State of New Jersey
DEPARTMENT OF HEALTH
PO BOX 369
TRENTON, N.J. 08625-0369

MIKIE SHERRILL
Governor

www.nj.gov/health

DR. RAYNARD E. WASHINGTON
Commissioner

October 6, 2026

Mr. David Zaback
Farmland Preservation Coordinator
New Jersey Department of Agriculture
State Agriculture Development Committee (SADC)
200 Riverview Plaza – 3rd Floor
Trenton, NJ 08611

Dear Mr. Zaback,

The New Jersey Department of Health (NJDOH) has prepared this Letter Health Consultation (LHC) at your request to evaluate the potential public health implications from exposure to 1,4-dioxane in drinking water and irrigation water that may be used to irrigate crops for a farm, known herein as the Oberly Farm, located in Franklin Township, Warren County, New Jersey. You also requested an evaluation of the risk to residents with 1,4-dioxane detected in several nearby private residential drinking water wells. This evaluation follows the risk assessment process in accordance with the federal Agency for Toxic Substances and Disease Registry (ATSDR).

Based on the information you provided,1,4-dioxane was found in the Oberly Farm property residential drinking water well in March 2020 at a concentration of 0.79 parts per billion (ppb) and in ten nearby residential private wells in June 2023. The 1,4-dioxane levels detected in these nearby wells ranged from 0.57 to 3.3 ppb. Per your request, the NJDOH evaluated the potential health risk to residents using this minimum and maximum concentration range for 1,4-dixoane in the nearby residential wells and did not conduct separate risk assessments for each of the ten nearby residential wells. Additionally, it should be noted that the Oberly Farm well was resampled in June 2023 and 1,4-dioxane was not detected in this sampling event.

Identifying Exposure

People are exposed to an environmental contaminant only through contact with a contaminant (e.g., breathing contaminated air, skin contact with a substance, or drinking a substance containing the contaminant). Exposure pathways are used to evaluate specific ways in which people were, are, or will be exposed to environmental contamination in the past, present, and future.

An exposure pathway is a series of steps starting with the release of a contaminant in environmental media and ending at the interface with the human body. A completed exposure pathway consists of five elements:

1. Source of contamination (potable well);
2. Environmental media and transport mechanisms (water and air);
3. Point of exposure (farm/residence);
4. Route of exposure (ingestion and inhalation); and

5. Exposed population (residents)

Generally, ATSDR considers three exposure categories:

a) completed exposure pathways — all five elements of a pathway are present;
b) potential exposure pathways — one or more of the elements might not be present, but information is insufficient to eliminate or exclude the element; and
c) eliminated exposure pathways —one or more of the elements is absent.

Completed Exposure Pathways

Based on the information and data provided by the SADC, three completed exposure pathways were identified and are described below. The NJDOH will evaluate the potential public health implications for these exposure pathways.

Oberly Farmhouse:

Ingestion of and dermal (skin) contact with contaminated drinking water (past): For the past, there was a completed exposure pathway for residents drinking and bathing in water contaminated with 1,4-dioxane from the private potable well providing water to the home. Current and future exposures to contaminated water are not a concern based on the most recent sampling event in June 2023, where 1,4-dioxane was not detected in the well water. Based on information provided to NJDOH, this residence will be connected to the municipal water supply in the near future.

Inhalation of contaminated water vapors in air while showering or bathing (past): For the past, there was a completed exposure pathway for residents breathing air contaminated with 1,4-dioxane while bathing or showering. The 1,4-dioxane in the well water supplying the home can volatilize into the air while showering and be inhaled by residents in the home. Current and future exposures are not a concern based on the most recent sampling event in June 2023, which did not detect 1,4-dioxane in the well water.

Ingestion of produce grown on farmland irrigated with well water (future): Based on the March 2020 sampling event where 1,4-dioxane was found in the well water, there is a completed exposure pathway for residents consuming produce (fruits and vegetables) grown on farmland that may be irrigated with water contaminated with 1,4-dioxane. This March 2020 sampling event was used to evaluate exposures even though the most recent data did not detect 1,4-dioxane in the potable well at the Oberly farm property.

Other Residences:

Ingestion of and dermal (skin) contact with contaminated drinking water (past, current and future): For the past, there was a completed exposure pathway for residents drinking and bathing in water contaminated with 1,4-dioxane from the private potable wells providing water to the ten homes near the Oberly Farm property. Based on well water data collected in June 2023, current and future exposures to contaminated water in these ten homes may be continuing until the homes are connected to the municipal water supply, which is expected to occur in the near future.

Inhalation of contaminated water vapors in air while showering or bathing (past, current and future): For the past, there was a completed exposure pathway for residents breathing air contaminated with 1,4-dioxane while bathing or showering. The 1,4-dioxane detected in the well water supplying these ten homes can volatilize into the air while showering and be inhaled by residents in the home. Based on well water data collected in June 2023, current and future exposures to contaminated water in these ten

homes may be continuing until the homes are connected to the municipal water supply, which is expected to occur in the near future.

Exposure and Health Effects Evaluation

Oberly Farm Property – 1,4 dioxane in drinking water and future crop irrigation

Although the most recent sampling event for the Oberly Farm well in June 2023 showed no detection of 1,4-dioxane, NJDOH was requested to evaluate the potential health impacts for this property using the 0.79 ppb concentration detected in March 2020 in the event that the water is used for crop irrigation in the future. NJDOH is also aware that this well is still being used for drinking water with plans to be connected to the municipal water supply in the near future. It should be noted that 1,4-dioxane is not currently regulated and therefore is not monitored per regulatory requirements in municipal drinking water supplies. While there are no current federal or New Jersey drinking water standards for 1,4-dioxane, the New Jersey Drinking Water Quality Institute (DWQI) recommended a health-based drinking water Maximum Contaminant Level (MCL) of 0.33 ppb, which was accepted by the New Jersey Department of Environmental Protection (NJDEP) in December 2021. Following this, the NJDEP has initiated stakeholder engagement in anticipation of rulemaking to establish and implement an MCL for 1,4-dioxane, which has not yet been established.

Exposure doses were calculated for the water ingestion scenario using the ATSDR Public Health Assessment Site Tool (PHAST). An exposure dose is the estimated amount of a contaminant that a person eats, drinks, or breathes in over a specific period of time. For this evaluation, the exposure doses estimate the amount of 1,4-dioxane residents may drink from their well water. For people with typical (average) drinking water ingestion rates, a central tendency exposure (CTE) scenario is used. For people with above-average ingestion rates, a reasonable maximum exposure (RME) scenario is used. The RME refers to people with above-average exposures but still within a realistic daily water intake. The RME scenario is the most conservative scenario and will be used to evaluate the potential for harmful health effects.

In order to estimate the risk from showering and bathing, ATSDR's Shower Model was used. The model also includes ingestion of and skin contact with contaminated drinking water [ATSDR 2024].

To evaluate the potential for health risks to people consuming farm produce irrigated with water containing 1,4-dioxane, NJDOH used the Risk Assessment Information System (RAIS) web-based tool. The RAIS tool is aligned with the U.S. Environmental Protection Agency's risk assessment approach and sponsored by the U.S. Department of Energy in collaboration with Oak Ridge National Laboratory and other environmental and public health organizations.

The RAIS tool includes a farming risk assessment scenario in which risks from the direct consumption of agricultural crops or homegrown produce irrigated with contaminated water are evaluated. To determine the risk for harmful noncancer health effects, NJDOH compared the calculated exposure doses for 1,4-dioxane to EPA's health guideline called a Reference Dose (RfD), which is an estimate of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of harmful non-cancer effects during a lifetime. It is measured in milligrams of a substance per kilogram of body weight per day (mg/kg/day)

To determine the risk for harmful noncancer health effects, NJDOH compared the calculated exposure doses for drinking water and the measured indoor air concentrations for 1,4-dioxane to ATSDR's health guideline called a Minimal Risk Levels (MRL). MRLs identify exposures that could be potentially hazardous to human health. MRLs can be set for three different time periods depending on the length of time people are exposed to the substance:

- acute (up to 14 days),
- intermediate (from 15-364 days), and
- chronic (exposure for more than 365 days)

Exposures to contaminants above the MRL (for the relevant time period) do not necessarily mean that health problems will occur. An MRL is an estimate of the amount of a chemical a person can breathe, eat, or drink each day without a detectable noncancer risk to health.

MRLs are based on toxicological studies in animals and on reports of human occupational (workplace) exposures. MRLs are usually extrapolated doses from observed effect levels in animal toxicological studies or occupational studies. They are adjusted by a series of uncertainty factors or through the use of statistical models. In toxicological literature, observations might be reported as:

- **No-observed-adverse-effect level (NOAEL)**: A NOAEL is the ***highest*** tested dose of a substance that has been reported to have ***no*** harmful health effects on people or animals.
- **Lowest-observed-adverse-effect level (LOAEL)**: A LOAEL is the ***lowest*** tested dose of a substance that has been reported to ***cause*** harmful health effects in people or animals.

For water ingestion and skin contact, the calculated exposure dose is compared to the MRL and the applicable NOAEL or LOAEL. As the exposure dose increases beyond the MRL and approaches the level of NOAEL and/or LOAEL, the likelihood of adverse health effects increases. For inhalation exposures, ATSDR uses the measured air concentrations of the contaminant compared to the MRL and if applicable, the LOAEL or NOAEL to evaluate the potential for noncancer health effects.

For health effects other than cancer, exposure doses and health guidelines are used to calculate hazard quotients (HQs). The hazard quotient is defined as the exposure dose divided by the appropriate health guideline value, which in this case is the MRL or the RfD. When the hazard quotient exceeds 1.0 and approaches effect levels seen in toxicological literature, the potential for harmful effects increases. Noncancer health effects are not expected for hazard quotients below 1.0.

Exposed individuals are defined by site-specific exposure scenarios (e.g., workplace or residence). For this evaluation, NJDOH used the residential scenario which assumes a 24 hours per day and seven days per week exposure duration.

As mentioned above, the three completed exposure pathways that will be evaluated for the potential for health effects are as follows:

- Inhalation of contaminated water vapors in air while showering or bathing,
- Ingestion of and dermal (skin) contact with contaminated drinking water, and
- Ingestion of produce grown on farmland irrigated with 1,4-dioxane-contaminated well water in the future.

ATSDR Shower Model – Inhalation, dermal (skin), and water ingestion exposures

To evaluate past exposures to 1,4-dioxane in drinking water, ATSDR's Shower Model was used. This model predicts how much 1,4-dioxane would be released into the air that could be breathed in while bathing or showering. It also calculates exposure doses for ingesting contaminated drinking water.

Due to the limited number of water samples collected for the Oberly Farm property, the only detection of 1,4-dioxane in the water of 0.79 ppb was used to calculate exposure doses for ingestion of

drinking water and as the input concentration for the shower model for breathing in water vapors while showering or bathing. The Shower model assumes four people, including children, live in the home and were exposed to 1,4-dioxane-contaminated water.

Table 1 summarizes the predicted air concentrations for 1,4-dioxane from showering or bathing for the most conservative RME scenario. This scenario assumes the first three people take 10-minute morning showers and the fourth person takes a 15-minute morning shower, each followed by five-minute bathroom stays. Due to the accumulation of vapors in the air from three consecutive showers, the fourth person is exposed to the highest concentration of vapors.

The adjusted 1,4-dioxane concentration in Table 1 is based on a time-weighted average air concentration calculated for the fourth person as they spend their time in various parts of the house. This daily exposure concentration applies to children and adults who take showers. Younger children may not take showers but are exposed from taking baths. Their inhalation and skin contact exposures from a 20-minute bath scenario are comparable to the RME shower scenario. Therefore, the adjusted 1,4-dioxane air concentration is the same for both adults and children.

Table 1. ATSDR Shower Model Results – Inhalation Exposures to 1,4-dioxane - Oberly Farm

Exposure group	Adjusted 1,4-dioxane concentration in air (ppb)	Chronic MRL (ppb)	Hazard Quotient (RME)	Potential for noncancer health effects
Child or adult resident	0.0047	30	0.00015	No (HQ < 1)

Definitions: RME = reasonable maximum (above average) exposure; ppb = parts per billion; MRL = chronic duration minimal risk level; Hazard Quotient (HQ) = Adjusted 1,4-dioxane concentration RME/MRL = 0.0047/30 = 0.00015

As shown above in Table 1, the RME hazard quotient is less than 1.0 and therefore there is no potential for harmful noncancer health effects for the residents in this home showering or bathing in water containing 1,4-dioxane at 0.79 ppb.

The shower model was also used to calculate exposure doses for adult and child residents in this home ingesting drinking water containing 1,4-dioxane. The calculated doses also include skin contact with contaminated water. Table 2 provides the combined doses for water ingestion and skin contact with 1,4-dioxane in drinking water at a concentration of 0.79 ppb. Exposure doses for children ages birth through age 20 years were calculated using ATSDR's PHAST tool. The highest calculated dose is for children ages birth to less than one year old and is presented in Table 2.

As shown below in Table 2, the RME hazard quotient is less than 1.0 and therefore, harmful noncancer health effects are not expected from ingesting or skin contact with 1,4-dioxane in drinking water for residents at the Oberly Farm property.

Table 2. Noncancer health effects – Ingestion and skin contact with water containing 1,4-dioxane – Oberly Farm

Exposure group	RME Dose [a] (mg/kg/day)	Chronic MRL (mg/kg/day)	Hazard Quotient (HQ)	Potential for noncancer health effects
Child (birth to < 1 year) *	0.00011	0.1	0.0011	No (HQ < 1)
Adult	0.000032	0.1	0.00032	No (HQ < 1)

Definitions: mg/kg/day = milligrams of contaminant per kilogram per day; RME = Reasonable maximum exposure; MRL = ATSDR chronic minimal risk level; * represents most sensitive age group and maximum child dose; [a] Represents the combined exposure doses for water ingestion and skin contact for chronic exposures to 1,4-dioxane at 0.79 ppb; Hazard quotient (HQ) = RME Dose / Chronic MRL

Exposures to 1,4-dioxane from ingestion of produce from future irrigation with contaminated well water

The NJDOH utilized the RAIS model to evaluate the potential health impacts of residents consuming crops irrigated by the Oberly farm potable well. The assessment was based on a "farmer/resident" scenario for consumption of farm products for a subsistence farmer, including a child and an adult. The farmer scenario assumes the adult and child living on the farm will be exposed via the consumption of homegrown produce (100% of fruit and vegetables are from the farm). In addition to produce, 100% of consumption of the following are also considered to be from the farm: beef and milk. All feed (100%) for farm products is considered to have been grown on contaminated portions of the site. The RAIS tool utilizes the RME scenario for exposure dose estimates.

The NJDOH used the RAIS model to estimate the risk to adults and children consuming farm produce irrigated with water containing 0.79 ppb of 1,4-dioxane. Table 3 shows the exposure doses and hazard quotients for people consuming farm produce irrigated with 1,4-dioxane contaminated water. As shown in Table 3, the hazard quotients for adults and children ingesting produce irrigated with water containing 0.79 ppb of 1,4-dioxane are less than 1.0. Therefore, harmful noncancer health effects are not expected.

Table 3. Noncancer health effects – Ingesting produce irrigated with water containing 1,4-dioxane at 0.79 ppb

Exposure group	Exposure Dose [a] (mg/kg/day)	Chronic RfD (mg/kg/day)	Hazard Quotient (HQ)	Potential for noncancer health effects
Child (birth to < 6 years) *	0.0022	0.03	0.074	No (HQ < 1)
Adult	0.0011	0.03	0.038	No (HQ < 1)

Definitions: mg/kg/day = milligrams of contaminant per kilogram per day; RfD = Reference Dose; [a] Represents the combined exposure doses for water ingestion and skin contact for chronic exposures to 1,4-dioxane at 0.79 ppb * represents most sensitive age group and maximum child dose. Hazard quotient (HQ) = Exposure dose / Chronic RfD

Residential Properties - 1,4-dioxane in residential private wells near Oberly Farm

NJDOH used the maximum detected concentration of 3.3 ppb of 1,4-dioxane found in the residential potable wells in the area of Oberly Farm to evaluate the potential risk for harmful health effects to residents in the ten homes where 1,4-dioxane was detected in June 2023. This evaluation includes exposures to residents while drinking, showering, and bathing in contaminated well water. Dermal (skin) contact was also included.

As shown below in Table 4, the RME hazard quotient is less than 1.0 and therefore there is no potential for harmful noncancer health effects showering or bathing in water containing 1,4-dioxane at 3.3 ppb.

Table 4. ATSDR Shower Model Results – Inhalation Exposures to 1,4-dioxane – Maximum concentration in residential well drinking water

Exposure group	Adjusted 1,4-dioxane concentration in air (RME) ppb	Chronic MRL (ppb)	Hazard Quotient (RME)	Potential for noncancer health effects
Child or adult resident	0.020	30	0.00067	No (HQ < 1)

Definitions: RME = reasonable maximum (above average) exposure; ppb = parts per billion; MRL = chronic duration minimal risk level; Hazard Quotient (HQ) = Adjusted 1,4-dioxane concentration RME/MRL

The shower model was also used to calculate exposure doses for adult and child residents in this home ingesting drinking water containing 1,4-dioxane. The calculated doses also include skin contact with contaminated water. Table 5 provides the combined doses for water ingestion and skin contact with 1,4-dioxane in drinking water at a concentration of 3.3 ppb. Exposure doses for children ages birth through age 20 years were calculated using ATSDR's PHAST tool. The highest calculated dose is for children ages birth to less than one year old and is presented in Table 2.

As shown below in Table 5, the RME hazard quotient is less than 1.0 and therefore, harmful noncancer health effects are not expected from ingesting or skin contact with 1,4-dioxane in drinking water for residents in the area of the Oberly Farm property.

Table 5. Noncancer health effects – Ingestion and skin contact with water containing maximum concentration of 1,4-dioxane in residential well drinking water

Exposure group	RME Dose [a] (mg/kg/day)	Chronic MRL (mg/kg/day)	Hazard Quotient (HQ)	Potential for noncancer health effects
Child (birth to < 1 year) *	0.00047	0.1	0.0047	No (HQ < 1)
Adult	0.00013	0.1	0.0013	No (HQ < 1)

Definitions: mg/kg/day = milligrams of contaminant per kilogram per day; RME = Reasonable maximum exposure; MRL = ATSDR chronic minimal risk level; * represents most sensitive age group and maximum child dose; [a] Represents the combined exposure doses for water ingestion and skin contact for chronic exposures to 1,4-dioxane at 3.3 ppb; Hazard quotient (HQ) = RME Dose / Chronic MRL.

Since harmful noncancer health impacts would not be expected using the maximum concentration of 1,4-dioxane detected in the ten residential well water samples, harmful health impacts would also not be expected for the remaining nine homes.

Evaluating the Potential for Cancer Health Effects

NJDOH evaluates the potential for cancer health effects by assessing the excess cancer risk relating to exposure over the background cancer risk. In New Jersey, approximately 45% of women and 47% of men (about 46% overall) will be diagnosed with cancer in their lifetime [NJDOH 2023]. This is referred to as the "background cancer risk."

The term "excess cancer risk" represents the risk on top of the background cancer risk and is referred to as the Lifetime Excess Cancer Risk, or LECR. An LECR of "one-in-a-million" (1/1,000,000 or 10^{-6} cancer risk) means that if one million people are exposed to a cancer-causing substance at a certain level for a period of time, then one cancer above the background number of cancers may develop in those

one million people over the course of their lifetime (considered 78 years).

To put the LECR of 10^{-6} in context of New Jersey's background cancer risk, the number of cancers expected in one million people over their lifetime is 460,000 (46%) in New Jersey. If these one million people are all exposed to a cancer-causing substance for a specific duration, then 460,001 people may develop cancer instead of the expected 460,000 over the course of their lifetime (78 years).

The NJDOH follows ATSDR's guidelines to evaluate theoretical cancer risks from environmental exposures (ATSDR 2022). A concern for an increased risk is categorized as an excess of one or more additional cancer cases per 10,000 people (expressed as risk in "the $1x10^{-4}$ range" or higher). This is a theoretical estimate of cancer risk that NJDOH and ATSDR use as a tool for deciding whether public health actions are needed to protect health. It is not an actual estimate of cancer cases in a community and is not a prediction that cancer will occur.

NJDOH and ATSDR categorize no concern for an increased risk to include risks in the range between one and nine additional cancer cases per 100,000 people (expressed as "the $1x10^{-5}$ range") and an even lower risk is represented by the range between one and nine additional cancer cases per 1,000,000 people (expressed as "the $1x10^{-6}$ range").

Health guidelines are typically developed for carcinogens based on one excess cancer case per 1,000,000 individuals exposed. According to the U.S. Department of Health and Human Services (DHHS), possible cancer classes of contaminants detected at a site are as follows:

- Known human carcinogen;
- Reasonably anticipated to be a carcinogen; and
- Not classified

The limited number of studies available do not show whether 1,4-dioxane causes cancer in humans. Laboratory rats that breathed 1,4-dioxane during most of their lives developed cancer inside the nose and abdominal cavity. Laboratory rats and mice that drank water containing 1,4-dioxane during most of their lives developed liver cancer; the rats also developed cancer inside the nose. Scientists are debating the degree to which the findings in rats and mice apply to exposure situations commonly encountered by humans. The DHHS considers 1,4-dioxane as reasonably anticipated to be a human carcinogen [ATSDR 2012].

Cancer exposure doses for ingesting drinking water containing 1,4-dioxane were calculated using the following formula:

$$\textit{Cancer Exposure Dose (mg/kg-day)} = \frac{C \times IR}{BW} \times \frac{ED}{AT}$$

where, C = 1,4-dioxane concentration in mg/L
IR = ingestion rate in liters per day (L/day)
BW = age specific body weight for children, 80 kg for adults
ED = exposure duration in years (varies with exposure scenario)
AT= averaging time = 78 years (approximate lifetime expectancy)

The site-specific assumptions and recommended exposure factors used to calculate the lifetime excess cancer risk for children and adults are the same as those used to assess noncancer health effects. Using the ATSDR water exposure dose guidance, the LECR was calculated by multiplying the cancer exposure dose by EPA's oral cancer slope factor (CSF).

CSF is a numerical value to estimate the risk of cancer associated with exposure to carcinogenic substances. It is defined as the slope of the dose-response curve obtained from animal or human cancer studies and represents the upper-bound estimate of the probability of developing cancer over a lifetime from exposure to a specific chemical at a given dose for a specified duration. The CSF is expressed as the inverse of the daily exposure dose, i.e., $(mg/kg/day)^{-1}$, which means that as the daily dose increases, so will the cancer risk estimate. The LECRs for drinking water exposures were calculated using the following formula [ATSDR 2023]:

$$LECR_{drinking\ water} = Cancer\ Exposure\ Dose\ from\ Drinking\ Water \times oral\ CSF$$

where,

LECR = Lifetime Excess Cancer Risk
CSF = Cancer Slope Factor $(mg/kg\text{-}day)^{-1}$

The LECR for indoor air exposures is calculated by multiplying the air concentration and exposure duration by the EPA's inhalation unit risk (IUR) for cancer. The IUR is the incremental risk posed by a specific concentration unit in air (usually expressed as micrograms of a pollutant in air per cubic meter ($\mu g/m^3$) of ambient air. This LECR calculation yields the relative increase in cancer risk (above the background rate) from indoor air exposure to pollutants.

Oberly Farm Property

As shown in Table 6, the LECR for Oberly Farm residents drinking, showering, and consuming produce potentially irrigated with water containing 1,4-dioxane is approximately eight in 100,000 similarly exposed people. This indicates no concern for an increased theoretical cancer risk.

Table 6. Cancer Risks (LECR) from 1,4-dioxane exposures - Oberly Farm well

Exposure Pathway	1,4-dioxane air concentration or exposure dose	Exposure duration (years)	Average lifetime (years)	Cancer inhalation unit risk or oral slope factor	LECR
Inhalation of air while showering or bathing	0.0047 ppb	33	78	1.8×10^{-5} ** $(ppb)^{-1}$	**4×10^{-8}**
Ingestion of and dermal (skin) contact with drinking water	3.2×10^{-5} mg/kg/day *	33	78	0.1^{+} $(mg/kg/day)^{-1}$	**1×10^{-6}**
Ingestion of produce irrigated with well water	7.5×10^{-4} mg/kg/day *	40 ***	70	0.1^{+} $(mg/kg/day)^{-1}$	**8×10^{-5}**
Total cancer risk					**8×10^{-5}**

Definitions: ppb = parts per billion; mg/kg/day = milligrams of contaminant per kilogram per day; LECR = lifetime excess cancer risk; Example LECR calculation = 1,4-dioxane concentration of 0.0047 ppb x 33 years/78-year lifetime x cancer unit risk of 1.8×10^{-5} = LECR of 4×10^{-8}; * Represents the calculated exposure dose from the ATSDR shower model; ** Represents the inhalation unit risk for cancer; $^{+}$ Represents the cancer slope factor for 1,4-dioxane; *** Represents a farmer scenario exposure duration.

Nearby residential properties

As shown in Table 7, the LECR for residents in the area of the Oberly Farm property drinking and showering with water containing 1,4-dioxane at the maximum detected concentration is approximately six in 1,000,000 similarly exposed people. This indicates no concern for an increased

theoretical cancer risk.

Table 7. Cancer Risks (LECR) from exposures to maximum concentration of 1,4-dioxane in residential well drinking water

Exposure Pathway	1,4-dioxane air concentration or exposure dose	Exposure duration (years)	Average lifetime (years)	Cancer inhalation unit risk or oral slope factor	LECR
Inhalation of air while showering or bathing	0.020 ppb	33	78	1.8×10^{-5} ** $(ppb)^{-1}$	**2×10^{-7}**
Ingestion of and dermal (skin) contact with drinking water	0.00013 mg/kg/day *	33	78	0.1 $^{+}$ $(mg/kg/day)^{-1}$	**6×10^{-6}**
Total cancer risk					**6×10^{-6}**

Definitions: ppb = parts per billion; mg/kg/day = milligrams of contaminant per kilogram per day; LECR = lifetime excess cancer risk; Example LECR calculation = 1,4-dioxane concentration of 0.020 ppb x 33 years/78-year lifetime x cancer unit risk of 1.85×10^{-5} = LECR of 2×10^{-7}; * Represents the calculated exposure dose from the ATSDR shower model; ** Represents the inhalation unit risk for cancer; $^{+}$ Represents the cancer slope factor for 1,4-dioxane;

Conclusions

Based on the information provided to NJDOH, harmful health effects are not expected for Oberly Farm residents or residents in the surrounding area with 1,4-dioxane present in potable well water. The results of the RAIS model showed no harmful health impacts to future residents consuming crops irrigated with well water containing 1,4-dioxane at 0.79 ppb for the Oberly farmhouse residents. Additionally, it should be noted that the Oberly Farm well was resampled in June 2023 and 1,4-dioxane was not detected in this sampling event.

NJDOH's evaluation also shows no harmful health effects are expected for residents at Oberly farm and surrounding homes drinking, showering, and bathing in water containing 1,4-dioxane using the maximum concentrations detected in these potable wells. It should be noted that these conclusions are based on limited data and levels of 1,4-dioxane could change over time. The NJDOH understands that these residences will be connected to the municipal water supply in the near future.

Please feel free to contact me or Christa Fontecchio at 609-826-4984 or by email at Somia.Aluwalia@doh.nj.gov or Christa.Fontecchio@doh.nj.gov with any questions.

Sincerely,

Somia Aluwalia

Somia Aluwalia, Ph.D.
Environmental and Occupational Health Surveillance Program
New Jersey Department of Health

References:

[ATSDR] Agency for Toxic Substances and Disease Registry. April 2012. Toxicological Profile for 1,4-Dioxane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. Available at: atsdr.cdc.gov/ToxProfiles/tp187.pdf

[ATSDR] Agency for Toxic Substances and Disease Registry. Public Health Assessment Guidance Manual (Update). U.S. Department of Health and Human Services, Atlanta, GA. 2022. Available from: atsdr.cdc.gov/pha-guidance/index.html.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2023. Exposure Dose Guidance for Water Ingestion. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Jan 31.

[ATSDR] Agency for Toxic Substances and Disease Registry. 2024. Shower and Household Water-use Exposure (SHOWER) Model v4.0, User's Guide. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, September 25.
[NJDOH] New Jersey Department of Health. 2023. New Jersey State Cancer Registry SEER*Stat Database 2022 Analytic File, accessed on 3/8/2023.

The Risk Assessment Information System (RAIS Tool). Available at: https://rais.ornl.gov/

Non-Certified

This publication was made possible by a cooperative agreement [program # CDC-RFA-TS-23-0001] from the Agency for Toxic Substances and Disease Registry (ATSDR). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the ATSDR, or the U.S. Department of Health and Human Services.