FINAL

Phase II Comprehensive Site Assessment Addendum for Demolition Debris Area

RTN 4-3024222

Former Bird Machine Company Site

Walpole, MA

Submitted to:

Baker Hughes Incorporated
Houston, TX

Submitted by:

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December 2011

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LIST OF ACRONYMS

ACM	asbestos containing material
AIS	asbestos in soil
AMEC	AMEC Environment and Infrastructure
AUL	Activity and Use Limitation
bgs	below ground surface
BHI	Baker Hughes Inc.
BMC	Bird Machine Company
CAM	Compendium of Analytical Methods
CIH	Certified Industrial Hygienist
CMR	Code of Massachusetts Regulations
CSA	Comprehensive Site Assessment
CSM	Conceptual Site Model
COC	contaminant of concern
DDA	Demolition Debris Area
DUA	data usability assessment
EPH	extractable petroleum hydrocarbon
ft	feet
IRA	Immediate Response Action
LRA	Lead Release Area
MADEP	Massachusetts Department of Environmental Protection
MBA	Manufacturing Building Area
MCP	Massachusetts Contingency Plan
MS/MSD	matrix spike/matrix spike duplicate
NSR	No Significant Risk
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PLM	polarized light microscopy
RAM	Release Abatement Measure
RAO	Response Action Outcome
RC	Risk Characterization
REDUA	representativeness and data usability assessment
RTN	Release Tracking Number
SDG	sample delivery group
SRS	South Rail Spur
STL	Severn Trent Laboratories
SVOC	semivolatile organic compound
TEM	transmission electron microscopy
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
VPH	volatile petroleum hydrocarbon
Weston	Weston Solutions, Inc.

EXECUTIVE SUMMARY

On behalf of Baker Hughes, Inc. (BHI), AMEC Earth and Environmental, Inc. (AMEC) has completed a Phase II Comprehensive Site Assessment (CSA) Addendum for the portion of the former Bird Machine Company (BMC) Property located in Walpole, Massachusetts known as the Demolition Debris Area (DDA). The DDA is an exposure area and is a portion of the site assigned Release Tracking Number (RTN) 4-3024222 under the Massachusetts Contingency Plan (MCP). This Phase II CSA Addendum serves as an update to a July 2007 Phase II CSA (Weston 2007). It presents the data collected at the DDA from June 2007 to the present, updates to the Phase II CSA as a result of the additional data collected, and an updated risk characterization. A Phase II CSA addressing three other exposure areas, the manufacturing building area (MBA), the lead release area 3 (LRA3), and the south rail spur (SRS) was finalized on October 18, 2011. These two Phase II CSAs together characterize the "Site", which is represented by the single unclosed RTN (4-3024222) at the property.

The Phase II CSA Addendum addresses volatile organic constituents (VOCs), semi-volatile organic constituents (SVOCs), extractable petroleum hydrocarbons (EPH), polycyclic aromatic hydrocarbons (PAHs), dioxin/furan congeners, and various metals detected in soil and groundwater samples collected from the DDA. The Phase II CSA also includes evaluations of asbestos in soil (AIS) identified within this exposure area.

Data from site investigations completed by AMEC, site assessment activities completed by Weston Solutions, Inc. of Concord, New Hampshire (Weston), and information from other sources (e.g., Massachusetts Department of Environmental Protection [MADEP] and United States Environmental Protection Agency [U.S. EPA] guidance documents), were used to complete the CSA.

In accordance with the requirements of 310 CMR 40.0000 Subpart I of the MCP, a Method 3 risk characterization (RC) of harm to human health, public welfare, safety, and the environment was completed. This RC replaces a Method 1 RC that was prepared by Weston. The Method 1 RC addressed soil and groundwater at the DDA and was not able to conclude NSR. Additionally, Weston determined that a Method 3 RC would eventually be necessary to support a response action outcome (RAO) statement due to the presence of dioxins (which are bioaccumulative) in the top two feet of soil, and the presence of asbestos. This Method 3 RC has been conducted assuming that an Activity and Use Limitation (AUL) will be implemented at the DDA prohibiting disruption of the ground surface. The risk characterization therefore does not evaluate any Site use or development other than incidental trespassing.

The Phase II investigations presented in this Phase II CSA Addendum consisted of ground water sampling in and around the DDA and soil sampling for asbestos within the DDA.

The nature and extent of soil contamination at the DDA was previously documented in Weston's 2007 Phase II CSA. Additional asbestos sampling has demonstrated that asbestos could be present within the footprint of the DDA fill area both horizontally and vertically. Groundwater sampling results are consistent with Weston's characterization in the 2007 Phase II CSA. Groundwater contains metals and sporadic PAH detections. Weston's 2007 Phase II CSA determined that these groundwater contaminants do not represent a significant source of contamination to river sediment or surface water.

The results of the human health and environmental risk characterization indicate that a condition of No Significant Risk (NSR) of harm to health, safety, public welfare, and the environment has been achieved at the DDA.

1.0 INTRODUCTION

On behalf of BHI, AMEC has completed a Phase II CSA Addendum pursuant to 310 Code of Massachusetts Regulations (CMR) 40.0830 of the Massachusetts Contingency Plan (MCP). This Phase II CSA Addendum serves as an update to a July 2007 Phase II CSA for the DDA portion of RTN 4-3024222 (Weston 2007). It presents the data collected at the DDA from June 2007 to the present, updates to the 2007 Phase II CSA as a result of the additional data collected, and an updated risk characterization. The property location is provided in Figure 1-1.

At the time of the July 2007 CSA, DDA was assigned RTN 4-3024105 and was classified as a Tier II Disposal Site under the MCP. The DDA was linked to RTN 4-3024222 in the January 2008 Tier IB Permit Application for the Site. A Phase II CSA addressing other exposure areas in this linked RTN – the manufacturing building area (MBA), the lead release area (LRA), the south rail spur (SRS), and the Neponset River – was finalized on October 18, 2011. These two Phase II CSAs together characterize RTN 4-3024222 at the property. Figure 1-2 presents all five exposure areas described in these two CSAs.

This Phase II CSA Addendum documents field investigations completed between June 2007 and the present and the resulting findings and laboratory analytical results. Any information collected prior to June 2007 for the DDA was presented in Weston's 2007 Phase II CSA. This report follows the same outline as Weston's 2007 report and only those sections where additional information was available were updated. Those sections that did not change indicate that there was no update from the 2007 Phase II CSA.

2.0 GENERAL SITE INFORMATION [310 CMR 40.0835(4)(A)]

There are no updates to Section 2.0 of Weston's 2007 Phase II CSA for the DDA.

3.0 SITE HISTORY [310 CMR 40.0835(4)(C)]

There are no updates to Section 3.0 of Weston's 2007 Phase II CSA for the DDA.

4.0 INVESTIGATIONS [310 CMR 40.0835(4)(D)1]

Weston's 2007 Phase II CSA for the DDA presents a discussion of the sampling activities conducted at the DDA through June 2007. The following sections present additional sampling that was conducted at the DDA after June 2007.

4.1 Investigation Activities and Results

4.1.1 Asbestos Sampling – April 2011

The Phase II CSA prepared by Weston in July 2007 was unable to conclude No Significant Risk (NSR) due to, among other things, the visually observed presence of asbestos in soil. In order to address the presence of asbestos at the Site and evaluate the risks associated with its presence, AMEC performed Asbestos in Soil (AIS) Investigations at the Site. During the week of April 25th, 2011, Certified Industrial Hygienist (CIH) / Certified Safety Professional (CSP) Michael Matilainen, of AMEC performed asbestos sampling assisted by Environmental Scientist, Alexander Ranieri.

AMEC collected soil samples at 42 locations, 20 of which were located at or just beyond the defined DDA perimeter, and 22 of which were collected within the DDA areas (further defined as the Eastern Clearing, Central Clearing, and Western Clearing areas). Figure 4-1 presents these soil sampling locations. Sample locations were predetermined based on a grid pattern and located in the field using a global positioning system (GPS) device. Soil samples were collected via hand excavation for lab analysis. At each location, samples were collected from two depth intervals, 0-3 inches (interval "A") and 3-24 inches (interval "B"). Note that additional sample was collected from locations 8 (both A & B) and 14 (both A & B). These samples were originally intended for Transmission Electron Microscopy (TEM) TEM analysis, and as such have "-TEM" at the end of each sample ID. However, this "-TEM" suffix does not necessarily correspond to TEM analysis, as some of these samples were submitted for Polarized Light Microscopy (PLM) analysis only. Sample duplicates were collected at a rate of approximately ten percent resulting in twelve duplicates from the following locations: 1A, 2A, 3A, 4A, 5A, 6A, 7A, 8A-TEM, 9A, 38A, 41B, and 42A. Due to the visual presence of asbestos containing material (ACM) at sampling Location 8, a surface sample and duplicate surface sample were collected from the leaf litter (samples 8AS- AR and 8AS-TEM) on the soil surface (above 0 inches).

These selected depth intervals were considered appropriate since the property is not proposed for any future intrusive activities or disturbance (such as construction or grading); an Activity and Use Limitation (AUL) to that effect will be implemented as part of the final Response Action Outcome (RAO) Statement. Samples from 0-24 inches adequately characterize surficial material that may potentially be contacted or suspended due to disturbance by trespassers or other transient Site occupants. Samples from 0-3 inches specifically address the potential for airborne asbestos to present an inhalation hazard under current and future Site conditions.

Samples were shipped to International Asbestos Testing Laboratories (IATL) of Mount Laurel, New Jersey, an asbestos-accredited laboratory. All samples were initially analyzed for total asbestos using PLM U.S. EPA Method 600/R-93/116. Mr. Matilainen, in conjunction with recommendation from IATL Laboratories, then selected an additional seven samples (Samples

8A-TEM, 8A-TEM-DUP, 8B-TEM, 14A-TEM, 14B-TEM, 33A, and 33B) for more sensitive analysis and specific asbestos type characterization via TEM. Samples were analyzed by an IATL proprietary TEM soil method based upon U.S. EPA Region 1 Asbestos in Soils, Sludge and Sediments, 1994. Table 4-1 presents a summary of soil samples and analyses[1].

PLM and TEM analysis results give the percent and type of asbestos in the sample. The asbestos content of manufactured items ranges from one percent to 100 percent. Materials containing asbestos greater than one percent (>1%) by weight are considered ACM by the U.S. EPA.

The only area where asbestos was detected visually or by either PLM or TEM was at Location 8. Table 4-2 presents a summary of results at this location. As described above, a total of seven samples were collected from Location 8 (two surficial debris samples, three soil samples from 0-3 inches which include one duplicate, and two soil samples from 3-24 inches). Chrysotile asbestos, the most common type of asbestos found in buildings (often defined as "white asbestos") was the primary type of asbestos found in this location. The following is a summary of the asbestos sampling results at location 8.

Asbestos was detected in both surficial samples with the following results: chrysotile asbestos was detected at 1.9% in 8AS-AR and chrysotile asbestos was detected at 1.7% and crocidolite was detected at 5.2% in sample 8AS-TEM (all detected via PLM).

Asbestos was detected in one of the three 0-3 inch samples (8A) at 1.3% as chrysotile via PLM. Trace amounts (<1%) of chrysotile asbestos were detected in the other two samples (8A-TEM and 8A-TEM-DUP) via PLM.

Chrysotile was detected at trace amounts in one of the associated deep samples (8B-TEM) collected from 3-24 inches via PLM. However, chrysotile asbestos was not detected in the other deep sample (8B) via PLM.

Of the seven samples that were submitted for TEM analysis, only two samples detected asbestos via this method. Samples 8B and 8A-TEM-DUP detected trace amounts of chrysotile asbestos via TEM analysis.

4.1.2 Asbestos Elutriator Results

Based on the results of the April 2011 asbestos sampling, asbestos was determined to be present in soil. Given the small area of AIS impact, the surficial presence of asbestos at the DDA is unlikely to be an exposure concern, especially given the unoccupied nature of the Site and the nature of the asbestos observed, which consisted of larger pieces (asbestos Transite board and fiber parts around 0.5 square inches in size) that are unlikely to become airborne. However, since asbestos was confirmed at >1% at Location 8, a condition of NSR could not be

[1] Because some submitted samples intended to be held for TEM analysis were analyzed by the laboratory by PLM, the sample IDs are not necessarily indicative of the method used. Table 4-1 clearly identifies the sample IDs and associated analyses.

demonstrated without further testing. AMEC conducted additional analysis that further characterizes the exposure potential associated with asbestos within the DDA.

To address the potential for risk, aliquots of the three DDA soil samples that had asbestos detections of >1% (sample 8A [0-3 inch surface soil] and samples 8AS-AR and 8AS-TEM [surface debris]) were tested for airborne fibers using the elutriator method[2]. Analyses were performed by EMS Laboratories of Pasadena, CA. This method provides "concentration measurements for the specific set of asbestos structure sizes and shapes that contribute to adverse biological effects" and is specifically designed for risk evaluation purposes. Specifically, it uses a dust generator (tumbler) to estimate the asbestos released from a soil sample during disturbance.

The analytical report from EMS Laboratories is presented in Appendix A. For the three samples analyzed, total asbestos fibers >5 micrometers (µm) ranged from 11.7 to 82.9 million fibers per gram. The sample with the maximum asbestos content was 8AS-TEM (surface debris). Table 4-3 presents a summary of the elutriator results for the asbestos analysis.

4.1.3 Groundwater Sampling

Weston's 2007 Phase II CSA for the DDA discussed investigation activities conducted within the DDA beginning in 1985 through June 2007. This Phase II CSA Addendum covers activities conducted at the Site from June 2007 to the present, that were not presented in the earlier CSA report. A total of four rounds of groundwater sampling have been conducted since June 2007. Copies of laboratory data reports are included in Appendix A.

On June 5 and 6, 2007, DD-MW-002, DD-MW-201, DD-MW-203, DD-MW-204, DD-MW-205, DD-MW-206, and DD-MW-207 were sampled for semivolatile organic compounds (SVOCs), extractable petroleum hydrocarbons (EPH), and dissolved metals. Groundwater samples were collected from upgradient (DD-MW-204 and DD-MW-205) and within and/or downgradient (DD-MW-002, DD-MW-201, DD-MW-203, DD-MW-206, and DD-MW-207) of the known fill area, depicted by the original RTN boundary of the DDA on Figure 4-2. The groundwater samples were analyzed by Severn Trent Laboratories, Inc. (STL) of Westfield, MA.

On June 25, 2007, DD-MW-208 was sampled and a duplicate was collected. The samples were submitted for analysis of SVOCs, volatile organic compounds (VOCs), EPH, and dissolved metals. DD-MW-208 was sampled again on July 23, 2007 and analyzed for SVOCs and EPH. The groundwater samples were analyzed by STL of Westfield, MA.

On December 11, 2007, DD-MW-201, DD-MW-203, DD-MW-207, and DD-MW-208 were sampled for SVOCs, EPH (carbon ranges only), and dissolved metals. A duplicate was collected at DD-MW-207. The groundwater samples were analyzed by Test America of Westfield, MA.

[2] Berman, DW and Kolk, A. Modified Elutriator Method for the Determination of Asbestos in Soils and Bulk Material. Aeolus, Inc., Albany, California and EMS Laboratories, Pasadena, California. Revision 1. http://www.aeolusinc.com/Modified_Elutriator_Method.pdf.

On May 19, 2008, DD-MW-002, DD-MW-201, DD-MW-203, DD-MW-204, DD-MW-205, DD-MW-206, DD-MW-207, and DD-MW-208 were sampled for SVOCs, EPH (carbon ranges only), dissolved metals, and 1,4-dioxane. A duplicate was collected at DD-MW-201and DD-MW-207. The groundwater samples were analyzed by Test America of Westfield, MA.

SVOCs were analyzed via U.S. EPA Method 8270C, EPH was analyzed via the MassDEP EPH method, dissolved metals were analyzed via U.S. EPA Method 6010, mercury was analyzed via U.S. EPA Method 7470a, VPH was analyzed via the MADEP volatile petroleum hydrocarbon (VPH) method, and VOCs were analyzed via USEPA Method 8260.

Historically, groundwater analytical results have detected polynuclear aromatic hydrocarbons (PAHs), dissolved metals, toluene, and bromoform in DDA groundwater. The most recent results confirm the detections of PAHs, and dissolved metals. Toluene and bromoform were not detected in any of the sampling rounds presented in this Phase II CSA Addendum. Refer to Table 4-4 for the groundwater analytical results presented in this Phase II CSA Addendum. Figure 4-2 presents the monitoring well locations at the DDA.

4.2 Field Methodology

Details regarding field methodology for work conducted prior to 2007 are included in the previously submitted Phase II CSA for the DDA.

The sampling activities associated with this Phase II Addendum were performed in accordance with MassDEP guidance and methods. Soil samples were collected via hand excavation using clean sampling tools and placed directly into sample containers. Groundwater samples were collected from monitoring wells using low-flow sampling techniques in accordance with U.S. EPA guidelines (U.S. EPA, 1996). Soil and groundwater samples were collected with sufficient quality assurance/quality control to meet MCP Presumptive Certainty criteria.

5.0 SITE HYDROGEOLOGICAL CHARACTERISTICS [310 CMR 40.0835(4)(D)3.]

There are no updates to Section 5.0 of Weston's 2007 Phase II CSA for the DDA.

6.0 NATURE AND EXTENT OF CONTAMINATION [310 CMR 40.0835(4)(F)]

6.1 Nature and Extent of Soil Contamination

The nature and extent of soil contamination was discussed in the 2007 Phase II CSA for the DDA for metals, PAHs, VOCs, SVOCs, EPH and VPH, dioxins, and polychlorinated biphenyls (PCBs). As discussed in the Phase II the boundary of the DDA was identified based on topography; clearings observed in historical aerial photographs; test pit and soil boring sampling conducted during investigations, RAMs, and IRAs; and geophysical surveys. This boundary is consistent with the observed presence of an artificial fill layer in this area.

The results of the asbestos delineation investigation identified ACM and asbestos fibers in soil (greater than 1%) in shallow soils [0-3 inches below ground surface (bgs)] in the vicinity of sampling location number 8. Trace amounts of asbestos were identified in samples from 3-24 inches bgs in the vicinity of sampling location number 8. The purpose of this AIS investigation was to delineate the extent of asbestos in the surface at the DDA. With the exception of sampling Location 8, asbestos was not detected or visually observed within sample locations both within and outside of the DDA boundary.

As described in the previous reports prepared by Weston, asbestos and ACM is a known component of the fill at the DDA. Although response actions during an IRA in 2005 removed 1,106 tons of asbestos-containing fill, Weston was not able to remove all of the asbestos-containing fill materials within the boundary of the DDA. The AIS sampling has confirmed that the surficial extent of asbestos and ACM has been delineated, and is most likely concentrated around Location 8; however, the Site has extensive vegetative cover throughout the inspected areas, which prohibited visual inspection of the entire DDA. While thorough inspections were completed in the sample locations, additional asbestos could be hidden in areas under vegetation. Although concentrations of asbestos appear to decrease with depth, asbestos could also be present in soil below 24 inches. AMEC has conservatively assumed that asbestos could be present within the footprint of the DDA fill area (the original RTN boundary) both horizontally and vertically.

6.2 Nature and Extent of Groundwater Contamination

As described in the Phase II CSA for the DDA, groundwater contamination at the DDA consists of dissolved metals, PAHs, and minimal VOCs. Table 6-1 presents a summary of the most recent DDA groundwater quality results.

All groundwater samples from the most recent sampling rounds contained detectable concentrations of one or more metals. In the 2007 Phase II CSA, detected metals included antimony, arsenic, barium, beryllium, cadmium, chromium, nickel, selenium, silver, thallium, vanadium, and zinc. The recent samples included some of these same metals, but not antimony, beryllium, cadmium, silver, and thallium. Two new metals were detected in the recent samples: mercury once at less than 1 part per billion (ppb) in DD-MW-201, and lead once at an estimated concentration below the 1 ppb reporting limit in DD-MW-208. Mercury was not detected in a subsequent sample from DD-MW-201. Recent concentrations of the other detected metals were similar to the levels reported in 2007; less than 10 ppb except for barium

and chromium. Barium (19-47 ppb) and chromium (1.9-35 ppb) levels were still highest in the wells located inside the DDA (DD-MW-001 and -002), but appeared to be declining over time.

A total of 13 SVOCs and two EPH carbon ranges were detected in groundwater samples collected from June 2007 to May 2008. Nine of these analytes (2,4-dinitrophenol, benzo(a)anthracene, benzo(g,h,i)pyrene, butylbenzylphthalate, chrysene, dibenzo(a,h,)anthracene, di-n-butyl phthalate, di-n-octyl phthalate, and indeno(1,2,3) pyrene) were detected only once in groundwater. Eight of the nine (all except 2,4-dinitrophenol) were detected in downgradient monitoring wells DD-MW-207 and DD-MW-208. 2,4-Dinitrophenol was detected in DD-MW-204 in 2008. All of these analytes had a low frequency of detection (less than 10%) and most were only detected once out of all of the groundwater sampling rounds. Bis(2-ethylhexyl)phthalate was detected in six wells (DD-MW-201, DD-MW-203, DD-MW-204, DD-MW-206, DD-MW-207, and DD-MW-208) in 2008. Fluoranthene was detected three times in 2007 using Method 8270 (DD-MW-207, DD-MW-208 and its duplicate); it was also detected in DD-MW-208 and its duplicate via the EPH analysis as well. Phenanthrene, C11-C22 Aromatic EPH, and C19-C36 Aliphatic EPH were detected in DD-MW-208 and its duplicate during the June 2007 sampling round.

As indicated in Weston's 2007 Phase II CSA, eight PAHs were detected in one groundwater sample collected in June 2006 from DD-MW-203, but the results of additional sampling later in the year suggested that the June 2006 results were an anomaly. The sporadic detections of PAHs in 2007-2008 suggest that 2006 results may not have been anomalous and low levels of PAHs may be present in groundwater at the Site. However, the infrequent and low detections of PAHs suggest that there is not a continuous plume of these contaminants at the DDA.

Both bromomethane and toluene were previously detected in groundwater samples in the DDA. Neither of these compounds were detected in the most recent sampling rounds, and as such are not considered to be a concern.

6.3 Nature and Extent of DDA Contamination in Surface Water/Sediment

As was indicated in Weston's 2007 Phase II CSA, the potential for impacts from the DDA to surface water or sediment has been evaluated and it has been confirmed that there are no impacts to surface water or sediment from the DDA. No new surface water or sediment data were collected since the 2007 CSA.

7.0 ENVIRONMENTAL FATE AND TRANSPORT [310 CMR 40.0835(4)(E)]

A complete discussion of the environmental fate and transport of the contaminants of concern (COCs) at the DDA were discussed in Weston's 2007 Phase II CSA. The additional data that were collected between Weston's 2007 Phase II CSA and this Phase II CSA Addendum did not encounter any new groups of analytes; as such, there are no updates to the Environmental Fate and Transport section.

8.0 CONCEPTUAL SITE MODEL

8.1 Introduction

There are no updates to Section 8.1 of Weston's Phase II 2007 CSA for the DDA.

8.2 Conceptual Site Model

Weston's 2007 Phase II CSA for the DDA presented a Conceptual Site Model (CSM) which is largely confirmed by the soil and groundwater sampling described in this Addendum, which was conducted after June 2007. Soil sampling for asbestos confirmed that this contaminant is present within the DDA boundary. The recent asbestos testing provided additional data on the type of ACM and the potential for airborne fibers as described in Sections 4 and 6.

Groundwater sampling confirmed that metals are the principal COCs, and concentrations appear to be stable or declining. Low-level detections of PAHs in groundwater were previously thought to be anomalous but have continued sporadically, and so are believed to be representative of groundwater. These compounds were included in the earlier CSM primarily as a soil contaminant, though the potential for migration to groundwater was recognized. The infrequent and low detections of PAHs suggest that there is not a continuous plume of these contaminants at the DDA.

9.0 EXPOSURE ASSESSMENT [310 CMR 40.0835(4)(G)]

Section 9.0 of Weston's 2007 Phase II CSA has been combined with Section 10.0 for this Phase II CSA Addendum. Refer to Section 10.0 for a discussion of the exposure assessment.

10.0 RISK CHARACTERIZATION [310 CMR 40.0835(4)(H)]

In accordance with the requirements of 310 CMR 40.0000 Subpart I of the MCP, a Method 3 Risk Characterization (RC) of harm to human health, public welfare, safety, and the environment has been completed. This Method 3 RC is included as Appendix B. A summary of the findings of the RC is presented below.

The Method 3 human health RC of soil and groundwater in the DDA evaluated potential exposures to current and future trespassers, and future hypothetical groundwater use as a potable supply. **The results of the human health risk characterization indicate that a condition of No Significant Risk can be demonstrated for soil and groundwater at DDA.**

The results of the evaluation of risk of harm to safety and public welfare indicates that no unsafe or nuisance conditions exist at the Site. Soil and groundwater constituent concentrations are less than their respective UCLs. **As such, a condition of No Significant Risk to public welfare and a condition of No Significant Risk to safety can be demonstrated at the Site.**

The evaluation of potential risk of harm to the environment included a Stage I screening evaluation of the presence of ecological receptors and potential habitat for terrestrial ecological receptors. **The Stage I screening demonstrated that potential risk to the environment could not be ruled out, so a Stage II Environmental Risk Characterization (ERC) was performed.**

In the Stage II ERC, potential exposures of herbivorous mammals, herbivorous avians, insectivorous mammals, insectivorous avians, carnivorous mammals, and carnivorous avians to COPECs in soil and the food web were evaluated using a hazard quotient approach. Hazard quotients are below 1 for all receptors except the short-tailed shrew. For the shrew, the NOAEL HQs exceeded 1 in DDA for only two COCs, and these HQs were below 10. These exposures are not expected to cause adverse environmental impacts to short-tailed shrew populations or populations at the Site, because the hazard quotient approach used in this evaluation is based on a sensitive individual receptor. Conservative exposure assumptions are combined with conservative toxicity assumptions, so that the resulting risk estimates overestimate potential effects to the populations. HQs within an order of magnitude of 1 are not likely to be associated with population effects. **Based on the finding that population-level effects for all receptors are not expected, a condition of No Significant Risk of harm to the environment exists.**

This human health and environmental risk characterization concludes that DDA achieves a condition of No Significant Risk.

11.0 DATA USABILITY AND REPRESENTATIVENESS

Data described in this Phase II CSA Addendum and in the original July 2007 Phase II CSA will be used in support of an RAO Statement for portions of the BMC Property. These data were collected after 2003 when the MADEP established "presumptive certainty" requirements as defined in "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data" (BWSC-CAM-VIIA, rev. 3.1 dated May 22, 2003). Copies of lab data packages used to support the RC for the DDA are provided in Appendix C of Weston's 2007 Phase II CSA for data collected up to June 2007, and are included in Appendix A of this Addendum for samples collected after that time.

Per 310 CMR 40.1056(2)(k), a representativeness evaluation and data usability assessment (REDUA) must be conducted for data that are used to support an RAO. MassDEP Policy #WSC-07-350, MCP Representativeness Evaluations and Data Usability Assessments, provides guidance on conducting REDUAs under the MCP. Appendix V of the MassDEP document is a REDUA worksheet.

REDUA has already been conducted for the data presented in Weston's July 2007 Phase II CSA for the DDA, though it was not documented in the REDUA worksheet format published by MassDEP in September 2007. As indicated in Section 9.2.1.1 of the 2007 CSA, Weston used only CAM-compliant, usable, and representative data, which included Weston's data collected from December 2004 through June 2007. Weston determined that data were CAM-compliant by confirming laboratory certification of data packages and by chemist review of each lab report. Weston removed results for individual analytes if they determined the results were not CAM-compliant. Weston also determined that data collected during these investigations were representative of the site conditions, and identified any results that had been affected by removal actions or were otherwise no longer representative of site conditions. Table 4-1 of Weston's 2007 Phase II CSA presents a summary of the soil and groundwater samples collected to support their Phase II CSA.

The information presented in Weston's 2007 Phase II CSA and in this Addendum have been compiled to complete the REDUA provided below. The following subsections provide a representativeness evaluation (11.1) and data usability assessment (11.2) in a format that coincides with the categories specified in the MassDEP worksheet. Appendix C presents the MassDEP worksheet for reference.

11.1 Representativeness Evaluation

A-1 <u>Conceptual Site Model (CSM)</u>

- Placement of fill at the Site or in the vicinity is believed to have started in the late 19th century coincident with the construction of the railroad and industrial development of the Property, and to have ended in the 1970s. The types of materials found in fill in the DDA include fill, demolition debris, machining waste, and testing waste. Some wastes were disposed in containers including 55-gallon drums. The types of contaminants include metals, PAH, EPH, dioxins, and asbestos.
- The fill at the Site was placed directly on the native soil surface. Soil contamination is thus of primary concern. However, other media that would have possibly been impacted

by the fill would include groundwater beneath the Site and surface water and sediment in Cedar Swamp Brook which bounds the Site to the north. Human or ecological receptors would be exposed to contaminants in soil, sediment, or surface water by direct contact or ingestion, and potentially through inhalation of suspended soil (dust).

- The sampling program was designed to characterize the nature and extent of contamination and evaluate potential migration pathways of contamination. Each release mechanism from waste source materials to impacted media was considered and corresponding sampling was conducted to the related media matrix. The results of the sampling program were used to verify and update the CSM. The data supports the following contamination migration pathways: from waste source materials to soil or groundwater, and from contaminated soil to groundwater. The data support the conclusion that contamination migration via groundwater flow or surface runoff, to surface water or sediment, is not a complete pathway.
- Waste source materials in drums and soils were transported off-site during RAM activities beginning in 2005. Approximately 2,191 tons of soil and debris were removed. The excavation ranged from 8-10 feet in depth in the western and eastern clearings and 13 feet in depth in the central clearing. All of the excavations were above the water table. Post excavation, contaminants in soil included metals, dioxin, and petroleum compounds. Concentrations in the depth interval of 0-5 ft bgs were higher than in the depth interval of 5-15 ft bgs.
- Asbestos-Containing Material (ACM) was encountered within the limits of the DDA fill, typically three feet in depth. Approximately 1,106 tons of ACM and soil were transported off-site during an IRA in 2005. Results of the recent asbestos sampling confirm that ACM is still present within the DDA boundary

A-2 Use of Field Screening Data

- The 2011 soil samples were visually screened for the presence of asbestos in addition to laboratory analysis of the samples. The visual observations correlated with the asbestos analytical results in terms of identifying a single location where asbestos was present.
- Weston performed field screening and visual observation of soil to select samples for laboratory analysis, during test pitting and soil boring advancement between 2004 and 2006. Some of the selected samples contained detectable levels of VOCs, SVOCs, dioxins, and metals based on laboratory analysis. Field screening was not used for characterizing exposure point concentrations.

A-3 Sampling Rationale in Support of RAO

- The boundary of the DDA was initially defined based on topography and clearings observed in historical air photos indicating potential disposal activities. The boundary that was initially developed based on these data was further supported by subsurface investigations confirming the presence of an artificial fill layer inside the DDA boundary.
- The analytical results of soil samples collected from inside the DDA boundary exhibited distinct characteristics, including elevated concentrations of metals, PAH/EPH, and dioxins as compared to samples collected from outside the DDA. RAM and IRA activities were conducted to remove buried waste barrels and significant quantities of source materials from the Site. Post-excavation soil samples indicate a significant reduction of the residual concentrations of these contaminants.

- The sampled area around the DDA boundary is called the Perimetric Area. All contaminants detected in soil samples in the Perimetric Area were detected at concentrations below background levels. Soil sample locations in the DDA and the Perimetric Area are indicated in Figure 4-1 from the July 2007 CSA.
- Groundwater samples and water table measurements have been collected from 12 monitoring wells screened at the water table, though some of these wells no longer exist due to RAM/IRA activity. Water level measurements indicate that DDA groundwater discharges to Cedar Swamp Brook. Of the nine remaining wells, two are upgradient of the DDA, two are in the center of the DDA, and five are downgradient of the DDA as indicated in Figure 4-2. Groundwater data confirmed the presence of metals, PAH, and EPH contamination within the boundary of the DDA. Metals and sporadic PAH/EPH were present at concentrations greater than background levels in groundwater samples collected from monitoring wells downgradient of the DDA. However, results of surface water and sediment sampling performed in Cedar Swamp Brook indicates that the impacted area does not extend to the brook.
- Soil sampling locations for asbestos were selected based on the delineated boundary of the DDA. Twenty samples were collected at or just beyond the DDA perimeter and 22 were collected from within the DDA area, as indicated in Figure 4-1. Separate samples were collected for surface (0-3 inches) and subsurface (3-24 inches) soils to evaluate the exposure potential associated with asbestos. Results confirmed the presence of asbestos at one location within the DDA boundary.

A-4 <u>Number, Distribution, and Handling of Samples</u>

- Sampling locations, as presented in the figures in this Phase II CSA Addendum and in the original July 2007 Phase II CSA, provide sufficient data for identifying the nature and extent of contaminants and conducting risk characterization. Discrete samples of soil, groundwater, surface water, and sediment were collected for laboratory analysis. Sample compositing was not performed prior to analysis.
- Soil sampling within the DDA was concentrated in areas where OHM was identified through test pits and soil borings. Soil sampling around the DDA was concentrated in the area of highest migration potential, along the steep slope between DDA and Cedar Swamp Brook. Five groundwater monitoring wells are positioned about equidistant along the downgradient (north) side of the Site, between DDA and Cedar Swamp Brook. Surface water and sediment were sampled at two upgradient and four downgradient locations.

A-5 <u>Temporal Distribution of Samples</u>

- Groundwater conditions warrant monitoring over time since seasonal water table changes may affect movement of contaminants. The fill materials in the DDA have been in place for 30 or more years; therefore groundwater conditions are expected to be relatively stable. The RAM and IRA activities that concluded in 2006 removed source materials, and these excavations and placement of fill could alter localized groundwater movement. Groundwater monitoring continued for three additional sampling rounds in June/July and December 2007, and May 2008. These rounds -- coupled with the earlier sampling rounds in May 2005, June 2006, and August 2006 – provide sufficient data to

assess temporal changes in groundwater conditions. Concentrations of contaminants appear to be stable or slowly diminishing over time, as indicated in Section 6.

- Soil concentrations are expected to diminish slowly over time based on migration of contaminants to groundwater, though this would be difficult to confirm since the same soil location cannot be sampled more than once. An evaluation of temporal changes in soil concentrations was not attempted. Surface water and sediment concentrations could change over time based on contaminant transport through groundwater; the temporal distribution of groundwater samples described above should be sufficient to predict changes in surface water or sediment.

A-6 Completeness of Data

- No significant data gaps were found.

A-7 Inconsistency and Uncertainty

- No investigation results were identified that are inconsistent with the CSM or would suggest uncertainty for an RAO.

A-8 Information Considered Unrepresentative

- The earlier rounds of groundwater data were not included in the RC, as these are considered to be less representative of current conditions compared to the most recent data. The May 2008 groundwater sampling results were used in the RC as indicated in Appendix B. Concentrations of contaminants appear to be stable or slowly diminishing over time, as indicated in Section 6.
- Because an AUL prohibiting intrusive activities will be instituted, only soils from 0 to 3 feet below ground surface were included in the RC.
- Any soil samples that were removed during the RAM or IRA excavation activities were not included in the RC, since they are no longer representative of soil at the Site.

Based on the above analysis, the data collected in the DDA that were used to support the RC are considered to be representative of conditions in this exposure area. Data are representative both spatially and temporally.

11.2 Data Usability Assessment

B-1 List MCP Activities and Data Evaluated

- The MCP investigations that resulted in site characterization data are described in Section 4 of the July 2007 Phase II CSA and this Addendum. The investigations have included sampling soil, groundwater, surface water, and sediment for laboratory analysis; test pit visual observations; a geophysical survey to evaluate buried metal; and removal of drums and other wastes through RAM and IRA activities.
- The data that were evaluated for this DUA -- including sample locations, dates, and lab report numbers -- are presented in Appendix C of the July 2007 Phase II CSA and in Table 11-1 of this Addendum.

B-2 Appropriateness of Analytical Methods

- Only CAM-compliant data were used in the 2007 Phase II CSA and this Addendum. Appropriate analytical methods were selected to provide data that quantitatively supports an RAO. Method types are listed in the lab data packages provided in Appendix C of Weston's 2007 Phase II CSA, and in Appendix A of this Addendum.

B-3 Appropriateness of Reporting Limits

- Analytical methods with appropriate reporting limits were selected to provide data that quantitatively support an RAO. Method reporting limits are listed in the lab data packages provided in Appendix C of Weston's 2007 Phase II CSA, and in Appendix A of this Addendum.

B-4 Analytical Accuracy and Precision

- An indication of whether or not the laboratory met all CAM requirements and performance standards without qualification is presented in the MCP Certification Forms and Case Narratives at the beginning of each laboratory report.
- Any data qualifications that were necessary were indicated on the Baker Hughes Data Validation Qualifiers spreadsheet presented along with each laboratory report in Appendix C of the July 2007 Phase II CSA, or in Appendix D of this Addendum. Data qualifiers were also incorporated into the data tables in Sections 4 and 6 and the RC of the July 2007 CSA and this Addendum.

B-5 Field Data Usability

- Samples were collected in accordance with accepted environmental practice including the CAM Quality Assurance and Quality Control Guidelines. Matrix spike/matrix spike duplicates (MS/MSDs), equipment blanks, and field duplicates were collected and were employed for appropriate qualification of data.

B-6 Rejected Data

- Data rejected as a result of the evaluation process are qualified as "R" and will not be used to support an RAO. Acid extractable analytes were rejected in DD-MW-208-R01-001-X and DD-MW-208-R01-001-D due to low surrogate recovery as indicated in Appendix D.

Based on the above analysis, the data collected in the DDA are considered to be usable to support an RAO, subject to the specific qualifications for selected data. There are sufficient unqualified and usable data to support an RAO.

12.0 CONCLUSIONS [310 CMR 40.0835(4)(l)]

As described in Weston's 2007 Phase II CSA, a RAM, IRA, Phase II investigations, and a Method 1 RC had been conducted at the Site. A condition of NSR could not be documented for the Site, among other reasons due to the presence of ACM and asbestos-contaminated soils.

Subsequent sampling for asbestos in soil, and groundwater sampling, have further characterized the Site and are documented in this Phase II CSA Addendum. In addition, a Method 3 RC has been conducted for the DDA, which replaces the earlier conclusions of Weston's Method 1 RC. The Method 3 RC was required to evaluate potential exposure to asbestos in soil, because Method 1 standards for asbestos are not currently available. Also, a Method 3 RC was required to evaluate potential environmental risks. The following conclusions are made based on the original July 2007 Phase II CSA and this Addendum:

- Environmental conditions at the Site have been significantly improved as a result of RAM and IRA activities completed to date. Removal of the buried waste barrels and significant quantities of dioxin, asbestos, and metals-containing materials from the Site has resulted in reduction of the residual concentrations of these contaminants in soil at the Site.
- Imminent Hazards do not exist at this Site under present conditions and site controls.
- A condition of No Substantial Hazard to human health and the environment has been achieved at the Site.
- The hydrogeological investigations within the Site and vicinity indicates that the Cedar Swamp Brook adjacent to the DDA serves as the final discharge point for the groundwater in the local area; hence, it is concluded that contamination present in the soil and groundwater at the Site would not migrate across the Cedar Swamp Brook and impact the groundwater quality in off-site areas.
- Results from soil and groundwater samples at the Site indicate that the concentration of metals, dioxin TEQ, and EPH in soil at the Site are elevated compared to the background concentrations at the Site. Contamination by dioxin, metals, and EPH is primarily present in soil at 0 to 5 ft depth within the Western and Central Clearing Area.
- Asbestos is present in surface and subsurface soil at the Site.
- Surface water and sediment sampling in Cedar Swamp Brook indicate that potential contaminant migration pathways from surface runoff or groundwater discharge to surface water and/or sediment are not complete pathways.
- A condition of NSR in soil and groundwater has been achieved for current and reasonably foreseeable future exposures, assuming the implementation of an AUL prohibiting disruption of the ground surface.
- A condition of NSR has been achieved for the environment as well.
- Background conditions have not been met for PAHs and for the metals barium, cadmium, chromium, mercury, nickel, vanadium, and zinc in Site groundwater.
- Background conditions exist in soil based on sampling performed in the Perimetric Area between the Site and Cedar Swamp Brook.

Based on the results of this Phase II CSA, a condition of NSR has been achieved at the Site.

13.0 REFERENCES

MADEP, 2003. Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data. Bureau of Waste Site Cleanup, Rev 3.1, May 22.

U.S. EPA, 1996. Method 1669 Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. July

Weston, 2007. Phase II Comprehensive Site Assessment Report, Demolition Debris Area, RTN 3-3023105. 30 July

Figures

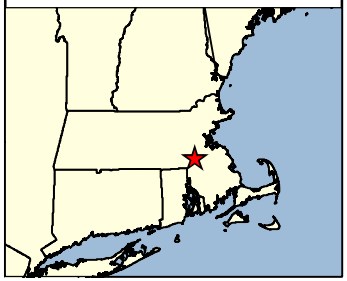
FIGURE 1-1

SITE LOCATION MAP

Bird Machine Inc. Company

100 Neponset Street
Walpole, MA

Location of Site



Source: Topo quad provided by National Geographic TOPO! Series: 2008

0 2,000 Feet

N

AMEC Earth & Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090

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Figure 1-2

Exposure Areas
Bird Machine Company
Risk Characterization

Property Boundary
Manufacturing Building Area
Lead Release Area 3
South Rail Spur Area
Neponset River Area
Demolition Debris Exposure Area

A Inset depicts full extent of Neponset River Exposure Area

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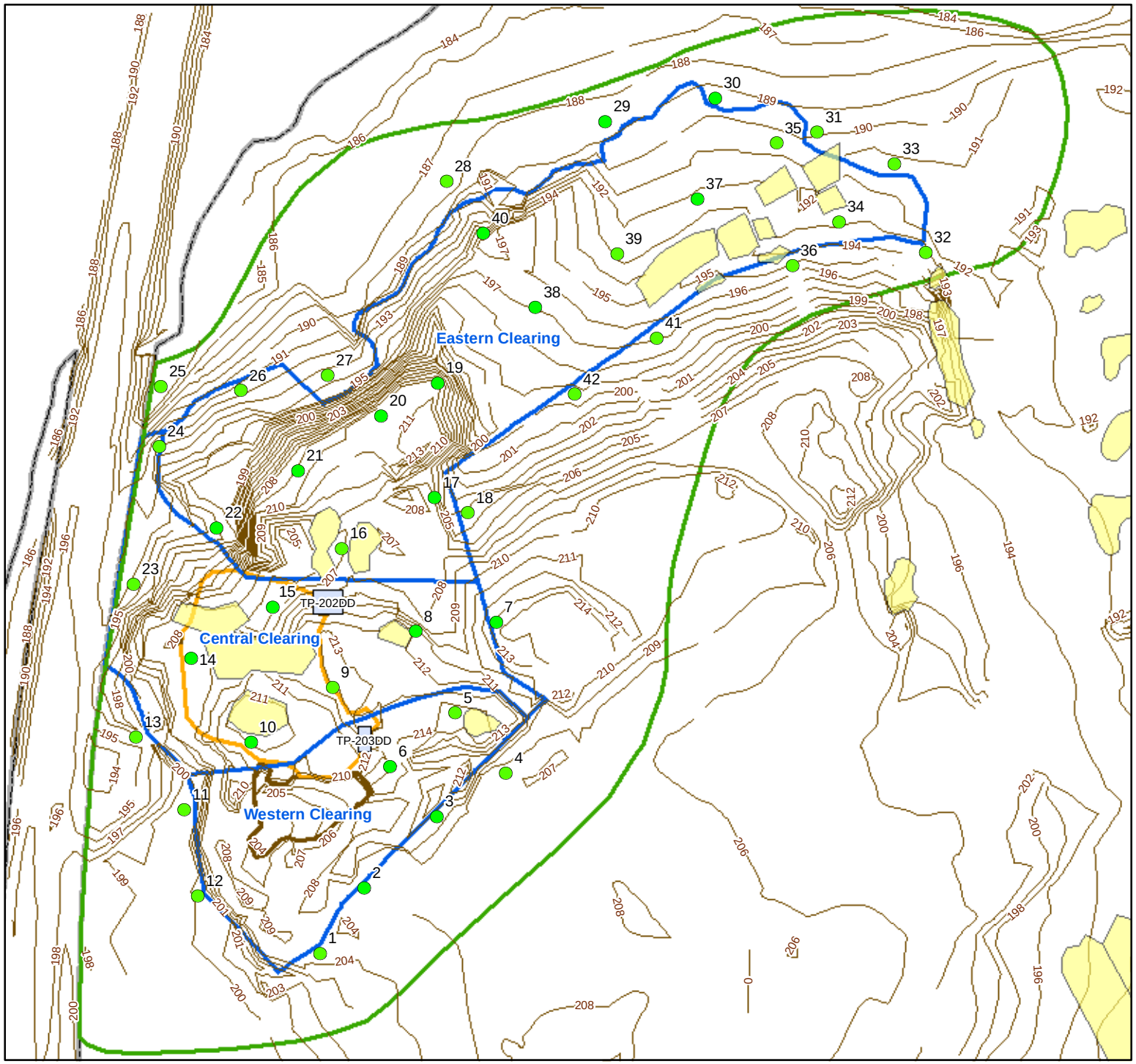


FIGURE 4-1

Asbestos In Soil Sampling Locations

Bird Machine Co.
Walpole, MA

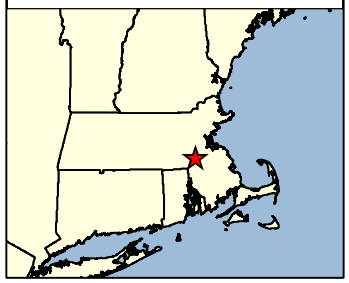
Legend

- Soil Sampling Location
- Demolition Debris Area
- Stockpile Area
- Test Pit
- Elevation Contour (feet)
- Perimetric Area
- Property Boundary

Excavation Area

- Central Clearing
- Western ACM

Location of Site



Elevation contour source: MassGIS
Base map source: Weston Solutions

0 100 Feet

N

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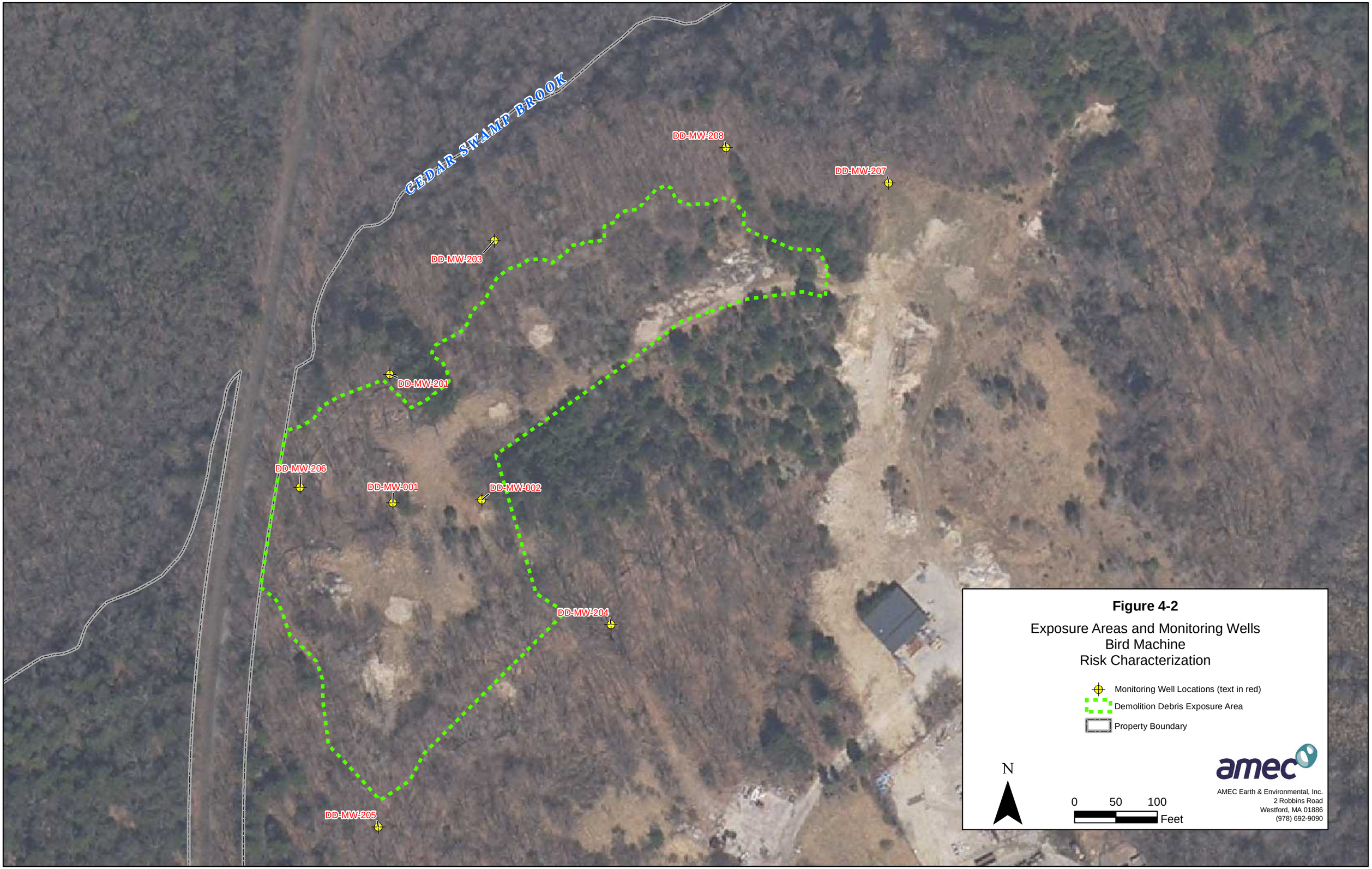

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Tables

Table 4-1
Asbestos Sampling and Analysis Plan
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

Sample ID (1)	Fill Observed (2)	PLM (3)	TEM (4)
1 A & B	No	X	
1A-DUP	No	X	
2 A & B	Yes	X	
2A-DUP	Yes	X	
3 A & B	Yes	X	
3A-DUP	Yes	X	
4 A & B	No	X	
4A-DUP	No	X	
5 A & B	No	X	
5A-DUP	No	X	
6 A & B	Yes	X	
6A-DUP	Yes	X	
7 A & B	Yes	X	
7A-DUP	Yes	X	
8AS	Yes	X	
8AS - TEM	Yes	X	
8 A & B	Yes	X	
8 A & B - TEM	Yes	X	X
8A - TEM DUP	Yes	X	X
9 A & B	No	X	
9A-DUP	No	X	
10 A & B	Yes	X	
11 A & B	No	X	
12 A & B	No	X	
13 A & B	No	X	
14 A & B	Yes	X	
14 A & B - TEM	Yes	X	X
15 A & B	Yes	X	
16 A & B	No	X	
17 A & B	Yes	X	
18 A & B	No	X	
19 A & B	Yes	X	
20 A & B	Yes	X	
21 A & B	Yes	X	
22 A & B	Yes	X	
23 A & B	No	X	
24 A & B	No	X	
25 A & B	No	X	
26 A & B	No	X	
27 A & B	No	X	
28 A & B	No	X	
29 A & B	Yes	X	
30 A & B	Yes	X	
31 A & B	No	X	
32 A & B	No	X	
33 A & B	No	X	
33 A & B	No	X	X
34 A & B	No	X	
35 A & B	No	X	
36 A & B	No	X	
36 A & B	No	X	
37 A & B	Yes	X	
38 A & B	Yes	X	
39 A & B	No	X	
40 A & B	Yes	X	
41 A & B	No	X	
42 A & B	No	X	

Notes:
(1)Samples were collected from two depths at each location, with the exception of location 8. For all samples, "A" designates samples collected from the 0-3" interval while "B" designates samples collected from 3-24" interval. A surface soil sample was also collected at location 8 which is designated by "AS"
(2) Visual characterization of samples as from fill material or native material
(3) "X" indicates sample was analyzed for total asbestos via Polarized Light Microscopy (PLM)
(4) "X" indicates sample was analyzed for asbestos via Transmission Electron Microscopy (TEM)

Table 4-2
Asbestos Soil Sampling Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

Sample ID	Depth	PLM Result (1)		TEM Result (2)	
8AS -AR	Surface	1.9	Chrysotile	--	
8AS-TEM	Surface	1.7 5.2	Chrysotile Crocidolite	--	
8A	0-3”	1.3	Chrysotile	--	
8A-TEM	0-3”	trace	Chrysotile	ND	
8A-TEM-DUP	0-3”	trace	Chrysotile	trace	Chrysotile
8B-TEM	3-24”	trace	Chrysotile	trace	Chrysotile

Notes:
(1) Results for samples analysed for total asbestos via Polaized Light Microscopy (PLM)
(2) Results for samples analysed for total asbestos via Transmission Electron Microscopy (TEM)
All samples were run for PLM analysis, while a smaller subset was analyzed via TEM
ND - Sample was non-detect for asbestos

Table 4-3
Results of Asbestos Elutriator Analysis
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

Sample ID	Depth	Elutriator Result Total Asbestos Fibers (MFG)
8AS -AR	Surface	15.1
8AS-TEM	Surface	82.9
8A-TEM	0-3”	11.7

Notes:
MFG - million fibers per gram
Results for samples analyzed for total asbestos via Elutriator Method Analysis

Table 4-4
Groundwater Sample Analytical Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

		Station:	DD-MW-001		DD-MW-002		DD-MW-201		DD-MW-203		DD-MW-204		DD-MW-205		DD-MW-206		DD-MW-207	
		Field Sample ID:	DD-MW-001-R02-X		DD-MW-002-R01-X		DD-MW-201-R04-X		DD-MW-203-R04-X		DD-MW-204-R02-X		DD-MW-205-R03-X		DD-MW-206-R04-X		DD-MW-207-R04-X	
		Sample Date:	6/5/2007		6/5/2007		6/5/2007		6/5/2007		6/5/2007		6/6/2007		6/5/2007		6/6/2007	
		Depth:	11.6 - 16.6 feet		9.8 - 14.8 feet		4 - 14 feet		4.5 - 12.5 feet		7.5 - 13.5 feet		5 - 11 feet		5 - 11 feet		5 - 15 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
120-82-1	1,2,4-TRICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
95-50-1	1,2-DICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
541-73-1	1,3-DICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
106-46-7	1,4-DICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
95-95-4	2,4,5-TRICHLOROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
88-06-2	2,4,6-TRICHLOROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
120-83-2	2,4-DICHLOROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
105-67-9	2,4-DIMETHYLPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
51-28-5	2,4-DINITROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
121-14-2	2,4-DINITROTOLUENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
606-20-2	2,6-DINITROTOLUENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
91-58-7	2-CHLORONAPHTHALENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
95-57-8	2-CHLOROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
91-57-6	2-METHYLNAPHTHALENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U
95-48-2	2-METHYLPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
95-48-7	2-METHYLPHENOL (O-CRESOL)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
88-75-5	2-NITROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
106-44-5	3&4-METHYLPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
91-94-1	3,3-DICHLOROBENZIDINE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
101-55-3	4-BROMOPHENYL PHENYL ETHER	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
106-47-8	4-CHLOROANILINE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
100-02-7	4-NITROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
83-32-9	ACENAPHTHENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U
208-96-8	ACENAPHTHYLENE	ug/l	0.3	U	0.3	U	0.32	U	0.31	U	0.31	U	0.3	U	0.31	U	0.3	U
98-86-2	ACETOPHENONE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
62-53-3	ANILINE	ug/l	51	UJ	51	UJ	53	UJ	52	UJ	51	UJ	51	UJ	52	UJ	51	UJ
120-12-7	ANTHRACENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U
103-33-3	AZOBENZENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	0.3	U	0.32	U	0.31	U	0.31	U	0.3	U	0.31	U	0.22	J
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.2	U	0.21	U	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	0.3	U	0.32	U	0.31	U	0.31	U	0.3	U	0.31	U	0.3	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.51	U	0.51	U	0.53	U	0.52	U	0.51	U	0.51	U	0.52	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	0.3	U	0.32	U	0.31	U	0.31	U	0.3	U	0.31	U	0.3	U
111-91-1	BIS(2-CHLOROETHOXY)METHANE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
111-44-4	BIS(2-CHLOROETHYL) ETHER	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
108-60-1	BIS(2-CHLOROISOPROPYL)ETHER	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
218-01-9	CHRYSENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	0.24	J
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.51	U	0.51	U	0.53	U	0.52	U	0.51	U	0.51	U	0.52	U	0.51	U
132-64-9	DIBENZOFURAN	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
84-66-2	DIETHYL PHTHALATE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
131-11-3	DIMETHYL PHTHALATE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	0.39	J
206-44-0	FLUORANTHENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	0.28	J
86-73-7	FLUORENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U
118-74-1	HEXACHLOROBENZENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U
87-68-3	HEXACHLOROBUTADIENE	ug/l	0.61	U	0.61	U	0.63	U	0.62	U	0.61	U	0.61	U	0.63	U	0.61	U
67-72-1	HEXACHLOROETHANE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.51	U	0.51	U	0.53	U	0.52	U	0.51	U	0.51	U	0.52	U	0.51	U
78-59-1	ISOPHORONE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
91-20-3	NAPHTHALENE	ug/l	1	U	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U
98-95-3	NITROBENZENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U
106-44-5	P-CRESOL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
87-86-5	PENTACHLOROPHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
85-01-8	PHENANTHRENE	ug/l	0.2	U	0.2	U	0.21	U	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U
108-95-2	PHENOL	ug/l	5.1	UJ	5.1	UJ	5.3	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
129-00-0	PYRENE	ug/l	5.1	U	5.1	U	5.3	U	5.2	U	5.1	U	5.1	U	5.2	U	0.29	J
35822-46-9	1,2,3,4,6,7,8-HpCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
67562-39-4	1,2,3,4,6,7,8-HpCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
55673-89-7	1,2,3,4,7,8,9-HpCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
39227-28-6	1,2,3,4,7,8-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
70648-26-9	1,2,3,4,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57653-85-7	1,2,3,6,7,8-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57117-44-9	1,2,3,6,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
19408-74-3	1,2,3,7,8,9-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
72918-21-9	1,2,3,7,8,9-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
40321-76-4	1,2,3,7,8-PeCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57117-41-6	1,2,3,7,8-PeCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
60851-34-5	2,3,4,6,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57117-31-4	2,3,4,7,8-PeCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
1746-01-6	2,3,7,8-TCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
51207-31-9	2,3,7,8-TCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
37871-00-4	HPCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
38998-75-3	HPCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
34465-46-8	HXCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
55684-94-1	HXCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
3268-87-9	OCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
39001-02-0	OCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
36088-22-9	PECDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
30402-15-4	PECDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
41903-57-5	TCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
55722-27-5	TCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
91-57-6	2-METHYLNAPHTHALENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
83-32-9	ACENAPHTHENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
208-96-8	ACENAPHTHYLENE	ug/l	0.3	U	0.32	U	0.32	U	0.3	U	0.3	U	0.3	U	0.31	U	0.32	U
120-12-7	ANTHRACENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	0.32	U	0.32	U	0.3	U	0.3	U	0.3	U	0.31	U	0.32	U
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.21	U	0.21	U	0.2	U	0.2	U	0.2	U	0.21	U	0.21	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	0.32	U	0.32	U	0.3	U	0.3	U	0.3	U	0.31	U	0.32	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.4	U	0.42	U	0.42	U	0.4	U	0.4	U	0.4	U	0.41	U	0.42	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	0.32	U	0.32	U	0.3	U	0.3	U	0.3	U	0.31	U	0.32	U
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	110	U	110	U	100	U	100	U	100	U	100	U	110	U
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
EPH1122	C11-C22 AROMATICS, UNADJUSTED	ug/l	100	U	110	U	110	U	100	U	100	U	100	U	100	U	110	U
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	110	U	110	U	100	U	100	U	100	U	100	U	110	U
EPH1936	C19-C36 ALIPHATICS (EPH-LL)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
VPH912	C9-C18 ALIPHATICS	ug/l	100	U	110	U	110	U	100	U	100	U	100	U	100	U	110	U
VPH912	C9-C18 ALIPHATICS (EPH-LL)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
218-01-9	CHRYSENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.4	U	0.42	U	0.42	U	0.4	U	0.4	U	0.4	U	0.41	U	0.42	U
206-44-0	FLUORANTHENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
86-73-7	FLUORENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.4	U	0.42	U	0.42	U	0.4	U	0.4	U	0.4	U	0.41	U	0.42	U
91-20-3	NAPHTHALENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
85-01-8	PHENANTHRENE	ug/l	0.2	U	0.21	U	0.21	U	0.2	U	0.2	U	0.2	U	0.21	U	0.21	U
129-00-0	PYRENE	ug/l	1	U	1.1	U	1.1	U	1	U	1	U	1	U	1	U	1.1	U
	TOTAL EPH	ug/l	100	U	110	U	110	U	100	U	100	U	100	U	100	U	110	U

Table 4-4
Groundwater Sample Analytical Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

		Station:	DD-MW-001		DD-MW-002		DD-MW-201		DD-MW-203		DD-MW-204		DD-MW-205		DD-MW-206		DD-MW-207	
		Field Sample ID:	DD-MW-001-R02-X		DD-MW-002-R01-X		DD-MW-201-R04-X		DD-MW-203-R04-X		DD-MW-204-R02-X		DD-MW-205-R03-X		DD-MW-206-R04-X		DD-MW-207-R04-X	
		Sample Date:	6/5/2007		6/5/2007		6/5/2007		6/5/2007		6/5/2007		6/6/2007		6/5/2007		6/6/2007	
		Depth:	11.6 - 16.6 feet		9.8 - 14.8 feet		4 - 14 feet		4.5 - 12.5 feet		7.5 - 13.5 feet		5 - 11 feet		5 - 11 feet		5 - 15 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
7440-36-0	ANTIMONY	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-38-2	ARSENIC	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-38-2	ARSENIC (DISSOLVED)	ug/l	2	U	2	U	0.81	J	1	U	1	U	2	U	1	U	5.7	V
7440-39-3	BARIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-39-3	BARIUM (DISSOLVED)	ug/l	47	V	32	V	44	V	12	V	17	V	18	V	26	V	38	V
7440-41-7	BERYLLIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-43-9	CADMIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-47-3	CHROMIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	35	V	7.3	V	25	V	16	V	11	V	8.4	V	23	V	4.9	V
7440-50-8	COPPER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7439-97-6	MERCURY	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
7440-02-0	NICKEL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-02-0	NICKEL (DISSOLVED)	ug/l	7.2	V	2.5	V	1.3	V	1.1	V	1.1	V	1.4	V	0.91	J	1	U
7782-49-2	SELENIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	2	U	2	U	9.3	J	1	U	1	U	2	U	1	U	1	U
7440-22-4	SILVER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-22-4	SILVER (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-28-0	THALLIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-28-0	THALLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-62-2	VANADIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-62-2	VANADIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-66-6	ZINC	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-66-6	ZINC (DISSOLVED)	ug/l	5	U	5	U	2.5	U	2.4	J	2.1	J	5	U	2.7	V	2.5	U
630-20-6	1,1,1,2-TETRACHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
71-55-6	1,1,1-TRICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
79-34-5	1,1,2,2-TETRACHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
79-00-5	1,1,2-TRICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-34-3	1,1-DICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-35-4	1,1-DICHLOROETHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
563-58-6	1,1-DICHLOROPROPENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
87-61-6	1,2,3-TRICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
96-18-4	1,2,3-TRICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
120-82-1	1,2,4-TRICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
95-63-6	1,2,4-TRIMETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
95-50-1	1,2-DICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
107-06-2	1,2-DICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
78-87-5	1,2-DICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108678	1,3,5-TRIMETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
541-73-1	1,3-DICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
142-28-9	1,3-DICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
106-46-7	1,4-DICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
123-91-1	1,4-DIOXANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
594-20-7	2,2-DICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
78-93-3	2-BUTANONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
95-49-8	2-CHLOROTOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
591-78-6	2-HEXANONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
106-43-4	4-CHLOROTOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
99-87-6	4-ISOPROPYLTOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108-10-1	4-METHYL-2-PENTANONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
67-64-1	ACETONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
71-43-2	BENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108-86-1	BROMOBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-27-4	BROMODICHLOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-25-2	BROMOFORM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
74-83-9	BROMOMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-15-0	CARBON DISULFIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
56-23-5	CARBON TETRACHLORIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108-90-7	CHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
74-97-5	CHLOROBROMOMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-00-3	CHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
67-66-3	CHLOROFORM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
74-87-3	CHLOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
156-59-2	CIS-1,2-DICHLOROETHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
10061-01-5	CIS-1,3-DICHLOROPROPENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
124-48-1	DIBROMOCHLOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
74-95-3	DIBROMOMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-71-8	DICHLORODIFLUOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
60-29-7	DIETHYL ETHER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108-20-3	DIISOPROPYL ETHER (DIPE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
106-93-4	ETHYLENE DIBROMIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
637-92-3	ETHYLENE TERT-BUTYL ETHER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
87-68-3	HEXACHLOROBUTADIENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
	ISOPROPYL ETHER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
98-82-8	ISOPROPYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
	M,P-XYLENES	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-09-2	METHYLENE CHLORIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
1634-04-4	METHYL-T-BUTYL ETHER (MTBE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
104-51-8	N-BUTYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
103-65-1	N-PROPYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
135-98-8	SEC-BUTYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
100-42-5	STYRENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
994-05-8	TERT-AMYL METHYL ETHER (TAME)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
98-06-6	TERT-BUTYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
127-18-4	TETRACHLOROETHYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
109-99-9	TETRAHYDROFURAN	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
156-60-5	TRANS-1,2-DICHLOROETHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
79-01-6	TRICHLOROETHYLENE (TCE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-69-4	TRICHLOROFLUOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
75-01-4	VINYL CHLORIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
71-43-2	BENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, ADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, UNADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
VPH910	C9-C10 AROMATICS	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
VPH912	C9-C12 ALIPHATICS, ADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
VPH912	C9-C12 ALIPHATICS, UNADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
	M,P-XYLENES	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
1634-04-4	METHYL-T-BUTYL ETHER (MTBE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
	TOTAL VPH	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	

Notes:
ug/L - micrograms per liter
V - Valid result, no qualification needed
U - not detected, laboratory reporting limit listed
J - concentration (or reporting limit) is estimated
DDA - Demolition Debris Area
NA - Not analyzed

Table 4-4
Groundwater Sample Analytical Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

		Station:	DD-MW-208		DD-MW-208		DD-MW-208		DD-MW-201		DD-MW-203		DD-MW-207		DD-MW-207		DD-MW-208	
		Field Sample ID:	DD-MW-208-R01-001-		DD-MW-208-R01-001-2		DD-MW-208-R02-X		DD-MW-201-R05-X		DD-MW-203-R05-X		DD-MW-207-R05-X		DD-MW-207-R05-D		DD-MW-208-R03-X	
		Sample Date:	6/25/2007		6/25/2007		7/23/2007		12/11/2007		12/11/2007		12/11/2007		12/11/2007		12/11/2007	
		Depth:	3 - 13 feet		3 - 13 feet		3 - 13 feet		4 - 14 feet		4.5 - 12.5 feet		5 - 15 feet		5 - 15 feet		3 - 13 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
120-82-1	1,2,4-TRICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
95-50-1	1,2-DICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
541-73-1	1,3-DICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
106-46-7	1,4-DICHLOROBENZENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
95-95-4	2,4,5-TRICHLOROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
88-06-2	2,4,6-TRICHLOROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
120-83-2	2,4-DICHLOROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
105-67-9	2,4-DIMETHYLPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
51-28-5	2,4-DINITROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.5	U	5.1	UJ
121-14-2	2,4-DINITROTOLUENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
606-20-2	2,6-DINITROTOLUENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
91-58-7	2-CHLORONAPHTHALENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
95-57-8	2-CHLOROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
91-57-6	2-METHYLNAPHTHALENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
95-48-2	2-METHYLPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
95-48-7	2-METHYLPHENOL (O-CRESOL)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
88-75-5	2-NITROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
106-44-5	3&4-METHYLPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
91-94-1	3,3-DICHLOROBENZIDINE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U *
101-55-3	4-BROMOPHENYL PHENYL ETHER	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
106-47-8	4-CHLOROANILINE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U *
100-02-7	4-NITROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
83-32-9	ACENAPHTHENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
208-96-8	ACENAPHTHYLENE	ug/l	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U	0.3	U	0.33	U	0.3	U
98-86-2	ACETOPHENONE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
62-53-3	ANILINE	ug/l	51	U	51	U	52	U	51	U	51	U	51	U	55	U	51	U
120-12-7	ANTHRACENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
103-33-3	AZOBENZENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U	0.3	U	0.33	U	0.3	U
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	0.2	U	0.22	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U	0.3	U	0.33	U	0.3	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.51	U	0.51	U	0.21	J	0.51	U	0.51	U	0.51	U	0.55	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U	0.3	U	0.33	U	0.3	U
111-91-1	BIS(2-CHLOROETHOXY)METHANE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
111-44-4	BIS(2-CHLOROETHYL) ETHER	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
108-60-1	BIS(2-CHLOROISOPROPYL)ETHER	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.1	U	5.1	U	0.34	J	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
218-01-9	CHRYSENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.51	U	0.51	U	0.42	J	0.51	U	0.51	U	0.51	U	0.55	U	0.51	U
132-64-9	DIBENZOFURAN	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
84-66-2	DIETHYL PHTHALATE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
131-11-3	DIMETHYL PHTHALATE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
206-44-0	FLUORANTHENE	ug/l	0.37	J	0.25	J	1	U	1	U	1	U	1	U	1.1	U	1	U
86-73-7	FLUORENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
118-74-1	HEXACHLOROBENZENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
87-68-3	HEXACHLOROBUTADIENE	ug/l	0.61	U	0.61	U	0.62	U	0.61	U	0.61	U	0.61	U	0.66	U	0.61	U
67-72-1	HEXACHLOROETHANE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.51	U	0.51	U	0.38	J	0.51	U	0.51	U	0.51	U	0.55	U	0.51	U
78-59-1	ISOPHORONE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
91-20-3	NAPHTHALENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U
98-95-3	NITROBENZENE	ug/l	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
106-44-5	P-CRESOL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
87-86-5	PENTACHLOROPHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
85-01-8	PHENANTHRENE	ug/l	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	0.2	U	0.22	U	0.2	U
108-95-2	PHENOL	ug/l	5.1	R	5.1	R	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.5	UJ	5.1	UJ
129-00-0	PYRENE	ug/l	0.28	J	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.1	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
67562-39-4	1,2,3,4,6,7,8-HpCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
55673-89-7	1,2,3,4,7,8,9-HpCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
39227-28-6	1,2,3,4,7,8-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
70648-26-9	1,2,3,4,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57653-85-7	1,2,3,6,7,8-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57117-44-9	1,2,3,6,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
19408-74-3	1,2,3,7,8,9-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
72918-21-9	1,2,3,7,8,9-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
40321-76-4	1,2,3,7,8-PeCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57117-41-6	1,2,3,7,8-PeCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
60851-34-5	2,3,4,6,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
57117-31-4	2,3,4,7,8-PeCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
1746-01-6	2,3,7,8-TCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
51207-31-9	2,3,7,8-TCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
37871-00-4	HPCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
38998-75-3	HPCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
34465-46-8	HXCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
55684-94-1	HXCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
3268-87-9	OCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
39001-02-0	OCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
36088-22-9	PECDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
30402-15-4	PECDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
41903-57-5	TCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
55722-27-5	TCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA	
91-57-6	2-METHYLNAPHTHALENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
83-32-9	ACENAPHTHENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
208-96-8	ACENAPHTHYLENE	ug/l	0.3	U	0.31	U	0.31	U	NA		NA		NA		NA		NA	
120-12-7	ANTHRACENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	0.31	U	0.31	U	NA		NA		NA		NA		NA	
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.21	U	0.21	U	NA		NA		NA		NA		NA	
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	0.31	U	0.31	U	NA		NA		NA		NA		NA	
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.4	U	0.41	U	0.42	U	NA		NA		NA		NA		NA	
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	0.31	U	0.31	U	NA		NA		NA		NA		NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	290	J	460	J	100	U	100	U	100	U	100	U	100	U	NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l							NA		NA		NA		NA			
EPH1122	C11-C22 AROMATICS, UNADJUSTED	ug/l	290	J	470	J	100	U	100	U	100	U	100	U	100	U	100	U
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	130	V	100	U	100	U	100	U	100	U	100	U	100	U
EPH1936	C19-C36 ALIPHATICS (EPH-LL)	ug/l							NA		NA		NA		NA			
VPH912	C9-C18 ALIPHATICS	ug/l	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U *
VPH912	C9-C18 ALIPHATICS (EPH-LL)	ug/l							NA		NA		NA		NA			
218-01-9	CHRYSENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.4	U	0.41	U	0.42	U	NA		NA		NA		NA		NA	
206-44-0	FLUORANTHENE	ug/l	3.4	V	3.5	V	1	U	NA		NA		NA		NA		NA	
86-73-7	FLUORENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.4	U	0.41	U	0.42	U	NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
85-01-8	PHENANTHRENE	ug/l	0.62	J	0.37	J	0.21	U	NA		NA		NA		NA		NA	
129-00-0	PYRENE	ug/l	1	U	1	U	1	U	NA		NA		NA		NA		NA	
	TOTAL EPH	ug/l	290	J	600	J	100	U	100	U	100	U	100	U	100	U	100	U

Table 4-4
Groundwater Sample Analytical Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

		Station:	DD-MW-208		DD-MW-208		DD-MW-208		DD-MW-201		DD-MW-203		DD-MW-207		DD-MW-207		DD-MW-208	
		Field Sample ID:	DD-MW-208-R01-001-		DD-MW-208-R01-001-2		DD-MW-208-R02-X		DD-MW-201-R05-X		DD-MW-203-R05-X		DD-MW-207-R05-X		DD-MW-207-R05-D		DD-MW-208-R03-X	
		Sample Date:	6/25/2007		6/25/2007		7/23/2007		12/11/2007		12/11/2007		12/11/2007		12/11/2007		12/11/2007	
		Depth:	3 - 13 feet		3 - 13 feet		3 - 13 feet		4 - 14 feet		4.5 - 12.5 feet		5 - 15 feet		5 - 15 feet		3 - 13 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
7440-36-0	ANTIMONY	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	1	U	NA		1	U	1	U	1	U	1	U	1	U
7440-38-2	ARSENIC	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-38-2	ARSENIC (DISSOLVED)	ug/l	1.7	J	1.7	J	NA		1	U	1	U	10	V	10	V	1	U
7440-39-3	BARIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-39-3	BARIUM (DISSOLVED)	ug/l	27	V	26	V	NA		38	V	11	V	45	V	44	V	25	V
7440-41-7	BERYLLIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	2	U	1	U	NA		2	U	2	U	2	U	2	U	2	U
7440-43-9	CADMIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	NA		1	U	1	U	1	U	1	U	1	U
7440-47-3	CHROMIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	9.8	V	11	V	NA		22	V	15	V	10	V	9.1	V	25	V
7440-50-8	COPPER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	1	U	NA		1	U	1	U	1	U	1	U	1	U
7439-97-6	MERCURY	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	NA		0.71	V	0.2	U	0.2	U	0.2	U	0.2	U
7440-02-0	NICKEL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-02-0	NICKEL (DISSOLVED)	ug/l	3.6	V	3.2	V	NA		3.3	V	2	U	2	U	2	U	0.96	J
7782-49-2	SELENIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	2	U	2	U	NA		1	U	1	U	1	U	1	U	1	U
7440-22-4	SILVER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-22-4	SILVER (DISSOLVED)	ug/l	1	U	1	U	NA		1	U	1	U	1	U	1	U	1	U
7440-28-0	THALLIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-28-0	THALLIUM (DISSOLVED)	ug/l	1	U	1	U	NA		1	U	1	U	1	U	1	U	1	U
7440-62-2	VANADIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-62-2	VANADIUM (DISSOLVED)	ug/l	0.91	J	1	J	NA		2	U	2	U	2	U	2	U	2	U
7440-66-6	ZINC	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
7440-66-6	ZINC (DISSOLVED)	ug/l	9.4	V	7.7	V	NA		2.4	J	1.9	J	1.5	J	1.2	J	20	V
630-20-6	1,1,1,2-TETRACHLOROETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
71-55-6	1,1,1-TRICHLOROETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
79-34-5	1,1,2,2-TETRACHLOROETHANE	ug/l	2.5	U	2.5	U	NA		NA		NA		NA		NA		NA	
79-00-5	1,1,2-TRICHLOROETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-34-3	1,1-DICHLOROETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-35-4	1,1-DICHLOROETHENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
563-58-6	1,1-DICHLOROPROPENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
87-61-6	1,2,3-TRICHLOROBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
96-18-4	1,2,3-TRICHLOROPROPANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
120-82-1	1,2,4-TRICHLOROBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
95-63-6	1,2,4-TRIMETHYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ug/l	25	U	25	U	NA		NA		NA		NA		NA		NA	
95-50-1	1,2-DICHLOROBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
107-06-2	1,2-DICHLOROETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
78-87-5	1,2-DICHLOROPROPANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
108678	1,3,5-TRIMETHYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
541-73-1	1,3-DICHLOROBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
142-28-9	1,3-DICHLOROPROPANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
106-46-7	1,4-DICHLOROBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
123-91-1	1,4-DIOXANE	ug/l	250	U	250	U	NA		NA		NA		NA		NA		NA	
594-20-7	2,2-DICHLOROPROPANE	ug/l	5	UJ	5	UJ	NA		NA		NA		NA		NA		NA	
78-93-3	2-BUTANONE	ug/l	50	U	50	U	NA		NA		NA		NA		NA		NA	
95-49-8	2-CHLOROTOLUENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
591-78-6	2-HEXANONE	ug/l	50	U	50	U	NA		NA		NA		NA		NA		NA	
106-43-4	4-CHLOROTOLUENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
99-87-6	4-ISOPROPYLTOLUENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
108-10-1	4-METHYL-2-PENTANONE	ug/l	50	U	50	U	NA		NA		NA		NA		NA		NA	
67-64-1	ACETONE	ug/l	250	U	250	U	NA		NA		NA		NA		NA		NA	
71-43-2	BENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
108-86-1	BROMOBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-27-4	BROMODICHLOROMETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-25-2	BROMOFORM	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
74-83-9	BROMOMETHANE	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
75-15-0	CARBON DISULFIDE	ug/l	50	UJ	50	UJ	NA		NA		NA		NA		NA		NA	
56-23-5	CARBON TETRACHLORIDE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
108-90-7	CHLOROBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
74-97-5	CHLOROBROMOMETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-00-3	CHLOROETHANE	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
67-66-3	CHLOROFORM	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
74-87-3	CHLOROMETHANE	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
156-59-2	CIS-1,2-DICHLOROETHENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
10061-01-5	CIS-1,3-DICHLOROPROPENE	ug/l	2.5	U	2.5	U	NA		NA		NA		NA		NA		NA	
124-48-1	DIBROMOCHLOROMETHANE	ug/l	2.5	U	2.5	U	NA		NA		NA		NA		NA		NA	
74-95-3	DIBROMOMETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-71-8	DICHLORODIFLUOROMETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
60-29-7	DIETHYL ETHER	ug/l	50	U	50	U	NA		NA		NA		NA		NA		NA	
108-20-3	DIISOPROPYL ETHER (DIPE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
106-93-4	ETHYLENE DIBROMIDE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
637-92-3	ETHYLENE TERT-BUTYL ETHER	ug/l	25	U	25	U	NA		NA		NA		NA		NA		NA	
87-68-3	HEXACHLOROBUTADIENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
	ISOPROPYL ETHER	ug/l	50	U	50	U	NA		NA		NA		NA		NA		NA	
98-82-8	ISOPROPYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
	M,P-XYLENES	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
75-09-2	METHYLENE CHLORIDE	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
1634-04-4	METHYL-T-BUTYL ETHER (MTBE)	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	25	U	25	U	NA		NA		NA		NA		NA		NA	
104-51-8	N-BUTYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
103-65-1	N-PROPYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
135-98-8	SEC-BUTYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
100-42-5	STYRENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
994-05-8	TERT-AMYL METHYL ETHER (TAME)	ug/l	25	U	25	U	NA		NA		NA		NA		NA		NA	
98-06-6	TERT-BUTYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
127-18-4	TETRACHLOROETHYLENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
109-99-9	TETRAHYDROFURAN	ug/l	50	U	50	U	NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
156-60-5	TRANS-1,2-DICHLOROETHENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ug/l	2.5	U	2.5	U	NA		NA		NA		NA		NA		NA	
79-01-6	TRICHLOROETHYLENE (TCE)	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-69-4	TRICHLOROFLUOROMETHANE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
75-01-4	VINYL CHLORIDE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
71-43-2	BENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, ADJUSTED	ug/l	100	U	100	U	NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, UNADJUSTED	ug/l	100	U	100	U	NA		NA		NA		NA		NA		NA	
VPH910	C9-C10 AROMATICS	ug/l	100	U	100	U	NA		NA		NA		NA		NA		NA	
VPH912	C9-C12 ALIPHATICS, ADJUSTED	ug/l	100	U	100	U	NA		NA		NA		NA		NA		NA	
VPH912	C9-C12 ALIPHATICS, UNADJUSTED	ug/l	100	U	100	U	NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
	M,P-XYLENES	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
1634-04-4	METHYL-T-BUTYL ETHER (MTBE)	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	10	U	10	U	NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	5	U	5	U	NA		NA		NA		NA		NA		NA	
	TOTAL VPH	ug/l	100	U	100	U	NA		NA		NA		NA		NA		NA	

Notes:
ug/L - micrograms per liter
V - Valid result, no qualification needed
U - not detected, laboratory reporting limit listed
J - concentration (or reporting limit) is estimated
DDA - Demolition Debris Area
NA - Not analyzed

Table 4-4
Groundwater Sample Analytical Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

		Station:	DD-MW-201		DD-MW-201		DD-MW-002		DD-MW-203		DD-MW-204		DD-MW-205		DD-MW-206		DD-MW-207		DD-MW-208	
		Field Sample ID:	DD-MW-201-R06-X		DD-MW-201-R06-D		DD-MW-002-R02-X		DD-MW-203-R06-X		DD-MW-204-R05-X		DD-MW-205-R05-X		DD-MW-206-R05-X		DD-MW-207-R06-X		DD-MW-208-R04-X	
		Sample Date:	5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008	
		Depth:	4 - 14 feet		4 - 14 feet		9.8 - 14.8 feet		4.5 - 12.5 feet		7.5 - 13.5 feet		5 - 11 feet		5 - 11 feet		5 - 15 feet		3 - 13 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
120-82-1	1,2,4-TRICHLOROBENZENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
95-50-1	1,2-DICHLOROBENZENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
541-73-1	1,3-DICHLOROBENZENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
106-46-7	1,4-DICHLOROBENZENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
95-95-4	2,4,5-TRICHLOROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	U	5.1	UJ	5.1	UJ	5.1	UJ	5.2	U	5.1	U
88-06-2	2,4,6-TRICHLOROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	U	5.1	U
120-83-2	2,4-DICHLOROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	U	5.1	U
105-67-9	2,4-DIMETHYLPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	U	5.1	U
51-28-5	2,4-DINITROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	0.84	J	5.1	UJ	5.1	UJ	5.2	U	5.1	U
121-14-2	2,4-DINITROTOLUENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
606-20-2	2,6-DINITROTOLUENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
91-58-7	2-CHLORONAPHTHALENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
95-57-8	2-CHLOROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	U	5.1	U
91-57-6	2-METHYLNAPHTHALENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
95-48-2	2-METHYLPHENOL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
95-48-7	2-METHYLPHENOL (O-CRESOL)	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	U	5.1	U
88-75-5	2-NITROPHENOL	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
106-44-5	3&4-METHYLPHENOL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
91-94-1	3,3-DICHLOROBENZIDINE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
101-55-3	4-BROMOPHENYL PHENYL ETHER	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
106-47-8	4-CHLOROANILINE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
100-02-7	4-NITROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
83-32-9	ACENAPHTHENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
208-96-8	ACENAPHTHYLENE	ug/l	0.31	U	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.31	U	0.3	U
98-86-2	ACETOPHENONE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
62-53-3	ANILINE	ug/l	52	U	51	U	51	U	51	UJ	51	U	51	U	51	U	52	U	51	U
120-12-7	ANTHRACENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
103-33-3	AZOBENZENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.31	U	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.31	U	0.3	U
50-32-8	BENZO(A)PYRENE	ug/l	0.21	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.21	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.31	U	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.31	U	0.3	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.52	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.52	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.31	U	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.31	U	0.3	U
111-91-1	BIS(2-CHLOROETHOXY)METHANE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
111-44-4	BIS(2-CHLOROETHYL) ETHER	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
108-60-1	BIS(2-CHLOROISOPROPYL)ETHER	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	0.48	J	5.1	U	5.1	U	0.43	J	0.45	J	5.1	U	0.49	J	0.51	J	1.6	J
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
218-01-9	CHRYSENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.52	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.52	U	0.51	U
132-64-9	DIBENZOFURAN	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
84-66-2	DIETHYL PHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
131-11-3	DIMETHYL PHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	1.5	J
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
206-44-0	FLUORANTHENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
86-73-7	FLUORENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
118-74-1	HEXACHLOROBENZENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
87-68-3	HEXACHLOROBUTADIENE	ug/l	0.62	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.61	U	0.62	U	0.61	U
67-72-1	HEXACHLOROETHANE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.52	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.52	U	0.51	U
78-59-1	ISOPHORONE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
91-20-3	NAPHTHALENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
98-95-3	NITROBENZENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
106-44-5	P-CRESOL	ug/l	5.2	U	5.1	U	5.1	UJ	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
87-86-5	PENTACHLOROPHENOL	ug/l	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	UJ	1	U	1	U
85-01-8	PHENANTHRENE	ug/l	0.21	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.21	U	0.2	U
108-95-2	PHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ
129-00-0	PYRENE	ug/l	5.2	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.2	U	5.1	U
35822-46-9	1,2,3,4,6,7,8-HpCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
67562-39-4	1,2,3,4,6,7,8-HpCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
55673-89-7	1,2,3,4,7,8,9-HpCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
39227-28-6	1,2,3,4,7,8-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
70648-26-9	1,2,3,4,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
57653-85-7	1,2,3,6,7,8-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
57117-44-9	1,2,3,6,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
19408-74-3	1,2,3,7,8,9-HxCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
72918-21-9	1,2,3,7,8,9-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
40321-76-4	1,2,3,7,8-PeCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
57117-41-6	1,2,3,7,8-PeCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
60851-34-5	2,3,4,6,7,8-HxCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
57117-31-4	2,3,4,7,8-PeCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
1746-01-6	2,3,7,8-TCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
51207-31-9	2,3,7,8-TCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
37871-00-4	HPCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
38998-75-3	HPCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
34465-46-8	HXCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
55684-94-1	HXCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
3268-87-9	OCDD	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
39001-02-0	OCDF	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
36088-22-9	PECDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
30402-15-4	PECDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
41903-57-5	TCDD (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
55722-27-5	TCDF (TOTAL)	pg/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
91-57-6	2-METHYLNAPHTHALENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
83-32-9	ACENAPHTHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
208-96-8	ACENAPHTHYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
120-12-7	ANTHRACENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
56-55-3	BENZO(A)ANTHRACENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
50-32-8	BENZO(A)PYRENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
205-99-2	BENZO(B)FLUORANTHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
207-08-9	BENZO(K)FLUORANTHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		100	U
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U		
EPH1122	C11-C22 AROMATICS, UNADJUSTED	ug/l	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U
EPH1936	C19-C36 ALIPHATICS	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		100	U
EPH1936	C19-C36 ALIPHATICS (EPH-LL)	ug/l	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U		
VPH912	C9-C18 ALIPHATICS	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		100	U
VPH912	C9-C18 ALIPHATICS (EPH-LL)	ug/l	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U		
218-01-9	CHRYSENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
206-44-0	FLUORANTHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
86-73-7	FLUORENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
85-01-8	PHENANTHRENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
129-00-0	PYRENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
	TOTAL EPH	ug/l	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U

Table 4-4
Groundwater Sample Analytical Results
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

		Station:	DD-MW-201		DD-MW-201		DD-MW-002		DD-MW-203		DD-MW-204		DD-MW-205		DD-MW-206		DD-MW-207		DD-MW-208	
		Field Sample ID:	DD-MW-201-R06-X		DD-MW-201-R06-D		DD-MW-002-R02-X		DD-MW-203-R06-X		DD-MW-204-R05-X		DD-MW-205-R05-X		DD-MW-206-R05-X		DD-MW-207-R06-X		DD-MW-208-R04-X	
		Sample Date:	5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008		5/19/2008	
		Depth:	4 - 14 feet		4 - 14 feet		9.8 - 14.8 feet		4.5 - 12.5 feet		7.5 - 13.5 feet		5 - 11 feet		5 - 11 feet		5 - 15 feet		3 - 13 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
7440-36-0	ANTIMONY	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	1	U	1	U	1	UJ	1	U	1	U	1	U	1	U	1	U
7440-38-2	ARSENIC	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-38-2	ARSENIC (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	2	U	1	U	1	U	3.9	V	1	U
7440-39-3	BARIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-39-3	BARIUM (DISSOLVED)	ug/l	46	V	45	V	19	V	11	V	20	V	7.6	V	16	V	31	V	31	V
7440-41-7	BERYLLIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-43-9	CADMIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-47-3	CHROMIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	2.1	J	3.5	J	1.9	V	0.63	J	1	U	0.52	J	0.51	J	1.3	V	0.36	J
7440-50-8	COPPER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	0.46	J
7439-97-6	MERCURY	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
7440-02-0	NICKEL	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-02-0	NICKEL (DISSOLVED)	ug/l	1.3	V	1.2	V	1.2	V	1.2	V	1.2	V	0.59	J	0.69	J	0.43	J	2	V
7782-49-2	SELENIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	6.8	V	7.8	V	1	U	1	U	2	U	1	U	1	U	1	U	1	U
7440-22-4	SILVER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-22-4	SILVER (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-28-0	THALLIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-28-0	THALLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-62-2	VANADIUM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-62-2	VANADIUM (DISSOLVED)	ug/l	1	U	0.18	J	1	U	0.25	J	1	U	0.29	J	1	U	1	U	0.52	J
7440-66-6	ZINC	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
7440-66-6	ZINC (DISSOLVED)	ug/l	2.7	V	2.3	J	1.2	J	5.3	V	5	U	1.6	J	1.9	J	1.9	J	110	V
630-20-6	1,1,1,2-TETRACHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
71-55-6	1,1,1-TRICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
79-34-5	1,1,2,2-TETRACHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
79-00-5	1,1,2-TRICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-34-3	1,1-DICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-35-4	1,1-DICHLOROETHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
563-58-6	1,1-DICHLOROPROPENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
87-61-6	1,2,3-TRICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
96-18-4	1,2,3-TRICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
120-82-1	1,2,4-TRICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
95-63-6	1,2,4-TRIMETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
96-12-8	1,2-DIBROMO-3-CHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
95-50-1	1,2-DICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
107-06-2	1,2-DICHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
78-87-5	1,2-DICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108678	1,3,5-TRIMETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
541-73-1	1,3-DICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
142-28-9	1,3-DICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
106-46-7	1,4-DICHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
123-91-1	1,4-DIOXANE	ug/l	3.1	UJ	3.1	UJ	3	UJ	3	UJ	3	UJ	3	UJ	3	UJ	3.1	UJ	3	UJ
594-20-7	2,2-DICHLOROPROPANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
78-93-3	2-BUTANONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
95-49-8	2-CHLOROTOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
591-78-6	2-HEXANONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
106-43-4	4-CHLOROTOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
99-87-6	4-ISOPROPYLTOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-10-1	4-METHYL-2-PENTANONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
67-64-1	ACETONE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
71-43-2	BENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-86-1	BROMOBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-27-4	BROMODICHLOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-25-2	BROMOFORM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
74-83-9	BROMOMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-15-0	CARBON DISULFIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
56-23-5	CARBON TETRACHLORIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-90-7	CHLOROBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
74-97-5	CHLOROBROMOMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-00-3	CHLOROETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
67-66-3	CHLOROFORM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
74-87-3	CHLOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
156-59-2	CIS-1,2-DICHLOROETHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
10061-01-5	CIS-1,3-DICHLOROPROPENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
124-48-1	DIBROMOCHLOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
74-95-3	DIBROMOMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-71-8	DICHLORODIFLUOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
60-29-7	DIETHYL ETHER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-20-3	DIISOPROPYL ETHER (DIPE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
106-93-4	ETHYLENE DIBROMIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
637-92-3	ETHYLENE TERT-BUTYL ETHER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
87-68-3	HEXACHLOROBUTADIENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
	ISOPROPYL ETHER	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
98-82-8	ISOPROPYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
	M,P-XYLENES	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-09-2	METHYLENE CHLORIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
1634-04-4	METHYL-T-BUTYL ETHER (MTBE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
104-51-8	N-BUTYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
103-65-1	N-PROPYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
135-98-8	SEC-BUTYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
100-42-5	STYRENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
994-05-8	TERT-AMYL METHYL ETHER (TAME)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
98-06-6	TERT-BUTYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
127-18-4	TETRACHLOROETHYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
109-99-9	TETRAHYDROFURAN	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
156-60-5	TRANS-1,2-DICHLOROETHENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
10061-02-6	TRANS-1,3-DICHLOROPROPENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
79-01-6	TRICHLOROETHYLENE (TCE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-69-4	TRICHLOROFLUOROMETHANE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
75-01-4	VINYL CHLORIDE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
71-43-2	BENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, ADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, UNADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
VPH910	C9-C10 AROMATICS	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
VPH912	C9-C12 ALIPHATICS, ADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
VPH912	C9-C12 ALIPHATICS, UNADJUSTED	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
	M,P-XYLENES	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
1634-04-4	METHYL-T-BUTYL ETHER (MTBE)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	
	TOTAL VPH	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA	

Notes:
ug/L - micrograms per liter
V - Valid result, no qualification needed
U - not detected, laboratory reporting limit listed
J - concentration (or reporting limit) is estimated
DDA - Demolition Debris Area
NA - Not analyzed

Table 6-1
Groundwater Quality
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

			Upgradient Area of DDA								Inside DDA						Downgradient of DDA							
		Station:	DD-MW-204				DD-MW-205				DD-MW-001		DD-MW-002				DD-MW-201							
		Field Sample ID:	DD-MW-204-R02-X		DD-MW-204-R05-X		DD-MW-205-R03-X		DD-MW-205-R05-X		DD-MW-001-R02-X		DD-MW-002-R01-X		DD-MW-002-R02-X		DD-MW-201-R04-X		DD-MW-201-R05-X		DD-MW-201-R06-X		DD-MW-201-R06-D	
		Sample Date:	6/5/2007		5/19/2008		6/6/2007		5/19/2008		6/5/2007		6/5/2007		5/19/2008		6/5/2007		12/11/2007		5/19/2008		5/19/2008	
		Depth:	7.5 - 13.5 feet		7.5 - 13.5 feet		5 - 11 feet		5 - 11 feet		11.6 - 16.6 feet		9.8 - 14.8 feet		9.8 - 14.8 feet		4 - 14 feet		4 - 14 feet		4 - 14 feet		4 - 14 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
51-28-5	2,4-DINITROPHENOL	ug/l	5.1	UJ	0.84	J	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.3	UJ	5.1	UJ	5.2	UJ	5.1	UJ
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.32	U	0.3	U	0.31	U	0.31	U
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.21	U	0.2	U	0.21	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.32	U	0.3	U	0.31	U	0.31	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.53	U	0.51	U	0.52	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.31	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.3	U	0.32	U	0.3	U	0.31	U	0.31	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	5.1	U	0.45	J	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.3	U	5.1	U	0.48	J	5.1	U
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.3	U	5.1	U	5.2	U	5.1	U
218-01-9	CHRYSENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U	1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.53	U	0.51	U	0.52	U	0.51	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.3	U	5.1	U	5.2	U	5.1	U
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.3	U	5.1	U	5.2	U	5.1	U
206-44-0	FLUORANTHENE	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1.1	U	1	U	1	U	1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.51	U	0.53	U	0.51	U	0.52	U	0.51	U
85-01-8	PHENANTHRENE	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.21	U	0.2	U	0.21	U	0.2	U
129-00-0	PYRENE	ug/l	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.1	U	5.3	U	5.1	U	5.2	U	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	NA		0.3	U	NA		0.3	U	0.32	U	NA		0.32	U	NA		NA		NA	
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	NA		0.2	U	NA		0.2	U	0.21	U	NA		0.21	U	NA		NA		NA	
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	NA		0.3	U	NA		0.3	U	0.32	U	NA		0.32	U	NA		NA		NA	
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.4	U	NA		0.4	U	NA		0.4	U	0.42	U	NA		0.42	U	NA		NA		NA	
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	NA		0.3	U	NA		0.3	U	0.32	U	NA		0.32	U	NA		NA		NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	NA		100	U	NA		100	U	110	U	NA		110	U	100	U	NA		NA	
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	NA		100	U	NA		100	U	110	U	NA		110	U	100	U	NA		NA	
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.4	U	NA		0.4	U	NA		0.4	U	0.42	U	NA		0.42	U	NA		NA		NA	
206-44-0	FLUORANTHENE	ug/l	1	U	NA		1	U	NA		1	U	1.1	U	NA		1.1	U	NA		NA		NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.4	U	NA		0.4	U	NA		0.4	U	0.42	U	NA		0.42	U	NA		NA		NA	
85-01-8	PHENANTHRENE	ug/l	0.2	U	NA		0.2	U	NA		0.2	U	0.21	U	NA		0.21	U	NA		NA		NA	
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-38-2	ARSENIC (DISSOLVED)	ug/l	1	U	2	U	2	U	1	U	2	U	2	U	1	U	0.81	J	1	U	1	U	1	U
7440-39-3	BARIUM (DISSOLVED)	ug/l	17		20		18		7.6		47		32		19		44		38		46		45	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	1	U	1	U
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	11		1	U	8.4		0.52	J	35		7.3		1.9		25		22		2.1	J	3.5	J
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.71		0.2	U	0.2	U
7440-02-0	NICKEL (DISSOLVED)	ug/l	1.1		1.2		1.4		0.59	J	7.2		2.5		1.2		1.3		3.3		1.3		1.2	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	1	U	2	U	2	U	1	U	2	U	2	U	1	U	9.3	J	1	U	6.8		7.8	
7440-22-4	SILVER (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-62-2	VANADIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	0.29	J	1	U	1	U	1	U	1	U	2	U	1	U	0.18	J
7440-66-6	ZINC (DISSOLVED)	ug/l	2.1	J	5	U	5	U	1.6	J	5	U	5	U	1.2	J	2.5	U	2.4	J	2.7		2.3	J
75-25-2	BROMOFORM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	

Notes:
ug/L - micrograms per liter
U - not detected, laboratory reporting limit listed
J - concentration (or reporting limit) is estimated
R - data is rejected
DDA - Demolition Debris Area
NA - Not analyzed

Table 6-1
Groundwater Quality
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

			Downgradient of DDA																											
		Station:	DD-MW-203						DD-MW-206				DD-MW-207								DD-MW-208									
		Field Sample ID:	DD-MW-203-R04-X		DD-MW-203-R05-X		DD-MW-203-R06-X		DD-MW-206-R04-X		DD-MW-206-R05-X		DD-MW-207-R04-X		DD-MW-207-R05-X		DD-MW-207-R05-D		DD-MW-207-R06-X		DD-MW-208-R01-001-D		DD-MW-208-R01-001-J		DD-MW-208-R02-X		DD-MW-208-R03-X		DD-MW-208-R04-X	
		Sample Date:	6/5/2007		12/11/2007		5/19/2008		6/5/2007		5/19/2008		6/6/2007		12/11/2007		12/11/2007		5/19/2008		6/25/2007		6/25/2007		7/23/2007		12/11/2007		5/19/2008	
		Depth:	4.5 - 12.5 feet		4.5 - 12.5 feet		4.5 - 12.5 feet		5 - 11 feet		5 - 11 feet		5 - 15 feet		5 - 15 feet		5 - 15 feet		5 - 15 feet		3 - 13 feet		3 - 13 feet		3 - 13 feet		3 - 13 feet		3 - 13 feet	
CAS Number	**Analyte**	**Units**	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
51-28-5	2,4-DINITROPHENOL	ug/l	5.2	UJ	5.1	UJ	5.1	UJ	5.2	UJ	5.1	UJ	5.1	UJ	5.1	UJ	5.5	U	5.2	U	5.1	R	5.1	R	5.2	UJ	5.1	UJ	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.31	U	0.3	U	0.3	U	0.31	U	0.3	U	0.22	J	0.3	U	0.33	U	0.31	U	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U
50-32-8	BENZO(A)PYRENE	ug/l	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	0.2	U	0.22	U	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.31	U	0.3	U	0.3	U	0.31	U	0.3	U	0.3	U	0.3	U	0.33	U	0.31	U	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.52	U	0.51	U	0.51	U	0.52	U	0.51	U	0.51	U	0.51	U	0.55	U	0.52	U	0.51	U	0.51	U	0.21	J	0.51	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.31	U	0.3	U	0.3	U	0.31	U	0.3	U	0.3	U	0.3	U	0.33	U	0.31	U	0.31	U	0.3	U	0.31	U	0.3	U	0.3	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	5.2	U	5.1	U	0.43	J	5.2	U	0.49	J	5.1	U	5.1	U	5.5	U	0.51	J	5.1	U	5.1	U	5.2	U	5.1	U	1.6	J
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.2	U	5.1	U	5.1	U	0.34	J	5.1	U	5.1	U
218-01-9	CHRYSENE	ug/l	1	U	1	U	1	U	1	U	1	U	0.24	J	1	U	1.1	U	1	U	1	U	1	U	1	U	1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.52	U	0.51	U	0.51	U	0.52	U	0.51	U	0.51	U	0.51	U	0.55	U	0.52	U	0.51	U	0.51	U	0.42	J	0.51	U	0.51	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U	5.1	U	5.5	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	1.5	J
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	0.39	J	5.1	U	5.5	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U
206-44-0	FLUORANTHENE	ug/l	1	U	1	U	1	U	1	U	1	U	0.28	J	1	U	1.1	U	1	U	0.37	J	0.25	J	1	U	1	U	1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.52	U	0.51	U	0.51	U	0.52	U	0.51	U	0.51	U	0.51	U	0.55	U	0.52	U	0.51	U	0.51	U	0.38	J	0.51	U	0.51	U
85-01-8	PHENANTHRENE	ug/l	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	0.2	U	0.22	U	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U
129-00-0	PYRENE	ug/l	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	0.29	J	5.1	U	5.5	U	5.2	U	0.28	J	5.1	U	5.2	U	5.1	U	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	NA		NA		0.31	U	NA		0.32	U	NA		NA		NA		0.3	U	0.31	U	0.31	U	NA		NA	
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	NA		NA		0.21	U	NA		0.21	U	NA		NA		NA		0.2	U	0.21	U	0.21	U	NA		NA	
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	NA		NA		0.31	U	NA		0.32	U	NA		NA		NA		0.3	U	0.31	U	0.31	U	NA		NA	
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.4	U	NA		NA		0.41	U	NA		0.42	U	NA		NA		NA		0.4	U	0.41	U	0.42	U	NA		NA	
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	NA		NA		0.31	U	NA		0.32	U	NA		NA		NA		0.3	U	0.31	U	0.31	U	NA		NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	100	U	NA		100	U	NA		110	U	100	U	100	U	NA		290	J	460	J	100	U	NA		100	U
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	100	U	NA		100	U	NA		110	U	100	U	100	U	NA		100	U	130		100	U	100	U	100	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.4	U	NA		NA		0.41	U	NA		0.42	U	NA		NA		NA		0.4	U	0.41	U	0.42	U	NA		NA	
206-44-0	FLUORANTHENE	ug/l	1	U	NA		NA		1	U	NA		1.1	U	NA		NA		NA		3.4		3.5		1	U	NA		NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.4	U	NA		NA		0.41	U	NA		0.42	U	NA		NA		NA		0.4	U	0.41	U	0.42	U	NA		NA	
85-01-8	PHENANTHRENE	ug/l	0.2	U	NA		NA		0.21	U	NA		0.21	U	NA		NA		NA		0.62	J	0.37	J	0.21	U	NA		NA	
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	1	U	1	UJ	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	1	U
7440-38-2	ARSENIC (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	5.7		10		10		3.9		1.7	J	1.7	J	NA		1	U	1	U
7440-39-3	BARIUM (DISSOLVED)	ug/l	12		11		11		26		16		38		45		44		31		27		26		NA		25		31	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	2	U	1	U	1	U	1	U	1	U	2	U	2	U	1	U	2	U	1	U	NA		2	U	1	U
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	1	U
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	16		15		0.63	J	23		0.51	J	4.9		10		9.1		1.3		9.8		11		NA		25		0.36	J
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	0.46	J
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	NA		0.2	U	0.2	U
7440-02-0	NICKEL (DISSOLVED)	ug/l	1.1		2	U	1.2		0.91	J	0.69	J	1	U	2	U	2	U	0.43	J	3.6		3.2		NA		0.96	J	2	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	2	U	NA		1	U	1	U
7440-22-4	SILVER (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	1	U
7440-62-2	VANADIUM (DISSOLVED)	ug/l	1	U	2	U	0.25	J	1	U	1	U	1	U	2	U	2	U	1	U	0.91	J	1	J	NA		2	U	0.52	J
7440-66-6	ZINC (DISSOLVED)	ug/l	2.4	J	1.9	J	5.3		2.7		1.9	J	2.5	U	1.5	J	1.2	J	1.9	J	9.4		7.7		NA		20		110	
75-25-2	BROMOFORM	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		5	U	5	U	NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		5	U	5	U	NA		NA		NA	

Notes:
ug/L - micrograms per liter
U - not detected, laboratory reporting limit listed
J - concentration (or reporting limit) is estimated
R - data is rejected
DDA - Demolition Debris Area
NA - Not analyzed

Table 11-1
Samples and Corresponding Sample Delivery Groups
Phase II CSA Addendum
Demolition Debris Area
Bird Machine Company - Walpole, MA

Well	Field Sample ID	Sample Date	SDG
DD-MW-001	DD-MW-001-R02-X	6/5/2007	360-10338
	DD-MW-001-R02-X	6/5/2007	360-10338
DD-MW-002	DD-MW-002-R01-X	6/5/2007	360-10381
	DD-MW-002-R01-X	6/5/2007	360-10381
	DD-MW-002-R01-X	6/5/2007	360-10381
	DD-MW-002-R01-X	6/5/2007	360-10381
	DD-MW-002-R02-X	5/19/2008	360-10338
	DD-MW-002-R02-X	5/19/2008	360-10338
DD-MW-201	DD-MW-201-R04-X	6/5/2007	360-10338
	DD-MW-201-R04-X	6/5/2007	360-10338
	DD-MW-201-R04-X	6/5/2007	360-10338
	DD-MW-201-R04-X	6/5/2007	360-10338
	DD-MW-201-R04-X	6/5/2007	360-10381
	DD-MW-201-R04-X	6/5/2007	360-10381
	DD-MW-201-R05-X	12/11/2007	360-10381
	DD-MW-201-R05-X	12/11/2007	360-10381
	DD-MW-201-R06-X	5/19/2008	360-10338
	DD-MW-201-R06-X	5/19/2008	360-10338
	DD-MW-201-R06-D	5/19/2008	360-10381
	DD-MW-201-R06-D	5/19/2008	360-10381
DD-MW-203	DD-MW-203-R04-X	6/5/2007	360-10381
	DD-MW-203-R04-X	6/5/2007	360-10381
	DD-MW-203-R05-X	12/11/2007	360-10767
	DD-MW-203-R05-X	12/11/2007	360-10767
	DD-MW-203-R06-X	5/19/2008	360-10767
	DD-MW-203-R06-X	5/19/2008	360-10767
	DD-MW-203-R06-X	5/19/2008	360-11279
	DD-MW-203-R06-X	5/19/2008	360-14013
	DD-MW-203-R06-X	5/19/2008	360-14013
	DD-MW-203-R06-X	5/19/2008	360-14013
DD-MW-204	DD-MW-204-R02-X	6/5/2007	360-14013
	DD-MW-204-R02-X	6/5/2007	360-14013
	DD-MW-204-R05-X	5/19/2008	360-14013
	DD-MW-204-R05-X	5/19/2008	360-14013
DD-MW-205	DD-MW-205-R03-X	6/6/2007	360-14013
	DD-MW-205-R03-X	6/6/2007	360-14013
	DD-MW-205-R05-X	5/19/2008	360-14013
	DD-MW-205-R05-X	5/19/2008	360-14013
DD-MW-206	DD-MW-206-R04-X	6/5/2007	360-14013
	DD-MW-206-R04-X	6/5/2007	360-14013
	DD-MW-206-R05-X	5/19/2008	360-14013
	DD-MW-206-R05-X	5/19/2008	360-16608
DD-MW-207	DD-MW-207-R04-X	6/6/2007	360-16608
	DD-MW-207-R04-X	6/6/2007	360-16608
	DD-MW-207-R05-X	12/11/2007	360-16608
	DD-MW-207-R05-X	12/11/2007	360-16608
	DD-MW-207-R05-D	12/11/2007	360-16608
	DD-MW-207-R05-D	12/11/2007	360-16608
	DD-MW-207-R06-X	5/19/2008	360-16608
	DD-MW-207-R06-X	5/19/2008	360-16608
DD-MW-208	DD-MW-208-R01-001-X	6/25/2007	360-16608
	DD-MW-208-R01-001-X	6/25/2007	360-16608
	DD-MW-208-R01-001-D	6/25/2007	360-16608
	DD-MW-208-R01-001-D	6/25/2007	360-16608
	DD-MW-208-R02-X	7/23/2007	360-16608
	DD-MW-208-R03-X	12/11/2007	360-16608
	DD-MW-208-R03-X	12/11/2007	360-16608
	DD-MW-208-R04-X	5/19/2008	360-16608
	DD-MW-208-R04-X	5/19/2008	360-16608

Notes:
SDG - Sample delivery group

Appendix A – Laboratory Analytical Reports

(provided on compact disc)

Appendix B – Risk Characterization

Method 3 Human Health and Environmental Risk Characterization

Demolition Debris Area, RTN 4-3024222
Former Bird Machine Company
Walpole, MA

Submitted to:

Baker Hughes Incorporated
Houston, TX

Submitted by:

AMEC Earth & Environmental, Inc.
Westford, Massachusetts

December 2011

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LIST OF ACRONYMS

ADD	Average Daily Dose
ADE	Average Daily Exposure
AIS	Asbestos in Soil
AUL	Activity and Use Limitation
bgs	Below Ground Surface
BMC	Bird Machine Company
COC	Chemical of Concern
COPC	Chemical of Potential Concern
COPEC	Chemical of Potential Environmental Concern
CSA	Comprehensive Site Assessment
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
d	Day
DDA	Demolition Debris Area
DWF	Division of Fisheries and Wildlife
EcoSSL	Ecological Soil Screening Level
EH 855	Estimated Habitat 855
ELCR	Excess Lifetime Cancer Risk
EPC	Exposure Point Concentration
EPH	Extractable Petroleum Hydrocarbon
ERC	Environmental Risk Characterization
ft	Feet
GI	Gastrointestinal
GW	Groundwater
HHRC	Human Health Risk Characterization
HI	Hazard Index
HQ	Hazard Quotient
hr	Hour
IRIS	Integrated Risk Information System
kg	Kilogram
LADD	Lifetime Average Daily Dose
LOAEL	Lowest Observed Adverse Effect Level
LRA3	Lead Release Area 3
MADEP	Massachusetts Department of Environmental Protection
MBA	Manufacturing Building Area
MCP	Massachusetts Contingency Plan
MESA	Massachusetts Endangered Species Act
MFG	Million Fibers per Gram
mg	Milligram
MMCL	Massachusetts Maximum Contaminant Level
m^3	Cubic Meter
µg	Microgram
NHESP	Natural Heritage and Endangered Species Program
NOAEL	No Observed Adverse Effect Level
NSR	No Significant Risk
PAH	Polycyclic Aromatic Hydrocarbon

LIST OF ACRONYMS, continued

PCB	Polychlorinated Biphenyls
PH 1072	Priority Habitat 1072
PM	Particulate Mass
PM10	Respirable fraction
RAF	Relative Absorption Factor
RC	Risk Characterization
RfC	Reference Concentration
RfD	Reference Dose
RTN	Release Tracking Number
SF	Scaling Factor
SRS	South Rail Spur
SVOC	Semi-volatile Organic Compound
TEF	Toxicity Equivalency Factor
TEQ	Toxic Equivalent
TRV	Toxicity Reference Value
UCL	Upper Concentration Limit
URF	Unit Risk Factor
USEPA	United States Department of Environmental Protection
UTL	Upper Tolerance Limit
VOC	Volatile Organic Compound
VPH	Volatile Petroleum Hydrocarbon
WOE	Weight-of-Evidence
WPA	Wetlands Protection Act

1.0 INTRODUCTION

The Bird Machine Company (BMC) facility property ("the BMC facility" or "the facility") occupies approximately 134 acres of land located in Walpole, Massachusetts. The BMC facility, which formerly manufactured machinery, has been assigned multiple Release Tracking Numbers (RTNs) under the Massachusetts Contingency Plan (MCP). This risk assessment addresses the release at the Demolition Debris Area (DDA), which was assigned RTN 4-3024105 and was classified as a Tier II Disposal Site in July 2005 (Weston, 2007). The DDA RTN was linked to RTN 4-3024222 in the January 2008 Tier 1B Permit Application for the facility. Bird Machine Company is no longer in operation, and most of the buildings have been permanently removed. The location of the property is depicted in **Figure 1-1**.

A Phase II Comprehensive Site Assessment (Phase II CSA) Addendum has been completed for the DDA. The Phase II CSA Addendum addresses volatile organic constituents (VOCs), semi-volatile organic constituents (SVOCs), volatile petroleum hydrocarbons (VPH), extractable petroleum hydrocarbons (EPH), polycyclic aromatic hydrocarbons (PAHs), dioxin/furan congeners, and various metals detected in soil and groundwater samples collected from the DDA. The Phase II CSA Addendum also includes evaluations of asbestos in soil (AIS) identified at the DDA.

This Risk Characterization (RC) has been prepared by AMEC Earth & Environmental, Inc. of Westford, Massachusetts (AMEC) to support the Phase II CSA Addendum. The previous reports prepared for the DDA by Weston Solutions, Inc. (Weston) of Concord, New Hampshire, contain information on regulatory compliance, the methods and findings of site assessment activities, and preliminary and comprehensive response actions conducted at the DDA. Information in these reports was used to prepare this risk characterization. Data from site investigations completed by AMEC, site assessment activities completed by Weston, and information from other sources (e.g., Massachusetts Department of Environmental Protection [MADEP] and United States Environmental Protection Agency [U.S. EPA]), were used to complete the RC.

In accordance with the requirements of 310 CMR 40.0000 Subpart I of the MCP, the Method 3 RC addresses risk of harm to human health, public welfare, safety, and the environment. This RC has been conducted assuming that an Activity and Use Limitation (AUL) will be implemented at the DDA prohibiting future development at the site and the disturbance of surface soil. Therefore the RC does not evaluate DDA use or development other than incidental trespassing.

The RC conforms with the requirements of 310 CMR 40.0000 Subpart I of the MCP, and the Massachusetts Department of Environmental Protection's (MADEP's) *Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan* (MADEP, 1995),

to evaluate potential risk of harm to human health, safety, public welfare and the environment posed by DDA conditions.

A Method 3 approach has been used to assess both human health and environmental risk. The Method 3 human HHRC has four steps. The first step, Hazard Identification, involves identification of the constituents of potential concern (COPCs) detected at the DDA. The second step, Dose response Assessment, describes the relationship between the magnitude of exposure for each COPC (dose) and the occurrence of health effects (response). The third step, Exposure Assessment, identifies of potential human receptors based on characteristics of the DDA and the surrounding area. Subsequently, the magnitude and frequency of receptors' potential exposure to COPCs is quantified. The fourth step, Risk Characterization, combines the information from the Exposure Assessment with the information from the Dose response Assessment to determine the likelihood of adverse non-carcinogenic health effects or excess lifetime carcinogenic effects for each receptor for each potential exposure pathway identified in the Exposure Assessment. The risks associated with each exposure pathway are summed to obtain an estimate of total risk for each receptor. Details on these steps of the HHRC, as well a characterization of risk to safety and public welfare, are provided in **Section 3.0** of this report.

Environmental risk characterizations (ERCs) typically consist of two phases: Stage I environmental screening and Stage II risk characterization. Environmental screening is designed to determine whether a more detailed evaluation is necessary based on three criteria: 1) whether environmental receptors could potentially be exposed to constituents at the DDA presently or in the future; 2) whether significant environmental harm is "readily apparent" for each of the potential exposures identified; and 3) whether any of the potential exposure pathways could result in "potentially significant" exposures. Since significant current or potential future exposures to constituents in DDA media were not ruled out by the environmental screening, a Stage II ERC was performed. The analysis was conducted in accordance with the MADEP's *Guidance for Disposal Site Risk Characterization* (MADEP, 1995; 1996).

Details of the risk characterization are presented in the remainder of this report, as follows: **Section 2.0** provides a brief overview of the DDA setting and history. **Section 3.0** presents the risk characterization of human health, safety, and public welfare. The environmental RC is presented in **Section 4.0**. The summary and conclusions are presented in **Section 5.0**. A list of reference materials used to conduct the RC follows **Section 6.0**.

2.0 SITE BACKGROUND

The BMC facility manufactured machinery for the paper industry and various other industries from 1920 until 2004, when the company ceased manufacturing operations at the property. Most of the buildings and equipment were then removed from the property, although some materials (such as pieces of concrete) remain.

For the purposes of evaluating potential exposures and risks, the BMC was divided into several exposure areas: the South Rail Spur (SRS) is in the southwestern section of the property; the lead Release Area 3 (LRA3) is in the eastern section of the property (which encompasses a fill area); the Manufacturing Building Area (MBA), which also contains Lead Release Area 1 and Lead Release Area 2, in the southeastern portion of the property (where most of the structures used during operations at the facility were housed); the Neponset River, which runs along the eastern boundary of the property; and the DDA (as previously defined, the Demolition Debris Area) (the "Site" as defined in this report) in the northwestern portion of the BMC property.

Figure 2-1 shows the DDA in relation to the other areas of the BMC. The DDA consists of three contiguous clearings known as the Eastern, Western and Central Clearing areas, which served as a disposal area dating back possibly to the 19th century. Material in the DDA is primarily inorganic fill, demolition debris, and manufacturing/product testing wastes. Since the most recent removal action (see below), the area has been undisturbed.

Various Release Abatement Measures and Immediate Response Actions have been performed throughout the BMC. The Phase I and Phase II reports for these various areas detail the regulatory and remedial history. The DDA was classified as a Tier II Disposal Site in July 2005. In September 2005, Weston observed fibrous material suspected of containing asbestos. Over the next few months, Weston and its subcontractors confirmed asbestos and conducted a series of removals as an Immediate Response Action. Weston concluded that asbestos could be visibly identified. Following the final removal, the excavation area was lined with geotextile and covered with soil.

A Phase II CSA was prepared by Weston in July 2007. The Phase II CSA included a Method 1 RC. The Phase II CSA was unable to conclude No Significant Risk (NSR) due to, among other things, the visually observed presence of asbestos in soil. A Phase III RAP was prepared by Weston in July 2007 which selected a soil cover remedy for implementation. Environmental risks were not characterized at the time. Shortly after these reports were finalized, the DDA was combined with other RTNs in the Tier IB permit.

Additional sampling was conducted in 2011 to delineate the nature and extent of the asbestos contamination at the DDA. With this additional data, this Method 3 RC was prepared to replace the previous Method 1 RC, and to provide environmental risk characterization for the DDA.

3.0 HUMAN HEALTH RISK CHARACTERIZATION

This section presents the methodology used to evaluate potential risks to human health using a Method 3 approach. Section 3.1 presents the Hazard Identification and Section 3.2 presents the Dose Response Assessment. The Exposure Assessment is described in Section 3.3; and the Risk Characterization is presented in Section 3.4. Uncertainties associated with the human health risk characterization are discussed in Section 3.5.

3.1 Hazard Identification

This section includes a description of the data used as the basis of the risk characterization and presents the selection of contaminants of potential concern (COCs) in each medium.

3.1.1 Database

The DDA has previously been determined to be limited to the upland area shown on Figure 2-1 and does not extend to Cedar Swamp Brook (Weston, 2007). The database for this RC consists of soil, groundwater, and tissue (earthworm) samples as follows:

- Soil Because an AUL prohibiting intrusive activities will be instituted, only surficial soil [0-3 feet (ft) below ground surface(bgs)] was considered. Soil data that were included in the DDA RC exposure point concentrations (EPCs) consist of results obtained from sampling events performed in December 2004; May, November, and December 2005; June, September and October 2006; and May 2007.

- Asbestos in soil An asbestos in soil (AIS) delineation program was performed for surficial soil in April 2011. In June 2011, three samples from the one sample in which asbestos was identified underwent elutriator analysis to estimate an airborne fiber concentration.

- Groundwater Multiple sampling events for groundwater have been performed dating back to 2006. The most recent data set (collected in May 2008) is used in this RC.

- Tissue (earthworm) collected September 2006.

Data have been reviewed and are of suitable quality for inclusion in site characterization. A representativeness and data usability assessment are presented in Section 11.0 of the Phase II.

For both soil and groundwater data, non-detect results for constituents detected in at least one sample in a medium and exposure area were assumed to equal one-half of the analytical reporting limit. Field duplicates were averaged using the following methodology:

1. When both samples in the pair of duplicates had detected values, the results from the primary and its duplicate were averaged and treated as one detected concentration at the location;
2. When only one of the duplicate samples had a detected value, the detected value was averaged with half the reporting limit of the non-detected value and the average was treated as one detected concentration at the location; and
3. When both samples had non-detect values, half of the lower of the two reporting limits was used as the non-detected concentration at the location.

When analytes were analyzed using multiple methods (for example, naphthalene from EPH and SVOC analyses), one result was selected using the following methodology:

1. When both samples in the pair of duplicates had detected values, the higher result from was selected and treated as one detected concentration at the location;
2. When only one of the duplicate samples had a detected value, the detected value was selected and treated as one detected concentration at the location; and
3. When both samples had non-detect values, the lower reporting limit was selected and treated as one non-detect concentration at the location.

The datasets used in this risk characterization are presented in **Attachment A**. Soil, groundwater, and earthworm sample locations are presented on **Figure 2-2.** AIS sampling locations are presented on **Figure 2-3**.

In total 78 soil samples, including duplicates, were collected from 57 locations in DDA between 12/20/2004 and 06/6/2007. Only those soil samples from the 0 to 3 ft bgs depth interval were used in the RC. Groundwater samples from eight shallow wells were collected on 05/19/2008. All data collected from these wells were used in the RC.

3.1.2 Selection of Contaminants of Concern

Soil: Any constituents detected at least once at a concentration exceeding background in an exposure area were included as a COC in that medium and exposure area. For metals and PAHs with background concentrations published in the MassDEP's (MADEP, 2002a) Technical Update entitled "Background Concentrations of Polycyclic Aromatic Hydrocarbons and Metals in Soil," the concentration in "natural" soil was considered background. For all other constituents, any concentration detected above the laboratory reporting limit was considered above background.

Groundwater: Because there are no published background concentrations for groundwater, any constituents detected in the most recent sampling round for groundwater were considered a COC. However, a background evaluation was completed for arsenic, which is ubiquitous and was detected at a relatively low concentration (4 ug/l) in one downgradient well in the most

recent sampling round. The background evaluation was based on groundwater data collected in other areas of the BMC determined to be free of influence from the DDA. ProUCL was used to calculate an upper tolerance limit (UTL), which represents the upper end of a fixed proportion of the population with a stated confidence, in this case the 90th percentile with 95% confidence. In other words, the UTL is the value above which, with 95% certainly, only 10% of the values in the true population fall. The UTL calculated by ProUCL using the background arsenic data for wells at the facility was 14.3 ug/L. This evaluation appears in **Attachment B.** Based on the background analysis, arsenic was excluded as a COC as it was detected below background concentrations. All other constituents detected in the 2008 sampling round at concentrations above the laboratory reporting limits were selected as COCs for groundwater, with the exception of 2,4-dinitrophenol, di-n-butylphthalate, and lead, which were eliminated because of low frequency of detection and low concentration.

Tables 3-1 and **3-2** present the selection of COCs for DDA soil and groundwater, respectively. Asbestos is also a COC; the estimated asbestos fiber concentrations is described in Section 3.3.8.3.

3.2 Dose Response Assessment

The purpose of the Dose Response Assessment is to identify the relationship between the quantity of COCs to which receptors may be exposed (dose) and the likelihood of an adverse health effect (response). Both noncarcinogenic (i.e., threshold) and carcinogenic (i.e., non-threshold) health effects were considered in the dose response assessment. The information provided in the Dose Response Assessment was combined with the results of the Exposure Assessment to provide an estimate of potential health risk. Noncarcinogenic dose response information is presented in Section 3.2.1, and Section 3.2.2 discusses carcinogenic dose response.

Dose response information used in this RC was obtained from MADEP and EPA publications. Toxicity values for EPH and VPH carbon fractions were obtained from the MADEP Policy #WSC-02-411, *Implementation of the MADEP VPH/EPH Approach* (MADEP, 2002b). Toxicity values for other COCs were obtained from MADEP's MCP Toxicity.xls spreadsheet used by MADEP to derive Method 1 Standards (MADEP, 2009). References in the MADEP spreadsheets to U.S. EPA data, including the Integrated Risk Information System (IRIS), were checked and updated, as necessary. The toxicity data used in the Method 3 RC of soil are shown in **Table 3-3**.

3.2.1 Noncarcinogenic Dose Response

Constituents with known or potential noncarcinogenic effects are assumed to have a dose below which no adverse effect occurs, or conversely, above which an effect may be seen. In laboratory experiments, this dose is known as the "No Observed Adverse Effect Level"

(NOAEL). The lowest dose at which an adverse effect is seen is called the "Lowest Observed Adverse Effect Level" (LOAEL). By applying uncertainty factors to the NOAEL or the LOAEL, Reference Doses (RfDs) or Reference Concentrations (RfCs; for air) are developed for chronic and, in some cases, subchronic exposures to constituents with potential noncarcinogenic effects. Many of the non-carcinogenic dose response values provided by MADEP (2009) were developed by the U.S. EPA and are reported in U.S. EPA (2010a,b), while other values provided in MADEP (2009) were developed or selected by MADEP.

Uncertainty factors account for uncertainties associated with the dose response data, such as the appropriateness of using an animal study to derive a human dose response value, and the potential for especially sensitive subpopulations to exist, which may not be adequately represented by the laboratory test animals. For constituents with potential noncarcinogenic effects, the RfD/RfC provides reasonable certainty that, if the specified exposure dose is below the threshold, no noncarcinogenic health effects are expected to occur. RfDs are expressed in terms of milligrams of constituent per kilogram of body weight per day (mg/kg-day) and are used to evaluate estimated oral and dermal exposures. RfCs are expressed as milligrams per cubic meter (mg/m^3) and are used for inhalation. RfDs and RfCs are sometimes inter-converted. **Table 3-3** summarizes the toxicity values for the COCs evaluated here by the ingestion, dermal, and inhalation exposure routes.

3.2.2 Carcinogenic Dose Response

The U.S. EPA assumes for regulatory risk assessment that no threshold dose exists (U.S. EPA, 1997b, 2010a). In other words, U.S. EPA assumes that a finite level of risk may be associated with any dose above zero. In March 2005, U.S. EPA issued new cancer guidelines (U.S. EPA, 2005), the purpose of which is to recommend principles and procedures to guide U.S. EPA scientists in assessing the cancer risks from constituents or other agents in the environment when deriving toxicity values. U. S. EPA uses a two-part system for characterizing the extent to which the available data support the hypothesis that an agent causes cancer in humans.

U.S. EPA's first step in evaluating a potential carcinogen is to assign a weight-of-evidence (WOE) classification. Under U.S. EPA's previous cancer guidelines released in 1986, the WOE was described by categories "Group A" through "Group E," with Group A category reserved for known human carcinogens, while Group E category was the other end of the spectrum, representing constituents/agents with evidence of non-carcinogenicity. In the U.S. EPA's more recent approach for carcinogen risk assessment (U.S. EPA, 2005), all scientific information is considered in determining whether and under what conditions an agent may cause cancer in humans. Furthermore, the WOE provides a narrative approach to characterize carcinogenicity rather than distinct categories by summarizing the evidence about the likelihood of the constituent being a human carcinogen. Five standard WOE descriptors are currently used as part of the narrative, including:

1. Carcinogenic to Humans;
2. Likely to be Carcinogenic to Humans;
3. Suggestive Evidence of Carcinogenic Potential;
4. Inadequate Information to Assess Carcinogenic Potential; and
5. Not Likely to be Carcinogenic to Humans.

As part of the updated guidance on evaluating potentially carcinogenic constituents, the U.S. EPA emphasizes the value of understanding the biological changes that the agent of interest can cause (e.g., mode of action) and how these changes might lead to the development of cancer. This information, as well as the agent's human carcinogenic potential, is to be described in a narrative prepared by U.S. EPA's scientists, summarizing the full range of available evidence and describes any conditions associated with conclusions about an agent's hazard potential, including which populations or life stages may be particularly susceptible. Since the data for many of the potentially carcinogenic constituents have not been re-evaluated since the initial derivation of the cancer slope factors under the 1986 cancer guidelines, the cancer toxicity information presented in Integrated Risk Information System (IRIS - U.S. EPA's database of recommended cancer slope factors and reference doses for use in risk assessments) represents cancer toxicity information derived under the 1986 guidelines, with more recent cancer evaluations conducted for a limited number of constituents under the more recent 2005 guidance (U.S. EPA, 2010a).

The second step in the carcinogenicity evaluation process is the calculation of a quantitative estimate of carcinogenic potency. The U.S. EPA has developed computer models that extrapolate the observed responses at high doses used in animal studies to predict responses in humans at the low doses encountered during environmental exposures. The models developed by the U.S. EPA assume no threshold and usually consider animal (and sometimes human) data to estimate carcinogenic potency. Further, the models assume that carcinogenic dose response is linear at low doses. U.S. EPA refers to this numerical estimate of the dose response factor (or the slope of the line plotted from dose vs. response) as the cancer slope factor (CSF) for oral exposures. A CSF is expressed in terms of the inverse of milligrams of agent per kilogram body weight per day [$(mg/kg\text{-}day)^{-1}$] and represents the upper-bound excess lifetime cancer risk estimate that results from a daily exposure to an agent at a dose of 1 mg/kg-day. A Unit Risk Factor (URF) represents the Excess Lifetime Carcinogenic Risk (ELCR) per microgram per cubic meter ($\mu g/m^3$) of contaminant in air and is expressed as $(\mu g/m^3)^{-1}$. CSFs and URFs are sometimes inter-converted.

Table 3-3 summarizes carcinogenic toxicity values for COPCs used in this risk characterization.

3.3 Exposure Assessment

This section identifies the type and magnitude of potential exposures to COPCs that may occur at the DDA under current and reasonably foreseeable future use. First, potential receptors are

identified based on conditions present at the DDA and surrounding area. Next, potential routes and pathways of exposure are identified for each receptor, based on information about activities that typically occur or may occur in the area. Following these steps, EPCs are estimated, and potential exposures are quantified for receptors.

3.3.1 Site Use and Activities

The DDA is located within the larger BMC property, which is inactive. Manufacturing operations at the property were discontinued in 2004, and most buildings associated with the property have been demolished. Fencing is present at a portion of the property. A security guard is on duty (at the entrance of the property) to prevent unauthorized vehicle access and to report trespassing activities to the owners and municipal authorities. No development of the DDA is currently planned.

The DDA was a disposal area at the northwest part of the property and remains undisturbed. Due to the fencing, current receptors at the facility, if any, are limited to occasional trespassers. This RC assumes an Activity and Use Limitation (AUL) will be implemented at the DDA to prevent disturbance. As such, future site use is considered to be limited to occasional trespassers as well.

3.3.2 Identification of Receptors

Consistent with the requirements of the MCP, 310 CMR 40.0923, the exposure assessment considered both current and reasonably foreseeable future Site activities and uses. The only potential current receptors are local resident adolescents who may trespass on the property and the security personnel. The existing fencing, waterways, and active railways surrounding the Site are expected to effectively prevent young children from gaining access to the Site.

This Method 3 RC assumes that an AUL will be implemented on the property that would prohibit disturbance of the soil at the DDA and excavation, grading or development for any purpose. As such, an occasional trespasser is the only current and future receptor.

3.3.3 Identification of Exposure Routes and Pathways

Exposure pathways are the mechanisms by which receptors may be exposed to COCs at the Site. According to MADEP (1995), the following elements must be present in order for a potential human exposure pathway to be complete:

1. a constituent source;
2. a mechanism by which a constituent may be released to the environment;
3. an environmental transport medium;
4. an exposure point (discussed above); and,
5. a receptor with a route of exposure at the point of contact (discussed above).

Under current and foreseeable future conditions, trespassers are the only receptors that may be exposed to COCs in DDA soil. The potentially complete exposure pathways for the trespasser include incidental ingestion, dermal contact, and inhalation of particles (dust); inhalation of asbestos fibers from DDA soil is also considered. The Town of Walpole has designated the BMC property as located within a groundwater Recharge Zone (BSWC, 2007). As such, although groundwater at the Site is not currently used nor is likely to be used in the future as a source of drinking water, use of Site groundwater as drinking water must be considered a potential future exposure pathway.

3.3.4 Soil and Groundwater Categorization

Based on current conditions, the most likely potential receptors are local resident adolescents who may trespass on the property. The waterways and active railways surrounding the Site are expected to effectively prevent young children from gaining access to the Site. The activity of adolescent trespassers is characterized as low frequency/low intensity, because access to the Site would similarly be limited by the fencing. The fencing only surrounds part of the Site, but it is still expected to have some effect as a deterrent when it comes to adolescent trespassers. Trespassers would not likely be engaged in activities that would result in contact with deeper soil. Although there are currently no plans for redevelopment of the property, this risk characterization was conducted assuming that an AUL will be implemented at the Site prohibiting future disturbance of surface soil. Based on this assumption, soil from 0 to 3 feet is categorized as S-2 and soil from 3 to 15 ft bgs is categorized as S-3.

As mentioned above, the Town of Walpole has designated the Site as a groundwater Recharge Zone (BSWC, 2007). As a result of this designation, the Town's Board of Sewer and Water Commissioners has indicated its belief that "the Site is in a Potential Drinking Water Source area" according to conditions specified at 310 CMR 40.0932(4). For this reason, groundwater in all exposure areas is categorized as GW-1. Because no buildings are present at the Site and future buildings will be prohibited by the AUL, groundwater category GW-2 is not applicable. Site groundwater is also categorized as GW-3 because, as described in 310 CMR 40.0932, this category is applicable to all groundwater in the Commonwealth, as all groundwater is assumed to potentially discharge to surface water.

3.3.5 Hot Spot Evaluation

The MCP requires identification and evaluation of "hot spots." As defined by the MCP in 310 CMR 40.0006, a hot spot is "a discrete area where the concentrations of oil or hazardous material or the thickness of Nonaqueous Phase Liquid are substantially higher than those present in the surrounding area. A hot spot shall be identified based on consideration of both the concentrations or thickness of an oil or hazardous material within a contaminated area and the spatial pattern of that contamination. The areal extent and spatial pattern of a hot spot may

be determined through the analytical results from multiple samples taken within the area, or the results of limited sampling in combination with other knowledge about the release, such as the presence of discoloration, odors or a defined source area." One method for evaluating whether an area is a hot spot includes comparison of OHM concentrations in an area with the concentrations in the surrounding area. An area that has a concentration greater than the applicable Method 1 standard and either 10 times (if the area may be contacted preferentially or more frequently) or 100 times greater than the concentration in the surrounding area. Since the Site is currently unoccupied and (although there are currently no plans for development of the property) future development could occur anywhere on the Site, and because no areas of the Site appear especially attractive to potential trespassers or would be expected to have higher exposure frequency than other areas, hot spots were defined as areas with concentrations 100 times higher than the concentration of the surrounding area. Hot spots may be a single sample, multiple samples from the same soil boring, or samples from multiple contiguous soil borings over a small area. Hot spots were identified using the methodology described in the following paragraphs.

Maximum detected concentrations in soil in each exposure area were first compared to Method 1 S-1/GW-1 soil standards. Any constituent with a maximum detected concentration in an exposure area below its Method 1 standard was excluded from further evaluation. Constituents with maximum concentrations above the S-1/GW-1 standard were further evaluated by plotting the highest detected concentrations on a map of the exposure area to determine if these high concentrations were scattered or clustered. Isolated high concentrations in a single sample were evaluated by comparing those concentrations to surrounding concentrations. When high concentrations were clustered, the concentrations were examined to determine if they extended over multiple contiguous sample locations. In such cases, the average concentrations of constituents in the samples with high concentrations were estimated and compared to the surrounding concentrations.

If concentrations were not more than 100 times higher than the concentrations in the surrounding area, they were not identified as "hot spots." Hot spot analysis of groundwater as a potential water supply was not performed because each well is considered a distinct exposure point. No hot spots were identified in DDA soil.

3.3.6 Identification of Exposure Points

As indicated in Section 3.1.1, data that are representative of current conditions in soil were used to develop EPCs in soil at the DDA. Soil from a depth of 0 to 3 ft bgs is considered to be accessible and therefore constitutes the current soil exposure zone. Due to the AUL that will be implemented for the Site, the only soil that will be available in the future is also surficial (0 to 3 feet).

3.3.7 Estimation of Exposure Point Concentrations

The methods used to calculate EPCs in soil and groundwater are described in the sections below. In the special case of dioxins/furans, one additional data management step is necessary to calculate EPCs. Toxicity values and Method 1 standards are not available for all of the individual dioxin/furan congeners included in the analytical method, but are available for 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). The toxicity of other dioxin/furan congeners has been estimated relative to the toxicity of 2,3,7,8-TCDD. In each sample analyzed for dioxins and furans, the concentration of 2,3,7,8-TCDD toxic equivalents (TEQ) was estimated by first multiplying the concentration of each congener by the toxicity equivalency factor (TEF) for that congener developed in 2005 by the World Health Organization (Van den Berg et al., 2006), then summing the toxic equivalent concentrations for the congeners. The 2005 WHO TEFs are presented in **Table 3-4**. Any congener not detected in a sample was assumed to be present at one half the detection limit in the computation of the TEQ concentration in that sample.

3.3.7.1 Soil EPCs

The arithmetic mean of COC concentrations was used to represent the EPC in each exposure area. Arithmetic mean concentrations were calculated assuming that non-detected constituents were present at one-half the sample quantitation limit. In accordance with the MCP, arithmetic mean concentrations are used as EPCs unless there is evidence of tremendous skew in the data, since it is unlikely that the arithmetic averages would underestimate the true means. It is our opinion that the sampling program conducted at the Site provides sufficient analytical data to estimate EPCs that are representative of Site conditions. Specifically, use of average concentrations is justified based on the following:

1. A review of the data indicates that the exposure areas have been adequately characterized based on the number of sampling locations. Qualitative evaluation of sampling density indicates that based on the size of the exposure area, a sufficient number of samples have been collected to provide adequate areal coverage of the release area(s); and
2. The sampling strategy employed at the exposure areas results in a conservative assessment of soil quality conditions as sampling locations are biased to areas of higher concentration (the release areas).

The EPCs for soil were calculated from samples collected for the 0 to 3 ft bgs depth, and are presented in **Table 3-1**. The locations of the soil samples are shown in **Figure 2-1**.

3.3.7.2 Groundwater EPCs

As required by the MCP, each groundwater well was considered a hypothetical potential source of future drinking water, and each was considered a separate exposure area. Therefore, all

groundwater wells sampled in 2008 were included, regardless of groundwater depth. EPCs in individual wells were estimated using the sample results for that well. EPCs for groundwater are presented in **Table 3-2**. The locations of the groundwater samples are shown in **Figure 2-1**.

3.3.8 Quantification of Potential Exposures

This section describes the equations and assumptions used to evaluate potential exposures to COPCs in the Method 3 evaluation at DDA. These equations are consistent with equations presented by MADEP (1995).

The Average Daily Dose (ADD) was calculated to estimate a receptor's potential daily intake from exposure to constituents with potential noncarcinogenic effects. According to MADEP (1995), the exposure dose should be calculated by averaging over the period of time for which the receptor is assumed to be exposed. The ADD for each constituent via each route of exposure was then compared to the noncarcinogenic toxicity value (that is, the RfD) for that constituent in order to estimate the potential noncarcinogenic hazard index due to exposure to that constituent via that route of exposure.

For constituents with potential carcinogenic effects, the lifetime average daily dose (LADD) was calculated to estimate potential exposures over the course of a lifetime (70 years). Subsequently, the LADD for each constituent via each route of exposure was multiplied by the CSF for that constituent to estimate the potential carcinogenic risk due to exposure to that constituent via that route of exposure.

The equations used to estimate ADDs and LADDs are presented below. The human exposure parameter values used in each potential exposure pathway are presented in **Table 3-6**, while **Table 3-5** summarizes certain constituent specific factors required to implement the equations (i.e., relative absorption factors). The spreadsheets used to calculate ADD and LADD from these equations and parameter values are contained in **Attachment D**.

3.3.8.1 Soil

Exposure to soil was assumed to occur via incidental ingestion, dermal contact, and inhalation of particles (fugitive dust). ADDs and LADDs for soil ingestion were calculated as follows:

$$ADD_{ing} \text{ or } LADD_{ing} = \frac{C_{soil} \times IR_{soil} \times FI \times RAF_{os} \times CF \times EF \times EP}{AP \times BW}$$

where:

ADD_{ing} = Average Daily Dose Due to Ingestion (mg/kg-day)
$LADD_{ing}$ = Lifetime Average Daily Dose Due to Ingestion (mg/kg/day)

C_{soil} = Constituent Concentration in Soil (mg/kg)
IR_{soil} = Soil Ingestion Rate (mg/day)
FI = Fraction of Soil Ingested from the Site (unitless)
RAF_{os} = Relative Absorption Factor (Oral-Soil) (unitless)
CF = Conversion Factor (10^{-6} kg/mg)
EF = Exposure Frequency (days/year)
EP = Exposure Period (years)
BW = Body Weight (kg)
AP = Averaging Time (EP x 365 days/yr, ADD; 70yr x 365 days/yr, LADD)

ADDs and LADDs for dermal absorption were calculated as follows:

$$ADD_{der} \text{ or } LADD_{der} = \frac{C_{soil} \times SA \times AF \times RAF_{ds} \times CF \times EF \times EP}{AP \times BW}$$

where:

ADD_{der} = Average Daily Dose Due to Dermal Contact (mg/kg-day)
$LADD_{der}$ = Lifetime Average Daily Dose Due to Dermal Contact (mg/kg/day)
C_{soil} = Constituent Concentration in Soil (mg/kg)
SA = Skin Surface Area Exposed (cm^2/day)
AF = Soil to Skin Adherence Factor (mg/cm^2)
RAF_{ds} = Relative Absorption Factor (Dermal-Soil) (unitless)
CF = Conversion Factor (10^{-6} kg/mg)
EF = Exposure Frequency (days/year)
EP = Exposure Period (years)
BW = Body Weight (kg)
AP = Averaging Period (EP x 365 days/yr, ADD; 70yr x 365 days/yr, LADD)

3.3.8.2 Inhalation of Particulates

Exposure via inhalation of soil-derived fugitive dust is a function of the concentration at the source (e.g., soil), frequency and duration of contact, and a factor describing the concentration of respirable particles in air.

MADEP (2008) considers that potential exposure via inhalation of dust occurs via two uptake pathways: uptake by the gastrointestinal (GI) tract following coughing up and subsequent swallowing of particulates trapped by the mucosa of the upper respiratory track and uptake by the respiratory system following inhalation into the lungs. To calculate the exposure associated with these two uptake pathways, MADEP assumes the following for the construction worker scenario (which AMEC conservatively also used for the trespasser and utility worker):

- 100% of respirable particulate mass (PM) is equal to or less than 30 microns in diameter (<=PM_{30})
- 40% of total respiratory particulate mass is equal to or less than 10 microns in diameter (<=PM_{10})

- 100% of inhaled particulates greater than 10 microns but less than or equal to 30 microns are swallowed. 50% of inhaled particulates equal to or less than 10 microns are swallowed
- 50% of inhaled particulates equal to or less than 10 microns enters the lungs.

Based on these assumptions, the effective exposure concentration of respirable particulates for the GI system is 1.5 times the concentration of PM_{10}, while that for the lungs is 0.5 times the concentration of PM_{10}. Using these effective exposure concentrations, compound average daily doses for the GI and respiratory systems can be estimated using the following equations.

Average Daily Dose for the GI System ($ADD_{inhal\text{-}GI}$):

$$\mathrm{ADD_{inhal}} = \frac{\mathrm{C_{part}} \times 1.5 \text{ x } \mathrm{PM_{10}} \times IR_{air} \ x \ \mathrm{RAF_i} \times \mathrm{ET} \times EF \ x \ \mathrm{EP} \text{ x } \mathrm{CF}}{\mathrm{AP} \times \mathrm{BW}}$$

where:

$ADD_{inhal\text{-}GI}$	=	Average Daily Dose due to coughing up and subsequent ingestion of inhaled particulates; expressed in mg/kg-day
$[C_{part}]$	=	Concentration of constituent in airborne particulates
$[PM_{10}]$	=	Concentration in air of particulates less than or equal to 10 microns in diameter
IR_{air}	=	Inhalation rate for the receptor of concern during the period of exposure
RAF_i	=	Relative Absorption Factor (inhalation)
ET	=	Duration of each exposure event (hr/day)
EF	=	Exposure frequency (days/year)
EP	=	Duration of the exposure period (years)
CF	=	Appropriate unit conversion factor
BW	=	Body weight of the receptor of concern during the averaging period
AP	=	Averaging period

Average Daily Dose for the Respiratory System (ADD_{inhal})

$$\mathrm{ADD_{inhal}} = \frac{[\mathrm{C_{part}}] \times 0.5 \times [\mathrm{PM_{10}}] \times \mathrm{IR_{air}} \times \mathrm{RAF_i} \times \mathrm{ET} \times \mathrm{EF} \times \mathrm{EP} \times \mathrm{CF}}{\mathrm{BW} \times \mathrm{AP}}$$

where:

ADD_{inhal}	=	Average Daily Dose due to inhaled particulates entering the lungs (mg/kg-day)
$[C_{part}]$	=	Concentration of constituent in airborne particulates (mg/kg)
$[PM_{10}]$	=	Concentration in air of particulates less than 10 microns in diameter (µg/m^3)
IR_{air}	=	Inhalation rate (m^3/hr)
RAF_i	=	Relative Absorption Factor

ET	=	Duration of each exposure event (hr/day)
EF	=	Exposure frequency (days/yr)
EP	=	Duration of the exposure period (years)
CF	=	Appropriate unit conversion factor (10^{-9} kg/µg)
BW	=	Body weight (kg)
AP	=	Averaging period (d)

Dose response values for inhalation exposure (i.e., unit risk factor and reference concentration) are expressed on a mass of compound per volume of air basis, using the assumption that a person weighs 70 kg and has a daily inhalation rate of 20 m^3. Therefore, prior to the characterization of risk, ADD_{inhal} (mg/kg-day) for the compound must be converted to an average daily exposure (ADE_{inhal}) (mg/m^3) in order to make it compatible with the corresponding dose response values. This can be accomplished using the following equation:

$$ADE_{inhal} = \frac{ADD_{inhal} \times BW_{assumed}}{Inh_{assumed}}$$

where:

ADE_{inhal}	=	Average daily exposure COPC concentration (mg/m^3)
ADD_{inhal}	=	Average daily dose due to inhaled particulates in the lungs (mg/kg-d)
$BW_{assumed}$	=	Body weight assumed in the development of RfCs and URFs (70 kg)
$Inh_{assumed}$	=	Inhalation rate assumed in the development of RfCs and URFs (20 m^3/d)

For the evaluation of the trespasser, the concentration of PM_{10} in air was assumed to be 32 µg/m^3 (residential concentration from MADEP, 2008).

3.3.8.3 Asbestos in Soil

As described in the Phase II CSA, AMEC collected 42 soil samples for asbestos analysis in April 2011. Visual and laboratory identification of asbestos were in agreement, with only one location presenting asbestos. Three aliquots from this location were submitted for elutriator testing to estimate airborne asbestos concentrations. These concentrations are expressed in million fibers per gram of soil (MFG) and were converted to airborne concentrations assuming they comprise the respirable (PM10) fraction of ambient dust:

$$OHM_{air} = OHM_{soil} \times PM_{10} \times C$$

Where:

OHM_{soil}	=	Asbestos fiber concentration reported by lab (MFG)
PM_{10}	=	Respirable dust concentration in air (mg/m^3)

C = Conversion factor $\left(\frac{\text{g soil}}{\text{mg soil}} \frac{\text{m}^3}{\text{ml}}\right)$

Risk is then calculated as follows:

$$ELCR = ADE_{air} \times IUR$$

Where the average concentration of the oil or hazardous material in air (ADE_{air}) over the exposure period is calculated as

$$ADE_{air} = \frac{OHM_{air} \times EF \times EP}{AP}$$

where:

OHM_{air}	=	Concentration of asbestos (f/ml)
EF	=	Exposure frequency
EP	=	Exposure period
AP	=	Averaging period

The risk calculations for asbestos appear in **Attachment D.**

3.3.8.4 Groundwater

Exposure to groundwater used as a residential water supply was assumed to occur via incidental ingestion, dermal contact, and inhalation of vapors while showering. Exposure and risk were estimated using the MassDEP Shortforms. The equations, assumptions and calculations appear in **Attachment E.**

3.3.9 Relative Absorption Factors (RAFs)

The premise of calculating risk or hazard using toxicity data from laboratory experiments is that potential human exposure dose is similar to the administered dose or applied dose in the laboratory experiment. The animal-derived cancer slope factors (CSFs) and reference doses (RfDs) used in quantitative risk assessment were based on applied doses in most cases. However, the efficiency of COPC absorption via a particular route and from a particular matrix (e.g., soil, water) under environmental exposure conditions may differ from the absorption efficiency for the exposure route and matrix used in the experimental study that serves as the basis for the CSF or RfD. RAFs are used to adjust the exposure dose based on these two µ absorption efficiencies. As recommended by MADEP (1995), RAFs for COPCs were derived and used in the calculation of human exposure to soil in the Method 3 evaluation of soil at the DDA.

The RAFs used in the RC were obtained from MADEP (2009) and are shown in **Table 3-5**. A value of 1 is used for inhalation RAFs (including asbestos).

3.4 RISK CHARACTERIZATION

3.4.1 Method 3 Risk Characterization

A Method 3 RC was selected for evaluating potential risk at the DDA. In the Method 3 approach, risk characterization is the step in the risk assessment process that combines the results of the exposure assessment and the toxicity assessment for each COPC in order to estimate the potential for noncarcinogenic and carcinogenic human health effects from exposure to that constituent. This section summarizes the results of the RC for each receptor evaluated in this risk assessment. **Tables 3-7** and **3-8** summarize the total noncarcinogenic risks and carcinogenic risks estimated for each receptor for soil and groundwater, respectively. RC calculations are presented in **Attachment C**.

3.4.1.1 Noncarcinogenic Risk Characterization of Soil

The potential for exposures to COPCs in soil at DDA to result in adverse noncarcinogenic health effects was estimated for each receptor by comparing the Average Daily Dose (ADD) for each constituent (derived in Section 3.3.8) with the Reference Dose for that constituent (presented in Section 3.2.1). The resulting ratio, which is unitless, is known as the Hazard Quotient (HQ) for that constituent. The HQ is calculated using the following formula:

$$HQ = \frac{ADD}{RfD}$$

where:

HQ = Hazard Quotient (unitless);
ADD = Average Daily Dose (mg/kg-day); and
RfD = Reference Dose (mg/kg-day).

When a Hazard Quotient for a COPC does not exceed 1, the Reference Dose has not been exceeded, and no adverse noncarcinogenic health effects are expected to occur as a result of exposure to that COPC via that route. The HQs for each pathway are summed to yield the Hazard Index (HI) for that COPC. A total HI for the receptor is estimated by summing the COPC-specific HIs. A total HI for a receptor that does not exceed 1 indicates that no adverse noncarcinogenic health effects are expected to occur as a result of that receptor's potential exposure to COPCs identified at the Site.

Table 3-7 presents the total HIs calculated for each receptor. **The total HIs do not exceed MADEP's noncancer risk limit of 1 for any receptor. Accordingly, DDA soil achieves a**

condition of No Significant Risk of harm to human health with respect to noncarcinogenic effects.

3.4.1.2 Carcinogenic Risk Characterization of Soil

The purpose of carcinogenic risk characterization is to estimate the likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of site-related exposures to COPCs in various environmental media. This likelihood is a function of the dose of a constituent and the Cancer Slope Factor (CSF) for that constituent. The relationship between the Excess Lifetime Cancer Risk (ELCR) and the estimated Lifetime Average Daily Dose (LADD) of a constituent may be expressed as:

$$ELCR = 1 - e^{CSF \times LADD}$$

where:

ELCR = Excess Lifetime Cancer Risk (unitless);
CSF = Cancer Slope Factor (1/(mg/kg-day)); and
LADD = Lifetime Average Daily Dose (mg/kg-day).

When the product of the CSF and the LADD is much greater than 1, the ELCR approaches 1 (i.e., 100% probability). When the product is less than 0.01 (1×10^{-2}), the equation can be closely approximated by:

$$ELCR = CSF \times LADD$$

The product of the equations is unitless, and provides an estimate of the potential carcinogenic risk associated with a receptor's exposure to that constituent via that pathway. ELCRs are calculated for each potentially carcinogenic constituent via each exposure pathway. For each receptor, the total ELCR for each COPC is calculated by summing the potential risks derived for each pathway by which the receptor is assumed to be exposed. A Total ELCR for the receptor is then calculated by summing the COPC-specific ELCRs.

ELCRs estimated for all receptors are presented in **Table 3-7**. **Total ELCRs are less than MADEP's cancer risk limit of 1×10^{-5} for all receptors. Accordingly, DDA soil achieves a condition of No Significant Risk of harm to human health with respect to carcinogenic effects.**

3.4.1.3 Risk Characterization of Groundwater as a Potable Supply

Groundwater at the Site is categorized as GW-1 and GW-3. It is unlikely that groundwater at the Site will be used for drinking water. However, because groundwater has been designated as a Potential Drinking Water Source by the Town of Walpole, exposure and risk associated

with use of groundwater as a potable supply (human heath) has been assessed as part of this RC. These estimated risks appear in **Table 3-8** and **Appendix E.**.

3.4.2 Summary of Human Health Risk Characterization

Potential noncarcinogenic and carcinogenic risks associated with exposure to COPCs in soil and groundwater are below 1 and 1 x 10^{-5}, respectively. **Therefore, soil and groundwater in the DDA achieve a condition of No Significant Risk.**

3.4.3 Applicable or Suitably Analogous Public Health Standards

The MCP at 310 CMR 40.0993 (3) requires an evaluation of Applicable and Suitably Analogous Standards (ASAS) in addition to quantitative risk characterization. The general list of ASAS provided in the MCP includes the Massachusetts Drinking Water Quality Standards and the Massachusetts Air Quality Standards. These two sets of ASAS are applicable to the Site.

The Massachusetts Air Quality Standards relate to ambient concentrations of the so-called "criteria pollutants" (sulfur oxides, particulate, carbon monoxide, ozone, nitrogen dioxide and lead). None of the COPCs at the Site is a criteria pollutant.

The Massachusetts Maximum Contaminant Levels (MMCLs) at 310 CMR 22.00 were compared with DDA groundwater concentrations, as groundwater is categorized as GW-1. **Table 3-2** presents the comparison to MMCLs. The concentration of arsenic in one sample and duplicate equaled the MMCL of 10 ppb, although earlier and later samples from this well were below the MMCL. **As described in Section 3.1 and Attachment B, arsenic represents a background condition and therefore does not pose Significant Risk.**

3.4.4 Risk of Harm to Safety

In accordance with 310 CMR 40.0994, the risk of harm to safety was evaluated. No structures are present at the Site. No overt situations posing a threat of physical harm or bodily injury exist. **As such, the Site demonstrates a condition of No Significant Risk of Harm to Safety.**

3.4.5 Risk of Harm to Public Welfare

In accordance with 310 CMR 40.0994, the risk of harm to public welfare was evaluated. No dangerous or nuisance conditions exist at the Site, nor are persistent odors reported. As part of the public welfare evaluation, EPCs for COPCs in Site soil and groundwater were compared to Upper Concentration Limit (UCLs). **Tables 3-1** through **3-3** shows these comparisons for soil and groundwater. No EPCs exceeded soil UCLs or groundwater UCLs. **Therefore, the Site achieves a condition of No Significant Risk of Harm to Public Welfare.**

3.4.6 Human Health Risk Characterization Conclusions

Conditions at DDA represent a condition of No Significant Risk with respect to human health, safety, and public welfare. Although arsenic concentrations in groundwater exceed MMCLs, arsenic concentrations are consistent with background and therefore do not represent Significant Risk. No other Applicable and Suitably Analogous Standards are exceeded.

3.5 Uncertainty Analysis of the Human Health Risk Characterization

Within any of the four steps of the risk assessment process, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. Every assumption introduces some degree of uncertainty into the risk assessment process. Conservative assumptions are made throughout the risk assessment to ensure that the health of local populations and the environment are protected. Therefore, when all of the assumptions are combined, it is much more likely that actual risks, if any, are over-estimated rather than under-estimated.

The assumptions that introduce the greatest amount of uncertainty in this risk assessment are discussed in this section. They are discussed in general terms, because for most of the assumptions there is not enough quantitative information to assign a numerical value that can be factored into the calculation of risk.

3.5.1 Hazard Identification

During the Hazard Identification step, constituents are selected for inclusion in the quantitative risk characterization. COPCs were selected based on potential association with historical Site activities and comparison to background conditions. Detected constituents were screened against background concentrations for both the human health and ecological risk characterizations. Maximum concentrations were also screened against ecological risk-based concentrations for the selection of COPECs for the ecological risk characterization (Section 4.1.2). It is unlikely that constituents have been overlooked in the MCP protocols utilized for the several rounds of sampling and analytical methodologies conducted at the property.

3.5.2 Toxicity Assessment

Dose response values are usually based on limited toxicological data. For this reason, a margin of safety is built into estimates of both carcinogenic and noncarcinogenic risk, and actual risks are lower than those estimated. The two major areas of uncertainty introduced in the dose response assessment are: (1) animal to human extrapolation; and (2) high to low dose extrapolation. These are discussed below.

Human dose response values are often extrapolated, or conservatively estimated, using the results of animal studies. Extrapolation from animals to humans introduces a great deal of uncertainty in the risk assessment because in most instances, it is not known how differently a human may react to the constituent compared to the animal species used to test the constituent. The procedures used to extrapolate from animals to humans involve conservative assumptions and incorporate several uncertainty factors that over-estimate the adverse effects associated with a specific dose. As a result, over-estimation of the potential for adverse effects to humans is more likely than under-estimation.

Predicting potential health effects from the exposure to site soil requires the use of generally-recognized models to extrapolate the observed health effects from the high doses used in laboratory studies to the anticipated human health effects from low doses experienced in the environment. The MCP-specified models contain conservative assumptions to account for the large degree of uncertainty associated with this extrapolation (especially for potential carcinogens) and therefore, tend to be more likely to over-estimate than under-estimate the risks.

3.5.3 Exposure Assessment

During the exposure assessment, average daily doses of COPCs to which receptors are potentially exposed are calculated, which involves assumptions about how often exposure occurs. Such assumptions include location, accessibility, and use of an area. With this in mind, the receptor, or person who may potentially be exposed, and the location of exposure, were both defined for this risk assessment. The locations where certain activities were assumed to take place have been purposely selected because chemical concentrations and frequency of exposure are expected to be high (i.e., use of the maximally affected areas).

Exposures and risks in this RC are based on the assumption of trespassing on a fairly routine basis. In fact, the DDA is not readily accessible and is unlikely to serve as a trespassing destination for local adolescents. In addition, asbestos exposure was based on a single identified location with surficial asbestos, the maximum modeled airborne concentration at that location, and the assumption that all inhalation while trespassing is at that location. These are highly conservative assumptions that are likely to vastly over-estimate the actual degree of fiber inhalation that might be experienced when traversing the area.

3.5.4 Risk Characterization

The risk of adverse human health effects depends on estimated levels of exposure and on dose response relationships. Once exposure to and risk from each of the selected constituents is calculated, the total risk posed by exposure to site soil is determined by combining the health risk contributed by each constituent. Where COPCs do not interact, do not affect the same target organ or do not have the same mechanism of action, summing the risks for multiple

COPCs results in an over-estimate of risk posed by the Site. However, in order not to understate the risk, it is assumed that the effects of different constituents may be added together. Overall, this conservative method of risk characterization is expected to over-estimate, rather than under-estimate, health risks posed by the Site. Because all potentially complete exposure pathways were evaluated in the HHRC, potential risks are not likely to be underestimated.

4.0 RISK TO THE ENVIRONMENT

Risk to the Environment was evaluated in this RC in accordance with MADEP guidance *Method 3 Environmental Risk Characterization* (MADEP, 1996). This MADEP guidance provides for two stages of environmental risk characterization:

1. Stage I Environmental Screening, which is used to identify those situations which require further evaluation; and
2. Stage II Environmental Risk Characterization, which is a detailed evaluation of those environmental exposure pathways identified in Stage I.

As part of Stage I, available site information is reviewed to identify the presence of environmental receptors and to determine whether the identified receptors are currently exposed, or could potentially be exposed, to site-related constituents. According to MADEP guidance, a "complete exposure pathway means that the contamination is actually reaching plants or animals, or is likely to do so in the future" (MADEP, 1996). Exposure pathways that are not complete and are not likely to be complete, are not required to be evaluated further.

As discussed in Section 3.1.1, the DDA is limited to upland areas and does not include Cedar Swamp Brook. Therefore, this ERC is limited to evaluation of surface soil.

4.1 Stage I Environmental Screening

Information about the Site was reviewed to determine whether environmental receptors are currently or may in the future be present, and to determine whether the identified receptors are currently exposed, or could potentially be exposed, to Site-related constituents of potential ecological concern (COPECs). Environmental screening begins with an assessment of whether the potential for exposure exists at the Site. Exposure pathways, or links between the presence of a constituent and ecological receptors, must be complete for exposure potential to exist.

4.1.1 Habitat Evaluation

AMEC conducted field evaluations of natural habitats in several areas of the BMC property to provide specific information about ecological communities and wildlife present in the area. These observations were used to support the ecological risk characterization and select representative species to be used in Stage II environmental RC. A field inspection was conducted on September 15, 2009, that documented species present in the DDA area. A field visit performed in August 2011 as part of the asbestos soil sampling provides additional, more recent, documentation as to current conditions.

Much of the former BMC property is disturbed by historical industrial activity. The property contains roads and other corridors (cleared paths, railroad spur), impervious areas, buildings, former building locations, areas of stockpiled soil, rock, construction debris, and channelized

water bodies. The property is surrounded by both undeveloped land (forested uplands and wetlands) and developed areas. Land uses in developed areas include residential, commercial, and industrial. The Neponset River flows from southwest to northeast through the eastern portion of the property; it has been channelized where it crosses the Site, and a part of the river is diverted into Ruckaduck Pond. The tributary Cedar Swamp Brook approaches the northern border of the Site from the west, and joins the Neponset east of the Site in a forested wetland system. A railroad right-of-way forms part of the western border of the Site. These features are important factors influencing the vegetative communities and the wildlife species that use the Site. Most areas of the Site are vegetated at least in part by invasive species and early colonizing species of disturbed lands.

Prior to the field evaluation, AMEC reviewed existing project documentation, publicly available maps, and related ecosystem information. The habitat evaluation then consisted of observing and describing ecological communities at the Site, classifying these ecological communities in relation to an existing classification system, investigating the Site for evidence of wildlife use of the areas, and based on literature references, identifying wildlife species that could reasonably be expected to occupy the areas of interest.

The reference ecological community description used for the habitat evaluation is the Classification of Natural Communities developed by the NHESP (Swain and Kearsley 2001). This classification system describes ecological communities according to vegetation species composition, landscape, and hydrology in particular environments. The classes are based on exemplary conditions of recurring assemblages of plants and animals as observed in undisturbed landscapes, and generally exclude those areas created or maintained by human activities. Although the NHESP classes may not strictly correspond to the areas under investigation at the Site as a result of historical industrial activities, it provides a convenient reference point for ecosystem description and development of species lists. Detailed field observations of environmental conditions were used with Site personnel reports and literature reports of similar ecosystems, species assemblages, and wildlife habitats to complete the ecological habitat characterization of the areas.

An AMEC ecologist inspected the Site on September 15, 2009, to view the entirety of the Site and the surroundings and describe the ecological communities. Communities were described by the plant strata present (tree canopy, subcanopy, shrubs, herbaceous vegetation, and vines), the vegetation species composition in each, and by a description of landscape including soils and hydrology. The inspection also looked for evidence of recent disturbance or stressed vegetation. Information on wildlife use of the areas was gathered through direct observation of species or their signs, and by comparing the observed habitats with published lists of animals known or expected to occur in those habitats.

The DDA is a highly disturbed area. The majority of the forested upland communities within the project area are unexceptional white pine / oak forests. These communities are dominated by

red oak and white pine in the canopy. The understory of this community is in large part dominated by oriental bittersweet, glossy buckthorn, and poison ivy. Debris from old machines and construction activities are present in this community.

Cover is characterized by a mix of grasses, shrubs and gravelly zones, with a road running through and areas of standing water. Habitat is of overall limited quality due to large patches of unvegetated surface. Trees are limited to the perimeter. Many of the flora species observed in the DDA area (listed below) are invasive species representative of highly disturbed areas:

Canopy - Oak Forest

Quercus rubra	Red oak
Acer rubrum	Red maple
Pinus strobusstrobes	White pine
Quercus alba	White oak
Populus tremula	Quaking aspen
Fraxinus americana	White ash
Ulmus americana	American elm
Betula alleghaniensis	Yellow birch
	Hemlock species

Shrub Layer

Elaeagnus angustifolia	Russian olive
Frangula alnus	Glossy buckthorn
Myric spp.	Bayberry
Betula populifolia	Gray birch
Toxicodendron radicans	Poison ivy
Celastrus orbiculatus	Oriental bittersweet
Rosa multiflora	Multiflora rose
	Grape

Understory

Toxicodendron radicans	Poison ivy
Parthenocissus quinquefolia	Virginia creeper
Arctium spp	Burdock
Graminoides	Grasses

Meadow

Ambrosia artemisifolia	Common ragweed
Solidago and Euthamia spp.	Goldenrod spp.
Daucus carota	Queen Anne's lace
Populus spp	Tree seedlings
Fallopia japonica	Japanese knotweed
Trifolium spp.	Red clover
Rudbeckia hirta	Black-eyed susan
Scrophulariaceae spp.	Mulleins

Wildlife observed or expected consists of those species normally inhabiting disturbed areas within and near forest edges, and mid-late old field successional communities, including suburban areas, roadsides, and waste areas. Deer tracks, and burrows were noted, as well as frogs and crickets. The following species have been observed or would be expected in the DDA area:

Amphibians

Bufo americanus	American toad
Bufo woodhouseii fowleri	Fowler's toad
Rana pipiens	Northern leopard frog

Reptiles

Chelydra serpentina	Snapping turtle
Chrysemas picta	Painted turtle
Coluber constrictor	Northern black racer
Diadophis punctatus edwardsii	Northern ringneck snake
Lampropeltis triangulum	Eastern milk snake
Lichlorophis vernalis	Eastern smooth green snake
Storeria dekayi	Northern brown snake
Storeria occipitomaculata	Northern redbelly snake
Thamnophis sirtalis	Eastern garter snake

Avian Species

Baeolophus bicolor	Tufted titmouse
Bombucilla cedrorum	Cedar waxwing
Bubo virginianus	Great-horned owl
Buteo jamaicensis	Red-tailed hawk
Cardinalis cardinalis	Northern cardinal
Carduelis tristis	American goldfinch
Carpodacus mexicanus	House finch
Cathartes aura	Turkey vulture
Corvus brachvrhvnchos	American crow
Cyanocitta cristata	Blue jay
Melospiza melodia	Song sparrow
Passer domesticus	House sparrow
Turdus migratorius	American robin
Zenaida macroura	Mourning dove

Mammals

Blarina brevicauda	Northern short-tailed shrew
Canis latrans	Coyote
Didelphis marsupialis	Opossum
Didelphis virginiana	Virginia opossum
Microtis pennsylvanicus	Meadow vole
Odocoileus virginianus	White-tailed deer

Mammals	
Peromyscus leucopus	White-footed mouse
Procyon lotor	Raccoon
Scalopus aquaticus	Eastern mole
Sciurus carolinensis	Gray squirrel
Sylvilaqus floridanus	Eastern cottontail rabbit
Tamias striatus	Eastern chipmunk

4.1.2 Comparison of Soil Concentrations to Ecological Risk-Based Concentrations

As required in 310 CMR 40.0995, maximum detected concentrations in soil from 0 to 2 ft bgs in the DDA were compared to MADEP's background concentrations from "natural" soil (MADEP, 2002a) and ecological risk-based concentrations in soil.

Table 4-1 presents the ecological screening for DDA soil. DDA maximum detected concentrations exceed screening levels for arsenic, several metals, several PAH compounds, and dioxin/furan compounds (TCDD TEQs). No screening criteria exist for the petroleum hydrocarbon fraction, so these have been included as COPECs for DDA. Because the Stage I screening process identified COPECs, a Stage II ERC was performed.

4.2 Stage II Environmental Risk Characterization

Environmental risk characterizations involve multiple steps. The first step, Problem Formulation, develops a Conceptual Site Model (CSM) that identifies ecological resources (Site biota) and identified the assessment endpoints (ecological "entities" and their characteristics and functions targeted for protection). Based on the key assessment endpoints, measurement endpoints (quantitative or measurable characteristics or attributes of the assessment endpoints) are developed, such as measures or estimates of exposure or effect. Risk characterization, the third step, evaluates the likelihood of adverse ecological effects on the assessment endpoints based on the results of the analysis. Each of these steps is described in more detail below.

4.2.1 Problem Formulation

Problem formulation includes the following:

1. Review of available data on ecological communities and existing data on constituent concentrations in environmental media (accomplished during the Stage I Environmental Screening);
2. Development of a conceptual site model (CSM);
3. Identifying assessment endpoints;
4. Selection of representative ecological receptor species; and
5. Selection of COPECs.

4.2.1.1 Development of a Conceptual Site Model

One important component of the Problem Formulation phase is the development of a CSM, which integrates existing knowledge of the physical, biological, and constituent conditions at the Site into a strategy for assessing whether concentrations of COPECs in soil or prey pose a potential threat to exposed populations.

CSMs describe the direct and indirect pathways through which ecological receptors might be exposed to COPECs. According to U.S. EPA (1998), the CSM presents a verbal description and visual representation of the pathways from constituent sources to potentially exposed receptors. The two objectives of a CSM are to: (1) illustrate the important relationships within the ecosystem and (2) specify exposure scenarios to be evaluated in the environmental risk characterization. The CSM for the Site is presented in **Figure 4-1**.

The CSM suggests ecological receptors may be directly exposed to COPECs through contact with soil and indirectly exposed by consumption of food organisms that have accumulated COPECs in their tissues due to soil exposure.

4.2.1.2 Assessment and Measurement Endpoints

Assessment endpoints represent an explicit expression of the actual environmental values to be protected at the Site. Assessment endpoints are either measured directly or evaluated through indirect measures. They have been developed based on the four selection criteria in the U.S. EPA guidance (1997a) and the requirement that the ecosystems, communities, and/or species selected as endpoints are present at the Site. The four selection criteria include:

1. Consideration of the constituents present and their concentrations;
2. Mechanisms of toxicity of the constituents to different groups of organisms;
3. Ecological relevance of receptor groups that are potentially sensitive or highly exposed to the constituent and attributes of their natural history; and
4. Potential completeness of exposure pathways from the constituent(s) to the relevant receptor group.

Measurement endpoints represent quantifiable ecological characteristics that can be measured, interpreted, and related to the valued ecological component(s) chosen as the assessment endpoints. When selecting measurement endpoints, there should be an explicit relationship between the measurement endpoint and the assessment endpoint (i.e., value to be protected) to which it is linked. Measurement endpoints should be selected based on the species/community/habitat patterns across the Site, the varying relationship to the COPEC concentrations, and considerations of the mechanisms of toxicity.

Assessment and measurement endpoints have been developed to evaluate COPEC concentrations and potential ecological risks at the Site. In some cases, more than one

measurement endpoint may be identified for a particular assessment endpoint. These instances permit a "weight-of-evidence" approach to be used in risk characterization, in which a measurement endpoint that has more relevance to the assessment endpoint than another measurement endpoint is assigned more "weight" in the interpretation of risk estimates. In other cases, a measurement endpoint may be relevant to more than one assessment endpoint, or a secondary assessment endpoint may not have a measurement endpoint associated with it

Based on the CSM for the Site (**Figure 4-1**) consisting of primary producers, primary consumers (herbivores), and secondary consumers (insectivores and carnivores), the following assessment and measurement endpoints have been evaluated for each of the three exposure areas:

Assessment Endpoint 1 – The reproductive success and population sustainability of herbivorous mammal and bird populations potentially exposed to COPECs in surface soil and prey.

Corresponding Measurement Endpoint – Comparison of predicted average daily doses of COPECs to toxicity reference values (TRVs) for mammalian and avian receptors.

Assessment Endpoint 2 – The reproductive success and population sustainability of insectivorous mammal and bird populations potentially exposed to COPECs in surface soil and prey.

Corresponding Measurement Endpoint – Comparison of predicted average daily doses of COPECs to TRVs for mammalian and avian receptors.

Assessment Endpoint 3 – The reproductive success and population sustainability of carnivorous mammal and bird populations potentially exposed to COPECs in surface soil and/or prey.

Corresponding Measurement Endpoint – Comparison of predicted average daily doses of COPECs to TRVs for mammalian and avian receptors.

4.2.1.3 Selection of Ecological Receptors

Criteria for the selection of wildlife receptors include three factors specified in U.S. EPA guidance (1989, 1992, 1997c) for determining "key organisms" in an ecological food web: (1) resident communities or species exposed to constituent concentrations in soil and surface water; (2) species or functional groups considered to be essential to, or indicative of, the normal functioning of the affected habitat; and (3) species representing federal or state threatened or endangered species. Other factors to be considered include the trophic level of the organisms, area use factors and feeding habits of the species, availability of life history and toxicity data for the species, and abundance of the species.

According the U.S. Fish and Wildlife Service published data "Federally Listed Endangered and Threatened Species in Massachusetts" revised 6/22/2009, (http://www.fws.gov/newengland/) there are no known occurrences of federally-listed species in Walpole, Massachusetts.

AMEC submitted a written request to the Massachusetts Division of Fisheries and Wildlife (DFW) Natural Heritage and Endangered Species Program (NHESP) for information regarding state-listed endangered, threatened, or species of special concern that may be known by NHESP to inhabit the vicinity of the site. NHESP responded with a letter on October 28, 2009 (NHESP, 2009) stating that, based on the information provided, the Site, or a portion thereof, is located within Priority Habitat 1072 (PH 1072) and Estimated Habitat 855 (EH 855) as indicated in the Massachusetts Natural Heritage Atlas (13th Edition). NHESP's database indicates that one state-listed rare species has been found in the vicinity of the Site: *Callophrys hesseli* (Hessel's Hairstreak), a Species of Special Concern. Hessel's hairstreak is a butterfly (*Lepidoptera*) that is protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the state's Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Hessel's Hairstreak exclusively inhabits Atlantic white cedar (*Chamaecyparis thyoides*) swamps and bogs. No Atlantic white cedar swamps or bogs exist at DDA. As such, it is highly unlikely that the species Hessel's hairstreak occurs in the investigated areas.

The following representative receptors have been selected for evaluation of the measurement endpoints discussed above.

Herbivorous Mammals. The meadow vole (*Microtus pennsylvanicus*) is a small plant-eating mammal commonly found in vegetated fields. They may also incidentally ingest surficial soils while feeding.

Herbivorous Birds. The quail, also referred to as northern bobwhite, (*Colinus virginianus*) subsists mainly on seed and low-lying vegetation. They are commonly found in grassy fields and pastures. They may also incidentally ingest surficial soils while feeding.

Insectivorous Mammals. The short-tailed shrew (*Blarina brevicauda*) is a species that preys mainly on insects and soil invertebrates. They can be found in almost any habitat, but prefer habitats with vegetation. They may also incidentally ingest surficial soils while feeding.

Insectivorous Birds. The American woodcock (*Scolopax minor*) subsist primarily on invertebrates. They are commonly found in woodlands and open fields. They may also incidentally ingest surficial soils while feeding.

Carnivorous Mammals. The red fox (*Vulpes vulpes*) primarily feeds on small animals. They can be found in a large variety of habitats, including abandoned fields and woodlands. They may also incidentally ingest surficial soils while feeding.

Carnivorous Birds. The red-tailed hawk (*Buteo jamaicensis*) subsists primarily on small mammals and can be found in woodlands and open fields. They may also incidentally ingest surficial soils while feeding.

4.2.1.4 Selection of COPECs

Constituents with maximum detected soil concentrations exceeding the screening concentrations presented in Section 4.1.2 were selected as COPECs. COPECs are shown in **Table 4-1** for DDA. Soil is the only identified medium of ecological concern

4.2.2 Analysis

The analysis stage of environmental RC consists of two steps: the exposure assessment and the effects assessment. These are described in the sections below.

4.2.2.1 Exposure Assessment

The exposure assessment estimates the magnitude, frequency, duration, and types of potential exposures to COPECs in food webs at the Site. This includes calculating EPCs in Site media and identifying equations and exposure parameter values used to estimate potential exposure for the ecological receptors. Potential receptors and exposure routes evaluated in the exposure assessment were identified in Section 4.2.1 above. The following sections describe the equations and exposure assumptions used to estimate potential exposure and derivation of EPCs. Exposure parameter values are presented in **Table 4-2**.

A food chain analysis was used to estimate exposure to Site COPECs for each representative receptor. The general calculation is

$$ADD\left({}^{mg}/_{kg-day}\right) = \frac{\left[\left(C_f x IR_f\right) + \left(C_s x IR_s\right)\right] x AUF}{BW}$$

where:

ADD	=	Average daily dose (mg/kg-day)
C_f	=	Concentration of COPEC in food (mg/kg)
IR_f	=	Ingestion rate of food (kg/day)
C_s	=	Concentration of COPEC in soil (mg/kg)
IR_s	=	Incidental ingestion rate of soil (kg/day)

AUF = Area use factor (unitless) and
BW = Body weight (kg).

The parameter values used in the above equation for each receptor, along with the reference, are shown in **Table 4-2**. Detailed calculations appear in **Attachment F**.

4.2.2.2 Exposure Point Concentrations

Using the methodology described in Section 3.3.7.1, soil EPCs were calculated as the arithmetic mean of concentrations from samples in 0 to 3 foot depth interval. Soil EPCs for ecological risk calculations are presented in **Table 4-1** for DDA.

Earthworm samples were collected from the DDA area. One sample location falls within the DDA boundary and was used to represent invertebrate dietary concentrations. For COPECs with no earthworm analytical results, the COPEC concentration in invertebrates was estimated by multiplying EPCs in soil by a constituent-specific soil-to-soil invertebrate BTF obtained from U.S. EPA (1999, 2007; see **Table 4-3**). For some inorganics, tissue concentrations are calculated using published logarithmic equations that reflect declining BTFs with increasing soil concentrations. These calculations appear in **Attachment F.**

4.2.3 Effects Assessment

The effects assessment entails a review of the ecotoxicology of the COPECs and development of TRVs for the selected ecological receptors for each COPEC. TRVs were selected using toxicity information developed by the U.S. EPA for the derivation of Ecological Soil Screening Levels (EcoSSLs) and toxicity information from other sources such as Oak Ridge National Laboratory (Sample et al., 1996).

Chronic No Observable Adverse Effect Level (NOAEL) and Lowest Observable Adverse Effect Level (LOAEL) values for mammals and birds were taken from literature sources such as Schafer et al. (1983); and databases including those available from the Oak Ridge National Laboratory (Sample et al., 1996), and the U.S. EPA Integrated Risk Information System (IRIS; U.S. EPA, 2010a). The selection of appropriate TRVs focused on identifying NOAELs and LOAELs for the following toxic effect endpoints in the following order of preference: (1) reproduction, (2) growth/development, and (3) survival. The lowest TRV for a particular constituent was selected from the sources cited above. Both NOAEL-based TRVs and LOAEL-based TRVs were used in this risk characterization.

For constituents without chronic NOAELs, but for which other toxicity values were available, uncertainty factors were applied to estimate chronic NOAELs from the available toxicity data. These other toxicity values include less-than-chronic NOAELs (e.g., subchronic NOAELs), LOAELs, and the lethal dose for 50 percent of a study population (LD_{50}). An uncertainty factor of 10 (as cited in Sample et al., 1996) was used to adjust subchronic LOAEL TRVs to NOAEL

TRVs, and an uncertainty factor of 10 (as cited in Sample et al., 1996) was used to adjust subchronic TRVs to chronic TRVs. The Standard Practice for Wildlife Toxicity Reference Values (USACHPPM, 2000) recommends the use of a total uncertainty factor of 100 to adjust LD_{50} values to chronic NOAEL equivalent values.

If no toxicity values were available for a particular constituent, the chronic NOAEL or LOAEL for an appropriate surrogate constituent was used as the mammalian or avian TRV. Surrogate constituents were selected based on structural chemistry, specifically, the active moiety/functional group of the constituent. TRVs are presented in **Table 4-4** for mammalian receptors and **Table 4-5** for avian receptors.

Toxicity studies for a COPEC may have been conducted on species other than the receptor species evaluated in the ERC. If toxicity values were not based on data for the receptor species, an allometric conversion based on body size (i.e., weight and surface area) was used to extrapolate between species. For the mammalian receptors, the body size-adjusted TRVs, referred to here as "adjusted NOAEL (or LOAEL)-equivalent TRVs," were calculated using the allometric conversion in the following equation (Sample et al., 1996, 1997):

$$TRV_{adj} = TRV_t \, (BW_t/BW_r)^{(1-SF)}$$

where:

TRV_{adj}	=	Adjusted NOAEL (or LOAEL)-equivalent TRV (mg/kg of body weight per day)
TRV_t	=	NOAEL (or LOAEL)-equivalent toxicity reference value for test organism (mg of constituent/kg of body weight per day)
BW_t	=	Body weight for test organism (kg)
BW_r	=	Body weight for receptor species (kg)
SF	=	Body size scaling factor (unitless)

A body size scaling factor (SF) of 0.75 was used in the above equation to extrapolate TRVs between mammalian species (Sample et al. 1996, 1997). A SF of 1 was used in this equation to extrapolate TRVs between avian species. Mineau et al. (1996) identified a mean SF of 1.15 for birds. However, Sample et al. (1996) report that SFs for a majority of the constituents evaluated (29 of 37) by Mineau et al. (1996) were not significantly different from 1. Therefore, a SF of 1 for TRV extrapolation between avian species was determined to be more appropriate.

4.3 Risk Characterization

Risk characterization is the culmination of the preceding steps of the ecological risk assessment and involves three principal components: (1) risk estimation, (2) risk description, and (3) uncertainty analysis. In this step, the risks associated with estimated exposures are characterized, and the strengths, weaknesses, and assumptions employed in the risk

assessment are fully described. In the risk estimation, the exposure assessment and effects assessment profiles from the Analysis phase are integrated to predict the likelihood of adverse effects to receptors.

4.3.1 Risk Estimation

The risk estimation component for the food chain analysis provides a quantitative evaluation of the exposure assessment and effects assessment results. Potential risks to the ecological receptors were estimated using the hazard quotient (HQ) method. In this method, the estimated exposure (the ADD) is compared to the TRV using the following equation:

$$HQ = ADD/TRV$$

where:

HQ = Hazard quotient (unitless)
ADD = Average daily dose (output of food web model) (mg/kg-day), and
TRV = Toxicity reference value (NOAEL and LOAEL-based) (mg/kg-day).

HQs are calculated separately for each COEPC in each exposure area for each assessment endpoint below. When the HQ does not exceed 1, the estimated potential exposure does not exceed the TRV, indicating that adverse effects are not likely to occur. When the HQ is greater than 1, the estimated potential exposure exceeds the TRV, and adverse effects cannot automatically be ruled out. However, the food chain model contains multiple conservative assumptions that produce a high bias of risk. Therefore, HQs over 1 need to be evaluated to determine if there is really a likelihood of hazard.

HQs for the DDA appear in **Table 4-6**. NOAEL-based HQs did not exceed 1 with the exception of the insectivorous receptors (shrew and woodcock). The maximum HQ was 9 for TCDD TEQs (shrew); other NOAEL-based HQs over 1 were for chromium (2 for shrew and 3 for woodcock), TCDD TEQs for woodcock (2) and vanadium for woodcock (2) The LOAEL-based HQs were all below 1.

These isolated results for receptors associated with one type of diet do not in and of themselves indicate overall hazard to the environment. Calculated insectivorous HQs are frequently over 1 because of the conservative assumptions associated with estimating dietary contaminant concentrations. For TEQs, the invertebrate concentration was estimated using a BTF of 1.5, which was derived from a single study (Meyn et al, 1997). This study was based on applied sludge, which could overestimate bioavailability from more weathered sources. For chromium, the BTF was based on earthworm intake using a single earthworm sample, which was the highest of the three worm samples analyzed. In addition, earthworms represent a relatively

small proportion of the shrew diet, which is 97% insects (Meyn et al, 1997). Overall, therefore, the dietary exposure to these insectivorous species is characterized by considerable uncertainty.

4.3.2 Risk Description

The risk description component of the ERC phase includes: (1) a summary of the risk estimate(s); (2) a discussion of the evidence supporting the risk estimate(s) – i.e., weight of evidence evaluation; and (3) an interpretation of the ecological significance and relevance of the estimate(s).

4.3.2.1 Summary of Risk Estimates

4.3.2.2 Weight of Evidence

The weight-of-evidence is a crucial element of the interpretation of the ERC results, and it is integral to the risk management evaluation. The following factors are some of the key considerations in the weight-of-evidence evaluation of the various risk estimates:

1. *The relevance of the evidence to the assessment endpoint*. The avian and mammalian indicator species chosen as measurement endpoints (meadow vole, quail, short - tailed shrew, American woodcock, red fox, and red-tailed hawk) were selected for several reasons. First, all six species selected represent upper (consumer rather than producer) trophic level predators so that potential food chain effects would be considered. Second, these receptors represent major animal families (mammals and birds) and are indigenous to the habitat at the Site. Thus, the risk estimates for the selected receptors are relevant to the ecological values articulated in the assessment endpoints.

2. *The relevance of the evidence to the CSM describing the physical fate and transport processes and their direct relevance to the assessment endpoints*. The CSM and understanding of historical chemical fate and transport at the Site suggest that the concentrations of COPECs in soil are likely due to historical operations. Media samples, receptors, and exposure pathways were selected for evaluation in the ERC based on the information in the CSM. Thus, the resulting risk estimates are relevant to the CSM.

3. *The confidence in the risk estimate or other information*. The confidence and representativeness in the risk estimates is reflected in the selection of the receptors exposure parameter values, BCFs and TRVs. The ERC evaluated receptors that are typically present in habitats like the exposure areas at the Site. The exposure and toxicity values used in the ERC were obtained from MADEP and U.S. EPA sources. As such, there is high confidence that the estimated HQs do not under-estimate potential risk.

4.3.2.3 Ecological Significance and Relevance

The determination of the ecological significance of potential adverse effects to wildlife species from exposures to COPECs included consideration of the following four items:

1. *The intensity, or severity, of the predicted adverse effect.* The HQ approach was used to assess potential risk. When the HQ is greater than 1, the estimated potential exposure exceeds the TRV and a potential risk may exist for *individual organisms*. However, an HQ exceeding 1 does not indicate that adverse effects are occurring or will occur, even for individual organisms because of the conservatism in the ERC inputs and methods. Moreover, an HQ greater than 1 (particularly, if less than 10) is unlikely to indicate an adverse effect to the *population* evaluated in the risk characterization.

2. *The size of the affected area that can be attributed to COPEC-induced unacceptable effects*. The surface soil samples used in the RC were collected from locations where historical disposal activities have occurred. There are large areas on the Site where industrial and disposal activities did not occur and where concentrations are likely lower than those used to estimate EPCs and risks. Because more samples were collected from areas expected to have higher concentrations, and fewer samples from large areas where concentrations are not expected to be elevated, any HQs exceeding 1 likely indicate that any area with adverse effects is limited in size.

3. *Temporal variation and frequency in the occurrence of unacceptable effects*. There are several conservative assumptions associated with the estimation of hazard. For metals, the dietary exposure was based on one worm sample, which may not be representative of the whole DDA exposure area nor of the actual diet, which is primarily insects for the shrew. Therefore, it is likely that the ERC over-estimated the exposure for the shrew.

4. *The capability of the affected area to recover naturally to partial or full recolonization of populations or communities and conditions that existed prior to the introduction of COPECs*. There is no indication that concentrations of COPECs in soil have resulted in actual adverse effects to either individual or populations of ecological receptors. Accordingly, “recovery” does not appear necessary. Given the presence of the remnants of the former manufacturing buildings and structures, a large portion of the MBA does not provide suitable habitat for ecological receptors. As such, receptors are not likely to routinely or frequently forage in these areas. Combined with the likely over-estimate of actual average concentrations as a result of a biased sampling plan, it is unlikely that adverse effects would occur frequently, if at all.

4.4 Uncertainty Analysis of the Environmental Risk Characterization

There are a number of sources of uncertainty in ecological risk assessments, which can be broadly grouped into three categories: conceptual model uncertainty, parameter values, and model error. Each of these is discussed below.

Conceptual Model Uncertainty: The CSM summarized the fate and transport processes that are believed to have resulted in current conditions at the Site, and have formed the basis for the field investigations, the exposure pathways that were assessed, the receptors of concern, and the assessment and measurement endpoints. There is uncertainty in the completeness of the fate and transport processes and the extent to which they contribute to the potential exposure pathways and the receptors evaluated.

Parameter Values: Because of inherent biological variability and differences in study design, there is some uncertainty associated with the exposure assumptions that were used for dose calculations, biotransfer factors used to estimate EPCs in dietary components, and the TRVs that were used to estimate the risks. Because the values chosen for these variables are conservative, the resulting exposures and risks are unlikely to be underestimated.

Exposure Point Concentrations: Because soil sampling focused on areas where concentrations were expected to be elevated, the EPCs estimated from this dataset likely over-estimate actual average concentrations. Moreover, samples were collected from areas outside the boundaries of the original RTNs were excluded from the dataset. Therefore the EPCs are likely an over-estimate of the soil contacted by terrestrial ecological receptors.

Conservative exposure assumptions: Many of the exposure assumptions were based on field studies performed in other areas but were assumed to be representative of the behavior of these receptors at the Site. The most important of the exposure assumptions was the conservative assumption of a bioavailability factor of 1. The simplified food-chain exposure models used conservative assumptions and it was assumed that the COPECs were 100 percent bioavailable from the exposure media. Because bioavailability virtually always less than 100 percent, the exposures estimated in this ERC likely over-estimate actual exposures.

TRVs: Chronic TRVs were derived from the lowest reported NOAEL or LOAEL of test organisms after applying uncertainty factors to estimate chronic TRVs for the receptors of interest. The uncertainty factors used in TRV development are well established (e.g., U.S. EPA, 1997d). The TRVs identified in this ERC are for screening purposes and do not indicate concentrations levels associated with specific hazards.

Population Risk Estimates. The hazard quotient approach used in this evaluation is based on a sensitive individual receptor. Because conservative exposure assumptions were combined with conservative toxicity assumptions, the resulting risk estimates represent potential effects to

highly exposed, sensitive individuals within the population. As such, the estimated risks all but certainly overestimate potential effects to the populations.

Model Error: There is model error uncertainty in the method used to derive indirect (food-web) uptake. Although the models are based on established fate and transport processes, dietary preferences, and receptor characteristics, they are generic and may not be representative of the processes that may be occurring at the Site.

5.0 SUMMARY AND CONCLUSIONS

In accordance with the requirements of 310 CMR 40.0000 Subpart I of the MCP, a Method 3 RC of harm to human health, public welfare, safety, and the environment has been completed. The Method 3 human health RC of soil and groundwater in the DDA evaluated potential exposures of current and future trespassers, and future hypothetical groundwater use as a potable supply.

Data from site assessment activities as well as information from other sources (e.g., MADEP and U.S. EPA guidance documents and databases) were used to conduct the risk characterization.

The results of the human health risk characterization indicate that a condition of No Significant Risk can be demonstrated for soil and groundwater at the DDA.

The results of the evaluation of risk of harm to safety and public welfare indicates that no unsafe or nuisance conditions exist at the Site. Soil and groundwater constituent concentrations are less than their respective UCLs. **As such, a condition of No Significant Risk to public welfare and a condition of No Significant Risk to safety can be demonstrated at the DDA.**

The evaluation of potential risk of harm to the environment included a Stage I screening evaluation of the presence of ecological receptors and potential habitat for terrestrial ecological receptors. Potential exposures of herbivorous mammals, herbivorous avians, insectivorous mammals, insectivorous avians, carnivorous mammals, and carnivorous avians to COPECs in soil and the food web were evaluated using a hazard quotient approach.

Hazard quotients were below 1 for all receptors except the short-tailed shrew. For the shrew, the NOAEL HQs exceeding 1 in DDA were below 10 and only for two COCs These exposures are not expected to cause adverse environmental impacts to short-tailed shrew populations or populations at the Site the because the hazard quotient approach used in this evaluation is based on a sensitive individual receptor. Conservative exposure assumptions are combined with conservative toxicity assumptions, so that the resulting risk estimates overestimate potential effects to the populations. HQs within an order of magnitude of 1 are not likely to be associated with population effects.

Based on the finding that population-level effects are not expected for all receptors, a condition of No Significant Risk of harm to the environment exists at the DDA.

This human health and environmental risk characterization concludes that DDA achieves a condition of No Significant Risk.

REFERENCES

Board of Sewer and Water Commissioners (BSWC). 2007. Letter from John Spillane, Chairman, Town of Walpole Board of Sewer and Water Commissioners to Dina Kuykendall of Baker Hughes dated October 27, 2005.

Massachusetts Department of Environmental Protection (MADEP). 1995. Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan. Interim Final Policy. WSC/ORS-95-141. July.

MADEP. 1996. Guidance for Disposal Site Risk Characterization - In Support of the Massachusetts Contingency Plan. Section 9.0: Method 3 - Environmental Risk Characterization. Interim Final Policy. WSC/ORS-95-141. April.

MADEP. 2002a. Technical Update: Background Levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil. Updates: Section 2.3 Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan (1992). Office of Research and Standards

MADEP. 2002b. Characterizing Risks posed by Petroleum Contaminated Sites: Implementation of MADEP VPH/EPH Approach. 2002.

MADEP. 2006, Bureau of Waste Site Cleanup, Massachusetts Contingency Plan, 310 CMR 40.0000, April 2006.

MADEP. 2008. Technical Update. Characterization of Risks due to Inhalation of Particulates by Construction Workers. http://www.mass.gov/dep/cleanup/laws/inh0708.pdf.

MADEP. 2009. Spreadsheets Calculating the Proposed Standards, MCP Toxicity spreadsheet. December 2009. http://www.mass.gov/dep/cleanup/laws/mcpsprds.zip.

Meyn et al, 1997. Terrestrial wildlife risk assessment for TCDDin land-applied pulp and paper mill sludge. Env. Contam. Toxicol. 16(9): 1789.

Mineau, P., B. Collins, and A. Baril. 1996. On the use of scaling factors to improve interspecies extrapolation of acute toxicity in birds. Regulatory Toxicology and Pharmacology. Vol. 24, pp. 24-29.

Natural Heritage and Endangered Species Program (NHESP). 2009. Letter from Thomas W. French Ph.D. to Stephen Herzog dated October 28, 2009.

Sample, B.E., D. M. Opresko, and G. W. Suter II. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Lockheed Martin Energy Systems. ES/ER/TM-86/R3.

Sample, B.E., M. S. Aplin, R. A. Efroymson, G. W. Suter II, and C. J. E. Welsh. 1997. Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants. Oak Ridge National Laboratory. Environmental Sciences Division. Publication No. 4650. ORNL/TM-13391

Schafer, E.W. Jr., W.A. Bowles, Jr., and J. Hurlburt. 1983. The acute oral toxicity, repellency, and hazard potential of 998 chemicals to one or more species of wild and domestic birds. Arch. Environ. Contam. Toxicol. 12:355-382.

Swain, P.C. and J. B. Kearsley. 2001, Classification of the Natural Communities of Massachusetts, Version 1.3. Natural Heritage & Endangered Species Program. www.mass.gov/dfwele/dfw/nhesp/natural_communities/natural_community_classification.htm

USACHPPM. 2000. Standard Practice for Wildlife Reference Values Technical Guide No. 254. U.S. Army Center for Health Promotion and Preventive Medicine Aberdeen Proving Ground, Maryland, October 2001.

U.S. EPA. 1989. U.S. Environmental Protection Agency. Risk Assessment Guidance for Superfund, Volume II. Environmental Evaluation Manual. Interim Final. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/1-89/001.

U.S. EPA. 1992. Framework for Ecological Risk Assessment. EPA/630/R-92-001. Office of Solid Waste and Emergency Response, United States Environmental Protection Agency. Washington, D.C. January.

U.S. EPA. 1997a. Exposure Factors Handbook, Volume I - General Factors. EPA/600/P-95/002Fa.

U.S. EPA. 1997b. Health Effects Assessment Summary Tables. Fiscal Year 1997. Office of Health and Environmental Assessment. PB97-921199.

U.S. EPA. 1997c. Ecological Risk Assessment for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final. U.S. EPA Environmental Response Team. EPA 540-R-97-006. PB97-963211.

U.S. EPA. 1997d. *Uncertainty Factor Protocol for Ecological Risk Assessment. Toxicological Extrapolations to Wildlife Receptors*. EPA Region VIII, Ecosystem Protection and Remediation Division. February.

U.S. EPA. 1998. Guidelines for Ecological Risk Assessment. Final. April, 1998. Risk Assessment Forum Washington, DC EPA/630/R-95/002F

U.S. EPA. 1999. Protocol for Screening Level Ecological Risk Assessment at Hazardous Waste Combustion Facilities, Vol. 1, 2, & 3. Peer Review Draft. U.S. Environmental Protection

Agency, Office of Solid Waste and Emergency Response.EPA530-D-99-001A, EPA530-D-99-001B, and EPA530-D-99-001C. August.

U.S. EPA. 2005. Revised Cancer Guidelines and the Supplemental Guidance. EPA/630/P-03/001B. March.

U.S. EPA. 2007. Guidance for Developing Ecological Soil Screening Levels (Eco SSL). OSWER Directive 9285.7-55. April.

U.S. EPA. 2010a. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office, Cincinnati, OH. www.epa.gov/iris.

U.S. EPA. 2010b. Regional Screening Tables. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/index.htm.

U.S. Fish and Wildlife Service. 2009. Federally Listed Endangered and Threatened Species in Massachusetts, revised 6/22/2009. www.fws.gov/newengland/pdfs/MA species by town.pdf.

Van den Berg, M., L.S. Birnbaum, M. Denison, M. De Vito, W. Farland, M. Feeley, H. Fiedler, H. Hakansson, A. Hanberg, L. Haws, M. Rose, S. Safe, D. Schrenk, C. Tohyama, A. Tritscher, J. Tuomisto, M. Tysklind, N. Walker and R.E. Peterson. 2006. The 2005 World Health Organization Re-evaluation of Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds. Toxicological Sciences, 93:223-241.

Weston, 2007. Phase II Comprehensive Site Assessment Report, Demolition Debris Area, RTN 3-3024105. 30 July

Figures

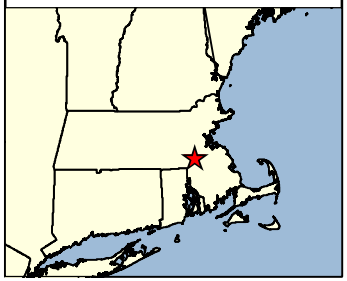
FIGURE 1-1

SITE LOCATION MAP

Bird Machine Inc. Company

100 Neponset Street
Walpole, MA

Location of Site



Source: Topo quad provided by National Geographic TOPO! Series: 2008

0 2,000 Feet

N

AMEC Earth & Environmental, Inc.
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Westford, MA 01886
(978) 692-9090

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Figure 2-1

Exposure Areas
Bird Machine Company
Risk Characterization

Property Boundary
Manufacturing Building Area
Lead Release Area 3
South Rail Spur Area
Neponset River Area
Demolition Debris Exposure Area

A Inset depicts full extent of Neponset River Exposure Area

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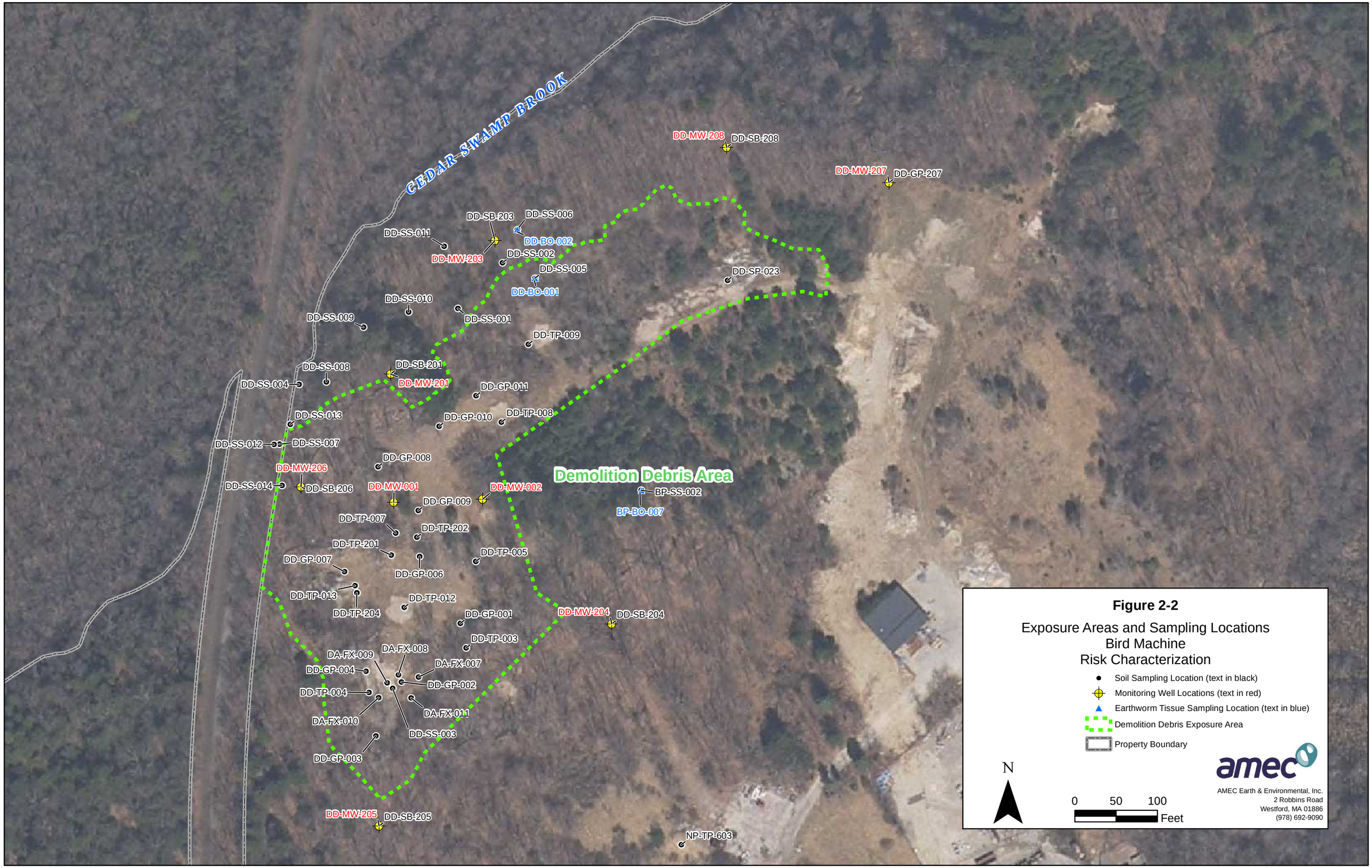

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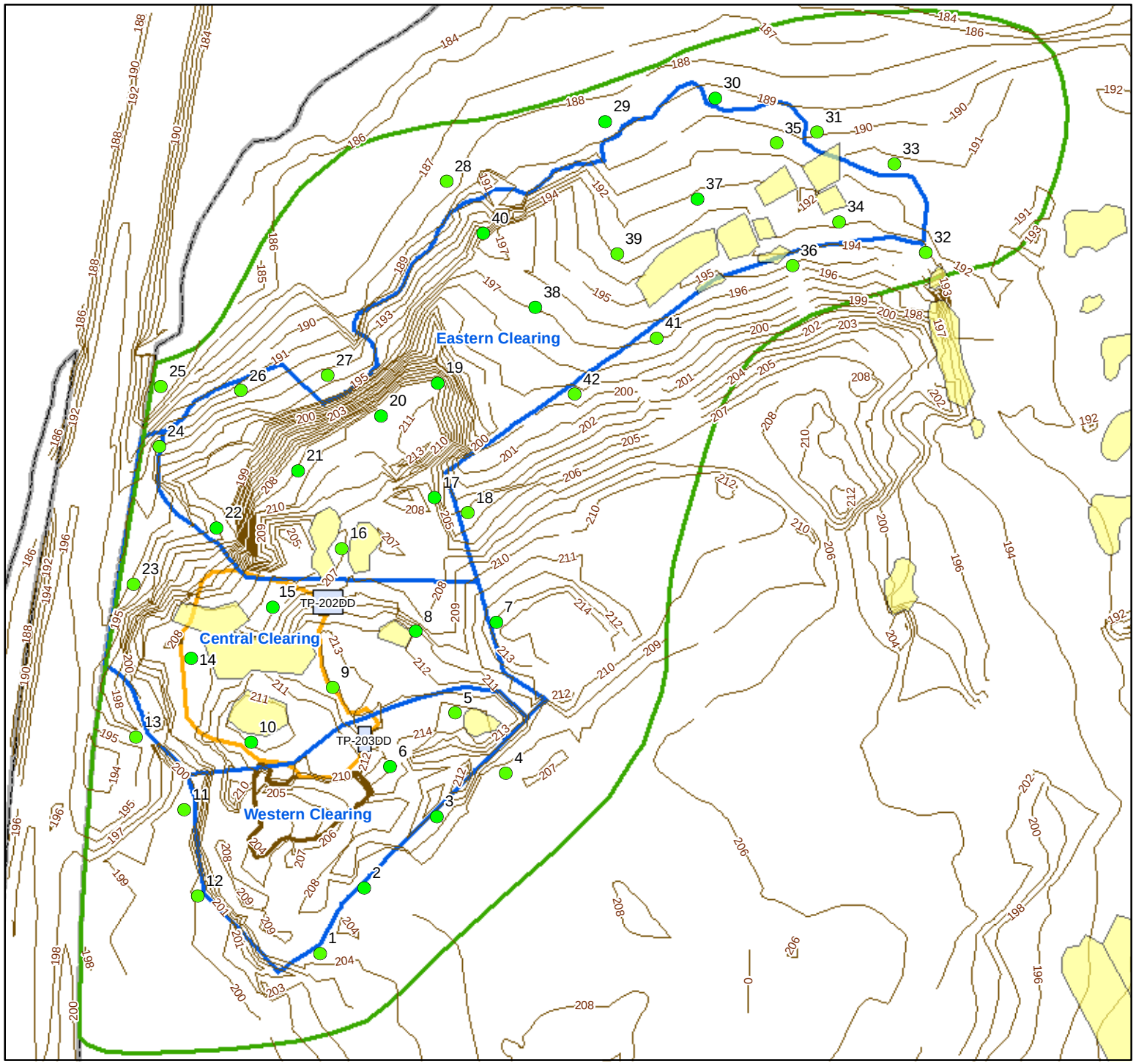


FIGURE 2-3

Asbestos In Soil Sampling Locations

Bird Machine Co.
Walpole, MA

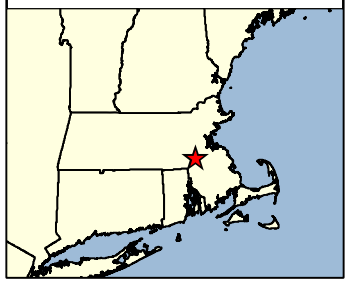
Legend

- Soil Sampling Location
- Demolition Debris Area
- Stockpile Area
- Test Pit
- Elevation Contour (feet)
- Perimetric Area
- Property Boundary

Excavation Area

- Central Clearing
- Western ACM

Location of Site



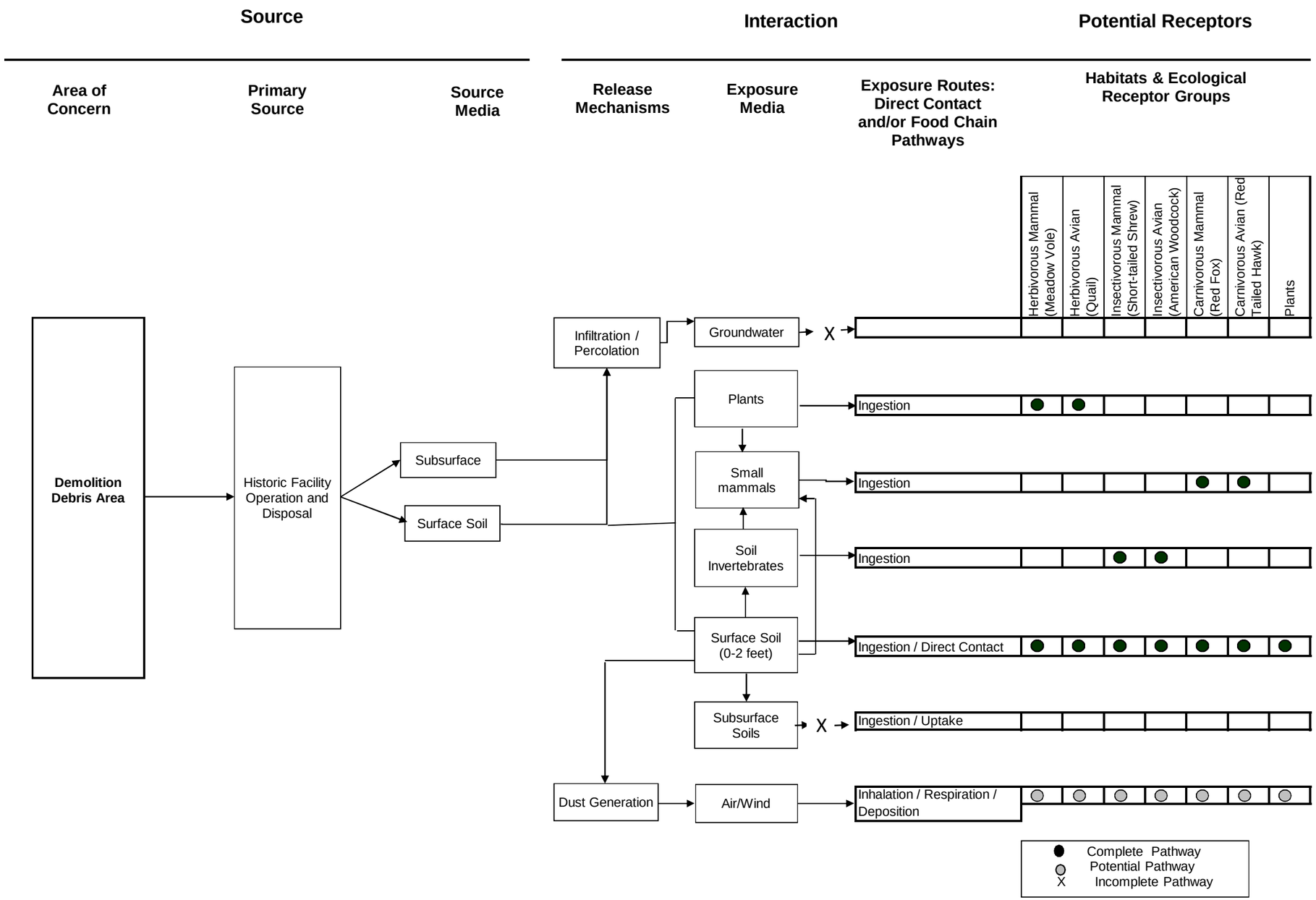
Elevation contour source: MassGIS
Base map source: Weston Solutions

0 100 Feet

N

AMEC Earth & Environmental, Inc.
2 Robbins Road
Westford, MA 01886
(978) 692-9090

Figure 4-1
Conceptual Site Model
for Environmental Risk Characterization
Bird Machine Company
Walpole, MA



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Tables

Table 2-1
Soil Samples Included in Exposure Areas
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Sample ID Number	Sample Used in Ecological Risk Calculations (0-2 ft bgs)	Sample Used in Human Health Risk Calculations (0-3 ft bgs)
DDA-GP-3 (0-2)RR & Dup	X	X
DDA-GP-4 (4-6)	X	X
DDA-GP-6 (0-2)	X	X
DDA-GP-9(4-6)RR & Dup	X	X
DD-GP-207-001-X		X
DD-SB-206-003-X	X	X
DD-SS-001-001-X	X	X
DD-SS-005-001-X	X	X
DD-SS-007-001-X & Dup	X	X
DD-SS-012-001-X	X	X
DD-SS-014-001-X	X	X
DD-TP-001-001-X	X	X
DD-TP-001-002-X	X	X
DD-TP03-2S	X	X
DD-TP04-2S	X	X
DD-TP05-2S	X	X
DD-TP07-2S-D & Dup	X	X
DD-TP08-2S	X	X
DD-TP09-2S-D & Dup	X	X
DD-TP12-5W	X	X
DD-TP-201-001-X	X	X
DD-TP-202-002-X	X	X
DD-TP-202-003-X	X	X

Table 3-1
Selection of COCs and Exposure Point Concentrations in Soil
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

CAS Number	Analyte (mg/kg)	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration	Background	UCL	COC	Rationale	EPC
95-63-6	1,2,4-TRIMETHYLBENZENE	7	1	14%	2.00	2.00	0.29	NA	1000	YES	AB	0.29
107-06-2	1,2-DICHLOROETHANE	7	1	14%	0.0020	0.0020	0.021	NA	6000	YES	AB	0.021
108-67-8	1,3,5-TRIMETHYLBENZENE	6	1	17%	0.68	0.68	0.11	NA	1000	YES	AB	0.11
51-28-5	2,4-DINITROPHENOL	15	0	0%	ND	ND	0.35	NA	900	NO	ND	
78-93-3	2-BUTANONE	7	0	0%	ND	ND	0.17	NA	10000	NO	ND	
91-57-6	2-METHYLNAPHTHALENE	17	2	12%	0.066	0.22	0.14	0.5	5000	NO	BB	
106-47-8	4-CHLOROANILINE	16	2	13%	0.11	0.13	0.64	NA	3000	YES	AB	0.64
99-87-6	4-ISOPROPYLTOLUENE	7	1	14%	0.040	0.040	0.026	NA	1000	YES	AB	0.026
100-02-7	4-NITROPHENOL	16	0	0%	ND	ND	1.68	NA	1000	NO	ND	
83-32-9	ACENAPHTHENE	17	1	6%	0.46	0.46	0.15	0.5	10000	NO	BB	
67-64-1	ACETONE	7	1	14%	0.24	0.24	2.051	NA	10000	YES	AB	2.051
120-12-7	ANTHRACENE	17	3	18%	0.22	1.035	0.22	1.0	10000	NO	BB	
7440-36-0	ANTIMONY	14	5	36%	1.30	8.10	2.18	1.0	300	YES	AB	2.18
11096-82-5	AROCLOR-1260	17	1	6%	1.35	1.35	0.13	NA	100	YES	AB	0.13
7440-38-2	ARSENIC	17	14	82%	1.30	26.00	4.73	20	200	YES	AB	4.73
7440-39-3	BARIUM	17	17	100%	1.70	1400.00	248.57	50	10000	YES	AB	248.57
71-43-2	BENZENE	7	0	0%	ND	ND	0.020	NA	9000	NO	ND	
56-55-3	BENZO(A)ANTHRACENE	17	5	29%	0.13	1.59	0.26	2.0	3000	NO	BB	
50-32-8	BENZO(A)PYRENE	17	4	24%	0.31	1.44	0.26	2.0	300	NO	BB	
205-99-2	BENZO(B)FLUORANTHENE	17	4	24%	0.14	2.30	0.29	2.0	3000	YES	AB	0.29
191-24-2	BENZO(G,H,I)PERYLENE	17	1	6%	1.30	1.30	0.20	1.0	10000	YES	AB	0.20
207-08-9	BENZO(K)FLUORANTHENE	17	4	24%	0.31	2.10	0.30	1.0	10000	YES	AB	0.30
7440-41-7	BERYLLIUM	17	3	18%	0.55	4.10	0.54	0.4	2000	YES	AB	0.54
EPH1122	C11-C22 AROMATICS, ADJUSTED	15	13	87%	11.50	69.00	27.82	NA	1000	YES	AB	27.82
EPH1936	C19-C36 ALIPHATICS	15	13	87%	5.30	170.00	48.070	NA	1000	YES	AB	48.070
VPH58	C5-C8 ALIPHATICS, ADJUSTED	6	1	17%	5.20	5.20	2.042	NA	1000	YES	AB	2.042
VPH910	C9-C10 AROMATICS	6	1	17%	24.00	24.00	5.17	NA	1000	YES	AB	5.17
VPH912	C9-C12 ALIPHATICS, ADJUSTED	6	0	0%	ND	ND	1.41	NA	1000	NO	ND	
VPH918	C9-C18 ALIPHATICS	16	4	25%	4.80	19.00	4.041	NA	1000	YES	AB	4.041
7440-43-9	CADMIUM	17	13	76%	0.38	2.60	0.93	2	300	YES	AB	0.93
7440-47-3	CHROMIUM	17	17	100%	1.20	2200.00	189.49	30	2000	YES	AB	189.49
18540-29-9	CHROMIUM VI	1	0	0%	ND	ND	0.23	30	2000	NO	ND	
218-01-9	CHRYSENE	17	6	35%	0.14	1.69	0.31	2	10000	NO	BB	
7440-50-8	COPPER	1	1	100%	56.00	56.00	56.00	40	1000	YES	AB	56
53-70-3	DIBENZ(A,H)ANTHRACENE	17	1	6%	1.30	1.30	0.20	0.5	1000	YES	AB	0.20
100-41-4	ETHYLBENZENE	7	1	14%	0.23	0.23	0.033	NA	10000	YES	AB	0.033
206-44-0	FLUORANTHENE	17	8	47%	0.16	4.40	0.63	4	10000	YES	AB	0.63
86-73-7	FLUORENE	17	1	6%	0.74	0.74	0.17	1	10000	NO	BB	
193-39-5	INDENO(1,2,3-CD)PYRENE	17	1	6%	0.94	0.94	0.20	1	3000	NO	BB	
7439-92-1	LEAD	17	17	100%	3.00	450.00	100.65	100	3000	YES	AB	101
1330-20-7	M,P-XYLENES	17	2	12%	0.27	0.27	0.18	NA	10000	YES	AB	0.18
7439-97-6	MERCURY	16	10	63%	0.062	2.90	0.42	0.3	300	YES	AB	0.42
91-20-3	NAPHTHALENE	17	3	18%	0.24	0.29	0.11	0.5	10000	NO	BB	
104-51-8	N-BUTYLBENZENE	6	1	17%	0.13	0.13	0.023	NA	1000	YES	AB	0.023
7440-02-0	NICKEL	15	15	100%	0.71	1400.00	224.90	20	7000	YES	AB	225
103-65-1	N-PROPYLBENZENE	7	1	14%	0.28	0.28	0.041	NA	1000	YES	AB	0.041
95-47-6	O-XYLENE	7	1	14%	0.49	0.49	0.070	NA	10000	YES	AB	0.070
85-01-8	PHENANTHRENE	17	7	41%	0.17	4.35	0.53	3	10000	YES	AB	0.53
129-00-0	PYRENE	17	8	47%	0.21	4.050	0.60	4	10000	YES	AB	0.60
7782-49-2	SELENIUM	16	0	0%	ND	ND	0.94	0.5	8000	NO	ND	
7440-22-4	SILVER	17	3	18%	0.83	3.20	1.16	0.6	2000	YES	AB	1.2
98-06-6	TERT-BUTYLBENZENE	7	1	14%	0.24	0.24	0.035	NA	1000	YES	AB	0.035
108-88-3	TOLUENE	7	2	29%	0.14	0.14	0.040	NA	10000	YES	AB	0.040

CAS Number	Analyte (mg/kg)	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration	Background	UCL	COC	Rationale	EPC
7440-62-2	VANADIUM	17	17	100%	1.30	150.00	38.27	30	10000	YES	AB	38
7440-66-6	ZINC	16	16	100%	4.10	810.00	169.19	100	10000	YES	AB	169
1746-01-6	2,3,7,8-TCDD TEQ	12	12	100%	0.00000072	0.000093	0.000027	2.00E-05	0.003	YES	AB	0.000027
NA	**Asbestos in Soil (MFG)**											
	TOTAL ASBESTOS FIBERS > 5µM	3	3	100%	11.7	82.9	36.6	NA	NA	YES	AB	83

Notes:
COCs - Contaminants of concern
EPC - Exposure Point Concentration
DDA - Drum Disposal Area
RL - Reporting limit
UCL - Upper concentration limit
NA - not applicable/not evaluated
ND - not detected in any sample
AB - above background
BB - below background
mg/kg - milligrams per kilogram
MFG - million fibers per gram
µM - micrometers

(1) Average concentration calculated using 1/2 RLs for non-detects.
For asbestos, the maximum concentration was used as the EPC due to the small data set and high uncertainty associated with predicting airborne concentrations.
(2) Background concentrations obtained from: Background Levels of
Polycyclic Aromatic Hydrocarbons and Metals in Soil (MassDEP, 2002).
(3) UCLs are the Upper Concentration Limit for soil published at 310 CMR 40.0996(7) Table 6, dated December 2007.
(4) EPCs are the average concentrations for each analyte.
(5) The UCLs for total PCBs and total xylenes were used for Aroclor-1260 and m,p-xylenes and o-xylenes, respectively.

Table 3-2
Selection of COCs and Exposure Point Concentrations in Groundwater
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

		All Data						2008 Only										
CAS Number	Analyte (ug/L)	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration	Number Analyzed	Number Detected	Frequency Of Detection	Minimum Detected	Maximum Detected	Average Concentration	MCL	UCL	COC	Rationale	EPC
51-28-5	2,4-DINITROPHENOL	38	1	3%	0.84	0.84	3.21	9	1	11%	0.84	0.84	2.37		100000	NO	FOD	
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	38	15	39%	0.43	5.3	3.57	9	6	67%	0.43	1.6	1.29	6	100000	YES	AB	1.29
84-74-2	DI-N-BUTYL PHTHALATE	38	1	3%	1.5	1.5	3.26	9	1	11%	1.5	1.5	2.44		10000	NO	FOD	
7440-38-2	ARSENIC (DISSOLVED)	40	10	25%	0.81	10	2.99	9	1	11%	3.9	3.9	0.93	10	9000	YES	AB	0.93
7440-39-3	BARIUM (DISSOLVED)	40	40	100%	6.1	110	30.53	9	9	100%	7.6	46	25.18	2000	100000	YES	AB	25.18
7440-47-3	CHROMIUM (DISSOLVED)	40	24	60%	0.36	43	7.62	9	8	89%	0.36	3.5	1.26	100	3000	YES	AB	1.26
7439-92-1	LEAD (DISSOLVED)	40	1	3%	0.46	0.46	1.22	9	1	11%	0.46	0.46	0.50	15	150	NO	FOD	
7440-02-0	NICKEL (DISSOLVED)	40	35	88%	0.43	110	5.55	9	9	100%	0.43	2	1.09		2000	YES	AB	1.09
7782-49-2	SELENIUM (DISSOLVED)	40	7	18%	5.5	9.3	3.02	9	2	22%	6.8	7.8	2.07	50	1000	YES	AB	2.07
7440-62-2	VANADIUM (DISSOLVED)	40	8	20%	0.18	120	5.37	9	4	44%	0.18	0.52	0.42		40000	YES	AB	0.42
7440-66-6	ZINC (DISSOLVED)	40	28	70%	1.2	850	28.94	9	8	89%	1.2	110	14.38		50000	YES	AB	14.38

Notes:
MCL - Maximum contaminant level
UCL - Upper concentration limit
COC - Contaminants of concern
EPC - Exposure point concentration
NA - Not applicable/not evaluated
ND - not detected in any sample
AB - above background
BB - below background
FOD - Low frequency of detection
(1) Average concentration calculated using 1/2 RLs for non-detects.
(2) MCLs were obtained from: 2006 Edition of the Drinking Water Standards and Health Advisories (USEPA, 2006).
(3) UCLs are the Upper Concentration Limit for soil published at 310 CMR 40.0996(7) Table 6, dated December 2007.
(4) EPCs are the average 2008 concentrations for each analyte.

Table 3-3
Toxicity Information for Method 3 Human Health Risk Characterization
Bird Machine Company - Walpole, MA
Human Health Risk and Environmental Risk Characterization

Analyte	Reference Dose Oral Chronic Value (mg/kg-day)	Reference Dose Oral Subchronic Value (mg/kg-day)	Reference Concentration Inhalation Chronic Value (mg/m^3)	Reference Concentration Inhalation Subchronic Value (mg/m^3)	Cancer Slope Factor Oral Value $(mg/kg\text{-}day)^{-1}$	Unit Risk Inhalation Value $(ug/m3)^{-1}$
1,2,4-TRIMETHYLBENZENE	NA	NA	0.007	0.007	NA	NA
1,2-DICHLOROETHANE	0.02	0.2	0.055	0.055	0.091	0.000026
1,3,5-TRIMETHYLBENZENE	0.01	0.01	NA	NA	NA	NA
4-CHLOROANILINE	0.004	0.004	0.014	0.014	0.2	NA
4-ISOPROPYLTOLUENE	NA	NA	NA	NA	NA	NA
ACETONE	0.9	2.7	0.8	0.8	NA	NA
ANTIMONY	0.0004	0.0004	0.01	0.01	NA	NA
AROCLOR-1260 (TOTAL PCBs)	0.00002	0.00005	0.00002	0.00002	2	1.0E-04
ARSENIC	0.0003	0.0003	0.0000025	0.0000025	1.5	0.0043
BARIUM	0.2	0.07	0.0005	0.005	NA	NA
BENZO(B)FLUORANTHENE	0.03	0.3	0.05	0.5	0.73	0.00011
BENZO(G,H,I)PERYLENE	0.03	0.3	0.05	0.5	NA	NA
BENZO(K)FLUORANTHENE	0.03	0.3	0.05	0.5	0.073	0.00011
BERYLLIUM	0.002	0.005	0.00002	0.00002	NA	0.0024
C11-C22 AROMATICS	0.03	0.3	0.05	0.5	NA	NA
C19-C36 ALIPHATICS	2	6	NA	NA	NA	NA
C5-C8 ALIPHATICS	0.04	0.4	0.2	0.2	NA	NA
C9-C10 AROMATICS	0.03	0.3	0.05	0.5	NA	NA
C9-C18 ALIPHATICS	0.1	1	0.2	0.6	NA	NA
CADMIUM	0.0005	0.0005	0.00002	0.00002	NA	0.00180
CHROMIUM (III)	1.5	1.5	0.0001	0.0003	NA	NA
COPPER	0.04	NA	NA	NA	NA	NA
DIBENZ(A,H)ANTHRACENE	0.03	0.3	0.05	0.5	7.3	0.0012
ETHYLBENZENE	0.1	1	1	1	0.11	0.0000025
FLUORANTHENE	0.04	0.4	0.05	0.5	NA	NA
LEAD	0.00075	0.00075	0.001	0.001	NA	NA
M,P-XYLENES (TOTAL XYLENES)	0.2	0.2	0.1	0.3	NA	NA
MERCURY	0.0003	0.0003	0.0003	0.0003	NA	NA
N-BUTYLBENZENE	0.05	0.05	NA	NA	NA	NA
NICKEL	0.02	0.02	0.001	0.001	NA	0.00026
N-PROPYLBENZENE	0.1	0.1	1	1	NA	NA
O-XYLENE (TOTAL XYLENES)	0.2	0.2	0.1	0.3	NA	NA

Table 3-3
Toxicity Information for Method 3 Human Health Risk Characterization
Bird Machine Company - Walpole, MA
Human Health Risk and Environmental Risk Characterization

Analyte	Reference Dose Oral Chronic Value (mg/kg-day)	Reference Dose Oral Subchronic Value (mg/kg-day)	Reference Concentration Inhalation Chronic Value (mg/m^3)	Reference Concentration Inhalation Subchronic Value (mg/m^3)	Cancer Slope Factor Oral Value $(mg/kg\text{-}day)^{-1}$	Unit Risk Inhalation Value $(ug/m3)^{-1}$
PHENANTHRENE	0.03	0.3	0.05	0.5	NA	NA
PYRENE	0.03	0.3	0.05	0.5	NA	NA
SILVER	0.005	0.005	0.00014	0.00014	NA	NA
TERT-BUTYLBENZENE	NA	NA	NA	NA	NA	NA
TOLUENE	0.08	0.8	5	5	NA	NA
VANADIUM	0.009	0.001	0.001	0.001	NA	NA
ZINC	0.3	0.3	0.0014	0.0014	NA	NA
2,3,7,8-TCDD TEQ	1E-09	1E-09	0.00000004	0.00000004	130000	38

Analyte	Reference Dose Oral Chronic Value (mg/kg-day)	Reference Dose Oral Subchronic Value (mg/kg-day)	Reference Concentration Inhalation Chronic Value (mg/m^3)	Reference Concentration Inhalation Subchronic Value (mg/m^3)	Cancer Slope Factor Oral Value $(mg/kg\text{-}day)^{-1}$	Unit Risk Inhalation Value $(fibers/ml)^{-1}$
ASBESTOS	NA	NA	NA	NA	NA	0.23

Notes:
mg/kg-day - milligrams per kilogram per day
mg/m3 - milligram per cubic meter
(ug/m3)-1 - inverse of microgram per cubic meter
NA - not available
(1) All un-shaded cells contain toxicity data from the December 2009 MassDEP Toxicity Spreadsheet.
(2) Gray cells contain toxicity data from USEPA (June 2011 RSLs for chemicals and the IRIS profile for asbestos).
(3) Benzo(b)fluoranthene, benzo(g,h,i)perylene and dibenzo(a,h)anthracene have calculated MassDEP IURs but RSLs were used in lieu of the calculated values.
(4) The values for total PCBs were used for Aroclor-1260.
(5) The value for chromium III were used for chromium.
(6) The values for total xylenes were used for m,p-xylenes and o-xylenes.

Table 3-4
World Health Organization Toxicity Equivalency Factors for Dioxin/Furan Congeners
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

	Mammalian TEF	Avian TEF
Chlorinated dibenzo-p-dioxins		
2,3,7,8-TCDD	1	1
1,2,3,7,8-PeCDD	1	1
1,2,3,4,7,8-HxCDD	0.1	0.05
1,2,3,6,7,8-HxCDD	0.1	0.01
1,2,3,7,8,9-HxCDD	0.1	0.01
1,2,3,4,6,7,8-HpCDD	0.01	0.001
OCDD	0.0003	0.0001
Chlorinated dibenzofurans		
2,3,7,8-TCDF	0.1	1
1,2,3,7,8-PeCDF	0.03	0.01
2,3,4,7,8-PeCDF	0.3	1
1,2,3,4,7,8-HxCDF	0.1	0.1
1,2,3,6,7,8-HxCDF	0.1	0.1
1,2,3,7,8,9-HxCDF	0.1	0.1
2,3,4,6,7,8-HxCDF	0.1	0.1
1,2,3,4,6,7,8-HpCDF	0.01	0.01
1,2,3,4,7,8,9-HpCDF	0.01	0.01
OCDF	0.0003	0.0001

Notes:
TEF - Toxicity equivalency factor
TEFs presented are the World Health Organization (WHO) 2005 values from Van den Berg et al., 2006

Table 3-5
Relative Absorption Factors
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Compound	Relative Absorption Factor Soil Ingestion Non-Cancer Chronic	Relative Absorption Factor Soil Dermal Non-Cancer Chronic	Relative Absorption Factor Soil Ingestion Non-Cancer Subchronic	Relative Absorption Factor Soil Dermal Non-Cancer Subchronic	Relative Absorption Factor Soil Ingestion Cancer	Relative Absorption Factor Soil Dermal Cancer	Relative Absorption Factor Air Inhalation Cancer	Relative Absorption Factor Air Inhalation Non-Cancer Chronic	Relative Absorption Factor Air Inhalation Non-Cancer Subchronic
1,2,4-TRIMETHYLBENZENE	1	1	1	1	NC	NC	NC	1	1
1,2-DICHLOROETHANE	1	0.1	1	0.1	1	0.1	1	1	1
1,3,5-TRIMETHYLBENZENE	1	1	1	1	NC	NC	NC	1	1
4-CHLOROANILINE	1	0.1	1	0.1	1	0.08	1	1	1
4-ISOPROPYLTOLUENE	1	0.12	1	0.12	NC	NC	NC	1	1
ACETONE	1	0.1	1	0.1	NC	NC	NC	1	1
ANTIMONY	1	0.1	1	0.1	NC	NC	NC	1	1
AROCLOR-1260	0.85	0.16	0.85	0.16	0.85	0.16	1	1	1
ARSENIC	1	0.03	1	0.03	1	0.03	1	1	1
BARIUM	1	0.05	1	0.05	NC	NC	NC	1	1
BENZO(B)FLUORANTHENE	0.28	0.02	0.28	0.02	0.28	0.02	1	1	1
BENZO(G,H,I)PERYLENE	0.36	0.1	0.36	0.1	NC	NC	NC	1	1
BENZO(K)FLUORANTHENE	0.28	0.02	0.28	0.02	0.28	0.02	1	1	1
BERYLLIUM	1	0.03	1	0.03	NC	0.03	1	1	1
C11-C22 AROMATICS	0.36	0.1	0.36	0.1	NC	NC	NC	1	1
C19-C36 ALIPHATICS	1	0.1	1	0.1	NC	NC	NC	1	1
C5-C8 ALIPHATICS	1	1	1	1	NC	NC	NC	1	1
C9-C10 AROMATICS	1	0.5	1	0.5	NC	NC	NC	1	1
C9-C18 ALIPHATICS	1	0.5	1	0.5	NC	NC	NC	1	1
CADMIUM	1	0.14	1	0.14	NC	NC	1	1	1
CHROMIUM	1	0.04	1	0.04	NC	NC	NC	1	1
COPPER	1	1	1	1	NC	NC	1	1	1
DIBENZ(A,H)ANTHRACENE	0.28	0.02	0.28	0.02	0.28	0.02	1	1	1
ETHYLBENZENE	1	0.2	1	0.2	1	0.08	1	1	1
FLUORANTHENE	0.36	0.1	0.36	0.1	NC	NC	NC	1	1
LEAD	0.5	0.006	0.5	0.006	NC	NC	NC	1	1
M,P-XYLENES	1	0.12	1	0.12	NC	NC	NC	1	1
MERCURY	1	0.05	1	0.05	NC	NC	NC	1	1
N-BUTYLBENZENE	1	1	1	1	NC	NC	NC	1	1
NICKEL	1	0.35	1	0.35	NC	NC	1	1	1
N-PROPYLBENZENE	1	1	1	1	NC	NC	NC	1	1
O-XYLENE	1	0.12	1	0.12	NC	NC	NC	1	1
PHENANTHRENE	0.36	0.1	0.36	0.1	NC	NC	NC	1	1
PYRENE	0.36	0.1	0.36	0.1	NC	NC	NC	1	1
SILVER	1	0.25	1	0.25	NC	NC	NC	1	1
TERT-BUTYLBENZENE	1	1	1	1	NC	NC	NC	1	1
TOLUENE	1	0.12	1	0.12	NC	NC	NC	1	1
VANADIUM	1	0.03	1	0.03	NC	NC	NC	1	1
ZINC	1	0.02	1	0.02	NC	NC	NC	1	1
2,3,7,8-TCDD TEQ	1	1	1	1	1	0.2	1	1	1
ASBESTOS	-	-	-	-	-	-	1	-	-

Notes:
NC - Not calculated
The Soil Cancer Ingestion, Soil Cancer Dermal, and Inhalation Cancer RAFs for benzene were used as surrogates for p-chloroaniline and ethylbenzene.

Table 3-6
Exposure Assumptions
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Medium	Route	Parameter	Units	Trespasser Older Child Value	Source	Comment
Soil	Incidental Ingestion & Dermal Contact	Soil Ingestion Rate	mg/d	50	c	
		Soil TWA Ingestion Rate	mg-y/kg-d			
		Soil Dermal Contact Skin Exposed	cm2/d	4260	a	Median values for face, hands, forearms, lower legs, and feet of females;average from age 8 to 15.
		Soil TWA Dermal Contact Skin Exposed	mg-cm2-y/kg-d-cm2			
		Soil Dermal Contact Adherence Rate	mg/cm2	0.14	c	
		Soil Exposure Frequency	d/y	50	b	
		Soil Exposure Period - Cancer	y	7	c	
		Soil Exposure Period - Non-Cancer	y	7	c	
		Soil Averaging Time - Cancer	d	25550	c	
		Soil Averaging Time - Non-Cancer	d	2555	c	
General		Body Weight	kg	39.9	c	

Notes:
mg/d - milligrams per day
mg-y/kg-d - milligram per year per kilogram per day
cm2/d - square centimeters per day
y - year
d - day
kg - kilogram
a - MADEP (1995a). Appendices to the Guidance for Disposal Site Risk Characterization - In support of the Massachusetts Contingency Plan. Interim Final Policy. WSC/ORS-95-141. July, 1995.
b - Professional judgement
c - Value for resident

$$CR_{TWA} = \frac{CR_{YC} \times EP_{YC}}{BW_{YC}} + \frac{CR_{OC} \times EP_{OC}}{BW_{OC}} + \frac{CR_{A} \times EP_{A}}{BW_{A}}$$

where :
$CR = Contact\ Rate$
$EP = Exposure\ Period$
$BW = Body\ Weight$
$TWA = Time-Weighted\ Average$
$YC = Young\ Child$
$OC = Older\ Child$
$A = Adult$

Table 3-7
Estimated Potential Human Health Risks - Soil
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Receptor	Non-Cancer HI	Cancer Risk	Asbestos Risk
Current Trespasser (0-3') DDA	0.10	9E-06	8.4E-06

Notes:
HI - Hazard Index
DDA - Demolition Debris Area
NC - not calculated

Table 3-8
Estimated Potential Human Health Risks - Groundwater
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Summary of Total HQs

COC	DD-MW-002	DD-MW-201	DD-MW-203	DD-MW-204	DD-MW-205	DD-MW-206	DD-MW-207
Bis(2-ethylhexyl)phthalate	0.0092	0.0056	0.0017	0.0018	0.0092	0.0020	0.0020
Barium	0.0056	0.013	0.0033	0.0059	0.0023	0.0047	0.0092
Chromium (total)	0.041	0.059	0.016	0.013	0.014	0.014	0.029
Nickel	0.0036	0.0037	0.0036	0.0036	0.0018	0.0021	0.0013
Selenium	0.0059	0.086	0.0059	0.012	0.0059	0.0059	0.0059
Vanadium	0.0036	0.0026	0.0020	0.0036	0.0023	0.0036	0.0036
Zinc	0.00024	0.00049	0.0010	0.00049	0.00032	0.00037	0.00037
Total	0.07	0.17	0.03	0.04	0.04	0.03	0.05

Summary of Total ELCRs

COC(1)	DD-MW-002	DD-MW-201	DD-MW-203	DD-MW-204	DD-MW-205	DD-MW-206	DD-MW-207
Bis(2-ethylhexyl)phthalate	8E-07	5E-07	1E-07	1E-07	8E-07	2E-07	2E-07
Total	8E-07	5E-07	1E-07	1E-07	8E-07	2E-07	2E-07

Notes:
COC - contaminant of concern
HQ - Hazard quotient
ELCR - Excess lifetime cancer risk

1. All other COCs are not considered to be carcinogenic

Table 4-1
Exposure Point Concentrations and Selection of COPECs in DDA Soil
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

CAS Number	Analyte	Number Analyzed	Number Detected	Detection Frequency	Minimum Detected	Maximum Detected	Average Concentration (1)	MCP Background (2)	Lowest Eco SSL	Rationale (3)	COPEC?	EPC (4)
107-06-2	1,2-DICHLOROETHANE	7	1	14.29%	0.0020	0.0020	0.021	NA	21.2	BB	no	NA
78-93-3	2-BUTANONE	7	0	0.00%	ND	ND	0.17	NA	89.6	ND	no	NA
91-57-6	2-METHYLNAPHTHALENE	16	2	12.50%	0.066	0.22	0.14	NA	29	BB	no	NA
106-47-8	4-CHLOROANILINE	15	2	13.33%	0.11	0.13	0.65	NA	1.1	BB	no	NA
83-32-9	ACENAPHTHENE	16	1	6.25%	0.46	0.46	0.16	0.5	20	BB	no	NA
67-64-1	ACETONE	7	1	14.29%	0.24	0.24	2.051	NA	2.5	BB	no	NA
120-12-7	ANTHRACENE	16	3	18.75%	0.22	1.035	0.23	1	29	BB	no	NA
7440-36-0	ANTIMONY	13	5	38.46%	1.30	8.10	2.24	1	0.27	AB, ASSL	yes	2.24
11096-82-5	AROCLOR-1260	16	1	6.25%	1.35	1.35	0.14	NA	0.000332	ASSL	yes	0.14
7440-38-2	ARSENIC	16	13	81.25%	1.30	26.00	4.84	20	18	AB, ASSL	yes	4.84
7440-39-3	BARIUM	16	16	100.00%	1.70	1400.00	262.42	50	330	AB, ASSL	yes	262.42
71-43-2	BENZENE	7	0	0.00%	ND	ND	0.020	NA	0.255	ND	no	NA
56-55-3	BENZO(A)ANTHRACENE	16	5	31.25%	0.13	1.59	0.27	2	1.1	BB	no	NA
50-32-8	BENZO(A)PYRENE	16	4	25.00%	0.31	1.44	0.28	2	1.1	BB	no	NA
205-99-2	BENZO(B)FLUORANTHENE	16	4	25.00%	0.14	2.30	0.30	2	1.1	AB, ASSL	yes	0.30
191-24-2	BENZO(G,H,I)PERYLENE	16	1	6.25%	1.30	1.30	0.21	1	1.1	AB, ASSL	yes	0.21
207-08-9	BENZO(K)FLUORANTHENE	16	4	25.00%	0.31	2.10	0.31	1	1.1	AB, ASSL	yes	0.31
7440-41-7	BERYLLIUM	16	3	18.75%	0.55	4.10	0.57	0.4	10	BB	no	NA
EPH1122	C11-C22 AROMATICS, ADJUSTED	14	13	92.86%	11.5	69	29.67	NA	NA	NA	yes	29.67
EPH1936	C19-C36 ALIPHATICS	14	13	92.86%	5.3	170	51.37	NA	NA	NA	yes	51.37
VPH58	C5-C8 ALIPHATICS, ADJUSTED	6	1	16.67%	5.2	5.2	2.042	NA	NA	NA	yes	2.042
VPH910	C9-C10 AROMATICS	6	1	16.67%	24	24	5.17	NA	NA	NA	yes	5.17
VPH912	C9-C12 ALIPHATICS, ADJUSTED	6	0	0.00%	ND	ND	1.41	NA	NA	ND	no	NA
VPH912	C9-C18 ALIPHATICS	15	4	26.67%	4.8	19	4.18	NA	NA	NA	yes	4.18
7440-43-9	CADMIUM	16	13	81.25%	0.38	2.60	0.98	2	0.36	AB, ASSL	yes	0.98
7440-47-3	CHROMIUM	16	16	100.00%	1.20	2200.00	200.27	30	0.4	AB, ASSL	yes	200.27
18540-29-9	CHROMIUM VI	1	0	0.00%	ND	ND	0.23	30	NA	ND	no	NA
218-01-9	CHRYSENE	16	6	37.50%	0.14	1.69	0.33	2	1.1	BB	no	NA
7440-50-8	COPPER	1	1	100.00%	56.00	56.00	56.00	40	28	AB, ASSL	yes	56.00
53-70-3	DIBENZ(A,H)ANTHRACENE	16	1	6.25%	1.30	1.30	0.21	0.5	1.1	AB, ASSL	yes	0.21
100-41-4	ETHYLBENZENE	7	1	14.29%	0.23	0.23	0.033	NA	5.16	BB	no	NA
206-44-0	FLUORANTHENE	16	8	50.00%	0.16	4.40	0.66	4	29	BB	no	NA
86-73-7	FLUORENE	16	1	6.25%	0.74	0.74	0.17	1	29	BB	no	NA
193-39-5	INDENO(1,2,3-CD)PYRENE	16	1	6.25%	0.94	0.94	0.20	1	1.1	BB	no	NA
7439-92-1	LEAD	16	16	100.00%	3.00	450.00	106.47	100	11	AB, ASSL	yes	106.47
0	M,P-XYLENES	16	2	12.50%	0.27	0.27	0.18	NA	10	BB	no	NA
7439-97-6	MERCURY	15	10	66.67%	0.062	2.90	0.44	0.3	0.1	AB	yes	0.44
91-20-3	NAPHTHALENE	16	3	18.75%	0.24	0.29	0.12	0.5	29	BB	no	NA
104-51-8	N-BUTYLBENZENE	6	1	16.67%	0.13	0.13	0.023	NA	5.16	BB	no	NA
7440-02-0	NICKEL	14	14	100.00%	0.71	1400.00	239.82	20	38	AB, ASSL	yes	239.82
103-65-1	N-PROPYLBENZENE	7	1	14.29%	0.28	0.28	0.041	NA	5.16	BB	no	NA
95-47-6	O-XYLENE	7	1	14.29%	0.49	0.49	0.070	NA	10	BB	no	NA
85-01-8	PHENANTHRENE	16	7	43.75%	0.17	4.35	0.56	3	29	BB	no	NA
129-00-0	PYRENE	16	8	50.00%	0.21	4.050	0.63	4	1.1	AB, ASSL	yes	0.63
7782-49-2	SELENIUM	15	0	0.00%	ND	ND	0.96	0.5	0.52	ND	no	NA
7440-22-4	SILVER	16	3	18.75%	0.83	3.20	1.19	0.6	4.2	BB	no	NA

Table 4-1
Exposure Point Concentrations and Selection of COPECs in DDA Soil
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

CAS Number	Analyte	Number Analyzed	Number Detected	Detection Frequency	Minimum Detected	Maximum Detected	Average Concentration (1)	MCP Background (2)	Lowest Eco SSL	Rationale (3)	COPEC?	EPC (4)
108-88-3	TOLUENE	7	2	28.57%	0.14	0.14	0.040	NA	5.45	BB	no	NA
7440-62-2	VANADIUM	16	16	100.00%	1.30	150.00	38.85	30	2	AB, ASSL	yes	38.85
7440-66-6	ZINC	15	15	100.00%	4.10	810.00	177.61	100	46	AB, ASSL	yes	177.61
1746-01-6	2,3,7,8-TCDD TEQ (mammalian)	12	12	100.00%	0.00000075	0.000095	0.000028	NA	1.99E-07	ASSL	yes	0.000027
1746-01-6	2,3,7,8-TCDD TEQ (avian)	12	12	100.00%	0.00000110	0.00018	0.000049	NA	1.99E-07	ASSL	yes	0.000045

Notes:
COPEC - Contaminants of potential ecological concern
EPC - Exposure point concentration; represented by average concentrations
DDA - Drum disposal area
NA - not applicable/not evaluated
ND - not detected in any sample
AB - above background
BB - below background
ASSL - Above lowest Eco-SSL
MCP - Massachusetts contingency plan
Eco SSL - Ecological soil screening level

(1) Average concentration was calculated using 1/2 RLs for non-detects.
(2) Background concentrations were obtained from: Background levels of Polycyclic Aromatic Hydrocarbons and Metals in Soil (MassDEP, 2002).
(3) Maximum detected concentrations were screened against MCP background as well as lowest Eco SSL for each analyte.

Table 4-2
Potential Exposure Parameter Values for Ecological Receptors
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

	Avian Carnivore		Avian Insectivore		Avian Herbivore		Mammal Carnivore		Mammal Insectivore		Mammal Herbivore	
	Red-Tailed Hawk		American Woodcock		Quail (Northern Bobwhite)		Fox		Short-tailed Shrew		Meadow Vole	
Parameter	**Value**		**Value**		**Value**		**Value**		**Value**		**Value**	
Body Weight (kg)	1.134	USEPA (1993), average of six adults	0.178	USEPA (1993) avg of A M & A F in central MA	0.174	USEPA (1993) avg of A M and A F	4.54	USEPA (1993). Mean of male and female BWs in spring and fall.	0.01681	USEPA (1993)	0.0373	USEPA (1993) avg of A M & F all year
Total Dietary Intake (kg ww/d)	0.1191	USEPA (1993) average of A M & F winter	0.1371	USEPA (1993)	0.0134	USEPA (1993)	0.510	USEPA (1993).	0.008	USEPA (1993) A M&F	0.01119	USEPA (1993)
Soil Ingestion Rate (kg dw/day)	0.00371	Calc. from Beyer (1994)	0.00532	Calc. from Beyer (1994)	0.00017	Calc. from Beyer (1994)	0.00428	Calc. from Beyer (1994)	0.00006	Calc. from Beyer (1994)	0.00003	Calc. from Beyer (1994)
Vegetation Ingestion Rate (kg ww/d)	NR		NR		0.0134	Assume 100% of diet.	NR		NR		0.01119	Assume 100% of diet.
Small Mammal Ingestion Rate (kg ww/d)	0.1191	Assumed 100% of diet	NR		NR		0.50999	Assume 100% of diet.	NR		NR	
Invert Ingestion Rate (kg ww/d)	NR		0.1371	Assumed 100% of diet	NR		NR		0.008	Assumed to be 100% of diet	NR	
Fraction Soil in Diet (kg soil dw/kg diet dw)	0.1040	Beyer et al, (1994) as cited in USEPA (1999) value for woodcock assumed	0.1040	Beyer et al, (1994) as cited in USEPA (1999)	0.1040	Beyer et al, (1994) as cited in USEPA (1999)	0.0280	Beyer et al, (1994)	0.020	Beyer et al, (1994) as cited in USEPA (1999) for deer mouse	0.024	Beyer et al, (1994) as cited in USEPA (1999)
Soil Dry wt./wet wt. CF	0.786	Soils comprised of 78.6% solids.	0.786	Soils comprised of 78.6% solids.	0.786	Soils comprised of 78.6% solids.	0.786	Soils comprised of 78.6% solids.	0.786	Soils comprised of 78.6% solids.	0.786	Soils comprised of 78.6% solids.
Veg Dry wt./wet wt. CF	NR		NR		0.12	USEPA (1999)	NR		NR		0.12	USEPA (1999)
Sm. Mammal Dry wt./wet wt. CF	0.3	USEPA (1999)	NR		NR		0.3	USEPA (1999)	NR		NR	
Invert Dry wt./wet wt. CF	NR		0.373	Site-specific data.	NR		NR		0.373	Site-specific data.	NR	
Home range (ha)	60	USEPA (1993) A M & F spring	3.8	USEPA (1993) avg of inactive A M and brooding A F	9.98	USEPA (1993) avg of A M and A F	1038	USEPA (1993)	0.39	USEPA (1993)	0.06	USEPA (1993) avg of A M & F grassy meadow MA
Area Use Factor (DDA)	0.0308	1.85. ha exposure area	0.4868	1.85. ha exposure area	0.185	1.85. ha exposure area	0.0018	1.85. ha exposure area	1	1.85. ha exposure area	1	1.85. ha exposure area

Notes:
(1) USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.
(2) USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
(3) Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
(4) MADEP. 2003. Updated Patroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology.

Table 4-3
Soil-to-Biota Transfer Factors
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Constituent	Invertebrate BTFs		Vegetation BTFs		Small Mammal BTFs	
Antimony	1.00E+00	(g)	---	(g)	---	(g)
Arsenic	---	(g)	3.75E-02	(g)	---	(g)
Aroclor-1260	*1.13E+00*	*(a)*	*1.00E-02*	*(a)*	*5.83E-05*	(e)
Barium	9.10E-02	(g)	1.56E-01	(g)	---	(g)
Benzo(b)fluoranthene	2.60E+00	(g)	3.10E-01	(g)	0.00E+00	(g)
Benzo(g,h,i)perylene	2.94E+00	(g)	---	(g)	0.00E+00	(g)
Benzo(k)fluoranthene	2.60E+00	(g)	---	(g)	0.00E+00	(g)
C11-C22 Aromatics	1.00E+00	(c)	1.00E+00	(c)	1.00E+00	(c)
C19-C36 Aliphatics	1.00E+00	(c)	1.00E+00	(c)	1.00E+00	(c)
C5-C8 Aliphatics	1.00E+00	(c)	1.00E+00	(c)	1.00E+00	(c)
C9-C10 Aromatics	1.00E+00	(c)	1.00E+00	(c)	1.00E+00	(c)
C9-C18 Aliphatics	1.00E+00	(c)	1.00E+00	(c)	1.00E+00	(c)
Cadmium	---	(g)	---	(g)	---	(g)
Chromium	3.06E-01	(g)	4.10E-02	(g)	---	(g)
Copper	5.15E-01	(g)	---	(g)	---	(g)
Dibenz(a,h)anthracene	2.31E+00	(g)	1.30E-01	(g)	0.00E+00	(g)
Lead	---	(g)	---	(g)	---	(g)
Mercury	*4.00E-02*	*(a)*	*4.30E-02*	*(a)*	*7.52E-06*	(b)
Nickel	*2.70E-02*	*(a)*	---	*(g)*	---	(g)
Pyrene	1.75E+00	(g)	7.20E-01	(g)	0.00E+00	(g)
Vanadium	4.20E-02	(g)	4.85E-03	(g)	1.23E-02	(g)
Zinc	---	(g)	---	(g)	---	(g)
2,3,7,8-TCDD TEQ	*1.45E+00*	*(d)*	*5.60E-03*	*(b)*	*7.81E-05*	(b)

<u>References</u>

(a) USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.
(b) USEPA (1999). Value for largest BTF in PAH class.
(c) Conservative default of 1.

(d) Dioxin insect BTF from Meyn, Ossi, Maurice Zeeman, Michael J Wise, and Susan E. Keane. 1997. Terrestrial Wildlife Risk Assessment for TCDD in Land-Applied Pulp and Paper Mill Sludge. Environmental Toxicology and Chemistry, Vol 16, No. 9, pp 1789-18
(e) USEPA (1999) for deer mouse. Value for Aroclor 1254
(f) Geomean of BTFs of all other metals.
(g) USEPA. 2003. Guidance for Developing Ecological Soil Screening Levels. (Eco-SSLs). OSWER Directive 9285.7-55.
-When BTFs were not available, EcoSSL uptake equations were used. See attachment F-3 for these values
-All units are in dry weight organism/dry weight soil with the exception of Aroclor 1260, Mercury, Nickel and 2,3,7,8-TCDD. These analytes are in wet weight organism/dry weight soil. Values are adjusted accordingly in risk calculations.

Table 4-4
Mammalian Toxicity Reference Values
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

NOAEL-Based TRVs

Chemical	Test Species Common Name	Test Species Body Weight (kg)	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	Subchronic to Chronic UF	LOAEL to NOAEL UF	Endpoint Adjusted TRV (mg/kg-day)	Carnivorous mammal Red Fox (mg/kg-day)	Herbivorous Mammal Meadow Vole (mg/kg-day)	Insectivorous Mammal Short-tailed Shrew (mg/kg-day)	Toxicity Value Surrogate	Initial Compilation Source
Antimony	mouse	0.03	NOAEL	chronic	growth, reproduction	13.3			13.3	3.79E+00	1.26E+01	1.54E+01		EPA 2005 (Antimony Eco SSL, geomean of TRVs for growth & reproduction)
Aroclor-1260	mouse	0.014	NOAEL	chronic	reproduction	0.068			0.068	1.60E-02	5.32E-02	6.50E-02	Aroclor-1254	Sample et al. 1996
Arsenic	mouse	0.03	NOAEL	chronic	growth, reproduction	2.47			2.47	7.04E-01	2.34E+00	2.85E+00		EPA 2005 (Arsenic Eco SSL, geomean of TRVs for growth & reproduction)
Barium	mouse	0.03	NOAEL	chronic	growth, reproduction	51.8			51.8	1.48E+01	4.90E+01	5.99E+01		EPA 2005 (Barium Eco SSL, geomean of TRVs for growth & reproduction)
Benzo(b)fluoranthene	mouse	0.03	NOAEL	chronic	growth, reproduction	18.0			18.0	5.12E+00	1.70E+01	2.08E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Benzo(g,h,i)perylene	mouse	0.03	NOAEL	chronic	growth, reproduction	18.0			18.0	5.12E+00	1.70E+01	2.08E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Benzo(k)fluoranthene	mouse	0.03	NOAEL	chronic	growth, reproduction	18.0			18.0	5.12E+00	1.70E+01	2.08E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
C11-C22 Aromatics	mouse	0.03	NOAEL	chronic	kidney toxicity	75			75	2.14E+01	7.10E+01	8.67E+01	Pyrene	MADEP 2003
C19-C36 Aliphatics	rat	0.35	NOEAL	chronic	liver toxicity	200			200	1.05E+02	3.50E+02	4.27E+02	white mineral oils	MADEP 2003
C5-C8 Aliphatics	rat	0.35	LOAEL	chronic	neurotoxicity	407		10	40.7	2.14E+01	7.12E+01	8.70E+01	n-hexane	MADEP 2003
C9-C10 Aromatics	mouse	0.03	NOAEL	chronic	kidney toxicity	75			75	2.14E+01	7.10E+01	8.67E+01	Pyrene	MADEP 2003
C9-C18 Aliphatics	rat	0.35	NOAEL	chronic	liver weight	100			100	5.27E+01	1.75E+02	2.14E+02	isoparaffins/naphthenes/n-alkanes	MADEP 2003
Cadmium	mouse	0.03	NOAEL	chronic	growth, reproduction	1.86			1.86	5.29E-01	1.76E+00	2.15E+00		EPA 2005 (Cadmium Eco SSL, geomean of TRVs for growth & reproduction)
Chromium	mouse	0.03	NOAEL	chronic	growth, reproduction	2.40			2.40	6.85E-01	2.28E+00	2.78E+00		EPA 2005 (Chromium Eco SSL, geomean of TRVs for growth & reproduction)
Copper	mouse	0.03	NOAEL	chronic	growth, reproduction	25.0			25.0	7.12E+00	2.36E+01	2.88E+01		EPA 2007 (Copper Eco SSL, geomean of TRVs for growth & reproduction)
Dibenz(a,h)anthracene	mouse	0.03	NOAEL	chronic	growth, reproduction	18.0			18.0	5.12E+00	1.70E+01	2.08E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Lead	mouse	0.03	NOAEL	chronic	growth, reproduction	40.7			40.7	1.16E+01	3.86E+01	4.71E+01		EPA 2005 (Lead Eco SSL, geomean of TRVs for growth & reproduction)
Mercury	mink	1	NOAEL	chronic	reproduction	1.0			1.0	6.85E-01	2.28E+00	2.78E+00		Sample et al. 1996
Nickel	mouse	0.03	NOAEL	chronic	growth, reproduction	7.70			7.70	2.19E+00	7.29E+00	8.90E+00		EPA 2007 (Nickel Eco SSL, geomean of TRVs for growth & reproduction)
Pyrene	mouse	0.03	NOAEL	chronic	growth, reproduction	18.0			18.0	5.12E+00	1.70E+01	2.08E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Vanadium	mouse	0.03	NOAEL	chronic	growth, reproduction	5.92			5.92	1.69E+00	5.61E+00	6.85E+00		EPA 2005 (Vanadium Eco SSL, geomean of TRVs for growth & reproduction)
Zinc	mouse	0.03	NOAEL	chronic	growth, reproduction	75.4			75.4	2.15E+01	7.14E+01	8.71E+01		EPA 2007 (Zinc Eco SSL, geomean of TRVs for growth & reproduction)
2,3,7,8-TCDD TEQ (mammalian)	rat	0.35	NOAEL	chronic	reproduction	0.000001			0.000001	5.27E-07	1.75E-06	2.14E-06		Sample et al. 1996

Table 4-4
Mammalian Toxicity Reference Values
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

LOAEL-Based TRVs

Chemical	Test Species Common Name	Test Species Body Weight (kg)	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	Subchronic to Chronic UF		Endpoint Adjusted TRV (mg/kg-day)	Carnivorous mammal Red Fox (mg/kg-day)	Herbivorous Mammal Deer Mouse (mg/kg-day)	Insectivorous Mammal Short-tailed Shrew (mg/kg-day)	Toxicity Value Surrogate	Initial Compilation Source
Antimony	mouse	0.03	LOAEL	chronic	growth, reproduction	2.76			2.76	7.86E-01	2.61E+00	3.19E+00		EPA 2005 (Antimony Eco SSL, geomean of TRVs for growth & reproduction)
Aroclor-1260	mouse	0.014	LOAEL	chronic	reproduction	0.68			0.68	1.60E-01	5.32E-01	6.50E-01	Aroclor-1254	Sample et al. 1996
Arsenic	mouse	0.03	LOAEL	chronic	growth, reproduction	4.55			4.55	1.30E+00	4.31E+00	5.26E+00		EPA 2005 (Arsenic Eco SSL, geomean of TRVs for growth & reproduction)
Barium	mouse	0.03	LOAEL	chronic	growth, reproduction	82.7			82.7	2.36E+01	7.83E+01	9.55E+01		EPA 2005 (Barium Eco SSL, geomean of TRVs for growth & reproduction)
Benzo(b)fluoranthene	mouse	0.03	LOAEL	chronic	growth, reproduction	38.4			38.4	1.09E+01	3.64E+01	4.44E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Benzo(g,h,i)perylene	mouse	0.03	LOAEL	chronic	growth, reproduction	38.4			38.4	1.09E+01	3.64E+01	4.44E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Benzo(k)fluoranthene	mouse	0.03	LOAEL	chronic	growth, reproduction	38.4			38.4	1.09E+01	3.64E+01	4.44E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
C11-C22 Aromatics	mouse	0.03	NOAEL	chronic	kidney toxicity	75		10	750	2.14E+02	7.10E+02	8.67E+02	Pyrene	MADEP 2003
C19-C36 Aliphatics	rat	0.35	NOAEL	chronic	liver toxicity	200		10	2000	1.05E+03	3.50E+03	4.27E+03	white mineral oils	MADEP 2003
C5-C8 Aliphatics	rat	0.35	LOAEL	chronic	neurotoxicity	407			407	2.14E+02	7.12E+02	8.70E+02	n-hexane	MADEP 2003
C9-C10 Aromatics	mouse	0.03	NOAEL	chronic	kidney toxicity	75		10	750	2.14E+02	7.10E+02	8.67E+02	Pyrene	MADEP 2003
C9-C18 Aliphatics	rat	0.35	NOAEL	chronic	liver weight	100		10	1000	5.27E+02	1.75E+03	2.14E+03	isoparaffins/naphthenes/n-alkanes	MADEP 2003
Cadmium	mouse	0.03	LOAEL	chronic	growth, reproduction	6.90			6.90	1.97E+00	6.54E+00	7.98E+00		EPA 2005 (Cadmium Eco SSL, geomean of TRVs for growth & reproduction)
Chromium	mouse	0.03	LOAEL	chronic	growth, reproduction	58.2			58.2	1.66E+01	5.51E+01	6.72E+01		EPA 2005 (Chromium Eco SSL, geomean of TRVs for growth & reproduction)
Copper	mouse	0.03	LOAEL	chronic	growth, reproduction	82.7			82.7	2.36E+01	7.83E+01	9.56E+01		EPA 2007 (Copper Eco SSL, geomean of TRVs for growth & reproduction)
Dibenz(a,h)anthracene	mouse	0.03	LOAEL	chronic	growth, reproduction	38.4			38.4	1.09E+01	3.64E+01	4.44E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Lead	mouse	0.03	LOAEL	chronic	growth, reproduction	186			186	5.31E+01	1.77E+02	2.15E+02		EPA 2005 (Lead Eco SSL, geomean of TRVs for growth & reproduction)
Mercury	mink	1	NOAEL	chronic	reproduction	1.0		10	10.0	6.85E+00	2.28E+01	2.78E+01		Sample et al. 1996
Nickel	mouse	0.03	LOAEL	chronic	growth, reproduction	14.8			14.8	4.21E+00	1.40E+01	1.71E+01		EPA 2007 (Nickel Eco SSL, geomean of TRVs for growth & reproduction)
Pyrene	mouse	0.03	LOAEL	chronic	growth, reproduction	38.4			38.4	1.09E+01	3.64E+01	4.44E+01	HMW PAHs	EPA 2007 (PAH Eco SSL, geomean of TRVs for growth & reproduction)
Zinc	mouse	0.03	LOAEL	chronic	growth, reproduction	298			298	8.48E+01	2.82E+02	3.44E+02		EPA 2007 (Zinc Eco SSL, geomean of TRVs for growth & reproduction)
2,3,7,8-TCDD TEQ (mammalian)	rat	0.35	LOAEL	chronic	reproduction	0.00001			0.00001	5.27E-06	1.75E-05	2.14E-05		Sample et al. 1996

Notes:
mg - milligram
kg - kilogram
LOAEL - lowest-observable-adverse-effect-level
NOAEL - no-observable-adverse-effect-level
TEF - toxicity equivalency factor
TRV - toxicity reference value
UF - uncertainty factor
Y - uncertainty factor used to derive TRV was included by original source

References:
USEPA. 2003. Guidance for Developing Ecological Soil Screening Levels. (Eco-SSLs). OSWER Directive 9285.7-55.
Sample B.E., Opresko D.M., Suter II G.W.. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for the US Department of Energy (ES/ER/TM-86/R3). 217pp.
Schafer Jr E.W., Bowles Jr W.A. Hurlbut J.. 1983. The Acute Oral Toxicity, Repellency, and Hazard Potential of 998 Chemicals to One or More Species of Wild and Domestic Bird. Archives of Environmental
Patton John F., Dieter Michael P.. 1980. Effects of petroleum hydrocarbons on hepatic function in the duck. Comparitive Biochemistry and Physiology. C: Comparitive pharmacology. 65C(1): 33-36.
MADEP. 2003. Updated Patroleum Hydrocarbon Fraction Toxicity Values for the VPH/EPH/APH Methodology.

Table 4-5
Avian Toxicity Reference Values
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

NOAEL-based TRVs

Chemical	Test Species Common Name	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	LD_{50} to NOAEL UF	Subchronic to Chronic UF	Avian NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate	Initial Compilation Source
Antimony	Black duck	NOAEL	chronic		1			1	Chromium	Sample et al. 1996
Aroclor-1260	Ring-Necked Pheasant	NOAEL	chronic	reproduction	0.18			0.18	Aroclor-1254	Sample et al. 1996
Arsenic	Chicken/Mallard duck	NOAEL	chronic	duction, growth, mo	3.70			3.70049858		EPA 2005 (Arsenic Eco SSL, geomean of TRVs for growth, reproduction, & mortality)
Barium	1-day Old Chicks	NOAEL	sub-chronic	mortality	20.8			20.8		Sample et al. 1996
Benzo(b)Fluoranthene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	100		1.01	fluorene	Schafer et al. 1983
Benzo(g,h,i)perylene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	100		1.01	fluorene	Schafer et al. 1983
Benzo(k)Fluoranthene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	100		1.01	fluorene	Schafer et al. 1983
C11-C22 Aromatics	Mallard duck	NOAEL	chronic		10000			10000	aromatic mixture	Patton and Dieter, 1979
C19-C36 Aliphatics	Mallard duck	NOAEL	chronic		400			400	paraffin	Patton and Dieter, 1979
C5-C8 Aliphatics	Mallard duck	NOAEL	chronic		400			400	paraffin	Patton and Dieter, 1979
C9-C10 Aromatics	Mallard duck	NOAEL	chronic		10000			10000	aromatic mixture	Patton and Dieter, 1979
C9-C18 Aliphatics	Mallard duck	NOAEL	chronic		400			400	paraffin	Patton and Dieter, 1979
Cadmium	various	NOAEL	chronic	growth, reproductio	1.47			1.467034136		EPA 2005 (Cadmium Eco SSL, geomean of TRVs for growth & reproduction)
Chromium	Chicken/Black duck/Turke	NOAEL	chronic	growth, reproductio	2.66			2.657649427		EPA 2005 (Chromium Eco SSL, geomean of TRVs for growth & reproduction)
Copper	various	NOAEL	chronic	growth, reproductio	18.5			18.49433983		EPA 2007 (Copper Eco SSL, geomean of TRVs for growth & reproduction)
Dibenz(a,h)anthracene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	100		1.01	fluorene	Schafer et al. 1983
Lead	various	NOAEL	chronic	growth, reproductio	10.9			10.9408261		EPA 2005 (Lead Eco SSL, geomean of TRVs for growth & reproduction)
Mercury	Japanese Quail	NOAEL	chronic	reproduction	0.45			0.45		Sample et al. 1996
Nickel	Chicken/Duck	NOAEL	chronic	growth, reproductio	6.71			6.706541477		EPA 2007 (Nickel Eco SSL, geomean of TRVs for growth & reproduction)
Pyrene	Red-Winged Blackbird	LD50	acute	mortality	111	100		1.11	anthracene	Schafer et al. 1983
Vanadium	Chicken/Japanese quail	NOAEL	chronic	growth, reproductio	1.19			1.185971649		EPA 2005 (Vanadium Eco SSL, geomean of TRVs for growth & reproduction)
Zinc	various	NOAEL	chronic	growth, reproductio	66.1			66.06591637		EPA 2007 (Zinc Eco SSL, geomean of TRVs for growth & reproduction)
2,3,7,8-TCDD TEQ (avian)	Ring-Necked Pheasant	NOAEL	chronic	reproduction	1.40E-05			0.000014		Sample et al. 1996

Table 4-5
Avian Toxicity Reference Values
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization
LOAEL-Based TRVs

Chemical	Test Species Common Name	Endpoint	Study Type	Effect to Test Organism	Toxicity Value (mg/kg-day)	LD_{50} to LOAEL UF	NOEAL to LOAEL UF	Avian NOAEL-Equiv TRV (mg/kg-day)	Toxicity Value Surrogate	Initial Compilation Source
Antimony	Black duck	LOAEL	chronic	reproduction	5			5	Chromium	Sample et al. 1996
Aroclor-1260	Ring-Necked Pheasant	LOAEL	chronic	reproduction	1.8			1.8	Aroclor-1254	Sample et al. 1996
Arsenic	Chicken/Mallard duck	LOAEL	chronic	duction, growth, mo	4.51			4.51		EPA 2005 (Arsenic Eco SSL, geomean of TRVs for growth, reproduction, & mortality)
Barium	1-day Old Chicks	LOAEL	sub-chronic	mortality	41.7			41.7		Sample et al. 1996
Benzo(b)Fluoranthene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	10		10.1	fluorene	Schafer et al. 1983
Benzo(g,h,i)perylene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	10		10.1	fluorene	Schafer et al. 1983
Benzo(k)Fluoranthene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	10		10.1	fluorene	Schafer et al. 1983
C11-C22 Aromatics	Mallard duck	NOAEL	chronic		10000		10	100000	aromatic mixture	Patton and Dieter, 1979
C19-C36 Aliphatics	Mallard duck	NOAEL	chronic		400		10	4000	paraffin	Patton and Dieter, 1979
C5-C8 Aliphatics	Mallard duck	NOAEL	chronic		400		10	4000	paraffin	Patton and Dieter, 1979
C9-C10 Aromatics	Mallard duck	NOAEL	chronic		10000		10	100000	aromatic mixture	Patton and Dieter, 1979
C9-C18 Aliphatics	Mallard duck	NOAEL	chronic		400		10	4000	paraffin	Patton and Dieter, 1979
Cadmium	various	LOAEL	chronic	growth, reproductio	6.35			6.35		EPA 2005 (Cadmium Eco SSL, geomean of TRVs for growth & reproduction)
Chromium	Chicken/Black duck	LOAEL	chronic	growth, reproductio	15.6			15.6		EPA 2005 (Chromium Eco SSL, geomean of TRVs for growth & reproduction)
Copper	various	LOAEL	chronic	growth, reproductio	34.9			34.9		EPA 2007 (Copper Eco SSL, geomean of TRVs for growth & reproduction)
Dibenz(a,h)anthracene	Red-Winged Blackbird	LD_{50}	acute	mortality	101	10		10.1	fluorene	Schafer et al. 1983
Lead	various	LOAEL	chronic	growth, reproductio	44.6			44.6		EPA 2005 (Lead Eco SSL, geomean of TRVs for growth & reproduction)
Mercury	Japanese Quail	LOAEL	chronic	reproduction	0.9			0.9		Sample et al. 1996
Nickel	Chicken/Duck	LOAEL	chronic	growth, reproductio	18.6			18.6		EPA 2007 (Nickel Eco SSL, geomean of TRVs for growth & reproduction)
Pyrene	Red-Winged Blackbird	LD_{50}	acute	mortality	111	10		11.1	anthracene	Schafer et al. 1983
Zinc	various	LOAEL	chronic	growth, reproductio	171			171		EPA 2007 (Zinc Eco SSL, geomean of TRVs for growth & reproduction)
2,3,7,8-TCDD TEQ (avian)	Ring-Necked Pheasant	LOAEL	chronic	reproduction	0.00014			0.00014		Sample et al. 1996

Notes:
mg - milligram
kg - kilogram
LD_{50} - lethal dose for 50% of study population
LOAEL - lowest-observable-adverse-effect-level
NA - Not available
NOAEL - no-observable-adverse-effect-level
TEF - toxicity equivalency factor
TRV - toxicity reference value
UF - uncertainty factor
Y - uncertainty factor used to derive TRV was included by original source

References:

USEPA. 2003. Guidance for Developing Ecological Soil Screening Levels. (Eco-SSLs). OSWER Directive 9285.7-55.
Sample B.E., Opresko D.M., Suter II G.W.. 1996. Toxicological Benchmarks for Wildlife: 1996 Revision. Prepared for the US Department of Energy (ES/ER/TM-86/R3). 217pp.
Schafer E.W., Bowles W.A., Hurlbut J.. 1983. The Acute Oral Toxicity, Repellency, and Hazard Potential of 998 Chemicals to One or More Species of Wild and Domestic Bird. Archives of Environmental Contamination and Toxicology. 12: 355-382.
Patton John F., Dieter Michael P.. 1980. Effects of petroleum hydrocarbons on hepatic function in the duck. Comparitive Biochemistry and Physiology. C: Comparitive pharmacology. 65C(1): 33-36.

Table 4-6
Estimated Potential Hazard Quotients for Ecological Receptors in DDA
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Analyte	Carnivorous Mammal Red Fox		Insectivorous Mammal Short-Tailed Shrew		Herbivorous Mammal Meadow Vole		Carnivorous Avian Red-Tailed Hawk		Insectivorous Avian Woodcock		Herbivorous Avian Quail	
	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ	NOAEL HQ	LOAEL HQ
Antimony	3E-06	2E-05	4E-03	2E-02	1E-03	6E-03	6E-04	1E-04	1E-01	2E-02	5E-04	1E-04
Arsenic	4E-05	2E-05	9E-02	5E-02	1E-02	8E-03	4E-04	3E-04	9E-02	7E-02	3E-04	3E-04
Barium	8E-05	5E-05	1E-01	6E-02	6E-02	4E-02	3E-03	2E-03	5E-01	3E-01	6E-03	3E-03
Cadmium	4E-05	1E-05	7E-01	2E-01	2E-02	4E-03	4E-04	8E-05	8E-01	2E-01	8E-04	2E-04
Chromium	3E-03	1E-04	**2E+00**	6E-02	6E-01	3E-02	3E-02	4E-03	**3E+00**	5E-01	2E-02	3E-03
Copper	5E-05	2E-05	1E-01	3E-02	3E-02	9E-03	9E-04	5E-04	2E-01	1E-01	1E-03	8E-04
Lead	8E-05	2E-05	2E-01	3E-02	2E-02	4E-03	3E-03	8E-04	8E-01	2E-01	2E-03	6E-04
Mercury	3E-06	3E-07	3E-02	3E-03	4E-03	4E-04	3E-04	1E-04	2E-01	9E-02	8E-04	4E-04
Nickel	8E-04	4E-04	4E-01	2E-01	2E-01	1E-01	1E-02	4E-03	1E+00	5E-01	8E-03	3E-03
Vanadium	1E-04	7E-05	2E-01	1E-01	4E-02	3E-02	9E-03	6E-03	**2E+00**	1E+00	6E-03	4E-03
Zinc	4E-04	9E-05	4E-01	9E-02	6E-02	1E-02	2E-03	9E-04	4E-01	2E-01	3E-03	1E-03
Aroclor-1260	4E-05	4E-06	1E+00	1E-01	2E-02	2E-03	2E-04	2E-05	3E-01	3E-02	2E-04	2E-05
2,3,7,8-TCDD TEQ (mammalian)	2E-04	2E-05	**9E+00**	9E-01	9E-02	9E-03	NA	NA	NA	NA	NA	NA
2,3,7,8-TCDD TEQ (avian)	NA	NA	NA	NA	NA	NA	9E-04	9E-05	**2E+00**	2E-01	7E-04	7E-05
Benzo(b)fluoranthene	3E-07	1E-07	7E-03	3E-03	3E-04	1E-04	8E-05	8E-06	1E-01	1E-02	2E-04	2E-05
Benzo(g,h,i)perylene	2E-07	8E-08	5E-03	2E-03	2E-04	9E-05	5E-05	5E-06	9E-02	9E-03	1E-04	1E-05
Benzo(k)fluoranthene	3E-07	1E-07	7E-03	3E-03	2E-04	9E-05	8E-05	8E-06	1E-01	1E-02	1E-04	1E-05
Dibenz(a,h)anthracene	2E-07	8E-08	4E-03	2E-03	1E-04	6E-05	5E-05	5E-06	7E-02	7E-03	8E-05	8E-06
Pyrene	5E-07	3E-07	1E-02	5E-03	1E-03	6E-04	2E-04	2E-05	2E-01	2E-02	8E-04	8E-05
C5-C8 Aliphatics	6E-06	6E-07	4E-03	4E-04	1E-03	1E-04	6E-06	6E-07	9E-04	9E-05	1E-05	1E-06
C9-C10 Aromatics	2E-05	2E-06	1E-02	1E-03	3E-03	3E-04	6E-07	6E-08	9E-05	9E-06	1E-06	1E-07
C9-C18 Aliphatics	2E-06	2E-07	1E-03	1E-04	3E-04	3E-05	4E-06	4E-07	6E-04	6E-05	7E-06	7E-07
C11-C22 Aromatics	9E-05	9E-06	6E-02	6E-03	2E-02	2E-03	4E-06	4E-07	5E-04	5E-05	6E-06	6E-07
C19-C36 Aliphatics	3E-05	3E-06	2E-02	2E-03	6E-03	6E-04	2E-04	2E-05	2E-02	2E-03	2E-04	2E-05

Notes:
Bold indicates HQ exceeds threshold of 1
HQ - Hazard quotient
NOAEL - No observed adverse effect level
LOAEL - Lowest observed adverse effect level

Attachment A (1)
Analytical Data - DDA Soil
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

		Location	DD-GP-003		DD-GP-004		DD-GP-006		DD-GP-009		DD-GP-207		DD-SB-206		DD-SS-003		DD-SS-005		DD-SS-007		DD-SS-012		DD-SS-014		DD-TP-013		
		Sample ID	DDA-GP-3 RR & Dup		DDA-GP-4		DDA-GP-6		DDA-GP-9 RR & Dup		DD-GP-207-001-X		DD-SB-206-003-X		DD-SS-001-001-X		DD-SS-005-001-X		DD-SS-007-001-X & Dup		DD-SS-012-001-X		DD-SS-014-001-X		DD-TP-001-001-X		DD-TP-001-002-X	
		Sample Date	5/16/2005		5/16/2005		5/16/2005		5/16/2005		6/9/2006		6/19/2006		12/8/2005		9/21/2006		10/26/2006		5/30/2007		5/30/2007		11/21/2005		11/21/2005	
CAS		Depth	0 - 3 feet		2 - 4 feet		0 to 3 feet		0 to 3 feet		0 to 2 feet		0 to 2 feet		0 to 3 feet		0 to 0.5 feet		0 to 0.5 feet		0 to 2 feet		0 to 2 feet		0 to 2 feet		2 to 4 feet	
Number	Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
7440-36-0	ANTIMONY	mg/kg	1.30	U	1.65	U	1.35	U	1.15	U	1.30	J	NA		NA		1.70		NA		NA		NA		NA		NA	
7440-38-2	ARSENIC	mg/kg	9.5		2.40		3.40		2.60		4.10	J	NA		NA		4.20		NA		NA		NA		NA		NA	
7440-39-3	BARIUM	mg/kg	52		43.00		220.00		24.00		59.00		NA		NA		47.00		NA		NA		NA		NA		NA	
7440-41-7	BERYLLIUM	mg/kg	0.13	U	0.17	U	0.55		0.12	U	0.65	U	NA		NA		0.13	U	NA		NA		NA		NA		NA	
7440-43-9	CADMIUM	mg/kg	0.61		0.43		0.78		0.38		1.40		NA		NA		1.30		NA		NA		NA		NA		NA	
7440-47-3	CHROMIUM	mg/kg	28		11.00		230.00		16.00		17.00		NA		NA		34.00		NA		NA		NA		NA		NA	
7440-50-8	COPPER	mg/kg	NA		NA		NA		NA		NA		NA		NA		56.00		NA		NA		NA		NA		NA	
7439-92-1	LEAD	mg/kg	110		20.00		60.00		40.00		150.00		NA		NA		88.00		NA		NA		NA		NA		NA	
7439-97-6	MERCURY	mg/kg	NA		0.062		0.13		0.081		0.29		NA		NA		2.90		NA		NA		NA		NA		NA	
7440-02-0	NICKEL	mg/kg	20		26.00		190.00		20.00		18.00		NA		NA		35.00		NA		NA		NA		NA		NA	
7440-22-4	SILVER	mg/kg	1.4		0.85	U	0.65	U	0.55	U	1.60	U	NA		NA		0.83		NA		NA		NA		NA		NA	
7440-62-2	VANADIUM	mg/kg	23		22.00		38.00		9.30		26.00		NA		NA		23.00		NA		NA		NA		NA		NA	
7440-66-6	ZINC	mg/kg	140		68.00		130.00		75.00		88.00		NA		NA		NA		NA		NA		NA		NA		NA	
11096-82-5	AROCLOR-1260	mg/kg	0.055	U	0.065	U	0.055	U	0.055	U	0.055	U	NA		NA		NA		NA		NA		NA		0.060	U	0.060	U
95-63-6	1,2,4-TRIMETHYLBENZENE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
107-06-2	1,2-DICHLOROETHANE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
108-67-8	1,3,5-TRIMETHYLBENZENE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
99-87-6	4-ISOPROPYLTOLUENE	mg/kg	NA		NA		NA		NA		0.040		NA		NA		NA		NA		NA		NA		NA		NA	
67-64-1	ACETONE	mg/kg	NA		NA		NA		NA		0.24	J	NA		NA		NA		NA		NA		NA		NA		NA	
91-20-3	NAPHTHALENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.019	U	NA		0.11	U	0.27		NA		NA		NA		NA		NA	
104-51-8	N-BUTYLBENZENE	mg/kg	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
103-65-1	N-PROPYLBENZENE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
98-06-6	TERT-BUTYLBENZENE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
108-88-3	TOLUENE	mg/kg	NA		NA		NA		NA		0.14	J	NA		NA		NA		NA		NA		NA		NA		NA	
91-57-6	2-METHYLNAPHTHALENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.066		NA		NA		NA		NA		NA	
106-47-8	4-CHLOROANILINE	mg/kg	0.385	U	0.13	J	0.11	J	0.37	U	0.39	U	NA		0.41	U	NA		NA		NA		NA		NA		NA	
56-55-3	BENZO(A)ANTHRACENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.13		NA		NA		NA		NA		NA	
50-32-8	BENZO(A)PYRENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.095	U	NA		NA		NA		NA		NA	
205-99-2	BENZO(B)FLUORANTHENE	mg/kg	0.095	U	0.11	U	0.090	U	0.14	J	0.10	U	NA		0.11	U	0.17		NA		NA		NA		NA		NA	
191-24-2	BENZO(G,H,I)PERYLENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.095	U	NA		NA		NA		NA		NA	
207-08-9	BENZO(K)FLUORANTHENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.11	U	NA		0.11	U	0.11	U	NA		NA		NA		NA		NA	
218-01-9	CHRYSENE	mg/kg	0.095	U	0.11	U	0.090	U	0.14	J	0.10	U	NA		0.11	U	0.16		NA		NA		NA		NA		NA	
53-70-3	DIBENZ(A,H)ANTHRACENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.095	U	NA		NA		NA		NA		NA	
206-44-0	FLUORANTHENE	mg/kg	0.095	U	0.11	U	0.090	U	0.16	J	0.38		NA		0.11	U	0.19		NA		NA		NA		NA		NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.19	U	NA		0.11	U	0.20	U	NA		NA		NA		NA		NA	
85-01-8	PHENANTHRENE	mg/kg	0.095	U	0.11	U	0.090	U	0.17	J	0.38		NA		0.11	U	0.17		NA		NA		NA		NA		NA	
129-00-0	PYRENE	mg/kg	0.095	U	0.11	U	0.090	U	0.21		0.34		NA		0.11	U	0.22		NA		NA		NA		NA		NA	
83-32-9	ACENAPHTHENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.095	U	NA		NA		NA		NA		NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	mg/kg	55		17.00		14.00		54.00		15.00		NA		17.00	V	NA		NA		NA		NA		NA		NA	
EPH1936	C19-C36 ALIPHATICS	mg/kg	170		15.00		23.00		120.00		5.30		NA		110.00	V	NA		NA		NA		NA		NA		NA	
VPH912	C9-C18 ALIPHATICS	mg/kg	1.95	U	2.15	U	1.90	U	6.30		1.95	U	NA		19.00	V	NA		NA		NA		NA		NA		NA	
VPH58	C5-C8 ALIPHATICS, ADJUSTED	mg/kg	NA		NA		NA		NA		2.75	U	NA		NA		NA		NA		NA		NA		NA		NA	
VPH910	C9-C10 AROMATICS	mg/kg	NA		NA		NA		NA		2.75	U	NA		NA		NA		NA		NA		NA		NA		NA	
100-41-4	ETHYLBENZENE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
95-47-6	O-XYLENE	mg/kg	NA		NA		NA		NA		0.0019	U	NA		NA		NA		NA		NA		NA		NA		NA	
120-12-7	ANTHRACENE	mg/kg	0.095	U	0.11	U	0.090	U	0.22		0.10	U	NA		0.11	U	0.095	U	NA		NA		NA		NA		NA	
86-73-7	FLUORENE	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.095	U	NA		NA		NA		NA		NA	
	M,P-XYLENES	mg/kg	0.095	U	0.11	U	0.090	U	0.095	U	0.10	U	NA		0.11	U	0.27		NA		NA		NA		NA		NA	
1746-01-6	2,3,7,8-TCDD TEQ	mg/kg	1.50E-05		1.30E-06		4.80E-06		7.50E-07		1.10E-06		9.23E-05		NA		NA		2.80E-05		1.40E-06		6.20E-05		NA		NA	

Notes:
DDA - Demolition Debris Area
mg/kg - milligram per kilogram
U - non-detect
J - concentration is an estimated value
NA - not analyzed
Q - qualifier
Only detected analytes are presented herein

Attachment A (1)
Analytical Data - DDA Soil
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

		Location	DD-TP-003		DD-TP-004		DD-TP-005		DD-TP-007		DD-TP-008		DD-TP-009		DD-TP-012		DD-TP-201		DD-TP-202		DD-TP-202	
		Sample ID	DD-TP03-2S		DD-TP04-2S		DD-TP05-2S		DD-TP07-2S-D & Dup		DD-TP08-2S		DD-TP09-2S-D & Dup		DD-TP12-5W		DD-TP-201-001-X		DD-TP-202-002-X		DD-TP-202-003-X	
		Sample Date	12/20/2004		12/20/2004		12/20/2004		12/20/2004		12/20/2004		12/20/2004		12/20/2004		6/6/2006		6/28/2006		6/28/2006	
CAS		Depth	0 to 3 feet		0 to 3 feet		0 to 3 feet		0 to 3 feet		0 to 3 feet		0 to 3 feet		0 to 3 feet		1 to 2 feet		2 to 3 feet		2 to 3 feet	
Number	Analyte	Units	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q	Result	Q
7440-36-0	ANTIMONY	mg/kg	3.10		1.35	U	8.10		NA		1.20	U	NA		3.90	U	NA		1.50	J	1.50	U
7440-38-2	ARSENIC	mg/kg	26.00		0.65	U	7.60		4.00		1.30		1.92		1.95	U	2.10	J	2.80	J	2.95	U
7440-39-3	BARIUM	mg/kg	79.00		18.00		240.00		71.00		19.00		1395.00		1400.00		500.00		30.00		1.70	J
7440-41-7	BERYLLIUM	mg/kg	0.15	U	0.14	U	0.73		0.14	U	0.12	U	0.14	U	4.10		0.65	U	0.60	U	0.60	U
7440-43-9	CADMIUM	mg/kg	0.50		0.14	U	2.60		0.94		0.12	U	1.75		2.10		1.40		0.57	J	0.60	U
7440-47-3	CHROMIUM	mg/kg	130.00		8.30		2200.00		45.50		9.80		24.50		300.00		120.00		29.00		1.20	J
7440-50-8	COPPER	mg/kg	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD	mg/kg	300.00		9.50		450.00		145.00		11.00		57.00		73.00		77.00		110.00		3.00	
7439-97-6	MERCURY	mg/kg	0.40		0.055	U	0.42		0.75		0.050	U	1.20		0.055	U	0.21		0.030	U	0.021	U
7440-02-0	NICKEL	mg/kg	1400.00		7.80		1200.00		NA		11.00		NA		260.00		95.00		74.00		0.71	J
7440-22-4	SILVER	mg/kg	0.75	U	0.65	U	3.20		0.70	U	0.60	U	0.65	U	1.95	U	1.70	U	1.50	U	1.50	U
7440-62-2	VANADIUM	mg/kg	29.00		17.00		150.00		35.50		13.00		27.50		120.00		71.00		16.00		1.30	J
7440-66-6	ZINC	mg/kg	150.00		34.00		810.00		195.00		45.00		175.00		510.00		130.00		110.00		4.10	J
11096-82-5	AROCLOR-1260	mg/kg	0.060	U	0.050	U	0.055	U	1.35		0.055	U	0.055	U	0.065	U	0.055	U	0.055	U	NA	
95-63-6	1,2,4-TRIMETHYLBENZENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	2.00		NA	
107-06-2	1,2-DICHLOROETHANE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.0020		0.0016	U	0.0013	U	0.14	U	NA	
108-67-8	1,3,5-TRIMETHYLBENZENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	NA		0.0016	U	0.0013	U	0.68		NA	
99-87-6	4-ISOPROPYLTOLUENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.14	U	NA	
67-64-1	ACETONE	mg/kg	NA		0.12	U	NA		NA		0.11	U	0.095	U	0.16	U	0.13	U	13.50	U	NA	
91-20-3	NAPHTHALENE	mg/kg	0.24	J	0.012	U	0.19	U	0.21	U	0.011	U	0.0095	U	0.016	U	0.29		0.095	U	NA	
104-51-8	N-BUTYLBENZENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.13	J	NA	
103-65-1	N-PROPYLBENZENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.28		NA	
98-06-6	TERT-BUTYLBENZENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.24	J	NA	
108-88-3	TOLUENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.14	J	NA	
91-57-6	2-METHYLNAPHTHALENE	mg/kg	0.20	U	0.18	U	0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	0.19	U	0.22		NA	
106-47-8	4-CHLOROANILINE	mg/kg	0.80	U	0.70	U	1.50	U	0.85	U	0.70	U	0.75	U	0.42	U	1.90	U	0.38	U	NA	
56-55-3	BENZO(A)ANTHRACENE	mg/kg	0.35		0.52		0.34	J	0.21	U	0.18	U	0.19	U	0.11	U	1.59		0.095	U	NA	
50-32-8	BENZO(A)PYRENE	mg/kg	0.31		0.79		0.41		0.21	U	0.18	U	0.19	U	0.11	U	1.44		0.095	U	NA	
205-99-2	BENZO(B)FLUORANTHENE	mg/kg	0.20	U	0.52		0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	2.30		0.095	U	NA	
191-24-2	BENZO(G,H,I)PERYLENE	mg/kg	0.20	U	0.18	U	0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	1.30		0.095	U	NA	
207-08-9	BENZO(K)FLUORANTHENE	mg/kg	0.31		0.69		0.42		0.21	U	0.18	U	0.19	U	0.11	U	2.10		0.10	U	NA	
218-01-9	CHRYSENE	mg/kg	0.44	J	0.94		0.60	J	0.22	U	0.18	U	0.19	U	0.11	U	1.69		0.095	U	NA	
53-70-3	DIBENZ(A,H)ANTHRACENE	mg/kg	0.20	U	0.18	U	0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	1.30		0.095	U	NA	
206-44-0	FLUORANTHENE	mg/kg	0.95		1.99		1.17		0.41		0.18	U	0.19	U	0.11	U	4.40		0.095	U	NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	mg/kg	0.20	U	0.18	U	0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	0.94		0.19	U	NA	
85-01-8	PHENANTHRENE	mg/kg	0.44	J	1.84		0.44		0.25	U	0.18	U	0.19	U	0.11	U	4.35		0.095	U	NA	
129-00-0	PYRENE	mg/kg	1.075		1.89		1.050		0.34	J	0.18	U	0.19	U	0.11	U	4.050		0.095	U	NA	
83-32-9	ACENAPHTHENE	mg/kg	0.20	U	0.18	U	0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	0.46		0.095	U	NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	mg/kg	29.00		35.00		22.00		NA		1.85	U	11.50		69.00		57.00		18.00		NA	
EPH1936	C19-C36 ALIPHATICS	mg/kg	20.00		32.00		56.00		NA		1.85	U	20.00		55.00		19.00		72.00		NA	
VPH912	C9-C18 ALIPHATICS	mg/kg	2.00	U	4.80		1.90	U	2.15	U	1.85	U	1.90	U	2.050	U	1.85	U	11.00		NA	
VPH58	C5-C8 ALIPHATICS, ADJUSTED	mg/kg	NA		1.25	U	NA		NA		0.90	U	0.75	U	NA		1.40	U	5.20		NA	
VPH910	C9-C10 AROMATICS	mg/kg	NA		1.25	U	NA		NA		0.90	U	0.75	U	NA		1.40	U	24.00		NA	
100-41-4	ETHYLBENZENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.23		NA	
95-47-6	O-XYLENE	mg/kg	NA		0.0012	U	NA		NA		0.0011	U	0.00095	U	0.0016	U	0.0013	U	0.49		NA	
120-12-7	ANTHRACENE	mg/kg	0.20	U	0.64		0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	1.035		0.095	U	NA	
86-73-7	FLUORENE	mg/kg	0.20	U	0.18	U	0.19	U	0.21	U	0.18	U	0.19	U	0.11	U	0.74		0.095	U	NA	
	M,P-XYLENES	mg/kg	0.27	J	0.18	U	0.38	U	0.21	U	0.18	U	0.19	U	0.11	U	0.47	U	0.095	U	NA	
1746-01-6	2,3,7,8-TCDD TEQ	mg/kg	9.90E-06		NA		9.50E-05		1.90E-05		NA		NA		NA		NA		NA		NA	

Notes:
DDA - Demolition Debris Area
mg/kg - milligram per kilogram
U - non-detect
J - concentration is an estimated value
NA - not analyzed
Q - qualifier
Only detected analytes are presented herein

Attachment A(2)
Analytical Data - DDA GW
Bird Machine Company
Human Health and Eironmental Risk Characterization

		Location:	DD-MW-001				DD-MW-002				DD-MW-003		DD-MW-007		DD-MW-201											
		Sample ID:	DD-MW-001-R02-X		MW-1-051705		DD-MW-002-R01-X		DD-MW-002-R02-X		MW-03-051705		GZA-7-051705		DD-MW-201-001-D		DD-MW-201-001-X		DD-MW-201-R02-X		DD-MW-201-R04-X		DD-MW-201-R05-X		DD-MW-201-R06-D	
		Sample Date:	6/5/2007		5/17/2005		6/5/2007		5/19/2008		5/17/2005		5/17/2005		6/26/2006		6/26/2006		8/14/2006		6/5/2007		12/11/2007		5/19/2008	
		Depth:	11.6 - 16.6 feet		14 - 14 feet		9.8 - 14.8 feet		9.8 - 14.8 feet		3.5 - 3.5 feet		0 - 0 feet		9 - 9 feet		9 - 9 feet		10 - 10 feet		4 - 14 feet		4 - 14 feet		4 - 14 feet	
CAS Number	**Analyte**	**Units**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
51-28-5	2,4-DINITROPHENOL	ug/l	5.1	U	NA		5.1	U	5.1	U	NA		NA		10	UJ5*	10	u*	5.1	UJ5	5.3	U	5.1	UJ	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	NA		0.3	U	0.3	U	NA		NA		0.32	u	0.33	u	0.3	u	0.32	U	0.3	U	0.31	U
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	NA		0.2	U	0.2	U	NA		NA		0.22	u	0.22	u	0.2	u	0.21	U	0.2	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	NA		0.3	U	0.3	U	NA		NA		0.32	U	0.33	U	0.3	U	0.32	U	0.3	U	0.31	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.4	U	NA		0.42	U	0.51	U	NA		NA		0.54	U	0.55	U	0.51	U	0.42	U	0.51	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	NA		0.3	U	0.3	U	NA		NA		0.32	U	0.33	U	0.3	U	0.32	U	0.3	U	0.31	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	5.1	J	NA		5.1	J	5.1	U	NA		NA		10	U	10	U	5.1	U	5.3	J	5.1	J	5.1	U
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.1	U	NA		5.1	U	5.1	U	NA		NA		10	U	10	U	5.1	U	5.3	U	5.1	U	5.1	U
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	NA		110	U	100	U	NA		NA		110	U	110	U	100	U	110	U	100	U	100	U
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	NA		110	U	100	U	NA		NA		110	U	110	U	100	U	110	U	100	U	100	U
PH912	C9-C18 ALIPHATICS	ug/l	100	U	NA		110	U	100	U	NA		NA		110	U	110	U	100	U	110	U	100	U	100	U
218-01-9	CHRYSENE	ug/l	1	U	NA		1	U	1	U	NA		NA		1.1	U	1.1	U	1	U	1.1	U	1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.4	U	NA		0.42	U	0.51	U	NA		NA		0.54	U	0.55	U	0.51	U	0.42	U	0.51	U	0.51	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.1	J	NA		5.1	J	5.1	U	NA		NA		10	U	10	U	5.1	U	5.3	J	5.1	J	5.1	U
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.1	U	NA		5.1	U	5.1	U	NA		NA		10	U	10	U	5.1	U	5.3	U	5.1	U	5.1	U
206-44-0	FLUORANTHENE	ug/l	1	U	NA		1	U	1	U	NA		NA		1.1	U	1.1	U	1	U	1.1	U	1	U	1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.4	U	NA		0.42	U	0.51	U	NA		NA		0.54	U	0.55	U	0.51	U	0.42	U	0.51	U	0.51	U
85-01-8	PHENANTHRENE	ug/l	0.2	U	NA		0.2	U	0.2	U	NA		NA		0.22		0.22	U	0.2	U	0.21	U	0.2	U	0.2	U
129-00-0	PYRENE	ug/l	1	U	NA		1.1	U	5.1	U	NA		NA		1.1	U	1.1	U	1	U	1.1	U	5.1	U	5.1	U
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	13		10	U	10	U	10	U	1	U	1	U	1	U
7440-38-2	ARSENIC (DISSOLVED)	ug/l	2	U	1	U	2	U	1	U	1	U	1	U	10	U	10	U	10	U	0.81	J	1	U	1	U
7440-39-3	BARIUM (DISSOLVED)	ug/l	47		39		32		19		34		110		40		40		42		44		38		45	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	2	U	1	U
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	5.7		1	U	1	U	1	U	1	U	1	U	1	U
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	35		1	U	7.3		1.9		43		1	U	5	U	5	U	5	U	25		22		3.5	J
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		5	U	NA		NA		5	U	22		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	1	U	5	U	5	U	5	U	1	U	1	U	1	U
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	J	0.71		0.2	U
7440-02-0	NICKEL (DISSOLVED)	ug/l	7.2		5.6		2.5		1.2		110		25		1.4	J	1.6	J	2.3	J	1.3		3.3		1.2	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	2	U	2	U	2	U	1	U	2	U	2	U	7.7	J	5.5	J	5.8	J	9.3	J	1	U	7.8	
7440-22-4	SILER (DISSOLVED)	ug/l	1	U	0.1	U	1	U	1	U	0.1	U	0.1	U	5	U	5	U	1.1	J	1	U	1	U	1	U
7440-62-2	ANADIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	1	U	120		10	U	10	U	10	U	1	U	2	U	0.18	J
7440-66-6	ZINC (DISSOLVED)	ug/l	5	U	10	U	5	U	1.2	J	10	U	850		3.2	J	50	U	9.6	J	2.5	U	2.4	J	2.3	J
75-25-2	BROMOFORM	ug/l	NA		NA		NA		NA		NA		NA		0.51	J	1	U	1	U	NA		NA		NA	
108-88-3	TOLUENE	ug/l	NA		NA		NA		NA		NA		NA		1	U	1	U	1	U	NA		NA		NA	

Notes:
DDA - Demolition Debris Area
GW - Groundwater
ug/l - microgram per liter
U - non-detect
J - concentration is an estimated value
NA - not analyzed
Q - qualifier

Attachment A(2)
Analytical Data - DDA GW
Bird Machine Company
Human Health and Enironmental Risk Characterization

		Location:			DD-MW-203												DD-MW-204						
		Sample ID:	DD-MW-201-R06-X		DD-MW-203-001-X		DD-MW-203-R02-X		DD-MW-203-R03-X		DD-MW-203-R03-X-FF_E		DD-MW-203-R04-X		DD-MW-203-R05-X		DD-MW-203-R06-X		DD-MW-204-001-X		DD-MW-204-R02-X		DD-MW-204-R05-X		DD-MW-205-001-X	
		Sample Date:	5/19/2008		6/26/2006		8/2/2006		8/14/2006		8/14/2006		6/5/2007		12/11/2007		5/19/2008		6/26/2006		6/5/2007		5/19/2008		6/26/2006	
		Depth:	4 - 14 feet		8.5 - 8.5 feet		8.5 - 8.5 feet		10.5 - 10.5 feet		10.5 - 10.5 feet		4.5 - 12.5 feet		4.5 - 12.5 feet		4.5 - 12.5 feet		10.5 - 10.5 feet		7.5 - 13.5 feet		7.5 - 13.5 feet		9 - 9 feet	
CAS Number	**Analyte**	**Units**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
51-28-5	2,4-DINITROPHENOL	ug/l	5.2	U	10	UJ	NA		5.8	UJ	NA		5.2	U	5.1	UJ	5.1	U	10	U	5.1	U	0.84	J	10	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.31	U	0.94		NA		0.35	u	0.34	u	0.3	U	0.3	U	0.3	U	0.32	U	0.3	U	0.3	U	0.3	U
50-32-8	BENZO(A)PYRENE	ug/l	0.21	U	0.79		NA		0.23	u	0.23	u	0.2	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.31	U	0.74		NA		0.35	U	0.34	u	0.3	U	0.3	U	0.3	U	0.32	U	0.3	U	0.3	U	0.3	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.52	U	0.79		NA		0.58	U	0.57	u	0.4	U	0.51	U	0.51	U	0.53	U	0.4	U	0.51	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.31	U	0.76		NA		0.35	U	0.34	u	0.3	U	0.3	U	0.3	U	0.32	U	0.3	U	0.3	U	0.3	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	0.48	J	10	UJ	NA		5.8	U	NA		5.2	J	5.1	J	0.43	J	10	U	5.1	J	0.45	J	10	U
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	5.2	U	10	UJ	NA		5.8	U	NA		5.2	U	5.1	U	5.1	U	10	U	5.1	U	5.1	U	10	U
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	100	U	NA		120	U	110	u	100	U	100	U	100	U	110	U	100	U	100	U	100	U
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	100	U	NA		120	U	110	u	100	U	100	U	100	U	110	U	100	U	100	U	100	U
PH912	C9-C18 ALIPHATICS	ug/l	100	U	100	U	NA		120	U	110	u	100	U	100	U	100	U	110	U	100	U	100	U	100	U
218-01-9	CHRYSENE	ug/l	1	U	1	U	NA		1.2	U	1.1	u	1	U	1	U	1	U	1.1	U	1	U	1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.52	U	0.82		NA		0.58	U	0.57	u	0.4	U	0.51	U	0.51	U	0.53	U	0.4	U	0.51	U	0.51	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	5.2	U	10	UJ	NA		5.8	U	NA		5.2	J	5.1	J	5.1	U	10	U	5.1	J	5.1	U	10	U
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	5.2	U	10	UJ	NA		5.8	U	NA		5.2	U	5.1	U	5.1	U	10	U	5.1	U	5.1	U	10	U
206-44-0	FLUORANTHENE	ug/l	1	U	1	U	NA		1.2	U	1.1	u	1	U	1	U	1	U	1.1	U	1	U	1	U	1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.52	U	0.81		NA		0.58	U	0.57	u	0.4	U	0.51	U	0.51	U	0.53	U	0.4	U	0.51	U	0.51	U
85-01-8	PHENANTHRENE	ug/l	0.21	U	0.23		NA		0.23	U	0.23	u	0.2	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	0.2	U
129-00-0	PYRENE	ug/l	5.2	U	1	U	NA		1.2	U	1.1	u	1	U	5.1	U	5.1	U	1.1	U	1	U	5.1	U	1	U
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	1	U	10	U	NA		10	U	NA		1	U	1	U	1	U	10	U	1	U	1	U	10	U
7440-38-2	ARSENIC (DISSOLVED)	ug/l	1	U	10	U	NA		3.9	J	NA		1	U	1	U	1	U	10	U	1	U	2	U	10	U
7440-39-3	BARIUM (DISSOLVED)	ug/l	46		14		NA		13		NA		12		11		11		26		17		20		7.3	J
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	NA		0.096	J	NA		1	U	2	U	1	U	0.16	J	1	U	1	U	1	U
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	NA		1	U	NA		1	U	1	U	1	U	1	U	1	U	1	U	1	U
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	2.1	J	5	U	NA		5	U	NA		16		15		0.63	J	5	U	11		1	U	5	U
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	1	U	5	U	NA		5	U	NA		1	U	1	U	1	U	5	U	1	U	1	U	5	U
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	NA		0.2	U	NA		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
7440-02-0	NICKEL (DISSOLVED)	ug/l	1.3		1.6	J	NA		1.3	J	NA		1.1		2	U	1.2		1.9	J	1.1		1.2		1.3	J
7782-49-2	SELENIUM (DISSOLVED)	ug/l	6.8		10	U	NA		7.3	J	NA		1	U	1	U	1	U	10	U	1	U	2	U	10	U
7440-22-4	SILER (DISSOLVED)	ug/l	1	U	5	U	NA		1.4	J	NA		1	U	1	U	1	U	5	U	1	U	1	U	5	U
7440-62-2	ANADIUM (DISSOLVED)	ug/l	1	U	10	U	NA		10	U	NA		1	U	2	U	0.25	J	10	U	1	U	1	U	10	U
7440-66-6	ZINC (DISSOLVED)	ug/l	2.7		50	U	NA		1.4	J	NA		2.4	J	1.9	J	5.3		1.6	J	2.1	J	5	U	50	U
75-25-2	BROMOFORM	ug/l	NA		1	U	NA		1	U	NA		NA		NA		NA		0.67	J	NA		NA		1	U
108-88-3	TOLUENE	ug/l	NA		1	U	NA		1	U	NA		NA		NA		NA		1	U	NA		NA		1	U

Notes:
DDA - Demolition Debris Area
GW - Groundwater
ug/l - microgram per liter
U - non-detect
J - concentration is an estimated value
NA - not analyzed
Q - qualifier

Attachment A(2)
Analytical Data - DDA GW
Bird Machine Company
Human Health and Eironmental Risk Characterization

		Location:	DD-MW-205						DD-MW-206																	
		Sample ID:	DD-MW-205-R02-X		DD-MW-205-R03-X		DD-MW-205-R05-X		DD-MW-206-001-X		DD-MW-206-R02-D		DD-MW-206-R02-X		DD-MW-206-R03-X		DD-MW-206-R03-X-D		DD-MW-206-R04-X		DD-MW-206-R05-X		DD-MW-207-001-X		DD-MW-207-R02-X	
		Sample Date:	8/14/2006		6/6/2007		5/19/2008		6/26/2006		8/2/2006		8/2/2006		8/14/2006		8/14/2006		6/5/2007		5/19/2008		6/27/2006		8/2/2006	
		Depth:	10 - 10 feet		5 - 11 feet		5 - 11 feet		8 - 8 feet		10 - 10 feet		10 - 10 feet		10 - 10 feet		10 - 10 feet		5 - 11 feet		5 - 11 feet		10 - 10 feet		12.5 - 12.5 feet	
CAS Number	**Analyte**	**Units**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
51-28-5	2,4-DINITROPHENOL	ug/l	10	U	5.1	U	5.1	U	11	UJ	NA		NA		5.1	UJ	5.1	UJ	5.2	U	5.1	U	10	U	NA	
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	0.3	U	0.3	U	0.32	U	NA		NA		0.3	U	0.3	U	0.31	U	0.3	U	0.3	U	NA	
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.2	U	0.2	U	0.21	U	NA		NA		0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	NA	
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	0.3	U	0.3	U	0.32	U	NA		NA		0.3	U	0.3	U	0.31	U	0.3	U	0.3	U	NA	
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.51	U	0.4	U	0.51	U	0.53	U	NA		NA		0.51	U	0.51	U	0.41	U	0.51	U	0.51	U	NA	
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	0.3	U	0.3	U	0.32	U	NA		NA		0.3	U	0.3	U	0.31	U	0.3	U	0.3	U	NA	
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	10	U	5.1	J	5.1	U	11	UJ	NA		NA		5.1	U	5.1	U	5.2	J	0.49	J	10	U	NA	
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	10	U	5.1	U	5.1	U	11	UJ	NA		NA		5.1	U	5.1	U	5.2	U	5.1	U	10	U	NA	
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	100	U	100	U	110	U	NA		NA		100	U	100	U	100	U	100	U	100	U	NA	
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	100	U	100	U	110	U	NA		NA		100	U	100	U	100	U	100	U	100	U	NA	
PH912	C9-C18 ALIPHATICS	ug/l	100	U	100	U	100	U	110	U	NA		NA		100	U	100	U	100	U	100	U	100	U	NA	
218-01-9	CHRYSENE	ug/l	1	U	1	U	1	U	1.1	U	NA		NA		1	U	1	U	1	U	1	U	1	U	NA	
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.51	U	0.4	U	0.51	U	0.53	U	NA		NA		0.51	U	0.51	U	0.41	U	0.51	U	0.51	U	NA	
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	10	U	5.1	J	5.1	U	11	UJ	NA		NA		5.1	U	5.1	U	5.2	J	5.1	U	10	U	NA	
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	10	U	5.1	U	5.1	U	11	UJ	NA		NA		5.1	U	5.1	U	5.2	U	5.1	U	10	U	NA	
206-44-0	FLUORANTHENE	ug/l	1	U	1	U	1	U	1.1	U	NA		NA		1	U	1	U	1	U	1	U	1	U	NA	
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.51	U	0.4	U	0.51	U	0.53	U	NA		NA		0.51	U	0.51	U	0.41	U	0.51	U	0.51	U	NA	
85-01-8	PHENANTHRENE	ug/l	0.2	U	0.2	U	0.2	U	0.21	U	NA		NA		0.2	U	0.2	U	0.21	U	0.2	U	0.2	U	NA	
129-00-0	PYRENE	ug/l	1	U	1	U	5.1	U	1.1	U	NA		NA		1	U	1	U	1	U	5.1	U	1	U	NA	
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	10	U	1	U	1	U	10	U	NA		NA		10	U	10	U	1	U	1	U	10	U	NA	
7440-38-2	ARSENIC (DISSOLVED)	ug/l	10	U	2	U	1	U	10	U	NA		NA		10	U	10	U	1	U	1	U	4.7	J	NA	
7440-39-3	BARIUM (DISSOLVED)	ug/l	6.1	J	18		7.6		23		NA		NA		27		28		26		16		38		NA	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	NA		NA		1	U	1	U	1	U	1	U	1	U	NA	
7440-43-9	CADMIUM (DISSOLVED)	ug/l	1	U	1	U	1	U	1	U	NA		NA		1	U	1	U	1	U	1	U	0.69	J	NA	
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	5	U	8.4		0.52	J	5	U	NA		NA		5	U	5	U	23		0.51	J	5	U	NA	
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	5	U	1	U	1	U	5	U	NA		NA		5	U	5	U	1	U	1	U	5	U	NA	
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	NA		NA		0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	NA	
7440-02-0	NICKEL (DISSOLVED)	ug/l	1.3	J	1.4		0.59	J	1.4	J	NA		NA		1.3	J	10	U	0.91	J	0.69	J	4.7	J	NA	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	10	U	2	U	1	U	10	U	NA		NA		10	U	10	U	1	U	1	U	10	U	NA	
7440-22-4	SILER (DISSOLVED)	ug/l	5	U	1	U	1	U	5	U	NA		NA		5	U	1.5	J	1	U	1	U	5	U	NA	
7440-62-2	ANADIUM (DISSOLVED)	ug/l	10	U	1	U	0.29	J	10	U	NA		NA		10	U	10	U	1	U	1	U	10	U	NA	
7440-66-6	ZINC (DISSOLVED)	ug/l	50	U	5	U	1.6	J	4.2	J	NA		NA		1.8	J	9.3	J	2.7		1.9	J	3.5	J	NA	
75-25-2	BROMOFORM	ug/l	1	U	NA		NA		0.83	J	NA		NA		1	U	1	U	NA		NA		1	U	NA	
108-88-3	TOLUENE	ug/l	1	U	NA		NA		1	U	NA		NA		1	U	0.52	J	NA		NA		1	U	NA	

Notes:
DDA - Demolition Debris Area
GW - Groundwater
ug/l - microgram per liter
U - non-detect
J - concentration is an estimated value
NA - not analyzed
Q - qualifier

Attachment A(2)
Analytical Data - DDA GW
Bird Machine Company
Human Health and Eironmental Risk Characterization

		Location:	DD-MW-207										DD-MW-208-R01-001-D									
		Sample ID:	DD-MW-207-R03-X		DD-MW-207-R04-X		DD-MW-207-R05-D		DD-MW-207-R05-X		DD-MW-207-R06-X		DD-MW-208-R01-001-D		DD-MW-208-R01-001-X		DD-MW-208-R02-X		DD-MW-208-R03-X		DD-MW-208-R04-X	
		Sample Date:	8/14/2006		6/6/2007		12/11/2007		12/11/2007		5/19/2008		6/25/2007		6/25/2007		7/23/2007		12/11/2007		5/19/2008	
		Depth:	12.5 - 12.5 feet		5 - 15 feet		5 - 15 feet		5 - 15 feet		5 - 15 feet		3 - 13 feet		3 - 13 feet		3 - 13 feet		3 - 13 feet		3 - 13 feet	
CAS Number	**Analyte**	**Units**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**	**Result**	**Q**
51-28-5	2,4-DINITROPHENOL	ug/l	10	U	5.1	U	5.5	U	5.1	UJ	5.2	U	5.1	U	5.1	UJ	5.2	U	5.1	UJ	5.1	U
56-55-3	BENZO(A)ANTHRACENE	ug/l	0.3	U	0.22	J	0.33	U	0.3	U	0.31	U	0.3	U	0.3	U	0.31	U	0.3	U	0.3	U
50-32-8	BENZO(A)PYRENE	ug/l	0.2	U	0.2	U	0.22	U	0.2	U	0.21	U	0.2	U	0.2	U	0.21	U	0.2	U	0.2	U
205-99-2	BENZO(B)FLUORANTHENE	ug/l	0.3	U	0.32	U	0.33	U	0.3	U	0.31	U	0.3	U	0.3	U	0.31	U	0.3	U	0.3	U
191-24-2	BENZO(G,H,I)PERYLENE	ug/l	0.51	U	0.42	U	0.55	U	0.51	U	0.52	U	0.4	U	0.41	U	0.21	J	0.51	U	0.51	U
207-08-9	BENZO(K)FLUORANTHENE	ug/l	0.3	U	0.3	U	0.33	U	0.3	U	0.31	U	0.3	U	0.3	U	0.31	U	0.3	U	0.3	U
117-81-7	BIS(2-ETHYLHEXYL) PHTHALATE	ug/l	10	U	5.1	J	5.5	J	5.1	J	0.51	J	5.1	U	5.1	U	0.78	J	5.1	J	1.6	J
85-68-7	BUTYLBENZYLPHTHALATE	ug/l	10	U	5.1	U	5.5	U	5.1	U	5.2	U	5.1	U	5.1	U	0.34	J	5.1	U	5.1	U
EPH1122	C11-C22 AROMATICS, ADJUSTED	ug/l	100	U	110	U	100	U	100	U	100	U	290		460		100	U	NA		100	U
EPH1936	C19-C36 ALIPHATICS	ug/l	100	U	110	U	100	U	100	U	100	U	100	U	130		100	U	100	U	100	U
PH912	C9-C18 ALIPHATICS	ug/l	100	U	110	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U	100	U
218-01-9	CHRYSENE	ug/l	1	U	0.24	J	1.1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
53-70-3	DIBENZ(A,H)ANTHRACENE	ug/l	0.51	U	0.42	U	0.55	U	0.51	U	0.52	U	0.4	U	0.41	U	0.42	J	0.51	U	0.51	U
84-74-2	DI-N-BUTYL PHTHALATE	ug/l	10	U	5.1	J	5.5	J	5.1	J	5.2	U	5.1	J	5.1	J	5.2	J	5.1	J	1.5	J
117-84-0	DI-N-OCTYL PHTHALATE	ug/l	10	U	0.39	J	5.5	U	5.1	U	5.2	U	5.1	U	5.1	U	5.2	U	5.1	U	5.1	U
206-44-0	FLUORANTHENE	ug/l	1	U	0.28	J	1.1	U	1	U	1	U	1.885	J	1.875	J	1	U	1	U	1	U
193-39-5	INDENO(1,2,3-CD)PYRENE	ug/l	0.51	U	0.42	U	0.55	U	0.51	U	0.52	U	0.4	U	0.41	U	0.38	J	0.51	U	0.51	U
85-01-8	PHENANTHRENE	ug/l	0.2	U	0.2	U	0.22	U	0.2	U	0.21	U	0.62	J	0.37	J	0.21	U	0.2	U	0.2	U
129-00-0	PYRENE	ug/l	1	U	0.29	J	5.5	U	5.1	U	5.2	U	0.28	J	1	U	1	U	5.1	U	5.1	U
7440-36-0	ANTIMONY (DISSOLVED)	ug/l	2.3	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	1	U
7440-38-2	ARSENIC (DISSOLVED)	ug/l	7.7	J	5.7		10		10		3.9		1.7	J	1.7	J	NA		1	U	1	U
7440-39-3	BARIUM (DISSOLVED)	ug/l	44		38		44		45		31		27		26		NA		25		31	
7440-41-7	BERYLLIUM (DISSOLVED)	ug/l	1	U	1	U	2	U	2	U	1	U	2	U	1	U	NA		2	U	1	U
7440-43-9	CADMIUM (DISSOLVED)	ug/l	0.84	J	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	1	U
7440-47-3	CHROMIUM (DISSOLVED)	ug/l	5	U	4.9		9.1		10		1.3		9.8		11		NA		25		0.36	J
7440-50-8	COPPER (DISSOLVED)	ug/l	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
7439-92-1	LEAD (DISSOLVED)	ug/l	5	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	0.46	J
7439-97-6	MERCURY (DISSOLVED)	ug/l	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U	NA		0.2	U	0.2	U
7440-02-0	NICKEL (DISSOLVED)	ug/l	4	J	1	U	2	U	2	U	0.43	J	3.6		3.2		NA		0.96	J	2	
7782-49-2	SELENIUM (DISSOLVED)	ug/l	10	U	1	U	1	U	1	U	1	U	2	U	2	U	NA		1	U	1	U
7440-22-4	SILER (DISSOLVED)	ug/l	5	U	1	U	1	U	1	U	1	U	1	U	1	U	NA		1	U	1	U
7440-62-2	ANADIUM (DISSOLVED)	ug/l	0.92	J	1	U	2	U	2	U	1	U	0.91	J	1	J	NA		2	U	0.52	J
7440-66-6	ZINC (DISSOLVED)	ug/l	3.5	J	2.5	U	1.2	J	1.5	J	1.9	J	9.4		7.7		NA		20		110	
75-25-2	BROMOFORM	ug/l	1	U	NA		NA		NA		NA		5	U	5	U	NA		NA		NA	
108-88-3	TOLUENE	ug/l	1	U	NA		NA		NA		NA		5	U	5	U	NA		NA		NA	

Notes:
DDA - Demolition Debris Area
GW - Groundwater
ug/l - microgram per liter
U - non-detect
J - concentration is an estimated value
NA - not analyzed
Q - qualifier

Attachment A(3)
Analytical Data - DDA Earthworm
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

		Location	**BP-BO-007**		**DD-BO-001**		**DD-BO-002**		**BP-BO-007**	
		Sample ID	**BP-BO-007-001-X**		**DD-BO-001-001-X**		**DD-BO-002-001-X**		**SH-BO-001-001-X**	
		Sample Date	**9/22/2006**		**9/21/2006**		**9/22/2006**		**9/22/2006**	
		Depth			**0 - 1 feet**		**0 - 1 feet**			
Cas Number	**Analyte**	**Units**	**Results**	**Q**	**Results**	**Q**	**Results**	**Q**	**Results**	**Q**
7440-36-0	ANTIMONY	mg/kg			0.26	B	0.10	B	0.091	B
7440-38-2	ARSENIC	mg/kg			1.30	V	0.82	V	0.34	V
7440-39-3	BARIUM	mg/kg							6.60	B
7440-41-7	BERYLLIUM	mg/kg			0.24	B	0.14	B	0.041	B
7440-43-9	CADMIUM	mg/kg			8.10	V	3.80	V	1.30	V
7440-47-3	CHROMIUM	mg/kg			16.20	V	10.30	V	4.100	V
7440-50-8	COPPER	mg/kg			14.80	V	3.90	V	2.00	V
7439-92-1	LEAD	mg/kg			36.20	V	101	V	28.30	V
7440-02-0	NICKEL	mg/kg			9.70	V	6.90	V	2.60	V
7782-49-2	SELENIUM	mg/kg							0.91	V
7440-22-4	SILVER	mg/kg			0.18	V	0.040	B	0.058	B
7440-28-0	THALLIUM	mg/kg			0.024	B	0.024	B	0.025	B
7440-62-2	VANADIUM	mg/kg			5.20	V	5.00	V	3.00	V
7440-66-6	ZINC	mg/kg			168	V	114	V	81.20	V
7439-97-6	MERCURY	mg/kg			0.45	V	0.10	V	0.066	V
% SOLIDS	% SOLIDS	%			37.30	V	38.90	V	28.40	V
	%LIPIDS DETERMINATION	%	1.60	V	0.90	V	1.00	V		

Notes:
mg/kg - milligrams per kilogram
Q - qualifier
DDA - Demoilition Debris Area

Attachment B – Evaluation of Background Arsenic in Groundwater

Background Arsenic Evaluation

Identification of Background Wells

Background is defined as those levels of oil and hazardous material (arsenic in this case) that would exist in the absence of the disposal site of concern, also usually described as naturally occurring or anthropogenic levels of "contaminants". Arsenic is naturally occurring in soil and groundwater throughout Massachusetts as a result of geologic processes. Monitoring Wells that appear to represent groundwater not influenced by the Site include the following locations:

- CP-MW-101 is located adjacent to the north side of Ruckaduck Pond, and upgradient of known manufacturing and disposal areas on the Site;
- DD-MW-204 and -205 are located upgradient of the DDA;
- MB-MW-360 and -361 are located east of the Neponset River; and
- MB-MW-368 is located near the southeast side of Ruckaduck Pond, upgradient from the former manufacturing buildings and crossgradient from the South Rail Spur source area.

Evidence of no Site impacts for these wells includes no organic contaminants detected, and positions that are upgradient or crossgradient of known source areas based on groundwater flow directions mapped in the Phase II and Phase III reports. All of these wells are screened in the shallow sandy aquifer where other Site monitoring wells are screened. The average arsenic concentration for each background well is listed in Table B-1.

Methods and Results

EPA's ProUCL software (version 4.1) was used to calculate upper tolerance levels (UTLs) for groundwater collected between 1992 and 2009. The UTL calculated represents the value below which 90% of background values are expected to fall with a 95% confidence. All UTLs provided by ProUCL for each distribution were evaluated. Note that ProUCL guidance recommends the use of either the largest value or the second largest value for a UTL, while cautioning that the largest UTL may result in an overestimate. For the purposes of this evaluation, the second largest recommended UTL was used to represent background concentrations at this site.

Results from ProUCL are provided in Table B-2 and indicate that groundwater data follow a normal, gamma and lognormal distribution (likely due to the relatively small sample size of the dataset; represented by 6 observations). Parametric statistics predict background concentrations at 0.0143 mg/l, 0.049 mg/l and 0.102 mg/l assuming a normal, gamma, and lognormal distribution, respectively. Since the dataset size is limited an alternate and more appropriate approach maybe to use non-parametric statistics to estimate background concentrations. The recommended UTL from this set of statistical tests calculates a background arsenic concentration of 0.0159 mg/l.

Table B-1
Background Results of Arsenic
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Sample ID	Units	Results	Qualifier
MW-101	mg/L	0.0103	
MW-204	mg/L	0.001	U
MW-205	mg/L	0.001	U
MW-360	mg/L	0.0039	
MW-361	mg/L	0.00079	
MW-368	mg/L	0.0086	

Notes:
mg/L - milligrams per liter
U - Value is non-detect

Table B-2. General Background Statistics for Data Sets with Non-Detects

User Selected Options

From File	ProUCL.wst
Full Precision	OFF
Confidence Coefficient	95%
Coverage	90%
Different or Future K Values	1
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Number of Valid Data	6	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	2
Tolerance Factor	3.006	Percent Non-Detects	33.33%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.00079	Minimum Detected	-7.143
Maximum Detected	0.0103	Maximum Detected	-4.576
Mean of Detected	0.0059	Mean of Detected	-5.505
SD of Detected	0.00435	SD of Detected	1.171
Minimum Non-Detect	0.001	Minimum Non-Detect	-6.908
Maximum Non-Detect	0.001	Maximum Non-Detect	-6.908

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set
the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

Background Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.945
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.876
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method

Mean	0.0041
SD	0.00437
95% UTL 90% Coverage	0.0172
95% UPL (t)	0.0136
90% Percentile (z)	0.0097
95% Percentile (z)	0.0113
99% Percentile (z)	0.0143

Maximum Likelihood Estimate(MLE) Method

Mean	0.00765
SD	0.00271
95% UTL with 90% Coverage	0.0158
95% UPL (t)	0.0135
90% Percentile (z)	0.0111
95% Percentile (z)	0.0121
99% Percentile (z)	0.0139

Assuming Lognormal Distribution

DL/2 Substitution Method

Mean (Log Scale)	-6.204
SD (Log Scale)	1.412
95% UTL 90% Coverage	0.141
95% UPL (t)	0.0437
90% Percentile (z)	0.0123
95% Percentile (z)	0.0206
99% Percentile (z)	0.054

Log ROS Method

Mean in Original Scale	0.00423
SD in Original Scale	0.00425
95% UTL with 90% Coverage	0.102
95% BCA UTL with 90% Coverage	0.0103
95% Bootstrap (%) UTL with 90% Coverage	0.0103
95% UPL (t)	0.0362
90% Percentile (z)	0.0118
95% Percentile (z)	0.0186
99% Percentile (z)	0.0436

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.539
Theta Star	0.0109
nu star	4.309
A-D Test Statistic	0.343
5% A-D Critical Value	0.662
K-S Test Statistic	0.276
5% K-S Critical Value	0.4

Data appear Gamma Distributed at 5% Significance Level

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics with Extrapolated Data

Mean	0.00412
Median	0.00252
SD	0.00436
k star	0.315
Theta star	0.0131
Nu star	3.778
95% Percentile of Chisquare (2k)	2.836
90% Percentile	0.0121
95% Percentile	0.0186
99% Percentile	0.0353

Nonparametric Statistics

Kaplan-Meier (KM) Method

Mean	0.0042
SD	0.00391
SE of Mean	0.00184
95% KM UTL with 90% Coverage	0.0159
95% KM Chebyshev UPL	0.0226
95% KM UPL (t)	0.0127
90% Percentile (z)	0.0092
95% Percentile (z)	0.0106
99% Percentile (z)	0.0133

Gamma ROS Limits with Extrapolated Data

95% Wilson Hilferty (WH) Approx. Gamma UPL	0.0273
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.0378
95% WH Approx. Gamma UTL with 90% Coverage	0.049
95% HW Approx. Gamma UTL with 90% Coverage	0.0784

Note: DL/2 is not a recommended method.

Attachment C – TCDD TEQ Calculations

Attachment C
TCDD TEQ Calculations
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

CAS Number	Analyte	units	Mammalian TEF	Avian TEF	DD-GP-003		DD-GP-004		DD-GP-006		DD-GP-009		DD-GP-207		DD-SB-206		DD-SS-003		DD-SS-005	
		Sample ID			DDA-GP-3 RR & Dup		DDA-GP-4		DDA-GP-6		DDA-GP-9 RR & Dup		DD-GP-207-001-X		DD-SB-206-003-X		DD-SS-001-001-X		DD-SS-005-001-X	
		Sample Date			5/16/2005		5/16/2005		5/16/2005		5/16/2005		6/9/2006		6/19/2006		12/8/2005		9/21/2006	
		Depth			0 - 3 feet		2 - 4 feet		0 - 3 feet		0 - 3 feet		0 - 2 feet		0 - 2 feet		0 - 3 feet		0 - 0.5 feet	
		Location			Results		Results		Results		Results		Results		Results		Results		Results	
1746-01-6	2,3,7,8-TCDD	mg/kg	1	1	2.35E-07	U	2.50E-07	U	1.30E-07	U	1.15E-07	U	8.50E-08	U	5.50E-06		NA		NA	
40321-76-4	1,2,3,7,8-PeCDD	mg/kg	1	1	3.50E-06	J	5.00E-07	U	3.35E-07	U	1.35E-07	U	3.85E-07	U	1.70E-05		NA		NA	
39227-28-6	1,2,3,4,7,8-HxCDD	mg/kg	0.1	0.05	1.35E-06	U	3.05E-07	U	2.60E-07	U	1.15E-07	U	2.20E-07	U	7.30E-06	J	NA		NA	
57653-85-7	1,2,3,6,7,8-HxCDD	mg/kg	0.1	0.01	1.40E-05	V	3.20E-07	U	1.40E-06	U	2.55E-07	U	2.00E-07	U	4.00E-05		NA		NA	
19408-74-3	1,2,3,7,8,9-HxCDD	mg/kg	0.1	0.01	6.00E-06	V	3.20E-07	U	9.00E-07	U	2.30E-07	U	2.00E-07	U	2.40E-05		NA		NA	
35822-46-9	1,2,3,4,6,7,8-HpCDD	mg/kg	0.01	0.001	3.10E-04	V	5.70E-06	J	7.10E-05	V	6.30E-06	V	9.20E-06	v	8.30E-04		NA		NA	
3268-87-9	OCDD	mg/kg	0.0003	0.0001	2.70E-03	V	4.20E-05	V	1.10E-03	V	4.40E-05	V	9.80E-05	v	7.20E-03		NA		NA	
51207-31-9	2,3,7,8-TCDF	mg/kg	0.1	1	2.10E-06		6.10E-07		1.30E-06		2.90E-07		4.90E-07		3.70E-05		NA		NA	
57117-41-6	1,2,3,7,8-PeCDF	mg/kg	0.03	0.01	9.50E-07	U	2.55E-07	U	7.50E-07	U	1.15E-07	U	2.70E-07	U	1.60E-05		NA		NA	
57117-31-4	2,3,4,7,8-PeCDF	mg/kg	0.3	1	5.70E-06	J	2.55E-07	U	3.80E-06	J	3.25E-07	U	2.70E-07	U	7.10E-05		NA		NA	
70648-26-9	1,2,3,4,7,8-HxCDF	mg/kg	0.1	0.1	7.20E-06	V	9.00E-07	U	4.30E-06	J	6.50E-07	U	9.50E-07	U	2.70E-05		NA		NA	
57117-44-9	1,2,3,6,7,8-HxCDF	mg/kg	0.1	0.1	8.90E-06	V	3.50E-07	U	4.20E-06	J	3.80E-07	U	3.40E-07	U	9.00E-05		NA		NA	
72918-21-9	1,2,3,7,8,9-HxCDF	mg/kg	0.1	0.1	4.55E-07	U	3.20E-07	U	5.50E-07	U	2.40E-07	U	1.80E-07	U	3.60E-06	U	NA		NA	
60851-34-5	2,3,4,6,7,8-HxCDF	mg/kg	0.1	0.1	8.70E-06	V	5.50E-07	U	5.50E-06	J	4.15E-07	U	6.50E-07	U	1.10E-04		NA		NA	
67562-39-4	1,2,3,4,6,7,8-HpCDF	mg/kg	0.01	0.01	9.00E-05	V	6.50E-06	J	2.30E-05	V	6.30E-06	V	6.80E-06	v	3.10E-04		NA		NA	
55673-89-7	1,2,3,4,7,8,9-HpCDF	mg/kg	0.01	0.01	4.00E-06	J	2.30E-07	U	5.50E-07	U	1.85E-07	U	2.50E-07	U	1.20E-05		NA		NA	
39001-02-0	OCDF	mg/kg	0.0003	0.0001	4.60E-04	V	3.90E-06	U	2.50E-05	V	6.40E-06	J	2.00E-05	v	1.50E-03		NA		NA	
	Mammalian TEQ	**mg/kg**			**0.000015**		**0.0000013**		**0.0000048**		**0.00000075**		**0.0000011**		**0.00009230**		**NA**		**NA**	
	Avian TEQ	**mg/kg**			**0.000016**		**0.0000019**		**0.0000075**		**0.00000112**		**0.0000016**		**0.00015965**		**NA**		**NA**	

Notes:
mg/kg-milligrams per kilogram
TEF - Toxicity equivalency factor
TEQ - Toxic equivalency quotient
NA - not analyzed
(1) TEFs presented are the World Health Organization
(WHO) 2005 values from Van den Berg et al., 2006
(2) Mammailian TEQs were calculated by multiplying the results for each individual
congener by the applicable Mammalian TEFs and summing the results.
Avian TEQs were calculated using the same process and the Avian TEFs.

Attachment C
TCDD TEQ Calculations
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

		Location			DD-SS-007		DD-SS-012		DD-SS-014		DD-TP-013				DD-TP-003		DD-TP-004		DD-TP-005	
		Sample ID			DD-SS-007-001-X & Dup		DD-SS-012-001-X		DD-SS-014-001-X		DD-TP-001-001-X		DD-TP-001-002-X		DD-TP03-2S		DD-TP04-2S		DD-TP05-2S	
		Sample Date			10/26/2006		5/30/2007		5/30/2007		11/21/2005		11/21/2005		12/20/2004		12/20/2004		12/20/2004	
CAS		Depth	Mammalian	Avian	0 - 0.5 feet		0 - 2 feet		0 - 2 feet		0 - 2 feet		2 - 4 feet		0 - 3 feet		0 - 3 feet		0 - 3 feet	
Number	Analyte	units	TEF	TEF	Results		Results		Results		Results		Results		Results		Results		Results	
1746-01-6	2,3,7,8-TCDD	mg/kg	1	1	1.75E-06	v	1.55E-07	U	3.90E-06	v	NA		NA		5.90E-07	J	NA		4.20E-06	V
40321-76-4	1,2,3,7,8-PeCDD	mg/kg	1	1	6.90E-06	v	3.10E-07	U	1.80E-05	v	NA		NA		1.50E-06	J	NA		1.40E-05	V
39227-28-6	1,2,3,4,7,8-HxCDD	mg/kg	0.1	0.05	1.35E-06	U	2.45E-07	U	7.70E-06	J	NA		NA		1.10E-06	J	NA		1.30E-05	V
57653-85-7	1,2,3,6,7,8-HxCDD	mg/kg	0.1	0.01	1.25E-05	v	4.15E-07	U	3.60E-05	v	NA		NA		3.30E-06	J	NA		2.70E-05	V
19408-74-3	1,2,3,7,8,9-HxCDD	mg/kg	0.1	0.01	7.15E-06	v	3.15E-07	U	2.40E-05	v	NA		NA		3.20E-06	J	NA		4.00E-05	V
35822-46-9	1,2,3,4,6,7,8-HpCDD	mg/kg	0.01	0.001	1.50E-04	v	7.20E-06	v	1.80E-04	v	NA		NA		2.10E-05	B	NA		6.70E-04	B
3268-87-9	OCDD	mg/kg	0.0003	0.0001	1.25E-03	v	5.40E-05	v	1.40E-03	v	NA		NA		1.00E-04	B	NA		5.70E-03	
51207-31-9	2,3,7,8-TCDF	mg/kg	0.1	1	1.30E-05		1.40E-06		2.50E-05		NA		NA		4.50E-06	V	NA		5.80E-05	V
57117-41-6	1,2,3,7,8-PeCDF	mg/kg	0.03	0.01	5.75E-06	J	4.70E-07	U	2.10E-05	v	NA		NA		3.30E-06	J	NA		3.30E-05	V
57117-31-4	2,3,4,7,8-PeCDF	mg/kg	0.3	1	2.30E-05	v	1.00E-06	U	4.70E-05	v	NA		NA		6.80E-06	V	NA		6.60E-05	V
70648-26-9	1,2,3,4,7,8-HxCDF	mg/kg	0.1	0.1	9.40E-06	v	8.50E-07	U	2.90E-05	v	NA		NA		2.00E-05	V	NA		1.60E-04	V
57117-44-9	1,2,3,6,7,8-HxCDF	mg/kg	0.1	0.1	2.55E-05	v	8.00E-07	U	4.70E-05	v	NA		NA		7.40E-06	V	NA		6.40E-05	V
72918-21-9	1,2,3,7,8,9-HxCDF	mg/kg	0.1	0.1	3.50E-07	U	3.15E-07	U	1.35E-06	U	NA		NA		8.50E-08	U	NA		2.90E-06	J
60851-34-5	2,3,4,6,7,8-HxCDF	mg/kg	0.1	0.1	3.15E-05	v	9.50E-07	U	5.30E-05	v	NA		NA		7.80E-06	V	NA		7.70E-05	V
67562-39-4	1,2,3,4,6,7,8-HpCDF	mg/kg	0.01	0.01	5.65E-05	v	3.50E-06	J	9.20E-05	v	NA		NA		6.20E-05	V	NA		2.70E-04	V
55673-89-7	1,2,3,4,7,8,9-HpCDF	mg/kg	0.01	0.01	4.80E-06	J	1.80E-07	U	6.70E-06	J	NA		NA		2.80E-06	J	NA		1.70E-05	V
39001-02-0	OCDF	mg/kg	0.0003	0.0001	1.05E-04	v	2.60E-06	U	1.30E-04	v	NA		NA		3.60E-05	B	NA		1.50E-04	B
	Mammalian TEQ	**mg/kg**			**0.000028**		**0.0000014**		**0.000062**		**NA**		**NA**		**0.0000099**		**NA**		**0.000095**	
	Avian TEQ	**mg/kg**			**0.000053**		**0.0000032**		**0.000109**		**NA**		**NA**		**0.000018**		**NA**		**0.00018**	

Notes:
mg/kg-milligrams per kilogram
TEF - Toxicity equivalency factor
TEQ - Toxic equivalency quotient
NA - not analyzed
(1) TEFs presented are the World Health Organization
(WHO) 2005 values from Van den Berg et al., 2006
(2) Mammailian TEQs were calculated by multiplying the results for each individual
congener by the applicable Mammalian TEFs and summing the results.
Avian TEQs were calculated using the same process and the Avian TEFs.

Attachment C
TCDD TEQ Calculations
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

		Location			DD-TP-007		DD-TP-008		DD-TP-009		DD-TP-012		DD-TP-201		DD-TP-202		DD-TP-202	
		Sample ID			DD-TP07-2S-D & Dup		DD-TP08-2S		DD-TP09-2S-D & Dup		DD-TP12-5W		DD-TP-201-001-X		DD-TP-202-002-X		DD-TP-202-003-X	
		Sample Date			12/20/2004		12/20/2004		12/20/2004		12/20/2004		6/6/2006		6/28/2006		6/28/2006	
CAS		Depth	Mammalian	Avian	0 - 3 feet		0 - 3 feet		0 - 3 feet		0 - 3 feet		1 - 2 feet		2 - 3 feet		2 - 3 feet	
Number	Analyte	units	TEF	TEF	Results		Results		Results		Results		Results		Results		Results	
1746-01-6	2,3,7,8-TCDD	mg/kg	1	1	6.70E-07	J	NA		NA		NA		NA		NA		NA	
40321-76-4	1,2,3,7,8-PeCDD	mg/kg	1	1	3.40E-06	J	NA		NA		NA		NA		NA		NA	
39227-28-6	1,2,3,4,7,8-HxCDD	mg/kg	0.1	0.05	2.10E-06	J	NA		NA		NA		NA		NA		NA	
57653-85-7	1,2,3,6,7,8-HxCDD	mg/kg	0.1	0.01	1.50E-05	V	NA		NA		NA		NA		NA		NA	
19408-74-3	1,2,3,7,8,9-HxCDD	mg/kg	0.1	0.01	7.40E-06	V	NA		NA		NA		NA		NA		NA	
35822-46-9	1,2,3,4,6,7,8-HpCDD	mg/kg	0.01	0.001	3.10E-04	B	NA		NA		NA		NA		NA		NA	
3268-87-9	OCDD	mg/kg	0.0003	0.0001	7.60E-03		NA		NA		NA		NA		NA		NA	
51207-31-9	2,3,7,8-TCDF	mg/kg	0.1	1	5.90E-06	V	NA		NA		NA		NA		NA		NA	
57117-41-6	1,2,3,7,8-PeCDF	mg/kg	0.03	0.01	3.30E-06	J	NA		NA		NA		NA		NA		NA	
57117-31-4	2,3,4,7,8-PeCDF	mg/kg	0.3	1	8.30E-06	V	NA		NA		NA		NA		NA		NA	
70648-26-9	1,2,3,4,7,8-HxCDF	mg/kg	0.1	0.1	1.70E-05	V	NA		NA		NA		NA		NA		NA	
57117-44-9	1,2,3,6,7,8-HxCDF	mg/kg	0.1	0.1	8.50E-06	V	NA		NA		NA		NA		NA		NA	
72918-21-9	1,2,3,7,8,9-HxCDF	mg/kg	0.1	0.1	1.20E-07	U	NA		NA		NA		NA		NA		NA	
60851-34-5	2,3,4,6,7,8-HxCDF	mg/kg	0.1	0.1	8.80E-06	V	NA		NA		NA		NA		NA		NA	
67562-39-4	1,2,3,4,6,7,8-HpCDF	mg/kg	0.01	0.01	6.30E-05	V	NA		NA		NA		NA		NA		NA	
55673-89-7	1,2,3,4,7,8,9-HpCDF	mg/kg	0.01	0.01	4.20E-06	J	NA		NA		NA		NA		NA		NA	
39001-02-0	OCDF	mg/kg	0.0003	0.0001	1.70E-04	B	NA		NA		NA		NA		NA		NA	
	Mammalian TEQ	**mg/kg**			**0.000019**		**NA**		**NA**		**NA**		**NA**		**NA**		**NA**	
	Avian TEQ	**mg/kg**			**0.000024**		**NA**		**NA**		**NA**		**NA**		**NA**		**NA**	

Notes:
mg/kg-milligrams per kilogram
TEF - Toxicity equivalency factor
TEQ - Toxic equivalency quotient
NA - not analyzed
(1) TEFs presented are the World Health Organization
(WHO) 2005 values from Van den Berg et al., 2006
(2) Mammailian TEQs were calculated by multiplying the results for each individual
congener by the applicable Mammalian TEFs and summing the results.
Avian TEQs were calculated using the same process and the Avian TEFs.

Attachment D – Human Health Risk Calculations for Soil

Attachment D
Exposure and Risk Estimates Associated With Soil Contact
Bird Machine Company - DDA
100 Neponset St, Walpole MA
Trespasser Older Child
Surface Soil
DDA current
0-3 feet

Receptor:	Trespasser Older Child
Medium:	Surface Soil
Exposure Area:	DDA current
Depth:	0-3 feet
Duration:	Chronic

$$ADD_{ing} = \frac{C_{soil} \times CF \times IR_{soil} \times RAF_{os} \times EF \times EP}{AT \times BW}$$

$$ADD_{der} = \frac{C_{soil} \times CF \times SA \times AF \times RAF_{ds} \times EF \times EP}{AT \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk_{ing} = ADD_{ing} \times CSF$$

$$Risk_{der} = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

Parameter	Definition	Units	Value	Comment
IRsoil	Soil Ingestion Rate	mg/d	50	
SA	Soil Dermal Contact Skin Exposed	cm2/d	4260	
AF	Soil Dermal Contact Adherence Rate	mg/cm2	0.14	
EF	Soil Exposure Frequency	d/y	50	
EP	Soil Exposure Period - Cancer	y	7	
EP	Soil Exposure Period - Non-Cancer	y	7	
ATc	Soil Averaging Time - Cancer	d	25550	
ATn	Soil Averaging Time - Non-Cancer	d	2555	
BW	Body Weight	kg	39.9	
CF	Conversion Factor	kg/mg	0.000001	

	EPC Surface Soil DDA current 0-3 feet			Incidental Ingestion						Dermal Contact						Total	
Compound	(mg/kg)	RfD (mg/kg-d)	CSF 1/(mg/kg-d)	RAFosc	ADDing-c mg/kg-d	Risking	RAFosnc	ADDing-nc mg/kg-d	HIing	RAFdsc	ADDder-c mg/kg-d	Riskder	RAFdsnc	ADDder-nc mg/kg-d	HIder	Risk (Soil)	HI (Soil)
1,2,4-TRIMETHYLBENZENE	2.87E-01	NA	NA	NC	NA	NA	1	NA	NA	NC	NA	NA	1	NA	NA	NA	NA
1,2-DICHLOROETHANE	2.06E-02	0.02	0.091	1	3.53E-10	3.22E-11	1	3.53E-09	1.77E-07	0.1	4.21E-10	3.84E-11	0.1	4.21E-09	2.11E-07	7.05E-11	3.87E-07
1,3,5-TRIMETHYLBENZENE	1.15E-01	0.01	NA	NC	NA	NA	1	1.97E-08	1.97E-06	NC	NA	NA	1	2.34E-07	2.34E-05	NA	2.54E-05
4-CHLOROANILINE	6.36E-01	0.004	0.2	1	1.09E-08	2.18E-09	1	1.09E-07	2.73E-05	0.08	1.04E-08	2.08E-09	0.1	1.30E-07	3.25E-05	4.26E-09	5.98E-05
4-ISOPROPYLTOLUENE	2.59E-02	NA	NA	NC	NA	NA	1	NA	NA	NC	NA	NA	0.12	NA	NA	NA	NA
ACETONE	2.05E+00	0.9	NA	NC	NA	NA	1	3.52E-07	3.91E-07	NC	NA	NA	0.1	4.20E-07	4.67E-07	NA	8.58E-07
ANTIMONY	2.18E+00	0.0004	NA	NC	NA	NA	1	3.74E-07	9.35E-04	NC	NA	NA	0.1	4.46E-07	1.12E-03	NA	2.05E-03
AROCLOR-1260	1.33E-01	0.00002	2	0.85	1.94E-09	3.88E-09	0.85	1.94E-08	9.70E-04	0.16	4.36E-09	8.71E-09	0.16	4.36E-08	2.18E-03	1.26E-08	3.15E-03
ARSENIC	4.73E+00	0.0003	1.5	1	8.13E-08	1.22E-07	1	8.13E-07	2.71E-03	0.03	2.91E-08	4.36E-08	0.03	2.91E-07	9.69E-04	1.66E-07	3.68E-03
BARIUM	2.49E+02	0.2	NA	NC	NA	NA	1	4.27E-05	2.13E-04	NC	NA	NA	0.05	2.54E-05	1.27E-04	NA	3.41E-04
BENZO(B)FLUORANTHENE	2.87E-01	0.03	0.73	0.28	1.38E-09	1.01E-09	0.28	1.38E-08	4.60E-07	0.02	1.18E-09	8.59E-10	0.02	1.18E-08	3.92E-07	1.87E-09	8.52E-07
BENZO(G,H,I)PERYLENE	2.01E-01	0.03	NA	NC	NA	NA	0.36	1.25E-08	4.15E-07	NC	NA	NA	0.1	4.13E-08	1.38E-06	NA	1.79E-06
BENZO(K)FLUORANTHENE	3.00E-01	0.03	0.073	0.28	1.44E-09	1.05E-10	0.28	1.44E-08	4.81E-07	0.02	1.23E-09	8.98E-11	0.02	1.23E-08	4.10E-07	1.95E-10	8.91E-07
BERYLLIUM	5.43E-01	0.002	NA	NC	NA	NA	1	9.32E-08	4.66E-05	0.03	NA	NA	0.03	3.34E-08	1.67E-05	NA	6.33E-05
C11-C22 AROMATICS	2.78E+01	0.03	NA	NC	NA	NA	0.36	1.72E-06	5.73E-05	NC	NA	NA	0.1	5.70E-06	1.90E-04	NA	2.47E-04
C19-C36 ALIPHATICS	4.81E+01	2	NA	NC	NA	NA	1	8.25E-06	4.13E-06	NC	NA	NA	0.1	9.84E-06	4.92E-06	NA	9.05E-06
C5-C8 ALIPHATICS	2.04E+00	0.04	NA	NC	NA	NA	1	3.50E-07	8.76E-06	NC	NA	NA	1	4.18E-06	1.05E-04	NA	1.13E-04
C9-C10 AROMATICS	5.17E+00	0.03	NA	NC	NA	NA	1	8.88E-07	2.96E-05	NC	NA	NA	0.5	5.30E-06	1.77E-04	NA	2.06E-04
C9-C18 ALIPHATICS	4.04E+00	0.1	NA	NC	NA	NA	1	6.94E-07	6.94E-06	NC	NA	NA	0.5	4.14E-06	4.14E-05	NA	4.83E-05
CADMIUM	9.26E-01	0.0005	NA	NC	NA	NA	1	1.59E-07	3.18E-04	NC	NA	NA	0.14	2.66E-07	5.31E-04	NA	8.49E-04

Attachment D
Exposure and Risk Estimates Associated With Soil Contact
Bird Machine Company - DDA
100 Neponset St, Walpole MA
Trespasser Older Child
Surface Soil
DDA current
0-3 feet

Receptor:	Trespasser Older Child
Medium:	Surface Soil
Exposure Area:	DDA current
Depth:	0-3 feet
Duration:	Chronic

$$ADD_{ing} = \frac{C_{soil} \times CF \times IR_{soil} \times RAF_{os} \times EF \times EP}{AT \times BW}$$

$$ADD_{der} = \frac{C_{soil} \times CF \times SA \times AF \times RAF_{ds} \times EF \times EP}{AT \times BW}$$

$$HI_{ing} = \frac{ADD_{ing}}{RfD}$$

$$HI_{der} = \frac{ADD_{der}}{RfD}$$

$$HI = HI_{ing} + HI_{der}$$

$$Risk_{ing} = ADD_{ing} \times CSF$$

$$Risk_{der} = ADD_{der} \times CSF$$

$$Risk = Risk_{ing} + Risk_{der}$$

Parameter	Definition	Units	Value	Comment
IRsoil	Soil Ingestion Rate	mg/d	50	
SA	Soil Dermal Contact Skin Exposed	cm2/d	4260	
AF	Soil Dermal Contact Adherence Rate	mg/cm2	0.14	
EF	Soil Exposure Frequency	d/y	50	
EP	Soil Exposure Period - Cancer	y	7	
EP	Soil Exposure Period - Non-Cancer	y	7	
ATc	Soil Averaging Time - Cancer	d	25550	
ATn	Soil Averaging Time - Non-Cancer	d	2555	
BW	Body Weight	kg	39.9	
CF	Conversion Factor	kg/mg	0.000001	

	EPC Surface Soil DDA current 0-3 feet			Incidental Ingestion						Dermal Contact						Total	
Compound	(mg/kg)	RfD (mg/kg-d)	CSF 1/(mg/kg-d)	RAFosc	ADDing-c mg/kg-d	Risking	RAFosnc	ADDing-nc mg/kg-d	HIing	RAFdsc	ADDder-c mg/kg-d	Riskder	RAFdsnc	ADDder-nc mg/kg-d	HIder	Risk (Soil)	HI (Soil)
CHROMIUM	1.89E+02	1.5	NA	NC	NA	NA	1	3.25E-05	2.17E-05	NC	NA	NA	0.04	1.55E-05	1.03E-05	NA	3.20E-05
COPPER	5.60E+01	0.04	NA	NC	NA	NA	1	9.61E-06	2.40E-04	NC	NA	NA	1	1.15E-04	2.87E-03	NA	3.11E-03
DIBENZ(A,H)ANTHRACENE	2.01E-01	0.03	7.3	0.28	9.68E-10	7.07E-09	0.28	9.68E-09	3.23E-07	0.02	8.25E-10	6.02E-09	0.02	8.25E-09	2.75E-07	1.31E-08	5.98E-07
ETHYLBENZENE	3.33E-02	0.1	0.11	1	5.71E-10	6.29E-11	1	5.71E-09	5.71E-08	0.08	5.45E-10	6.00E-11	0.2	1.36E-08	1.36E-07	1.23E-10	1.93E-07
FLUORANTHENE	6.30E-01	0.04	NA	NC	NA	NA	0.36	3.89E-08	9.73E-07	NC	NA	NA	0.1	1.29E-07	3.22E-06	NA	4.20E-06
LEAD	1.01E+02	0.00075	NA	NC	NA	NA	0.5	8.64E-06	1.15E-02	NC	NA	NA	0.006	1.24E-06	1.65E-03	NA	1.32E-02
M,P-XYLENES	1.78E-01	0.2	NA	NC	NA	NA	1	3.06E-08	1.53E-07	NC	NA	NA	0.12	4.38E-08	2.19E-07	NA	3.72E-07
MERCURY	4.19E-01	0.0003	NA	NC	NA	NA	1	7.19E-08	2.40E-04	NC	NA	NA	0.05	4.29E-08	1.43E-04	NA	3.83E-04
N-BUTYLBENZENE	2.27E-02	0.05	NA	NC	NA	NA	1	3.90E-09	7.79E-08	NC	NA	NA	1	4.65E-08	9.29E-07	NA	1.01E-06
NICKEL	2.25E+02	0.02	NA	NC	NA	NA	1	3.86E-05	1.93E-03	NC	NA	NA	0.35	1.61E-04	8.06E-03	NA	9.99E-03
N-PROPYLBENZENE	4.11E-02	0.1	NA	NC	NA	NA	1	7.06E-09	7.06E-08	NC	NA	NA	1	8.42E-08	8.42E-07	NA	9.13E-07
O-XYLENE	7.04E-02	0.2	NA	NC	NA	NA	1	1.21E-08	6.04E-08	NC	NA	NA	0.12	1.73E-08	8.65E-08	NA	1.47E-07
PHENANTHRENE	5.35E-01	0.03	NA	NC	NA	NA	0.36	3.31E-08	1.10E-06	NC	NA	NA	0.1	1.10E-07	3.65E-06	NA	4.75E-06
PYRENE	6.02E-01	0.03	NA	NC	NA	NA	0.36	3.72E-08	1.24E-06	NC	NA	NA	0.1	1.23E-07	4.11E-06	NA	5.35E-06
SILVER	1.16E+00	0.005	NA	NC	NA	NA	1	2.00E-07	3.99E-05	NC	NA	NA	0.25	5.96E-07	1.19E-04	NA	1.59E-04
TERT-BUTYLBENZENE	3.54E-02	NA	NA	NC	NA	NA	1	NA	NA	NC	NA	NA	1	NA	NA	NA	NA
TOLUENE	4.00E-02	0.08	NA	NC	NA	NA	1	6.87E-09	8.59E-08	NC	NA	NA	0.12	9.83E-09	1.23E-07	NA	2.09E-07
VANADIUM	3.83E+01	0.009	NA	NC	NA	NA	1	6.57E-06	7.30E-04	NC	NA	NA	0.03	2.35E-06	2.61E-04	NA	9.91E-04
ZINC	1.69E+02	0.3	NA	NC	NA	NA	1	2.90E-05	9.68E-05	NC	NA	NA	0.02	6.93E-06	2.31E-05	NA	1.20E-04
2,3,7,8-TCDD TEQ	2.75E-05	0.000000001	130000	1	4.73E-13	6.15E-08	1	4.73E-12	4.73E-03	0.2	1.13E-12	1.47E-07	1	5.64E-11	5.64E-02	2.08E-07	6.11E-02
						1.98E-07			2.49E-02			2.08E-07			7.51E-02	4.06E-07	9.99E-02

NA - Not available
NC - Not calculated
ND - Not detected

Attachment D
Exposure and Risk Estimates Associated With Inhalation of Soil-Derived Particulates in Air
Bird Machine Company - DDA
100 Neponset St, Walpole MA
Trespasser Older Child
Ambient Air
DDA current
0-3 feet

Receptor:	Trespasser Older Child
Medium of Origin:	Surface Soil
Exposure Medium:	Ambient Air
Exposure Area:	DDA current
Depth:	0-3 feet
Duration:	Chronic

Parameter	Definition	Units	Value	Comment
IRair	Outdoor Air Inhalation Rate - Particulates	m3/hr	0.94	
PEF	Outdoor Air PM10 - Particulates	ug/m3	32	
ET	Outdoor Air Exposure Time - Particulates	hr/d	2	
EF	Outdoor Air Exposure Frequency - Particulates	d/y	50	
EP	Outdoor Air Exposure Period - Cancer - Particula	y	7	
EP	Outdoor Air Exposure Period - Non-Cancer - Par	y	7	
ATc	Outdoor Air Averaging Time - Cancer - Particulates	d	25550	
ATn	Outdoor Air Averaging Time - Non-Cancer - Particulates	d	2555	
BW	Body Weight	kg	39.9	
C	Conversion Factor	ug/mg	1000	

$$C_{air} = C_{soil} \times PM_{10} \times 1 \times 10^{-9}\ kg/ug$$

$$ADD_{inh-gi} = \frac{C_{air} \times 1.5 \times IR_{air} \times RAF_i \times ET \times EF \times EP}{AT \times BW}$$

$$ADD_{inh} = \frac{C_{air} \times 0.5 \times IR_{air} \times RAF_i \times ET \times EF \times EP}{AT \times BW}$$

$$ADE_{inh} = \frac{ADD_{inh} \times 70\,kg}{20\,m^3/d}$$

$$HI = \frac{ADD_{inh-gi}}{RfD} + \frac{ADE_{inh}}{RfC}$$

$$Risk = \left(ADD_{inh-gi} \times CSF\right) + \left(ADE_{inh} \times URF \times C\right)$$

Compound	EPC Surface Soil DDA current 0-3 feet (mg/kg)	EPC Fugitive Dust (mg/m3)	RfC (mg/m3)	URF 1/(ug/m3)	RfD (mg/kg-d)	CSF 1/(mg/kg-d)	RAFic	ADD-inhc mg/kg-d	ADE-c mg/m3	Riskinh	ADD-ingc	Risking	RAFinc	ADD-inhnc mg/kg-d	ADE-nc mg/m3	HIinh	ADD-ingnc	HIing	Risk (Particulates in Air)	HI (Particulates in Air)
1,2,4-TRIMETHYLBENZENE	2.87E-01	9.18E-09	0.007	NA	NA	NA	NC	NA	NA	NA	NA	NA	1	2.96E-11	1.04E-10	1.48E-08	NA	NA	NA	1.48E-08
1,2-DICHLOROETHANE	2.06E-02	6.59E-10	0.055	0.000026	0.02	0.091	1	2.126E-13	7.439E-13	1.93E-14	6.377E-13	5.81E-14	1	2.13E-12	7.44E-12	1.35E-10	6.38E-12	3.19E-10	7.74E-14	4.54E-10
1,3,5-TRIMETHYLBENZENE	1.15E-01	3.66E-09	NA	NA	0.01	NA	NC	NA	NA	NA	NA	NA	1	NA	NA	NA	3.55E-11	3.55E-09	NA	3.55E-09
4-CHLOROANILINE	6.36E-01	2.03E-08	0.014	NA	0.004	0.2	1	NA	NA	NA	1.969E-11	3.94E-12	1	6.56E-11	2.30E-10	1.64E-08	1.97E-10	4.92E-08	3.94E-12	6.56E-08
4-ISOPROPYLTOLUENE	2.59E-02	8.28E-10	NA	NA	NA	NA	NC	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	NA
ACETONE	2.05E+00	6.56E-08	0.8	NA	0.9	NA	NC	NA	NA	NA	NA	NA	1	2.12E-10	7.41E-10	9.27E-10	6.35E-10	7.06E-10	NA	1.63E-09
ANTIMONY	2.18E+00	6.97E-08	0.01	NA	0.0004	NA	NC	NA	NA	NA	NA	NA	1	2.25E-10	7.87E-10	7.87E-08	6.75E-10	1.69E-06	NA	1.77E-06
AROCLOR-1260	1.33E-01	4.25E-09	0.00002	0.0001	0.00002	2	1	1.373E-12	4.805E-12	4.81E-13	4.119E-12	8.24E-12	1	1.37E-11	4.81E-11	2.40E-06	4.12E-11	2.06E-06	8.72E-12	4.46E-06
ARSENIC	4.73E+00	1.51E-07	0.0000025	0.0043	0.0003	1.5	1	4.889E-11	1.711E-10	7.36E-10	1.467E-10	2.20E-10	1	4.89E-10	1.71E-09	6.84E-04	1.47E-09	4.89E-06	9.56E-10	6.89E-04
BARIUM	2.49E+02	7.95E-06	0.0005	NA	0.2	NA	NC	NA	NA	NA	NA	NA	1	2.57E-08	8.98E-08	1.80E-04	7.70E-08	3.85E-07	NA	1.80E-04
BENZO(B)FLUORANTHENE	2.87E-01	9.19E-09	0.05	0.00011	0.03	0.73	1	2.966E-12	1.038E-11	1.14E-12	8.897E-12	6.49E-12	1	2.97E-11	1.04E-10	2.08E-09	8.90E-11	2.97E-09	7.64E-12	5.04E-09
BENZO(G,H,I)PERYLENE	2.01E-01	6.45E-09	0.05	NA	0.03	NA	NC	NA	NA	NA	NA	NA	1	2.08E-11	7.28E-11	1.46E-09	6.24E-11	2.08E-09	NA	3.54E-09
BENZO(K)FLUORANTHENE	3.00E-01	9.61E-09	0.05	0.00011	0.03	0.073	1	3.101E-12	1.085E-11	1.19E-12	9.304E-12	6.79E-13	1	3.10E-11	1.09E-10	2.17E-09	9.30E-11	3.10E-09	1.87E-12	5.27E-09
BERYLLIUM	5.43E-01	1.74E-08	0.00002	0.0024	0.002	NA	1	5.607E-12	1.962E-11	4.71E-11	NA	NA	1	5.61E-11	1.96E-10	9.81E-06	1.68E-10	8.41E-08	4.71E-11	9.90E-06
C11-C22 AROMATICS	2.78E+01	8.90E-07	0.05	NA	0.03	NA	NC	NA	NA	NA	NA	NA	1	2.87E-09	1.01E-08	2.01E-07	8.62E-09	2.87E-07	NA	4.88E-07
C19-C36 ALIPHATICS	4.81E+01	1.54E-06	NA	NA	2	NA	NC	NA	NA	NA	NA	NA	1	NA	NA	NA	1.49E-08	7.45E-09	NA	7.45E-09
C5-C8 ALIPHATICS	2.04E+00	6.53E-08	0.2	NA	0.04	NA	NC	NA	NA	NA	NA	NA	1	2.11E-10	7.38E-10	3.69E-09	6.33E-10	1.58E-08	NA	1.95E-08
C9-C10 AROMATICS	5.17E+00	1.66E-07	0.05	NA	0.03	NA	NC	NA	NA	NA	NA	NA	1	5.34E-10	1.87E-09	3.74E-08	1.60E-09	5.34E-08	NA	9.09E-08
C9-C18 ALIPHATICS	4.04E+00	1.29E-07	0.2	NA	0.1	NA	NC	NA	NA	NA	NA	NA	1	4.17E-10	1.46E-09	7.30E-09	1.25E-09	1.25E-08	NA	1.98E-08
CADMIUM	9.26E-01	2.96E-08	0.00002	0.0018	0.0005	NA	1	9.568E-12	3.349E-11	6.03E-11	NA	NA	1	9.57E-11	3.35E-10	1.67E-05	2.87E-10	5.74E-07	6.03E-11	1.73E-05
CHROMIUM	1.89E+02	6.06E-06	0.0001	NA	1.5	NA	NC	NA	NA	NA	NA	NA	1	1.96E-08	6.85E-08	6.85E-04	5.87E-08	3.91E-08	NA	6.85E-04
COPPER	5.60E+01	1.79E-06	NA	NA	0.04	NA	1	NA	NA	NA	NA	NA	1	NA	NA	NA	1.73E-08	4.34E-07	NA	4.34E-07
DIBENZ(A,H)ANTHRACENE	2.01E-01	6.45E-09	0.05	0.0012	0.03	7.3	1	2.081E-12	7.282E-12	8.74E-12	6.242E-12	4.56E-11	1	2.08E-11	7.28E-11	1.46E-09	6.24E-11	2.08E-09	5.43E-11	3.54E-09
ETHYLBENZENE	3.33E-02	1.07E-09	1	0.0000025	0.1	0.11	1	3.437E-13	1.203E-12	3.00E-15	1.031E-12	1.13E-13	1	3.44E-12	1.20E-11	1.20E-11	1.03E-11	1.03E-10	1.16E-13	1.15E-10

Attachment D
Exposure and Risk Estimates Associated With Inhalation of Soil-Derived Particulates in Air
Bird Machine Company - DDA
100 Neponset St, Walpole MA
Trespasser Older Child
Ambient Air
DDA current
0-3 feet

Receptor:	Trespasser Older Child
Medium of Origin:	Surface Soil
Exposure Medium:	Ambient Air
Exposure Area:	DDA current
Depth:	0-3 feet
Duration:	Chronic

Parameter	Definition	Units	Value	Comment
IRair	Outdoor Air Inhalation Rate - Particulates	m3/hr	0.94	
PEF	Outdoor Air PM10 - Particulates	ug/m3	32	
ET	Outdoor Air Exposure Time - Particulates	hr/d	2	
EF	Outdoor Air Exposure Frequency - Particulates	d/y	50	
EP	Outdoor Air Exposure Period - Cancer - Particula	y	7	
EP	Outdoor Air Exposure Period - Non-Cancer - Par	y	7	
ATc	Outdoor Air Averaging Time - Cancer - Particulates	d	25550	
ATn	Outdoor Air Averaging Time - Non-Cancer - Particulates	d	2555	
BW	Body Weight	kg	39.9	
C	Conversion Factor	ug/mg	1000	

$$C_{air} = C_{soil} \times PM_{10} \times 1 \times 10^{-9}\ kg/ug$$

$$ADD_{inh-gi} = \frac{C_{air} \times 1.5 \times IR_{air} \times RAF_i \times ET \times EF \times EP}{AT \times BW}$$

$$ADD_{inh} = \frac{C_{air} \times 0.5 \times IR_{air} \times RAF_i \times ET \times EF \times EP}{AT \times BW}$$

$$ADE_{inh} = \frac{ADD_{inh} \times 70\,kg}{20\,m^3/d}$$

$$HI = \frac{ADD_{inh-gi}}{RfD} + \frac{ADE_{inh}}{RfC}$$

$$Risk = \left(ADD_{inh-gi} \times CSF\right) + \left(ADE_{inh} \times URF \times C\right)$$

Compound	EPC Surface Soil DDA current 0-3 feet (mg/kg)	EPC Fugitive Dust (mg/m3)	RfC (mg/m3)	URF 1/(ug/m3)	RfD (mg/kg-d)	CSF 1/(mg/kg-d)	RAFic	ADD-inhc mg/kg-d	ADE-c mg/m3	Riskinh	ADD-ingc	Risking	RAFinc	ADD-inhnc mg/kg-d	ADE-nc mg/m3	HIinh	ADD-ingnc	HIing	Risk (Particulates in Air)	HI (Particulates in Air)
FLUORANTHENE	6.30E-01	2.01E-08	0.05	NA	0.04	NA	NC	NA	NA	NA	NA	NA	1	6.50E-11	2.28E-10	4.55E-09	1.95E-10	4.88E-09	NA	9.43E-09
LEAD	1.01E+02	3.22E-06	0.001	NA	0.00075	NA	NC	NA	NA	NA	NA	NA	1	1.04E-08	3.64E-08	3.64E-05	3.12E-08	4.16E-05	NA	7.80E-05
M,P-XYLENES	1.78E-01	5.70E-09	0.1	NA	0.2	NA	NC	NA	NA	NA	NA	NA	1	1.84E-11	6.44E-11	6.44E-10	5.52E-11	2.76E-10	NA	9.20E-10
MERCURY	4.19E-01	1.34E-08	0.0003	NA	0.0003	NA	NC	NA	NA	NA	NA	NA	1	4.33E-11	1.51E-10	5.05E-07	1.30E-10	4.33E-07	NA	9.38E-07
N-BUTYLBENZENE	2.27E-02	7.26E-10	NA	NA	0.05	NA	NC	NA	NA	NA	NA	NA	1	NA	NA	NA	7.03E-12	1.41E-10	NA	1.41E-10
NICKEL	2.25E+02	7.20E-06	0.001	0.00026	0.02	NA	1	2.323E-09	8.129E-09	2.11E-09	NA	NA	1	2.32E-08	8.13E-08	8.13E-05	6.97E-08	3.48E-06	2.11E-09	8.48E-05
N-PROPYLBENZENE	4.11E-02	1.32E-09	1	NA	0.1	NA	NC	NA	NA	NA	NA	NA	1	4.25E-12	1.49E-11	1.49E-11	1.27E-11	1.27E-10	NA	1.42E-10
O-XYLENE	7.04E-02	2.25E-09	0.1	NA	0.2	NA	NC	NA	NA	NA	NA	NA	1	7.27E-12	2.55E-11	2.55E-10	2.18E-11	1.09E-10	NA	3.64E-10
PHENANTHRENE	5.35E-01	1.71E-08	0.05	NA	0.03	NA	NC	NA	NA	NA	NA	NA	1	5.53E-11	1.93E-10	3.87E-09	1.66E-10	5.53E-09	NA	9.39E-09
PYRENE	6.02E-01	1.93E-08	0.05	NA	0.03	NA	NC	NA	NA	NA	NA	NA	1	6.22E-11	2.18E-10	4.35E-09	1.86E-10	6.22E-09	NA	1.06E-08
SILVER	1.16E+00	3.72E-08	0.00014	NA	0.005	NA	NC	NA	NA	NA	NA	NA	1	1.20E-10	4.21E-10	3.00E-06	3.60E-10	7.21E-08	NA	3.08E-06
TERT-BUTYLBENZENE	3.54E-02	1.13E-09	NA	NA	NA	NA	NC	NA	NA	NA	NA	NA	1	NA	NA	NA	NA	NA	NA	NA
TOLUENE	4.00E-02	1.28E-09	5	NA	0.08	NA	NC	NA	NA	NA	NA	NA	1	4.13E-12	1.45E-11	2.89E-12	1.24E-11	1.55E-10	NA	1.58E-10
VANADIUM	3.83E+01	1.22E-06	0.001	NA	0.009	NA	NC	NA	NA	NA	NA	NA	1	3.95E-09	1.38E-08	1.38E-05	1.19E-08	1.32E-06	NA	1.52E-05
ZINC	1.69E+02	5.41E-06	0.0014	NA	0.3	NA	NC	NA	NA	NA	NA	NA	1	1.75E-08	6.12E-08	4.37E-05	5.24E-08	1.75E-07	NA	4.39E-05
2,3,7,8-TCDD TEQ	2.75E-05	8.81E-13	0.00000004	38	1E-09	130000	1	2.845E-16	9.956E-16	3.78E-11	8.534E-16	1.11E-10	1	2.84E-15	9.96E-15	2.49E-07	8.53E-15	8.53E-06	1.49E-10	8.78E-06
Total										3.01E-09		3.96E-10				1.76E-03		6.62E-05	3.40E-09	1.82E-03

NA - Not available
NC - Not calculated
ND - Not detected

Attachment D
Human Health Risk Calculations for Soil - Asbestos
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Calculations:

OHMsoil fibers/g	PM10 mg/m3	C g-m3/mg-ml	OHMair fibers/ml
8.29E+07	0.032	1.00E-09	2.65E-03

OHMair fibers/ml	EF days/year	EP years	AP days	ADEair fibers/ml
2.65E-03	50	7	25550	3.63E-05

ADEair fibers/ml	IUR ml/fiber	ELCR
3.63E-05	0.23	8.4E-06

Equations:

$$OHM_{air} = OHM_{soil} x PM_{10} x C$$

$$ADE_{air} = \frac{OHM_{air} x EF x EP}{AP}$$

$$ELCR = ADE_{air} x IUR$$

Notes:

OHM - Oil and/or hazardous materials
fibers/g - fibers per gram
PM10 - particulate matter measuring 10 micrometers or less
ml - milliliter
C - conversion factor
EF - exposure frequency
EP - exposure period
AP - averging period
ADE - average daily exposure
IUR - inhalation unit risk
ELCR - excess lifetime cancer risk

Attachment E – Human Health Risk Calculations for Groundwater

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-002
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 8E-07
HI (all chemicals) = 7E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	2.6E+00	6.7E-07	1.3E-07	7.6E-10	8.0E-07	7.5E-03	1.5E-03	2.2E-04	9.2E-03
Barium	1.9E+01					5.6E-03	3.3E-05		5.6E-03
Chromium (total)	1.9E+00					3.7E-02	3.7E-03		4.1E-02
Nickel	1.2E+00					3.5E-03	3.8E-05		3.6E-03
Selenium	5.0E-01					5.9E-03	5.3E-05		5.9E-03
Vanadium	5.0E-01					3.3E-03	3.6E-04		3.6E-03
Zinc	1.2E+00					2.4E-04	1.7E-06		2.4E-04

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-201
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 5E-07
HI (all chemicals) = 2E-01

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	1.5E+00	4.0E-07	7.9E-08	7.6E-10	4.8E-07	4.5E-03	8.9E-04	2.2E-04	5.6E-03
Barium	4.6E+01					1.3E-02	3.3E-05		1.3E-02
Chromium (total)	2.8E+00					5.5E-02	3.7E-03		5.9E-02
Nickel	1.3E+00					3.7E-03	3.8E-05		3.7E-03
Selenium	7.3E+00					8.6E-02	5.3E-05		8.6E-02
Vanadium	3.4E-01					2.2E-03	3.6E-04		2.6E-03
Zinc	2.5E+00					4.9E-04	1.7E-06		4.9E-04

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-203
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 1E-07
HI (all chemicals) = 3E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	4.3E-01	1.1E-07	2.2E-08	7.6E-10	1.4E-07	1.3E-03	2.5E-04	2.2E-04	1.7E-03
Barium	1.1E+01					3.2E-03	3.3E-05		3.3E-03
Chromium (total)	6.3E-01					1.2E-02	3.7E-03		1.6E-02
Nickel	1.2E+00					3.5E-03	3.8E-05		3.6E-03
Selenium	5.0E-01					5.9E-03	5.3E-05		5.9E-03
Vanadium	2.5E-01					1.6E-03	3.6E-04		2.0E-03
Zinc	5.3E+00					1.0E-03	1.7E-06		1.0E-03

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-204
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 1E-07
HI (all chemicals) = 4E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	4.5E-01	1.2E-07	2.4E-08	7.6E-10	1.4E-07	1.3E-03	2.6E-04	2.2E-04	1.8E-03
Barium	2.0E+01					5.9E-03	3.3E-05		5.9E-03
Chromium (total)	5.0E-01					9.8E-03	3.7E-03		1.3E-02
Nickel	1.2E+00					3.5E-03	3.8E-05		3.6E-03
Selenium	1.0E+00					1.2E-02	5.3E-05		1.2E-02
Vanadium	5.0E-01					3.3E-03	3.6E-04		3.6E-03
Zinc	2.5E+00					4.9E-04	1.7E-06		4.9E-04

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-205
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 8E-07
HI (all chemicals) = 4E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	2.6E+00	6.7E-07	1.3E-07	7.6E-10	8.0E-07	7.5E-03	1.5E-03	2.2E-04	9.2E-03
Barium	7.6E+00					2.2E-03	3.3E-05		2.3E-03
Chromium (total)	5.2E-01					1.0E-02	3.7E-03		1.4E-02
Nickel	5.9E-01					1.7E-03	3.8E-05		1.8E-03
Selenium	5.0E-01					5.9E-03	5.3E-05		5.9E-03
Vanadium	2.9E-01					1.9E-03	3.6E-04		2.3E-03
Zinc	1.6E+00					3.1E-04	1.7E-06		3.2E-04

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-206
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 2E-07
HI (all chemicals) = 3E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	4.9E-01	1.3E-07	2.6E-08	7.6E-10	1.5E-07	1.4E-03	2.9E-04	2.2E-04	2.0E-03
Barium	1.6E+01					4.7E-03	3.3E-05		4.7E-03
Chromium (total)	5.1E-01					1.0E-02	3.7E-03		1.4E-02
Nickel	6.9E-01					2.0E-03	3.8E-05		2.1E-03
Selenium	5.0E-01					5.9E-03	5.3E-05		5.9E-03
Vanadium	5.0E-01					3.3E-03	3.6E-04		3.6E-03
Zinc	1.9E+00					3.7E-04	1.7E-06		3.7E-04

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-207
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 2E-07
HI (all chemicals) = 5E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	5.1E-01	1.3E-07	2.7E-08	7.6E-10	1.6E-07	1.5E-03	3.0E-04	2.2E-04	2.0E-03
Barium	3.1E+01					9.1E-03	3.3E-05		9.2E-03
Chromium (total)	1.3E+00					2.5E-02	3.7E-03		2.9E-02
Nickel	4.3E-01					1.3E-03	3.8E-05		1.3E-03
Selenium	5.0E-01					5.9E-03	5.3E-05		5.9E-03
Vanadium	5.0E-01					3.3E-03	3.6E-04		3.6E-03
Zinc	1.9E+00					3.7E-04	1.7E-06		3.7E-04

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment E
Human Health Risk Calculations for Groundwater
Bird Machine Company DDA
100 Neponset Street, Walpole, MA

DD-MW-208
Resident - Drinking Water: Table RW-1
Exposure Point Concentration (EPC) and Risk
Based on Resident Ages 1-31 (Cancer) and 1-8 (Noncancer)

ShortForm Version 4-06
Vlookup Version v0808

ELCR (all chemicals) = 5E-07
HI (all chemicals) = 6E-02

Contaminant of Concern	EPC (ug/L)	ELCR ingestion	ELCR dermal	ELCR inhalation	$ELCR_{total}$	Chronic HQ_{ing}	Chronic HQ_{derm}	Chronic HQ_{inh}	HQ_{total}
Bis(2-ethylhexyl)phthalate	1.6E+00	4.2E-07	8.4E-08	7.6E-10	5.0E-07	4.7E-03	9.4E-04	2.2E-04	5.9E-03
Barium	3.1E+01					9.1E-03	3.3E-05		9.2E-03
Chromium (total)	3.6E-01					7.1E-03	3.7E-03		1.1E-02
Nickel	2.0E+00					5.9E-03	3.8E-05		5.9E-03
Selenium	5.0E-01					5.9E-03	5.3E-05		5.9E-03
Vanadium	5.2E-01					3.4E-03	3.6E-04		3.8E-03
Zinc	1.1E+02					2.2E-02	1.7E-06		2.2E-02

Notes:
EPC - The concentration detected in the monitoring well during the 2008 sampling round. One-half of the reporting limit was used if the analyte was not detected.
ug/L - micrograms per liter
ELCR - excess lifetime cancer risk
HQ - hazard quotient
HI - hazard index

Attachment F – Ecological Risk Calculations for Soil

Attachment F-1
Table 1A - Evaluation of Potential Risk to Red Fox
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterizatrion

Site:	DDA
Receptor:	Red Fox
Pathway:	Soil ingestion
	Consumption of small mammals

Parameter	Value	
Small Mammal Ingestion Rate (kg ww/d)	0.510	Assume 100% of diet.
Total Dietary Intake (kg ww/d)	0.510	USEPA (1993).
Soil Ingestion Rate (kg dw/day)	0.01122	Calc. from Beyer (1994)
Body Weight (kg)	4.54	USEPA (1993). Mean of male and female BWs in spring and fall.
Sm. Mammal Dry wt./wet wt. CF	0.3	USEPA (1999)
Home range (ha)	1038	USEPA (1993)
Area Use Factor	0.00178	1.85. ha exposure area

		Surface Soil							
Constituent	**NOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in small mammals (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from small mammals (mg/kg-d)**	**TQ-soil**	**TQ-small mammals**	**Total TQ**
Antimony	3.79E+00	2.24E+00	(a)	3.5E-02	9.86E-06	2.09E-06	2.60E-06	5.52E-07	3.2E-06
Arsenic	7.04E-01	4.84E+00	(a)	6.9E-02	2.13E-05	4.13E-06	3.03E-05	5.87E-06	3.6E-05
Barium	1.48E+01	2.62E+02	(a)	4.8E-01	1.16E-03	2.88E-05	7.83E-05	1.95E-06	8.0E-05
Cadmium	5.29E-01	9.76E-01	(a)	2.8E-01	4.30E-06	1.69E-05	8.12E-06	3.19E-05	4.0E-05
Chromium	6.85E-01	2.00E+02	(a)	1.7E+01	8.82E-04	1.01E-03	1.29E-03	1.47E-03	2.8E-03
Copper	7.12E+00	5.60E+01	(a)	2.4E+00	2.47E-04	1.44E-04	3.47E-05	2.03E-05	5.5E-05
Lead	1.16E+01	1.06E+02	(a)	8.1E+00	4.69E-04	4.89E-04	4.04E-05	4.21E-05	8.3E-05
Mercury	6.85E-01	4.43E-01	7.5E-06	3.3E-06	1.95E-06	6.67E-10	2.85E-06	9.74E-10	2.9E-06
Nickel	2.19E+00	2.40E+02	(a)	1.0E+01	1.06E-03	6.03E-04	4.81E-04	2.75E-04	7.6E-04
Vanadium	1.69E+00	3.89E+01	1.2E-02	4.8E-01	1.71E-04	2.87E-05	1.01E-04	1.70E-05	1.2E-04
Zinc	2.15E+01	1.78E+02	(a)	1.1E+02	7.83E-04	6.80E-03	3.64E-05	3.16E-04	3.5E-04
Aroclor-1260	1.60E-02	1.38E-01	5.8E-05	8.0E-06	6.07E-07	1.61E-09	3.79E-05	1.00E-07	3.8E-05
2,3,7,8-TCDD TEQ (mammalian)	5.27E-07	2.76E-05	7.8E-05	2.2E-09	1.22E-10	4.31E-13	2.31E-04	8.19E-07	2.3E-04
Benzo(b)fluoranthene	5.12E+00	2.99E-01	0.0E+00	0.0E+00	1.32E-06	0.00E+00	2.57E-07	0.00E+00	2.6E-07
Benzo(g,h,i)perylene	5.12E+00	2.08E-01	0.0E+00	0.0E+00	9.17E-07	0.00E+00	1.79E-07	0.00E+00	1.8E-07
Benzo(k)fluoranthene	5.12E+00	3.13E-01	0.0E+00	0.0E+00	1.38E-06	0.00E+00	2.69E-07	0.00E+00	2.7E-07
Dibenz(a,h)anthracene	5.12E+00	2.08E-01	0.0E+00	0.0E+00	9.17E-07	0.00E+00	1.79E-07	0.00E+00	1.8E-07
Pyrene	5.12E+00	6.34E-01	0.0E+00	0.0E+00	2.79E-06	0.00E+00	5.45E-07	0.00E+00	5.4E-07
C5-C8 Aliphatics	2.14E+01	2.04E+00	1.0E+00	2.0E+00	9.00E-06	1.23E-04	4.19E-07	5.72E-06	6.1E-06
C9-C10 Aromatics	2.14E+01	5.17E+00	1.0E+00	5.2E+00	2.28E-05	3.11E-04	1.07E-06	1.45E-05	1.6E-05
C9-C18 Aliphatics	5.27E+01	1.41E+00	1.0E+00	1.4E+00	6.21E-06	8.46E-05	1.18E-07	1.61E-06	1.7E-06
C11-C22 Aromatics	2.14E+01	2.97E+01	1.0E+00	3.0E+01	1.31E-04	1.78E-03	6.11E-06	8.33E-05	8.9E-05
C19-C36 Aliphatics	1.05E+02	5.14E+01	1.0E+00	5.1E+01	2.26E-04	3.09E-03	2.15E-06	2.93E-05	3.1E-05

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
NOAEL - No observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 1B - Evaluation of Potential Risk to Red Fox
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Red Fox
Pathway:	Soil ingestion
	Consumption of small mammals

Parameter	Value	
Small Mammal Ingestion Rate (kg ww/d)	0.510	Assume 100% of diet.
Total Dietary Intake (kg ww/d)	0.510	USEPA (1993).
Soil Ingestion Rate (kg dw/day)	0.01122	Calc. from Beyer (1994)
Body Weight (kg)	4.54	USEPA (1993). Mean of male and female BWs in spring and fall.
Sm. Mammal Dry wt./wet wt. CF	0.3	USEPA (1999)
Home range (ha)	1038	USEPA (1993)
Area Use Factor	0.00178	1.85. ha exposure area

		Surface Soil							
Constituent	**LOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in small mammals (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from small mammals (mg/kg-d)**	**TQ-soil**	**TQ-small mammals**	**Total TQ**
Antimony	7.86E-01	2.24E+00	(a)	3.5E-02	9.86E-06	2.09E-06	1.25E-05	2.66E-06	1.5E-05
Arsenic	1.30E+00	4.84E+00	(a)	6.9E-02	2.13E-05	4.13E-06	1.64E-05	3.18E-06	2.0E-05
Barium	2.36E+01	2.62E+02	(a)	4.8E-01	1.16E-03	2.88E-05	4.91E-05	1.22E-06	5.0E-05
Cadmium	1.97E+00	9.76E-01	(a)	2.8E-01	4.30E-06	1.69E-05	2.18E-06	8.58E-06	1.1E-05
Chromium	1.66E+01	2.00E+02	(a)	1.7E+01	8.82E-04	1.01E-03	5.32E-05	6.06E-05	1.1E-04
Copper	2.36E+01	5.60E+01	(a)	2.4E+00	2.47E-04	1.44E-04	1.05E-05	6.12E-06	1.7E-05
Lead	5.31E+01	1.06E+02	(a)	8.1E+00	4.69E-04	4.89E-04	8.83E-06	9.21E-06	1.8E-05
Mercury	6.85E+00	4.43E-01	7.5E-06	3.3E-06	1.95E-06	6.67E-10	2.85E-07	9.74E-11	2.9E-07
Nickel	4.21E+00	2.40E+02	(a)	1.0E+01	1.06E-03	6.03E-04	2.51E-04	1.43E-04	3.9E-04
Vanadium	2.69E+00	3.89E+01	1.2E-02	4.8E-01	1.71E-04	2.87E-05	6.36E-05	1.07E-05	7.4E-05
Zinc	8.48E+01	1.78E+02	(a)	1.1E+02	7.83E-04	6.80E-03	9.22E-06	8.01E-05	8.9E-05
Aroclor-1260	1.60E-01	1.38E-01	5.8E-05	8.0E-06	6.07E-07	1.61E-09	3.79E-06	1.00E-08	3.8E-06
2,3,7,8-TCDD TEQ (mammalian)	5.27E-06	2.76E-05	7.8E-05	2.2E-09	1.22E-10	4.31E-13	2.31E-05	8.19E-08	2.3E-05
Benzo(b)fluoranthene	1.09E+01	2.99E-01	0.0E+00	0.0E+00	1.32E-06	0.00E+00	1.20E-07	0.00E+00	1.2E-07
Benzo(g,h,i)perylene	1.09E+01	2.08E-01	0.0E+00	0.0E+00	9.17E-07	0.00E+00	8.38E-08	0.00E+00	8.4E-08
Benzo(k)fluoranthene	1.09E+01	3.13E-01	0.0E+00	0.0E+00	1.38E-06	0.00E+00	1.26E-07	0.00E+00	1.3E-07
Dibenz(a,h)anthracene	1.09E+01	2.08E-01	0.0E+00	0.0E+00	9.17E-07	0.00E+00	8.38E-08	0.00E+00	8.4E-08
Pyrene	1.09E+01	6.34E-01	0.0E+00	0.0E+00	2.79E-06	0.00E+00	2.55E-07	0.00E+00	2.5E-07
C5-C8 Aliphatics	2.14E+02	2.04E+00	1.0E+00	2.0E+00	9.00E-06	1.23E-04	4.19E-08	5.72E-07	6.1E-07
C9-C10 Aromatics	2.14E+02	5.17E+00	1.0E+00	5.2E+00	2.28E-05	3.11E-04	1.07E-07	1.45E-06	1.6E-06
C9-C18 Aliphatics	5.27E+02	1.41E+00	1.0E+00	1.4E+00	6.21E-06	8.46E-05	1.18E-08	1.61E-07	1.7E-07
C11-C22 Aromatics	2.14E+02	2.97E+01	1.0E+00	3.0E+01	1.31E-04	1.78E-03	6.11E-07	8.33E-06	8.9E-06
C19-C36 Aliphatics	1.05E+03	5.14E+01	1.0E+00	5.1E+01	2.26E-04	3.09E-03	2.15E-07	2.93E-06	3.1E-06

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
LOAEL - Lowest observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 2A - Evaluation of Potential Risk to Short-tailed Shrew
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Short-tailed Shrew
Pathway:	Soil ingestion
	Consumption of invertebrates

Parameter	Value	
Invert Ingestion Rate (kg ww/d)	0.0080	Assumed to be 100% of diet
Total Dietary Intake (kg ww/d)	0.0080	USEPA (1993) A Male & Female
Soil Ingestion Rate (kg dw/day)	0.00012	Calc. from Beyer (1994)
Body Weight (kg)	0.0168	USEPA (1993)
Invert Dry wt./wet wt. CF	0.373	Site-specific data.
Home range (ha)	0.39	USEPA (1993)
Area Use Factor	1	1.85. ha exposure area

		Surface Soil							
Constituent	**NOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in invert (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from invert (mg/kg-d)**	**TQ-soil**	**TQ-invert**	**Total TQ**
Antimony	1.54E+01	2.24E+00	(a)	2.6E-01	1.66E-02	4.59E-02	1.08E-03	2.98E-03	4.1E-03
Arsenic	2.85E+00	4.84E+00	(a)	1.3E+00	3.60E-02	2.29E-01	1.26E-02	8.04E-02	9.3E-02
Barium	5.99E+01	2.62E+02	9.1E-02	2.4E+01	1.95E+00	4.21E+00	3.26E-02	7.04E-02	1.0E-01
Cadmium	2.15E+00	9.76E-01	(a)	8.1E+00	7.25E-03	1.43E+00	3.38E-03	6.66E-01	6.7E-01
Chromium	2.78E+00	2.00E+02	(a)	1.6E+01	1.49E+00	2.86E+00	5.36E-01	1.03E+00	**1.6E+00**
Copper	2.88E+01	5.60E+01	(a)	1.5E+01	4.16E-01	2.61E+00	1.44E-02	9.05E-02	1.0E-01
Lead	4.71E+01	1.06E+02	(a)	3.6E+01	7.91E-01	6.39E+00	1.68E-02	1.36E-01	1.5E-01
Mercury	2.78E+00	4.43E-01	(a)	4.5E-01	3.30E-03	7.94E-02	1.19E-03	2.86E-02	3.0E-02
Nickel	8.90E+00	2.40E+02	(a)	9.7E+00	1.78E+00	1.71E+00	2.00E-01	1.92E-01	3.9E-01
Vanadium	6.85E+00	3.89E+01	(a)	5.2E+00	2.89E-01	9.17E-01	4.22E-02	1.34E-01	1.8E-01
Zinc	8.71E+01	1.78E+02	(a)	1.7E+02	1.32E+00	2.96E+01	1.52E-02	3.40E-01	3.6E-01
Aroclor-1260	6.50E-02	1.38E-01	1.1E+00	1.6E-01	1.02E-03	7.36E-02	1.58E-02	1.13E+00	**1.1E+00**
2,3,7,8-TCDD TEQ (mammalian)	2.14E-06	2.76E-05	1.5E+00	4.0E-05	2.05E-07	1.89E-05	9.60E-02	8.86E+00	**9.0E+00**
Benzo(b)fluoranthene	2.08E+01	2.99E-01	2.6E+00	7.8E-01	2.22E-03	1.37E-01	1.07E-04	6.61E-03	6.7E-03
Benzo(g,h,i)perylene	2.08E+01	2.08E-01	2.9E+00	6.1E-01	1.55E-03	1.08E-01	7.45E-05	5.20E-03	5.3E-03
Benzo(k)fluoranthene	2.08E+01	3.13E-01	2.6E+00	8.1E-01	2.33E-03	1.44E-01	1.12E-04	6.91E-03	7.0E-03
Dibenz(a,h)anthracene	2.08E+01	2.08E-01	2.3E+00	4.8E-01	1.55E-03	8.48E-02	7.45E-05	4.08E-03	4.2E-03
Pyrene	2.08E+01	6.34E-01	1.8E+00	1.1E+00	4.71E-03	1.96E-01	2.27E-04	9.42E-03	9.6E-03
C5-C8 Aliphatics	8.70E+01	2.04E+00	1.0E+00	2.0E+00	1.52E-02	3.60E-01	1.75E-04	4.14E-03	4.3E-03
C9-C10 Aromatics	8.67E+01	5.17E+00	1.0E+00	5.2E+00	3.85E-02	9.13E-01	4.44E-04	1.05E-02	1.1E-02
C9-C18 Aliphatics	2.14E+02	1.41E+00	1.0E+00	1.4E+00	1.05E-02	2.48E-01	4.90E-05	1.16E-03	1.2E-03
C11-C22 Aromatics	8.67E+01	2.97E+01	1.0E+00	3.0E+01	2.21E-01	5.23E+00	2.54E-03	6.04E-02	6.3E-02
C19-C36 Aliphatics	4.27E+02	5.14E+01	1.0E+00	5.1E+01	3.82E-01	9.06E+00	8.94E-04	2.12E-02	2.2E-02

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
NOAEL - No observable adverse effect level
(a) Earthworm data collected at the site was used in place of BTF. Earthworm data used were from Sample DD-BO-001

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.

Attachment F-1
Table 2B - Evaluation of Potential Risk to Short-tailed Shrew
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Short-tailed Shrew
Pathway:	Soil ingestion
	Consumption of invertebrates

Parameter	Value	
Invert Ingestion Rate (kg ww/d)	0.0080	Assumed to be 100% of diet
Total Dietary Intake (kg ww/d)	0.0080	USEPA (1993) A Male & Female
Soil Ingestion Rate (kg dw/day)	0.00012	Calc. from Beyer (1994)
Body Weight (kg)	0.0168	USEPA (1993)
Invert Dry wt./wet wt. CF	0.373	Site-specific data.
Home range (ha)	0.39	USEPA (1993)
Area Use Factor	1	1.85. ha exposure area

		Surface Soil							
Constituent	**LOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in invert (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from invert (mg/kg-d)**	**TQ-soil**	**TQ-invert**	**Total TQ**
Antimony	3.19E+00	2.24E+00	(a)	2.6E-01	1.66E-02	4.59E-02	5.22E-03	1.44E-02	2.0E-02
Arsenic	5.26E+00	4.84E+00	(a)	1.3E+00	3.60E-02	2.29E-01	6.84E-03	4.36E-02	5.0E-02
Barium	9.55E+01	2.62E+02	9.1E-02	2.4E+01	1.95E+00	4.21E+00	2.04E-02	4.41E-02	6.5E-02
Cadmium	7.98E+00	9.76E-01	(a)	8.1E+00	7.25E-03	1.43E+00	9.09E-04	1.79E-01	1.8E-01
Chromium	6.72E+01	2.00E+02	(a)	1.6E+01	1.49E+00	2.86E+00	2.21E-02	4.25E-02	6.5E-02
Copper	9.56E+01	5.60E+01	(a)	1.5E+01	4.16E-01	2.61E+00	4.35E-03	2.73E-02	3.2E-02
Lead	2.15E+02	1.06E+02	(a)	3.6E+01	7.91E-01	6.39E+00	3.67E-03	2.96E-02	3.3E-02
Mercury	2.78E+01	4.43E-01	(a)	4.5E-01	3.30E-03	7.94E-02	1.19E-04	2.86E-03	3.0E-03
Nickel	1.71E+01	2.40E+02	(a)	9.7E+00	1.78E+00	1.71E+00	1.04E-01	1.00E-01	2.0E-01
Vanadium	1.09E+01	3.89E+01	(a)	5.2E+00	2.89E-01	9.17E-01	2.65E-02	8.41E-02	1.1E-01
Zinc	3.44E+02	1.78E+02	(a)	1.7E+02	1.32E+00	2.96E+01	3.84E-03	8.61E-02	9.0E-02
Aroclor-1260	6.50E-01	1.38E-01	1.1E+00	1.6E-01	1.02E-03	7.36E-02	1.58E-03	1.13E-01	1.1E-01
2,3,7,8-TCDD TEQ (mammalian)	2.14E-05	2.76E-05	1.5E+00	4.0E-05	2.05E-07	1.89E-05	9.60E-03	8.86E-01	9.0E-01
Benzo(b)fluoranthene	4.44E+01	2.99E-01	2.6E+00	7.8E-01	2.22E-03	1.37E-01	5.01E-05	3.09E-03	3.1E-03
Benzo(g,h,i)perylene	4.44E+01	2.08E-01	2.9E+00	6.1E-01	1.55E-03	1.08E-01	3.49E-05	2.43E-03	2.5E-03
Benzo(k)fluoranthene	4.44E+01	3.13E-01	2.6E+00	8.1E-01	2.33E-03	1.44E-01	5.24E-05	3.24E-03	3.3E-03
Dibenz(a,h)anthracene	4.44E+01	2.08E-01	2.3E+00	4.8E-01	1.55E-03	8.48E-02	3.49E-05	1.91E-03	1.9E-03
Pyrene	4.44E+01	6.34E-01	1.8E+00	1.1E+00	4.71E-03	1.96E-01	1.06E-04	4.41E-03	4.5E-03
C5-C8 Aliphatics	8.70E+02	2.04E+00	1.0E+00	2.0E+00	1.52E-02	3.60E-01	1.75E-05	4.14E-04	4.3E-04
C9-C10 Aromatics	8.67E+02	5.17E+00	1.0E+00	5.2E+00	3.85E-02	9.13E-01	4.44E-05	1.05E-03	1.1E-03
C9-C18 Aliphatics	2.14E+03	1.41E+00	1.0E+00	1.4E+00	1.05E-02	2.48E-01	4.90E-06	1.16E-04	1.2E-04
C11-C22 Aromatics	8.67E+02	2.97E+01	1.0E+00	3.0E+01	2.21E-01	5.23E+00	2.54E-04	6.04E-03	6.3E-03
C19-C36 Aliphatics	4.27E+03	5.14E+01	1.0E+00	5.1E+01	3.82E-01	9.06E+00	8.94E-05	2.12E-03	2.2E-03

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
LOAEL - Lowest observable adverse effect level
(a) Earthworm data collected at the site was used in place of BTF. Earthworm data used was from Sample DD-BO-001

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.

Attachment F-1
Table 3A - Evaluation of Potential Risk to Meadow Vole
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Charaterization

Site:	DDA
Receptor:	Meadow Vole
Pathway:	Soil ingestion
	Consumption of vegetation

Parameter	Value	
Vegetation Ingestion Rate (kg ww/d)	0.0112	Assume 100% of diet.
Total Dietary Intake (kg ww/d)	0.0112	USEPA (1993)
Soil Ingestion Rate (kg dw/day)	0.00021	Calc. from Beyer (1994)
Body Weight (kg)	0.0373	USEPA (1993) avg of A Male & Female all year
Veg Dry wt./wet wt. CF	0.120	USEPA (1999)
Home range (ha)	0.06	USEPA (1993) avg of A Male & Female grassy meadow MA
Area Use Factor	1	1.85. ha exposure area

		Surface Soil							
Constituent	**NOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in vegetation (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from vegetation (mg/kg-d)**	**TQ-soil**	**TQ-vegetation**	**Total TQ**
Antimony	1.26E+01	2.24E+00	(a)	8.4E-02	1.27E-02	3.02E-03	1.01E-03	2.40E-04	1.2E-03
Arsenic	2.34E+00	4.84E+00	3.8E-02	1.8E-01	2.74E-02	6.54E-03	1.17E-02	2.80E-03	1.5E-02
Barium	4.90E+01	2.62E+02	1.6E-01	4.1E+01	1.49E+00	1.47E+00	3.03E-02	3.01E-02	6.0E-02
Cadmium	1.76E+00	9.76E-01	(a)	6.1E-01	5.52E-03	2.21E-02	3.14E-03	1.26E-02	1.6E-02
Chromium	2.28E+00	2.00E+02	4.1E-02	8.2E+00	1.13E+00	2.96E-01	4.98E-01	1.30E-01	6.3E-01
Copper	2.36E+01	5.60E+01	(a)	9.7E+00	3.17E-01	3.50E-01	1.34E-02	1.48E-02	2.8E-02
Lead	3.86E+01	1.06E+02	(a)	3.6E+00	6.03E-01	1.31E-01	1.56E-02	3.39E-03	1.9E-02
Mercury	2.28E+00	4.43E-01	4.3E-02	1.9E-02	2.51E-03	5.72E-03	1.10E-03	2.51E-03	3.6E-03
Nickel	7.29E+00	2.40E+02	(a)	6.5E+00	1.36E+00	2.35E-01	1.86E-01	3.22E-02	2.2E-01
Vanadium	5.61E+00	3.89E+01	4.9E-03	1.9E-01	2.20E-01	6.78E-03	3.92E-02	1.21E-03	4.0E-02
Zinc	7.14E+01	1.78E+02	(a)	8.5E+01	1.01E+00	3.07E+00	1.41E-02	4.29E-02	5.7E-02
Aroclor-1260	5.32E-02	1.38E-01	1.0E-02	1.4E-03	7.80E-04	4.13E-04	1.47E-02	7.77E-03	2.2E-02
2,3,7,8-TCDD TEQ (mammalian)	1.75E-06	2.76E-05	5.6E-03	1.5E-07	1.56E-07	5.56E-09	8.92E-02	3.18E-03	9.2E-02
Benzo(b)fluoranthene	1.70E+01	2.99E-01	3.1E-01	9.3E-02	1.69E-03	3.34E-03	9.95E-05	1.96E-04	3.0E-04
Benzo(g,h,i)perylene	1.70E+01	2.08E-01	(a)	6.2E-02	1.18E-03	2.22E-03	6.92E-05	1.30E-04	2.0E-04
Benzo(k)fluoranthene	1.70E+01	3.13E-01	(a)	4.3E-02	1.77E-03	1.53E-03	1.04E-04	9.01E-05	1.9E-04
Dibenz(a,h)anthracene	1.70E+01	2.08E-01	1.3E-01	2.7E-02	1.18E-03	9.74E-04	6.92E-05	5.73E-05	1.3E-04
Pyrene	1.70E+01	6.34E-01	7.2E-01	4.6E-01	3.59E-03	1.64E-02	2.11E-04	9.65E-04	1.2E-03
C5-C8 Aliphatics	7.12E+01	2.04E+00	1.0E+00	2.0E+00	1.16E-02	7.35E-02	1.62E-04	1.03E-03	1.2E-03
C9-C10 Aromatics	7.10E+01	5.17E+00	1.0E+00	5.2E+00	2.93E-02	1.86E-01	4.12E-04	2.62E-03	3.0E-03
C9-C18 Aliphatics	1.75E+02	1.41E+00	1.0E+00	1.4E+00	7.97E-03	5.07E-02	4.55E-05	2.90E-04	3.4E-04
C11-C22 Aromatics	7.10E+01	2.97E+01	1.0E+00	3.0E+01	1.68E-01	1.07E+00	2.36E-03	1.50E-02	1.7E-02
C19-C36 Aliphatics	3.50E+02	5.14E+01	1.0E+00	5.1E+01	2.91E-01	1.85E+00	8.30E-04	5.28E-03	6.1E-03

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
NOAEL - No observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 3B - Evaluation of Potential Risk to Meadow Vole
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Meadow Vole
Pathway:	Soil ingestion
	Consumption of vegetation

Parameter	Value	
Vegetation Ingestion Rate (kg ww/d)	0.0112	Assume 100% of diet.
Total Dietary Intake (kg ww/d)	0.0112	USEPA (1993)
Soil Ingestion Rate (kg dw/day)	0.00021	Calc. from Beyer (1994)
Body Weight (kg)	0.0373	USEPA (1993) avg of A Male & Female all year
Veg Dry wt./wet wt. CF	0.120	USEPA (1999)
Home range (ha)	0.06	USEPA (1993) avg of A Male & Female grassy meadow MA
Area Use Factor	1	1.85. ha exposure area

		Surface Soil							
Constituent	**LOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in vegetation (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from vegetation (mg/kg-d)**	**TQ-soil**	**TQ-vegetation**	**Total TQ**
Antimony	2.61E+00	2.24E+00	(a)	8.4E-02	1.27E-02	3.02E-03	4.85E-03	1.16E-03	6.0E-03
Arsenic	4.31E+00	4.84E+00	3.8E-02	1.8E-01	2.74E-02	6.54E-03	6.36E-03	1.52E-03	7.9E-03
Barium	7.83E+01	2.62E+02	1.6E-01	4.1E+01	1.49E+00	1.47E+00	1.90E-02	1.88E-02	3.8E-02
Cadmium	6.54E+00	9.76E-01	(a)	6.1E-01	5.52E-03	2.21E-02	8.45E-04	3.38E-03	4.2E-03
Chromium	5.51E+01	2.00E+02	4.1E-02	8.2E+00	1.13E+00	2.96E-01	2.06E-02	5.37E-03	2.6E-02
Copper	7.83E+01	5.60E+01	(a)	9.7E+00	3.17E-01	3.50E-01	4.05E-03	4.47E-03	8.5E-03
Lead	1.77E+02	1.06E+02	(a)	3.6E+00	6.03E-01	1.31E-01	3.41E-03	7.41E-04	4.2E-03
Mercury	2.28E+01	4.43E-01	4.3E-02	1.9E-02	2.51E-03	5.72E-03	1.10E-04	2.51E-04	3.6E-04
Nickel	1.40E+01	2.40E+02	(a)	6.5E+00	1.36E+00	2.35E-01	9.70E-02	1.68E-02	1.1E-01
Vanadium	8.94E+00	3.89E+01	4.9E-03	1.9E-01	2.20E-01	6.78E-03	2.46E-02	7.59E-04	2.5E-02
Zinc	2.82E+02	1.78E+02	(a)	8.5E+01	1.01E+00	3.07E+00	3.57E-03	1.09E-02	1.4E-02
Aroclor-1260	5.32E-01	1.38E-01	1.0E-02	1.4E-03	7.80E-04	4.13E-04	1.47E-03	7.77E-04	2.2E-03
2,3,7,8-TCDD TEQ (mammalian)	1.75E-05	2.76E-05	5.6E-03	1.5E-07	1.56E-07	5.56E-09	8.92E-03	3.18E-04	9.2E-03
Benzo(b)fluoranthene	3.64E+01	2.99E-01	3.1E-01	9.3E-02	1.69E-03	3.34E-03	4.66E-05	9.18E-05	1.4E-04
Benzo(g,h,i)perylene	3.64E+01	2.08E-01	(a)	6.2E-02	1.18E-03	2.22E-03	3.24E-05	6.09E-05	9.3E-05
Benzo(k)fluoranthene	3.64E+01	3.13E-01	(a)	4.3E-02	1.77E-03	1.53E-03	4.87E-05	4.22E-05	9.1E-05
Dibenz(a,h)anthracene	3.64E+01	2.08E-01	1.3E-01	2.7E-02	1.18E-03	9.74E-04	3.24E-05	2.68E-05	5.9E-05
Pyrene	3.64E+01	6.34E-01	7.2E-01	4.6E-01	3.59E-03	1.64E-02	9.86E-05	4.52E-04	5.5E-04
C5-C8 Aliphatics	7.12E+02	2.04E+00	1.0E+00	2.0E+00	1.16E-02	7.35E-02	1.62E-05	1.03E-04	1.2E-04
C9-C10 Aromatics	7.10E+02	5.17E+00	1.0E+00	5.2E+00	2.93E-02	1.86E-01	4.12E-05	2.62E-04	3.0E-04
C9-C18 Aliphatics	1.75E+03	1.41E+00	1.0E+00	1.4E+00	7.97E-03	5.07E-02	4.55E-06	2.90E-05	3.4E-05
C11-C22 Aromatics	7.10E+02	2.97E+01	1.0E+00	3.0E+01	1.68E-01	1.07E+00	2.36E-04	1.50E-03	1.7E-03
C19-C36 Aliphatics	3.50E+03	5.14E+01	1.0E+00	5.1E+01	2.91E-01	1.85E+00	8.30E-05	5.28E-04	6.1E-04

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
LOAEL - Lowest observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 4A - Evaluation of Potential Risk to Red-tailed Hawk
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Red-tailed Hawk
Pathway:	Soil ingestion
	Consumption of small mammals

Parameter	**Value**	
Small Mammal Ingestion Rate (kg ww/d)	0.119	Assumed 100% of diet
Total Dietary Intake (kg ww/d)	0.119	USEPA (1993) average of A Male & Female winter
Soil Ingestion Rate (kg dw/day)	0.00973	Calc. from Beyer (1994)
Body Weight (kg)	1.13	USEPA (1993), average of six adults
Sm. Mammal Dry wt./wet wt. CF	0.3	USEPA (1999)
Home range (ha)	60	USEPA (1993) A Male & Female spring
Area Use Factor	0.03083	1.85. ha exposure area

		Surface Soil							
Constituent	**NOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in small mammals (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from small mammals (mg/kg-d)**	**TQ-soil**	**TQ-small mammals**	**Total TQ**
Antimony	1.00E+00	2.24E+00	(a)	3.5E-02	5.92E-04	3.39E-05	5.92E-04	3.39E-05	6.3E-04
Arsenic	3.70E+00	4.84E+00	(a)	6.9E-02	1.28E-03	6.68E-05	3.46E-04	1.80E-05	3.6E-04
Barium	2.08E+01	2.62E+02	(a)	4.8E-01	6.94E-02	4.66E-04	3.34E-03	2.24E-05	3.4E-03
Cadmium	1.47E+00	9.76E-01	(a)	2.8E-01	2.58E-04	2.73E-04	1.76E-04	1.86E-04	3.6E-04
Chromium	2.66E+00	2.00E+02	(a)	1.7E+01	5.30E-02	1.63E-02	1.99E-02	6.12E-03	2.6E-02
Copper	1.85E+01	5.60E+01	(a)	2.4E+00	1.48E-02	2.33E-03	8.01E-04	1.26E-04	9.3E-04
Lead	1.09E+01	1.06E+02	(a)	8.1E+00	2.82E-02	7.91E-03	2.58E-03	7.23E-04	3.3E-03
Mercury	4.50E-01	4.43E-01	7.5E-06	3.3E-06	1.17E-04	1.08E-08	2.61E-04	2.40E-08	2.6E-04
Nickel	6.71E+00	2.40E+02	(a)	1.0E+01	6.35E-02	9.75E-03	9.46E-03	1.45E-03	1.1E-02
Vanadium	1.19E+00	3.89E+01	1.2E-02	4.8E-01	1.03E-02	4.64E-04	8.67E-03	3.91E-04	9.1E-03
Zinc	6.61E+01	1.78E+02	(a)	1.1E+02	4.70E-02	1.10E-01	7.11E-04	1.66E-03	2.4E-03
Aroclor-1260	1.80E-01	1.38E-01	5.8E-05	8.0E-06	3.65E-05	2.60E-08	2.03E-04	1.45E-07	2.0E-04
2,3,7,8-TCDD TEQ (avian)	1.40E-05	4.92E-05	7.8E-05	3.8E-09	1.30E-08	1.24E-11	9.30E-04	8.88E-07	9.3E-04
Benzo(b)fluoranthene	1.01E+00	2.99E-01	0.0E+00	0.0E+00	7.92E-05	0.00E+00	7.84E-05	0.00E+00	7.8E-05
Benzo(g,h,i)perylene	1.01E+00	2.08E-01	0.0E+00	0.0E+00	5.51E-05	0.00E+00	5.45E-05	0.00E+00	5.5E-05
Benzo(k)fluoranthene	1.01E+00	3.13E-01	0.0E+00	0.0E+00	8.29E-05	0.00E+00	8.20E-05	0.00E+00	8.2E-05
Dibenz(a,h)anthracene	1.01E+00	2.08E-01	0.0E+00	0.0E+00	5.51E-05	0.00E+00	5.45E-05	0.00E+00	5.5E-05
Pyrene	1.11E+00	6.34E-01	0.0E+00	0.0E+00	1.68E-04	0.00E+00	1.51E-04	0.00E+00	1.5E-04
C5-C8 Aliphatics	4.00E+02	2.04E+00	1.0E+00	2.0E+00	5.40E-04	1.98E-03	1.35E-06	4.96E-06	6.3E-06
C9-C10 Aromatics	1.00E+04	5.17E+00	1.0E+00	5.2E+00	1.37E-03	5.03E-03	1.37E-07	5.03E-07	6.4E-07
C9-C18 Aliphatics	4.00E+02	1.41E+00	1.0E+00	1.4E+00	3.73E-04	1.37E-03	9.32E-07	3.42E-06	4.4E-06
C11-C22 Aromatics	1.00E+04	2.97E+01	1.0E+00	3.0E+01	7.85E-03	2.88E-02	7.85E-07	2.88E-06	3.7E-06
C19-C36 Aliphatics	4.00E+02	5.14E+01	1.0E+00	5.1E+01	1.36E-02	4.99E-02	3.40E-05	1.25E-04	1.6E-04

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
NOAEL - No observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 4B - Evaluation of Potential Risk to Red-tailed Hawk
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Red-tailed Hawk
Pathway:	Soil ingestion
	Consumption of small mammals

Parameter	Value	
Small Mammal Ingestion Rate (kg ww/d)	0.119	Assumed 100% of diet
Total Dietary Intake (kg ww/d)	0.119	USEPA (1993) average of A Male & Female winter
Soil Ingestion Rate (kg dw/day)	0.00973	Calc. from Beyer (1994)
Body Weight (kg)	1.13	USEPA (1993), average of six adults
Sm. Mammal Dry wt./wet wt. CF	0.3	USEPA (1999)
Home range (ha)	60	USEPA (1993) A Male & Female spring
Area Use Factor	0.03083	1.85. ha exposure area

		Surface Soil							
Constituent	**LOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in small mammals (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from small mammals (mg/kg-d)**	**TQ-soil**	**TQ-small mammals**	**Total TQ**
Antimony	5.00E+00	2.24E+00	(a)	3.5E-02	5.92E-04	3.39E-05	1.18E-04	6.77E-06	1.3E-04
Arsenic	4.51E+00	4.84E+00	(a)	6.9E-02	1.28E-03	6.68E-05	2.84E-04	1.48E-05	3.0E-04
Barium	4.17E+01	2.62E+02	(a)	4.8E-01	6.94E-02	4.66E-04	1.67E-03	1.12E-05	1.7E-03
Cadmium	6.35E+00	9.76E-01	(a)	2.8E-01	2.58E-04	2.73E-04	4.07E-05	4.30E-05	8.4E-05
Chromium	1.56E+01	2.00E+02	(a)	1.7E+01	5.30E-02	1.63E-02	3.39E-03	1.04E-03	4.4E-03
Copper	3.49E+01	5.60E+01	(a)	2.4E+00	1.48E-02	2.33E-03	4.25E-04	6.69E-05	4.9E-04
Lead	4.46E+01	1.06E+02	(a)	8.1E+00	2.82E-02	7.91E-03	6.31E-04	1.77E-04	8.1E-04
Mercury	9.00E-01	4.43E-01	7.5E-06	3.3E-06	1.17E-04	1.08E-08	1.30E-04	1.20E-08	1.3E-04
Nickel	1.86E+01	2.40E+02	(a)	1.0E+01	6.35E-02	9.75E-03	3.42E-03	5.25E-04	3.9E-03
Vanadium	1.70E+00	3.89E+01	1.2E-02	4.8E-01	1.03E-02	4.64E-04	6.05E-03	2.73E-04	6.3E-03
Zinc	1.71E+02	1.78E+02	(a)	1.1E+02	4.70E-02	1.10E-01	2.74E-04	6.41E-04	9.2E-04
Aroclor-1260	1.80E+00	1.38E-01	5.8E-05	8.0E-06	3.65E-05	2.60E-08	2.03E-05	1.45E-08	2.0E-05
2,3,7,8-TCDD TEQ (avian)	1.40E-04	4.92E-05	7.8E-05	3.8E-09	1.30E-08	1.24E-11	9.30E-05	8.88E-08	9.3E-05
Benzo(b)fluoranthene	1.01E+01	2.99E-01	0.0E+00	0.0E+00	7.92E-05	0.00E+00	7.84E-06	0.00E+00	7.8E-06
Benzo(g,h,i)perylene	1.01E+01	2.08E-01	0.0E+00	0.0E+00	5.51E-05	0.00E+00	5.45E-06	0.00E+00	5.5E-06
Benzo(k)fluoranthene	1.01E+01	3.13E-01	0.0E+00	0.0E+00	8.29E-05	0.00E+00	8.20E-06	0.00E+00	8.2E-06
Dibenz(a,h)anthracene	1.01E+01	2.08E-01	0.0E+00	0.0E+00	5.51E-05	0.00E+00	5.45E-06	0.00E+00	5.5E-06
Pyrene	1.11E+01	6.34E-01	0.0E+00	0.0E+00	1.68E-04	0.00E+00	1.51E-05	0.00E+00	1.5E-05
C5-C8 Aliphatics	4.00E+03	2.04E+00	1.0E+00	2.0E+00	5.40E-04	1.98E-03	1.35E-07	4.96E-07	6.3E-07
C9-C10 Aromatics	1.00E+05	5.17E+00	1.0E+00	5.2E+00	1.37E-03	5.03E-03	1.37E-08	5.03E-08	6.4E-08
C9-C18 Aliphatics	4.00E+03	1.41E+00	1.0E+00	1.4E+00	3.73E-04	1.37E-03	9.32E-08	3.42E-07	4.4E-07
C11-C22 Aromatics	1.00E+05	2.97E+01	1.0E+00	3.0E+01	7.85E-03	2.88E-02	7.85E-08	2.88E-07	3.7E-07
C19-C36 Aliphatics	4.00E+03	5.14E+01	1.0E+00	5.1E+01	1.36E-02	4.99E-02	3.40E-06	1.25E-05	1.6E-05

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
LOAEL - Lowest observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 5A - Evaluation of Potential Risk to American Woodcock
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	American Woodcock
Pathway:	Soil ingestion
	Consumption of invertebrates

Parameter	Value	
Invert Ingestion Rate (kg ww/d)	0.1371	Assumed 100% of diet
Total Dietary Intake (kg ww/d)	0.1371	USEPA (1993)
Soil Ingestion Rate (kg dw/day)	0.0112	Calc. from Beyer (1994)
Body Weight (kg)	0.1780	USEPA (1993) avg of A Male & A Female in central MA
Invert Dry wt./wet wt. CF	0.373	Site-specific data.
Home range (ha)	3.80	USEPA (1993) avg of inactive A Male and brooding A Female
Area Use Factor	0.4868	1.85. ha exposure area

		Surface Soil							
Constituent	**NOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in invert (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from invert (mg/kg-d)**	**TQ-soil**	**TQ-invert**	**Total TQ**
Antimony	1.00E+00	2.24E+00	(a)	2.6E-01	6.86E-02	3.64E-02	6.86E-02	3.64E-02	1.0E-01
Arsenic	3.70E+00	4.84E+00	(a)	1.3E+00	1.48E-01	1.82E-01	4.01E-02	4.91E-02	8.9E-02
Barium	2.08E+01	2.62E+02	9.1E-02	2.4E+01	8.04E+00	3.34E+00	3.87E-01	1.61E-01	5.5E-01
Cadmium	1.47E+00	9.76E-01	(a)	8.1E+00	2.99E-02	1.13E+00	2.04E-02	7.72E-01	7.9E-01
Chromium	2.66E+00	2.00E+02	(a)	1.6E+01	6.14E+00	2.27E+00	2.31E+00	8.52E-01	**3.2E+00**
Copper	1.85E+01	5.60E+01	(a)	1.5E+01	1.72E+00	2.07E+00	9.28E-02	1.12E-01	2.0E-01
Lead	1.09E+01	1.06E+02	(a)	3.6E+01	3.26E+00	5.06E+00	2.98E-01	4.63E-01	7.6E-01
Mercury	4.50E-01	4.43E-01	(a)	4.5E-01	1.36E-02	6.29E-02	3.02E-02	1.40E-01	1.7E-01
Nickel	6.71E+00	2.40E+02	(a)	9.7E+00	7.35E+00	1.36E+00	1.10E+00	2.02E-01	**1.3E+00**
Vanadium	1.19E+00	3.89E+01	(a)	5.2E+00	1.19E+00	7.27E-01	1.00E+00	6.13E-01	**1.6E+00**
Zinc	6.61E+01	1.78E+02	(a)	1.7E+02	5.44E+00	2.35E+01	8.24E-02	3.56E-01	4.4E-01
Aroclor-1260	1.80E-01	1.38E-01	1.1E+00	1.6E-01	4.22E-03	5.84E-02	2.35E-02	3.24E-01	3.5E-01
2,3,7,8-TCDD TEQ (avian)	1.40E-05	4.92E-05	1.5E+00	7.1E-05	1.51E-06	2.67E-05	1.08E-01	1.91E+00	**2.0E+00**
Benzo(b)fluoranthene	1.01E+00	2.99E-01	2.6E+00	7.8E-01	9.17E-03	1.09E-01	9.08E-03	1.08E-01	1.2E-01
Benzo(g,h,i)perylene	1.01E+00	2.08E-01	2.9E+00	6.1E-01	6.38E-03	8.56E-02	6.31E-03	8.47E-02	9.1E-02
Benzo(k)fluoranthene	1.01E+00	3.13E-01	2.6E+00	8.1E-01	9.60E-03	1.14E-01	9.50E-03	1.13E-01	1.2E-01
Dibenz(a,h)anthracene	1.01E+00	2.08E-01	2.3E+00	4.8E-01	6.38E-03	6.72E-02	6.31E-03	6.66E-02	7.3E-02
Pyrene	1.11E+00	6.34E-01	1.8E+00	1.1E+00	1.94E-02	1.55E-01	1.75E-02	1.40E-01	1.6E-01
C5-C8 Aliphatics	4.00E+02	2.04E+00	1.0E+00	2.0E+00	6.26E-02	2.85E-01	1.56E-04	7.14E-04	8.7E-04
C9-C10 Aromatics	1.00E+04	5.17E+00	1.0E+00	5.2E+00	1.59E-01	7.24E-01	1.59E-05	7.24E-05	8.8E-05
C9-C18 Aliphatics	4.00E+02	1.41E+00	1.0E+00	1.4E+00	4.32E-02	1.97E-01	1.08E-04	4.92E-04	6.0E-04
C11-C22 Aromatics	1.00E+04	2.97E+01	1.0E+00	3.0E+01	9.09E-01	4.15E+00	9.09E-05	4.15E-04	5.1E-04
C19-C36 Aliphatics	4.00E+02	5.14E+01	1.0E+00	5.1E+01	1.57E+00	7.18E+00	3.94E-03	1.80E-02	2.2E-02

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
NOAEL - No observable adverse effect level
(a) Earthworm data collected at the site was used in place of BTF. Earthworm data used was from Sample DD-BO-001

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.

Attachment F-1
Table 5B - Evaluation of Potential Risk to American Woodcock
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	American Woodcock
Pathway:	Soil ingestion
	Consumption of invertebrates

Parameter	Value	
Invert Ingestion Rate (kg ww/d)	0.1371	Assumed 100% of diet
Total Dietary Intake (kg ww/d)	0.1371	USEPA (1993)
Soil Ingestion Rate (kg dw/day)	0.0112	Calc. from Beyer (1994)
Body Weight (kg)	0.1780	USEPA (1993) avg of A Male & A Female in central MA
Invert Dry wt./wet wt. CF	0.373	Site-specific data.
Home range (ha)	3.80	USEPA (1993) avg of inactive A Male and brooding A Female
Area Use Factor	0.4868	1.85. ha exposure area

		Surface Soil							
Constituent	**LOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in invert (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from invert (mg/kg-d)**	**TQ-soil**	**TQ-invert**	**Total TQ**
Antimony	5.00E+00	2.24E+00	(a)	2.6E-01	6.86E-02	3.64E-02	1.37E-02	7.27E-03	2.1E-02
Arsenic	4.51E+00	4.84E+00	(a)	1.3E+00	1.48E-01	1.82E-01	3.29E-02	4.03E-02	7.3E-02
Barium	4.17E+01	2.62E+02	9.1E-02	2.4E+01	8.04E+00	3.34E+00	1.93E-01	8.01E-02	2.7E-01
Cadmium	6.35E+00	9.76E-01	(a)	8.1E+00	2.99E-02	1.13E+00	4.71E-03	1.78E-01	1.8E-01
Chromium	1.56E+01	2.00E+02	(a)	1.6E+01	6.14E+00	2.27E+00	3.93E-01	1.45E-01	5.4E-01
Copper	3.49E+01	5.60E+01	(a)	1.5E+01	1.72E+00	2.07E+00	4.92E-02	5.93E-02	1.1E-01
Lead	4.46E+01	1.06E+02	(a)	3.6E+01	3.26E+00	5.06E+00	7.31E-02	1.13E-01	1.9E-01
Mercury	9.00E-01	4.43E-01	(a)	4.5E-01	1.36E-02	6.29E-02	1.51E-02	6.99E-02	8.5E-02
Nickel	1.86E+01	2.40E+02	(a)	9.7E+00	7.35E+00	1.36E+00	3.96E-01	7.30E-02	4.7E-01
Vanadium	1.70E+00	3.89E+01	(a)	5.2E+00	1.19E+00	7.27E-01	7.00E-01	4.28E-01	**1.1E+00**
Zinc	1.71E+02	1.78E+02	(a)	1.7E+02	5.44E+00	2.35E+01	3.17E-02	1.37E-01	1.7E-01
Aroclor-1260	1.80E+00	1.38E-01	1.1E+00	1.6E-01	4.22E-03	5.84E-02	2.35E-03	3.24E-02	3.5E-02
2,3,7,8-TCDD TEQ (avian)	1.40E-04	4.92E-05	1.5E+00	7.1E-05	1.51E-06	2.67E-05	1.08E-02	1.91E-01	2.0E-01
Benzo(b)fluoranthene	1.01E+01	2.99E-01	2.6E+00	7.8E-01	9.17E-03	1.09E-01	9.08E-04	1.08E-02	1.2E-02
Benzo(g,h,i)perylene	1.01E+01	2.08E-01	2.9E+00	6.1E-01	6.38E-03	8.56E-02	6.31E-04	8.47E-03	9.1E-03
Benzo(k)fluoranthene	1.01E+01	3.13E-01	2.6E+00	8.1E-01	9.60E-03	1.14E-01	9.50E-04	1.13E-02	1.2E-02
Dibenz(a,h)anthracene	1.01E+01	2.08E-01	2.3E+00	4.8E-01	6.38E-03	6.72E-02	6.31E-04	6.66E-03	7.3E-03
Pyrene	1.11E+01	6.34E-01	1.8E+00	1.1E+00	1.94E-02	1.55E-01	1.75E-03	1.40E-02	1.6E-02
C5-C8 Aliphatics	4.00E+03	2.04E+00	1.0E+00	2.0E+00	6.26E-02	2.85E-01	1.56E-05	7.14E-05	8.7E-05
C9-C10 Aromatics	1.00E+05	5.17E+00	1.0E+00	5.2E+00	1.59E-01	7.24E-01	1.59E-06	7.24E-06	8.8E-06
C9-C18 Aliphatics	4.00E+03	1.41E+00	1.0E+00	1.4E+00	4.32E-02	1.97E-01	1.08E-05	4.92E-05	6.0E-05
C11-C22 Aromatics	1.00E+05	2.97E+01	1.0E+00	3.0E+01	9.09E-01	4.15E+00	9.09E-06	4.15E-05	5.1E-05
C19-C36 Aliphatics	4.00E+03	5.14E+01	1.0E+00	5.1E+01	1.57E+00	7.18E+00	3.94E-04	1.80E-03	2.2E-03

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
LOAEL - Lowest observable adverse effect level
(a) Earthworm data collected at the site was used in place of BTF. Earthworm data used was from Sample DD-BO-001

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.

Attachment F-1
Table 6A - Evaluation of Potential Risk to Quail
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Quail
Pathway:	Soil ingestion
	Consumption of vegetation

Parameter	Value		
Vegetation Ingestion Rate (kg ww/d)	0.0134	Assume 100% of diet.	
Total Dietary Intake (kg ww/d)	0.0134	USEPA (1993)	
Soil Ingestion Rate (kg dw/day)	0.0002	Calc. from Beyer (1994)	
Body Weight (kg)	0.1736	USEPA (1993) avg of A Male and A Female	
Veg Dry wt./wet wt. CF	0.120	USEPA (1999)	1.16E-02
Home range (ha)	9.98	USEPA (1993) avg of A Male and A Female	
Area Use Factor	0.185	1.85. ha exposure area	

		Surface Soil							
Constituent	**NOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in vegetation (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from vegetation (mg/kg-d)**	**TQ-soil**	**TQ-vegetation**	**Total TQ**
Antimony	1.00E+00	2.24E+00	(a)	8.4E-02	3.99E-04	1.44E-04	3.99E-04	1.44E-04	5.4E-04
Arsenic	3.70E+00	4.84E+00	3.8E-02	1.8E-01	8.63E-04	3.11E-04	2.33E-04	8.41E-05	3.2E-04
Barium	2.08E+01	2.62E+02	1.6E-01	4.1E+01	4.67E-02	7.01E-02	2.25E-03	3.37E-03	5.6E-03
Cadmium	1.47E+00	9.76E-01	(a)	6.1E-01	1.74E-04	1.05E-03	1.18E-04	7.16E-04	8.3E-04
Chromium	2.66E+00	2.00E+02	4.1E-02	8.2E+00	3.57E-02	1.41E-02	1.34E-02	5.29E-03	1.9E-02
Copper	1.85E+01	5.60E+01	(a)	9.7E+00	9.98E-03	1.66E-02	5.39E-04	9.00E-04	1.4E-03
Lead	1.09E+01	1.06E+02	(a)	3.6E+00	1.90E-02	6.23E-03	1.73E-03	5.69E-04	2.3E-03
Mercury	4.50E-01	4.43E-01	4.3E-02	1.9E-02	7.90E-05	2.72E-04	1.75E-04	6.05E-04	7.8E-04
Nickel	6.71E+00	2.40E+02	(a)	6.5E+00	4.27E-02	1.12E-02	6.37E-03	1.67E-03	8.0E-03
Vanadium	1.19E+00	3.89E+01	4.9E-03	1.9E-01	6.92E-03	3.23E-04	5.84E-03	2.72E-04	6.1E-03
Zinc	6.61E+01	1.78E+02	(a)	8.5E+01	3.16E-02	1.46E-01	4.79E-04	2.21E-03	2.7E-03
Aroclor-1260	1.80E-01	1.38E-01	1.0E-02	1.4E-03	2.45E-05	1.97E-05	1.36E-04	1.09E-04	2.5E-04
2,3,7,8-TCDD TEQ (avian)	1.40E-05	4.92E-05	5.6E-03	2.8E-07	8.76E-09	4.72E-10	6.26E-04	3.37E-05	6.6E-04
Benzo(b)fluoranthene	1.01E+00	2.99E-01	3.1E-01	9.3E-02	5.33E-05	1.59E-04	5.28E-05	1.57E-04	2.1E-04
Benzo(g,h,i)perylene	1.01E+00	2.08E-01	(a)	6.2E-02	3.71E-05	1.05E-04	3.67E-05	1.04E-04	1.4E-04
Benzo(k)fluoranthene	1.01E+00	3.13E-01	(a)	4.3E-02	5.58E-05	7.30E-05	5.52E-05	7.22E-05	1.3E-04
Dibenz(a,h)anthracene	1.01E+00	2.08E-01	1.3E-01	2.7E-02	3.71E-05	4.63E-05	3.67E-05	4.59E-05	8.3E-05
Pyrene	1.11E+00	6.34E-01	7.2E-01	4.6E-01	1.13E-04	7.81E-04	1.02E-04	7.04E-04	8.1E-04
C5-C8 Aliphatics	4.00E+02	2.04E+00	1.0E+00	2.0E+00	3.64E-04	3.50E-03	9.09E-07	8.74E-06	9.7E-06
C9-C10 Aromatics	1.00E+04	5.17E+00	1.0E+00	5.2E+00	9.22E-04	8.86E-03	9.22E-08	8.86E-07	9.8E-07
C9-C18 Aliphatics	4.00E+02	1.41E+00	1.0E+00	1.4E+00	2.51E-04	2.41E-03	6.27E-07	6.03E-06	6.7E-06
C11-C22 Aromatics	1.00E+04	2.97E+01	1.0E+00	3.0E+01	5.28E-03	5.08E-02	5.28E-07	5.08E-06	5.6E-06
C19-C36 Aliphatics	4.00E+02	5.14E+01	1.0E+00	5.1E+01	9.15E-03	8.80E-02	2.29E-05	2.20E-04	2.4E-04

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
NOAEL - No observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-1
Table 6B - Evaluation of Potential Risk to Quail
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

Site:	DDA
Receptor:	Quail
Pathway:	Soil ingestion
	Consumption of vegetation

Parameter	Value	
Vegetation Ingestion Rate (kg ww/d)	0.0134	Assume 100% of diet.
Total Dietary Intake (kg ww/d)	0.0134	USEPA (1993)
Soil Ingestion Rate (kg dw/day)	0.0002	Calc. from Beyer (1994)
Body Weight (kg)	0.1736	USEPA (1993) avg of A Male and A Female
Veg Dry wt./wet wt. CF	0.120	USEPA (1999)
Home range (ha)	9.98	USEPA (1993) avg of A Male and A Female
Area Use Factor	0.185	1.85. ha exposure area

		Surface Soil							
Constituent	**LOAEL-based TRV (mg/kg-d)**	**Conc. in soil (mg/kg)**	**BTF**	**Conc. in vegetation (mg/kg)**	**Intake from soil (mg/kg-d)**	**Intake from vegetation (mg/kg-d)**	**TQ-soil**	**TQ-vegetation**	**Total TQ**
Antimony	5.00E+00	2.24E+00	(a)	8.4E-02	3.99E-04	1.44E-04	7.97E-05	2.88E-05	1.1E-04
Arsenic	4.51E+00	4.84E+00	3.8E-02	1.8E-01	8.63E-04	3.11E-04	1.91E-04	6.91E-05	2.6E-04
Barium	4.17E+01	2.62E+02	1.6E-01	4.1E+01	4.67E-02	7.01E-02	1.12E-03	1.68E-03	2.8E-03
Cadmium	6.35E+00	9.76E-01	(a)	6.1E-01	1.74E-04	1.05E-03	2.74E-05	1.66E-04	1.9E-04
Chromium	1.56E+01	2.00E+02	4.1E-02	8.2E+00	3.57E-02	1.41E-02	2.28E-03	9.00E-04	3.2E-03
Copper	3.49E+01	5.60E+01	(a)	9.7E+00	9.98E-03	1.66E-02	2.86E-04	4.77E-04	7.6E-04
Lead	4.46E+01	1.06E+02	(a)	3.6E+00	1.90E-02	6.23E-03	4.25E-04	1.40E-04	5.6E-04
Mercury	9.00E-01	4.43E-01	4.3E-02	1.9E-02	7.90E-05	2.72E-04	8.77E-05	3.02E-04	3.9E-04
Nickel	1.86E+01	2.40E+02	(a)	6.5E+00	4.27E-02	1.12E-02	2.30E-03	6.02E-04	2.9E-03
Vanadium	1.70E+00	3.89E+01	4.9E-03	1.9E-01	6.92E-03	3.23E-04	4.07E-03	1.90E-04	4.3E-03
Zinc	1.71E+02	1.78E+02	(a)	8.5E+01	3.16E-02	1.46E-01	1.85E-04	8.51E-04	1.0E-03
Aroclor-1260	1.80E+00	1.38E-01	1.0E-02	1.4E-03	2.45E-05	1.97E-05	1.36E-05	1.09E-05	2.5E-05
2,3,7,8-TCDD TEQ (avian)	1.40E-04	4.92E-05	5.6E-03	2.8E-07	8.76E-09	4.72E-10	6.26E-05	3.37E-06	6.6E-05
Benzo(b)fluoranthene	1.01E+01	2.99E-01	3.1E-01	9.3E-02	5.33E-05	1.59E-04	5.28E-06	1.57E-05	2.1E-05
Benzo(g,h,i)perylene	1.01E+01	2.08E-01	(a)	6.2E-02	3.71E-05	1.05E-04	3.67E-06	1.04E-05	1.4E-05
Benzo(k)fluoranthene	1.01E+01	3.13E-01	(a)	4.3E-02	5.58E-05	7.30E-05	5.52E-06	7.22E-06	1.3E-05
Dibenz(a,h)anthracene	1.01E+01	2.08E-01	1.3E-01	2.7E-02	3.71E-05	4.63E-05	3.67E-06	4.59E-06	8.3E-06
Pyrene	1.11E+01	6.34E-01	7.2E-01	4.6E-01	1.13E-04	7.81E-04	1.02E-05	7.04E-05	8.1E-05
C5-C8 Aliphatics	4.00E+03	2.04E+00	1.0E+00	2.0E+00	3.64E-04	3.50E-03	9.09E-08	8.74E-07	9.7E-07
C9-C10 Aromatics	1.00E+05	5.17E+00	1.0E+00	5.2E+00	9.22E-04	8.86E-03	9.22E-09	8.86E-08	9.8E-08
C9-C18 Aliphatics	4.00E+03	1.41E+00	1.0E+00	1.4E+00	2.51E-04	2.41E-03	6.27E-08	6.03E-07	6.7E-07
C11-C22 Aromatics	1.00E+05	2.97E+01	1.0E+00	3.0E+01	5.28E-03	5.08E-02	5.28E-08	5.08E-07	5.6E-07
C19-C36 Aliphatics	4.00E+03	5.14E+01	1.0E+00	5.1E+01	9.15E-03	8.80E-02	2.29E-06	2.20E-05	2.4E-05

Notes:
kg ww/d - kilograms wet weight per day
kg dw/d - kilograms dry weight per day
CF - conversion factor
mg/kg-day - milligrams per kilogram per day
BTF - Biotransfer factor
TQ - Task quotient
TRV - Toxicity reference value
LOAEL - Lowest observable adverse effect level
(a) BTF not available; ECO-SSL uptake equations are used

References:
USEPA 1993. Wildlife Exposure Factors Handbook. EPA 600-R-93-187
Beyer W. Nelson. Connor Erin E. Gerould Sarah. 1994. Estimates of soil ingestion by wildlife. Journal of Wildlife Management. 58(2): 375-382.
USEPA. 1999. Screening Level Ecological Risk Assessment Protocol for Hazardous Waste Combustion Facilities. EPA 530-D-99-001A.

Attachment F-2
Biotransfer Factors using Uptake Equations
Bird Machine Company - Walpole, MA
Human Health and Environmental Risk Characterization

	DDA Uptake Equations from EcoSSLs		
Constituent	**Invertebrate BTFs**	**Vegetation BTFs**	**Small Mammal BTFs**
Antimony		8.40E-02	3.49E-02
Arsenic	7.35E-01		6.88E-02
Barium			4.80E-01
Benzo(a)anthracene			
Benzo(a)pyrene			
Benzo(g,h,i)perylene		6.15E-02	
Benzo(k)fluoranthene		4.26E-02	
Cadmium	8.12E+00	6.14E-01	2.81E-01
Chromium			1.67E+01
Copper		9.72E+00	2.40E+00
Lead	3.48E+01	3.64E+00	8.15E+00
Nickel		6.53E+00	1.00E+01
Zinc	4.68E+02	8.52E+01	1.13E+02

Notes:
All units are in dry weight soil.
Uptake equations are used in risk calculations whenever published BTFs (Table 4-4) are not available.

Appendix C – REDUA Worksheets

APPENDIX V REPRESENTATIVENESS AND DATA USABILITY WORKSHEET

A. <u>Representativeness Evaluation</u> *(Specific to information/samples used to support the RAO. Refer to Section 6.0 through 6.8.)*	
A-1 Provide a succinct summary of the Conceptual Site Model (CSM) for the disposal site. Discussion should include: - Disposal site history - Geologic/hydrogeological setting - Contaminant Source(s) and Type(s) - Description of the volume/mass and types of contaminants released to the environment - Date/time period of release(s), if known - Release location, affected media, and horizontal and vertical extent of the contamination - Contaminant migration pathways - Mechanism/pathways and points of exposure by human and ecological receptors ***(Refer to Section 6.1)***	
A-2 Discuss use of Field/Screening Data in response action decision making, including: - Contaminant of Concern screening/elimination - Selection of sampling locations - Comparison to laboratory results - Comparison to visual/olfactory observations ***(Refer to Section 6.2)***	( ) No Field/Screening Data were used to directly support this RAO. ( ) Field/Screening Data were used, as follows:
A-3 Discuss and justify sampling locations and depths collected in support of RAO regarding: <u>For Class A or B RAOs</u> -Delineation of disposal site boundaries (horizontal and vertical) -Elimination/control of OHM source(s) -Characterization of Risk (Exposure Pathways/Receptors, Hot Spots, samples included in EPCs, Background) -Achievement of No Significant Risk (NSR) <u>For Class C RAOs</u> -Delineation of disposal site boundaries (horizontal and vertical) -Elimination/control of OHM source(s) -Characterization of Risk (Exposure Pathways/Receptors, Hot Spots, samples included in EPCs, Background) -Achievement of No Substantial Hazard (NSH) ***(Refer to Table1 and Section 6.3; A-3 and A-4 of the worksheet may be combined, as appropriate.)***	

A. <u>Representativeness Evaluation</u> *(Specific to information/samples used to support the RAO. Refer to Section 6.0 through 6.8.)*	
A-4 Discuss and justify the density, spatial distribution, collection methods, and handling (compositing, split sampling) of samples collected in support of RAO (in relation to the justification provided in A-3 for meeting the RAO requirements) ***(Refer to Table 1 and Section 6.4)***	
A-5 Identify disposal site conditions, if any, that warrant the collection and analysis of temporal samples. For disposal sites that require monitoring over an extended time period, discuss and justify the number and time interval for sampling rounds conducted in support of the RAO for the following: <u>For Class A or B RAOs</u> - Delineation of disposal site boundaries (horizontal and vertical) - Characterization of Risk (Exposure Pathways/Receptors, Hot Spots, samples included in EPCs, Background) - Elimination/control of OHM source(s) - Achievement of No Significant Risk (NSR) <u>For Class C RAOs</u> - Delineation of disposal site boundaries (horizontal and vertical) - Characterization of Risk (Exposure Pathways/Receptors, Hot Spots, samples included in EPCs, Background) - Elimination/control of OHM source(s) - Achievement of No Substantial Hazard (NSH) ***(Refer to Table 1 and Section 6.5)***	( ) Temporal sampling not warranted for this disposal site.
A-6 Field Completeness of Data: Discuss data gaps identified in sampling and analytical information used to support RAO and their significance. ***(Refer to Section 6.6)***	
A-7 Identify any inconsistent information or uncertainty and justify disregarding such information or uncertainty (e.g., site assessment data inconsistent with historical information, field screening data/observations inconsistent with analytical data, use of data to support the RAO in spite of identified analytical or other deficiencies, etc.) in rendering the RAO Opinion. ***(Refer to Section 6.7)***	

A. <u>Representativeness Evaluation</u> *(Specific to information/samples used to support the RAO. Refer to Section 6.0 through 6.8.)*	
A-8 Where it is not otherwise apparent or discussed in previous sections, identify/discuss information generated during the course of response actions that was not used to support the RAO because it was determined to be unrepresentative or no longer representative of disposal site conditions. ***(Refer to Section 6.8)***	

B. <u>Data Usability Assessment</u> *(Specific to samples used to support the RAO. Refer to Table 1, Section 7.0 through 7.3, and Appendices I, II, III and IV.)*	
B-1 List all MCP activities that provided the analytical data reviewed in the course of conducting the Data Usability Assessment in support of the RAO. Include the media sampled and the month and year the data were acquired.	( ) Listed below. ( ) Attached separately (provide attachment reference).
B-2 Discuss appropriateness of selected analytical methods to quantitatively support the RAO.	
B-3 Discuss appropriateness of selected analytical methods' Reporting Limits (RL) to quantitatively support the RAO.	( ) All Reporting Limits were at or below applicable standards.
B-4 Discuss laboratory performance criteria and data quality indicators used to assess overall <u>Analytical Accuracy</u> (continuing calibration, laboratory control spikes, etc.) and <u>Analytical Precision</u> (laboratory duplicates, laboratory control spike duplicates, etc.). For CAM data, see MCP Analytical Method Report Certification Form and Laboratory Case Narrative.	( ) Met all CAM requirements and performance standards without qualification. ( ) If not, discuss data usability implications.
B-5 Discuss performance criteria and data quality indicators used to assess overall <u>Field Data Usability</u> (sample preservation compliance, sample sub sampling/compositing, etc.).	
B-6 Discuss any data rejected pursuant to **Appendix IV**, Rejection Criteria – Analytical Data Usability Assessments.	( ) No data rejected pursuant to **Appendix IV**.

C. <u>Representativeness Evaluation and Data Usability Assessment Summary and Conclusions</u> *(Refer to Section 8.0)*	
Provide a summary declaration that the data set relied upon to support the RAO is: 1. Scientifically valid and defensible, and of sufficient accuracy, precision and completeness; and 2. Representative with regards to the spatial and temporal distribution of sampling points.	

Appendix D – Data Usability Assessment

Data Usability Assessment

Data in support of this RAO were reviewed to ensure applicable MCP guidelines and policies were followed in regards to data quality and data usability. The data usability assessment has both an analytical and a field component, each of which are provided in the following subsections. All analytical data were collected after August 2003 when the MADEP established "presumptive certainty" requirements as defined in "Quality Assurance and Quality Control Guidelines for the Acquisition and Reporting of Analytical Data" (BWSC-CAM-VIIA, rev. 3.1 dated May 22, 2003). AMEC utilized the data usability criteria as defined in "MCP Representativeness Evaluations and Data Usability Assessments" (BWSC Policy # WSC-07-350), as well as the individual analytical methods defined in MADEP's *Compendium of Analytical Methods (CAM,)* to assess data quality and data usability. Data are considered to meet the requirements for defensibility, precision, accuracy and reporting of data are of sufficient quality to support this RAO unless otherwise stated below.

Groundwater Analytical Data Usability

This data usability assessment includes groundwater samples collected by Weston Solutions, Inc. The groundwater samples were collected on June 5, 2007; June 25, 2007; July 23, 2007; December 11, 2007; and May 19, 2008. The analytical data review elements included, but were not limited to laboratory control samples (LCS), surrogate recoveries, matrix spike/matrix spike duplicate (MS/MSD) recoveries, blank results, laboratory duplicates, field duplicates and laboratory case narratives.

Summary of Analytical Data Qualifications

Sample	Parameter	Issue	Use Limitation
DD-MW-002-R01-X DD-MW-204-R02-X DD-MW-203-R04-X DD-MW-207-R04-X DD-MW-205-R03-X	8270	Di-n-butyl phthalate and bis(2-ethylhexyl)phthalate were detected in the method blank below the reporting limits at 1.2 µg/L and 0.77 µg/L, respectively.	AMEC U-qualified all the detected values that were < 5X the blank concentrations.
DD-MW-002-R01-X DD-MW-204-R02-X DD-MW-203-R04-X DD-MW-207-R04-X DD-MW-205-R03-X	8270	The surrogate phenol-d5 recovered low in all associated samples.	AMEC UJ-qualified all acid extractable analytes in these samples due to the potential low bias.
DD-MW-002-R01-X DD-MW-204-R02-X DD-MW-203-R04-X DD-MW-207-R04-X DD-MW-205-R03-X	8270	Aniline and phenol recovered low in the LCS/LCSD at 35%/27% and 12%/12%, respectively.	AMEC UJ-qualified aniline and phenol in all samples due to the low bias.
DD-MW-206-R04-X DD-MW-201-R04-X DD-MW-001-R02-X	8270	Di-n-butyl phthalate and bis(2-ethylhexyl)phthalate were detected in the method blank below the reporting limits at 0.89 µg/L and 0.48 µg/L, respectively.	AMEC U-qualified all the detected values that were < 5X the blank concentrations.
DD-MW-206-R04-X DD-MW-201-R04-X DD-MW-001-R02-X	8270	Aniline and phenol recovered low in the LCS/LCSD at 36%/32% and 12%/12%, respectively.	AMEC UJ-qualified aniline and phenol in all samples due to the low bias.

Sample	Parameter	Issue	Use Limitation
DD-MW-201-R04-X	8270	Aniline and phenol recovered low in the MS/MSD at 33%/26% and 12%/12%, respectively.	AMEC UJ-qualified aniline and phenol in this sample due to the low bias.
DD-MW-206-R04-X DD-MW-201-R04-X DD-MW-001-R02-X	8270	The surrogate phenol-d5 recovered low in all associated samples.	AMEC UJ- or J-qualified all acid extractable analytes in these samples due to the potential low bias.
DD-MW-206-R04-X DD-MW-201-R04-X DD-MW-001-R02-X	Mercury	Mercury was detected in the method blank below the reporting limit at 0.12 µg/L.	AMEC U-qualified all the detected values that were < 5X the blank concentrations.
DD-MW-201-R04-X	Metals	Arsenic and selenium recovered high in the MS/MSD at 128%/137% and 138%/156%, respectively.	AMEC J-qualified both arsenic and selenium in this sample due to the potential high bias.
DD-MW-208-R01-001-X DD-MW-208-R01-001-D	8270	Di-n-butyl phthalate and bis(2-ethylhexyl)phthalate were detected in the method blank below the reporting limits at 0.37 µg/L and 0.14 µg/L, respectively.	AMEC U-qualified all the detected values that were < 5X the blank concentrations.
DD-MW-208-R01-001-X DD-MW-208-R01-001-D	8270	The surrogate phenol-d5 recovered <10% in both samples.	AMEC R-qualified all acid extractable analytes in these samples due to the potential low bias.
DD-MW-208-R01-001-X DD-MW-208-R01-001-D	8270	Phenol recovered low in the LCS/LCSD at 13%/15%. 2,4-Dimethylphenol and 2,4-dinitrophenol had elevated RPDs at 21% and 36%, respectively.	These analytes were previously R-qualified by AMEC and have not been further qualified.
DD-MW-208-R01-001-X DD-MW-208-R01-001-D	8260	2,2-Dichloropropane and carbon disulfide recovered low in the LCSD at 66% and 67%.	AMEC UJ-qualified both compounds in these samples due to the low bias.
DD-MW-208-R01-001-X DD-MW-208-R01-001-D	EPH	Sample DD-MW-208-R01-001-D was submitted as a field duplicate of sample DD-MW-208-R01-001-X. Phenanthrene, C11-C22 aromatic ranges and total EPH had elevated RPDs.	AMEC J-qualified these analytes in the primary sample and its field duplicate due to the imprecision.
DD-MW-208-R02-X	8270	Di-n-butyl phthalate and bis(2-ethylhexyl)phthalate were detected in the method blank below the reporting limits at 0.77 µg/L and 0.70 µg/L, respectively.	AMEC U-qualified all the detected values that were < 5X the blank concentrations.
DD-MW-208-R02-X	8270	Phenol recovered low in the LCS/LCSD at 12%/13%.	AMEC UJ-qualified phenol in this sample due to the low bias.

Sample	Parameter	Issue	Use Limitation
DD-MW-208-R02-X	8270	The surrogate phenol-d5 recovered low in this sample.	AMEC UJ-qualified all acid extractable analytes in this sample due to the potential low bias.
DD-MW-207-R05-X DD-MW-207-R05-D DD-MW-208-R03-X DD-MW-203-R05-X DD-MW-201-R05-X	8270	Di-n-butyl phthalate and bis(2-ethylhexyl)phthalate were detected in the method blank below the reporting limits at 0.80 µg/L and 0.61 µg/L, respectively.	AMEC U-qualified all the detected values that were < 5X the blank concentrations.
DD-MW-207-R05-X DD-MW-207-R05-D DD-MW-208-R03-X DD-MW-203-R05-X DD-MW-201-R05-X	8270	Phenol recovered low in the LCS/LCSD at 23%/25%.	AMEC UJ-qualified phenol in all samples due to the low bias.
DD-MW-207-R05-X DD-MW-207-R05-D DD-MW-208-R03-X DD-MW-203-R05-X DD-MW-201-R05-X	Antimony	Antimony was detected in the method blank below the reporting limit at 0.78 µg/L.	All associated samples are ND and not impacted by the high bias.
DD-MW-002-R02-X DD-MW-201-R06-X DD-MW-201-R06-D DD-MW-204-R05-X DD-MW-205-R05-X DD-MW-206-R05-X	8270	The surrogate phenol-d5 recovered low in all associated samples.	AMEC UJ- or J qualified all acid extractable analytes in these samples due to the potential low bias.
DD-MW-002-R02-X DD-MW-201-R06-X DD-MW-201-R06-D DD-MW-203-R06-X DD-MW-204-R05-X DD-MW-205-R05-X DD-MW-206-R05-X DD-MW-207-R06-X DD-MW-208-R04-X	8270	Phenol (24%/25%), 4-nitrophenol (LCS 26%), and 1,4-dioxane (18%/20%) recovered low in the LCS/LCSD. Also 2,4-dinitrophenol had an elevated RPD of 46%.	AMEC UJ-qualified phenol, 4-nitrophenol, and 1,4-dioxane in all associated samples due to the low recovery. AMEC J-qualified 2,4-dinitrophenol in sample DD-MW-204-R05-X. This analyte was ND in all other samples and not impacted.
DD-MW-203-R06-X	8270	Aniline (29%/37%), phenol (20%/20%), 4-nitrophenol (MSD 28%), and 1,4-dioxane (14%/16%) recovered low in the MS/MSD. Also 4-chloroaniline had an elevated RPD of 26%.	AMEC UJ-qualified aniline, phenol, 4-nitrophenol, and 1,4-dioxane in sample DD-MW-203-R06-X due to the low bias. 4-Chloroaniline was ND and not impacted by the non-directional bias.
DD-MW-201-R06-X DD-MW-201-R06-D	Chromium	Sample DD-MW-201-R06-D was submitted as a field duplicate of sample DD-MW-201-R06-X. Chromium had an elevated RPD of 50%.	AMEC J-qualified chromium in the primary sample and its field duplicate due to the imprecision.

Sample	Parameter	Issue	Use Limitation
DD-MW-002-R02-X DD-MW-201-R06-X DD-MW-201-R06-D DD-MW-203-R06-X DD-MW-204-R05-X DD-MW-205-R05-X DD-MW-206-R05-X DD-MW-207-R06-X DD-MW-208-R04-X	Antimony	Antimony was detected in the method blank below the reporting limit at 0.37 µg/L.	AMEC U-qualified the detected antimony value in sample DD-MW-207-R06-X since the concentration was < 5X the blank concentration.
DD-MW-203-R06-X	Antimony	Antimony recovered low in the MS at 70%.	AMEC UJ-qualified antimony due to the potential low bias.

Groundwater Field Data Usability

The field component of the Data Usability Assessment evaluates whether the sampling procedure ensures that the samples collected and delivered to the laboratory are representative of each sampling point. The review elements included, but were not limited to appropriate sample collection procedures, holding times, sample receipt, appropriate sample containers, and sample preservation. Weston collected groundwater samples at the Site for laboratory analysis. The samples were kept in coolers with ice and submitted to the laboratory. All samples were analyzed within the required holding times specific for the analysis.

Groundwater data are considered to be usable under the MCP. The data are scientifically valid and defensible, and of a sufficient level of precision, accuracy, and completeness to support this RAO, with the exception of the acid extractable analytes in samples DD-MW-208-R01-001-X and DD-MW-208-R01-001-D.

Appendix E – Responses to Public Comments

COMMENTS ON THE NOVEMBER 2011 DRAFT PHASE II CSA ADDENDUM & DRAFT RAO STATEMENT

The Draft Phase II Comprehensive Site Assessment (CSA) Addendum and the Draft Response Action Outcome (RAO) Statement for RTN 4-3024222 were issued for public comment on November 16, 2011. Copies of the draft documents were provided to the Public Information Plan (PIP) repositories at the Walpole Library and MassDEP's Lakeville office on that date. A copy of the transmittal letter which summarized the documents was also provided to the PIP Mailing List on that date. A meeting to present a summary of each document was conducted on December 6, 2011 after publishing a legal notice and providing copies of the notice to the PIP Mailing List. The comment period for these documents was set to close on December 12, 2011. No comments were received after this date.

Public comments relevant to the Draft CSA Addendum and RAO Statement consisted of oral questions from attendees at the 12/6/11 PIP Meeting. No written comments or questions were received on these documents. Questions raised at the meeting were answered during the presentation, and a summary of this discussion is provided herein. Each question is presented in bold font followed by the response in italics.

RESPONSES TO COMMENTS

1. Could a public supply well be installed near the Demolition Debris Area (DDA), considering the groundwater monitoring results presented in the CSA Addendum?

Contaminant concentrations measured around the DDA did not exceed drinking water standards, therefore the groundwater may be considered to be of sufficient quality to be used for drinking water. We note that this was not the case south of the DDA in the Manufacturing Building Area, where contamination above drinking water standards is the subject of ongoing remedial response actions. Both areas are part of the same Site (Release Tracking Number 4-3024222) as indicated in the draft documents.

2. Where are the requirements for the various types of RAOs spelled out?

These requirements are part of the Massachusetts Contingency Plan (MCP), as specified at 310 CMR 40.1000.

3. What types and numbers of monitoring wells are envisioned for the upcoming Remedy Implementation Plan (RIP) that will present a program for the Monitored Natural Attenuation (MNA) remedy?

The preliminary conceptual design for MNA, included in Figure 8 of the Phase III report, indicates 14 well clusters consisting of shallow/deep pairs, 2 bedrock monitoring wells, and 2 shallow (unpaired) wells. However, the well locations would be optimized during construction using field screening results, such that the locations shown in the Phase III report may be adjusted considerably. The Draft RIP will explain this process in detail.

4. What types of reports would be provided to the public during implementation of MNA?

The Final Inspection Report expected by June 2012 will present the results of monitoring system construction as needed to ensure that the system satisfies the design requirements, and will involve another public meeting and comment period. As the Site begins Phase V Operation, Maintenance, and Monitoring under the MCP, status and remedial monitoring reports will be required in accordance with 310 CMR 40.0892, typically at 6-month intervals. These reports will document interim results and progress in achieving remediation goals.

Appendix F – BWSC Form and Public Notifications

1. BWSC Form 108 (to be included in final paper copy of document)
2. Draft Transmittal Letter including Notice of Document Availability, Public Comment Period, and date of upcoming Public Meeting
3. Final Transmittal Letter including Notice of Document Availability

Massachusetts Department of Environmental Protection
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BWSC108

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COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM & PHASE I COMPLETION STATEMENT

Pursuant to 310 CMR 40.0484 (Subpart D) and 40.0800 (Subpart H)

A. SITE LOCATION:

1. Site Name: **BAKER HUGHES INC FMLY BIRD MACHINE CO**

2. Street Address: **100 NEPONSET ST**

3. City/Town: **WALPOLE** 4. ZIP Code:

☑ 5. Check here if a Tier Classification Submittal has been provided to DEP for this disposal site.

☐ a. Tier IA ☑ b. Tier IB ☐ c. Tier IC ☐ d. Tier II

6. If applicable, provide the Permit Number: **W204776**

B. THIS FORM IS BEING USED (check all that apply)

☐ 1. Submit a **Phase I Completion Statement**, pursuant to 310 CMR 40.0484.

☐ 2. Submit a **Revised Phase I Completion Statement**, pursuant to 310 CMR 40.0484.

☐ 3. Submit a **Phase II Scope of Work**, pursuant to 310 CMR 40.0834.

☐ 4. Submit an **interim Phase II Report**. This report does not satisfy the response action deadline requirements in 310 CMR 40.0500.

☐ 5. Submit a **final Phase II Report and Completion Statement**, pursuant to 310 CMR 40.0836.

☑ 6. Submit a **Revised Phase II Report and Completion Statement**, pursuant to 310 CMR 40.0836.

☐ 7. Submit a **Phase III Remedial Action Plan and Completion Statement**, pursuant to 310 CMR 40.0862.

☐ 8. Submit a **Revised Phase III Remedial Action Plan and Completion Statement**, pursuant to 310 CMR 40.0862.

☐ 9. Submit a **Phase IV Remedy Implementation Plan**, pursuant to 310 CMR 40.0874.

☐ 10. Submit a **Modified Phase IV Remedy Implementation Plan**, pursuant to 310 CMR 40.0874.

☐ 11. Submit an **As-Built Construction Report**, pursuant to 310 CMR 40.0875.

☐ 12. Submit a **Phase IV Status Report**, pursuant to 310 CMR 40.0877.

☐ 13. Submit a **Phase IV Completion Statement**, pursuant to 310 CMR 40.0878 and 40.0879.

Specify the outcome of Phase IV activities: (check one)

☐ a. Phase V Operation, Maintenance or Monitoring of the Comprehensive Remedial Action is necessary to achieve a Response Action Outcome.

☐ b. The requirements of a Class A Response Action Outcome have been met. No additional Operation, Maintenance or Monitoring is necessary to ensure the integrity of the Response Action Outcome. A completed Response Action Outcome Statement and Report (BWSC104) will be submitted to DEP.

☐ c. The requirements of a Class C Response Action Outcome have been met. No additional Operation, Maintenance or Monitoring is necessary to ensure the integrity of the Response Action Outcome. A completed Response Action Outcome Statement and Report (BWSC104) has been or will be submitted to DEP.

☐ d. The requirements of a Class C Response Action Outcome have been met. Further Operation, Maintenance or Monitoring of the remedial action is necessary to ensure that conditions are maintained and that further progress is made toward a Permanent Solution. A completed Response Action Outcome Statement and Report (BWSC104) has been or will be submitted to DEP.

B. THIS FORM IS BEING USED TO (cont.):(check all that apply)

☐ 14. Submit a **Revised Phase IV Completion Statement**, pursuant to 310 CMR 40.0878 and 40.0879.

☐ 15. Submit a **Phase V Status Report**, pursuant to 310 CMR 40.0892.

☐ 16. Submit a **Remedial Monitoring Report**. (This report can only be submitted through eDEP.)

a. Type of Report: (check one) ☐ i. Initial Report ☐ ii. Interim Report ☐ iii. Final Report

b. Frequency of Submittal: (check all that apply)

☐ i. A Remedial Monitoring Report(s) submitted monthly to address an Imminent Hazard.

☐ ii. A Remedial Monitoring Report(s) submitted monthly to address a Condition of Substantial Release Migration.

☐ iii. A Remedial Monitoring Report(s) submitted concurrent with a Status Report.

c. Status of Site: (check one) ☐ i. Phase IV ☐ ii. Phase V ☐ iii. Remedy Operation Status ☐ iv. Class C RAO

d. Number of Remedial Systems and/or Monitoring Programs: _____

A separate BWSC108A, CRA Remedial Monitoring Report, must be filled out for each Remedial System and/or Monitoring Program addressed by this transmittal form.

☐ 17. Submit a **Remedy Operation Status**, pursuant to 310 CMR 40.0893.

☐ 18. Submit a **Status Report to maintain a Remedy Operation Status**, pursuant to 310 CMR 40.0893(2).

☐ 19. Submit a **Transfer and/or a Modification of Persons Maintaining a Remedy Operation Status (ROS)** , pursuant to 310 CMR 40.0893(5) (check one, or both, if applicable).

☐ a. Submit a Transfer of Persons Maintaining an ROS (the transferee should be the person listed in Section D, "Person Undertaking Response Actions").

☐ b. Submit a Modification of Persons Maintaining an ROS (the primary representative should be the person listed in Section D, "Person Undertaking Response Actions").

c. Number of Persons Maintaining an ROS not including the primary representative: _____

☐ 20. Submit a **Termination of a Remedy Operation Status**, pursuant to 310 CMR 40.0893(6).(check one)

☐ a. Submit a notice indicating ROS performance standards have not been met. A plan and timetable pursuant to 310 CMR 40.0893(6)(b) for resuming the ROS are attached.

☐ b. Submit a notice of Termination of ROS.

☐ 21. Submit a **Phase V Completion Statement**, pursuant to 310 CMR 40.0894.

Specify the outcome of Phase V activities: (check one)

☐ a. The requirements of a Class A Response Action Outcome have been met. No additional Operation, Maintenance or Monitoring is necessary to ensure the integrity of the Response Action Outcome. A completed Response Action Outcome Statement (BWSC104) will be submitted to DEP.

☐ b. The requirements of a Class C Response Action Outcome have been met. No additional Operation, Maintenance or Monitoring is necessary to ensure the integrity of the Response Action Outcome. A completed Response Action Outcome Statement and Report (BWSC104) will be submitted to DEP.

☐ c. The requirements of a Class C Response Action Outcome have been met. Further Operation, Maintenance or Monitoring of the remedial action is necessary to ensure that conditions are maintained and/or that further progress is made toward a Permanent Solution. A completed Response Action Outcome Statement and Report (BWSC104) will be submitted to DEP.

☐ 22. Submit a **Revised Phase V Completion Statement**, pursuant to 310 CMR 40.0894.

☐ 23. Submit a **Post-Class C Response Action Outcome Status Report**, pursuant to 310 CMR 40.0898.

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COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM & PHASE I COMPLETION STATEMENT

Pursuant to 310 CMR 40.0484 (Subpart D) and 40.0800 (Subpart H)

Release Tracking Number

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C. LSP SIGNATURE AND STAMP:

I attest under the pains and penalties of perjury that I have personally examined and am familiar with this transmittal form, including any and all documents accompanying this submittal. In my professional opinion and judgment based upon application of (i) the standard of care in 309 CMR 4.02(1), (ii) the applicable provisions of 309 CMR 4.02(2) and (3), and 309 CMR 4.03(2), and (iii) the provisions of 309 CMR 4.03(3), to the best of my knowledge, information and belief,

> *if Section B indicates that a* ***Phase I, Phase II, Phase III, Phase IV or Phase V Completion Statement*** *and/or a* ***Termination of a Remedy Operation Status*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed and implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B indicates that a* ***Phase II Scope of Work*** *or a* ***Phase IV Remedy Implementation Plan*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) has (have) been developed in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal;

> *if Section B indicates that an* ***As-Built Construction Report****, a* ***Remedy Operation Status****, a* ***Phase IV, Phase V or Post-Class C RAO Status Report,*** *a* ***Status Report to Maintain a Remedy Operation Status,*** *a* ***Transfer or Modification of Persons Maintaining a Remedy Operation Status*** *and/or a* ***Remedial Monitoring Report*** *is being submitted*, the response action(s) that is (are) the subject of this submittal (i) is (are) being implemented in accordance with the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, (ii) is (are) appropriate and reasonable to accomplish the purposes of such response action(s) as set forth in the applicable provisions of M.G.L. c. 21E and 310 CMR 40.0000, and (iii) comply(ies) with the identified provisions of all orders, permits, and approvals identified in this submittal.

I am aware that significant penalties may result, including, but not limited to, possible fines and imprisonment, if I submit information which I know to be false, inaccurate or materially incomplete.

1. LSP #: 7122

2. First Name: KIM M 3. Last Name: HENRY

4. Telephone: 9783925334 5. Ext.: 6. FAX: 9786926633

7. Signature: KIM M HENRY

8. Date: 12/16/2011
(mm/dd/yyyy)

9. LSP Stamp:

Massachusetts Department of Environmental Protection
Bureau of Waste Site Cleanup

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COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM & PHASE I COMPLETION STATEMENT

Pursuant to 310 CMR 40.0484 (Subpart D) and 40.0800 (Subpart H)

D. PERSON UNDERTAKING RESPONSE ACTIONS:

1. Check all that apply: ☐ a. change in contact name ☐ b. change of address ☐ c. change in the person undertaking response actions

2. Name of Organization: BAKER PROCESS INC

3. Contact First Name: CHRIS 4. Last Name: CLODFELTER

5. Street: 2929 ALLEN PKWY STE 2100 6. Title:

7. City/Town: HOUSTON 8. State: TX 9. ZIP Code: 770197111

10. Telephone: 7134398329 11. Ext.: 12. FAX:

E. RELATIONSHIP TO SITE OF PERSON UNDERTAKING RESPONSE ACTIONS: ☐ Check here to change relationship

☑ 1. RP or PRP ☐ a. Owner ☐ b. Operator ☐ c. Generator ☐ d. Transporter

☑ e. Other RP or PRP Specify: NON-SPECIFIED PRP

☐ 2. Fiduciary, Secured Lender or Municipality with Exempt Status (as defined by M.G.L. c. 21E, s. 2)

☐ 3. Agency or Public Utility on a Right of Way (as defined by M.G.L. c. 21E, s. 5(j))

☐ 4. Any Other Person Undertaking Response Actions Specify Relationship:

F. REQUIRED ATTACHMENT AND SUBMITTALS:

☐ 1. Check here if the Response Action(s) on which this opinion is based, if any, are (were) subject to any order(s), permit(s) and/or approval(s) issued by DEP or EPA. If the box is checked, you MUST attach a statement identifying the applicable provisions thereof.

☑ 2. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the submittal of any Phase Reports to DEP.

☐ 3. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the availability of a Phase III Remedial Action Plan.

☐ 4. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of the availability of a Phase IV Remedy Implementation Plan.

☐ 5. Check here to certify that the Chief Municipal Officer and the Local Board of Health have been notified of any field work involving the implementation of a Phase IV Remedial Action.

☐ 6. If submitting a Transfer of a Remedy Operation Status (as per 310 CMR 40.0893(5)), check here to certify that a statement detailing the compliance history for the person making this submittal (transferee) is attached.

☐ 7. If submitting a Modification of a Remedy Operation Status (as per 310 CMR 40.0893(5)), check here to certify that a statement detailing the compliance history for each new person making this submittal is attached.

☐ 8. Check here if any non-updatable information provided on this form is incorrect, e.g. Site Name.
Send corrections to: BWSC.eDEP@state.ma.us.

☑ 9. Check here to certify that the LSP Opinion containing the material facts, data, and other information is attached.

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COMPREHENSIVE RESPONSE ACTION TRANSMITTAL FORM & PHASE I COMPLETION STATEMENT

Pursuant to 310 CMR 40.0484 (Subpart D) and 40.0800 (Subpart H)

G. CERTIFICATION OF PERSON UNDERTAKING RESPONSE ACTIONS:

1. I, **Chris Clodfelter**, attest under the pains and penalties of perjury (i) that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this transmittal form, (ii) that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material information contained in this submittal is, to the best of my knowledge and belief, true, accurate and complete, and (iii) that I am fully authorized to make this attestation on behalf of the entity legally responsible for this submittal. I/the person or entity on whose behalf this submittal is made am/is aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate, or incomplete information.

>*if Section B indicates that this is a* **Modification of a Remedy Operation Status (ROS)**, I attest under the pains and penalties of perjury that I am fully authorized to act on behalf of all persons performing response actions under the ROS as stated in 310 CMR 40.0893(5)(d) to receive oral and written correspondence from MassDEP with respect to performance of response actions under the ROS, and to receive a statement of fee amount as per 4.03(3).

I understand that any material received by the Primary Representative from MassDEP shall be deemed received by all the persons performing response actions under the ROS, and I am aware that there are significant penalties, including, but not limited to, possible fines and imprisonment, for willfully submitting false, inaccurate or incomplete information.

2. By: **Chris Clodfelter**
Signature

3. Title:

4. For: **BAKER PROCESS INC**
(Name of person or entity recorded in Section D)

5. Date: **12/16/2011**
(mm/dd/yyyy)

☐ 6. Check here if the address of the person providing certification is different from address recorded in Section D.

7. Street: _____

8. City/Town: _____ 9. State: _____ 10. ZIP Code: _____

11. Telephone: _____ 12. Ext.: _____ 13. FAX: _____

YOU ARE SUBJECT TO AN ANNUAL COMPLIANCE ASSURANCE FEE OF UP TO $10,000 PER BILLABLE YEAR FOR THIS DISPOSAL SITE. YOU MUST LEGIBLY COMPLETE ALL RELEVANT SECTIONS OF THIS FORM OR DEP MAY RETURN THE DOCUMENT AS INCOMPLETE. IF YOU SUBMIT AN INCOMPLETE FORM, YOU MAY BE PENALIZED FOR MISSING A REQUIRED DEADLINE.

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November 16, 2011

Mr. Gerard Martin
Massachusetts Department of Environmental Protection
Southeast Regional Office
Bureau of Waste Site Cleanup
20 Riverside Drive, Lakeville, Massachusetts 02347

Dear Mr. Martin:

Re: Public Comment Drafts
Phase II Comprehensive Site Assessment Addendum
and Response Action Outcome Statement
Former Bird Machine Company
100 Neponset Street
Walpole, Massachusetts
RTN 4-3024222

On behalf of Baker Hughes, Inc. (Baker Hughes), AMEC Earth and Environmental (AMEC) is providing this Public Comment Draft of the Phase II Comprehensive Site Assessment (CSA) Addendum and the Response Action Outcome (RAO) Statement for the Bird Machine Company Site. The Site has been assigned Release Tracking Number (RTN) 4-3024222 and is located at 100 Neponset Street in Walpole, Massachusetts. The attached CSA Addendum updates the nature and extent of contamination for the Demolition Debris Area (DDA) portion of this RTN, based on data collected since the original 2007 CSA for this area. The Addendum includes an updated risk characterization based on the latest data, which finds that a condition of No Significant Risk applies to the DDA portion of the Site.

A Draft Phase III Remedial Action Plan (RAP) for areas of groundwater contamination associated with this RTN was submitted on October 6, 2011. The groundwater contamination is not related to the DDA, and the conclusions of the CSA Addendum do not necessitate revisions to the Draft RAP. A response to public comments on the Draft RAP is being prepared and will be provided shortly. The RAP concludes that a Permanent Solution is feasible through design and implementation of Monitored Natural Attenuation (MNA) for groundwater contaminants. A Final RAP is expected to be completed in December 2011.

The attached Draft RAO Statement indicates that a Temporary Solution (Class C-2 RAO) has been achieved. A Phase III evaluation is nearing completion, a condition of No Substantial Hazard exists, sources of contamination have been identified and eliminated to the extent feasible, and response actions to achieve a Permanent Solution are feasible and will be conducted. MNA will be designed and implemented as an Active Remedial Monitoring Program to advance the Site from a Temporary Solution to a Permanent Solution. MNA is expected to achieve a condition of No Significant Risk at the Site within 5-10 years of implementation. MNA

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has already produced significant reductions in contaminant concentrations at individual wells over the past four years of groundwater monitoring. This alternative appears capable of achieving or approaching background for all contaminants that exceed drinking water standards.

The public comment period for the Draft CSA Addendum and Draft RAO Statement will begin on November 16, 2011 and will extend through December 12, 2011. Comments can be submitted to Chris Clodfelter of Baker Hughes at the following address:

Chris Clodfelter
Senior HS&E Specialist
Baker Hughes Incorporated
2929 Allen Parkway
Suite 2100
Houston, Texas 77019-2118
Office: 713.439.8329 | Fax: 713.439.8383

Copies of the Draft CSA Addendum and Draft RAO Statement will be available at the MassDEP Southeast Regional Office (File Review Telephone Number: 508-946-2718) and at the Walpole Public Library (Telephone Number: 508-660-7341). A copy of the executive summary of the Draft CSA Addendum, which summarizes the findings and conclusions presented in the document, is attached to this letter. A copy of this letter including the summary is being sent via US Mail to the Public Involvement Plan (PIP) Mailing List for the Site.

Baker Hughes will present a summary of the attached documents and be available to answer questions at a public meeting scheduled for Tuesday December 6, 2011, in the Main Meeting Room at Walpole Town Hall. The legal notice for this meeting will be published this week and a copy is attached to this letter. Please contact me if you have any questions regarding the Public Involvement process for this document.

Sincerely,

Kim M. Henry
LSP No. 7122

cc:

Mr. Michael Boynton, Walpole Town Administrator
Ms. Robin Chapell, Walpole Health Agent
Ms. Landis Hershey, Walpole Conservation Agent
Ms. Deborah Burke, Key Petitioner
Public Involvement Plan Mailing List

Enclosures:

1. Copy of Draft Phase II CSA Addendum – Executive Summary
2. Notice of a Public Involvement Plan Meeting for the Former Bird Machine Site

COPY OF DRAFT PHASE II CSA ADDENDUM - EXECUTIVE SUMMARY

On behalf of Baker Hughes, Inc. (BHI), AMEC Earth and Environmental, Inc. (AMEC) has completed a Phase II Comprehensive Site Assessment (CSA) Addendum for the portion of the former Bird Machine Company (BMC) Property located in Walpole, Massachusetts known as the Demolition Debris Area (DDA). The DDA is an exposure area and a portion of the site assigned Release Tracking Number (RTN) 4-3024222 under the Massachusetts Contingency Plan (MCP). This Phase II CSA Addendum serves as an update to a July 2007 Phase II CSA (Weston 2007). It presents the data collected at the DDA from June 2007 to the present, updates to the Phase II CSA as a result of the additional data collected, and an updated risk characterization. A Phase II CSA addressing three other exposure areas, the manufacturing building area (MBA), the lead release area 3 (LRA3), and the south rail spur (SRS) was finalized on October 18, 2011. These two Phase II CSAs together characterize the "Site," which is represented by the single unclosed RTN (4-3024222) at the property.

The Phase II CSA Addendum addresses volatile organic constituents (VOCs), semi-volatile organic constituents (SVOCs), extractable petroleum hydrocarbons (EPH), polycyclic aromatic hydrocarbons (PAHs), dioxin/furan congeners, and various metals detected in soil and groundwater samples collected from the DDA. The Phase II CSA also includes evaluations of asbestos in soil (AIS) identified within this exposure area.

Data from site investigations completed by AMEC, site assessment activities completed by Weston Solutions, Inc. of Concord, New Hampshire (Weston), and information from other sources (e.g., Massachusetts Department of Environmental Protection [MADEP] and United States Environmental Protection Agency [U.S. EPA] guidance documents), were used to complete the CSA.

In accordance with the requirements of 310 CMR 40.0000 Subpart I of the MCP, a Method 3 risk characterization (RC) of harm to human health, public welfare, safety, and the environment was completed. This RC replaces a Method 1 RC that was prepared by Weston. The Method 1 RC addressed soil and groundwater at the DDA and was not able to conclude NSR. Additionally, Weston determined that a Method 3 RC would eventually be necessary to support a response action outcome (RAO) statement due to the presence of dioxins (which are bioaccumulative) in the top two feet of soil, and the presence of asbestos. This Method 3 RC has been conducted assuming that an Activity and Use Limitation (AUL) will be implemented at the Site prohibiting disruption of the ground surface. The risk characterization therefore does not evaluate any Site use or development other than incidental trespassing.

The Phase II investigations presented in this Phase II CSA Addendum consisted of ground water sampling in and around the DDA and soil sampling for asbestos within the DDA.

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The nature and extent of soil contamination at the DDA was previously documented in Weston's 2007 Phase II CSA. Additional asbestos sampling has demonstrated that asbestos could be present within the footprint of the DDA fill area both horizontally and vertically. Groundwater sampling results are consistent with Weston's characterization in the 2007 Phase II CSA. Groundwater contains metals and sporadic PAH detections. Weston's 2007 Phase II CSA determined that these groundwater contaminants do not represent a significant source of contamination to river sediment or surface water.

The results of the human health and environmental risk characterization indicate that a condition of No Significant Risk (NSR) of harm to health, safety, public welfare, and the environment has been achieved at the DDA.

December 16, 2011

Mr. Gerard Martin
Massachusetts Department of Environmental Protection
Southeast Regional Office
Bureau of Waste Site Cleanup
20 Riverside Drive, Lakeville, Massachusetts 02347

Dear Mr. Martin:

Re: Final Phase II Comprehensive Site Assessment Addendum
and Response Action Outcome Statement
Former Bird Machine Company
100 Neponset Street
Walpole, Massachusetts
RTN 4-3024222

On behalf of Baker Hughes, Inc. (Baker Hughes), AMEC Earth and Environmental (AMEC) is submitting the Final Phase II Comprehensive Site Assessment (CSA) Addendum and a Response Action Outcome (RAO) Statement for the Bird Machine Company Site. The Site has been assigned Release Tracking Number (RTN) 4-3024222 and is located at 100 Neponset Street in Walpole, Massachusetts. The attached CSA Addendum updates the nature and extent of contamination for the Demolition Debris Area (DDA) portion of this RTN, based on data collected since the original 2007 CSA for this area. The Addendum includes an updated risk characterization based on the latest data, which finds that a condition of No Significant Risk applies to the DDA portion of the Site.

A Final Phase III Remedial Action Plan (RAP) for areas of groundwater contamination associated with this RTN was submitted on December 14, 2011. The groundwater contamination is not related to the DDA, and the conclusions of the CSA Addendum do not necessitate revisions to the RAP. The RAP concludes that a Permanent Solution is feasible through design and implementation of Monitored Natural Attenuation (MNA) for groundwater contaminants.

The attached RAO Statement indicates that a Temporary Solution (Class C-2 RAO) has been achieved. A Phase III evaluation is complete, a condition of No Substantial Hazard exists, sources of contamination have been identified and eliminated to the extent feasible, and response actions to achieve a Permanent Solution are feasible and will be conducted. MNA will be designed and implemented as an Active Remedial Monitoring Program to advance the Site from a Temporary Solution to a Permanent Solution. MNA is expected to achieve a condition of No Significant Risk at the Site within 5-10 years of implementation. MNA has already produced significant reductions in contaminant concentrations at individual wells over the past four years of groundwater monitoring. This alternative appears capable of achieving or approaching background for all contaminants that exceed drinking water standards.

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A paper copy of the Final CSA Addendum and the Final RAO Statement is being provided to the PIP repository at the Walpole Public Library (Telephone Number: 508-660-7341). The electronic version of each report has been uploaded to the MassDEP website (http://db.state.ma.us/dep/cleanup/sites/Search.asp) and is being provided to the Town of Walpole for upload to their website for this property: http://walpole-ma.gov/BirdMachine.htm. The final reports include responses to public comments on the draft versions issued in November, which were the subject of our public meeting in Walpole on December 6, 2011. Please contact me if you have any questions on this document.

Sincerely,

Kim M. Henry
LSP No. 7122

cc: Mr. Michael Boynton, Walpole Town Administrator
Ms. Robin Chapell, Walpole Health Agent
Ms. Landis Hershey, Walpole Conservation Agent
Ms. Deborah Burke, Key Petitioner
Public Involvement Plan Mailing List

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The results of the human health and environmental risk characterization indicate that a condition of No Significant Risk (NSR) of harm to health, safety, public welfare, and the environment has been achieved at the DDA.

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