

# A Guide to the Hexavalent Chromium in Household Dust Studies

## Prepared by the New Jersey Department of Environmental Protection

### Background

During much of the twentieth century, waste material from the production of chromate was deposited in many locations in Jersey City. Some of this material was used as fill in construction and some of this material was simply disposed in convenient locations. This waste material contained hexavalent chromium, a known human carcinogen as well as the trivalent form of chromium, which is generally considered to have little toxicity and is a necessary nutrient. The locations where this waste was used or disposed eventually became characterized as waste sites.

In February of 2007, the NJDEP, by policy, chose to apply a soil cleanup criterion of 20 ppm for sites contaminated with hexavalent chromium. This criterion is the most protective interim human health criterion in the nation.

Despite extensive progress in remediation of chromate production waste that resulted in permanent or, in a few cases, interim remediation of all known sites in Jersey City, questions and concerns among residents of Hudson County continue to be raised regarding exposure to hexavalent chromium from these waste sites.

In order to investigate this possibility, the New Jersey Department of Environmental Protection (NJDEP) and its academic collaborator, the Environmental and Occupational Health Sciences Institute (EOHSI) of Rutgers University and the University of Medicine and Dentistry of New Jersey conducted *two linked studies* of hexavalent chromium in household dust.

### What did the first study investigate?

The *first study*, focusing on dust collected from Jersey City households took place between November, 2006, and April, 2008. Residents were recruited from five different neighborhoods, each of which was located near one or more chromate waste sites with permanent or interim remediations: Droyer's Point, Freedom Place, Garfield Ave, Lafayette, and Society Hill. In addition, individual Jersey City residents requested that their homes be included in the study even though they were not in a targeted area. These were grouped together in an "other" category. A total of 100 homes were sampled in Jersey City.

### What did the second study investigate?

To determine if the hexavalent chromium in dust is unique to Jersey City, a *second household dust study* of other urban communities in New Jersey was conducted between April, 2008 and September, 2008. This study is called a reference study. Four urban areas in New Jersey were selected: New Brunswick; Highland Park; Somerset; and North

Brunswick. These areas have no known chromate production waste and no other known sources of hexavalent chromium. A total of 20 homes were sampled in these locations.

### **What were the results of the two household dust studies?**

Hexavalent chromium was found in the dust in all of the houses sampled in Jersey City and all of the houses in the reference study. In total, the levels of hexavalent chromium found in Jersey City households were NO higher, and in many cases lower, than the levels found in other urban communities where no known chromium waste sites exist. This means that if someone looked at the results without knowing their locations, they would have no way of knowing if the results were from Jersey City or from the reference communities.

In Jersey City, two percent of the samples, or six out of 289 samples, had concentrations higher than 20 ppm (parts per million). Two percent of samples taken from households in other urban communities were also higher than 20 ppm. In each of the samples from Jersey City and the background communities, when a house had a sample higher than 20 ppm, it came from a single sample on a single surface in that house. In all cases, that surface was wood.

### **How was the dust collected from the homes?**

Dust samples were taken from three locations where possible in each house—the window well, a living area (living room, bedroom, or dining room) and the basement, if a home had one. In order to determine if any hexavalent chromium was present, samples were taken from places in a home that tends to collect dust such as places people don't routinely clean like the top of a tall bookcase or window wells. Collection of dust in these locations allows enough dust to be collected so that even small amounts of hexavalent chromium can be detected and also reflects the accumulation of hexavalent chromium in dust over time. The dust samples were then analyzed in the laboratory specifically for hexavalent chromium. When hexavalent chromium levels were found to be at least moderately elevated, a dust sample collected next to that sample was also analyzed for total chromium.

The most useful indication of sources of hexavalent chromium in dust is its concentration (micrograms of hexavalent chromium per gram of dust, also referred to as parts-per-million, or ppm) which indicates how strong the source of the hexavalent chromium is. The higher the concentration, the stronger the source.

### **Does hexavalent chromium in dust come from chromium waste sites?**

Although these studies were not designed to identify the sources of hexavalent chromium in dust, they indicate that the levels of hexavalent chromium in household dust in Jersey City are not different from the levels of household dust in the reference communities where there are no chromate waste sites.

The scientific literature suggests that household materials, including some wood stains used in the past, may be a source of hexavalent chromium in household dust.

### **How much risk is posed by hexavalent chromium in household dust?**

It depends on the level of hexavalent chromium. The higher the level, the higher the risk. NJDEP recently developed a risk assessment for hexavalent chromium in soil that indicates the human health criterion is 1 ppm (parts per million) for ingestion of hexavalent chromium in *soil* at residential locations. This corresponds to one additional cancer in a population of one million people exposed over a lifetime. Although outdoor soil and indoor dust are not exactly the same, the 1 ppm criterion is a reasonable guide for indoor dust.

### **What are the health effects from exposure to dust with hexavalent chromium in it?**

Hexavalent chromium is known to increase the risk of lung cancer when inhaled. When ingested over a lifetime of exposure, it is likely that hexavalent chromium poses a health risk for gastro intestinal (GI) cancers. Hexavalent chromium can also result in allergic responses in some people when exposure occurs on the skin. The extent of the risks of health effects depends on the amount and duration of exposure.

### **Since I'm pregnant (or planning to get pregnant) is it safe to live here?**

Hexavalent chromium is not known to have specific effects on someone's ability to become pregnant or maintain a pregnancy. It is also not known to have any specific effects on the developing fetus.

### **How can people be exposed to hexavalent chromium from dust?**

In addition to possible sources from household materials, hexavalent chromium occurs as particles that become part of outdoor soil and dust. Those particles can spread from their original source on waste sites. When those particles are present in the outside environment, they can be dispersed by rain and wind.

Outdoor soil and dust becomes transported into houses through windows and doors, on shoes, clothing and on pets. When it enters the house it becomes a major part of house dust. Household dust, therefore contributes to people's exposure to soil contaminants.

Unlike outdoor soil and dust, however, house dust isn't removed by outdoor weather conditions. House cleaning removes a large part of house dust, but even in very clean houses there are generally odd surfaces and corners such as the tops of shelves and high furniture, doorway lintels, and window wells that escape cleaning. In these locations dust can build up slowly over time.

Hexavalent chromium can also enter houses by seepage of contaminated ground water that if not contained can leach into and through the foundations of homes. When this water dries, any dissolved chromium becomes a dry powder that can mix with house dust.

### **Can people be tested for chromium?**

Yes, through a urine test. The NJDEP in cooperation with EOSHI is in the process of recruiting participants in Jersey City for a Phase Two study. This study will collect urine samples as well as dust samples from households. The results will help us further understand possible exposure from hexavalent chromium.

### **What can people do to reduce exposure to hexavalent chromium in dust in their homes?**

General dust reducing procedures like using doormats at the entrances to the home (to keep out outdoor dust) and mopping floors with a damp mop (rather than sweeping) and damp wiping surfaces, are useful. Reducing dust in your home is the best short term solution. Regularly washing hands and washing any toys that children may put in their mouths is also helpful in reducing exposure.

### **Has a hexavalent chromium dust study ever been done before?**

No, because until recently, laboratory methods had not been developed to accurately measure hexavalent chromium in house dust. Past studies of community exposure have measured total chromium, not hexavalent chromium.

### **What previous studies were conducted?**

In the 1990's, NJDEP and EOHSI conducted a series of studies of total chromium in house dust. These early studies showed that houses that were closer to chromate production waste sites that had not yet been remediated had higher levels of total chromium in their dust than houses that were further away. They also showed that total chromium in children's urine reflected the level of total chromium in the dust in their homes. These results provided strong evidence that these waste sites were contributing to the exposure of nearby residents. Equally importantly, these studies showed that following remediation of chromate production waste sites, the levels of total chromium in the dust of nearby houses rapidly decreased to background levels. At the time, hexavalent chromium could not be measured in household dust. This provided strong evidence that the remediation of those sites was effective in reducing the risk to the surrounding population.

### **How did the recent studies differ from the older studies?**

One difference is that the recent studies were conducted about two decades after the older studies. They, therefore reflect conditions and activities such as site remediation and construction that have occurred over that period. Another major difference between the older and recent studies is that the recent studies focused specifically on hexavalent chromium while the older studies measured only total chromium. Hexavalent chromium is the type of chromium that is linked to cancer. Total chromium includes hexavalent chromium, but also includes the non-toxic trivalent form. At the time of the older studies, it was not possible to measure hexavalent chromium in house dust samples. Since then, improvements in laboratory equipment allow these studies to focus on the hexavalent form.