Division of Science, Research and Technology

Research Project Summary

*November, 2008*

# *Assessment of Exposure in the Community Surrounding the Martin Luther King/Jefferson School Construction Site in Trenton*

***Authors***

Clifford P. Weisel, Ph.D[1]., Michael Gochfeld, M.D., Ph.D.[1],Paul J. Lioy, Ph.D.[1]

Alan H. Stern, Dr.P.H.[2]

***Abstract***

In 2004-2005, the construction of a new school at the site of the Martin Luther King/Jefferson School in Trenton resulted in the release of dust from fill material that had been brought to the site. This fill material contained both soil material and concrete construction debris. In addition, the fill was found to have low-to-moderate levels of lead and polycyclic aromatic hydrocarbons (PAHs). During the period of construction, residents in the vicinity of the school reported experiencing acute respiratory symptoms. After the source of dust emissions had ceased due to the stoppage of the construction, the NJDEP Division of Science, Research and Technology (DSRT) was requested by the community to investigate the extent and spread of dust from the construction site. NJDEP/DSRT worked with the Environmental and Occupational Health Sciences Institute (EOHSI) of Rutgers/UMDNJ to carry out this investigation. To investigate this, elemental analysis was conducted on soil samples from the construction site, dust samples from the inside and outside of the houses in the surrounding area, and dust samples in the adjacent (unused) school building. Air samples were also collected during the demolition of the partially completed construction. These samples were compared based elemental analysis to determine whether a signal of the construction-site soil could be identified in the surrounding area. Samples were also analyzed for PAHs. Statistical analysis of the samples provided evidence for the spread of construction-site soil to the outside of homes in an area within one block of the site. However, dust inside the homes was not related to the construction-site soil. Lead levels outside the homes did not appear to be related to the construction-site soil. PAH levels were found to be below a level of health concern. Air samples showed that during demolition, dust control measures were sufficient to prevent further exposure.

## Introduction

As part of the construction of a new school at the existing Martin Luther King/Jefferson School site in Trenton, NJ in 2004-2005, exogenous fill material consisting of soil and concrete fragments was introduced to the site to stabilize the foundation. Subsequent construction in and around this material resulted in reports from the community of dust transport into residential areas. There were also anecdotal reports of respiratory symptoms in surrounding residents. Testing of the fill material revealed low to moderate levels of lead and polycyclic aromatic hydrocarbons (PAHs) in the fill material. The NJDEP Division of Science and Research was asked to investigate whether and to what extent the fill material was transported to and within homes in the surrounding community.

## Methods

Soil/fill samples on the construction site were taken at a depth of 7-8 inches where the soil changed appearance consistent with the presence of fill material. Dust samples were collected from exterior window sills or from interior surfaces where dust had accumulated.

Elemental analysis was conducted using inductively coupled plasma-mass spectrometry (ICP-MS) for most elements and inductively coupled plasma-optical emissions mass spectrometry (ICP-OES) for calcium and aluminum.

## Results

Most of the elements in the soil/fill material were found to have a normal distribution as would be expected from samples from a uniform mixture. However, calcium, strontium and possibly magnesium were found to be log-normally distributed suggesting a non-uniform mixture in the soil. These elements are consistent with concrete and the non-uniform distribution is consistent with the known nature of the fill material. These concrete associated elements correlated strongly with each other in the larger particle size range (75-500 μm) but not in the smaller particles (<75 μm). This suggests that the concrete particles were relatively large and would be

expected to deposit close to the site. PAH levels in two samples from the same area of the construction site (1.2 and 0.99 ppm) marginally exceeded the NJDEP residential soil cleanup level of 0.9 ppm, but were below the non-residential cleanup level of 4 ppm. All other samples from the site had PAH levels below the NJDEP cleanup standards. With the dispersion of particulate that would have occurred during off-site transport from the site, PAH levels in off-site dust would not have been significant. In the outdoor dust collected from exterior window wells, dust, lead levels were generally higher in the areas around the homes than in the soil/fill from the construction site and varied greatly from house to house. This is consistent with generalized urban lead contamination, and did not suggest that the site was a source of lead in residential areas. Based on statistical analysis (ANOVA) of the window well samples, investigating differences in concentration with differences from the site, several metals (elements) were found to be possible candidates for signals of off-site transport of site soil/fill. The relationship of these elements to distance from the site were further analyzed using hierarchical clustering. This is a statistical technique that groups samples based on their measured characteristics, in this case, the elements found to vary by distance from the site. Residential sites were identified by their proximity to the construction site and the clustering of these residential sites relative to the measured levels of the target elements was investigated. The hierarchical clustering analysis grouped 32 homes together as having significant similarities in the levels of the target elements. With the exception of 6 homes, all of homes in this grouping were within one block of the site. Homes that were more distant from the construction site were not closely grouped by the analysis, suggesting that these elements at those homes arose from diverse sources not connected to the school. In contrast, dust samples collected inside the homes did not show any consistent patterns relative to the construction site or to each other. This suggests that the interior of these houses was not significantly impacted by material transported off the construction site. Air samples collected during the demolition of the partially constructed school showed levels of particulates (i.e., nuisance dust) well below standards, and none of the metals analyzed in these samples exceeded 1 $\mu g/m^3$. This indicates that dust suppression measures mandated by the NJDEP were successful in preventing significant dust transport off-site.

## Conclusions

This study found evidence that material from the soil/fill brought to the Martin Luther King/Jefferson school construction site during the first construction effort was transported off-site and accumulated to a measurable extent outside houses within approximately one-block of the site. No evidence was found for transport or accumulation at greater distances from the site. Also, no evidence was found that measurable amounts of material from the soil/fill entered into houses. Although low-moderate levels of lead were detected in the soil/fill material, the lead found dust outside and inside houses did not appear to be related to the lead in the soil/fill, but rather, was consistent with the highly variable nature of background urban lead contamination. Background urban lead contamination arises from flaking of indoor and outdoor lead paint and from the historical use of leaded gasoline. Although PAH levels were marginally elevated in two closely located samples from the site these levels would not have resulted in significant levels off-site due to dispersion of airborne particulates. Air sampling indicated that dust control measures during subsequent demolition of the partial construction at the site were adequate to control further off-site transport of soil/fill material. This approach of sampling off-site dust and comparison, through statistical analysis, to an elemental “fingerprints” of the putative source material is a powerful approach to reconstruction of historical transport of exogenous material into the surrounding area.

**Prepared By**

[1]UMDNJ-Robert Wood Johnson Medical School and Environmental and Occupational Health Sciences Institute
[2] NJDEP, Division of Science, Research and Technology

**RESEARCH PROJECT SUMMARY**

Please send comments or requests to:
Division of Science, Research and Technology
P.O.Box 409, Trenton, NJ 08625
Phone: 609 984-6070
Visit the DSRT web site @ www.state.nj.us/dep/dsr

**Division of Science, Research & Technology**
*Dr. Eileen Murphy, Director*

**STATE OF NEW JERSEY**
*Jon S. Corzine, Governor*

**Department of Environmental Protection**
*Lisa P. Jackson, Commissioner*