Health Consultation

HEALTH IMPLICATIONS OF EXPOSURE TO RUN-OFF SURFACE WATER USED IN EXTINGUISHING A FIRE AT

DETCO INDUSTRIES INCORPORATED

CONWAY, FAULKNER COUNTY, ARKANSAS 72032
EPA FACILITY ID: ARR000012955

APRIL 4, 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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Prepared by:

Arkansas Department of Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
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ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ADH

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STATEMENT OF ISSUES AND BACKGROUND

Statement of Issues

On January 6, 2004, the Conway Fire Department was called to extinguish a fire at Detco Industries Incorporated. Fire fighting activities lead to site-specific chemical run-off into nearby Railroad Creek. The Arkansas Department of Health (ADH) was asked by the Arkansas Department of Environmental Quality (ADEQ) to participate in an integrated assessment of the event.

ADH's role was to review available relevant information and make a determination of potential risks to public health. In order to provide a timely response and meet the needs of the requestor, surface water sampling data was reviewed as it was received. This health consultation has been prepared under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

ADH previously prepared a health consultation evaluating the potential health effects for residents exposed to the soil in residential yards adjacent to the Detco Warehouse destroyed by the fire in January 2004. ADH, after having reviewed the environmental sampling data collected by the ADEQ, concluded the soil posed "*No Apparent Public Health Hazard*" [1].

Detco Industries Incorporated is located in the industrial park of Conway, Faulkner County, Arkansas (Appendix A, Figures 1 and 2). Incorporated in 1988, Detco produces liquid products, powders, and a line of aerosol products, and other chemicals for use in industrial maintenance. The facility regularly stored and used methanol, hydrofluoric acid, and sulfuric acid.

Tuesday morning, January 6, 2004, an explosion occurred in the 37,000-square-foot Detco Warehouse used to produce industrial chemicals [2]. An estimated 2 million gallons of surface water from the firefighting effort ran off from the Detco site. Conway Public Works contained the run-off surface water by building a dam on Railroad Creek (Appendix A, Figure 3). The dam prevented run-off from flowing into Stone Dam Creek some 8,500 feet south of the Detco Warehouse, as well as Lake Conway located approximately 3,000 feet southeast of the Railroad Creek and Stone Dam Creek confluence [3].

ADEQ collected surface water samples along Railroad Creek between January 6 – 15, 2004 (Appendix A, Figure 2). The purpose of collecting the surface water samples was to identify and quantify the compounds present in order to assess the potential impact of receiving waters downstream. A list of analytes measured in the analytical procedure can be seen in Appendix B: List of Analytes.

At the time of the fire, Detco had 31 employees [4]. Population size within the ½-mile radius of the Detco Warehouse is not known. However, an evacuation in the ½-mile radius of the site of the fire involved residents in 190 mobile homes, three houses, an elementary school, a day-care center, and a paper factory that employs 540 people [5].

PUBLIC HEALTH IMPLICATIONS

Introduction

Exposure to, or contact with, chemical contaminants drives the ADH Health Consultation processes. Chemicals may only adversely affect people if exposure occurs; that is, they must come into contact with the chemicals and absorb them into their bodies. The presence of chemical contaminants in the environment does not always result in contact and contact does not always result in the chemical being absorbed into the body. The most common ways people come into contact with chemicals are by inhalation (breathing), ingestion (eating or drinking), or by dermal contact (absorption through skin) with a substance containing the contaminant.

Pathway Analysis

Generally, for chemicals found in sediment or water, absorption through the gastrointestinal (GI) tract by incidental ingestion or through the skin by direct contact is the exposure pathways of greatest concern. Whether adverse health effects occur depends on: 1) the toxicological properties of the chemicals; 2) the manner in which the person contacts the chemical; 3) the concentration of the chemical; 4) how often the exposure occurs; 5) how long the exposure occurs; and 6) how much of the chemical is absorbed into the body during each exposure event.

Health assessors use comparison values as screening tools to evaluate environmental data relevant to exposure pathways. Comparison values are concentrations of contaminants that are considered to be safe levels of exposure. Several comparison values were used in this public health consultation. Maximum Contaminant Levels (MCLs) represent contaminant concentrations that the U.S. Environmental Protection Agency (EPA) deems protective of public health over a lifetime (70 years) at an exposure rate of 2 liters of water per day. MCLs are enforceable standards. The Reference Dose (RfD) is an estimate of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of harmful effects during a lifetime. Drinking Water Lifetime Health Advisories (LTHA) are derived by EPA from a drinking water equivalent level below which no adverse non-cancer health effects are expected to occur. EPA Action Levels are the estimated contaminant concentrations in water that indicate that additional evaluation is needed to determine whether action is required to eliminate or reduce exposure. Reference Dose Media Evaluation Guide (REMG) is the concentration of a contaminant in air, water or soil that corresponds to EPA's RfD for that contaminant when default values for body weight and intake rates are taken into account. No Observed Adverse Effect Level (NOAEL) is the highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals. The Acceptable Daily Intake (ADI) is defined as the amount of a food additive that can be ingested daily in the diet without appreciable risk on the basis of all facts known at the time. "Without appreciable risk" refers to the practical certainty that injury will not result, even after a lifetime of exposure [6].

Temperature for the month of January 2004, ranged from 33 – 75 degrees Fahrenheit with an average of 52.5 degrees Fahrenheit [7]. This temperature range makes it likely that a person would be outdoors, thereby increasing the chance of exposure to possible contaminants that may have run into Railroad Creek. Water in Railroad Creek is not used for drinking water, as area

homes are connected to the local public water utility. However, incidental ingestion and dermal contact is possible, especially for children who may play along the creek. Exposure via these means would be limited because the water remained in Railroad Creek only ten days before being transferred by tanks for proper disposal to the waste water treatment plant in Conway. Because of the short exposure opportunity, the comparison values used for evaluating risk to the public are highly protective.

TOXICOLOGICAL EVALUATION

ADEQ collected four surface water samples January 6 – 15, 2004, from four locations along the flow path (Railroad Creek) of run-off surface water that originated from the fire extinguishing efforts at the Detco Warehouse. Appendix A, Figure 2 depicts the sites where the samples were collected. ADH reviewed the sampling results and screened the contaminants by comparing reported concentrations to health-based screening values. Those that exceeded the health-based screening values – 11 contaminants of the 154 analytes tested and measured in the analytical procedure – were selected for further consideration (Appendix B, Table 1 and Appendix B: List of Analytes). Table 1 also includes the comparison values used in these evaluations.

The selected contaminants included antimony, arsenic, bromide, lead, manganese, molybdenum, p-isopropyltoluene, tetrachloroethene, 1,2,3-trichlorobenzene, selenium, and zinc. The potential public health implications of the selected 11 contaminants were assessed by considering the toxicological properties of the contaminants, the probable routes of exposure, and the types of exposures that might occur. Conservative assumptions were used in these assessments.

The estimated exposure dose for a child, either through dermal contact or incidental ingestion, was higher than those estimated for an adult. For this reason, the assessments for the selected contaminants that follow represent the estimated exposure dose for a child. None of the estimated exposure doses exceeded the associated screening value or RfD for the exposure pathways evaluated (dermal contact and incidental ingestion). Thus, as a general description of the exposure doses estimated, we have described below those associated only with incidental ingestion. Further, information on the methods used in calculating an estimated exposure dose can be found in Appendix C of this document.

Antimony

Because antimony is found naturally in the environment, the general population is exposed to low levels of it every day, primarily in food, drinking water, and air. Exposure to antimony at high levels can result in a variety of adverse health effects.

Ingesting large doses of antimony can cause vomiting. Long-term animal studies have reported liver damage and blood changes when animals ingested antimony. Antimony can cause skin irritation when exposed over an extended period of time. Antimony can have beneficial effects when used for medical reasons. It has been used as a medicine to treat people infected with parasites [8].

Results of the surface water analysis indicated that antimony ranged from no detect (ND) to 0.225 milligrams per liter (mg/L). The highest concentration detected (0.225 mg/L), at sampling site #3, was above the MCL of 0.006 mg/L. The estimated daily chronic intake through inadvertent ingestion of water by a child weighing 35 pounds (16 kilograms) was calculated at 1.2×10^{-7} milligram per kilogram-day (mg/kg-day). This value is three orders of magnitude less than the RfD of 4.0×10^{-4} mg/kg-day. No adverse health effects are expected to occur as a result of exposure to antimony at these concentrations.

Arsenic

EPA has classified inorganic arsenic as a human carcinogen (EPA 1988). Several studies have shown that ingestion of arsenic in drinking water can increase the risk of lung, bladder, liver, kidney, skin, or prostate cancer. Perhaps the single most common and characteristic sign of oral exposure to inorganic arsenic is the appearance of skin ailments: hyperkeratinization (thickening) of the skin, especially on the palms and soles; formation of multiple hyperkeratinized corns or warts; and hyperpigmentation (darkening, usually a speckled pattern) of the skin with some hypopigmentation (loss of pigmentation). These effects are usually the earliest observable sign of chronic (long-term) exposure to arsenic. Direct dermal contact might cause local irritation and contact dermatitis (a rash). The effects may be mild, but they might progress to papules and vesicles in extreme cases [9].

Arsenic was only detected at sampling site #4 (Appendix A, Figure 2). The concentration of arsenic at this location was 0.146 mg/L, exceeding the drinking water comparison value or MCL of 0.010 mg/L. The estimated daily dose of arsenic for children inadvertently ingesting arsenic was calculated to be 7.5×10^{-8} mg/kg-day. The NOAEL for chronic exposure to arsenic is 4.0×10^{-4} mg/kg-day representing four orders of magnitude above the estimated daily dose that a child would be expected to ingest. No adverse health effects are expected to occur as a result of exposure to arsenic at these concentrations.

Bromide

In 1968, the Joint Food and Agriculture Organization of the United Nations and World Health Organization Meeting on Pesticide Residues set an acceptable daily intake of 0-1 mg/kg - body weight for bromide based on a minimum pharmacologically effective dosage in humans of about 900 mg of potassium bromide, equivalent to 600 mg of bromide ion.

Since bromide was introduced as a medicine, clinical symptoms of bromide intoxication have been reported. Large doses of bromide cause nausea and vomiting, abdominal pain, coma and paralysis. The chronic state of bromide intoxication is reported as bromism. The signs and symptoms are referable to the nervous system, skin, glandular secretions, and gastrointestinal tract [10].

Results of the surface water analysis indicated that bromide ranged from 0.05 to 2.0 mg/L. An estimated ingestion dose of bromide for a child was calculated to be 1.0×10^{-6} mg/kg-day, which

is 6 orders of magnitude below the RfD stated above. Therefore, no adverse health effects are expected to occur as a result of exposure to bromide at the concentrations found in Railroad Creek.

p-Isopropyltoluene

p-Isopropyltoluene is an important product and valuable intermediate in the chemical industry. Among others, it is used as a solvent for dyes and varnishes, as a heat transfer medium, as an additive in fragrances and musk perfumes, and as a masking odor for industrial products [11].

p-Isopropyltoluene was detected at a maximum concentration of 0.21 mg/L, which is two times the RfD of 0.1 mg/kg-day. However, calculating an estimated ingestion dose of p-isopropyltoluene for a child, the most conservative estimate, resulted in an estimated exposure dose that was over 900,000 times less than the RfD. Therefore, no adverse health effects are expected to occur as a result of exposure to p-isopropyltoluene at these concentrations.

Lead

The maximum lead concentration found in the surface water of Railroad Creek was 0.223 mg/L. Using this maximum concentration to calculate an estimated exposure dose for a child incidentally ingesting water was 1.2×10^{-7} mg/kg-day. This value is 125,000 times less than the Action Level set in EPA's National Primary Drinking Water Regulation. Adverse health effects are not expected from exposure to the levels of lead detected in Railroad Creek.

Manganese

EPA has determined that manganese is not classifiable as a human carcinogen. Some people have been shown to experience allergic reactions such as skin rash because of exposure to pesticides containing manganese. The human body typically contains small quantities of manganese, and under normal circumstances, the body controls these amounts so that neither too little nor too much is present. Human diets with too little manganese can lead to slow blood clotting, skin problems, changes in hair color, lowered cholesterol levels, and other alterations in metabolism. If too much manganese is brought into the body, it will often be excreted in feces. It is possible, however, to breathe in or ingest more manganese than the body can regulate normally [12].

There is no primary MCL for manganese; however, EPA has set a National Secondary Drinking Water Regulation Standard (NSDWRS) of 5.0×10^{-2} mg/L. NSDWRSs are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (such as taste, odor, or color) in drinking water.
The comparison value for manganese was exceeded at every location. The highest concentration was detected at sampling site #4 at a level of 6.03 mg/L.

An estimated ingestion dose of manganese for a child was calculated to be 3.1×10^{-6} mg/kg-day or 15,000 times less than the RfD of 4.7×10^{-2}. Therefore, no adverse health effects are expected to occur as a result of exposure to manganese at the concentrations found in Railroad Creek.

Molybdenum

The pure metal is silvery white in color and very hard, and has one of the highest melting points of all pure elements. In small quantities, molybdenum is effective at hardening steel. Molybdenum is important in plant nutrition, and is found in certain enzymes [13].

Molybdenum was detected at a maximum concentration of 0.547 mg/L. The estimated exposure dose for a child incidentally ingesting molybdenum was 2.8×10^{-7} mg/kg-day. This figure is 17,857 times lower than the RfD of 5.0×10^{-3} mg/kg-day. No adverse health effects are expected to occur as a result of exposure to molybdenum at these concentrations.

Tetrachloroethene

Tetrachloroethene, also known as tetrachloroethylene or perchloroethylene (PERC), is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal degreasing. It is also used to make other chemicals and is used in some consumer products. The health effects of drinking water with low levels of tetrachloroethene are not known [14].

The maximum concentration of tetrachloroethene was detected at 2.56 mg/L. The estimated exposure dose value of 1.3×10^{-6} mg/kg-day was determined to be 7,692 times lower than the RfD of 1.0×10^{-2} mg/L. No adverse health effects are expected to occur as a result of exposure to tetrachloroethene at these concentrations.

1,2,3-Trichlorobenzene

1,2,3-Trichlorobenzene was detected above the LTHA value of 0.04 mg/L. The maximum concentration of 1,2,3-trichlorobenzene detected was 0.322 mg/L at sampling site #3. The estimated exposure dose of 1,2,3-trichlorobenzene for a child was 1.7×10^{-7} mg/kg-day, or 235,000 times less than the LTHA value of 4.0×10^{-2} mg/kg-day. No adverse health effects are expected to occur as a result of exposure to 1,2,3-trichlorobenzene at this concentration.

Selenium

Selenium is a trace mineral that is essential to good health but required only in small amounts. High blood levels of selenium (greater than 100 microgram per deciliter) can result in a condition called selenosis. Symptoms of selenosis include gastrointestinal upsets, hair loss, white blotchy nails, garlic breath odor, fatigue, irritability, and mild nerve damage [15].

Selenium was detected at sample site #4 at a maximum concentration of 1.1 mg/L. The estimated exposure dose of selenium for a child was 87,719 times less than the amount likely to be of an appreciable risk of having a harmful effect during a lifetime (RfD). No adverse health effects are expected to occur as a result of exposure to selenium at this concentration.

Zinc

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal. Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful. Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. It is unknown if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile [16].

The highest concentration of zinc was detected at sample site #4 at 50.5 mg/L. There is no primary MCL for zinc; however, the NSDWRS is 5.0 mg/L. ADH estimated that incidental ingestion of water from Railroad Creek would result in an exposure dose to zinc in the amount of 2.6×10^{-5} mg/kg-day for children or 11,500 times less than the RfD of 0.3 mg/kg-day. Adverse health effects are not expected from exposure to the levels of zinc in Railroad Creek.

COMMUNITY HEALTH CONCERNS

ADH investigated the public health concerns received through meetings and written correspondence. A letter from an attorney representing some of the community members reported that community members had expressed a variety of symptoms, including: headaches, blurred vision, dizziness/lightheadedness, lack of energy, impaired taste, loss of appetite, diarrhea, upset stomach, nausea, vomiting, burns/burning of face, facial sores, itching skin, rash, raw nostrils, raw sinuses, sore throat, loss of voice, coughing, shortness of breath, heart palpitations, and chest pain.

There were no public health concerns pertaining specifically to the run-off surface water used in extinguishing the Detco Warehouse fire. The contaminants detected in the run-off surface water were below adverse health effect levels. In a previously prepared health consultation, ADH concluded that the levels of contaminants detected in the soil of residential yards adjacent to the Detco Warehouse were also below adverse health effect levels.

Visible smoke was present, however, during the fire. Most community concerns were specifically related to the smoke plume. Exposure by the inhalation pathway should be examined for the potential adverse health effects associated with breathing the smoke. The 61st Civil Support Team (CST) of the Arkansas National Guard has requested ADH evaluate air samples that were collected at the site the day of the fire. Once these data are received by ADH, a health consultation will be conducted.

CHILD HEALTH CONSIDERATIONS

In communities faced with air, soil, 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. 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, 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.

In an effort to account for children's unique vulnerabilities, ADH used the potential exposure of children as a guide in assessing the potential public health implications of the contaminants. The 11contaminants that exceeded the health-based screening values were evaluated for potential exposure risk for children. All 11 contaminants were below levels expected to result in adverse health effects.

CONCLUSIONS

ADH evaluated surface water sampling data collected by ADEQ from January 6 – 15, 2004, from Railroad Creek in Conway, Arkansas, following the fire that destroyed the Detco Warehouse. The 11 contaminants detected in the run-off surface water were below adverse health effect levels. Therefore, ADH concludes that the levels of contaminants in the surface water samples collected from Railroad Creek represents *No Apparent Public Health Hazard*.

In a previously prepared health consultation, ADH concluded that the soil of residential yards adjacent to the Detco Warehouse were also below adverse health effect levels. The inhalation exposure pathway should be examined for potential adverse health effects associated with breathing the smoke from the fire.

RECOMMENDATION

- ADH recommends that our office conduct a health consultation to evaluate the ambient air data from the Detco site once the data is received, to determine whether possible past inhalation exposures pose a public health hazard.

PUBLIC HEALTH ACTION PLAN

Public Health Action Plans (PHAP) are developed to describe actions to be taken by ADH at and in the vicinity of sites subsequent to the completion of the Health Consultation. The purpose of the PHAP is to ensure that health consultations not only identify public health hazards, but also provide a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The public health actions by ADH are as follows:

Completed Actions

- ADH evaluated soil samples analyzed by ADEQ in January 2004.

- ADH initiated a community needs assessment in January 2004.

- ADH attended a public meeting in January 2004, along with ADEQ and local city officials to inform residents about re-entry into their homes.

- ADH prepared a soil data health consultation in September 2004.

- ADH evaluated surface water samples analyzed by ADEQ in January 2004.

Future Activities

- ADH will provide concerned residents and other interested stakeholders with copies of this completed health consultation on the health implications of exposure to run-off from surface water used in extinguishing the fire at Detco Industries Incorporated.

- ADH will provide health education activities in the vicinity of the Detco as needed and/or requested.

- ADH will complete a health consultation on ambient air data for the Detco site once the air data is received by the 61st CST.

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CERTIFICATION

This Health Consultation for Detco Industries Incorporated was prepared by the Arkansas Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

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

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APPENDICES