

FOODCHAIN PATHWAY ANALYSIS FOR CKD CONSTITUENTS AT CONTINENTAL CEMENT HANNIBAL, MISSOURI

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INTRODUCTION

In the U.S. EPA 1993 Report to Congress on Cement Kiln Dust (CKD), EPA addressed the potential danger to human health from CKD released to the environment. This risk analysis included an evaluation of the 'worst case' scenario foodchain pathway exposures for CKD. Utilizing this conservative and potentially nonexistent exposure scenario, the EPA risk analysis model predicted significant carcinogenic and noncarcinogenic effects for some CKD constituents that have migrated off-site through air dispersion and surfacial drainage. In recognition that the conservative approach taken by EPA may not accurately predict actual conditions, Continental Cement Company (CCC) contracted Schreiber, Grana & Yonley, Inc. (SGY) to conduct a study on potential foodchain pathways for CKD constituents in surface waters and backyard gardens in the vicinity of the plant.

Meetings were conducted between CCC, SGY and the following agencies: Missouri Department of Health (MDH), Missouri Department of Natural Resources (MDNR), and the Missouri Department of Conservation (MDOC). Through these meetings, a workplan was developed for the in-situ sampling at the plants. The study was structured according to the workplan *Foodchain Pathway Analysis for CKD at Continental Cement, Hannibal, Missouri*, April 24, 1994, to establish actual quantities of CKD constituents in a variety of human foodchain pathways from potentially exposed areas downgradient from CCC's operations located south of Hannibal, Missouri. The study also included control populations obtained from areas which would not have been impacted by surfacial drainage or air dispersion of CKD constituents as comparative background matrices.

The primary focus of this presentation is to present the comparison between control populations and facility data. Analysis of data from the study will also be utilized to evaluate hypothetical foodchain pathway values presented in "Guidance for Performing Screening Level Risk Analyses at Combustion Facilities Burning Hazardous Wastes" (USEPA, 1994). Additional risk evaluations will be performed utilizing site-specific data and the screening guidance.

This document outlines preliminary sampling performed by SGY personnel and the results of sample analyses. To date, foodchain pathways sampled include down

gradient stream fish and backyard garden vegetables from community residents adjacent to the plant.

SAMPLING SITE DESCRIPTIONS

Monkey Run

The Monkey Run area population was selected as representative of a downgradient "back-yard" farming community which takes a substantial part of its diet from produce grown within potentially exposed areas adjacent to the plant. Monkey Run is located approximately 0.75 mile southeast of CCC and represents the closest residential population to the cement manufacturing facility (Figure 1). This community of approximately 50 people would be the most potentially impacted by CKD constituents which might have migrated off-site. The community has been established since facility start-up in the early 1900s.

Downgradient soil erosion and site stormwater drainage, as well as wind dispersion of particulates, would both generally move in a southeasterly direction from the facility. However, due to its proximity to the facility and the topography of the area (the land surface slopes for 280 feet over 0.75 mile from the top of the highest point on the facility property toward the Monkey Run area adjacent to the Mississippi River), a natural barrier for the local airshed is created by bluffs surrounding the facility and Monkey Run area on the northwest through southeast sides. Consequently, this community would not be impacted when weather conditions were such that pronounced wind movement to the north or northwest was occurring. Wind movement during the winter (January) is predominately from the northwest at 13 to 18 mph. In the summer (July) the wind is from the south southwest at 8 to 12 mph. Overall, yearly averages for wind direction and speed indicates movement from the south at wind speed of 10.4 mph.

Adjacent Surface Water

Marble Creek drains the watershed which includes CCC's former CKD management pile, located to the northwest, for approximately 1.25 miles of its length along the west side of Highway 79 (Figure 1). Throughout the course of a year, the creek is small and intermittent through sections of its reach. It provides habitat for a number of minnow species, which is dominated by the sand shiner *Notropis stramineus* and the bluntnose minnow *Pimephales notatus*. No other species of fishes were found during early survey of the creek area, probably due to its intermittent nature. However, later sampling collections at an upstream small pool location yielded the central stoneroller *Campostoma anomalum* as well as *P. notatus*.

Since the creek is adjacent to and immediately downgradient of the former CKD management pile, the creek and its minnow populations were selected as the highest potential surface drainage impact location for this site. Although minnows are not considered to be a directly consumable species, they represent a food source for consumable fishes, and thus are an available indicator of CKD constituents which would be present in consumable fishes.

Control Vegetables

Tomatoes, green beans and cucumbers were obtained from a home-grown vegetable stand located on State Highway CC (Wild Horse Creek Road) directly north of the Chesterfield Elementary School in Chesterfield, Missouri on August 1, 1994. The samples were chopped using plastic cutting boards and stainless steel knives, with the respective sample matrices placed on clean aluminum foil. Three replicate samples were placed in labeled glass teflon-lined screw-top jars as above. Remaining portions of sample matrices were approximately measured and combined to represent equivalent volumes of a composite sample made of tomatoes, cucumbers and beans. Three composite replicate samples were taken from this mix. Samples were stored and shipped on ice. The potato control sample was obtained from an Eckert's Farms roadside stand on September 27, 1994. These potatoes were grown in a Mississippi River floodplain area known as the American Bottoms, near Cahokia, Illinois. Samples were processed and shipped as indicated above.

Control Fish

Control samples of sand shiner *Notropis stramineus* and the bluntnose minnow *Pimephales notatus* were collected on May 12, 1994 by seining Mills Creek at the junction of the Marion and Ralls County lines, immediately south of Hannibal, Missouri. A survey of this creek showed it to be ecologically similar to the Marble Creek drainage, and the minnow species present were identical to those species found in Marble Creek. The surface drainage area of Mills Creek is out of the influence from the CCC CKD management pile. Seined fishes from this sampling run were characterized and divided between three replicate 8 oz. glass teflon-lined screw top jars. The jars were immediately stored on ice in a cooler to prevent tissue breakdown.

A second control location was established on September 27, 1994, after the third collection to attempt to 1) collect *C. anomalum* as in the on-site collection, and 2) develop an alternate location with more persistent flow further away from the city of Hannibal. Peno Creek is a small but permanent creek located in Pike Co. approximately 0.5 miles south of the Ralls Co. line on state Hwy. 61. Fish were collected in three seine hauls and were characterized as equal populations of *C. anomalum* and *P. notatus*. The second control fish sample collection followed the same procedures indicated above for sample processing.

ANALYTICAL RESULTS

Results of analyses for fish are provided in Tables 1 and 2 for dioxins and furans. Dioxins and furan analysis in all vegetable yielded no detectable concentrations above reporting limits and are not tabularized in this manuscript.

Results from on-site populations were evaluated against the control locations for increased levels of constituents of concern. Statistical evaluations were conducted at a probability level of $p = 0.05$ primarily utilizing ANOVA (Analysis of Variance), and then the Bonferroni T-Test. Prior to these analyses, the data was evaluated for normal

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distribution (as determined by the Chi-Square Test for normality), and for homogeneity of variance (utilizing the Bartlett's Test for Homogeneity of Variance).

DISCUSSION

Analyses of study matrices have indicated that there were no significant differences ($p=0.05$) in fish tissue dioxin/furan levels found between control and on-site populations where these analytes were detected above reporting or detection limits.

Analyses of fish samples indicated that no dioxins or furans were found in on-site fish tissues, with the exception of OCDD and 2,3,7,8-TCDF. OCDD was also present in the control fish populations. The levels of 2,3,7,8-TCDF were found at one sample location near the CKD pile and were detected at less than 1.0 ppt.

For vegetable samples, dioxins and furans were not detected in any vegetable matrices for on-site or control populations.

Based on all current sampling results, there are no apparent significant elevation in dioxins and furans in on-site populations when compared to control populations.

TABLE 1 RESULTS OF FURANS AND DIOXINS ANALYSES (PG/G) - ON-SITE FISH TISSUES

Parameter	Method <u>Blank</u>	05/12/94 <u>CCMS1</u>	08/01/94 <u>CCMS2</u>	09/27/94 <u>CCMS3</u>	Mean <u>± SD</u>
TCDFs (total)	ND	ND	ND	0.82	-
2,3,7,8-TCDF	ND	ND	ND	0.82	-
PeCDFs (total)	ND	ND	ND	ND	-
1,2,3,7,8-PeCDF	ND	ND	ND	ND	-
2,3,4,7,8-PeCDF	ND	ND	ND	ND	-
HxCDFs (total)	ND	ND	ND	ND	-
1,2,3,4,7,8	ND	ND	ND	ND	-
1,2,3,6,7,8	ND	ND	ND	ND	-
2,3,4,6,7,8	ND	ND	ND	ND	-
1,2,3,7,8,9	ND	ND	ND	ND	-
HpCDFs (total)	ND	ND	ND	ND	-
1,2,3,4,6,7,8	ND	ND	ND	ND	-
1,2,3,4,7,8,9	ND	ND	ND	ND	-
OCDF	ND	ND	ND	ND	-
Dioxins:					
TCDDs (total)	ND	ND	ND	ND	-
2,3,7,8-TCDD	ND	ND	ND	ND	-
PeCDDs (total)	ND	ND	ND	ND	-
1,2,3,7,8-PeCDD	ND	ND	ND	ND	-
HxCDDs (total)	ND	ND	ND	ND	-
1,2,3,4,7,8	ND	ND	ND	ND	-
1,2,3,4,7,8	ND	ND	ND	ND	-
1,2,3,7,8,9	ND	ND	ND	ND	-
HpCDDs (total)	ND	ND	ND	ND	-
1,2,3,4,6,7,8	ND	ND	ND	ND	-
OCDD	ND	75	96	70	85.4

Footnotes: ND Not Detected

TABLE 2 RESULTS OF FURANS AND DIOXINS ANALYSES (PG/G) - CONTROL FISH TISSUES

<u>Parameter</u>	<u>MILL1</u>	<u>MILL2</u>	<u>MILL3</u>	<u>SCOQ1</u>	<u>SCOQ2</u>	<u>SCOQ3</u>	<u>Mean ± SD</u>
Furans:							
TCDFs (total)	ND	ND	ND	ND	ND	ND	-
2,3,7,8-TCDF	ND	ND	ND	ND	ND	ND	-
PeCDFs (total)	ND	ND	ND	ND	ND	ND	-
1,2,3,7,8-PeCDF	ND	ND	ND	ND	ND	ND	-
2,3,4,7,8-PeCDF	ND	ND	ND	ND	ND	ND	-
HxCDFs (total)	ND	ND	ND	ND	ND	ND	-
1,2,3,4,7,8-HxCDF	ND	ND	ND	ND	ND	ND	-
1,2,3,6,7,8-HxCDF	ND	ND	ND	ND	ND	ND	-
2,3,4,6,7,8-HxCDF	ND	ND	ND	ND	ND	ND	-
1,2,3,7,8,9-HxCDF	ND	ND	ND	ND	ND	ND	-
HpCDFs (total)	ND	ND	ND	ND	ND	ND	-
1,2,3,4,6,7,8	ND	ND	ND	ND	ND	ND	-
1,2,3,4,7,8,9	ND	ND	ND	ND	ND	ND	-
OCDF	ND	ND	ND	ND	ND	ND	-
Dioxins:							
TCDDs (total)	ND	ND	ND	ND	ND	ND	-
2,3,7,8-TCDD	ND	ND	ND	ND	ND	ND	-
PeCDDs (total)	ND	ND	ND	ND	ND	ND	-
1,2,3,7,8-PeCDD	ND	ND	ND	ND	ND	ND	-
HxCDDs (total)	ND	ND	ND	ND	ND	ND	-
1,2,3,4,7,8	ND	ND	ND	ND	ND	ND	-
1,2,3,6,7,8	ND	ND	ND	ND	ND	ND	-
1,2,3,7,8,9	ND	ND	ND	ND	ND	ND	-
HpCDDs (total)	ND	ND	ND	ND	ND	ND	-
1,2,3,4,6,7,8	ND	ND	ND	ND	ND	ND	-
OCDD	24	21	60	19	14	17	25.8 ± 17.

Footnotes: ND Not Detected