



Colorado Department  
of Public Health  
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Tri-County  
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## 1,4-Dioxane In Shallow Groundwater Lowry Landfill Superfund Site

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This fact sheet provides information about the plume of 1,4-dioxane found in the shallow groundwater north of the Lowry Landfill Superfund site. The plume is under investigation because 1,4-dioxane has been classified as a probable human carcinogen.

### BACKGROUND

Lowry Landfill operated as a municipal landfill from 1966-1980. During that time liquid and solid municipal refuse and industrial wastes, including hazardous substances, were placed in the site. The Lowry site was added to the Environmental Protection Agency's National Priorities List for investigation and remediation in 1984. The City and County of Denver, Waste Management of Colorado, Inc. and Chemical Waste Management, Inc. (collectively "Working Settling Defendants") have entered into an agreement with EPA and numerous other parties to implement the remedy. All components of the remedy are constructed and an extensive monitoring system is in place to monitor their effectiveness.

### 1,4-DIOXANE FOUND IN SHALLOW GROUNDWATER

1,4-Dioxane was detected in Murphy Creek at locations where contaminated groundwater is thought to enter the creek. Concentrations measured in Murphy Creek range from non-detect up to 79 ug/L within the Denver Arapahoe Disposal Site (DADS) property north of the Lowry Landfill, and range from non-detect up to 10 ug/L north of the DADS property. Colorado does not have a 1,4-dioxane standard for surface water.

EPA evaluated the health risk associated with public exposure to 1,4-dioxane north of the site and found no significant health risk associated with surface water or groundwater.

The 1,4-dioxane found in shallow groundwater is not considered a health risk because the shallow groundwater is not used for drinking water and the risk from occasional contact with contaminated groundwater entering Murphy Creek is insignificant. The exposure scenarios evaluated include children who occasionally play in the creek and golfers at the Murphy Creek Golf Course.

Aurora drinking water is not connected to the surface water in Murphy Creek or to the contaminated groundwater. No 1,4-dioxane was found in samples of water supplied by Aurora in the Murphy Creek subdivision.

Nearby domestic wells were sampled and do not contain 1,4-dioxane. These wells are hundreds of feet deep and do not extract water from shallow groundwater.

Investigations indicate that the 1,4-dioxane in the shallow groundwater outside the Lowry Landfill's north boundary could be the result of historical releases that occurred before 1,4-dioxane was a known or detected contaminant of concern, and prior to operating improvements made to the groundwater collection system in 2003.

The City and County of Denver and Waste Management, with oversight from the Environmental Protection Agency (EPA), the Colorado Department of Public Health and Environment (CDPHE) and Tri-County Health Department, are taking steps to contain and reduce the 1,4-dioxane plume in shallow groundwater. In 2007 Lowry Landfill installed additional wells to capture and remove the 1,4-dioxane from groundwater north of the site boundary. This water is being treated. The objective of this program is to intercept and remove 1,4-dioxane from groundwater, reducing the size of the plume. It is believed that in time concentrations will be reduced to the regulatory levels. Groundwater monitoring will be used to measure the effectiveness of the remedy.

### **Where is the plume located?**

This fact sheet includes a map of the plume boundary in relation to major streets and subdivisions. The plume map shows where the concentration of 1,4-dioxane in groundwater is at least 6.1 micrograms per liter. Solid lines indicate high confidence in the plume boundary where well data are available on both sides of the lines. Dashed lines indicate the inferred plume boundary based on the fact that data are available on only one side of the lines. The current understanding of the subsurface geology and hydrology was also used to develop this plume interpretation

### **What is 1,4-dioxane?**

In its pure form, 1,4-dioxane is a clear, odorless liquid that dissolves in water at all concentrations. It is used primarily as a solvent stabilizer in industrial chemicals and laboratory reagents.

### **What concentrations of 1,4-dioxane did you find?**

It depended on where the samples were taken. Within the boundaries of the Denver Arapahoe Disposal Site (DADS) north of the Lowry Landfill, 1,4-dioxane concentrations in groundwater range from non-detect to 230 micrograms/liter. However, concentrations in groundwater north of the DADS property, including the Murphy Creek neighborhood, are much lower, ranging from non-detect to 42 micrograms/liter.

### **Is the 1,4-dioxane north of the Lowry Landfill a threat to human health?**

No. The 1,4-dioxane detected north of the Lowry site boundary is in shallow groundwater, but it is not considered a threat to people living in the vicinity because it is not used as drinking water. All other residents get their drinking water from municipal sources. Surface water from Murphy Creek was sampled north of the landfill and found to contain 1,4-dioxane in some locations. At the concentrations found, the health risk from occasional contact with the surface water is considered insignificant (falls below EPA's risk management levels). There is no health risk if there is no contact with the water in Murphy Creek.

### **Is there an indoor air risk to people whose homes and workplaces are over the plume?**

No. The contaminated groundwater is not located under any existing Murphy Creek subdivision residences. It is on the west edge of the Murphy Creek Golf Course. Therefore, sumps in the area do not contact the contaminated groundwater.

1,4-Dioxane in groundwater does not evaporate and move through soil into buildings. Therefore, it would not pose an indoor-air quality risk even if it were present in groundwater under someone's home.

### **When did you learn that there was 1,4-dioxane in the groundwater and surface water beyond the North Boundary Barrier Wall (NBBW)?**

In 2003, during routine monitoring of the Lowry Landfill's numerous compliance wells, 1,4-dioxane was found in shallow groundwater north of the site. Between 2003 and 2007, investigations north of the site took place to determine the extent of the chemical plume. Samples collected from monitoring wells north of the site contained 1,4-dioxane in concentrations above the Colorado Interim Groundwater Standard for 1,4-dioxane.

### **Why wasn't the 1,4-dioxane plume found earlier?**

In 2005, the Colorado Water Quality Control Commission established a groundwater standard of 6.1 micrograms per liter for 1,4-dioxane. Consequently, the City and County of Denver and Waste Management began using a method capable of detecting and measuring 1,4-dioxane at or below the level of the CDPHE standard, a lower detection limit than had been used previously. At that time, groundwater samples taken north of the site were found to contain 1,4-dioxane.

### **How did the plume get there?**

There are several possible historical sources for the plume:

- 1,4-Dioxane probably was present in shallow groundwater before the North Boundary Barrier Wall (NBBW) was installed.
- Before the standard for 1,4-dioxane changed, the substance passed undetected through the water treatment plant and was reinjected north of the NBBW groundwater collection system. This is a likely source for some areas, but probably is not responsible for all 1,4-dioxane in the north end plume. It is not a current source.
- It may have bypassed the NBBW prior to 2003 when operational improvements were made.
- It moved through an area east of the NBBW, prior to 2003. There is some uncertainty as to whether or not this movement continues to occur. Therefore, careful evaluation of the network of monitoring wells will continue and additional groundwater extraction wells are in place and operating.

- Surface water and/or storm water also are possible sources prior to installation of the Surface Water Removal Action in 1992.

### **Why is the 1,4-dioxane plume still there?**

There are several possible explanations:

- The aquifer's fine-grained siltstones are relatively "tight." Therefore, the rate and volumes of groundwater movement through them are quite low.
- Due to the slow movement of the groundwater, there has been insufficient time for contaminants from the historical sources responsible for the plume to be flushed.
- The source may be ongoing.

### **What response actions are being taken to deal with the 1,4-dioxane plume?**

The City and County of Denver and Waste Management, who are responsible for implementing the remedy, are extracting groundwater north and east of the NBBW, transporting it to the treatment plant and treating it to remove 1,4-dioxane. Groundwater monitoring and evaluation of the 1,4-dioxane plume will continue. Officials from federal, state and local agencies, along with Denver and Waste Management, will continue to inform interested citizens on the course of the investigation and the effectiveness of these response actions. If the response actions are not effective, additional investigations and additional response actions will be undertaken.

### **What will be the ultimate fate of the plume?**

The objective of the current remediation efforts is to first slow the spread of the plume and facilitate its removal. It is believed that the system presently in place will remove contaminated water allowing fresh water to recharge the shallow aquifer. At this time, we don't know how long this will take. If further monitoring indicates the actions being undertaken are not effective, the situation will be evaluated and other courses of action will be taken.

### **Where can I get more information?**

In addition to contacting the people listed on the first page of the fact sheet, information about the Lowry Landfill is available on the following websites:

[www.lowrylandfillinfo.com](http://www.lowrylandfillinfo.com)  
[www.epa.gov/region8/superfund/co/lowry](http://www.epa.gov/region8/superfund/co/lowry)  
[www.cdphe.state.co.us/hm/rplowry.htm](http://www.cdphe.state.co.us/hm/rplowry.htm)  
[www.tchd.org](http://www.tchd.org)

**Information repositories for the Lowry Landfill site are located at:**

EPA Superfund Records Center  
1595 Wynkoop, 3<sup>rd</sup> Floor  
Denver, CO 80202  
(303) 312-6473

Colorado Department of Public Health and Environment  
Hazardous Materials and Waste Management  
Division Records Center  
4300 Cherry Creek Drive South, B-215  
Denver, CO 80246  
(303) 692-3331

Aurora Central Public Library  
14949 E. Alameda Dr.  
Aurora, CO 80002  
(303) 340-2290

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