HHE Health Hazard® Evaluation Program

Evaluation of Cancer Concerns Among Employees at an Elementary School

HHE Report No. 2025-0092-3428

February 2026

CDC NIOSH

Authors: Rachael Zacks, MD, MPH

Karl Feldmann, MS, REHS/RS, CIH

Desktop Publisher: Shawna Watts

Editor: Anne Blank

Keywords: North American Industry Classification System (NAICS) 611110 (Elementary and Secondary Schools), Cancer, Cancer Cluster, Non-Ionizing Radiation, Missouri

Program Description

The National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluation Program investigates possible health hazards in the workplace under the authority of the Occupational Safety and Health Act of 1970 [29 USC 669a(6)]. The Health Hazard Evaluation Program also provides, upon request, technical assistance to federal, state, and local agencies to investigate occupational health hazards and to prevent occupational disease or injury. Regulations guiding the Program can be found in Title 42, Code of Federal Regulations, Part 85; Requests for Health Hazard Evaluations [42 CFR Part 85].

Disclaimer

This document is a NIOSH health hazard evaluation report prepared in response to a specific workplace or technical assistance request. The recommendations in this report are made on the basis of the findings at the workplace evaluated and may not be applicable to other workplaces. As such, this health hazard evaluation report is not intended as industrywide Centers for Disease Control and Prevention (CDC) or NIOSH guidelines or policy, and it does not establish new health standards, guidance, or regulatory requirements.

Mention of any company or product does not constitute endorsement by NIOSH/CDC. In addition, citations to websites, national guidelines, or recommendations external to NIOSH/CDC do not constitute NIOSH/CDC endorsement of the sponsoring organizations or their programs, products, or guidelines. Furthermore, NIOSH is not responsible for the content of these websites. All web addresses referenced in this document were accessible as of the publication date.

Availability of Report

Copies of this report have been sent to the employer, unions, and employees. The state health department and the Occupational Safety and Health Administration Regional Office have also received a copy. This report is not copyrighted and may be freely reproduced.

Recommended Citation

NIOSH [2026]. Evaluation of cancer concerns among employees at an elementary school. By Zacks R, Feldmann K. Cincinnati, OH: Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Health Hazard Evaluation Report 2025-0092-3428, https://www.cdc.gov/niosh/hhe/reports/pdfs/2025-0092-3428.pdf.

Table of Contents

Main Report

Supporting Technical Information

Introduction

Request

In June 2025, the National Institute for Occupational Safety and Health (NIOSH) received a Health Hazard Evaluation (HHE) request from management at an elementary school to evaluate concerns about the number of cancer cases diagnosed among school employees. The request cited employee concerns related to a cell tower located on campus, a nearby business and general environmental concerns (e.g., soil, air, water).

Workplace

The workplace is an elementary school that serves students in kindergarten through fifth grade. The building was built in 2006 and has only ever operated as a school. During the same year as building construction, the city approved the construction of a 120-foot cellular service tower (cell tower) on the school campus. The cell tower is leased for use by a telecommunications company and is approximately 100 feet from the east side of the school building.

The workforce includes employees in certificated positions (e.g., teachers, social workers, counselors) and classified positions (e.g., custodial services, nutrition services, safety & security). The school employed approximately 60–95 employees per year across all positions from 2013–2025. Limitations in school records only allowed us to evaluate employees from 2013–2025.

To learn more about the workplace, go to Section A in the Supporting Technical Information

Our Approach

Consistent with the Centers for Disease Control and Prevention's (CDC) Guidelines for Examining Unusual Patterns of Cancer and Environmental Concerns, NIOSH designed this evaluation to address the following questions:

- Have employees experienced more of a specific type or related types of cancer than expected?
- Have employees experienced an unusual distribution of a specific type or related types of cancer?
- Was there exposure to carcinogens at levels known or suspected of causing cancer occurring at the workplace?
- Has enough time passed since a potential exposure began for excess cancer rates or an unusual pattern of cancer to be observed among employees (i.e., latency)?

We completed the following activities during our evaluation:

- Met with management, employee representatives, union representatives, and state public health representatives regarding the concerns.

- Reviewed a list of deidentified, self-reported cancer diagnoses provided by management.
- Reviewed reports of previous evaluations and environmental sampling conducted from 2015–2025.
- Reviewed documents describing pest control, groundskeeping, and custodial chemical use and reviewed associated safety data sheets (SDS).

To learn more about our methods, go to Section B in the Supporting Technical Information

Our Key Findings

There is no evidence of an excess or unusual pattern of cancer among school employees.

- The period from 2013–2025 yielded 11 of 294 employees (4%) reporting 12 cancer diagnoses, with one employee reporting two distinct cancer diagnoses. Reported cancers included many different types of solid cancers.
- Cancer takes time to develop after an exposure. The estimated amount of time that it takes for cancer to develop after an exposure is called latency. Considering latency helps focus on cancer cases that could plausibly be related to a specific workplace exposure. Because of the types of cancer reported by employees, we focused on a minimum latency of 4 years. When we considered latency, 7 of 294 employees (2%) reported at least one cancer diagnosis that met the latency requirement.
- The types of cancer reported were mainly the most common types that occur in the general population.
- The most common type of cancer reported by employees was breast cancer, reported by three employees. Breast cancer is one of the most common cancers in women in the United States and most of the employees (86%) at this workplace were female.

There is no evidence of employee overexposure to a cancer-causing chemical or hazard at the school.

- Environmental sampling conducted by consultants showed that levels of radon, carbon dioxide, carbon monoxide, nitrogen dioxide, ammonia, total volatile organic compounds, ozone, chlorine, and particulate in the air were below occupational exposure limits.
- The cell tower compliance report evaluated exposure levels to radiofrequency radiation among both workers who service cell towers and the public. General public measurements were less than 5% of the Federal Communication Commission's maximum permissible exposure (MPE) limit.

- Polycyclic aromatic hydrocarbons (PAHs) are a class of over 100 organic compounds that are primarily created through combustion of organic material. PAHs found in soil samples collected near sidewalks leading to school entrances were above state target levels. The levels are likely due to rainwater runoff from adjacent blacktop paving, which contains PAHs. While present, these levels are unlikely to represent a substantial occupational exposure due to the lack of time employees spend during their workday in the area and the lack of an exposure route (e.g., inhalation, ingestion, etc.).
- Lead and arsenic found in soil samples on school grounds were above state target levels, but the levels were consistent with levels naturally found in soil throughout the state, according to the United States Geological Survey. While present, these levels are unlikely to represent a substantial occupational exposure due to the lack of time employees spend during their workday in the area and the lack of an exposure route (e.g., inhalation, ingestion, etc.).
- The employee's concern that a nearby commercial site was a hazardous waste storage facility that could lead to environmental contamination was evaluated. We reviewed a 2025 state compliance report that stated the site near the school was operated by a company that does work in hazardous waste removal and disposal, but the site is an equipment storage and vehicle repair facility. No hazardous waste was currently or historically handled, processed, or stored at the site according to the information we reviewed.

To learn more about our results, go to Section B in the Supporting Technical Information

Our Recommendations

The potential benefits of improving workplace health and safety are:

↑ Improved worker health and well-being	↑ Enhanced image and reputation
↑ Better workplace morale	↑ Superior products, processes, and services
↑ Easier employee recruiting and retention	↑ Increased overall cost savings

The recommendations below are based on the findings of our evaluation. These recommendations are workplace-specific, based on the information available for the workplace evaluated, and are intended to improve this workplace's conditions. For each recommendation, we list a series of actions you can take to address the issue at your workplace. The actions at the beginning of each list are preferable to the ones listed later. The list order is based on a well-accepted approach called the "hierarchy of controls." The hierarchy of controls is a way of determining which actions will best control exposures. In most cases, the preferred approach is to eliminate hazards or to replace the hazard with something less hazardous (i.e., substitution). Installing engineering controls to isolate people from the hazard is the next step in the hierarchy. Until such controls are in place, or if they are ineffective or impractical, administrative controls and personal protective equipment might be needed. Read more about the hierarchy of controls on the NIOSH website.

Recommendation 1: Create a multi-disciplinary occupational safety and health committee at the school

Why? Employees directly involved in the work can best set priorities and assess the feasibility of our recommendations for the specific situation at the school. Both employee representatives and management representatives should be included on the committee.

How? At your workplace, we recommend these specific actions:

Use the safety and health committee to discuss our recommendations and develop an action plan.

- Helpful guidance can be found in OSHA's Recommended Practices for Safety and Health Programs at Safety Management - A safe workplace is sound business.
- Undirected environmental sampling for chemical or microbial agents in an elementary school generally is not recommended. Our reason is that sampling results are difficult to interpret because of (a) the absence of guidelines, (b) the common and widespread presence of microbial agents (such as fungi and bacteria), and (c) uncertainty about the relationship between low levels of chemical or microbial agents and specific health effects.

Recommendation 2: Encourage employees to learn more about known risk factors and ways to reduce the risk of cancers

Why? Cancer risk factors are characteristics, conditions, or behaviors that increase the likelihood of developing cancer. Employees may have individual cancer risk factors associated with certain types of cancer such as genetics, age, tobacco use, alcohol use, diets low in fruits and vegetables, physical inactivity, and obesity. Employees should discuss their risk factors with their healthcare providers. Discussions may include interventions like behavior modification (e.g., smoking cessation, physical activity incentives, or wellness program participation) to reduce modifiable cancer risk factors. Additionally, discussions on risk factors can inform decisions on when cancer screening tests should be performed.

Cancer screening tests are used to find cancer before it causes symptoms. Screening can help find and treat cancer early, reducing the chance that it spreads or becomes more serious. Cancer screening guidelines in the United States are developed and adopted by expert organizations to balance the benefits and risks of the screening test. Healthcare providers can advise their patients on the appropriate screening guidance based on factors like their age, sex, family history, and other risk factors.

How? At your workplace, we recommend these specific actions:

Encourage employees to work with their healthcare providers to determine what cancer screenings are recommended for them based on personal risk factors such as age, sex, and family history or personal history of cancer.

- Provide employees with information about cancer from the American Cancer Society website, including information on cancer risks and prevention methods. Include information specifically about breast cancer.
- Find information about screening for breast cancer at Screening for Breast Cancer.
- Tell employees that specifics about screening, such as at what age to start and stop and which test to use, can vary for individuals based on their specific personal risk factors. Therefore, having input about screening from a healthcare provider is important.
- Tell employees that it is important to consult with a healthcare provider before pursuing screening tests beyond those recommended based on their personal risk factors since cancer screening tests are not without risks.

Recommendation 3: Encourage employees to seek assessment and treatment from a qualified health professional if they are experiencing work-related symptoms

Why? When employees are concerned that exposures at their workplace may be related to a health symptom or diagnosis, it can be useful to have a qualified health professional that specializes in workplace-related exposures evaluate their concerns.

How? At your workplace, we recommend these specific actions:

Encourage employees with work-related health concerns to tell their healthcare providers about their work in the building.

- Employees can share a copy of this report with their healthcare provider.
- Employees who need assistance identifying a primary care provider can be referred to their health insurance plan to identify available providers in their area.
- Employees who need assistance identifying a specialist in workplace exposures can find occupational medicine healthcare providers through a variety of sources, including the Association of Occupational and Environmental Clinics and the American College of Occupational and Environmental Medicine.

Supporting Technical Information

Evaluation of Cancer Concerns Among Employees at an Elementary School

HHE Report No. 2025-0092-3428

February 2026

Section A: Workplace Information

Workplace

Built in 2006 on approximately 7 acres, the single-story 76,260 square foot building accommodates approximately 600 students (kindergarten through fifth grade). No major additions or renovations have occurred since construction was completed. During the same year as building construction, the city approved the construction of a 120-foot cellular service tower (cell tower) on the school campus. The cell tower is leased for use by a telecommunications company and is approximately 100 feet from the east side of the school building. Before the building's construction, there were no commercial or industrial buildings or active agricultural operations on the site. The land was undeveloped homestead and pasture.

Employee Information

At the time of this evaluation (2024–2025 school year), there were approximately 91 employees in the school that included certificated positions (e.g., teachers, social workers, counselors) and classified positions (e.g., employees in custodial services, nutrition services, safety & security). Employees have the option to join two local unions, although unions do not have collective bargaining agreements with the school.

History of Issues at Workplace

Employee concerns about cancer diagnoses began in 2022 when two employees who worked in the school were diagnosed with breast cancer within the same year. The concern was brought to management, who then notified the county public health center. An initial report by the county public health center found that the number of breast cancer cases among employees was not higher than expected when compared to county and state breast cancer rates. In addition, environmental sampling conducted at the school had not identified any carcinogenic exposures. The county public health center did not recommend further environmental investigation at that time.

In 2024, after the death of a teacher with cancer and a new cancer diagnosis among the staff, employee concerns resurfaced. Management decided to ask the county public health center to review the number of cancer cases with the new cancer diagnosis and to bring the concerns to the state's cancer inquiry advisory committee. In June 2025, the school's management was made aware of the NIOSH HHE program and submitted an HHE request.

Section B: Methods, Results, and Discussion

Consistent with CDC's Guidelines for Examining Unusual Patterns of Cancer and Environmental Concerns NIOSH designed this evaluation to address the following questions:

- Have employees experienced more of a specific type or related types of cancer than expected?
- Have employees experienced an unusual distribution of a specific type or related types of cancer?
- Was there exposure to carcinogens at levels known or suspected of causing cancer occurring at the workplace?
- Has enough time passed since a potential exposure began for excess cancer rates or an unusual pattern of cancer to be observed among employees (i.e., latency)?

We addressed these questions through the activities described in the following sections.

Methods: Evaluation of Reported Employee Cancer Cases

We reviewed records of how many individuals had worked at the school from 2013–2025 organized by sex and employee category (certificated vs. classified) provided by management. They were unable to provide estimates from before 2013 due to limitations in available records.

We reviewed a management-generated list of current and former employees diagnosed with cancer. The list was generated from results of a voluntary survey created and distributed to current school employees by management via email on May 16, 2025. Current employees were invited to provide information by email, on the phone, or during an in-person meeting. Current employees had until May 30, 2025, to provide information to be included in the list. The voluntary survey requested information on name, sex, date of birth, type of cancer diagnosis, year of cancer diagnosis, start date (month and year) at the school, and end date (month and year) at the school. Additionally, management added to the list known cancer cases among former school employees who were not employed at the school as of May 16, 2025, and information on whether each employee on the list was certificated or classified.

We calculated two variables (age at diagnosis and time between start date year and diagnosis year) for all individuals with cancer on the list. Age at diagnosis in years was estimated by subtracting the employee's year of diagnosis from their year of birth for employees who had available information.

Latency is defined as the time between first exposure to a hazardous agent and clinical recognition of a disease. Latency periods vary by cancer type but are usually estimated to be a minimum of 10–12 years [Rugo 2004]. Some latency estimates are as short as 4 years for solid tumors and 0.4 years for lymphoproliferative and hematopoietic cancers, which are blood cancers such as leukemias, lymphomas, and myelomas [Howard 2015]. We calculated the number of years between start of work and diagnosis and compared it to the appropriate latency assumption.

Results: Evaluation of Reported Employee Cancer Cases

The best estimate of the total number of people who worked at the school during the past 13 years (2013–2025) was 294 employees, of whom the majority were female (86%, (254/294)) and employed in classified (63%, (184/294)) positions.

Management provided a list of 13 employees with reported diagnoses. Of the 13 employees, 2 employees reported non-cancerous health conditions, and 11 employees reported 12 cancer diagnoses, with one employee providing detailed information for two distinct cancer diagnoses. All reported cancer diagnoses were of solid tumors; therefore, we considered a 4-year latency assumption when evaluating whether diagnoses could plausibly be related to a workplace exposure. Of the reported cancer diagnoses, 67% (8/12) met the latency assumption. Among the 8 diagnoses (7 employees) meeting the latency assumption, 3 diagnoses were breast cancer (38%) and the remaining 5 were different types of solid cancers. The four cancer diagnoses that did not meet the latency assumption were all breast cancer.

Of the seven employees with cancer diagnoses that met latency assumptions, 86% (6/7) were female and 57% (4/7) were certificated. The employees were diagnosed in their 30s through 50s with a median age at cancer diagnosis of 46 years (n=6, one employee did not provide date of birth or age at diagnosis). The range of years of when cancers were diagnosed was 2015–2024, and the median time between diagnosis year and start date year was 13.5 years (range: 5–17 years; n=7).

All three employees with a reported breast cancer diagnosis that met latency assumptions were female. Their median age at diagnosis was in their 40s. The median time between diagnosis year and start date was 12 years (range: 6–16 years, n=3). All employees with breast cancer meeting the latency assumption were certificated employees (100%, (3/3)).

Methods: Review of Environmental Assessments

We reviewed reports of all environmental assessments conducted as part of routine state testing (e.g., lead in drinking water) and at the request of employees for possible workplace exposures performed from 2015 to 2025. Consultants evaluated the air, surfaces, building materials, drinking water, and soil in and around the school. When a consultant compares sample results to an OEL, we report that and reference other published OELs when available. We also reviewed a compliance report for the nearby cell tower and a report from the state regarding a company near the school that employees were concerned was handling hazardous waste. Finally, we reviewed documents provided by management describing pest control, groundskeeping, and custodial chemical use at the school and then reviewed associated safety data sheets (SDS) to identify the presence of potential carcinogens.

Air Sampling

Air assessment reports, one for a state radon assessment conducted in November 2015 and one for indoor air quality assessment conducted in January 2024, evaluated levels of radon, mold, carbon dioxide (CO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ammonia (NH_3), total volatile organic compounds (VOCs), ozone, chlorine, and particulate in the air throughout the school. The indoor air quality assessment also measured temperature and relative humidity.

The radon report compared radon results to the Environmental Protection Agency's (EPA) action level of 4 picocuries per liter of air (pCi/L) [EPA 2020]. The indoor air quality report cited the recommendations for relative humidity from the EPA document titled Mold Remediation in Schools and Commercial Buildings. This same document also noted that "…there are no recognized standards for airborne fungal spore concentrations in indoor environments." The CO_2, temperature, and relative humidity results were compared to ASHRAE recommendations [ANSI/ASHRAE 2023]. The reports did not cite any regulatory or recommended reference levels for the remaining analytes.

Surface Sampling

A surface assessment, conducted in January 2024, used vacuum and tape lift sampling methods to evaluate mold levels in three classrooms, and mold and pet dander levels in the nurse's office. The reports did not cite any regulatory or recommended reference levels for comparison.

Building Material Sampling

One bulk material assessment, conducted in February 2022, evaluated insulation material in a rooftop heating, ventilation, and air-conditioning (HVAC) unit (RTU) for asbestos. A second bulk building material assessment, conducted in April 2025, evaluated drywall and joint compound for asbestos throughout the school. Both assessments compared the results to the EPA Asbestos National Emission Standards for Hazardous Air Pollutants (NESHAP).

Drinking Water Sampling

The first two drinking water reports, conducted in November 2022 and August 2024, discussed testing for lead in drinking water from sinks in four classrooms, the library, teachers' lounge, and a kitchen. The results were compared to reference levels in the EPA document titled "Lead in Drinking Water in Schools and Non-Residential Buildings." The EPA Lead and Copper Rule sets limits for lead at 15 parts per billion (ppb) and copper at 1.3 parts per million (ppm). Maximum Contaminate Levels (MCLs) are set by the state's Safe Water Drinking Act which ensures the state's drinking water quality meets federal standards.

A third drinking water sampling evaluation, conducted in August 2025, analyzed for water turbidity, polychlorinated biphenyls, chlorinated herbicides, pesticides, semi-volatiles, metals, mercury, VOCs, anions, nitrates, nitrites, total dissolved solids, pH, total coliforms, pesticides, gasoline-range organics, and diesel-range organics. These sample results were compared to state MCLs.

Soil Sampling

Consultants evaluated the outdoor soil in August 2025 by collecting soil samples in three locations around the school they felt represented the normal daily path of students and employees (two samples from walkways near school entrances and one near the playground. The laboratory used seven EPA methods to analyze pesticides (21 types), chlorinated herbicides (11 types), polycyclic aromatic hydrocarbons (PAHs) (16 types), volatile organic carbons (3 types), and metals (4 types). The results were compared to the state's department of natural resources risk-based corrective action process for contaminated sites and a natural resource study conducted by the U.S. Department of the Interior. It is important to note that the consultant compared soil sample results to the state's risk-based corrective action process for soil target levels despite the school site not being designated as a contaminated site.

Cell Tower Compliance Report (Radiofrequency Radiation)

We reviewed a 2023 site compliance report evaluating radiofrequency (RF) radiation. This evaluation was performed by a contractor hired by the operator of the cell tower located ~100 feet away from the school, on school property. The cell tower compliance report compared results to the Federal Communications Commission (FCC) Rules and Regulations for occupational and public RF exposure.

Local Hazardous Waste Site

We reviewed a state compliance report from 2025 regarding activities at a business located about 700 feet from the school property.

Safety Data Sheets

We reviewed a management provided list of the school's commonly used cleaning, housekeeping, and groundskeeping products and compared them to SDSs for potential carcinogens by looking at section 11 (toxicological information) of the SDS. We then took any chemical listed as a possible human carcinogen and compared it to the corresponding International Agency for Research on Cancer (IARC) monograph.

Results: Review of Environmental Assessments

Review of consultant environmental assessment reports found no evidence of carcinogenic substances at levels above occupational exposure limits in the air, surface sampling, and drinking water. There were some carcinogenic substances found in soil samples, likely due to runoff from nearby environmental sources or background levels naturally present in soils in the region.

Additional details by topic are explained below.

Air Sampling

OSHA sets legally enforceable Permissible Exposure Limits (PELs) for occupational exposure to chemicals in the workplace. Additionally, NIOSH publishes Recommended Exposure Limits (RELs). None of the environmental assessments for potential hazardous air contaminants (e.g., radon, CO_2, CO, NO_2, NH_3, ozone, chlorine, particulate) were above OSHA PELs [29 CFR 1910 for general industry; 29 CFR 1926 for construction industry; and 29 CFR 1917 for maritime industry] or NIOSH RELs [NIOSH 2007].

Air sample results for total VOC's were measured at "…very low levels" (19–115 ppb). OSHA does not regulate (nor NIOSH recommend) occupational exposure to total VOCs collectively but does regulate workplace exposure to VOCs individually. The exposure limits set by OSHA for most VOCs are regulated in the ppm range, which are levels 1,000 times higher than ppb (i.e., 115 ppb equals 0.115 ppm) levels measured here.

Air sample results for mold showed that indoor levels were similar to outdoor levels. Visual observations in the building did not find moisture or visible mold growth within the building at the time of the evaluations. Temperature levels were within acceptable ranges according to ASHRAE guidelines (64°F–79°F). Humidity levels were just below guidelines (30%–60% relative humidity) [ANSI/ASHRAE 2022, 2023]

Sampling results for radon were all within acceptable ranges according to the EPA guideline for radon in schools and well below the OSHA PEL.

One evaluation found "outside chemicals" and fragrance products in classrooms. The consultants recommended management remove all outside chemicals and create a fragrance-free workplace.

Surface Sampling

Vacuum and tape lift samples for mold and pet dander were reported to be "high" for pet dander in the nurse's office. There are no regulations for workplace exposures to mold or pet dander, but the report included recommendations on ways to reduce levels of these allergens in the workplace.

Building Material Sampling

In 1986, Congress passed the Asbestos Hazard Emergency Response Act. The Act (40 CFR Part 763 Subpart E) required the EPA to enforce regulations requiring educational agencies to inspect their school buildings for asbestos-containing building materials (ACBMs), prepare asbestos management plans, and perform asbestos response actions to prevent or reduce asbestos hazards. The EPA issued the Asbestos Ban and Phase-Out Rule, which sought to ban asbestos-containing products. However, this rule was overturned in 1991, resulting in a partial ban. The EPA issued a final rule discontinuing the sale and use of new building materials containing asbestos in 2019.

The school was built in 2006. Thus, it is very unlikely to have any ACBMs. All bulk sampling results for asbestos were reported as "No Asbestos Detected (NAD)."

Drinking Water Sampling

The EPA's National Primary Drinking Water Regulations for Lead establishes a treatment level of 15 ppb in municipal drinking water systems. State regulations (beginning in the school year 2023–2024) require schools to provide drinking water with lead levels below 5 ppb (Missouri Revisor of Statutes - Revised Statutes of Missouri, RSMo Section 160.077). Drinking water sample results ranged from below the limit of detection (0.4 ppb) to 0.7 ppb.

All water samples collected were below the EPA and state levels for all analytes, including total coliforms and turbidity.

Soil Sampling

The report showed that most chemicals analyzed from the outdoor soil samples were below the state's target levels. However, some soil samples contained levels of lead, arsenic and PAHs above the state's target levels.

Lead and arsenic levels in all three samples were above the state's target level. The samples were taken near walkways to school entrances and the playground. Lead levels ranged from 11.7–15.5 milligrams per kilogram of soil (mg/kg). Arsenic levels ranged from 5.7–6.7 mg/kg. The state's target level for lead is 3.74 mg/kg and for arsenic is 3.89 mg/kg. The consultant reported that although the levels of lead and arsenic in the soil samples were above target soil cleanup levels by the state's department of natural resources, they were below levels that occur naturally in the state. The reported geometric means for naturally occurring metal levels in soil for the state are 20 mg/kg for lead and 8.7 mg/kg for arsenic [Tidball 1984].

Two of the three samples found detectable levels of PAHs in the soil. Both samples with detectable levels of PAH's were found near walkways that led to school entrances. The state's target levels are set

for individual PAHs in micrograms per kilograms of soil (µg/kg). One sample, with the walkway near the school parking lot, reported eight of sixteen detectable PAHs above the state's target level (range of elevated PAHs: 1,680 µg/kg–22,300 µg/kg). The other walkway entrance sample only reported one of the thirteen detectable PAHs above the state's target level (401 µg/kg). There are no occupational exposure limits for PAHs in soil for comparison.

Cell Tower Compliance Report (Radiofrequency Radiation)

Review of the cell tower inspection report concluded that: (1) occupational exposure controls to protect workers who serviced the tower complied with regulatory requirements and (2) exposures to the public were within regulations.

The cell tower compliance report evaluated exposure levels to RF radiation among both workers who service cell towers and the public. The compliance report listed the results of 22 ground level spatial average measurements collected inside (n=5) and outside (n=17) the fenced area around the tower. Spatial average measurement is a technique used to average a minimum of 10 measurements taken at 10-second intervals from 0 to 6 feet off the ground. This is intended to model the average energy a 6-foot-tall human body would absorb while present in the RF field. These data are used in conjunction with computer modeling to estimate RF exposure levels to employees working within the fence, such as workers servicing the cell tower, and the public outside the fence of the tower. The report states that theoretical (software) modeling was used for determining compliance, and the percentage of maximum permissible exposure (MPE) contributions, and that site measurements were used to validate modeling results. The report also stated that software modeling assumed all antennas in the tower are operating at 100% duty cycle and at maximum radiated power. This is a common compliance evaluation procedure for RF levels at cell towers.

The compliance report stated RF levels were well below (<5%) reference levels for public RF exposures, which are substantially lower than allowable exposures in occupational environments.

Local Hazardous Waste Site

The nearby commercial site was not a hazardous waste storage facility. The site was operated by a company that does work in hazardous waste removal and disposal, but the site operates as an equipment storage and vehicle repair facility. No hazardous waste was currently or historically handled, processed, or stored at the site according to the information we reviewed. It is not known if any of the equipment stored at the site was previously used for hazardous waste removal, and or if proper decontamination was done prior to storage.

Safety Data Sheets

The list of pesticides and chemicals used in the workplace consisted of products commonly used in schools for pest control (n=6), custodial (n=30), and groundskeeping (36 current, 23 discontinued).

Some of the herbicides used by groundskeeping contain glyphosate which IARC classifies as Group 2A (probably carcinogenic to humans) with a positive association observed for non-Hodgkin's lymphoma [IARC 2017]. Other herbicides contain chemicals such as 2,4-D 2-ethylhexyl ester and 2,4-D dimethylamine salt. These chemicals are classified as chlorophenoxy herbicides which, as a group,

IARC classifies as Group 2B (possibly carcinogenic to humans), with no association to a specific cancer type [IARC 2018].

According to SDS we reviewed, most products used for pest control, custodial, and groundskeeping contain no ingredients classified as known human carcinogens by IARC. All these products, if used according to manufacturer labeling instructions and SDS, should pose no increased risk of exposure to school employees.

Discussion

After review of available information, we did not find evidence of an unusual pattern of cancer or exposure to specific carcinogens at levels known to cause cancer. The sections below provide more details on how we came to this conclusion. We describe how we evaluate whether an unusual pattern of cancer has occurred among employees and whether evidence suggests those cancers are likely to be associated with workplace exposures.

Have employees experienced more of a specific type or related types of cancer than expected?

No. The number of cancer cases does not appear to be greater than expected based on the available information. Cancer is a common disease, with many different types and many different risk factors. When multiple cases of cancer occur in a workplace, they may be part of a cluster if the number is greater than we expect compared to the number in other groups of people similar in age, sex, and race. However, small populations can have highly variable disease or tumor rates that rarely match the overall rate for a larger area, such as the state. At any given time, some populations have rates above or below the overall rate. Even when high rates occur, it may still be consistent with the expected random variability. Comparing rates without adjusting for age, sex, or other population characteristics assumes that such characteristics have the same distribution in the workplace as in the larger population, which may not be true.

Given the limitations in estimating cancer rates in a small working population, we use proportions to give us an idea on whether there may be an excess number of cancer cases among employees at the workplace. Calculations using proportions make many assumptions that may not be appropriate for every workplace. Ideally, we would like to know how many individuals had worked at the school since its construction in 2006, as that would have been the earliest time that an employee could have been potentially exposed to carcinogens at the school. Due to limitations in records, we were only able to get estimates of the total number of employees who have worked at the school since 2013. Of approximately 294 employees who worked in the school from 2013–2025, 11 employees reported 12 different cancer diagnoses. Of those 11 employees, 7 employees had cancer diagnoses that met latency assumptions, corresponding to approximately 2% (7/294) of school employees. Approximately 40% of men and women in the United States will be diagnosed with cancer at some point during their lifetimes [NCI 2025a]. Thus, seven employees with reported cancer diagnoses during a 13-year period does not exceed general expectations.

Furthermore, it is estimated that one in eight women in the United States will develop breast cancer over their lifetime [ACS 2024]. Since records indicated that 254 of the employees from 2013–2025 were female, we would expect approximately 32 women might develop breast cancer in their lifetime. The

three breast cancer cases that met latency assumptions reported among three female employees is lower than the estimated expected number. Additionally, the National Cancer Institute finds that the likelihood of developing breast cancer among women during their working ages of 20 to 65 years is 7.3% [NCI 2025b]. A proportion of 3 female employees with breast cancer among an estimated 254 female employees (1%) does not suggest an excess burden of breast cancer compared to the general working-age female population. Lastly, the other five reported cancer diagnoses that met the latency assumption included only one diagnosis each of unrelated types of solid tumors and therefore did not suggest an excess of any other type of reported cancer.

We acknowledge that additional cases of cancer beyond those considered here may exist among employees who either did not receive or respond to the survey distributed by management, such as employees who left the school before 2022 with no known cancer diagnoses. However, based on the available information, we have no evidence that additional case finding would identify an excess of a specific type or related types of cancer. As employees age, more cases of cancer are expected and will occur over time, including more cases of breast cancer.

Have employees experienced an unusual distribution of a specific type or related types of cancer?

No. Occupational exposure-related cancer is more likely when employees have been diagnosed with the same type of cancer, related types of cancer, or a rare type of cancer that is not common in the general population. When a group of reported cancers in a workplace includes multiple types of cancer or multiple cases of a common type of cancer, occupational causes of the observed cancers are less likely and difficult to identify. The distribution of cancer among school employees does not appear unusual. The cancer distribution includes several different types of cancer that are not related and the most reported cancer diagnosis in the predominately female employee population was breast cancer, the most common type of cancer diagnosed in women in the United States [Xie et al. 2022].

Key risk factors for breast cancer include increasing age, female sex, family history of breast cancer, genetic mutations (such as *BRCA1* and *BRCA2*), and hormonal factors (e.g., use of estrogen-progestogen contraceptives or menopausal therapy, early menarche, late menopause, and pregnancy history) [CDC 2025]. Key lifestyle risk factors include alcohol consumption and obesity [CDC 2025]. Although less common, occupational exposures, such as those to certain carcinogens and endocrine disruptors in industry sectors like plastics and textiles, have also been implicated in some studies [Brophy et al. 2012; Fenga 2016].

Was there exposure to carcinogens at levels known or suspected of causing cancer occurring at the workplace?

No. We reviewed reports of the results of multiple air, surface, building material, water, and soil samples collected and tested by consultants in the school or on school grounds from 2015–2025. The chemicals tested were not found at levels exceeding occupational exposure limits (for chemicals that have such limits). Many of the substances sampled were not known to cause cancer (e.g., mold, dander). For potential or known carcinogens (e.g., PAHs), none were likely to present an occupational exposure nor were found at levels exceeding occupational exposure limits (for carcinogens that have such limits).

PAHs were found at levels in soil above state targets for two of three samples collected. Although no current occupational exposure limits exist for PAHs in soil, some states have target soil levels for PAHs

at designated contaminated sites. The school is not designated as a contaminated site, but since no other target levels existed, the consultant chose to use the state's contamination target soil levels for comparison.

PAHs are a class of over 100 organic compounds that are primarily created through combustion of organic material. The general population is exposed to PAHs in their daily life through multiple routes, such as eating contaminated food (e.g., grilled or charred meat, contaminated cereals, flour, vegetables, pickled foods), inhaling contaminated air (e.g., tobacco smoke, vehicle exhaust or wood smoke from burning logs) or drinking contaminated water [Park et al. 2025]. Studies have shown that exposure to PAHs through environmental pollution and occupational exposure (e.g., paving and roofing with coal-tar pitch, coal-tar distillation) are associated with higher incidence of cancer such as lung, skin, bladder, and breast cancer [Armstrong and Gibbs 2009; Burstyn et al. 2007; Gamboa-Loira et al. 2022; IARC 2010; Lee et al. 2019]. These associations were found among the general population and among workers having inhalation, skin, and, to a lesser extent, ingestion exposure to PAHs through combustion products they worked with on a regular basis (e.g., coal tar, petroleum sources).

The PAHs at the levels found in the soil near the school entrances are unlikely to contribute to an occupational exposure due to a lack of exposure routes. School employees are not involved in work tasks that regularly expose them to air contaminants from the soil, should have negligible dermal exposure to the soil, do not consume food grown from the soil, and do not ingest the soil. Additionally, the levels detected in the soil are likely due to environmental contamination from rainwater runoff from the nearby sidewalk and parking lot, as PAHs are naturally found in asphalt as well as combustion product residue from vehicles.

Discussions with management and employees revealed two other concerns about potential carcinogenic sources, RF radiation from the cell tower located on the school campus and hazardous materials released from a nearby company. Both potential sources, after review, are unlikely to result in exposures to carcinogens at levels known or suspected of causing cancer in the workplace.

The cell tower inspection report concluded that occupational controls to protect workers met regulatory requirements and RF exposures to the public were within regulatory limits. Cell towers emit RF radiation, also called non-ionizing radiation. RF radiation is sometimes mistaken for ionizing radiation. Ionizing radiation refers to any type of electromagnetic radiation that has enough energy to remove an electron from an atom. This is the most generally known use of the term "radiation". Ionizing radiation can change the chemical composition of material with which it interacts, such as DNA in living tissue. Alternatively, non-ionizing radiation refers to any type of electromagnetic radiation that does not carry enough energy to remove electrons from atoms or molecules. Near ultraviolet and visible light, infrared, microwave, and radio waves are all forms of non-ionizing radiation. Radio waves regulated for communication use (e.g., mobile phones, cell towers) are referred to by their RF wavelength, with the frequency range of 100 kilohertz (kHz) to 300 gigahertz (GHz) [FCC Safety FAQ].

An extensive review of the scientific literature on possible health effects from RF exposure was published in 2009 by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and reviewed again with their updated guidelines in 2020 [ICNIRP 2009, 2020]. The authors of those studies reviewed biophysical, cellular, animal, human laboratory, and epidemiologic studies related to RF

and health effects, including carcinogenicity. They found that although two animal studies reported possible associations with increased cancer risk in long-term animal models, the statistical methods and data interpretation weaknesses of those studies made it unlikely that they alone in isolation would override the larger body of evidence on RF and carcinogenicity. The larger body of evidence includes multiple types of cellular and epidemiological studies (i.e., case-control, cohort, and environmental RF studies). They concluded that there is currently no substantiated evidence that RF affects the induction or development of cancer [ICNIRP 2020].

IARC has classified RF radiation as "possibly carcinogenic to humans" but acknowledges this is based on "…limited evidence of a possible increase in risk for brain tumors among cell phone users, and inadequate evidence for other types of cancer" [IARC 2013].

The cell tower compliance report stated RF levels were well below (<5%) the FCC MPE limit for public RF exposures. General public exposure limits are more protective than those set for occupational exposures, making it unlikely that RF from the cell tower near the school would be at levels known or suspected of causing cancer in an occupational setting.

Regarding employee concerns about a company releasing hazardous materials in the local environment, we reviewed state records that showed that while the company is involved in hazardous waste disposal, the company location near the school is a vehicle maintenance location and there is no permitting for hazardous waste at that location. This, combined with environmental sampling at the school that did not find evidence of hazardous materials, makes it unlikely the company's location nearby is a source of carcinogenic exposures at the school.

Has enough time passed since a potential exposure began for excess cancer rates or an unusual pattern of cancer to be observed among employees (i.e., latency)?

Unclear. Latency is the time between exposure to a cancer-causing agent and clinical recognition of the disease. Latency periods vary by cancer type but are usually estimated to be a minimum of 10–12 years [Rugo 2004], with estimates as short as 4 years for solid tumors and 0.4 years for lymphoproliferative and hematopoietic cancers, which are blood cancers such as leukemias, lymphomas, and myelomas [Howard 2015]. Most studies on occupational exposures related to breast cancer suggest that at least 10 years of latency is needed to see effects in the working population [Labrèche et al. 2010; Pedersen et al. 2020; Videnros et al. 2019; Villeneuve et al. 2011]. Because of this, exposures in the past are typically more relevant than recent or current exposures when determining potential causes of cancers occurring today.

We selected a minimum latency assumption of 4 years based on the review of available literature conducted for different groups of cancers by the NIOSH World Trade Center Program [Howard 2015]. By using a conservative minimum latency assumption of 4 years we remained as inclusive as possible in evaluating school employees' cancer diagnoses. However, because we did not identify any unusual pattern of a specific type of cancer nor a suspected exposure of concern, there is no additional information we can consider to identify a more specific latency requirement. Therefore, of the 12 reported cancer diagnoses, 8 cases (66%, (8/12)) met latency assumptions.

Limitations

Due to the occupational scope of the HHE program, we only included employees who worked in the building in this evaluation. We could not include other people who spent time in the building, such as students, volunteers, or visitors. Therefore, the findings presented here may not be generalizable to those non-occupational groups.

Limitations in the types of information available for the evaluation may have affected our results. We acknowledge that additional cases of cancer beyond those considered here may exist. Examples of missed cases could include current employees who either did not receive or chose not to respond to the voluntary survey distributed by management. Additionally, former employees who left before 2022 and developed cancer may not have been included in the provided list because management was not aware of their diagnoses and the survey was not actively sent to former employees. This may mean that some cancer diagnoses may have been left out of the evaluation and the actual percentage of employees with cancer is higher.

For cancer diagnoses reviewed, we did not have individual-level information about factors such as identifiable genetic or familial risk factors. In addition, we relied on self-reported cancer diagnoses, which were not necessarily verified by medical records. Diagnoses can be complicated, and therefore it is possible we may have misclassified the type or timing of some of the cancer diagnoses.

Environmental sampling can only document exposures on the days of sampling and in the locations sampled. For example, the cell tower compliance report results are limited to the RF sources, frequencies, and power levels present during the evaluation. Changes to any of these parameters may change the amount of RF present. Additionally, we only know information about the analytes that were sampled, and we do not know how or if exposures may have changed over time.

Conclusions

This evaluation found no evidence that cancers reported by former and current employees at the school are the result of a workplace carcinogenic exposure. We did not identify evidence of an excess number of cancer cases among employees, an unusual distribution of cancer types reported by employees, or potential employee exposures to hazardous levels of cancer-causing substances in the workplace. We do not think further case finding or investigation would lead to the identification of an unusual pattern of cancer among employees at this time. However, we acknowledge that concerns about the occurrence of cancer among school employees can have an important effect on employee health. Therefore, we provide recommendations to assist management in continuing to evaluate concerns and ensure the workplace is safe and healthy for all employees.

Section C: References

ACS [2024]. Breast cancer facts & figures 2024-2025. American Cancer Society, https://www.cancer.org/content/dam/cancer-org/research/cancer-facts-and-statistics/breast-cancer-facts-and-figures/2024/breast-cancer-facts-and-figures-2024.pdf.

Armstrong BG, Gibbs G [2009]. Exposure–response relationship between lung cancer and polycyclic aromatic hydrocarbons (PAHs). Occup Environ Med *66*:740–746, https://doi.org/10.1136/oem.2008.043711.

ANSI/ASHRAE [2022]. Standard 62.1–2022 Ventilation for acceptable indoor air quality. American National Standards Institute/ASHRAE. Peachtree Corners, GA: ASHRAE, https://www.ashrae.org/.

ANSI/ASHRAE [2023]. Standard 55-2023 Thermal conditions for human occupancy. American National Standards Institute/ASHRAE. Peachtree Corners, GA: ASHRAE, https://www.ashrae.org/.

Brophy JT, Keith MM, Watterson A, Park R, Gilbertson M, Maticka-Tyndale E, Beck M, Abu-Zahra H, Schneider K, Reinhartz A, Dematteo R, Luginaah I [2012]. Breast cancer risk in relation to occupations with exposure to carcinogens and endocrine disruptors: a Canadian case-control study. Environ Health *11*:87, http://doi.org/10.1186/1476-069X-11-87.

Burstyn I, Kromhout H, Johansen C, Langard S, Kauppinen T, Shaham J, Ferro G, Boffetta P [2007]. Bladder cancer incidence and exposure to polycyclic aromatic hydrocarbons among asphalt pavers. Occup Environ Med *64*(8):520–526, https://doi.org/10.1136/oem.2006.029801.

CDC [2022]. Guidelines for examining unusual patterns of cancer, the environment, and community concerns. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, https://www.cdc.gov/cancer-environment/php/guidelines/index.html.

CDC [2025]. Breast cancer risk factors. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, https://www.cdc.gov/breast-cancer/risk-factors/index.html.

CFR. Code of Federal Regulations. Washington, DC: U.S. Government Printing Office, Office of the Federal Register, https://www.ecfr.gov/cgi-bin/ECFR?page=browse.

EPA [2020]. Health risk of radon. Washington, DC: U.S. Environmental Protection Agency, https://www.epa.gov/radon/health-risk-radon.

Fenga C [2016]. Occupational exposure and risk of breast cancer. Biomed Rep *4*(3):282–292, http://doi.org/10.3892/br.2016.575.

Gamboa-Loira B, López-Carrillo L, Mar-Sánchez Y, Stern D, Cebrián ME [2022]. Epidemiologic evidence of exposure to polycyclic aromatic hydrocarbons and breast cancer: a systematic review and meta-analysis. Chemosphere *290*:133237, https://doi.org/10.1016/j.chemosphere.2021.133237.

Howard J [2015]. Minimum latency & types or categories of cancer. World Trade Center Health Program, https://www.cdc.gov/wtc/pdfs/policies/WTCHP-Minimum-Cancer-Latency-PP-01062015-508.pdf.

IARC [2010]. IARC monographs on the evaluation of carcinogenic risks to humans. Some non-heterocyclic polycyclic aromatic hydrocarbons and some related exposures. Vol. 92. Lyon, France: World Health Organization, International Agency for Research on Cancer, http://publications.iarc.fr/110.

IARC [2013]. IARC monographs on the evaluation of carcinogenic risks to humans. Non-ionizing radiation, part 2: radiofrequency electromagnetic fields. Vol. 102. Lyon, France: World Health Organization, International Agency for Research on Cancer, http://publications.iarc.fr/126.

IARC [2017]. IARC monographs on the evaluation of carcinogenic risks to humans. Some organophosphate insecticides and herbicides. Vol. 112. Lyon, France: World Health Organization, International Agency for Research on Cancer, http://publications.iarc.fr/549.

IARC [2018]. IARC monographs on the evaluation of carcinogenic risks to humans. DDT, Lindane, and 2,4-D. Vol. 113. Lyon, France: World Health Organization, International Agency for Research on Cancer, http://publications.iarc.fr/550.

ICNIRP [2009]. Guidelines on limits of exposure to static magnetic fields. Oberschleissheim, Germany: International Commission on Non-Ionizing Radiation Protection.

ICNIRP [2020]. Guidelines for limiting exposure to electromagnetic fields (100 KHz to 300 GHz). Health Phys *118*(5):483–524, https://doi.org/10.1097/hp.0000000000001210.

Labrèche F, Goldberg MS, Valois MF, Nadon L [2010]. Postmenopausal breast cancer and occupational exposures. Occup Environ Med *67*(4):263–269, https://doi.org/10.1136/oem.2009.049817.

Lee DG, Burstyn I, Lai AS, Grundy A, Friesen MC, Aronson KJ, Spinelli JJ [2019]. Women's occupational exposure to polycyclic aromatic hydrocarbons and risk of breast cancer. Occup Environ Med *76*(1):22–29, https://doi.org/10.1136/oemed-2018-105261.

NCI [2025a]. Cancer statistics. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, https://www.cancer.gov/about-cancer/understanding/statistics.

NCI [2025b]. Cancer query system: probability of developing or dying of cancer. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute, Division of Cancer Control & Population Sciences, https://surveillance.cancer.gov/devcan/canques.html.

NIOSH [2007]. NIOSH pocket guide to chemical hazards. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2005-149, http://www.cdc.gov/niosh/npg/.

Park S, Park NY, Lim JE, Shin MY, Kim S, Moon HB, Park J, Kho Y, Choi K [2025]. Exposure assessment of PAHs on duplicate diet, indoor dust, and air measurements, and comparison with urinary biomonitoring: a family-based panel (CAFE-P) study. Environ Int *203*:109726, https://doi.org/10.1016/j.envint.2025.109726.

Pedersen JE, Strandberg-Larsen K, Andersson M, Hansen J [2020]. Occupational exposure to specific organic solvents and risk of subtypes of breast cancer in a large population of Danish women, 1964-2016. Occup Environ Med *78*(3):192–198. Advance online publication, https://doi.org/10.1136/oemed-2020-106865.

Rugo H [2004]. Occupational cancer. In: LaDou J, ed. Current occupational and environmental medicine. 3rd ed. New York: McGraw Hill Companies, Inc.

Tidbal [1984]. Geography of soil geochemistry of Missouri agricultural soils; Geochemical classification by factor analysis of Missouri agricultural soils. U.S. G.P.O.; For sale by the Branch of Distribution, U.S. Geological Survey, Washington, Alexandria, VA, 1984

Videnros C, Selander J, Wiebert P, Albin M, Plato N, Borgquist S, Manjer J, Gustavsson P [2019]. Postmenopausal breast cancer and occupational exposure to chemicals. Scand J Work Environ Health *45*(6):642–650, https://doi.org/10.5271/sjweh.3822.

Villeneuve S, Févotte J, Anger A, Truong T, Lamkarkach F, Gaye O, Kerbrat P, Arveux P, Miglianico L, Imbernon E, Guénel P [2011]. Breast cancer risk by occupation and industry: analysis of the CECILE study, a population-based case-control study in France. Am J Ind Med *54*(7):499–509, https://doi.org/10.1002/ajim.20952.

Xie Z, Xie W, Liang Y, Lin H, Wu J, Cui Y, Su X, Zeng D [2022]. Associations of obesity, physical activity, and screening with state-level trends and racial and ethnic disparities of breast cancer incidence and mortality in the US. JAMA Netw Open *5*(6):e2216958, https://doi.org/10.1001/jamanetworkopen.2022.16958.

National Institute for Occupational Safety and Health

NIOSH®

Promoting productive workplaces through safety and health research

HHE®

HHE Report No. 2025-0092-3428