304-A West Millbrook Road
Raleigh, North Carolina 27609
Tel: (919) 845-1422 Fax: (919) 845-1424

February 16, 2007   via email

Ms. Rachel Rineheart
U.S. Environmental Protection Agency
Region 5
77 W. Jackson Blvd.
Chicago, IL 60604

Subject: **Impacts Assessment Data for Archer Daniels Midland (ADM)
             Company's Proposed Decatur, Illinois Glycols Plant**

Dear Ms. Rineheart:

Attached to this letter is a memorandum from Steve Zemba of Cambridge Environmental,
Inc. This memo was prepared at my request to evaluate the impacts of emissions
associated with Archer Daniels Midland (ADM) Company's proposed Glycols
Production plant to be located on the grounds of ADM's existing complex in Decatur,
Illinois. This document was prepared based on the procedures outlined in the "Roadmap"
document provided by you on December 20th, 2006.

It is my hope that you will be able to review this document prior to our meeting on
March 1st and my expectation that we can reach a consensus at that meeting on next
steps, if any, that are required to finalize the ESA process for this facility. Please feel
free to call me with any questions you may have on this information. Thanks in advance
for your time and consideration of this matter. I look forward to our discussions.

Sincerely,

Jack M. Burke, P.E.
Senior Project Manager

c: Mike Coffey, U.S. Fish and Wildlife Service
       Staci Bogue-Buchholz, Archer Daniels Midland Company
       Steve Zemba, Cambridge Environmental, Inc.

MEMORANDUM

To: Jack Burke – RTP Environmental Associates, Inc.
               Staci Bogue-Buchholz – Archer Daniels Midland Company

From: Stephen G. Zemba. Ph.D., P.E. – Cambridge Environmental, Inc.

Subject: Ecological Consultation support for ADM's proposed Glycols production facility

Date: February 15, 2007

I write to provide the findings of a screening-level assessment of potential impacts to threatened and endangered wildlife species associated with the proposed construction of a Glycols Production Plant at the Archer Daniels Midland (ADM) facility in Decatur, Illinois. I have conducted some very conservative screening-level calculations that, even under extreme assumptions, indicate no potential adverse impacts should result from the increased emissions from the proposed Glycols plant.

The following text and tables describe my preliminary calculations.

Threatened and endangered species

U.S. EPA Region 5 provided a "roadmap" outline for the ecological consultation that identifies four federally-listed threatened and endangered species for Macon County, Illinois, in which ADM's facility is located. These species are:

- Bald Eagle (*Haliaeetus leucocephalus*);
- Indiana Bat (*Myotis sodalist*);
- Eastern Prairie Fringed Orchid (*Platanthera leucophaea*); and
- Prairie Bush Clover (*Lespedeza leptostachya*).

RTP Environmental's previous consideration of land use in the vicinity of ADM's facility indicates no potentially suitable habitat for the two plant species. EPA Region 5 has agreed with RTP's assessment. Hence, the Bald Eagle and Indiana Bat serve as the focus of my analysis.

Pollutants of Potential Concern, Emission rates, and Concentrations in Ambient Air

I have built on the spreadsheet in which RTP provided estimates of facility emissions and air dispersion modeling results. I understand that the two main sources of potential pollutant emissions are the Glycols Production Plant and the increased consumption of fuels by existing equipment at the ADM facility to supply heat/energy to the proposed production process. All

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Jack Burke and Staci Bogue-Buchholz
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relevant Hazardous Air Pollutant (HAP) emissions are considered. Emission rate estimates are based on the U.S. EPA's AP-42 emission factor methods, and the U.S. EPA's AERMOD model was used to predict the dispersion of pollutant emissions in ambient air. The spreadsheet estimates assume continuous emissions at full rates of production.[1] The modeled concentrations in air are the highest annual-average values (based on five year meteorological data set) predicted at any off-facility ground-level location within 3 km of the ADM's Decatur complex. As there are multiple emission sources, the locations of the maximum projected impacts for all pollutants do not necessarily coincide.

Table 1 provides estimates of the various HAP emission rates and projected worst-case annual average concentrations.[2] I have supplemented RTP's calculations to develop additional modeling estimates for polychlorinated dibenzo(p)dioxin and furan (PCDD/PCDF). The AP-42 emission factors for coal combustion (the potential source of PCDD/PCDF emissions) appear to have been developed prior to the now common treatment of PCDD/PCDF on a toxic equivalency (TEQ) basis, and hence do not reflect congener-specific test data. However, the U.S. EPA's dioxin reassessment work provides more recent and complete information on PCDD/PCDF emissions from coal combustion. These data are provided in Table 2 along with toxic equivalency (TEQ) weighting factors derived for ecological receptors. A total PCDD/PCDF TEQ emission factor is calculated as the summed products of the congener-specific emission factors and the receptor-specific TEQs. The highest overall TEQ emission factor of 0.273 ng TEQ/kg coal (5.45×10^{-10} lb/ton, estimated for birds) is used to derive the emission estimate of 7.64×10^{-9} lb PCDD/PCDF TEQ/hr in conjunction with the maximum coal consumption of 122,745 tons/year anticipated for capacity operation of the Glycols plant. The worst-case ambient PCDD/PCDF TEQ concentration of 7.57×10^{-12} μg/m^3 is estimated using a dispersion modeling transfer factor of 9.90×10^{-4} μg/m^3 per lb/hr for the coal-fired boiler emission source.

Ambient Air Background Screening

Pollutants can potentially affect ecological resources only if emissions are great enough to significantly change existing environmental conditions. For an air pollution source such as ADM's proposed Glycols Plant, the initial question of relevance is whether emissions will lead to substantial increases in the existing background concentrations of pollutants in ambient air. Table 1 compares the worst-case modeled concentrations of pollutants anticipated for Glycols Plant emissions to representative background concentrations taken from the U.S. EPA's 1999 National Air Toxics Assessment (NATA) and ambient sampling programs. Polycyclic aromatic hydrocarbons (PAHs) are grouped according to designations used in the NATA based on relative

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[1] The emissions from increased utilization of existing equipment in ADM's Decatur facility are estimated based on the maximum demand placed on this equipment by the Glycols Plant operating at its full production rate.
[2] Table 1 also includes several chemicals that are not designated as Hazardous Air Pollutants (HAPs) for which the U.S. EPA provides emission factors in its AP-42 database.

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toxicity (*e.g.*, the projected incremental concentrations of ten different PAHs in Group 2 are summed and compared to the NATA Group 2 PAH background concentration). Using a nominal cut off of a 2% increase as a level of insignificant increase to background eliminates most Chemicals of Potential Concern (COPC). Two classes of pollutants require further evaluation: (1) production-related chemicals for which incremental impacts to air are projected to be many times background (ethylene glycol and methanol); and (2) certain COPCs associated with coal combustion emissions (*i.e.*, barium, magnesium, molybdenum, vanadium, zinc, dimethyl sulfate, 7,12-dimethylbenz(a)anthracene, and 3-methylcholanthrene).

Soil, surface water, and sediment comparisons

The ten Chemicals of Potential Concern (COPCs) not eliminated through ambient air background screening are further evaluated with respect to potential impacts to environmental media assuming contaminant deposition from the atmosphere. Simple screening-level models are used to estimate worst-case pollutant concentrations that might result in soil, surface water, and sediment due to emissions from the proposed Glycols Plant. The models are in fact designed to overestimate potential environmental impacts – in some cases by substantial degrees. For each medium, projected increases in concentrations due to facility emissions are compared to available background concentrations and screening-level ecological benchmarks.

The following sources of screening-level ecological benchmarks were searched to identify region-appropriate values for the chemicals of interest:

- The Illinois Water Quality Criteria for aquatic life for surface water benchmarks (http://www.ipcb.state.il.us/documents/dsweb/Get/Document-33354/);

- The U.S. EPA Ecological Soil Screening Levels (SSLs) for soil benchmarks (http://www.epa.gov/ecotox/ecossl/);

- The U.S. EPA Region 5, RCRA Ecological Screening Levels (ESLs) for surface water, soil, and sediment benchmarks (see http://www.epa.gov/reg5rcra/ca/edql.htm); and

- The Risk Assessment Information System (RAIS, http://rais.ornl.gov/), developed and supported by the Oak Ridge National Laboratory (ORNL), which has compiled media-based ecological benchmarks from a number of regulatory databases and sources that collectively cover a wide variety of potential ecological endpoints.

As the last potential source of benchmarks, the RAIS was searched to identify the lowest (and hence most protective) ecotoxicity benchmarks from any of its data sources. This non-selective method is designed to identify the lowest ecotoxicity benchmark established by regulatory authorities under any conditions, and is therefore not necessarily relevant to the specific threatened and endangered species of concern in the vicinity of ADM's Decatur complex.

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Soil modeling and comparisons

Concentrations of most COPCs in soil are estimated with a simple mixing model that assumes pollutants deposit from the atmosphere over a period of thirty years of facility operation and remain within a shallow (1 cm deep) layer of soil (of bulk density 1.5 g/cm^3) near the surface. This soil deposition/concentration model is recommended in the U.S. EPA's multi-pathway risk assessment protocol guidance for untilled soils. A high-end deposition velocity of 1 cm/s is used to estimate deposition based on modeled ground-level concentrations in air.

The fugacity modeling approach developed by the Canadian Environmental Modelling Centre (CEMC)[1] is used to estimate potential concentrations of dimethyl sufate, ethylene glycol, and methanol in soil, as the volatility of these chemicals invalidates the simple mixing model assumptions. The CEMC Soil Model predicts the equilibrium distribution of a pollutant among solid (sorbed), liquid, and air phases in unsaturated soil systems. To apply the model to estimate a concentration in bulk soil from a modeled airborne concentration, the assumption is made that the pollutant concentration in soil air pores is equal to the modeled concentration in air just above the soil layer. Over the long-term, this assumption implies equilibrium conditions exist between the pollutant distribution in surficial soils and ground-level air.

The Soil Model requires the specification of various physicochemical properties as well as properties of the surface soil layer. Chemical-specific parameters include molecular weight, vapor pressure, solubility, octanol-water partition coefficient (K_{ow}), organic carbon partition coefficient (K_{oc}), mineral matter-water partition coefficient (K_{mw}), and degradation half-life, as specified at a standard temperature of 25ºC. Relevant soil parameters include water- and air-filled porosities, organic matter content, and solids densities. Relevant physicochemical properties were obtained from the Risk Assessment Information System (http://rais.ornl.gov/). Model predictions were generated for the CEMC Soil Model's default (Version 3.00) soil profile, for which the key parameters include an overall soil porosity of 50% (30% water-filled pores, 20% air-filled pores) and a 2% organic carbon fraction (dry weight basis). Table 3 provides physicochemical property values and the resulting CEMC Soil Model predictions, transformed into ratios of the predicted concentration in bulk soil to that in the soil-air phase (the soil to air ratio, $C_{soil}/_{soil-air}$).

Table 4 lists the predictions of the soil models, which are based on the worst-case air pollutant concentrations modeled at ground-level (Table 1). Observations relative to background concentrations (for inorganic COPCs) and ecological screening benchmarks include:

- There are no incremental soil concentrations predicted at levels above either background levels or ecotoxicity benchmarks;

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[1] Soil version 3.00, Canadian Environmental Modelling Centre, Trent University, www.trentu.ca/cemc/.

- No ecotoxicity benchmarks were identified for magnesium or dimethyl sulfate; the predicted increment for magnesium, however, is substantially smaller than the background level (magnesium is a significant component of soil), and the modeled increment of dimethyl sulfate is much smaller than levels that can be measured by typical analytical methods; and

- Background concentrations of vanadium and zinc in soil exceed their respective screening-level ecotoxicity benchmarks.

Surface water modeling and comparisons

The screening-level model to estimate worst-case concentrations in surface water assumes that all stack emissions are mixed within Lake Decatur (a widened portion of the Sangamon River), the most significant surface water feature near the ADM facility. Concentrations are calculated by dividing the emission rate of each COPC (Table 1) by the measuring flow rate of the lake/river. The longest running stream gaging station is located at the outlet of Lake Decatur, near where it is crossed by State Route 48 (latitude 39°49'52", longitude 88°58'35", NAD27). Streamflow at this location averaged 699.3 cfs from 1983 to 2005 (http://il.water.usgs.gov/annual_report/data/discl_86/indices0/index.htm). This streamflow rate likely underestimates the amount of water that enters Lake Decatur, which serves as a drinking water supply to the City of Decatur (which actively withdraws water). Surface water concentrations of contaminants calculated by the simple mixing model are provided in Table 5 along with relevant background concentrations (for inorganic COPCs) and ecological screening benchmarks.

Relevant observations include:

- Incremental concentrations of COPCs are smaller than all of their respective surface water benchmark concentrations and background concentrations;

- Neither benchmark nor background concentrations are available for dimethyl sulfate and methanol; the worst-case modeled concentration of dimethyl sulfate is lower than typical detection limits for volatile organic compound analyses; and

- The background concentration of magnesium is significantly greater than its benchmark concentration.

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Sediment modeling and comparisons

Sediment concentrations are estimated under the assumption that all stack emissions deposit within Lake Decatur and remain in the bottom sediment. COPC concentrations in sediment (Table 6) are estimated as the projected facility emission rates (Table 1) divided by the rate of sediment deposition. A recent study estimates that 8.3 acre-ft of sediment are deposited within Lake Decatur each year at an average density of 1,056 tons/acre-ft,[3] which equates to an annual sediment deposition rate of 8,765 tons/yr. Table 6 compares worst-case sediment concentrations to background levels (as measured in Lake Decatur sediments) and benchmark concentrations.

Preliminary observations concerning predicted concentrations of COPCs in sediments include

- Few benchmark concentrations are available for COPCs in sediment; predicted incremental concentrations in sediment are much smaller than ecotoxicity benchmark concentrations for the three COPCs for which they are available;

- The modeled worst-case concentrations in sediment are smaller than representative background concentrations for the inorganic COPCs;

- Neither benchmark concentrations nor ecotoxicity thresholds are available for the three organic chemicals (dimethyl sulfate, ethylene glycol, and methanol);

- An alternate, yet still conservative, model for sediment might be to assume that all potential facility emissions mix into the water column and adhere to suspended sediment; based on an average total suspended solids concentration of 23.4 mg/l measured in 29 samples collected in Lake Decatur from 2001 to 2003 (http://www.epa.gov/storet) and the Lake's exit streamflow of 699.3 cfs from 1983 to 2005 (see surface water modeling), the alternate model would predict incremental COPC sediment concentrations about two times lower than those listed in Table 6; and

- The estimated concentrations in ethylene glycol and methanol in sediment are relatively high with respect to typical levels of organic compounds in sediment, a likely consequence of the overpredictive nature of the mixing model that assumes complete deposition of all emissions within Lake Decatur sediments; further, ethylene glycol and methanol share similar physicochemical properties of complete miscibility with water and limited (if any) tendency to associate with solids (as evidenced by low Kow/Koc values, Table 3), making the sediment retention model unrealistic as constructed for these COPCs – if introduced to aquatic systems, methanol will almost predominantly dissolve in the water phase and remain in the water column, where it is expected to rapidly biodegrade.[4]

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[3] Bogner, W., *Sedimentation Survey of Lake Decatur's Basin 6, Macon County, Illinois*, Illinois State Water Survey Champaign, IL, Contract Report 2001-07. The average sediment density of 1,056 tons/acre-ft is calculated as the total sediment weight (1,421,437 tons) divided by the accumulation volume (1,346 acre-ft) (see Table 3 of the Water Survey report).

[4] An evaluation of methanol's fate and transport is available at http://www.methanol.org/pdf/evaluation.pdf.

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Conclusions and Recommendations

Considering the simplicity/conservatism of the models considered, there is no reason to believe that there are any potential concerns with respect to ecological risks, as judged by the comparisons with available ecotoxicity benchmark concentrations. The simple fate-and-transport models do not account for removal/degradation by chemical reactions, leaching, and/or biodegradation, a factor of potential significance to all of the organic chemicals (and still another reason to believe that the simple "mix in" models greatly over-predict the likely consequences of facility emissions. The organic process-related chemicals potentially emitted in the greatest amounts (ethylene glycol and methanol) are also not known to bioaccumulate to any significant degree, and hence potential risks from foodchain pathways to the predatory species of interest (Indiana bat and bald eagle) are not likely to be significant. Polychlorinated dioxins and furans, a potentially greater foodweb concern due to their bioaccumulative nature, are not likely to be of concern due to the low level of their impacts relative to background. Coal combustion is not a large emission source of these compounds, as reflected by the model estimates relative to background. The predicted worst-case ambient air concentration of PCDD/PCDF TEQs is less than 0.1% of the representative ambient background level (<0.1%, Table 1). Based on the low levels of projected impacts and the conservative assumptions used to develop them, I see no reason to conduct a more detailed foodweb evaluation for the threatened and endangered species of concern.

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Table 1   Background Screening of Projected Ambient Air Impacts [A]
Chemicals of Potential Concern are highlighted in color (see note A for explanation)

Air Pollutant (non-HAPs *italicized*)	Emission Rate (lb/hr)	Highest Predicted Increment to Ambient Air (μg/m^3)	Background Concentration (μg/m^3) [B]	Worst-case percentage increase to existing background
Metals and inorganic compounds				
Antimony	2.52E-04	2.50E-07	3.94E-04	0.1%
Arsenic	5.76E-03	6.21E-06	9.41E-03	0.1%
Barium	3.12E-04	8.14E-05	1.82E-02 (9.2%)	0.4%
Beryllium	2.95E-04	3.23E-07	4.63E-04	0.1%
Cadmium	7.93E-04	2.04E-05	1.16E-03	1.8%
Chromium	3.74E-03	2.60E-05	4.29E-03	0.6%
Chromium (VI)	1.21E-03	2.59E-05	3.94E-03	0.7%
Cobalt	1.41E-03	1.61E-06	2.37E-03	0.1%
Copper	6.02E-05	1.57E-05	3.53E-03 (45%)	0.4%
Hydrogen chloride	9.00E+01	8.91E-02	5.84E+00	1.5%
Lead	6.13E-03	8.66E-05	2.20E-02	0.4%
Magnesium	1.54E-01	1.53E-04	1.47E-02 (7.9%)	1.0%
Manganese	6.89E-03	7.79E-06	1.34E-02	0.1%
Mercury	1.35E-02	1.40E-05	1.63E-03	0.9%
Molybdenum	7.79E-05	2.04E-05	3.60E-03 (2.1%)	0.6%
Nickel	4.07E-03	3.89E-05	7.95E-03	0.5%
Selenium	1.82E-02	1.81E-05	2.89E-02	0.1%
Vanadium	1.63E-04	4.26E-05	1.70E-03 (6.9%)	2.5%
Zinc	2.05E-03	5.37E-04	2.27E-02 (98.3%)	2.4%

Table 1   Background Screening of Projected Ambient Air Impacts [A]
Chemicals of Potential Concern are highlighted in color (see note A for explanation)

Air Pollutant (non-HAPs *italicized*)	Emission Rate (lb/hr)	Highest Predicted Increment to Ambient Air ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$) [B]	Worst-case percentage increase to existing background
Organic compounds (except PAHs)				
1,1,1-Trichloroethane	2.80E-04	2.77E-07	1.21E+00	0.0%
2,4-Dinitrotoluene	3.92E-06	3.88E-09	1.31E-05	0.0%
2-Chloroacetophenone	9.81E-05	9.71E-08	8.17E-06	1.2%
Acetaldehyde	7.99E-03	7.91E-06	7.97E-01	0.0%
Acetophenone	2.10E-04	2.08E-07	3.49E-04	0.1%
Acrolein	4.06E-03	4.02E-06	1.95E-02	0.0%
Benzene	1.84E-02	3.92E-05	6.91E-01	0.0%
Benzyl chloride	9.81E-03	9.71E-06	8.19E-04	1.2%
Biphenyl	2.38E-05	2.36E-08	3.97E-05	0.1%
Bis(2-ethylhexyl)phthalate (DEHP)	1.02E-03	1.01E-06	1.60E+00	0.0%
Bromoform	5.46E-04	5.41E-07	2.10E-02	0.0%
Carbon disulfide	1.82E-03	1.80E-06	4.99E-02	0.0%
Chlorobenzene	3.08E-04	3.05E-07	1.24E-02	0.0%
Chloroform	8.27E-04	8.18E-07	4.76E-02	0.0%
Cumene	7.43E-05	7.35E-08	1.00E-04	0.1%
Dichlorobenzene	8.50E-05	2.22E-05	1.33E-02	0.2%
Dimethyl sulfate	6.73E-04	6.66E-07	5.65E-08	1179.3%
Ethyl benzene	1.32E-03	1.30E-06	1.22E-01	0.0%
Ethyl chloride	5.89E-04	5.83E-07	1.89E-03	0.0%
Ethylene dibromide	1.68E-05	1.66E-08	1.91E-02	0.0%
Ethylene dichloride	5.60E-04	5.55E-07	3.30E-02	0.0%
Ethylene Glycol	1.81E+00	4.05E+00	7.99E-03	50768.0%
Formaldehyde	8.68E-03	1.39E-03	9.86E-01	0.1%
Hexane	1.28E-01	3.33E-02	9.85E+00	0.3%
Isophorone	8.13E-03	8.05E-06	1.11E-03	0.7%
Methanol	9.12E+00	1.92E+01	6.26E-01	3060.7%
Methyl bromide	2.24E-03	2.22E-06	7.70E-02	0.0%
Methyl chloride	7.43E-03	7.35E-06	1.20E+00	0.0%

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Table 1   Background Screening of Projected Ambient Air Impacts [A]
Chemicals of Potential Concern are highlighted in color (see note A for explanation)

Air Pollutant (non-HAPs *italicized*)	Emission Rate (lb/hr)	Highest Predicted Increment to Ambient Air (μg/m^3)	Background Concentration (μg/m^3) [B]	Worst-case percentage increase to existing background
Methyl hydrazine	2.38E-03	2.36E-06	1.74E-04	1.4%
Methyl methacrylate	2.80E-04	2.77E-07	1.31E-04	0.2%
Methyl tert butyl ether	4.90E-04	4.86E-07	1.87E-02	0.0%
Methylene chloride	4.06E-03	4.02E-06	3.39E-01	0.0%
Napthalene	2.25E-04	1.13E-05	1.67E-02	0.1%
Phenol	2.24E-04	2.22E-07	2.42E-02	0.0%
PCDD/PCDF TEQs [C]	7.64E-09	7.57E-12	1.50E-08 [C]	0.1%
Propionaldehyde	5.32E-03	5.27E-06	1.95E-01	0.0%
Styrene	3.50E-04	3.47E-07	1.12E-02	0.0%
Tetrachloroethylene	6.03E-04	5.96E-07	1.51E-01	0.0%
Toluene	3.60E-03	6.30E-05	9.88E-01	0.0%
Vinyl acetate	1.06E-04	1.05E-07	7.97E-03	0.0%
Xylenes	5.18E-04	5.13E-07	7.09E-01	0.0%
Polycyclic Aromatic Hydrocarbons (PAHs) [D]				
Group 2 PAHs [D]				
2-Methylnaphthalene	3.44E-06	5.65E-07		
Acenaphthene	7.40E-06	4.25E-08		
Acenaphthylene	3.76E-06	4.24E-08		
Anthracene	3.29E-06	5.65E-08		
Benzo(b,j,k)fluoranthene	1.54E-06	1.53E-09		
Benzo(g,h,i)perylene	5.50E-07	2.82E-08		
Fluoranthene	1.04E-05	7.08E-08		
Fluorene	1.32E-05	6.61E-08		
Phenanathrene	4.03E-05	4.01E-07		
Pyrene	5.34E-06	1.18E-07		
Total Group 2 PAHs		1.39E-06	3.04E-03	0.0%

Table 1 Background Screening of Projected Ambient Air Impacts [A]
Chemicals of Potential Concern are highlighted in color (see note A for explanation)

Air Pollutant (non-HAPs *italicized*)	Emission Rate (lb/hr)	Highest Predicted Increment to Ambient Air ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$) [B]	Worst-case percentage increase to existing background
Group 3 PAHs [D]				
7,12-Dimethylbenz(a)anthracene	2.29E-06	3.76E-07		
Total Group 3 PAHs		3.76E-07	7.70E-07	48.9%
Group 4 PAHs [D]				
3-Methylcholanthrene	2.58E-07	4.23E-08		
Total Group 4 PAHs		4.23E-08	0.00E+00	#N/A
Group 5 PAHs [D]				
5-Methyl chrysene	3.08E-07	3.05E-10		
Benzo(a)pyrene	7.04E-07	2.82E-08		
Dibenzo(a,h)anthracene	1.72E-07	2.82E-08		
Total Group 5 PAHs		5.68E-08	4.09E-05	0.1%
Group 6 PAHs [D]				
Benzo(a)anthracene	1.38E-06	4.24E-08		
Benzo(b)fluoranthene	2.58E-07	4.23E-08		
Benzo(k)fluoranthene	2.58E-07	4.23E-08		
Indeno(1,2,3-cd)pyrene	1.11E-06	4.24E-08		
Total Group 6 PAHs	1.38E-06	1.69E-07	2.10E-04	0.1%
Group 7 PAHs [D]				
Chrysene	1.66E-06	4.24E-08		
Total Group 7 PAHs		4.24E-08	1.45E-04	0.0%

Table 1   Background Screening of Projected Ambient Air Impacts [A]
Chemicals of Potential Concern are highlighted in color (see note A for explanation)

Air Pollutant (non-HAPs *italicized*)	Emission Rate (lb/hr)	Highest Predicted Increment to Ambient Air ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$) [B]	Worst-case percentage increase to existing background

Notes: A   Chemicals of Potential Concern are those highlighted in green for which projected worst-case facility-related incremental concentrations exceed 2% of the existing representative ambient background concentration and those highlighted in blue for which incremental concentrations may exceed the 2% background threshold (due to uncertainty in the background estimate)

B   Background concentrations for most chemicals are those predicted in the U.S. EPA's 1999 National Air Toxics Assessment modeling study for the census tract in which the ADM facility is located (http://www.epa.gov/ttn/atw/nata1999/nsata99.html). Concentrations followed by parenthetical percentages reflect measured values in Decatur, IL in 2005 based on speciation of fine particle (PM2.5) samples. Since PM2.5 constitutes only a portion of total suspended particulate matter, the measured values underestimate background, and the degree of underestimation is likely substantial for chemicals such as magnesium that typically derive from crustal sources and hence are predominantly found on coarse particles. The percentage values that follow the background concentrations indicate frequency of detection with respect to analytical detection limits. Since the background concentrations of infrequently detected chemicals influence the reported annual average concentrations (non-detects are included in averages at ½ of reported detection limits), background estimates for some chemicals are uncertain, and hence barium, magnesium, and molybdenum are retained as Chemicals of Potential Concern even though projected incremental concentrations are smaller than 2% of background.

C   PCDD/PCDF TEQs represent the sum of polychlorinated dibenzo(p)dioxin and furan congeners weighted by toxicity equivalency factors relative to the 2,3,7,8-tetrachlorodibenzo(p)dioxin congener. The background concentration of 15 fg/m^3 (1.5E-08 $\mu g/m^3$) is a representative background concentration for rural areas in Illinois derived from the National Dioxin Air Monitoring Network (see http://www.epa.gov/ncea/pdfs/dioxin/dei/NDAMN_PAPER3a.pdf and http://esm.versar.com/pprp/features/Atmosdep/national_site_links/NDAMN-2002.ppt).

D   Polycyclic aromatic hydrocarbons (PAHs) are grouped according to their relative toxicity as considered in the U.S. EPA's 1999 National Air Toxics Assessment (http://www.epa.gov/ttn/atw/nata1999/99pdfs/pomapproachjan.pdf).

Table 2   Polychlorinated dibenzo(*p*)dioxin and furan (PCDD/PCDF) emission factors
expressed on a toxic equivalency (2,3,7,8-tetrachlorodibenzo(*p*)dioxin TEQ) basis

PCDD/PCDF Congener	Emission factor (ng/kg coal) [A]		Toxic Equivalency (TEQ) Factor [B]			TEQ Emission Factor (ng TEQ/kg coal)		
	ND=0	ND=1/2 DL	Mammals	Birds	Fish	Mammals	Birds	Fish
2,3,7,8-TCDD	0.005	0.018	1	1	1	0.018	0.018	0.018
1,2,3,7,8-PeCDD	0	0.016	1	1	1	0.016	0.016	0.016
1,2,3,4,7,8-HxCDD	0	0.034	0.1	0.05	0.5	0.0017	0.017	0.0017
1,2,3,6,7,8-HxCDD	0.004	0.028	0.1	0.01	0.01	0.00028	0.00028	0.00028
1,2,3,7,8,9-HxCDD	0.004	0.035	0.1	0.1	0.01	0.0035	0.00035	0.0035
1,2,3,4,6,7,8-HpCDD	0.216	0.241	0.01	0.001	0.001	0.00024	0.00024	0.00024
OCDD	0.513	0.644	0.0001	0.0001	0.0001	6.4E-05	6.4E-05	6.4E-05
2,3,7,8-TCDF	0.109	0.117	0.1	1	0.05	0.0117	0.117	0.00585
1,2,3,7,8-PeCDF	0.007	0.021	0.05	0.1	0.05	0.00105	0.0021	0.00105
2,3,4,7,8-PeCDF	0.074	0.084	0.5	1	0.5	0.042	0.084	0.042
1,2,3,4,7,8-HxCDF	0.098	0.12	0.1	0.1	0.1	0.012	0.012	0.012
1,2,3,6,7,8-HxCDF	0.014	0.03	0.1	0.1	0.1	0.003	0.003	0.003
1,2,3,7,8,9-HxCDF	0.013	0.038	0.1	0.1	0.1	0.0038	0.0038	0.0038
2,3,4,6,7,8-HxCDF	0.043	0.06	0.1	0.1	0.1	0.006	0.006	0.006
1,2,3,4,6,7,8-HpCDF	0.354	0.385	0.01	0.01	0.01	0.00385	0.00385	0.00385
1,2,3,4,7,8,9-HpCDF	0.087	0.112	0.01	0.01	0.01	0.00112	0.00112	0.00112
OCDF	0.158	0.281	0.0001	0.0001	0.0001	2.8E-05	2.8E-05	2.8E-05
PCDD/PCDF TEQ Totals	1.699	2.264				0.13072	0.27268	0.13063

Notes: A   EPA/600/P-00/001Cb, December 2003 Exposure and Human Health Reassessment of 2,3,7,8-
Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds National Academy Sciences (NAS)
Review Draft www.epa.gov/ncea, Table 4-19.

B   EPA/630/P-03/002A, June 2003, External Review Draft, Framework for Application of the Toxicity
Equivalence Methodology for Polychlorinated Dioxins, Furans and Biphenyls in Ecological Risk
Assessment

Table 3   CEMC Soil Model (version 3.00) input parameters and predictions [A]

Parameter [B]	Methanol	Ethylene Glycol	Dimethyl Sulfate
Molecular weight (g/mol)	32.04	62.07	126.13
Vapor Pressure (Pa)	16500	12.3	90.3
Solubility (g/m^3)	1.00E+06	1.00E+06	28000
Log(Octanol-water partition coefficient – K_{ow})	-0.77	-1.36	0.16
Organic carbon partition coefficient (K_{oc}) (l/kg)	1	1	24.17
Mineral matter-water partition coefficient (K_{mw}) (l/kg) [C]	1	1	1
Degradation half-life (hours) [D]	1.00E+11	1.00E+11	1.00E+11
Soil to air ratio (C_{soil}/C_{air}) derived from CEMC Soil Model predictions (mg/kg per μg/m^3)	0.00464	3.22	0.00828
Worst-case modeled concentration in air C_{air} (μg/m^3) (Table 1)	1.92E+01	4.05E+00	6.66E-07
Predicted equilibrium concentration in soil (mg/kg) ($C_{soil}/C_{air} \times C_{soil\text{-}air}$)	8.89E-02	1.31E+01	5.51E-09

Notes:
   [A] The CEMC Soil Model (Soil version 3.00, Canadian Environmental Modelling Centre, Trent University, is available on-line at www.trentu.ca/cemc/.
   [B] Property values (specified at 25°C) from the Human Health Risk Assessment Protocol's chemical database (http://www.epa.gov/earth1r6/6pd/rcra_c/protocol/protocol.htm) unless otherwise noted.
   [C] Value of 1 l/kg is provided for the default value for all chemicals in the CEMC Soil Model library.
   [D] Value assigned a very large number to discount the potential effects of degradation (note that this parameter is not important to predicting the equilibrium distribution among phases in soil).

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Table 4   Estimated impacts of facility emissions to soil

Chemical of Potential Concern	Concentrations in Soil (mg/kg)		
	Worst-case modeled increment due to proposed facility emissions [A]	Background [C]	Benchmark [E]
Metals and Inorganic Compounds			
Barium	5.14E-02	1.10E+02	3.30E+02 [H]
Magnesium	9.62E-02	4.82E+03	#N/A
Molybdenum	1.28E-02	1.20E+00 [D]	2.00E+00 [F]
Vanadium	2.68E-02	2.52E+01	7.80E+00 [H]
Zinc	3.38E-01	9.50E+01	6.62E+00
Organic Compounds			
Dimethyl Sulfate	5.51E-09 [B]	#N/A	#N/A
Ethylene Glycol	1.31E+01 [B]	#N/A	9.00E+01 [G]
Methanol	8.89E-02 [B]	#N/A	3.30E+01 [G]
7,12-Dimethylbenz(a)anthracene	2.37E-04	#N/A	1.63E+01
3-Methylcholanthrene	2.67E-05	#N/A	7.79E-02

Notes:
- A   Concentrations in soil are calculated with the deposition/surface mixing model, unless noted
- B   Concentrations calculated with the CEMC/equilibrium approach
- C   Background values from a statewide survey of soils located within Metropolitan Statistical Areas (see http://www.ilga.gov/commission/jcar/admincode/035/03500742ZZ9996agR.html)
- D   Average concentration measured in seven Illinois surface soil samples in a recent nationwide transect crossing southern Illinois – see http://pubs.usgs.gov/of/2005/1253/pdf/OFR1253.pdf (Open file report 2005-1253, *Major- and Trace-Element Concentrations in Soils from Two Continental-Scale Transects of the United States and Canada*, U.S. Geological Survey)
- E   Benchmark concentrations are U.S. EPA Ecological Screening Levels (ESLs) unless noted (see http://www.epa.gov/RCRIS-Region-5/ca/ESL.pdf for ESL descriptions)
- F   U.S. EPA Region 4 Soil Screening Benchmark, as obtained from the Oak Ridge National Laboratory's Risk Assessment Information System (http://rais.ornl.gov/)
- G   Dutch Intervention Soil Screening Benchmark, as obtained from the Oak Ridge National Laboratory's Risk Assessment Information System (http://rais.ornl.gov/)
     U.S. EPA Interim Ecological Soil Screening Level (ECO-SSL) of 330 mg/kg for barium based on soil invertebrate toxicity (the interim ECO-SSL for mammalian toxicity is 2000 mg/kg); U.S. EPA Interim
- H   Ecological Soil Screening Level (ECO-SSL) of 7.8 mg/kg for vanadium based on avian toxicity (the interim ECO-SSL for mammalian toxicity is 280 mg/kg); see http://www.epa.gov/ecotox/ecossl/

Table 5   Estimated impacts of facility emissions to surface water

Chemical of Potential Concern	Concentrations in Surface Water (μg/l)		
	Worst-case modeled increment due to proposed facility emissions [A]	Background [B]	Benchmark [C]
Metals and Inorganic Compounds			
Barium	1.98E-03	5.16E+01	5.00E+03 [F]
Magnesium	9.81E-01	2.56E+04	6.47E+02 [D]
Molybdenum	4.96E-04	#N/A	7.30E+01 [E]
Vanadium	1.04E-03	#N/A	1.20E+01
Zinc	1.31E-02	5.00E+00	1.00E+03 [F]
Organic Compounds			
Dimethyl Sulfate	4.28E-03	#N/A	#N/A
Ethylene Glycol	1.15E+01	#N/A	1.92E+05 [E]
Methanol	5.80E+01	#N/A	#N/A
7,12-Dimethylbenz(a)anthracene	1.46E-05	#N/A	5.48E-01
3-Methylcholanthrene	1.64E-06	#N/A	8.91E-02

Notes:
- A Concentrations in surface water are worst-case estimates that assume 100% of the proposed emission increases mix into Lake Decatur
- B Background values from sampling conducted in Lake Decatur in 2001 to 2003. Values represent the averages of five samples except for zinc, for which the value of 5 μg/l represents the single detected value in five samples (also the approximate value of the method detection limit). Values obtained from the U.S. EPA's STORET database (http://www.epa.gov/storet).
- C Benchmark concentrations are U.S. EPA Ecological Screening Levels (ESLs) unless noted (see http://www.epa.gov/RCRIS-Region-5/ca/ESL.pdf for ESL descriptions)
- D U.S. EPA Region 6 Surface Water Screening Benchmark, as obtained from the Oak Ridge National Laboratory's Risk Assessment Information System (http://rais.ornl.gov/)
- E Canadian Water Quality Guideline Surface Water Screening Benchmark, as obtained from the Oak Ridge National Laboratory's Risk Assessment Information System (http://rais.ornl.gov/)
- F Values are Illinois Water Quality Standards based on the protection of Indigenous Aquatic Life (see http://www.ipcb.state.il.us/documents/dsweb/Get/Document-33354/)

Table 6   Estimated impacts of facility emissions to sediment

Chemical of Potential Concern	Concentrations in Sediment (mg/kg)		
	Worst-case modeled increment due to proposed facility emissions [A]	Background [B]	Benchmark [D]
Metals and Inorganic Compounds			
Barium	1.56E-01	1.85E+02	#N/A
Magnesium	7.70E+01	8.30E+03 [C]	#N/A
Molybdenum	3.89E-02	< 2.00E+00 [C]	#N/A
Vanadium	8.14E-02	7.50E+01 [C]	#N/A
Zinc	1.03E+00	8.75E+01	1.21E+02
Organic Compounds			
Dimethyl Sulfate	3.36E-01	#N/A	#N/A
Ethylene Glycol	9.03E+02	#N/A	#N/A
Methanol	4.56E+03	#N/A	#N/A
7,12-Dimethylbenz(a)anthracene	1.15E-03	#N/A	6.64E+01
3-Methylcholanthrene	1.29E-04	#N/A	8.19E+03

Notes:

A   Concentrations in sediment are worst-case estimates that assume 100% of the proposed emission increases mix into Lake Decatur bottom sediments

B   Unless noted, background values from sampling conducted in Lake Decatur in 2003, unless noted. Values represent the averages of two samples. Values obtained from the U.S. EPA's STORET database (http://www.epa.gov/soret).

Background values sampled and reported in 1996 by the U.S. Geological Survey for bed sediment
C   in the Sangamon River near Monticello, IL, the main tributary that feeds Lake Decatur.   See http://pubs.usgs.gov/wdr/2005/wdr-il-05/data/swq_m_96/alt_1.htm for data.

D   Benchmark concentrations are U.S. EPA Ecological Screening Levels (ESLs) (see http://www.epa.gov/RCRIS-Region-5/ca/ESL.pdf for ESL descriptions)