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Dear Mr. Costentino:

This Letter Health Consultation (LHC) has been completed for the E.C. Electroplating site located at 125 Clark Street in Garfield, Bergen County, New Jersey. The details of site operations, environmental history and analytical data have been provided by the United States Environmental Protection Agency (USEPA), Region 2. This LHC provides discussion of public health implications, conclusions, and recommendations concerning potential human exposures to hexavalent chromium contamination in groundwater for the surrounding community.

Statement of Issues

This LHC was prepared in response to a USEPA Region 2 request that the New Jersey Department of Health and Senior Services (NJDHSS), through a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR), evaluate potential exposure pathways and health risks to the surrounding residential and commercial community posed by groundwater contaminated with hexavalent chromium. The source of this contamination is believed to originate from the E.C. Electroplating site located in Garfield, Bergen County, New Jersey.

Background

The E.C. Electroplating site is located on a ¼ acre (approximate) parcel in a mixed residential and commercial area. In December 1983, approximately 3,600 gallons of chromium plating solution was discharged from a partially below ground storage tank. Background reports indicate that 1,044 gallons of the material was recovered while the remaining portion entered bedrock below the area of the storage tank. In May 1985, the New Jersey Department of Environmental Protection (NJDEP) allowed E.C. Electroplating to cease contaminant recovery efforts and continue with groundwater monitoring from two on-site wells. E.C. Electroplating failed to comply with this monitoring directive from NJDEP. In June 1993, chromium contaminated groundwater and crystals were discovered in the nearby Garfield Fire House #3 forcing E.C. Electroplating into a Memorandum of Agreement to comply with regulatory

investigation requirements. As of April 2000, groundwater samples indicated maximum concentrations of total chromium and hexavalent chromium at 1,500,000 and 1,490,000 parts per billion, respectively, at one on-site monitoring well (NJDEP 2002).

The groundwater sampling results prompted additional investigation in October 2000 revealing chromium contaminated groundwater within the basement sumps of several residences and commercial properties in the immediate vicinity. In September 2002, NJDEP issued a Notice of Violation to E.C. Electroplating for failing to comply with continued investigation and initiate remedial actions. The company cited financial difficulty in further pursuit of regulatory compliance. As such, NJDEP deferred this case to the US EPA in 2002 to complete groundwater delineation and mitigate contaminant impact to the surrounding community (NJDEP 2002). The January 2003 investigation of the nearby Golden Age Apartments, lead by the Garfield Housing Authority, revealed elevated hexavalent and total chromium contamination within the basement area. In September 2006, the USEPA requested assistance from the ATSDR and NJDHSS to evaluate the potential exposure pathways to groundwater contaminated with hexavalent chromium for the surrounding community.

Environmental Contamination

Residential Housing

A total of 10 residences were investigated by the NJDEP in 2000 and 2001 for the presence of chromium contamination. Analytical results for basement sump water samples from 7 residences indicate total chromium was detected in 6 residences and hexavalent chromium was detected in 3 residences. Analytical results for residue solids collected from within the basement sumps of four residences indicate total chromium was detected in all residences while hexavalent chromium was not detected.

Information provided for Golden Age Apartments indicates the basement of this complex flooded at an unspecified time prior to the January 2003 sampling event which left a yellow powder-type residue on the basement floor. Two samples of the residue indicated the presence of total chromium and hexavalent chromium (Garfield 2003). Based on the analytical results, the chromium contamination was remediated from the basement in February 2003 through services retained by Boswell McClave Engineering of South Hackensack, New Jersey, under contact with the Garfield Housing Authority. This remediation included caulking the basement wall area where contaminated groundwater was believed to have infiltrated (Boswell 2003). Hexavalent chromium was not detected in one post-remedial air sample collected in February 2003 (Boswell). Post-remedial surface residue sampling does not appear to have been conducted. One water sample collected within the basement area (unspecified location) in January 2003 indicated the presence of total chromium (hexavalent chromium not analyzed).

Garfield Fire House #3

Analytical results for the water sample (location not specified) collected in 2003 within the basement of this municipal building indicated the presence of total chromium, but did not indicate the presence of hexavalent chromium.

Groundwater

Analytical results for groundwater samples indicate that total chromium and hexavalent chromium are approximately 15,000 times higher than the federal drinking water MCL of 100 parts per billion for total chromium (including hexavalent chromium) below the E.C. Electroplating site. Total chromium was detected approximately 3 to 5 orders of magnitude less in groundwater from monitoring wells located approximately 2,000 feet hydraulically downgradient of the site.

The following table summarizes the analytical results for the 2000 through 2003 sampling period:

Sample Location (Number of Locations)	Sample Type	Total Chromium Results (ppm)		Hexavalent Chromium Results (ppm)	
		Range of Detected	Average of Detected	Range of Detected	Average of Detected
Residences (7)	Basement Sump Water	0.002 - 12.1 ^(b)	3.96	0.054 - 11.3 ^(c)	6.24
Residences (4)	Basement Sump Residue Solids	5.71 - 18.7	11.75	ND	-
Golden Age Apts. (1)	Basement Sump Water	42	-	NA	-
Golden Age Apts. (1) ^(a)	Basement Residue Solids	77,900	-	95,800	-
Garfield Fire House No. 3 (1)	Sump Water	0.209	-	ND	-
Monitoring Wells (4)	Groundwater	0.083 - 7.77	4	NA	-
E.C. Electroplating (1)	Groundwater	1,500	-	1,490	-

(a) Basement remediated following sample event.

(b) Total chromium detected in samples from 6 of 7 locations.

(c) Hexavalent chromium detected in samples from 3 of 7 locations.

ppm – parts per million; ND – Not detected; NA – Not available

Discussion

The method for assessing whether a health hazard exists to a community is to determine whether there is a completed exposure pathway from a contaminant source to a receptor population and whether exposures to contamination are high enough to be of health concern. Site-specific exposure doses can be calculated and compared with health guideline CVs. Analytical results for samples collected during the period of 2000 through 2003 for groundwater, basement sump water and basement residue solids were evaluated for potential public health exposure implications.

Potential Pathways

There are no completed exposure pathways associated with hexavalent chromium contamination in groundwater as available information does not present sufficient evidence individuals came into contact with chromium contaminated sump water and/or residue detected at several sampled locations. Therefore, due to the lack of data to support actual exposures, pathways can only be presumed as potential exposures for locations with confirmed chromium contamination present.

Based on the information provided to the NJDHSS, there may have been a potential past exposure pathway to residents accessing the basement area of the Golden Age Apartments via incidental ingestion, dermal contact and possibly particulate inhalation of hexavalent chromium found in the powder residue present within the basement. An inhalation pathway may have been present if the residue powder was disturbed, became airborne, and then inhaled by residents accessing this area. Since the interior of the basement was remediated in February 2003, the exposure pathway appears to have been eliminated. However, as hexavalent chromium contamination remains within groundwater, any future flooding conditions within this building may re-create these potential exposure pathways to residents accessing the basement. There is an additional concern that individuals accessing the basement area may have transported contaminated residue (i.e. via shoes, clothing) into other areas of the apartment complex, including living spaces; however, there is no evidence to support if individuals accessed the contaminated area(s) of the basement to establish a transport mechanism (i.e. tracking) to create this potential pathway.

There is a potential exposure pathway to individuals living within the three residences in which hexavalent chromium was detected within sump water. No solid samples were collected within the sumps to determine if hexavalent chromium is present in residue form. However, the confirmed presence of this contaminant in sump water indicates the potential exists for it to precipitate in residue form under supporting conditions. Currently, individuals within these residences may become exposed through ingestion or dermal exposure routes if they come into contact with contaminated sump water (i.e. performing maintenance or repair activities associated with the sumps). There is an additional concern that a potential exposure pathway may exist if hexavalent chromium residue is present on basement surfaces of residences which may have been subject to flooding events in the past.

Eliminated Pathways

Ingestion of hexavalent chromium via drinking water is eliminated as a pathway as the information provided does not indicate there are potable groundwater wells within the area.

There is no exposure pathway evident for the Garfield Firehouse #3 as hexavalent chromium was not detected in the basement water sample. It is noted that background information indicates that “crystals” were observed in the basement of this building; however, there is no supporting documentation that this material was sampled to determine if it is contaminated.

Public Health Implications

Total chromium is composed of chromium in its trivalent and hexavalent forms. The hexavalent form of chromium is much more toxic than the trivalent form, which is an essential nutrient that occurs naturally in food and helps the body process sugar, protein, and fat. Hexavalent chromium is listed as a known human carcinogen via the inhalation route of exposure by several agencies. EPA has not classified it as a human carcinogen via the ingestion route of exposure. Inhalation exposure to high levels of hexavalent chromium can cause mucous membrane irritation, ulcers, and damage to the nasal septum. Ingestion of hexavalent chromium can cause stomach ulcers, convulsions, kidney and liver damage, and death. Dermal exposure to hexavalent chromium can cause skin ulcers and contact dermatitis (ATSDR 2000).

Oral absorption of chromium compounds in the human body is low, estimated at approximately 0.5 to 2 percent. Trivalent chromium is absorbed in the human body at a rate about one quarter of that of hexavalent chromium. Hexavalent chromium is rapidly transformed to trivalent chromium within the stomach limiting its systemic availability; however, hexavalent chromium can still cause kidney and liver toxicity through ingestion. The degree of toxicity of hexavalent chromium greatly lies within its ability to readily penetrate cellular membranes while trivalent chromium is less able to do so. The reduction of hexavalent chromium to the trivalent form outside the cellular membrane is considered a major mechanism of protection (ATSDR 2000; NTP 2006).

The U.S. Department of Health and Human Services, National Toxicology Program (NTP) has submitted the results of a two-year study (currently in peer review) indicating clear evidence that ingestion of drinking water contaminated with hexavalent chromium caused malignant tumors in mice and rats. A two-year study on laboratory animals is considered the primary method to determine the potential to be hazardous to humans. NTP rodent studies are used by regulatory agencies to promulgate regulations to protect human health and are used in the hazard identification process for risk assessment (NTP 2007).

Potentially exposed individuals would not necessarily exhibit the adverse health effects described above. The risk of adverse health effects would depend on the degree of exposure (magnitude and duration) and route of exposure.

Once it has been determined that individuals have or are likely to come in contact with site-related contaminants (i.e., a completed exposure pathway), the next step in the health assessment process is the calculation of site-specific exposure doses. This is called a health guideline comparison which involves looking more closely at site-specific exposure conditions, the estimation of exposure doses, and comparison to health guideline CVs. Health guideline CVs are based on data drawn from the epidemiologic and toxicologic literature and often include uncertainty or safety factors to ensure that they are amply protective of human health.

It is noted that due to the lack of sufficient evidence to substantiate completed exposures, only potential exposures can be supported at this time. Therefore, the following public health implications are provided as a guide to evaluate exposures based on site-specific exposure conditions and estimation of exposure doses if completed exposure pathways could be supported.

Though no data exists regarding the frequency the basement of the Golden Age Apartments is accessed, estimated exposure doses were calculated for children and adults to gain a perspective on the concentration of hexavalent chromium detected in residue prior to remediation. Exposure doses for children and adults were based on daily exposure, the concentration of hexavalent chromium, intake rate based on incidental ingestion, and body weight. The calculated exposure doses for children and adults (0.913 mg/kg/day and 0.137 mg/kg/day, respectively) indicated there was no exceedance above the chronic No Observed Adverse Effect Level of 2.5 milligrams per kilogram per day (ATSDR 2000); therefore, non-cancer adverse health effects for chronic ingestion exposures are not expected for adults and children. It is noted that if an inhalation exposure was created from the generation of airborne particulates containing hexavalent chromium, the exposure dose would have likely increased and would include the potential for carcinogenic health effects to exposed individuals. As the contaminated residue was located in the basement area and access to this area was likely infrequent, daily, long-term exposures to airborne chromium were unlikely to have occurred in the past.

Conclusions

Based on review of available hexavalent chromium results, there is presently an ***Indeterminate Public Health Hazard*** in residences and other buildings above the groundwater chromium contamination plume. The hazard is considered indeterminate because the extent of contamination is unknown, and only a limited number of samples from a small number of locations have been taken. Depending on groundwater plume movement, contaminant concentration, and interior building conditions (i.e. flooding), hexavalent chromium contamination noted within water samples may precipitate onto surfaces increasing the risk of exposure.

A flooding incident which previously occurred within the apartment complex contaminated basement surfaces with hexavalent chromium. For the past, potential exposures via ingestion and inhalation are not expected to produce non-cancer adverse health effects and are uncertain to produce cancer health effects in individuals accessing the basement area. It is noted that exposures in the basement area may not have been frequent and long-term which

would reduce the likelihood for individuals to develop adverse health effects. Since the hexavalent chromium contamination was remediated from the basement of the apartment complex, there is no completed exposure pathway evident for this location.

Recommendations

In some of the residences, total chromium was measured but hexavalent chromium was not detected. However, since groundwater conditions may change, the ATSDR and NJDHSS recommend the following actions be taken by the USEPA to reduce or eliminate the potential for exposures to hexavalent chromium for the investigated areas:

- 1 Off-site delineation of the total and hexavalent chromium groundwater plume is essential to understand the scope of the impacted area. Measures should be implemented to remediate the chromium contamination from groundwater to reduce the threat of exposure to individuals in the area.
- 2 Since groundwater remains contaminated, routine monitoring should be conducted to ensure hexavalent chromium contamination does not become present within sampled locations at concentrations sufficient to create an elevated risk of exposure to individuals.
- 3 EPA should evaluate the three residences where hexavalent chromium was detected in basement sump water to determine if this compound is present in solid form. If present, depending on the concentrations, EPA may need to implement a cleaning and maintenance plan to service the sumps to reduce any exposure potential to residents.
- 4 EPA should re-inspect the basement of the Garfield Fire House #3 to determine if the documented "crystals" observed in this area are contaminated with hexavalent chromium.
- 5 Background information is unclear as to whether groundwater seepage is occurring through the basement walls of investigated residential properties, the Golden Age Apartment complex and the Garfield Fire House #3. Additionally, there is no information confirming the absence of basement flooding events for sampled locations other than the apartment complex. EPA should investigate to determine if flooding event(s) and/or groundwater seepage through the walls has occurred to warrant additional sampling.
- 6 If hexavalent chromium residue is present on basement walls, remedial and/or control measures may be immediately required to prevent the potential for dermal, oral and inhalation exposures to individuals.
- 7 EPA should consider sampling of the living spaces of the Golden Age Apartments for the presence of hexavalent chromium. This would involve identifying target

individuals likely to have frequented the basement area and may have potentially transported contaminated residue into living spaces in the past.

The ATSDR and NJDHSS should be kept informed of new data results so exposure pathways can be re-evaluated to determine if a public health hazard exists.

Please contact me at 609-588-7497, Glenn.Pulliam@doh.state.nj.us or alternately, Ms. Leah Graziano, Associate Regional Representative, ATSDR Region II at 732-906-6932, Escobar.Leah@epamail.epa.gov.

Yours truly,



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References

[ATSDR] Agency for Toxic Substances and Disease Registry. September 2000. Toxicological Profile for Chromium. Atlanta: US Department of Health and Human Services.

[BOSWELL] Boswell McClave Engineering, Letter regarding sampling and remedial actions at Golden Age Apartment complex, February 13, 2003 to Anthony DeMarco, Garfield Housing Authority. Received via fax by NJDEP on September 21, 2007.

[BOSWELL] Boswell McClave Engineering, Letter regarding post-remedial air sampling at Golden Age Apartment complex, February 24, 2003 to Anthony DeMarco, Garfield Housing Authority. Received via fax by NJDEP on September 21, 2007.

[DHHS] Department of Health and Human Services, National Toxicology Program. Draft May 16, 2007. Toxicology and Carcinogenesis Studies of Sodium Dichromate Dihydrate (CAS No. 7789-12-0) in F344/N Rats and B6C3F1 Mice (Drinking Water Studies)
<http://ntp.niehs.nih.gov/index.cfm?objectid=E1C04561-F1F6-975E-7B21E8B231BAB44F>

[DHHS] Department of Health and Human Services, National Toxicology Program. 2006. Fact Sheet Hexavalent Chromium.

[GARFIELD] The Housing Authority of the City of Garfield, Letter regarding sampling and remedial actions at Golden Age Apartment complex, February 3, 2003 to Carmen Valenti, New Jersey Department of Housing & Urban Development. Received via fax by NJDEP on September 21, 2007.

[NJDEP] New Jersey Department of Environmental Protection, E.C. Electroplating Site - site description and background summary via fax dated October 7, 2002.

[NJDEP] New Jersey Department of Environmental Protection, Letter regarding E.C. Electroplating Site
– Results of Aqueous Sampling Event, December 12, 2001 to Richard Chapin, Chapin Engineering.
March 27, 2002.

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