

**APPENDIX C**  
**SCOPING PRESENTATION**

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***DRAFT*** Evaluation of  
Vapor Intrusion and Protectiveness at C-400



C-3

# Approach: DQO Process

- ❑ Use Data Quality Objectives (DQO) Process
  - ❑ Review Issue / State Problem
  - ❑ Identify Data Quality Objectives
  - ❑ Evaluate Existing Data / Identify Data Gaps
  - ❑ Develop Approach to Address Data Gaps / Identify Study Bounds
  - ❑ Develop Analytical Approach and Acceptance Criteria
  - ❑ Develop Plan to Achieve DQOs

C-4



# Issue: Deferred Protectiveness Statement

## Pending Results of Vapor Intrusion Studies

### Background:

- ❑ DOE submitted a Five-Year Review (FYR) for Remedial Actions on 5/30/14
- ❑ Per EPA correspondence, DOE adequately addressed comments on the FYR
- ❑ However, EPA issued *Deferred* Protectiveness Statement for the FYR on 9/30/14 for the C-400 building
  - ❑ The protectiveness determination of the remedy for the C-400 Building cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: a vapor intrusion study will be conducted that is consistent with EPA protocol and based on current toxicity values and risk assessment methodology.
- ❑ DOE responded that it will continue scoping discussions to understand vapor intrusion concerns.

C-5

# Vapor Intrusion (VI) Evaluation

## DQO Process Steps<sup>1</sup>

- ❑ **Step 1. State the Problem.** Define the problem that necessitates the study; identify the planning team, examine budget, schedule
- ❑ **Step 2. Identify the Goal of the Study.** State how environmental data will be used in meeting objectives and solving the problem, identify study questions, define alternative outcomes
- ❑ **Step 3. Identify Information Inputs.** Identify data & information needed to answer study questions
- ❑ **Step 4. Define the Boundaries of the Study.** Specify the target population & characteristics of interest, define spatial & temporal limits, scale of inference
- ❑ **Step 5. Develop the Analytic Approach.** Define the parameter of interest, specify the type of inference, and develop the logic for drawing conclusions from findings
- ❑ **Step 6. Specify Performance or Acceptance Criteria.** Specify probability limits for false rejection and false acceptance decision errors. Develop performance criteria for new data being collected or acceptable criteria for existing data being considered for use
- ❑ **Step 7. Develop the Plan for Obtaining Data.** Select the resource-effective sampling and analysis plan that meets the performance criteria

<sup>1</sup>EPA 2006, Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4, EPA/240/B-06/001

# Vapor Intrusion Evaluation

## DQO Step 1. State the Problem

### ❑ Problem Statement:

*Determine if vapor intrusion is occurring.*

--Adapted from U.S. Environmental Protection Agency (EPA) letter, dated 9/30/2014: “. . . Further information will be obtained by taking the following actions: a vapor intrusion study will be conducted that is consistent with EPA protocol and based on current toxicity values and risk assessment methodology.”

### ❑ Problem Description:

Trichloroethene (TCE) and other VOCs are present in the Upper Continental Recharge System (UCRS) and the Regional Groundwater Aquifer (RGA) soils and groundwater (GW) around C-400. Due to the concentration of TCE/VOCs, vapor from the TCE/VOCs has the potential to migrate into the C-400 building and pose a possible risk to the workers.

### ❑ Problem Approach:

- ❑ The planning team will review existing data; identify data gaps, if any; and, if necessary, determine what new data are needed to evaluate the potential for vapor intrusion into the C-400 building.
- ❑ Planning Team: Federal Facility Agreement (FFA) Parties; Leader: U.S. Department of Energy (DOE)
- ❑ Conceptual Model: Evaluate EPA VI Conceptual Site Model (CSM), adapt to PGDP conditions. Evaluate VI driving factors against PGDP CSM conditions.
- ❑ Determine Resources:
  - ❖ Schedule: within 18 months of 9/30/2014
  - ❖ Budget: Based upon scope
  - ❖ Personnel: FPDP

#### 1. State the Problem

- ❑ Give a concise description of the problem
- ❑ Identify leader and members of the planning team
- ❑ Develop a CSM of the environmental hazard to be investigated
- ❑ Determine resources—budget, personnel, and schedule

# Conceptual Site Model from 2015 EPA VI Guidance<sup>2</sup>

June 2015

Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air

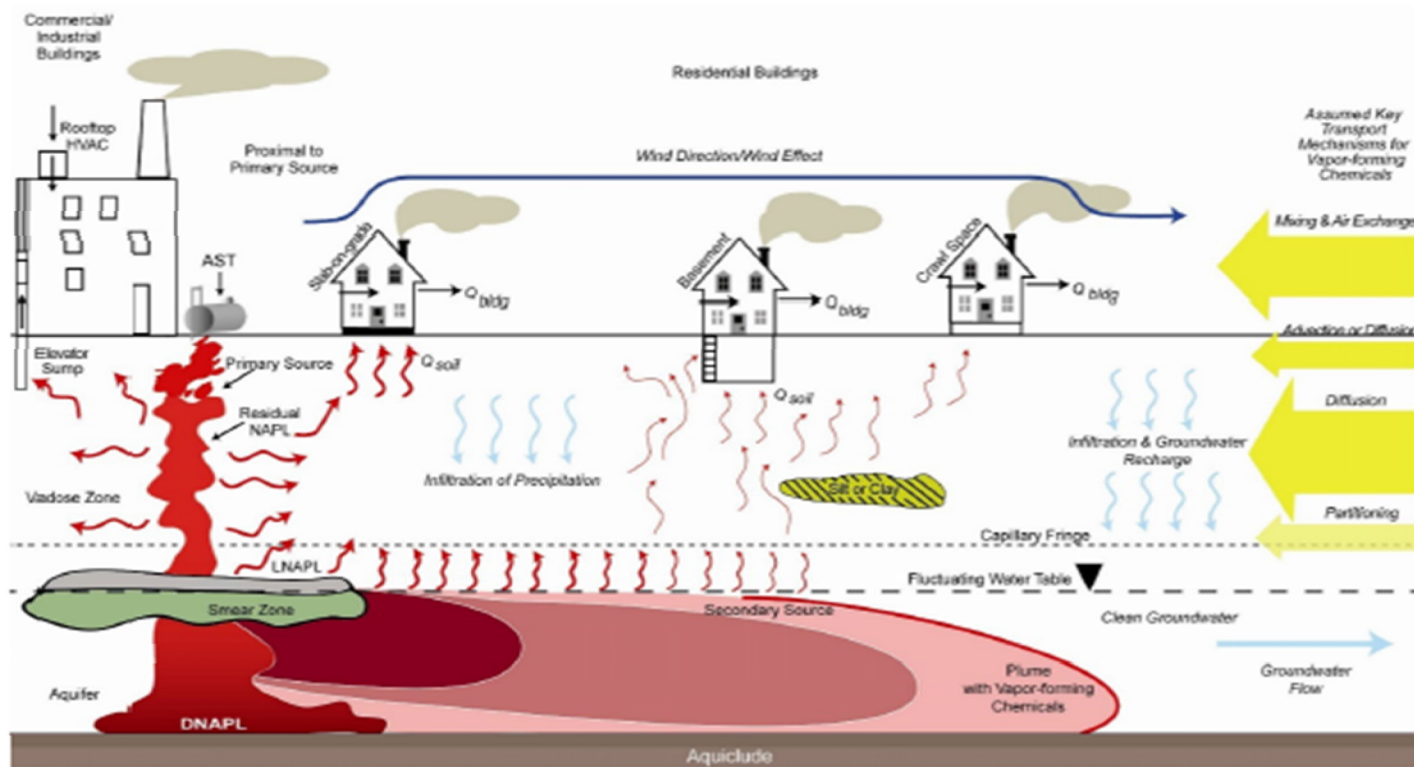


Figure 2-1 Illustration of Key Elements of the Conceptual Model of Soil Vapor Intrusion  
Note:  $Q_{soil}$  represents soil gas entry;  $Q_{bldg}$  represents air exchange.

<sup>2</sup>EPA 2015, OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air, OSWER Publication 9200.2-154

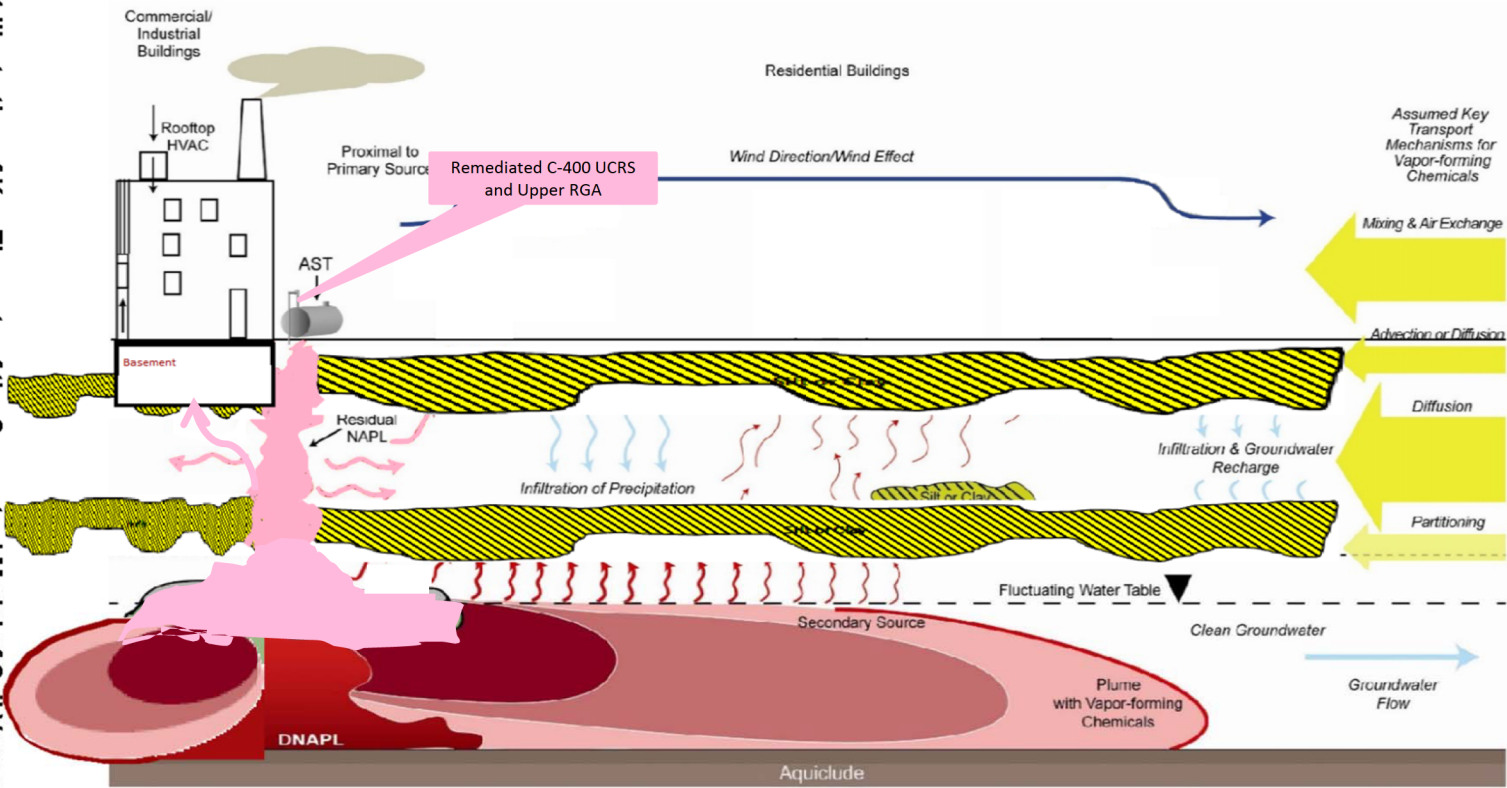


# Conceptual Site Model for PGDP C-400

## Adapted from 2015 EPA VI Guidance<sup>2</sup>

June 2015

Assessing and Mitigating the Vapor Intrusion Pathway from  
Subsurface Vapor Sources to Indoor Air



**Figure 2-1 Illustration of Key Elements of the Conceptual Model of Soil Vapor Intrusion**  
 Note:  $Q_{soil}$  represents soil gas entry;  $Q_{indoor}$  represents air exchange.

# Vapor Intrusion Evaluation

## DQO Step 2. Identify the Goal of the Study

- ❑ Determine degree of vapor intrusion at C-400 relative to appropriate benchmarks
  - ❑ C-400 status: Working toward being demo ready
    - ❖ Anticipated that only remediation workers to be in building after end of FY16
    - ❖ Anticipated non-remediation worker potential exposure less than 2 years
  - ❑ Current use: support for demo-ready process and laundry
    - ❖ Most staff are remediation workers (see slide 15)
    - ❖ Benchmark different for remediation workers and non-remediation workers
  - ❑ Approach: compare historical indoor air concentrations in work areas to benchmarks
    - ❖ Remediation worker benchmarks based on worker health and safety: uses American Conference for Governmental Industrial Hygienists (ACGIH) numbers
    - ❖ Non-remediation worker benchmark: Vapor Intrusion Screening Level (VISL) for commercial scenario adjusted to actual potential for exposure <http://www.epa.gov/oswer/vaporintrusion/documents/VISL-Calculator.xlsm>
- ❑ Current Hypotheses:
  - ❑ Vapor intrusion not an issue for remediation workers in C-400 who are protected by a worker health and safety plan; historical/current monitoring demonstrates [VOC] below benchmark
  - ❑ Vapor intrusion may be an issue for non-remediation workers because detection limits of past monitoring may not be above benchmark values

### 2. Identify the Goal of the Study

- ❑ Identify principal study question(s)
- ❑ Consider alternative outcomes or actions that can occur upon answering the question(s)
- ❑ For decision problems, develop decision statement(s), organize multiple decisions
- ❑ For estimation problems, state what needs to be estimated and key assumptions



# VI Evaluation

## DQO Step 2. Identify the Goal of the Study

### Decision Statement Development

- ❑ If C-400 occupants are only remediation workers and thus protected by an in-place worker health and safety program, then historical and recent monitoring demonstrate vapor intrusion is not an issue at C-400 for these workers because workplace air concentrations are below ACGIH levels
  
- ❑ If there are C-400 occupants who are not remediation workers and recent monitoring demonstrates that workplace air concentrations are below the VISL values, as adjusted for realistic exposure potential, then vapor intrusion is not an issue at C-400 for these workers

C-11



#### **2. Identify the Goal of the Study**

- ❑ Identify principal study question(s)
- ❑ Consider alternative outcomes or actions that can occur upon answering the question(s)
- ❑ For decision problems, develop decision statement(s), organize multiple decisions
- ❑ For estimation problems, state what needs to be estimated and key assumptions

# Vapor Intrusion (VI) Evaluation

## DQO Step 3. Identify Information Inputs

- ❑ Identify Information Inputs (What Information Do We Need)
  - ❑ Industrial Hygiene (IH) samples results compared to ACGIH value for TCE
    - ❑ TCE IH ACGIH benchmark = 10 ppm TWA (8-hour time weighted average)
    - ❑ Vinyl chloride (VC) ACGIH benchmark = 1 ppm TWA
    - ❑ 1,2-Dichloroethene (DCE) ACGIH benchmark = 200 ppm TWA
  - ❑ Historical air sampling results evaluated using the conceptual site model
  - ❑ Determination of the number of non-remediation workers currently working in C-400
  - ❑ Evaluation of the potential for relocation of the workers/activities (office, laundry)
  - ❑ Evaluation of the timing for relocation of workers/activities

### 3. Identify Information Inputs

- ❑ Identify types and sources of information needed to resolve decisions or produce estimates.
- ❑ Identify the basis of information that will guide/support choices to be made in later steps of the DQO Process.
- ❑ Select appropriate sampling and analysis methods for generating the information.

# Vapor Intrusion (VI) Evaluation

## DQO Step 4. Define the Boundaries of the Study

### ❑ Target Populations / Spatial Boundaries

- ❑ Non-Remediation Workers in C-400 designated work areas; e.g., office, laundry, etc.
- ❑ Remediation Workers in C-400; work in entire C-400 building to remove unused equipment, asbestos, etc.

### ❑ Temporal Limits

- ❑ Non-Remediation workers expected exposure less than two years
- ❑ Recent air samples collected under current building use (i.e., post-GDP shutdown)

### ❑ Scale of Inference

- ❑ If VOC conc's below AGCIH limits, inference is VI not a problem for remediation workers at C-400
- ❑ If VOC conc's below VISL values (commercial) adjusted for reasonably anticipated exposure, inference is VI is not a problem for non-remediation workers
  - ❖ Adjustment for maximum of 2 years' exposure for workers (post GDP) **compared** to VISL exposure duration of 25 years
  - ❖ Adjustment changes driving factor for TCE from Excess Lifetime Cancer Risk (ELCR) to Hazard Index (HI)
    - TCE HI = **8.8  $\mu\text{g}/\text{m}^3$**  (from VISL calculator commercial)
    - Vinyl Chloride (VC) driving factor =  $\text{ELCR} \times 25/2 = 2.8 \mu\text{g}/\text{m}^3$  (from VISL calculator) \* 12.5 = **35  $\mu\text{g}/\text{m}^3$**  (NOTE: VC HI = 440  $\mu\text{g}/\text{m}^3$ )

#### 4. Define the Boundaries of the Study

- ❑ Define the target population of interest & relevant spatial boundaries
- ❑ Define what constitutes a sampling unit
- ❑ Specify temporal boundaries and other practical constraints associated with sample/data collection
- ❑ Specify the smallest unit on which decisions or estimates will be made

# Vapor Intrusion (VI) Evaluation

## DQO Step 5. Develop the Analytic Approach

- ❑ Remediation Workers
  - ❑ Compare [VOC] results of air samples at C-400 to ACGIH values
  - ❑ If [VOC] (and method detection limit) is < ACGIH values, then VI is considered to not be an issue for remediation workers and no additional study is needed for remediation workers
- ❑ Non-remediation Workers
  - ❑ Compare [VOC] results of indoor air samples at C-400 to adjusted VISL values
  - ❑ If [VOC] (and method detection limit [MDL]) in air is < 8.8 µg/m<sup>3</sup> TCE (and <35 µg/m<sup>3</sup> VC), then VI is not considered to be an issue for non-remediation workers and no additional study is needed
  - ❑ If [VOC] (or method detection limit) in air is > 8.8 µg/m<sup>3</sup> TCE (or >35 µg/m<sup>3</sup> VC), then design investigation to generate new air results from non-remediation worker occupied areas

### ***Step 5 Summary: Develop the Analytic Approach***

- ❑ *Compared recent IH [VOC] to ACGIH values and found [VOC] and MDL < ACGIH levels*
- ❑ *Compared recent IH [VOC] to adjusted VISL values and found MDLs and one detection > VISL*
- ❑ ***Thus, if non-remediation workers are to remain in C-400, propose sample indoor air of C-400 areas, including laundry and office***

### **5. Develop the Analytic Approach**

- ❑ Specify appropriate population parameters for making decisions or estimates
- ❑ For decision problems choose a workable Action Level and generate an “If...then...else” decision rule
- ❑ For estimation problems, specify the estimator and the estimation procedure



# Vapor Intrusion (VI) Evaluation

## DQO Step 6. Specify Performance or Acceptance Criteria

- ❑ Verify when there will be only remediation workers in C-400; establish and maintain access limitations
  - ❑ Existing access controls (standard practices and procedures)
- ❑ If non-remediation workers to remain in C-400, collect samples in work areas, analyze, confirm [VOC] and MDL < adjusted VISL
  - ❑ Propose collect six SUMMA samples over 10-hours on working days including at office/laundry
    - ❑ [TCE] and MDL < 8.8  $\mu\text{g}/\text{m}^3$  ?
    - ❑ [VC] and MDL < 35  $\mu\text{g}/\text{m}^3$  ?

### ***Step 6 Summary: Specify Performance or Acceptance Criteria***

- ❑ ***Verify when there will be only remediation workers in C-400; if not, hypothesis not confirmed***
- ❑ ***If non-remediation workers remain, collect air samples and confirm [VOC] and MDL < VISL***

### **6. Specify Performance or Acceptance Criteria**

- ❑ For decision problems, specify the decision rule as a statistical hypothesis test, examine consequences of making incorrect decisions and place acceptable limits on the likelihood of making decision errors
- ❑ For estimation problems, specify acceptable limits on estimation uncertainty

# Vapor Intrusion (VI) Evaluation

## DQO Step 7. Develop the Detailed Plan for Obtaining Data

- ❑ Identify whether non-remediation workers to remain
  - ❑ If no, C-400 evaluation complete
  - ❑ If yes, develop sampling and analysis plan (SAP)
  
- ❑ Submit SAP for review and approval to FFA parties

C-16

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14

### **7. Develop the Detailed Plan for Obtaining Data**

- ❑ Compile information and outputs from Steps 1-6
- ❑ Use information to identify alternative sampling and analysis designs are appropriate for intended use
- ❑ Select/document a design that will yield data that will best achieve your performance or acceptance criteria

# C-400 Preliminary Evaluation: Vapor Intrusion Unlikely at Levels of Concern

- ❑ C-400 is large building with significant air exchange between inside and outside air
  - ❑ At least one exhaust fan operates continuously at 41,000 cfm
- ❑ Multiple soil gas/Industrial Hygiene (IH) evaluations, many conducted during active remediation & during vapor degreasing operations, have shown no vapors at IH levels of concern
  - ❑ Historical soil gas and indoor air evaluations show little VI
  - ❑ UCRS and upper RGA were substantially remediated by 6-phase and Phase I/IIa Electrical Resistance Heating (ERH)
- ❑ The use of TCE as a degreaser ceased on July 1, 1993. (*Remedial Investigation Report for Waste Area Grouping 6 at Paducah Gaseous Diffusion Plant Paducah, Kentucky, DOE/OR/07-1727/V1 & D2, May 1999*)
- ❑ Building scheduled to be demo-ready by end of FY2016 (i.e., no non-remediation workers present after this date).
- ❑ Workers currently in C-400
  - ❑ ~2+ laundry workers over past year
  - ❑ Currently 9 workers
  - ❑ Expect maximum of 61 over next year: 55 supporting demo & 6 supporting laundry
    - ❖ 40 workers (HAZWOPER trained) for removal and clean out
    - ❖ 3 workers sampling
    - ❖ 5 professional personnel (office type personnel supporting the project)
    - ❖ 7 asbestos workers

C-17

# C-400 Phase IIa LATA Kentucky Results:

## No VOCs Detected Above TLV in Personal Sampling

- ❑ Sampling Conducted During C-400 Phase IIa Remediation Activities on Personnel Installing/Operating Equipment
  - ❑ 65 Personal Air Samplers Compared to TWA
    - ❑ One result at 0.14 ppmv TCE > detection limit
    - ❑ Result less than the ACGIH TCE TWA (adjusted for 10-hour day) of 7 ppmv
  - ❑ 5 Personal Air Samplers Compared to ACGIH Short Term Exposure Limit (STEL)
    - ❑ One result at 0.053 ppmv TCE > detection limit
    - ❑ Result less than Short Term Exposure Limit of 25 ppmv
  
- ❑ Summary: Personnel Drilling/Working in Proximity to Highly Contaminated Soils Not Exposed to TCE above ACGIH Levels

C-18



# Fluor C-400 Monitoring, April 2015

## No Detectable TCE



Location of Sample	Mass of TCE	Volume of Sample	Results of Sample Analysis	
	mg	m <sup>3</sup>	mg/m <sup>3</sup>	µg/m <sup>3</sup>
Laundry Break Area	<0.010	0.01855	<0.539	<539
South East Corner of Office	<0.010	0.018304	<0.546	<546
Boundry Control Station Near Cylinder Wash	<0.010	0.017791	<0.562	<562
Basement Fan Room Catwalk	<0.010	0.016442	<0.608	<608

C-19

- ❑ All results non-detect but MDLs higher than Adjusted VISL Values
- ❑ Adapted from National Institute of Occupational Safety and Health (NIOSH) Method 1022
  - ❑ Measured volume of breathing zone air pulled through charcoal tube
  - ❑ TCE extracted into solvent and injected into Gas Chromatograph



C-20

# BACKUP

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# Proposed Path Forward and Rationale

## Vapor Intrusion Evaluations to fill Perceived / Actual Data Gaps

### ❑ C-400

- ❑ Identify six locations with highest concentrations (or highest potential for VOC concentrations) using process knowledge and PID
- ❑ Collect SUMMA samples at six locations (including laundry and office area) using 10-hr integrated sampling
- ❑ Compare VOC results to 2015 ACGIH TLV values, adjusted to current schedule
  - ❑ *Rationale: provide **current** data to demonstrate (if confirmed) that air building concentrations are below concentrations considered acceptable for a lifetime of exposure by a healthy remediation worker*
- ❑ Compare VOC results to 2015 VISL values, adjusted to expected exposure duration
  - ❑ *Rationale: provide **current** data to demonstrate (if confirmed) that air building concentrations are below concentrations considered acceptable for a two year maximum exposure by a commercial occupant*

C-21

# Data/Information Summary Discussion

## Historical C-400 / C-720 Monitoring

- ❑ USEC Personnel Monitoring
  - ❑ Outdoor monitoring when TCE transfer piping and storage tank removed
    - ❑ *No TCE detected outdoors*
    - ❑ *Determination no indoor monitoring required*
  - ❑ IH TCE air monitoring of workers, C-400/C-720
    - ❑ *No issues at IH levels*
  
- ❑ Six-phase C-400 monitoring
  - ❑ No indoor issues at OSHA levels even when active remediation occurring

C-22

# C-400: 6-Phase Heating Air Samples (2003)

Collected to evaluate impact on C-400 indoor air

- ❑ Gas indicator tube sampling in 4 locations
  - ❑ C-400 basement (1)
  - ❑ Tunnel adjacent to Six-Phase Site (3)
  
- ❑ No detections of either TCE or VC at detection limit of 2 ppmv TCE and 0.5 ppmv VC
  
- ❑ Ten weeks of weekly SUMMA samples at same 4 locations
  - ❑ 24-hour Integrated sample
  - ❑ Detection limit of 0.5 ppmv TCE and VC
  
- ❑ Two detections (<2.8 ppmv TCE) in 40 samples attributed to sump water outgassing

C-23

# Summary of Relevant Vapor Studies

Results show vapor found only in high concentration/source areas  
Vapor migration not evident

- ❑ 1986 Tracer Soil Gas Survey
  - ❑ 28 Samples; TCE concentrated in SE corner of C-400
  - ❑ Occurred before the degreaser use discontinued and the C-400 Tank and Line remediation (early 1990s)
- ❑ 1990 Soil Gas Survey Phase I Site Investigation (includes C-400)
  - ❑ 250' intervals around C-400 plus near other site buildings (43 locations, 41 samples)
  - ❑ TCE only at two locations
    - ❑ 2.9 ppmv at SE corner, C-400, [former tank location]
    - ❑ 0.28 ppmv at NW corner, C-400 [NW Plume centerline]
    - ❑ "Sample collection at all locations was more difficult than expected due to the tightness of the soil formation being sampled."
- ❑ 2000 IH Summa monitoring at C-400, C-300, C-333, C-337, and EW-230
  - ❑ Only 1 of 277 IH samples had detectable TCE or VC: NW Plume extraction well (EW)-230 had 26.6 ppmv).
  - ❑ No detectable TCE or VC at C-400
- ❑ 2003 Indoor air study during Six-Phase
  - ❑ Identified only 2 samples with detectable TCE (and these detections were attributed to off-gas of TCE from the sump).
  - ❑ ~70 Draeger Tubes; all ND
- ❑ 2005 EPA Soil Gas Study
  - ❑ 3 samples attempted in water policy; 1 collected; no TCE
- ❑ 2013 SWMU 4: above TCE plume
  - ❑ Two (of 69 passive samples) had detectable TCE (near detection limit)
  - ❑ 29 ng and 54 ng (detection limit of 25 ng)

C-24



# EPA-Identified Reasons for Deferred Protectiveness

## □ C-400

- EPA asserted vapor intrusion into C-400 is likely due to the magnitude of volatile organic compound (VOC) contamination in subsurface soils
- Protectiveness deferred until VOC intrusion level can be determined
- Although previous studies did not indicate a vapor intrusion problem even with the high soils and groundwater VOC contamination, including during the 6-phase treatability study, some additional/more recent information is sought

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