Health Consultation

Review of
Surface Soil Data
Somers Industrial Finishing Corporation Site
Tolland County
Somers, Connecticut

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Prepared by
Connecticut Department of Public Health
Under Cooperative Agreement
With
The Agency For Toxic Substances and Disease Registry

The conclusions and recommendations in this health consultation are based on the data and information made available to the Connecticut Department of Public Health and the Agency for Toxic Substances and Disease Registry. The Connecticut Department of Public Health and the Agency for Toxic Substances and Disease Registry will incorporate additional information when received. The incorporation of additional data could change the conclusions and recommendations listed in this document.

BACKGROUND AND STATEMENT OF ISSUES

On January 31, 1996, the U.S. Environmental Protection Agency (EPA) issued a memorandum [1] asking the Agency for Toxic Substances and Disease Registry (ATSDR) to examine the report entitled: "Removal Program Preliminary Assessment/Site Investigation for the Somers Industrial Finishing Corp. (SIFC) Somers, CT 14 November 1995." During a removal site investigation, the EPA documented four metals and cyanide in surface soil. The purpose of this Health Consultation is to determine whether the five contaminants in surface soil at the Somers Industrial Finishing Site pose a public health hazard.

Somers Industrial Finishing Corporation (SIFC) is an inactive plating processing facility. Operations began in 1954 and continued through 1984. SIFC is located in Somers, Connecticut (CT), in Tolland County. The site encompasses one half acre, including the one-story plating facility building. The site is bordered on the north by Fields Road, and on the west by an automobile parts and repair shop. There is a day-care center located about 200 feet from the south-southeast section of the site. The easterly boundary is occupied by a vacant lot. The topography of the site is mostly level, with a gradual slope from the north to south. Two lagoons and a drainage swale[1] are located south of the plating facility building. The southern portions of the lagoons contain a six foot high berm. This berm is presumably designed to prevent runoff from the lagoons. The plating facility is connected to the lagoons and the drainage swale through discharge piping. In addition, the secondary lagoon is connected to the drainage swale through two 4 inch fiberglass pipes [2].

During metal finishing, and electroplating operations, constituents such as cadmium, chromium, nickel, zinc, and "black oxide" were used. The spent plating and treatment bath wastes from the plating operations were discharged into two unlined surface lagoons (one primary and one secondary).

Within the interior of the facility are plating and wastewater treatment equipment. In addition, there are twelve 1-quart capacity vessels containing nickel, chromium, and zinc compounds [2]. During 1991, a RCRA inspection was conducted at the facility. The inspection was performed by the CT DEP. These inspectors learned from the facility owner that the plating and wastewater treatment equipment were decontaminated [2].

Representatives of the CT DPH (Gary Perlman and Kenny Foscue) conducted a site visit on March 14, 1996, from 11 am - 11:30 am. The building is cinder block construction and appears structurally sound. Numerous windows were broken, primarily the windows in the rear of the building nearest the two lagoons. There is unrestricted access to the entire site including the two lagoons. Snow cover of approximately 3 inches was observed over the site. No human foot prints were noted in the snow. The day care center is located approximately 200 feet directly behind the second lagoon. The day care facility has a 4 foot high fenced in play ground on the property nearest the second lagoon. The distance from the fenced in play ground to the drainage swale is about 100 feet. There is a residence located about 400 feet from the site with a child's play area in the back yard. The facility entrance door was unlocked during a previous site visit [2].

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[1] A dip in a section of land, that is characteristically wet or marshy.

SIFC is adjacent to the Preston well field serving about 1,200 people [2]. The site is not likely to influence this drinking water source, as the direction of groundwater flow does not place the well field at risk.[2]. On-site contamination of the soil include inorganic and metal compounds. The inorganic compounds and metal contaminants include: cadmium, chromium, cyanide, nickel, and zinc [2].

ENVIRONMENTAL SAMPLING

The surface soil was sampled at fifteen locations. The surface soil was obtained at depths from 0-3 inches below the surface. The locations selected included: the two lagoons, the drainage swale, and the exterior of the facility. All samples were analyzed for: cadmium, chromium, nickel, and zinc. Twelve of the same samples were also analyzed for cyanide. Table 1 lists the number of samples collected from each sampling location. These sampling locations were selected to determine the concentration in surface soil at areas most likely to have been contaminated by site-related activities. See figure 1 for the sample location map.

Table 1.
Surface Soil Collection Locations
Somers Industrial Finishing Corporation
November 1995.

Location	Number of samples
Lagoon 1	6
Lagoon 2	4
Outside building	1
Drainage swale	4

ENVIRONMENTAL CONTAMINATION

Three of the five contaminants, (cadmium, chromium, and nickel), were detected in the surface soil above health comparison values. Comparison values for health consultations are contaminant concentrations in specific media that are used to select contaminants for further evaluation. These values include Environmental Media Evaluation Guides (EMEGs) and other relevant guidelines. EMEGs are calculated from Minimal Risk Levels (MRLs). An MRL is an estimate of daily human exposure to a chemical that is likely to be without appreciable risk of an adverse, non-carcinogenic risk. Reference Dose Media Evaluation Guides (RMEGs) are used when EMEGs are not available for a specific medium. RMEGs are calculated from the EPA Reference Dose (RfD) which are estimates of the daily exposure to a contaminant that is unlikely to cause adverse health effects. A concentration is calculated from RfDs making certain assumptions about human exposure.

The maximum detected concentrations of each contaminant and the respective health comparison value are displayed in table 2. The surface lagoon nearest the plating facility building contained the highest levels of the metals.

Table 2.
Maximum Detected Concentrations of Contaminants in Surface Soil
Somers Industrial Finishing Corporation
December 1995.

Chemical	Concentration (ppm)	Location	Comparison ppm	Value Source	Above Comparison Value
Cadmium	820	Lagoon 1	40	EMEG-Child	Yes
Chromium*	1,850	Lagoon 1	300	RMEG-Child	Yes
Nickel	1,060	Lagoon 1	1,000	RMEG-Child	Yes

* Chromium(VI) health comparison values were used.
EMEG-Child Environmental Media Evaluation Guidelines for children
ppm parts per million
RMEG-Child Reference Dose Media Evaluation Guidelines for children.

DISCUSSION

Exposure Pathways and Exposure Duration

The potential exists for ingestion and dermal exposures of contaminated soils to occur for persons who trespass on the SIFC site. Inhalation of airborne soil particles is a possible route of exposure, however, the CT DPH lacks sufficient information to characterize this exposure scenario. Drainage form the site may have transported site-related contaminants off-site. We do not know the extent of this contaminant transport. Consequently, children may have received exposure to site-related contaminants that may have migrated off-site. The exposure pathways examined in the following section include the incidental ingestion of contaminated soil (200 mg), and the dermal absorption of contaminants from soil adhering to the skin. The exposure duration examined include chronic exposure scenarios (more than one year), as well as acute (less than 15 days) exposure scenarios. When short-term health comparison values were not available, and there are elevated risks for non-cancerous health effects at the chronic duration, we developed *provisional* acute comparison values.

The former plating facility building represents physical and public health hazards to children over the age of six, who may trespass on the site The building houses equipment, and twelve 1-quart capacity vessels containing nickel, chromium, and zinc compounds housed in the building. The nearest residence is about 400 feet from the site. In addition, a day care facility is located a similar distance from the site. Trespassing has occurred, as indicated by the numerous broken windows.

TOXICOLOGICAL EVALUATION

To evaluate health effects, the ATSDR has developed a Minimal Risk Level (MRL) for contaminants commonly detected at hazardous waste sites. The MRL is an estimate of daily human exposure to a contaminant below which non-cancer, adverse health effects are unlikely to occur. MRLs are developed for each route of exposure such as ingestion, inhalation, and dermal absorption and for the length of exposure, such as acute (less than 15 days), intermediate (15 to 364 days), and chronic (greater than 364 days).

The amount of contaminant ingested per body weight was calculated for adults. A similar value was calculated for children. The value for children, however, includes a component known as dermal absorption. The dermal absorption fraction for the metals were obtained from the EPA [3]. The dermal absorption component was incorporated into the exposure scenario, because access to the site is unrestricted, and the possibility exists for children to play in the contaminated soil.

Cadmium

Exposure to cadmium may have occurred in the past, and may be occurring now to persons who trespass on the SIFC site and contact contaminated soil. The principal individual for whom exposure to contaminated soils may be of most concern is a child. Cadmium was detected above the health comparison value in the surface soil sampled from: lagoons 1 and 2, outside the former plating facility building, and the drainage swale.

Non-cancerous Effects

Based on the Chronic MRL

The maximum measured concentration of cadmium in the surface soil is 820 ppm. Using this value, the ingestion exposure was calculated for adults (0.0006 mg/kg/day), and the combined ingestion-dermal exposure was calculated for children (0.007 mg/kg/day). The child value exceeds the chronic MRL (0.0007 mg/kg/day). Non-carcinogenic health risks for a child exposed chronically to cadmium in the surface soil at SIFC may be characterized as likely. The main target of cadmium toxicity is the kidney. Exposures presented in this scenario are at concentrations that may result in proteinuria (a kidney disorder). This affect, however, was based on a worst case scenario exposure of 200 mg per day, and daily exposure for more than one year. Other scenarios utilizing a lower frequency of exposure would be associated with lower risks. Recent studies support lower soil ingestion rates of 50 mg to 100 mg per day [4].

The main target of cadmium toxicity is the kidney. This specificity has been confirmed in animal studies examining rats, mice, and rabbits. These investigations have lead to a better understanding of cadmium toxicity. The toxic effect appears only to occur after a critical concentration is reached. In other words, low levels of cadmium may not cause damage. However, once the cadmium level has reached the critical value, kidney damage may continue subsequent to exposure cessation. This damage may alter the calcium balance in the body, and increase the risk for osteoporosis among women [5]. In studies examining adults exposed to cadmium, twenty five per cent of the original exposed dose remained in the body after 3-5 days. Exposure to high levels of cadmium may result in gastrointestinal problems including: nausea, vomiting, salivation, abdominal pain, cramps, and diarrhea [5]. In addition, skin contact with cadmium contaminated soil may result in skin irritation [5].

A child who is exposed to contaminated soil at SIFC for more than one year would potentially be at risk for developing non-carcinogenic health effects. In order to fully characterize the risks posed by this site, the CT DPH has also calculated the risks using a provisional acute duration comparison value. This acute value is based on the EPA Ten-Day Health Advisory.

Non-cancerous Effects

Based on a Ten-day Health Advisory

The EPA has developed a ten-day health advisory for a child exposed to contaminated drinking water. Health advisories are reported in concentration-based units (i.e., mg/L). A concentration is an amount of a contaminant per unit of media, such as milligrams of cadmium per liter of water. The ten-day health advisory concentration is 0.04 mg/L. This value is then converted into a dose (i.e., mg/kg/day). A dose is an amount of contaminant per a unit of body weight per unit time. A dose is associated with the human body, whereas a concentration is associated with a specific media (water, soil, etc.). The dose conversion allows for the direct utilization in the soil consumption and dermal absorption exposure scenario. This conversion was conducted using the assumption of 1 liter of water consumed per day, and a body weight of 10 kg. The resultant dose is 0.004 mg/kg/day. This value is called the provisional acute health comparison value. Although the combined ingestion-dermal exposure for the child (0.007 mg/kg/day) exceeds the provisional acute health comparison value, non-carcinogenic health risks may be characterized as unlikely. This is due to the use of a worst case scenario exposure of 200 mg per day. As stated previously, recent studies support lower soil ingestion rates of 50 mg to 100 mg per day [4].

Carcinogenicity Classification:
Cadmium has been classified by the EPA as a probable human carcinogen (EPA group B1) by inhalation. However, there is insufficient evidence to ascertain whether cadmium is a carcinogen by ingestion. No cancer risk estimates were calculated for individuals potentially exposed via contaminated surface soil.

Chromium

Exposure to chromium may have occurred in the past, and may be occurring now to persons who trespassed on the SIFC site and contact contaminated soil. The principal individual for whom exposure to contaminated soils may be of most concern is the child. Chromium was detected above the health comparison value in the surface soil sampled from: lagoons 1 and 2, outside the former plating facility building, and the drainage swale.

Chromium is present in three forms in the environment, chromium(0), chromium(III) and chromium(VI). The most toxic form is chromium(VI). Chromium(III) is much more common than chromium(VI) in the environment, but the two forms are usually found together. An investigation conducted by the Robert Wood Johnson Medical School and the New Jersey Department of Environmental Protection examined the ratio of chromium(VI) to total chromium in soil. They concluded that the ratio of chromium(VI) to total chromium is approximately 0.14 [6]. The researchers calculated this value from combined data from 40 sites located in New Jersey. The percentage of sites that were metal plating facilities is unavailable. Although the entire concentration of chromium is therefore not likely to be present in the most toxic form, we have calculated two scenarios: 1)one hundred per cent chromium (VI) and 2) fourteen per cent chromium (VI).

100 % Chromium (VI)

Non-cancerous Effects

Based on a Chronic RfD

Using the highest chromium concentration detected (1,850 ppm) the ingestion exposure was calculated for adults (0.001 mg/kg/day), and the combined ingestion-dermal exposure was calculated for children (0.016 mg/kg/day). Since there is no chronic MRL, the calculated dose from the maximal concentration of 1,850 ppm has been compared to a reference dose. The reference dose (RfD) is an estimated daily intake of a chemical that is likely to be without an appreciable risk of health effects, and has been developed by the EPA. Using the RfD (0.005 mg/kg/day) as a comparison non-carcinogenic health risks for a child or an adult exposed to chromium(VI) in the surface soil at SIFC are possible. However, this was based on worst case of 100% chromium(VI) as stated previously, chromium is not likely to be 100% chromium(VI).

14 % Chromium (VI)

Based on a Chronic RfD

Non-cancerous Effects

Using the highest chromium concentration detected (1,850*14% = 259 ppm) the ingestion exposure was calculated for adults (0.0002 mg/kg/day), and the combined ingestion-dermal exposure was calculated for children (0.002 mg/kg/day). Since there is no chronic MRL, the calculated dose from the maximal concentration of 1,850*14% = 259 ppm has been compared to a reference dose. Using the RfD (0.005 mg/kg/day) as a comparison the non-carcinogenic health risks for an adult exposed to chromium(VI) in the surface soil at SIFC may be characterized as unlikely. The health risks for a child exposed to chromium(VI) in the surface soil at SIFC may be characterized as unlikely.

The main target organs of chromium toxicity are the kidney and liver. Ingesting very large amounts of chromium may result in upset stomach, ulcers, spasms, kidney damage, and liver damage. Skin contact with liquids or soils containing high levels of chromium may lead to skin ulcers. Some people may have allergic reactions including severe redness and swelling [7]. The allergic reactions are known an allergic contact dermatitis, and may be worsened after exposure to strong sunlight during the period from April through mid-November [6]. The health effects of chromium-induced allergic dermatitis may persist for several years [6].

Carcinogenicity Classification:
Chromium(VI) has been classified by the EPA as a known human carcinogen (group A) via inhalation. However, there is insufficient information to determine cancer risk estimations for individuals exposure to chromium in contaminated soil.

Nickel

Exposure to nickel may have occurred in the past, and may be occurring now to persons who trespass on the SIFC site and contact contaminated soil. The principal individual for whom exposure to contaminated soils may be of most concern is the child. Nickel was detected above the health comparison value in the surface soil sampled from: lagoons 1 and 2, outside the former plating facility building, and the drainage swale.

Non-cancerous Effects
Based on a Chronic RfD
Using the highest nickel concentration detected (1,060 ppm) the ingestion exposure was calculated for adults (0.00076 mg/kg/day), and the combined ingestion-dermal exposure was calculated for children (0.009 mg/kg/day). Since there is no chronic MRL, the calculated dose from the maximal concentration of 1,060 ppm has been compared to a reference dose. Using the RfD (0.02 mg/kg/day) as a comparison the non-carcinogenic health risks for an adult exposed to nickel in the surface soil at SIFC may be characterized as unlikely. The health risks for a child exposed to nickel in the surface soil at SIFC may be characterized as unlikely.

Carcinogenicity Classification:
Nickel has not been classified by the EPA as to its carcinogenicity. Consequently, no cancer risk estimations were calculated.

SUMMARY

When exposure to these contaminants were examined for older children (up to age 10), only cadmium posed a likely risk of non-carcinogenic affects for chronic daily exposures (beyond one year). The CT DPH does not anticipate that daily exposure to contaminated soil is a likely exposure scenario. However, intermittent chronic exposure may be a likely occurrence. The levels of cadmium in the soil do not pose a risk of non-carcinogenic affects for short-term exposures (10 days) for older children (up to 10 years old).

CONCLUSIONS

Based on the information reviewed, the CT DPH has concluded that this site represents a public health hazard based on the contaminated soil which poses a chronic public health hazard to children under worst case exposure scenarios. Additionally, this site represents a physical hazard posed by the abandoned easily accessible plating facility building.

- The surface soil located on the Somers Industrial Finishing Corporations Site contains cadmium at levels that pose a risk of non-carcinogenic affects in children under chronic exposure scenarios
- The surface soil located on the Somers Industrial Finishing Corporations Site contains cadmium at levels that pose an unlikely risk of non-carcinogenic affects in children under short-term exposure scenarios

- The Somers Industrial Finishing Corporation facility building is unlocked, contains numerous smashed windows, and represents a physical hazard to trespassers who currently have unrestricted access to the building.

- The Somers Industrial Finishing Corporation facility building currently stores twelve vessels containing unknown concentrations of nickel, chromium, and zinc compounds. This represents a possible public health hazard to trespassers who currently have unrestricted access to the building.

- Access to all contaminated areas at the SIFC site are unrestricted, and is of particular concern due to the proximity of the day care center located within 200 feet of the site.

- Contaminants from the Somers Industrial Finishing Corporation facility may have migrated off-site by rain and/or snow melt streaming over the contaminated surface soil.

RECOMMENDATIONS

The CT DPH recommends the following:

1) Prevent access to the contaminated soil.

2) Determine the extent of contamination transport off-site.

3) Prevent access to the contaminants present inside the abandoned plating facility building.

4) Prevent access to the equipment housed inside the plating facility building.

5) The CT DPH will evaluate new data as it becomes available.

CERTIFICATION

The Health Consultation for the Somers Industrial Finishing Corporation site was prepared by the Connecticut Department of Public Health and Addition Services under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was initiated.

Technical Project Officer. SPS, SSAB, DHAC

The Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this Health Consultation and concurs with its findings.

Chief, SSAB, DHAC, ATSDR

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