

Health Consultation

FORMOSA PLASTICS PLANT EXPLOSION
CANTRELL ROAD AND OLD U.S. ROUTE 36
ILLIOPOLIS, SANGAMON COUNTY, ILLINOIS
EPA FACILITY ID: ILD005158548

SEPTEMBER 8, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

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

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

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HEALTH CONSULTATION

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CANTRELL ROAD AND OLD U.S. ROUTE 36
ILLIOPOLIS, SANGAMON COUNTY, ILLINOIS

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Prepared by:

Illinois Department of Public Health
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Purpose

On April 23, 2004, an explosion took place at the Formosa Plastics Plant near Illiopolis, Sangamon County, Illinois. The plant contained chemicals used to make polyvinyl chloride such as vinyl chloride and other materials. Vinyl chloride is a flammable gas that is converted into polyvinyl chloride in the plastic-making process. Area residents were evacuated, and a 20-mile stretch of nearby highway was temporarily closed.

This health consultation is a summary of the steps taken during and following the explosion at the Formosa Plastics Plant and a description of how health hazards regarding chemical exposure were evaluated and addressed. The Illinois Department of Public Health (IDPH) reviewed the environmental data to determine whether the conditions created by the explosion posed a continued health hazard to the public.

Background and Statement of Issues

Emergency Response

An immense explosion, followed by two to three smaller blasts, occurred at approximately 10:40 p.m. on April 23, 2004 at the Formosa Plastics Plant near Illiopolis, Illinois. The plant is about 1 mile west of Illiopolis, just north of Interstate 72 (Attachment 1). The plant contained chemicals that are used to manufacture plastic materials. These include vinyl chloride, vinyl acetate, and catalysts. The plant converts vinyl chloride, a flammable gas, into polyvinyl chloride (PVC) resin, which is used to manufacture plastic materials. This conversion involves the mixing of vinyl chloride and vinyl acetate by the workers.

An estimated 50 to 75 percent of the plant was demolished by the explosions. Wind direction at the time of the explosions was out of the north. As the fire burned winds shifted and came out of the west. Area residents were evacuated, and a 20-mile section of Interstate 72 was closed for about 6 hours, until IDPH and the Illinois Environmental Protection Agency (Illinois EPA) declared the smoke was not hazardous to motorists. By the afternoon of April 24, all but 30 residents were allowed back to their homes. A no-fly zone was established for the area in case another explosion occurred. Shelters were set up in malls, stores, and at Illiopolis High School (Herald and Review, Apr 25).

The Illiopolis fire department estimated that 265 rescue workers from 28 agencies responded to the incident. A team of professionals, trained in hazardous materials response and special rescue techniques, were the first to search the plant for four missing workers. The rescue team began the search at the perimeter of the plant.

A portable dump tank was set up to hold the water used to fight the fire. Tankers from 20 different fire departments provided the water for the tank. A portable generator was used to pump water from a nearby well field that provided access to a 7 million gallon reservoir. The

plant was equipped with a water deluge system designed to flood the area with water in the event a vinyl chloride release was detected.

Potential Hazards

Potential hazards from the explosion included:

- The release of large quantities of vinyl chloride.
- The release of hydrochloric acid into the air. When vinyl chloride is burned, hydrochloric acid is released.
- The possible release of asbestos from building materials as a result of the fire.
- Formation of dioxins from the fire. Illinois EPA has collected samples to determine dioxin levels since they may have been produced by the fire.

Initial Environmental Sampling

Federal and state officials and company representatives tested for a variety of chemicals at the site and in nearby areas. Formosa hired an environmental consulting firm, the Center for Toxicology and Environmental Health, to collect additional samples. Officials from the Illinois EPA Office of Emergency Response arrived on the scene at approximately 12:00 a.m. on April 24, and began to monitor the air for volatile organic compounds (VOCs), including vinyl chloride. In addition, they looked for anything that could be an immediate hazard to the responders. These measurements were used to determine the personal protective equipment necessary at the site. On April 24, the following locations were tested:

- The area of I-72 where the plume crossed the road south of the plant,
- The towns of Mechanicsburg, Buffalo, and Lanesville.
- Areas of the Formosa plant property.

The plant property and surrounding areas were tested for contaminants for the following two days.

Emergency response officials determined that no chemicals were detected at levels that would be expected to cause adverse health effects. The first readings taken, indicated that the total VOC levels were approaching the worker safety level. This led to the use of a Draeger sampling system, which is a more chemical-specific device that can be calibrated to show the presence of vinyl chloride. This system was used on Cope Road and on I-72 in the smoke plume. The readings indicated vinyl chloride levels that were ten times less than the worker safety level of 2.6 milligrams per cubic meter (Illinois EPA Fact Sheet 2).

Air monitors were used to test for the presence of VOCs, vinyl acetate, vinyl chloride and asbestos. Measurements from three monitors were taken within the plant boundaries and two monitors were used at the fence line area. Samples were taken at nearby homes on the night of the explosion and over the next few days. These samples were tested for vinyl chloride, VOCs and vinyl acetate. Residential asbestos samples were taken upon request; however, only one resident requested this sampling. None of the residential readings showed the presence of vinyl

acetate, vinyl chloride or asbestos. Total VOCs readings were taken in kitchens, but the levels were equivalent to those expected from indoor sources.

Illinois EPA received daily reports from Formosa contractors, including asbestos levels in the air from the previous day. The asbestos standard established for site workers was 0.1 fibers per cubic centimeter of air in the work zone. While there is no established acceptable level for asbestos in a community, the community measurements have ranged from one to four percent of the worker standard. These levels are considered to be within typical levels found in urban areas and are considered safe for the general population (Illinois EPA Fact Sheet 2).

The U.S. Chemical Safety and Hazard Investigation Board (CSB) has evaluated the plant in an attempt to identify the cause of the explosion. At least 25 witnesses were originally interviewed. CSB has requested documents and records from the Formosa Plant and chemical releases prior to the explosion continue to be examined (CSB Apr 30).

A vessel containing radioactive material was located in a building adjacent to the explosion site. Following the explosion, the vessel was checked and secured by the plant radiation safety officer. The Springfield fire department and OSHA later checked the vessel and confirmed its safety (SJ-R, Apr 29).

Firefighters, other first responders, and citizens with health concerns were asked to undergo a physical examination paid for by Formosa. Included in the exam was a urine sample analyzed for a full toxicological screen. On May 11, the test results from 311 people showed no significant exposure to vinyl chloride. Sixty-five of the 311 people who were tested sought additional evaluation with tests such as a liver function test, because exposure to vinyl chloride could result in liver problems. All of these tests came back negative (SJ-R May 12).

Drinking Water and Area Surface Water

Illioopolis and the surrounding communities were under a “boil water only” order until the public drinking water was determined to be safe (Herald and Review Apr 25). The wastewater treatment plant at the site did not have power from the time of the explosion until about 20 hours later. Illinois EPA sampled the water for VOCs and bacteria and did not detect contamination. During the weekend of the explosion and the following week, Illinois EPA and the operator of Illioopolis’ public water supply tested the drinking water (Illinois EPA Fact Sheet 1). The wastewater plant was fully operational on April 24 and the load was reduced due to lack of production at the plant. The water treatment plant was subsequently monitored weekly (Illinois EPA Fact Sheet 2).

Five locations from the Illioopolis community water supply, which is located at the Formosa Plastics plant, and the Mt. Auburn and Mechanicsburg-Buffalo community water supply wells have been sampled. All of these samples tested negative for contamination.

Samples of surface water from the discharge location of the plant, upstream, and downstream at six locations were tested as well. These samples were collected from an unnamed creek that flows southeast of the plant, in Long Point Slough, and from the Sangamon River. Some of the

runoff from water that had been used to fight the fire was released, but through the construction of an earthen dike and the use of portable pumping equipment, the runoff was held on the site (Illinois EPA Fact Sheet 2). Runoff water was added into the water treatment plant until it could not hold any more.

The water samples did not show levels of contaminants that exceed the permitted criteria for aquatic life or human health. The Illinois Department of Natural Resources and Illinois EPA have been observing macro invertebrates and fish in the water upstream and downstream from the plant. They monitored for odor and any visible sheen upstream and downstream from the plant (Illinois EPA Fact Sheet 2). 

Area Soil Sampling

On June 30, 2004, under the direction of Illinois EPA, surface soil, surface dust, and vegetable samples were collected from nearby residential properties. These samples were analyzed for dioxins and semi-volatile organic chemicals (SVOCs) using a Calux bioassay method. The highest level of dioxins (49.75 parts per trillion) was in a soil sample. On July 15, IDPH sent letters to the residents who had their soil, dust or vegetables sampled. These letters provided a health-based interpretation of their results (Attachment 2). 

On July 22, 2004, more surface soil and surface dust samples were collected, specifically within a 1-mile radius of the Formosa plant. These included samples from farm fields, as well as residential properties. The samples were analyzed for dioxins and SVOCs. The highest level of dioxins in an on-site sample was 65.8 parts per trillion. The highest level of dioxins in an off-site sample was 23.3 parts per trillion. On August 13, IDPH sent letters to the land owners and residents who had their soil or dust sampled. These letters provided a health-based interpretation of their results (Attachment 2). 

On September 16, 2004, follow up soil sampling was conducted at the home with the highest level of dioxins during the June 30 sampling event. The previous soil sample was collected at the base of a downspout and resampling of this soil found 125.8 parts per trillion of dioxins. However, a composite sample of surface soil collected from various points in the yard yielded a result of 0.45 parts per trillion of dioxins. On October 28, IDPH sent a letter to this resident and advised that the levels of dioxins detected would not be expected to cause adverse health effects from long-term, daily exposure.

Discussion

Chemicals of Interest

IDPH compared the results of each environmental sample with the appropriate comparison values used to select chemicals for further evaluation for carcinogenic and non-carcinogenic health effects. Chemicals found at levels greater than comparison values or those for which no comparison value exists were selected for further evaluation. A brief explanation of each comparison value used is found in Attachment 3.

The levels of SVOCs did not exceed comparison values. The only dioxins sample result that exceeded the Agency for Toxic Substances and Disease Registry (ATSDR) comparison value of 50 parts per trillion was found at the base of a downspout and a composite surface soil sample from the same yard did not exceed the comparison value. None of the sample results approached the ATSDR action level of 1,000 parts per trillion for dioxins in soil.

Because there were no chemicals of interest, IDPH determined that the people in the area would not be expected to experience adverse health effects from the chemical concentrations present in the soil, air and water.

The next section contains an exposure evaluation of conditions following the explosion.

Exposure Evaluation

The potential for persons to experience adverse effects from exposure to a chemical depends on:

- the amount of chemical a person comes in contact with,
- the length of time the exposure lasts,
- the age and health condition of the person exposed.

Residents

Residents near the Formosa Plastics Plant were evacuated from their homes shortly after the explosion. This included all of Illiopolis and residents in the surrounding communities of Niantic and Mechanicsburg (Attachment 1). This action was taken to prevent prolonged exposure to harmful levels of chemicals emitted as a result of the explosion. Residents were not allowed back into the area until emergency response personnel determined it was safe to do so. In addition, residents were requested to stay indoors with their windows closed and their air conditioners running. Some residents reported they had experienced eye, nose, throat and respiratory irritation during and briefly following the fire. Long-term health effects are unlikely because of the short exposure time.

IDPH suggested cleaning surfaces in homes and disposing of any food that was exposed to the outside air following the explosion. Residents were also told to make sure vegetables grown in the area are washed and rinsed with soap and water before they are consumed.

By the afternoon of April 24, all but 30 evacuees were allowed back into their homes. The evacuation had completely ended by April 25, but it was requested that residents not come near the plant.

Workers

Eighteen of the plant's 138 employees were at the plant during the explosion. Four employees were killed in the explosion and three were sent to the hospital for their injuries (SJ-R May 16). One of these employees died later due to the injuries sustained from the explosion (SJ-R Jun 4).

The emergency response workers were equipped with the proper personal protective equipment and skills needed to respond to this incident involving the release of chemicals.

Child Health Considerations

IDPH recognizes children who are exposed to the same levels of vinyl chloride as adults might receive a higher dose than adults. This is because they have greater lung surface area to body weight ratios and children breathe larger volumes of air than adults on a per weight basis. There may be higher levels of vinyl chloride in the air they breathe when they are at the same location as adults because they are generally shorter and there are higher levels of vinyl chloride near the ground.

Nevertheless, IDPH does not expect children to experience adverse health effects because exposures were small and of short duration.

Conclusions

IDPH concludes that under existing conditions, exposure to chemicals associated with the explosion at the Formosa Plastics Plant, particularly vinyl chloride and dioxins, poses no apparent public health hazard. Chemicals were not found at levels expected to cause adverse health effects. Some persons reported irritant effects immediately after the explosion and subsequent fires but these effects ended after exposure ceased. The levels of VOCs and asbestos were monitored after the explosion and fire to ensure that public health was protected. Off-site sampling of soil, dust and vegetables demonstrate that dioxins are not present at levels that would cause adverse health effects.

Public Health Action Plan

Illinois EPA will have oversight of the continued investigation and cleanup activities at the site. The Occupational Safety and Health Administration (OSHA) has evaluated the potential dangers to employees. Formosa has hired the Center for Toxicology and Environmental Health, an environmental firm, to monitor the site. IDPH will review future environmental data and provide health-based interpretation of this data as necessary.

Preparers of Report

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Environmental Toxicologists
Illinois Department of Public Health

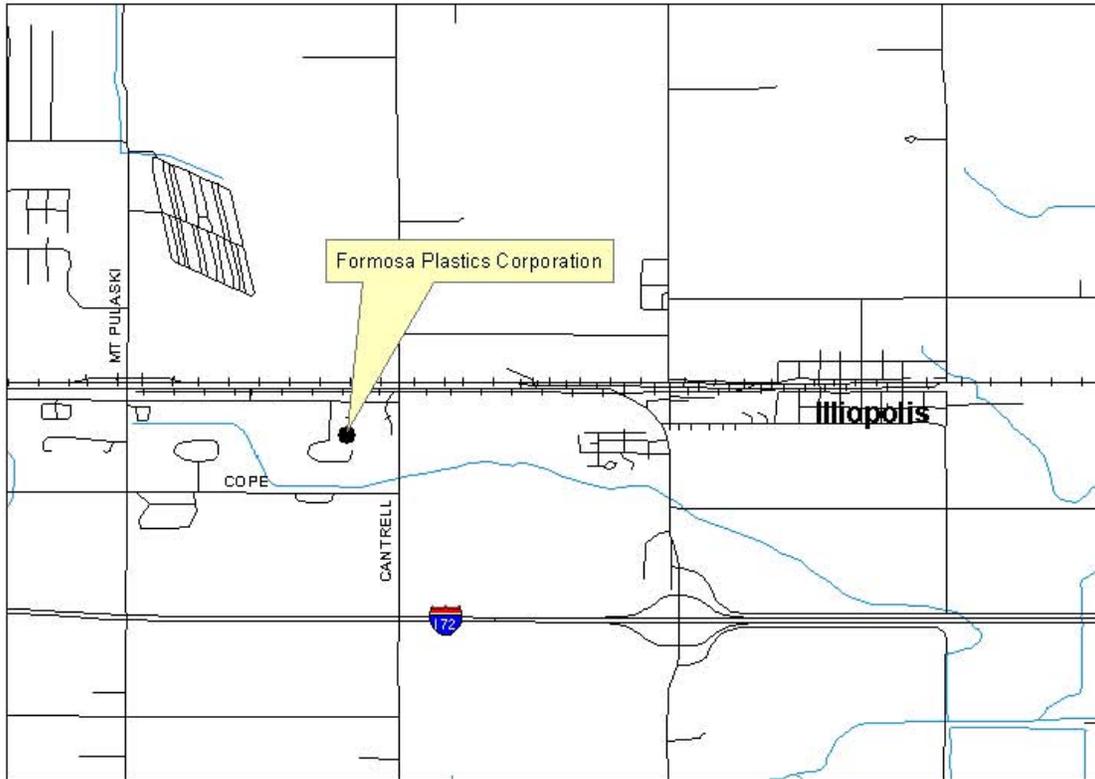
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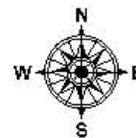
Approximate Location of Formosa Plastics Corporation

Attachment 1



Legend

- +—+— Rails
- Roads
- Surface Water



Source: Illinois Department of Public Health GIS, May 2005

#404290401H

July 15, 2004

xxxxxxxxx
xxxxxxxxx
xxxxxxxxx
Illipolis, IL 62539

Dear xxxxxxxx:

On July 15, 2004, the Illinois Department of Public Health (IDPH) received the results of the soil sample collected at the school on June 30, 2004 under the direction of the Illinois Environmental Protection Agency (Illinois EPA). The soil sample was collected from an area that would be expected to be impacted from airborne deposition. Your soil sample was tested for dioxins and semi-volatile organic chemicals (SVOCs). Your dioxins results are shown in the table below and your SVOC results are enclosed.

Chemical	Type of Sample	Level Detected (in parts per trillion)
dioxins	soil	8.95

The levels of SVOCs detected in your soil do not present a public health hazard. The level of dioxins in your soil sample was elevated compared to background levels. Background levels are those normally found in the overall environment. Dioxins are present at very low levels throughout the environment because of human activities over time. IDPH believes that further sampling is necessary to better characterize the extent and level of dioxins in your soil. Although elevated above background levels, the levels of dioxins detected to date would not be expected to cause adverse health effects from long-term, daily exposure.

IDPH will work with Illinois EPA to review any future residential sampling results. If you have any health-related questions, please contact us at 217-782-5830.

Sincerely,

C. Michael Moomey
Toxicology Section

cc: Illinois EPA
IDPH Edwardsville Regional Office
Sangamon County Health Department

Comparison Values Used in Screening Contaminants for Further Evaluation

Environmental media evaluation guides (EMEGs) are developed for chemicals on the basis of their toxicity, frequency of occurrence at National Priorities List (NPL) sites, and potential for human exposure. They are derived to protect the most sensitive populations and are not action levels, but rather comparison values. They do not consider carcinogenic effects, chemical interactions, multiple route exposure, or other media-specific routes of exposure, and are very conservative concentration values designed to protect sensitive members of the population.

Reference dose media evaluation guides (RMEGs) are another type of comparison value derived to protect the most sensitive populations. They do not consider carcinogenic effects, chemical interactions, multiple route exposure, or other media-specific routes of exposure, and are very conservative concentration values designed to protect sensitive members of the population.

Cancer risk evaluation guides (CREGs) are estimated contaminant concentrations that are based on a probability of 1 excess cancer in 1 million persons exposed to a chemical over a lifetime. These are also very conservative values designed to protect sensitive members of the population.