

# Health Consultation

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MARTIN COUNTY COAL SLURRY RELEASE

INEZ, MARTIN COUNTY, KENTUCKY

EPA FACILITY ID: KYN000407233

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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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EPA FACILITY ID: KYN000407233

Prepared by:

Exposure Investigation and Consultation Branch  
Division of Health Assessment and Consultation  
Agency for Toxic Substances and Disease Registry

## Summary

On October 11, 2000, a Martin County Coal Company (MCCC) coal slurry impoundment located south of Inez, Kentucky, collapsed and released approximately 300 million gallons of slurry into area streams located under the impoundment, the Coldwater Fork of Rockcastle Creek and Wolf Creek, tributaries to the Tug Fork and the Big Sandy River. In April of 2001, a citizens group in Inez, Kentucky, petitioned the Agency for Toxic Substances and Disease Registry (ATSDR) to evaluate environmental data and address community health concerns related to the coal slurry spill. This Health Consultation is the product of that investigation.

More than 100 miles of streams and floodplains in and around Martin County were affected by the spill, which caused streams to overflow and flood the valleys and floodplains around the streams. Slurry covered the yards and property of approximately 30 residences in the Inez area. Citizens were concerned that (1) skin rashes, nausea, and headaches might be related to drinking and showering in contaminated public water, (2) growing vegetables in the floodplains of Wolf and Coldwater Creeks might now pose some safety issues, and (3) the recurrence of blackwater events (surface water appearing black due to suspended particles in water) during heavy rains near the municipal water intake might pose a contamination hazard to the public water supply.

Most of the slurry material had been removed from Coldwater Fork and the first 5 miles of Wolf Creek within one year of the spill. The levels of metals in the slurry were similar to those in area background soil, and those detected in the drinking water supply after the spill were below EPA's Maximum Contaminant Levels (MCLs). None of the volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs), identified exceeded comparison values. Results were negative for acrylamide. (Polyacrylamide was used to flocculate the coal fines.) According to the information available to ATSDR, the Martin County Water District #1 did not take slurry materials into the water treatment system. Although, some private drinking water wells had elevated concentrations of some metals (arsenic, barium, and lead), they were unrelated to the slurry spill.

Direct contact with the slurry, contaminated stream water, or soil may have caused short-term effects (e.g., skin rashes) in sensitive residents in the past, but poses no public health hazard in present or in the future. Neither the Martin County Water District distribution system nor private drinking water wells were impacted by slurry material. Blackwater events may continue to occur, but the concentrations of metals currently found during these events are too low to cause adverse health effects. Nor would any adverse health effects be expected to occur as a result of eating vegetables grown in residential soil potentially contaminated by the slurry spill.

Using all available information, ATSDR concludes that although some exposure may have occurred or might be occurring as a result of the slurry spill, exposures are not at levels expected to cause adverse health effects. Therefore, ATSDR concludes that this site poses no apparent public health hazard.

## **Background and Statement of Issues**

### **Background**

In April 2001, the Agency for Toxic Substances and Disease Registry (ATSDR) was asked by a citizens group in Inez, Kentucky, to evaluate environmental data and address community health concerns related to a coal slurry spill that flooded area streams. In response to that petition, ATSDR conducted a site visit in January 2002 and collected available environmental data. In this health consultation, ATSDR evaluates the available site data and addresses community health concerns related to the spill.

On October 11, 2000, a Martin County Coal Company (MCCC) coal slurry impoundment located south of Inez, Kentucky, collapsed and released approximately 300 million gallons of slurry into two mines located under the impoundment [1]. An impoundment is a holding pond for coal “fines” and wastes from the coal washing process. The slurry moved through the mines and spilled out into the Coldwater Fork of Rockcastle Creek and Wolf Creek. Wolf Creek flows into Tug River and Levisa Fork, part of the Big Sandy River, which is a tributary to the Ohio River. More than 100 miles of streams and floodplains in and around Martin County were affected by the spill [1]. (See Appendix A, Figure 1.) Representatives from the Environmental Protection Agency (EPA), Region 4 and the Mine Safety and Health Administration (MSHA) responded to the spill. The slurry caused the streams to overflow, flooding the surrounding areas. This region of Kentucky is very mountainous; most towns and residential homes are located in the valleys and floodplains around the streams. Following the spill, slurry covered the yards and property of many of these homes.

The slurry spill impacted two streams, the Coldwater Fork of Rockcastle Creek and Wolf Creek, tributaries to the Tug Fork and the Big Sandy River (See the dark blue lines in Figures 1 and 2, Appendix A.) The volume of released material caused the streams to overflow into the surrounding floodplains. Slurry materials were deposited as sediment, on stream banks, and in the floodplains, including residential yards. Overall, more than 100 miles of streams and floodplains in and around Martin County were affected by the spill [1].

Most of the slurry material had been removed from Coldwater Fork and the first 5 miles of Wolf Creek within one year of the spill [2]. The slurry materials were removed using long-boom excavators, dredges, vacuum trucks, tractor pumps, and pumping systems in the stream channel and excavators and front-end loaders on the floodplains [3]. Slurry deposits directly affected approximately 30 residences in the Inez area (personal communication with R. Penix of The Martin County Sun, Inez, Ky., May 2001). The slurry in residential yards was either removed or covered with a layer of topsoil. No soil samples were taken from residences either before or after clean-up activities for comparison. Stream banks and floodplain areas were re-seeded to assist in restoring the area [4]. Residual slurry deposits may still remain farther downstream in areas of Wolf Creek, Rockcastle Creek, and the Big Sandy River that are difficult to access [2].

The city of Inez is located in eastern Kentucky's Appalachian Mountains, approximately 9 miles north of the Martin County Coal Company impoundment. According to Census Bureau 2000 data, there are 466 residents in Inez and 12,578 residents in 4,776 households in Martin County (see Figure 3)[5]. According to the mayor, as a result of slurry depositing in their yards, approximately 30 residences located on the flood plain were directly affected by the spill. The Martin County Water District provides water to 10,246 (~80%) residents, including those in the city of Inez [6]. The remaining 2,332 (20%) residents rely on private wells or cisterns [7].

### **Community Concerns**

The citizens' concerns included skin rashes, nausea, and headaches believed to be related to drinking and showering in contaminated public water; safety issues in growing vegetables in the floodplains of Wolf and Coldwater Creeks; continuing occurrences of surface water appearing black due to suspended particles in water (blackwater events) during flood events that may cause recurrent problems for the municipal water intake

### **Activities at the Site**

MCCC has taken responsibility for cleaning up slurry in the watersheds and surrounding floodplains. As of October 2001, most of the slurry had been removed [2]. Slurry deposited in residential yards was either removed or covered with a layer of topsoil. Slurry deposits may still remain farther downstream in areas of Wolf Creek, Rockcastle Creek, and the Big Sandy River that are difficult to access [2].

The Martin County Water District supplies water to Inez. Its water source is an intake on the Tug Fork. (See Appendix A, Figure 2). Information provided by the Water District Superintendent indicated that before the spill the intake was closed for maintenance. After the spill, a temporary intake was placed on an unaffected part of the Middle Fork of Rockcastle Creek to supply water for the area [8]. Concern was expressed that contaminated water may have been taken in during the spill, or may be taken in during future blackwater events.

Extensive sediment sampling was performed along the Tug Fork at Kermit, Inez, and Fort Gay to determine the depth of slurry deposits [9]. Deposits ranged from 1 to 36 inches in depth, with the thickest deposits at the Big Sandy Lock #3 at Fort Gay and a few other pools on the Big Sandy River. The depth of slurry in most of the river system was estimated to be 3-4 inches [9]. Sampling revealed that slurry deposits were washing downstream over time, minimizing the slurry in the creeks and upper Tug Fork.

Following the spill incident, ATSDR's Emergency Response Section assisted EPA Region 4 in evaluating available drinking water data. Also, in response to a request from the mayor of Inez, ATSDR provided a written evaluation of the raw water data and tap water samples collected by the Inez Waste Water Department [10]. The metals concentrations detected were below maximum contaminant levels (MCLs) and not expected to cause health effects due to ingestion. The water may be considered "hard," indicating that some of the metals in the water may leave residues and affect taste and odor. The evaluation is available at the mayor's office, where a repository has been established.

## Environmental Data

### *Slurry Materials*

According to the MSHA, there are more than 600 impoundments throughout the Appalachian region [11]. Mined coal often has impurities and small pieces unsuitable for use that are known as “fines”. The coal is “washed” with water and flocculants, starches, or lime to settle out the fines [12]. The slurry that escaped from the impoundment contained coal fines and residual flocculant. The slurry consisted primarily of coal fines, containing elemental carbon, some hydrocarbons, complex organic compounds, sulfur, silica, iron oxide, calcium oxide, sodium, and traces of metals [13]. In addition, the slurry was expected to contain traces of the flocculant used to settle out the coal fines in the impoundment. MCCC used a polyacrylamide flocculant, which also contains some hydrocarbons and traces of acrylamide.

The US EPA and an environmental consultant working for MCCC collected slurry samples to determine what chemicals were released. EPA took additional slurry material samples in December, and an independent consulting firm took samples in January 2001. (See Appendix B, Table 1). EPA also took several soil samples in unaffected areas, and the consulting firm took sediment samples in Coldwater creek and the Curtis Crum reservoir.

Samples were analyzed for metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs), which includes polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). Additionally, the first samples taken for MCCC were analyzed for compounds that were leachable. Other major constituents of the coal (e.g. carbon, sulfur) were not analyzed as they are understood to be present in the slurry.

Analyses for acrylamide or polyacrylamide, the chemicals that make up flocculent, were not performed on slurry samples. However, neither was expected to be found in slurry or soil at significant levels. Polyacrylamides bind strongly with soil particles and are used commercially to improve soil quality. Binding to soil reduces the bioavailability of a contaminant [14]. Acrylamide does not bind to soil and instead moves into soil rapidly and is degraded by microbes within a few days [15].

The sampling results confirmed that the slurry contained metals that are natural constituents of coal. These results were fairly consistent for the different slurry samples taken. Although metals were released to the environment with the coal slurry, they are similar to those in area background soil [16, 17]. (See Appendix B, Table 2.) Aluminum and arsenic levels were above screening values, however, both were within the background range for Kentucky soils. The sediment sample taken from the Curtis Crum Reservoir, not impacted by the coal slurry, had lower metal concentrations than were seen in the slurry.

The slurry material also contained some VOCs and SVOCs which are consistent with the expected hydrocarbon content of coal. (See Appendix B, Table 3.) Naphthalene, toluene and xylenes, were hydrocarbons found in three of the slurry samples. Additionally, 2-

methylnaphthalene and phenanthrene were identified in most slurry samples. Polycyclic aromatic hydrocarbons (PAHs) were identified in the impacted Coldwater creek sediment sample. No leachable compounds or polychlorinated biphenyls (PCBs) were identified in the slurry samples. Also, none of the VOCs and SVOCs (including PAHs) identified exceeded comparison values. No residential soil samples were taken from yards and property after the coal slurry spill. Therefore, ATSDR based its evaluation on the conservative assumption that metal concentrations in residential soil were the same as those found in slurry.

#### *Surface water samples*

Surface water quality was directly impacted by slurry materials. More than 300 surface water samples were taken from the surface waters in Martin County between October 2000 and February 2001. Analyses were completed for metals, SVOCs, flocculant, and oil and grease (HEM- n-hexane extractable material). Also, more than 300 samples to monitor turbidity were collected in Wolf and Coldwater creeks between November 2000 and May 2001. Surface water quality samples were collected by the Kentucky Department of Environmental Protection (KDEP) according to their standard operating procedures for quality assurance and quality control (QA/QC) data. These were evaluated based on the assumption that they were collected and analyzed according to proper methods and procedures. Additional results received from the MCCC contractors had acceptable QA/QC and were used in the evaluation.

Surface water contained elevated concentrations of various metals following the spill event. (See Appendix B, Table 4.) Metal types seen in the surface water were similar to those found in slurry. The highest metal concentrations were measured in the first 2 weeks following the spill. Sample results indicate that the concentration of metals in surface water decreased over the following months as the slurry was diluted in water, settled out, and washed downstream.

Slurry material remaining in stream sediment may be resuspended during blackwater events. Blackwater events occur when sediments, including coal fines, are stirred up from heavy rains, causing the streams to look black. To evaluate the effect that blackwater events may have on metal concentrations, data on turbidity and metal concentrations were compared. Turbidity is a measure of the amount of particles suspended in water, which causes the water to look muddy or black. ATSDR evaluated the data to compare the metal concentrations in surface water during dates of increased turbidity to concentrations during dates of low turbidity and to concentrations immediately following the spill event. The metal concentrations were higher during blackwater events than during times of clear water, but were still much lower than the concentrations found during the weeks after the spill. Additionally, the metal concentrations found during these events continued to decrease over time. (See Appendix A, Figure 4.) Therefore, the maximum metal levels observed after the October 2000 slurry release can be considered the highest concentrations that would be found.

Surface water samples were also collected from November 2000 to February 2001 to determine whether acrylamide was present in the water. Results were negative for acrylamide.



## *Groundwater quality*

The impact of the slurry on groundwater and private wells in the floodplains of Martin County was a concern for the community of Inez. The geology in some regions of Kentucky allows surface water and groundwater to mix fairly easily. Hand-dug wells are particularly susceptible to contamination [18]. Following the spill, Kentucky Department of Environmental Protection (KDEP) and a private contractor collected samples and reported the results for private well water in the area.

Between October 18, 2000, and March 14, 2001, 70 private well water samples from 38 different wells were collected by the KDEP and 2 additional wells were sampled by the private consultant. Samples collected by KDEP were gathered according to their standard operating procedures for QA/QC. These results were evaluated assuming that KDEP followed the proper sample-collection procedures. An analysis of the QA/QC information provided by the contractor indicated that the sample results were valid and of good quality. Samples were analyzed for SVOCs and metals. Well-water samples contained metals that naturally occur in groundwater in this region of Kentucky and were similar to historical samples. SVOCs were found at very low levels in some of the wells. However, the SVOCs detected in slurry were not the same as those detected in the private well water. Overall, private well-water conditions are consistent with regional groundwater quality and none of the wells appears to be impacted by the slurry spill.

## **Pathway Analysis**

An exposure pathway is the route by which an individual is exposed to contaminants originating from a contamination source. Although a large amount of material was released during this incident, a potential public health issue only exists for people who were exposed to slurry materials. An exposure pathway consists of the following five elements: 1) a *source* of contamination; 2) a *medium* such as air or soil through which the contaminant is transported; 3) a *point of exposure* where people can contact the contaminant; 4) a *route of exposure* by which the contaminant enters or contacts the body; and 5) a *receptor population*. A pathway is considered complete if all five elements are present and connected. If one of the elements is missing, the pathway is considered incomplete because no exposure can occur. (See Appendix B, Table 5.)

## *Residential Yards and Property*

Following the spill, slurry covered the yards and property of many homes in Martin County. (See Appendix A, Figure 1.) It is likely that residents came into contact with slurry material during the time period it was present in their yards. People may have ingested small amounts of soil (incidental ingestion) during various activities: playing in the yard, gardening or working in the yard, eating unwashed vegetables grown in slurry contaminated soil or by materials brought indoors on hands and shoes. The potential for exposures to residential slurry-contaminated soil occurred during the year following the spill. Because the slurry material was removed from the yards or covered within a year, this exposure pathway no longer exists.

### *Recreational Use of Streams*

The spill released a large amount of slurry into the streams, and materials were deposited in and on the banks and floodplains. People may have come into contact with the slurry material in the water and with sediment materials on the banks of the streams during recreational activities. Small amounts of slurry may have been accidentally ingested (incidental) during these activities.

Local residents were aware of the slurry-release event, and the material was visually different than normal stream conditions and the surrounding soils. Any contact with slurry materials would, most likely, have been both brief and intermittent. The spill incident caused streams to flood, limiting community use of the streams for recreation. Interestingly, despite the huge influx of coal slurry into the Tug Fork of the Big Sandy River, no apparent fish kill resulted from the pollution, possibly because the fish swam ahead of the sludge. (The Herald-Dispatch, Tuesday, October 24, 2000.) Most of the slurry material was removed within a year of the incident. Only residents who accessed the streams during that first year would have been exposed through this pathway.

### *Blackwater Events*

Blackwater events occur when sediments are disturbed and brought into the water column. This pathway is limited to times when an increase in turbidity occurs. These events are episodic and correspond with increased precipitation in the area. Residents are not normally expected to use the stream for recreational purposes during blackwater events, because of the poor weather conditions and increase in water flow. Therefore, this is a potential pathway of exposure. (See Appendix B, Table 7).

### *Public Water System*

The community was particularly concerned about the potential for slurry materials from the coal slurry spill event to enter the local drinking water treatment reservoir and then be ingested by residents that use public water. Investigation indicated that slurry materials did not directly enter the water treatment plants during the spill incident. According to Martin County Water District representatives, the permanent water intake on Tug Fork was closed for maintenance before the slurry release. The plant used a temporary water intake on the Middle Fork of Rockcastle Creek before and after the spill event [6]. The evidence available to ATSDR suggests that the Martin County Water District #1 did not take any slurry materials into the water treatment system. Therefore, municipal drinking water was not a pathway of exposure for residents of Martin County.

The increase of particles in the water during a blackwater event may result in slurry materials being taken into the water treatment plant. The Martin County Water District #1 treatment process removes most of suspended sediment and therefore any associated metals from drinking water. Water quality is tested on a quarterly basis to ensure that the treatment plant is working correctly. This is not considered a completed pathway of exposure to slurry materials. A properly operating water treatment plant would not allow exposures of significance.

Residents were drinking water from a temporary intake immediately following the spill incident and noticed changes in their water quality. An evaluation of the water quality results for the Martin County Water District #1 are discussed in the public health implications section.

### *Groundwater*

In addition to the public water system, private wells provide water to about 20% of the Martin County population. Residents who ingest water from private wells would be exposed to any contaminants found in groundwater. Some of the wells have elevated metal concentrations (arsenic, barium, and lead) that are unrelated to the slurry spill. The public health significance of this is discussed in the public health implications section. Private wells do not appear to have been impacted by the slurry spill. Therefore, this was considered an eliminated exposure pathway. (See Appendix B, Table 6.)

## **Public Health Implications**

The Public Health Implications section will address the completed pathways of exposure, which were determined in the previous section. These pathways include: residential yards and property and the recreational use of streams. (See Appendix B, Table 5.) In addition, the water quality of Martin County Water District #1 and the groundwater quality is discussed to address the community's concerns.

### *Residential Yards and Property*

ATSDR is unaware of any residential soil samples taken from homes impacted by the slurry release in Martin County. Therefore, ATSDR evaluated a worst-case scenario that assumed the metal concentrations found in slurry would also be found at the same concentration in residential soil. This is very unlikely because the slurry was diluted in the stream water and most of deposited slurry has been removed from yards.

Ingestion of small amounts of soil is the primary exposure of concern in this scenario. Children may eat soil while playing or get soil on their hand/clothes and inadvertently get it in their mouths. Working and gardening may also result in incidental ingestion of soil. Also a very small percentage of children aggressively eat soil and other inert materials. Although most children eat more than 200 mg of soil only once or twice a year, less than 2% of children (so-called 'pica children') may eat more than 5000 mg (5 grams) of soil 35- 40 days out of the year, or 2-3 times per month, on average [19].

Although the slurry contained several organic compounds and heavy metals, the amount one may eat through gardening or playing in the yard is much less than would be needed to pose a potential health hazard, especially for only one year of exposure. This would still be true, even if one assumed that a local pica child ingested 5 grams of slurry twice a week for a year. The remaining bulk of the slurry is not toxic, consisting as it does of water, coal fines, silt, sand, and clay particles [20].

Plants can take up a limited amount of metals from soil. The amount of metal that can accumulate in a plant depends on the plant type, the chemical form of the metal, soil type and pH, and the concentration of metal in the soil [21]. Metals typically do not bio-

accumulate in vegetables to such an extent that they could pose a health risk to humans. (Metal-accumulating plants do exist, but they tend to be small, wild species that pose a health hazard only to their natural enemies and to wandering cattle.) Even if crop plants could absorb toxic doses of metals from the soil, that toxicity would prevent the production of fruits or vegetables, thereby eliminating vegetable consumption as a potential route of exposure for humans [21-23]. Good public health practice includes washing all fruits and vegetables before eating them to remove dirt that may contain environmental contaminants. Eating vegetables grown in areas impacted by the slurry deposits does not pose a public health hazard.

Direct exposure to contaminated soil can cause skin irritation in sensitive individuals. If sensitive residents came into direct contact with the slurry material during the spill event, they may have experienced some irritation. Such skin rashes or allergic-type reactions would be only short-term events.

### *Recreational Use of Streams*

Recreational exposures are brief or intermittent exposures that would have occurred for residents that accessed the streams or floodplain areas while slurry material was present. These exposures are considered to be even less frequent than those of residents, because the area would only be accessed occasionally. The concentrations of contaminants found in the water or slurry material were not at levels that would pose a health hazard if accidentally ingested during these activities. Direct contact with metals can cause skin irritation in sensitive individuals. Some residents may have experienced such irritation after coming into contact with slurry during the spill event. The concentration of metals in sediment and water decreased over time, therefore, any current or future exposures to stream water or sediments are expected to be even less and do not pose a potential health hazard.

### *Groundwater Quality*

Although the private groundwater wells sampled on March 14, 2001, were not believed to be impacted by the slurry spill, the results for some individual wells indicated that the water may not be suitable for drinking. Metals were detected at levels that could affect the taste, smell, or look of the water. Specifically, aluminum, chloride, iron, manganese and zinc were above Secondary Drinking Water Standards set to avoid adverse taste, smell, or appearance of the water. These metals were not above any health screening values and would not be expected to affect health.

Arsenic, barium, and lead were above screening values or EPA drinking water standards in some of the wells tested. Individuals whose wells tested above the maximum contaminant level (MCL) for any of these metals were notified by the KDEP that their water was not suitable for drinking. The MCL is the highest level of a contaminant that is allowed in a public drinking water system. MCLs are enforceable standards but only apply to public drinking water systems. The KDEP also provided information on what could be done to improve the water quality in these wells.

In two of the wells sampled, lead was detected at levels of 0.020 parts per million (ppm) and 0.023 ppm, which is only slightly above EPA's action level of 0.015 ppm. (ATSDR does not have a comparison value for lead [24]. But, the dose that would result from chronic consumption of drinking water that always contained 0.023 ppm lead is lower than all of the LOAELs published in ATSDR's Toxicological Profile for Lead [25].) The lead that was detected in these two wells probably leached into the water from the plumbing, because (a) the majority of the wells sampled showed no evidence of lead contamination and (b) when it was re-sampled, one of the two wells that were previously identified as containing elevated levels of lead also showed no signs of lead contamination. The average lead concentration from multiple samples from the re-tested well was 0.005 ppm, below the action level. Therefore, ATSDR considers that lead in private well water at this site does not pose a public health hazard. Flushing out pipes by allowing water to run until cold will reduce the chance of ingesting any lead that may have leached into the water through corrosion of the pipes.

Arsenic was found in two private wells above the MCL of 10 ppb; the maximum concentration detected 16 ppb. However, adverse health effects, including cancer, are not expected at this level of exposure. EPA's MCL for arsenic in drinking water is based on a large Taiwanese study in which consumption of arsenic-contaminated well water (170-800 ppb) was associated with increased skin cancer. However, in the United States, where levels of arsenic in drinking water are much lower (average 5 ppb or less), no excess skin cancer incidence has ever been observed in people consuming relatively high levels of arsenic (100-200 ppb) in drinking water [26]. It has been suggested that total arsenic exposure was underestimated in the Tseng study, leading to an overestimation of risk. It is also possible that the protein- and methionine-deficient population studied in Taiwan was more sensitive than typical U.S. populations, because of a compromised ability to detoxify (i.e., methylate) ingested arsenic [26, 27, 28].

Depending on the region of Kentucky being considered, barium levels above the MCL of 2 ppm are not necessarily unusual in the state's groundwater. The 6,170 barium measurements in the Kentucky Groundwater Data Repository indicate that, *on a statewide basis*, less than 1.6% of recorded levels of barium in groundwater exceed the MCL of 2 ppm [29]. However, that percentage increases sharply as one focuses on selected areas *within* the state. In an apparent reference to the coal-mining regions of eastern Kentucky, one official of the Kentucky Division of Water estimated that barium concentrations in well water are above the MCL roughly 10% of the time (J. Webb, Kentucky Division of Water, personal communication, 2002). (The maximum barium concentration for three study sites in eastern Kentucky was 15 ppm [29].) In high-barium areas of eastern Kentucky such as Martin County, where barium is a naturally-occurring metal found in rock and coal, relatively high concentrations of barium can also occur in well water [13]. This is especially true for older wells that may have been constructed without complete protective casings, because the latter are more subject to contamination by naturally occurring minerals and chemicals leaching from the earth. Considering only the data collected for this health assessment, barium levels exceeded the 2 ppm MCL in approximately 20% of the private wells tested. Nevertheless, none of the barium concentrations found in these private well water samples would pose any health hazard to people who may have drunk that water [30]. Even the highest level of barium detected in private wells (24.9 ppm) would result in a daily barium intake (0.71 mg/kg/day, assuming a 70-kg person drinking 2 liters of water every day) that would exceed EPA's 2005 oral

reference dose for barium (0.2 mg/kg/day) by a factor of only 3.6, which is insignificant from a public health standpoint, compared to the 300-fold safety factor that is built into this RfD.

### *Public Water System*

Some residents noticed differences in the water quality during the change of locations of the water intake and were concerned that the slurry spill had an adverse impact. Because material from the slurry spill did not enter the drinking water plant, ATSDR examined monitoring results from the drinking water plant to determine what may have been the cause of altered water quality. In ATSDR's report to Mayor Penix in April 2001, Emergency Response personnel evaluated three water samples taken by the Inez Waste Water Department that included analyses for metals and SVOCs [10]. Additionally, routine water analyses from the plant for calcium, hardness, and turbidity were reviewed.

The Kentucky Geological Survey rates as "hard" or "very hard" most of the groundwater in Kentucky (<http://www.uky.edu/KGS/water/gnet/kentuckygeologyspring2001.pdf>). Calcium levels and total hardness were both higher in the temporary water supply. The iron, manganese, sulfate, and total dissolved solid results are also all higher. These are above the secondary drinking water standards (SDWS) set by EPA based on water color, taste, and smell quality. The SDWS values are non-enforceable and do not represent health screening values. None of the constituents tested was above screening values based on health effects. Conversations with the water district superintendent indicated that they did not adjust for the difference in alkalinity when the temporary intake was first used [8]. The increased mineral content of the water may have left noticeable residues on pipes, pots, and pans during this time. The changes in drinking water quality are associated with taste, smell, and scaling properties of the water. None of these parameters is expected to affect public health or be associated with the community health concerns, such as skin rashes, nausea, and headaches.

A review of historical and recent water quality data for the Martin County water system indicates that the water is generally of good quality. Results for past monitoring events provided by KDEP for 1995, 1998, 2000, 2001, and 2002 were all below MCLs for the parameters monitored. A few trace metals were found in the drinking water, but they were within standards set for public drinking water systems. The results were consistent with the geology of the area and were expected in this type of water source.

### **Children's Health Considerations**

Children are at a greater risk than adults from certain kinds of exposure to hazardous substances emitted from waste sites. They are more likely to be exposed for several reasons (e.g., they play outdoors more often than adults do, increasing the likelihood that they will come into contact with chemicals in the environment). Because of their smaller stature, they may breathe dust, soil, and heavy vapors close to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if certain toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

The slurry spill did not pose a significant health hazard to children or young adults. ATSDR specifically evaluated children's exposures to site contaminants in their evaluation of this site.

## Conclusions

ATSDR categorized this site currently as a No Apparent Public Health Hazard.

1. Direct contact with the slurry, contaminated stream water, or soil *does not currently pose a public health hazard*.
2. Although the possibility that some individuals may have experienced short-term hypersensitivity reactions such as contact dermatitis cannot be entirely ruled out, direct contact with the slurry, contaminated stream water, or soil would generally not have been expected to produce adverse health effects in residents.
3. The Martin County Water District distribution system was not contaminated by the spill event. Changes in water quality at the time of the spill and shortly after were most likely due to a change in water source. No adverse health effects are expected to occur as a result of drinking water from the alternate water source.
4. Well-water sampling indicates that private drinking water wells were not impacted by slurry material.
5. Private wells in the area do contain naturally occurring heavy metals such as arsenic, iron, manganese, barium, and cadmium, but not at levels that would be expected to cause any adverse health effects in residents who drink water from those wells.
6. No adverse health effects are expected to occur as a result of residents ingesting vegetables grown in residential soil potentially contaminated by the slurry spill.
7. Blackwater events may continue to occur, but the concentrations of metals currently found during these events are not expected to cause adverse health effects.

## Recommendations

None.

## Public Health Action Plan

- Kentucky Division of Water continues to collect water samples during wet-weather events for analyses including turbidity and some metals.

**For More Information:** Two good sources of information are the Kentucky Division of Water's Web site, <http://water.nr.state.ky.us/dow/domwell.htm>, and EPA's Web site, <http://www.epa.gov/safewater/pwells1.html>. Both of these Web sites offer important information for well owners and contact numbers for additional assistance.



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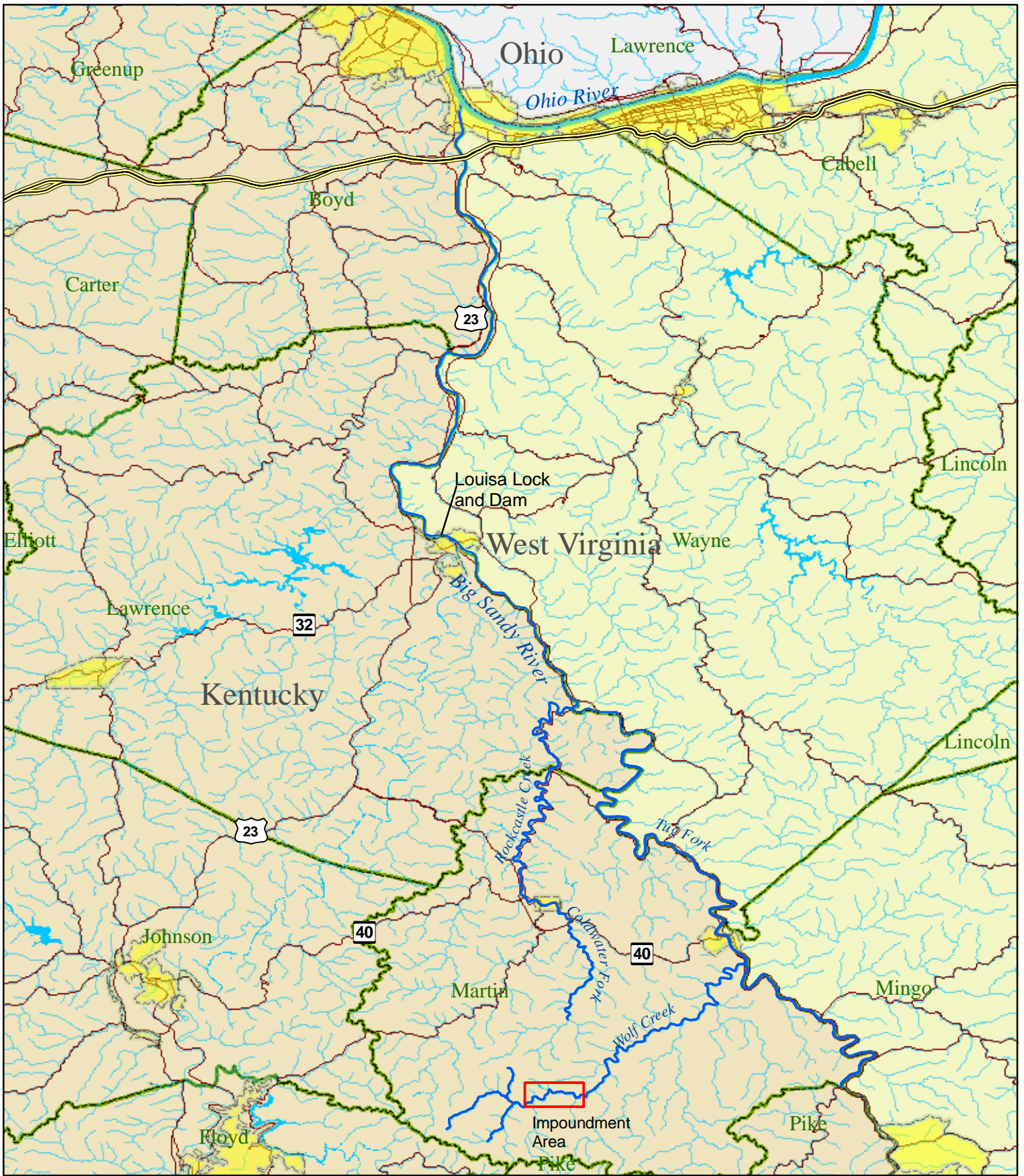
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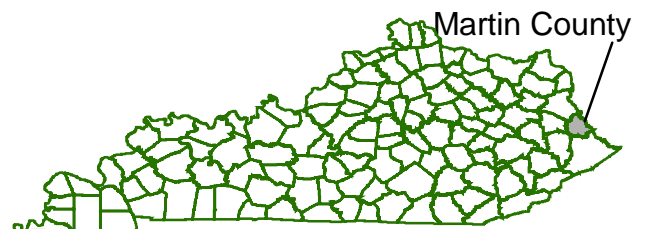
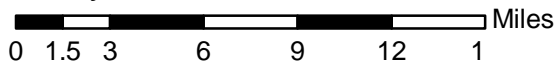
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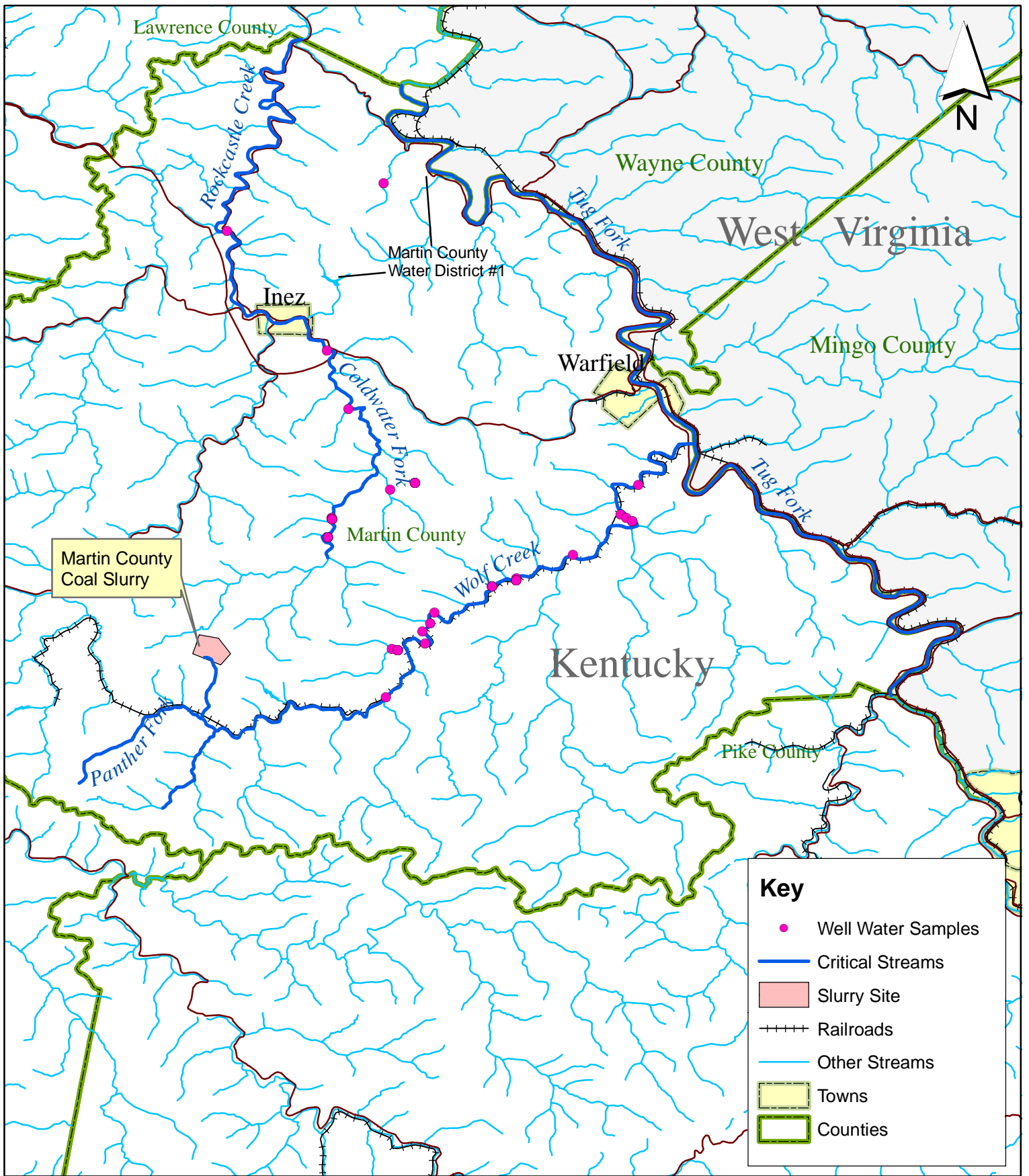
## Appendix A - Figures



# Martin County Coal Slurry Overview

Martin County, Kentucky

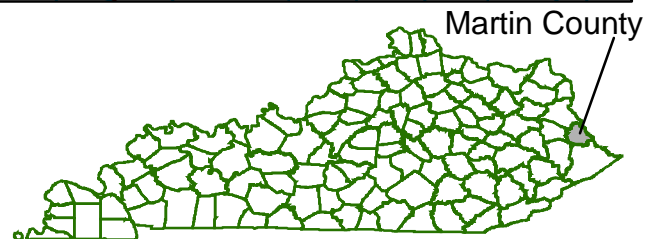




# Martin County Coal Slurry

## Well Water Sampling Locations

Martin County, Kentucky

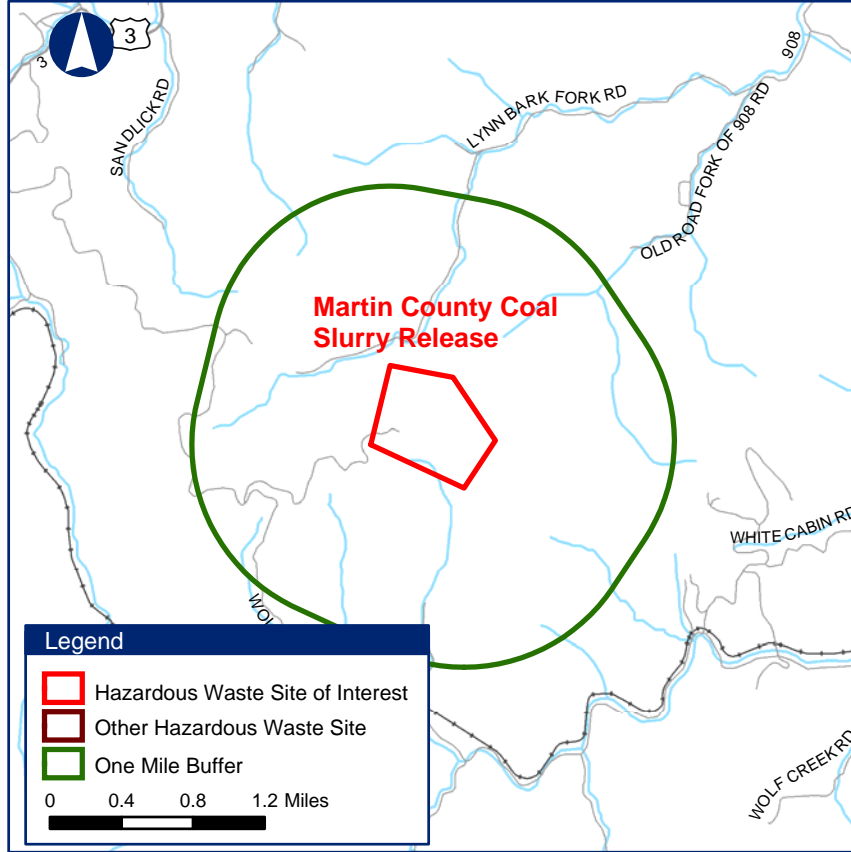


# Martin County Coal Slurry Release

Inez, KY



EPA Facility ID: KYN000407233

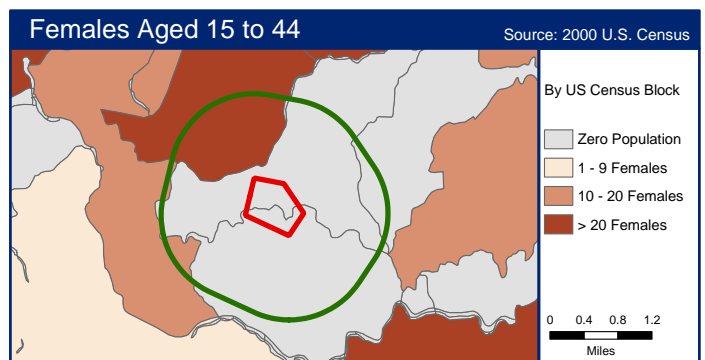
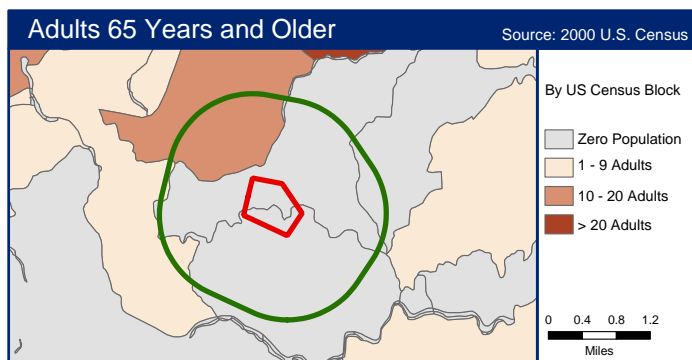
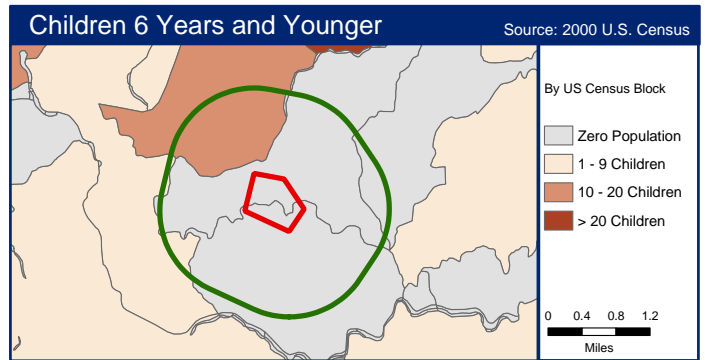
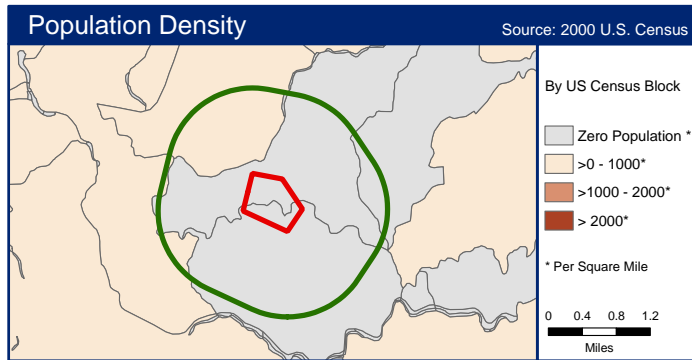


Demographic Statistics  
Within One Mile of Site\*

Total Population	34
White Alone	34
Black Alone	0
Am. Indian & Alaska Native Alone	0
Asian Alone	0
Native Hawaiian & Other Pacific Islander Alone	0
Some Other Race Alone	0
Two or More Races	0
Hispanic or Latino**	0
Children Aged 6 and Younger	2
Adults Aged 65 and Older	3
Females Aged 15 to 44	7
Total Housing Units	17

Base Map Source: Geographic Data Technology, May 2005.  
 Site Boundary Data Source: ATSDR Geospatial Research, Analysis, and Services Program, Current as of Generate Date (bottom left-hand corner).  
 Coordinate System (All Panels): NAD 1983 StatePlane Kentucky South FIPS 1602 Feet

Demographics Statistics Source: 2000 U.S. Census  
 \* Calculated using an area-proportion spatial analysis technique  
 \*\* People who identify their origin as Hispanic or Latino may be of any race.



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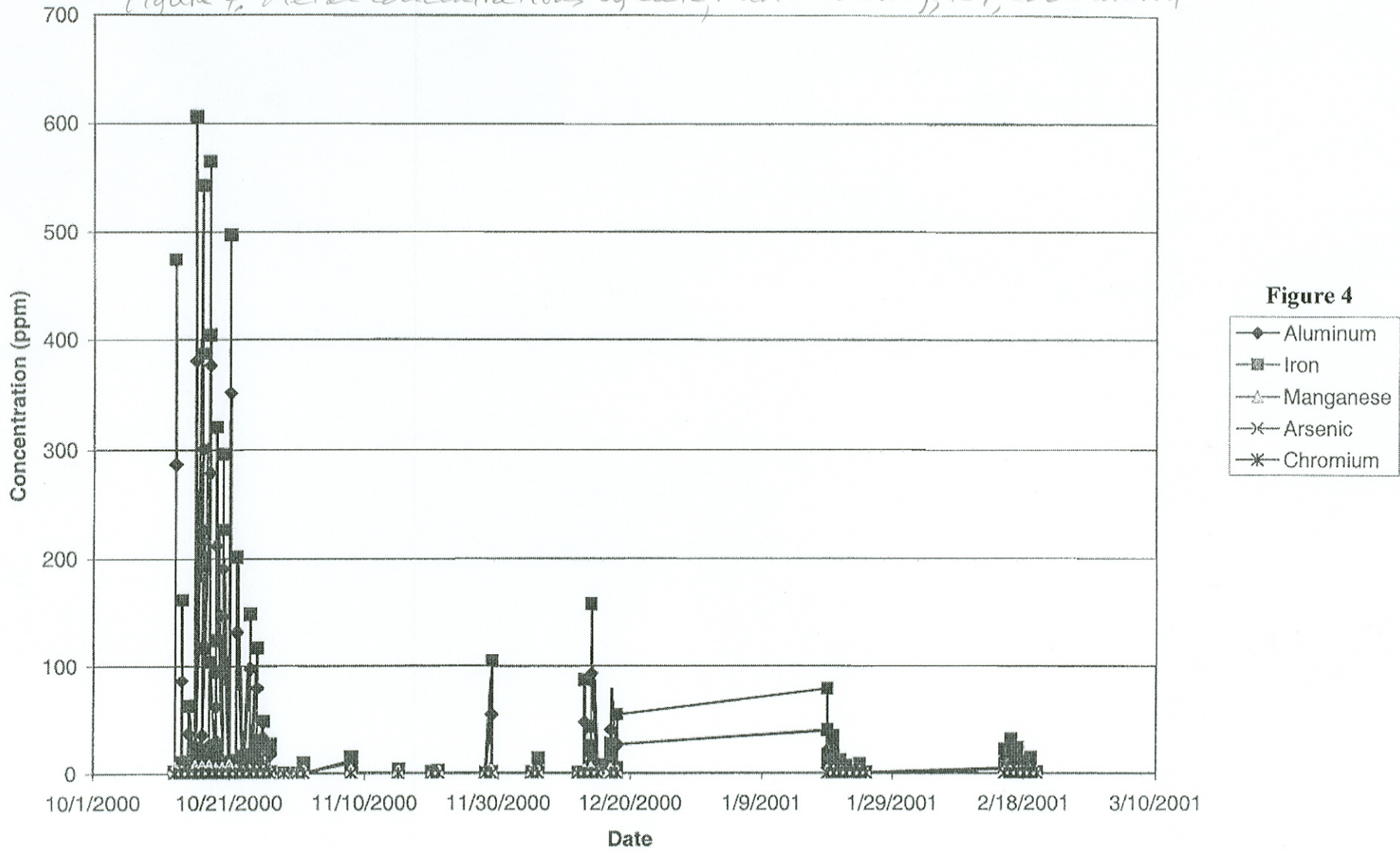
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Figure 4. Metal concentrations by date, Martin County, KY, coal slurry release



## **Appendix B - Data Tables**

**Table 1. Summary of sampling locations, dates, and analyses**

Who	Location/Media	Date	VOCs	SVOCs	Metals
EPA	Panther Fork- Slurry	10/23/00		X	X
	Panther & Big Andy- Slurry	10/23/00		X	X
	Coldwater Creek (Preece)- Slurry	10/23/00		X	X
Potesta	Impoundment-Slurry	10/16/00			X
	Coldwater Creek-Slurry	10/16/00		X	X
	Wolf Creek at Abrams Creek-Slurry	10/16/00		X	X
LCHB	Coldwater Creek-Slurry	1/12/01	X	X	X
	Wolf Creek-Slurry	1/12/01	X	X	X
	Coldwater Creek-Sediment	1/12/01	X	X	X
	Curtis Crum Reservoir-Sediment	3/14/01	X		X
Tetra Tech	#2 North Mains Portal-Slurry	12/21/00			X
	#2 North Mains Portal-Slurry	12/21/00			X

VOC = Volatile Organic Compounds

SVOC = Semi-Volatile Organic Compounds

EPA = Environmental Protection Agency

LCHB = the law firm of Lief Cabraser Heimann & Bernstein, LLP

**Table 2. Range of metals detected in slurry and background samples**

<b>Element</b>	<b>Range<sup>*†‡</sup> Dry Weight (ppm)</b>	<b>Background Means<sup>§**††</sup> Dry Weight (ppm)</b>
Aluminum	5,195.40 - 7,790.89	6,982.67- 63,300
Antimony	ND	0.76 - 2.66
Arsenic	ND - 8.0	2.736 - 8.64
Barium	‡‡	113.267 – 114.38
Beryllium	0.89 - 1.3	0.75 - 1.23
Cadmium	ND - 1.43	0.88 - 2.16
Calcium	963.22 - 4,000	1,500 <sup>§§</sup>
Chromium	9.4 - 14.3	10.88 - 46
Chromium, Hexavalent	ND	NA
Copper	19.08 - 35.24	20.18 - 34.24
Iron	8,600 - 18,043.84	17,078 – 28,500
Lead	7.72 - 21	16.5 - 29.81
Magnesium	1,839.08 - 2,360.88	3,200 - 3,726.67
Manganese	85.86 - 310	770 - 1,510.60
Mercury	ND - 0.07	0.08 - 0.14
Nickel	14 - 18.38	23 - 62.56
Potassium	1,425.29 - 2,000	1, 834 - 13,100
Selenium	ND - 2.56	0.51 - 3.66
Silver	ND	0.88 - 1.152
Sodium	72.76 - 109.95	106.67 - 3,800
Thallium	ND - 0.49	5.963 <sup>***</sup>
Zinc	26.55 - 41.65	77.32 - 123.56

NA – material was not analyzed for

ND – material was analyzed for but not detected

PPM – parts per million

\* Potesta & Associates Inc. Comparison of released material from Martin County Coal Corporation and typical soil and sediment conditions, Nov 2001. In: Martin County Coal Corporation slurry release project impact assessment report #1 (historical data submission); 2001 Nov 16.

† Laboratory analytical report from Northeast Environmental Laboratory, Inc. dated Jan 2001, for samples collected by Mr. Jan Schlichtmann. Provided to ATSDR pursuant to request for data.

‡ Laboratory analytical report from Kemron Environmental Services, Inc. April 2001.

§ Association for the Environmental Health of Soils. Study of State Soil Arsenic Regulations; 1999. Available from: <http://www.aehs.com/publications/catalog/contents/arsenic.pdf>. Accessed 2002.

\*\* Kentucky Division of Water. Summary of bulk sediment data from Kentucky streams and rivers from 1980-1994. Kentucky Department for Environmental Protection, Natural Resources and Environmental Protection Cabinet, Appendix D; 2001 Jan. Available from: <http://www.water.ky.gov/wq/sediment.pdf>. Accessed 2002.

†† West Virginia Division of Environmental Protection, Office of Environmental Remediation. West Virginia voluntary remediation and redevelopment act guidance manual, v. 2.1. March 13, 2001. Available at: [http://www.dep.state.wv.us/Docs/3200\\_RemediationGuidanceVersion2-1.pdf](http://www.dep.state.wv.us/Docs/3200_RemediationGuidanceVersion2-1.pdf).

‡‡ Barium was only analyzed for in the samples collected for EPA. Results were reported as wet weight and are not directly comparable to other data collected and reported as dry weight. The range detected in the EPA samples was 18 – 110 ppm.

§§ Only one source reported an average for calcium.

\*\*\* Only one source reported an average for thallium.

**Table 3. Range of detection for SVOCs and VOCs in slurry and sediment**

<b>Chemical Name</b>	<b>Range of Results (ppm)</b>
2-methylnaphthalene	ND – 2.7
Naphthalene	0.09 - 1.6
Phenanthrene	ND – 0.9
Toluene	ND – 0.08
o-Xylene	ND – 0.08
m-Xylene	ND - 0.05
p-Xylene	ND – 0.05
Total xylenes	NA
Benzo (a) anthracene	ND – 0.08
Benzo (b) fluoranthene	ND – 0.05
Benzo (k) fluoranthene	ND – 0.04
Benzo (a) pyrene	ND – 0.07
Benzo (ghi) perylene	ND – 0.03
Chrysene	ND – 0.09
Dibenzo (a,h) anthracene	ND – 0.02
Fluoranthene	ND – 0.15
Fluorene	ND – 0.07
Indeno (1,2,3-CD) pyrene	ND – 0.02
Pyrene	ND – 0.22

VOC = Volatile Organic Compounds

SVOC = Semi-Volatile Organic Compounds

NA – material was not analyzed for

ND – material was analyzed for but not detected

PPM – parts per million

**Table 4. Metals in surface water**

<b>Chemical</b>	<b>Range of Results (mg/L)</b>	<b>Background Levels* (mg/L)</b>
Aluminum	0.027 – 381.0	0.1
Antimony	ND	
Arsenic	ND – 0.12	ND – 0.018
Barium	0.028 - 7.49	
Beryllium	ND – 0.056	
Cadmium	ND – 0.021	ND – 0.005
Calcium	0.021 – 206	
Chromium	ND – 0.499	
Cobalt	ND – 0.056	ND – 0.017
Copper	ND – 1.26	0.002 – 0.1
Iron	0.194 – 606	70 – 34,000
Lead	ND – 0.645	ND – 0.140
Magnesium	8.69 – 233	
Manganese	0.029 – 7.67	10 – 1,200
Mercury	ND – 0.00167	ND – 0.0006
Molybdenum	ND – 0.015	
Nickel	ND – 0.724	
Potassium	2.21 – 60.6	
Selenium	ND – 0.008	ND – 0.003
Silver	ND – 0.015	
Sodium	4.15 – 202	
Strontium	0.018 – 2.9	
Tin	ND – 0.41	
Vanadium	ND – 0.589	
Zinc	ND – 5.25	ND – 0.3

mg/L – milligrams per liter (ppm)

ND – material was analyzed for but not detected

\*Source: M. Unthank at Kentucky USGS, personal communication, Feb. 2002

Samples collected Oct 2000 – Feb 2001.

**Table 5. Completed exposure pathways**

COMPLETED EXPOSURE PATHWAYS							
Pathway Name	Source	Contaminants	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Time
Recreational use of streams	Slurry release	Metals	Surface water, Sediment	Direct stream access	Incidental ingestion	Martin County residents (12,578)	Past (1 year from date of spill)
Residential yards & property	Slurry release	Metals	Surface soil	Residential yards, floodplains	Incidental ingestion	Residents or recreational users of floodplains	Past (1 year from date of spill)

**Table 6. Eliminated exposure pathways**

<b>ELIMINATED EXPOSURE PATHWAYS</b>							
<b>Pathway Name</b>	<b>Source</b>	<b>Contaminants</b>	<b>Environmental Medium</b>	<b>Point of Exposure</b>	<b>Route of Exposure</b>	<b>Exposed Population</b>	<b>Time</b>
Public drinking water system	Slurry release	Metals	Surface water	Public drinking water	Ingestion, Dermal	Martin County residents (12,578)	Past (1 year from date of spill), present, future
Private wells	Slurry release	Metals	Groundwater	Well-supplied drinking water	Ingestion, Dermal	Citizens with private wells (2,332)	Past (1 year from date of spill), present, future



**Table 7. Potential exposure pathways**

POTENTIAL EXPOSURE PATHWAYS							
Pathway Name	Source	Contaminants	Environmental Medium	Point of Exposure	Route of Exposure	Exposed Population	Time
Blackwater events	Slurry release	Metals	Sediments in area streams	Streams and stream-banks	Ingestion	Recreational users of streams and floodplains	Past Present Future
Vegetables from residential gardens	Slurry release	Metals	Soil in residential yards	Vegetables grown for consumption	Ingestion	Residents of floodplains	Past

## Appendix C - Public Comments

## Responses to Public Comments Received Since April 2003

**Comment #1:** Magnetite and Acrylamide/ Polyacrylamide are two of the principal agents used in coal preparation and treatment. Are the toxicological profiles for these chemicals available to the public?

**Response:** *The Agency for Toxic Substances and Disease Registry (ATSDR) has no toxicological profiles for either magnetite (a.k.a. “rust”) or acrylamide. Substances chosen as subjects of ATSDR Toxicological Profiles are chemicals that have been determined to pose the most significant potential threat to human health based on a combination of (1) their frequency of detection at National Priorities List (NPL) sites, (2) their known or suspected toxicity, and (3) their potential for human exposure (<http://www.atsdr.cdc.gov/clist.html>) By these criteria, neither magnetite nor acrylamide has been judged an appropriate subject for its own toxicological profile.*

**Comment #2:** In its public health consult, ATSDR assessed magnetite (Fe<sub>3</sub>O<sub>4</sub>) as Iron (Fe). What was ATSDR’s scientific justification for considering magnetite (Fe<sub>3</sub>O<sub>4</sub>) and iron (Fe) to be toxicologically similar?

**Response:** *Magnetite was treated conservatively as elemental iron in ATSDR’s consult because it is the iron in magnetite, and not the compound as a whole or the oxygen it contains, that can be toxic at high enough levels by the oral route.*

**Comment #3:** ATSDR should review and provide full reference to the most recent science and toxicology on arsenic and arsenic exposure beyond the 1985 citation referenced by ATSDR in its public health assessment.

**Response:** *ATSDR considers that the documentation presented in its final public health consultation on the Martin County coal slurry release (specifically, ATSDR’s 2000 Toxicological Profile for Arsenic and the two articles by Stöhrer 1991, and Marcus and Rispin 1988) was adequate to support its conclusion (#5) that “naturally occurring arsenic in private well water is not expected to cause any adverse health effects.” However, those seeking additional information from more current sources might also consult Guo and Tseng, 2000; Karagas et al., 2001; Moore et al., 2002; Tollestrup et al., 2003; Steinmaus et al., 2003; and Lamm et al., 2004. None of the latter studies provided evidence for a causal link between cancer and arsenic in drinking water in the United States. Several earlier U.S. studies documented similar findings, including: Lewis et al., 1999; Bates et al., 1995; Tollestrup et al., 1995; Engel and Smith, 1994; and Frost et al., 1987. Those earlier studies are discussed in ATSDR’s Toxicological Profile for Arsenic of September 2000. (See Reference section below for the full citations of these and other articles.)*

**Comment #4:** ATSDR dismissed reported skin rashes and skin irritations within the community after the October 2000 release as probable cases of “metal sensitivity.” Did ATSDR do any follow-up interviews to determine whether these purported individual cases of skin irritation were, in fact, due to persons being sensitive to metals? If not, then ATSDR has no scientific basis for their stated public assertion of “metal sensitivity.” ATSDR should do follow-up investigations and interviews with area citizens on past and current reported skin rashes and irritations as well as on other health incidences to empirically determine probable cause and explanation.

**Response:** *The relevant text on page 9 of this consult currently reads as follows: “Direct exposure to contaminated soil can cause skin irritation in sensitive individuals. If sensitive residents came into direct contact with the slurry material during the spill event, they may have experienced some irritation. Such skin rashes or allergic-type reactions would be short-term events, only..” The purpose of ATSDR public health assessments and consultations is to determine whether, under site-specific conditions of exposure, contaminants at a site are present at concentrations likely to produce adverse health effects in exposed residents. ATSDR concluded that, in the case of the Martin County coal slurry release, site-specific exposures were not likely to pose a hazard to public health. This conclusion did not, and could not, preclude the possibility that hypersensitive individuals might exhibit skin reactions to subthreshold dermal exposures that would normally have no effect at all on individuals who are not hypersensitive. However, the Agency can and did exclude contaminants in the coal slurry as probable causes of non-hypersensitivity reactions.*

**Comment #5:** A Martin County citizen has reported four verifiable cases of cancer in her small neighborhood community at the top of Coldwater Creek. The Coldwater area spoken of was one of the areas most heavily inundated by the massive sludge release of October 2000. Given four reported and verifiable cases of cancer among several families living at the top of Coldwater Creek, it is recommended that ATSDR systematically investigate this cancer cluster to determine its probable cause.

**Response:** *To qualify as a “cancer cluster,” the four cases reported above would have to represent a significantly greater-than-expected age-specific incidence of cancers of the same or related types in the local population. However, even if the four reported cancers did qualify statistically as a cluster, both the identity of the site-specific contaminants and their concentrations are inconsistent with any cause-and-effect relationship with the Martin County coal slurry spill. If one assumed that the exposures were causal, and if the diagnoses were all made after the slurry spill, the time elapsed since the potential exposure would still imply an implausibly small latency period of less than 3 years which would mitigate against the assumption of causality.*

*Cancer is actually much more common than is generally appreciated; approximately one half of men, and one third of women, will develop cancer of some kind during their lifetimes (Thun and Sinks 2004). The most common types are cancers of the lung, prostate, breast, and colon (MMWR, June 4, 2004).*

*Reports of “cancer clusters” are also more common than is generally supposed. In the United States, state and local health departments respond to more than 1,000 inquiries about suspected cancer clusters each year. However, only 5 - 15% of these clusters are statistically significant (i.e., are confirmed to fit the technical definition of a cancer cluster), and most of those could still be the result of chance (Thun and Sinks 2004). During the period 1961-1982, the Centers for Disease Control and Prevention (CDC) investigated over 100 community cancer clusters in 29 states and 5 foreign countries, but was unable to establish a causal link with environmental exposures in any of them (Thun and Sinks 2004; ATSDR 2001; Caldwell 1990). Such investigations were particularly unproductive when the clusters were small (i.e., consisted of five or fewer people), even when the suspect exposures were relatively high. Thus, when the National Institute for Occupational Safety and Health (NIOSH) investigated 61 suspected occupational cancer clusters during 1978-1984, most of which included five or fewer cases, that agency did not find a plausible occupational cause for any of them (Thun and Sinks 2004). In those rare instances where causal links have been firmly established between cancer clusters and environmental factors, the latter have typically involved unusually high occupational exposures or, less often, specific lifestyle factors. Examples of the former include: scrotal cancer in chimney sweeps; hepatic angiosarcoma in vinyl chloride workers; acute myelogenous leukemia in benzene workers; mesothelioma in asbestos workers; and bladder cancer in aniline dye workers. Examples of the latter include: lung cancer in smokers; clear cell vaginal cancer in the daughters of mothers who took DES during pregnancy; and Kaposi’s sarcoma in patients infected with the HIV virus (Thun and Sinks 2004; ATSDR 2001).*

**Comment #6:** It is recommended that ATSDR initiate a complete and systematic health investigation of the Martin County slurry release on area human health.

**Response:** *Because the levels of slurry-related chemical contamination at this site were too low, even before remediation was complete, to produce any long-term adverse health effects in the affected communities, a health study is not indicated.*

**Comment #7:** ATSDR should scientifically address and empirically document how chemically sensitive and vulnerable subpopulations might be, or might not be, more at risk to chemical toxicities than healthy populations. This is central to protecting human health, given that it is the most economically distressed subpopulations of Martin County that are relying on the public water system as their drinking and cooking water source.

**Response:** *In its health consultation, ATSDR has concluded that, at the levels detected at this site, none of the potential contaminants would be expected to produce any adverse health effects in local residents, including children, with the possible exception of the aforementioned “metal sensitivities.”*

**Comment #8:** ATSDR dismissed the public drinking water system as a potential exposure pathway, stating: “To the best of our knowledge, the Martin County Water District #1 did not take slurry materials into the water treatment system, preventing it from being a pathway of exposure for residents of Martin County.” However verifiable

data shows the MCWD plant pulling from its permanent intake on the Tug River in early January 2001.

**Response:** *In a December 27, 2000 story in the Martin County Sun News, “EPA OK’d Pumping from Tug,” Cletus Turner reported that “Water plant operators at Kermit and Inez had opted to begin pumping from the Tug River again after weeks of using temporary lines provided by Martin County Coal. But the Tug River pumping was stopped after the rains brought black water out once again. ‘We’re waiting for the turbidity levels to go down some. We don’t want to pump black water into the reservoir,’ Inez plant manager Niles Gumbo said.” ATSDR considers that this story confirms the statement made in this consultation that the “Martin County Water District#1 did not take slurry materials into the water treatment system” (pg 8 of the consultation).*

**Comment #9:** ATSDR states in its PHA on the Martin County slurry release that “the increase of particles in the water during a blackwater event may result in slurry materials being taken into the water treatment plant. The Martin County Water District #1 treatment process removes Most of suspended sediment and therefore any associated metals from drinking water, limiting exposures to sediment particles. Water quality is tested on a quarterly basis to ensure that the treatment plant is working correctly. This is not considered a completed pathway of exposure to slurry materials. A properly operating water treatment plant would not allow exposures of significance.” However, the Martin County Water District was cited for a number of noncompliance violations in December 2000. How might spring turn-over and seasonal flooding and the subsequent re-suspension of slurry particulate matter affect the public water system at the intake and at the reservoir?

**Response:** *On page 12 of the consultation, ATSDR states (as conclusion #7) that “blackwater events may continue to occur, but the concentrations of metals currently found during these events are not expected to cause adverse health effects.” Even so, the State of Kentucky continues to monitor these events and will take protective measures, if it deems them necessary.*

**Comment #10:** Based on a verifiable history of noncompliance and poor operating procedures, we recommend that ATSDR systematically review and revisit its page 7 statement, “A properly operating water treatment plant would not allow exposures of significance.

**Response:** *In the statement cited above, the word “significance” is a reference to toxicological significance. Generally, the legally enforceable MCLs with which water treatment facilities must comply are, by design, much lower (often by orders of magnitude) than the lowest levels known to produce any adverse health effects in sensitive species. Therefore, regulatory non-compliance by itself does not necessarily constitute a public health hazard. The maximum levels of chemical contaminants detected at this site did not pose any hazard to public health.*

**Comment #11:** ATSDR should request that the Environmental Protection Agency (EPA) Region 4 conduct additional sampling and monitoring on the impacted raw and finished water sources using state-of-the-art water quality testing protocols.

*Response:* ATSDR is satisfied that the data it has already reviewed are sufficiently complete to support its general conclusions.

**Comment #12:** Considering evidence of past agency and company collusion in environmental assessment and monitoring at the Martin County site, ATSDR should recommend to EPA Region 4 that a citizen oversight committee be appointed to oversee water quality testing and assessment of the Martin County watershed.

*Response:* ATSDR is satisfied that EPA has provided this agency with data of sufficient quality to support its general conclusions. ATSDR also considers that the environmental actions taken by EPA have been effectively protective of public health.

**Comment #13:** It is recommended that ATSDR also assess the impact of the slurry spill on other public water systems, especially the Lawrence County (Louisa) Water Treatment Facility, which might also represent potential paths of exposure to the October 2000 slurry release

*Response:* In April of 2001, ATSDR was petitioned by a citizens group in Inez, KY, for the specific purpose of assessing the potential public health implications in the area immediately affected by the October 11, 2000, coal slurry spill. In the subsequent Public Health Consultation, ATSDR concluded that exposures in the vicinity of Inez were not at levels that would be expected to produce adverse health effects. The people of Louisa were even less likely to have been exposed to slurry contaminants in their drinking water than were the residents of Inez, because (1) Louisa was at least three times further downstream of the collapsed coal slurry impoundment than was Inez, (2) it drew its water from the Levisa Fork, rather than the heavily contaminated Tug Fork, as Inez did, (3) the Louisa Water Plant was immediately shut down when sludge that had previously been only in the Tug Fork of the Sandy River backed up into Levisa Fork, and (4) throughout the emergency, water supplies were provided from alternative sources, including water hauled in from Lowmansville, KY, and 1-gallon jugs of drinking water contributed by the Martin County Coal Corporation. (The Cincinnati Enquirer, Monday October 16, 2000). Louisa's drinking ban for customers was lifted Monday, October 23, 2000, after tests were completed on water pumped from another intake upstream from its normal Levisa Fork source (The Huntington Herald-Dispatch, Tuesday, October 24, 2000). As a result of these protective actions, the slurry which gushed from the collapsed impoundment near Inez, KY, on Wednesday Oct. 11, 2000, posed no effective threat to drinking-water supplies or industrial uses downstream, according to the Army Corps of Engineers' water-quality chief George P. Kincaid. In addition, the chemical analyses that were shared with the Corps by Kentucky officials indicated no unusual levels of toxic metals in the water (The Cincinnati Enquirer, Sunday, October 22, 2000).

**Comment #14:** The background soil data which ATSDR used to compare impacted with un-impacted areas were inappropriate, given wide variances in the geology and the Appalachian orogeny in the eastern part of the state. All background data sources used in establishing range comparisons should be fully cited and these separate data sources should be reported as separate range data as would be standard scientific reporting protocol. This would allow the public and its representatives to better assess the validity and verifiability of the soil data presented by ATSDR and to separately assess and evaluate the impacts of the slurry release on area soils based on the clear presentation of the data and data comparisons.

**Response:** *Background data were cited for perspective only. The fact that a substance is present at background levels implies only that the source of that substance, whether natural or man-made, is not contributing “elevated” amounts to the local environment. But, it is no guarantee that those levels are “safe” from a public health standpoint. (For example, due to very high “background” levels of sodium chloride, seawater is not safe to drink.) That is why ATSDR’s assessment of the public health implications of site-specific exposures are based on a thorough toxicological evaluation of chemicals of concern identified using health-based screening values.*

**Comment #15:** To allow the public to better assess the data and distributions, the MCPT recommends that the data be presented more fully than range data.

**Response:** *For the purposes of assessing the potential public health implications of site-specific exposures, a detailed, statistically valid characterization of the distribution of contaminant concentrations is not required. If, as was the case with the Martin County coal slurry release (most of which had been cleaned up one year later), the maximum detected concentrations of contaminants would pose no public health hazard, under site-specific conditions of exposure, then a more detailed presentation of the intermediate concentrations (i.e., those between the minimum and the maximum) would have no impact on ATSDR’s conclusion of “No Apparent Public Health Hazard.”*

**Comment #16:** ATSDR concludes, “No adverse health effects are expected to occur as a result of drinking water from the alternate water source (p.12).” Such statements suggest that much of ATSDR’s drinking water assessment was based on temporary intake data. If that is the case, it is recommended that these statements be clarified and that drinking water data from the permanent intake be the subject of analysis and scientific discussion in the ATSDR public health assessment (PHA).

**Response:** *In assessing the plausible public health implications of potential human exposure to site-specific contaminants, ATSDR considered all of environmental media to which local residents were likely to be significantly exposed, including surface water, groundwater, sediments in area streams, and the slurry itself. Because (a) none of the environmental media which could potentially impact the drinking water supply contained hazardous levels of chemical substances, and (b) the municipal drinking water supply must, by law, meet safe drinking water standards, whether derived from the temporary or the permanent intake, analysis of the municipal water supply by ATSDR was deemed unnecessary.*



**Comment #17:** Concerning ATSDR's measurement and assessment of combined and interactive toxic impacts on human health, combined and interactive effects were neither presented nor reported. It is recommended that ATSDR include in its final draft an appendix reporting combined and interactive toxicological impacts of water and soil contaminants on human health.

*Response: Because the individual contaminants detected at this site were present at levels that would not be expected to result in adverse health effects, the effect of all these contaminants combined would also be of no public health concern. This conclusion is based on numerous studies which suggest that a mixture produces no adverse health effects in dosed animals when the components of that mixture are all present at levels below their respective No-Observed-Adverse-Effect-Levels (NOAELs), i.e., at concentrations that would have produced no adverse effects in animals treated separately with those component chemicals (Feron et al., 1993; Jonker et al., 1993a; Jonker et al., 1993b; Jonker et al., 1990; Groton et al., 1991). In two of these experiments (Jonker et al., 1993a, b), all of the component chemicals affected the same target organ, but through different mechanisms. In two others (Jonker et al., 1990; Groton et al., 1991), the chemicals had different target organs and exhibited different modes of action, as do most chemicals in typical environmental mixtures. Subsequent experiments have shown similar results (Feron et al., 1995; Groton et al., 1997). (Note that these studies merely confirm a long-standing pharmacological principle which states that the potential for biologically significant interactions of chemicals exists only at pharmacologically active doses of those chemicals.) Considering that ATSDR Comparison Values are typically 10-100 times lower than the NOAELs for the corresponding chemicals, it is reasonable to expect that environmental contaminants will produce no combined effects of any kind, even if their individual concentrations each exceed their respective Environmental Media Evaluation Guides (EMEGs) by some small fraction of these built-in safety margins, i.e., are several-fold higher than the relevant comparison values.*

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