



**Results of the Health Investigation Following Fly Ash  
Contamination in Forward Township, Allegheny County,  
PA**

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**Background:**

On the afternoon of January 25, 2005, thousands of tons from a fly ash hill overlooking a section of Forward Township tumbled down, flowing through the Rostosky Ridge neighborhood and then into the Perry Mills Run, which feeds directly into the Monongahela River. The landslide began along River Hill Road near Elizabeth when a 100-yard-long slab of saturated fly ash gave way and slipped down into the creek, blocking its flow and creating an 80-foot-high cliff. On January 26, a half-acre lake had formed behind the dam created by the fly ash. On that day, DEP issued an emergency contract to excavate a channel around the ash to help stabilize the slide area.

On February 3, 2005, State Representative David Levdansky held a public meeting with the affected residents. At this meeting, there were about 50 residents, and representatives from the DEP. At this time, residents claimed that they or their children were experiencing headaches, coughing, throat irritation, and watery or burning eyes.

On February 9, 2005, the Allegheny County Health Department (ACHD) Director and Epidemiologist met to discuss a potential health assessment of affected Forward Township residents. The ACHD began 24-hour air sampling every three days on Rostosky Ridge Road on February 12, 2005. On March 4, 2005, an ACHD Epidemiologist visited the area to determine exposed and unexposed households. See Figure 1, Figure 2.

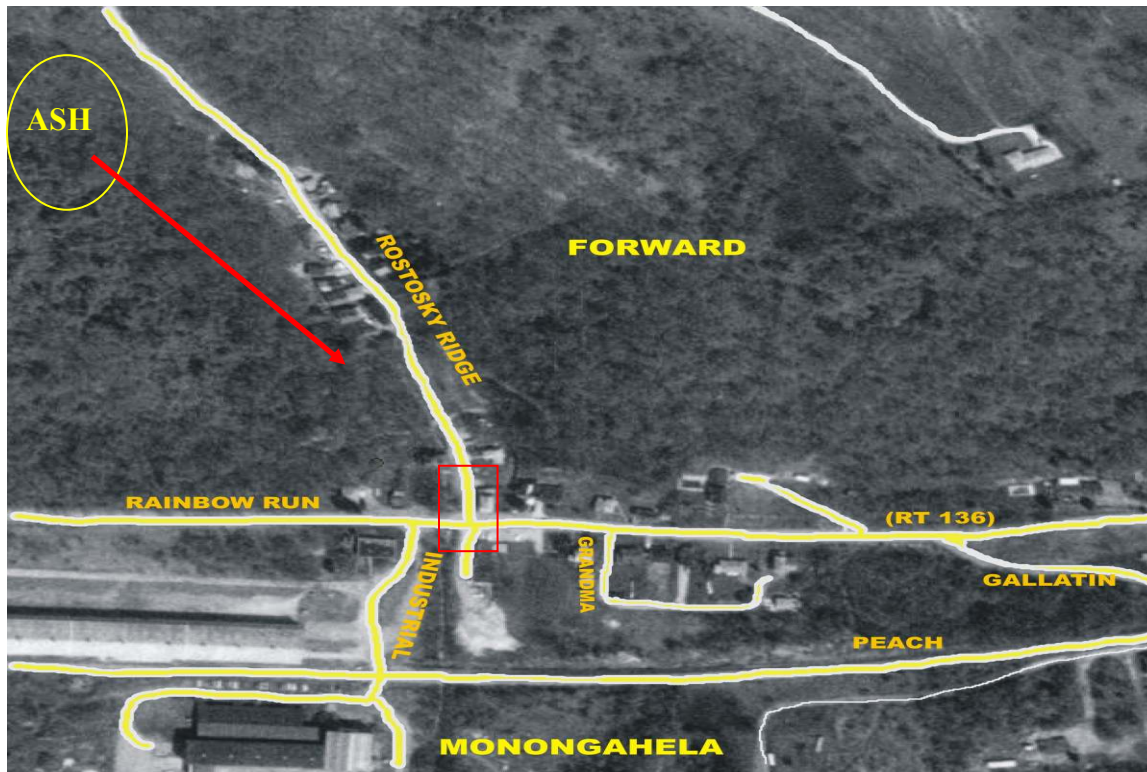
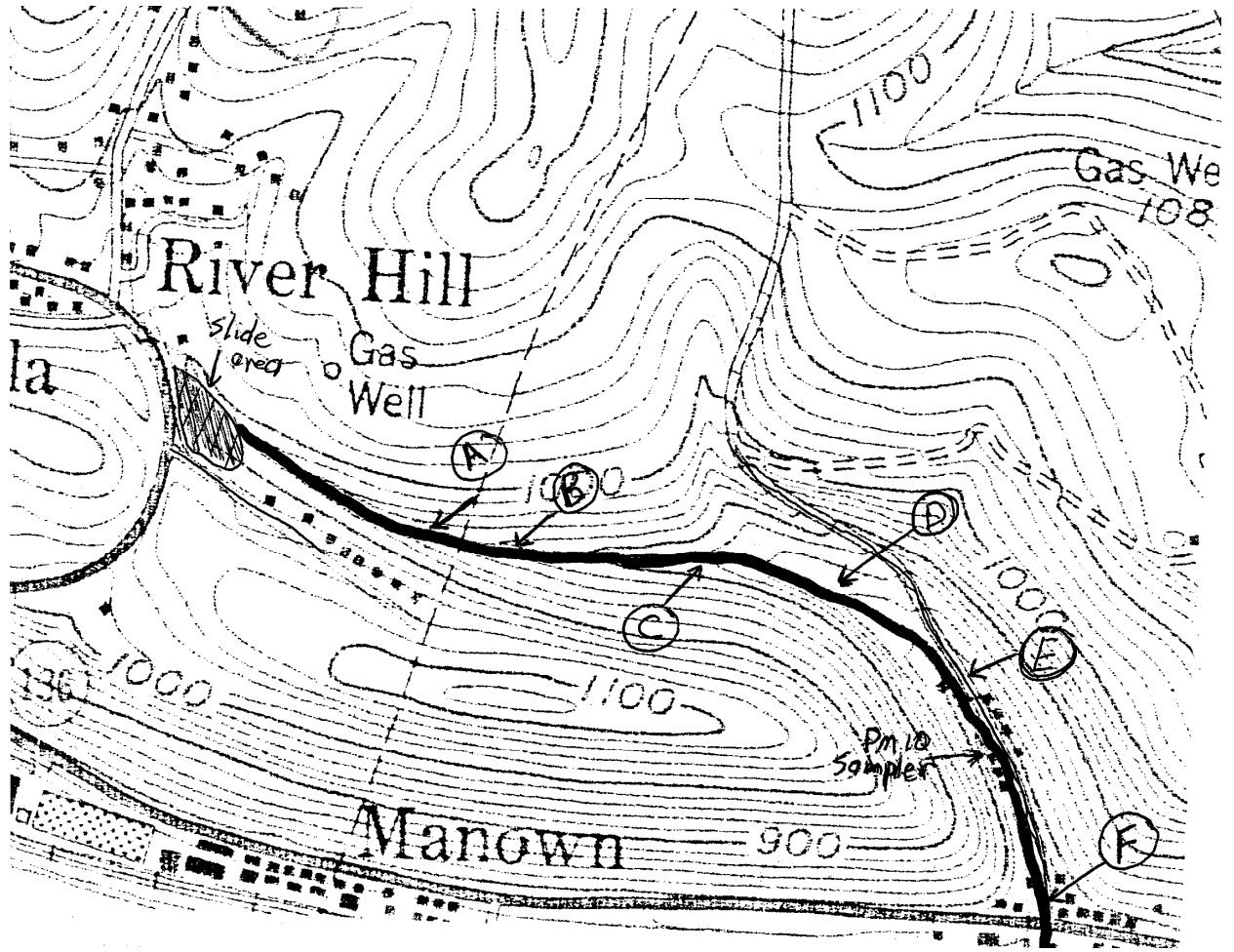


Figure 1: Map of Forward Township with affected area highlighted.



- A: Base of first large waterfall
- B: Base of second large waterfall
- C: Intersection of creek and hillside runoff channel
- D: 200 yards upstream from the first house on Rostosky Ridge Road
- E: Campfire area just past 4324 Rostosky Ridge Road
- F: Side of creek near Rt. 136 intersection

Figure 2: Topographic map of Rostosky Ridge and the fly ash spill.

On March 7, 2005, ACHD distributed specimen kits to representatives of eleven households to collect a 24-hour urine samples. In addition, a questionnaire (see Appendix A) was either given or administered to 23 local residents. On March 10-11, representatives from the federal Agency for Toxic Substances and Disease Registry (ATSDR) met with representatives of the ACHD and with Forward Township residents. They recommended that extra efforts be undertaken to ensure that children's exposure to fly ash contaminants be assessed. Therefore, on March 11, accommodations were made for five resident children to submit either 24-hour or random urine specimens for testing. All twenty of the urine specimens available for testing were submitted to the laboratory on or before March 14, 2005.

On April 1, 2005, specimen kits to collect a 24-hour urine sample were again distributed to representatives of eleven households. According to initial communications with the PA DEP, cleanup was to begin on April 4, 2005. Twelve urine samples (including those from three children) were submitted to the contracted analytical laboratory, LabCorp, on or before April 10, 2005.

On April 19, 2005, residents and an anti-fly ash advocate testified before National Academies of Sciences (NAS) Committee on Coal Combustion Wastes. Although the meeting was actually to discuss fly ash being dumped into mine pits, the group chose to discuss their experience with fly ash being deposited near residences.



Figure 3: From where the ash originated.

On April 25, 2005, ACHD distributed specimen kits to eight households to collect hair and nail samples. A letter instructing residents as to how they should take the hair or nail sample was distributed, as well. The letter (See Appendix B) described why these specimens were to be taken around the 100-day anniversary of the incident. On that date, the DEP contractor, Weavertown Environmental, began cleanup. The cleanup was completed on May 13, 2005.

On May 12, 2005, only 3 of the 8 households submitted nail specimens. No hair samples were submitted. No residents from Rostosky Ridge Road (the area that was primarily affected by the slide) submitted a sample.

## **II. Methods:**

### *Ash:*

The DEP conducted ash sampling according to established sampling and analysis protocols.

### *Air:*

Air sampling was conducted with a high volume air sampler through an 8"x10" high purity quartz filter media at 40 cubic feet per minute. This sampler was located at 4312 Rostosky Ridge Road. It ran for 24 hours every three days, starting February 12, 2005, and ending August 23, 2005. The filter was analyzed according to established protocols for arsenic and for particles less than 10 microns.

Portions of air sample filters collected between 2/12 and 3/23 were sent to the DEP laboratory for metals analysis to assure quality. Their results correlated very well with Allegheny County's results. All of ACHD sample calculations were also shared with DEP staff for verification.

### *Urine:*

Urine was collected in sterile containers supplied by Lab Corp, Dublin, Ohio. Those residents who felt able to provide 24-hour urine samples did so. Those who were too young or otherwise unable to provide 24-hour sample gave first morning voids.

### *Hair and nails:*

Nail specimens were to be taken according to specifications provided by Lab Corp. A letter with explicit instructions on how to take the specimens was provided to the residents with the specimen collection kits on April 25, 2005.

## **III. Results:**

### *Ash:*

Ash sample results were made available to the ACHD on March 9, 2005 (see Table 1). Only arsenic (As) was detected at levels above the levels that are considered safe. The sample results

of 219, 198, 268 and 265 mg/kg are all in excess of the recommended limits of 150 mg/kg for soil and groundwater and a great deal higher than the limits for residential direct contact with soil of 12 mg/kg.

Table 1: Ash sample results from Rostosky Ridge Road, Monongahela, PA.

|                                            | soil / Groundwater | Residential direct Contact | sample 44 | Sample 45 | Sample 46 | Sample 47 |    |    |        |
|--------------------------------------------|--------------------|----------------------------|-----------|-----------|-----------|-----------|----|----|--------|
| Beryllium                                  | 320                | 440                        | 2         | 1.87      | 2.29      | 2.65      |    |    |        |
| calcium                                    |                    |                            | 15,314    | 16368     | 19061     | 22772     |    |    |        |
| Cadmium                                    | 38                 | 47                         | 1         | 1.11      | 1.25      | 1.47      |    |    |        |
| Cobalt                                     | 81                 | 20.7                       | 4,400     | 24.1      | 27.2      | 13.9      |    |    |        |
| Total Cromium                              | 190                | 94                         | 38        | 43.4      | 51.2      | 58.5      |    |    |        |
| Copper                                     | 36000              | 8200                       | 25        | 24.6      | 29.2      | 32        |    |    |        |
| Iron                                       | not applicable     | 66,000                     | 57,092    | 85240     | 83607     | 77117     |    |    |        |
| Aluminum                                   | not applicable     | 190,000                    | 20,963    | 21986     | 26127     | 29478     |    |    |        |
| Magnesium                                  |                    |                            | 2,319     | 2337      | 2848      | 3339      |    |    |        |
| Manganese                                  | not applicable     | 31,000                     | 169       | 198       | 210       | 314       |    |    |        |
| sodium                                     | not applicable     |                            | 614       | 585       | 691       | 852       |    |    |        |
| Nickel                                     | 650                | 4,400                      | 42        | 47.6      | 54.5      | 44        |    |    |        |
| tin                                        | 190,000            | 130,000                    | 30        | <27.7     | <29.4     | <27.9     |    |    |        |
| vandrum                                    | 20,000             | 1,500                      | 83        | 84.6      | 102       | 117       |    |    |        |
| zinc                                       | 12,000             | 66,000                     | 34        | 33.9      | 45.8      | 45.9      |    |    |        |
| potassium                                  |                    |                            | 2,022     | 2136      | 2591      | 2654      |    |    |        |
| Lead                                       | 450                | 500                        | 13.8      | 13        | 17.5      | 17.4      |    |    |        |
| silver                                     | 84                 | 1,100                      | 6.62      | <.694     | <736      | <698      |    |    |        |
| Barium                                     | 8,200              | 15,000                     | 401       | 429       | 580       | 495       |    |    |        |
| arsenic                                    | 150                | 12                         | 219       | 198       | 268       | 265       |    |    |        |
| Selenium                                   | 26                 | 1,100                      | 5.2       | <4.86     | 5.15      | <4.89     |    |    |        |
| Thallium                                   | 14                 | 15                         | 2.75      | 2.22      | 3.09      | 3         |    |    |        |
| Antmony                                    | 27                 | 88                         | 1.86      | 1.87      | 2.58      | 3.35      |    |    |        |
| mercury                                    | 10                 | 66                         |           |           |           |           |    |    |        |
| ACHD Solid grab samples / results in mg/kg |                    |                            |           |           |           |           |    |    |        |
| SCN#                                       | Date               | As                         | Be        | Cd        | Cr        | Cu        | Pb | Ni | Zn     |
| Blank                                      |                    | <0.0859                    |           |           |           | <0.112    |    |    | <0.324 |
| 05-011                                     | 2/12/2005          | 200.0                      |           |           |           | 29.7      |    |    | 79.7   |

## Grab Sample Analysis

Collected on 2/12/05 from an obvious ash deposition near the PM10 sampler at 4312 Rostosky Ridge Road

|                        | Solid grab samples / results in mg/kg |                  | Dry sample results |
|------------------------|---------------------------------------|------------------|--------------------|
|                        | As                                    | Cu               | Zn                 |
| <b>Matrix Blank</b>    | <b>&lt;0.0859</b>                     | <b>&lt;0.112</b> | <b>&lt;0.324</b>   |
| <b>Sample # 05-011</b> | <b>200.0</b>                          | <b>28.5</b>      | <b>78.5</b>        |

Collected on 3/28/05 from various locations along Perry Mills Run. Samples were taken from obvious fly ash depositions near the stream channel.

| Solid grab samples | Dry sample results |             |
|--------------------|--------------------|-------------|
|                    | As (mg/kg)         | pH          |
| <b>Sample A</b>    | <b>187</b>         | <b>8.84</b> |
| <b>Sample B</b>    | <b>206</b>         | <b>8.85</b> |
| <b>Sample C</b>    | <b>161</b>         | <b>8.86</b> |
| <b>Sample D</b>    | <b>181</b>         | <b>8.81</b> |
| <b>Sample E</b>    | <b>194</b>         | <b>9.27</b> |
| <b>Sample F</b>    | <b>174</b>         | <b>8.88</b> |

### *Air:*

The ACHD Air Quality Division provided results from sampling conducted in February through August 2005. Results of the air samples are found in Table 2. Arsenic was normally found in concentrations between 1-5 nanograms/cubic meters (ng/m<sup>3</sup>) of air. Arsenic has been found at these levels in other parts of the county unaffected by fly ash slides like Liberty Borough, the City of Clairton, and Elizabeth, PA. (See Tables 3A and 3B.) On April 19, 2005, the concentration of arsenic in the air apparently increased 10-fold. This corresponded with a 2-week period without precipitation, during which the temperatures climbed to an average of 80 degrees F. Soon afterward, As levels returned to previous levels. See Figure 4. Other such “spikes” were also observed at other air sampling locations in the county on the same day, indicating this was a regional phenomenon and not a localized event.



**Table 2: Air results from the Forward Township Fly Ash Study**

Report Date 05/09/05

PM10 Monitoring Site

Stuart Diess, 4312 Rostosky Ridge Road

Start Date: 02/12/05

Frequency: Every three days

Duration: 24 hours

Flow Rate: 40 CFM

Filter Media: High Purity Quartz, 8" x 10"

| <b>Date</b>         | <b>As (ng/m3)</b> | <b>Cu</b>       | <b>Zn</b>       | <b>Pb</b>    | <b>Cr</b>   | <b>PM10 (ug/m3)</b> |
|---------------------|-------------------|-----------------|-----------------|--------------|-------------|---------------------|
| <b>Filter blank</b> | <b>&lt;0.64</b>   | <b>&lt;0.84</b> | <b>&lt;2.42</b> | <b>0.82</b>  | <b>2.49</b> | -----               |
| <b>2/12/2005</b>    | <b>5.29</b>       | <b>22.99</b>    | <b>27.28</b>    | <b>8.96</b>  | <b>2.62</b> | -----               |
| <b>2/15/2005</b>    | <b>5.77</b>       | <b>20.34</b>    | <b>30.08</b>    | <b>8.31</b>  | <b>4.75</b> | -----               |
| <b>2/17/2005</b>    | <b>4.58</b>       | <b>37.56</b>    | <b>26.42</b>    | <b>6.61</b>  | <b>3.39</b> | -----               |
| <b>2/21/2005</b>    | <b>4.04</b>       | <b>38.69</b>    | <b>38.62</b>    | <b>10.37</b> | <b>4.57</b> | -----               |
| <b>2/24/2005</b>    | <b>2.36</b>       |                 |                 |              |             | -----               |
| <b>2/27/2005</b>    | <b>1.81</b>       |                 |                 |              |             | -----               |
| <b>3/2/2005</b>     | <b>0.71</b>       |                 |                 |              |             | -----               |
| <b>3/5/2005</b>     | <b>2.00</b>       |                 |                 |              |             | -----               |
| <b>3/8/2005</b>     | <b>1.39</b>       |                 |                 |              |             | -----               |
| <b>3/11/2005</b>    | <b>1.02</b>       |                 |                 |              |             | -----               |
| <b>3/15/2005</b>    | <b>3.32</b>       |                 |                 |              |             | -----               |
| <b>3/17/2005</b>    | <b>4.93</b>       |                 |                 |              |             | -----               |
| <b>3/20/2005</b>    | <b>1.42</b>       |                 |                 |              |             | -----               |
| <b>3/23/2005</b>    | <b>2.02</b>       |                 |                 |              |             | -----               |
| <b>3/26/2005</b>    | <b>5.19</b>       |                 |                 |              |             | -----               |
| <b>3/29/2005</b>    | <b>1.01</b>       |                 |                 |              |             | <b>15.9</b>         |
| <b>3/31/2005</b>    | <b>1.22</b>       |                 |                 |              |             | -----               |
| <b>4/4/2005</b>     | <b>0.82</b>       |                 |                 |              |             | <b>18.8</b>         |
| <b>4/7/2005</b>     | <b>4.32</b>       |                 |                 |              |             | -----               |
| <b>4/10/2005</b>    | <b>2.69</b>       |                 |                 |              |             | <b>30.3</b>         |
| <b>4/13/2005</b>    | <b>1.06</b>       |                 |                 |              |             | -----               |
| <b>4/16/2005</b>    | <b>1.50</b>       |                 |                 |              |             | <b>30.2</b>         |
| <b>4/19/2005</b>    | <b>22.31</b>      |                 |                 |              |             | -----               |
| <b>4/22/2005</b>    | <b>4.06</b>       |                 |                 |              |             | <b>22.6</b>         |
| <b>4/26/2005</b>    | <b>16.47</b>      |                 |                 |              |             | -----               |
| <b>4/28/2005</b>    | <b>3.24</b>       |                 |                 |              |             | <b>20.9</b>         |

|           |       |  |  |  |  |       |
|-----------|-------|--|--|--|--|-------|
| 5/01/2005 | 14.50 |  |  |  |  | ----- |
| 5/04/2005 | 6.25  |  |  |  |  | ----- |
| 5/07/2005 | 6.29  |  |  |  |  | ----- |
| 5/10/2005 | 5.15  |  |  |  |  | ----- |
| 5/12/2005 | 1.74  |  |  |  |  | ----- |
| 5/16/2005 | 1.55  |  |  |  |  | ----- |
| 5/19/2005 | 1.35  |  |  |  |  | ----- |
| 5/22/2005 | 4.66  |  |  |  |  | ----- |
| 5/25/2005 | 1.18  |  |  |  |  | ----- |
| 5/28/2005 | 0.87  |  |  |  |  | ----- |
| 6/1/2005  | 1.03  |  |  |  |  | ----- |
| 6/3/2005  | <0.68 |  |  |  |  | 9.9   |
| 6/7/2005  | 2.14  |  |  |  |  | ----- |
| 6/9/2005  | 1.40  |  |  |  |  | 30.8  |

| Date      | As (ng/m3) | Cu | Zn | Pb | Cr | PM10 (ug/m3) |
|-----------|------------|----|----|----|----|--------------|
| 6/12/2005 | 1.88       |    |    |    |    | -----        |
| 6/15/2005 | <0.63      |    |    |    |    | 18.7         |
| 6/18/2005 | 3.37       |    |    |    |    | -----        |
| 6/21/2005 | 1.97       |    |    |    |    | 36.4         |
| 6/23/2005 | 1.23       |    |    |    |    | -----        |
| 6/27/2005 | 1.08       |    |    |    |    | 34.5         |
| 6/30/2005 | 1.76       |    |    |    |    | -----        |
| 7/3/2005  | 2.15       |    |    |    |    | -----        |
| 7/6/2005  | 2.53       |    |    |    |    | -----        |
| 7/9/2005  | 2.23       |    |    |    |    | -----        |
| 7/12/2005 | 2.13       |    |    |    |    | -----        |
| 7/15/2005 | 1.37       |    |    |    |    | -----        |
| 7/19/2005 | 1.75       |    |    |    |    | -----        |
| 7/24/2005 | 2.78       |    |    |    |    | -----        |
| 7/27/2005 | 1.64       |    |    |    |    | -----        |
| 7/30/2005 | 2.76       |    |    |    |    | -----        |
| 8/2/2005  | 2.08       |    |    |    |    | -----        |
| 8/4/2005  | 3.65       |    |    |    |    | -----        |
| 8/8/2005  | 1.94       |    |    |    |    | -----        |
| 8/11/2005 | 1.57       |    |    |    |    | -----        |
| 8/14/2005 | 2.53       |    |    |    |    | -----        |
| 8/17/2005 | 4.71       |    |    |    |    | -----        |
| 8/20/2005 | 0.84       |    |    |    |    | -----        |

|                          |             |  |  |  |  |       |
|--------------------------|-------------|--|--|--|--|-------|
| <b>8/23/2005 (final)</b> | <b>1.35</b> |  |  |  |  | ----- |
|--------------------------|-------------|--|--|--|--|-------|

\* PM10 mass will be measured on the following sample dates: March 29, April 4, 10, 16, 22, 28, June 3, 9, 15, 21, 27, 2005

**Table 3A: Liberty and Clairton PM10 Sample Analysis**

| Date      | Liberty, SA High School |                   | Clairton (501 Waddel St.) |                   |
|-----------|-------------------------|-------------------|---------------------------|-------------------|
|           | As (ng/m3)              | PM10 Mass (ug/m3) | As (ng/m3)                | PM10 Mass (ug/m3) |
| 2/03/2005 | 2.82                    | 24.4              | 1.20                      | 16.3              |
| 2/09/2005 | 1.86                    | 15.5              | 0.94                      | 15.8              |
| 2/15/2005 | 12.91                   | 38.7              | <0.69                     | 9.8               |
| 2/21/2005 | 2.78                    | 18.3              | 0.87                      | 14.8              |
| 2/27/2005 | -----                   | -----             | 3.37                      | 13.5              |
| 4/19/2005 | 24.08                   | 90.0              | -----                     | -----             |
| 4/22/2005 | 5.53                    | 20.2              | 2.62                      | 17.7              |
| 4/28/2005 | 1.16                    | 12.4              | <0.69                     | 12.3              |
| 5/1/2005  | 3.37                    | 20.4              | -----                     | -----             |

**Table 3B: Former PM10 Monitoring Site, 5118 Dorris Drive, Elizabeth, PA**

| Date       | Forward, Dorris Drive |                   |
|------------|-----------------------|-------------------|
|            | As (ng/m3)            | PM10 Mass (ug/m3) |
| 11/23/2003 | 2.86                  | 17.0              |
| 12/5/2003  | 0.92                  | 6.7               |
| 12/11/2003 | 3.40                  | 8.5               |
| 12/17/2003 | 8.30                  | 12.9              |
| 12/23/2003 | 1.26                  | 10.4              |
| 12/29/2003 | 1.83                  | 12.1              |

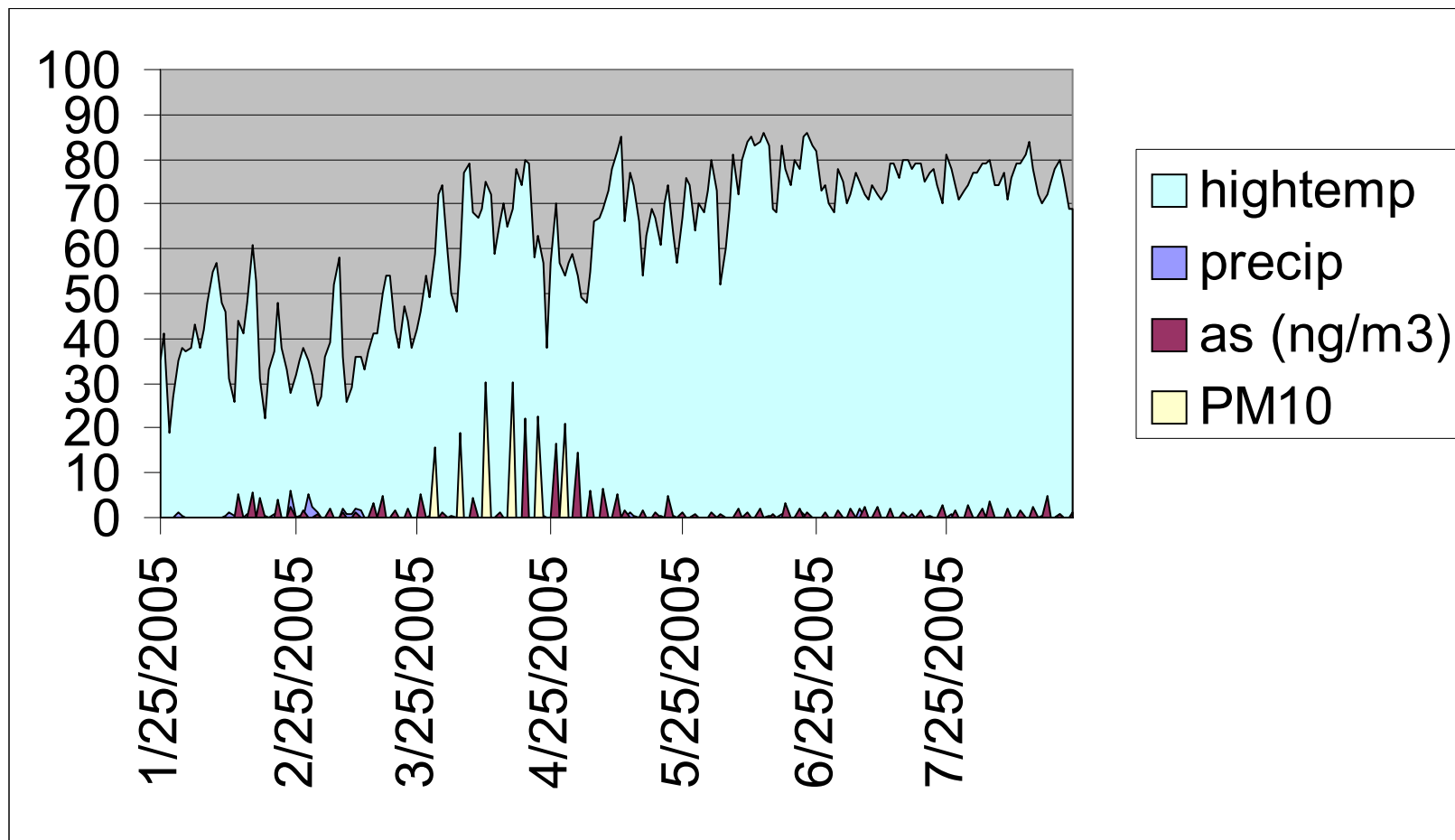


Figure 4: Arsenic, PM10, temperature, and precipitation in Monongahela, PA.

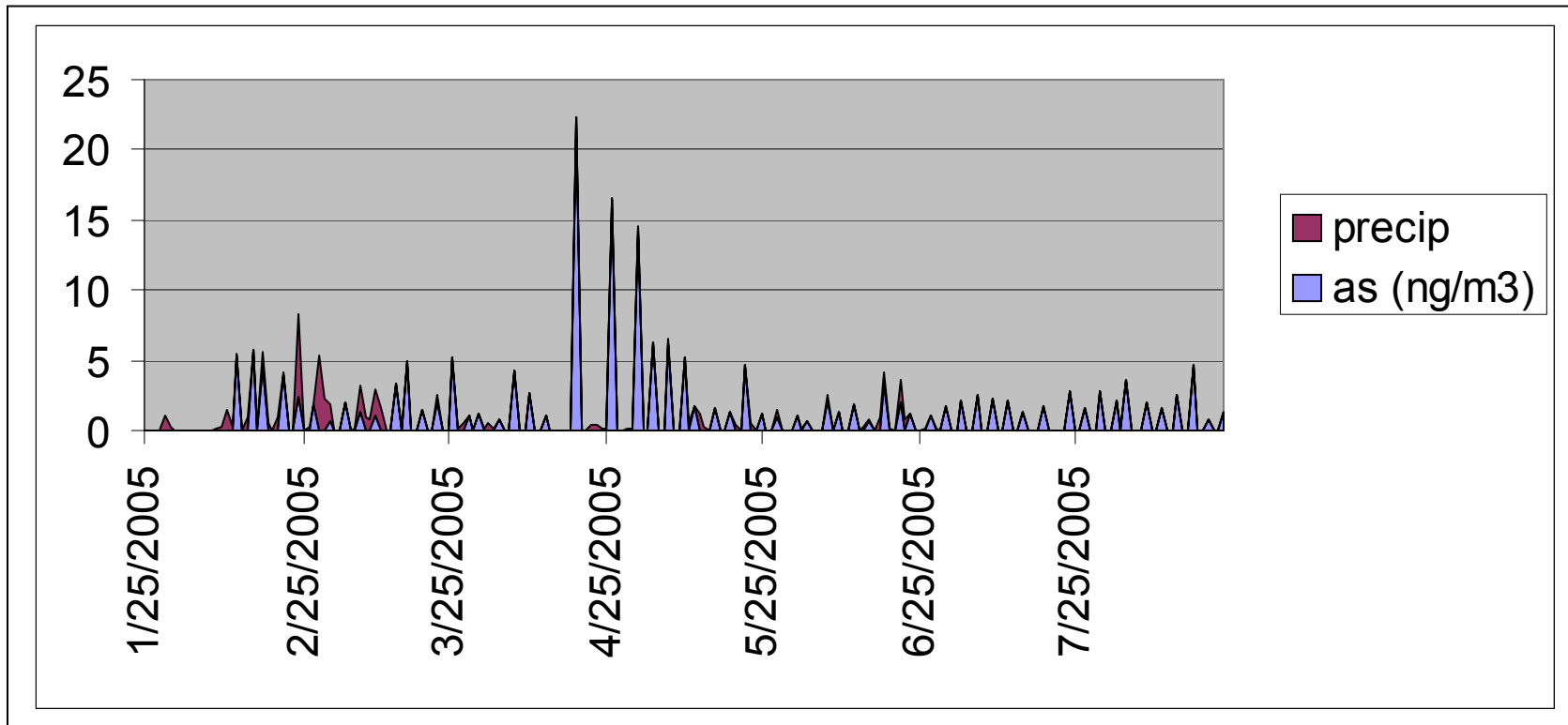


Figure 5: Arsenic in air and recent precipitation in Monongahela, PA.

## Human Health Analyses:

### *ATSDR Record of Activity*

On March 28, 2005, ATSDR published a report of estimated public exposures to the fly ash contaminating the neighborhood (see Appendix C). In addition to results made available to ATSDR by the ACHD and DEP, ATSDR had independently analyzed a citizen-collected ash sample at a U.S. Environmental Protection Agency (EPA)-certified laboratory. In this ash sample, 22% of the particles were smaller than 10 microns. The pH of this sample was noted to be 9.65 (alkaline). Based on available information, ATSDR classified the site as a potential public health hazard in its condition at that time. This classification was based upon the pH, chemical components, and particle size distribution of the ash. ATSDR's paper asserted that 1 -- these properties made the fly ash material a potential dermal and respiratory irritant and 2 -- the arsenic in the ash may have been associated with the reported gastrointestinal disturbances in residents.

ATSDR conducted a risk assessment of exposure to the fly ash with the following assumptions for adults in a "contact-intense worker scenario" for assessment of exposure for those who removed the fly ash from their properties. The following conditions were assumed:

- No respiratory, ocular, and/or dermal protection on the worker,
- Ingestion of 2 grams of material,
- The material contains 200 ppm arsenic,
- The estimated mechanism of removal, duration of exposure and respiratory rate were not published.

Given these conditions, a person would have an estimated exposure dose of 0.0057 mg/kg-day, which is above their provisional acute minimal risk level of 0.005 mg/kg-day by 7/10,000 of a mg/kg-day.

Additionally, ATSDR noted that the arsenic concentration in the fly ash was in excess of their limit (10 ppm) for children exhibiting pica behavior. In conversation and interview with the ACHD, no residents described that their children had persistent and compulsive cravings to eat nonfood items, such as dirt.

### *Biologicals collected by the ACHD*

The ACHD collected urine and fingernails from individuals residing on Rostosky Ridge and Rainbow Run Roads. Regional controls were recruited, but only one urine specimen was collected, so this person was removed from the results.

### *Urine:*

#### Round 1:

Of the 20 urine specimen containers distributed, all (100%) were returned and tested. Of the 20, 16 were collected over a 24-hour period. The remaining four were the first urine of the day, and were all from children under 12 years. Of the 24-hour urines, the youngest was 3 and oldest 82. Four people had detectable levels of total arsenic at or above 10 micrograms/L. They were all within normal limits: less than 50 micrograms/L. There was no inorganic arsenic detected in residents' urine. Inorganic arsenic in urine is that element which indicates exposure to environmental contamination – such as fly ash. Organic arsenic is indicative of ingesting organic material (food, tobacco) contaminated with arsenic. The remaining sixteen did not have detectable levels of arsenic in their urine.

#### Round 2:

Of the 20 urine containers distributed, only 12 (60%) were returned and tested. Of the 12, 9 were collected over a 24-hour period. The other three were the first morning void. Of the 24-hour urines, the youngest was 3 and oldest 82. The maximum amount of arsenic detected was 16 micrograms/L. When the results were provided to the individual with an arsenic level of 16, she reported that she had eaten fish two days before voiding the specimen. One other person (age 3) had organic arsenic (10 micrograms) in his 24-hour specimen. The remaining 10 people had no detectable arsenic in their urine.

### *Hair and Nails:*

Of the 8 exposed families who received specimen cups, only 3 provided nail samples. No hair samples were provided. Nail samples for the seven participants were all incomplete; the samples were either fingernails or toenails, not both as the instructions specified. Of the 7 residents who submitted nail samples, 3 had arsenic levels that could not be detected. The mean level was 0.06 microgram of As per gram of fingernail (mcg/g). Normal levels are 0.03-3.00 mcg/g. All were within normal limits, with the highest level being 0.15 mcg/g. The ages of those submitting ranged from 3 years to 51 years.

#### Questionnaire:

The questionnaire was administered to reveal three characteristics of the residents: 1 – the individual's potential for exposure to fly ash in the neighborhood; 2 – other potential exposures to arsenic through daily activities such as cigarette smoking, eating fish, or cleaning a coal-burning stove; 3 – symptoms experienced since the fly ash spill.

The average age in the neighborhood was 39.8 years (SD=25.0). Six children were known to be residing in the neighborhood at the time that the questionnaire was administered. Of all respondents, 82% responded that they had ash in their yard. Of these, only 26.3% had claimed to have had it removed at the time the questionnaire was administered, on March 1, 2005. Of all respondents, 25% heated their homes with coal stoves, and 75% heated with natural gas.

Rostosky Ridge neighborhood residents were asked -- via questionnaire on March 1, 2005 -- what symptoms they had been experiencing since the fly ash spill. Their responses are found in Table 4 below.

**Table 4: Symptoms experienced during the first month after the fly ash spill on Rostosky Ridge Road (n=21)**

| Symptom                | Total adults with symptom (n=15) | Percentage | Children with symptom (n=6) | Percentage |
|------------------------|----------------------------------|------------|-----------------------------|------------|
| Fever                  | 6                                | 40.0       | 4                           | 66.7       |
| Numbness               | 3                                | 20.0       | 1                           | 16.7       |
| Cramping               | 4                                | 26.7       | 1                           | 16.7       |
| Vomiting               | 5                                | 33.3       | 4                           | 66.7       |
| Difficulty breathing   | 6                                | 35.3       | 2                           | 33.3       |
| Chills                 | 6                                | 40.0       | 1                           | 16.7       |
| Tingling               | 3                                | 20.0       | 0                           | 0.0        |
| Joint pain             | 5                                | 33.3       | 0                           | 0.0        |
| Disoriented            | 0                                | 0.0        | 1                           | 16.7       |
| Heart palpitations     | 0                                | 0.0        | 0                           | 0.0        |
| Malaise                | 2                                | 13.3       | 3                           | 50.0       |
| Nausea                 | 6                                | 40.0       | 6                           | 100.0      |
| Weakness               | 7                                | 46.7       | 3                           | 50.0       |
| Discoloration of urine | 1                                | 6.7        | 0                           | 0.0        |
| Blurred vision         | 0                                | 0.0        | 0                           | 0.0        |
| Sore throat            | 10                               | 66.7       | 3                           | 50.0       |
| Diarrhea               | 4                                | 26.7       | 2                           | 33.3       |
| Headache               | 10                               | 66.7       | 4                           | 66.7       |
| Facial flushing        | 2                                | 13.3       | 3                           | 50.0       |
| Excessive thirst       | 6                                | 40.0       | 3                           | 50.0       |

Children were significantly more likely to have been nauseous than were adults. According to ATSDR, the following symptoms are associated with exposure to arsenic, the only contaminant noted in unacceptable levels on Rostosky Ridge.

Acute exposure:

- Gastrointestinal: severe abdominal pain, nausea and vomiting, and bloody or rice-water diarrhea
- Cardiovascular and respiratory: hypotension, shock; ventricular arrhythmia; congestive heart failure; and pulmonary edema
- Neurologic: light-headedness; headache; weakness, lethargy; delirium; encephalopathy; convulsions; coma; and sensorimotor peripheral neuropathy



- Hepatic and renal: elevated liver enzymes; hematuria, oliguria, proteinuria; and acute tubular necrosis, renal cortical necrosis
- Hematologic: anemia, leukopenia, thrombocytopenia, and disseminated intravascular coagulation
- Other: rhabdomyolysis, garlic odor on the breath, and delayed appearance of Mees lines.
- Chronic arsenic dust inhalation may be accompanied by upper respiratory symptoms, nasal perforation, and lung cancer; however, since permissible workplace arsenic levels have been lowered, these conditions are rarely encountered in workers.

### **Discussion:**

#### *Arsenic in the air*

It was originally hypothesized that small particulates of the dry fly ash would become bioavailable to the residents. In general, this seemed to have not happened. Airborne arsenic and PM10 levels on Rostosky Ridge have remained similar to other communities on Allegheny's border with Washington County. With the exception of April 19-May 1, 2005, arsenic levels in the Rostosky Ridge neighborhood have been within normal limits ( $<5 \text{ ng/m}^3$ ). Although they were unacceptable in this neighborhood on April 19-May 1, 2005, arsenic and PM10 levels in nearby boroughs' air were even higher. The fly ash remaining in the Rostosky Ridge neighborhood probably had little – if anything – to do with these unexpected air arsenic levels.

There are additional sources of air pollution in the Monongahela Valley. Particulate emissions are shown in relation to the fly ash landslide in Figure 6.

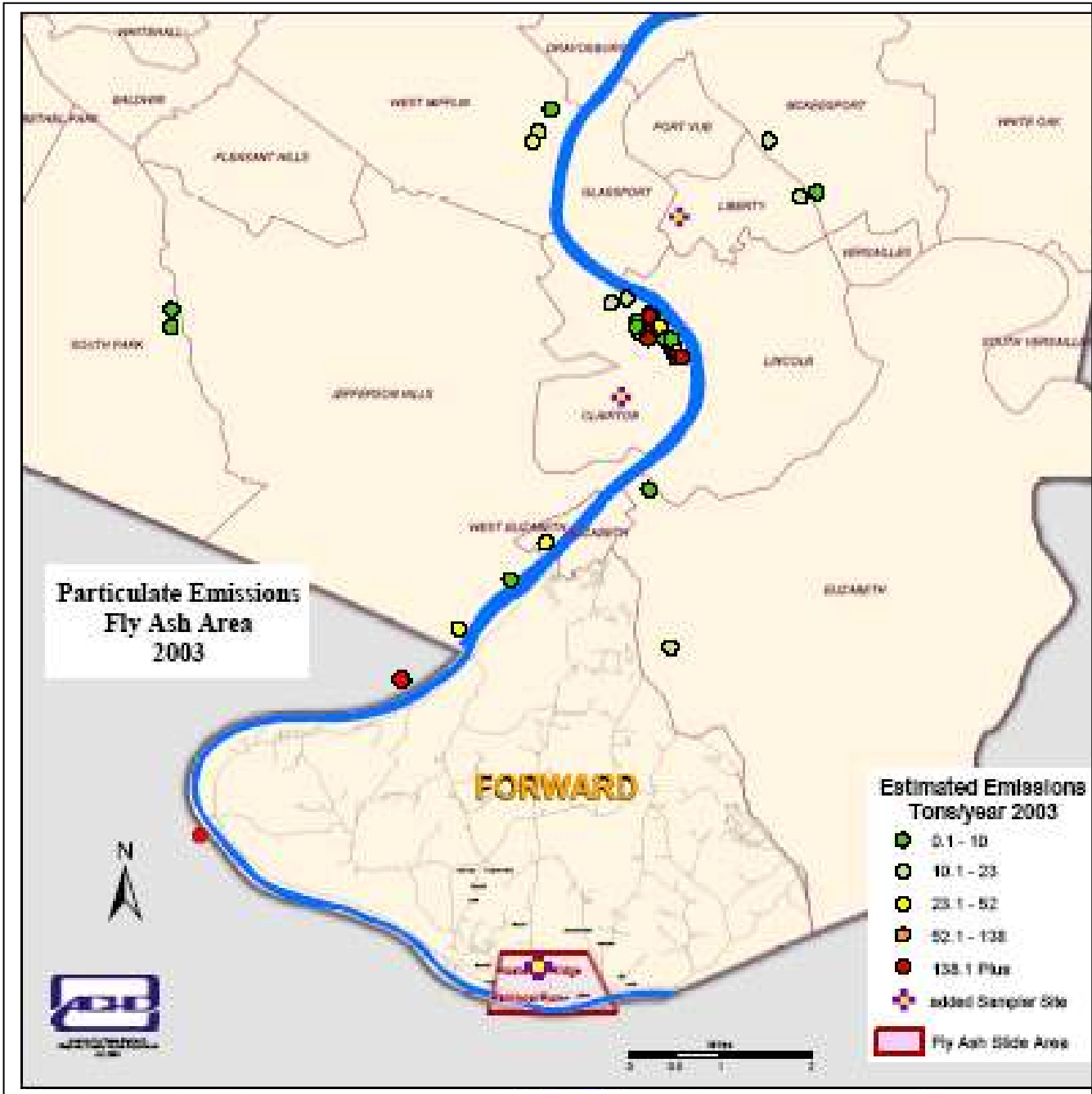


Figure 6: Particulate emissions near the Forward Twp. Fly ash spill.

### *Human Health Analyses:*

No inorganic arsenic exposures were identified through either urine or nail testing of potentially affected residents. It can be argued that the first round of urinary arsenic testing occurred long after the initial exposure. An independent physician performed the first human exposure estimate of a Rostosky Ridge resident on 2/4/05. The results were shared with the ACHD on 2/22/05. No blood arsenic was detected (detection limit: 3 micrograms/L). Blood arsenic -- however -- only depicts the arsenic that a person took in within the few hours prior to testing. According to the ATSDR ToxFAQ on arsenic, urine is the most reliable test for arsenic exposure within the last few days. Hair and nail sample tests for arsenic can measure exposure to high levels of arsenic over the long-term.

At the time of the landslide, the contaminant of concern had not yet been identified so that residents could participate in a specific test. The ACHD attempted to measure this past exposure through the nail testing for arsenic. Compliance was extremely low with nail testing, as no residents of Rostosky Ridge Road participated. The residents of Rainbow Run (see Figures 1, 2) were the only ones to participate. Again, no inorganic arsenic was found.

**Conclusions:**

Arsenic was the only component of the fly ash for which the ACHD was able to test for human exposure. There is little question that the fly ash that came into this neighborhood was of small particle size (potentially dusty), alkaline, and an unsightly nuisance. The small alkaline particles likely served as a respiratory irritant to the community. It is quite likely that this dust more adversely affected those with pre-existing respiratory issues. The unacceptably high levels of arsenic present in this ash did not become airborne to expose residents at detectable levels. There should be no long-term health affects associated with this fly ash slide. The consequences of this environmental accident should be short-term, given that the following actions are taken:

- The fly ash is removed from residential and commercial properties, and the stream,
- The fly ash pile near River Hill Road is stabilized or removed.

## APPENDIX A

Allegheny County Health Department Investigation  
Epidemiology Section  
Forward Township residents affected by fly ash  
3/1/05

Answers to the following questions are being requested to assist the Allegheny County Health Department (ACHD) in an investigation of a fly ash spill. Your participation in this investigation is voluntary, and you may choose not to answer any of the following questions. However, the more complete the information gathered from this investigation, the more likely that the results will yield useful information related to the reported cluster. All of the information you provide will be kept **confidential**, in compliance with ACHD Rules and Regulations, and state and federal statutes pertaining to the confidentiality of public health records. Only ACHD staff involved in this investigation will know the identity of those providing information, and any experts who participate in evaluating the data collected will receive de-identified data that cannot be traced to the individual providing it.

Name: \_\_\_\_\_  
DOB: \_\_\_\_\_  
Ethnicity: \_\_\_\_\_  
Marital Status: \_\_\_\_\_  
Address: \_\_\_\_\_  
\_\_\_\_\_

How many people in household >18? \_\_\_\_\_ <18 \_\_\_\_\_

|                                            |   |   |
|--------------------------------------------|---|---|
| Did you find fly ash in your yard?         | Y | N |
| Did DEP remove the fly ash from your yard? | Y | N |
| Did you remove the fly ash from your yard? | Y | N |

When did you move into your current address? \_\_\_\_\_ month \_\_\_\_\_ year

|                                           |       |   |
|-------------------------------------------|-------|---|
| Do you take any prescription medications? | Y     | N |
| If yes, what is name, dosage, frequency?  | _____ |   |

|                                               |       |   |
|-----------------------------------------------|-------|---|
| Do you take any non-prescription medications? | Y     | N |
| If yes, what is name, dosage, frequency?      | _____ |   |

|                                          |       |   |
|------------------------------------------|-------|---|
| Do you take vitamins?                    | Y     | N |
| If yes, what is name, dosage, frequency? | _____ |   |

|                                     |   |   |
|-------------------------------------|---|---|
| Do you take any herbal medications? | Y | N |
|-------------------------------------|---|---|

If yes, what is name, dosage, frequency? \_\_\_\_\_

Do you smoke? Y/N

If yes, number per day      0-5    6-15    16-25    26+

Do you eat fish or seafood?

If yes, number of servings per week    1-2    3-4    5+

What do you use to heat your home in the winter?

If you use a coal stove, who empties the ashes?    You    Spouse    Child    Parent

Do you exercise?    Y    N

Where do you exercise?    Home    Gym    Outside

Do you garden?    Y    N

Have you been ill (have a cold, flu...) in the past month?    Y    N

What were your symptoms (circle all that apply)?

|                      |                   |                  |                  |
|----------------------|-------------------|------------------|------------------|
| Fever                | Chills            | Malaise          | Sore throat      |
| Numbness             | Tingling          | Nausea           | Diarrhea         |
| Abdominal cramping   | Joint pain        | Weakness         | Headache         |
| Vomiting             | Disorientation    | Urine discolored | Face flushing    |
| Difficulty breathing | Heart palpitation | Blurred vision   | Excessive thirst |

Have you been ill (cold, flu) in the past year?    Y    N

What were your symptoms (circle all that apply)?

|                      |                   |                  |                  |
|----------------------|-------------------|------------------|------------------|
| Fever                | Chills            | Malaise          | Sore throat      |
| Numbness             | Tingling          | Nausea           | Diarrhea         |
| Abdominal cramping   | Joint pain        | Weakness         | Headache         |
| Vomiting             | Disorientation    | Urine discolored | Face flushing    |
| Difficulty breathing | Heart palpitation | Blurred vision   | Excessive thirst |

Do you have any pets?    Y    N

Percentage of time they spend outdoors? \_\_\_\_\_

Where do you work? \_\_\_\_\_

Where does your spouse work? \_\_\_\_\_

Where do other household members work? \_\_\_\_\_

\_\_\_\_\_

## APPENDIX B

April 25, 2005

«Title» «First\_Name» «Last\_name»  
«Address»  
«City» «State» «Zip\_code»

Dear «Title» «First\_Name» «Last\_name»:

To further assess the potential health affects of the recent fly ash spill into your neighborhood, the Allegheny County Health Department (ACHD) would like to test for the presence of arsenic in your nails or hair. This test will measure past arsenic exposure, and we are looking for exposure at the time of the slide (January 25, 2005). If you helped with cleanup, please consider submitting a specimen. Please consider submitting a specimen from a child in your home.

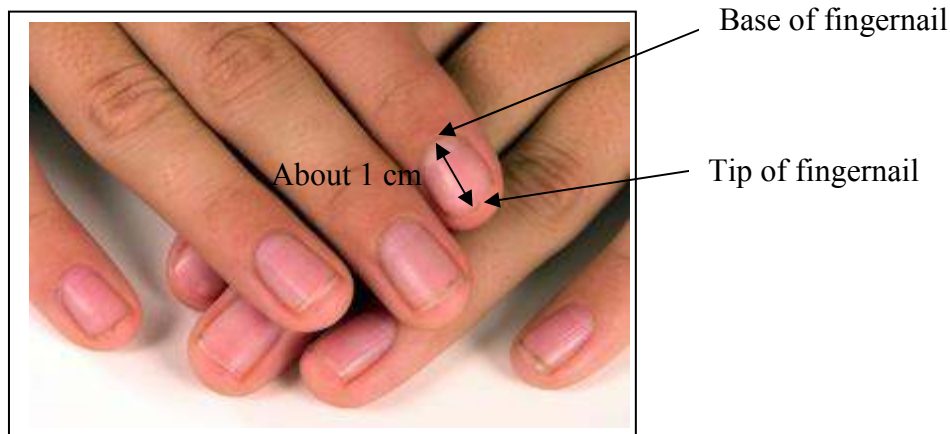
### *Fingernails:*

Thursday, May 5 will mark 100 days since the fly ash spill into your neighborhood. This is the same amount of time that it takes for the average fingernail to grow from the base to the tip.

Fingernails grow at about 1/10 (0.1) millimeter (mm) per day. Fingernails are about 1 centimeter – or 10 millimeters long. At the rate of 0.1 mm per day, it takes 10 days to grow 1 mm, and 10 times that -- 100 days -- to grow 10 millimeters (1 cm) from base to tip.

Fingernail growth depends on a number of factors, including the age and sex of the individual and the time of year. Fingernails generally grow faster in young people, in males, and in the summer. A good diet and increased activity can increase nail growth rate.

Dr. Brink will be coming to your community on April 28, 2005. At this time, she will bring sterile containers in which you can submit your nail samples to the ACHD.



To submit the sample, cut your nails as you usually would. Place all 10 fingernails into one container and all 10 toenails into the other. If you feel that your nails grow quickly, cut them soon after you receive the

container. If you feel that they grow slowly, wait a week or two. Specimens will be picked up on May 12, 2005.

*Hair:*

Hair to be submitted should be at least 4 inches long. Because hair grows at a rate of about one inch per month, if you keep your hair shorter than 4 inches, you have already cut that which was present on January 25, 2005. Do not submit hair less than 4 inches long. If you can submit your hair for arsenic testing, grab a thickness of hair from your head that is about as thick as a pencil. Cut it as close to your head (scalp) as possible. Put a rubber band at the end that was closest to your scalp. Place it in the sterile container provided so that it too can be picked up on May 12, 2005.

*We at the ACHD appreciate your cooperation with the investigation of your health consequences since you have been affected by the fly ash spill into your neighborhood. As always, you will be informed of the results of this health testing. We hope that the fly ash is or will be removed shortly so that your potential exposure to this material will be eliminated. We cannot measure your exposure to the alkaline dust that is part of this ash, but are measuring your exposure to the arsenic, which is the greater long-term health concern. As you know, we have not found any person – adult or child – in your community to have inorganic arsenic in their systems during urine testing.*

Sincerely,



Bruce W. Dixon, M.D.

LuAnn L. Brink, Ph.D.