ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

ARIVEC CHEMICALS, INCORPORATED
DOUGLASVILLE, DOUGLAS COUNTY, GEORGIA
EPA FACILITY ID: GAD990740714
MARCH 15, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30-day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment 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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PETITIONED PUBLIC HEALTH ASSESSMENT

ARIVEC CHEMICALS, INCORPORATED

DOUGLASVILLE, DOUGLAS COUNTY, GEORGIA

EPA FACILITY ID: GAD990740714

Prepared by:

The U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia

Foreword

The Agency for Toxic Substances and Disease Registry, ATSDR, was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. The public health assessment program allows the scientists flexibility in the format or structure of their response to the public health issues at hazardous waste sites. For example, a public health assessment could be one document or it could be a compilation of several health consultations - the structure may vary from site to site. Nevertheless, the public health assessment process is not considered complete until the public health issues at the site are addressed.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists evaluate whether or not these contacts may result in harmful effects. ATSDR recognizes that children, because of their play activities and their growing bodies, may be more vulnerable to these effects. As a policy, unless data are available to suggest otherwise, ATSDR considers children to be more sensitive and vulnerable to hazardous substances. Thus, the health impact to the children is considered first when evaluating the health threat to a community. The health impacts to other high risk groups within the community (such as the elderly, chronically ill, and people engaging in high risk practices) also receive special attention during the evaluation.

ATSDR uses existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries, to determine the health effects that may result from exposures. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further public health actions are needed.

Conclusions: The report presents conclusions about the public health threat, if any, posed by a site. When health threats have been determined for high risk groups (such as children, elderly, chronically ill, and people engaging in high risk practices), they will be summarized in the conclusion section of the report. Ways to stop or reduce exposure will then be recommended in the public health action plan.

ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-60), Atlanta, GA 30333.

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LIST OF ABBREVIATIONS

ATSDR	Agency for Toxic Substances and Disease Registry
BRB	Brokerage Recovery & Blends, Inc.
CSF	Cancer Slope Factor
COC	Chemical of Concern
CREG	Cancer Risk Evaluation Guide
CV	Comparison Value
EDR	Environmental Data Resources, Inc.
EMEG	Environmental Media Evaluation Guide
EPA	U.S. Environmental Protection Agency
GA DNR	Georgia Department of Natural Resources
GA EPD	Georgia Environmental Protection Division
HWMB	Hazardous Waste Management Branch
IARC	International Agency for Research on Cancer
MRL	Minimal Risk Level
mg/kg/day	milligram per kilogram of body weight per day (unit of dose)
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
PHAP	Public Health Action Plan
ppb	parts per billion (e.g., µg/L water or µg/kg soil)
ppm	parts per million (e.g., mg/L water or mg/kg soil)
RBC	Risk Based Concentration
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RFI	RCRA Facility Investigation
RMEG	Reference Dose Media Evaluation Guide
SVOC	semi-volatile organic compound
SWMU	Solid Waste Management Unit
TCE	trichloroethylene
U.S.	United States
EPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compound
WPB	Water Protection Branch

SUMMARY

The Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned by a community activist to prepare a public health assessment to address community concerns related to Arivec Chemicals, Inc. (Arivec) site in Douglasville, Georgia. Arivec was a solvent recovery operation from 1956 to 1994. The facility was used to reclaim spent cooking oils from 1995-1997. The facility is currently inactive.

Community residents expressed concerns in the petition and interviews about air quality in the area of the facility concerned that site-related contaminants might have migrated into groundwater and surface water and wanted information about potential health effects associated with exposures to sight related substances in these media. The community also perceived an excess of cancer, respiratory illnesses, and skin rashes among area residents living near the facility and wanted to know if adverse health effects were associated with exposures to site-related contaminants. The community also was concerned about the health of children who reside or attend school near the site.

ATSDR evaluated available environmental and health outcome data, and classified the Arivec site as an indeterminate public health hazard because of insufficient data. ATSDR found the following data gaps: 1) off-site groundwater data are not available to assess contaminant migration relative to off-site private wells, 2) off-site surface water and sediment-exposures data sets are limited, and 3) air data are not available to evaluate past exposures.

Soil sampling data indicate elevated concentrations of lead that would pose a health hazard to children if they were exposed to on-site soil on a daily basis; however, this exposure scenario is considered to be unlikely. Access to the site is restricted by a fence; however, the front gate is in disrepair. ATSDR recommends that the fence and gate be repaired to minimize trespassers' access to the site. If the site is developed in the future, this pathway should be evaluated further for public health implications.

On-site groundwater investigations indicate the presence of trichloroethylene, vinyl chloride, and other chlorinated organic compounds at concentrations greater than their respective maximum contaminant level (MCL). On-site groundwater does not represent a current public health hazard because on-site groundwater is not being used as a source of drinking water or for other uses. On-site groundwater might represent a public health concern for the future if on-site groundwater contamination migrates to off-site, down gradient private wells. ATSDR has identified several private wells that are used for drinking water within ¼ to ½ mile down gradient (i.e., north and northwest) of the site on Huey and Pirkle Roads. Sample results of these wells in August 2000, did not indicate the presence of site-related contaminants. ATSDR recommends that off-site groundwater be characterized to determine how far on-site contamination has spread.

PURPOSE AND HEALTH ISSUES

In 1990, the Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned to prepare a public health assessment to address community concerns about the Arivec Chemicals, Inc. (Arivec) site in Douglasville, Georgia [1]. Community members expressed concerns about air quality in the area and also were concerned that site-related contaminants might have migrated into groundwater and into nearby water bodies. Area residents wanted information about potential adverse health effects associated with possible exposures to hazardous substances in these media. Community residents also thought an excess of cancer and respiratory illnesses were occurring in the area, and they and wanted to know if these health effects were associated with exposures to site-related contaminants.

The purpose of this public health assessment is to review all available environmental data and to identify data gaps, to evaluate and identify potential exposure pathways, and to discuss potential health effects associated with exposures to site-related contaminants.

BACKGROUND

A. Site Description and History

The Arivec Chemicals, Inc. site (Arivec) is located at 7962 Huey Road, approximately 2 miles northeast of Douglasville, Douglas County, Georgia (Figure 1, Appendix A). The site is approximately 3.2 acres in size. Arivec is bordered by the Young Refining Corporation site (Young Refining) to the north and east, Central Oil and Asphalt to the south, and Huey Road to the west [2]. Residential areas are to the west, north, and east of the site, and the nearest residence is approximately 75 yards from the site's boundary.

Arivec operated as a solvent-recovery facility from 1956 to 1994. The facility accepted spent solvents from various industries to recycle via a distillation process. Arivec stored the waste products generated through the reclamation process in on-site drums. The facility disposed of these wastes in local landfills until 1980; after 1980, the drums were transported to hazardous waste treatment facilities. Untreated wastewater generated through plant processes was piped to two on-site storm water-retention ponds that drained to Cracker Creek [2]. The Arivec site consists of three tank farms Arivec used to store solvent, a distillation process area, two storm water retention ponds, a storage area for waste drums, an earthen dike, an administrative office and laboratory, a maintenance area, and a junkyard (Figure 2, Appendix A) [2]. The various tank farms and drum storage areas were surrounded by concrete walls high enough to contain tank contents in the event of a spill or leak. Access to the site is restricted by a 6-foot chain link fence topped with barbed wire [4]. Currently, the fence at the front gate is in disrepair that could provide limited access to the property [5].

The Georgia Department of Natural Resources, Environmental Protection Division (GA EPD) regulated Arivec's air, wastewater, and hazardous-waste handling practices. In June 1976, GA

EPD issued an air permit for the operation of Arivec's refining and fuel-burning equipment used in the distillation process. Wastewater discharges were regulated under a water-control permit. In August 1984, GA EPD issued a hazardous-waste-facility permit to Arivec. This permit required Arivec to operate in accordance with the requirements of the Resource Conservation and Recovery Act (RCRA).

In 1993, GA EPD identified 16 Solid Waste Management Units (SWMUs) as part of an RCRA Facility Assessment (Figure 2, Appendix A) [2]. In 1994, GA EPD requested that Arivec investigate the nature and extent of possible contamination in these areas as part of the RCRA Facility Investigation (RFI) [6]. Arivec ceased operating as a hazardous-waste-handling facility in 1994, and initiated closure activities as required by their Georgia Department of Natural Resources permit.

Brokerage Recovery & Blends, Inc. (BRB) formerly operated the Arivec site from 1995-1997. BRB reclaimed used cooking oil from restaurants. The process waste water and solid wastes (nonhazardous) were shipped off site. The reclaimed oil was sold to feedstock manufacturers. BRB operated under a Commercial Feed License issued by the Georgia Department of Agriculture.

In December 1998, Arivec finalized Phase I of the RFI and submitted a report of its findings to GA EPD. The Phase I investigation focused on groundwater quality at the site [7, 8]. GA EPD deemed the Phase I investigation incomplete and inadequate to assess groundwater contamination at the site. In March 2000, Young Refining Corporation conducted preliminary groundwater investigations on Arivec property. Table 1, Appendix B, presents more operational and regulatory history for the site.

B. Demographics and Land Use

The 1990 the Bureau of the Census estimates that approximately 71,120 persons live in Douglas County [11]. Approximately 5,163 people live within a 1-mile radius of the site. Data indicate that the area's population is made up of transient individuals with lower-middle income levels. The breakdown of the demographic structure of this area is presented in Table 2, Appendix B.

Land use is a mix of industrial (light and heavy), commercial, and residential. An area south of the site is zoned for industrial and commercial uses. Several small commercial businesses form a business corridor along U.S. Route 78, which runs northeast to southwest of the site. Approximately 30 residences are located within 1,000 feet of the site (1997 RFI Work Plan). Several schools are located within a 1-mile radius of the site: Eastside and Burnett Elementary Schools are approximately ½-mile south-southeast of the site, and Stewart Middle School is almost 1 mile to the west-southwest [4]. A private nursing home is located directly across from the site entrance.

C. Site Visits

ATSDR staff visited the site met with the community in June and July 1991, January 1994, and October 1996 [4, 9, 10]. In 1991, ATSDR staff met with community members to gather their health concerns about the site. In 1994, ATSDR held a public availability session that served as an informal forum for community members to discuss their health concerns. In 1996, ATSDR staff observed the characteristics and accessibility of nearby creeks, then talked with some community members who indicated that residents of the area avoid Cracker Creek because they believe that it is contaminated. The health concerns gathered are discussed in the "*Community Health Concerns"* section of this document and are evaluated in the "*Community Health Concerns Evaluation"* section.

COMMUNITY HEALTH CONCERNS

The community expressed concerns about Arivec and the neighboring Young Refining site. ATSDR gathered concerns from the petition letter, through meetings with the community, and through file searches and consultation with staff from the GA EPD. According to GA EPD, some of the residents' concerns about odors from the facility date back to the 1970s. In recent years, however, only sporadic concerns have been received from the community. Community health concerns include the following:

- Respiratory problems, eye irritation, headaches, and nausea related to odors in the air.
- Potential excess of cancers, respiratory illnesses, and skin rashes occurring in the vicinity of the site.
- Concern regarding the overall health of children who live or attend schools near the site.
- Concerns regarding contamination in Cracker Creek

DISCUSSION

To evaluate community health concerns and the possible public health implications of contamination related to the Arivec site, ATSDR reviewed the available environmental data for the site and its vicinity. Section A of this discussion briefly describes ATSDR methodologies; Section B presents ATSDR's evaluation of possible exposures associated with the site; Section C evaluates potential physical/safety hazards associated with the site; Section D discusses health-outcome data; and Section E focuses on children's health.

A. Methods

The following sections contain evaluations of available environmental data for the Arivec site. ATSDR used established methodologies for determining how people might be exposed to site-related contaminants and for evaluating what health effects, if any, might be associated with exposures to contaminant concentrations in the environmental media (e.g., air, water, soil, biota). See Appendix C for more details. To make this determination, ATSDR identified exposure pathways (i.e., the means by in which chemicals can enter a person's body). If an exposure pathway is or was possible in the past, the concentrations of contaminants are evaluated to determine whether adverse health effects could occur. Potential exposure pathways from groundwater, soil, surface water, sediment, and air are summarized in Table 3 of Appendix B.

ATSDR selects contaminants for further investigation on the basis of whether their chemical concentrations exceed health-based comparison values (CVs). CVs are conservative screening values containing built-in safety factors to account for uncertainties and sensitive populations (e.g., children, the elderly). Although a concentration equal to or below the relevant comparison value may be considered safe, it does not necessarily follow that a contaminant that exceeds its comparison value is a health threat. If a contaminant exceeds its CV, ATSDR performs a more detailed exposure analysis for that chemical.

Although the relative toxicity of a chemical is important, the response of the human body to a chemical exposure is determined by additional factors; i.e., 1) the magnitude (how much), 2) the duration (how long), and 3) the route of exposure (breathing, eating, drinking, or skin contact). Lifestyle factors (e.g., occupation and certain personal habits) have a major impact on these three elements of exposure. After an exposure, individual characteristics such as age, sex, nutritional status, overall health, and genetic constitution will affect how a contaminant is absorbed, distributed, metabolized, and eliminated from the body. All of these factors help determine the individual's physiological response to chemical contaminants and any adverse health effects he or she may experience.

To screen individual contaminants, ATSDR typically compares the lowest available CV (e.g., Cancer Risk Evaluation Guides [CREGs] or other chronic exposure values) for the most sensitive of the potentially exposed individuals (usually children or pica children) to the highest single concentration of a contaminant detected at a site. This procedure selects many contaminants as "contaminants of concern" that do not pose a health hazard. ATSDR uses a

screening value that "lets through" many harmless contaminants rather than one that overlooks even a single potential hazard to public health. Even those contaminants of concern that are ultimately labeled in the toxicological evaluation as potential public health hazards are so identified solely on the basis of the maximum concentration detected. When interpreting the potential health implications of ATSDR's toxicology evaluations, the reader should keep in mind the degree of protection afforded by this approach.

B. Environmental Data and Public Health Implications

Groundwater

Groundwater Use

According to the Douglasville-Douglas County Water and Sewer Authority, public water is available to all Huey Road residences. Records indicate that water in the vicinity of Huey Road and Bankhead Highway was available in 1977/1978. Residences on a private road running west off of Huey Road (approximately ¼ of a-mile north of the site) and residences on Pirkle Road (almost ½-mile north of the site) do not have access to public water [52].

The water authorities of Douglasville and Douglas County were combined in 1985 and the Douglasville-Douglas County Water and Sewer Authority was formed. The Douglasville water supply system began operating in 1942. Records indicate that Douglasville provided water lines to Arivec between 1974 and 1979 [52]. It is unknown whether Arivec used groundwater as a drinking water supply from its startup in 1956 to 197.4

ATSDR performed a well search 1996, as part of investigation of the Young Refining site. The closest well was identified up gradient, approximately ½ to 1 mile southeast of the site [13, 20]. The 1996 well search relied on the Federal Reporting Data System, the National Radon Database, USGS records, and information on public supply wells obtained from the Georgia Department of Community Affairs. However, ATSDR identified several private wells used for drinking water by physical inspection within ¼- to ½-mile down gradient (north and northwest) of the site.

Evaluation of groundwater data

On-Site Groundwater

In March 2000, groundwater samples were collected from five borings. The samples were analyzed for organic and inorganic compounds. Vinyl chloride (750 - 4,000 parts per billion (ppb), tetrachloroethylene (PCE) (210-39,000 ppb), trichloroethylene (210 - 39,000, cis 1,2 - dichloroethylene (Cis 1,2-DCE) (9,700 - 85,000), 1,1,2 trichloroethane (60 - 1,700 ppb), benzene (122 - 4,100 ppb), and other organic compounds were detected at levels that exceeded the Maximum Contaminant Levels (EPA's safe drinking water standards) and vinyl chloride exceeded the ATSDR chronic EMEG.

Currently, on-site groundwater is not a public health concern because it is not used and there is no human exposure. Groundwater represents a potential public health concern in the future if this water is used for drinking or domestic purposes.

Off-Site Groundwater

On October 28, 1987, GA EPD collected a sample from one well used as a private drinking water well. This well was approximately 20 feet deep and located 1 mile down gradient (northwest of the site). The sample was analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and total metals. No contaminants of concern were identified [18].

Most area residents are supplied municipal water. Water from the Douglasville-Douglas County Water Authority meets safe drinking water standards [52].

Currently, private wells located near the site that are used for drinking water purposes has not been completely determined. Conversations of ATSDR staff with area residents indicate that there is no private use of water from wells located within ½ mile down gradient of the site to the north and northwest. This is consistent with water-distribution maps from the Douglasville-Douglas County Water and Sewer Authority, which indicate that no public water is currently supplied at these locations. The Young Refining Corporation (Young Refining) installed two monitoring wells (MW-15B and MW -15R), located down gradient of both Young Refining and Arivec. In January 1999, samples from these monitoring wells detected Cis-1,2-dichloroethene at 5 ppb and 8 ppb and 1,1,2-trichloroethane was detected at 2 ppb and 4 ppb, respectively. The source of this contamination has not been determined, but these contaminants have been detected at Young Refining Arivec. GA EPD sampled private wells along Huey and Pirkle Roads down gradient (north) of Young Refining on August 21, 2000. GA EPD sampled the private wells for metals, VOCs, SVOCs, pesticides, PCBs, and bacteriological contaminants. No contaminants of concern were identified in any of the private wells [57].

ATSDR cannot fully evaluate this pathway because the extent of off-site groundwater contamination has not been completely defined. Although results of private well sampling in August 2000 did not indicate the presence of site related contaminants, migration of site related contaminants toward down gradient off-site private wells should be fully delineated.

Soil

Evaluation of Soil Data

On-Site Soil

Access to the site is currently restricted by a 6-foot-high chain link fence that is topped with barbed wire; however, GA EPD staff noted that the front gate was in disrepair during the site visit in July 1999 [40]. The gate was bent down and GA EPD staff returned the fence to the upright position. Theoretically, an older child, teen, or adult could gain access to the site if they were to climb over the fence; however, this scenario is considered unlikely.

On July 31, 1992, GA EPD collected four surface-oil samples at 3-6 inch depths from the junkyard area, vehicle parking area, the area near the heating oil tank, and the area east of the hot oil unit at Plant No. 2 (Figure 2, Appendix A). Three deeper soil samples (at approximate 1-foot depths) were collected from the junkyard area and from the north and east sides of the drum storage pad. Samples were analyzed for VOCs, SVOCs, and selected metals (arsenic, barium, cadmium, chromium, mercury, lead, and selenium). Arsenic, chromium, and lead were identified at 14 parts per million (ppm), 260 ppm, and 1400 ppm, respectively from samples collected in the junkyard area [22 - 23]. These concentrations exceed the ATSDR CVs for soil. Table 4 of Appendix B presents the contaminants of concern identified for this medium.

On February 3 - 4,1994, GA EPD collected 15 soil samples from all of the Solid Waste Management Units (SWMUs) at the Arivec site (Figure 2, Appendix A) [24]. The sample depths were not specified. The samples were analyzed for VOCs, SVOCs, polychlorinated biphenyls (PCBs), and metals. Arsenic, lead, n-nitrosodimethylamine, PCB-1254, and PCB-1260 all exceeded ATSDR CVs. Arsenic was detected only once at 7.5 ppm from SWMU #1. Lead was detected in all samples collected at values ranging from 6.2 - 1600 ppm, but the highest lead concentration was collected in the junkyard (SWMU #4). N-nitrosodimethylamine was detected twice in SWMU #15; the concentrations were 0.79 ppm and 2.9 ppm; PCB-1254 was detected at 1.73 ppm in SWMU #15, and PCB-1260 was detected at 2.57 ppm at SWMU #3.

Exposures to the concentrations of n-nitrosodimethylamine (NDMA) found in Arivec soils are not expected to result in adverse health effects. NDMA was detected in a 1994 sampling event in 2 of 21 samples at a maximum concentration of 2.9 ppm. It is unlikely that NDMA would be detected again at these locations if sampled again. NDMA evaporates quickly and is very mobile in soil. Its half-life is about three weeks under laboratory conditions [MAB Malik and K Tesfai.1981. Bull Environ Contam Toxicol 27:115-21]. Volatilization and leaching would remove most of the NDMA from the soil surface, where most contact would occur [S Greene, et al. 1981. J Environ Qual 10: 416-21] [JE Oliver, et al. 1979. J Agric Food Chem 27:887-91].

Surface Water and Sediment

Site Drainage Characteristics

Most storm water and surface water on the site is retained by an earthen dike that runs and enters a storm water collection area, originally intended for primary containment of chemical spills at the facility. An additional storm water retention area is located between the earthen dike and the northeast property line. Arivec referred to these areas as storm water retention areas #1 and #2, respectively (later designated as SWMU #11 and SWMU #2). Water leaves the ponds via drain pipes and enters a system of drainage ditches that also collect storm water or surface water from outside of the dike (Figure 2, Appendix A) [2].

Evaluation of Surface-Water and Sediment Data

Surface Water

On July 31, 1992, GA EPD collected a surface-water sample from storm water pond #2 (SWMU #12). The sample was analyzed for VOCs, SVOCs, and seven metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver). On February 4, 1994, GA EPD sampled SWMU #12 and water from an unknown location, thought to be SWMU #11. The 1994 samples were analyzed for the same parameters as in 1992, and for mercury [22-24]. Table 5 of Appendix B presents the contaminants of concern in this environmental medium.

Arivec collected surface-water samples from on-site ponds from 1986 to 1993. Samples were analyzed for VOCs and five chemical parameters (pH, total suspended solids, oil and grease, biological oxygen demand, chemical oxygen demand). In 1986, several VOCs exceeded ATSDR's drinking water comparison values (Table 5, Appendix B).

On October 3 and November 9, 1988, GA EPD collected water samples near Malone Road, downstream of the confluence of Cracker Creek, within an unnamed tributary to Gothard's Creek (Figure 5, Appendix A.) Samples were analyzed for certain physical/biological parameters, selected metals, sulfide, ammonia, VOCs, SVOCs, and pesticides/PCBs [47-48]; no contaminants of concern were identified.

On June 14, 1989, GA EPD collected samples from Cracker Creek (downstream of the confluence with the unnamed tributary of Gothard's Creek) and from the unnamed tributary (upstream from where it is fed by Cracker Creek). The latter location was sampled to assess conditions in the unnamed tributary before receiving water from Cracker Creek. Samples were analyzed for certain physical/biological parameters, ammonia, and selected metals [49]. Manganese was identified at 1000 ppb, exceeding the drinking water CV of 50 ppb.

On February 17, 1993, samples were collected from the unnamed tributary of Gothard's Creek (downstream of Cracker Creek) and at a location up gradient of the site. Samples were analyzed

for selected metals, VOCs, and SVOCs. The only contaminant of concern identified was manganese that was detected at 300 ppb from the downstream location [30].

In 1998, the Douglasville-Douglas County Water and Sewer Authority performed an assessment of Gothard's Creek. Samples were collected on seven dates between June 29, 1998 and October 10, 1998 from an area located approximately 1.5 miles downstream of the site, near Maroney Mill Road. Samples were analyzed for certain physical/biological parameters, zinc, and ammonia; no contaminants of concern were identified [26, 50].

Sediment

GA EPD collected sediment samples on October 3, 1988, November 9, 1988, and June 14, 1989 [30, 47- 49]. No VOCs, SVOCs, or pesticides/PCBs were detected above their CVs. Metals were detected at concentrations typically found in the Eastern United States [51]. In 1998, thallium was detected in two samples collected from the unnamed tributary (downstream of Cracker Creek) at 120 ppm and 26 ppm; both levels are above the soil CV.

On July 31, 1992, GA EPD collected one sediment sample from SWMU #12. The sample was analyzed for VOCs, SVOCs, and seven metals (arsenic, barium, cadmium, chromium, lead, selenium, and silver). On February 4, 1994, GA EPD collected one sample from SWMU 11 and one from SWMU 12. Samples were analyzed for the same parameters as in 1992 and for mercury and PCBs. All contaminants were detected either at, or below the CV for soils.

Air

The facility was a small-scale generator of air pollution that emitted VOCs and other chemicals into the atmosphere [45]. The only emissions data available are those that report estimated releases as volume measurement (i.e., in pounds per day or tons per year of VOCs). VOC emissions ranged from 30-100 pounds per day; these levels are within GA EPD regulatory limits [7]. The data do not provide contaminant concentration information; without this information, air data cannot be evaluated.

The GA EPD early site investigations of the Arivec facility were in response to community concerns expressed about odors in the area. As part of a facility inspection in July 1986, the GA EPD inspector observed a plume of steam emanating from the Arivec cooling tower and a "fruity" odor of ethyl acetate near the stream jet vent; however, the facility did not violate its air permit and no Arivec-related odors were detected off property [50]. During the 1991 site visits, ATSDR staff noted asphalt and sulfur odors near the Arivec and Young Refining sites. No appreciable odors were detected in the 1994 visit [4, 10]. In 1997, GA EPD responded to a report of "organic" odors that were believed to be emanating from the BRB facility that operated the facility at that time. No violations of the Georgia Hazardous Waste Management Rules were identified; a sample of BRB's wastewater and oil/grease revealed no hazardous constituents [51]. No air samples were taken during the above investigations.

The site is currently inactive and no air emissions are occurring. During a July 1999 site visit, GA EPD staff noted some "greasy/oily" odors in the containment areas on the site; but did not notice off-site odors [40].

C. Stored Wastes and Physical Hazards

Historical data indicate that Arivec stored all waste products generated through the reclamation process on the site in drums, until they disposed of. Limited data are available to characterize the nature and quantities of these materials. In July 1992, GA EPD collected a sample from an unmarked on-site drum [23]. The sample was analyzed for VOCs, SVOCs, and metals. Sampling analysis indicated that the drum's contents were acidic and contained tetrachloroethylene at a concentration of 1200 ppb. That same year, GA EPD staff observed a white powder on pine trees near the storm water ponds at the Arivec facility. Samples of the powder were collected and analyzed for VOCs and SVOCs; no contaminants of concern were detected. In 1994, Arivec reported that acetate, tetrachloroethylene with butanol, trichloroethylene, diesel fuel, gasoline, lacquer thinner, and mixed solvents remained in on-site tanks [7, 56].

The most likely potential exposure to the wastes stored on the site would have occurred in the past to on-site workers [2]. However, no data exist from the past to further evaluate this potential exposure pathway. The front gate at the site is currently in disrepair and this poses a potential physical hazard to persons who may want to trespass on the site [40]. However, the fence would have to be climbed to gain access to the site, and this scenario is considered unlikely.

Public Health Implications

Toxicologic Evaluation

On-Site Soil

GA EPD collected samples from areas thought to be the most contaminated on the site. Arsenic, chromium, and lead were detected at concentrations that exceed ATSDR's comparison values. On the basis of the current land use scenario for the site, the toxicity of the metals and the potential for exposures, no adverse health effects are expected to occur. However, if the land use on the site were to change, on-site soil should be further characterized and the public health implications should be re-evaluated.

Arsenic is a naturally occurring element typically found in surface soils at levels ranging from 0.1 to 80 ppm [26]. The sample with the highest arsenic concentration (14 ppm) detected on the Arivec site. This sample was collected from the junkyard. This concentration does not exceed ATSDR's CVs for noncancer health effects, but it exceeds the Cancer Risk Evaluation Guide (CREG) of 0.5 ppm. Please note that the development of CREGs was based on drinking water studies, and its applicability to soil exposures is not entirely appropriate. The CREG is based on lifetime daily exposures. Site exposures are infrequent and of short duration; and even if people were exposed daily, the estimated arsenic doses are much lower than those known to result in

cancer. Therefore, the arsenic concentrations detected are considered to be far below those expected to result in cancer.

Chromium was detected in all soil samples. The maximum detected concentration (260 ppm) did not exceed ATSDR's CV for adults, but it does exceed the child CV of 200 ppm. Children are not expected to be exposed currently to on-site soil; therefore, the concentration of chromium detected does not pose a health hazard. Even if children were regularly exposed to on-site soil, it is highly unlikely that the exposures would result in adverse health effects because: 1) the CV is based on the most toxic form of chromium (hexavalent chromium) which is typically not found in environmental samples; 2) detected chromium levels were much lower than CVs for trivalent chromium ,which tends to be more prevalent; and 3) the CV for hexavalent chromium has an "uncertainty factor" of 900, meaning that the CV is set 900 times lower than the dose levels at which no adverse no adverse health effects have been observed [32, 53].

Exposures to the concentrations of lead detected in on-site soils are unlikely to pose a health risk to adults or to older children who may trespass on the site. However, young children are particularly susceptible to adverse health effects from lead exposure; the concentrations detected on the site could be of potential concern if young children are regularly exposed to on-site soil. However, this exposure scenario is considered highly unlikely based on current site conditions and limited accessibility to the site.

PCBs

Exposures to the concentrations of PCBs detected in on-site soils will not result in adverse health effects. The Arivec site is an industrial site that is fenced to limit potential exposures from trespassing. PCBs can be present in the environment in different forms (e.g., PCB-1254 and PCB-1260). The concentrations detected at the Arivec site slightly exceed the CVs. The CVs are based on chronic exposures, and the CVs have "safety factors" applied [42].

n-Nitrosodimethylamine

Exposures to the maximum -detected concentration of NDMA are not likely to result in cancer or noncancer health effects. Although the comparison values (CVs) for cancer health effects are exceeded, these CVs are based on daily exposures for a lifetime, or 70 years. Realistic occupational exposure scenarios do not result in an apparent increase in the risk for developing cancer.

ATSDR has not developed CVs for noncancer health effects for NDMA; however, health effects have not been reported at environmental levels as low as those detected at the Arivec site. The lowest published lethal dose was reported as 20 mg/kg for 2.5 years, this far exceeds the estimated maximum occupational exposure dose of 0.00007 mg/kg/day [Oncology (S. Karger AG. Postfach CH-4009 Basil Switzerland)v 21-1967-(37,273,1980)]. The mean daily intake of NDMA was reported as 0.00019 mg/day; this exceeds the estimated maximum occupational

exposure dose (0.00007 mg/day) [H Biaudet, T Mavelle, and G Debry; 1994]. Mean daily intake of N-nitrosodimethylamine from foods and beverages in France in 1987-1992. [Food and Chemical Toxicology 32(5):417-21].

Surface Water and Sediment

Although surface water sampling data identified some contaminants of concern, the limited exposure to these on-site areas would not be expected to result in adverse health effects. CVs for drinking water were used as screening values. These CVs are based on the assumption that individuals drink 2 liters of water per day. ATSDR does not have information about actual exposures to the ponds, but incidental exposures to the ponds would have been significantly lower than that expected from a drinking-water exposure scenario. Therefore, adverse health effects are not associated with exposures to contaminants on the site.

Groundwater

Because on-site groundwater is not being used and because the results of private well sampling indicate that site-related contaminants are not present in private wells, no exposure to groundwater contamination is occurring. Therefore groundwater currently does not represent a public health hazard on or off the site.

D. Health-Outcome Data Evaluation

Government agencies routinely collect health information of populations in different geographic areas; many state health departments have developed registries of illnesses and diseases; some county and local health departments periodically collect health information; and community members and groups might also collect health information in particular areas of interest.

Community members were concerned about an excess of cancer and of respiratory illnesses in the area around the site. ATSDR contacted the Georgia Division of Public Health, the Douglas County Board of Health, and GA EPD to gather pertinent health-outcome data. The Georgia State Health Department maintains a cancer registry that records cancer deaths, tracks overall cancer rates and specific cancers by sex and age, and generates an overall “age-adjusted cancer death rate for the county and the state. The Georgia Department of Health also maintains registries for other diseases. This agency is the only agency in the area with a disease registry. No health studies or other health-outcome data were generated for this area. The county level is the smallest geographic unit that the health department tracks. According to the 1990 Census, the population of Douglas County is 71,120; of these, 5,163 persons reside within a 1-mile radius of the Arivec site [11]. The available health-outcome information does not adequately represent information for the specific study area it is smaller than the level for which data is available. In addition, available environmental data do not indicate exposure. Therefore, no conclusion can be drawn concerning health outcomes for residents in the area surrounding the Arivec site.

Health-outcome data are evaluated to identify trends in populations and any unusual increases in disease in specific geographical areas. Cancer mortality data for Douglas County (1992-1996) indicate that, overall, cancer mortality rates were slightly higher in Douglas County (182.2 cases/100,000 persons) than in the State of Georgia (174.7/100,000). Information for specific cancer types are displayed in the table below.

Incidence Rates for Various Cancer Types for Douglas County, Georgia, and for the State of Georgia

TYPE OF CANCER	COUNTY DATA	STATE DATA
Breast	26.7	23.9
Colon	10.7	15.8
Leukemia	6.2	6.3
Lung	65.6	54.3
Non-Hodgkin's Lymphoma	7.2	5.7
Pancreas	6.4	8.2
Prostate	23.5	31.6

Incidence rates are per 100,000 persons.

E. ATSDR Child Health Initiative

Children are at greater risk of adverse health effects from exposures to hazardous substances than adults because: 1) children play outside more often than adults, increasing the likelihood of contact with chemicals in the environment; 2) children are shorter than adults and more likely to be exposed to soil, dust, and heavy vapors that are close to the ground; 3) children are smaller than adults, and their exposures would result in higher doses of chemical per body weight; and 4) children's developing body systems can sustain damage if toxic exposures occur during certain growth stages. Therefore, ATSDR evaluated how children might be affected by the types and quantities of chemicals detected in water and soil at the site, seeking to determine if detected contaminant levels might be associated with any reproductive or developmental effects.

ATSDR believes that child trespassing on the site is unlikely. Although unlikely, ATSDR evaluated exposure scenarios for children (e.g. trespassing onto the site). ATSDR used the most conservative comparison values for children while evaluating the data. On the basis of the current land use and the available data, no special hazards to children exist.

COMMUNITY HEALTH CONCERNS EVALUATION

The concerns expressed by community members are presented in italics, and the ATSDR responses immediately follow each concern.

What types of respiratory health effects, eye irritation, headaches, and nausea are associated with the odors around the site, and what is the air quality in this area?

GA EPD records indicate that community members have reported odor complaints (rotten eggs, natural gas, oil, and asphalt) since the 1970s. Some residents reported that the odors made them gag, burned their eyes, nose, throat, and/or skin, and were especially bad at night. ATSDR could not fully evaluate the air exposure pathway because no past or present data are available for review. However, Arivec's application for a state air permit lists particulates, carbon monoxide, hydrocarbons, and smoke as potential emission components.

Sulfur-containing compounds are particularly odoriferous (e.g, the smell of rotten eggs) and are a by-product of many industrial processes, such as oil refining. The human senses can detect such compounds at very low concentrations. These odors might be offensive and very unpleasant. In reaction to these odors, some people might experience nausea or headaches. At concentrations of sulfides in air above 100 ppb, sensitive people might begin to experience eye, nose, and throat irritation. These effects reverse when the odor goes away [55].

The site is currently inactive. If the site is developed in the future, or if the GA EPD requires any site clean-up activities, ATSDR recommends that air monitoring be implemented as part of the clean-up process.

Is there an excess of cancers, skin rashes, and respiratory illnesses in the vicinity of the site?

ATSDR reviewed state and county cancer mortality rates. Cancer mortality rates at the county level are not specific enough to make a determination in the immediate vicinity of the site. Data indicate that the cancer rates are slightly higher in Douglas County than in the state of Georgia; however, this information is not site specific. A comparative table for different cancers is presented under the Health Outcome Data section of this document.

It is generally difficult to link observed heath effects with environmental exposures. A detailed evaluation of all possible risk factors (e.g., work, hobbies, smoking, age, family history, etc.) is necessary when health scientists study adverse health effects in a community to further investigate possible causes for reported diseases. The available environmental and exposure data are currently not sufficient to evaluate this community concern for the populations near the Arivec site.

What health effects can occur from exposure(s) from Cracker Creek?

Only limited environmental data are available for Cracker Creek. ATSDR is unable to make a public health determination on the basis of the available data. ATSDR will evaluate additional environmental data from Cracker Creek as it becomes available

CONCLUSIONS

The Arivec Chemicals, Inc. site is classified as an indeterminate public health hazard. This classification is made because ATSDR identified a number of data gaps during its public health assessment process. ATSDR concludes that on-site soil does not pose a health hazard under the current industrial land use. Limited data indicate that surface water and sediment do not pose a health hazard, but additional data are needed to fully evaluate this pathway. On-site groundwater does not pose a public health hazard because this water is not being used. Additional data are needed to address community health concerns. Additional data is needed to determine the extent of off-site migration of contaminants in groundwater and to evaluate surface water and sediment from Cracker Creek The facility is no longer operational, therefore, air emissions do not pose a hazard to public health. ATSDR did not have sufficient data to make a determination regarding past air emissions.

RECOMMENDATIONS

1. Characterize groundwater beneath the site to determine groundwater flow patterns and delineate on-site and off-site groundwater contamination.

2. Evaluate data as it becomes available and inform the community of the findings.

3. Repair or replace sections of the fence around the site to restrict site access.

4. Connect remaining residents to municipal water who live within one half a mile north of the site to eliminate the potential of future exposure to contaminated groundwater.

5. Conduct air monitoring during remedial activities at the site.

PUBLIC HEALTH ACTION PLAN

This Public Health Action Plan (PHAP) was developed for actions needed at the Arivec site. The purpose of the PHAP is to ensure that this public health assessment identifies public health hazards and to provide a plan of action designed to mitigate and prevent adverse human health effects that might result from exposure to hazardous substances in the environment. The public health actions that are completed, being implemented, or planned are as follows:

Actions Completed

1. GA EPD conducted a Preliminary Assessment (1985) and a RCRA Facility Assessment (1993) to identify areas of potential contamination at the Arivec site.
2. Since 1991, ATSDR has conducted several site visits and met with concerned community members.

3. In response to concerns about potential site contamination, parties responsible for the site, under the supervision of GA EPD, developed plans to investigate site contamination and to prepare the site for closure.

4. Arivec conducted Phase I of the RCRA Facility Investigation to identify possible areas of soil and groundwater contamination at the site.

5. EPD sampled private wells within ½ a mile down gradient (north and northwest) of the site in August 2000.

Actions Planned

1. GA EPD will evaluate environmental conditions at the site and oversee additional site investigation.

2. ATSDR will evaluate private well data and other environmental data as they become available and will update this document accordingly.

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APPENDIX A

FIGURES

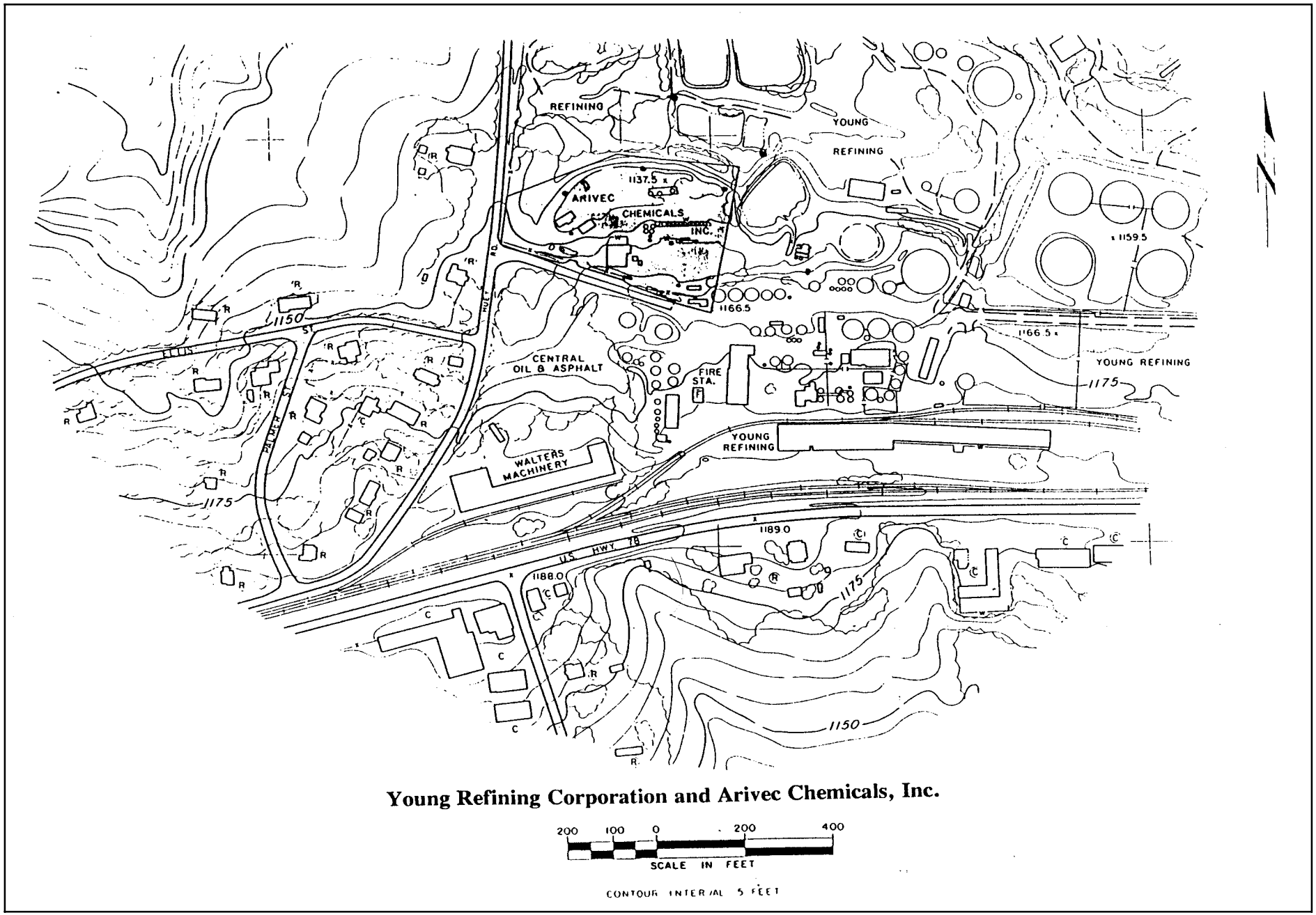
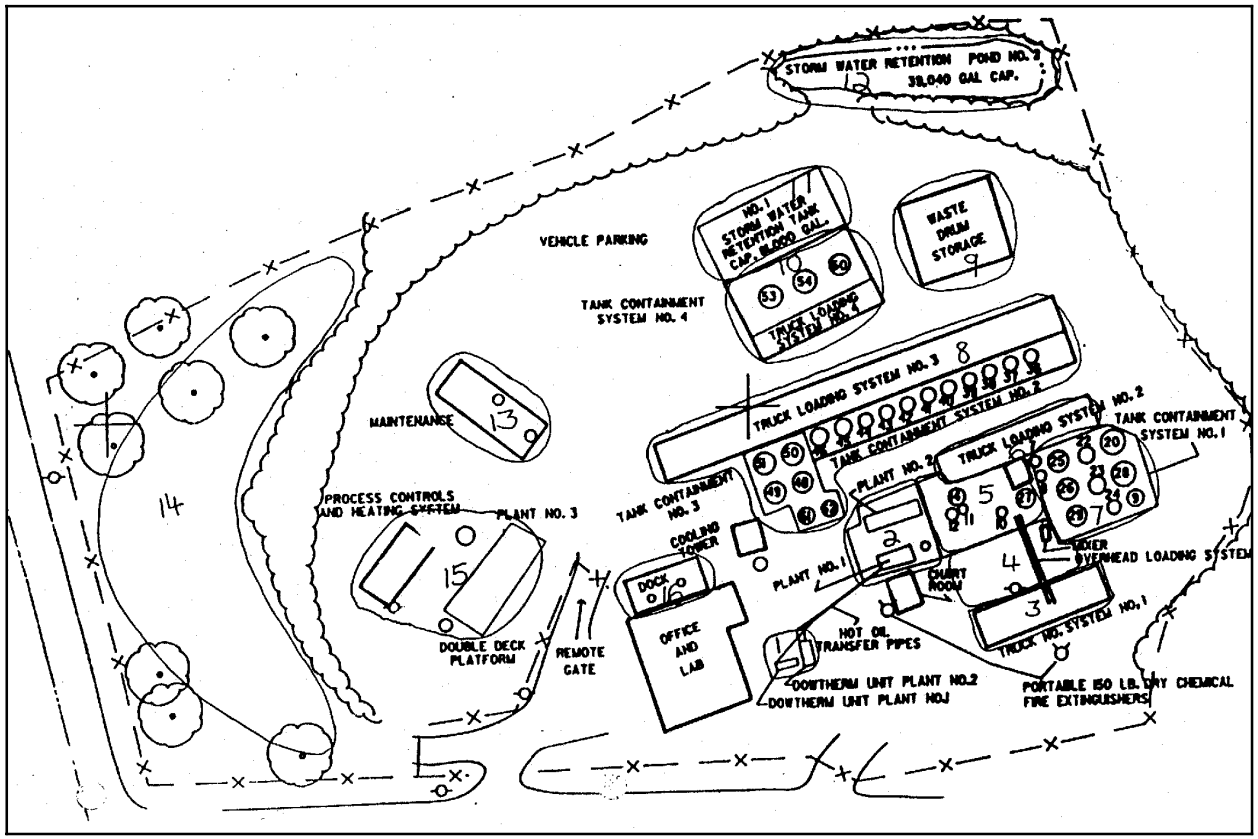


Figure 1. Arivec Chemicals, Inc. Site Location Map **Source: [56]**

Figure 2. Arivec Chemicals, Inc. Site Layout and Solid Waste Management Units (SWMUs)



SWMU ID	LOCATION
SWMU #1	Downtherm Units (Hot Oil Heaters), Plants No. 1 and No. 2
SWMU #2	Distillation Process Area
SWMU #3	Truck Loading System No. 1
SWMU #4	Staging Area
SWMU #5	Tank Storage Area
SWMU #6	Truck Loading System No. 2
SWMU #7	Tank Containment System No. 1
SWMU #8	Truck Loading System No. 3 and Product Storage Tanks
SWMU #9	Hazardous Waste Container Storage Area
SWMU #10	Truck Loading System No. 4
SWMU #11	Stormwater Retention Pond #1
SWMU #12	Stormwater Retention Pond #2
SWMU #13	Maintenance and Parking Area
SWMU #14	Junkyard Area
SWMU #15	Process Control and Heating Area
SWMU #16	Loading Dock

Source: [2]

APPENDIX B

TABLES

Table 1. Operational and Regulatory History at the Arivec Chemicals, Inc. Site.

Date	Event
1956	Arivec Chemicals, Inc. (Arivec) begins operations as a solvent recycling facility.
December 1975	Douglas County refused to permit Arivec to dump solvent sludges at the Cedar Mountain Landfill.
January 8, 1976	The Georgia Department of Natural Resources, Environmental Protection Division (GA EPD) issued Arivec an air permit (#2869-048-4735-0) to operate re-refining and fuel burning equipment.
January 26, 1976	Arivec applied for a National Pollutant Discharge Elimination System Permit (NPDES). The application indicated that the facility discharged 50 gallons per day of wastewater from its solvent recovery process into a pond, which discharged into the drainage system know as Cracker Creek.
1977	GA EPD issued a solid waste handling permit to Arivec.
November 1981	37 Arivec empty drums found abandoned in Douglasville which had been given to a citizen by Arivec.
June 1984	South Carolina issued a hazardous waste transporter permit to Arivec under the Resource Conservation and Recovery Act (RCRA).
August 10, 1984	GA EPD issued Arivec a hazardous waste facility permit (#HW-007).
August 1985	GA EPD conducted a Preliminary Assessment of Arivec under its hazardous waste management program.
July 11, 1986	GA EPD's Air Protection Branch inspected Arivec and found the facility to be in compliance with the conditions of its air permit. No Arivec-related odors were noticed outside Arivec's boundary.
June 1987	Arivec cited for failure to maintain the required liability insurance under RCRA.
July 31, 1992	GA EPD Hazardous Waste Management Branch conducts a site investigation (report issued in December 1992).
March 30, 1993	Arivec submitted an application for hazardous waste permit renewal (Part A application).
August 19, 1993	GA EPD received correspondence from Arivec's owner/operator announcing its intent to close facility.
September 16, 1993	GA EPD conducted a RCRA Facility Assessment (RFA) during which it identified 16 areas of potential contamination (Solid Waste Management Units [SWMUs]) (report issued September 30, 1993).
October 29, 1993	Arivec submitted a letter to GA EPD rescinding its March 1993 renewal application and announced its intent to close with a target closure date of February 5, 1994.

Date	Event
November 4, 1993	Arivec submitted a notice of facility closure to GA EPD detailing scheduled steps for facility closure (per the requirements of its hazardous waste permit).
December 17, 1993	GA EPD issued letter approving Arivec's closure schedule.
January 31, 1994	"Certification of Closure" was signed by an independent engineer and submitted to GA EPD.
February 1994	GA EPD collected samples at each of the 16 SWMUs. Analytical data from samples indicated the release of hazardous waste, hazardous waste constituents, or hazardous constituents.
May 27 and June 1, 1994	EPA conducted a site inspection of Arivec and subsequently issued letter requiring the removal of waste left in tanks.
June 1994	GA EPD issued Arivec an Administrative Order (EPD-HW-1088) requiring Arivec to perform a RCRA Facility Investigation (RFI) to further investigate the 16 SWMUs. EPA issued a Notice of Liability for Removal Action letter to Arivec, advising the facility of its obligation to remove certain site-related contamination.
July 18, 1994	In response to the Administrative Order, Arivec submitted a letter to GA EPD indicating the type of substances remaining in on-site tanks (including acetate, tetrachloroethylene with butanol, trichloroethylene, diesel fuel, gasoline, lacquer thinner, and mixed solvents). Arivec stated its intent to 1) properly dispose tank contents within 90 days, with the exception of the heating and motor oils, 2) decontaminate all storage structures, 3) cease storage of bulk chemicals, and 4) prepare an RFI work plan, but requested an extension.
August 4, 1994	GA EPD issued a letter to Arivec indicating that the description of chemicals in their July 18, 1994, letter was deficient and refusing Arivec's request for an extension for submitting the RFI work plan.
August 17, 1994	Arivec submitted a letter to GA EPD indicating that they were currently operational as a "nonhazardous industrial activity;" the letter defined "mixed solvents" stored on site as including methyl ethyl ketone, acetone, toluene, and xylene.
September 1995	Brokerage Recovery & Blends, Inc. (BRB) was issued a commercial feed license by the Georgia Department of Agriculture (license renewed 1996 and 1997) to operate a cooking oil reclamation operation on the site.
November 3, 1995	GA EPD letter to the Douglas County Board of Commissioner indicated that Arivec had relinquished its hazardous waste permit and could no longer engage in hazardous waste-related activities, and noted that the administrative order required them to decontaminate all structures and remediate any contamination, but that use of the property was not restricted by GA EPD, provided it did not interfere with ongoing investigations.
March 8, 1996	GA EPD issued a memorandum indicating that Arivec has failed to provide GA EPD with a satisfactory RFI work plan (after 18 months and three attempts) and recommends that the site be referred the Hazardous Sites Response Program for investigation and remediation.

Date	Event
March 28, 1997	GA EPD Administrative Order was made an Order of the Court.
July 7, 1997	Arivec submitted a revised RFI work plan to GA EPD.
June 19, 1997	In response to an odor complaint, GA EPD inspected BRB operations. No violations of Georgia Hazardous Waste Management Rules were observed.
July 7, 1997	Arivec submitted a revised RFI work plan to GA EPD.
September 10, 1997	GE EPD approved Arivec's revised RFI work plan.
December 16, 1998	Arivec submitted a Phase I RFI Report to GA EPD.
July 9, 1999	GA EPD conducted a site visit to observe site conditions.

References: [2, 4, 7, 8, 21, 22, 40, 50, 54, and 56]

Table 2. 1990 Census Information for the Area within a 1-mile Radius of the Arivec Chemicals, Inc. Site

	Site Area[1]		Census Tract 803		Douglas County	
Total Population	5,163		11,709		71,120	
White	3,939	76.3%	9,334	79.7%	64,734	91.0%
Black	1,154	22.4%	2,222	19.0%	5,597	7.9%
American Indian, Eskimo, Aleut	16	0.3%	26	0.2%	176	0.2%
Asian or Pacific Islander	30	0.6%	87	0.7%	386	0.5%
Other	24	0.5%	40	0.3%	227	0.3%
Hispanic Origin	57	1.1%	128	1.1%	749	1.1%
Less than 18 Years of Age	1,457	28.2%	3,105	26.5%	20,149	28.3%
18 Years of Age or Greater	3,706	71.8%	8,604	73.5%	50,971	71.7%
Children Aged 6 and Younger	651	12.6%	1,336	11.4%	7,850	11.0%
Females Aged 15 – 44	1,331	25.8%	2,989	25.5%	18,395	25.9%
Adults Aged 65 and Older	527	10.2%	1,168	10.0%	4,997	7.0%
Occupied Housing Units			4,154		24,277	
Owner Occupied			2,607	62.8%	18,880	77.8%
Average Housing Value			78,000		81,200	

Reference: [11]

[1]Site Area is defined as the population within 1mile of Arivec Chemicals, Inc. and Young Refining Corporation.

Table 3. Potential Exposure Pathways for Arivec Chemicals, Inc. Site

Pathway Name	Exposure Elements					Time
	Source	Medium	Route of Exposure	Point of Exposure	Receptor Population	
Groundwater	Chemical leaching through soil at Arivec	Groundwater	Inhalation, Ingestion, Dermal Contact	Residences with private water wells	Residents owning private wells	unknown
Soil	Corrosion of Process Equipment/ Scrap Metal, Chemical Spills, and/or mishandling of Chemical Wastes at Arivec	Surface Soil	Inhalation, Inadvertent Ingestion, Dermal Contact	Facility Grounds	Workers	past current future
					Trespassers	unknown
Surface Water & Sediment	Stormwater discharges and stormwater ponds from Arivec	Surface Water & Sediment	Inhalation, Inadvertent Ingestion, Dermal Contact	waste-water ponds	Workers	past current future
					Trespassers	unknown
				Cracker Creek & Residences adjacent to creek	Nearby Residents	past current future
Air	Stack and fugitive air emissions from Arivec	Ambient Air	Inhalation	Facility	Workers	past current future
					Trespassers	
				Nearby Residences	Nearby Residents	
Food Chain	Stormwater discharge from Arivec into nearby creeks; air emissions from Arivec.	Fish in nearby creeks and homegrown produce	Ingestion	Nearby Residences	Trespassers	unknown
					Nearby Residents	unknown
Stored Wastes & Physical Hazards	Chemical spills and/or stored chemical wastes at Arivec	Chemical Wastes & Other Raw Materials	Inhalation, Dermal Contact	Facility	Workers	past current future
					Trespassers	unknown

Table 4. Arivec Chemicals, Inc. Surface Soil Data (July 31, 1992 and February 3-4, 1994).

Chemical of Concern	Concentration Range (ppm)	CV	Type of CV	Number of samples	Number of detections	Location of Maximum	Date of maximum
Arsenic	<3 - 14	0.5 20	CREG C-EMEG-child	21	4	Junkyard area, composite (Sample 1)	1992
Chromium	2.3 - 260	200 2000	RMEG-child RMEG-adult	21	21	Junkyard area, composite (Sample 1)	1992
Lead	6.2 - 1,600	400	EPA action level	21	21	SWMU 14 (Sample 17B)	1994
n-Nitrosodimethylamine	<0.66 - 2.9	0.01 0.11	CREG RBC-N	21	2	SWMU 15 (Sample 18)	1994
PCB-1254	<0.006 - 1.73	1	RMEG-child	14	3	SWMU 15 (Sample 18)	1994
PCB-1260	<0.006 - 2.57	0.32	RBC-C	14	8	SWMU 3 (Sample 3)	1994

Reference: [22, 23, 24]

Notes:
A chemical is designated as a chemical of concern if the chemical level exceeds at least one of its comparison values (CVs).

Twelve additional compounds were “tentatively identified.” Identity was based on a mass spectral library search. Because the identity and quantity of the compounds is estimated and uncertain, they are not included in this table and were not considered contaminants of concern.

C-EMEG = Environmental Media Evaluation Guide for Chronic Exposure
CREG = Cancer Risk Evaluation Guide for 10^{-6} excess cancer risk
CV = comparison value
PCB = polychlorinated biphenyl
ppm = parts per million
RBC-C = Risk Based Concentration for Carcinogens (EPA)
RBC-C = Risk Based Concentration for Noncarcinogens (EPA)
RMEG = Reference Dose Media Evaluation Guide

Table 5. Arivec Chemicals, Inc. Surface Water Data, Stormwater Ponds (June 1986 through February 4, 1994).

Chemical of Concern[1]	Concentration Range (ppb)	CV	Type of CV	Number of samples[2]	Number of detections	Location of maximum	Date of maximum[3]
Arsenic	<30 - 30	0.02 3	CREG C-EMEG-child	4	1	SWMU 12	June 1986
Chloroform	<5 - 56	6 100	CREG C-EMEG-child	17	1	SWMU 12	June 1986
Chromium	<10 - 100	30	RMEG-child	5	2	SWMU 12	June 1986
1,1-Dichloroethene	15 - 268	0.06 90	CREG C-EMEG-child	17	1	SWMU 12	June 1986
Lead	<50 - 68	15	EPA action level	3	1	SWMU 12	July 31, 1992
Methylene chloride	<5 - 206	5 600	CREG RMEG-child	17	1	SWMU 12	June 1986
Silver	<30 - 400	50	RMEG-child	4	1	SWMU 12	June 1986
Tetrachloroethylene	<5 - 1,170	0.7 100	CREG RMEG-child	17	3	SWMU 11	January 25, 1990
Toluene	169 - 1,130	200	I-EMEG-child	17	2	SWMU 11	January 25, 1990
1,1,1-Trichloroethane	12 - 1,670	540	RBC-N	17	3	SWMU 11	January 25, 1990
Trichloroethylene	32 - 56	3 5	CREG MCL	17	2	SWMU 12	June 1986

Reference: [22, 23, 24, 46, 48]
Notes: 1. A chemical is designated as a chemical of concern if the chemical level exceeds at least one of its comparison values (CVs).
2. NPDES data documentation does not indicate whether water was sampled for metals.
3. Dates sampled: June, 1986; August 16, 1988; September 7, 1988; March 20, 1989; January 11, 1990; January 25, 1990; March 21, 1990; January 22, 1991; June 19, 1991; February 13, 1992; March 25, 1992; July 31, 1992; October 30, 1992; January 6, 1993; May 25, 1993; February 4, 1994.
C-EMEG = Environmental Media Evaluation Guide for chronic exposure
CREG = Cancer Risk Evaluation Guide for 10^{-6} excess cancer risk
I-EMEG = Environmental Media Evaluation Guide for intermediate exposure
MCL = Maximum Contaminant Level for drinking water (EPA)
PCB = polychlorinated biphenyl
ppb = parts per billion
RBC-N = EPA's Risk Based Concentration for Noncarcinogens
RMEG = Reference Dose Media Evaluation Guide
SWMU = Solid Waste Management Unit

APPENDIX C

GLOSSARY

AND

ATSDR PUBLIC HEALTH ASSESSMENT METHODOLOGY

GLOSSARY

Absorption
The process of taking in. For a person or an animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

1. **Acute**
Occurring over a short time [compare with chronic].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with intermediate duration exposure and chronic exposure].

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with antagonistic effect and synergistic effect].

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems

Aerobic
Requiring oxygen [compare with anaerobic].

Ambient
Surrounding (for example, *ambient* air).

Anaerobic
Requiring the absence of oxygen [compare with aerobic].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with additive effect and synergistic effect].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) biomedical testing or (b) the measurement of a substance [an analyte], its metabolite, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see exposure investigation].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP [see Community Assistance Panel.]

Cancer
Any one of a group of diseases that occur when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980]

Chronic
Occurring over a long time [compare with acute].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with acute exposure and intermediate duration exposure]

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people from a community and from health and environmental agencies who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Comparison value (CV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during

the public health assessment process. Substances found in amounts greater than their CVs might be selected for further evaluation in the public health assessment process.

Completed exposure pathway [see exposure pathway].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as Superfund, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances. This law was later amended by the Superfund Amendments and Reauthorization Act (SARA).

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or an injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see route of exposure].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An "exposure dose" is how much of a substance is encountered in the environment. An "absorbed dose" is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [dose] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, biota (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and biota (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The environmental media and transport mechanism is the second part of an exposure pathway.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance [see Public health surveillance].

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a source of contamination (such as an abandoned business); an environmental media and transport mechanism (such as movement through groundwater); a point of exposure (such as a private well); a route of exposure (eating, drinking, breathing, or touching), and a receptor population (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a completed exposure pathway.

Exposure registry
A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].

Half-life ($t_{½}$)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with public health assessment].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to evaluate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with prevalence].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see route of exposure].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with acute exposure and chronic exposure].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with in vivo].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with in vitro].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of metabolism.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see reference dose].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, a condition, or an injury) is stated.

Mutagen
A substance that causes mutations (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites (National Priorities List or **NPL)**

EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

National Toxicology Program (NTP)
Part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see National Priorities List for Uncontrolled Hazardous Waste Sites]

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see exposure pathway].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with incidence].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with health consultation].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or radionuclides that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are no public health hazard, no apparent public health hazard, indeterminate public health hazard, public health hazard, and urgent public health hazard.

Public health statement
The first chapter of an ATSDR toxicological profile. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public health surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA [see Resource Conservation and Recovery Act (1976, 1984)]

Receptor population
People who could come into contact with hazardous substances [see exposure pathway].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see exposure registry and disease registry].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD [see reference dose]

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].

Safety factor [see uncertainty factor]

SARA [see Superfund Amendments and Reauthorization Act]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see population]. An environmental sample (for example, a small amount of

soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or an environment.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an exposure pathway.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's toxicological profiles. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund [see Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and Superfund Amendments and Reauthorization Act (SARA)

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at

hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].

Surveillance [see public health surveillance]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see prevalence survey].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see additive effect and antagonistic effect].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a safety factor].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

ATSDR Public Health Assessment Methodology

Quality Assurance

To prepare a health assessment, ATSDR relies on the referenced data/information. ATSDR assumes that adequate quality assurance and control measures were taken during chain-of-custody, laboratory procedures, and data reporting. The validity of the analyses and conclusions drawn in this document are determined by the availability and reliability of the information.

Human Exposure Pathway Evaluation and the Use of ATSDR Comparison Values

ATSDR assesses a site by evaluating the level of exposure in potential or completed exposure pathways. An exposure pathway is the way chemicals may enter a person's body to cause a health effect. It includes all the steps between the release of a chemical and the population exposed: 1) a chemical release source, 2) chemical movement, 3) a place where people can come into contact with the chemical, 4) a route of human exposure, and 5) a population that could be exposed. In this assessment, ATSDR evaluates chemicals in the soil and groundwater that people living in nearby residences may consume or come into contact with.

Data evaluators use comparison values (CVs), which are screening tools used to evaluate environmental data that is relevant to the exposure pathways. Comparison values are concentrations of contaminants that are considered to be safe levels of exposure. Comparison values used in this document include ATSDR's environmental media evaluation guide (EMEG), the reference dose media evaluation guide (RMEG), and cancer risk evaluation guide (CREG). When an ATSDR comparison value was unavailable, the U.S. Environmental Protection Agency (EPA) risk-based concentration (RBC) served as the comparison value. Comparison values are derived from available health guidelines, such as ATSDR's minimal risk levels and EPA's cancer slope factors and reference doses.

The derivation of a comparison value uses conservative exposure assumptions, resulting in values that are much lower than exposure concentrations observed to cause adverse health effects, thus ensuring the comparison values are protective of public health in essentially all exposure situations. That is, if the concentrations in the exposure medium are less than the CV, the exposures are not of health concern and no further analysis of the pathway is required. However, while concentrations below the comparison value are not expected to lead to any observable health effect, it should not be inferred that a concentration greater than the comparison value will necessarily lead to adverse effects. Depending on site-specific environmental exposure factors (for example, duration of exposure) and activities of people that result in exposure (time spent in area of contamination), exposure to levels above the comparison value may or may not lead to a health effect. Therefore, ATSDR's comparison values are not used to predict the occurrence of adverse health effects.

Listed below are the abbreviations and description of CVs and health guidelines considered in the Arivec public health assessment:

CREG	Cancer Risk Evaluation Guides: Health comparison values derived by ATSDR. CREGs are estimated media-specific concentrations expected to cause no more than one excess cancer in a population of a million individuals exposed over a 70-year lifetime. CREGs are calculated from EPA's cancer slope factors (CSFs). CREGs are the most conservative of comparison values because no threshold for the effects are assumed for chemical carcinogens. The resulting CREG is therefore often below typical background levels and common detection limits. CREGs do not define levels of actual hazard (e.g., a 1-in-a-million "risk" level) and cannot be used to predict actual cancer incidence under specified conditions of exposure. As stated in EPA's 1986 Cancer Risk Assessment Guidelines, the true risk in unknown and may be as low as zero.
CSF	Cancer Slope Factor: EPA's quantitative assessment to define the relationship between the chemical dose and carcinogenic effects as a linear function on the assumption of zero threshold and lifetime exposure; however, it must be noted that the true value of risk is unknown and could be as low as zero.
EMEG	Environmental Media Evaluation Guides: Health comparison values derived by ATSDR. They are media-specific concentrations that are calculated from ATSDR's minimal risk levels (MRLs) and factoring in default body weights and ingestion rates. Different EMEGs are calculated for adults, children, and (in the case of soil) pica children. Likewise, different EMEGS are computed for varying durations of exposure such as acute (1-14 days), intermediate (15-365 days), and chronic (more than 365 days).
MRL	Minimal Risk Levels: Health guidelines derived by ATSDR representing estimates of daily human exposure to chemical substances (i.e., doses expressed in mg/kg/day) that the agency considers unlikely to be associated with any appreciable risk of deleterious noncancer effects over a specified duration of exposure. MRLs are calculated using data from human and animal studies and are reported for acute (1-14 days), intermediate (15-365 days), and chronic (more than 365 days) exposures. MRLs are published in ATSDR Toxicological Profiles for specific chemicals.
RfD	Reference Doses: Health guidelines derived by EPA representing estimates of human daily exposure to chemical substances unlikely to cause any non-carcinogenic adverse health effects over a lifetime. Like ATSDR's MRL, EPA's RfD is a dose expressed in mg/kg/day.

RMEG Reference Dose Media Evaluation Guides: Health comparison values derived by ATSDR representing concentrations of chemical substances in air, water, or soil that are estimated from EPA's RfD and factoring in default values for body weight and intake rate. Different RMEGs are calculated for adults and children.

RBC Risk-Based Concentrations: Health comparison values derived by EPA's Region III Office. They represent levels of chemical substances (non-carcinogens and carcinogens, when applicable) in air, water, soil, and fish that are considered safe, assuming default values for body weight, exposure duration, and ingestion/inhalation rates.

Selecting Contaminants of Concern

Contaminants of concern (COCs) are the site-specific chemical substances that the health assessor selects for further evaluation of potential health effects. Identifying contaminants of concern is a process that requires the assessor to examine contaminant concentrations at the site, the quality of environmental sampling data, and the potential for human exposure. A thorough review of each of these issues is required to accurately select COCs in the site-specific human exposure pathway. The following text describes the selection process.

In the first step of the COC selection process, the maximum contaminant concentrations are compared directly to health comparison values. ATSDR considers site-specific exposure factors to ensure selection of appropriate health comparison values. If the maximum concentration reported for a chemical was less than the health comparison value, ATSDR concluded that exposure to that chemical was not of public health concern; therefore, no further data review was required for that chemical. However, if the maximum concentration was greater than the health comparison value, the chemical was selected for additional data review. In addition, any chemicals detected that did not have relevant health comparison values were also selected for additional data review.

Comparison values have not been developed for some contaminants, and, based on new scientific information, other comparison values may be determined to be inappropriate for the specific type of exposure. In those cases, the contaminants are included as contaminants of concern if current scientific information indicates exposure to those contaminants may be of public health concern.

The next step of the process requires a more in-depth review of data for each of the contaminants selected. Factors used in the selection of the COCs included the number of samples with detections above the minimum detection limit, the number of samples with detections above an acute or chronic health comparison value, and the potential for exposure at the monitoring location.

Chemical of Concern[1]	Concentration Range (ppb)	CV	Type of CV	Number of samples[2]	Number of detections	Location of maximum	Date of maximum[3]
1,1 Dichloroethene	<910-22,000	90 0.06	C-EMEG-child CREG	5	5	Boring 5	March 2000
1,2,3 Trichloropropane	0-80	.0015	RBC-C	5	1	Boring 4	March 2000
1,2,4 Trimethylbenzene	<38 - 5700	1.2	RBC-N	5	5	Boring 5	March 2000
1,2 Dichlorobenzene	50-360	64 900	CREG I-EMEG-child	5	4	Boring 5	March 2000
trans 1,2, Dichloroethene	<490	120	RBC-N	5	1	Boring 5	March 2000
trans 1,3, Dichloropropene	15	0.077	RBC-C	5	1	Boring 4	March 2000
1,2 Dichloropropane	210	3 0.16	I-EMEG - child RBC-C	5	1	Boring 2	March 2000
1,3 Dichlorobenzene	14	5.5	RBC-N	5	1	Boring 1	March 2000
2 - chlorotoluene	<54-620	200	RMEG-child	4	1	Boring 4	March 2000
Benzene	<122-4100	1	CREG	5	5	Boring 3	March 2000
Carbon Tetrachloride	60	0.3 70	CREG I-EMEG-child	5	5	Boring 2	March 2000
Chloroethane	110-1200	3.6	RBC	5	5	Boring 5	March 2000
Chloroform	490	6 100	CREG C-EMEG-child	5	1	Boring 4	March 2000

Reference: [22, 23, 24, 46, 48]
Notes: 1. A chemical is designated as a chemical of concern if the chemical level exceeds at least one of its comparison values (CVs).
2. NPDES data documentation does not indicate whether water was sampled for metals.
3. Date sampled: March 14, 2000
C-EMEG = Environmental Media Evaluation Guide for chronic exposure
CREG = Cancer Risk Evaluation Guide for 10^{-6} excess cancer risk
I-EMEG = Environmental Media Evaluation Guide for intermediate exposure
MCL = Maximum Contaminant Level for drinking water (EPA)
ppb = parts per billion
RBC-N = EPA's Risk Based Concentration for Noncarcinogens
RMEG = Reference Dose Media Evaluation Guide

Chemical of Concern[1]	Concentration Range (ppb)	CV	Type of CV	Number of samples[2]	Number of detections	Location of maximum	Date of maximum[3]
Chloroethane	110-1200	3.6	CREG	5	5	Boring 5	March 2000
Chloroform	490	100 6	EMEG-child CREG	5	1	Boring 5	March 2000
Chloromethane	14	2.1	RBC-C	5	5	Boring 5	March 2000
Cis 1,2 Dichloroethene	<9700-85000	3000	I-EMEG-child	5	5	Boring 5	March 2000
Ethylbenzene	<38-4000	1000	I-RMEG-child	5	5	Boring 5	March 2000
Total Xylenes	184-10,300	2000	I-EMEG-child	5	1	Boring 4	March 2000
Methylene Chloride	110-2700	5 2000	CREG C-EMEG- child	5	5	Boring 2	March 2000
Naphthalene	25-3200	200	I-EMEG -child	5	5	Boring 5	March 2000
n-Butylbenzene	<2400	6.1	RBC-N	5	1	Boring 5	March 2000
n-Propylbenzene	<75-1500	6.1	RBC-N	5	4	Boring 5	March 2000
sec-butylbenzene	54-0	6.1	RBC-N	5	5	Boring 5	March 2000
Chloroethane	110-1200	3.6	RBC-C	5	5	Boring 5	March 2000
Chloroform	490	6 100	CREG C-EMEG-child	5	1	Boring 4	March 2000

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