

Understanding the Hexavalent Chromium Risk Assessment and Soil Standard Setting Process

Prepared by the New Jersey Department of Environmental Protection

Background

It has been known for a long time that hexavalent chromium can cause lung and respiratory cancer when people are exposed to it by inhalation. However, until recently, it was not known if hexavalent chromium could cause cancer by ingestion.

In 2008, the National Toxicology Program (NTP), an arm of the U.S. Department of Health and Human Services, released the results of a study on mice exposed to hexavalent chromium through ingestion of drinking water. This study gave clear evidence that the exposed animals developed cancer from drinking the water containing hexavalent chromium. These data provided the necessary information for New Jersey Department of Environmental Protection (NJDEP) to conduct a risk assessment to determine cancer risk to humans from hexavalent chromium through ingestion of soil.

Results of the risk assessment

The conclusion of the risk assessment is that the human health criterion for ingestion of hexavalent chromium in soil at residential locations is 1 ppm (parts per million). This value was derived by translating the results of the NTP study in mice (small intestine tumors) to human health effects. This was then applied to the NJDEP Site Remediation Technical Regulations.

What is a risk assessment?

A risk assessment is a process for taking scientific data on the effects of a chemical or other environmental hazard and using those data to estimate the health effects to the population when the population is exposed. Risk assessments can use different kinds of data to make these estimates. Sometimes, these data come from observations of exposed human populations and sometimes, as in this case, data come from studies in which animals are exposed.

All estimates of risks to the public from risk assessments have uncertainties associated with them. When risk assessments are based on animal studies, some uncertainties come from translating the dose and conditions of exposures of the animals to what humans will experience.

To address these uncertainties, it is necessary for risk assessments to make certain assumptions. The assumptions that are selected are chosen because they are both scientifically plausible and protective of public health. When such choices need to be made, the choices that are selected are more likely to protect public health. This makes

the resulting criterion and resulting standard more “conservative”— meaning more protective of public health.

How can people be exposed to Hexavalent Chromium by ingestion of soil?

Soil ingestion sometimes occurs because children (and less commonly adults) put soil or soil covered objects into their mouth on purpose. Soil ingestion occurs commonly as a result of hand-to-mouth contact, even though we may be unaware that we are doing it.

Outdoors, hands accumulate small amounts of soil through normal contact with the ground and with objects that have come in contact with the ground. Indoors, people accumulate dust on their hands by touching everyday household surfaces. A portion of household dust is comprised of outdoor soil. When people bring their hands to their mouths, the soil particles transfer to the mouth and are swallowed. Although the total amount of soil that is ingested is relatively small, hand-to-mouth activity occurs continually throughout a day.

What does a change in the cleanup criterion for hexavalent chromium from 20 ppm to 1 ppm mean for me?

Currently, there is no national Environmental Protection Agency (EPA) clean up criterion or standard for hexavalent chromium in soil.

In February 2007, the NJDEP by *policy* chose to apply a soil cleanup criterion of 20 ppm for sites contaminated with hexavalent chromium. This policy, though not enforceable, is intended to provide guidance for voluntary compliance by those responsible for site clean up until the Department completes the process for standard setting through formal rulemaking. ***This criterion is the most protective interim human health criterion in the nation.*** The 20 ppm was initially applied only to inhalation exposure on industrial sites. Because it is the lowest supportable cleanup number for hexavalent chromium, it was applied in all cases in order to be protective of public health.

The value of 1 ppm corresponds to a lifetime cancer risk for the exposed population of one additional cancer in a population of one-million people as compared to 20 ppm which is two additional cancers in a population of 100,000 exposed over a lifetime.

While a 1 ppm soil remediation criterion is one-twentieth of the 20 ppm, it should be noted that both numbers fall within the risk range of one-in-a-million to one-in-ten thousand which is the public health risk range often applied nationally to the setting of standards and guidelines for exposure to carcinogens for the protection of human health.

Am I still being exposed to hexavalent chromium?

Whether the criterion for hexavalent chromium in soil is 20 ppm or 1 ppm, three recent studies conducted by the NJDEP provide strong evidence that there is little or no continuing exposure to hexavalent chromium from waste sites in Jersey City. Two of

these studies measured hexavalent chromium in household dust in Jersey City and in other New Jersey urban communities. The levels 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.

See “A Guide to the Hexavalent Chromium in Household Dust Studies” for additional information. http://www.state.nj.us/dep/dsr/chromium/chromium_dust_guide.pdf

A third ongoing soil sampling study in Jersey City has concluded that in the 250 surface soil samples taken thus far at sites in proximity to known chromium contaminated sites, hexavalent chromium was NOT detected in 95% of the soil samples.

Elements Needed to Set Standards

Based upon a 1984 New Jersey Supreme Court Decision, the NJDEP cannot require a party conducting a cleanup to comply with a criterion established by policy or guideline. In order to compel a party to meet a specified cleanup criterion, a formal standard must be set through rulemaking under the Administrative Procedure Act which requires a published proposal, public comment period and published adoption. Currently, the parties responsible for cleanup have been voluntarily complying with the 2007 chromium cleanup policy.

The results of the risk assessment discussed above provide one of the critical pieces of information needed to proceed with standard setting and rulemaking. There are three elements needed to establish a soil standard for any contaminant. The first is a health based criterion. With regard to hexavalent chromium, this is the 1 ppm criterion derived from the risk assessment. The second element is information on the content of hexavalent chromium contained in the region’s soil that is not from specific sources of contamination. This is referred to as soil background. The third is the level at which hexavalent chromium can readily and accurately be measured in soil using existing technologies and laboratory techniques.

By law, specifically the Brownfields and Contaminated Site Remediation Act, the NJDEP cannot require soil cleanups for a contaminant at levels below the background level of that contaminant in the soil. Background levels mean the level of a contaminant that occurs naturally in soils or that exist in soils due to non-specific contamination such as air deposition. In order to apply a criterion of 1 ppm, it is necessary to investigate whether background hexavalent chromium could be widespread in urban soils at 1 ppm or above. The Department will be performing a study to determine if background levels of hexavalent chromium exist in the soil throughout the state, and if they do, at what levels they would be found.

The final step in standard setting involves determining how close to 1 ppm the analytical laboratory methods can accurately measure hexavalent chromium in soil. In the past, it had not been necessary to routinely measure hexavalent chromium at levels around 1 ppm. The analytical methods used have been capable of measuring levels at the current interim cleanup criterion of 20 ppm. The NJDEP is in the process of determining

whether previously used methods will be appropriate for routine measurement of hexavalent chromium in soil at 1 ppm and if not, how low it will be practical to measure hexavalent chromium.

Conclusion

The NJDEP is fully committed to developing residential and nonresidential soil remediation standards for hexavalent chromium based on the risk assessment and consideration of soil background and analytical methods. As stated in the response to comments in the June 2, 2008 adoption of the Remediation Standards, the NJDEP committed to proceed with a hexavalent chromium standard once the NTP final report was issued and evaluated by the Department. With the risk assessment completed and reviewed, the Department is one step closer to having a hexavalent chromium standard in soil based on ingestion. The two remaining pieces needed to complete standard setting are in the process of development and investigation. It is expected that the NJDEP will initiate rulemaking for hexavalent chromium in soil in early 2010.

For More Information:

- Link to Petitions for Rulemaking (residential and non residential)
<http://www.state.nj.us/dep/dsr/chromium/index.htm#petitions>
- Link to Response to Petitions or Rulemaking (residential and non residential)
<http://www.state.nj.us/dep/dsr/chromium/index.htm#petitions>
- Link to Guide to Hexavalent Chromium in Household Dust Studies
http://www.state.nj.us/dep/dsr/chromium/final_guide_dust_studies.pdf
- Link to Office of Science Chrome Web Page
<http://www.state.nj.us/dep/dsr/chromium/index.htm>
- Link to Site Remediation Chrome Web Page
<http://www.state.nj.us/dep/srp/siteinfo/chrome/bkgrnd.htm>