## Division of Science, Research and Technology

# Research Project Summary

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# *Cultural Uses of Mercury in New Jersey – Year 2 Mercury Vapor in Residential Buildings – Comparison of Communities That Use Mercury for Cultural Purposes with a Reference Community*


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### *Abstract*

The first year of this study compared levels of mercury (Hg) vapor in hallways and common areas of apartment buildings in West New York, New Jersey and Union City, New Jersey to outdoor levels (Garetano et al. 2006). These two communities were chosen based on the prevalence of botanicas that sold Hg for cultural uses (e.g., Santeria and related practices). The results from the first year's study suggested that levels of mercury in apartment buildings in these areas were significantly elevated above outdoor levels. However, these results could not distinguish between intentional cultural use and unintentional spills from household mercury-containing devices such as thermometers. In the second year of this study, the researchers increased the number of buildings sampled in West New York and Union City (the study communities), and compared the Hg vapor levels in these buildings to levels in a reference community with comparable housing stock, but no evidence of cultural use of Hg. There was no difference between the outdoor Hg levels in the study communities versus the reference community (2.9 vs. 2.3 ng/m$^3$; p=0.20). However, compared with the reference community, public spaces in buildings in the study communities had significantly higher mean Hg levels (9.8 vs. 5.0 ng/m$^3$; p=0.03) and higher average maximum values (13.3 vs. 6.4 ng/m$^3$; p=0.01). Comparison of levels in the reference community to outdoor levels suggests an elevated background of indoor Hg vapor possibly from a history of unintentional Hg spills. However, the significantly increased levels above this background that were observed in the study communities strongly suggest (but do not prove) the prevalence of intentional cultural use of Hg. These findings call attention to the potential for significant exposure in areas with likely cultural use of Hg.


## Introduction

Based on the first year of this study it was clear that elemental mercury (Hg) was used in some portion of the Hispanic community of New Jersey in cultural practices such as Santeria, and perhaps to a greater extent, in less formal folk practices (Gochfeld et al. 2002). For the study communities of West New York and Union City, this was reflected in the number of botanicas selling mercury. Given suspicion of outsiders and cultural sensitivities in these communities, direct measurement of Hg vapor levels in residences was not considered feasible. As an alternative approach, Hg vapor was measured in common areas of apartment buildings (hallways, vestibules). Such measurements can provide a signal of residential Hg exposure in apartments, but do not provide direct information on levels of exposure. During the first year of this study, Hg vapor levels in common areas of apartment buildings were compared to building-specific outdoor levels (Garetano et al. 2006). Results from the first year were consistent with cultural use of Hg in a significant proportion of buildings in the study area, but were also consistent with unintentional spills of Hg (Carpi and Chen 2001). Therefore, the second year of this study was designed to compare the levels of Hg vapor in comparable buildings in the study communities and a reference community that does not have an ethnic profile likely to be associated with cultural use of Hg, and consistent with this, does not have botanicas.

## Methods

As in the first year of this study, because of suspicion of outsiders and cultural sensitivities, it was not feasible to sample Hg levels in air inside residences. Therefore, the same approach of measuring Hg vapor levels in building hallways was used in the second year. This approach is not intended to measure exposure, but instead, is intended to identify a signal of elevated Hg levels in residences by the appearance of Hg vapor in the hallways outside the residences. Hg vapor was measured using a highly sensitive and portable direct-reading instrument with a detection limit of 2 ng/m$^3$. As in the first year study, the study communities were West New York and Union City, New Jersey. The reference community, Montclair, is located 16 km from the study communities, and was determined to have apartment buildings of similar age and construction. Based on the absence of botanicas and the low Hispanic population, cultural use of mercury was considered unlikely in this area. Buildings in each area were selected at random. In the study area, 62 buildings were monitored, and in the reference area, 38 buildings were monitored. Buildings selected for monitoring had at least three floors. Hg vapor levels were surveyed in multiple locations on each floor, and at least one location on each floor and each wing of a floor was chosen as representative of that area. In addition, areas with notably elevated Hg levels were also selected for monitoring. Results from each sampling location were reported as the mean of three, ten-second real-time measurements. Results were reported as building-wide mean levels and building maximum levels. Relative ventilation rates were estimated based on $CO_2$ air concentrations.

## Results

Ventilation rates were similar in buildings in the study and reference areas, and did not account for differences in Hg vapor concentrations. Likewise, temperature did not differ significantly between the two areas. Outdoor Hg vapor levels (< 3.0 ng/$m^3$) did not differ significantly between the study and reference areas. In both areas, indoor levels were significantly greater than outdoor levels. Mean building levels were significantly greater in the study area (9.8 ng/$m^3$ +/- 11.3) compared to the reference area (5.0 ng/$m^3$ +/- 3.0). Likewise, the mean of building maximum levels in the study area (13.3 ng/$m^3$ +/- 14.9) were greater than the mean building maximum level in the reference area (6.4 ng/$m^3$ +/- 4.1). In the study area, 19 of the 62 monitored buildings (31%) had maximum Hg levels that exceeded the top fifth of all maximum building results. In contrast, only 1 of the 38 monitored buildings in the reference area (3%) had a maximum Hg level in the top fifth of overall maximum levels. A similar contrast between the maximum levels in the study and reference areas was observed when the 90$^{th}$ percentile of all maximum levels was used as the basis of comparison. However, in comparing Hg vapor levels in the study and reference areas to outdoor levels, it was found that there was no significant difference in the proportion of buildings in the study area (37%) and reference area (47%) that exceeded the 95$^{th}$ percentile of outdoor Hg vapor concentrations. This indicates that compared to outdoor levels, there is a significant background level of indoor Hg vapor that appears to be independent of cultural use. Neither the presence of fluorescent bulbs in common areas, nor spills from basement gas meters appeared to explain these observations.

## Discussions and Conclusions

Although none of the buildings monitored in the study location in the second year of the study were the same as the buildings monitored in the first year of the study, the results of the second year study are highly comparable to those from the first year, with 35% and 37% of the buildings in the first and second year, respectively, exceeding the 95$^{th}$ percentile of outdoor levels of Hg vapor. This provides confidence that the results from both years are representative of the study area. The observation that 47% of the buildings in the reference area, where cultural use of Hg is considered unlikely, also exceeded the 95$^{th}$ percentile of outdoor levels indicates that, independent of cultural use, there are significant background sources of indoor Hg. While we have no direct information on the nature of such sources, they seem to be consistent with unintentional spills of mercury from household appliances including thermometers (Carpi and Chen, 2001). However, taking this background level of Hg vapor into account, it is still clear that the study area differs from the reference area with respect to the maximum building levels of Hg that were measured. Buildings in the study area were highly disproportionately represented among the highest of the measured maximum levels. In fact, the only building in the reference area that occurred among those in the top 20% of maximum building levels was a building in which a specific Hg spill was discovered in a common area. While these observations cannot prove that this difference between the study and reference areas results from cultural uses of Hg in the study area, they are highly suggestive of such uses. Furthermore, having eliminated other obvious possible sources of Hg vapor as explanations, there do not appear to be other likely explanations for these results. Although none of the measured levels in common areas exceeded standards or guidelines for environmental exposure, these common areas are not representative of the residential areas in which exposure is likely. These measurements represent only a signal of exposure and exposure cannot be estimated from these data. Nonetheless, it is reasonable to assume that exposure levels in the actual residential spaces (i.e., apartments) exceed those measured in the common areas. These results point to the need for the development of a public health policy to reduce exposures resulting from cultural use of Hg.

## References

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