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Contamination still above cleanup levels at Livingston superfund site

Pilot testing will analyze whether additional technologies can reduce PCE in groundwater

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Superfund site boundaries, according to the DEQ.

Montana's environmental protection agency plans to enter another phase of a decades-long groundwater cleanup operation in Livingston with pilot testing of additional remediation methods, following revelations of deeper contamination than initially known.

Officials with the Montana Department of Environmental Quality held a public meeting on June 8 at the City-County Complex in Livingston. They offered results from four test wells at or near the superfund site in Livingston that showed tetrachloroethylene, or

PCE, had decreased since about 2019.

All of the latest readings presented June 8, however, showed PCE amounts still above the cleanup level of 5 micrograms/liter, and two of the wells showed increases since 2022.

Tetrachloroethylene, also known as perchloroethylene, or "perc," or PCE, is a colorless liquid widely used for dry cleaning of fabrics, and is considered a contaminant that has been found in waters that could be used as drinking water sources.

An alluvial aquifer monitoring well at the superfund site yielded about 10 micrograms/liter of PCE, but water from this well was as high as about 45 micrograms/liter in 2015. Bedrock wells at the site yielded PCE levels of about 20 micrograms/liter, compared to below 5 micrograms/liter in early and late 2021, according to the June 8 DEQ presentation.

Officials said cleanup efforts, led by BNSF Railway, are ongoing, and public comment will be sought in the near future on some new methods.

Bedrock contamination

At the meeting, DEQ Environmental Project Officer Andrew Nordberg told attendees that tetrachloroethylene, or PCE, had been found in bedrock groundwater. It's a volatile organic compound used for dry cleaning and textile processing, as a chemical intermediate, and for vapor degreasing in metal-cleaning operations, according to the EPA.

Exposure to PCE may cause irritation of the eyes, skin, nose, throat, and respiratory system; and it may also cause liver damage and is a potential occupational carcinogen, according to the CDC.

"We have learned more about this site in recent years and have found probably more contamination than we thought was present when the record of decision was issued (in 2001) by the department (DEQ)," said Denise Martin, DEQ site response section manager.

There appears to be some interaction between shallow groundwater with the deeper groundwater in the bedrock, from one aquifer to another, according to Nordberg.

“Underneath the (superfund) facility, groundwater typically flows from shallow to deep, but there are locations where groundwater flows vertically upwards, and so that has an impact — it could have an impact on the migration of contamination from deeper zones into shallow zones,” Nordberg said.

The bedrock contamination of PCE was detected by a company that had drilled a well into the bedrock.

“They shared that info with the DEQ and the DEQ and BNSF went about doing additional investigation...,” Martin said.

Before this discovery, it had been assumed bedrock was too impermeable for contamination to enter it, Nordberg said. This could have implications for other superfund sites, DEQ officials said.

“Something I’ve learned in looking at remediation technology courses and site characterization is that there definitely should be an upfront site characterization effort to really pin down where contamination goes,” Nordberg said. “It is a lesson learned over time, and that is being shared.”

The highest concentration of PCE measured at the superfund site was 68,800 micrograms per liter in well 16-6 during a sampling event on Dec. 6, 2016. This sample came from bedrock groundwater from 45-50 feet below ground surface, according to Nordberg. This well is in the bioremediation injection area, which is found just east of the Former Electric Shop on the Livingston Railyard. The contamination at the C&P Packing Property at the superfund site has been removed to levels that are now protective of commercial industrial use and leaching to groundwater, he added.

Diesel plume

DEQ officials also presented evidence the floating diesel plume under the superfund site had shrunk since 2009. As of March, there were four wells at or near the superfund site that indicated the presence of diesel, according to their presentation. The March samples indicated there was diesel floating on top of the water table in that area. Some samples indicated there was only an oily sheen floating on groundwater. One well had a measurable diesel thickness that was above the ROD cleanup level of 1/8 inch, according to Nordberg.

Potable water wells

The DEQ is monitoring groundwater that's downstream of the contaminant source, according to information presented at the meeting.

Groundwater in Livingston flows from the southwest to the northeast in the essentially the same direction as the Yellowstone River, and toward the river, Nordberg said.

"A plume containing chlorinated VOCs is migrating to the east (of the railyard) and does not present a direct threat of contaminating Livingston's wells," reads an April 9, 2001, report from the City of Livingston at https://tinyurl.com/ykut4v7b. "Groundwater development near the plume is limited however."

Potable water in Livingston is obtained from wells as part of various public water systems. The city has six wells, and other wells are operated by mobile home parks, at least one church, at least one RV campsite, and various businesses including lodging establishments and restaurants, according to the 2001 report.

It wasn't immediately clear where the city's wells are in relation to the superfund site. The city draws and distributes potable water from six water wells — no other sources, confirmed City Manager Grant Gager. The wells range from 33 to 75 feet deep, he said in an email.

In general, the depth groundwater in the alluvial aquifer is 20-25 feet below ground surface, and the depth to bedrock is approximately 30-35 feet below ground surface,

according to Nordberg.

“For safety and security reasons, we do not disclose our well sites publicly,” reads Gager’s June 12 email. “There are 6 wells all outside of the plume that are active. Additionally, we have 2 that are not currently in use.”

Gager said there are no wells active in the superfund area.

"There are no pumps east of D Street nor closer than Lewis Street to the site ... all are farther away than that by several blocks in each direction," reads a June 13 email from Gager.

The reason for not disclosing the location of the wells is that other cities have had tamper attempts that close wells for days or weeks, Gager said.

Contamination above cleanup levels is present in the same aquifers used for potable water, but the contamination is not in the same area as the public water supply wells that provide drinking water to residents, according to Nordberg.

"BNSF Railway (BNSF) is required to monitor the boundary of the shallow and deep aquifer plumes to ensure the contamination above the cleanup level does not encroach on public or private water systems," Nordberg wrote in a June 13 email. "Currently, there is no indication that public or private water supplies are at risk, and DEQ will continue to review results and require additional sampling or action when appropriate."

The six city public water supply wells are located either upgradient or cross gradient from the area with the highest concentrations of PCE and/or from the alluvial aquifer plume, according to Nordberg, and the contamination in the aquifers above drinking water standards is currently outside of the area where public water systems draw water, according to Nordberg.

"BNSF Railway (BNSF) is required to monitor the boundary of the shallow and deep

aquifer plumes to ensure the contamination above the cleanup level does not encroach on public or private water systems," reads Nordberg's June 13 email. "BNSF also annually reviews available databases to determine if any new wells have been installed in the area and reports those results to DEQ."

Sampling can be expanded if future results indicate it is necessary, he added.

"I will use the distance to D Street Well as an example that it is not likely for contamination to reach this location: the PCE groundwater plume that is above the cleanup level in the alluvial aquifer is approximately 900 feet wide, while the well is located approximately 2,850 feet cross gradient from the source area and/or plume," Nordberg wrote. "Since the well is cross gradient, this means that groundwater from the contamination area does not flow towards the well. Further, the deeper bedrock contamination with the highest recorded concentrations is localized within the rail yard."

There are three other public water supply wells located downgradient, but they are also not located in the plume boundary of the alluvial aquifer or within the currently known bedrock aquifer plume, according to Nordberg.

Five of the city's wells were tested for volatile organic compounds on Aug. 22, 2022, and all are due to be tested in 933 days as of Tuesday, according to DEQ figures at https://tinyurl.com/3h5k4bad.

More on the volatile organic compounds found in bedrock

From DEQ Environmental Project Officer Andrew Nordberg:

At the time the Record of Decision (ROD) was issued in 2001, no information was available indicating whether the bedrock aquifer(s) underlying the Facility had been impacted by releases from the railyard. Previous investigations at the Facility identified volatile organic compounds (VOCs), specifically chlorinated VOCs (cVOCs), as chemicals of concern (COCs) in the overlying alluvial aquifer. After publication of the ROD, additional information became available that suggested bedrock groundwater underlying the Facility may contain VOCs. Three bedrock wells (MW-11, MW-12, and RUG-1) had been constructed as part of other investigations not conducted by BNSF Railway. The analytical results for groundwater samples indicated tetrachloroethylene (PCE) concentrations ranging from 2.6 to 24 micrograms per liter (µg/L),

exceeding the ROD cleanup level of 5 µg/L. Trichloroethylene (TCE) concentrations ranging from 1.3 to 2.2 µg/L, and cis-1,2-dichloroethene (cis-1,2-DCE) concentrations ranging from 0.92 to 1.9 µg/L. DEQ required for BNSF to complete a supplemental investigation to better identify the nature and extent of bedrock groundwater contamination.

As part of the supplemental investigation, DEQ also required that passive soil gas (vapor-phase PCE) surveys be conducted (1) in the area of the Former Electric Shop/Locomotive Shop and east of the Locomotive Shop, and (2) at the cinder pile to assess the presence and relative concentrations of VOCs in the shallow soil gas in an attempt to locate possible historical PCE release locations and VOC-containing vadose zone soils. The passive soil gas survey indicated elevated PCE soil gas concentrations in the Former Electric Shop and areas within the cinder pile. There currently is no soil gas cleanup level for this facility, and this will be evaluated in the future feasibility study that was mentioned in the public meeting.

Background

In 1883, the Northern Pacific Railroad constructed a rail yard at the site, which by the early 1900s had expanded to include a passenger depot, machine shops, a turntable, a roundhouse and a powerhouse. Historical rail yard operations contaminated soil and groundwater with hazardous chemicals including chlorinated solvents, petroleum hydrocarbons and asbestos. The site closed in 1986.

After completion of a remedial investigation, a risk assessment, two feasibility studies, and several interim remedial actions, DEQ issued a record of decision for the facility in September 2001. The selected final remedy includes several remedial actions and additional investigations.

Subsequent years saw negotiations and litigation, and DEQ has required BNSF, which owns the facility, to develop the remaining work plans and schedules to complete the work required by the record of decision, and BNSF has been given the opportunity to implement the work.

The 1985 Environmental Quality Protection Fund Act created a legal mechanism for DEQ to investigate and clean up, or require liable persons to investigate and clean up, hazardous or deleterious substance facilities in Montana.

“The enforcement mechanisms available to the State will ensure that the work will be timely performed with ongoing state oversight,” reads a 2017 EPA report. “If BNSF does not implement any future work, then DEQ will complete the remedial actions itself utilizing funds from the Environmental Quality Protection Fund (EQPF) and cost recover the remedial tion costs or take other administrative or legal action under CECRA to ensure that the remedial ctions are completed.”

**EPA, https://tinyurl.com/5er4d6mx, https://tinyurl.com/r8wxa37z.*

MORE INFORMATION

2023_06_BNLivingston-MWYE_PublicMeeting_Combined_website.pdf

Contaminants associated with the Burlington Northern Livingston Shop Complex State Superfund Facility

Media	Contaminant
Air	Chloroethene (vinyl chloride)
Air	Tetrachloroethene
Air	Trans-1,2-dichloroethene
Air	Trichloroethene
Air	Cis-1,2-dichloroethene
Groundwater	1,4-dichlorobenzene
Groundwater	2-chlorotoluene
Groundwater	Chlorobenzene
Groundwater	Chloroethene (vinyl chloride)
Groundwater	Methylene chloride
Groundwater	Tetrachloroethene
Groundwater	Trichloroethene
Groundwater	Cis-1,2-dichloroethene
Sediment	2-chlorotoluene
Soil	Benzo(b)fluoranthene
Soil	Benzo(k)fluoranthene

Media	Contaminant
Soil	Benzo[a]pyrene
Soil	Chrysene
Soil	Dibenzo(a,h)anthracene
Soil	Indeno(1,2,3-cd)pyrene
Soil	Lead