UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

OCT 12 2006

REPLY TO THE ATTENTION OF

(AR-18J)

Richard Nelson, Field Supervisor
Rock Island Illinois Field Office
United States Fish and Wildlife Service
4469 48th Avenue Court
Rock Island. Illinois 61201

Dear Mr. Nelson:

Pursuant to Section 7 of the Endangered Species Act (ESA), (87 Stat. 884, as amended; 16 U.S. C. 1531 et seq.), the United States Environmental Protection Agency (USEPA) has reviewed the biological information and analysis related to a Prevention of Significant Deterioration (PSD) permit for the Lafarge Midwest, Inc. Joppa Cement Plant to determine what impact there may be to any threatened or endangered species in the area around the proposed facility. The purpose of this letter is to seek concurrence from the United States Fish and Wildlife Service (USFWS) on our determination that the proposed project is not likely to adversely affect any federally listed species in relation to the proposed air quality permit for this facility.

The parties utilized the informal consultation process as specified in the "Endangered Species Consultation Handbook, procedures for conducting consultation and conference activities under Section 7 of the Endangered Species Act, (March 1998 final)," by the USFWS and National Marine Fisheries Service. The USEPA prepared this biological assessment following the guidance provided in the ESA consultation handbook, as well as the recommended content suggested in the ESA regulations found in 50 CFR Part 402.12(f). As part of developing the biological evaluation, Cambridge Environmental prepared a project impact analysis on behalf of Lafarge, dated March 24,2006. This document was subsequently revised on April 11 and May 18,2006.

Project Description

Lafarge plans to expand its cement manufacturing operations at its Joppa Cement Plant, increasing annual production capacity to 3.25 million tons of cement. The expansion project will include:

- Installation of two new preheater/precalciner kiln systems,
- Shutdown of existing kiln #2,

Recycled/Recyclable ▪ Printed with Vegetable Oil Based Inks on 100% Recycled Paper (50% Postconsumer)

- Installation of two new finish mills; and
- Changes to material handling operations.

The increase in carbon monoxide (CO) resulting from the project of 2913 tons per year has triggered the requirement for a PSD permit. The project will result in small increases of sulfur dioxide (SO2) and nitrogen oxides (NOx) of 39 tons per year, volatile organic compounds (VOC) of 29 tons per year, and lead of 0.1 tons per year. The project will result in a decrease in particulate matter (PM/PM10) emissions. The emission changes in hazardous air pollutant emissions resulting from the project are summarized in Table 2 of the Cambridge Environmental analysis which is provided as an attachment to this letter.

Action Area

The Joppa Cement Plant is located in Massac County, Illinois near the border of Pulaski County, Illinois. The Ohio River is to the south. Rather than defining the action area for this project, worst case surface water, sediment, air and soil concentrations were determined and compared to the appropriate benchmarks for each species.

List of Species

There are five listed species potentially occumng in Massac County, and one additional species potentially occurring in Pulaski County. These species include:

Indiana Bat;
Pink mucket pearly mussel;
Fat pocketbook pearly mussel;
Least tern;
Spectacle case mussel; and
- Orange-footed pearly mussel.

Summary of Analysis

Cambridge Environmental performed modeling for emissions associated with the planned project. Air concentrations were estimated using the ISCST3 model. Surface water concentrations were estimated using a screening-level model to estimate worst-case concentrations assuming that all stack emissions are mixed within the Ohio River. Sediment concentrations were estimated assuming that all stack emissions mix into the Ohio River and blend with the exiting solids suspended in the river. Soil concentrations were estimated using a simple mixing model that assumed that hazardous air pollutants deposit from the atmosphere over a period of thirty years of facility operation and remain within a shallow layer near the surface. A more detailed discussion of the modeling performed can be found in the impact analysis which has been included as Attachment 1 to this letter.

ESA Effects Analysis

Criteria Pollutants

Ozone: The project will result in a small increase in VOC emissions of 29 tons per year. At the current time, USEPA is unaware of any reliable means to assess ozone changes through "point source" modeling. Although point source screening models have been developed, they have not been consistently applied with success for source changes of this small magnitude. Such screening models were developed for much larger VOC and NOx sources and/or emissions changes. Urban scale photochemical ozone models, such as the Urban Airshed Model, could be employed to assess the ambient impact of emission increases as well as emission decreases resulting from the implementation of emissions control programs. Past experience, however, with such models indicates that a VOC change of 29 tons per year would not produce a predicted change in ozone concentrations. The Urban Airshed Model, for example, has been shown to be relatively insensitive to changes in VOC emissions. Past modeling results considering VOC emissions changes on the order of hundreds to several thousand tons per year of VOC in major urban areas have shown only modest decreases in predicted peak ozone concentrations. Therefore, it is concluded that such models would likely show a zero ozone change for a VOC increase of 29 tons per year. Stated another way, based on the best available tools and information that exist today, one would not expect any measurable change in ambient ozone concentrations due to the Project's projected worst case VOC emissions increase of 29 tons per year. Based on this information, USEPA concludes the project will have no measurable effect, if not no effect, on the endangered species with respect to ozone. At a minimum, the project is not likely to adversely effect the endangered species as no measurable change in ozone will result from the project.

SO2 and NOx: The projected increase in emissions for both pollutants is 39 tons per year; however, due to changes in source configuration the estimated ambient concentrations of those pollutants actually decrease as a result of the project. This is due to the elimination of emissions from a presently-used shorter stack. Because ambient concentrations are anticipated to decrease as a result of this project, USEPA finds that the project is not likely to have an adverse impact on any of the endangered species due to the changes in SO2 and NOx emissions resulting from the proposed project.

PM/PM10: The project will result in a decrease in PM emissions of 200 tons per year and of 9 tons per year of PM10. Because the project will result in a decrease in emissions from current levels, USEPA finds that the project is not likely to have an adverse impact on any of the endangered species due to PM/PM10 emissions impacts.

Lead: An increase of 0.1 tons per year is projected for this project. The results of modeling for lead can be found in Table 2 of the Cambridge Environmental impacts analysis. Table 2 also contains a hazard quotient for lead, which was calculated as the ratio of the predicted contaminant concentration in an environmental media divided by the corresponding benchmark concentration for that media. The hazard quotients for all media for lead are well below one, indicating that no adverse impacts would be anticipated.

CO: All modeled increases are below the significant impact levels. In addition, modeling performed for the PSD permit shows compliance with the primary and secondary National Ambient Air Quality Standards (NAAQS). USEPA believes that compliance with the NAAQS would be protective of the listed species.

Hazardous Air Pollutants

Hazardous air pollutant impacts from the project were evaluated using the hazard quotient approach as discussed above for lead. A more detailed discussion of the approach is provided in the Cambridge Environmental impacts analysis. The hazard quotient exceeded 1 for the sediment and soil impacts from benzene, the soil impacts for naphthalene, the soil impacts for selenium.

The modeling performed for this analysis is very conservative, and likely over-predicts some impacts by several orders of magnitude. USEPA has reviewed the explanation of modeled results provided by Cambridge Environmental in it's analysis in the section titled "Screening-level Ecotoxicity Hazard Ratios." Based on this information, USEPA does not believe that an adverse impact is likely to occur based on the emissions from the project with respect to soil impacts.

USEPA has provided additional analysis of surface water and sediment impacts in Attachment 2 "Additional Information and Analysis of Surface Water and Sediment Impacts from the Lafarge Midwest, Inc – Joppa Cement Plant Expansion." Based on this additional analysis and the analysis provided by Cambridge Environmental, USEPA does not believe an adverse impact is likely to occur based on the emissions of hazardous air pollutants with respect to sediment or surface water contamination.

ESA Determination

After reviewing the analysis provided by Cambridge Environmental, the pollutants with the greatest potential for adverse impact would include benzene, naphthalene, selenium and polychlorinated dioxins and furans. However, due to the conservative assumptions made in the screening level models, we believe that the impacts have been greatly over-predicted.

Considering this analysis in its entirety, USEPA concludes that the proposed construction and operation of this facility may affect, but is not likely to adversely affect, any of the threatened and endangered species. USEPA respectfully requests USFWS concurrence on this determination.

Sincerely yours,

Pamela Blakley

Pamela Blakley, Chief
Air Permits Section

Attachments

cc: Laurel Kroak, IEPA

MEMORANDUM

To: Michael Pelan and Timothy Weible

From: Stephen Zemba, Ph.D., P.E.

Subject: Project update – Potential impact of Joppa facility expansion on threatened and endangered species

Date: March 24,2006
Revised April 11,2006 to add new Figures 6–10
Further revised May 18,2006 per discussion with U.S. EPA Region 5

I write to provide a sense of the preliminary findings of the screening-level assessment of potential impacts to threatened and endangered wildlife species associated with the proposed expansion of Lafarge's Joppa facility. At this point, my summary is sketchy, but I would like to convey the sense that I anticipate being able to demonstrate that there are no significant risks to threatened and endangered species. To this point, I have conducted some very conservative screening-level calculations that, even under extreme assumptions, indicate no potential adverse impacts should result from increased emissions from the proposed facility stacks for most contaminants. There are a few contaminants that fail the simple screening-level tests, but I expect that refined modeling and consideration will be able to demonstrate insignificant risks for those chemicals also.

The following text and tables describe my preliminary calculations.

Threatened and endangered species

There are four federally-listed threatened and endangered species for Massac County, Illinois, in which Lafarge's Joppa facility is located, and a fifth has been recommended for inclusion, also. These species are:

- Pink mucket pearly mussel (Ohio River) ;
- Fat pocketbook pearly mussel (Wabash River) ;
- Least tern (Sterna antillarum);
- Spectacle case mussel (Ohio River); and
- Orange-footed pearly mussel (Ohio River).[1]

[1] The orange-footed pearly mussel is not a listed Threatened and Endangered species for Massac County, but it is listed in neighboring Pulaski County, and the U.S. Fish and Wildlife Service requested that it be included in the evaluation.

Cambridge Environmental Inc
58 Charles Street Cambridge, Massachusetts 02141
617-225-0810 FAX: 617-225-0813 www.CambridgeEnvironmental.com

In addition, the Indiana bat (Myotis sodalis) is a listed species in all of the counties that border Massac County. As you know, this species received considerable attention in the Prairie States consultation, and I would anticipate the need to consider it in the evaluation of Lafarge's proposed expansion.

The four mussel species suggest the need to evaluate impacts to rivers. For this purpose, I have considered potential impacts to both surface water and sediment. Additionally, the least tern feeds on small fish and nests on open beach areas, and hence consideration of the river environment (as its food supply) is appropriate for this species, also. The Indiana bat, however, feeds on insects in either a terrestrial or aquatic habitat. As a media-based screening, I have developed a simple model of potential impacts to soil to evaluate potential risks to the bat (as well as other terrestrially-based species) in addition to the aquatic screening analyses of sediment and surface water.

Emission rates

I have built on the Ecological Screening Assessment (ESA) emission spreadsheet that you provided, making a number of minor corrections and adjustments discussed by e-mail. Hazardous air pollutant (HAP) emissions are estimated with emission factors and clinker production volumes. The basic list of HAPs is derived from the U.S. EPA's AP42 emission factor database (AP42 Table 11.6-9), with several additional HAPs presumably based on data and/or testing of other cement production facilities (antimony, nickel, and polycyclic aromatic compounds [PACs]). HAP emission rates are calculated on a net increase basis by estimating the maximum future potential emissions of the expanded facility (at full projected capacity) and subtracting the present actual emissions based on the last few years of production data. Table 11.6-9 provides emission factors for cement kilns equipped with both fabric filters and electrostatic precipitators (ESPs). In cases for which emission factors for both control devices are provided for the same HAP, net emissions differentiate future emissions (with all three kilns utilizing fabric filters) from present emissions (in which one kiln is equipped with a fabric filter and the other with an ESP). In several cases for which the ESP-based emission factor is substantially higher than that of the fabric filter-based value, emissions are projected to decrease for the expanded facility despite the increase in production capacity.

A number of HAPs have AP42 emission factors for a single air pollution control device option (i.e., for either a fabric filter or an ESP, but not both). All of these HAPs are considered, including those based on ESP control (even though the updated facility will solely use fabric filter control, potentially limiting the relevance of ESP-based emission factors). In cases for which only a single emission factor is available (fabric filter or ESP), the increase in HAP

emissions is proportional to the potential change in production volume (future potential less present actual).

Additionally, AP42 Section 11.6 includes some dated information on polychlorinated dibenzo(*p*)dioxin and furan (PCDDPCDF) emissions from cement kilns. Emission factors for one specific congener (1,2,3,4,6,7,8-HeptaCDD) and four classes of congeners, are reported on a total basis not weighted by toxic equivalency factors (total HeptaCDD, total OctaCDD, total PentaCDD, and total PentaCDF). The AP42 data appear to have been developed prior to the now common treatment of PCDDPCDF on a toxic equivalency (TEQ) basis, and hence reflect incomplete test data (excepting 1,2,3,4,6,7,8-HeptaCDD and the singular OctaCDD). Data on individual congeners are not provided, and I suspect that congener classes without positive detections were not reported as emission factors. The U.S. EPA's dioxin reassessment work provides more recent and complete information on PCDDPCDF emissions from cement kilns. These data are provided in Table 1 along with toxic equivalency (TEQ) weighting factors derived for ecological receptors. Total TEQ emission factors are calculated as the summed products of the congener-specific emission factors and the receptor-specific TEQs. The highest overall TEQ emission factor is 1.076 ng TEQ/kg clinker (2.15×10^{-9} lb/ton), estimated for birds, is used to derive screening-level emission estimates.

The present actual and future potential production volumes for the four kilns at the Joppa facility are those provided in your spreadsheet. The present production values of 484,666 and 628,340 tons/year for existing Kilns 1 and 2, respectively, are based on recent production levels. Projected production volumes for Kilns 1, 3, and 4 are 209,437, 1,377,875, and 1,377,875 tons/year, respectively. Note that the proposed expansion ceases operation of Kiln 2, but the future emissions from Kiln 1 will be rerouted to the present Kiln 2 fabric filter. Table 1 lists the projected increases in HAP emissions based on the supporting emission factors and calculations contained in the ESA emissions spreadsheet.

Surface water concentrations

The screening-level model to estimate worst-case concentrations in surface water assumes that all stack emissions are mixed within the Ohio River. Concentrations are calculated by dividing the emission rate of each HAP by the gaged flow rate of the river. The closest gaging station to Lafarge's Joppa facility is a short distance upstream at Metropolis, Illinois. The average discharge (flow) rate is used to estimate long-term average concentrations. This flow rate of 277,000 ft^3/s is reported by the U.S. Geological Survey as the long-term average over a period of 75 years (1928-2003). (http://il.water.usgs.gov/annual_report/data/disc2003/03611500.htm). Surface water concentrations of contaminants calculated by the model are provided in Table 2.

Sediment concentrations

Sediment concentrations are estimated under the assumption that all stack emissions mix into the Ohio River and blend with the existing solids suspended in the river. In this way, the concentrations of contaminants in any settling solids is assumed equivalent to the modeled worst-case concentration in the overlying water column. A suspended sediment load of 113,000 tons/day is assumed based on data collected from 1998 to 2003 at the Ohio River Lock and Dam 53 near Grand Chain, Illinois (http://il.water.usgs.gov/annual_report/data/chem19981036l2500.htm). Sediment concentrations of contaminants calculated by the model are provided in Table 2.

Air concentrations

The U.S. EPA's ISCST3 model is used to estimate the dispersion of emissions from the kilns, and net impacts are estimated as the predicted concentrations from potential future emissions less those due to present actual emissions. Stack parameters for the present and proposed future configuration of the plant are taken from the screening-level model files that you provided. These parameters are provided in Table 3. Three years of meteorological data from the Paducah, KY airport, as downloaded from the U.S. EPA's Support Center for Regulatory Air Modeling (SCRAM) website, are modeled (1989 through 1991). Explicit receptor elevations are considered at an extensive monitoring network centered about the facility location. Building downwash is also considered as appropriate. Each source is modeled using a unitized (1 g/s) emission rate. The ISCST3 model predictions for each of the five sources are averaged over the three model years at each receptor, and the results weighted by kiln emission rates (future positive, existing negative) to provide estimates of net concentration impacts. The maximum (at any receptor) net concentration values are provided in Table 4. For the sake of comparison, Table 4 also includes estimates of background concentrations for pollutants that are considered in the U.S. EPA's 1996 National Air Toxics Study (modeled estimates) and Illinois' 2004 ambient monitoring program. For contaminants with available background concentration estimates, Table 4 indicates that all of the modeled worst-case increases in concentration in air due to the Lafarge facility are smaller than background.

The several contaminants for which there are projected decreases in net emissions (future potential less present actual) also have projected decreases in ambient concentrations. Hence, the negative values in Table 4 reflect the smallest decreases that are projected to occur. One HAP – cadmium – has a projected decrease in ambient concentrations at all receptors despite a projected increase in net emissions, a condition that results from a change in source

configuration (specifically, eliminating emissions from a presently-used shorter stack). This same phenomenon also occurs for all of the criteria pollutant emissions excepting carbon monoxide – Table 4 has been expanded to reflect these projected decreases.

Several figures are provided to depict the nature of the ISCST3 model predictions (patterns are similar for most contaminants). Figure 1 depicts the air modeling receptor grid. Figures 2 – 4 provide projected annual average impacts of sulfur dioxide (SO,), independently for the future and existing facility configurations (Figures 2 and 3, respectively), and superposed (Figure 4) to depict the pattern of net anticipated impacts (future potential less present actual). Note that the Figure 3 impacts are depicted as negative values to reflect the decreases that will result from the discontinued present emissions. Note further that net impacts (Figure 4) are negative at all receptors, indicating anticipated decreases in overall SO, concentrations (despite small expected increases in overall emissions). Figure 5 depicts the predicted pattern of net annual average impacts for benzene, for which concentrations are expected to decrease at locations very close to the Lafarge facility, and increase at more distant locations.

Figures 6 – 8 plot a sequence of NO, (nitrogen oxides) impacts similar to those of SO,, with Figures 6 and 7 plotting the annual average model predictions for actual present and potential future emissions, respectively. Figure 6 contours are plotted as negative values to reflect the decreases that will result from the elimination of present emissions, and similar to SO,, the net impacts depicted in Figure 8 (Figures 6 and 7 combined) indicate net decreases in annual average NO, concentrations at all receptors (as reflected by the negative contour levels).

Figures 9 and 10 depict net changes in carbon monoxide concentrations, plotting the highest net increase in 1-hour (Figure 9) and 8-hour (Figure 10) averaging periods. In each case, the highest modeled increases are well below Significant Impact Levels.

Soil concentrations

Concentrations of HAPs in soil are estimated with a simple mixing model that assumes that HAPs deposit from the atmosphere over a period of thirty years of facility operation and remain within a shallow (1 cm, bulk density 1.5 g/cm^3) layer near the surface. The soil deposition/concentration model is that 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. Predicted worst-case contaminant concentrations in soil are listed in Table 2 based on the highest net projected impacts to ambient air.

Table 5 compares the modeled concentrations of inorganic contaminants in soil with background levels in Illinois soils (where available). In all cases, the predicted increases in contaminant concentrations are smaller than background levels. The predicted increases for most chemicals are smaller than 0.1%, and only for two metals are the increases greater than 1% (copper at 10%, selenium at 19%).

Benchmark concentrations

Per the suggestion of U.S. EPA Region 5, 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://mountain.epa.gov/ecotox//ecossl/); and
- 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).

Ecological benchmark concentrations for other combinations of chemicals and environmental media are obtained from the Risk Assessment Information System (RAIS) developed and supported by the Oak Ridge National Laboratory (ORNL). The RAIS has compiled media-based ecological benchmarks from a number of regulatory databases and sources that collectively cover a wide variety of potential ecological endpoints. A search of the RAIS was conducted to identify the lowest (and hence most protective) ecotoxicity benchmark from any of the data sources contained in the RAIS. This conservative, 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 Lafarge's Joppa facility. The lowest benchmark concentrations identified by this method for the surface water, sediment, and soil media are listed in Table 2. In many cases, benchmark concentrations are not available.

Screening-level ecotoxicity hazard ratios

The final three columns of Table 2 provide simple hazard quotients, calculated as the ratios of the predicted contaminant concentrations in environmental media divided by their corresponding benchmark concentrations. Most hazard quotients are smaller than one, indicating that, even

using very simple, highly conservative models, adverse impacts to ecological receptors of all kinds (including threatened and endangered species) would not be anticipated.

Because some contaminants are ubiquitous chemicals in soil, Table 5 calculates hazard ratios for the combined sum of background and modeled increases in soil. Some of the hazard ratios in Table 5 are quite large, indicating in most cases that the conservative screening-level benchmark concentrations are well below natural background levels.

A handful of hazard quotients exceed one, as indicated in boldface in Table 2. These calculations may require additional work to demonstrate insignificant risks, but based on some simple preliminary considerations, I would anticipate that refined modeling and consideration would yield ratios smaller than one. The sediment and surface water models are quite conservative, assuming that all plume emissions mix into the Ohio River water and sediment (which are also considered separately in whole, without consideration of partitioning between bound and dissolved phases). Hence, the hazard ratios of 2.4 for PCDD/PCDF in surface water and 3.1 for benzene in sediment are likely overestimated simply due to the nature of the "mix it all in" screening models.

Four of the six hazard ratios exceeding one are estimated for soil. A gross conservatism in the soil model is the assumption that all contaminants deposit from the air at a deposition velocity of 1 cm/s. Based on experience, particle emissions from the Lafarge facility will likely be very small in diameter, in the so-called fine particulate range (aerodynamic diameters of the order of 1 μm). These particles settle and deposit very slowly from the atmosphere. A deposition velocity of 0.1 cm/s or even lower is more appropriate for small particles under most atmospheric conditions (G. Sehmel, Deposition and Resuspension, Chapter 12 in Atmospheric Science and Power Production, U.S. Department of Energy, OE/TIC-27061, 1984). Thus, contaminants bound to particles, which would include most metals and a substantial portion of PCDD/PCDFs, would likely deposit at rates more than ten times smaller than estimated in the soil model. Consequently, the preliminary hazard ratios for PCDDPCDF and selenium for soil would likely be lower than one upon deposition modeling refinement.

A similar observation holds for the gaseous species benzene and naphthalene for which preliminary estimates of soil hazard ratios are greater than one. Based on previous assessments for Indeck and ExxonMobil, the fate-and-transport properties of benzene (and naphthalene, by analogy) are such that its tendencies are to remain airborne and resist deposition. The modeled benzene concentration in air is 0.015 $\mu g/m^3$ at the worst-case location, a small fraction of typical background levels of about 1 $\mu g/m^3$ (see Table 4). The modeled concentration of benzene in soil is 9.7 mg/kg (Table 2) based on this modeled air concentration of 0.015 $\mu g/m^3$. If, as one would expect, background benzene in air deposited to soil in the same manner as that modeled for the

Lafarge emissions, one would anticipate the background soil concentration of benzene to be (by ratio) 9.7 mg/kg times (1 ÷ 0.015) = 650 mg/kg! Clearly, widespread benzene contamination of this sort does not exist due to its background presence in air. Typically, benzene is not even detectable in soils except in cases in which petroleum products have been spilled directly into soil. Since the detection limit for benzene is of the order of 0.001 mg/kg, it would appear that modeling benzene with the simple deposition model may overpredict concentrations by more than five orders of magnitude. Hence, there is probably very little reason for concern over the preliminary hazard ratio of 38 calculated for benzene in soil.

Similar arguments apply for naphthalene. Background concentrations of naphthalene in the greater Chicago area have been measured to be about 0.1 $\mu g/m^3$ (see http://www.epa.state.il.us/air/ohare/ohare-toxic-report.pdf), more than 50 times the worst-case modeled estimate due to Lafarge facility emissions (0.0018 pg/m^3, as indicated in Table 4). Extrapolating the modeled soil concentration of 1.1 mg/kg in soil for naphthalene (Table 2), one would anticipate background concentrations of naphthalene in soil of 50 mg/kg to be present ubiquitously in the environment. Again, given naphthalene is not known to be present in soils even at concentrations orders of magnitude lower, the preliminary hazard ratio of 11 for naphthalene in soil (Table 2) is likely to be grossly overstated.

The conservative nature of the screening-level hazard ratios may also be influenced by the benchmark concentrations. As an example, the selenium benchmark concentration of 0.028 mg/kg in soil is more than ten times smaller than the typical background level of 0.37 mg/kg of selenium in soil (Table 5), suggesting the benchmark concentration to be unrealistically conservative. In fact, the projected increases in the concentrations of all inorganic contaminants are smaller than background levels in Illinois soils – the projected incremental impacts for many contaminants are only small fractions of existing background (Table 5). Even for organic contaminants such as PCDDPCDF, the benchmark concentration of 0.2 ng/kg in soil (Table 2) is considerably lower than the U.S. EPA's estimates of background levels in urban and rural soils (12 ng/kg and 3 ng/kg, respectively – see p. 3-191 of the U.S. EPA's draft dioxin reassessment:
http://www.epa.gov/ncea/pdfs/dioxin/nas-review/pdfs/part1_vol2/dioxin_pt1_vol2_ch03_dec2003.pdf).

The PCDDPCDF assessment is also influenced by the choice of the avian species TEFs in constructing the TEQ emission factor (Table 1). If either the mammalian-based or the fish-based TEQ emission factor is considered instead of the avian-based value, the screening-level hazard indices decrease by at least a factor of 3.5, making all of the PCDDPCDF screening-level hazard ratios smaller than one. This choice is potentially important, as the avian-based TEQ emission factor may be relevant only to the least tern.

Table 1 Polychlorinated dibenzo(*p*)dioxin and furan (PCDD/PCDF) emission factors expressed on a toxic equivalency (TEQ) basis

PCDD/PCDF Congener	Emission factor (ng/kg clinker) (EPA, 2003a)		Toxic Equivalency (TEQ) Factor (EPA, 2003b)			TEQ Emission Factor (ng TEQ/kg clinker)		
	ND=0	ND=1/2 DL	Mammals	Birds	Fish	Mammals	Birds	Fish
2,3,7,8-TCDD	0.01	0.02	1	1	1	0.02	0.02	0.02
1,2,3,7,8-PeCDD	0.03	0.04	1	1	1	0.04	0.04	0.04
1,2,3,4,7,8-HxCDD	0.03	0.04	0.1	0.05	0.5	0.004	0.002	0.02
1,2,3,6,7,8-HxCDD	0.04	0.05	0.1	0.01	0.01	0.005	0.0005	0.0005
1,2,3,7,8,9-HxCDD	0.04	0.06	0.1	0.1	0.01	0.006	0.006	0.0006
1,2,3,4,6,7,8-HpCDD	0.39	0.39	0.01	0.001	0.001	0.0039	0.00039	0.00039
OCDD	0.64	0.64	0.0001	0.0001	0.0001	6.4E-05	6.4E-05	6.4E-05
2,3,7,8-TCDF	0.73	0.73	0.1	1	0.05	0.073	0.73	0.0365
1,2,3,7,8-PeCDF	0.1	0.11	0.05	0.1	0.05	0.0055	0.011	0.0055
2,3,4,7,8-PeCDF	0.22	0.23	0.5	1	0.5	0.115	0.23	0.115
1,2,3,4,7,8-HxCDF	0.17	0.18	0.1	0.1	0.1	0.018	0.018	0.018
1,2,3,6,7,8-HxCDF	0.05	0.06	0.1	0.1	0.1	0.006	0.006	0.006
1,2,3,7,8,9-HxCDF	0.01	0.02	0.1	0.1	0.1	0.002	0.002	0.002
2,3,4,6,7,8-HxCDF	0.08	0.08	0.1	0.1	0.1	0.008	0.008	0.008
1,2,3,4,6,7,8-HpCDF	0.13	0.14	0.01	0.01	0.01	0.0014	0.0014	0.0014
1,2,3,4,7,8,9-HpCDF	0	0.02	0.01	0.01	0.01	0.0002	0.0002	0.0002
OCDF	0.22	0.24	0.0001	0.0001	0.0001	2.4E-05	2.4E-05	2.4E-05
Totals	1.71	1.81				0.308	1.076	0.274

(1) 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 5-3.

(2) 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 2 Preliminary screening-level modeling estimates and comparisons to conservative benchmarks

Chemical	Net emission rate (tons/year)	Screening-level concentration			Screening-level benchmark concentration			Screening-level hazard ratio		
		Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water	Sediment	Soil
Polychlorinated dioxins and furans (PCDD/PCDF, expressed as 2,3,7,8-TCDD toxic equivalents)	2.0E-06	7.3E-09	4.9E-08	5.1E-07	3.0E-9	1.2E-07	2.0E-07	**2.4E+00**	4.0E-01	**2.5E+00**
C3 Benzenes (a)	2.4E-03	8.8E-06	5.9E-05	6.1E-04	8.6E+02	1.4E-01	2.6E-01	1.0E-08	4.1E-04	2.4E-03
C4 Benzenes (a)	5.6E-03	2.0E-05	1.4E-04	1.4E-03	8.6E+02	1.4E-01	2.6E-01	2.4E-08	9.5E-04	5.5E-03
C6 Benzenes (a)	8.5E-04	3.1E-06	2.1E-05	2.2E-04	8.6E+02	1.4E-01	2.6E-01	3.6E-09	1.5E-04	8.5E-04
Acenaphthylene	1.1E-01	4.1E-04	2.7E-03	2.8E-02	4.8E+03	5.9E-03	6.8E+02	8.4E-08	4.6E-01	4.1E-05
Acetone	3.4E-01	1.3E-03	8.4E-03	8.7E-02	1.7E+03	9.9E-03	2.5E+00	7.4E-07	8.4E-01	3.5E-02
Benzaldehyde (b)	2.2E-02	8.2E-05	5.4E-04	5.7E-03	NoBench	NoBench	3.0E-01	NoBench	NoBench	1.9E-02
Benzene	1.8E+01	6.6E-02	4.4E-01	9.7E+00	8.6E+02	1.4E-01	2.6E-01	7.7E-05	**3.1E+00**	**3.8E+01**
Benzo(a)anthracene	4.0E-05	1.5E-07	9.7E-07	1.0E-05	2.5E-02	1.1E-01	5.2E+00	5.8E-06	9.0E-06	1.9E-06
Benzo(a)pyrene	1.2E-04	4.4E-07	2.9E-06	3.1E-05	1.4E-02	1.5E-01	1.5E+00	3.2E-05	2.0E-05	2.0E-05
Benzo(b)fluoranthene	5.2E-04	1.9E-06	1.3E-05	1.3E-04	9.1E+00	1.0E+01	6.0E+01	2.1E-07	1.2E-06	2.2E-06
Benzo(g,h,i)perylene	7.2E-05	2.7E-07	1.8E-06	1.8E-05	7.6E+00	1.7E-01	1.2E+02	3.5E-08	1.0E-05	1.5E-07
Benzo(k)fluoranthene	1.4E-04	5.1E-07	3.4E-06	3.5E-05	NoBench	2.4E-01	1.5E+02	NoBench	1.4E-05	2.4E-07
Benzoic Acid	3.2E+00	1.2E-02	7.9E-02	8.2E-01	4.0E+01	6.5E-01	NoBench	3.0E-04	1.2E-01	NoBench
Biphenyl	5.6E-03	2.1E-05	1.4E-04	1.4E-03	1.0E+01	1.1E+00	6.0E+01	2.1E-06	1.2E-04	2.4E-05
Bis(2-ethylhexyl)phthalate	8.8E-02	3.2E-04	2.1E-03	2.2E-02	3.0E-01	1.8E-01	9.2E-01	1.1E-03	1.2E-02	2.4E-02

Table 2 Preliminary screening-level modeling estimates and comparisons to conservative benchmarks

Chemical	Net emission rate (tons/year)	Screening-level concentration			Screening-level benchmark concentration			Screening-level hazard ratio		
		Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water	Sediment	Soil
Bromomethane	4.0E-02	1.5E-04	9.7E-04	1.0E-02	1.6E+01	1.4E-03	2.4E-01	9.1E-06	7.1E-01	4.3E-02
Carbon Disulfide	1.0E-01	3.7E-04	2.5E-03	2.6E-02	1.5E+01	2.4E-02	9.4E-02	2.5E-05	1.0E-01	2.8E-01
Chlorobenzene	1.5E-02	5.4E-05	3.6E-04	3.8E-03	4.7E+01	2.9E-01	1.3E+01	1.2E-06	1.2E-03	2.9E-04
Chloromethane	3.5E-01	1.3E-03	8.6E-03	8.9E-02	5.5E+03	NoBench	1.0E+01	2.3E-07	NoBench	8.6E-03
Chrysene	1.5E-04	5.4E-07	3.6E-06	3.8E-05	7.0E+00	1.7E-01	4.7E+00	7.8E-08	2.2E-05	8.0E-06
Di-n-butylphthalate	3.8E-02	1.4E-04	9.3E-04	9.7E-03	5.0E+00	2.2E+00	1.5E-01	2.8E-05	4.2E-04	6.4E-02
Dibenz(a,h)anthracene	5.8E-04	2.1E-06	1.4E-05	1.5E-04	4.0E+00	3.3E-02	1.8E+01	5.4E-07	4.3E-04	8.1E-06
Ethylbenzene	1.8E-02	6.5E-05	4.3E-04	4.5E-03	1.4E+01	1.8E-01	5.2E+00	4.6E-06	2.5E-03	8.7E-04
Fluoranthene	8.1E-03	3.0E-05	2.0E-04	2.1E-03	1.9E+00	4.2E-01	1.2E+02	1.6E-05	4.7E-04	1.7E-05
Fluorene	1.8E-02	6.5E-05	4.3E-04	4.5E-03	1.9E+01	7.7E-02	1.2E+02	3.4E-06	5.5E-03	3.7E-05
Formaldehyde	4.3E-01	1.6E-03	1.0E-02	1.1E-01	NoBench	NoBench	3.0E-01	NoBench	NoBench	3.6E-01
Freon 113	4.6E-02	1.7E-04	1.1E-03	1.2E-02	4.1E+02	NoBench	NoBench	4.1E-07	NoBench	NoBench
Indeno(1,2,3-cd)pyrene	8.1E-05	3.0E-07	2.0E-06	2.0E-05	4.3E+00	2.0E-01	1.1E+02	6.9E-08	9.8E-06	1.9E-07
Methyl Ethyl Ketone	2.8E-02	1.0E-04	6.8E-04	7.1E-03	2.2E+03	4.2E-02	9.0E+01	4.6E-08	1.6E-02	7.9E-05
Methylene Chloride	4.5E-01	1.7E-03	1.1E-02	1.2E-01	9.4E+02	1.6E-01	4.0E+00	1.8E-06	7.0E-02	2.8E-02
Methylnaphthalene (c)*	3.9E-03	1.4E-05	9.5E-05	9.9E-04	3.3E+02	2.0E-02	3.2E+00	4.3E-08	4.7E-03	3.1E-04
Naphthalene	1.9E+00	7.1E-03	4.7E-02	1.1E+00	1.3E+01	1.8E-01	9.9E-02	5.5E-04	2.7E-01	**1.1E+01**
PACs (d)	1.0E-02	3.7E-05	2.5E-04	2.6E-03	NoBench	1.6E+00	1.0E+00	NoBench	1.5E-04	2.6E-03
Phenanthrene	3.6E-01	1.3E-03	8.8E-03	9.2E-02	3.6E+00	2.0E-01	4.6E+01	3.7E-04	4.3E-02	2.0E-03

Table 2 Preliminary screening-level modeling estimates and comparisons to conservative benchmarks

Chemical	Net emission rate (tons/year)	Screening-level concentration			Screening-level benchmark concentration			Screening-level hazard ratio		
		Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water	Sediment	Soil
Phenol	1.0E-01	3.7E-04	2.5E-03	2.6E-02	1.8E+02	4.9E-02	1.2E+02	2.1E-06	5.1E-02	2.2E-04
Pyrene	4.1E-03	1.5E-05	9.9E-05	1.0E-03	3.0E-01	2.0E-01	7.8E+01	5.0E-05	5.1E-04	1.3E-05
Styrene	1.4E-03	5.1E-06	3.4E-05	3.5E-04	3.2E+01	2.5E-01	4.7E+00	1.6E-07	1.3E-04	7.5E-05
Toluene	1.8E-01	6.5E-04	4.3E-03	4.5E-02	6.0E+02	1.2E+00	5.4E+00	1.1E-06	3.5E-03	8.2E-03
Xylenes	1.2E-01	4.4E-04	2.9E-03	3.1E-02	3.6E+02	4.3E-01	1.0E+01	1.2E-06	6.8E-03	3.1E-03
Aluminum	1.2E+01	4.4E-02	2.9E-01	3.1E+00	7.0E+01	5.8E+04	5.0E+01	6.3E-04	5.1E-06	6.1E-02
Ammonia	9.3E+00	3.4E-02	2.3E-01	2.4E+00	1.47E+03 (e)	NoBench	NoBench	2.3E-05	NoBench	NoBench
Ammonium	1.0E+02	3.7E-01	2.5E+00	2.6E+01	1.47E+03 (e)	NoBench	NoBench	2.5E-04	NoBench	NoBench
Antimony	1.3E-03	4.8E-06	3.2E-05	3.3E-04	8.0E+01	2.0E+00	2.7E-01 (M)	6.0E-08	1.6E-05	1.2E-03
Arsenic	1.1E-02	4.0E-05	2.7E-04	2.4E-03	1.9E+02	9.8E+00	4.3E+01 (A)	2.1E-07	2.7E-05	5.5E-05
Barium	4.5E-01	1.7E-03	1.1E-02	2.9E-03	2.2E+02	NoBench	3.3E+02 (I)	4.3E-04	NoBench	8.9E-06
Beryllium	6.1E-04	2.2E-06	1.5E-05	1.6E-04	3.6E+00	NoBench	2.1E+01 (M)	4.2E-06	NoBench	7.4E-06
Cadmium	5.6E-04	2.1E-06	1.4E-05	Net Decrease	1.3E+00 (f)	9.9E-01	Net Decrease	1.6E-04	1.4E-05	Net Decrease
Calcium	2.2E+02	8.2E-01	5.4E+00	5.7E+01	1.2E+05	NoBench	NoBench	7.0E-06	NoBench	NoBench
Chloride	-1.6E+02	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease

Table 2 Preliminary screening-level modeling estimates and comparisons to conservative benchmarks

Chemical	Net emission rate (tons/year)	Screening-level concentration			Screening-level benchmark concentration			Screening-level hazard ratio		
		Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water	Sediment	Soil
Chromium	1.6E-01	5.9E-04	3.9E-03	1.0E-01	2.4E+02 (f)	**4.3E+01**	**2.6E+01 (A)**	7.0E-05	9.1E-05	4.0E-03
Copper	4.9E+00	1.8E-02	1.2E-01	1.2E+00	1.4E+01 (f)	**3.2E+01**	**5.4E+00**	8.8E-02	3.8E-03	2.3E-01
Fluoride	8.3E-01	3.1E-03	2.0E-02	2.1E-01	1.2E-01	NoBench	NoBench	2.5E-02	NoBench	NoBench
Iron	1.6E+01	5.8E-02	3.8E-01	4.0E+00	1.0E+01	2.0E+04	2.0E+02	5.8E-03	1.9E-05	2.0E-02
Hydrogen Chloride (HCl) (g)	1.5E+02	5.6E-01	3.7E+00	7.5E+01	2.3E+05 (g)	NoBench	NoBench	2.4E-06	NoBench	NoBench
Lead	9.3E-02	3.4E-04	2.3E-03	2.4E-02	**2.5E+01 (f)**	3.6E+01	**1.1E+01 (A)**	9.7E-04	6.3E-05	2.1E-03
Manganese	8.0E-01	2.9E-03	1.9E-02	2.0E-01	8.0E+01	4.6E+02	1.0E+02	3.7E-05	4.2E-05	2.0E-03
Mercury	-2.5E-02	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease
Nickel	3.0E-03	1.1E-05	7.2E-05	7.5E-04	5.8E+00 (f)	2.3E+01	**1.4E+01**	2.2E-06	3.2E-06	5.5E-05
Nitrate	**4.3E+00**	1.6E-02	1.0E-01	1.1E+00	NoBench	NoBench	NoBench	NoBench	NoBench	NoBench
Potassium	1.7E+01	6.1E-02	4.1E-01	4.2E+00	5.3E+04	NoBench	NoBench	1.2E-06	NoBench	NoBench
Selenium	2.0E-01	7.2E-04	4.8E-03	7.0E-02	**5.0E+00**	NoBench	**2.8E-02**	7.2E-04	NoBench	**2.5E+00**
Silver	5.6E-04	2.1E-06	1.4E-05	1.4E-04	**1.2E-01**	**5.0E-01**	**4.0E+00**	1.7E-04	2.8E-05	3.6E-05
Sodium	3.5E+01	1.3E-01	8.6E-01	8.9E+00	6.8E+05	NoBench	NoBench	1.9E-07	NoBench	NoBench
Sulfate	-4.0E+01	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease
Sulfuric Acid Mist (H_2SO4)	-5.5E+00	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease	Net Decrease
Thallium	5.0E-03	1.8E-05	1.2E-04	1.3E-03	**1.0E+01**	NoBench	**5.7E-02**	2.3E-05	NoBench	2.2E-02

Table 2 Preliminary screening-level modeling estimates and comparisons to conservative benchmarks

Chemical	Net emission rate (tonslyear)	Screening-level concentration			Screening-level benchmark concentration			Screening-level hazard ratio		
		Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water (µg/l)	Sediment (mg/kg)	Soil (mg/kg)	Surface water	Sediment	Soil
Titanium	3.4E-01	1.3E-03	8.4E-03	8.7E-02	NoBench	NoBench	1.0E+03	NoBench	NoBench	8.7E-05
Zinc	2.7E-01	9.8E-04	6.5E-03	3.2E-02	2.5E+01 (f)	1.2E+02	6.6E+00	4.9E-05	5.4E-05	4.8E-03

Values highlighted in pink are recommended U.S. EPA Ecological Soil Screening Levels (http://mountain.epa.gov/ecotox/ecossl/). The lowest value among mammalian (M), avian (A), or soil invertebrate (I) endpoints is selected.

Values highlighted in yellow are Illinois Water Quality Standards based on the protection of aquatic organisms. The chronic standards are taken from Section 302.208 (e) of the general use water quality standards (Title 35, Subtitle C, Chapter I of the Illinois Environmental Regulations. Available at: http://www.ipcb.state.il.us/documents/dsweb/Get/Document-33354/

Values highlighted in blue are U.S. EPA Region 5 RCRA Ecological Screening Levels (ESLs) available at http://www.epa.gov/reg5rcra/ca/edql.htm

Notes:
- (a) Benzene used as a chemical surrogate
- (b) Formaldehyde used as a chemical surrogate
- (c) Values selected for 2-Methylnaphthalene
- (d) PACs are polycyclic aromatic compounds. The category of total PAHS (polycyclic aromatic hydrocarbons) was selected from the RAIS to identify benchmarks.
- (e) Value obtained from Section 302.212 of the general use water quality standards for Illinois. Value may not be specific to ecological receptors of concern, and is applied to both ammonia and ammonium as a screening-level evaluation.
- (f) Values based on a hardness of 119 mg/l (the average of measurements at Ohio River Lock and Dam 53 near Grand Chain, Illinois in 2005, available at http://il.water.usgs.gov/annual_report/data/sw_q2005/03612500.htm) and reflect total water column concentrations (dissolved phase adjustment factors not included)
- (g) Evaluated as chloride

Table 3 Modeling parameters for kiln emission sources

Kiln	Clinker Production (tons/year, Present Actual or Future Potential)	Stack coordinates (UTM m)		Stack Parameters			
		Easting	Northing	Height (m)	Diameter (m)	Exit temperature (K)	Exit velocity (m/s)
Existing 1 (ESP)	484,666	332972	4120358	45.72	3.90	385	5.47
Existing 2	628,340	332965	4120322	69.01	2.59	461	16.2
Future 1	209,437	332965	4120322	68.88	2.59	464	22.8
Future 3	1,377,875	333171	4120842	134.1	2.90	385	16.5
Future 4	1,377,875	333194	4120482	134.1	2.90	385	16.5

Table 4 Maximum net increases in ambient concentrations (annual average basis)

Contaminant (Italics indicate POM and boldface indicates 7-PAH group)	Maximum net Increase in annual average concentration due to Lafarge facility expansion (μg/m³)	Average modeled concentrations (μg/m³), U.S. EPA's National Air Toxics Assessment (NATA), County-average estimates for 1996		Measured concentrations in air, 2004 Illinois EPA monitoring program (μg/m³)
		Massac County	Cook County	
NO_x (nitrogen oxides)	-1.18E-01			30 to 54
SO_2 (sulfur dioxide)	-4.22E-02			5 to 18
CO (carbon monoxide)	2.19E+00			
VOCs (Volatile organic compounds)	-2.08E-03			
PM (TSP) (total particulate matter)	-1.28E-03			
PM_{10} (particulate matter smaller than 10 μm diameter)	-3.48E-03			17 to 38
PCDD/PCDF	8.03E-10			
C3 Benzenes	9.71E-07			
C4 Benzenes	2.24E-06			
C6 Benzenes	3.43E-07			
Acenaphthylene	4.48E-05			
Acetone	1.38E-04			
Benzaldehyde	8.96E-06			
Benzene	1.53E-02	7.15E-01	2.19E+00	1.0 to 1.3
Benzo(a)anthracene	1.61E-08			
Benzo(a)pyrene	4.85E-08			
Benzo(b)fluoranthene	2.09E-07			
Benzo(g,h,i)perylene	2.91E-08			
Benzo(k)fluoranthene	5.60E-08			
Benzoic Acid	1.31E-03			
Biphenyl	2.28E-06			
Bis(2-ethylhexyl)phthalate	3.55E-05			
Bromomethane	1.61E-05			
Carbon Disulfide	4.11E-05			
Chlorobenzene	5.97E-06			

Table 4 Maximum net increases in ambient concentrations (annual average basis)

Contaminant (Italics indicate POM and boldface indicates 7-PAH group)	Maximum net increase in annual average concentration due to Lafarge facility expansion (pg/m^3)	Average modeled concentrations (μg/m^3), U.S. EPA's National Air Toxics Assessment (NATA), County-average estimates for 1996		Measured concentrations in air, 2004 Illinois EPA monitoring program (μg/m^3)
		Massac County	Cook County	
Chloromethane	1.42E-04			
Chrysene	5.97E-08			
Di-n-butylphthalate	1.53E-05			
Dibenz(a,h)anthracene	2.35E-07			
Ethylbenzene	7.09E-06			
Fluoranthene	3.29E-06			
Fluorene	7.09E-06			
Formaldehyde	1.72E-04	5.99E-01	2.29E+00	0.7 to 1.7
Freon 113	1.87E-05			
Indeno(1,2,3-cd)pyrene	3.25E-08			
Methyl Ethyl Ketone	1.12E-05			
Methylene Chloride	1.83E-04			
Methylnaphthalene	1.57E-06			
Naphthalene	1.78E-03			
*PACs**	4.11E-06	2.68E-01	9.24E-02	
Phenanthrene	1.46E-04			
Phenol	4.11E-05			
Pyrene	1.64E-06			
Styrene	5.60E-07			
Toluene	7.09E-05			2.3 to 3.0
Xylenes	4.85E-05			
Aluminum	4.85E-03			
Ammonia	3.73E-03			
Ammonium	4.11E-02			1.5 to 1.6
Antimony	5.23E-07			
Arsenic	3.76E-06	6.13E-05	1.57E-04	0.001 to 0.007
Barium	4.66E-06			

Table 4 Maximum net increases in ambient concentrations (annual average basis)

Contaminant (Italics indicate POM and boldface indicates 7-PAH group)	Maximum net increase in annual average concentration due to Lafarge facility expansion (pg/m^3)	Average modeled concentrations (μg/m^3), U.S. EPA's National Air Toxics Assessment (NATA), County-average estimates for 1996		Measured concentrations in air, 2004 Illinois EPA monitoring program (μg/m^3)
		Massac County	Cook County	
Beryllium	2.46E-07	4.88E-06	2.80E-05	
Cadmium	-1.03E-07	1.56E-04	7.62E-04	<0.001 to 0.003
Calcium	8.96E-02			
Chloride	-1.58E-02			
Chromium	1.63E-04	3.43E-04	4.60E-03	<0.001 to 0.011
Copper	1.98E-03			
Fluoride	3.36E-04			
Iron	6.35E-03			0.2 to 3.1
Hydrogen Chloride (HCl)	1.18E-01			
Lead	3.73E-05	1.49E-03	1.76E-02	0.010 to 0.060
Manganese	3.21E-04	6.54E-04	1.64E-03	0.008 to 0.174
Mercury	-4.14E-06	1.81E-03	1.96E-03	0.002 to 0.002
Nickel	1.19E-06	2.04E-04	4.41E-03	<0.001 to 0.010
Nitrate	1.72E-03			2.0 to 3.0
Potassium	6.72E-03			
Selenium	1.11E-04			
Silver	2.28E-07			
Sodium	1.42E-02			
Sulfate	-4.37E-03			2.5 to 3.0
Sulfuric Acid Mist (H_2SO_4)	-1.75E-03			
Thallium	2.02E-06			
Titanium	1.38E-04			
Zinc	5.03E-05			
7 Polycyclic Aromatic Hydrocarbons (PAHs)	4.82E-07	6.75E-03	1.87E-03	
Polycyclic Organic Matter (POM)	1.99E-03	2.68E-01	9.24E-02	

Table 5 Comparison of modeled concentrations in soil to background levels for inorganic contaminants (http://www.ilga.gov/commission/jcar/admincode/035/03500742ZZ9996agR.html)

Contaminant	Maximum modeled increase in soil (mg/kg)	Illinois background (mg/kg)	Screening-level soil benchmark (mg/kg)	Total hazard ratio (sum background plus increment divided by benchmark)	Percent increase in background due to increment
Aluminum	3.1	9,200	50	180	0.03%
Ammonia	2.4		NoBench		
Ammonium	25.9		NoBench		
Antimony	0.00033	3.3	0.27	12	0.01%
Arsenic	0.00237	11.3	43	0.3	0.02%
Barium	0.00294	122	330	0.4	0.002%
Beryllium	0.00016	0.56	21	0.03	0.03%
Cadmium	-0.00007	0.5	0.36	1.4	Net decrease
Calcium	56.5	5525	NoBench		1%
Chloride	-9.9				Net Decrease
Chromium	0.1	13	26	0.5	0.8%
Copper	1.2	12	5.4	2.5	10%
Fluoride	0.2		NoBench		
Iron	4.0	15,000	200	75	0.03%
Hydrogen Chloride (HCI)	74.5		NoBench		
Lead	0.02	20.9	11	1.9	0.1%
Manganese	0.2	630	100	6.3	0.03%
Mercury	-0.0026	0.05	0.1	0.5	Net Decrease
Nickel	0.0008	13	14	1.0	0.006%
Nitrate	1.1		NoBench		
Potassium	4.2	1,100	NoBench		0.4%
Selenium	0.07	0.37	0.028	16	19%
Silver	0.00014	0.5	4	0.1	0.5
Sodium	8.9	130	NoBench		7%
Sulfate	-2.8	110	2	55	Net Decrease
Sulfuric Acid Mist (H_2SO_4)	-1.1				Net Decrease
Thallium	0.0013	0.42	0.057		0.3%
Titanium	0.09		1000		
Zinc	0.03	60.2	6.6	9	0.05%

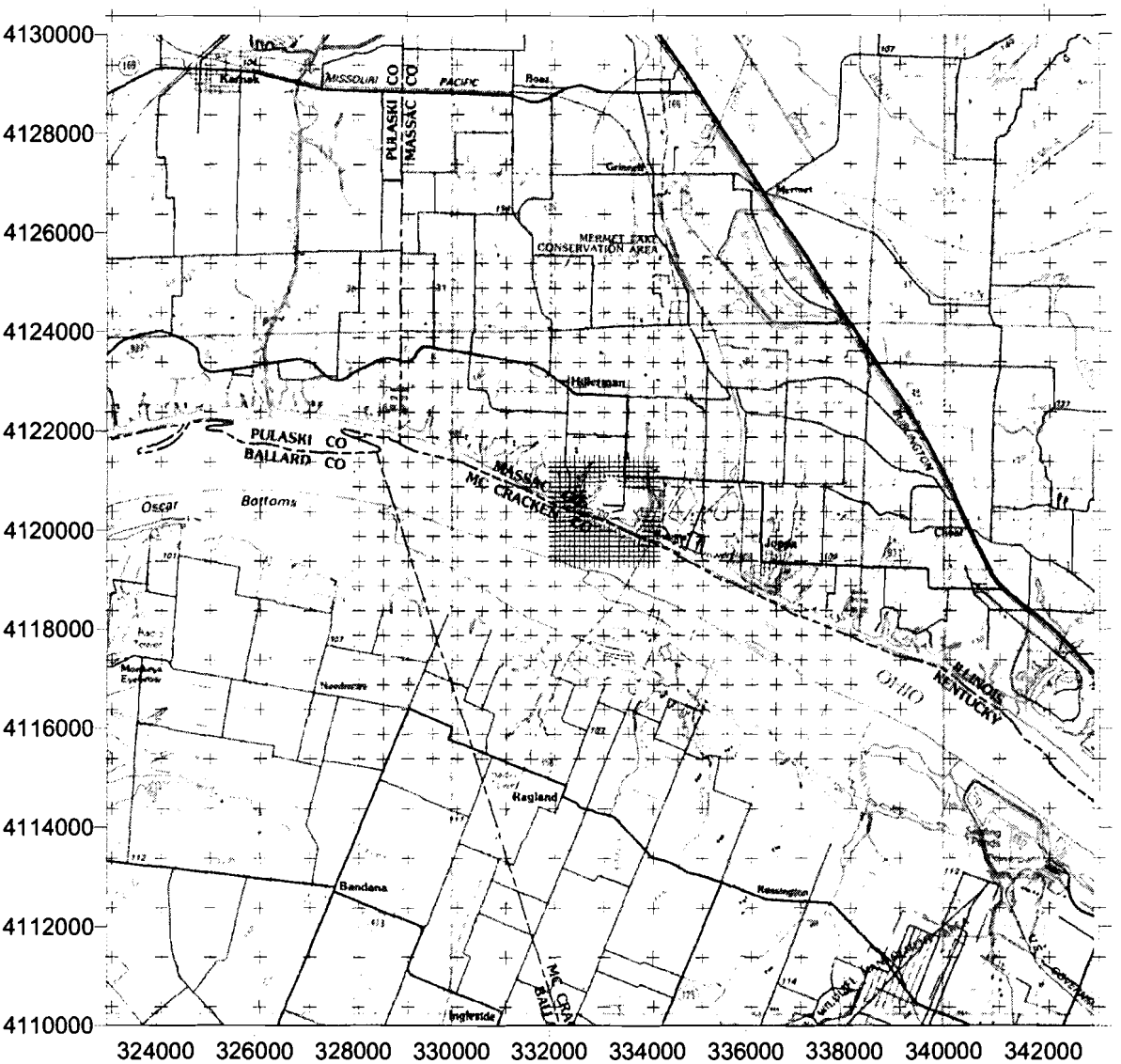

Figure 1 ISCST3 **Receptor Modeling Grid. Fenceline receptors indicated in blue.**

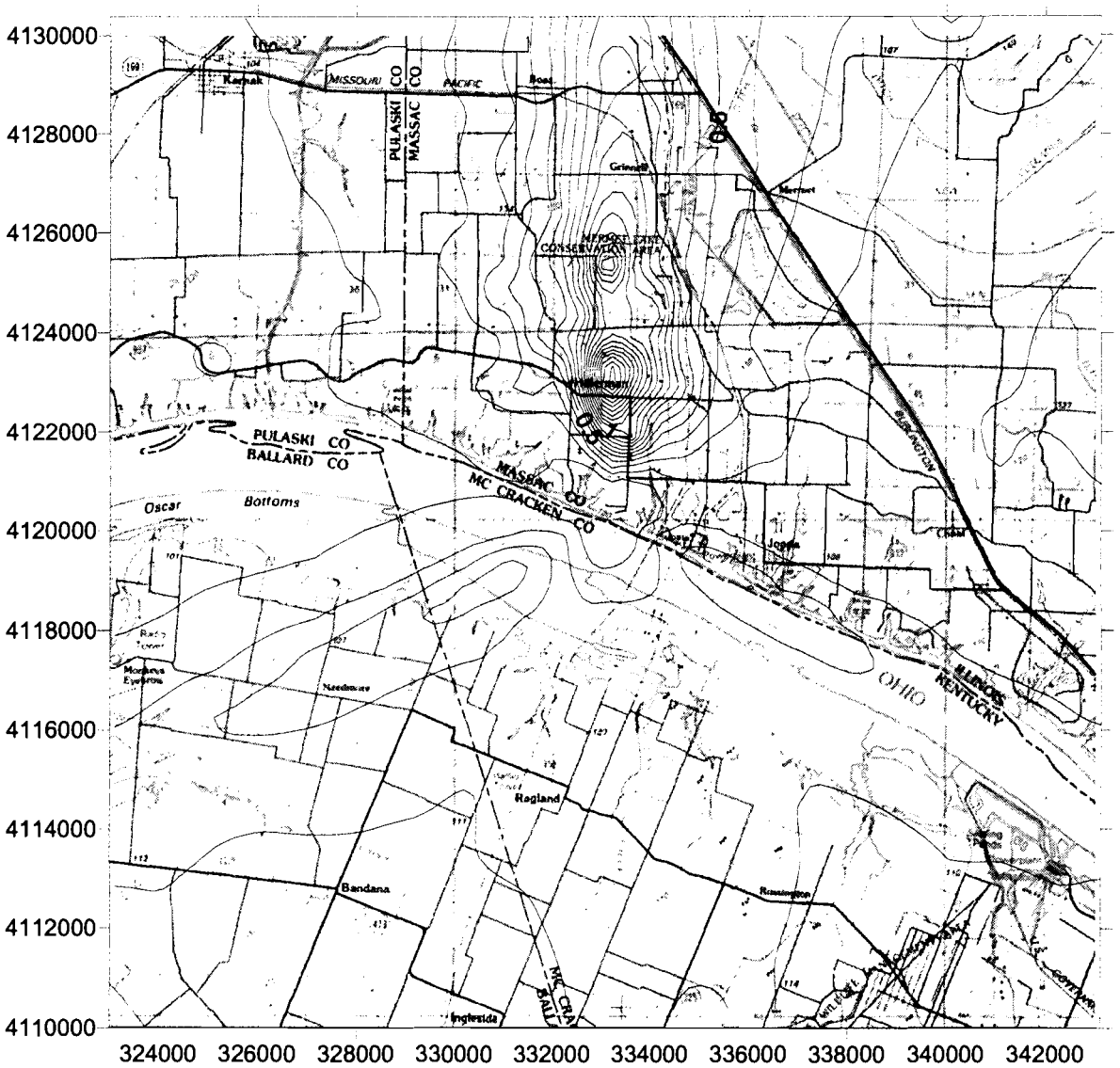

Figure 2 **Modeled SO, ground-level annual average concentrations (pg/m^3) for the proposed facility modification at maximum emission rates. The contour interval is 0.1 µg/m^3 and the peak contour is 2 pg/m^3.**

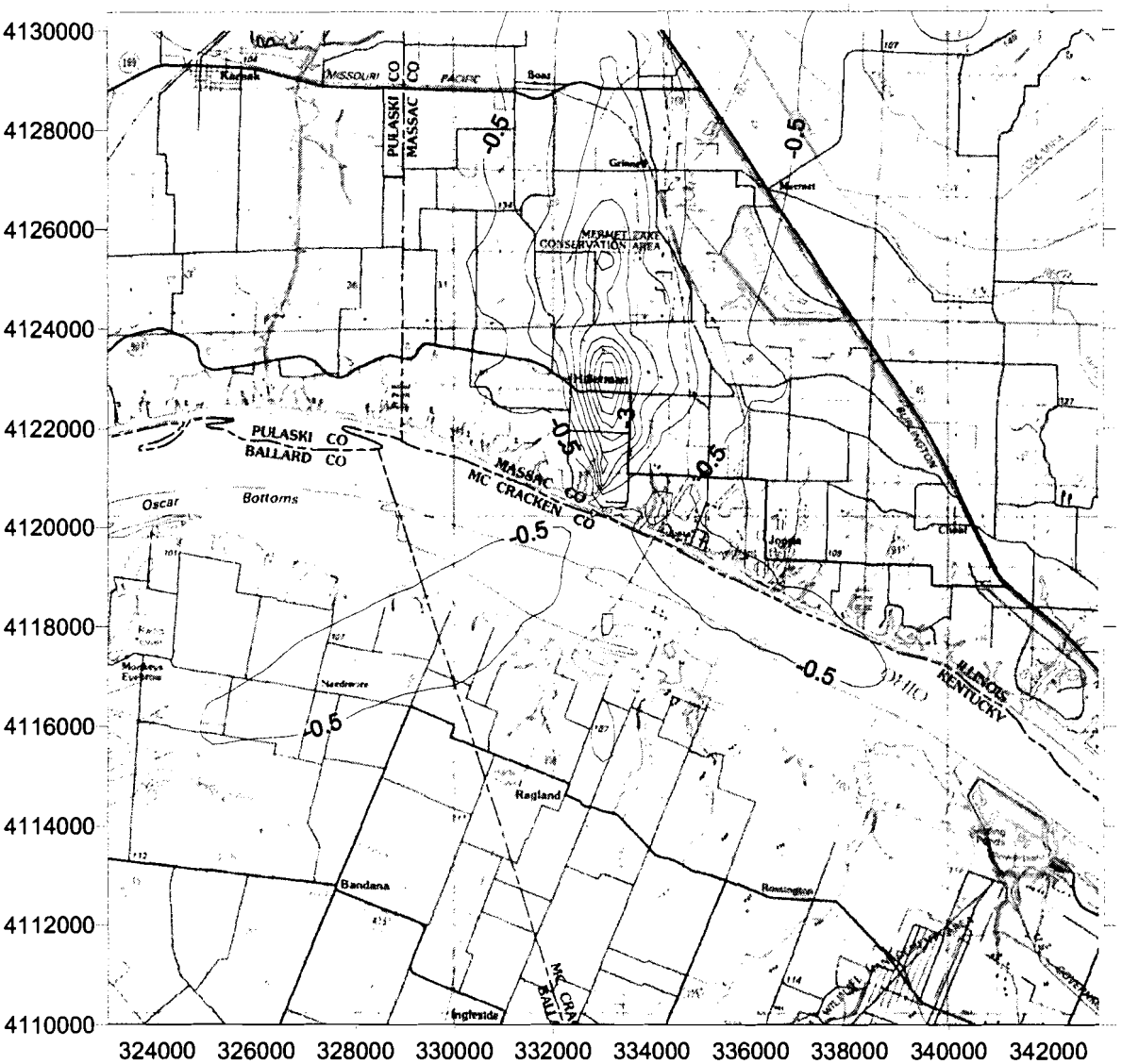

Figure 3 Modeled SO, ground-level annual average concentrations (pg/m^3) for the existing facility at actual emission rates. The contour interval is –0.5 pg/m^3 and the peak contour is –5.5 pg/m^3. Negative values are used to allow superposition with Figure 2.

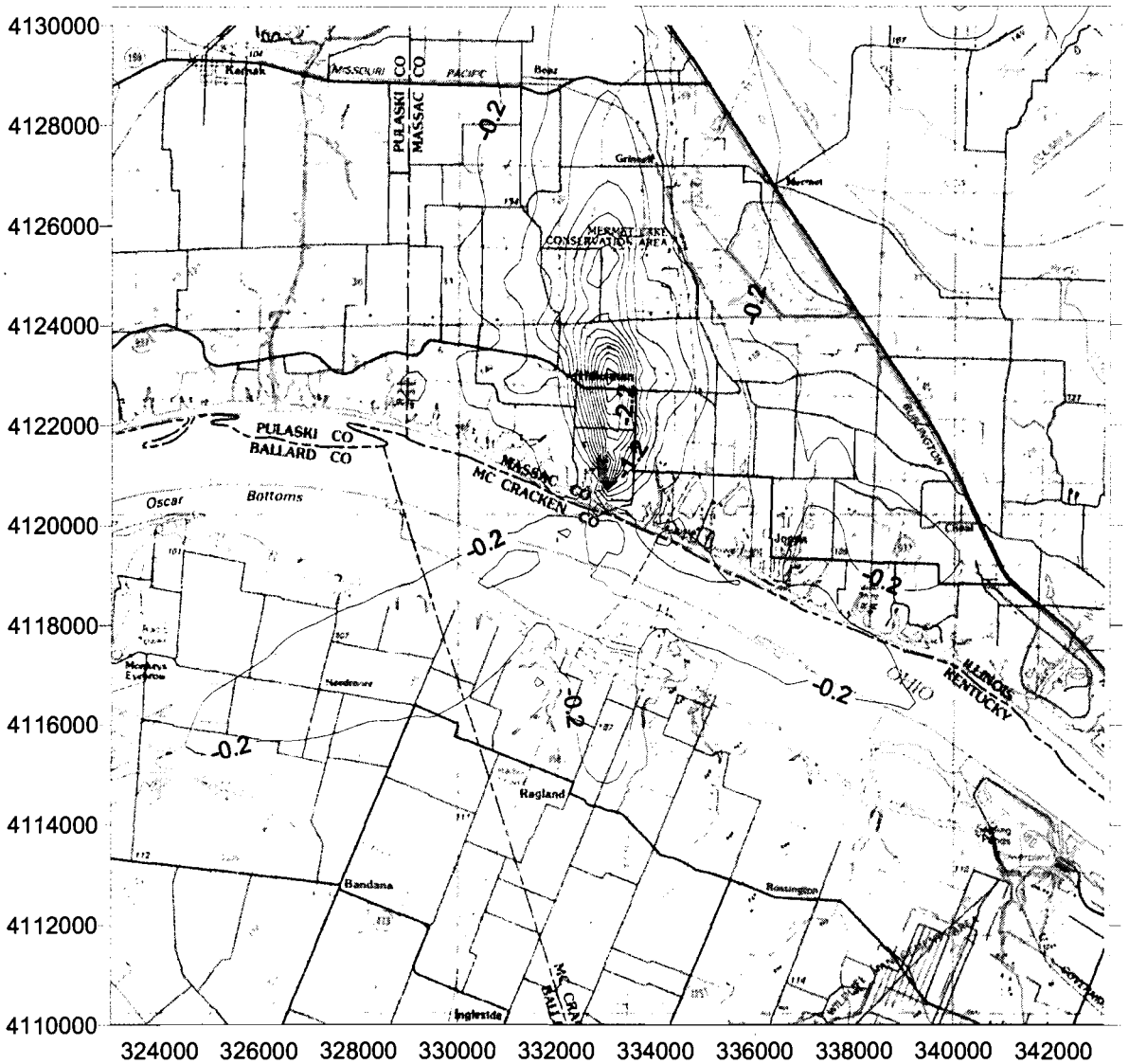

Figure 4 Modeled net SO, ground-level annual average concentrations (pg/m^3) for the proposed facility modification, calculated as maximum potential emission rate impacts less present actual emission rate impacts. The contour interval is –0.2 μg/m^3 and the peak contour is –3.2 μg/m^3. Impacts are the superposed values of Figures 2 and 3.

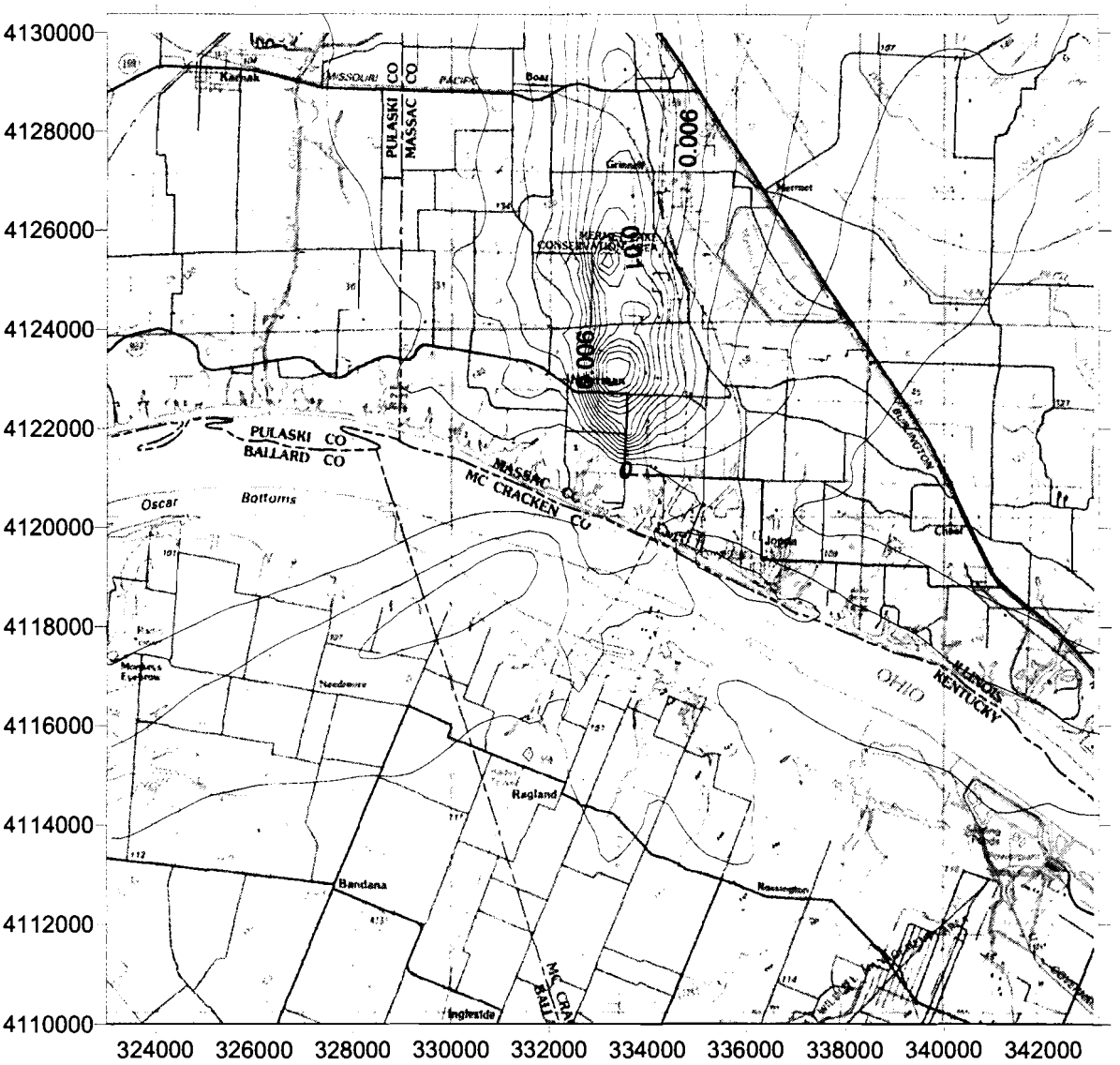

Figure 5 Modeled net benzene ground-level annual average concentrations (pg/m^3) for the proposed facility modification, calculated as maximum potential emission rate impacts less present actual emission rate impacts. The contour interval is 0.001 μg/m^3 and the minimum and maximum contours are -0.004 μg/m^3 and 0.015 μg/m^3, respectively. Negative contours are indicated in red (near the facility) and the green contour indicates zero (no net impact).

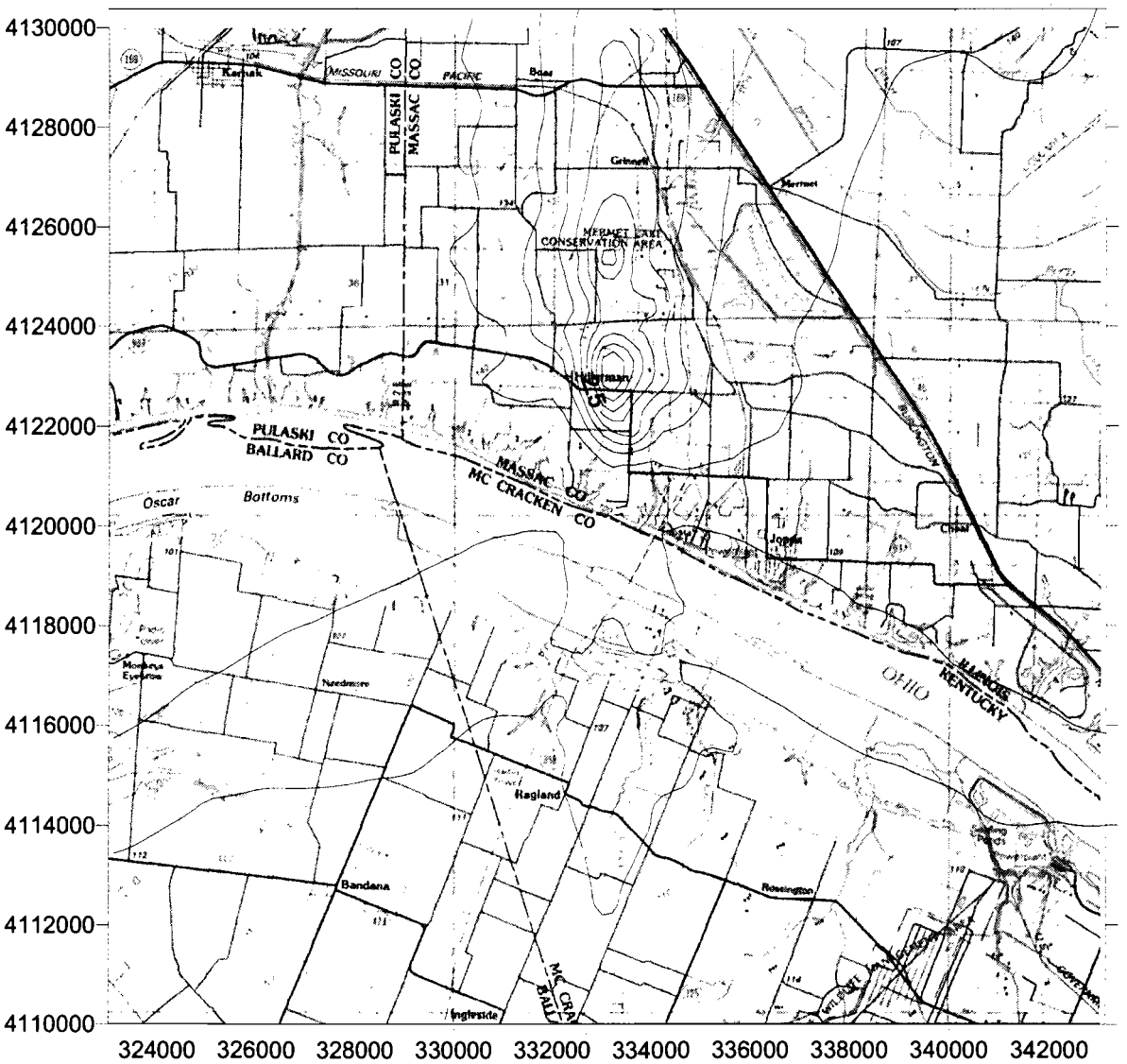

Figure 6 **Modeled NO, (as NO,) ground-level annual average concentrations (pg/m^3) for the proposed facility modification at maximum emission rates. The contour interval is 0.5 pg/m^3 and the peak contour is 4.5 µg/m^3.**

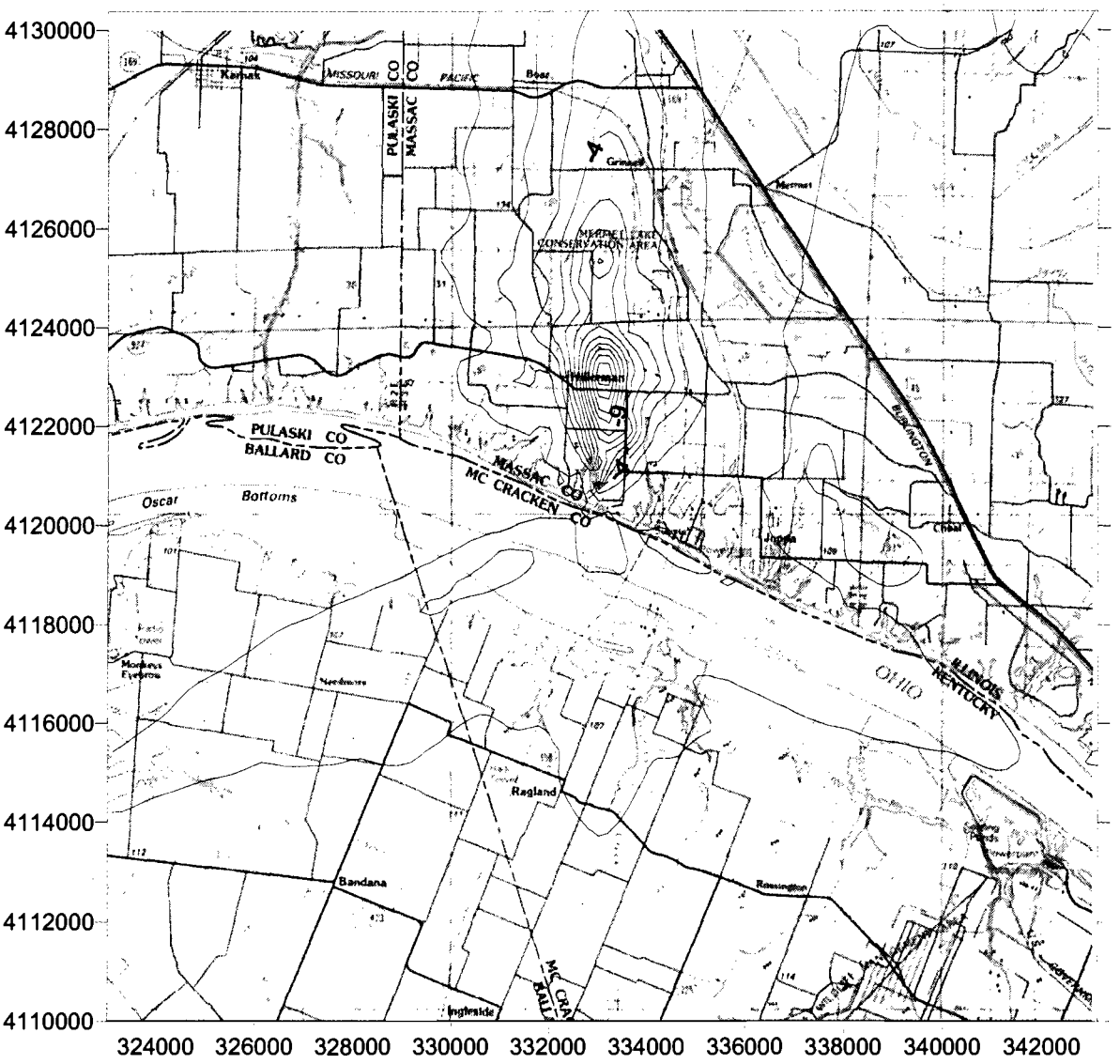

Figure 7 **Modeled NO, (as NO,) ground-level annual average concentrations (pg/m^3) for the existing facility at actual emission rates. The contour interval is –1 pg/m^3 and the peak contour is –14 pg/m^3. Negative values are used to allow superposition with Figure 6.**

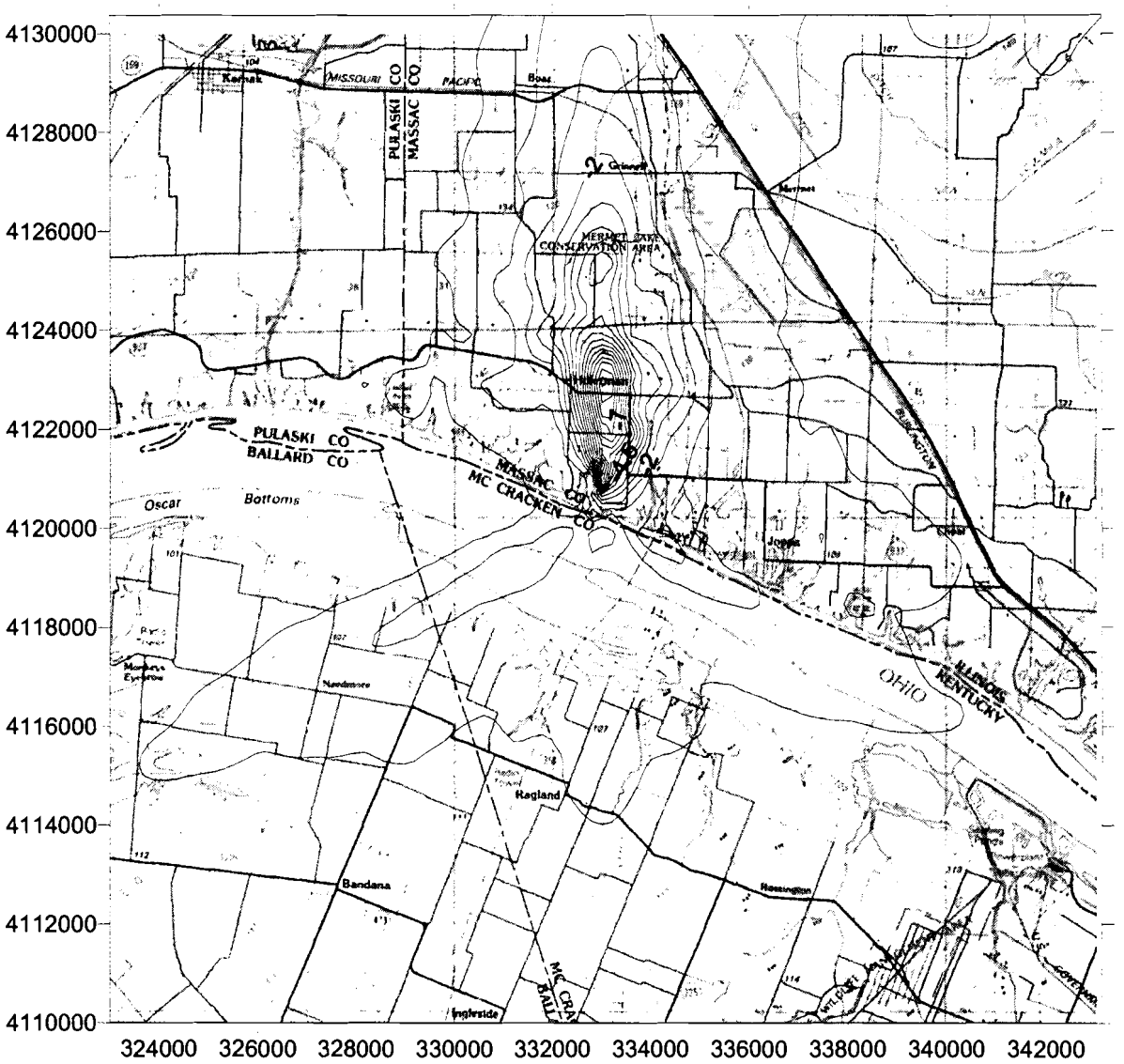

Figure 8 Modeled net NO, (as NO,) ground-level concentrations ($\mu g/m^3$) for the proposed facility modification, calculated as maximum potential emission rate impacts less present actual emission rate impacts. The contour interval is -0.5 pg/m^3 and the peak contour is –9.5 pg/m^3. Impacts are the superposed values of Figures 6 and 7.

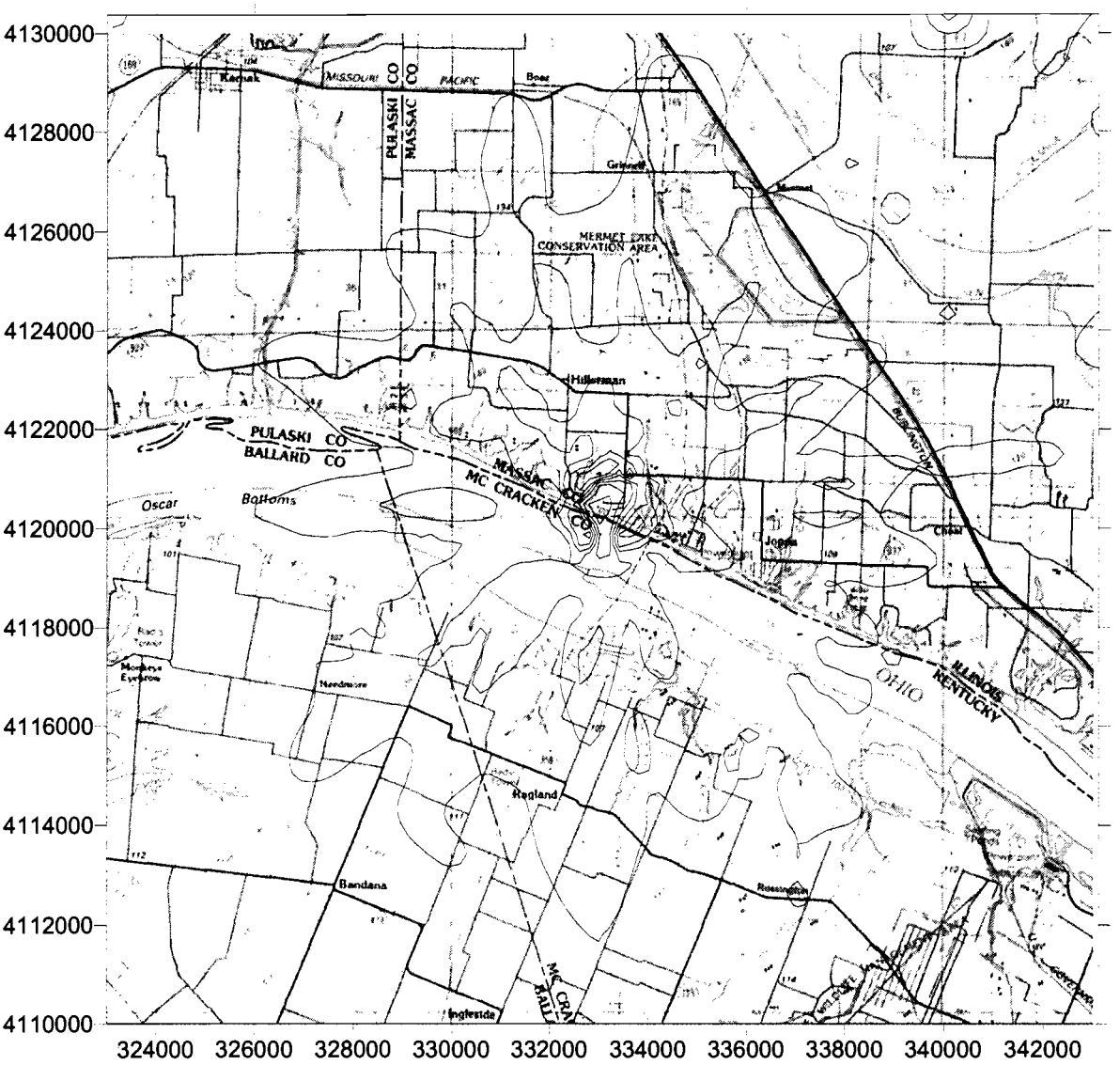

Figure 9 Modeled maximum net carbon monoxide (CO) ground-level 1-hour average concentrations (pg/m^3) for the proposed facility modification, calculated as maximum potential emission rate impacts less present actual emission rate impacts. The contour interval is 20 $\mu g/m^3$ and the peak contour is 140 pg/m^3. All values are below the Significant Impact Level (SIL) of 2,000 pg/m^3.

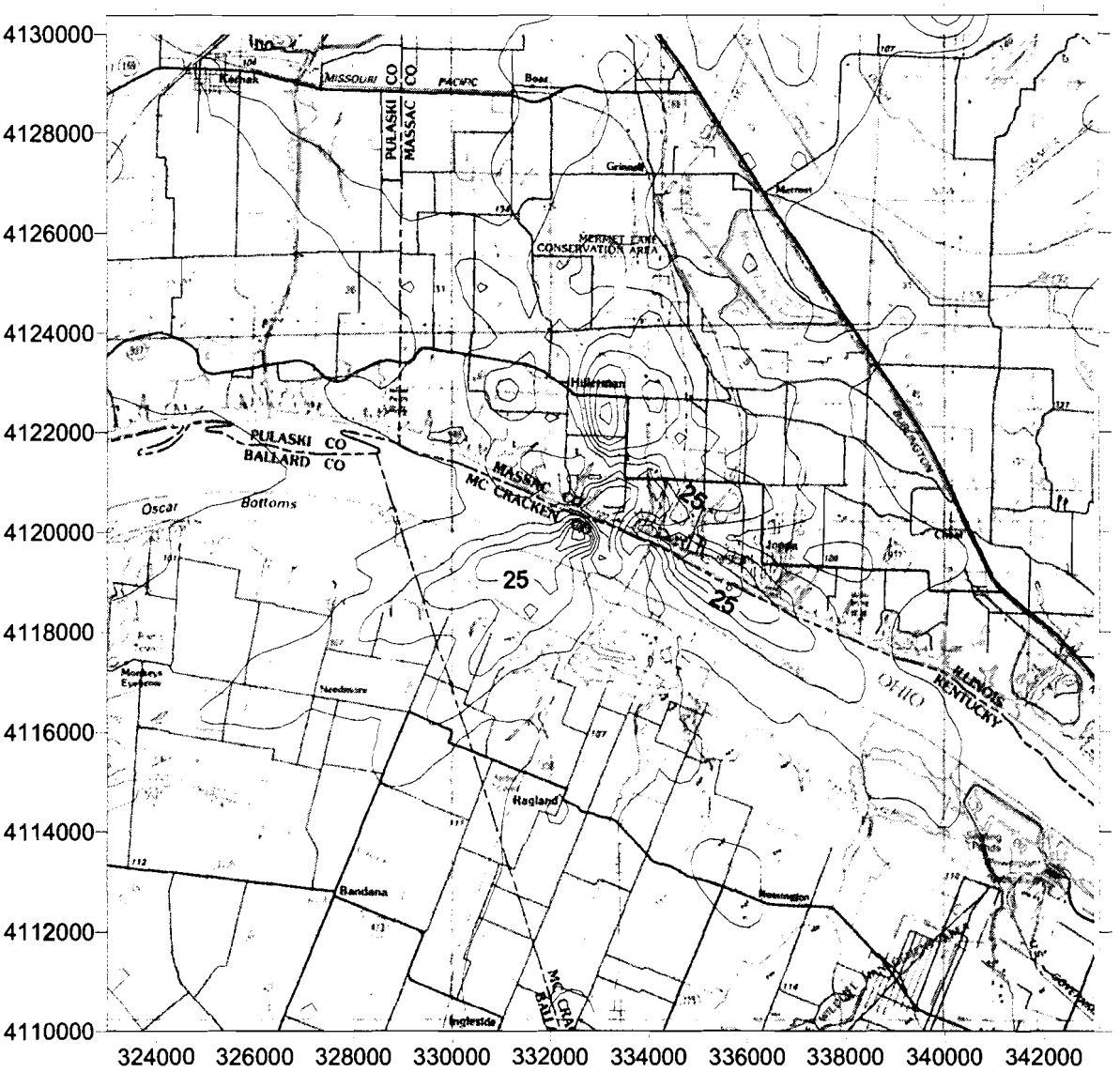

Figure 10 Modeled maximum net carbon monoxide (CO) ground-level 8-hour average concentrations (pg/m^3) for the proposed facility modification, calculated as maximum potential emission rate impacts less present actual emission rate impacts. The contour interval is 5 pg/m^3 and the peak contour is 45 μg/m^3. All values are below the Significant Impact Level (SIL) of 500 pg/m^3.

Attachment 2

Additional Information and Analysis of Surface Water and Sediment Impacts from the Lafarge Midwest, Inc. – Joppa Cement Plant Expansion

Sediment Impacts

Run-of and Erosion: The analysis provided by Cambridge Environmental for the Lafarge Midwest Inc. expansion did not consider impacts due to run-off and erosion. For a worst case scenario we have assumed sediment concentration is 2 times the soil concentration (erosion of soil to water body with no loss, deposition to water body same as to soil and 100% ends up on surface of sediment). Table 1 provides a comparison of the adjusted sediment concentration estimates to the screening-level benchmark concentration. The screening level benchmarks selected are the lowest ecotoxicity benchmark from any of the data sources contained in the Risk Assessment Information System (RAIS). A hazard ratio was calculated by dividing the adjusted screening-level estimate by the screening level benchmark. As a result of this adjustment two additional pollutants have a hazard ratio greater than one, acetone (1.7) and bromomethane (1.4).

The Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Acetone (Section 5.3.1 Transport and Partitioning) indicates that small amounts of acetone may be removed from the atmosphere by wet deposition. The complete miscibility of acetone in water would suggest that partitioning to sediments and suspended solids in water is not significant. Volatilization will control the fate of acetone in water. Furthermore, data suggests that bioconcentration of acetone in aquatic organisms is not significant and that biomagnification of acetone from animals of lower to higher trophic level is unlikely.

Based on the ATSDR information on acetone, it is likely that the Cambridge Environmental estimation of sediment concentration was greatly overestimated. USEPA believes that emissions of acetone into the ambient air by Lafarge would not likely adversely impact any endangered species.

The ATSDR toxicological profile for bromomethane (Section 5.3.1 Transport and Partitioning) indicates that the partitioning of bromomethane from air into water would be quite small, while the rate of volatilization from water into are would be quite high. Bromomethane would not be expected to bioconcentrate. Again the modeled values provided by Cambridge Environmental are likely greatly exaggerated, and USEPA does not anticipate an adverse impact from the emission of bromomehtane.

Consideration of Background Contamination

The analysis provided by Cambridge Environmental did not include background concentrations in the evaluation of project effects. USEPA was not able to locate data on sediment contamination or water column contamination in the Ohio River for several pollutants. Table 2 and Table 3 provide a comparison of project impact plus background to the screening-level environmental benchmark where background information was available.

The project has the potential for emissions of 69 hazardous air pollutants. USEPA was able to locate background information as follows:

Sediments:

The Ohio River Valley Water Sanitation Commission provided data on 2,3,7,8 TCDD from samples taken between river miles 904.7 and 980.3 in August of 2002.

The USFWS provided data on Aluminum, Barium, Beryllium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Zinc, Naphthalene, Fluorine, Phenanthrene, Fluoranthene, Pyrene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(e)pyrene, Benzo(g,h,i)perylene, and Benzo(a)pyrene. Samples were taken at river miles 950.3, 950.9, and 952.3 in 1992.

Surface Water:

Surface Water Quality data was obtained from the USGS for the Ohio River at Lock and Dam 53 near Grand Chain, Illinois at river mile 962.2 for water year October 2004 through September 2005. Information for the following pollutants was available: Calcium, Potassium, Sodium, Chloride, Fluoride, Ammonia, Nitrite, Aluminum, Antimony, Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Selenium, Silver, and Zinc.

When considering background plus project impact estimates in comparison to the screening-level benchmark, a hazard ratio greater than one was found for Benzo(g,h,i)perylene (1.2), Phenantrhrene (1.7), Pyrene (1.6), Chromium (1.2), Iron (1.3), Manganese (2.4), Nickel (1.5) and Zinc (1.1) for sediment impact. Surface water hazard ratios exceeded one for 2,3,7,8-TCDD (2.4) and Silver (1.7). For complete results see table 2 for Sediment impacts and table 3 for surface water impacts.

Benzo(g,h,i)perylene: The background concentration for this pollutant was 2.1E-01 mg/kg. The screening-level benchmark concentration was 1.7E-01 mg/kg. The project contribution was estimated to be 1.8E-06 mg/kg. The background concentration alone exceeds the benchmark concentration. The project impact of 1.8E-06 mg/kg is 0.0009% of the existing background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

Phenanthrene: The background concentration for this pollutant is 3.3E-01 mg/kg. The screening-level benchmark concentration is 2.0E-01 mg/kg. The estimated impact from the project is 1.8E-02 mg/kg. The background concentration alone exceeds the benchmark concentration. The project impact of 1.8E-02 is 5.5% of the existing background. It should be noted that the amount of phenanthrene contributed by the project has been greatly exaggerated. Additionally, the low additional exposure resulting from the project estimates would not likely result in an adverse impact on the Indiana Bat

or the Bald Eagle based on the fact that Polycyclic Aromatic Hydrocarbons (PAHs) are readily metabolized. With respect to the 4 mussel species, Unionids are not known to be particularly sensitive to PAHs. At the low level selected for the benchmark, the conservatively estimated impact from the project is not expected to have an adverse impact on the Unionids.

Pyrene: The background concentration for this pollutant is 3.1E-01 mg/kg. The screening-level benchmark concentration is 2.0E-01 mg/kg. The estimated impact from the project is 2.0E-04 mg/kg. The background concentration alone exceeds the benchmark concentration. The project impact of 2.0E-04 mg/kg is 0.06% of the existing background. The project impacts are insignificant in comparison to existing background.
Chromium: The existing background for this pollutant is 5.1E+01 mg/kg. The screening-level benchmark concentration is 4.3E+01 mg/kg. The estimated contribution from the project is 7.8E-03 mg/kg. The project impact of 7.8E-03 mg/kg is 0.02% of the background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

Iron: The existing background for this pollutant is 2.6E+04 mg/kg. The screening-level benchmark concentration is 2.0E+04 mg/kg. The estimated project impact is 7.6E-01 mg/kg. The project impact of 7.6E-01 mg/kg is 0.003% of the existing background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

Manganese: The existing background for this pollutant is 1.1E+03 mg/kg. The screening-level benchmark concentration is 4.6E+02 mg/kg. The estimated project impact is 3.8E-02 mg/kg. The project impact is 0.003% of the existing background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

Nickel: The existing background for this pollutant is 3.5E+01 mg/kg. The screening-level benchmark is 2.3E+01 mg/kg. The estimated project impact is 1.4E-04 mg/kg. The existing background alone exceeds the benchmark concentration. The project impact of 1.4E-04 is 0.0004% of the existing background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

Zinc: The existing background for this pollutant is 1.3E+02 mg/kg. The screening-level benchmark is 1.2E+02 mg/kg. The estimated project impacts are 1.3E-02 mg/kg. The background concentration alone exceeds the benchmark concentration. The project impact of 1.3E-02 mg/kg is 0.01% of the existing background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

2,3,7,8-TCDD: USEPA was unable to locate background surface water data for 2,3,7,8-TCDD. The estimated project impacts alone exceed the screening level benchmark; however, based on the discussion provided by Cambridge Environmental, USEPA finds that the project is not likely to adversely impact an endangered species. (See page 8 of Attachment 1.)

Silver: The background concentration for Silver is <2.0E-01 µg/l. For calculating the background plus project contribution, the background was assumed to be equal to 2.0E-01 µg/l, which exceeds the selected benchmark of 1.2 E-01 µg/l. The project contribution of 2.1E-06 µg/l is 0.001% of the assumed background. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution. With respect to sediment, USEPA was unable to locate any site specific background data. The project contribution is 0.006% of the benchmark for sediment. The project impacts are insignificant in comparison to existing background. It would not likely be possible to measure or detect any negative response to an endangered species in response to the project contribution.

There are a total of 69 hazardous air pollutants affected by this project. Of those 69, 4 pollutants (Chloride, Mercury, Sulfate, Sulfuric Acid Mist) are actually decreasing as a result of the project. Because emissions are decreasing, the project is not likely to have an adverse impact on any of the endangered species. There are 17 additional pollutants for which no benchmark exists for sediments. These pollutants are Benzaldehyde, Chloromethane, Formaldehyde, Freon 113, Ammonia, Ammonium, Barium, Beryllium, Calcium, Fluoride, Hydrogen Chloride, Nitrate, Potassium, Selenium, Sodium, Thallium, and Titanium. For surface water, no benchmark could be identified for 6 pollutants, Benzaldehyde, Benzo(k)flouranthene, Formaldehyde, PACs, Nitrate, and Titanium.

Of the remaining pollutants, we were unable to obtain sediment background information for the following pollutants: C3 Benzenes, C4 Benzenes, C6 Benzenes, Acenaphthylene, Acetone, Benzene, Benzo(a)anthracene, Benzoic Acid, Biphenyl, Bis(2-ethylhexyl)phthalate, Bromomethane, Carbon Disulfide, Chlorobenzene, Di-n-butylphthalate, Bibenz(a,h)anthracene, Ethylbenzene, Indeno(1,2,3-cd)pyrene, Methyl Ethyl Ketone, Methylene Chloride, Methnaphthalene, Polycyclic Aromatic Compounds (PACs), Phenol, Styrene, Toluene, Xylenes, Antimony, Arsenic and Silver. We were unable to locate surface water background information for: Polychlorinated Dioxins and Furans, C3 Benzenes, C4 Benzenes, C6 Benzenes, Acenaphtylene, Acetone, Benzene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Benzoic Acid, Biphenyl, Bis(2-ethylhexyl)phthalate, Bromomethane, Carbon Disulfide, Chlorobenzene, Chrysene, Di-n-butylphthalate, Dibenz(a,h)antrhacene, Ethylbenzene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Methyl Ethyl Ketone, Methylene Chloride, Methnaphthalene, Naphthalene, PACs, Phenanthrene, Phenol, Pyrene, Styrene, Toluene, Xylenes, Ammonium, Hydrogen Chloride, and Thallium.

Polychlorinated dioxins and furans: A search of STORET data in all locations found surface water sampling had been performed by the National Park Service in 1994 for an unspecified mix of dioxins and furans in South Carolina. The highest concentration detected was 0.00001 μg/l. Because this pollutant is hydrophobic, concentrations of these compounds in water tend to be adsorbed on to particulate matter in water. Background sediment data was available for this compound, and the background plus project contribution were less than the benchmark value. USEPA has concluded that emissions of this compound resulting from the project will not likely have an adverse impact on any of the endangered species.

Benzene, **C3** *Benzenes, C4 Benzenes, C6 Benzenes:* According to the ATSDR Toxicological Profile for Benzene (Section 6.3.1 Transport and Partitioning), benzene is highly volatile and partitions readily to the atmosphere from surface water. Any emissions from the project that might be deposited to surface water are expected to quickly volatilize. The Cambridge Environmental estimates are likely greatly exaggerated. Additionally the Toxicological Profile states that biconcentration/bioaccumulation of benzene in the aquatic food chain does not appear to be important. Based on this information, USEPA has concluded that emissions of these compounds will not likely adversely impact any of the endangered species.

Acetone: As stated previously, the ATSDR Toxicological Profile for Acetone (Section 5.3.1 Transport and Partitioning) indicates that small amounts of acetone may be removed from the atmosphere by wet deposition. The complete miscibility of acetone in water would suggest that partitioning to sediments and suspended solids in water is not significant. Volatilization will control the fate of acetone in water. Furthermore, data suggests that bioconcentration of acetone in aquatic organisms is not significant and that biomagnification of acetone from animals of lower to higher trophic level is unlikely. USPEA has concluded that emissions of acetone will not likely adversely impact any of the endangered species.

Acenaphthylene: The National Park Service "Environmental Contaminants Encyclopedia" has an entry for this pollutant. According to the entry for Acenaphtylene, this pollutant may partition from the water column to organic matter contained in sediments and suspended solids. It also indicates that it is not expected to bioconcentrate in the environment. Because this contaminant is not expected to bioconcentrate, no background information is available, and the actual source contribution is less than the benchmark, USEPA finds that the project is not likely to have an adverse impact on the endangered species as a result of this pollutant.

PAHs: The PAHs potentially emitted by Lafarge include Acenaphtylene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Biphenyl, Chrysene, Dibenz(a,h)antrhacene Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Methnaphthalene, Naphthalene, PACs, Phenanthrene, and Pyrene. Some of these compounds have been discussed previously where we were able to locate background data. The RAIS benchmark selected for total PAHs is 1.6 mg/kg for sediment. There was no benchmark identified for surface water. The total

project contribution from PAHs for the project were estimated to be approximately 6.0E-02 mg/kg, which is roughly 4% of the selected benchmark. Background concentrations for PAHs as a group or for all PAHs individually were not available. PAHs at this level are not expected to be a concern for the Bald Eagle or the Indiana Bat, as they are readily metabolized. With respect to the 4 mussel species, Unionids are not known to be particularly sensitive to PAHs. At the low level selected for the benchmark, the conservatively estimated impact from the project is not expected to have an adverse impact on the Unionids.

Benzoic Acid: In searching STORET data, the vast majority of water samples and sediment samples found benzoic acid to be non-detectable or in quantities too small to measure. Because there is no site specific background data for this pollutant, and because the impact from the project alone are considerably less than the benchmark, USEPA finds that benzoic acid emissions from this project are not likely to adversely impact any endangered species.

Bis(2-ethylhexyl)phthalate ***and*** *Di-n-butylphthalate*: USEPA was unable to locate site specific background sediment or surface water concentrations for these two pollutants. The project contribution of Bis(2-ethylhexyl)phthalate is 2.3% of the sediment benchmark and 0.12% of the surface water benchmark. The project contribution of Di-n-butylphtalate is 0.09% of the sediment benchmark and 0.003% for surface water. Due to the small contribution of these pollutants from the project and the conservative estimate of project impacts, USEPA finds that the project is not likely to have an adverse impact on the endangered species with respect to these pollutants.

Bromomethane: The ATSDR toxicological profile for bromomethane (Section 5.3.1 Transport and Partitioning) indicates that the partitioning of bromomethane from air into water would be quite small, while the rate of volatilization from water into are would be quite high. Bromomethane would not be expected to bioconcentrate. Again the modeled values provided by Cambridge Environmental are likely greatly exaggerated, and USEPA does not anticipate an adverse impact from the emission of bromomehtane.

Carbon Disulfide: According to the ATSDR Toxicological Profile for this pollutant (Section 5.3.1 Transport and Partitioning), Carbon Disulfide in surface water would be expected to partition to the atmosphere rapidly. Additionally, Carbon Disulfide is not expected to bioaccumulate significantly in aquatic organisms. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Chlorobenzene: According to the ATSDR Toxicological Profile for this pollutant (Section 5.3.1 Transport and Partitioning), Chlorobenzene is volatile and has only moderate solubility in water. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the

benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Ethylbenzene: According to the ATSDR Toxicological Profile for this pollutant (Section 5.3.1 Transport and Partitioning), a significant proportion of Ethylbenzene will partition from water into air. Additionally, Ethylbenzene does not significantly bioaccumulate in aquatic food chains. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Methyl Ethyl Ketone (2-Butanone): According to the ATSDR Toxicological Profile for this pollutant (Section 5.3.1 Transport and Partitioning), Methyl Ethyl Ketone in water is expected to rapidly volatilize to the atmosphere. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Methylene Chloride: According to the ATSDR Toxicological Profile for this pollutant (Section 5.3.1 Transport and Partitioning), Methylene Chloride tends to volatilize to the atmosphere from water and soil. Methylene Chloride is not strongly sorrbed to soils or sediment. There is no evidence of biomagnifications and significant biomagnification of Methylene Chloride in aquatic food chains is not expected. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Phenol: According to the ATSDR Toxicological Profile for Phenol (Section 5.3.1 Transport and Partitioning), some Phenol may wash out of the atmosphere; however, it is probable that only limited amounts wash out because of the short atmospheric half-life of this pollutant. Sorption to sediment is not an important transport process, and Phenol is not expected to bioconcentrate significantly in aquatic organisms. The estimated project contribution to surface water and sediment for this pollutant is considerably less than the benchmark values. Based on this information and the fact that site specific background data could not be located, USEPA finds that project emissions of Phenol are not likely to adversely impact any endangered species.

Styrene: According to the ATSDR Toxicological Profile for Styrene (Section 5.3.1 Transport and Partitioning), physical processes such as precipitation and dry deposition would not be significant mechanisms for removing styrene from the atmosphere because of its high photochemical reactivity. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Toluene: According to the ATSDR Toxicological Profile (Section 5.3.1 Transport and Partitioning), Toluene is sufficiently volatile that the majority of toluene released to the environment partitions to air. Based on this fact, USEPA finds that the emissions of Toluene from the proposed project are not likely to have an adverse impact on any endangered species.

Xylenes: According to the ATSDR Toxicological Profile for this pollutant (Section 5.3.1 Transport and Partitioning) , Xylenes are expected to rapidly volatilize in surface water and will not adsorb strongly to organic matter. Based on this information, the fact that no background data for the location could be located, and the fact that project emissions are less than the benchmark values for surface water and sediments, USEPA finds that emissions of this pollutant are not likely to adversely impact any endangered species.

Ammonium: The estimated project impact of 3.7E-01 μg/l is 0.025% of the benchmark for surface water. USEPA was unable to identify a benchmark for sediment contamination. Due to the small contribution of these pollutants from the project and the conservative estimate of project impacts, USEPA finds that the project is not likely to have an adverse impact on the endangered species with respect to these pollutants.

Hydrogen Chloride: The estimated project impact of 5.6E-01 μg/l is 0.0002% of the benchmark concentration for surface water. USEPA was unable to identify a benchmark for sediment contamination. Due to the small contribution of these pollutants from the project and the conservative estimate of project impacts, USEPA finds that the project is not likely to have an adverse impact on the endangered species with respect to these pollutants.

Thallium: The estimated project impact of 1.8E-05 μg/l is 0.0002% of the benchmark identified for surface water. USEPA was unable to identify a benchmark for sediment contamination. Due to the small contribution of these pollutants from the project and the conservative estimate of project impacts, USEPA finds that the project is not likely to have an adverse impact on the endangered species with respect to these pollutants.

Table 1 - Sediment Adjusted Account for Run-off and Erosion

Chemical	Screening-level concentration	Screening-level concentration (adjusted for run-off and soil erosion)	Screening-level benchmark concentration	Screenin-level hazard ratio
Polychlorinated dioxins and furans (PCDD/PCDF, expressed as 2,3,7,8-TCDD toxic equivalents)	4.9E-08	9.8E-08	1.2E-07	8.2E-01
C3 Benzenes (a)	5.9E-05	1.2E-04	1.4E-01	8.4E-04
C4 Benzenes (a)	1.4E-04	2.8E-04	1.4E-01	2.0E-03
C6 Benzenes (a)	2.1E-05	4.2E-05	1.4E-01	3.0E-04
Acenaphthylene	2.7E-03	5.4E-03	5.9E-03	9.2E-01
Acetone	8.4E-03	1.7E-02	9.9E-03	1.7E+00
Benzaldehyde (b)	5.4E-04	1.1E-03	NoBench	NoBench
Benzene	4.4E-01	8.8E-01	1.4E-01	6.3E+00
Benzo(a)anthracene	9.7E-07	1.9E-06	1.1E-01	1.8E-05
Benzo(a)pyrene	2.9E-06	5.8E-06	1.5E-01	3.9E-05
Benzo(b)fluoranthene	1.3E-05	2.6E-05	1.0E+01	2.6E-06
Benzo(g,h,i)perylene	1.8E-06	3.6E-06	1.7E-01	2.1E-05
Benzo(k)fluoranthene	3.4E-06	6.8E-06	2.4E-01	2.8E-05
Benzoic Acid	7.9E-02	1.6E-01	6.5E-01	2.4E-01
Biphenyl	1.4E-04	2.8E-04	1.1E+00	2.5E-04
Bis(2-ethylhexyl)phtalate	2.1E-03	4.2E-03	1.8E-01	2.3E-02
Bromomethane	9.7E-04	1.9E-03	1.4E-03	1.4E+00
Carbon Disulfide	2.5E-03	5.0E-03	2.4E-02	2.1E-01
Chlorobenzene	3.6E-04	7.2E-04	2.9E-01	2.5E-03
Chloromethane	8.6E-03	1.7E-02	NoBench	NoBench
Chrysene	3.6E-06	7.2E-06	1.7E-01	4.2E-05
Di-n-butylphtalate	9.3E-04	1.9E-03	2.2E+00	8.5E-04
Dibenz(a,h)anthracene	1.4E-05	2.8E-05	3.3E-02	8.5E-04
Ethylbenzene	4.3E-04	8.6E-04	1.8E-01	4.8E-03
Fluoranthene	2.0E-04	4.0E-04	4.2E-01	9.5E-04
Fluorene	4.3E-04	8.6E-04	7.7E-02	1.1E-02
Formaldehyde	1.0E-02	2.0E-02	NoBench	NoBench
Freon 113	1.1E-03	2.2E-03	NoBench	NoBench
Indeno(1,2,3-cd)pyrene	2.0E-06	4.0E-06	2.0E-01	2.0E-05
Methyl Ethyl Ketone	6.8E-04	1.4E-03	4.2E-02	3.2E-02
Methylene Chloride	1.1E-02	2.2E-02	1.6E-01	1.4E-01
Methlnaphthalene (c)*	9.5E-05	1.9E-04	2.0E-02	9.5E-03
Naphthalene	4.7E-02	9.4E-02	1.8E-01	5.2E-01

Table 1 - Sediment Data Adjusted to Account for Run-off and Erosion

Chemical	Screening-level concentration	Screening-level concentration (adjusted for run-off and soil erosion)	Screening-level benchmark concentration	Screenin-level hazard ratio
PACs (d)	2.5E-04	5.0E-04	1.6E+00	3.1E-04
Phenanthrene	8.8E-03	1.8E-02	2.0E-01	8.8E-02
Phenol	2.5E-03	5.0E-03	4.9E-02	1.0E-01
Pyrene	9.9E-05	2.0E-04	2.0E-01	9.9E-04
Styrene	3.4E-05	6.8E-05	2.5E-01	2.7E-04
Toluene	4.3E-03	8.6E-03	1.2E+00	7.2E-03
Xylenes	2.9E-03	5.8E-03	4.3E-01	1.3E-02
Aluminum	2.9E-01	5.8E-01	5.8E+04	1.0E-05
Ammonia	2.3E-01	4.6E-01	NoBench	NoBench
Ammonium	2.5E+00	5.0E+00	NoBench	NoBench
Antimony	3.2E-05	6.4E-05	2.0E+00	3.2E-05
Arsenic	2.7E-04	5.4E-04	9.8E+00	5.5E-05
Barium	1.1E-02	2.2E-02	NoBench	NoBench
Beryllium	1.5E-05	3.0E-05	NoBench	NoBench
Cadmium	1.4E-05	2.8E-05	9.9E-01	2.8E-05
Calcium	5.4E+00	1.1E+01	NoBench	NoBench
Chloride	Net Decrease	Net Decrease	NoBench	NoBench
Chromium	3.9E-03	7.8E-03	4.3E+01	1.8E-04
Copper	1.2E-01	2.4E-01	3.2E+01	7.5E-03
Fluoride	2.0E-02	4.0E-02	NoBench	NoBench
Iron	3.8E-01	7.6E-01	2.0E+04	3.8E-05
Hydrogen Chloride (HCl) (g)	3.7E+00	7.4E+00	NoBench	NoBench
Lead	2.3E-03	4.6E-03	3.6E+01	1.3E-04
Manganese	1.9E-02	3.8E-02	4.6E+02	8.3E-05
Mercury	Net Decrease	Net Decrease	NoBench	NoBench
Nickel	7.2E-05	1.4E-04	2.3E+01	6.3E-06
Nitrate	1.0E-01	2.0E-01	NoBench	NoBench
Potassium	4.1E-01	8.2E-01	NoBench	NoBench
Selenium	4.8E-03	9.6E-03	NoBench	NoBench
Silver	1.4E-05	2.8E-05	5.0E-01	5.6E-05
Sodium	8.6E-01	1.7E+00	NoBench	NoBench
Sulfate	Net Decrease	Net Decrease	NoBench	NoBench
Sulfuric Acid Mist (H_2SO_4)	Net Decrease	Net Decrease	NoBench	NoBench
Thallium	1.2E-04	2.4E-04	NoBench	NoBench

Table 1 ▪ Sediment Data Adjusted to Account for Run-off and Erosion

Chemical	Screening-level concentration	Screening-level concentration (adjusted for run-off and soil erosion)	Screening-level benchmark concentration	Screenin-level hazard ratio
Titanium	8.4E-03	1.7E-02	NoBench	NoBench
Zinc	6.5E-03	1.3E-02	1.2E+02	1.1 E-04

Notes: (a) Benzene used as a chemical surrogate

(b) Formaldehyde used as a chemical surrogate

(c) Values selected for 2-Methylnaphtalene

(d) PACs are polycyclic aromatic compounds. The category of total PAHs (polycyclic aromatic hydrocarbons) was selected from the RAIS to identify benchmarks.

(e) Value obtained from Section 302.212 of the general use water quality standards for Illinois. Value may not be specific to ecological receptors of concern, and is applied to both ammonia and ammonium as a screening-level evaluation.

(f) Values based on a hardness of 119 mg/l (the average measurements at Ohio River Lock and Dam 53 near Grand Chain, Illinois in 2005, available at http://il.water.usgs.gov/annual_report/data/sw_q2005/03612500.htm) and reflect total waer column concentrations (dissolved phase adjustment factors not included)

(g) Evaluated as chloride

Table 2 - Project Impacts Plus Background Sediment Concentrations and Comparisons to Conservative Benchmarks

Chemical	Screening-level concentration (mg/Kg)	Screening-level concentration (adjusted for run-off and soil erosion) (mg/Kg)	Background concentration (mg/Kg)	Adjusted Screening-level concentration + Background (h) (mg/Kg)	Screening-level benchmark concentration	Adjusted Screenin-level + background hazard ratio
Polychlorinated dioxins and furans (PCDD/PCDF, expressed as 2,3,7,8-TCDD toxic equivalents)	4.9E-08	9.8E-08	1.9E-12	9.8E-08	1.2E-07	8.2E-01
C3 Benzenes (a)	5.9E-05	1.2E-04	Not Available	Unknown	1.4E-01	Unknown
C4 Benzenes (a)	1.4E-04	2.8E-04	Not Available	Unknown	1.4E-01	Unknown
C6 Benzenes (a)	2.1E-05	4.2E-05	Not Available	Unknown	1.4E-01	Unknown
Acenaphthylene	2.7E-03	5.4E-03	Not Available	Unknown	5.9E-03	Unknown
Acetone	8.4E-03	1.7E-02	Not Available	Unknown	9.9E-03	Unknown
Benzaldehyde (b)	5.4E-04	1.1E-03	Not Available	Unknown	NoBench	NoBench
Benzene	4.4E-01	8.8E-01	Not Available	Unknown	1.4E-01	Unknown
Benzo(a)anthracene	9.7E-07	1.9E-06	Not Available	Unknown	1.1E-01	Unknown
Benzo(a)pyrene	2.9E-06	5.8E-06	1.4E-01	1.4E-01	1.5E-01	9.3E-01
Benzo(b)fluoranthene	1.3E-05	2.6E-05	1.6E-01	1.6E-01	1.0E+01	1.6E-02
Benzo(g,h,i)perylene	1.8E-06	3.6E-06	2.1E-01	2.1E-01	1.7E-01	1.2E+00
Benzo(k)fluoranthene	3.4E-06	6.8E-06	5.0E-02	5.0E-02	2.4E-01	2.1E-01
Benzoic Acid	7.9E-02	1.6E-01	Not Available	Unknown	6.5E-01	Unknown
Biphenyl	1.4E-04	2.8E-04	Not Available	Unknown	1.1E+00	Unknown
Bis(2-ethylhexyl)phtalate	2.1E-03	4.2E-03	Not Available	Unknown	1.8E-01	Unknown
Bromomethane	9.7E-04	1.9E-03	Not Available	Unknown	1.4E-03	Unknown
Carbon Disulfide	2.5E-03	5.0E-03	Not Available	Unknown	2.4E-02	Unknown
Chlorobenzene	3.6E-04	7.2E-04	Not Available	Unknown	2.9E-01	Unknown
Chloromethane	8.6E-03	1.7E-02	Not Available	Unknown	NoBench	NoBench
Chrysene	3.6E-06	7.2E-06	1.5E-01	1.5E-01	1.7E-01	8.8E-01
Di-n-butylphtalate	9.3E-04	1.9E-03	Not Available	Unknown	2.2E+00	Unknown
Dibenz(a,h)anthracene	1.4E-05	2.8E-05	Not Available	Unknown	3.3E-02	Unknown
Ethylbenzene	4.3E-04	8.6E-04	Not Available	Unknown	1.8E-01	Unknown
Fluoranthene	2.0E-04	4.0E-04	3.1E-01	3.1E-01	4.2E-01	7.4E-01
Fluorene	4.3E-04	8.6E-04	4.0E-02	4.1E-02	7.7E-02	5.3E-01
Formaldehyde	1.0E-02	2.0E-02	Not Available	Unknown	NoBench	NoBench
Freon 113	1.1E-03	2.2E-03	Not Available	Unknown	NoBench	NoBench
Indeno(1,2,3-cd)pyrene	2.0E-06	4.0E-06	Not Available	Unknown	2.0E-01	Unknown
Methyl Ethyl Ketone	6.8E-04	1.4E-03	Not Available	Unknown	4.2E-02	Unknown
Methylene Chloride	1.1E-02	2.2E-02	Not Available	Unknown	1.6E-01	Unknown
Methinaphthalene (c)*	9.5E-05	1.9E-04	Not Available	Unknown	2.0E-02	Unknown
Naphthalene	4.7E-02	9.4E-02	7.0E-02	1.6E-01	1.8E-01	9.1E-01
PACs (d)	2.5E-04	5.0E-04	Not Available	Unknown	1.6E+00	Unknown
Phenanthrene	8.8E-03	1.8E-02	3.3E-01	3.5E-01	2.0E-01	1.7E+00
Phenol	2.5E-03	5.0E-03	Not Available	Unknown	4.9E-02	Unknown
Pyrene	9.9E-05	2.0E-04	3.1E-01	3.1E-01	2.0E-01	1.6E+00
Styrene	3.4E-05	6.8E-05	Not Available	Unknown	2.5E-01	Unknown
Toluene	4.3E-03	8.6E-03	Not Available	Unknown	1.2E+00	Unknown
Xylenes	2.9E-03	5.8E-03	Not Available	Unknown	4.3E-01	Unknown
Aluminum	2.9E-01	5.8E-01	2.1E+04	2.1E+04	5.8E+04	3.6E-01

Table 2 - Project Impacts Plus Background Sediment Concentrations and Comparisons to Conservative Benchmarks

Chemical	Screening-level concentration (mg/Kg)	Screening-level concentration (adjusted for run-off and soil erosion) (mg/Kg)	Background concentration (mg/Kg)	Adjusted Screening-level concentration + Background (h) (mg/Kg)	Screening-level benchmark concentration	Adjusted Screenin-level + background hazard ratio
Ammonia	2.3E-01	4.6E-01	Not Available	Unknown	NoBench	NoBench
Ammonium	2.5E+00	5.0E+00	Not Available	Unknown	NoBench	NoBench
Antimony	3.2E-05	6.4E-05	Not Available	Unknown	2.0E+00	Unknown
Arsenic	2.7E-04	5.4E-04	Not Available	Unknown	9.8E+00	Unknown
Barium	1.1E-02	2.2E-02	3.9E+02	3.9E+02	NoBench	NoBench
Beryllium	1.5E-05	3.0E-05	1.4E+00	1.4E+00	NoBench	NoBench
Cadmium	1.4E-05	2.8E-05	6.0E-01	6.0E-01	9.9E-01	6.1E-01
Calcium	5.4E+00	1.1E+01	Not Available	Unknown	NoBench	NoBench
Chloride	Net Decrease	Net Decrease	Not Available	Unknown	NoBench	NetDecrease
Chromium	3.9E-03	7.8E-03	5.1E+01	5.1E+01	4.3E+01	1.2E+00
Copper	1.2E-01	2.4E-01	2.6E+01	2.6E+01	3.2E+01	8.2E-01
Fluoride	2.0E-02	4.0E-02	Not Available	Unknown	NoBench	NoBench
Iron	3.8E-01	7.6E-01	2.6E+04	2.6E+04	2.0E+04	1.3E+00
Hydrogen Chloride (HCl) (g)	3.7E+00	7.4E+00	Not Available	Unknown	NoBench	NoBench
Lead	2.3E-03	4.6E-03	3.7E+01	3.7E+01	3.6E+01	1.0E+00
Manganese	1.9E-02	3.8E-02	1.1E+03	1.1E+03	4.6E+02	2.4E+00
Mercury	Net Decrease	Net Decrease	1.0E-01	1.0E-01	NoBench	NetDecrease
Nickel	7.2E-05	1.4E-04	3.5E+01	3.5E+01	2.3E+01	1.5E+00
Nitrate	1.0E-01	2.0E-01	Not Available	Unknown	NoBench	NoBench
Potassium	4.1E-01	8.2E-01	Not Available	Unknown	NoBench	NoBench
Selenium	4.8E-03	9.6E-03	6.0E-01	6.1E-01	NoBench	NoBench
Silver	1.4E-05	2.8E-05	Not Available	Unknown	5.0E-01	Unknown
Sodium	8.6E-01	1.7E+00	Not Available	Unknown	NoBench	NoBench
Sulfate	Net Decrease	Net Decrease	Not Available	Unknown	NoBench	NoBench
Sulfuric Acid Mist (H_2SO_4)	Net Decrease	2.0E+00	Not Available	Unknown	NoBench	NoBench
Thallium	1.2E-04	2.4E-04	Not Available	Unknown	NoBench	NoBench
Titanium	8.4E-03	1.7E-02	Not Available	Unknown	NoBench	NoBench
Zinc	6.5E-03	1.3E-02	1.3E+02	1.3E+02	1.2E+02	1.1E+00

Notes: (a) Benzene used as a chemical surrogate

(b) Formaldehyde used as a chemical surrogate

(c) Values selected for 2-Methylnaphtalene

(d) PACs are polycyclic aromatic compounds. The category of total PAHs (polycyclic aromatic hydrocarbons) was selected from the RAIS to identify benchmarks.

(e) Value obtained from Section 302.212 of the general use water quality standards for Illinois. Value may not be specific to ecological receptors of concern, and is applied to both ammonia and ammonium as a screening-level evaluation.

(9 Values based on a hardness of 119 mgll (the average measurements at Ohio River Lock and Dam 53 near Grand Chain, Illinois in 2005, available at http://il.water.usgs.gov/annual_report/data/sw_q2005/03612500.htm) and reflect total waer column concentrations (dissolved phase adjustment factors not included)

(g) Evaluated as chloride

(h) Sediment background data is an average of 20 samples taken between milepoint 980.3 and 904.7 near Massac County, IL. Data provided by the Ohio River Valley Sanitation Commission

Table 3 Project Impacts Plus Background for Surface Water and Comparisons to Conservative Benchmarks

Chemical	Screening-level concentration (µg/l)	Background concentration (µg/l)	Screening-level concentration + Background (h) (µg/l)	Screening-level benchmark concentration	Screening-level Concentration Hazard Ratio	Screenin-level + background hazard ratio
Polychlorinated dioxins and furans (PCDD/PCDF, expressed as 2,3,7,8-TCDD toxic equivalents)	7.3E-09	Not Available	Unknown	3.0E-09	2.4E+00	Unknown
C3 Benzenes (a)	8.8E-06	Not Available	Unknown	8.6E+02	1.0E-08	Unknown
C4 Benzenes (a)	2.0E-05	Not Available	Unknown	8.6E+02	2.3E-08	Unknown
C6 Benzenes (a)	3.1E-06	Not Available	Unknown	8.6E+02	3.6E-09	Unknown
Acenaphthylene	4.1E-04	Not Available	Unknown	4.8E+03	8.5E-08	Unknown
Acetone	1.3E-03	Not Available	Unknown	1.7E+03	7.6E-07	Unknown
Benzaldehyde (b)	8.2E-05	Not Available	Unknown	NoBench	NoBench	NoBench
Benzene	6.6E-02	Not Available	Unknown	8.6E+02	7.7E-05	Unknown
Benzo(a)anthracene	1.5E-07	Not Available	Unknown	2.5E-02	6.0E-06	Unknown
Benzo(a)pyrene	4.4E-07	Not Available	Unknown	1.4E-02	3.1E-05	Unknown
Benzo(b)fluoranthene	1.9E-06	Not Available	Unknown	9.1E+00	2.1E-07	Unknown
Benzo(g,h,i)perylene	2.7E-07	Not Available	Unknown	7.6E+00	3.6E-08	Unknown
Benzo(k)fluoranthene	5.1E-07	Not Available	Unknown	NoBench	NoBench	NoBench
Benzoic Acid	1.2E-02	Not Available	Unknown	4.0E+01	3.0E-04	Unknown
Biphenyl	2.1E-05	Not Available	Unknown	1.0E+01	2.1E-06	Unknown
Bis(2-ethylhexyl)phtalate	3.2E-04	Not Available	Unknown	3.0E-01	1.1E-03	Unknown
Bromomethane	1.5E-04	Not Available	Unknown	1.6E+01	9.4E-06	Unknown
Carbon Disulfide	3.7E-04	Not Available	Unknown	1.5E+01	2.5E-05	Unknown
Chlorobenzene	5.4E-05	Not Available	Unknown	4.7E+01	1.1E-06	Unknown
Chloromethane	1.3E-03	Not Available	Unknown	5.5E+03	2.4E-07	Unknown
Chrysene	5.4E-07	Not Available	Unknown	7.0E+00	7.7E-08	Unknown
Di-n-butylphtalate	1.4E-04	Not Available	Unknown	5.0E+00	2.8E-05	Unknown
Dibenz(a,h)anthracene	2.1E-06	Not Available	Unknown	4.0E+00	5.3E-07	Unknown
Ethylbenzene	6.5E-05	Not Available	Unknown	1.4E+01	4.6E-06	Unknown
Fluoranthene	3.0E-05	Not Available	Unknown	1.9E+00	1.6E-05	Unknown
Fluorene	6.5E-05	Not Available	Unknown	1.9E+01	3.4E-06	Unknown
Formaldehyde	1.6E-03	Not Available	Unknown	NoBench	NoBench	NoBench
Freon 113	1.7E-04	Not Available	Unknown	4.1E+02	4.1E-07	Unknown
Indeno(1,2,3-cd)pyrene	3.0E-07	Not Available	Unknown	4.3E+00	7.0E-08	Unknown
Methyl Ethyl Ketone	1.0E-04	Not Available	Unknown	2.2E+03	4.5E-08	Unknown
Methylene Chloride	1.7E-03	Not Available	Unknown	9.4E+02	1.8E-06	Unknown
Methlnaphthalene (c)*	1.4E-05	Not Available	Unknown	3.3E+02	4.2E-08	Unknown
Naphthalene	7.1E-03	Not Available	Unknown	1.3E+01	5.5E-04	Unknown
PACs (d)	3.7E-05	Not Available	Unknown	NoBench	NoBench	NoBench
Phenanthrene	1.3E-03	Not Available	Unknown	3.6E+00	3.6E-04	Unknown
Phenol	3.7E-04	Not Available	Unknown	1.8E+02	2.1E-06	Unknown
Pyrene	1.5E-05	Not Available	Unknown	3.0E-01	5.0E-05	Unknown
Styrene	5.1E-06	Not Available	Unknown	3.2E+01	1.6E-07	Unknown
Toluene	6.5E-04	Not Available	Unknown	6.0E+02	1.1E-06	Unknown
Xylenes	4.4E-04	Not Available	Unknown	3.6E+02	1.2E-06	Unknown
Aluminum	4.4E-02	5.8E+00	5.8E+00	7.0E+01	6.3E-04	8.3E-02

3 Project Background for Comparisons Benchmarks

Chemical	Screening-level concentration (µg/l)	Background concentration (µg/l)	Screening-level concentration + Background (h) (µg/l)	Screening-level benchmark concentration	Screening-level Concentration Hazard Ratio	Screenin-level + background hazard ratio
Ammonia	3.4E-02	< 4.0E-02	7.4E-02	1.5E+03	2.3E-05	5.0E-05
Ammonium	3.7E-01	Not Available	Unknown	1.5E+03	2.5E-04	Unknown
Antimony	4.8E-06	2.0E-01	2.0E-01	8.0E+01	6.0E-08	2.5E-03
Arsenic	4.0E-05	6.1E-01	6.1E-01	1.9E+02	2.1E-07	3.2E-03
Barium	1.7E-03	3.3E+01	3.4E+01	2.2E+02	7.7E-06	1.5E-01
Beryllium	2.2E-06	< 6.0E-02	6.0E-02	3.6E+00	6.1E-07	1.7E-02
Cadmium	2.1E-06	< 4.0E-02	4.0E-02	1.3E+00	1.6E-06	3.1E-02
Calcium	8.2E-01	3.4E+01	3.4E+01	1.2E+05	6.8E-06	2.9E-04
Chloride	Net Decrease	1.4E+01	Net Decrease	NetDecrease	NetDecrease	NetDecrease
Chromium	5.9E-04	< 8.0E-01	8.0E-01	2.4E+02	2.5E-06	3.3E-03
Copper	1.8E-02	-1.4E+00	1.4E+00	1.4E+01	1.3E-03	1.0E-01
Fluoride	3.1E-03	1.1E-01	1.1E-01	1.2E-01	2.6E-02	9.4E-01
Iron	5.8E-02	1.0E+01	1.0E+01	1.0E+01	5.8E-03	1.0E+00
Hydrogen Chloride (HCl) (g)	5.6E-01	Not Available	Unknown	2.3E+05	2.4E-06	Unknown
Lead	3.4E-04	< 8.0E-02	8.0E-02	2.5E+01	1.4E-05	3.2E-03
Manganese	2.9E-03	6.0E-01	6.0E-01	8.0E+01	3.6E-05	7.5E-03
Mercury	Net Decrease	Not Available	Net Decrease	NetDecrease	NetDecrease	NetDecrease
Nickel	1.1E-05	2.1E+00	2.1E+00	5.8E+00	1.9E-06	3.6E-01
Nitrate	1.6E-02	Not Available	Unknown	NoBench	NoBench	NoBench
Potassium	6.1E-02	2.3E+00	2.4E+00	5.3E+04	1.2E-06	4.5E-05
Selenium	7.2E-04	4.7E-01	4.7E-01	5.0E+00	1.4E-04	9.4E-02
Silver	2.1E-06	< 2.0E-01	2.0E-01	1.2E-01	1.8E-05	1.7E+00
Sodium	1.3E-01	1.1E+01	1.1E+01	6.8E+05	1.9E-07	1.7E-05
Sulfate	Net Decrease	Not Available	Net Decrease	NetDecrease	NetDecrease	NetDecrease
Sulfuric Acid Mist (H_2SO_4)	Net Decrease	Not Available	Net Decrease	NetDecrease	NetDecrease	NetDecrease
Thallium	1.8E-05	Not Available	Unknown	1.0E+01	1.8E-06	Unknown
Titanium	1.3E-03	Not Available	Unknown	NoBench	NoBench	NoBench
Zinc	9.8E-04	8.5E-01	8.5E-01	2.5E+01	3.9E-05	3.4E-02

Notes: (a) Benzene used as a chemical surrogate

(b) Formaldehyde used as a chemical surrogate

(c) Values selected for 2-Methylnaphtalene

(d) PACs are polycyclic aromatic compounds. The category of total PAHs (polycyclic aromatic hydrocarbons) was selected from the RAIS to identify benchmarks.

(e) Value obtained from Section 302.212 of the general use water quality standards for Illinois. Value may not be specific to ecological receptors of concern, and is applied to both ammonia and ammonium as a screening-level evaluation.

(f) Values based on a hardness of 119 mg/l (the average measurements at Ohio River Lock and Dam 53 near Grand Chain, Illinois in 2005, available at http://il.water.usgs.gov/annual_report/data/sw_q2005/03612500.htm) and reflect total waer column concentrations (dissolved phase adjustment factors not included)

(g) Evaluated as chloride

(h) Surface water background data is from Lock and Dam 53 Near Grand Chain, IL. Data was collected bu USGS between October 2004 and November 2005.

Ohio River Substrate Chemistry Data. Joppa, IL, collected and analyzed by the USFWS (Young 1993), taken from near IL shoreline in 1992 with Ekman dredge
Concentrations in milligrams per kilogram (dry weight), blank cells = analyte not detected above detection limit
Spreadsheet created 10/04/2006 by Mike Coffey, USFWS. RIFO-EC

Metals	River Mile	Al	Ba	Be	B	Cd	Co	Cr	Cu	Fe	Pb	Mg	Mn	Hg	Mo	Ni	Se	Ag	Sr	Sn	V	Zn
	950.3 RC-7	19400.0	331.0	1.4	331	0.6	22.6	48.4	26.0	23800.0	343	3670.0	964.0			34.3	0.6		52.6		76 8	132.0
	950.9 RC-8	20900.0	386.0	1 3	28.3	0.5	21.4	509	26.3	25500.0	367	3590.0	11100			34.9	0.5		55.7		74.1	128.0
	952.3 RC-9	10900.0	112.0	0 7		0.5	16.3	23.5	19.7	19400.0	243	4270.0	10000	0.1		31.3	0.6		34.2		19 1	112.0

PAHs	River Mile	Napthalen	Flourene	Phenanthr	Anthracen	Flouranth	Pyrene	1,2-benant	Chrysene	Benzo(b)fl	Benzo(k)fl	Benzo(e)p	Benzo(a)p	Benzo(g,h,i)perylene	SUM	SUM ppb
Detected	950.3 RC-7	0.05	0.03	0.33	0.08	031	0.31	0.14	0.15	0.14	0.05	0.14	0.14	0.21	2.08	2,080.00
	950.9 RC-8	0.06	0.04	0.27	0.06	0.21	0.24	0.10	0.12	016	004	0.10	012	0.18	1 70	1,700.00
	952.3 RC-9	007	0.04	0.31	0.06	021	0.22	0.09	0.12	009	0.04	0.09	0.11	0.17	1.62	1,615.00

Ohio River Substrate Chemistry Data, Joppa, IL, collected and analyzed by the USFWS (Young 1993), taken from near IL shoreline in 1992 with Ekman dredge
Concentrations in milligrams per kilogram (dry weight), blank cells = analyte not detected above detection limit
Spreadsheet created 10/04/2006 by Mike Colley, USFWS, RIFO-EC

Metals	River Mile	Al	Ba	Be	B	Cd	Co	Cr	Cu	Fe	Pb	Mg	Mn	Hg	Mo	Ni	Se	Ag	Sr	Sn	V	Zn
	950.3 RC-7	19400.0	331.0	1.4	33.1	0.6	22.6	48.4	26.0	23800.0	34.3	3670.0	964.0			34.3	0.6		52.6		76.6	132.0
	950.9 RC-8	20900.0	386.0	1.3	26.3	0.5	21.4	50.9	26.3	25500.0	36.7	3590.0	1110.0			34.9	0.5		55.7		74.1	128.0
	952.3 RC-9	10900.0	112.0	0.7		0.5	16.3	23.5	19.7	19400.0	24.3	4270.0	1000.0	0.1		31.3	0.8		34.2		19.1	112.0

PAHs Detected	River Mile	Nepthalene	Flourene	Phenanthrene	Anthracene	Flouranthrer	Pyrene	1,2-benanthrancene	Chrysene	Benzo(b)flouranthrene	Benzo(k)fluoranthrene	Benzo(e)pyrene	Benzo(a)pyrene	Benzo(g,h,i)perylene	SUM	SUM ppb
	950.3 RC 7	0.05	0.03	0.33	0.08	0.31	0.31	0.14	0.15	0.14	0.05	0.14	0.14	0.21	2.08	2,080.00
	950.9 RC 8	0.06	0.04	0.27	0.06	0.21	0.24	0.10	0.12	0.16	0.04	0.10	0.12	0.16	1.70	1,700.00
	952.3 RC-9	0.07	0.04	0.31	0.06	0.21	0.22	0.09	0.12	0.09	0.04	0.09	0.11	0.17	1.62	1,615.00