

PUBLIC HEALTH ASSESSMENT

Asbestos Contamination at Illinois Beach State Park

ILLINOIS BEACH PARK
ZION, LAKE COUNTY, ILLINOIS

SUMMARY

Construction materials containing asbestos were found scattered along the beach at Illinois Beach State Park (the Park), Zion, Lake County, Illinois, in 1997. Following that discovery, the Illinois Department of Natural Resources (IDNR) began an investigation into the source and extent of asbestos contamination at the popular recreation area. The Illinois Department of Public Health (IDPH) and the Illinois Environmental Protection Agency (Illinois EPA) were asked to assist in the investigation and to determine whether conditions at the beach are a health threat to visitors and workers at the Park.

Investigations and remedial work at the Park have included removal of asbestos-containing material (ACM), removal of debris suspected of containing asbestos, extensive sampling of the Park area, and investigations into the source of ACM. Sampling results showed no detectable quantities of asbestos fibers present in the air and water samples collected at the Park. In some sand samples, very small quantities of asbestos were found. The amount found never exceeded 1% asbestos, which is the definition the U.S. Environmental Protection Agency uses for asbestos-containing material.

[Completed exposure pathways](#) at the Park are incidental [ingestion](#) of contaminated sand and [dermal exposure](#) to contaminated sand. These pathways apply to workers at the Park and to people who visit the Park. IDPH would expect, based on the levels found and the minimal biological uptake through those [exposure pathways](#), neither of those pathways to cause [adverse health effects](#). Potential exposure pathways at the Park include ingestion of contaminated water, [inhalation](#) of contaminated sand, and dermal exposure to contaminated water. Water and air [samples](#) did not contain asbestos fibers, but the continued presence of ACM in sand on the beach indicates that people can be exposed to ACM in the future.

From the extensive sampling and the pathways evaluated, IDPH concludes that the asbestos at Illinois Beach State Park is not a [public health hazard](#) for visitors and workers. Recommendations are to continue the investigation to find the source of the asbestos, to remove ACM that appears on the beach, and to continue education and notification of the public.

PURPOSE AND HEALTH ISSUES

Asbestos-containing materials (ACM) were found scattered along the beach at Illinois Beach State Park (the Park) in 1997. Most ACM found on the beach has been construction materials, such as house siding, water and sewer pipe, floor tile, and roofing material. Following this discovery, the Illinois Department of Natural Resources (IDNR) began an investigation into the source and extent of asbestos contamination. The Illinois Department of Public Health (IDPH) and the Illinois Environmental Protection Agency (Illinois EPA) were asked to assist in this investigation and to determine whether conditions at the beach are a threat to visitors and workers at the Park. IDNR specifically asked IDPH to evaluate the data collected from the sand, water, and air at the Park and to determine whether asbestos was present at levels that posed a health [hazard](#).

BACKGROUND

Illinois Beach State Park consists of 6.5 miles of Lake Michigan shoreline in the city of Zion, Lake County, Illinois ([Figure 1](#)). It is bordered by the Wisconsin state line to the north, Lake Michigan to the east, the town of Zion to the west, and the Johns-Manville [National Priorities List \(NPL\) hazardous waste](#) site to the south ([Figure 2](#)). The Park encompasses 4,160 acres of shoreline and received approximately 2.75 million visitors in 1998. Recreational activities available include camping, swimming, fishing, hiking, bicycling, and picnicking. Structures within the Park boundaries include the North Point Marina, a 244-unit campground, two major public swimming areas, several inland fishing ponds, a visitor center, the Commonwealth Edison Power Plant, and the Illinois Beach Resort and Conference Center ([Figure 3](#)). Besides seasonal tourism, the Park holds special events that draw visitors, including the In-Campground Camper Show in May and the National Jet Ski Championships in July.

The Park is considered a natural resource with the only remaining Lake Michigan beach ridge shoreline left in the state. Glacial advance and retreat created the area that left dunes, swales, marshes, and a variety of wildlife and vegetation in the area. Before becoming a state park, the area was used for military training. In 1948, the state of Illinois acquired the first parcels of what is now Illinois Beach State Park.

In late 1997, pieces of transite pipe, siding, and roofing materials suspected of containing asbestos were found scattered along the beach. In February 1998, IDNR collected two bulk samples of the material and found they contained asbestos fibers. Following this discovery, IDNR began an investigation to determine the extent and possible source of asbestos contamination. Hanson Engineers Incorporated (Hanson), under contract with IDNR, developed a sampling strategy for the Park. This strategy was presented to IDPH and Illinois EPA for approval before sampling began.

The approved plan included sampling the beach sand, the ancient dune area for a background comparison, and water from Lake Michigan. If asbestos were found in

samples of beach sand, air samples would be taken to assess the potential for exposure to airborne asbestos fibers. The response was considered time-critical because the spring tourist season was approaching and extensive media coverage generated concerns in the community.

Besides sampling at the Park, Illinois EPA began investigating potential sources of the ACM. One possible source is former beachfront homes that have since washed into Lake Michigan. Much of the material found at the Park is common construction material used in the past. According to historical maps, the present lakeshore contained about 232 homes that wave action destroyed and washed into the lake. Recent excavations also uncovered an old transite sewer line near the lodge.

Other potential sources include:

- The Johns-Manville site immediately south of the Park. This plant has manufactured a variety of roofing, flooring, wall covering, and insulating materials since 1922. The raw materials used at Johns-Manville include Portland cement, asphalt, paper, and asbestos. A 120-acre parcel of the property was used for disposal of ACM and was placed on the NPL in 1982.
- Fill sand used at the Park. Commonwealth Edison performed dredging operations at its Waukegan Generating Station, and the dredged material, mainly sand, was used for beach nourishment at the Park and the Commonwealth Edison Zion Station. This material may have been contaminated with ACM.
- A former rifle range in the Camp Logan area. The rifle range was built for the 1959 Pan American games and contained a large berm built with factory waste material donated by Johns-Manville. Wave action may have destroyed this berm that also potentially contained ACM.

The source of the asbestos has not been determined. Illinois EPA and the Illinois Attorney General are still investigating. For this [public health assessment](#), knowledge of the source is not necessary for evaluating conditions at the Park.

SAMPLING AND REMEDIAL ACTIVITIES

The first activity completed at the Park was removal of potential ACM, which began in early March 1998. Hanson contractors conducted these early removal operations and picked up suspicious materials. Besides removing ACM from the beach, they flagged areas where ACM was found. These locations were then mapped using a global positioning system to target geographic areas for subsequent sand sampling. Hanson disposed of all ACM according to Illinois EPA regulations.

To assess asbestos exposure to the contractors during removal activities, personal air sampling was conducted according to Occupational Safety and Health Administration (OSHA) regulations. The results showed that the very low levels of asbestos in the air during removal activities were less than the OSHA permissible exposure limit (PEL) of 0.1 fibers per cubic centimeter. Upon receiving those results, IDPH wrote a letter authorizing the downgrade of personal protective equipment worn by workers because respirators were not necessary, and their use contributes greatly to worker fatigue and to public concern.

Extensive sampling of the Park began following removal activities. A total of 191 sand samples, most along the shoreline of the Park near areas flagged during the pick-up of ACM, were collected during the investigation. Of those, 98 samples were collected from public swimming beaches, 81 samples were collected from infrequently used shoreline, and four samples were collected from the Van Patten Woods nature preserve. Public swimming beaches were the area of focus because they attract the most visitors. The areas classified as "infrequently used shoreline" are accessible to the public but are not as heavily used as are the public beaches. The Van Patten Woods nature preserve is closed to the public.

Air samples were also collected, eight from the public beaches and four at the infrequently used shoreline. The sand was disturbed by leaf blowers for 30 minutes before sample collection to assess the worst-case scenario for air exposure. Four surface-water samples were also collected from Lake Michigan near the public beaches.

DISCUSSION

Asbestos is the only contaminant of interest under investigation at the Park. It is a mineral consisting of fibers that vary in length and shape and can be found naturally in soil and rocks. Asbestos fibers are classified into six different types, and some are considered more hazardous than others. These fibers are resistant to heat and have been used to make insulation, ceiling tiles, floor tiles, roof shingles, drainage pipes, and automotive brakes and clutches. Because of concerns about potential health effects, the U.S. Environmental Protection Agency (USEPA) developed an asbestos ban and phase-out rule in 1989. Detecting asbestos in air and water samples is not uncommon because asbestos is naturally occurring and once was used in many commercial products, such as brake pads, that wear.

Exposure Potential and Toxicity

ACM is considered "friable" when it can be easily crushed by hand. Friable asbestos can release fibers into the air, creating a potential health hazard. When asbestos fibers are intact, such as in an asbestos-containing cement pipe, they are considered "non-friable." This means that the individual fibers are contained and are not readily released into the surrounding air. From a public health and regulatory standpoint, "friable" asbestos is the

greatest health concern. People can be exposed to asbestos by swallowing contaminated water, swallowing ACM, or by breathing fibers in the air. Asbestos fibers are poorly absorbed through the skin.

The greatest concern about asbestos is inhalation of fibers. The toxicity of asbestos is related to the fiber size. Smaller fibers are more easily cleared from the lung. They are less likely to remain in the lung and cause health effects. Shipbuilders and other workers who have inhaled high levels of asbestos over long periods have developed asbestosis and cancer. Asbestosis, the build-up of scar-like tissue in the lungs that causes breathing difficulties, is an irreversible condition that develops over many years. Studies of those workers have also shown increased chances of getting lung cancer or mesothelioma. Mesothelioma is a cancer of the membrane that surrounds the lung. USEPA classifies asbestos as a human carcinogen. However, asbestos is commonly found at very low levels in urban air, and no evidence has shown an increased cancer risk in people exposed to those very low levels.

Laboratory Analysis

Attention was focused on the type of laboratory analysis to use. Unlike other chemical contaminants, no standard laboratory analytic method exists to test for asbestos in sand and soil. Because asbestos is a fiber, all methods involve some sort of identification and quantification under a microscope. The two most common microscopic procedures used are light microscopy and electron microscopy.

The standard method for determining asbestos fibers in air of a workplace is phase contrast microscopy (PCM), a type of light microscopy. This method defines a fiber as anything with a length greater than 5 microns (m) with a length-to-diameter ratio of 3:1 or greater. This method is relatively fast and inexpensive, but it cannot distinguish between asbestos and non-asbestos fibers or detect fibers shorter than 5 m. Another type of light microscopy is polarized light microscopy (PLM), which is frequently used to determine the asbestos content of bulk samples of building materials. This method is useful when samples are composed mainly of asbestos and when most of the fibers are large enough to be counted. Electron microscopy allows detection of much smaller fibers than does light microscopy. Transmission electron microscopy (TEM) is the most common method used for analyzing samples collected from ambient air and air inside schools or other buildings. TEM allows distinction between asbestos and non-asbestos fibers and allows differentiation of fiber classes. TEM is relatively slow and expensive compared with light microscopy methods.

All air samples and water samples were tested using TEM, which is the standard method used in analyzing air and public water supply samples under the Asbestos Hazard Emergency Response Act (AHERA). The method for water samples was modified to be more precise and to include all fibers greater than 0.5 microns in length. The main concern was about the method used to analyze the sand samples. The contract laboratory, TEM Incorporated, used PLM, a USEPA method that detects friable asbestos in building materials, for most sand samples. Some sand samples were also analyzed by a refined,

point-counting method, also in accordance with USEPA methods. Selected sand samples were analyzed using a hybrid method based on an American Society for Testing and Materials (ASTM) method for detecting asbestos structures in dust. To test the accuracy of this method, TEM Incorporated spiked samples of clean sand. Results of those tests showed that the method has an excellent recovery rate.

IDPH reviewed the laboratory report presented by TEM Incorporated, an accredited laboratory, and believes that the most feasible methods of analyses were used. Although electron microscopy can more precisely detect small quantities and types of fibers, use of PLM was sufficient to determine that the asbestos content of the sand was below a level of health concern.

Evaluation of Sampling Results

Results of the Hanson sampling are shown in [Table 1](#). When evaluating data, IDPH uses comparison values to screen results. A comparison value is not meant to predict health effects but helps investigators decide which results and contaminants should be evaluated further. For water samples, a comparison value of 70 million fibers per liter was used. That is the USEPA-enforced maximum contaminant level allowed in public water supplies. For air samples, a comparison value of 0.01 fibers per cubic centimeter was used. This value was obtained by adding a safety factor of 10 to the OSHA PEL of 0.1 fibers per cubic centimeter. Asbestos fibers were not detected in any air or water samples. Although fibers might exist at levels less than the detection limits of the analytic methods, the detection limits were well below the comparison values used. Therefore, exposure to any fibers that might be present would not be expected to cause health effects.

In some instances, sand samples did contain small numbers of fibers, but no comparison value or "acceptable level" of asbestos is available for soil or sand. Therefore, other regulations regarding asbestos were examined. Under USEPA regulations, a material is considered ACM only if asbestos is present at greater than 1%. This standard is used for classifying ACM in schools under AHERA and for classifying ACM emissions under the National Emission Standards for Hazardous Air Pollutants. If the material is not classified as ACM, no removal or encapsulation of the material is required. None of the sand samples had more than 1% asbestos, and as such, would not be considered ACM under USEPA standards. IDPH considered this an acceptable comparison.

PATHWAYS ANALYSIS

A person must be exposed to a contaminant in sufficient quantity for it to cause an adverse health effect. A *completed* exposure pathway must have a source of contamination, a contaminated environmental medium, a point where people are exposed, a way for the contaminant to enter the body, and an exposed population. If any of these

situations is not present, the pathway is called a *potential* exposure pathway. The exposure pathways evaluated at the Park are shown in [Table 2](#).

Completed Exposure Pathways

Completed pathways at the Park include the incidental ingestion of contaminated beach sand, and dermal exposure to contaminated beach sand. All people ingest small amounts of soil, or for those at the Park, sand, each day. The amount ingested can vary from 500 to 1,500 milligrams per day. Young children playing in the sand who exhibit excessive hand-to-mouth activity would ingest the most and be most at risk from this pathway.

Studies show that ingestion of asbestos causes little risk for non-cancer health effects. Some evidence exists, however, that ingestion of high levels of asbestos can cause lesions and tumors in the gastrointestinal tract that may lead to cancer. Most studies have been conducted on animals fed large doses of asbestos, but some studies of humans have shown small increases in gastrointestinal cancer in areas where asbestos in drinking water is elevated. These studies are not conclusive because cancer increases may be attributed to other factors such as smoking. This pathway at the site is not expected to cause adverse health effects because of the small quantities of asbestos detected, the lack of evidence to show that ingestion is a health threat, and the fact that most children would only visit the Park occasionally.

Dermal exposure is also possible, but the only health effects ever observed from this route are the development of warts and corns. This skin irritation has been observed in persons handling asbestos-containing insulation. Although fibers can penetrate the skin, they are not absorbed into the blood and would not be expected to cause any adverse health effects. Thus, the dermal route of exposure is considered insignificant.

Potential Exposure Pathways

The potential exposure pathway of greatest concern at the Park is inhalation of asbestos fibers from air. As stated previously, inhaling high levels of asbestos fibers in air can lead to serious health effects, but asbestos fibers were not found in the air. Additional potential pathways are the ingestion of contaminated water and dermal contact with contaminated water. Water samples at the Park did not contain asbestos fibers.

COMMUNITY CONCERNS

The community was very concerned about the Park, and Chicago-area media publicized the issue. Two public availability sessions were held on May 26, 1998, to address the public's questions. In addition, an area schoolteacher and her class wrote IDPH a letter asking questions about Park conditions. IDPH responded to that letter. Because of this exchange, a meeting with the class and state government officials occurred on July 2, 1998. Most concerns were about past, present, and future exposures to people who visited

the park and about the potential for developing adverse health effects. Some concerns were also posed about drinking Lake Michigan water. The public was informed that Illinois EPA regulates and requires testing of public water supplies for asbestos. Parents also expressed concerns about their children who might inadvertently pick up a piece of ACM mistaking it for a rock.

IDPH, IDNR, and Illinois EPA jointly developed a fact sheet to communicate information regarding ACM at the Park. The fact sheet is available in kiosks at heavily used areas in the Park, such as the lodge, the marina, and the public swimming beaches. The kiosks also have display boxes with examples of what ACM might look like. In addition, signs printed in both English and Spanish were placed throughout the Park to warn people about potential asbestos contamination. The signs were intended to discourage people from picking up suspected ACM and to have them notify the Park Office if suspected ACM was found.

This public health assessment was made available for public comment from March 2 to April 3, 2000, at the Zion Public Library and on the IDPH home page. No public comments were received.

CHILD HEALTH INITIATIVE

IDPH recognizes that children are especially vulnerable to the effects of many contaminants in the environment. When exposure pathways are evaluated, children are taken into consideration. At Illinois Beach State Park, children would be expected to be part of the exposed population. The exposures evaluated could be especially important for young children with excessive hand-to-mouth activity that would lead to greater ingestion of asbestos in soil. This was taken into consideration when evaluating the completed pathways. No adverse health effects are expected to occur for any children exposed to the very low levels of asbestos found at the Park.

CONCLUSIONS

The information available indicates that no apparent public health hazard exists related to asbestos contamination at Illinois Beach State Park. Completed exposure pathways at the Park include ingestion of and dermal contact with asbestos-contaminated sand/soil. Because of the low asbestos levels found, the fact that most of the ACM is non-friable, the limited absorption into the body, and results of current toxicological information reviews, exposures would not be expected to cause adverse health effects in Park workers or visitors. A potential exposure pathway to Park workers and visitors exists through airborne exposure to contaminated sand, but sampling has not shown that this exposure is occurring.

RECOMMENDATIONS AND PUBLIC HEALTH ACTION PLAN

IDPH recommends:

1. Continued investigation of the source of ACM. Illinois EPA plans to continue the investigation.
2. Continued removal of suspected ACM found at the Park. Illinois EPA plans to arrange removal of any suspected ACM found.
3. Continued provision of educational pamphlets for the public visiting the Park. IDPH will have fact sheets available at the kiosks until ACM is no longer found at the Park.
4. Maintaining signs warning of asbestos contamination at the Park. Illinois EPA and IDPH will work with Park officials to be sure signs are maintained until they are no longer needed.

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DOCUMENTS REVIEWED

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"Combing the Sands for Asbestos Clues," Casey Bukro, Chicago Tribune, June 10, 1999

Illinois Beach State Park Pamphlet, Illinois Department of Natural Resources, June 1996

Sampling for Asbestos Material, Oversight of Asbestos Removal Activities, Hanson Engineers, May 1998

Toxicological Profile for Asbestos, Update, Agency for Toxic Substances and Disease Registry August 1995

Reconnaissance of Environmental Conditions of Illinois Beach State Park (Draft), Illinois Department of Natural Resources, February 4, 1998

TABLES

Table 1. Sampling Results from Illinois Beach State Park

Area Sampled	Number of Detections	Range Found	Detection Limit	Comparison Used
Air Samples				
Public Beach	0 /8	ND	0.005 structures/cc	0.01 fibers/cc
Infrequently Used Shoreline	0/4	ND	0.005 structures/cc	0.01 fibers/cc
Background ¹	0/1	ND	0.005 structures/cc	0.01 fibers/cc
Water Samples				
Public Beach	0/4	ND	0.8 mf/L	70 mf/L
Background ²	0/1	ND	0.8 mf/L	70 mf/L

Sand Samples by Polarized Light Microscopy (PLM)				
Public Beach	4/90 ³	ND - <1%	1%	1%
Infrequently Used Shoreline	6/71 ⁴	ND - <1%	1%	1%
Forest Preserve	0/4	ND	1%	1%
Nutrient Sand Stockpile	0/2	ND	1%	1%
Ancient Dunes	0/5	ND	1%	1%
Sand Samples by Transmission Electron Microscopy (TEM)				
Public Beach	4/8	ND - <1%	1% ⁵	1%
Infrequently Used Shoreline	9/10	ND - <1%	1% ⁵	1%
Ancient Dunes	0/1	ND	1% ⁵	1%

¹ Sample taken at the intersection of Wadsworth and Sheridan Roads at the entrance of the Park

² Sample taken in Wisconsin at Prairie Harbor Yacht Club

³ Twenty-four were also analyzed by Point Counting Method EPA

⁴ Fourteen were also analyzed by Point Counting Method EPA

⁵ reporting limit of hybrid method

ND - not detected

cc - cubic centimeter

mf/L - million fibers per liter

Table 2. Exposure Pathways

Completed Pathways

Pathway Name	Source	Media	Exposure Point	Exposure Route	Receptor Population	Time of Exposure	Exposure Activities	Estimated Number Exposed	Chemicals
Ingestion of contaminated sand	ACM from unknown source	Sand Soil	Beaches	Ingestion	Park workers Park visitors	Past Present Future	Working at or visiting the Park. Sunbathing, swimming, running along beach	2.75 million	Asbestos
Dermal contact with contaminated sand	ACM from unknown source	Sand Soil	Beaches	Dermal	Park workers Park visitors	Past Present Future	Playing in sand, sunbathing	2.75 million	Asbestos

Potential Pathways

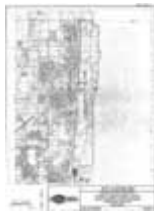
Pathway	Source	Media	Exposure	Exposure	Receptor	Time of	Exposure	Estimated	Chemicals
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Name			Point	Route	Population	Exposure	Activities	Number Exposed	
Ingestion of contaminated water	ACM from unknown source	Lake Michigan water	Swimming Beaches	Ingestion	Park visitors	Future	Swimming in Lake Michigan at the Park	2.75 million	Asbestos
Inhalation of asbestos fibers	ACM from unknown source	Sand Soil Water	Beaches	Inhalation	Park workers Park visitors	Future	Working at or visiting the beach, playing in sand, sunbathing, swimming	2.75 million	Asbestos

FIGURES



[Figure 1. Location of Illinois Beach State Park](#)



[Figure 2. Site Location Map](#)



[Figure 3. Site Location Map](#)

CERTIFICATION

This Illinois Beach State Park public health assessment was prepared by the Illinois Department of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry. It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with its findings.

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