Hydrogen Sulfide Exposure Summary for Overland Park, Kansas—September 3rd – November 2nd, 2005

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Background

Citizens of Overland Park have expressed concern regarding health effects associated with both short-term exposure as well as potential long-term health effects from hydrogen sulfide (H_2S) from the APAC-Reno Landfill prior to the installation of current controls. Although levels of hydrogen sulfide in the air around the perimeter of the landfill have been monitored for H_2S since August 2005, information on actual levels of H_2S is not available prior to this time.

The APAC-Reno Landfill is an active disposal site and asphalt plant located in Overland Park, Kansas. This landfill is approximately fifty acres and operates under permits issued by the Kansas Department of Health and Environment (KDHE). Both Johnson County and KDHE inspect the landfill for compliance with solid waste environmental requirements. The landfill is permitted to receive waste material produced during the construction, renovation, and demolition of structures. Examples of materials routinely disposed of include asphalt, concrete, wood, tiles, shingles, furniture, certain appliances, trees, and shrubs.

In the spring and summer of 2005, there was a significant increase in odors which were identified as hydrogen sulfide. During this time numerous odor complaints were filed with local and state authorities. In the fall of 2005 and the winter of 2006, KDHE required the landfill to implement a number of corrective actions[1].

The Agency for Toxic Substances and Disease Registry (ATSDR) conducted an exposure investigation during the summer of 2006. The purpose of the investigation was to directly measure the amount of hydrogen sulfide in the outdoor air in nearby residential areas and to determine if exposures to hydrogen sulfide presented a public health hazard[2]. ATSDR concluded that the measured airborne concentrations of H_2S during the exposure investigation were lower than levels shown to cause adverse health effects[2].

Hydrogen sulfide is a colorless gas with a rotten-egg odor. Some people can smell hydrogen sulfide at very low levels (0.0005 to 0.3 parts per million)[3]. Most hydrogen sulfide in the air comes from natural sources such as swamps and volcanoes. Certain industries also produce hydrogen sulfide and include pulp and paper manufacturing and waste disposal[3]. The complete toxicological profile for H_2S can be found at: http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=67

The health effects caused by H_2S depend upon the amount, duration and route of the exposure. Exposure to H_2S from a landfill would occur when someone inhales H_2S. Hydrogen sulfide is rapidly removed from the body and does not accumulate in the body[3]. Exposure to high levels ($\geq$500 ppm) are dangerous and can cause unconsciousness[3]. Exposure to lower concentrations (50-200 ppm) of H_2S can cause eye irritation, respiratory tract irritation, sore throat and cough, shortness of breath, accumulation of fluid in the lungs and memory changes[3]. Sensitive populations, such as persons with asthma, have shown changes in lung function at levels of H_2S as low as 2 ppm[4]. Unpleasant odor itself can cause headache, nausea, appetite loss, irritability and fatigue.

The purpose of this report is to provide the community with information regarding potential health effects from exposure to hydrogen sulfide that may have occurred prior to the installation of a landfill gas treatment and control system.

Methods

From September 3rd – November 2nd 2005, hydrogen sulfide levels were monitored along the north and east APAC property line. Readings of H_2S were collected every 15 minutes. The monitoring units used could detect levels of hydrogen sulfide as low as 0.1 ppm. The highest reading was used to evaluate potential health impacts by comparing that concentration to health based guidelines for H_2S exposures.

Results

From September 3rd – November 2nd, 2005 the levels of H_2S ranged from non-detectable to 0.6 ppm. The east property line had measurable H_2S concentrations daily from September 3rd – 15th with sporadic H_2S activity after; the highest reading was 0.4 ppm. The north property line had sporadic H_2S activity; the highest H_2S reading was 0.6 ppm taken on September 3rd. These results can be found in Appendix A.

Discussion

Fifteen-minute, thirty-minute or one-hour average concentrations of H_2S readings are typically used to determine the concentration of H_2S over the course of days or weeks. This information can be used to assess potential exposures and health effects. The data collected from September 3rd – November 2nd is insufficient to calculate an average concentration of H_2S. From September 3rd – November 2nd, 2005 the highest H_2S reading at the APAC-Reno Landfill property line was 0.6 ppm. We used this value as a reference to evaluate potential health impacts by comparing this level to health based guidelines values and observed health effect levels.

The Agency for Toxic Substances and Disease Registry (ATSDR) has established minimal risk levels (MRLs) for exposure to H_2S. A MRL represents an exposure level at which no adverse health effects are expected occur. The acute MRL value is for continuous exposure to H_2S up to 14 days. The acute MRL for inhalation of H_2S is 0.07 ppm[3]. An intermediate MRL value is for continuous exposure to H_2S from 15-364 days. The intermediate MRL is 0.03 ppm[3]. A lowest-observed-adverse-effect level (LOAEL) is the lowest dose of a substance that causes a harmful health effect. Hydrogen sulfide affects the respiratory tract at 2 ppm[3].

The highest concentration of H_2S from September 3rd – November 2nd was 0.6 ppm, which is three times below the LOAEL for H_2S, but exceeded the intermediate-duration inhalation MRL of 0.07 ppm recommended by ATSDR. Therefore it is possible that a few sensitive individuals with asthma may have experienced diminished lung function during this time. It is also possible that some individuals may have experienced headaches, eye irritation, and mood changes when levels of H_2S were elevated.

Limitations

The concentrations of H_2S referenced in this report were measured at the north and east property line of the landfill for an 8 week period during the fall of 2005. The highest concentration during this period was used to describe potential health effects those exposed may have experienced during this time. We were unable to calculate average concentrations of H_2S which would have been lower than 0.6ppm (Appendix A). Therefore these measurements may not be an accurate representation of what people were potentially exposed to.

Conclusions

The levels of hydrogen sulfide measured at the property line of the APAC-Reno Landfill from September 3rd – November 2nd, 2005 varied from non-detectable to 0.6ppm. The highest concentration of 0.6 ppm, recorded once at the north property line, was used to discuss potential adverse health effects. The actual level of H_2S people were exposed to was likely lower. Exposure to 0.6ppm of H_2S could have resulted in adverse health effects for sensitive individuals. Strong odors themselves can cause adverse health effects, such as headache, nausea, eye irritation and mood changes that people may have experienced during his time. These symptoms would have resolved following the reduction of hydrogen sulfide. Exposure to measured concentrations of H_2S during this time frame is not expected to cause long-term health effects.

References

1. Johnson County Environmental Department. 2007. *Landfill Fact Sheet for APAC-Reno Construction and Demolition Landfill*. Available at: http://jced.jocogov.org/solid_waste/reno/APACRenoFactSheet307.pdf
2. Agency for Toxic Substances and Disease Registry. 2008. *Health Consultation, Exposure Investigation Report for Airborne Exposures to Hydrogen Sulfide, APAC-Reno Landfill, City of Overland Park, Kansas.* Available at: http://www.atsdr.cdc.gov/hac/pha/Apac-RenoLandfilll/Apac-Reno%20Landfill%20EI%20093008.pdf
3. Agency for Toxic Substances and Disease Registry. 1999. *Toxicological Profile for Hydrogen Sulfide.* Public Health Service, US Department of Health and Human Services, Atlanta, Georgia.
4. Jappinen, P., Vikka V., Marttila, O. et al. 1990. *Exposure to hydrogen sulfide and respiratory function.* British Journal of Industrial Medicine. 47:824-828.

Attachments

Appendix A – Hydrogen Sulfide Concentrations, September 3rd – November 2nd, 2005.

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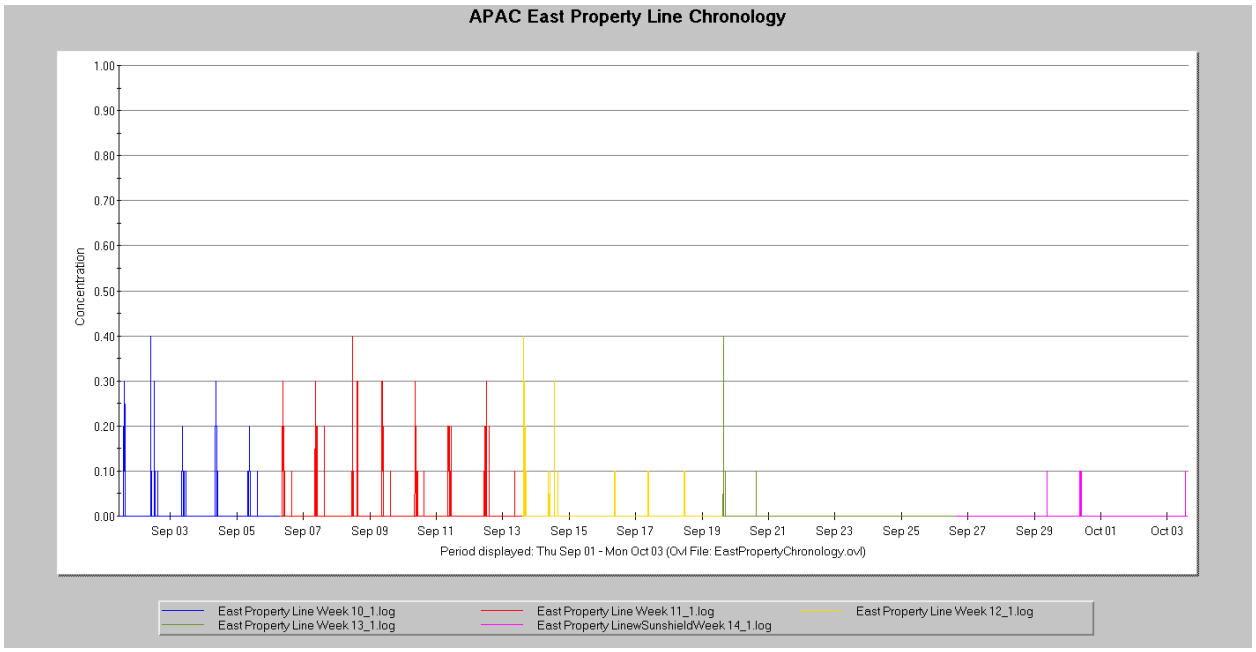
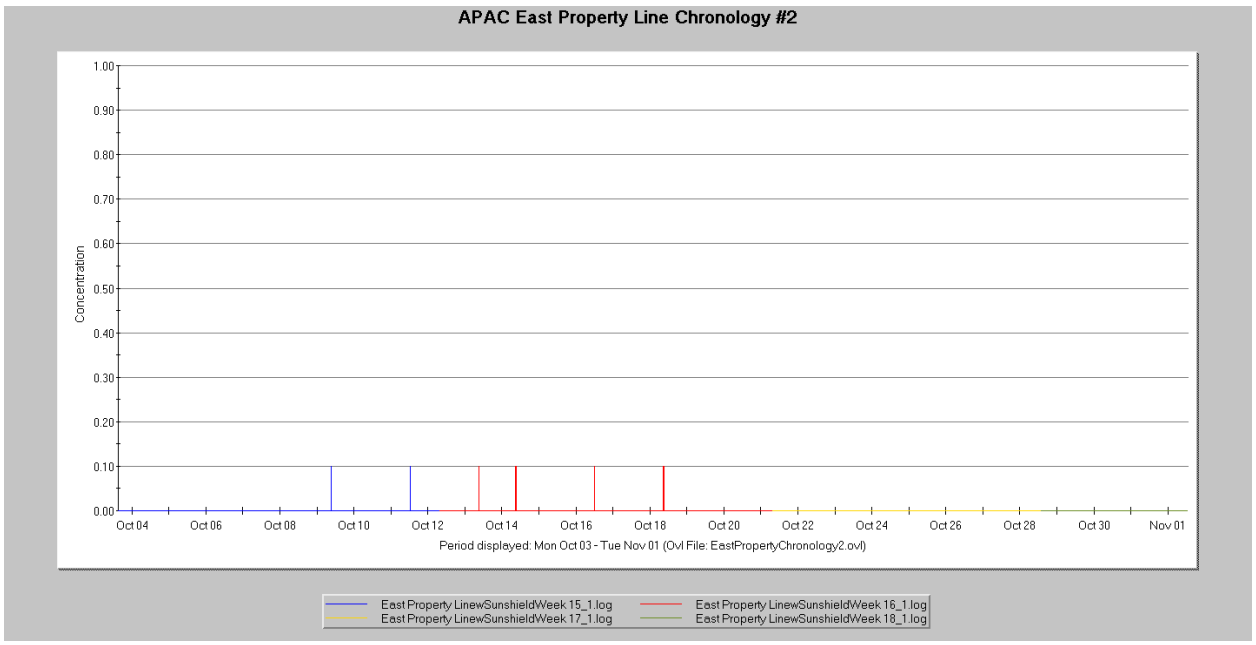
Appendix A.

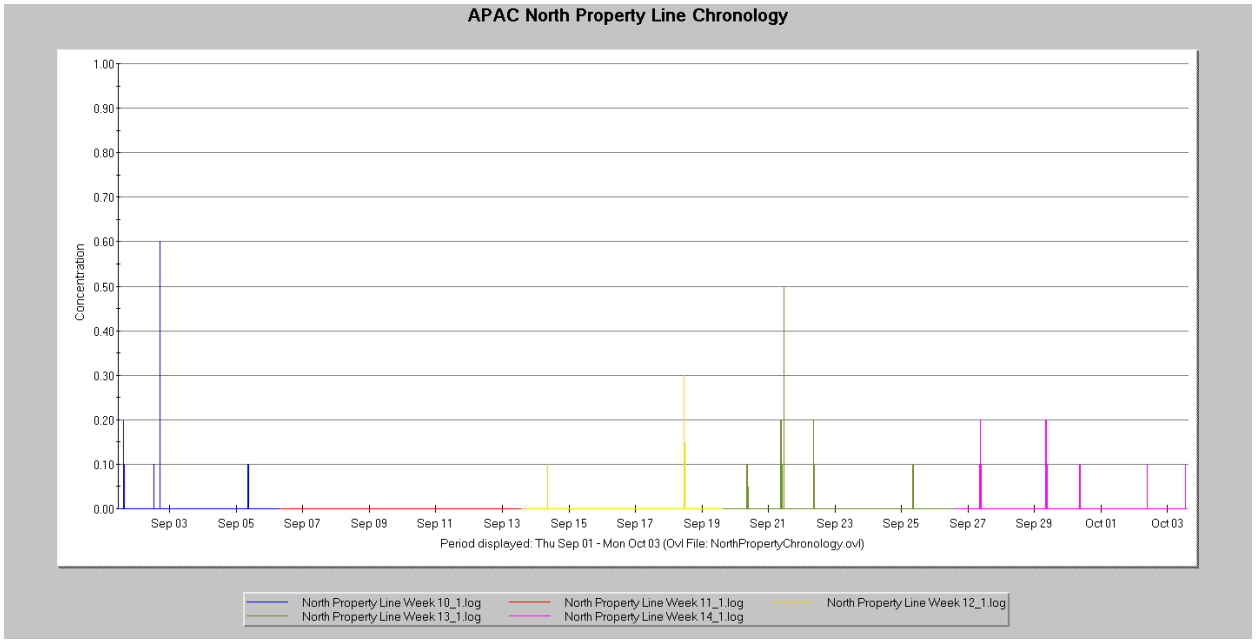
Hydrogen Sulfide Concentrations
September 3rd – November 2nd, 2005



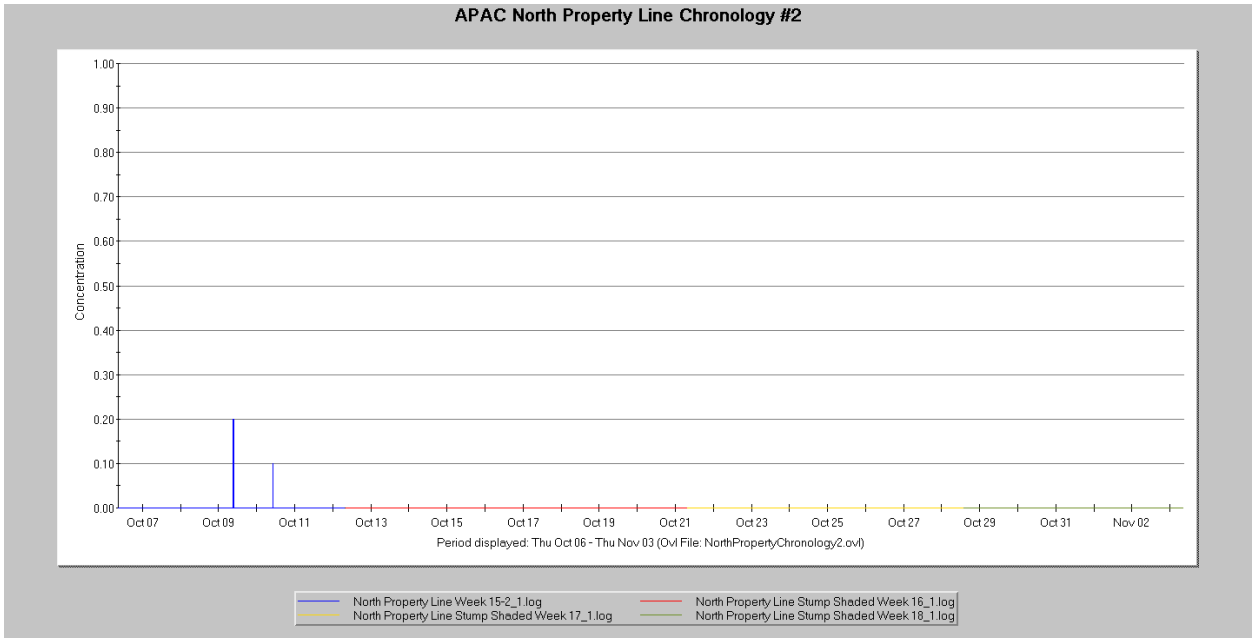
**Concentration of Hydrogen Sulfide is in parts per million (ppm)*



**Concentration of Hydrogen Sulfide is in parts per million (ppm)*



**Concentration of Hydrogen Sulfide is in parts per million (ppm)*



**Concentration of Hydrogen Sulfide is in parts per million (ppm)*