

Health Consultation

SOUTHWEST WIRE ROPE, INC. NOTIFICATION SITE

NEW IBERIA, IBERIA PARISH, LOUISIANA

EPA FACILITY ID: LAR000015560

MARCH 9, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

Division of Health Assessment and Consultation

Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

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Prepared by:

Louisiana Department of Health and Hospitals
Office of Public Health
Section of Environmental Epidemiology and Toxicology
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

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List of Acronyms

| | |
|-----------|--|
| AT | averaging time |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| BW | body weight |
| COC | contaminant of concern |
| CSF | cancer slope factor |
| CW | contaminant concentration in water |
| DHAC | Division of Health Assessment and Consultation |
| ED | exposure duration |
| EF | exposure frequency |
| EPA | United States Environmental Protection Agency |
| IR | ingestion rate |
| kg | kilogram |
| L/day | liters per day |
| LDEQ | Louisiana Department of Environmental Quality |
| LDHH | Louisiana Department of Health and Hospitals |
| mg | milligram |
| mg/kg/day | milligrams per kilogram per day |
| mg/L | milligrams per liter |
| NOAEL | no-observed-adverse-effects level |
| OPH | Office of Public Health |
| PC | permeability constant |
| RECAP | Risk Evaluation/Corrective Action Program |
| RfD | reference dose |
| SEET | Section of Environmental Epidemiology and Toxicology |
| yr | year |

Summary and Statement of Issues

In August of 2004, a family residing in New Iberia, Louisiana, received a letter of notification from the Louisiana Department of Environmental Quality (LDEQ) informing them of groundwater contamination in a monitoring well located on land abutting their property. The letter stated that four contaminants of concern (COCs), including arsenic, were detected in the monitoring well (designated MW-2), which lies on property currently occupied by Southwest Wire Rope, Inc. (also known as South West Wire Rope, Inc.) [1]. These COCs were present at concentrations that exceed LDEQ Risk Evaluation/Corrective Action Program (RECAP) screening standards for groundwater samplings. The LDEQ letter was followed by an offer from the Louisiana Department of Health and Hospitals/Office of Public Health/Section of Environmental Epidemiology and Toxicology (LDHH/OPH/SEET) to address any public health related questions this family might have regarding this site [2].

Following receipt of these letters, a member of this family contacted LDHH about concerns over the family's health. The family member said that until they received the letter of notification from the LDEQ, the family's entire water supply was retrieved from a private well adjacent to the Southwest Wire Rope Inc. property. Since learning about the site contaminants, the family has been drinking bottled water, but they still use the well water for all other purposes because their property is not linked to New Iberia's municipal water supply.

The LDEQ sampled the family's private well on September 9, 2004. None of the COCs found in Southwest Wire Rope, Inc. monitoring well MW-2 were detected in the private well. However, until modeling of groundwater flow at the site is completed, the possibility remains that water contaminated with these COCs may migrate off-site. The LDHH/OPH/SEET, in partnership with the Agency for Toxic Substances and Disease Registry (ATSDR), reviewed the COC concentrations measured from MW-2 to estimate whether daily exposure to these concentrations would pose a threat to human health and to identify what further public health actions, if any, may be needed.

Background

Site Description and History

Southwest Wire Rope, Inc. is located at 1404 Highway 90 in New Iberia, Louisiana. The company primarily stores, handles, and distributes wire rope, rigging, and hoisting equipment. In March 2002, as part of a due diligence process to evaluate the environmental condition of the site, the company hired Geosyntec Consultants to perform a site assessment and soil sampling. In December 2002, the company hired C-K Associates to perform five additional soil borings and install one monitoring well on the site. Additional groundwater sampling activities were performed by February of 2003. In September 2003, C-K Associates installed four additional monitoring wells and performed additional soil sampling to delineate the horizontal and vertical extent of COCs in the groundwater on the site [1].

Table 1: Contaminants of Concern Exceeding RECAP Screening Standards

| Contaminant of Concern (COC) | RECAP Screening Standard (mg/L [*]) | MW-2 Concentration (mg/L) | Neighboring Private Well Concentration (mg/L) |
|------------------------------|---|---------------------------|---|
| Arsenic | 0.010 | 0.368 | ND [†] |
| 1,1-Dichloroethene | 0.007 | 0.066 | ND |
| Cis-1,2-Dichloroethene | 0.070 | 0.13 | ND |
| Vinyl Chloride | 0.002 | 0.063 | ND |

* mg/L = milligrams per liter

[†]Not detected

Adapted from: Louisiana Department of Environmental Quality. Notification to a New Iberia family from Kyle S. Blanchard concerning contamination at South West Wire Rope, Inc. property. New Iberia, Louisiana. August 2, 2004.

Analysis of the resulting data indicated groundwater as the media of concern. The four COCs identified in the groundwater were arsenic (0.368 milligrams per liter [mg/L]), 1,1-dichloroethane (0.066 mg/L), cis-1,2-dichloroethane (0.13 mg/L), and vinyl chloride (0.063 mg/L). As illustrated in Table 1, all of these concentrations exceed RECAP screening standards, which are levels identified by the LDEQ above which contaminants would pose unacceptable risks to human health or the environment. Chlorinated solvents have not been used at Southwest Wire Rope, Inc. since the mid-1980s, and there is no evidence that chlorinated solvents were ever spilled at the site. No distinct source of arsenic or other metals is known to have existed on the site. The contamination found at the site is therefore considered to originate from an unknown historical source [1, 3].

The LDEQ noted that, due to the nature of groundwater flow, these contaminants may already have migrated underground from the current Southwest Wire Rope, Inc. property to off-site areas. A private well adjacent to the MW-2 monitoring well was tested for contamination on September 9, 2004. None of the COCs found in the monitoring well were detected in water samples from the private well. To identify the possibility of future migration of the COCs off-site, the LDEQ has asked that C-K Associates continue to characterize the direction of groundwater flow on the Southwest Wire Rope, Inc. property. Following LDEQ procedures, the COCs identified at the Southwest Wire Rope, Inc. site will undergo further investigation, and cleanup standards will be developed for application at the site [1, 4].

Demographics

The three incorporated communities in Iberia Parish, Louisiana are Jeanerette, Loreauville, and New Iberia. Census 2000 results record a parish population of 74,146. The largest ethnic group in the parish at that time was Caucasian (65.1%), followed by African-American (30.8%), Asian (1.9%), and American Indian or Alaska Native (0.3%), with the remaining 0.6% reporting as Other. Of the population age 25 years or older in 2000, 66.9% had earned at least a high school diploma. The median household income was \$31,204, with 23.6% of persons living below the poverty level [5]. The largest employers were the manufacturing industry; the retail trade industry; health care and social assistance; the mining industry; and administrative, support, waste management, and remediation services [6].

Discussion

Exposure Pathways

Exposure to contaminants in water can occur through ingestion when individuals drink or cook with water and through skin contact when individuals bathe or shower with water. It can also occur when individuals inhale water vapor during a shower or during subsequent bathroom use. Residents using municipal water are not exposed to the Southwest Wire Rope, Inc. site groundwater contamination because the municipal water system is isolated from this source of contamination. Because the COCs were not detected in water samples from the neighboring private well, there is also no completed exposure pathway between this source of contamination and residents using the private well. However, a future potential pathway could exist if the direction of groundwater flow at MW-2 causes a plume of the COCs to migrate off-site toward private wells.

Evaluation Process

The reported concentrations of COCs in Southwest Wire Rope, Inc. groundwater samples were evaluated by estimating doses for residential exposures to each of the contaminants above RECAP values using equations and assumptions summarized in Appendix A. These exposure doses were then compared to the appropriate health guidelines for each chemical. If the exposure doses for a chemical were less than the health guideline for that chemical, adverse health effects were considered to be unlikely. If the exposure dose was greater, then this dose was compared to known health effect levels identified in the ATSDR's toxicological profiles.

The cancer risk was estimated for all contaminants identified as carcinogens. The U.S. Environmental Protection Agency's (EPA's) range of acceptable cancer risk levels is from 1 excess cancer per 10,000 people to 1 excess cancer per 1,000,000 people exposed for a lifetime (1×10^{-4} – 1×10^{-6}) [7].

Health Effects Evaluation

No health effects are currently expected from the COCs in Southwest Wire Rope, Inc. monitoring well MW-2 because residents off-site are not currently exposed to this source of contamination. If these contaminants were to migrate into off-site sources of drinking water at present concentrations, a number of health effects could be expected. Table 2 lists the estimated oral doses for residential exposure to current concentrations of the COCs detected in MW-2. Doses resulting from skin exposures and inhalation of aerosol during or after showering are relatively minute for these contaminants and would be additive to those estimated for ingestion.

Arsenic

The no-observed-adverse-effects level (NOAEL) for arsenic, or the highest dose reported to have no adverse effects on human health, is 8×10^{-4} milligrams per kilogram per day (mg/kg/day). The estimated oral exposure doses for the concentration of arsenic found in monitoring well MW-2 are at least 13 times greater than the NOAEL. At these conservatively estimated doses, individuals younger than 15 years would be exposed to levels of arsenic that may cause hyperpigmentation (patchy darkening of the skin) and hyperkeratosis (a thickening of the skin that may ultimately develop into skin cancer) [8].

Dichloroethene

The estimated oral exposure doses for the concentration of dichloroethene found in monitoring well MW-2 for all age groups were below the reference doses (RfDs) for each of these contaminants. There are no apparent health risks associated with residential exposure to 1,1-dichloroethene and cis-1,2-dichloroethene at levels reported from monitoring well MW-2.

Vinyl Chloride

The estimated oral exposure doses for vinyl chloride found in monitoring well MW-2 for children 11 years old and younger are higher than the RfD for vinyl chloride (3.00×10^{-3} mg/kg/day). They are, however, more than 30 times below the NOAEL for adverse human health effects from vinyl chloride exposure (1.30×10^{-1} mg/kg/day). Oral doses for all other age groups were below the vinyl chloride RfD [9]. There are no apparent noncancer health risks associated with residential exposure to vinyl chloride at levels reported from monitoring well MW-2.

Cancer Health Effects Evaluation

Estimation of lifetime cancer risks is described in Appendix A. Table 3 lists lifetime cancer risks estimated for ingestion of the COCs detected in groundwater at the current Southwest Wire Rope, Inc. site.

Table 2: Estimated Doses for Oral Exposure to Southwest Wire Rope, Inc. Site Contaminants of Concern
(expressed in ng/kg/day*)

| Chemical Name | 1-6 yrs | 6-8 yrs | 9-11 yrs | 12-14 yrs | 15-17 yrs | adult (>18 yrs) | Reference Dose (mg/kg/day)* |
|--------------------------------------|----------|----------|----------|-----------|-----------|--------------------|-----------------------------------|
| Arsenic | 2.02E-02 | 1.42E-02 | 1.94E-02 | 1.41E-02 | 1.17E-02 | 1.05E-02 | 3.00E-04 |
| 1,1-Dichloroethene | 3.63E-03 | 2.54E-03 | 3.48E-03 | 2.52E-03 | 2.10E-03 | 1.89E-03 | 5.00E-02 |
| cis-1,2-Dichloroethene | 7.14E-03 | 5.00E-03 | 6.86E-03 | 4.97E-03 | 4.14E-03 | 3.71E-03 | 1.00E-02 |
| Vinyl Chloride (from birth) | 3.46E-03 | 2.42E-03 | 3.32E-03 | 2.41E-03 | 2.01E-03 | 1.80E-03 | 3.00E-03 |
| Vinyl Chloride (during adulthood) | 3.46E-03 | 2.42E-03 | 3.32E-03 | 2.41E-03 | 2.01E-03 | 1.80E-03 | 3.00E-03 |

* milligrams per kilograms per day

Arsenic

Estimated lifetime cancer risks for oral exposure to arsenic in groundwater from MW-2 were more than 20 times higher than the upper limit of the EPA's range of acceptable cancer risk levels. The estimated lifetime exposure to this source of arsenic yielded a cancer risk of 158 excess cancers per 10,000 people. The adult dose estimated for chronic exposure to this concentration of arsenic is 1.05×10^{-2} mg/kg/day. This dose is higher than doses observed to cause cases of lung cancer (1.1×10^{-3} mg/kg/day) and skin cancer (7.5×10^{-3} mg/kg/day) in epidemiological studies of exposed humans [8].

Dichloroethene

Lifetime cancer risks were not estimated for oral exposures to 1,1-dichloroethene and cis-1,2-dichloroethene because of a lack of sufficient data to support a causal association between exposure to these contaminants and cancer. 1,1-Dichloroethene is categorized by the EPA's carcinogenicity classification as a group C compound. Under this classification, 1,1-dichloroethene is identified as a possible human carcinogen for which there is limited evidence from animal studies and inadequate or no data in humans to support causal association between exposure and cancer. cis-1,2-Dichloroethene is categorized by the EPA as a group D compound, for which there is inadequate or no human or animal evidence of carcinogenicity.

Vinyl Chloride

Lifetime cancer risks for oral exposure to vinyl chloride in groundwater from MW-2 were estimated using separate cancer slope factors for an exposure from birth versus an exposure during adulthood [9]. Both yielded cancer risks that were more than 10 times higher than the upper limit of the EPA's range of acceptable cancer risk levels. The estimated lifetime exposure to this source of vinyl chloride yielded risks of 25 excess cancers per 10,000 people for exposure from birth and 13 excess cancers per 10,000 people for exposure during adulthood. No epidemiological studies concerning vinyl chloride and cancer in humans are available for comparison. Doses estimated for chronic consumption of water from MW-2 were below those observed to cause cancer in rats in laboratory studies (lowest at 3×10^{-1} mg/kg/day). Liver cancer, specifically angiosarcoma of the liver, is the most well-documented type of cancer that may develop over time due to vinyl chloride consumption [9].

Child Health Considerations

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages,

Table 3: Cancer Risks for Oral Exposure to Southwest Wire Rope, Inc. Contaminants of Concern

| Contaminant of Concern | Adult Dose (mg/kg/day)* | Cancer Slope Factor (mg/kg/day) ⁻¹ | Cancer Risk |
|-----------------------------------|-------------------------|---|-------------------------|
| Arsenic | 1.05 x 10 ⁻² | 1.5 | 1.58 x 10 ⁻² |
| Vinyl Chloride (from birth) | 1.80 x 10 ⁻³ | 1.4 | 2.53 x 10 ⁻³ |
| Vinyl Chloride (during adulthood) | 1.80 x 10 ⁻³ | 7.20 x 10 ⁻¹ | 1.30 x 10 ⁻³ |

* mg/kg/day = milligrams per kilogram per day

the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

Two of the four MW-2 contaminants found to have exceeded the LDEQ's RECAP standards could be of particular concern for child health considerations. As discussed in the Health Effects Evaluation section of this document, the arsenic concentration found in MW-2 would produce adverse health effects in children under the age of 15 years. Estimated doses of vinyl chloride for children 6 years old and younger were below the NOAEL for vinyl chloride, but existing data suggests that infants and young children may be unusually susceptible to vinyl chloride [9]. These chemical contaminants will only present possible health risks to children if a completed exposure pathway exists between MW-2 and private wells. Because no exposure pathway currently exists, children off-site are not at risk for health effects from these contaminants.

Conclusions

No completed exposure pathway exists between the MW-2 monitoring well at the Southwest Wire Rope, Inc. site and residents of New Iberia, Louisiana. SEET has therefore classified the site as posing *no public health hazard*. The levels of arsenic and vinyl chloride present at the site will pose a public health hazard in the future if migration of the contamination affects nearby private wells.

Recommendations

- Groundwater at the Southwest Wire Rope, Inc. site should be monitored for contamination on a continual basis, particularly if the direction of groundwater flow at the site is found to be toward private wells in the immediate vicinity.

- If a pattern of groundwater flow from contaminated areas on the Southwest Wire Rope, Inc. site to private wells off-site is identified, an alternate water supply should be suggested for those whose wells might be affected. Private wells potentially affected by this pattern should be tested for the COCs found at the Southwest Wire Rope, Inc. site.
- Future information about levels of groundwater contamination at property currently occupied by the Southwest Wire Rope, Inc. site should be disseminated to the residents of New Iberia who have previously received notification of the site.

Public Health Action Plan

The Public Health Action Plan for the Southwest Wire Rope, Inc. site contains a description of actions that have been or will be taken at the site by ATSDR and/or other government agencies. The purpose of this plan is to ensure that this health consultation not only identifies public health hazards at the site but also outlines a plan of action to prevent or minimize the potential for adverse human health effects resulting from exposure to site-related hazardous substances. ATSDR will follow up on this plan to ensure its implementation.

Actions Completed:

- The family has been notified by the LDEQ that the contaminants found in the Southwest Wire Rope, Inc. monitoring well MW-2 were not detected in their private well.

Actions Planned:

- Southwest Wire Rope, Inc. will perform additional monitoring of MW-2 as necessary, with LDEQ oversight.
- LDHH will review the results of any additional monitoring and make the appropriate recommendations.

Preparers of this Report

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References

1. Louisiana Department of Environmental Quality. Notification to a New Iberia family* from Kyle S. Blanchard concerning contamination at South West Wire Rope, Inc. property. New Iberia, Louisiana. August 2, 2004.
2. Louisiana Department of Health and Hospitals. Letter of acknowledgment to a New Iberia family* from Dianne Dugas concerning notification of contamination at South West Wire Rope, Inc. property. New Iberia, Louisiana. August 18, 2004.
3. Southwest Wire Rope. Company background information. Accessed 2004 Sep 9 at URL: <http://www.southwestwirerope.com/company.html>.
4. The Association for Environmental Health and Sciences. Louisiana cleanup standards for contaminated groundwater. Accessed 2004 Sep 9 at URL: <http://www.aehs.com/surveys/groundwater/LA00.HTM>.
5. US Census Bureau. State and county Quickfacts. Louisiana Quickfacts. Iberia Parish, Louisiana. Accessed 2004 Sep 10 at URL: <http://quickfacts.census.gov/qfd/states/22/22045.html>.
6. US Census Bureau. 2000 County business patterns for Iberia, LA. Accessed 2004 Sep 10 at URL: <http://www.census.gov/epcd/cbp/map/00data/22/045.txt>.
7. US Environmental Protection Agency. Guidelines for carcinogen risk assessment. EPA/630/P-03/001A. Washington, DC: Risk Assessment Forum, US Environmental Protection Agency; 2003 Feb.
8. Agency for Toxic Substances and Disease Registry. Toxicological profile for arsenic. Atlanta: US Department of Health and Human Services; 2000 Sep.
9. Agency for Toxic Substances and Disease Registry. Toxicological profile for vinyl chloride. Atlanta: US Department of Health and Human Services; 1997 Sep.

* Family name has been removed to protect confidentiality.

Certification

This Southwest Wire Rope, Inc. Notification Site health consultation was prepared by the Louisiana Department of Health and Hospitals under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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Appendix A: Evaluation Process

Noncancer Health Effects

Exposure doses for each contaminant of concern (COC) were estimated for residential exposure conditions. The following equation was used to calculate the doses from ingestion of Southwest Wire Rope, Inc. groundwater:

$$\text{Water Ingestion Dose (mg/kg/day)} = \frac{\text{CW} \times \text{IR} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

Table A-1 lists the variables of the water ingestion exposure dose formula and their corresponding values.

The calculated exposure dose for each COC was compared to the corresponding *reference dose* (RfD), a health guideline which is the estimated daily lifetime exposure to a hazardous substance that is not likely to cause adverse noncancer health effects to human populations. RfDs are developed by the U.S. Environmental Protection Agency (EPA) and may be found at <http://www.epa.gov/iris>.

Calculation of Carcinogenic Risk

Because of the uncertainties involved in estimating carcinogenic risk, the Agency for Toxic Substances and Disease Registry (ATSDR) employs a weight-of-evidence approach in evaluating all relevant carcinogenic data, describing carcinogenic risk in words as well as in numerical terms.[†] The estimated risk of developing cancer resulting from exposure to the contaminants within the water bodies was calculated by multiplying the exposure dose over a 70-year (lifetime) period by the EPA's *cancer slope factor* (CSF: available at URL: <http://www.epa.gov/iris>). The results estimate the worst-case maximum increase in the risk of developing cancer after exposure to the contaminant. This estimation is accurate within one order of magnitude; a calculated cancer risk of 2 excess cancers per 10,000 people might actually be 2 excess cancers per 1,000 people or 2 excess cancers per 100,000 people.

[†] Agency for Toxic Substances and Disease Registry. 1993. Cancer policy framework. Atlanta, Georgia: US Department of Health and Human Services.

Table A-1: Equation Variables for Water Ingestion Dose, Southwest Wire Rope, Inc. Notification Site, Well MW-2

| Variable | Value used |
|---|---|
| CW = Concentration in water | Chemical-specific (mg/L) |
| IR _c = Ingestion rate child (1–10 years) | 1 L/day* |
| IR _a = Ingestion rate adult | 2 L/day* |
| EF = Exposure frequency | Residential: 365 days/year |
| ED = Exposure duration | 4 years (1–6) 7 years (6–8) 10 years (9–11) 13 years (12–14) 16 years (15–17) 44 years (18–70) |
| BW _c = Body weight [†] | child 1–6 18.2 kg child 6–8 26 kg child 9–11 37.9 kg child 12–14 52.3 kg child 15–17 62.8 kg adult (>18) 70 kg |
| AT = Averaging time | Residential: 365 days/year x ED |

* U.S. Environmental Protection Agency. 2000. Estimated per capita water ingestion in the United States. EPA-822-R-00-008.

† U.S. Environmental Protection Agency. 1997. *Exposure Factors Handbook*. EPA/600/P-95/002. Office of Health and Environmental Assessment, Washington, D.C.