Harding ESE
A MACTEC COMPANY

Harding ESE, Inc.
511 Congress Street
P.O. Box 7050
Portland, ME 04112-7050
Telephone: 207/775-5401
Fax: 207/772-4762
Home Page: www.mactec.com

January 3, 2002

Mr. Kenneth Feathers
State of Connecticut
Department of Environmental Protection
79 Elm Street
Hartford, CT 06106-5127

SUBJECT: RESPONSE TO CTDEP AND USEPA COMMENTS DRAFT INDOOR AIR MODELING WORK PLAN STRATFORD ARMY ENGINE PLANT

Dear Mr. Feathers,

Enclosed for your review are responses to Connecticut Department of Environmental Protection and U.S. Environmental Protection Agency comments on the Draft Indoor Air Modeling Work Plan (October 2001) for the Stratford Army Engine Plant (SAEP). The responses to comments were prepared by Harding ESE, Inc., a MACTEC Company, under contract to the Chemical, Biological Defense Command, Contract Number DAAAM-02-97-D-0005.

Please review and forward any questions or concerns regarding these responses to comments to my attention by January 31, 2001. In the interim, please call me at (207) 775-5401 x3637 if you have any questions or comments on this submittal.

Sincerely,

HARDING ESE, Inc.
A MACTEC Company

D. Roderick Pendleton

for Nelson Walter, P.E.
Project Manager

cc: Meghan Cassidy, USEPA Region I
J. Burleson, TACOM-SAEP
M. Clemens, USAEC-NAE
J. Frye, USACE-NYD

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RESPONSE TO COMMENTS ON THE DRAFT INDOOR AIR MODELING WORK PLAN DATED OCTOBER 2001 STRATFORD ARMY ENGINE PLANT STRATFORD, CONNECTICUT

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

by

HARDING ESE, INC.
A MACTEC COMPANY
PORTLAND, MAINE

January 2002

RESPONSE TO COMMENTS ON THE
INDOOR AIR MODELING WORK PLAN
DATED OCTOBER 2001
STRATFORD ARMY ENGINE PLANT
STRATFORD, CONNECTICUT

Comment # Comment/Response

CTDEP Comments Dated November 1, 2001 on the Indoor Air Modeling Work Plan Stratford Army Engine Plant, Stratford, Connecticut

1. **Comment:** DEP expects the newer model proposed for use will yield more conservative (protective) results. In the report, please also compare results to the site specific calculations that would be conducted under the Remediation Regulations and, if the model results are less conservative, provide justification as to why they are more appropriate for use at this site.

   Response: Review of the CTDEP site-specific formulae with those used as the basis for the Johnson-Ettinger model indicates they are essentially the same. Model runs made with the CT soil gas criteria to indoor air using the site specific building conditions showed computed indoor air quality results comparable to the CT indoor air criteria. The model is believed to be an equal representation of the CT site-specific formulae for migration from groundwater to indoor air.

2. **Comment:** Explain in the report the rational used for any site-specific inputs such as soil moisture, slab thickness, etc.

   Response: The basis for use of site-specific data will be presented in the modeling report.

3. **Comment:** As discussed at the BCT, ensure that the choice of decaying source vs. constant source takes into account how each model handles breakdown products, and selects the model option most conservative for DCE.

   Response: The use of the term "decaying source" for the model does not refer to breakdown of VOCs to daughter products. Rather it means a finite source that may be time averaged if the period of significant source depletion is on the order of the exposure time. This is available for only the soil-to-indoor air variant of the model. The constant source term assumption is the more conservative in that it applies the constant source concentrations over the period of exposure, rather than allow some lesser concentration to be derived from the depletion of a finite source.

4. **Comment:** Consider the use of several chemicals with differing chemodynamics of transport for the sensitivity analysis.

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Response: Different chemicals will be considered when conducting the sensitivity analyses.

5. **Comment:** A discussion of how the site departs from the major model assumptions, and the potential effects on the results, should be included in the report.

Response: Use of site-specific input parameters will be explained in the modeling report, including effects of these parameter values relative to default parameters implicit in the CT site-specific formulae.

6. **Comment:** Also evaluate how vadose zone NAPL pollution may affect the predictive results.

Response: Extensive subsurface soil sampling does not indicate the presence of free-product, nor of significant concentrations in soil of the VOCs of concern. See response to USEPA General Comment 2 for a more detailed discussion.

7. **Comment:** DEP understands that this modeling effort will be used to evaluate remedial options for solvent polluted groundwater. DEP notes that the modeling may require supplementation if it is to be used for evaluation of compliance with remedial regulation requirements, as the actual building configuration for reuse may be different.

Response: The modeling is being used to provide a set of target concentrations in groundwater with which to evaluate remedial alternatives for the groundwater to be protective of indoor air quality. While final or future use/configuration of the buildings cannot be foreseen, both the indoor air modeling to be provided here, and the groundwater modeling being conducted by the U.S. Army Corps of Engineers Waterways Experiment Station should include margin of safety factors that reflect the uncertainties in both aspects of modeling.

USEPA Comments Dated October 30, 2001 on the Indoor Air Modeling Work Plan Stratford Army Engine Plant, Stratford, Connecticut

GENERAL COMMENTS

1. **Comment:** The Revised Johnson and Ettinger Model (December 2000) is not designed to

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properly account for the presence of free product in the subsurface and, in fact, the discussion of the Model in Section 2.0 of the User's Guide for the Johnson and Ettinger Model (User's Guide) suggests that the NAPLSCREEN or NAPLADV models be used for situations where free product is an issue. While it is understood that the entire subsurface area beneath the building floors does not contain free product, in some instances, such as for Building 2, the likely presence of free product may be great enough to cause inappropriate results if this is not properly considered. Also, it appears that this may be a consideration in the floor area of the chrome plating facility in Building 2 as well. Please describe in greater detail the rationale for the exclusive use of the Revised Johnson and Ettinger Model.

Response: Results presented in the Draft Remedial Investigation Report (URSGWC, September 2000) do not indicate the presence of free product in subsurface soils beneath the SAEP facility. Numerous soil samples from the vadose and saturated subsurface zones did not reveal the presence of any free product. Further, the purpose of the modeling is not to model the potential effects of contaminants in vadose-zone soil on indoor air (as the NAPL-SCREEN or NAPL-ADV models would do), but to back-calculate targets in groundwater protective of indoor air from that source alone as a guide to the extent of remediation of groundwater that would be needed. If NAPL were of concern in this modeling application, the User's Guide indicates: "Use of these models *[SL-SCREEN or SL-ADV]* when a residual phase is present, results in an over-prediction of the soil vapor concentration and subsequently the building vapor concentration." So the exclusive use of the Revised J&E Model would be conservative if the soil were being considered in this modeling.

2. **Comment:** The User's Guide includes the addition of two new soil gas models, SOILSCREEN and SOILADV, that use empirical soil gas data rather than theoretically determined soil gas concentrations. Please clarify in the work plan why the SOILADV model should not also be used to add credence to the results obtained with the Revised Johnson and Ettinger Model.

Response: Harding ESE expected to attempt to use the soil gas model versions in the course of the modeling as there are soil gas data available. Results of the use of these models will be included in the modeling report. However, Harding ESE regards the soil gas data as having limited use in validating the modeling in that concentrations in soil vary greatly from location to location, and are only available for one sampling event. The use of the soil gas models assumes constant soil gas concentrations in the vadose zone and that these concentrations represent the soil gas concentrations at the point of entry (mainly along the

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perimeter of the floor/foundation). In addition, there may be great uncertainty in the validity of individual samples to represent average concentrations present in soils.

3. **Comment:** The Revised Johnson and Ettinger Model uses a large number of parameters to make the calculations for the model. The value used for several of the parameters is not a default value and is not intuitively obvious from the data set for the site. Consequently, assumptions or calculations will have to be made to derive a value for these parameters. A few examples are the number and character of the soil layers beneath each building, the effective concentration of the contaminants in the zone of contamination, the pressure difference between the building environments and atmospheric pressure, and the ventilation rate for the buildings. The value used for one or more of these parameters may have a significant impact on the model conclusions. Consequently, the value of the parameters used in the model may be a point of contention when the modeling results are reviewed. Therefore, it is strongly recommended that a preliminary submittal of proposed model parameters be made for review and comment prior to initiation of the actual modeling work.

   Response: Note that the CTDEP guidance for determination of the target concentrations consists of the Johnson-Ettinger equations with a single soil layer of constant properties. The Revised Johnson-Ettinger Models allow the use of up to three soil horizons with varying thickness, soil bulk density, total porosity, and air-filled porosity. However, in application, a typical profile of these parameters is expected to display a decrease in total porosity, and an increase in each of the other parameters due to soil compaction and approach to the water table and capillary zone. The use of a single layer with constant properties based on average values is apt to produce a lower back-calculated target value for groundwater (more conservative) than would a multi-layered vadose zone. This conclusion is based on three criteria assigned to the layer immediately above the water table in a multi-layered model that make it less conservative: 1) higher than average assigned water filled porosity; 2) higher bulk density; and 3) lower total porosity. That is, the single layer with average parameter values approach is apt to be more conservative than if such detailed data were available and used in the model. The model parameters will be available for review in the Draft Indoor Air Modeling Report.

5. **Comment:** The work plan should discuss the rationale used to select Buildings 2, 10, and 12 as the subjects for indoor air modeling.

   Response: The referenced buildings were selected due to the presence of VOC groundwater

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hot-spots beneath these structures, and the results of indoor air sampling, which indicate the highest VOC indoor air concentrations within these structures. The Work Plan will be revised to include the rationale for selection of these buildings as the subjects for indoor air modeling.

6. **Comment:** The work plan should include a discussion of the rationale used to limit the use of the Johnson and Ettinger Model to only contamination dissolved in groundwater rather than also evaluating contamination in soil beneath the buildings.

Response: The modeling is being done to back-calculate a concentration in groundwater that is protective of indoor air quality, and thereby guide decisions regarding extent of groundwater remediation. It is not intended to address soil contamination, which, as discussed above (see response to Comment 1), has been determined through extensive sampling to not indicate the presence of free-product nor of significant concentrations in soil of the VOCs of concern. The results of the modeling will consider uncertainty in the parameter input values and results of sensitivity runs to propose groundwater concentrations to help guide evaluations of clean-up of groundwater to be evaluated by the U.S. Army Corps of Engineers Waterways Experiment Station with their groundwater model.

SPECIFIC COMMENTS

1. **Comment: Section 2.1, Page 1, Paragraph 1:** The last sentence in this paragraph references an emphasis on short-term exposures for rationale for using a constant source model option. While this is appropriate, it should also be noted that the possible presence of free product in the subsurface makes it imperative to use a constant source model option and consider long-term exposure to the contaminants of concern. Provide additional justification to support addressing short-term exposure only.

Response: The question of short- or long-term exposures does not come into play as the model is not being used to calculate or propose new target indoor air concentrations, but to use CT regulation indoor air exposure target concentrations to back-calculate estimates of groundwater concentrations that will be protective of these numbers. The assumption of a constant source is simply the more conservative of the source condition options in the model.

2. **Comment: Section 2.1, Page 2, Paragraph 1:** This paragraph states that the model computes only an average concentration for the contaminant in the building space. This is

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correct but it is also a significant deficiency in the model for buildings in which the air is not well mixed, which we believe is the case for the three buildings that are the subject of the modeling. Because the model does not account for the expected stagnancy of the air in the buildings, the model results will need to be assessed and adjusted to account for that situation. The contaminants of concern are heavier than air and, in the absence of convective forces, will preferentially settle near the floor of the buildings. This should be incorporated into the work plan discussion and into the report of findings for the modeling.

Response: It is not clear how the EPA is suggesting that the model results be "adjusted to account for that situation" [assumed condition of air being not well mixed]. Sensitivity analysis will, however, look at changes in air exchange rate. Indoor air measurements are taken at floor level and provide a conservatively high set of values against which to compare model results. Some discussion of this effect will be provided in the modeling report.

3. **Comment: Section 2.1, Page 2, Paragraph 3:** This paragraph discusses the runs that will be completed for the modeling effort, suggesting, we believe, that one run for each of the five contaminants for each of the three buildings will be completed, in addition to an unspecified number of sensitivity runs for one contaminant. EPA recommends that sensitivity runs be conducted for each of the three buildings, especially if there are significant differences in the input parameters for the buildings. This should include, for each building, sensitivity runs for several of the more sensitive parameters and include a minimum of two contaminants, which may not be the same contaminants for each building. Concurrence on the details of the sensitivity runs could be achieved after a preliminary review of the initial runs by the regulatory agencies and a meeting or teleconference to discuss and select appropriate sensitivity run parameters. It may not be appropriate to identify the details of the sensitivity runs prior to review of the initial model runs.

Response: Sensitivity runs for each of the buildings were intended with a single compound, a different one for each building. Sensitivity runs would be run for the following parameters and ranges: temperature (plus/minus 5 degrees C); air exchange rate (plus/minus 25 percent); depth to water table (plus/minus 1 foot); soil bulk density (plus/minus 0.2 g/cc); total soil porosity (plus/minus 0.05); pressure differential (plus/minus 25 percent); water-filled porosity (plus/minus 0.05); and seam crack width (plus/minus 0.05 cm).

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4. **Comment: Section 2.1, Page 2, Paragraph 4:** The report should also include documentation of the derivation of input parameter values where calculations were required.

   Response: The report will provide documentation of the derivation of input parameter values where calculations are required.