Health Consultation

KUHLMAN ELECTRIC CORPORATION

CRYSTAL SPRINGS, MISSISSIPPI

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Background and statement of issues

The Mississippi Department of Environmental Quality (MDEQ) requested a health hazard determination because of five properties contaminated with PCBs (Arochlor 1260) migrating from the Kuhlman Electric Corporation (KEC) in Crystal Springs, Mississippi [1]. The source of the contamination is reportedly a drainage channel carrying storm water from the KEC plant 0.66 mile northwest to Lake Chautauqua [2]. Analytical results indicate that within the north drainage channel PCBs have affected multiple locations in excess of the MDEQ maximum allowable concentration of 1 ppm, with some areas exceeding 50 ppm [2]. Approximately 10.5 acres of the 20.1-acre study area have been contaminated by PCB concentrations exceeding 1 ppm [2]. Of these 10.5 acres, 0.6 acre is estimated to be contaminated with PCB levels greater that 50 ppm [2]. MDEQ will require initial remediation at locations with PCB contamination greater than 10 ppm. Later it will require remediation at contamination locations greater than 1 ppm.

The question MDEQ posed to ATSDR is whether the average PCB levels measured in the five Crystal Springs residential properties pose a public health hazard for intermediate exposures?

Environmental data submitted

For this health consultation, ATSDR reviewed the *North Drainage Channel Site Characterization Report, Kuhlman Electric Corporation Crystal Springs, Mississippi,* which contains details of sampling analytical methodologies and the quality assurance/quality control procedures [2]. The five residential properties are located near the drainage channel, and soil borings were collected on each property. For the intermediate exposure assessment, ATSDR only considered soil samples collected at a depth of 0–6", given that surface soil is more representative of potential exposures. The properties on which ATSDR was asked to comment are the following:

Property #1

This property is estimated at 13,891 square feet (0.32 acre) [2]. 40 PCB samples were collected on this property (Table 1 below). PCBs were detected at levels above 1 ppm in many of the discrete surface soil samples (0–6") collected north and east of the house. The highest concentration in surface soil reported was 30 ppm, with the second highest at 27 ppm [2]. All of the elevated PCB levels are near or in the drainage ditch adjacent to the eastern or northern borders of the property [2]. The average PCB level for the property is 3.9 ppm.

Table 1. PCB Surface Soil Concentrations, Property 1

Sample	***PCB Concentration (ppm)***
WRP-GP14-001	<0.1
DP-891-001	<0.1
WRP-GP13-001	<0.1
WRP-GP12-001	<0.1
DP-900-001	<0.1
DP-892-001	0.17
DP-885-001	<0.1
WRP-GP2-001	<0.1
WRP-GP15-001	0.13
WRP-GP4-001	15
DP-886-001	<0.1
DP-890-001	<0.1
WRP-GP11-001	<0.1
DP-894-001	<0.1
DP-893-001	<0.1
DP-883-001	0.21
DP-894-001	<0.1
WRP-GP20-001	0.1
DP-887-001	0.21
DP-845-001	0.42
DP-882-001	0.4
WRP-GP5-001	0.56
WRP-GP1-001	11
DP-894-B-001	1.5
WRP-GP9-001	<0.1
DP-896-001	<0.1
WRP-GP10-001	<0.1

Sample	*PCB Concentration (ppm)*
DP-898-001	<0.1
WRP-GP8-001	<0.1
DP-897-001	0.52
WRP-GP17-001	0.21
WRP-GP7-001	<0.1
FWP-GP47-001	0.19
DP-895-001	9.3
WRP-GP16-001	2.4
WRP-GP18-001	27
CSP-GP22-001	25
WRP-GP19-001	27
DP-889-001	3.4
DP-846-001	30
Average	3.9

Property #2

This property is approximately 6,194 square feet (0.14 acre) [2]. Twenty soil borings were collected on this property (Table 2). None of the surface soil samples (0–6") taken from the soil borings within the property boundaries were above 1 ppm. Still, in two samples detection limits were at 5 and 2 ppm. The average PCB level inside the property boundary was 0.505 ppm.

Table 2. PCB Surface Soil Concentrations, Property 2

Sample	*PCB Concentration (ppm)*
RWP-GP4-001	<0.1
DP-919-001	0.22
DP-917-001	0.18
DP-918-001	<0.1
DP-857-001	<0.1
RWP-GP5-001	0.12
DP-916-001	<0.2

Sample	*PCB Concentration (ppm)*
DP-915-001	<0.5
DP-854-001	<0.1
DP-905-001	<0.1
DP-910-001	<5
DP-909-001	<2
DP-911-001	<0.4
RWP-GP3-001	0.13
DP-853-001	<0.1
DP-907-001	0.21
DP-908-001	<0.1
DP906-001	<0.1
RWP-GP2-001	<0.1
RWP-GP1-001	0.24
Average	0.505

Property #3

This property is approximately 16,195 square feet (0.37 acre) [2]. Five samples collected on this property were collected to define the edge of the PCB migration pattern. The highest measured concentration in surface soils (0–6") is 1.2 ppm, near the edge of the ditch [2]. The average soil level on the property is 0.38 ppm.

Table 3. PCB Surface Soil Concentrations, Property 3

Sample	*PCB Concentration (ppm)*
DP-832-001	<0.1
HP-GP13-001	0.19
HP-GP9-001	0.33
HP-GP8-001	1.2
HP-GP5-001	<0.1
Average	0.38

Property #4

This property is approximately 5,692 square feet (0.13 acre) [2]. Thirteen soil borings were collected (Table 4). In most of the surface soil samples on this property, PCBs in surface soils (0–6") are below detection levels. The average PCB level on the property is 0.22 ppm [2].

Table 4. PCB Surface Soil Concentrations, Property 4

Sample	*PCB Concentration (ppm)*
DP-926-001	0.15
DP-925-001	0.52
BSP-GP1-001	<0.1
DP-924-001	0.21
BSP-GP2-001	<0.1
DP-923-001	<0.1
DP-920-001	0.13
DP-922-001	0.21
DP-921-001	<0.1
BSP-GP5-001	<0.1
DP-927-001	<0.5
DP-928-001	<0.1
BSP-GP4-001	<0.5
Average	0.22

Property #5

This property is approximately 11,059 square feet (0.25 acre) [2]. Records show that 29 soil borings were collected. In soil samples collected from a depth of 0 to 6" PCBs were detected at less than 1 ppm in most of the discrete surface soil samples, with the highest at 1.8 ppm and the second highest at 0.76 ppm [2]. The area containing greater than 1 ppm PCB's is estimated at 600 square feet [2]. The average soil level is 0.38 ppm.

Table 5. PCB Surface Soil Concentrations, Property 4

Sample	***PCB Concentration (ppm)***
HGP-GP15-001	0.12
DHP-GP1-001	0.32
DP-931-001	0.32
DP-932-001	0.11
DP-865-B-001	0.84
DP-866-001	0.28
DP-950-001	0.66
DP-945-001	0.48
DP-933-001	0.38
DP-951-001	<0.1
DP-949-001	0.25
DP-946-001	0.15
DP-867-001	<0.1
DP-868-001	0.43
DP-952-001	0.76
DP-963-001	0.42
DP-948-001	<0.1
DP-954-001	0.15
DP-961-001	0.16
DP-955-001	<0.1
DP-944-001	0.46
DP-956-001	1.8
DP-957-001	0.31

Sample	*PCB Concentration (ppm)*
DP-959-001	<0.1
DP-958-001	0.12
DP-942-001	0.15
DP-960-001	<0.1
DP-941-001	<0.1
DP-938-001	<0.1
Average	0.38

Discussion

Exposure activities and contaminant concentration both play an important role in determining the amount of PCBs to which a person is exposed. That said, however, a variety of other factors are involved that determine whether environmental contamination will result in significant exposure. Some of these factors include

- duration of exposure: when the contamination occurred and how long residents have lived there,
- frequency of exposure: how often the person has contact with the soil,
- area of contamination: does the person come into contact with the highest level of PCBs all the time?, and
- bioavailability: (what is the potential for absorption from the gastrointestinal tract?)

EPA informed ATSDR that children do not reside at these five properties.

PCB exposure in the general environment

- People can be exposed to PCBs from ingestion of contaminated food or soil, from breathing dust or air containing PCBs, from drinking contaminated water, or from absorbing PCBs through the skin [3].
- For most people who do not work with PCBs, exposure occurs primarily through ingesting fish, meats and milk containing small amounts of PCB residues [3].
- Most people in industrialized countries have very small amounts of PCB stored in their body tissues. These background levels of PCBs appear harmless. Over time, our bodies slowly eliminate them. Since PCBs were banned in the late 1970s, levels in the environment, in animal foods, and in human bodies have been slowly declining [3]. At Crystal Springs, the pathway of concern from contaminated soils is incidental ingestion of contaminated soils.

Public health implications

PCBs have been associated with several noncancerous health effects in animals, including liver, thyroid, dermal, and ocular changes, immunological alterations, neurodevelopmental changes, reduced birth weight, and reproductive effects [3]. Studies attempting to show the same health effects in humans as have been observed in animals have generally been inconclusive. PCB exposures among workers in some occupations such as manufacture and testing of electrical equipment were very high. Some study populations include workers with job-related exposures of 20 years or more. Both the magnitude and duration of exposure provide the best opportunity to observe clearly the kinds of effects attributable to PCB exposure. Studies of PCB-exposed populations collectively suggest that the primary adverse health effects attributable to PCB exposure are chloracne (a severe form of cystic acne), pigmentation changes, and eye irritation [3] This dermal effect was also seen in populations who consumed PCB-contaminated rice oil [3]. Some recent human studies have found associations between PCB exposure and neurodevelopmental effects in children—particularly infants exposed *in utero* by mothers who ate contaminated fish [3]. ATSDR's chronic Minimal Risk Level (MRL) for PCBs (0.00002 mg/kg/day) is based on the lowest effect level reported in the scientific literature, (i.e., a lowest observed effect level (LOAEL)) of 0.005 mg/kg/day for decreased antibody levels in Rhesus monkeys treated daily for 55 months with Aroclor 1254 in a glycerol/corn oil mixture [3,4,5]. Similar doses for 37 months induced adverse skin effects in adult monkeys as well as their offspring [5,6,7].

Carcinogenicity of PCBs in humans has been investigated in retrospective occupational studies. These studies have evaluated cancer mortality in workers exposed during capacitor manufacturing and repairing, and in case-control studies they have evalutated the general population, examining associations between cancer and serum or adipose tissue levels of PCBs resulting from environmental exposures [3]. A review of the human studies, particularly indications of PCB-related cancer at several sites (e.g., liver, biliary tract, intestines, and skin (melanoma)), provide suggestive evidence that PCBs are carcinogenic [3]. The evidence is unequivocal that PCBs are hepatocarcinogenic in animals. The suggestive evidence for the carcinogencity of PCBs in humans is supported by extensive conclusive evidence in animals [3]. Both IARC and EPA have classified PCBs as probable human carcinogens, based mainly on evidentiary findings of carcinogenicity in animals [3]. IARC regards the human evidence of carcinogenicity as “limited” or even “inadequate,” while EPA finds the evidence “suggestive.” Still, neither assessment is based on all currently available studies [3]. NTP similarly concludes that PCBs are reasonably anticipated to be carcinogenic in humans based on sufficient evidence of carcinogenicity in animals [3].

Serum PCB levels were within background ranges in persons at highest risk of non-occupational exposure to PCBs at 10 different contaminated sites, even though the soil was highly contaminated with PCBs [8]. At two other sites, where average blood levels were elevated, it was subsequently determined that occupational exposures and consumption of PCB-contaminated fish had also occurred [8]. These data indicate that in contaminated environments, where food contamination is not an issue, humans did not accumulate additional body burdens of PCBs [9].

ATSDR used an intermediate exposure (up to 365 days) scenario in evaluating the PCB soil contamination of the five properties, based on MDEQ’s anticipated completion of remediation of any PCB contaminated spots on the property greater than 10 ppm within 1 year. Although several soil samples with maximum PCB concentrations of 30 mg/kg or less were collected, the average PCB soil concentration for those residential yards was well below 10 ppm. Because no children reside at these properties, we only evaluated adult exposures. ATSDR evaluated the five properties only, which may not be representative of other surrounding residential properties or the drainage ditch. If a 70 kilogram (kg) adult ingested 100 milligrams (mg) of soil containing 10 ppm of PCBs per day, the daily PCB dose would be 0.000014 mg/kg/day. This is less than ATSDR's *chronic* Minimal Risk Level of 0.00002 mg/kg/day and less than ATSDR's *intermediate* MRL of 0.00003 mg/kg/day for PCBs.

Conclusions

Question to ATSDR: For the initial remediation, do the average PCB levels measured in the five Crystal Springs residential properties pose a public health hazard for intermediate exposures?

For the five residential properties, ATSDR concluded that short- to intermediate-term exposure to the average level of PCBs in these surface soils does not constitute a public health hazard, provided:

- Measures are taken to prevent children from accessing contaminated soils (>1 ppm) in the ditch.
- Measures for planned remediation efforts are implemented within an intermediate timeframe (i.e., initial removal or remediation of soil levels greater than 10 ppm, with follow-up removal or remediation of soils with PCB concentrations greater than 1 ppm).
- Measures are taken to educate the community members concerning the areas of their properties that are contaminated and the appropriate steps they can take to reduce their exposure to the soil.

Recommendations

ATSDR recommends

- Completing the clean up of these properties within an intermediate time frame (approximately 365 days).
- Prevent children's access to areas with PCB contamination (>1 ppm).
- Informing residents of areas of contamination and steps residents can take to reduce their exposures while removal or remediation is ongoing.

Public health action plan

The Public Health Action Plan for the site contains a description of actions ATSDR has taken or will take, or actions taken by other government agencies at the site, individually or in combination. The purpose of the Public Health Action Plan is to ensure that this public health consultation not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of ATSDR to follow up on this plan to ensure its implementation.

- ATSDR Division of Regional Operations will forward this health consultation to the appropriate contacts within EPA and MDEQ. They will work with the appropriate parties to implement these recommendations.

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