Multiple Metal Contamination from House Paints: Consequences of Power Sanding and Paint Scraping in New Orleans

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Power sanding exterior paint is a common practice during repainting of old houses in New Orleans, Louisiana, that triggers lead poisoning and releases more than Pb. In this study we quantified the Pb, zinc, cadmium, manganese, nickel, copper, cobalt, chromium, and vanadium in exterior paint samples collected from New Orleans homes (n = 31). We used interior dust wipes to compare two exterior house-painting projects. House 1 was measured in response to the plight of a family after a paint contractor power sanded all exterior paint from the weatherboards. The Pb content (~130,000 µg Pb/g) was first realized when the family pet died; the children were hospitalized, the family was displaced, and cleanup costs were high. To determine the quantity of dust generated by power sanding and the benefits of reducing Pb-contaminated dust, we tested a case study house (house 2) for Pb (~90,000 µg/g) before the project was started; the house was then dry scraped and the paint chips were collected. Although the hazards of Pb-based paints are well known, there are other problems as well, because other toxic metals exist in old paints. If house 2 had been power sanded to bare wood like house 1, the repainting project would have released as dust about 7.4 kg Pb, 3.5 kg Zn, 9.7 g Cd, 14.8 g Cu, 8.8 g Mn, 1.5 g Ni, 5.4 g Co, 2.4 g Cr, and 0.3 g V. The total tolerable daily intake (TTDI) for a child under 6 years of age is 6 µg Pb from all sources. Converting 7.4 kg Pb to this scale is vexing—more than 1 billion (109) times the TTDI. Also for perspective, the one-time release of 7.4 × 109 µg of Pb dust from sanding compares to 50 × 109 µg of Pb dust emitted annually per 0.1 mile (0.16 km) from street traffic during the peak use of leaded gasoline. In this paper, we broaden the discussion to include an array of metals in paint and underscore the need and possibilities for curtailing the release of metal dust. Key words Cd, Co, comparison of paint and gasoline as Pb sources, Cr, Cu, dust control, dust wipe, metal contents of old paint, Mn, Ni, Pb, sanding old paint, scraping paint, Zn, V.

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New Orleans, Louisiana, is an old city with architecturally distinguished wood houses that were mostly constructed pre-1950 when lead-based paints were in common use (1). In the United States, about 10 million metric tons of Pb went into paint products and anti-knock additives for gasoline (2). The removal of Pb from gasoline resulted in a phenomenal reduction of childhood Pb exposure (3). Now, policy emphasis is on the residential reservoir of deteriorated Pb-based paint, Pb-contaminated dust, and Pb-contaminated residential soil (4).

Many homeowners understand the importance of maintenance but remain ignorant or confused about Pb hazards. They rely upon professional painters, salespersons, or contractors, who often do not have the knowledge, expertise, or willingness to clearly communicate the consequences of improper removal of old Pb-based paints (5). The basic question is whether families with young children can safely inhabit and maintain old homes coated with Pb-based paint.

A New Orleans couple with three healthy children (ages 4 years, 2 years, and 1 year) and a family pet hired a professional painting company to repaint the exterior surface of their two-story, wood frame house built in 1925 (house 1): the painter’s contract specified pressure washing and machine sanding. Pb was never discussed. After 6 weeks of unconfined powered sanding of several thousand square feet of cypress weatherboards, the family pet died. The veterinarian, familiar with house renovation hazards to pets, was the first to discuss Pb. Shortly thereafter, the three children were hospitalized for 4 days at a cost of $10,000, the family was displaced from the home, and a $70,000 cleanup effort began (6).

Table 1 and Table 2 illustrate the condition of the house immediately after sanding exterior paint containing ~130,000 µg Pb/g to bare wood and the gradual improvement of interior conditions during the cleanup. The current U.S. EPA Pb standards for soil are 400 µg/g for bare soils of play areas and 1,200 µg/g average for all other bare areas of the residential environment (4). [Our empirical research of the association between soil Pb and children in New Orleans suggests that 80 µg Pb/g soil provides a more appropriate margin of safety for children (8).] The parents encouraged the children to play on grassy areas and plan to replace or cover bare soil with clean soil in the near future. The interior Pb-dust loading of the family home (Table 1, Table 2) illustrates the hazard of sanding old Pb-based paint. The amount and severity of contamination raises questions about how to manage and improve the residential environment (5).
safety of exterior paint renovation on old houses. To develop understanding of the issue, we set out to evaluate the Pb as well as the zinc, cadmium, manganese, nickel, copper, cobalt, chromium, and vanadium content of paint samples from 31 houses in New Orleans. We then conducted a case study on a house (house 2) to test whether scraping is a safer method for removing Pb-based paint than power sanding because it reduces the amount of dust released.

A family of two adults and two children (ages 33 months and 12 months), who lived near the paint-sanding project, was preparing to hire a painter to sand their house (house 2). They were acquainted with the family who lived in house 1, which was power sanded. After learning that they too had Pb-paint, the family who lived in house 2 decided to seek another method of exterior house renovation. With the full cooperation of the family, we used the house as a case study site to evaluate scraping as a method for paint renovation. The Pb content of the paint measured >90,000 µg Pb/g. According to the Louisiana Department of Environmental Quality (Baton Rouge, LA), interim control of Pb-based paint is a system of management that minimizes the release of Pb dust and does not involve the total removal of Pb-based paint. The exterior siding of the two-story, wood frame house built in the 1920s was coated with deteriorating paint with chips that were falling to the ground. The family agreed to hire a painter who would not power sand, but instead would hand scrape the deteriorated paint to prepare the exterior siding for painting. The family was given a copy of Lead Paint Safety: A Field Guide for Painting, Home Maintenance, and Renovation Work (9) and encouraged to vacuum and wet-mop frequently. The family owned a good household vacuum cleaner that was efficient but not HEPA rated. We selected key health and environmental measures to evaluate the effectiveness of the interim controls before, during, and after renovating the exterior Pb-based paint on the house. These measures included determination of blood Pb (B-Pb), paint analysis, renovation preparation, dust and soil sample collection, and analysis methods.

Materials and Methods

Blood Pb. Blood was drawn from the two case study children by the children’s pediatrician during a regular medical appointment in May before the work was started; a second test was performed in October after the project was completed. Venipuncture, the preferred method for measuring Pb, could only be used to test the older child (33 months of age). Because of difficulty in locating a suitable vein for venipuncture, the finger-stick method was used with the 12-month-old child. The pediatrician’s contract laboratory analyzed the blood samples for Pb.

Paint extraction and analysis. We collected paint samples from the case study house (house 2) and 30 other houses throughout the city (n = 31). The paint chips were ground into a fine powder using a porcelain pestle and mortar. Then, 0.250 g sample duplicates were weighed into a 50-mL polypropylene centrifuge tube. Concentrated trace-metal-grade nitric acid (5 mL) was added to each sample. The paint and acid were mixed and allowed to react for 20 hr. Then, 18 MΩ cm–1 deionized water (Fisher Scientific, Pittsburgh, PA) was added to fill the tubes to 25 mL. Samples were placed in a reciprocating shaker for 1 hr at room temperature. After shaking, 18 MΩ cm–1 deionized water was added to fill the tubes to 50 mL. The tubes were then centrifuged for 5 min at 1,000 × g. Finally, the samples were filtered and measured with an inductively coupled plasma atomic emission spectrometer (ICP-AES) calibrated with National Institute of Standards and Technology (NIST; Gaithersburg, Md) certified standards. The samples were measured for Pb, Zn, Cd, Mn, Ni, Cu, Cr, Co, and V.

Scraping paint from the house. We informed the painting contractor about the quantity of Pb in the paint and provided a copy of Lead Paint Safety: A Field Guide for Painting, Home Maintenance, and Renovation Work (9). He agreed not to use a power sander, but to perform scraping by hand to remove the loose and deteriorated paint chips; paint chips were to be collected on plastic sheeting placed along the foundation. The painter tried wet scraping, but the paint became an unmanageable mess of wet paint chips that stuck to the plastic sheeting, which was difficult to gather into a single container. Dry scraping was easier, and the paint chip residues from the project were readily collected and managed. Photographs were taken, and we and the painter estimated that about one-half of the paint remained intact on the house. The dry paint chips were collected and weighed, and the total metal quantities were estimated for the house.

Surface wipes. We measured the amount of metals in the interior surface dust of house 2 before, during, and after the project was completed. Using the U.S. EPA protocol (10), we collected wipe samples on interior floors and exterior hard surfaces, either on a measured 1 ft2 area, or if irregular, the measured area. Wipe samples were collected and stored in the labeled sample cups that are used for extraction. Extraction was performed by adding 40 mL of 1N trace-metal-grade nitric acid to containers and soaking overnight. The wipes were then shaken for 2 hr at low speed on an Eberbach reciprocal shaker (Eberbach Corporation, Ann Arbor, MI). The samples were filtered with Fisher P4 filter paper (Fisher Scientific) and the extractant was placed into vials. We analyzed the extractant using an ICP-AES (Spectro CIROS; Spectro Analytical Instruments, Fitchburg, MA) that was calibrated with NIST-certified standards. The final dilution for a 1 ft2 wipe sample was 0.125 mL.

Table 1. Pb (µg/ft2) after power sanding house 1, which was covered with old exterior paint containing >130,000 µg Pb/g.

| Location | 17 June 1999 | 23 June 1999 | 8 July 1999 | 10 February 2000 |
|----------|--------------|--------------|-------------|-----------------|
| Side entrance, walk outside basement | 5.270 | 1.370 | 900 | 1,340 |
| Front entrance porch, brick | 27.600 | 2,790 | 970 | 79 |
| Back, brick patio | 7.360 | 2,440 | 3,280 | 730 |
| Back, upper porch, plastic | 127 |
| Interior window sill, child’s BR first floor | 390 | 84 | NA | <3 |
| Wood floor at child’s BR door, first floor | 200 | 100 | 130 | <3 |
| Living room, first floor behind stereo | 23,300 | 44 | 94 | <3 |
| Bathroom floor by sink, first floor | 320 | 190 | <3 |
| Kitchen floor (middle), first floor | 580 | 230 | <3 |
| Brown shelving with toys, basement | 1,770 | 230 | 550 | <3 |
| Ping-pong table, top surface, basement | 390 | 120 | 17 |

Abbreviations: BR, bedroom; NA, not available.

Table 2. Pb (µg/ft2) in multiple consecutive samples collected 28 July 2000 after power sanding house 1 (which was covered with old exterior paint containing >130,000 µg Pb/g) and in soil samples.

| Location | Wipe 1 | Wipe 2 | Wipe 3 | 10 February 2000 |
|----------|--------|--------|--------|-----------------|
| Wipe samples | | | | |
| Floor outside children’s BR (HEPA vacuumin) | 24 | 50 | 40 | <3 |
| Varnished door frame of children’s BR | 190 | 270 | 130 | <3 |
| Soil samples (mg/kg) | | | | |
| Yard sample | 360 |
| House side, drip line sample | 3,900 |
| Near parking pad | 3,000 |
| Street-side sample | 1,200 |
The case study house is shown for comparison with paint samples from other houses.

Table 3. Metals (µg/g) present in paint samples from New Orleans houses (n = 31).

| Metal | Pb | Zn | Cd | Cu | Mn | Ni | Co | Cr | V |
|-------|----|----|----|----|----|----|----|----|---|
| Minimum | 112 | 52 | 7 | 5 | 24 | 4 | 13 | 2 | 2 |
| 10th percentile | 416 | 1,343 | 9 | 8 | 31 | 8 | 22 | 3 | 3 |
| 25th percentile | 5,045 | 15,365 | 14 | 11 | 44 | 11 | 39 | 5 | 3 |
| Median | 35,248 | 31,101 | 27 | 21 | 70 | 19 | 70 | 16 | 4 |
| 75th percentile | 91,804 | 55,305 | 83 | 59 | 99 | 25 | 108 | 52 | 6 |
| 90th percentile | 126,022 | 72,707 | 131 | 178 | 135 | 34 | 158 | 186 | 9 |
| Maximum | 256,797 | 98,056 | 439 | 667 | 309 | 114 | 214 | 417 | 15 |
| Case study | 90,547 | 43,145 | 118 | 180 | 107 | 18 | 66 | 29 | 4 |

The case study house is shown for comparison with paint samples from other houses.

Results

Weight of paint on the house. We weighed 41 kg paint that was scraped from house 2.

Quantity of metals in paint. Quantities of metals from paint samples collected from houses throughout New Orleans (Pb, Zn, Cd, Mn, Ni, Cu, Cr, Co, and V) are shown in Table 3.

Soil samples. We collected soil samples outside house 2 before, during, and after the project. Soils were collected in several locations on the property, with emphasis on locations near the sides of the house and areas where the children played. All samples were placed in labeled plastic bags and taken to the laboratory. For initial preparation, we laid the samples out on paper towels to air dry for 24 hr (12,13). The air-dried soils were sieved with a 2-mm U.S. Geological Survey #10 stainless steel sieve (Fisher Scientific). The sieved samples were placed into labeled bags for storage. Extraction was carried out by weighing 4 g soil into labeled 50-ml centrifuge tubes. Ten percent of the samples were prepared as duplicates. Sample blanks (~5% of the samples) and in-house reference samples were included in the analytical runs. We added 20 mL 1M trace-metal-grade nitric acid to the centrifuge tubes; the samples were then shaken for 2 hr at room temperature on the low speed setting of the Eberbach reciprocal shaker. After shaking, the samples were centrifuged at 1,000 × g for 10 min. The supernatant was transferred (Fisher M filter paper) into labeled 20 mL scintillation vials. Finally, samples were diluted 1:10 for a dilution factor of 50. Samples were analyzed by ICP-AES.

From the data collected, we estimated the potential amount of Pb (and other metals) released into the local environment if the paint had been sanded to bare wood. We also appraised dust conditions from 14 sites in the house before, during, and after work phases to evaluate the effectiveness of the interim controls for managing the dust from the Pb-based paint renovation project.

Discussion

Pb poisoning in New Orleans is common, with about 25-30% of children < 6 years of age exhibiting blood lead levels of ≥ 10 µg/dL. Pb poisoning is directly linked to learning disabilities and behavioral and other health problems that begin during prenatal life and persist throughout life (14,15). Pb-based paint was marketed for house use from the late nineteenth century to its ban in 1978. The highest quantity of Pb in paint occurred before 1950, with peak use during the 1920s (2,9). Both the power-sanded house and the case study house were built during the peak use of Pb-based paint. Deteriorated paint and loose chips, although not desirable, existed on both houses (~5-10% on house 1 and ~50% on house 2) for 14 interior sites of the house are shown in Table 5. The Friedman two-way layout test showed that there was a statistically significant difference (p = 0.000036) in the quantity of Pb in dust wipes before, during, and after the work phases of the project (11).
before renovation and did not seem to be the condition that triggered Pb poisoning. The poisoning episode was triggered by the enormous amount of Pb dust that resulted from power sanding. The idea that dust is a major contributor to medically significant Pb exposure has been ascribed to inappropriate interruption of Pb-based paints as, indicated by the literature and applied experience (2,9).

Environmental changes during the case study project. The case study demonstrates that scraping and collecting deteriorated paint from a house is relatively safe and does not significantly contribute Pb dust to either the interior or exterior of the house. Before, during, and after the project, there were significant changes in the overall Pb dust in the house, and there were some specific areas where Pb dust increased. Pb dust increases were detected on the front porch and in the entry area. However, once the areas were identified as a problem, the painter and the family took immediate measures to manage those areas. Clean cardboard was placed on the porch floor, and the family increased the frequency of wet mopping the entry area near the front door. Compared with the power sanding experience described for the background family, scraping as a means of painting preparation introduced relatively small amounts of Pb dust, and the dust that was formed was easily cleaned up. Levels of Pb on the basement floor and stairs remained consistently high and not in cleanable condition until these areas were sealed with floor paint. This experience was also noted for house 1 (Table 1, Table 2).

The case study family took a 2-week vacation, so they did not inhabit the house during the most intensive period of paint scraping. In addition, the family was conscientious about child care and in keeping their home clean. They paid careful attention to the details of the dust wipe results and worked out measures, such as removing shoes at the entrances, to prevent accidental tracking of paint chips and dust into the house. Other informed families, working closely with knowledgeable painting contractors should be able to duplicate the safer work and cleanup practices used in this project.

There are some potential problems with the method of disposal of the paint chips, although the paint contractor followed the standard procedure for household waste as provided by an official of the Louisiana Department of Environmental Quality. The paint chips (41 kg) were bagged and placed into the waste container and removed from the property as part of routine garbage pickup by City of New Orleans; they were presumably deposited into a landfill. The metals in the paint chips are relatively stable and probably do not leach into the water table as long as water pH is not acidic. If the paint chip wastes were to become acidified or to end up at a poorly designed and operated incinerator, they could become dispersed as a hazardous material into the environment. If the painters do not collect the scrapings, the paint debris would add to the accumulation of Pb and other metals in soils around the house.

Quantification of potential metal emissions. The case study house (house 2) provides information necessary to quantify the hazard associated with old paints. The total tolerable daily intake (TTDI) for children <6 years of age is about 6 µg Pb daily from all sources (17,18). The TTDI is empirically derived by measuring excretion of Pb through urine, feces, sweat, hair, and nails; studies indicate that 6 µg/day is the maximum amount of Pb that can be excreted. This represents the maximum amount of Pb that can be ingested on a daily basis without an increase in body burden. Perspective on the impact of renovation can be estimated by comparing the TTDI of children with the amount of Pb that can be potentially released from a renovation project. In the case study, scraping yielded 41 kg paint chips. We and the painter both estimated that about one-half of the paint remained on the house. Thus, 82 kg paint containing ~90,000 µg Pb and other metals (Table 3) was present on the house. If the house had been sanded as first proposed, approximately 7.4 kg Pb would have been turned into dust, or over a billion (109) times more Pb than is tolerable to a child under 6 years of age. This would have been sanded as first proposed, approximately 7.4 kg Pb would have been turned into dust, or over a billion (109) times more Pb than is tolerable to a child under 6 years of age.

Table 4. Results of the case study house, which was covered with exterior paint containing ~90,000 µg Pb/g.

| Samples | Work phase | Number 9 | September 2001 | Environmental Health Perspectives |
|---------|------------|-----------|-----------------|----------------------------------|
| Wipe samples (µg/ft²)¹| 1 (B) 2 (D1) 3 (D2) 4 (A1) 5 (A2) | 1 May 2000 22 May 2000 22 Jun 2000 26 Jul 2000 11 Oct 2000 | 1 (B) 2 (D1) 3 (D2) 4 (A1) 5 (A2) | 1 May 2000 22 May 2000 22 Jun 2000 26 Jul 2000 11 Oct 2000 | 1 May 2000 22 May 2000 22 Jun 2000 26 Jul 2000 11 Oct 2000 |
| LR, front door entrance | 12 | 187 | 7 | 15 | 9 |
| LR, center of room | 9 | 14 | 4 | 8 | 6 |
| LR, window sill | 38 | 24 | 5 | 86 | 28 |
| LR floor, under window | 22 | 53 | 8 | 7 | 4 |
| Kitchen floor (middle) | 9 | 71 | 1 | 7 | 6 |
| Child’s BR, next to window | 8 | 29 | 21 | 5 | 5 |
| Children BR, window sill | 42 | 32 | 8 | 131 | 21 |
| Master BR, next to AC | 11 | 13 | 3 | 5 | 4 |
| Closet, unsealed floor 1 | 15 | 18 | 13 | 17 | 7 |
| Closet, unsealed floor 2 | 16 | 20 | 10 | 13 | 21 |
| Guest BR, window well | 2,800 | 682 | 40 | 317 | 321 |
| Guest BR, window sill | 12 | 29 | 18 | 216 | 168 |
| Guest BR floor, window | 10 | 23 | 9 | 19 | 14 |
| Other wipe samples²| 9 | 6 | 5 | 13 | 7 |

Other wipe samples²:

| Samples | Number 9 | September 2001 | Environmental Health Perspectives |
|---------|-----------|-----------------|----------------------------------|
| Hall at basement stairs | 475 | 4 | 8 | 2 |
| Top stair to basement | 318 | 22 |
| Basement floor (middle) | 259 | 231 | 145 | 148 |
| Outdoor wipe samples (µg/ft²) | 35 | 1,200 | 224 | 29 | 11 |
| Backyard, slab near AC | 205 | 511 | 243 | 90 | 24 |
| Fence treated, bare wood | 29 | 23 | 9 | 10 | 8 |
| Sandbox, wood ledge | 35 | 7 | 7 | 13 | 8 |
| Back of house siding | 35 | 7 | 7 | 13 | 8 |
| Soil samples (µg/g) | 10 | 22 | 9 | 19 | 14 |
| Backyard, next to house | 750 | 530 | 880 | 560 | 730 |
| Backyard, next to sandbox | 115 | 60 | 37 | 150 | 59 |
| Driveway play area | 1,100 | 1,300 | 130 | 590 |
| Sand box | <4 |

Abbreviations: AC, air conditioner; BR, bedroom; LR, living room. Samples were collected during various work phases: before (B), during (D1 & D2), and after (A1 & A2) the scraping and painting project.

¹Used for statistical evaluation. ²No plastic on the windows. ³Not included in the statistical evaluation.
result illustrates the toxicologic hazard that
sanding poses to pets and children. Sanding
paint contributes many metals that can accu-
mulate in the environment. In addition,
because elemental Pb and the other metals
do not decompose, they remain a permanent
feature of the environment until they are
removed or covered. Moreover, metals in
dust, as described for wood trim and floors
in the power sanded house (house 1) and
demonstrated on the basement floor of the
case study house (house 2), are often difficult
to remove.

Other impacts of dust from sanding. Pb
dust also poisons workers who sand the
houses (19, 20). Pb dust is easily transferred
to workers' clothes to their home environ-
ments, and other members of their families
may also be exposed. The dust blows in the
wind and permeates the surrounding neigh-
borhood, thereby transferring Pb to nearby
homes and properties. Power sanding to
remove paint is not neighbor friendly. In the
case study project, no measurements were
taken of the workers or of neighboring
houses. As an adjunct aspect of the sanding,
in addition to Pb there are other metals in
old paints that are also toxic; the survey of
exterior paint samples in New Orleans (Table 3) shows the quantities and ranges of
metals that are present. For example, the
current air standard for Cd is 10 µg/m³ for
inhaleable dust, and 2 µg/m³ for the respirable
fraction during an 8-hr time-weighted aver-
age (21); sanding the case study house would
release 9.7 million µg Cd into air. This
amount would place a worker sanding the	house at risk to excessive Cd exposure.
Likewise, 8.8 million µg Mn dust, 1.5 mil-
lion µg Ni dust, and the other metals may
contribute to exposure during a critical win-
dow of childhood that may contribute to
chronic health problems later on in life (15).

Alternative renovation using coating
products that minimize metal dust. Paint
manufacturers recommend paint renovation
methods similar to those used in the case
study project; these include scraping loose
paint (no dry sanding) and collecting and
disposing of the paint chips in the trash (30).
(As household wastes, the paint chips are
exempt from laws governing hazardous
waste.) As part of preparation for repainting,
it is important to treat and destroy mildew,
and it is essential to wash the entire surface
with a solution of detergent to remove grease
and grime (22). The surface must be rinsed
thoroughly and allowed to dry before applic-
ing a primer coat to bare wood areas. The
100% acrylic paint formulations currently in
use have reported a 20-year durability and
are recommended for this method of prepa-
rating. An alternative to scraping, not tested
here, includes new coating products that
require little or no preparation at all. These
coatings can be brushed or sprayed directly
onto the unprepared surface to encapsulate
old paint, dust, and chips, and they provide
a tough, durable coating on interior and
exterior surfaces. The development of encap-
sulating paints is progressing and now
includes several products, Leadlock (23),
Lead Block (24), and Child Guard (25), that
are currently available. This growing list of
products hold promise for managing and
eliminating metal dust release during paint
renovation of old homes.

Pb-based paint and leaded gasoline as
sources of environmental contamination.
The case study house is in a neighborhood
where the median soil Pb is mapped at
approximately 400–500 µg/g (8, 13). Before
the paint scraping project began, the soils
near the house contained 500–900 µg Pb/g
(Table 4). Pb loading of the urban environ-
ment is controlled by factors such as city
size, inner-city location, traffic flow, and
concentration during the five decades of use
of Pb in gasoline (26). Pb loading continues
because of the use of wheel weights that
commonly detach and become ground into
dust by the action of road traffic (27). About
equal quantities of Pb, roughly 5 million
metric tons each, was manufactured as
leaded gasoline and Pb-based paint, or a
total of 10 million metric tons of Pb, during
the commercial use of these products; the
history of these two products has been well
researched (2, 28, 29). How do Pb-based
paints compare with Pb gasoline as a com-
munity source of metal contamination?
The case study house (house 2) is located
about 25 m from a busy city street. During
the peak use of Pb in gasoline, the city street
had traffic flows of around 10,000 cars/day.
In the late 1960s and early 1970s, gasoline
contained around 2 g Pb/gallon (0.53 g/L).
At the peak use of leaded gasoline, 10,000
cars/day emitted at a rate of about 500 kg
Pb/mile (310 kg Pb/km) of street per year
(13). Thus, the traffic along a 0.1-mile (0.16
km) stretch of street in front of the case study
house was releasing about 50 kg annually of
an invisible cloud of Pb dust that dispersed on
properties and in and around houses along
the street. When the peak use of leaded gas-
oline occurred, the property along the street
was being dusted with 50 kg/0.1 mile, or
nearly 7 times more Pb per 0.1 mile annually
than the potential one-time emission of ~7.4
g of the case study house. It is possible that
old paints contribute larger portions of Pb
than vehicle traffic, although this topic
requires further evaluation. The major diffi-
culty is that there is a legacy of Pb and other
metals from paint and automobile-related
emissions that have accumulated in urban
environments and now require management
both indoors and outdoors to fully protect
children from Pb exposure (4). Pb and other
metal dust from power sanding old paint
exacerbate the metal accumulation in the
neighborhood beyond what has already taken
place. The case study suggests that preventing
interior and exterior accumulation of haz-
ardous metal dust from old paint is an
achievable goal.

Conclusions
Paint from old houses is hazardous, and
power sanding poses a condition of severe
risks, especially to children and pets. The sce-

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