing the QAPP, and the name of the organization conducting the project (if different from preparer). For Federal Facilities, the Lead Organization is the Facility (DOD, DOE). <b>Worksheet 1</b>	Y	
Dated Signatures: Investigative Organization's Project Manager, Investigative Organization's QA Officer, and Lead Organization's Project Manager. <b>Worksheet 1</b>	N	Signatures not provided. No comment generated.
Date and Signature of Quality Assurance Manager's approval for the Lead Organization. <b>Worksheet 1</b>	N	Signatures not provided. No comment generated.
Date and Signature of USEPA Quality Assurance Manager or Designated Approving Official <b>Worksheet 1</b>	N	EPA Signature not required, but EPA concurrence required. No comment generated.
<b>QAPP Identifying Information</b> <b>Worksheet 2</b>	Y	
<b>Distribution List: Including all entities or agencies requiring copies of the QAPP</b>	N	Field Team Leader, analytical laboratory, validator, and subcontractors for the project are not included. See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	<b>Noted Deficiencies based on comparison with EPA R4 UFP-QAPP</b>
<b>Worksheet 3</b>		
<b>Project Personnel Sign-Off Sheet:</b> Identifies key project personnel and specifies technical disciplines. <b>Worksheet 4</b>	N	QAPP does not include signatory lines for all applicable project personnel including the project manager, QA staff, and Field Team Lead. See QAPP comments.
<b>Project Organizational Chart:</b> Organization chart provided: Depicts lines of authority, independence (of QA manager), and reporting responsibilities. Org-chart also contains entries for all agencies contractors and individuals responsible for performing QAPP preparation, sample collection, laboratory analysis, data verification, review and validation, data quality assessment; and project oversight responsibilities. <b>Worksheet 5</b>	N	The Organization Chart is incomplete and does not all applicable personnel. See QAPP comments.
<b>Communication Pathways:</b> Details their. Roles/responsibilities and details communication pathways. <b>Worksheet 6</b>	N	Communication pathways are incomplete, do not indicate when regulatory agencies will be notified and do not provide timing and form of communications. See QAPP comments.
<b>Personnel Responsibilities and Qualifications Table</b> <b>Worksheet 7</b>	N	The Field Team Leader and QA personnel are not included in this worksheet. See QAPP comments.
<b>Special Training Requirements and Special Certifications</b> <b>Worksheet 8</b>		
Identifies how training needs are determined and lists all training requirements for the project. Specifies whether certain professionals require a license or certification to perform duties as required by federal or state laws. <b>Worksheet 8</b>	Y	
<b>Project Scoping Session Participants</b> <b>Worksheet 9</b>	Y	

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
<b>Problem Definition/Background Worksheet 10</b>		
Clearly states the particular environmental problem to be solved, decision to be made, or outcome to be achieved. Include sufficient background information to provide a historical, scientific, and regulatory perspective for this particular project. <b>Worksheet 10</b>	Y	Historical information is found in the main body of the Work Plan and in Appendix A.
Provides historical and background information concerning prior environmental investigations or assessments performed at the site. Discusses the data collected from these prior investigations and identifies any additional information that may be contained in computer databases (secondary data), etc. <b>Worksheet 10</b>	Y	Historical data provided in Appendix A.
<b>Project Quality Objectives/Systematic Planning Process Statements Worksheet 11</b>		
Provides the Data Quality Objectives in accordance and compliance with EPA's Data Quality Objective Process (EPA-QA/G-4) document. Lists the seven steps of the DQO process and provides the project-specific information pertaining to each of these steps. Applies a systematic planning process to the project study undertaken. Provided the qualitative and quantitative data quality objectives for all aspects of the project. Must provide clearly delineated project objectives such as determining the presence/absence of potential contaminants, nature and extent of contamination, determining whether human health is affected. Must provide a list of decisions and alternative actions (remediation, removal, further	N	Neither the Work Plan nor the QAPP provide Data Quality Objectives (DQOs) consistent with the seven steps process provided in EPA's QA/G-4 <i>Guidance on Systematic Planning Using the Data Quality Objectives Process</i> EPA/240/B-06/001, February 2006. [DQO guidance].  See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
assessments, no further action, etc.). <b>Worksheet 11</b>		
<b>Measurement Performance Criteria Table</b> <b>Worksheet 12</b>		
Identifies the data quality indicators, measurement performance criteria, and QC sample and/or activity used to assess the measurement performance for both the sampling and analytical measurement systems. <b>Worksheet 12</b>	N	Measurement performance criteria for evaluating sampling and analysis precision, accuracy, and bias have not been provided. See QAPP comments.
<b>Secondary Data Criteria and Limitations Table</b> <b>Worksheet 13</b>		
Identifies the type and frequency of non-direct measurement techniques for the project (for computer databases, literature searches, etc.) <b>Worksheet 13</b>	Y	Information is provided in Appendix A, and reference provided to site database (OREIS) where historical data from groundwater and soil data is stored.
Clearly identifies and describes the limitations of such data. <b>Worksheet 13</b>	Y	
Discusses the rationale for using this data and explains its relevance to the project. <b>Worksheet 13</b>	Y	
Specifies how limitations in this data will be communicated to all end data users and stakeholders. <b>Worksheet 13</b>	Y	QAPP states that all secondary data will be quantitative and definitive; rejected data will not be used.
<b>Summary of Project Tasks</b> <b>Worksheet 14</b>		
Provides a summary of all work to be performed, products to be produced, data and management assessment. Lists the actual measurements to be made: Including in-situ field measurements, fixed laboratory measurements, or any other type of information collected as	N	Information provided is very general. It is recommended that the appropriate sections of the Work Plan be added to the QAPP. See QAPP comments on data management.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
part of the project. <b>Worksheet 14</b>		
<b>Reference Limits and Evaluation Table</b> <b>Worksheet 15</b>		
Cites applicable regulatory standards or criteria such as action limits, ARARs, PRGs, MCLs, risk assessment screening levels, etc. Must provide the actual numerical criteria for the above items. Provides all regulatory standards/criteria as part of DQO process (action limits, ARARs, PRGs, MCLs, etc.) on an analyte by analyte basis. <b>Worksheet 15</b>	N	PALs are not provided for 1,2- dichloroethene (cis and trans). See QAPP comments
Provides a list of all the critical contaminants/analytes along with their respective detection limit requirements (for chemical parameters) and quantitation limit. <b>Worksheet 15</b>	Y	
<b>Project Schedule\Timeline Table</b> <b>Worksheet 16</b>		
Provides work schedule for all tasks including report preparation, response to comments, etc. <b>Worksheet 16</b>	N	Worksheet states project schedule has not yet been developed. See QAPP comments.
Identifies all required reports, records, data reports, quality assurance reports/documents. <b>Worksheet 16</b>	N	Not provided. See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
<b>Sampling Design and Rationale Worksheet 17</b>		
Provides design of the sampling/collection network. <b>Worksheet 17</b>	N	Worksheet #17 should reference Sections 7 (Sampling Locations and Rationale) and 8 (Sampling and Analysis Methods) of the Work Plan, rather than Section 9 as currently stated. However, neither the Work Plan nor the QAPP provide sufficient rationale for why proposed sample numbers, locations and analyses are sufficient to meet project DQOs. See QAPP comments.
Provides an extensive discussion regarding the rationale for the sampling design. (This also includes a discussion regarding the rationale and relevance of the analytical program). <b>Worksheet 17</b>	N	See QAPP comments.
<b>Sampling locations and Methods/SOP Requirements Table Worksheet 18</b>		
Provides a table with type and number of samples required for collection such as surface, subsurface, or groundwater. <b>Worksheet 18</b>	N	This information is not provided in a table in either the QAPP or Work Plan. Additionally, this worksheet incorrectly references Section 9 of the Work Plan. See QAPP comments.
Provides maps or diagrams with sample locations/collection locations and provides table with frequency of sampling events. <b>Worksheet 18</b>	Y – incorrect reference	Section 7 of the Work Plan includes the sampling diagram. This worksheet references Section 9, therefore this reference should be corrected.
Provides the sample matrices slated for collection in the sample table (surface soil, subsurface soil, sediment, surface	Y	

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
water, groundwater samples, etc). <b>Worksheet 18</b>		
<b>Analytical SOP Requirements Table Worksheet 19</b>		
Clearly identifies the extraction, digestion, analytical methodologies (provides the actual method numbers) to be followed (includes all relevant options or modifications required), identifies the required instrumentation. Include copies of the SOPs as attachments or reference in the QAPP. <b>Worksheet 19</b>	N	Laboratory-specific analytical SOP(s) not referenced or included in the QAPP. See QAPP comments.
Provides table listing sample container requirements and preparation requirements for these containers (if provided by laboratory, clearly states such). <b>Worksheet 19</b>	N	Sample container and preparation requirements have not been provided. See QAPP comments.
Provides table listing sample preservation requirements (for chemical parameters) and holding time criteria (where applicable). <b>Worksheet 19</b>	N	Requirements for holding time, checking flow rate and final pressure of summa canisters prior to shipment back to lab not listed. See QAPP comments.
<b>Field Quality Control Sample Summary Table Worksheet 20</b>	N	The table incorrectly references "SAP p. 21" for all planned field quality control sample information. See QAPP comments.
<b>Project Sampling SOP Reference Worksheet 21</b>	N	
Identifies all instruments/equipment needed to conduct project. <b>Worksheet 21</b>	N	Worksheet #21 references SOPs for all required information, but SOPs are not provided for review. Worksheet #21 itself does not list any of the instruments/equipment needed to collect the proposed air samples. See QAPP comments.
Provides the required field sample collection procedures, protocols and methods. <b>Worksheet 21</b>	Y	However, SOPs were not provided for review.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
Provides a list of sampling/collection equipment (including make and model of equipment). <b>Worksheet 21</b>	N	Worksheet #21 references SOPs for all required information, but SOPs are not provided for review. Worksheet #21 does not list any of the instruments/equipment needed to collect the proposed air samples. See QAPP comments.
Identifies on-site support facilities that are available to field staff. <b>Worksheet 21</b>	Not Applicable	Does not appear applicable.
Identifies key study personnel in charge of or overseeing sampling/collection activities. <b>Worksheet 21</b>	N	Personnel information is provided in Worksheets 3-7. No comment generated.
Describes equipment decontamination procedures and requirements. Discusses whether sampling equipment is dedicated or non-dedicated. <b>Worksheet 21</b>	N	Not provided. See QAPP comments.
<b>Field Equipment Calibration, Maintenance, Testing and Inspection Tables</b> <b>Worksheet 22</b>	N	
Provides a list of all in-situ testing instruments and field equipment. <b>Worksheet 22</b>	Not Applicable	
Provides the technical criteria by which the field instruments or sampling equipment is checked for acceptable performance. <b>Worksheet 22</b>	N	Worksheet #22 was not completed. See QAPP comments.
Provides a comprehensive list of the supplies required for the project. <b>Worksheet 22</b>	N	Worksheet #22 was not completed. See QAPP comments.
Identifies the individual(s) responsible for checking and inspecting consumables and supplies. <b>Worksheet 22</b>	N	Worksheet #22 was not completed. See QAPP comments.
Provides the acceptance criteria for consumable items, instruments, and equipment. <b>Worksheet 22</b>	N	Worksheet #22 was not completed. See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
Describes equipment and corrective maintenance practices to ensure that on-site equipment or instruments are performing within the required specifications. <b>Worksheet 22</b>	N	Worksheet #22 was not completed. See QAPP comments. Inspection of canisters, flow controller devices, or vacuum gauges prior to, during, and at the completion of sampling is not listed in Worksheet #22. See QAPP comments.
Identifies the availability and location of spare parts. <b>Worksheet 22</b>	N	Worksheet #22 was not completed. See QAPP comments. Availability and location of spare parts for instruments and equipment has not been provided. See QAPP comments.
<b>Analytical SOP Reference Table</b> <b>Worksheet 23</b>		
List all SOPs that will be used to perform on-site or off-site analysis. Indicate whether the procedure produces screening or definitive data. Sequentially number analytical SOP references in the Reference Number column. Include copies of the SOPs as attachments or reference in the QAPP. The reference number can be used throughout the QAPP to refer to a specific SOP. <b>Worksheet 23</b>	N	The analytical method number is provided (TO-15), but the lab-specific SOP number is not provided. Copies of SOPs not provided. See QAPP comments.
<b>Analytical Instrument Calibration Table</b> <b>Worksheet 24</b>		
Identifies all equipment requiring calibration and discusses the frequency of calibration <b>Worksheet 24</b>	N	Instrument calibration not provided. See QAPP comments.
Identifies the calibration requirements for each instrument requiring calibration. (For fixed laboratory this may be in the SOPs or QA manual). <b>Worksheet 24</b>	N	Requirements for calibrations not provided and laboratory SOP not included in QAPP. See QAPP comments.
Provides the calibration requirements and calibration acceptance criteria for each type of equipment or instrument. (Again for the off-site laboratory this information will reside in the method-specific SOPs and the QA manual). <b>Worksheet 24</b>	N	Acceptance criteria for calibrations not provided and laboratory SOP not included in QAPP. See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	<b>Noted Deficiencies based on comparison with EPA R4 UFP-QAPP</b>
Identifies the type of documentation required for calibrations and instrument checks and discusses how calibrations are traced back to specific instruments for each analytical parameter. (Once again for the off-site laboratory this information will reside in the method-specific SOPs and the QA manual). <b>Worksheet 24</b>	N	Traceability of calibrations to specific samples not discussed and laboratory SOP not included in QAPP. See QAPP comments.
<b>Analytical Instrument and Equipment Maintenance, Testing, and inspection Table</b> <b>Worksheet 25</b>		
Identifies all analytical instrumentation that requires maintenance, testing, and inspection and provide the SOP reference number for each. In addition, document the frequency, acceptance criteria, and corrective action requirements. <b>Worksheet 25</b>	Y	
Provides a comprehensive list of the consumables such as, solvents, reagents, buffer solutions and other consumables or supplies required for the project. <b>Worksheet 25</b>	N	List of consumables not provided. See QAPP comment on missing SOP.
Provides the acceptance criteria for each of these items. <b>Worksheet 25</b>	N	No information is provided on consumables. See QAPP comments on missing SOP.
Identifies those individual(s) responsible for checking/inspecting supplies and consumables. <b>Worksheet 25</b>	N	Individuals responsible for checking/inspecting supplies and consumables not listed. No comment generated.
<b>Sample Handling</b> <b>Worksheet 26</b>		
Provides a detailed description of the procedures for post sample handling (once the sample has been collected). <b>Worksheet 26</b>	Y	

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
<b>Sample Custody Requirements Worksheet 27</b>		
Provides a detailed description of the chain-of-custody procedures. <b>Worksheet 27</b>	Y	
<b>QC Sample Table Worksheet 28</b>		
Identifies the type, number and frequency of procedures and frequency of QA/QC sample collection along with the required QC statistically derived limits for each analyte (for spike samples, internal standards, surrogate spikes). <b>Worksheet 28</b>	N	Worksheet # 28 and #20 do not provide consistent information about field quality control sample requirements. Additionally, Worksheet #28 does not provide a complete list of QC samples and acceptance criteria. See QAPP comments.
Provides the statistical equations for accuracy, precision, and comparability. Specifies the acceptance criteria for these measurements. <b>Worksheet 28</b>	N	Worksheet #37 references an SOP for this information. See QAPP comments.
<b>Project Documents and Records Table Worksheet 29</b>		
Provides a comprehensive list of the documents and records required for this project (including raw data, field logs, audit reports, QA reports, progress or status reports, analytical data reports, data validation reports/data quality assessments reports.) <b>Worksheet 29</b>	N	Project documents list is incomplete. See QAPP comments.
Describes the record-keeping, archival and retrieval requirements for hard-copy and electronic information produced during the course of the project. <b>Worksheet 29</b>	N	Record-keeping, archival, and retrieval requirements for hard-copy and electronic information is incomplete. See QAPP comments.
Provides assessment checklists or other standardized forms in an appendix to the QAPP. <b>Worksheet 29</b>	N	Assessment checklists not provided. See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
Provides the retention time and location of study records, reports and formal documents. <b>Worksheet 29</b>	N	The retention time and location requirement for records has not been specified. See QAPP comments.
Describes data handling equipment and procedures used to process, compile and analyze data (provides a complete list of computer hardware and software needs) - Specifies whether computer databases will have restricted access or will be password protected Discusses how the accuracy of computer databases is assured. <b>Worksheet 29</b>	N	QA/QC of the database information (SOPs for data handling and tracking), and database security not provided. See QAPP comments.
Describes process for assuring that applicable Office of Information Resource Management requirements are satisfied (mainly this is required if the data will be entered into an EPA or other Federal Database) <b>Worksheet 29</b>	N	The Office of Information Resource Management requirements have not been discussed in the RAWP. See QAPP comments.
<b>Analytical Services Table</b> <b>Worksheet 30</b>		
Provides validation criteria for non-standard or unpublished methodologies proposed for use for a given study. <b>Worksheet 30</b>	Not Applicable	Non-standard measurements will not be used.
Identifies individual(s) responsible for overseeing the success of the analysis and for implementing corrective actions if deemed necessary. <b>Worksheet 30</b>	N	Individuals responsible for oversight of analyses and corrective actions have not been specified. See QAPP comments on missing laboratory personnel information in Worksheet #7.
Specifies the turnaround time for hardcopy and electronic laboratory data deliverables. <b>Worksheet 30</b>	Y	

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
<b>Planned Project Assessment Table Worksheet 31</b>		
Lists the required number, frequency and type of assessments with approximate dates and names of individual(s) responsible for performing these assessments. <b>Worksheet 31</b>	N	Organization responsibilities are listed for oversight assessments; however, the dates and types of QA/QC assessments and individuals responsible for such assessments have not been provided. See QAPP comments.
Discusses one or more of the following types of assessments: peer reviews, technical audits, surveillance, management system reviews, readiness reviews, quality system audits, performance evaluations, data quality assessments. <b>Worksheet 31</b>	Y	
<b>Assessment Findings and Corrective Action Responses Worksheet 32</b>		
Identifies the individual(s) performing these assessments and discusses the authority and independence of these individual(s) in relation to those being assessed. <b>Worksheet 32</b>	N	Worksheet #32 does not identify the individuals responsible for assessments, only organizations. No comment generated as WS #31 comment will also address this.
Provides a description of the types of corrective actions that may be instituted to resolve any issues identified during the audit. <b>Worksheet 32</b>	N	References an SOP for corrective action. See QAPP comments on SOPs.
Discusses where assessment findings will be documented and how the assessment findings will be communicated to all key project staff, state and EPA personnel responsible for the study oversight. <b>Worksheet 32</b>	Y	

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
<b>QA Management Report Table</b> Identifies the frequency and distribution of the following types of reports: <b>Worksheet 33</b>		
Project Status Reports <b>Worksheet 33</b>	Not Applicable	Worksheet #33 does not include a requirement for submittal of project status reports. No comment required.
Results of Assessments or Audits <b>Worksheet 33</b>	Y	
Results of periodic Data Quality Assessments <b>Worksheet 33</b>	N	The DQA results, report format and distribution requirements have not been specified. See QAPP comments.
QA Audit Reports <b>Worksheet 33</b>	Y	
Identifies the individual(s) responsible for preparing, reviewing and receiving these reports - discusses the retention time for maintaining such reports. <b>Worksheet 33</b>	N	Individuals not listed, and the required retention time for project/management assessments and reports is not provided. See QAPP comments on personnel.
<b>Verification (Step I) Process Table</b> <b>Worksheet 34</b>		
Identifies the guidance documents or SOPs governing the data review, verification and validation processes. <b>Worksheet 34</b>	Y	
<b>Validation (Steps IIa and IIb) Process Table</b> <b>Worksheet 35</b>		
Clearly discusses the criteria by which data will be accepted or rejected and provides a comprehensive list of the data flags or qualifiers that will be assigned to non-compliant data points (including the definitions for each of these flags). <b>Worksheet 35</b>	N	Data review/validation procedure referenced but a copy of the procedures have not been provided and therefore, could not be reviewed for compliance. See QAPP comments.
Describes the process, and provides the criteria by which the data will be assessed for its overall usability and intended purpose. <b>Worksheet 35</b>	N	Contents of the validation reports are not specified. Additionally, the data validation and assessment procedures are referenced but copies of the procedures has not been provided; therefore, compliance could not be verified. See QAPP comments.

<b>Element</b>	<b>Requirement Met in Appendix B of C-400 VI WP Yes (Y) or No (N)</b>	Noted Deficiencies based on comparison with EPA R4 UFP-QAPP
<b>Validation (Steps IIa and IIb) Summary Table Worksheet 36</b>	Y	
<b>Usability Assessment Worksheet 37</b>		
Describes the process by which the on-site and off-site analytical data will be reconciled to the project-specific requirements. <b>Worksheet 37</b>	N	The data assessment procedures do not specify how data will be reconciled with DQOs. See QAPP comments.
Discusses how limitations in the final data set will be documented and communicated to all end data users and stakeholders. <b>Worksheet 37</b>	N	The QAPP does not state how validation and assessment findings including but not limited to statistical assessments will be documented and reported. See QAPP comments.
Describes the circumstances under which data would be rejected and removed from the final data set. <b>Worksheet 37</b>	N	Data review/validation and data assessment procedures are referenced. However, a copy of the procedures has not been provided. See QAPP comments.
Identifies the individual(s) responsible for reconciling the data to the project-specific requirements. <b>Worksheet 37</b>	N	The responsible organization is listed, but the actual contractor (company) or individual(s) are not listed. See QAPP comments on personnel.
Identifies the SOP or guidance document outlining the data usability process. <b>Worksheet 37</b>	Y	