RESPONSE TO COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION WORK PLAN ADDITIONAL GROUNDWATER INVESTIGATIONS DATED OCTOBER 2001 STRATFORD ARMY ENGINE PLANT STRATFORD, CONNECTICUT

U.S. ARMY CORPS OF ENGINEERS
NEW ENGLAND DISTRICT
CONCORD, MASSACHUSETTS

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RESPONSE TO COMMENTS ON THE
DRAFT REMEDIAL INVESTIGATION WORK PLAN
ADDITIONAL GROUNDWATER INVESTIGATION
DATED OCTOBER 2001
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Comment # Comment/Response

CTDEP Comments Dated November 20, 2001 from Ken Feathers on the Draft Remedial Investigation Work Plan Additional Groundwater Investigation, Stratford Army Engine Plant, Stratford, Connecticut

Groundwater Investigation

1. **Comment:** The groundwater conceptual model for the site requires further refinement and validation, especially as it focuses on mid-depth flow systems. This may necessitate additional or relocated wells or target screen elevations. Data from the OU2 investigation may fill some of the data gap. If not, triply nested deeper wells under building 2 may be needed, as the vertical interval is long. Also, co-located water table piezometers may be needed.

   Response: Previous groundwater profiling, performed using GeoProbe and cone penetrometer techniques, adequately identified the zones of highest concentrations of groundwater contaminants beneath Building 2. The Army feels that the Proposed groundwater monitoring well screened intervals target these identified zones.

2. **Comment:** The inorganic groundwater quality requires further characterization, relative to aquifer material as a source of pollutants and fate and transport to the tidal flats. This may necessitate filtered and unfiltered samples and/or low flow sampling. Ensure data is acquired with an appropriate analytical sensitivity for evaluation of chronic toxicity. Metals data from the tidal flats nests may be useful, and a third near surface sampling point might complete the picture.

   Response: Concur that groundwater inorganics data may provide additional information relative to fate and transport of contaminants. A third near-surface piezometer at each nested location is not likely to provide significant additional data, particularly as the distance from the Dike increases; any contaminants traveling horizontally from the Dike are likely to be attenuated by the organic carbon and reducing conditions of the tidal sediments. The shallower of the piezometers (screened from 5 to 15 feet bgs) proposed in the Work Plan is intended to provide potential information on "daylighting" of groundwater and contaminants from beneath the tidal sediments to the tidal flats.

3. **Comment:** Additional data acquisition to support model development may be needed- see

Comment #	Comment/Response

below discussion of the model.

With regard to details of the work plan:

Please ensure that details of wells/piezometers installation in the tidal flats have been checked with OLISP and meet coastal requirements.

Response: A letter exercising the Army's option to use Section 300.120 of the NCP has been submitted to CTDEP-OLISP.

4. **Comment:** DEP often requests that well sampling be lagged several weeks after installation and development. The optimum delay depends upon drilling methods and amount of water used. It is also influenced by the regional gradient's ability to flush the disturbed aquifer zone past the well location.

   Response: Groundwater sampling will begin at least two weeks following well installation/development.

5. **Comment:** Please note that DEP expects decisions regarding remediation compliance to be based on multiple samples, not a single sampling round. Follow-up will be need for confirming critical data.

   Response: Additional rounds of groundwater sampling will be conducted under future scopes of work.

6. **Comment:** DEP expects that any further bedrock evaluation will be under a separate work plan, building on data obtained from this investigation.

   Response: Correct.

7. **Comment:** Soil samples from wells penetrating hot spots should be examined for presence of NAPL in the horizons where such concentrations could be expected. In addition, if NAPL is encountered, a contingency for a more robustly isolating nested well casing limiting the potential for downward NAPL migration may be needed.

Comment # Comment/Response

Response: Due to the timing of CTDEP responses on the Work Plan and the progress of activities in the field, split-spoon samples will be collected only in the boring associated with monitoring well HESE-01-12D; these split-spoon samples will be visually assessed for the presence of NAPL.

8. **Comment:** Please ensure that sufficient field chemical information is gathered to allow determination of sulphur speciation in evaluation of controls on metals transport.

Response: Groundwater samples will be field-analyzed for sulfate and sulfite.

9. **Comment:** Evaluation of solvents in the tidal flats should include evaluation of chronic toxicity. Traci Iott of DEP should be consulted for criteria to be used.

Response: CTDEP will be consulted for chronic toxicity criteria.

USEPA Comments Dated October 12, 2001 on the Draft Remedial Investigation Work Plan Additional Groundwater Investigations, Stratford Army Engine Plant, Stratford, Connecticut

GENERAL COMMENTS

1. Comment: In the Introduction, the text indicates that "This Work Plan is intended to address comments by the United States Environmental Protection Agency ... on the Draft Remedial Investigations Report..." EPA notes, and the text should be clear on this fact, that EPA comments on the Draft RI were quite extensive. While the work proposed in this Work Plan will address many issues raised in relation to the groundwater beneath the site, this Work Plan does not address all of EPA's concerns. The text should be clarified to ensure that it is clear that EPA's December 2000 comments discussed more than just the need to further delineate VOC groundwater contamination.

Response: The text will be clarified to indicate that the work plan addresses the USEPA's comments relative to additional groundwater investigations only.

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Comment # **Comment/Response**

2. **Comment:** The Work Plan represents an important and welcome effort to constrain better the extent of VOC contamination in groundwater, particularly beneath Building 2. A significant data gap in characterization of deep groundwater has been identified in previous reviews of various site reports. A particular concern for potential DNAPL has been noted, based on the very high concentrations of dissolved TCE observed in the overburden groundwater (approaching the solubility limit) and detections at or near the bedrock interface (e.g., 1,1,1-TCA greater than 100,000 micrograms per liter at CP-99-08). In general, the proposed drilling and sampling is well conceived to develop a better conceptual model for the extent and transport of chlorinated solvents. Deep wells HESE-01-05D, -06D, and -07D are particularly important, in that they target the apparent bedrock valley running to the northwest (identified in a seismic refraction survey), with -5D located in a local buried topographic minimum. Spatial coverage of the targeted VOC contamination in the map plane is generally good, and target screen depths appear to be appropriate. The latter are either just above expected bedrock (appropriate for the DNAPL investigation) or in the known highly contaminated zone (typically ~20-30 ft bgs). A general reservation concerning targeting particular, pre-determined depths for well installation is noted in the following General Comment.

Response: Comments noted.

3. **Comment:** It is strongly recommended that all VOC drilling be coupled with interval sampling of groundwater to examine the vertical distribution of VOCs at the location of each new monitoring well. Experience at SAEP, as well as at many other locales, shows that VOCs can be found vertically in quite a complex distribution, particularly if the contaminant moved as a DNAPL. A case in point is cone-penetrometer location CP-99-08, where 1,1,1-TCA was found with two distinct maxima (concentrations >100,000 micrograms per liter), one in the interval approximately -20 to -40 ft msl, and the second above bedrock in the interval approximately -120 to -150 ft msl. One can easily miss important information about the distribution of the VOCs by targeting a single depth interval in advance. The screens placed just above bedrock are well motivated to characterize potential DNAPL that might be localized along this interface. However, with more detailed information, both the screened interval and the screen length might be better chosen. For example, if one of the deep borings is found to go through a VOC zone at intermediate

Comment # **Comment/Response**

depth, but finds nothing at the bedrock interface, it may make more sense to screen the well in the contaminated interval rather than at the pre-determined target depth. Similarly, if there are indications that DNAPL is present in a very thin zone at the base of the overburden, a shorter screen may be appropriate for the final well installation. The hollow-stem auger (HSA) proposed for the shallower drilling is well suited to close-interval screening sampling (i.e., using a screened HSA). For the deeper drilling, other methods may be necessary. Extensive experience with deep, close-interval sampling has been developed at the Massachusetts Military Reservation. On-site GC analysis of the screening samples can guide the drilling and well construction.

Response: Interval sampling of groundwater conducted during previous SAEP investigations provided sufficient information to identify the presence of the groundwater VOC hot-spots. Proposed well locations and depth intervals presented in the Draft Work Plan will provide additional groundwater data to refine delineation of the VOC hot-spots.

4. **Comment:** It is not clear that the proposed program to delineate VOCs can be separated entirely from the chromium problem also found beneath Building 2. Proposed wells HESE-01-14I, HESE-01-15I, HESE-01-08D, and HESE-01-10D are all located within the area previously shown to be highly contaminated by Cr(VI) (e.g., 950,000 micrograms per liter at WP-99-15). Previous work in this area has shown both Cr(VI) and TCE at very high concentrations within the same general depth horizon (~25 ft msl). This alone indicates that the chemistry of the groundwater, the detailed distribution of these contaminants, and their interactions are not adequately understood. These contaminants might be expected to interact strongly; for example, chromate may be expected to oxidize TCE, in turn reducing the Cr(VI) to Cr(III). The resulting Cr(III) may then become sorbed by, or co-precipitate with, ferric iron oxyhydroxide or other solid phases. Given the expense and obstacles of drilling inside the building, further exploration of the chromium problem should be folded into the VOC investigation proposed. This is particularly critical for the wells named above, which are in an area previously mapped as being impacted by chromium plating solutions. The interval sampling discussed in the previous comment should be performed in the shallow and intermediate-depth wells proposed for this area, and the analyte list for these wells should be expanded to include, at a minimum, chromium (both Cr(VI) and total) and iron. Manganese (already on the analyte list for MNA wells) should also be on the analyte list for all wells within the Cr-impacted area, as it can play a significant role in the reaction chemistry and transport of chromium. It would also be of value to the assessment of the

Comment # **Comment/Response**

chromium problem, as well as its interaction with the TCE, to obtain soil samples from the borings. The soils should be analyzed, at a minimum, for total chromium (total, water-soluble, and water-soluble Cr(VI)) and organic carbon. In addition, analyses yielding information relevant to chromium mobility in groundwater – e.g., total water-soluble chromium and water-soluble Cr(VI) – should be considered, as well as analyses for iron, manganese, and other metals. Chromium could be present as Cr(III), in various solid phases, e.g. such as CrOOH or $(Cr, Fe)(OH)_3$ following reduction by oxidizing TCE in the system. Alternatively, the chromium may be present as Cr(VI) in phases such as jarosite, where CrO_4^{-2} substitutes in the mineral structure for SO_4^{-2}. Solid phases should be investigated, as they may represent a significant residual and persistent source of chromium (including Cr(VI)) to the groundwater.

Any information that is already available regarding the above information should be briefly discussed in this Work Plan.

Response: The Army feels that the soil and groundwater investigations previously conducted at the former Chromium Plating Facility have been adequate to delineate and characterize soil and groundwater chromium contamination. In addition to the Final OU 2 Pre-Design Investigation Report (HLA, 2000), the Final Pilot-Scale Treatability Study Report for the Chromium and VOC Groundwater OU 2 EE/CA (HLA, 2000) presents additional information regarding characterization of chromium in soils and groundwater.

Concentrations of hexavalent chromium in groundwater at the proposed locations for monitoring wells HESE-01-14I and HESE-01-8D are estimated to be less than 0.1 mg/L (Final OU 2 Pre-Design Investigation Report, Harding Lawson Associates, May 2000).

The objective of proposed monitoring well HESE-01-15I is to provide a monitoring point for collection of groundwater MNA data for the TCE hot-spot identified at this location. The objective of proposed monitoring well HESE-01-10D is to characterize potential VOC groundwater contamination at depth beneath the former Chromium Plating Facility.

5. **Comment:** The analytical parameters proposed to support the MNA assessment are important and well motivated. Reduced iron, Fe(II), should be analyzed in the field (e.g., with a Hach kit) for these wells to provide further key information regarding the redox and microbial environment. In addition, because of the extreme VOC and Cr(VI) concentrations

observed in groundwater for this site, additional characterization for MNA potential may be justified. In particular, it seems entirely possible that the concentrations of TCE and/or Cr(VI) are so high as to render significant domains sterile. Perhaps some sort of microbial assay could ascertain whether or not the site will support a population of degradative bacteria, and if there are thresholds for TCE and/or Cr(VI) above which such organisms cannot survive. This may be critical to an assessment of the potential for MNA as an effective remedy. If attenuation of the core of the TCE plume is to rely primarily on physical mechanisms (e.g., dispersion), the remedial time frame may prove to be exceedingly long, particularly given the low groundwater velocity shown to prevail at the site.

Response: Comments noted. The work plan will be revised to include analysis of ferrous iron in the field using Hach test kits.

6. **Comment:** The deep borings intended to explore for possible DNAPL at the overburden-bedrock interface seem to be based on an assumption that DNAPL would pool at this surface. While there is certainly some suggestion that this may be the case (e.g., 1,1,1-TCA at CP-99-08), it is also possible that the bedrock beneath the site is fractured, and that DNAPL has entered the bedrock. Consideration should be given to coring into the top of bedrock to characterize the nature of fractures that may be present, and to seek evidence for penetration of DNAPL.

Response: As part of URSGWC's RI field investigations, three monitoring well borings (WC2-2D, WC2-3D, and WC5-1D) were advanced to the bedrock and bedrock cores were collected. Five feet of NX-size rock core was collected at each location from the bedrock encountered during the drilling of monitoring wells WC2-2D, WC2-3D, and WC5-1D. Bedrock was encountered at 62 feet bgs in WC2-2D, and 85 feet bgs in WC2-3D and WC5-1D. The bedrock at WC2-3D and WC5-1D is described as a gray, strong, thickly-bedded, fine-grained. The bedrock at WC2-2D is described as a gray, strong, thickly-bedded, medium-grained schist. Rock quality designations (RQDs) are 75% in WC2-3D, 85% in WC5-1D, and 89% in WC2-2D, all of which classify the bedrock quality as "good".

SPECIFIC COMMENTS

1. **Comment: p. 4, sec. 3.2.2:** The rationale for siting the proposed piezometers is provided in the text, and includes previous detections, relationship to groundwater flow directions,

Comment # **Comment/Response**

and relationship to known sources. The locations chosen are well motivated in these regards. NAE peizometers D-4 and D-13 have previously detected rather high levels of TCE degradation products, and these areas are appropriately targeted for further characterization. Piezometer D-8 also shows fairly high levels of chlorinated VOCs, although not, apparently, directly related to the TCE (detections at this piezometer included 1,1,1-TCA and 1,1-DCA). This area is not targeted for further characterization. It is noted that the total VOCs (based on the results shown in Figure 3) at D-8 is about the same as that at D-13, which is proposed for further work. Additional delineation by piezometers should be considered for the vicinity of D-8.

Response: The Army will perform an additional round of groundwater sampling on D-8 and all other NAE-installed piezometers in the tidal flats.