1

THE TRUE COST OF A BAD CONCEPTUAL SITE MODEL

❖Conceptual Site Model Issues and Impact on Site Closure

Jason Blair P.G.
MMDC Project Manager

"The views, opinions and findings contained in this report are those of the authors(s) and should not be construed as an official Department of the Army position, policy or decision, unless so designated by other official documentation."

1

2

TRUE COST OF A BAD CSM IS UNDEFINED:

❖A bad CSM can disrupt program objectives for schedule of completion and cause a team to take multiple steps backwards in the CERCLA process.

❖A bad CSM in the RI can lead to underestimation of the actual cleanup costs.

❖ A bad CSM can impact the development of a good Decision Document (DD) and lead to ESDs and/or Modifications to an approved DD.

❖A bad CSM in support of the RA can lead to costly REAs and scope expansion.

2

3

CSM SIMPLIFIED

❖A CSM defines the most current description of a site and its environment, including both natural and man-made features. The CSM describes sources of contamination known or suspected to be present at a site(i.e., MEC, MC, and/or HTRW).

❖The CSM describes current and reasonably anticipated future land uses and related receptors, as well as the potential interactions between the receptors and contamination sources (i.e., exposure pathways).

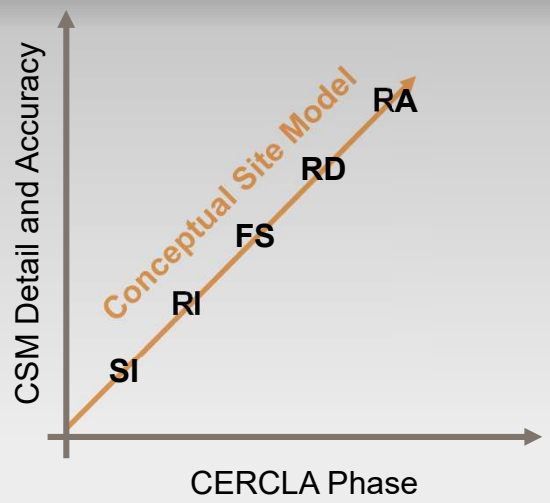
❖A CSM provides a structure to summarize and display information about a site and identify additional information needed to develop technically sound decisions.

❖The CSM is a critical part of a project that supports planning, modeling, data interpretation, communication between members of the PDT and with the public, and decision-making.

4

WS #10: CSM – WHY IS IT SO IMPORTANT?

- ❖ The CSM is THE common element that runs through all MMRP phases
  - – It starts being pulled together during the SI…
  - – And may be updated throughout every phase until Site Closeout
- ❖ It sets the stage for the investigation
  - – Describes known elements
  - – Reveals data gaps
- ❖ And reports the results
  - – The revised CSM essentially is the product of the field investigation



REFERENCE: Conceptual Site Models, U.S. Army Corps of Engineers, EM 1110-1-1200

4

WS #10: CONCEPTUAL SITE MODEL (CSM)

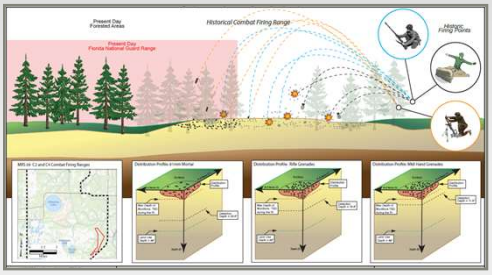
- Basic understanding of site
  - Types of MEC/MC and where they are expected
  - Land use and receptors
  - Potential exposure scenarios
- Narrative description supported by:
  - Maps, figures, graphics
  - Tables
- Forms basis for communication with stakeholders
- Assists in developing investigation strategy and Data Quality Objectives (DQOs)

- Note:
  - Multiple sites or sources, or other unique problems may require separate CSMs

REFERENCE: Conceptual Site Models, U.S. Army Corps of Engineers, EM 1110-1-1200

Table 10-1. Overview of Preliminary Conceptual Site Model, Camp Example – MRS A

Site Details	Potential/Suspected Location and Distribution of MEC	Known/ Suspected Munitions	Exposure Medium	Current and Future Receptors	Exposure Pathways
Camp Example, MRS A Boundaries and acreage: See Figure 10-2 Background anomaly density (estimated): 75/acre Known/suspected past DoD activities (release mechanisms): Bombing Target #1: Proposed, but no evidence-of-use Bombing Target #2: 100-lb practice bombs Bombing Target #3: Proposed but no-evidence-of-use Current land use: Low-density residential, agricultural, and wildlife preserve Future land use: Future increased residential density expected in northwest area of MRS	High-use areas (HUA): -Evidence of munitions handling or use (e.g., target areas) -High likelihood of finding residual MEC, MD, or range-related debris (RRD) -Anomaly density ≥ critical density Low-use areas (LUA): -Low likelihood of finding residual MEC, MD, or RRD -Anomaly density < critical density No-evidence-of-use areas (NEU): -No evidence of munition use	-Bomb, HE, M30A1 -Bomb, practice, 100-lb, M38A2 -nose fuze, AN-M103 Series -tail fuze, AN-M100 Series M1A1 spotting charges for 100-lb practice bombs	Surface soil and subsurface soil	Ranchers Farmers Hunters Hikers Campers Residents U.S. Forestry Service	HUA: Potentially complete exposure to surface and/or subsurface MEC LUA: Potentially complete exposure to surface and/or subsurface MEC NEU: Incomplete



WS #10: CSM – ELEMENTS

- Facility Profile
  - Site location, size and ownership
  - Concise history of the use, storage, and disposal of munitions and other hazardous substances at the site
    - Before, during, and post-DoD use (to present)
  - Identification of munitions and hazardous substances known or suspected to be present
  - Concise summary of relevant findings from previous investigations

- Physical Profile
  - Topography and vegetation
  - Geologic and hydrogeologic setting
  - Climate
  - Endangered species, sensitive habitats, and cultural resources
  - Areas that are or might be inaccessible to investigation

[1] Conceptual Site Models, U.S. Army Corps of Engineers, EM 1110-1-1200

WS #10: CSM – ELEMENTS, CONT'D.

7

- Release Profile
  - Description and locations of known or suspected areas where MEC were handled, used, stored, or disposed
    - e.g., targets, maneuver areas, storage facilities or OB/OD areas
  - Current understanding of location and distribution of munitions and hazardous substances
    - Horizontal AND vertical
    - Affected environmental media
    - Anomaly densities?
  - Evaluation of prior land-disturbing activities that may have redistributed MEC

- Land Use and Exposure Profile
  - Current and reasonably anticipated future site uses
    - Include ownership and zoning
  - Neighboring land uses
  - Current and reasonably anticipated future receptors
    - Including related activities and frequencies
  - Access conditions
  - Potentially complete exposure pathways

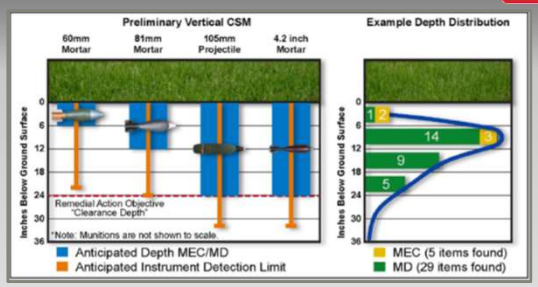
[1] Conceptual Site Models, U.S. Army Corps of Engineers, EM 1110-1-1200

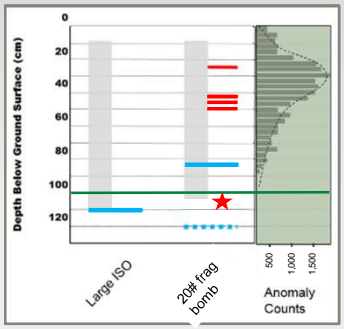
7

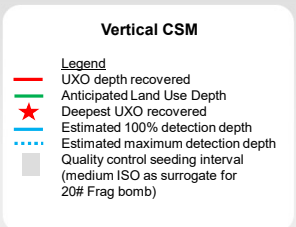
WS #10: CSM – VERTICAL CSM

8

- The vertical CSM is critical to the project
  - MEC depths
    - Estimated and results-based
  - Seed depths
  - Instrument detection depths
    - Reliable and maximum
  - Land use depths
    - Current and future
  - RAO depths
    - For FSs and Remedial Actions
- Consider vertical CSM data needs







8

9

HOW THE CSM OFTEN GETS OVERLOOKED

❖The biggest issue noted is not updating the CSM during the RI when new information comes in.

❖Not revising decision logic real time as contradictory data is collected.

❖Carrying a Bad CSM through the FS/DD directly impacting the CTC and potential future Remedial Action.

❖Root of the issue is poor communication between field teams, technical leads, and management.

9

10

THE GOAL IS TO SAVE EVERYONE TIME AND EFFORT

❖The intent is not to single out any contractor or government team but to get folks thinking about the overall implications of carrying a Bad CSM forward, and the negative impact it can have on meeting program objectives.

❖Today we will discuss a few projects where an incomplete CSM has impacted the project.

10

CSM: THE PHYSICAL PROFILE EXAMPLE

11

- **Physical Profile:**
- Describes natural factors at the site that may affect contaminant release, fate and transport.
- Accessibility, such as Climate, Topography, Soils, Geology, Hydrology.
- Differences in Earth materials at the near-surface can impact investigation and remediation strategies.

- **A few ?'s worth consideration**
- Do we have unconsolidated sediments or bedrock, what types of sediments and bedrock?
- How deep is the bedrock?
- What is a realistic depth for MEC penetration based on near-surface conditions?

ALL IMPORTANT CONSIDERATIONS FOR THE CSM

11

CSM: THE PHYSICAL PROFILE EXAMPLE

12

- Contractor moved out with approved UFP QAPP to execute a MMRP in MT.
- All work completed with a mix of DGM and analog instruments.

Up Front From the RI Report:

- "Geology at the MRS is largely made up of Quaternary alluvium, mainly valley fill consisting of silt, sand, and gravel, including some terrace deposits and glacial drift of Pleistocene age in some areas. Locally, it includes hot spring tufa".

12

13

EXAMPLE 1: RI MT DGM

- DGM investigation was completed
- Field work consisted of:
  - Establishing an instrument verification strip (IVS) and
  - preparing an IVS report.
  - Placing QC seeds.
  - Surveying pre-established transects utilizing a person portable EM61-MK2 sensor and RTK GPS.
  - Transects were spaced ~490 feet apart.
  - Transects were placed to approximately follow equal lines of elevation
- DGM target reacquisition and investigation completed:
  - No MEC items.
  - 2 MD items (frag and an ejection plate).
  - 61 NMRD items.
  - 11 QC seeds

13

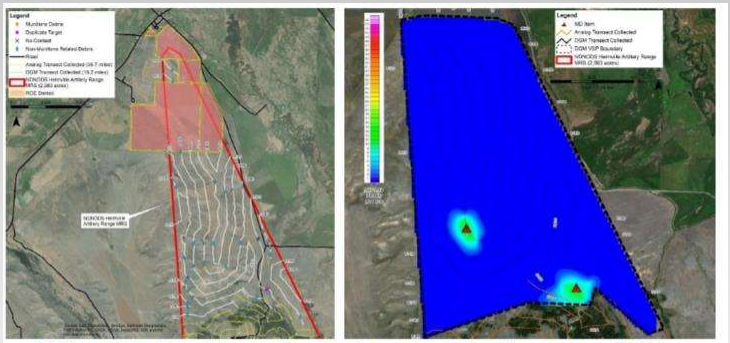
14

EXAMPLE 1: RI MT INITIAL ANALOG SURVEY

- Analog geophysical survey and intrusive investigation was completed.
- Field work consisted of:
  - Installing instrument test strip.
  - Placing QC seeds.
  - Surveying 29 pre-established transects using 5 feet wide swaths with a White's MXT all metals detectors.
  - Anomalies were investigated when encountered.
  - Transects were spaced ~490-feet apart and approximately followed lines of equal elevation
- Intrusive Results:
  - No MEC items.
  - 183 MD items (frag from 105-mm M1 HE rounds).
  - 186 NMRD items.
  - 10 SAA items.
  - 54 QC seeds.

14

EXAMPLE 1: RI MT SURVEY LAYOUT AND VSP ANALYSIS



- A VSP spatial density analysis was performed and no concentrated munitions use areas (CMUAs) were identified.
- Background density is less than 5 anomalies/acre with two small localized areas of elevated anomaly densities based on the two MD items found.
- As no CMUAs were identified, no DGM grids were investigated.

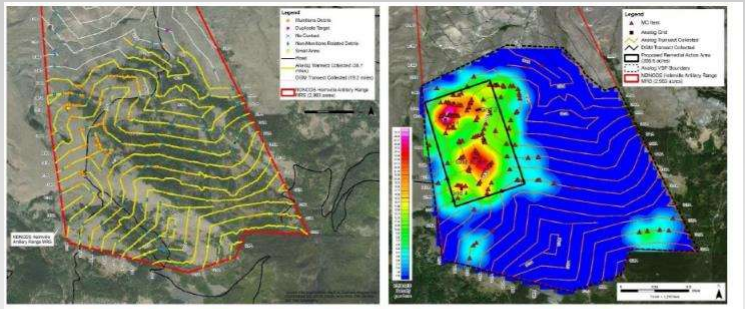
EXAMPLE 1: RI MT RESULTS PHASE II ANALOG GRID INVESTIGATION

❖Analog survey and intrusive investigation of 4-grids

❖Field work consisted of:
- Placing QC seeds.
- 100% coverage of four 100' x 100' grids (0.90 acres) using Whites MXT all metals detectors in 5-feet swaths

❖Intrusive Results:
- No MEC items.
- 70 MD items
- 37 NMRD items.
- 1 SAA item.
- 16 QC seeds.

EXAMPLE 1: RI MT GRID LAYOUT AND REPORTED FINDINGS



- A VSP spatial density analysis was performed and no CMUAs were identified (>40 anomalies per acre above background).
- Background density is less than 5 anomalies/acre with localized areas of elevated anomaly densities.
- Although the areas with elevated MD densities did not meet the criteria to be CMUAs, four 100-feet by 100-feet grids were selected to further characterize these areas.

EXAMPLE 1: RI MT THE LITTLE BIG ISSUE

❖During Government QA of deliverables, it was noted the contractor did not meet the expected burial depth for QC seed items in analog areas or within the instrument test strip.

❖The contractor's position was that the depth to bedrock was shallower than described n the CSM; therefore, SEED items could not be buried to proposed depths of detection.

❖No Field change request, NCR, or CAR was submitted to the Government team during field work explaining the change in approved field procedures based on the change in CSM.

❖The deliverable was rejected based on improper burial depth of ISOs, which should have been identified by USACE OESS and Contractor UXOQC manager.

❖After weeks of discussion, the proposed path forward was for the contractor to update the CSM based on geologic setting of the site with field verification and documentation.

19

WHERE THE TEAM WENT OFF TRACK:

❖Poor understanding of local geologic conditions prior to developing the UFP QAPP

❖Specifying ISO size and burial depths without accounting for near-surface bedrock.

❖Field team unilaterally changed the metrics in the field without buyoff from the larger PDT.

❖Breakdown in communication between Field Leads and Technical Managers

"it's imperative when there is a change in accepted CSM, the CSM must be updated and if the situation warrants a Field Change Request, that the FCR is routed immediately for Government/Stakeholder awareness."

20

CSM: THE RELEASE PROFILE EXAMPLE

❖ Release Profile
- Description and locations of known or suspected areas where MEC were handled, used, stored, or disposed
  - e.g., targets, maneuver areas, storage facilities or OB/OD areas
- Current understanding of location and distribution of munitions and hazardous substances
  - Horizontal AND vertical
  - Affected environmental media
  - Anomaly densities?
- Evaluation of prior land-disturbing activities that may have redistributed MEC

❖ A Few Questions worth consideration
- What does the CSM indicate for potential MEC
  - Are we accounting for the "potential" in survey design?
- What are our anticipated vertical depths for encountering "potential" contamination?
- How will the team characterize the lateral extent if anomalies at the boundaries are encountered?
  - Are we accounting for step out sampling if needed?
- What does the CSM indicate about DoD and post DoD activities?

[1] Conceptual Site Models, U.S. Army Corps of Engineers, EM 1110-1-1200

EXAMPLE 2: RA PA INTRO WITH RI SUMMARY

❖Contract Awarded for RI/FS/PP/DD

❖ An analog geophysical survey completed with a Schonstedt at a spacing of 225 ft between centerlines.

❖Transect spacing designed to detect potential concentrated munition use areas (CMUAs) with greater that a 95 percent (%) probability based on Visual Sampling Plan (VSP) calculations.

❖Approximately 11.2 miles of analog geophysical (mag and dig) survey transects were conducted across the MRS to traverse, detect, and delineate potential target/impact areas (CMUAs).

❖The team finalized the DD and gained regulatory concurrence on path forward.

❖Same contractor awarded RA under a separate contract action.

EXAMPLE 2: RI RESULTS PA

EXAMPLE 2: RA PA CONTINUED RI RESULTS

❖1-MEC item, 3-MPPEH items, and 52-MD items discovered in central portion of the MRS.

❖The locations of the munitions items found during the RI were evaluated using VSP software, which generated a 0.1 MEC/MD per acre density contour over a 78.7-acre area

❖Note: This 78.7-acre area was later identified as the potential MEC source area.

❖ No MEC were found in the remaining 114.4 acres of the MRS.

DECISION DOCUMENT

❖The selected remedy for the MRS, as specified in the ROD, was Alternative 5, a surface and subsurface removal of MEC conducted over the entire 78.7-acre MRS to a depth of 16 inches bgs.

❖MC-contaminated soil removal conducted to a depth of 12 inches over a 0.08-acre portion of the 950-yard berm backstop within the MRS.

❖Alternative 5 provides the greatest effectiveness over the long term for hazards associated with munitions, risk from MC impacted soil to ecological receptors, and the presence of an RCRA characteristic hazardous waste without the need for LUCs or long-term monitoring (LTM).

EXAMPLE 2: RA EXECUTION PA CONTINUED

❖**RA contract awarded to same company that completed RI/FS/PP/DD**

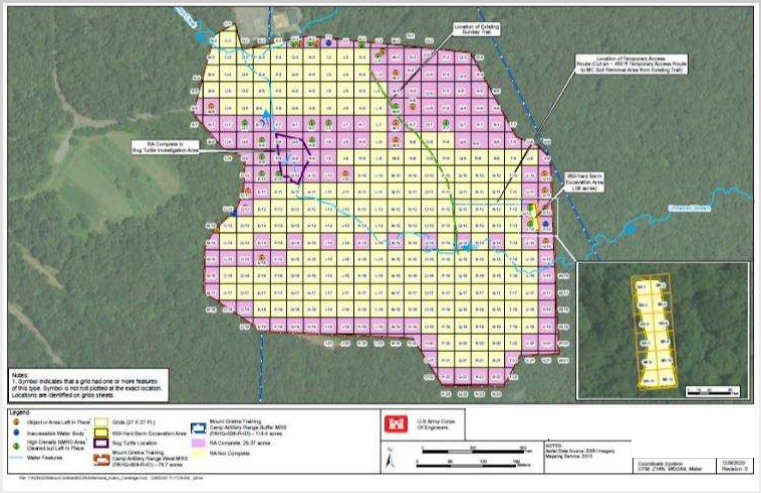
❖An analog MEC removal was completed at 170 grids (100 ft by 100 ft), totaling approximately 29 acres, within the 78.7-acre MRS

❖Intrusive investigations resulted in the recovery of:
- 20 MEC/MPPEH items
- 9,661 MD items
- 20,011 NMRD items

INTRUSIVE RESULTS FROM ANALOG SURVEY

Category	No. of Items
MEC	
Projectile, 37mm (fuzed)	9
Projectile, 37mm, MKII A1	3
Projectile, 3-inch Stokes Mortar, High Explosive	1
Total MEC Items	13
MPPEH	
Projectile, Practice, 3-inch Stokes Mortar (sand filled, fuzed)	17
Projectile, Practice, 3-inch Stokes Mortar (sand filled, unfuzed) – MD following demolition	88
Projectile, Practice, 3-inch Stokes Mortar (sand filled)	2
Total MPPEH	107
Total MD	9,661
Total NMRD	20,011

EXAMPLE 2: RA RESULTS PA



27

EXAMPLE 2: RA RESULTS PA

28

29

RI CARRYOVER ISSUES WITH THE CSM

❖The RI underestimated the expected density and depth of MD and NMRD and did not fully capture the boundaries of the target areas.

❖VSP transects spacing based on detecting a 3-inch Stokes mortars impact area and not on 37mm projectiles.

❖Transect spacing during the RI was more conservative than VSP calculated to detect 3-inch Stokes mortars.

❖¼ of the VSP recommended transect spacing was used (225 ft rather than 938 ft) to ensure a 95% probability of traversing and detecting a MEC impact area.

30

RI CARRYOVER ISSUES WITH THE CSM CONTINUED

❖A substantially higher anomaly density has been encountered at the MRS than anticipated based on the conceptual site model (CSM) used to develop the Remedial Action approach.

❖MEC has been recovered near the MRS boundary which is substantially different than the CSM used to develop the Remedial Action approach.

❖Nature and Extent not fully characterized.

❖The Remedial Action Alternative identified in the ROD cannot be achieved based on current site conditions and technology.

SSFR CONCLUSION AND SUGGESTED PATH FORWARD

❖The northwest corner of the area, where only one MD item and 3,699 lb of NMRD were recovered, should be further characterized to determine if the area is completely outside of the munitions use area.

❖The boundary of the existing MRS may not completely capture the extent of the 3-inch Stokes mortar target area identified during the RI or the potential 37mm projectile target area observed during the RA.

❖For this expanded RI and any other future RIs should include sample grids in addition to transects to measure the density of MEC, MPPEH, MD, and NMRD more accurately.

SUMMARY OF RA ISSUES

❖RI did not adequately capture Nature and Extent to support a good CSM moving into FS/PP/DD.

❖Incomplete update and verification of existing CSM during the project.

❖Utilizing incorrect VSP inputs based on CSM.

❖Not completing a DUA or evaluating the known assumptions as a project progresses.

❖Wasting to much time/effort/budget investigating cultural debris rather than potential MEC across the site.

❖Not being able to achieve ROD objectives of UU/UE with an analog instrument
- Most likely will never happen.

33

SHORT STORIES OF OTHER EXAMPLES OF POOR CSM

❖Time permitting other examples:
- Montana RAs
- Idaho RI's

34

THE TRUE COST OF A BAD CSM IS UNDEFINED

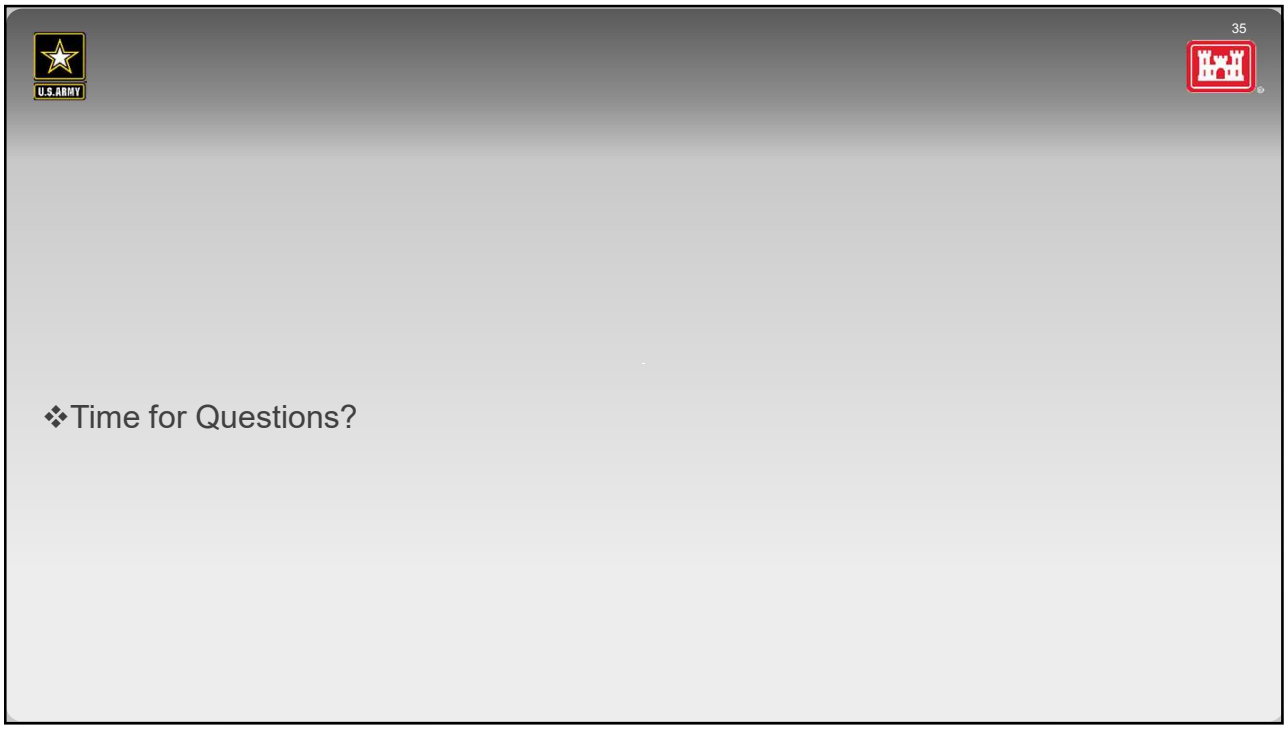
❖A bad CSM can disrupt program objectives for schedule of completion and cause a team to take multiple steps backwards in the CERCLA process.

❖A bad CSM in the RI can lead to underestimation of the actual cleanup costs.

❖ A bad CSM can impact the development of a good Decision Document (DD) and lead to ESDs and/or Modifications to an approved DD.

❖A bad CSM in support of the RA can lead to costly REAs and scope expansion.

❖Beans come out of the jar and cost escalation for any potential RA.


35
❖Time for Questions?