# Public Health Assessment

**Final Release**

FRIT INDUSTRIES

WALNUT RIDGE, LAWRENCE COUNTY, ARKANSAS

EPA FACILITY ID: ARD059636456

**Prepared by the**
**Arkansas Department of Health**

April 8, 2011

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

## THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner 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's Cooperative Agreement Partner 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's Cooperative Agreement Partner 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's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.



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# 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 [1]. 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. 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 flexibility in the format or structure of the 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 are 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 exposures. 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

**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: Arkansas Department of Health, Environmental Epidemiology, 4815 West Markham Street, Slot 32, Little Rock, Arkansas, 72205

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# Summary

**INTRODUCTION**

The Frit Industries facility produces micronutrients for the fertilizer industry. This site specializes in granular formulations used as crop additives, as well as horticultural formulations in liquid or powder form. It is located in Walnut Ridge, Lawrence County, Arkansas. The facility is located in the Walnut Ridge Air Base Industrial Park at 156 Frit Road on approximately 30 acres.

Frit Industries has been in operation since the 1950's, and the company is still an active fertilizer manufacturing site today. Frit Industries holds several active permits with the Arkansas Department of Environmental Quality (ADEQ), and has a known history of water and ambient air contamination from its use of chemical waste and hazardous waste materials. A fire in 1979 led to run-off contamination of heavy metals. It was placed on the U.S. Environmental Protection Agency's (EPA) National Priorities List (NPL) as a Superfund site in 1983, and was removed from this list in 1997.

Data evaluated in this Public Health Assessment (PHA) include sampling results for soil, sediment, surface water, groundwater monitoring wells, and air, as well as health outcome data. Based upon the 1989 ATSDR surface water and sediment data along with information provided by the ADEQ, the contaminants of concern (COCs) that warranted closer evaluation in this PHA were cadmium, chromium, lead, and zinc.

**CONCLUSION**

**ATSDR reached two conclusions in this PHA for current and past exposures:**

1. **ADH concludes that *current* exposure to levels of cadmium and zinc in the on-site soil through skin contact and accidental ingestion at Frit Industries is not expected to harm people's health.**

2. **ADH cannot currently conclude whether *past* exposure to chemicals in the on-site soil from Frit Industries could harm people's health because we do not have sufficient data and information.**

   **In response to community concerns, ADH examined health outcome data related to cancer incidence in the general area of Frit Industries, specifically Lawrence County. Rates for cancers which may be linked to the metal contaminants found at Frit Industries were examined. Elevations in the rate of lung/bronchus and other cancers were found for Lawrence County as compared to the state of Arkansas. However, due to other risk factors (like smoking) we are unable to determine that the elevated rates of these cancers are related to Frit Industries.**

**BASIS FOR DECISION**

1. Since Frit Industries is still an active facility and is gated with access monitored by the company, we do not expect exposures to soil contaminants by unsupervised children. Based on the unlikelihood of on-site exposures, cancer and non-cancer health effects from on-site contamination is unlikely.
2. Data and information in areas where people may have been exposed to site-related contaminants are not available to evaluate whether harmful effects may have occurred because of these exposures. Individual's health conditions before and after the 1979 fire and subsequent contaminated off-site run-off were not recorded, making it difficult to discern what part of the surrounding community was potentially exposed.

Although we found an elevation in certain cancers in Lawrence County as a whole, there is a major limitation to this analysis in that health outcome data are not readily available at a geographical level (i.e., census tract or census block) to allow it to be highly correlated to residents potentially exposed in the past to contaminants associated with Frit Industries. It is likely that the increased rates of lung/bronchus and other cancers may be due to the increased prevalence of smoking in the county compared to state rates. Other limitations of the health outcome data analysis include unknown contributions such as a resident's years of residency within Lawrence County, and past occupations. Since cancer is a multifaceted condition, each person's individual exposures, along with lifestyle and genetic components, can contribute to potential adverse health effects and carcinogenic risks.

**NEXT STEPS**

At this time, no additional *public health actions* are needed concerning the environmental media at the Frit Industries site or for people living in the surrounding community. ADH will continue to monitor state and county health outcome data, including cancer registries, as well as provide public health education, as needed.

**FOR MORE INFORMATION**

If you have concerns about your health, you should contact your health care provider. You can also call ADH at 1-501-661-2893 and ask for information on the Frit Industries site.

## Purpose and Health Issues

This public health assessment (PHA) was prepared to assess and address exposures to environmental contaminants, as well as to address community health concerns, from the Frit Industries site in accordance with the Cooperative Agreement between the Agency for Toxic Substances and Disease Registry (ATSDR) and the Arkansas Department of Health (ADH). In preparing this PHA, ADH and ATSDR used environmental sampling data previously collected by private contractors and laboratories reporting to the Arkansas Department of Environmental Quality (ADEQ) and made available through public records. Based on ATSDR evaluated data reported in 1989, the primary contaminants of concern (COCs) associated with Frit Industries are the metals: cadmium, chromium, lead, and zinc. This PHA presents conclusions about whether a health threat is present due to the potential exposure to identified COCs, and reports results of the health outcome data evaluated. The information in this PHA is specifically designed to provide information about public health issues, and it is not intended to address liability or other non-health issues.

## Background

The Frit Industries site located in Walnut Ridge, Arkansas, is one company of the national parent-company, Frit Incorporated. The 30-acre Arkansas facility produces micronutrients for the fertilizer industry, specializing in granular formulations used as crop additives, as well as horticultural formulations in liquid or powder form. Frit Industries holds several active permits with the ADEQ, and has a known history of water and ambient air contamination from its use of chemical waste and hazardous waste materials. A fire in 1979 led to run-off contamination of heavy metals [2, 3, 4]. It was placed on the U.S. Environmental Protection Agency's (EPA) National Priorities List (NPL) as a Superfund site in 1983, and was removed from this list in 1997 [5]. Presently, ADEQ regulates and monitors all the facility's permitting conditions for hazardous wastes, air, and water [6].

A request was made to personnel at ADEQ by a citizen regarding health concerns due to this site. ADEQ brought it to the attention of ADH and ATSDR. The citizen's request involved concern of high cancer rates, as well as the number of non-cancerous health problems, around Walnut Ridge in Lawrence County where Frit Industries is located. This citizen expressed concern that the perceptibly higher occurrences of these disorders may be above the averages for the entire state due to the close proximity of the site, and requested information to address these specific concerns. Walnut Ridge is a city which is the county seat of Lawrence County. The health outcome data evaluation in this PHA discusses the review of available cancer data from Lawrence County and the state in regards to the citizen's interest and initial community request.

## Site History

Frit Industries is located on what was once a U.S. Army Air Corps training base during World War II, and has been the site of the fertilizer production facility since the early 1950s. It is located in the Walnut Ridge Air Base Industrial Park, along with several other offices, national and local industrial facilities, commercial aircraft services, a fire training center, a restaurant, and an aircraft museum. According to permits held through ADEQ, Frit Industries currently operates 24 hours a day four days per week, producing approximately 500 tons of micronutrient product per week.

The Frit Industries site has been historically contaminated with piles of raw material, product, and waste material from the site's fertilizer micronutrient process, which were – in the past – stored directly on the ground surface without a liner or a cover. This unlined ground storage was documented in a 1989 ATSDR Preliminary Health Assessment; however, it is no longer stored this way as indicated by a 2009 ADEQ inspection report [6]. This site was placed on the EPA's NPL as a Superfund site in 1983. The most notable contamination that has occurred as a result of the piles is from surface water runoff at the site. The facility is located in an interstream area of the White River watershed, between Coon Creek and Village Creek. Surface runoff from the facility drains directly into an unnamed stream that discharges into Coon Creek; Coon Creek is a tributary of Village Creek, which discharges into the White River.

Sampling of the surface water and the sediment has historically shown the ditches and Coon Creek to be contaminated with heavy metals, especially cadmium, chromium, lead, and zinc [7]. Results from surface water and sediment samples taken in 1985 indicated concentrations of cadmium, lead, and zinc to be of public health concern in the surface water; however, there were no heavy metal compounds above levels of public health concern in the sediment [7]. While on EPA's NPL, several environmental samples were taken to determine the extent of contamination, including those recorded in a Facility Investigation Report (FIR) completed in 1996 [8]. Results of environmental sampling from that time to the present are evaluated in this report. Sediment samples from the various drainage ditches, streams, and creeks around the Frit Industries property were collected in 1994 through 1995 and analyzed for heavy metals for environmental and ecological purposes, and there were no sample concentrations found to exceed public health screening levels in the eight sediment samples taken from on-site and background locations [8].

The EPA announced the deletion of the Frit Industries Superfund site from the NPL on October 14, 1997. Therefore, this site no longer falls under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Later, the EPA, in consultation with the ADEQ, determined that the site would be deferred to the Resource Conservation and Recovery Act

(RCRA) and all appropriate response activities conducted and scheduled henceforth would be enforceable and should remain protective of the public health, welfare, and the environment [5]. Since the 1980's, Frit Industries has been inspected regularly and monitored by ADEQ following federal and state environmental regulations. The FIR summarizes the review or investigation of all environmental media on-site, including soil, sediment, surface water, groundwater, and air sampling. Based on data from the FIR and subsequent groundwater monitoring, a deed restriction for groundwater use was placed on the facility and surrounding area. According to ADEQ, this deed restriction was filed in the city court on May 12, 2009 (see Appendix C). Site groundwater monitoring is actively conducted and currently ongoing, and state-regulated inspections are conducted yearly to ensure the effectiveness of the deed restriction [9].

# Process Description

During the formulation process, all environmental media types (soil, water, air) have the potential to be affected by on-site manufacturing at Frit Industries. According to an ADEQ Air Inspection form from January 2005, a detailed description of the micronutrient production process at Frit Industries is described as follows [10]:

"Upon receipt at the granulation plant, raw materials are stored in floor bins, super-sacks, or in piles. In order to be processed, the materials are then fed into feed bins according to the desired product recipe. Raw materials are metered out of the bins and transferred with recycle material by conveyor and elevator to a horizontal rotary granulation drum. Inside the drum, water, sulfuric acid, and calcium lignosulfate are sprayed onto a moving bed of material. The wet granules created in this process exit through a chute leading to a rotary dryer. A natural gas burner at the dryer inlet supplies direct heat to dry the granules. The dried solids are then elevated to two parallel screens to separate the materials into product, undersize grades, and oversize grades. The oversize solids are passed through a hammer mill crusher and then returned back to the screens for sizing. Undersized solids are recycled back to the granulation drum by way of conveyor, elevator, recycle hopper, and the weigh feeder. Product grade solids are transported via conveyor and elevator to a dryer/cooler fluid bed. Ambient air flows through the bed, cooling the product to a level suitable for storage. The cooled product passes through a chute to a rotating, horizontal coating drum where a 0.25% solution of coating material is sprayed on the granules to prevent dusting and caking during storage. The finished product is then transported via conveyors and elevators to product storage for eventual bagging or bulk loadout. Particulate emissions at the facility are controlled and regulated under the State Air Code (Regulation 18) and the State Implementation Plan (Regulation 19)."

# Demographics

The 2000 United States Census reported the total population for Walnut Ridge as 4,925 and 17,774 for Lawrence County [11, 12]. The Census reported 2,065 people (90.5%) residing in 2,283 housing units within the town of Walnut Ridge [11]. Located within a one-mile radius of the site is Williams Baptist College campus and a residential community that has grown around it, known as College City with a population of 269 [13]. College City has a total of 77 housing units, and 68 of those are occupied [13]. At the time of the 2000 census, 324 children under the age of five and 1,149 women of child-bearing age (15 to 44 years old) resided in Walnut Ridge. The median age in Walnut Ridge is 40.4, and there are approximately 1,128 people over the age of 65 [11]. According to the FIR, Frit Industries is used only for industrial purposes and access to the property is limited to business. The Frit Industries property is fenced and gates are locked at night and on the weekends. Lands adjacent to Frit Industries are agricultural (mainly used as rice fields), commercial, or residential, and access to these land sites varies [8].

# Discussion

The public health assessment process for NPL and other hazardous waste sites frequently involves the evaluation of multiple data sets. These data include available environmental data, exposure data, health effects data, and community health concerns.

As the first step in the evaluation, ADH scientists review available environmental data to determine what contaminants are present in the various media to which people may be exposed (*e.g.*, surface water, groundwater, air, and soil) and at what concentrations. ATSDR generally does not collect its own environmental sampling data, but instead, reviews information provided by other federal or state agencies and/or their contractors, by individuals, or by potentially responsible parties (PRPs) [*i.e.*, companies that may have generated the hazardous waste found at an NPL site, shippers that may have delivered hazardous waste to the site, and individuals or corporations that own (or owned) the property on which the site is located].

The presence of hazardous chemical contaminants in the environment does not always mean that people who spend time in the area are likely to experience adverse health effects. Such effects are possible only when people in the area engage in activities that make it possible for a sufficient quantity of the hazardous chemicals to be transported into and absorbed into the body. This transport process is required in order for there to be a true exposure; thus, the assessment of real and potential exposures defines the real and potential health hazards of the site and drives the public health assessment process.

As the second step in the health assessment process, ADH scientists conduct an evaluation of the various site-specific pathways through which individuals may become exposed to site contaminants and be at risk for adverse health effects. Chemicals can be transported into the body through the lungs, through the gastrointestinal (GI) tract, or directly through the skin by dermal absorption. People can be exposed to site contaminants by breathing air containing volatile or dust-borne contaminants, by eating or drinking food or water that contain contaminants from the site (or through hand-to-mouth activities with contaminated soil, dust, sediment, water, or sludge present on the hands), or by coming into direct skin-contact with contaminated dust, sediment, water, sludge, or soil resulting in dermal absorption of toxicants.

***Pathways Analysis***

To conduct a pathways analysis, ADH scientists review available information to determine whether people visiting the site or living nearby have been, currently are, or could be exposed (at some time in the future) to contaminants associated with this site. To determine whether people are exposed to site-related contaminants, investigators evaluate the environmental and human behavioral components leading to human exposure. Exposure to contaminants of concern is determined by examining human exposure pathways through the following criteria:

1. A source of contamination (e.g., hazardous compound(s) in the soil, water, or air),
2. An environmental medium such as water, air, or soil that can hold or move the contamination,
3. A point at which people come in contact with a contaminated medium,
4. An exposure route, such as skin contact or accidental ingestion, and
5. A population who could come in contact with the contaminants.

Exposure pathways can be **complete**, **potential**, or **eliminated**. A pathway is **complete** when all five elements in the pathway are present and exposure has occurred, is occurring, or will occur in the future. If one or more of the five elements of a pathway is missing, but could become completed at some point in the future, the pathway is said to be a **potential** pathway. A pathway is **eliminated** if one or more of the elements are missing and there is no plausible way of it ever being completed.

From a preliminary health assessment prepared by ATSDR in 1989, potential human exposure pathways did exist based on the criteria listed. At or near the Frit Industries site, exposure to the soil could potentially occur (in the past, present, or future) through direct contact, incidental ingestion, or inhalation of fugitive dusts. Exposure to the contaminated surface water on-site or off-site could potentially occur through dermal absorption or incidental ingestion [7]. However, since the implementation of the groundwater monitoring plan and engineering controls, a

potential human exposure pathway from contaminated water sources is unlikely. Along with required testing, there is also a concrete and dirt berm that encircles the perimeter of the facility to contain any untreated storm water runoff and process water [6].

Because the original request was made by residents concerning cancer and disease rates in the area in which they live, statistical analysis was used to evaluate the available percentage of cancer cases in Lawrence County compared to the state of Arkansas and an examination of health outcome data was undertaken. Concurrently, further exposure pathway analysis was performed through a review of more recent environmental data (1994 through 2009) from surface water, groundwater, air, and soil for both child and adult receptors to address all community concerns. The site is fenced. No trespassing is expected to occur and children are supervised when on site, so that exposures to children are expected to be minimal.

# Environmental Contamination

After pathways have been evaluated, ADH scientists construct a number of plausible exposure scenarios, depicting a range of exposure possibilities, in order to determine whether people in the community have been (or might be) exposed to hazardous materials from the site at levels that are of potential public health concern. To do this, they must take into consideration the various contaminants, the media that have been contaminated, the site-specific and media-specific pathways through which people may be exposed, and the general accessibility to the site. In some cases, it is possible to determine that exposures have occurred or are likely to have occurred in the past. However, a lack of appropriate historical data often makes it difficult to quantify past exposures. If scientists determine that combined exposures from multiple pathways (or individual exposures from a single pathway) pose a public health hazard, ADH makes recommendations for actions that will eliminate or significantly reduce the exposure(s) causing the threat to public health.

The following sections discuss the most recent data collected by contractors preparing a required FIR or groundwater monitoring report for ADEQ during their field activities from 1994 to 2009 [8, 16]. In preparing this report, ADH and ATSDR relied on the data provided by ADEQ as having been collected according to approved Quality Assurance Project Plans. Thus, it is assumed that adequate quality assurance/quality control (QA/QC) procedures were followed with regard to data collection, chain of custody, laboratory procedures, and data reporting.

### ***Surface Water***

Historical data shows contamination occurred from surface water run-off after an on-site fire occurred in 1979. Just outside the Frit Industries facility, the area is drained by an unnamed tributary of Coon Creek. This stream is the receiving stream for any surface runoff from the

facility. This stream flows from northeast to southwest, through the Williams Baptist College and College City. Flow rates in the stream are extremely slow, and periodically the county has the stream dredged to promote flow [8].

Between March and June 1994 (the last surface water data reported), eight samples were collected at five sample locations chosen to characterize the surface water quality. Five on-site samples were taken once a month in March, April, May, and June and analyzed for COC concentrations, and three samples were taken during the same time at different locations to be used as background samples [8]. There were no sample concentrations found to exceed screening levels in the eight surface water samples taken from on-site and background locations.

***Groundwater Monitoring Wells***

Frit Industries sampled groundwater during data collection of the FIR in 1994 through 1996, and it is still currently monitoring groundwater and submitting reports under an agreement with ADEQ. From March 1994 to April 2009, there have been approximately 29 separate sampling events from 28 wells located throughout the property [8, 16].

As noted in the FIR, there are several structures around the facility that may potentially influence the groundwater flow, including pipelines, ditches, ponds, and National Pollutant Discharge Elimination System (NPDES) outfalls. The old military airfield the facility now occupies historically obtained water through a network of buried waterlines connected to a nearby well. After closure of the base, the water well was operated by College City. In 1972, College City hooked up to the Walnut Ridge municipal water system, and the well was closed. The well is now inactive [8].

Although zinc concentrations higher than screening levels were detected in four of the groundwater monitoring samples during the most recent sampling event, there were no concentrations of cadmium, chromium, or lead that exceeded screening values. Zinc is not classified as a carcinogen by the Department of Health and Human Services (DHHS), EPA, or the International Agency for Research on Cancer (IARC). Since the groundwater at Frit Industries is not used for drinking water, and no private wells were identified in the area, no further evaluation was done on ingestion of groundwater.

When a dermal exposure pathway was evaluated for an agricultural worker scenario exposed to elevated zinc levels in the groundwater, the theoretical calculations were less than ATSDR's chronic Minimal Risk Level (MRL) and this potential exposure pathway scenario has been eliminated. The MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. The calculations performed for this evaluation were based on an adult

exposure time of ten minutes per day for one year with an exposed body surface area of 2,300 square centimeters (approximately equivalent to an adult's hands and arms being exposed to the contaminated water). Using a concentration of 32 milligrams per liter (mg/l) of zinc in the groundwater sample, the calculated exposure dose of 0.088 milligrams per kilogram per day (mg/kg/day) is less than the ATSDR MRL for zinc of 0.3 mg/kg/day [15, 16]. Therefore, no further evaluation of a possible agricultural worker's dermal (skin) exposure to zinc in the groundwater is necessary since the appreciable risk of adverse health effects is unlikely at this site. See Appendix E for equations used in calculations.

### ***Ambient Air***

The Frit Industries site provides little hindrance to wind flow since it is surrounded by predominantly flat land with few trees or other tall vegetation. Manmade features that could affect the wind patterns include the buildings within the facility used for manufacture or storage purposes. Air sampling was performed at Frit Industries on four separate events from April through July 1994 **(the last ambient air data reported)**; each event was conducted for four consecutive days.

Five separate Wedding and Associates (W&A) $PM_{10}$ Critical Flow Rate High-Volume Samplers were installed at off-site locations and utilized to sample the air and particulate matter of 10 microns in diameter or less ($PM_{10}$). No samples indicated that any 24-hour COC average air concentrations were above their perspective threshold limit values (TLVs) for potential on-site worker exposures. For off-site, potential residential exposures, only two of the samples exceeded EPA's National Ambient Air Quality Standards (NAAQS) $PM_{10}$ level of 150 micrograms per cubic meter ($\mu g/m^3$) for a 24-hour period during the four months of sampling. The two exceedances occurred at location number 2 (approximately 190 meters from the source) on June 13 – 14 and June 14 – 15, with a total particulate reading of 207 $\mu g/m^3$ and 220 $\mu g/m^3$, respectively [8]. Additionally, in 1996 the Frit Industries facility installed air emission abatement equipment which is designed to further reduce COC concentrations [8]. ADH is not aware of any other possible sources of particulates, such as from other agricultural fields or nearby commercial operations. Due to the singular event of a slightly elevated NAAQS value reading and the installation of new equipment on-site to prevent the majority of contaminated air emissions from leaving Frit Industries, it is unlikely that high concentrations of COCs would exist in ambient air.

### ***Soil***

Soil in this region of the state is typically sandy clay, and was reported in the FIR as mostly silty sands. During the FIR field activities, 29 soil samples were collected on-site and off-site for the purposes of soil characterization and classification. These samples were taken from 0 to 6 inches, 6 to 12 inches, and 48 to 72 inches of depth. Background samples were also taken

approximately one mile southwest of the facility to record the soil chemistry and naturally occurring metal concentrations [8]. Soil samples for COC concentration analysis were as follows: 12 samples from background, 84 on-site samples, and 60 off-site samples.

Of the 156 soil samples, three on-site samples were found to be above screening levels for cadmium, three on-site samples were found to be above screening levels for lead, and one on-site sample was found to be above screening levels for zinc. There were no samples taken from the background site or the off-site location that had concentrations exceeding the screening levels used for public health evaluation. Concentration levels, screening levels, and theoretical cancer and non-cancer analysis for these 7 samples can be found in **Table 1**.

While evaluating potential public health effects due to exposures to the COCs in the soil from the Frit Industries site, ADH used ATSDR Health Comparison Values (CVs) as screening values for soil, where available. CVs are substance concentrations set well below levels that are known or anticipated to result in adverse health effects; so, concentrations at or below the relevant CV may reasonably be considered likely not to harm people's health.

The CV for cadmium is 10 parts per million (ppm) for a child [14]. This CV is an environmental media evaluation guide (EMEG) level for soil evaluation. There is no listed soil CV for lead. Based on alternate environmental screening sources, the EPA Region 6 Human Health Medium Specific Screening Level (HHMSSL) was used for lead. The HHMSSL screening level of 800 ppm for industrial soil represented an adequate value that was unlikely to cause harm to public health while on the Frit Industries site, because no residents (children or adults) are expected to be on the industrial property. Additionally, the property use on this site will remain industrial in the future due to a land-use restriction clause that limits the site to "Industrial/Commercial" use only (see Appendix D).

Evaluation of the soil samples exceeding cadmium and zinc CVs was performed using the ATSDR Toxicological Profile and Health Assessment Toolkit (TopHat). TopHat is a software program that provides the health assessor a means by which one can take site-specific chemical levels and estimate a theoretical excess health risk expressed as the proportion of a population that may be affected by a carcinogen during a lifetime of exposure [15]. TopHat algorithms were used to calculate exposure dose (ED) in units of milligram per kilogram per day (mg/kg/day), which was then used to calculate a potential hazard quotient (HQ) and theoretical lifetime cancer risk (LCR) value for each concentration of cadmium and each exposure pathway and receptor (*i.e.*, child or adult). Exposure pathway scenarios involving dermal (skin) contact or accidental ingestion of soil particulates were used in these measurements. See below for further description and interpretation of the HQ and LCR related to calculations in Table 1. Please see Appendix E for details of the exposure dose calculation.

***Table 1. On-Site Soil Samples As Reported In The Frit Industries Facility Investigation Report* Representing Contaminants of Concern for the Public Health Assessment***

| Sample ID | Compound | Concentration in Sample (mg/kg *or* ppm) | Screening Level Comparison Concentration | Hazard Quotient (HQ) | Theoretical Lifetime Cancer Risk (LCR) | Hazard Quotient (HQ) | Theoretical Lifetime Cancer Risk (LCR) |
|---|---|---|---|---|---|---|---|
| | | | | Skin Contact Exposure | | Accidental Ingestion Exposure | |
| BB-1 | Cadmium | 15 | ATSDR Soil EMEG-child 10 ppm | 1.4E-7 child<br>4.7E-5 adult | 1.3E-8 child<br>4.2E-9 adult | 9.4E-4 child<br>2.1E-4 adult | 8.5E-8 child<br>1.9E-8 adult |
| BB-1 | Lead | 1,242 | EPA Region 6 HHMSSL soil-industrial 800 ppm | N/A | N/A | N/A | N/A |
| BD-1 | Cadmium | 50.4 | ATSDR Soil EMEG-child 10 ppm | 4.7E-4 child<br>1.6E-4 adult | 4.2E-8 child<br>1.4E-8 adult | 3.2E-3 child<br>7.2E-4 adult | 2.9E-7 child<br>6.5E-8 adult |
| BD-1 | Lead | 5,058 | EPA Region 6 HHMSSL soil-industrial 800 ppm | N/A | N/A | N/A | N/A |
| BD-1 | Zinc | 29,210 | ATSDR Soil EMEG-child 20,000 ppm | 9.0E-4 child<br>3.1E-4 adult | N/A | 6.0E-3 child<br>1.4E-3 adult | N/A |
| DC-2 | Cadmium | 26.1 | ATSDR Soil EMEG-child 10 ppm | 2.4E-4 child<br>8.1E-5 adult | 2.2E-8 child<br>7.3E-9 adult | 1.6E-3 child<br>3.7E-4 adult | 1.4E-7 child<br>3.3E-8 adult |
| EC-1 | Lead | 1,425 | EPA Region 6 HHMSSL soil-industrial 800 ppm | N/A | N/A | N/A | N/A |

*Frit Industries Facility Investigation Report data published in 1996.

mg/kg = milligram per kilogram; ppm = parts per million; N/A = not applicable; ATSDR = Agency for Toxic Substances and Disease Registry; EMEG = Environmental Media Evaluation Guide; EPA Reg. 6 = Environmental Protection Agency Region 6; HHMSSL = Human Health Medium Specific Screening Level

**NOTE**: Individual samples were calculated and shown, rather than the ranges for each contaminant to demonstrate the small number of samples that exceeded screening levels.

For the dermal pathway evaluation, the assumptions used in the calculations include: a contaminant concentration based on the laboratory reports; an exposure factor of one hour per day for 14 days per year over a one year period; a conversion factor (unitless); a body weight of 16 kilograms [(kg) or 35 pounds] for a child or 70 kg [154 pounds] for an adult; and a total soil adherence of 1750 milligrams (mg) for a child or 1358 mg for an adult. For the accidental ingestion pathway evaluation, the assumptions used in the calculations include: a contaminant concentration based on the laboratory reports; a model default ingestion rate of one (1.0) mg per day; an exposure factor (unitless); and a body weight of 16 kg for a child or 70 kg for an adult. These factors resulted in a calculated exposure dose (ED) in units of milligram per kilogram per day (mg/kg/day), which was then used to calculate a potential hazard quotient (HQ) and lifetime cancer risk (LCR) value for each concentration of cadmium and each exposure pathway and receptor (*i.e.,* child or adult). Since zinc is not considered a carcinogen, only the HQ for a child or adult was calculated for zinc concentrations.

To put the calculated exposure doses into a meaningful context for non-cancer, intermediate health effects [*meaning a rapid onset of an illness, or an illness that happens in less than a year (i.e., short duration)*] the HQ was calculated for each potentially exposed child or adult. An HQ is the average daily intake divided by a chemical specific reference dose (RfD) set by the EPA or minimal risk level (MRL) set by ATSDR. If the HQ for a chemical is equal to or less than one, it is believed that there is no appreciable risk that non-cancer health effects will occur. If the HQ exceeds one, there is some possibility that non-cancer effects may occur, although an HQ above one does not indicate an effect will definitely occur. This is because of the margin of safety inherent in the derivation of all RfD values. The larger the HQ value, the more likely it is that an adverse effect may possibly occur.

For LCR ranges, potential risks greater than one in 1,000,000 (or $1 \times 10^{-6}$), which likely represents negligible risk of cancer, but less than one in 10,000 (or $1 \times 10^{-4}$) are within the EPA's target risk range and considered an adequate level of health safety. If the additional lifetime cancer risk is greater than one in 10,000 (or $1 \times 10^{-4}$), it is generally considered an indicator that further evaluation may be warranted if the source of contamination is not removed. The estimated cancer risks for a child (age 1 – 11) and an adult (age 18 – 70) were calculated for elevated cadmium in soil for the dermal and accidental ingestion pathways.

Due to the nature of the citizen's initial request, a more conservative child scenario along with the adult scenario was calculated. Since Frit Industries is still an active facility and is gated and monitored by the company, children have limited access to the property. It is not expected that unsupervised children will be on site. Adults should practice diligent public health efforts to take precautions if children are on the site. Although there were three on-site soil samples that exceeded the lead screening value of 800 ppm, calculations based on exposure to lead-contaminated soil were not done. Instead of having an RfD to measure exposure, lead evaluation uses an Integrated Exposure Uptake Biokinetic (IEUBK) model to measure lead exposure in

children. The IEUBK model looks at a child's potential blood-level exposure to lead from all sources, including soil, air, food (including maternal milk), and household dust. ADH does not have access to data on all the external lead sources that could pose a potential exposure source to children in Walnut Ridge. Therefore, values relating to potential exposure to lead in the soil were not calculated.

Based on COC concentrations found in the data, all human exposure pathways were eliminated except skin (dermal) contact and accidental ingestion of on-site soil. Surface water and sediment sample concentrations did not indicate public health levels of potentially harmful exposure. The groundwater exposure pathway was eliminated because groundwater is not a source of drinking water for the facility or nearby community. Air samples were reviewed; however, because of the nature of the contaminants of concern, their low volatility and their high affinity for soil particles, this pathway also was eliminated as a plausible pathway of concern. Skin contact and accidental ingestion of on-site soil pathways are the basis for the public health conclusions and recommendations reached in this PHA.

# Health Outcome Data

## ***Contaminants of Concern***

### *Current Contaminants of Concern*

In this assessment, data from the Arkansas Central Cancer Registry were evaluated to compare general and specific cancers in Lawrence County to the state of Arkansas to address the community's concerns regarding cancer occurrence in the area. The overall cancer rate was examined, as well as four other specific cancers: (1) lung and bronchus, (2) oral cavity and pharynx, (3) kidney, and (4) stomach. These cancer types were selected based on the target organs typically affected by the COCs connected with this site (according to the 1989 ATSDR Preliminary Health Assessment), namely cadmium, chromium, and lead. Zinc was not considered as part of this cancer incidence analysis because the DHHS and the IARC have not classified zinc for carcinogenicity. Furthermore, based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity [17]. However, zinc was considered when calculating the HQ values because of the potential for non-cancerous health effects (see Table 1).

ATSDR's Toxicological Profiles for the compounds previously identified at the Frit site were used to classify the health relevance for each COC. The carcinogenic properties and their probable impact on designated target organs for cadmium, chromium, and lead were considered when choosing the specific cancer types to evaluate since these three COCs have shown contamination in the past. Currently, cadmium and lead are still considered contaminants that were evaluated in this document.

Cadmium exposure may occur through ingestion of contaminated food and drinking water, inhalation of particulates from ambient air or tobacco smoke, or ingestion of contaminated soil or dust. For nonsmokers, food is the major source of cadmium exposure, and inhalation of cigarette smoke is the major source of cadmium exposure for smokers. Cadmium is introduced to the food chain through agricultural soils, which may contain naturally-occurring cadmium or cadmium found in phosphate fertilizer applications. Long-term exposure to low levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease. Other long-term effects are lung damage and fragile bones. DHHS has determined that cadmium and cadmium compounds are known human carcinogens, and research shows cadmium primarily targets the lungs[18].

Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, drinking contaminated water, or exposure to cigarette smoke. The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in the body, and may cause damage to the nervous system, kidneys, or reproductive system. There is no conclusive proof that lead causes cancer in humans. However, kidney tumors have developed in rats and mice that had been given large doses of certain kinds of lead compounds. DHHS has determined that lead and lead compounds are reasonably anticipated to be human carcinogens, and the EPA has determined that lead is a probable human carcinogen. IARC has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans [20].

### *Past Contaminant of Concern Used for Cancer Registry Analysis*

Chromium can be found in air, soil, and water after release from the use and disposal of chromium-containing products, and during the manufacturing process. It is also a component of cigarette smoke. Chromium is a naturally occurring element found in rocks, animals, plants, and soil. It can exist in several different forms. DHHS, IARC, and the EPA have determined that chromium (VI) compounds are known human carcinogens. Studies involving chromium have shown evidence of oral, gastrointestinal, and lung cancers in humans and animals [19].

### *Mixtures of Contaminants of Concern*

Typically, health effects such as those listed above are examined for individual chemicals for specific exposure pathways. However, some exposures can involve multiple chemicals, or “mixtures”, and can occur through more than one exposure pathway. The ATSDR Guidance Manual was consulted for effects of mixtures. As indicated by research, if detected levels of chemicals are generally below conservative screening values, then exposure to these chemicals collectively is not expected to be of health concern [1]. The toxicological profile for each COC was reviewed, and potential toxic interactions at environmentally relevant doses of cadmium,

chromium, lead, and or zinc show no known evidence of additive toxicity at concentration levels found within this PHA review.

***Statistics and Registry Data Review***

Health outcome data identify certain health conditions that occur in populations. These data can provide information on the general health of communities living near a hazardous waste site. They also can provide information on patterns of specified health conditions. Some examples of health outcome databases are tumor registries and vital records (or statistics). Information from local hospitals and other health care providers also can be used to investigate patterns of disease in a specific population.

Using ADH Arkansas Central Cancer Registry data, overall cancer incidence (*i.e.*, morbidity) and cancer incidence for specific primary organ types were calculated from 1997 through 2005 for Lawrence County and statewide. Lawrence County was used as the exposure area because when a more defined area of exposure via the zip code was examined, the case count number was too low and displayed too much variance. The state of Arkansas was chosen as the reference population to assess possible excess cancer incidence in Lawrence County. A limitation to this analysis is that health outcome data are not *readily* available at a geographical level (i.e., census tract or census block) to allow it to be highly correlated to residents potentially exposed to contaminants associated with Frit Industries. County level data was the best readily available resource to explore possible elevated cancer risk in the surrounding area. However, the geographic unit (county level) available to evaluate the health outcome data may be a limitation in this type of analyses given that the size of the actually exposed population is likely to be much smaller than the county level population.

Crude rates were calculated by dividing the number of cancer cases reported to the AR cancer registry by the number of people in the population according to the U.S. 2000 census. Crude rates, however, can only be used to compare populations with similar distributions of age, gender, race, socioeconomic class, geographic distribution, or any other characteristics that might affect the incidence of cancer in a population.

Age-standardized rates allow comparisons between populations without the influence of age. As such, a diagnosed-to-expected ratio was calculated by dividing the number of cancers diagnosed in the area by the number of expected cases. This ratio is called a standardized incidence ratio (SIR). The SIR compares the crude rate observed in Lawrence County to an expected rate calculated from age-specific rates for all of Arkansas. An SIR of one indicates that the number of cancer cases diagnosed in Lawrence County is the same as the number of cancer cases expected. If the SIR is greater that one, more cancer cases than expected were diagnosed in Lawrence County. To determine if the number of diagnosed cases is significantly greater than the expected number, a confidence interval (CI) was calculated for each SIR. The CI has a minimum (lower) value and a maximum (higher) value. Analysts commonly use a 95% CI. A

95% CI is the range of estimated SIR values that includes the true SIR value with 95% certainty. If the lower bound of the 95% CI range is greater than one, then number of diagnosed cases in the county significantly exceeded the number of expected cases. However, an excess of cancer cases in Lawrence County relative to the state does not indicate exposure route or exposure duration.

Cancer incidence by primary organ type for Lawrence County, as well as statewide, from 1997 to 2005 can be found in **Table 2**.

***Table 2. Case Counts (Observed and Expected) for Lawrence County and Arkansas, 1997-2005***

| | Arkansas Overall | | Lawrence County | | | | |
|---|---|---|---|---|---|---|---|
| **Cancer Type** | **Cases** | **Crude Rate (per 100,000)** | **Observed Cases** | **Expected Cases** | **Crude Rate (per 100,000)** | **SIR*** | **CI*** |
| **All Cancers** | | | | | | | |
| 1997-2005 | 122,902 | 508.1 | 1004 | 768.4 | 682.1 | 1.31 | (1.23, 1.39) |
| **Lung & Bronchus** | | | | | | | |
| 1997-2005 | 21,584 | 89.2 | 233 | 142.1 | 148.9 | 1.64 | (1.53, 1.75) |
| **Oral cavity and Pharynx** | | | | | | | |
| 1997-2005 | 2,917 | 12.1 | 37 | 18.7 | 23.4 | 1.97 | (1.33, 2.61) |
| **Kidney** | | | | | | | |
| 1997-2005 | 3,428 | 14.2 | 34 | 22.1 | 21.5 | 1.54 | (1.01, 2.07) |
| **Stomach** | | | | | | | |
| 1997-2005 | 1,683 | 7 | 10 | 10.6 | 10.2 | 0.94 | (0.34, 1.54) |

***Source: Arkansas Central Cancer Registry, 2009***

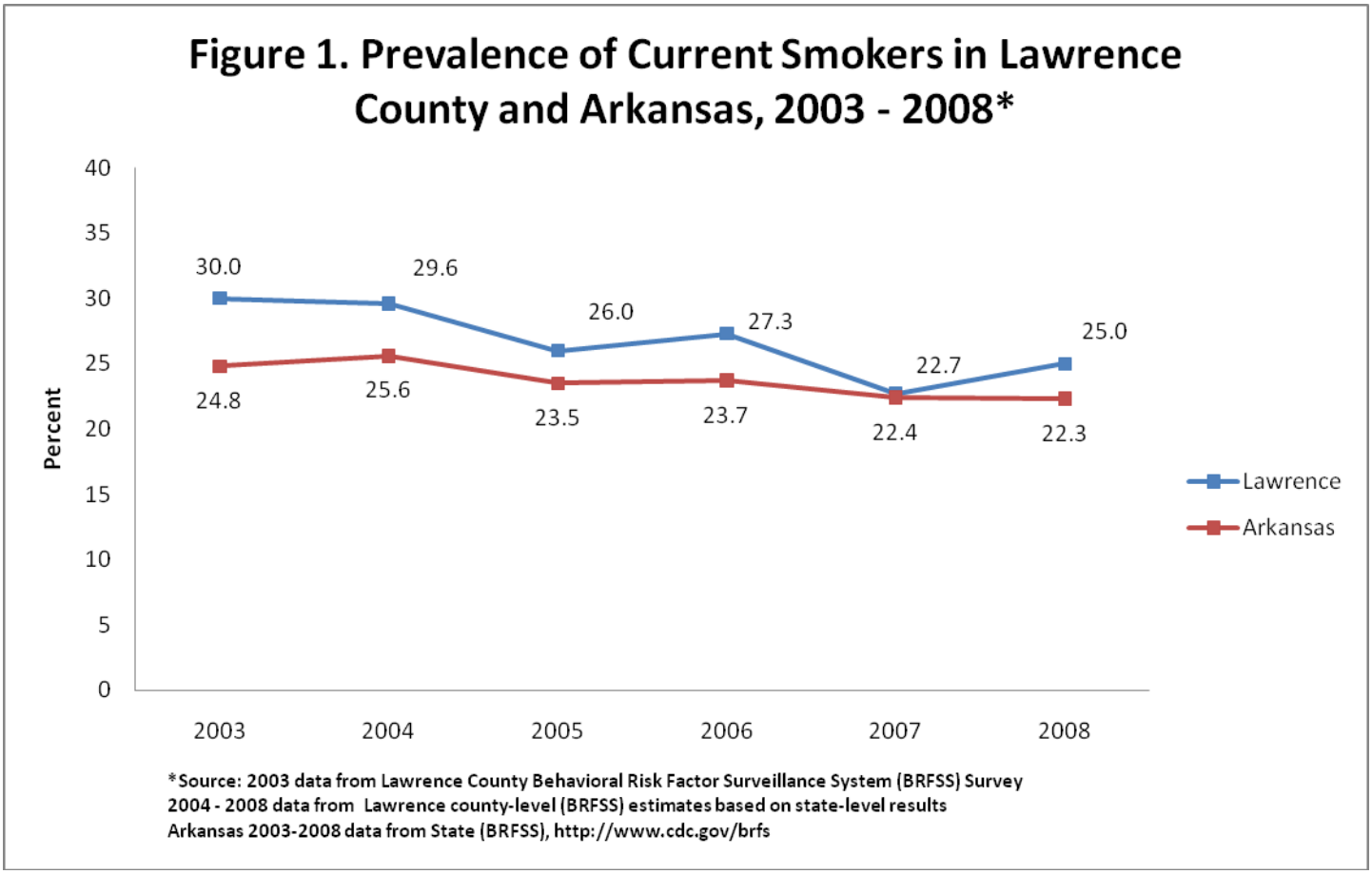
**** SIR denotes Standardized Incidence Ratio, CI denotes 95% Confidence Intervals***

Based on the analysis using the data from the Arkansas Central Cancer Registry, potentially elevated risks (values above 1.0, as seen by the SIR) are observed for all cancers combined, as well as cancer of lung and bronchus, cancer of oral cavity and pharynx, and cancer of the kidney in Lawrence County. Stomach cancer, with a SIR below 1.0, does not exceed the number of expected cases for the county. According to the table values, lung cancers account for approximately 38% of the excess cancers seen in Lawrence County.

According to the American Cancer Society statistics, one out of three Americans now living may eventually develop cancer. Cancer is the second leading cause of death in the United States following heart disease. Cancers may be caused by a variety of factors acting alone or together, usually over a period of many years. Scientists estimate that most cancers are due to factors

related to how we live, or lifestyle factors which increase the risk for cancer including: smoking cigarettes, drinking alcohol heavily, and unhealthy diet (for example, excess calories, high fat, and low fiber). A family history of cancer may also increase a person's chances of developing cancer.

Since cancer, like other chronic diseases, is multi-factorial in origin, research shows there are many factors that may contribute to the development of cancer, such as an individual's past and current health status, genetic make-up, or lifestyle choices. Considering this, we examined total tobacco use in the area, which increases the risk of cancers of the lung and bronchus, cancers of oral cavity and pharynx, and cancers of the kidney. **Figure 1** shows the prevalence of current smokers in Lawrence County and the state overall from 2003 to 2008. Based on the available data, although there is a downward trend in smoking rates in both the state and in Lawrence County over the past six years, the rates of smoking among those living in Lawrence County have remained higher than the overall smoking rates in the state.



Although age can be accounted for, information on years of residence and occupation of patients with these cancers in Lawrence County is limited. Of the total cases of cancers (122,902), only ten cases were from patients younger than 30 years of age. This number is too small in the overall data set to make a significant impact to the incidence rate. So, while the age of the patient may be in the accurate range for this site, cancers reported to the cancer registry only list the patient's current residence and current occupational information. Since there is a long latency period (*i.e., time from initial exposure to development of disease*) for most of the cancers, it is important to have all the residential information and occupation history of the patients with cancer. However, as with the smoking history of each individual, this type of information is not currently available. Additionally, information about direct past exposure to the COCs associated with the Frit Industries site for each individual is limited.

***Limitations***

As previously stated, the geographic unit (county level) used to evaluate the health outcome data may be a limitation in this type of analyses given that the size of the actually exposed population is likely to be much smaller than the county level population. Moreover, descriptive epidemiologic analyses like this cannot establish cause and effect. Elevated cancer rates alone cannot be considered conclusive evidence that living near a waste site is the sole cause for the occurrence of a specific disease. Because these type of diseases are based on many variables as well as the concentration level and exposure levels to each contaminant, all the data may not be available to effectively reach a public health decision. With the higher prevalence of smoking in Lawrence County, coupled with the small population involved and the lack of historical information relative to each case, ADH currently lacks the adequate data to assess the overall health outcome to determine a potential adverse public health effect within the community due to past contamination from the Frit Industries site.

# Children's Health Considerations

To protect the health of the nation's children, ATSDR has implemented an initiative to protect children from exposure to hazardous substances. In communities faced with contamination of the water, soil, or air, ATSDR and ADH recognize that the unique vulnerabilities of infants and children demand special emphasis. Due to their immature and developing organs, infants and children are usually more susceptible to toxic substances than are adults. Children are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are also more likely to encounter dust, soil, and contaminated vapors close to the ground. Children are generally smaller than adults, which results in higher doses of chemical exposure because of their lower body weights relative to adults. In addition, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

Based on the 2000 U.S. Census, approximately 15 children (age 5 and younger) live in College City, within the one mile of Frit Industries [12]. However, because the site is private property and located in the Air Base Industrial Park, it is unlikely that children will come into contact with environmental media on-site. Moreover, based on the sample concentrations found on the Frit Industries site, exposure to heavy metals in the soil, sediment, water, or air is not considered likely to create adverse health effects.

# Community Health Concerns

ADH and ATSDR have been made aware of some of the health concerns within the community surrounding the Frit Industries site, in addition to the one expressed through the private citizen's request originally made to ADEQ. The citizen was contacted by the ADH Chronic Disease and Cancer Registry Section Chief and informed of the health outcome data findings. Should other concerned citizens or organizational groups direct complaints to ATSDR or ADH, a copy of this PHA will be provided to them.

An initial draft release of this document was sent to state and federal agencies in September 2009. After a minimum 30-day review period, ADEQ responded with comments, which have since been incorporated into the document for clarification. Following that initial PHA release phase, an updated version served as the public comment release phase with a minimum 30-day review period in June 2010. The public comment PHA release was made available for public viewing both electronically on the ATSDR website and as a hardcopy at the Walnut Ridge City Hall and the Lawrence County Library. Announcements of this release were made on the ATSDR website and as a press release to the local news paper and local radio stations. The public were given a 30-day period of time to make comments to the document either by telephone, postal mail, or electronic mail. There were no public comments received for the final release of this PHA. One internal comment received by ADH personnel was in regards to editing, and changes have been made accordingly.

# Conclusions

ATSDR reached two separate conclusions in this PHA regarding current and past exposures and based on the environmental data and cancer statistics (or health outcome) data:

1. Based upon all environmental data reviewed for sediment, surface water, groundwater, air, and soil, exposure pathways still exists for incidental skin (dermal) contact and accidental ingestion of the on-site soil on the Frit Industries property. After evaluation of the elevated levels of cadmium and zinc in the soil, ADH/ATSDR concludes that ***current***

exposure to elevated levels of cadmium and zinc in the on-site soil through skin contact and accidental ingestion at Frit Industries is not expected to harm people's health (*i.e.*, exposure to site-related contaminants might have occurred in the past or is still occurring, but the exposures are not at levels likely to cause adverse health effects).

2. Based upon information and historical data previously reviewed, there may have been a completed exposure pathway to ***past*** contaminants found in surface water and surface soil at Frit Industries. ADH cannot currently conclude whether ***past*** exposure to elevated levels of cadmium, chromium, lead and zinc in the contaminated surface water and surface soil from Frit Industries could harm people's health. The lack of information on before and after the 1979 fire make it difficult to discern what part of the surrounding community was potentially exposed.

The health outcome data, evaluated in response to community concerns, indicate an increase between cancer rates in Lawrence County as compared to the state. Yet due to the high prevalence of smokers in Lawrence County records, ADH cannot currently conclude whether *past* exposure to chemicals from Frit Industries alone could harm people's health because the cancer incidence factors are not conclusive in relation to this site. It is likely that the increased rates of lung/bronchus and other cancers may be due to the increased prevalence of smoking in the county compared to state rates. Limited health or personal data from the past, such as the individual smoking habits, residential activity, exposure, and occupational histories make it difficult to fully assess whether or not the site has had sole adverse impacts on human health within the community. Additionally, only a few residents would have been likely to have had past exposure to site COCs, which would not account for the increase in county cancer rates.

# Recommendations

Since all environmental media reviewed in this PHA indicates there are no current potential adverse health effects to children and adults that could occur through contact with contaminated soil, drainage sediment, surface water, groundwater, or ambient air at the Frit Industries site, there are no further recommendations at this time.

Public health education regarding cancer will be provided, as needed or requested. See *Appendix E: ATSDR "What is Cancer?" Fact Sheet* for more information about cancer.

# Public Health Action Plan

The purpose of the Public Health Action Plan (PHAP) is to ensure that this PHA not only identifies any public health hazards, but also provides a plan of action designed to mitigate and

prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The PHAP implemented by ADH/ATSDR with regards to the Frit Industries site is as follows:

***Completed Actions***

- Received from ADEQ the private citizen's request for a review of the cancer rates in Lawrence County.
- Consulted ADH Chronic Disease and Cancer Registry Section Chief to find cancer rates (SRI, 95%CI) for Lawrence County and Arkansas.
- Contacted the citizen that made the original request and informed them of our findings.
- Obtained and reviewed all historical and current electronic records/data from ADEQ for the Frit Industries site.
- Conducted a follow-up area site visit on June 19, 2009.
- Completed a community needs assessment on June 30, 2009.

***Future Activities***

- Continue to work with state and federal officials regarding this site. Should new information or environmental data become available, ADH/ATSDR will review for public health evaluation.
- Continue to monitor the state and county statistics and cancer registries.
- Continue to educate the public and address citizen requests in regards to this site.
- Provide public health education regarding cancer, as needed or requested. See *Appendix E: ATSDR "What is Cancer?" Fact Sheet* for more information about cancer.
- Complete an updated community needs assessment, as needed.

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# Appendix A: Acronyms and Abbreviations

| | |
|---|---|
| ADEQ | Arkansas Department of Environmental Quality |
| ADH | Arkansas Department of Health |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act of 1980 |
| CV | Comparison Value |
| DHHS | United States Department of Health and Human Services |
| e.g. | [*exempli gratia*] : for example |
| EMEG | Environmental Media Evaluation Guide |
| EPA | United States Environmental Protection Agency |
| FIR | Facility Investigation Report |
| GI | Gastrointestinal |
| HQ | Hazard Quotient |
| IARC | International Agency for Research on Cancer |
| i.e. | [*id est*] : that is |
| IEUBK | Integrated Exposure Uptake Biokinetic Model |
| IRIS | Integrated Risk Information System |
| LCR | Lifetime Cancer Risk |
| µg/L | microgram per liter |
| mg/kg | milligram per kilogram |
| mg/kg/day | milligram per kilogram per day |
| MRL | Minimal Risk Level |
| NA | Not Applicable |
| NAAQS | National Ambient Air Quality Standards |
| ND | Not Detected |
| NPL | National Priorities List |
| NPDES | National Pollutant Discharge Elimination System |
| PHA | Public Health Assessment |
| PHAP | Public Health Action Plan |
| PM | Particulate Matter |
| ppb | parts per billion |
| ppm | parts per million |
| PRP | Potentially Responsible Party |
| QA/QC | Quality Assurance/Quality Control |
| RCRA | Resource Conservation and Recovery Act of 1976 |
| RfD | Reference Dose |
| SARA | Superfund Amendments and Reauthorization Act of 1986 |
| TLV | Threshold Limit Value |

# Appendix B: Maps


Frit Industries
Bluff
Mountain Home
Jonesboro
65
67
63
Searcy
Memphis
40
Forrest City
Little Rock
167
Pine Bluff
Clarksdale
Legend
Frit Industries Boundary
0 0.025 0.05 0.1 0.15 0.2
Miles
Production date: 8/26/09 Data: Geostor Ortho 2006 By: Jim Files, ADH Epidemiology

# Appendix C: Groundwater Deed Restriction

ORDINANCE NUMBER 723-09

AN ORDINANCE PROHIBITING THE WITHDRAWL OF GROUNDWATER FOR USE AS A POTABLE WATER SUPPLY BY THE INSTALLANTION OR USE OF POTABLE WATER SUPPLY WELLS OR BY ANY OTHER METHOD IN CERTAIN DEFINED AREAS.

WHEREAS, certain properties in Walnut Ridge, Arkansas, have been used over a period of time for industrial purposes; and

WHEREAS, because of said use, concentrations of certain chemical constituents in the groundwater beneath certain properties in Walnut Ridge may exceed drinking water standards for potable water as set forth in the Safe Drinking Water act, 42, U.S.C. Section 201, et seq and the regulations promulgated thereunder, 40 C.F.R. Part 131; and

WHEREAS, Walnut Ridge desires to limit the potential threats to human health from the groundwater contamination by such constituents while facilitating the redevelopment and productive use of properties that are the source of said chemical constituents;

NOW, THEREFORE, BE IT ORDAINED BY THE CITY OF WALNUT RIDGE, ARKANSAS:

Section One. Withdrawal of groundwater for use as a potable water supply prohibited.

The withdrawal of groundwater for the use of, or attempted use of, groundwater as a potable water supply from the properties identified as the exclusion zone on the map attached hereto, located within Walnut Ridge, by the installation or drilling of potable water supply wells or by any other method, is hereby prohibited. Such installation or drilling of potable water supply wells, or the withdrawal of water from any well for potable water use within the exclusion zone identified on the map and legal description attached hereto is hereby prohibited.

Section Two. Remedy and Penalties.

Any person violating the provisions of this ordinance shall be subject to injunctive relief and a fine of up to $500.00 for each violation.

Section Three. Definitions.

"Person" is any individual, partnership, co-partnership, firm, company, limited liability company, corporation, association, joint stock company, trust, estate, political subdivision, or any other legal entity, or their legal representatives, agents of assigns.

"Potable water" is any water used for human or domestic consumption, including but not limited to, water used for drinking, bathing, swimming, washing dishes, or preparing foods.

Section Four. Repealer.

All ordinances or parts of ordinances in conflict with this ordinance are hereby repealed insofar as they are in conflict with this ordinance.

Section Five. Severability.

If any provision of this ordinance or its application to any person or under any circumstances is adjudged invalid, such adjudication shall not affect the validity of the ordinance as a whole or in any portion not adjudged invalid.

Section Six. Effective Date – Emergency Clause.

Passage of this ordinance is necessary to promote economic development in the community and secure employment of citizens of Walnut Ridge, therefore, an emergency is declared and this ordinance, being necessary for the immediate preservation of the peace, health, safety and general welfare of the people of this municipality, shall take effect immediately upon its passage and approval.

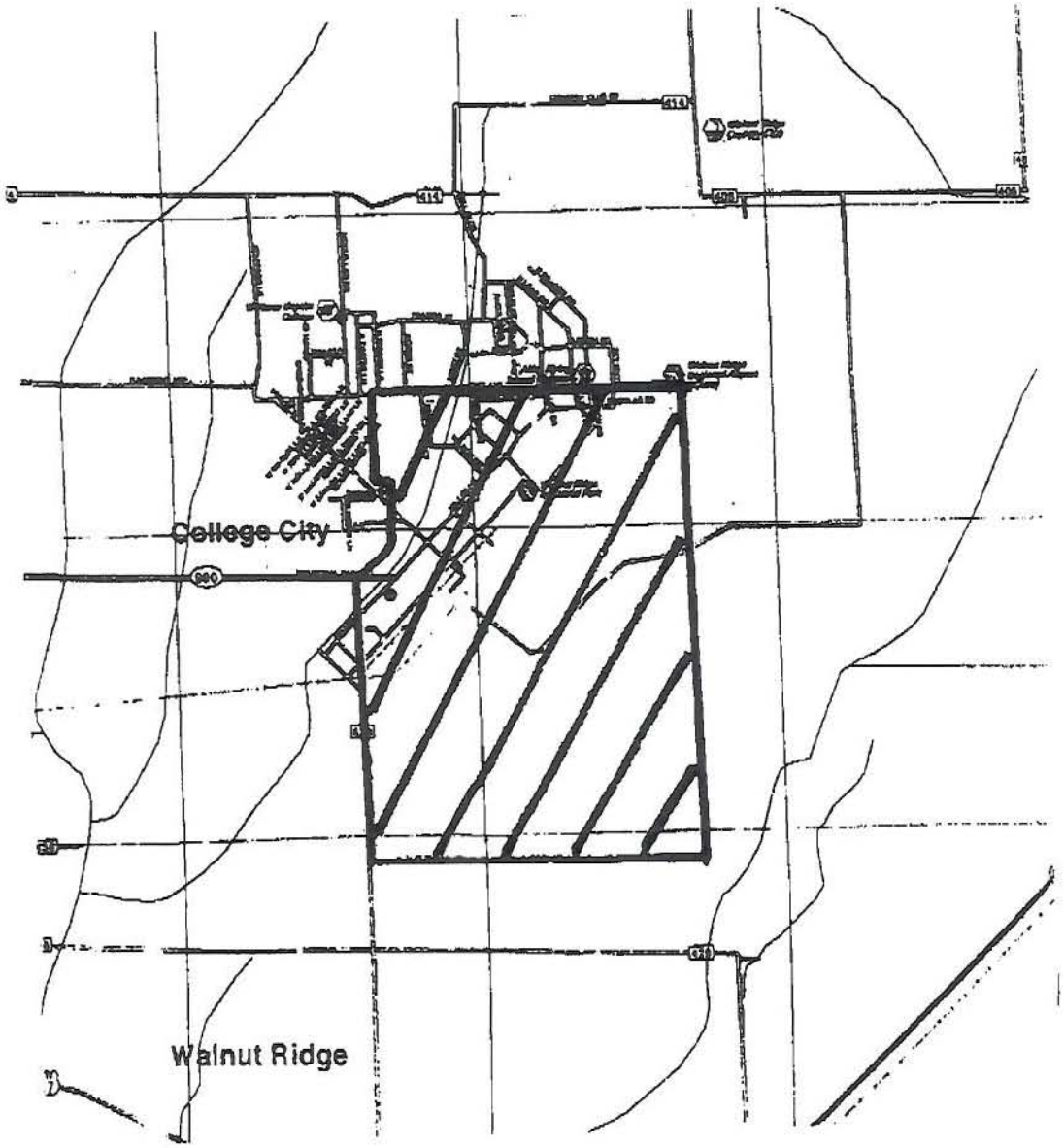
**PASSED AND APPROVED THIS** 12 **DAY OF** May, **2009.**

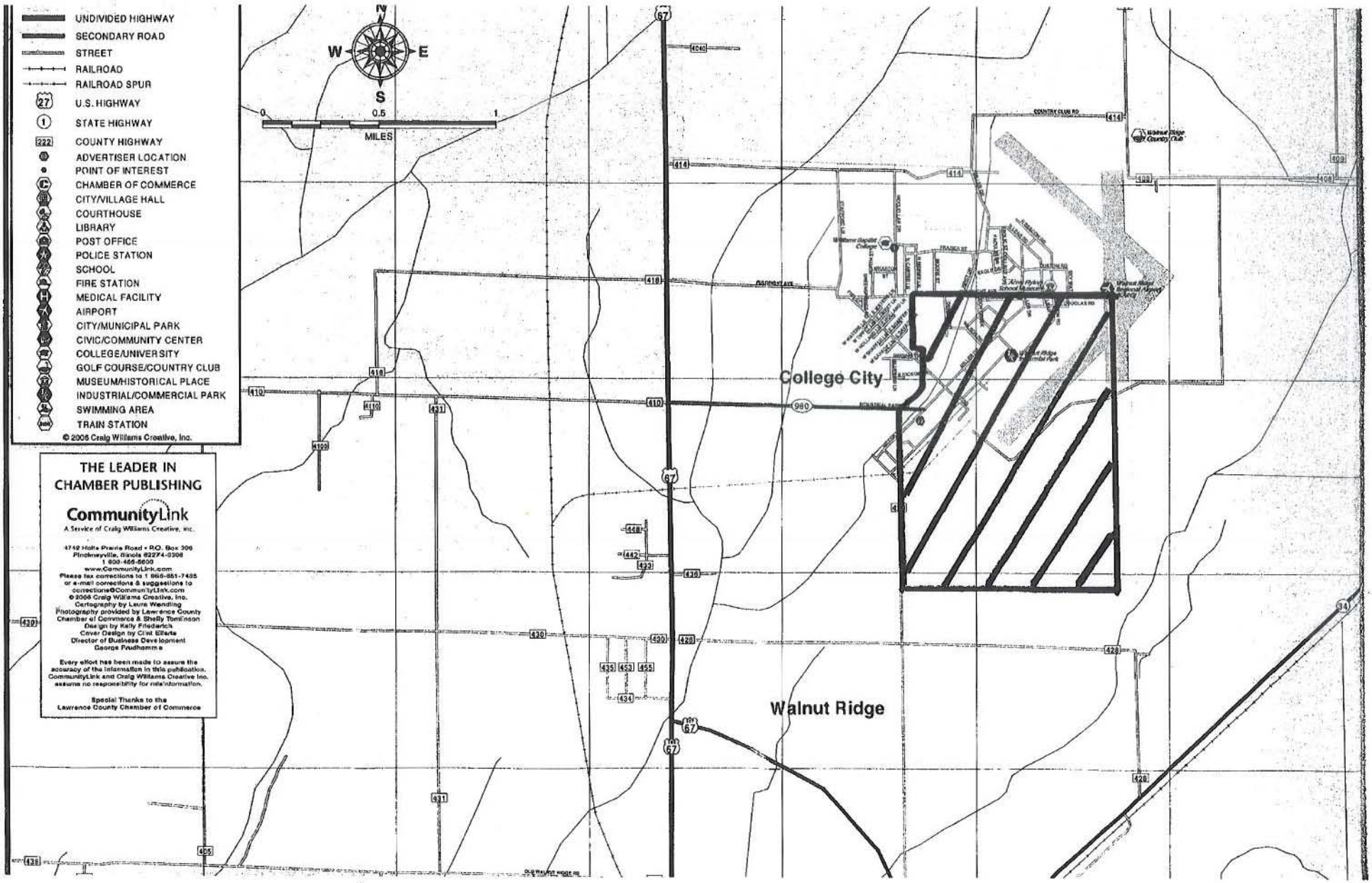
**APPROVED** Michelle Rogers
**Mayor**

**ATTEST:** Amelia Hayes
**City Clerk**

## EXCLUSION ZONE

The exclusion zone is defined as follows: Start at intersection of Fulbright Avenue and Dunlap Road, thence East along the center line of Fulbright Avenue and continuing East on a straight line past Second Street to the center line of the North-South runway of the Walnut Ridge Regional Airport, thence South along the center line of the North-South runway of the Walnut Ridge Regional Airport and continuing on a straight line South for a total distance of 6,000 feet, thence West on a straight line to the East right of way line of Highway 429 (the West boundary of the Walnut Ridge Industrial Park), thence North along the East right of way line of Highway 429 (the West boundary of the Walnut Ridge Industrial Park) and continuing North on a straight line to the South boundary of College City, thence East, Northeast, North, West and North along the boundary of College City (the same as the West boundary of the Walnut Ridge Industrial Park) to Fulbright Avenue, thence East on Fulbright Avenue to the point of beginning, all located within Lawrence County, Arkansas.




UNDIVIDED HIGHWAY
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STREET
RAILROAD
RAILROAD SPUR
U.S. HIGHWAY
STATE HIGHWAY
COUNTY HIGHWAY
ADVERTISER LOCATION
POINT OF INTEREST
CHAMBER OF COMMERCE
CITY/VILLAGE HALL
COURTHOUSE
LIBRARY
POST OFFICE
POLICE STATION
SCHOOL
FIRE STATION
MEDICAL FACILITY
AIRPORT
CITY/MUNICIPAL PARK
CIVIC/COMMUNITY CENTER
COLLEGE/UNIVERSITY
GOLF COURSE/COUNTRY CLUB
MUSEUM/HISTORICAL PLACE
INDUSTRIAL/COMMERCIAL PARK
SWIMMING AREA
TRAIN STATION
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College City
Walnut Ridge
THE LEADER IN CHAMBER PUBLISHING
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or e-mail corrections & suggestions to
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Chamber of Commerce & Shelly Tomlinson
Design by Kelly Friedrich
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Director of Business Development
George Poudhomme
Every effort has been made to assure the
accuracy of the information in this publication.
CommunityLink and Craig Williams Creative Inc.
assume no responsibility for misinformation.
Special Thanks to the
Lawrence County Chamber of Commerce

# Appendix D: Land-use Restriction Clause

# American Environmental Engineering

537 1st Avenue S.E. • Post Office Box 10 • Leeds, Alabama 35094
(205) 699-8505 • FAX (205) 699-5697 • (800) 238-8744


August 8, 1997

Mr. Clark McWilliams
Arkansas Department Of Pollution
Control And Ecology
8001 National Drive
P.O. Box 9583
Little Rock, AR 72219

RE: Land-use Restriction Clause
City of Walnut Ridge, AR
Deed for Property Leased to
Frit Industries

Dear Mr. McWilliams:

As per our recent conversations, regarding a deed restriction, limiting the use of the property occupied by Frit Industries in Walnut Ridge, Arkansas, I have been informed by Frit Industries that the City of Walnut Ridge has filed a **DECLARATION OF RESTRICTIONS** for the property with the County. I am enclosing a copy of these restrictions that were provided to us. Please note Items 4 and 5, which limit the use of the land and extends this restriction to future occupants. This should eliminate any problems with the question of selection of industrial land use as a future land use scenario in the risk assessments being prepared for the site. This information will be incorporated into the final draft of the risk assessments as supporting data.

If you have any questions regarding this matter, please contact me at (205) 699-8505.

Respectfully,

**AMERICAN ENVIRONMENTAL ENGINEERING, INC.**

Robert W. Bellamy
Director of Technical Services

RWB/rwb
file/landuse.frt

Enclosure

cc: Carl Schauble, Frit Industries

AUG 14 1997
91R-7695

# DRAFT

## DECLARATION OF RESTRICTIONS

**THIS DECLARATION OF RESTRICTIONS (Declaration)** is made and entered into this 25 day of July, 1997, by and between Frit Industries, Inc. (Frit) and the City of Walnut Ridge, Arkansas (the "City.")

**WHEREAS:**

A. The City is the current owner of certain real property (the "Property) in Lawrence County, Arkansas, as legally described in Exhibit A attached and incorporated herein. The Property is currently being leased to Frit pursuant to the Lease dated _____, a copy of which is attached and incorporated herein as Exhibit B.

B. The Property has been listed on the Comprehensive Environmental Response, Compensation and Liability Information System list and has been the subject of an environmental response project under the authority of the Arkansas Department of Pollution Control & Ecology (PC&E), pursuant to the Arkansas Remedial Action Trust Fund Act, codified at Ark. Code Ann. § 8-7-501 *et seq*. On September 17, 1991, with respect to cleanup of the Property, Frit entered into a Consent Administrative Order with PC&E at PC&E LIS No. 91-161, and on November 4, 1991, Frit entered into a second Consent Administrative Order with PC&E at PC&E LIS NO. 90-044 (the "CAOs.")

C. Restriction on future uses of the Property is necessary and desirable for the City, the citizens of Walnut Ridge and surrounding communities in order the maintain the effectiveness of the environmental response project performed pursuant to the CAOs and to protect human health and safety.

D. The City agrees to impose the restrictions contained herein upon the use and occupancy of the Property beginning on the effective date of this Declaration, which restrictions shall be and constitute perpetual covenants running with the Property and shall be binding upon the City, its successors in ownership of the Property and all persons now or hereafter having any legal right to use or occupancy of the Property or any part thereof.

**NOW, THEREFORE,** the City hereby declares as follows:

1. The above premises are incorporated herein by reference as operative terms of this Declaration.

2. This Declaration is made, among other things, to prevent the breach or destruction of any measures implemented under the CAOs, and to protect human health and safety.

3. The environmental response actions taken under the CAOs have involved the sampling, analysis and removal from the Property of certain constituents, consistent with the

requirements of the CAOs.

4. Except as provided herein, the Property shall not be used in any manner which would involve direct bodily contact by humans with soil. The Property shall only be used for industrial or commercial use. No other use, including, without limitation, agricultural use, residential use, residential/commercial use, recreational use, day care facilities, educational facilities, hospitals, churches, or like facilities, is permitted or authorized on the Property. The use of the Property as an industrial or commercial area is distinguished from usage as a residential/commercial area as such term is defined in 40 CFR § 761.123, and does not include such use.

5. Each prospective tenant, purchaser, occupant and invitee of the Property shall be given notice of this Declaration and the terms of this Declaration shall be incorporated in any document transferring legal or equitable title to the Property, or any part thereof.

IN WITNESS WHEREOF, the City of Walnut Ridge declared the restrictions set forth in this Declaration.

FILED
AUG 4 1997
Carolyn Hayes
Circuit Clerk
D.C.

**DECLARANT:**

**CITY OF WALNUT RIDGE**

BY: _____

TITLE: Mayor

CERTIFICATE OF RECORD
State of Arkansas } ss
County of Lawrence }
I, Carolyn Hayes, Clerk of the Circuit Court and Ex-Officio Recorder for the County aforesaid do hereby certify that the annexed and foregoing instrument or writing was filed for record in my office on the 4 day of August A.D. 1997 at 10:50 o'clock A.M. and the same is duly recorded in Book, Vol. 42 Page 470
In testimony whereof I have hereunto set my hand and affixed the seal of said Court this 4 day of August A.D. 1997
Carolyn Hayes Clerk
by Bobby Keas

STATE OF ARKANSAS )
)ss.
COUNTY OF LAWRENCE )

Subscribed and sworn to before me this 25 day of July, 1997.

_____
Notary Public

My Commission Expires:

Jan 12 2005
(SEAL)

NATHAN CRAFTON NOTARY PUBLIC MY APPOINTMENT EXPIRES Jan. 12, 2005 LAWRENCE COUNTY, ARKANSAS

fritcitydeclrest

# Appendix E: Exposure Dose Equations Used in Calculations

The following equations, taken from the ATSDR Public Health Assessment Guidance Manual (2005), were used to calculate exposure dose (ED) in units of milligram per kilogram per day (mg/kg/day), which was then used to calculate a potential hazard quotient (HQ) and theoretical lifetime cancer risk (LCR) value for each concentration of cadmium and each exposure pathway and receptor (*i.e.*, child or adult). Exposure pathway scenarios involving dermal (skin) contact or accidental ingestion of soil particulates were used in determining values found in Table 1.

The exposure dose is calculated using the following equation:

$$\mathbf{ED = (C \times IR \times EF) / BW}$$

ED = Exposure Dose (milligrams per kilogram per day, mg/kg/day)
C = Contaminant Concentration (micrograms per liter, μg/L)
IR = Intake Rate of Contaminated Air (fluid ounces per day, fl. oz./day)
EF = Exposure Factor (unitless)
BW = Body Weight (kilograms, kg)

The hazard quotient is calculated using the following equation:

$$\mathbf{HQ = ED / RfD}$$

HQ = Hazard Quotient (unitless)
ED = Exposure Dose (milligrams per kilogram per day, mg/kg/day)
RfD = Reference Dose (milligrams per kilogram per day, mg/kg/day)

The theoretical lifetime cancer risk is calculated using the following equation:

$$\mathbf{LCR = ED \times SF \times (Exposure\ Duration\ Years / 70)}$$

LCR = Lifetime Cancer Risk (unitless)
ED = Exposure Dose (milligrams per kilogram per day, mg/kg/day)
Slope Factor = [(milligrams per kilogram per day)$^{-1}$, (mg/kg/day)$^{-1}$]
Exposure Duration Years = 30 years for this site scenario
70 = Average number of years per one's lifetime

# Appendix F: ATSDR "What is Cancer?" Fact Sheet

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

# What Is Cancer?

## Overview

Cancer is not a single disease. It is a group of more than 200 different diseases. Cancer can be generally described as an uncontrolled growth and spread of abnormal cells in the body. Cells are basic units of life. All organisms are composed of one or more cells. Normally, cells divide to produce more cells only when the body needs them.

Sometimes cells keep dividing and thus creating more cells even when they are not needed. When this happens, a mass of tissue forms. This mass of extra tissue is called a tumor. Tumors are found in all kinds of tissue, and can be benign or malignant.

## Tumors

### Benign

**Benign tumors are not cancer.** They usually can be removed and, in most cases, they do not come back. Most important, cells from benign tumors do not spread to other parts of the body. Cells from benign tumors stay together and often they are surrounded by a containing membrane. Benign tumors are not usually a threat to life.

**Examples of Benign Tumors**

- Papilloma — A projecting mass on the skin (for example, a wart)
- Adenoma — A tumor that grows in and around the glands
- Lipoma — A tumor in fatty tissue
- Osteoma — A tumor originating in the bones
- Myoma — A tumor of muscle tissue
- Angioma — A tumor usually composed of small blood or lymph vessels (for example, a birthmark)
- Nevus — A small skin tumor of one variety of tissues (for example, a mole).

### Malignant

**Malignant tumors are cancer.** Cancer cells can invade and damage tissues and organs near the tumor. Cancer cells also can break away from a malignant tumor and enter the lymphatic system or the bloodstream, which is how cancer can spread to other parts of the body. The characteristic feature of cancer is the cell's ability to grow rapidly, uncontrollably, and independently from the tissue where it started. The spread of cancer to other sites or organs in the body through the blood stream or lymphatic system is called metastasis.

Malignant tumors generally can be classified in two categories.

**Carcinomas.** These cancers originate in the epithelium. The epithelium is the lining cells of an organ. Carcinomas are the most common type of cancer. Common sites of carcinomas are the skin, mouth, lung, breast, stomach, colon and uterus.

**Sarcomas.** Sarcomas are cancers of connective and supportive tissue (soft tissues) of all kinds. Sarcomas can be found anywhere in the body, and they often form secondary growths in the lungs.

## Characteristics of Benign and Malignant Tumors

| Characteristic | Benign | Malignant |
|---|---|---|
| Differentiation | Tumor cells resemble the original mature cells | Tumor cells might not resemble the original mature cells |
| Growth Rate | Slow; might stop or regress | Rapid, autonomous; usually does not stop or regress |
| Type of Growth | Expand and displace | Invade, destroy, and replace |
| Metastasis | No | Yes |
| Health Effect | Usually does not cause death | May cause death if not diagnosed and treated |

## Some Causes of Cancer

Different types of cancer have different causes and are likely to depend on many factors. Some cancers are more common than others, and chances for survival vary among different types. Most cancers do not have known causes from a chemical, environmental, genetic, immunologic, or viral origin. Cancers also can arise spontaneously from causes that are thus far unexplained.

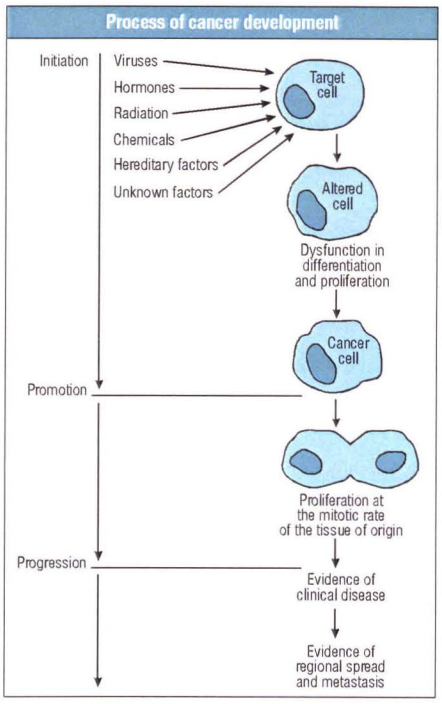
The causes of cancer are very complex, involving both the cell and factors in the environment. Much progress has been made in identifying possible causes of cancer, including:

**Chemicals and other substances.** Being exposed to substances such as certain chemicals, metals, or pesticides can increase the risk of cancer. Any chemical that is known to cause cancer is called a carcinogen. Asbestos, nickel, cadmium, uranium, radon, vinyl chloride, benzidene, and benzene are examples of well-known carcinogens. These may act alone or along with another carcinogen, such as cigarette smoke, to increase the risk of cancer. For example, inhaling asbestos fibers increases the risk of lung diseases, including cancer, and the cancer risk is especially high for asbestos workers who smoke.

**Tobacco.** The most common carcinogens in our society are those present in cigarette smoke. Tobacco smoke is known to contain at least 60 carcinogens and 6 developmental toxicants. In addition to being responsible for 80 to 90 percent of lung cancers, cigarette smoking is also associated with cancers of the mouth, pharynx, larynx, esophagus, pancreas, kidney, and bladder. Avoiding tobacco products is one way to decrease a person's risk of cancer.

**Ionizing radiation.** Certain types of radiation, such as x-rays, rays from radioactive substances, and ultraviolet rays from exposure to the sun, can produce damage to the DNA of cells, which might lead to cancer.

**Heredity.** Certain types of cancer occur more frequently in some families than in others, indicating some inherited predisposition to the development of cancer. Even in these cases, however, environment plays a part in the development of cancer.




Source: Medical/Surgical Nursing, 5th Edition, (2000), Chapter 14, pg 272.

## How Cancer Develops

Cancer can develop in people of all ages, but it is more common in people over 60 years old. One of every three people will develop cancer at some point in their lives. Because people are living longer, the risk of developing cancer is increasing.

The development of cancer is a long process that usually starts with genetic changes in the cells, and continues in the growth of these cells over time. The time from genetic change to development of cancer is called the latency period. The latency period can be as long as 30 years or more. This means that some cancers diagnosed today may be due to genetic changes that occurred in the cells a long time ago.

Theoretically, the body develops cancer cells continuously, but the immune system recognizes them as foreign cells and destroys them. The body's ability to protect itself from cancer can be impaired by some drugs and viral infections.

**Diagram Definitions:** 1) **Differentiation** -characteristic trait distinguishing one cell from another; 2) **Proliferation** - the rapid and repeated production of new cells; 3) **Mitotic** - cell division resulting in the formation of two new nuclei each having the same number of chromosomes as the parent nucleus.

## Symptoms of Cancer

Everyone should be familiar with certain signs that may indicate early cancer. It is important to report them immediately, before the condition spreads. It is unfortunate that early stages of cancer are typically painless; because they are painless, diagnosis and treatment are often delayed.

Early symptoms can include

- unaccountable weight loss
- unusual bleeding or discharge
- persistent indigestion
- the presence of white patches inside the mouth or white spots on the tongue
- chronic hoarseness or cough
- changes in the color or size of moles
- a sore that does not heal in a reasonable time
- the presence of an unusual lump

## Detection of Cancer

Early detection and prompt treatment are directly responsible for increased survival rates. Tools for cancer detection include

- Self-exams
- Biopsy (the removal of living tissue for the purpose of microscopic examination of cells)
- Ultrasound (the use of reflected high-frequency sound waves to differentiate various kinds of tissue)
- Computed tomography (CT) (the use of x-rays to produce a cross-sectional picture of body parts)
- Magnetic resonance imaging (MRI) (the use of magnetic fields and radio waves to show changes in soft tissues without the use of x-rays).

## Health Promotion Tips

- Reduce or avoid exposure to known or suspected carcinogens or cancer-promoting agents, including cigarettes and sun exposure.
- Eat a balanced diet that includes vegetables, fresh fruit, whole grains, and adequate amounts of fiber.
- Reduce the amount of fat and preservatives in the diet, including smoked and salt-cured meats.
- Participate in regular exercise.
- Obtain adequate, consistent periods of rest (at least 6 to 8 hours per night).
- Eliminate or reduce stress and enhance the ability to effectively cope with stress.
- Go to annual health check-ups.
- Enjoy consistent periods of relaxation and leisure.
- Learn to practice self-examination (breast and testicular).
- Seek immediate medical care if cancer is suspected.

## Risk Factors for Cancer

Because cancer is not a single disease, it does not have a single cause. Many causes or risk factors can contribute to a person's chance of getting cancer. Risk factors are different with each type of cancer. It is important to remember that 1 in 3 people will develop a cancer during their lifetime.

**Risk factors are things that can increase the chances of getting cancer.**

**Most cancers are likely to be related to more than one risk factor.**

**Some risk factors can be controlled and others cannot.**

Risk factors can include such things as age, race, sex, genetic factors, diet, and exposure to chemicals, radiation, and tobacco.

Genetics play a large role for many cancers, such as breast and colon cancer. This means that a family's health history can be a risk factor for some types of cancers.

## Lifestyle Factors

Personal choices we make about the way we live our lives can increase our chance of developing cancer. These choices are called lifestyle factors, and they include smoking, heavy drinking, and eating foods that have excess calories, high fat, and low fiber. Other factors that increase risk are related to sexual contact and sunlight exposure.

### Tobacco

Thirty percent of all cancers are attributed to smoking or chewing tobacco. Cigarette smoking is also associated with cancers of the mouth, pharynx, larynx, esophagus, pancreas, kidney, and bladder.

### Diet

Researchers found that different types of food you eat affect your risk of developing cancer. Approximately 30% of cancers are related to diet.

### Infectious Agents

Some viruses have the ability to transform cells into cancer. Examples include (a) human papilloma virus (HPV) and cervical cancer, and (b) Epstein-Barr virus and lymphoma.

### Occupational Exposure

Occupational exposure includes high-risk occupations such as uranium miners, asbestos factory workers, certain chemical plant workers, and workers in nuclear power plants.

### Reproductive Factors

The reproductive factors category refers mostly to women's risk factors. For example, the risk of breast cancer goes up if a woman does not have children before the age of 30. Sexually transmitted diseases also increase the risk of cervical cancer.

### Sedentary Lifestyle

Not moving around much during the day may increase the risk of cancer. The body's own defenses work better when you exercise and maintain an ideal weight. Moderate exercise such as walking or climbing a flight of stairs can help.

### Alcohol/Drugs

Alcohol contributes to the risk of developing cancer. People who drink too much or abuse drugs may not eat well or take care of themselves, which will increase their overall risk of cancer.

### Pollution

Although people think environmental pollution is a major of cancer, in fact few cancers have been found to be caused by pollution, but research is still ongoing. The cause of many cancers is not known. Other factors that interact to increase the risk of cancer are age, hormonal balance, response to stress, and status of the immune system.

# Risk and Protective Factors in the Development of Cancer

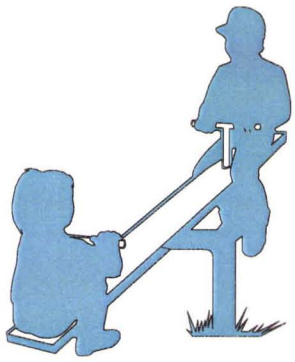
| | Protective Factors | | | Risk Factors | | | |
|---|---|---|---|---|---|---|---|
| Type of Cancer | Vegetables | Fruits | Physical Activity | Alcohol | Obesity | Tobacco Use | Environmental Exposure |
| Lung | ✔✔✔ | ✔✔✔ | ✔ | ✘ | | ✘✘✘ | ✘✘ |
| Colon/Rectum | ✔✔✔ | | ✔✔✔ | ✘✘ | ✘ | ✘ | |
| Breast | ✔✔ | ✔✔ | ✔ | ✘✘ | ✘✘ | | |
| Prostate | ✔ | | | | | | ✘ |
| Stomach | ✔✔✔ | ✔✔✔ | | | | | ✘ |
| Oral/Pharynx | ✔✔✔ | ✔✔✔ | | ✘ | | ✘✘✘ | ✘ |
| Kidney | ✔ | | | | ✘✘ | ✘ | |
| Ovary | ✔ | ✔ | | | | | |
| Pancreas | ✔✔ | ✔✔ | | | | ✘✘✘ | |
| Liver | ✔ | | | ✘✘✘ | | | ✘ |
| Cervix | ✔ | ✔ | | | | ✘✘✘ | |
| Bladder | ✔✔ | ✔✔ | | | | ✘✘✘ | ✘✘ |
| Esophagus | ✔✔✔ | ✔✔✔ | | ✘✘✘ | | ✘✘✘ | ✘ |
| Larynx | ✔✔ | ✔✔ | | ✘✘✘ | | ✘✘✘ | ✘ |
| Thyroid | ✔ | ✔ | | | | | ✘✘ |
| Uterus | ✔ | ✔ | | | ✘✘✘ | | |
| Gallbladder | | | | | ✘ | | |
| Nasopharynx | | | | | | ✘✘ | ✘ |

Adapted from: Westcott S. A Journey Into Cancer's Causes. Anchorage (AK): Alaska Native Health Board; 1999. p. 11..

## Legend

| | | | |
|---|---|---|---|
| ✔✔✔ | Greatly lowers your risk | ✘✘✘ | Highly raises your risk |
| ✔✔ | Somewhat lowers your risk | ✘✘ | Somewhat raises your risk |
| ✔ | Might lower your risk | ✘ | Might raise your risk |

# Cancer and Children[1]



It can be especially difficult to understand and accept when a child develops cancer. The most common cancers in children are leukemia, brain tumors, and lymphomas. Nearly 1 in 450 children will be diagnosed with cancer before the age of 15.

Many pediatric cancers occur very early in life and many parents want to know why. The cause of most childhood cancers is not known, although some of these cancers are the result of genetic predisposition (cancer runs in the family). Radiation exposure also contributes to certain types of childhood cancers. Other factors that have been implicated in childhood cancers include infectious diseases, prenatal conditions, environmental pollutants, electromagnetic fields, and use of medications.

Unlike most cancers of adults, childhood cancers are not significantly related to lifestyle risk factors such as tobacco or alcohol use, poor diet, or not enough physical activity. Many organ systems in children are undergoing rapid growth and development in the first years of life. These systems are especially vulnerable to injury during these periods of development.

The types of cancer that occur in children vary greatly from those seen in adults.

## Most Common Cancers in Children and Adults

| Children | Adults |
|---|---|
| Leukemias: acute lymphocytic (lymphoblastic) | Lung |
| Brain and Other nervous system tumor: neuroblastoma | Breast (carcinoma) |
| Lymph-node cancers (lymphomas) | Colorectal |
| Bone (osteosarcoma) | Prostate |
| Soft-tissue sarcomas: rhabdomyosarcoma | Skin (melanoma) |
| Kidney: Wilms tumor | |
| Eye: retinoblastoma | |
| Adrenal gland (adrenocortical carcinoma) | |

**Acute lymphocytic leukemia** (ALL) is the most common childhood malignancy. ALL accounts for almost one-third of all childhood cancers.

**Brain and spinal cord** cancers are the second most common cancers in children. Most brain cancers of children involve the cerebellum or brain stem. Adults are more likely to develop cancers in different parts of the brain—usually the cerebral hemispheres. Spinal cord tumors are less common than brain tumors in both children and adults.

[1]This information on children and cancer was compiled from *Childhood Cancer—General Statement*, published by the American Cancer Society.

Bone cancer is uncommon. The incidence of primary bone cancer (cancer starting in bones) is highest in children and adolescents. Cancer that spreads to the bones is more common than primary bone cancer in all age groups. Osteosarcoma is the most common type of primary bone cancer in children and young adults. Ewing sarcoma is a less common primary bone cancer that occurs mostly in children and adolescents.

## Detecting Cancer in Children

Cancers in children are often difficult to recognize. Parents should take their children to regular medical checkups and should be alert to any unusual signs or symptoms that persist. It is important to report unusual signs or symptoms to a health care provider.

Unusual signs or symptoms include

- unusual mass or swelling
- unexplained paleness
- loss of energy
- sudden tendency to bruise
- persistent, localized pain or limping
- prolonged, unexplained fever or illness
- frequent headaches, often with vomiting
- sudden eye or vision changes
- excessive, rapid weight loss.

# What About Chemicals in the Environment?

> **"All substances are poisons: there is none which is not a poison. The right dose differentiates a poison and a remedy."**
>
> **Paracelsus (1493–1541)**

Environmental pollutants are only one of the many connections between cancer and our lives. Not all contaminants are deadly or even cause disease.

The amount of a contaminant a person is exposed to
**plus** the length of time that person is exposed
**plus** how many times that person is exposed
**plus** how the person was exposed
**equals** whether a person will experience negative health effects from an exposure.

Exposures to some chemicals in the environment, at home, and at work may contribute to an individual's risk of developing cancer. Toxic substances such as benzene, asbestos, vinyl chloride, and arsenic can increase the risk of cancer in those exposed to them. The International Agency for Research on Cancer (IARC) classified these substances as known human carcinogens because studies showed a link in humans between exposure to these substances and cancer.

Some chemicals have been shown to cause cancer in animals, but there is not enough evidence to show that these chemicals also cause cancer in humans. These chemicals are classified by IARC as possibly or probably carcinogenic to humans. Chloroform, DDT, formaldehyde, and polychlorinated biphenyls are examples of such chemicals.

Most of what we know about chemicals and cancer in humans comes from scientists' observation of workers. The most significant exposures to cancer-causing chemicals have occurred in workplaces where large amounts of toxic chemicals have been used regularly.

The amount of toxic chemicals found in food, air, and drinking water are typically much lower than those in the work environment. Therefore, cancer risk from environmental exposures is thought to be lower compared to the risk in occupational settings. In fact, the cancer risk from environmental exposures is often difficult to measure.

## Environmental Toxicants

Environmental toxicants are classified by the National Toxicology Program as (a) known human carcinogens and (b) reasonably anticipated to be (suspected) human carcinogens to differentiate the level of evidence available to support the carcinogenicity of a probable toxicant. Carcinogens include a wide diversity of synthetic and naturally occuring substances, including hormones, immunosuppressants, organic and inorganic chemicals, and cytotoxins.

It is difficult to study populations living near a hazardous waste site and determine if their cancers are associated with exposures. A major difficulty for those studying these populations is not knowing the exact level of individual exposure to a carcinogenic agent. Waste sites often contain more than one chemical, which makes it difficult to associate health outcomes to a single exposure. Often other variables must be accounted for before making any associations of the disease outcome to a given exposure from the site.

Because of the long latency period of cancer development and the type of behavioral risk factors associated with cancers (such as tobacco use, alcohol consumption, and diet), it is difficult to collect information about environmental exposures that occurred years ago.

# A List of Known and Suspected Human Carcinogenic Agents by Organ

| | Human Carcinogenic Agent | |
|---|---|---|
| Organ | Known | Suspected |
| Lung | Arsenic<br>Asbestos<br>Benzo(a)pyrene<br>bis(Chloromethyl)ether<br>Chromium<br>Nickel subsulfide<br>Zinc chromate<br>Tobacco smoking<br>Mustard gas<br>Uranium | Acrylonitrile<br>Beryllium<br>Cadmium<br>1,2-Dibromo-3-chloropropane<br>Polyclic aromatic hydrocarbons (PAHs) |
| Kidney | Coke oven emissions<br>Zinc chromate | Tetrachloroethylene |
| Bladder | Benzidine<br>Cyclophosphamide<br>4-Aminodiphenyl<br>Tobacco smoking<br>Chloraphazine | Tetrachloroethylene |
| Stomach | Zinc chromate | Ethylene oxide |
| Skin | Arsenic<br>Benzo(a)pyrene<br>Overexposure to the sun | PAHs<br>Tetrachloroethylene |
| Liver | Vinyl chloride<br>Aflatoxin<br>Alcoholic drinks | |
| Mouth, pharynx, larynx, esophagus | Alcoholic drinks<br>Tobacco smoking<br>Tobacco chewing (mouth only)<br>Mustard gas (larynx) | |
| Prostate | Cadmium | |

Source: Lybarger JA, Spengler RF, DeRosa CT, editors. Priority health conditions: an integrated strategy to evaluate the relationship between illness and exposure to hazardous substances. Atlanta: Agency for Toxic Substances and Disease Registry; 1993. p. 61.

## For more information about Cancer:

Contact your Health Care Provider
Your local American Cancer Society Chapter

or visit the following sites on the Internet:

http://cancernet.nci.nih.gov
http://www.yourcancerrisk.harvard.edu/
http://cdc.gov/cancer
http://www.acor.org/disease/ped-onc
http://www.pbs.org/wgbh/nova/cancer

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NCI Fact Sheet: National Cancer Institute Research on Causes of Cancers in Children; (1999); www.oncolink.upenn.edu/pdq_html

Cancer Information Service; www.fhcrc.org/cipr/pnwcis

# ATSDR

AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

For more information,

contact ATSDR's toll-free information line:

**(888) 42-ATSDR. . . that's (888) 422-8737**

ATSDR's Internet address is www.atsdr.cdc.gov

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# Appendix G: Glossary of Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, **1-800-CDC-INFO (232-4636)**.

**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.

**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

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

**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 Abstracts Service [external link].

**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.

**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-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.

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

**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]

**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.

**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].

**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.

# Certification

The Arkansas Division of Health prepared this public health assessment for Frit Industries, Walnut Ridge, Arkansas under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedure existing at the time the health consultation was initiated. Editorial review was completed by the cooperative agreement partner.

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The Cooperative Agreement and Program Evaluation Branch, (CAPEB), Division of Health Assessment and Consultation (DHAC), ATSDR, has reviewed this health consultation and concurs with its findings.

Alan W. Yarbrough
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