DATE: March 9, 1989

TO: Mark Landa, Legal Services

FROM: Morris Preston

SUBJECT: Transmittal of the Electro-Coatings Inc. Site information package.

An information package is enclosed for the Electro-Coatings Inc. site which we are proposing for the State Abandoned or Uncontrolled Site Registry (SAUSR). The current owners are identified in the package and a copy of the deeds are enclosed.

It is our intention to classify the site as a class "b" site. An unknown amount of chromic acid solution has leaked into the groundwater. As a result high levels of chromium have contaminated a neighboring well. This determination has been reviewed by the Department of Public Health and they are in agreement. A copy of their memorandum and draft preliminary health assessment is enclosed.

The site boundary includes both the property of the Electro-Coatings site and that of the Hawkeye Rubber Company. Hawkeye Rubber Company is included as part of the disposal site because of the offsite migration of hazardous waste. The high chromium level in Hawkeye Rubber Well No. 1 indicates significant movement of the hazardous waste into the aquifer beneath the Hawkeye Rubber Company property.

Please notify the site's owners of the department's intention to include the site on the SAUSR.

ATTACHMENT
DATE: January 11, 1989

TO: John Eure
    Director of Environmental Health
    Iowa Department of Health
    Lucas Building

FROM: Morris Preston

SUBJECT: Electro-Coatings Inc. Site
         State Abandoned or Uncontrolled State Registry
         Site Information Package

An information package is attached for the Electro-Coatings Inc.
site which we will be proposing for the State Abandoned or Uncon­trolled Site Registry (SAUSR). We are requesting your depart­ment's review of the information and intended classification with
respect to matters relating to public health.

It is our intent to classify the site as a class "b" site in ac­cordance with the Code of Iowa Section 455B.427.3. This classi­fication states that the site poses a significant threat to the
environment and that remedial action is necessary. This determi­nation is based on the following:

1. An unknown amount of chromic acid solution has leaked
   into the groundwater. Water in a soil sample taken near the
   leaking tank, showed high levels of total and hexavalent
   chromium at 810 and 730 mg/l respectively.

2. High concentrations of chromium have contaminated the
   cooling water wells at Hawkeye Rubber Company. Chromium
   concentrations as high as 11.0 mg/l have been detected in
   Hawkeye Rubber Well No. 1.

3. The extent of the contamination in the alluvial aquifer
   is unknown. There is a possibility that contamination may
   have moved deeper into the Devonian aquifer (1986 sampling
   at Hawkeye Rubber Well No. 2).

4. An unknown amount of chromium tank sludge has been
   dumped at the site.

The site boundary includes both the property of the Electro­
Coatings site and that of the Hawkeye Rubber Company. Hawkeye
Rubber Company is included as part of the disposal site because
of the offsite migration of hazardous waste. The high chromium
level in Hawkeye Rubber Well No.1 indicates significant movement
of the hazardous waste into the aquifers beneath the Hawkeye Rub­ber Company property.
We await your comments to allow us to complete the documentation on the site. If you have any questions or require additional information, please contact me at 515/281-4968.

ATTACHMENT
DATE: February 14, 1989

TO: Morris Preston
Solid Waster/Abandoned Uncontrolled Sites
Iowa Department of Natural Resources
LOCAL

FROM: John A. Eure
Assistant to the Division Director
for Environmental Health
Division of Disease Prevention
Telephone: (515) 281-4928

RE: Electro Coating, Inc. Site
Site State Abandoned or Uncontrolled Site Registry
Site Information Package

The information package pertaining to the referenced site was reviewed with respect to the site's impact on public health. We concur with your proposed class "b" classification. We consider the site as posing a potential threat to public health and that remedial action is needed. We consider a potential threat to the public health to be equivalent to "significant threat to the environment" under 455B.427(3), the Iowa Code. Our concurrence is based on the following data interpretation:

1. Cadmium, total chromium and chromium VI have been detected in the on-site and off-site groundwater samples at levels that may pose adverse health effects upon chronic exposure via ingestion.

2. At the present time, there is the possibility of human exposure to the contaminants via ingestion of groundwater from the Cedar Rapids east city well field or private wells in the vicinity of the site. However, to confirm the absence of existing human exposure it is recommended that confirmatory groundwater sampling be performed on the Cedar Rapids east city well field and on any private wells located as close as the east field.

A copy of our draft Health Assessment for the site is attached for your information. You are advised that this draft is not a public document until it is finalized by ATSDR.
PRELIMINARY HEALTH ASSESSMENT
ELECTRO-COATING, INC.
LINN COUNTY
CEDAR RAPIDS, IOWA
February 10, 1989

Prepared by:
Iowa Department of Public Health
Des Moines, Iowa

prepared for:
Office of Health Assessment
Agency for Toxic Substances and Disease Registry (ASTDR)

NOTE: It should be noted that this is the cover sheet only and the final public health assessment is in 3.6.
ELECTRO-COATINGS INC.

GENERAL DESCRIPTION

RE: 83420036

LOCATION

The Electro-Coatings, Inc., site is located at 911 Shaver Road NE in Cedar Rapids, in the East 1/2 of the Southwest 1/4 of Section 16, T83N, R7W, Linn County, Iowa. A detailed description the Electro-Coatings site appears in Appendix A. The site occupies approximately one acre along the north shoreline of Cedar Lake. The site location is shown in figure 1.

SITE DESCRIPTION

Electro-Coatings, Inc., is a nationwide corporation whose headquarters is located in Morago, California. The Electro-Coatings plant in Cedar Rapids has been in operation since 1947. The plant is involved in chromium and copper plating processes. It also had a cadmium plating operation until 1983 (Tetra Tech, 1987). The plant is still in operation. However, the company has filed under Chapter XI bankruptcy in California (Electro-Coatings, 1988).

Adjacent to the Electro-Coatings plant is the Hawkeye Rubber Company. The location of the company is shown in figure 2. The Hawkeye Rubber Company operates two wells for its plant's cooling water. On March 4, 1976, an employee of the Cedar Rapids Water Treatment Plant noticed a yellow tinge to the cooling water being discharged from the Hawkeye Rubber Company into Cedar Lake. A sample of the discharge was analyzed and high levels of total chromium and hexavalent chromium were detected. It was later determined that the chromium contamination was caused by a leaking deep pit tank, located at the Electro-Coatings, Inc. building annex (Rattenborg, 1976).

Hawkeye Rubber occupies 3.75 acres; it is located at 915 Shaver Road NE, in the Southwest 1/4 of Section 16, T83N, R7W, Linn County, Iowa. A detailed description of the Hawkeye Rubber property appears in Appendix A.

CURRENT OWNER

The owner of the site property is Shaver Road Investments. Shaver Road Investments is a partnership, filed by Mrs. Stella O. Mohr, Mr. Charles R. Earl, and Mrs. Helen J. Earl (Tetra Tech, 1987).
The property on which Hawkeye Rubber is located is owned by the Hawkeye Rubber Manufacturing Company (Linn County Deed Record).

GEOLGIC AND HYDROGEOLOGIC SETTING

GEOLOGY

The topography within the area of the site is generally flat and lies within the floodplain of the Cedar River.

In the vicinity of the site the bedrock is of Devonian age. The Devonian series is composed of the Wapsipinicon Formation (limestone and dolomite) and the La Porte City Chert (dolomite and chert) (Hansen, 1970).

The bedrock is overlain by alluvial deposits 10 to 20 feet thick. The alluvial deposits consist mainly of fine to medium silty sand, and a thin sandy silty clay with traces of gravel (IDNR, 1987).

SURFACE WATER

Cedar Lake is approximately 200 feet south of the Electro-Coatings plant. Cedar Lake is a 150 acre lake, with an average depth of less than 5 feet and a maximum depth of about 15 feet. The lake bottom is composed primarily of soft mud (McDonald, 1984).

The lake is privately owned by the Iowa Electric Company. The lake receives substantial amounts of urban and suburban runoff. It has been used as a discharge point for industries located near the lake. The Hawkeye Rubber facility had been discharging its cooling water into the lake up until March 8, 1976. The Cedar Rapids Waste Water Treatment Plant now receives Hawkeye Rubber's wastewater (Rattenborg, 1979).

The lake is being developed into a recreational area for the city of Cedar Rapids. (IDNR, 1987). The lake supports a diverse and productive fishery (McDonald, 1984).

The Cedar River is located about 1200 feet west of the site. It flows generally to the southeast. The river is a recreation resource to the area and is used by local residents for boating and fishing.

The site is in the 500-year floodplain of the Cedar River (FEMA, 1982).

GROUNDWATER

The bedrock aquifer in the vicinity of the Electro-Coatings site is the Silurian-Devonian aquifer. This aquifer is
interconnected with the alluvial aquifer which is directly above it (Hanson, 1970). The bedrock aquifer is composed of Devonian-age dolomites, which have a very low primary porosity. Fluid flow is principally along connected fissures and bedding planes (Bruner, 1986). The flow pattern of the aquifers is generally in a southwesterly direction toward the Cedar River (Bruner, 1986).

The groundwater flow pattern in the Cedar Rapids area is affected by the Cedar River, which is a regional discharge point for the bedrock aquifer, and by two cones of depression. One of the cones of depression is in the industrial section of town, and is caused by a high concentration of industrial wells. The other cone of depression is caused by the city well field northwest of the site. These conditions make the groundwater flow pattern near the site very complex (Bruner, 1986).

The city of Cedar Rapids obtains its water from 42 alluvial wells located adjacent to the Cedar River. All of the wells are approximately 65 feet deep and range from about 50 to 500 feet from the river (WAWM, 1986).

The city water supply is a blended system; that is, the water from all the wells is mixed-together while being treated. The estimated average demand is 23 to 24 million gallons a day (mgd), with a maximum demand of 34 to 36 mgd (WAWM, 1986).

Forty out of the 42 city wells are located within three miles of the Electro-Coatings site (IDNR, 1986). The closest city well is City Well No. 6 of the east well field. It is 2000 feet west of the Electro-Coatings plant (Electro-Coatings, 1976). The location of the city's well fields are shown in figure 3. There are 20 wells in the east well field, 11 wells in the west well field, and 11 wells in the Seminole well field (IDWAWM, 1986). While the wells are mostly upgradient of the site, the drawdown from the wells is substantial (Bruner, 1986). The estimated population served by the Cedar Rapids water system is 108,987 people (IDWAWM, 1986).

The Hawkeye Rubber Company's wells are the closest industrial wells. Well No. 1 is located 400 feet west-southwest of the Electro-Coatings plant, at a depth of 60 feet. Well No. 2 is located 200 feet west-southwest of the Electro-Coatings plant at a depth of about 150 feet (Electro-Coatings, 1976). The Hawkeye Well No. 1 was drilled into 15 feet of alluvial material and penetrates approximately forty feet of the Devonian bedrock (Bruner, 1986). Hawkeye Well No. 1 can be pumped at 100 gallons per minute (Roberts, 1986). The locations of the Hawkeye Rubber Company wells are shown in figure 4.
SITE HISTORY

In March 1976, an employee of the Cedar Rapids water treatment plant noted a yellow tinge in the cooling water discharge from the Hawkeye Rubber Company. Samples were collected and high levels of total and hexavalent chromium were found (Rattenborg, 1976).

Electro-Coatings examined their plant building and found that the chromic acid solution level was dropping eight inches every night in their deep pit tank, located at the southwest end of their building annex. Soil samples were taken confirming the contaminant source.

The 4-feet by 5-feet by 12-feet deep tank was removed and found to have numerous leaks. The concrete-lined pit that the tank was set in was completely eaten away in areas where the tank was leaking. The tank had been installed in 1968 and the leaks developed between 1968 and 1976 (Electro-Coatings, Inc., 1976).

In April 1976, Electro-Coatings Inc., acting on a suggestion by the City Water Department, initiated a chemical addition program to reduce the hexavalent chromium in the soil to the less toxic trivalent chromium. Electro-Coatings constructed a deep pit. Approximately 18,000 pounds of ferrous sulfate and 6,600 pounds of sulfuric acid were added to the pit and rinsed into the soil (Electro-Coatings, 1976).

In June 1977, an Executive Order was issued by the Iowa Department of Environmental Quality. The order required Electro-Coatings to monitor the Hawkeye Rubber Company Wells 1 and 2, to install monitoring wells, and to submit monthly sample results to the Water Quality Management Division of the Department (IDEQ, 1977).

In April 1978, two monitoring wells were installed and sampled. The wells were drilled to a depth of 21 1/2 feet and 28 1/2 feet, reaching the top of the limestone bedrock. The location of monitoring wells 1 and 2 are shown in figure 4. The sampling program was conducted until February, 1979. No data were submitted by the company since that date (IDEQ, 1982).

The Cedar Rapids wastewater treatment plant collected samples from the Hawkeye Rubber Well No. 1 on December 15, 1982 and January 7, 1983. The results showed that trivalent and hexavalent chromium levels of up to 11 mg/l were still present (Baumgarm, 1983).

On January 7, 1983, analyses of samples collected from Hawkeye Rubber Company Well No. 1 showed the presence of cyanide. The contamination was due to cadmium plating operations at the Electro-Coatings, Inc. facility. This process was eventually eliminated (Baumgarm, 1983).
In May 1983, two additional monitoring wells were installed along the shoreline of Cedar Lake. A fifth monitoring well was installed west of the Electro-Coatings, Inc. building in 1985. The depth of the wells are unknown (Roberts, 1986). The locations of the monitoring wells are shown in figure 4.

In July 1986, the Iowa Department of Water, Air and Waste Management submitted the Electro-Coatings site to the Environmental Protection Agency for the seventh update of the National Priorities List (Stokes, 1986).

In September 1986, a Hazard Ranking Score of 42.24 was given to the Electro-Coatings site (IDNR, 1987).

On September 30, 1986, the Iowa Department of Natural Resources conducted a site inspection of the Electro-Coatings site to determine if chromium contamination still existed at the site. Water was collected from the monitoring wells and from the Hawkeye Rubber Company wells. Water and sediment samples also were collected from Cedar Lake (IDNR, 1987).


**WASTES**

The waste is a chromic acid solution used in chromium plating. The chromic acid has high concentrations of hexavalent chromium and some trivalent chromium (IDNR, 1987).

The quantity of chromic acid solution leaked into the groundwater from the deep pit tank is unknown. It was noted that the solution level in the tank was dropping eight inches every night and that a large quantity had leaked out before the loss was discovered. It is probable that much more than one tank-full of chromic acid solution had leaked out based on the state of the pit's deterioration. However, assuming one tank-full had leaked out, a quantity of 8.88 cubic yards can be estimated (IDNR, 1986).

The specific gravity of the chromic acid solution is heavier than water and the solution would sink to the bedrock. The contaminant would flow through conduits within the bedrock and would follow the natural gradient of the bedrock. Monitoring wells would be expected to miss the contaminant movement into the bedrock if they are not at that same level or do not intersect fractures in the bedrock (Roberts, 1986b).

Chromium tank sludge had at one time been dumped regularly at the site. The amount and the number of years the sludge was dumped is unknown. The sludge was reportedly dumped
within 40 feet behind the Electro-Coatings building (Electro-Coating, 1976).

Electro-Coatings Inc., in their attempt to reduce the hexavalent chromium in the soil, dumped 18,000 pounds of ferrous sulfate and 6,600 pounds of sulfuric acid into a deep pit (Electro-Coatings, 1976). Sulfuric acid is a very corrosive chemical.

It also was reported in 1983 that a cadmium plating line of the company was leaking and that cyanide was found in the Hawkeye well no. 1. The company shut down the cadmium plating line at that time (Baumgarm, 1983).

**ACTUAL OR POTENTIAL CONTAMINANT LEVELS IN VARIOUS MEDIA**

**SURFACE WATER**

Two surface water samples collected from Cedar Lake during the September 1986 site investigation. The samples were collected near the Hawkeye Rubber Company at sites "K" and "J". The approximate sample locations are shown in figure 4. Sample analysis showed metal levels generally below detection limits (IDNR, 1987).

**GROUNDWATER**

**HAWKEYE RUBBER COMPANY**

The Hawkeye Rubber Company wells have been monitored since March 1976, when the leak was discovered. Hawkeye Well No. 1 was first sampled every two days, then weekly, and finally monthly until August 1979. Since this time, the well had been sampled three times. Table 1 shows, on a monthly basis, the highest concentrations of total chromium and hexavalent chromium found in Well No. 1 (IDNR, 1987).

On January 7, 1983, cyanide was detected at 0.24 mg/l in a sample collected from Hawkeye Well No. 1. The contaminant was identified as coming from the cadmium plating operations at Electro-Coatings, Inc. (Baumgarm, 1983). The U. S. Public Health Service has recommended that concentrations of cyanide in drinking water not exceed .02 mg/l (USEPA, 1985).

At first, Hawkeye Well No. 2 was sampled when Well No. 1 was sampled. However, it was discovered that Hawkeye Well No. 1 and 2 were cross-connected by internal piping. After the problem was corrected, Well No. 2 showed levels of hexavalent chromium and total chromium at less than 0.1 mg/l (IDNR, 1987).

Hawkeye Wells 1 and 2 were sampled during a site investigation in September 1986. Samples were taken from a sampl-
ing tap on the pressure tanks. It was not certain how long the water sat in the pressure tank before the samples were taken. The sample analysis showed 1.3 mg/l total chromium and 1.3 mg/l hexavalent chromium in Well No. 1. Well No. 2 showed 0.67 mg/l total chromium and less than 0.05 mg/l hexavalent chromium (IDNR, 1987). The investigation report noted that Hawkeye Well No. 1 was not used as much as it had been in the past. The current use of the well was four to six hours daily (IDNR, 1987).

The drinking water criterion for hexavalent chromium is 0.050 mg/l. The maximum contaminant level (MCL) for total chromium in drinking water is 0.050 mg/l (USPHS, 1987a).
**TABLE 1**

**HAWKEYE RUBBER CO. WELL NO. 1**

**(mg/1)**

<table>
<thead>
<tr>
<th>Date</th>
<th>Hexavalent Chromium</th>
<th>Total Chromium</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/1976</td>
<td>11.0</td>
<td>18.0</td>
</tr>
<tr>
<td>4/1976</td>
<td>6.0</td>
<td>7.9</td>
</tr>
<tr>
<td>5/1976</td>
<td>5.0</td>
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<td>6/1976</td>
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<td>6.5</td>
</tr>
<tr>
<td>7/1976</td>
<td>5.5</td>
<td>7.5</td>
</tr>
<tr>
<td>8/1976</td>
<td>6.2</td>
<td>7.3</td>
</tr>
<tr>
<td>9/1976</td>
<td>6.5</td>
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</tr>
<tr>
<td>3/1983</td>
<td>11.0</td>
<td>11.0</td>
</tr>
</tbody>
</table>

The samples from Hawkeye Well No. 1 were analyzed by the Cedar Rapids Water Pollution Control Lab (IDNR, 1978).
MONITORING WELLS
Monitoring wells 1 and 2 were sampled in 1978 and were checked and resampled occasionally between 1979 and 1983. The amounts of total chromium and hexavalent chromium were generally found to be less than 0.1 mg/l. Monitoring wells 3 and 4 were installed in 1983 and all four monitoring wells were sampled at that time. Generally the levels of total chromium and hexavalent chromium were less than 0.01 mg/l. The highest levels were detected on January 25, 1983. The levels for total chromium were reported at 0.23 mg/l for monitoring well no. 1 and 0.05 mg/l for well no. 2. Monitoring well no. 2 showed total chromium at 0.13 mg/l on March 24, 1983. The October sampling found 0.08 mg/l total chromium in well no. 3 and 0.02 mg/l total chromium in well no. 4 (IDNR, 1987). There is no information available concerning the background levels of chromium in the aquifers of concern.

During the September 1986 site investigation, all five monitoring wells were sampled. It was noted that monitoring well no. 3 had been broken off at the top and monitoring well no. 5 had its top missing. Thus, the wells were open to the atmosphere prior to being sampled (IDNR, 1987). A water sample was collected from the Hillary Erickson Well to serve as a background sample. The depth of this well is not known. Water also was collected from City Well No. 1 of the East Well Field (IDNR, 1987). Sample analysis results are shown in Table 2.

TABLE 2
GROUNDWATER ANALYSIS RESULTS
September 1986
(mg/l)

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CADMIUM</th>
<th>TOTAL CHROMIUM</th>
<th>HEXAVALENT CHROMIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well No. 1</td>
<td>0.53</td>
<td>0.03</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Well No. 2</td>
<td>0.08</td>
<td>0.06</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Well No. 3</td>
<td>&lt;0.02</td>
<td>0.10</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Well No. 4</td>
<td>&lt;0.02</td>
<td>0.07</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Well No. 5</td>
<td>0.23</td>
<td>1.3</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>City Well No. 1</td>
<td>&lt;0.02</td>
<td>&lt;0.02</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Hillary Erickson Well</td>
<td>&lt;0.02</td>
<td>&lt;0.02</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Field Blank</td>
<td>&lt;0.02</td>
<td>&lt;0.02</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>
Four of the five monitoring wells had total chromium levels higher than the MCL of 0.05 mg/l for drinking water (USPHS, 1987a). Cyanide was reported at levels below the detection limit (IDNR, 1987). Three of the monitoring wells had levels of cadmium higher than the 0.010 mg/l MCL for drinking water (USPHS, 1987b).

The analytical results show that the contaminant plume containing chromium and cadmium is present at the monitoring well locations. The wells may be monitoring the top of the plume. The levels of chromium and cadmium may be much higher than what the monitoring well are showing because of the shallowness of the monitoring wells. It is not known how far the plume may have traveled since its outermost extent has not been identified and the heaviest part of the contaminant plume has not been monitored for the last ten years (IDNR, 1987).

SOIL

An examination of the Electro-Coatings plant in March 1976 revealed that numerous areas in the plating area floor were deteriorated by acid contact and were open directly to the soil. To measure the magnitude of soil contamination below the floor areas, soil samples were collected from three of the most deteriorated areas. Two of the soil samples were taken at 5 and 6 feet depths. Analysis showed total chromium at 19 mg/l and 8.1 mg/l for the samples, and hexavalent chromium at less than 0.1 mg/l for the samples. A third sample was taken at a depth of 12 feet at the water table. It contained 7.3 mg/l total chromium and 0.2 mg/l hexavalent chromium (Electro-Coatings, 1976).

A soil sample also was collected from an area 40 feet from the back of the Electro-Coatings building. Chromium tank sludge had been dumped at this location regularly in previous years. The sample was taken at a depth of 5 feet. Analysis showed 45 mg/l total chromium and 3.6 mg/l hexavalent chromium (Electro-Coatings, 1976). Another soil sample was taken outside the building that houses the deep pit tank. The sample was collected at a depth of 12 feet at the water table. The soil at this level was orange. Water from the sample showed 810 mg/l total chromium and 730 mg/l hexavalent chromium (Electro-Coatings, 1976). The results were reported in mg/l rather than in mg/kg as would normally be reported for soils. Therefore, it is not known if the results refer to soil concentrations or to extracted water concentration.

SEDIMENT

On January 25, 1983, two sediment samples were collected from Cedar Lake at the Hawkeye Rubber Company property.
Analysis of samples showed 9.8 mg/kg total chromium at site "K" and 26 mg/kg total chromium at site "J" (Baungarm, 1983). The approximate sample locations are shown in figure 4.

Two sediment samples were collected during a site investigation in September 1986. Samples were collected at the approximate locations shown in figure 4, corresponding to the samples collected during the 1983 sampling. Analysis of samples showed total chromium to be 28 mg/kg at site "K" and 68 mg/kg total chromium at site "J" (IDNR, 1987).

There is another electroplating company called All-Brite Chrome Plating Company located on the east shore of Cedar Lake. The location of this company is shown in figure 2. Sediments collected in the lake near this company show total chromium levels at 71.0 mg/kg (McDonald, 1984). This chromium level is higher than those found at the Electro-Coatings site. Sediment samples collected in the center of Cedar Lake show total chromium at 100 mg/kg (McDonald, 1984). The approximate sample locations are shown in figure 4. This suggests that Electro-Coatings is not the sole source of the chromium pollution in Cedar Lake.

**TOXICITY AND ENVIRONMENTAL FATE OF CONTAMINANTS**

Informational summaries concerning the toxicity, including the health effects, and the environmental fate of the contaminants observed at the Electro-Coatings Inc. site appear in Appendix A.

**POPULATION AND LOCATION OF SIGNIFICANT FEATURES**

According to the 1980 Census the population for Cedar Rapids is 110,243 people. Cedar Rapids is partially bordered on the north by the cities of Hiawatha (population 4,825) and Robins (population 726), and on the northeast by the city of Marion (population 19,474).

Forty of the 42 Cedar Rapids wells are within three miles of the Electro-Coatings site. The estimated population served by the Cedar Rapids water system is 108,987 people. In addition, 190 more people are served by this system since the Cedar Rapids water department sells water to the Glenbrook Cove area located within the Marion city limits. There is no alternative source of drinking water that can meet the maximum daily demand of the city. The city has one surface water intake; however, this intake was shut down because of taste and odor problems associated with the river. The city needs approximately 17 operating wells to meet the average daily demand of Cedar Rapids (IDNR, 1987).


Iowa Department of Environmental Quality (IDEQ). 1977. "Order of the Executive Director." Order No. 77-WQ-017. DNR Files: Con 12-15 Electro-Coatings, Inc.


U. S. Public Health Service (USPHS). 1987a. *Toxicological Profile for Chromium (Draft).*

U. S. Public Health Service (USPHS). 1987b. *Toxicological Profile for Cadmium (Draft).*
Cedar Rapids South, Iowa

Site Location

Figure 1
FIGURE 3

CEDAR RAPIDS WELL FIELDS LOCATIONS

Water Distribution System Map for Cedar Rapids

SCALE
1 inch = 2000 feet
SAMPLING LOCATIONS

A - Well No. 1
B - Well No. 2
C - Well No. 3
D - Well No. 4
E - Well No. 5
F - Hawkeye Rubber Well No. 2
G - Hawkeye Rubber Well No. 1

H - City Well No. 1 - East Field
I - Hillary Erickson Well
J - Cedar Lake - Midpoint of Hawkeye Rubber Co. Property
K - Cedar Lake - East Edge of Hawkeye Rubber Co. Property
L - Cedar Lake - Center of Lake
M - Cedar Lake - Near All-Brite Chrome Plating Company

*Buildings are identified in figure 2.

FIGURE 4
APPENDIX A

SITE DESCRIPTION

ELECTRO-COATINGS INC.,

Electro-Coatings Inc. is located at 911 Shaver Road NE in Cedar Rapids, Iowa. The property is described in the Cedar Rapids Auditor's Plat Book 49 as Lot 1 with dimensions of 60 feet, by 406 feet, by 296 feet, by 290 feet (approximately one acre). Located in the SW 1/4 of Section 16, T83N, R7W of Linn County, Iowa.

HAWKEYE RUBBER MANUFACTURING COMPANY

Hawkeye Rubber Company is located at 915 Shaver Road NE Cedar Rapids, Iowa. The property is described in the Deed Record, Linn County, Vol. 806 as follows:

The following described premises in the County of Linn, State of Iowa, to-wit: A part of the SW 1/4 of Section 16, T83N, R7W, more particularly as follows: Beginning at the NW corner of Lot 1, Auditor's Plat No. 49, Cedar Rapids, Iowa, as recorded in the records of Linn County, Iowa; thence South along the West line of said Auditor's Plat No. 49, Cedar Rapids, Iowa, 331.7 feet; thence NW-ly angle 91° 36' to the right from the West line of said Auditor's Plat No. 49, Cedar Rapids, Iowa, 493 feet; thence North angle 88° 24' to the right from the last described course 331.7 feet; thence E-ly angle 91° 36' to the right from the last described course 493 feet to the point of beginning.

RE: 90090026
APPENDIX B

TOXICITY AND ENVIRONMENTAL FATE SUMMARIES

CADMIUM

CHROMIUM

CYANIDE
GENERAL

Cadmium is a naturally occurring element that is usually encountered as stable compounds with such elements as oxygen, chlorine or sulfur (USPHS, 1987). Biologically, cadmium is a nonessential, nonbeneficial element (USEPA, 1976) that has a cumulative and highly toxic effect on man in all its chemical forms (Environment Canada, 1979). Because of the sensitivity of certain species, the criteria necessary to protect freshwater fish and other aquatic life are more stringent than the standards necessary to protect human health (USEPA, 1976).

HUMAN TOXICITY (USPHS, 1987)

Acute exposure to cadmium compounds is highly irritating to the surface cells of the stomach, intestines, and the respiratory tract. However, acute exposures are unlikely, even in an occupational setting.

The principal public health concern is for chronic low-level exposure to cadmium by either the oral or inhalation route. Dermal exposure is not considered a significant health concern.

There is a strong tendency for cadmium to accumulate in the body (estimated half life of 17 to 38 years), with preferential accumulation in the kidney and liver. The kidney is generally recognized as the most sensitive target for systemic damage from low-level cadmium exposure. Protection of this organ is the design basis of the drinking water standard for cadmium.

The chief effect of cadmium caused kidney damage is impairment of tubular reabsorption of filtered solutes. While this is usually not life threatening, it can result in painful bone resorption and kidney stone formation. Cadmium has been observed to cause high blood pressure in animals, but its role in human cardiovascular disease remains uncertain.

There is no evidence linking oral cadmium exposure and carcinogenic effects in animals or humans. However, cadmium is a probable human carcinogen (Group B1) for inhalation exposure. There is limited evidence for humans and sufficient evidence for animals that cadmium is carcinogenic by the inhalation route. Lung damage, such as fibrosis or emphysema, is also associated with chronic exposure to low levels of cadmium in air.

ENVIRONMENTAL TOXICITY (USEPA, 1985)

The acute and chronic effects of cadmium have been studied for both freshwater aquatic life-forms. Freshwater acute values for cadmium range from 1.0 ug/L for rainbow trout to 28,000 ug/L for a mayfly. Daphnia magna had the lowest chronic test results, 0.15 ug/L. Freshwater aquatic plants are affected by cadmium at concentrations ranging from 2 to 7,400 ug/L.
Increasing water hardness reduces the toxicity of cadmium to freshwater aquatic organisms. For this reason, the Water Quality Criteria for cadmium has an adjustment factor for hardness. It is indicated by some data, that sensitive species such as brook trout and brown trout might not be protected by the Water Quality Criteria.

ENVIRONMENTAL FATE (USPHS, 1987)
Compared to most other heavy metals, cadmium is relatively mobile in surface water. However, the sulfide of cadmium has a very low solubility product. Therefore, reducing conditions that yield sulfide, tend to remove cadmium as a cadmium sulfide precipitate. Exposure of this sediment to oxygen could reverse this process. Cadmium concentrations tend to be inversely related to the pH value and the amount of organic material present. Cadmium does not form volatile compounds in surface water.

Groundwater concentrations of cadmium tend to be kept low by several processes. These include sorption by mineral matter and clay and binding by humic substances. Precipitation occurs as cadmium sulfide in the presence of sulfide and as the carbonate at relatively high alkalinities.

Cadmium is strongly accumulated by plants and animals. Bioaccumulation of cadmium in feed crops, mainly because of the use of cadmium containing fertilizers, results in higher cadmium levels in beef and poultry. The various aspects of bioaccumulation has important health implications for human exposure.

REGULATORY AND ADVISORY LIMITS
The Primary Drinking Water Standard (MCL) and the Ambient Water Quality Criteria to Protect Human Health for cadmium are both 0.010 mg/L. The proposed Maximum Contaminant Level Goal (MCLG) for cadmium is 0.005 mg/L. The MCLG is a nonenforceable guideline which is solely based on a consideration of health effects. The MCLG was not proposed as zero because there is no evidence linking ingestion of cadmium with carcinogenic effects in animals or humans (USPHS, 1987).

The National Water Quality Criteria for the Protection of Aquatic Organisms uses a formula that adjusts for freshwater hardness. For example, at hardnesses of 50 and 200 mg/L as CaCO3 the criteria four-day average concentrations of cadmium are 0.66 and 2.0 ug/L (USEPA, 1985).
REFERENCES


GENERAL INFORMATION
Chromium (Cr) is a naturally occurring element that forms a hard, silver-gray metal. It is used commercially in the manufacture of metal alloys, electroplating, refractory brick making, pigments, chemicals, leather tanning, and textiles. Chromium occurs in two common valence states, Cr(III) and Cr(VI) (USEPA, 1987; USPHS, 1987).

All stable Cr(VI) compounds are quite toxic and will strongly oxidize organic matter on contact. In contrast, Cr(III) is considerably less toxic and is an essential nutrient required in trace quantities. A normal diet meets this need, providing 50-200 ug/day of Cr(III). Most drinking water supplies contain less than 5 ug/L total chromium (both valence states). Both forms of chromium can enter the body through inhalation, ingestion, and skin and eye contact (USEPA, 1987; USPHS, 1987; NIOSH/OSHA, 1981; Goyer, 1986).

HUMAN TOXICITY
Cr(VI) is irritating and corrosive to all tissues. Oral exposure to it can damage the kidneys, liver, immune system, and nervous system. Symptoms of acute exposure include nausea, vomiting, diarrhea, internal hemorrhage, shock, coma, and death (USEPA, 1987; USPHS, 1987). Doses of 0.5 to 1.5 grams of potassium dichromate have been fatal to humans. The estimated lowest lethal dose for this compound in children is 9.2 mg/kg as Cr (USEPA, 1987). Little is known concerning chronic oral exposure to chromium. A volunteer who drank water for 14 days containing 5 mg/L Cr(VI) developed mild nausea (USPHS, 1987).

When damaged skin is extensively exposed to Cr(VI), the result can be rapid absorption causing kidney damage and fatal poisoning (Smith and Blough, 1983; USPHS, 1987). Exposure of Cr(VI) to intact skin can produce ulcers and dermatitis. Chronic dermal exposure to Cr(III) or Cr(VI) can hypersensitize a person, resulting in allergic dermatitis with eczema (USPHS, 1987). Chronic exposure to the eyes can cause eye lesions (Smith and Blough, 1983).

The carcinogenicity of inhaled Cr(VI) is well established. Animal experiments suggest a weak carcinogenic effect for some Cr(III) compounds when inhaled. There is no evidence associating ingestion or contact exposure of chromium with any cancer (USEPA, 1987; USPHS, 1987). Both Cr(VI) and Cr(III) are considered mutagenic, although the evidence concerning Cr(III) is weak (USEPA, 1987; Goyer, 1986). The presence of Cr(VI) increases the genotoxic potential of some viruses, zinc, and benz(a)pyrene (USPHS, 1987).

ENVIRONMENTAL TOXICITY
Oral LD50 values in rats for soluble Cr(VI) compounds range from 16.7 to 22.5 mg/kg. Oral LD50 values for Cr(III) compounds range from 422 to 2370 mg/kg. Cr(VI) also exhibits
dermal toxicity among animals. The dermal exposure LD50 values in rabbits for Cr(VI) compounds range from 397 to 677 mg/kg (USPHS, 1987).

The acute toxicity values for Cr(VI) for freshwater animal species range from 23.1 ug/L for a cladoceran to 1,870,000 ug/L for a stonefly. Obviously, there is a great amount of interspecies variation in sensitivity to Cr(VI). The toxicity of Cr(VI) appears to decrease as water hardness and/or pH increases. The acute toxicity values for Cr(III) for freshwater animal species range from 2221 ug/L for a mayfly to 71,060 ug/L for a caddisfly. Cr(III) is much more toxic as water hardness decreases (USEPA, 1985a).

Growth retardation is observed in chinook salmon and rainbow trout at Cr(VI) concentrations of 16 and 21 ug/L, respectively (USEPA, 1985a).

Among aquatic plants, Cr(VI) causes growth retardation for a blue alga at 2 ug/L. Cr(VI) inhibits photosynthesis of a natural population of river algae exposed to 20 ug/L. Other aquatic plants can tolerate considerably greater concentrations of Cr(VI). There is a lack of similar information concerning Cr(III), but it is thought to be less toxic to aquatic plants (USEPA, 1985a).

Cr(III) is bioaccumulated by a variety of aquatic organisms, especially some plants and invertebrates. It can be transferred through the natural food chain (USEPA, 1979).

ENVIRONMENTAL FATE
Cr(III), when in solution at pH greater than 5, quickly precipitates due to formation of the insoluble hydroxide or oxide. Sorption processes and bioaccumulation will remove any remaining Cr(III) from solution (USEPA, 1979).

Cr(VI) is quite soluble, staying in solution regardless of pH or the presence of other ions. These chromium compounds are quite mobile in the aqueous environment. Cr(VI) is not adsorbed to any significant degree by clays or other inorganic compounds. In waters with pH greater than 6.5, it will exist in the form of the chromate ion, which is a strong oxidizing agent. This eventually reacts with organic matter or aqueous hydroxide, reducing to insoluble Cr(III) compounds. Thus, precipitation to the bed sediments is the dominant fate of chromium in natural waters (USEPA, 1979). The insoluble forms persist indefinitely in sediments and soils (USPHS, 1987).

REGULATORY AND ADVISORY LIMITS
A series of health advisories (HA) for drinking water have been issued for total chromium, conservatively based on the effects of Cr(VI). The Ten-day HA for a 10-kg child is 1400 ug/L. The Lifetime HA is 120 ug/L (USEPA, 1987).
The oral Reference Dose (RfD) for Cr(VI) is 0.005 mg/kg/day. The oral RfD for Cr(III) is 1 mg/kg/day (USPHS, 1987).

The drinking water criterion for Cr(VI) is 50 ug/L (USPHS, 1987). The maximum contaminant level for total chromium in drinking water is 50 ug/L, while the proposed maximum contaminant level goal for total chromium (VI and III) in drinking water is 120 ug/L (USPHS, 1987; USEPA, 1985b).

The Water Quality Criteria (WQC) for protecting freshwater aquatic organisms limits the four-day average concentration of Cr(VI) to 11 ug/L and the one-hour average concentration to 16 ug/L. The WQC for Cr(III) are affected by the water hardness. For example, at hardnesses of 50 and 200 mg/L as calcium carbonate, the four-day averages are 120 and 370 ug/L, respectively, and the one-hour averages are 980 and 3100 ug/L, respectively (USEPA, 1985a).

REFERENCES


U.S. Environmental Protection Agency (USEPA). 1979. Water-Related Environmental Fate of 129 Priority Pollutants. (EPA-440/4-79-029a,b)


GENERAL INFORMATION
Cyanides are a group of organic and inorganic compounds that contain the cyano (CN) group. Free cyanide is the sum of cyanide present as hydrogen cyanide (HCN) and as the cyanide anion. Organic cyanides are called nitriles. Other cyanide compounds include the inorganic salts and metallo cyanide complexes (USEPA, 1985b, 1987).

Cyanides are naturally occurring substances, but most cyanide found in the environment comes from industrial sources (USPHS, 1988). Cyanide is relatively uncommon in U.S. drinking water. The highest reported concentration is 8 μg/L. Commercially, cyanide is used in pest poisons, metal polishes, photographic solutions, fumigation products, electroplating, and the production of various chemicals and resins (USEPA, 1985b, 1987).

The cyanides exhibit different toxicities. Free cyanide is the most toxic and the best studied. The nitriles generally are much less toxic (USEPA, 1979). The toxicity data presented here are expressed in terms of free cyanide as CN. Cyanide is readily absorbed by inhalation, ingestion, and skin contact (Sittig, 1985; USEPA, 1985b, 1987).

HUMAN TOXICITY
Once absorbed, cyanide is distributed rapidly by the blood throughout the body. Low levels of cyanide can be detoxified and eliminated. If too much cyanide enters the body, it is capable of rapidly stopping cellular respiration by blocking the transfer of oxygen (NIOSH/OSHA, 1981; USEPA, 1985b, 1987; USPHS, 1988). An acute oral dose produces symptoms of weakness, headache, confusion, nausea, and vomiting. Larger doses also cause rapid breathing, gasping, tremors, convulsions, coma, and respiratory arrest leading to death (Sax, 1984; NIOSH/OSHA, 1981; USEPA, 1987; USPHS, 1988). Large enough doses can cause death in minutes (USEPA, 1987). An oral LD50 of 1.52 mg/kg CN is reported for humans. The lowest reported fatal oral dose is 0.56 mg/kg CN (USPHS, 1988).

Chronic exposure to low levels of cyanide results in nervous system effects, such as deafness, visual problems, and loss of muscle coordination. It also results in thyroid gland effects, such as retarded physical and mental growth in children (USPHS, 1988). Other reported effects of chronic exposure include loss of appetite, headache, dizziness, and weakness (Sax, 1984; USEPA, 1987).

Cyanides are moderately lipid-soluble, allowing them to penetrate the skin. Exposure of the skin to strong cyanide solutions can cause itching and ulceration. The dust of cyanide salts can irritate the eyes (NIOSH/OSHA, 1981; Sax 1984; USPHS, 1988).

ENVIRONMENTAL TOXICITY
All animals must either metabolize cyanide quickly or suffer its toxic effects. The oral LD50 for sodium cyanide in the rat is 3.4 mg/kg CN. An oral dose of 1.5 mg/kg CN is fatal to the dog. Animals can tolerate much higher doses when the cyanide is mixed
in the diet or drinking water. Rats tolerated 25 daily doses of 4 mg/kg CN when mixed in the diet (USEPA, 1987; USPHS, 1988).

The toxicity of cyanide compounds to aquatic organisms is due mainly to the presence of free cyanide (USEPA, 1985a). Fish exhibit a relatively narrow range of sensitivities. Lethal concentrations of free cyanide range from 50 ug/L for the brook trout to 180 ug/L for the fathead minnow. The toxicity of free cyanide increases as the dissolved oxygen concentration decreases or as the temperature decreases. Chronic effects in fish have been reported for concentrations as low as 7.85 ug/L (USEPA, 1976, 1985a).

Invertebrates generally are less sensitive to acute doses than are fish. Aquatic plants exhibit a wide range of sensitivities, but generally are less sensitive than aquatic animal species (USEPA, 1985a).

ENVIRONMENTAL FATE
Cyanides are a diverse group of compounds whose fate in the environment varies widely. In the aquatic environment cyanides are biodegraded by almost all organisms. At pH 9.2 or less, most of the free cyanide is HCN, which is quite volatile. Simple metal cyanides are insoluble and probably accumulate in the sediments. Metallocyanide complexes are quite soluble and can be transported in solution. These compounds also tend to be mobile in soils, due to their ready solubility (USEPA, 1979).

The stability of the metallocyanide complexes is highly variable. The zinc and cadmium complexes are not stable, while the cobalt complex is extremely stable. The iron complexes are quite stable, but subject to photodecomposition when exposed to sunlight, releasing free cyanide (USEPA, 1976, 1979).

REGULATORY AND ADVISORY LIMITS
A lifetime Health Advisory for exposure to cyanide in drinking water is set at 154 ug/L (USEPA, 1987). The U.S. Public Health Service has recommended that concentrations of cyanide in drinking water not exceed 200 ug/L (USEPA, 1987).

The Ambient Water Quality Criteria to protect freshwater aquatic organisms limits the four-day average concentration of cyanide to 5.2 ug/L and limits the one-hour average to 22 ug/L (USEPA, 1985a).

REFERENCES


U.S. Environmental Protection Agency (USEPA). 1979. *Water-Related Environmental Fate of 129 Priority Pollutants.* (EPA-440/4-79-029a,b)


