Harpers Mill Community Environmental Concerns

Harpers Mill
CHESTERFIELD COUNTY, VIRGINIA

Letter Health Consultation

January 7, 2026

Virginia Department of Health
Office of Environmental Health Services
109 Governor Street
Richmond, Virginia 23219

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Dear Dr. Alexander and Mr. Michniak:

Thank you for contacting us regarding a request from a Harpers Mill resident concerned about cancer cases in their community. The resident asked if a historic coal mine in Winterpock or matchstick factory in Harpers Mill could be a source of environmental contamination. We met with Virginia Energy (VA Energy) to visit the site of the coal mine in Winterpock and reviewed information about the history of the matchstick factory.

Background

July 22, 2025, the Chesterfield County Deputy Administrator contacted the Chesterfield Health District, sharing concerns from a Harpers Mill resident. The resident reports multiple people in their community have been diagnosed with cancer in recent years, and is concerned these cases could be due to environmental contamination. Specific environmental concerns include:

- A nearby coal waste pile that has spontaneously combusted multiple times beginning in 2023, requiring response by local environmental and fire authorities
- Acid mine drainage and other legacy contamination leaching into groundwater, soil, or air, potentially affecting local drinking water or air quality

- Possibility of chemical contamination at the former grounds of an early 1900's matchstick factory in the community

You contacted the Virginia Department of Health's Toxicology Program and Cancer Registry to provide additional assistance. The following discussion pertains to the Toxicology Program's involvement and assessment. The Virginia Cancer Registry will provide additional information after consulting with federal partners which have been affected by the recent government shutdown.

Discussion

Matchstick Factory

The matchstick factory operated briefly in the early 1900's before a fire destroyed most of the factory and the operator went out of business. The matchstick factory manufactured strike-anywhere matches that were made with white phosphorus, which is poisonous. While most adults are unlikely to be acutely poisoned by contact with white phosphorus, the matches historically posed a danger of potentially fatal poisoning to children who might put matchsticks in their mouth, and employees at matchstick factories were at risk for necrosis of the jaw, also called "phossy jaw".

The process to manufacture the matchsticks involved cutting the sticks, dipping them into paraffin, and then dipping them into a mixture that contained glue, white phosphorus, and potassium chlorate. The matchsticks were then dried before being packaged. The white phosphorus would have been made onsite, since it is highly reactive. This is done using a mixture of bone ash or phosphorite (phosphate-rich rock), coke, and sand heated in an electric furnace. This would produce phosphorus gas, which would be condensed under water as white phosphorus. The other byproduct would be slag, which may have been disposed of onsite. It is thought that the coke used to prepare the white phosphorus was also mined at the matchstick factory.

The chemicals of interest in the matchstick factory would have been white phosphorus and potassium chlorate.

White Phosphorus

The health effects in humans of exposure to white phosphorus are well understood due to the widespread occupational exposure of matchstick factory employees to this chemical. White phosphorus is not associated with cancer in humans or in animal studies. In humans, the health effects of longer-term exposure to white phosphorus are primarily phosphorus jaw necrosis. This condition was called "phossy jaw" after its link with white phosphorus exposure. It is a gradually developing condition, occurring after months or years of exposure, that normally started with toothache before leading to tooth loss, infection, and bone deterioration. Treatment options at the time were limited, and people with the condition normally required surgery, sometimes

extensive, to remove dead bone and tissue. Phosphorus jaw necrosis occurred in people working in the matchstick factory who were involved with match dipping and packaging. For hours each day, these employees were exposed to high levels of white phosphorus in air and in the mixture applied to matchstick heads. The problem was compounded by poor ventilation, limited access to handwashing facilities, and the practice of eating and drinking at the workstation. With the stop in production and sale of white phosphorus containing strike anywhere matches, phosphorus jaw necrosis disappeared. A similar condition is sometimes seen in modern times as a rare side effect of treatment with bisphosphonates of osteoporosis, metastatic bone cancer, or Paget's disease.

White phosphorus is highly reactive and had to be stored under water to prevent reaction with oxygen in the air. Since the matchstick factory burned down, any white phosphorus stored there was likely immediately destroyed. White phosphorus that was buried in soil or debris may have persisted longer, but it is unlikely that it would survive more than a century in the environment. It is possible that some could be preserved in the environment if it were protected from any exposure to oxygen. This may be more likely for white phosphorus preserved within slag. In this case someone could be exposed to small amounts of white phosphorus through crushing a piece of slag or handling recently fractured slag. Since development of phossy jaw requires longer term, consistent exposure, this would not be expected to cause any harm to health. However, it is recommended children do not handle slag due to the potential presence of toxic metals such as lead and chromium.

Potassium Chlorate

Potassium chlorate would have been purchased and shipped to the matchstick factory. Potassium chlorate is also reactive and expected to have degraded in the environment since the matchstick factory fire. It is also low toxicity, with potential skin and eye irritation as the most immediate hazards. Longer duration exposure can interfere with thyroid activity by preventing the absorption of iodine. Potassium chlorate is not known to cause cancer in humans or animals.

GOB Pile

Description

The other site that the community members had concerns about was a garbage of bituminous (GOB) pile south in Winterpock, Virginia. GOB is a mixture of coal dust, low-quality coal fragments, and shale that is discarded at a mine entrance when high-quality coal is sorted out and sent for sale. The GOB pile was left at the site of the Beaver Slope Mine, which was owned by Bright Hope Coal Company and operated in 1877. After the mine closed the Brighthope Railway used the area as one of its shipping stops.

The mine was a slope mine, which has a gradually sloping shaft into the ground. It extends perhaps 200 feet below ground. Due to the swampy surroundings, the mine itself is believed to be flooded, and while it was operating water would have been pumped out of the mine workings. The mine entrance remains on the western side of the GOB pile. On the eastern side, adjacent to

Winterpock Creek, is an air shaft. Both the entrance and the air shaft are currently marked, and the air shaft has been temporarily filled and surrounded with cattle fencing to prevent anyone accidentally falling into the shaft.

The GOB pile itself is probably approximately 35 feet deep at its deepest. It is unknown whether there were historical problems with fires at the site. The current problem with fires at the site began in 2023, and VA Energy has responded to five incidents. Temperatures deep within the GOB pile are very high, and when oxygen infiltrates the GOB pile spontaneous combustion can occur. On multiple occasions this appears to have happened due to spring tree growth pulling water from the GOB pile and allowing oxygen to move in. The fires are detected when smoke emits from the pile, and VA Energy responds to excavate and extinguish the burning material. Although the fires are within the GOB pile, there is concern that if ignored they could lead to a forest fire, so VA Energy makes it priority to respond promptly.

Remediation Plan

VA Energy intends to permanently remediate the GOB pile to prevent future fires in spring of 2026. This will involve excavating the GOB pile, cooling with water, and mixing with gravel to dilute the coal debris below a concentration where it can spontaneously ignite. This will then be spread across the site and the site capped to prevent oxygen from penetrating. While this should prevent future fires, during the work release of smoke is likely, since they will be digging into the pile and uncovering very hot material that will likely smoke on contact with air.

Groundwater Concerns

In addition to smoke, residents have expressed concern about groundwater contamination and runoff. None of the residents at Harpers Mill have private wells for drinking water, so if groundwater contamination did exist no one would be exposed. Runoff from the GOB pile will not reach the Harpers Mill community since it drains eastward into Winterpock Creek, which flows southward away from Harpers Mill.

Limitations of Human Health Assessment

No air sampling has been done to measure smoke components at the Winterpock GOB pile that can be evaluated for health impact. Also, the acute nature of the events would limit interpreting or linking any environmental findings to chronic diseases. Coal has been in use as a fuel for power generation, heating, and cooking for centuries, and health effects of exposure to coal smoke studied. Like other types of smoke, coal smoke is a respiratory irritant that can aggravate diseases like asthma and chronic obstructive pulmonary disease (COPD). Exposure to coal smoke can also increase blood pressure and the risk of cardiovascular events like heart attack and stroke. Long-term exposure to coal smoke puts people at risk for lung cancer. Coal smoke exposure has not been linked to other types of cancer.

No environmental sampling has been done at the site of the matchstick factory, so it is possible there are chemical hazards that are not anticipated from the limited information available on the site.

Conclusions

While information is limited and no environmental sampling has been done, based upon information on how strike-anywhere matches containing white phosphorus were manufactured, we do not anticipate the matchstick factory increasing cancer risk in the community.

The GOB pile fires could contribute to respiratory problems in Harpers Mill residents while fires are burning. Children and people with health risks like respiratory and cardiovascular disease should avoid breathing GOB pile smoke. Coal smoke is a potential contributor to lung cancer, but has not been linked to other cancer types. Since the GOB pile has only been catching fire periodically for the last two years and burn time is limited to several weeks or less on each occasion, exposure to GOB pile smoke has been too short in duration to increase risk of lung cancer significantly.

Recommendations

Increased smoke emission is likely in spring 2026 when VA Energy remediates the GOB pile. If smoke from GOB pile fires reaches the Harpers Mill community, residents should take steps to limit their exposure to smoke. Breathing smoke from any source can cause respiratory irritation, asthma attacks, and potentially increase risk of heart attack or stroke in people with cardiovascular disease. Staying indoors with windows closed and using a high-efficiency filter on the home HVAC system can help clean smoke particles from the air. For those especially sensitive, a HEPA air filter for rooms most often used may be helpful.

At other sites slag sometimes has been found to contain high levels of toxic metals such as lead and arsenic. Sampling has not been done on slag at the matchstick factory, but as a precaution children should not play with slag or coke mining debris from the matchstick factory grounds.

VA Energy should notify the public prior to beginning remediation in 2026 since work on the GOB pile will result in smoke being released. If people receive prior notice, they can plan outdoor activities to avoid times when work is going on in case this affects air quality at Harpers Mill.

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