Interdepartmental Memo
Department of Environmental Protection
Bureau of Water Management

To: Ken Feathers

From: Traci Iott

Date: February 25, 2004

Re: Evaluation of Ecological Risks Associated with Stratford Army Engine Plant

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I have reviewed the Draft Remedial Investigation Report for the Stratford Army Engine Plant. This report was prepared by Harding ESE and dated January 10, 2003. In general, the report organization and presentation is much improved over previous drafts. However, I find that the report underestimates the potential for risk to ecological populations associated with the site. Additionally, there are some errors and omissions that need to be corrected in the final version of the document.

Section 13.0 Baseline Ecological Risk Assessment

13.1.2 Conceptual Site Model

The Conceptual Site Model presented in Figure 12-1 adequately describes the migration pathways for contaminants and identifies affected media present at the Stratford Army Engine Plant. However, the identification of potential contaminant sources, both within the text of the report as well as Figure 12-1 is incomplete. There is a clear focus on the releases of chromium and chlorinated solvents from the facility. However, other portions of the report indicate that metal-bearing wastes, potentially containing nickel, copper, cadmium, aluminum, magnesium, zinc were discharged from the site. Cyanide was used in conjunction with some of the metal-bearing waste streams. Additionally, releases from manometers used at the engine testing facilities may have contributed mercury to the environment. Section 11.3 provides some general information regarding the types of chemicals potentially released to the tidal flats and through Outfall 008, including the identification of direct industrial discharges to the tidal flat prior to the construction of wastewater treatment facilities. The Conceptual Site Model must be revised to include these other contaminant sources.

13.1.3.1 Available Data

Available groundwater data for both metals and organic compounds should be discussed within the Ecological Risk Assessment. Groundwater concentrations should be compared with Water Quality Criteria, not the Surface Water Protection Criteria contained in the Remediation Standard Regulations since the groundwater discharges, at least in part, to intermittent waterbodies. Additionally, there are no data describing the concentration of metals in the shallow groundwater. Samples of shallow groundwater should be collected and analyzed for metals to determine the potential for groundwater to contribute to the contamination observed within the Tidal Flats, Outfall 008 and the Marine Basin.

The Ecological Risk Assessment should identify any contaminated soils from Stratford Army Engine Plant that could potentially erode into a surface waterbody. If such soils exist, the contaminant levels in such soils must be evaluated using the appropriate sediment criteria.

Sediments collected from deeper sediment horizons should also be screened using Sediment Quality Benchmarks to provide a better understanding of the distribution of contaminants and potential for impact on environmental receptors if the deeper sediments are exposed. Additionally, sediment data for PAHs and PCBs should be summed for each group, providing information on total PAHs and total PCBs. Evaluate potential environmental impacts using these total values.

Are there any data available describing the physical nature of the sediments collected, such as grain size, total organic carbon or sulfide?

Sediment samples dated June 1999 were analyzed for total and trivalent arsenic. The results of these samples are several orders of magnitude greater than arsenic results collected in similar areas at other times. Are the June 1999 sample results valid? Please explain the discrepancy.

13.1.3.2 Data Summarization Methods

For samples with duplicate analyses – both samples should be averaged and the average used in the risk assessment.

13.1.3.3 Selection Criteria Used to Identify COPCs

Water Quality Criteria –

Provide a copy of the reference for the criteria listed in Table 13-33 under the columns labeled Federal – AQWC. These values do not appear to be referenced correctly.

When evaluating which water quality criteria to use, use the Connecticut DEP values first (be sure to have the most recent values from the December, 17,

2002 updates). Also, don't adjust the hardness value for the criteria, use the value in the Connecticut Water Quality Standards. If the value is not available, then use values from EPA, Oak Ridge National Laboratory or other appropriate sources.

Sediment Quality Benchmarks-

Use NOAA values for metals, total PAHS, and total PCBs. If a NOAA value is unavailable, then use the MacDonald consensus paper, Ontario Ministry of the Environment or Oak Ridge National Laboratory values as needed. Use secondary chronic values preferentially over the lowest chronic values.

For sediments, calculate the ERM quotient for metals and PCBs combined for each sample.

13.1.3.4-7 COPCs

A summary table of COPCs by media incorporated should be incorporated into the text of the Risk Assessment.

13.1.4.2 Ecological Receptors

Critical Habitats and Species: The Atlantic Sturgeon and Bald Eagle may be found in the vicinity of the Stratford Army Engine Plant. The potential impact of contaminants from the site on these receptors should be explicitly discussed within the Ecological Risk Assessment.

13.1.5.2 Measurement Endpoints

13.2.1.1 Calculation of Exposure Point Concentrations

The maximum value for each dataset should be used in place of the 95^{th} upper confidence level on the mean for datasets for which a valid 95^{th} UCL cannot be calculated. It is not appropriate to set the Reasonable Maximum Exposure concentrations equal to the mean value. The use of the maximum concentration observed in the dataset to estimate the Reasonable Maximum Exposure concentrations is further supported since some of the receptors evaluated in this Ecological Risk Assessment have home ranges less than the size of the various site-related areas.

13.2.1.2 Quantification of Exposure for Wildlife – Food Chain Model

Sediment Ingestion Rates – Don't assume a generic sediment ingestion rate of 5% for all receptors. The 5% assumption is appropriate for the Black Duck and Great Blue Heron. However, information developed by Beyer at al and included in the EPA Wildlife Exposure Factors Handbook indicates that the sediment ingestion

rate for the Spotted Sandpiper should be 18% (the average of the sandpiper values in Table 4-4 and 9.4% for raccoons.

Exposure concentrations for prey items should not be calculated based on BSAF values since there are direct measurements of prey items available. Literature based BSAFs can be used to evaluate chemical concentrations in plants since this data is not available in the current study.

The estimates of the exposure areas for the Tidal Flats, Outfall 008 and Marine Basin must be reviewed and verified. The values contained within the text appear to be wrong. The Outfall 008 Area is the smallest, not the largest of the three site-related areas. Additionally, based on maps, the Tidal Flats should be a much larger area than either of the other two areas.

The Site Foraging Frequency should be set equal to one. For receptors for which their home range is larger than the Exposure Area, an additional evaluation of risk using a receptor-specific foraging frequency may also be calculated. However, this calculation is made by dividing the Exposure Area by the receptor's home range. The Site Foraging Frequency was calculated incorrectly in the Ecological Risk Assessment.

13.2.2.1 Ecological Effects Assessment – Aquatic Receptors

Toxicity Tests –
Provide the laboratory sheets and supporting information for the toxicity tests included within the Ecological Risk Assessment. What types of statistical tests and assumptions were made when analyzing the data?

Benthic Community Analyses-
In addition to the measures provided in Table 13-32, provide data on the percentage of the following taxonomic groups: Annelid, Capitella, Arthropod, Amphipod and Mollusc. Include the same data summary for the benthic community samples collected in 1994. The data is presented in Table A-1 of the Draft Final Baseline Ecological Risk Assessment, Stratford Army Engine Plant, Stratford, Connecticut prepared by Woodward-Clyde and dated April 1996.

Reference Toxicity Values-

Surface Water and Sediment - See comments on Section 13.1.3.3 Selection Criteria Used to Identify COPCs, above.

Biological Tissue – The Critical Body Residues were developed in a manner that allows data from less sensitive receptors and life stages to influence the values used to evaluate data collected from Stratford Army Engine Plant. In place of the method used, the available Reference Toxicity Values should be reviewed to

determine a sensitive surrogate organism for the invertebrate, shellfish and finfish populations under evaluation at Stratford Army Engine Plant. Suggested values are appended to this memo. Additionally, Reference Toxicity Values for some site-related chemicals, such as chromium and nickel, were not included in the report. There are additional values available for some of these chemicals. For those chemicals for which reference toxicity values are unavailable, these chemicals should be explicitly identified in the text and discussed qualitatively, with respect to background, as well as included within the evaluation of uncertainties within the report.

13.3 Risk Characterization

The risk characterization portion of the report must be revised using the proper RME values, appropriate criteria and other corrections noted above. Quantitative comparisons should be included in the report, as opposed to qualitative comparisons. Statements such as "are generally the same as" should be replaced by are X times lesser/greater than".

Evaluation of the Data

I have reviewed the data contained in the Draft Remedial Investigation Report for the facility and conclude that the report underestimates the potential impact on the ecosystem surrounding the facility. Many of the values used in the current evaluation, from calculation of exposure point concentrations to toxicity-based benchmarks, under represent environmental conditions or the potential for impact. The magnitude and extent of potential environmental impacts will be further refined through the revisions to the draft Ecological Risk Assessment. However, I have evaluated the benthic community data as well as conducted a revised estimate of risk for the Spotted Sandpiper. My review indicates that there is greater risk to these communities than presented in the report.

The sediments collected from the Tidal Flats, Outfall 008, and the Marine Basin have higher concentrations of site related constituents such as metals and PCBs than do sediments from reference areas. Sediments from these areas are more likely to exceed both ERL and ERM benchmarks, both due to the number of chemicals that exceed these benchmarks as well as the magnitude of the difference. As these metrics increase, there is an increased likelihood of impact to benthic organisms.

This is supported by the sediment toxicity test data as well as the evaluation of the benthic communities in these areas. Sediments for which greater number of chemicals exceeded sediment quality benchmarks and which had greater concentrations of these chemicals exhibited greater toxicity. All sediments tested were acutely toxic to

amphipods. Sediments collected from the Tidal Flats were also acutely toxic to the species of marine worm tested. Additionally, the communities evaluated from the reference areas had greater diversity within the invertebrate populations. While the reference areas were dominated by Annelids, there were lesser amounts of known pollution tolerant species such as Capitellids, and greater percentages of Arthropods and Amphipods than observed in site related areas. For example, the Annelids represented an even greater percentage of the organisms observed within the Tidal Flats. Capitellids made up approximately 16% of the benthic community, as compared to less than 1% for the reference areas. The percentages for both Arthropods and Amphipods were an order of magnitude less than that observed in the reference areas.

The co-occurrence of elevated concentrations of site related chemicals with increased sediment toxicity and impaired benthic communities, strongly suggest that site related activities have had a high degree of impact on the Tidal Flats and Outfall 008 and a lesser, but measurable, impact on the Marine Basin.

Similarly, I re-calculated the potential risks to the spotted sandpiper for both the Tidal Flats and Marine Basin using average and maximum chemical concentrations for prey items as directly measured within the study. I corrected the percent sediment within the diet and assumed that it was possible that birds from Short Beach would forage primarily within these areas. The Hazard Indices that I calculated were greater than those presented in the report, indicating a greater potential for impact to this species, and by extension, the federally-listed piping plover, for which the spotted sandpiper serves as a surrogate. Additionally, chromium was the largest contributor to risk to the spotted sandpiper in both the Tidal Flats and Marine Basin.

Risks to Spotted Sandpiper
Tidal Flats

	Report Value		Re-calculated Value	
Exposure Conditions	C.T.*	Max.	C.T.	Max.
NOEL Based Hazard Index	12	15	21	133
LOEL Based Hazed Index	1.9	2.3	3.9	35.3

* C.T.= Central Tendency

Recommendations

The Draft Remedial Investigation Report for the Stratford Army Engine Plant must be revised to address the comments provided above. Additionally, I recommend that Preliminary Remedial Goals be developed for site related constituents that result in

or contribute to risks to the ecological populations surrounding the facility and included in the revised submittal.