Children's Health and Groundwater Quality at Child Care Operations Using Private Water Wells

White Paper Prepared by the Texas Groundwater Protection Committee (TGPC)
Groundwater Issues (GWI) Subcommittee

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Executive Summary

Water is essential to human life. Many Texans rely on groundwater as their primary source of drinking water. Groundwater can become contaminated by naturally occurring processes or by human activities. Drinking water contaminated with unsafe levels of contaminants or pathogenic microorganisms can cause serious illness and even death. Infants and young children are more susceptible to the harmful health effects of certain groundwater contaminants than adults. They rely on the institutions designated to protect them and the adults who care for them to keep them safe from harmful exposures in the places where they live, learn, grow, and play. This white paper discusses regulatory gaps in protecting children from groundwater contaminants in unregulated private water wells in child care settings and offers recommendations to enhance protection.

Laws and regulations require Public Water Systems (PWSs) to treat groundwater so that the water they deliver does not contain levels of contamination exceeding the National Primary Drinking Water Regulations (NDPWR), or Maximum Contaminant Levels (MCLs), established by the United States (U.S.) Environmental Protection Agency (EPA) to protect public health. However, groundwater quality in private water wells is not regulated by federal or state agencies in Texas. Child Care Operations (CCOs) are not required to disclose the source of their drinking water or to perform water quality testing if they use a private water well. While the Texas Health and Human Services Commission's (HHSC's) Child Care Regulations Program (CCR) requires CCOs who use private water supplies to meet certain conditions, these conditions may not be adequate to ensure that children are not exposed to harmful levels of groundwater contaminants. These regulatory gaps may put children and staff served by these CCOs at risk for harm.

The number of CCOs using private water wells is unknown as this information is not currently collected by a state agency or any other entity. It is reasonable to assume that CCOs that are located in areas not served by PWSs and that are licensed with a total capacity to care for less than 25 children may use water supplied by private water wells. Because water systems that serve 25 or more persons for at least 60 days out of the year would meet criteria to be classified and regulated as a PWS, CCOs that use a private water well and care for 25 or more children would likely meet criteria to be regulated as a PWS by the Texas Commission on Environmental Quality (TCEQ). Analyses were done using publicly available datasets to determine 1) how many CCOs are in areas not served by PWSs and care for less than 25 persons, and 2) the proximity of these CCOs to known groundwater contamination. The analyses were limited to licensed or registered child Day Care Operations (DCOs), a subset of CCOs that excludes residential operations or child placing agencies. The analyses found:

- 221 DCOs care for less than 25 children and are located outside the service boundaries of a PWS, with a combined capacity to serve 2,077 infants and children.
- Of these 221 DCOs, 20 were within 1 mile of an active groundwater contamination case in 2021 as per TCEQ's Groundwater Contamination Viewer.

- A majority of DCOs that have a capacity to care for less than 25 children and are more than 55 feet from a PWS service boundary (n=200) were located in a county and aquifer zone in which a groundwater sample exceeded state or federal MCLs or Health Advisory Levels (HALs). Twenty-seven percent were in a county and aquifer zone where a groundwater sample exceeded the MCL for nitrate/nitrite. Consuming nitrates at levels above the MCL can cause methemoglobinemia, a serious and potentially fatal illness in infants and children under six years of age.

The analyses are useful for showing that a number DCOs likely to rely on private water wells are located in areas where documented groundwater contamination exists, or where levels of some naturally occurring contaminants exceed MCLs. However, it is not possible to reliably estimate the number of children and staff who may be potentially impacted by this issue due to limitations in the available data.

Illness or death from drinking contaminated groundwater is completely preventable. The Texas Legislature should ensure that state agencies take steps to close regulatory gaps and promote public health efforts to protect infants and young children from groundwater contamination in child care settings. Recommendations for the first steps in accomplishing this goal include the following:

1. Direct HHSC's CCR to update its process to document the source of drinking water (e.g., public drinking water, private water well, purchased consumer water, other) in the initial licensing application, and also during the renewal process for licensed, registered, and listed CCOs.
2. Direct the Texas Department of State Health Services (DSHS) or another appropriate state agency or partner to develop voluntary guidance for child care providers on health-based well water safety. This guidance should include when to test well water, which constituents should be tested, and what to do if a value exceeding MCLs or HALs for safe drinking water is found.
3. Direct CCR or another appropriate state agency or partner to evaluate the data on drinking water sources collected in licensing documents to determine if children may be consuming drinking water from unregulated private water wells at CCOs.
4. If the evaluation finds that children attending CCOs may be consuming drinking water from unregulated private water wells, the Texas Legislature should take action, or ensure that relevant state agencies take action, to protect children from potentially harmful constituents in groundwater using the evaluation to inform policy decisions. Options for possible regulatory and nonregulatory actions that state agencies can take to protect children are described in Appendix A.
5. Require all CCOs to test water from drinking water faucets for lead based on following guidance from U.S. EPA's 3Ts Program. If lead levels exceed state or federal lead action levels, require that water used for drinking, cooking, or making formula be treated to reduce lead to below action levels, or that an alternative source of drinking water with levels below the action level be provided.

These recommendations aim to:

- Strengthen protection of children's health in Texas from potentially harmful groundwater contaminants.
- Ensure that current rules and regulations in Texas promote the health, safety, and welfare of children attending CCOs.
- Support Texas CCOs in keeping children safe through clear guidance and actionable rules relating to the use of private water wells.

Every child in Texas deserves access to safe drinking water in the places where they live, learn, grow, and play.

Acronym List

AAP	American Academy of Pediatrics
ac-ft	acre-feet
ATSDR	Agency for Toxic Substances and Disease Registry
CCO	Licensed, registered, or listed Child Care Operation
CCL	Child Care Licensing
CCR	HHSC's Child Care Regulations Program (formerly Child Care Licensing)
CDC	Centers for Disease Control and Prevention
CFOC	Caring for Our Children: National Health and Safety Performance Standards Guidelines for Early Care and Education Programs
CFR	Code of Federal Regulations
CPD	Consumer Protection Division
DCO	Child Day Care Operations*
	*A subset of CCOs that includes child care centers, registered and licensed child care homes, and before-school and after-school child care programs, but not foster care or residential child care operations
DSHS	Texas Department of State Health Services
EPA	Environmental Protection Agency
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
GHRC	Texas Human Resources Code
GWI	Groundwater Issues
HAL	Health Advisory Level
HHSC	Texas Health and Human Services Commission
kg	Kilogram
L	Liter
LCRI	Lead and Copper Rule Improvements
LCRR	Lead and Copper Rule Revision
LTSCC	Lead Testing in School and Child Care
MCL	Maximum Contaminant Level
ml	Milliliter
NPDWR	National Primary Drinking Water Regulations
NOAA	National Oceanic and Atmospheric Administration
NRC	National Resources Center for Health and Safety in Child Care and Early Education
PCB	Polychlorinated biphenyls
PCE	Perchloroethylene (also known as tetrachloroethylene)

PEHSU	Pediatric Environmental Health Specialty Unit
PWS	Public Water System
RRC	Railroad Commission of Texas
§	Section
SDWA	Safe Drinking Water Act
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TGPC	Texas Groundwater Protection Committee
TT	Treatment Technique
TTUHSC	Texas Tech University Health Sciences Center
TWC	Texas Water Code
TWDB	Texas Water Development Board
U.S.	United States
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds

Introduction

Many Texans rely on groundwater as their primary source of drinking water. In 2021, Texans used approximately 14.4 million acre-feet (ac-ft) of water, with approximately 54% (7.8 million ac-ft) from groundwater sources [1]. Groundwater may contain contaminants. The U.S. EPA defines a contaminant as any physical, chemical, biological, or radiological substance or matter in water [2]. Some contaminants are harmful to human health. Compared to adults, infants and young children are at greater risk for potential harm from exposure to contaminated groundwater, due to their size, physiology, and behaviors.

Children must rely on the adults who care for them and the institutions that serve them to ensure they have access to water that is safe from potentially harmful groundwater exposure. Adequate water consumption is critical to meeting the nutritional needs of infants and young children and supporting their healthy development [3]. Drinking water free from harmful pathogens or other contaminants is also critical to children's health and development. Drinking contaminated water may result in serious illness and even death in infants and young children. Exposure to certain contaminants during critical periods of development may also cause health effects that produce no initial symptoms but negatively impact a child's development or future health.

The presence of contaminants in groundwater is widespread in Texas [4]. Contaminants in groundwater may be the result of naturally occurring substances found in rocks and soil (e.g., arsenic, uranium, or radon) dissolving into groundwater. In some areas of Texas, these naturally occurring contaminants have been measured in groundwater at levels that may threaten human health. Contaminants, as well as hazardous substances, can also enter groundwater from various human-related activities, such as the use of agricultural fertilizers and pesticides, manufacturing activities and industrial processes, sanitary sewer overflows, and improperly maintained septic systems [5].

Congress passed the Safe Drinking Water Act (SDWA) in 1974 to protect public health by regulating the nation's public drinking water supply [6]. SDWA authorizes the U.S. EPA to set national health-based standards for drinking water to protect the public from harmful levels of contaminants in public water supplies. These standards are called Maximum Contaminant Levels, or MCLs. All PWSs must comply with the rules and standards outlined in the SDWA. However, many Texans may get their drinking water from unregulated private water wells rather than PWSs. In addition to the contaminants that may be present in groundwater, water from private water wells may also become contaminated if the wells are improperly built or maintained or are damaged.

No federal or state regulations currently require monitoring or treatment of private water wells for drinking water quality in Texas. Private water well owners are not required to test for or achieve health-based water quality standards. Households using water from private water wells are responsible for ensuring the water is safe to drink. For this white paper, safe drinking water is defined as water free from potentially harmful levels of contaminants or disease-causing microorganisms.

While parents or caregivers are responsible for ensuring access to safe drinking water at home, many children in Texas spend time in child care facilities outside of their homes. DCOs may provide care for infants and children under the age of 13 years for less than 24 hours a day. Residential CCOs may provide 24-hour care to children under the age of 17 years [7]. All CCOs are responsible for providing adequate access to drinking water for the infants and children in their care. In addition to providing drinking water, CCOs may use water to prepare food or formula, for handwashing, or other activities.

This white paper assesses the regulatory and public health measures currently in place to protect children from potentially harmful groundwater contaminants in child care settings and identifies opportunities to strengthen health protections for children who attend child care programs.

Full Issue Information and Discussion

Groundwater Quality and Children's Health

Infants and children are particularly susceptible to harm from exposure to environmental hazards such as certain groundwater contaminants because they are physiologically quite different from adults [8]. At birth, their nervous, respiratory, reproductive, and immune systems are not yet fully developed. Compared to adults, their still-growing bodies differ in how they take in, metabolize, and remove certain substances. This is because children are in a dynamic state of growth, with cells multiplying and organ systems developing at a rapid rate. Exposure to certain contaminants can injure or disrupt the growth and development of children's still-growing organ systems, which might affect their health now or in the future. Further, infants and toddlers can be at increased risk of certain hazards due to their unique behaviors, such as crawling and putting their hands in their mouths. These differences may result in harmful effects at lower levels of exposure, more severe illness, or unique adverse outcomes [5]. Some contaminants may cause serious and immediate illness and even death in infants and young children.

Child-specific Health Effects from Groundwater Contaminants

The bullets below provide examples of potential child-specific health effects from exposure to certain groundwater contaminants.

- <u>Methemoglobinemia in infants under the age of six months</u>

  Nitrate and nitrite are common groundwater contaminants that enter groundwater from agricultural runoff, sewage, and leaking septic tanks [5]. Infants under the age of six months who ingest water containing nitrates or nitrites at levels greater than 10 milligrams per liter (mg/L) can develop methemoglobinemia, also known as blue-baby syndrome. Methemoglobinemia is a serious condition in which nitrites (a metabolite of nitrates) bind to hemoglobin in the blood, interfering with hemoglobin's ability to transport oxygen to the cells of the body. If not treated, methemoglobinemia can be fatal [9]. Methemoglobinemia in young infants occurs at exposure levels that are not harmful to most children and adults. This is because of the unique physiology of infants. The lower acidity in infants' stomachs favors the growth of bacteria that convert nitrates to toxic nitrites, and their still-developing bodies are not yet able to produce enough of the protective enzymes necessary to counteract the toxic effects of nitrate metabolites in the body [10, 11]. Some children and adults with digestive or genetic conditions may also be sensitive to high levels of nitrates in drinking water [12]. The U.S. EPA set the MCL for nitrates at 10 mg/L specifically to protect against infant methemoglobinemia [13].

- <u>Severe illness from waterborne pathogens</u>

  Compared to older children and adults, infants and young children are also more susceptible to serious harm from diarrheal illnesses spread by waterborne pathogens (microorganisms) that can contaminate private water wells. *E. coli* and other microorganisms that cause gastrointestinal illnesses can quickly lead to dehydration in young children. Young children have a higher body water content (60-75%) compared to adults (55-60%), which makes them more prone to water, sodium, and potassium loss during acute illnesses [14]. Without proper medical treatment, severe dehydration in infants and toddlers can lead to death [15]. The major source of water-borne pathogens is fecal material from animals and humans [16]. Water run-off from rainfall or snowmelt can contaminate private water wells by washing microorganisms into the well system or seeping underground. Leakage of waste from septic tanks and effluent from septic leach fields can reach a water source and result in microorganisms being present in water wells [17].

- Long-term potential for noncancerous health effects

  Many toxic substances can cause injuries that do not result in immediate or visible illness but may have serious permanent effects on a child's future health and well-being. Research shows that the normal development of an infant and child can be disrupted by even low levels of exposure to certain chemicals. These developmental stages are called "windows of susceptibility," during which there is increased vulnerability to the effects of toxic chemicals [18]. For example, the brain and central nervous system undergo rapid growth and development in the first five years of life. Exposure to even small amounts of lead during this time can impair neurocognitive development, increasing risks for future behavioral problems and decreasing cognitive capacity [16, 19]. Corrosive groundwater can cause lead from lead-containing plumbing and well components to leach into water [20].

  Another example is perchlorate exposure. Children may be more likely than adults to be harmed by exposure to perchlorate in groundwater because it interferes with the body's thyroid function. Thyroid hormones are essential for a child's normal growth and development. Perchlorates can occur naturally in some locations, including regions of west Texas [21]. Perchlorates are also found as impurities in nitrate salts or potash ore, and they may also enter the environment from anthropogenic sources and activities, such as explosives, fireworks, road safety flares, rocket fuel, military applications, manufacturing, and releases from industries that use or produce the chemical [22].

- Long-term potential for cancerous health effects

  Children are also more susceptible to the carcinogenic effects of chemical substances. Early-life exposure to a substance capable of causing cancer may increase a child's risk for developing childhood cancer, as well as an increased risk for the development of cancers later in life [23]. Cancer potencies per year of exposure to a mutagenic carcinogen in childhood can be magnitudes higher than the same exposure during adulthood [24]. Once a tissue is fully developed, it is less sensitive to functional changes from chemical exposures that can lead to increased susceptibility to diseases later in life, such as heart disease and cancer [25]. For example, chronic exposure to benzene may increase the risk of developing leukemia [26], the most common childhood cancer. Benzene is present in crude oil and gasoline and is used in many industrial processes. Benzene can enter the environment from industrial discharge, disposal of products containing benzene, and gasoline leaks from underground storage tanks [27]. Examples of other carcinogenic groundwater contaminants include arsenic, radionuclides, and dioxins.

Table 1 provides additional examples of contaminants found in groundwater in Texas and their potential effects on health.

Table 1. Potential health effects and sources of select groundwater contaminants.

Contaminant	**Associated health effects**	**Potential contamination sources [1, 5, 16]**
Arsenic	May cause neurodevelopmental effects increased risk for kidney, bladder, skin, lung, gastrointestinal, lymphatic, and hematopoietic cancers [8, 28].	Industrial activities and waste, arsenical pesticides, smelting of copper, lead, and zinc ore. May also be naturally occurring. Levels of arsenic that exceed SDWA MCLs have been measured in aquifers in Texas.
Benzene	May cause leukemia (most common childhood cancer) and other blood disorders [26, 27].	Releases from crude oil, gasoline, many consumer/commercial products, and certain industrial activities.
Dioxins	May cause cancer, reproductive and developmental problems, damage to the immune system, and can interfere with hormones [29].	Emissions from waste incineration and other combustion; discharge from chemical factories.
Fluoride	At recommended levels, can protect against dental caries. High levels in early childhood (up to eight years) can cause dental fluorosis, a condition that causes changes in the appearance and potential pitting of tooth enamel in permanent teeth [30].	Naturally occurring. Levels of naturally occurring fluoride that exceed SDWA MCLs have been measured in aquifers in Texas.
Lead	Toxic to the developing brain. Impairs neurocognitive development, increasing risks for behavioral problems, and decreased cognitive capacity [19, 31].	Lead can leach from pipes and other plumbing components to contaminate private water wells and household drinking water.
Nitrate/Nitrite	Methemoglobinemia (blue-baby syndrome). Infants under six months who drink water with high levels of nitrate can become seriously ill and die [9].	Present in chemical fertilizers, human sewage, and animal waste and fertilizers. Can contaminate a private water well through groundwater movement and surface water seepage and water run-off.
Perchlorate	Children may be more likely to be adversely affected by exposure to perchlorate because perchlorate interferes with thyroid function. Thyroid hormones are essential for normal growth and development [21].	Perchlorates occur naturally in west Texas and may enter the environment from explosives, fireworks, road safety flares, rocket fuel, and releases from industries that use or produce the chemical.
Polychlorinated biphenyls (PCBs)	May cause cancer, adverse developmental and reproductive effects, and is toxic to the liver, kidneys, nervous system [32].	Runoff from landfills, discharge of waste chemicals, and industrial waste.
Radionuclides (alpha particles from elements such as radium and uranium)	May cause increased risk for bone, liver, and breast cancer later in life. Uranium may damage kidneys [5].	Naturally occurring, uranium mining and milling, coal mining, and nuclear power production. Levels of radionuclides that exceed SDWA MCLs have been measured in aquifers in Texas.
Radon	Radon may cause an increased risk of lung cancer [5].	Naturally occurring. Levels of radon that exceed SDWA MCLs have been measured in aquifers in Texas.
Tetrachloroethylene (PCE)	May cause cancers. Is toxic to the nervous system and may cause changes in mood, memory, attention, reaction time, and vision [33].	Discharge from factories and dry cleaners.

Children's Increased or Unique Risks for Exposure to Groundwater Contaminants

Infants and young children may be exposed to higher doses of contaminants in water than adults, due to differences in their behaviors, diets, and physiology. Ingesting contaminants through drinking contaminated water or consuming formula or foods prepared with contaminated drinking water is the most significant way they are likely to be exposed to groundwater contaminants. Infants and young children drink more water per kilogram (kg) of body weight than adults. This is especially true for infants who may ingest up to eight times more water on a milliliters per kilogram (ml/kg) basis than the average adult [34]. Infants and young children also more readily absorb certain substances through their digestive tract. For instance, the percentage of lead absorbed in the gut is estimated to be as much as five to ten times greater in infants and young children than in adults, especially on an empty stomach [19].

In addition to drinking contaminated well water, children can also be exposed to groundwater contaminants while bathing, washing hands, or playing with water recreationally, such as in pools or with water play tables. An increased ratio of body surface area per kilogram of body weight means that they may be exposed at higher doses to contaminants that can be absorbed through the skin. The absorptive and other properties of infants' skin differ from that of older children and adults, which may impact dermal absorption [35, 36]. Children may also be exposed to contaminants by breathing them in, such as with Volatile Organic Compounds (VOCs), which are common contaminants found in groundwater [37]. VOCs in groundwater can vaporize out of water into the air. The amount of air passing through the lungs of a resting infant is up to twice that of a resting adult on a body weight basis [24]. This means that an infant may breathe in double the dose of contaminants in air containing volatilized chemicals compared to adults breathing the same air.

Infants and young children may also be at increased risk for exposure due to their unique behaviors. They are at a developmental stage where they frequently put their hands and other objects in their mouths. These mouthing behaviors may increase exposure to residuals on washed hands or surfaces. These infants and young children may also be more likely to accidentally or intentionally ingest bath or recreational water [24].

Regulatory Framework for Addressing Groundwater Quality in Relation to CCOs

This section describes federal and state regulatory activities relevant to protecting children from potentially harmful exposures to groundwater contamination.

Relevant Child Care Regulations

CCOs are regulated in Texas by HHSC. HHSC's CCR program regulates both DCOs, general residential operations, and child-placing agencies [7]. Table 2 lists the types of operations based on the number and ages of children they serve, the hours they operate, the services they provide, and whether the services are provided from the operator's home.

Table 2. CCOs regulated by CCR.

Operation Type	**Number and/or ages served**	**Service hours**
Licensed Child Care Center	Seven or more children ages 13 or younger	At least two hours but less than 24 hours per day of three or more days a week at a location other than the license holder's home
Licensed Before-school or After-School Programs	Pre-kindergarten through 6th grade	At least two hours per day, three or more days a week, before and/or after customary school days and during school holidays
Licensed School-Age Program	Pre-kindergarten through 6th grade	At least two hours per day, three or more days a week, before and/or after the customary school day and during school holidays, the summer period, or any other time when school is not in session
Licensed Child-Care Home	Seven to 12 children ages 13 or younger	At least two hours but less than 24 hours per day of three or more days a week in the primary caregiver's home
Registered Child-Care Home	Up to six unrelated children who are ages 13 or younger during school hours and an additional six school-age children after school hours (no more than 12 children at any time)	At least four hours a day, three or more days a week, for three or more consecutive weeks, or four hours a day for 40 or more days in a 12-month period in the primary caregiver's home
Listed Family Home	Up to three unrelated children	At least four hours a day, three or more days a week, for three or more consecutive weeks, or four hours a day for 40 or more days in a 12-month period in the primary caregiver's home
Small Employer-based Child Care Operation	Up to 12 children of employer's employees	n/a; no minimum standards and not routinely inspected by CCR
General Residential Operation	Seven or more children ages 17 and younger	24-hour care and supervision
Child-Placing Agency*	Does not provide direct care for children; responsible for supervising and regulating foster and adoptive homes	n/a

*CCR regulates child-placing agencies, including setting the minimum standards for health, safety, and environment that such agencies must use to regulate foster homes (26 Texas Administrative Code (TAC) Section (§)749 [38].)

Chapter 42 of Title 2 of the Texas Human Resources Code (GHRC) requires HHSC to create and enforce minimum standards that CCOs must follow. The code states that these minimum standards must promote the health, safety, and welfare of children attending CCOs [39]. HHSC is required to conduct a comprehensive review of all rules and standards at least every six years (2 GHRC §42.042). The last review period occurred in 2022.

The rules establishing minimum standards for licensed and registered DCOs (26 TAC Chapter 747, Minimum Standards for Childcare Homes; 26 TAC 744, Minimum Standards For School-Age And Before Or After-School Programs; and 26 TAC 746, Minimum Standards for Child-Care Centers) were reviewed for this white paper [26, 40-42]. The rules require DCOs to "ensure a supply of drinking water is always available to each child at every snack, mealtime, and after active play" and that this water is "served in a safe and sanitary manner." In addition to providing drinking water to children, DCOs may also use water when preparing food or infant formula, for handwashing, or for recreational water activities.

The rules allow DCOs to use water from a private water supply rather than a public water supply if they meet two conditions. While the terms public water supply and private water supply are not defined within the rules, we assume public water supply refers to water from a PWS. These conditions are that the DCO:

1. Maintain the water supply in a safe and sanitary manner.
2. Maintain written records indicating that the private water supply meets the requirements of TCEQ, if applicable.

However, the rules do not define "safe and sanitary manner" for maintaining a private water supply, nor do they describe which private water supplies must meet TCEQ requirements. The term "safe and sanitary," as it might apply to maintaining a private water supply, is also not defined by any state or federal agency. This puts the responsibility of interpreting what "safe and sanitary" means onto the operator of the DCO and could result in varied interpretations. CCR training requirements for DCOs do not include training on private water well maintenance or groundwater quality monitoring and safety.

State rules do not currently require DCOs to disclose their source of drinking water in licensing applications or license renewals.

Relevant Water Quality Regulations

Under the SDWA, the U.S. EPA sets MCLs and treatment requirements for PWSs to be protective of public health. The law allows individual states to set and enforce their own drinking water standards, given the standards are at least as stringent as the national standards. However, the U.S. EPA does not regulate private water wells which serve fewer than 25 people [6].

The U.S. EPA recently promulgated the Lead and Copper Rule Revision (LCRR), 40 Code of Federal Regulations (CFR) 141.92, and Lead and Copper Rule Improvements (LCRI), 40 CFR 141.93, which increased the lead testing requirements for schools and child care facilities. Under the LCRR and LCRI, all community water systems must conduct directed public education and lead monitoring at the schools and child care facilities they service if those schools or child care facilities were constructed prior to January 1, 2014 or the date that the state adopted standards that meet the definition of lead-free, or that are not served by a lead, galvanized requiring replacement, or unknown service line [43]. These rules are anticipated to increase the protection of children from lead in drinking water in schools and child care settings. However, they do not apply to child care facilities that use private water wells unless the well meets the definition of a non-transient, non-community water system.

In Texas, public drinking water is regulated by TCEQ. The TCEQ public drinking water program is part of the state's Public Water System Supervision (PWSS) program. TCEQ regulates all PWSs, including community, non-transient non-community, and transient non-community systems under the PWSS program. TCEQ ensures that PWSs provide water that meets federal health and safety standards defined in the U.S. EPA's SDWA and in Texas rule Title 30 TAC §290.38 [44]. Table 3 outlines the criteria for qualifying as a PWS in Texas.

Table 3. Types of PWSs in Texas.

Type of PWS	Criteria	Examples
Community	· Potential to serve at least 15 residential service connections on a year-round basis or · Serves at least 25 persons on a year-round basis [30 TAC §290.38(15)]	Most municipalities, some boarding schools, and prisons
Non-transient non-community	· Not a community water system · Regularly serves at least 25 of the same persons at least six months out of the year [30 TAC §290.38(58)]	Schools, camps, child care facilities, recreational vehicle parks with long-term residents, and other businesses
Transient non-community*	· Not a community water system · Serves at least 25 persons at least 60 days out of the year · Does not meet the definition of a non-transient non-community water system [30 TAC §290.38(84)]	Parks, recreation parks, convenience stores, restaurants, and other businesses

* All community and non-transient non-community public water systems are required to comply with LCRR and LCRI requirements in addition to others under the SDWA. Transient non-community systems are not required to adhere to the LCRR and LCRI but still must adhere to other requirements of the SDWA.

Water wells that supply drinking water to a child care facility that do not meet the above criteria would be classified as private water wells rather than PWS wells and would not be regulated by the TCEQ. Smaller child care centers licensed to care for less than 25 children, or home-based CCOs that do not meet the minimum definition of a PWS to serve at least 25 persons at least 60 days out of the year, may use private water wells. According to the Texas Open Data Portal's HHSC Child Care Licensing (CCL) Daycare and Residential Operations Data [45] downloaded in August 2022, there were over 5,700 DCOs in the state having a total capacity of fewer than 25 children. Most of these were listed, registered, and licensed child care homes operated from residential properties.

In addition to regulating public drinking water, state agencies have additional responsibilities related to the regulation of activities that could impact groundwater quality. Chapter 26 of Texas Water Code Title 2 (2 TWC §26.406) identifies TCEQ, the Texas Department of Agriculture, the Railroad Commission of Texas, and the Texas State Soil and Water Conservation Board as state agencies that have responsibilities related to groundwater protection [46]. The statute requires each state agency having responsibilities related to groundwater protection to notify the TGPC of groundwater contamination that may affect a private water well (2 TWC §26.408). Agencies must also maintain a public file of all documented groundwater contamination cases reasonably suspected of having been caused by activities regulated by the agency (2 TWC §26.406). TCEQ is then required to notify owners of private water wells that may be affected by known groundwater contamination.

TCEQ makes efforts to notify property owners with private water wells within a certain distance (typically one-fourth to one-half of a mile) of any known groundwater contamination in their area. However, the property owner is not required to test their well water for possible contamination. The statute does not require that the notification be provided to current or future tenants of the property. Furthermore, DCOs may lease a property or purchase water from property owners without knowing that a water well may be located near groundwater contamination.

DSHS does not set MCLs for groundwater contaminants, nor regulate groundwater quality, but it does enforce public health measures relating to access to potable water. For instance, 25 TAC §295.165(a)(1), Sanitation at Temporary Places of Employment, Standards for Water Supply, states the following:

> "Every temporary place of employment shall be provided with an adequate supply of potable water for drinking. Employers shall make drinking water readily accessible to all employees during all working hours and rest periods in sufficient amounts to meet their needs. All drinking water shall be obtained from a water system complying with 31 TAC §§290.38-290.49 concerning Rules and Regulations for Public Water Systems. Drinking water may also be supplied in sealed glass or plastic containers from producers inspected by the Food and Drug Division of the Texas Department of Health [now named the Consumer Protection Division (CPD) of DSHS] according to the provisions of the Health and Safety Code, Chapter 431. All water supplies must be protected from contamination to the point of consumption." [47]

The above excerpt describes allowed water sources for potable water as those meeting TCEQ's standards for PWSs or consumer water sources licensed by the DSHS CPD. For this rule, drinking (or potable) water is defined as "all water which may be distributed by any organization or individual, public or private, for all purposes of human consumption, washing of the person, the preparation of foods or beverages, or for the cleansing of any utensil or article used in the course of preparation or consumption of food or beverages." This statute provides an example of a public health regulation that outlines steps that private businesses must take to ensure that drinking water quality does not pose a health hazard to their employees.

DSHS also enforces water quality standards for retail food establishments using nonpublic water systems. 25 TAC §228.141 requires food establishments to meet the requirements of 30 TAC Chapter 290, Subchapter F (TCEQ Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements for Public Water Systems), pertaining to transient non-community water systems [48]. 25 TAC §228.142 requires that water from a nonpublic water system be sampled and tested according to 30 TAC Chapter 290, Subchapter F, concerning transient non-community water systems, except nondrinking water, and that the most recent sample report for the nonpublic water system shall be retained on file in the food establishment, or the report shall be maintained as specified in 30 TAC Chapter 290, Subchapter F, concerning transient non-community water systems. DSHS currently does not license child care facilities as food establishments.

Relevant Nonregulatory Guidance

The U.S. EPA offers voluntary guidance to schools and child care facilities on lead testing through its 3Ts – Training, Testing, and Taking Action toolkit. The 3Ts toolkit provides information and recommendations to prepare schools, child care facilities, and states to build a voluntary implementation program to reduce lead levels in drinking water [73]. TCEQ offers the Lead Testing in School and Child Care Program (LTSCC, [74]) to help Texas public schools and regulated child care facilities test for lead in drinking water and take action to reduce lead where children are served [74]. The program is free and program training, support, and sample analysis are provided at no cost to participants. Following the U.S. EPA 3Ts program for reducing lead in drinking water, TCEQ's LTSCC team can provide technical assistance and on-going support to participants.

The U.S. EPA and the U.S. Centers for Disease Control and Prevention (CDC) offer educational resources to members of the public on issues of private water well safety, testing, and maintenance [49, 50]. In their guidance for families, they recommend routine groundwater quality monitoring to protect the health and safety of children. Both the CDC [50] and the American Academy of Pediatrics (AAP) [16] recommend that private water wells be tested annually for total coliform bacteria and nitrates, with additional testing as recommended by the U.S. EPA or local health or environmental agencies. AAP recommends testing wells near gas stations, buried fuel tanks, landfills, junkyards, or dry cleaners for VOCs. AAP makes further recommendations aimed at pediatricians, which include:

1. Asking whether a family drinks water from a private water well at home, in child care, or in other locations.

2. Advising families with high school age or younger children to test private water wells for total coliform bacteria, nitrates, lead, fluoride, and arsenic, at a minimum, as well as for additional contaminants that may be present due to site-specific conditions or nearby activities.

Currently, no federal or Texas state agency has published health and safety guidelines for groundwater quality for CCOs that use private water wells rather than municipal or PWSs. However, the Caring for Our Children (CFOC) National Health and Safety Performance Standard offers recommendations for voluntary best practices for CCOs using water from private water wells. CFOC is a collection of recommended standards representing best practices for quality health and safety policies and practices for early child care and education settings based on evidence, expertise, and experience [51]. CFOC National Health and Safety Performance Standard 5.2.6.1 recommends the following voluntary best practices for CCOs using water from private water wells:

> "Well water should be tested annually for pH (acidity levels to determine whether the water is corrosive) and for bacteria, parasites, viruses, and chemical content (including, but not limited to, arsenic, radon, methyl tert-butyl ether, lead, nitrates, heavy metals, or other runoff chemicals) or according to the local regulatory health authority.
>
> Any facility not served by a public water supply should keep on file documentation of approval, from the local regulatory authority, of the water supply."

In CCR's most recent revisions of child care minimum standards published in March of 2023, CCR added the following informational bullets to the minimum standards documents [40-42]:

- "Caring For Our Children recommends well water be tested annually, or as required by the local health department, for bacterio-logical quality, nitrates, total dissolved solids, pH levels, and other water quality indicators as required by the local health department. Testing for nitrate is especially important if there are infants under six months of age in care.
- High levels of nitrates in drinking water can be dangerous and potentially fatal to infants. If you are unsure if your private water supply may contain nitrates, you can contact your state certification officer for a list of laboratories in your area that will perform tests on your water supply for a fee."

In addition to contacting a state certification officer for a list of laboratories, CCOs can access TCEQ's Steps to Locate an Accredited Environmental Laboratory webpage which provides information on how to access a list of qualified local laboratories [65]. CCR's inclusion of information about CFOC recommendations and nitrate testing in the informational bullets of their minimum standards documents may increase awareness and knowledge about these issues among CCOs.

Exploring the Potential Scope of the Issue

Several geospatial analyses were conducted to better understand the potential impact of the identified gaps in regulatory and nonregulatory measures to protect children from groundwater contaminants in CCOs using private water wells. The analyses were limited to DCOs (a subset of licensed and registered CCOs that exclude general residential operations or child placing agencies) because public geospatial data was easily accessible for these types of CCOs.

Number of Children Potentially Impacted in DCOs

The number of DCO facilities using private water wells in Texas is unknown because there is no state agency or other entity that captures this information. During the public comment period for revisions to the minimum standards rules in 2022, TGPC submitted a written recommendation to CCR that they capture the drinking water source during the CCO licensing process.

To attempt to understand the potential scope of the issue, a geospatial analysis using publicly available data sources estimated the number of DCO facilities that may rely on private water wells.

The analysis used child care location data downloaded on November 24, 2022 from the Texas Open Data Portal's HHSC Daycare and Residential Operations Data [45] and the Texas Water Development Board (TWDB) Water Service Boundary Viewer [52]. The Daycare and Residential Operations Data provided geocoded addresses for 14,918 listed, registered, and licensed DCOs. The dataset also included the characteristics of each operation (e.g., its total capacity (i.e., maximum number of children) and ages of children they may serve). The Viewer provided polygon shapefiles showing service boundaries of PWSs across Texas.

Using the near analysis function in ArcGIS Pro 3.1, 657 of the 14,918 geocoded DCOs were identified as being located outside the boundaries of a PWS. These 657 DCOs had the combined capacity to serve 64,085 children. Of these, 436 DCOs had a total capacity to care for 25 or more children. TCEQ defines a water system that serves at least 25 persons at least 60 days out of the year as a PWS. Therefore, water systems for DCOs that serve 25 or more children should meet the criteria to serve at least 25 persons at least 60 days a year and would be regulated as a PWS by TCEQ. Water systems in compliance with TCEQ drinking water standards are unlikely to pose a health risk to children in DCOs.

The remaining 221 DCOs each had the capacity to care for fewer than 25 children. However, these DCOs had a combined capacity to serve 2,077 children, and 74% offered care for infants. It is plausible that DCOs in a location not served by a PWS that care for less than 25 children may rely on private water wells. If DCOs use a private water well as a source for drinking water, it may pose a potential health risk to infants and children if the water contains potentially harmful levels of groundwater contaminants.

This analysis has several limitations that should be considered when interpreting the results. The boundaries found in the Viewer are for areas currently served by the PWSs and self-reported from authorized PWS representatives and may change over time. TWDB acknowledges that there may be missing boundaries, and though they make every effort to provide users with accurate boundaries, it is not always possible to do so [53]. It is not stated what percentage of public water service boundaries TWDB estimates the Viewer currently captures. Water wells that meet the criteria to be a PWS also may not show up in the Viewer because they have not been registered as a PWS with the state.

Another variable that may lead to overestimation is the difference in geocoding methods for DCO addresses in the HHSC dataset versus public water service boundaries in the Viewer. The edges of public water service boundary polygons appear to run along street lines or linear water main lines and may exclude service lines that connect properties to the main lines. DCO locations are each geocoded as a single point with the longitude and latitude within a property, often set back from the street. Thus, DCO locations near a polygon's edge may be served by the PWS even if they do not fall within the polygon.

To account for water service lines, additional analysis was done to see how the results would vary if filtered to exclude DCOs geolocated within 55 feet of a public water service boundary. This distance was chosen because a national survey by the American Water Works Association Research Foundation found that the average total length of service lines from a public water line to a property was 55–68 feet [54]. The results found that 200 DCOs with the individual capacity to serve less than 25 children were located greater than 55 feet from a public water service boundary.

There are additional considerations when interpreting the results above. First, it cannot be assumed that facilities not served by PWSs use groundwater from a private water well as their source of potable water. While private water wells are a common nonpublic drinking water source, a facility can use other sources, such as bottled water, water from rain cisterns, or surface water.

Second, the analysis does not consider DCOs that are located within public water service areas but choose to use a private water well. This results in a potential underestimation of DCOs not served by PWSs. Private water wells exist in rural, suburban, and urban settings across Texas. TWDB estimates that about 1.75 million water wells have been drilled in Texas since 1900 [55]. While there are several searchable databases for water well reports, only a fraction of these databases provides location data that could be used for geospatial analysis.

Lastly, the scope of the analysis was limited to DCOs. General residential operations and CCOs regulated by child-placing agencies were excluded from these analyses.

Proximity of DCOs to Known Groundwater Contamination

In addition to estimating the number of DCOs that may use private water wells, the location of DCOs in relation to areas with known groundwater contamination was explored. These analyses have several limitations and do not attempt to determine whether existing groundwater contamination may impact any individual DCO. Multiple factors contribute to whether a private water well is vulnerable to groundwater contamination, including unique characteristics of the contaminant, the aquifer, and the well itself [56].

The first analysis used the near analysis function in ArcGIS Pro 3.1 to identify DCOs within a one-mile radius of active groundwater contamination cases, using data from the Texas Open Data Portal's HHSC Daycare and Residential Operations Data (downloaded November 24, 2022) [45] and active cases for the most recent year (at that time, 2021) in TCEQ's Groundwater Contamination Viewer (downloaded December 20, 2022) [57]. Here, a groundwater contamination case refers to contamination reported by a TGPC member in which the groundwater contamination is reasonably suspected of having been caused by activities regulated by that member.

A one-mile radius was selected because the groundwater contamination data in the Viewer is presented as a single point defined by an x, y coordinate. However, groundwater contamination occurs in three-dimensional plumes that can take variable shapes and sizes and move within groundwater for variable distances. A plume's shape and movement are based on variables such as the hydrogeological characteristics of the area and the chemical properties and amounts of the contaminants. Chlorinated solvents and gasoline-related additives were listed as contaminants in most TCEQ groundwater contamination cases. One mile was selected as a conservative radius for possible impact based on published distribution data on plume lengths for such contaminants [58, 59].

The analysis found that 5,239 DCOs were located within one mile of an active groundwater contamination case. Of those DCOs:

- 1,763 are licensed to care for less than 25 children.
- 129 are located outside public water service boundaries.
- 20 fall outside public water service boundaries and are licensed to care for less than 25 children.

Proximity of DCOs to Groundwater MCL Exceedances

The second analysis estimated the number of DCOs most likely to have private water wells which were also located in areas where a groundwater sample in the TWDB Groundwater Database [71] for nitrate/nitrate or naturally occurring contaminants (arsenic, fluoride, manganese, perchlorate, and certain radionuclides) has exceeded MCLs. To focus the analysis on those DCOs most likely to use private water wells, only DCOs more than 55 feet from a public water service boundary with the licensed capacity to serve less than 25 persons were used (n=200). Datasets with well location, county, aquifer, and test values (whether numeric or binary as a yes/no for exceedance) for different contaminants were provided by TWDB.

Geospatial analysis was used to identify the number of DCOs located in the same county and aquifer zone as a well location where a sample in the TWDB Groundwater Database showed an exceedance.

This measure was selected, as opposed to a radius from the water well, because these contaminants are likely a result of geological composition and are less local than point source contamination, such as those related to a regulated activity. This approach was also used for nitrate/nitrite contamination because it often occurs due to land uses, such as agriculture, that span larger areas and may be more concentrated in specific counties.

The results in Table 4 show that a majority of the DCOs were located in a county and aquifer zone where a groundwater sample had exceeded the MCL for manganese (74%), fluoride (64%), arsenic (57%), and gross alpha radionuclide (55%). One hundred and eighty five DCOs (93%) were in a county where a sample equaled the MCL for arsenic. Fifty-three (27%) of these DCOs were in a county and aquifer zone where a groundwater sample exceeded MCLs for nitrate/nitrite. Ingesting drinking water with nitrates above the MCL may cause series illness and potential death in infants under the age of six months. Forty-three (22%) DCOs were in a county and aquifer zone where a groundwater sample exceeded the MCL for radium. For radon and perchlorate, only 41 (21%) and 3 (2%) DCOs, respectively, were located in a county and aquifer zone where a sample exceeded the MCL or TCEQ advisory level; however, 156 (78%) and 197 (99%) DCOs, respectively, were in counties where no radon or perchlorate sampling data was available. Appendix B provides additional details on the GIS methodology used in the analysis for this white paper.

Table 4. Number of DCOs located within the boundaries of a county and aquifer(s) where the TWDB Groundwater Database showed a level exceeding an MCL, or in a county where no sampling data for a contaminant was available.

Groundwater contaminant	**Number (Percent[1]) of DCOs in the same county and aquifer(s) as a sample exceeding an MCL for a contaminant[2]**	**Number (Percent[1]) of DCOs in a county with no sampling data for a contaminant**
Manganese	147 (74%)	5 (3%)
Fluoride	128 (64%)	0
Arsenic	114 (57%); 185 (93%)[3]	2 (1%)
Gross Alpha Radionuclide	111 (55%)	14 (7%)
Nitrate / Nitrite	53 (27%)	9 (5%)
Radium	43 (22%)	55 (28%)
Radon	41 (21%)	156 (78%)
Perchlorate[4]	3 (2%)	197 (99%)

[1] Percent of DCOs out of the total number of DCOs (n/200 x 100).

[2] A CCO with exceedance in the same county and aquifer(s) is counted if at least one major or minor aquifer has an exceedance in cases where there are multiple aquifers below the geospatial coordinates for the CCO.

[3] Includes samples where arsenic concentration was equal to or exceeded the MCL. This was not done for other contaminants because available exceedance data was binary (yes/no) versus numeric test results for arsenic.

[4] The number of DCOs in the same county and aquifer as a sample exceeding TCEQ advisory levels. No MCL has been established for perchlorate.

A major limitation of this analysis is that the TWDB Groundwater Database reports available data collected by TWDB staff, cooperators, and other entities, and is not a comprehensive set of systematically collected samples for each contaminant. The TWDB Ambient Groundwater Monitoring Program samples a representative number of wells and springs from each of the state's nine major and 22 minor aquifers approximately once every four years and relies on an existing and voluntary well network. Although TWDB strives to sample a consistent network of wells for a standard set of constituents, access consent and well conditions may require changes to the monitoring network between sampling cycles. Additionally, staffing levels, a lack of available well sites, laboratory budget, and other factors may result in more limited data collection activities some years. Thus, the dataset may not provide a clear indication of current water quality conditions and may not accurately represent the number of DCOs that are in counties and within aquifer zones with an exceedance for a particular contaminant. The variability in sampling is evident by the differences in number of samples taken for different contaminants, and by the number of DCOs that are in counties where no sampling results were available for a contaminant. The TWDB website acknowledges that the quality of the sampling data is variable and that there may be discrepancies based on changes or differences in data collection methods and data maintenance [60].

In addition, private water wells may also be adversely affected by components of the well itself and localized events, such as septic tank leaks and flooding. A private water well's vulnerability to groundwater contamination depends not only on the groundwater quality issues in the aquifer itself, but also on the well's location, design, construction, operation, and maintenance [56].

Coliform bacteria were not included in the analysis. Coliform bacteria typically contaminate private water wells from surface water or a subsurface source nearby, such as a septic tank, rather than through groundwater from a confined aquifer [61]. These variables cannot be assessed using available geospatial data.

Conclusions

A number of DCOs are located in areas where documented groundwater contamination exists, or where levels of some naturally occurring contaminants exceed MCLs. Several federal and state regulations exist to protect the public and consumers from exposure to potentially harmful groundwater contamination. However, no federal, state, or local laws exist that require disclosure of the use, or water quality monitoring, of private water wells (or other private water sources) for CCOs that serve children.

This white paper identified several regulatory gaps regarding the groundwater quality of private water wells at CCOs in Texas, including:

- State rules do not require disclosure of private water well use by a CCO.
- State rules do not require groundwater quality testing of private water wells used by CCOs.
- Current rules for CCOs do not include clear regulatory guidance on how to implement the requirement to "maintain the water supply in a safe and sanitary manner" and do not require testing nor documentation of water quality for private water wells.
- There is currently no Texas nor federal agency that provides authoritative guidance on private water well testing for CCOs that are not PWSs. However, some national sources provide best practice recommendations that local health departments outline the water quality testing required to determine that the water is safe to use. It is unclear if the infrastructure to support this voluntary best practice exists in Texas.

These regulatory gaps may put children and staff served by these CCOs at risk for harm. There is inadequate data available to reliably estimate the number of children and staff who may be potentially impacted these gaps. More work is needed to determine which CCO facilities, and how many children and staff, are potentially impacted.

Continuing Research Needs

- Identify the number of CCOs using private water wells for drinking water and estimate the number of children they serve. This data would allow one to assess the costs and benefits of policy options and help inform regulatory and public health policy decision-making to address gaps that put children at risk for serious illness and death.
- Assess CCO owners' knowledge and attitudes about groundwater quality issues and current water well testing and maintenance practices. Published data on homeowner beliefs and knowledge about water well testing and practices exists, but none was found for child care owners or operators. This data could be used to guide public health actions, such as prioritizing topics for outreach and education.
- Determine the number of CCOs in areas at risk for hurricanes, flooding, or wildfires, using data from the Federal Emergency Management Agency (FEMA) National Risk Index Maps [62], National Oceanic and Atmospheric Agency (NOAA) Storm Surge Risk Maps [63], and United States Department of Agriculture (USDA) spatial dataset of probabilistic wildfire risk [64]. Naturally occurring disasters can impact groundwater quality and cause damage and contamination to private water wells. Such data could inform public health actions such as outreach and education or disaster relief efforts.
- Identify barriers, or perceived barriers, to water quality testing by CCOs, such as renting versus owning a home, shared water wells, testing costs, or lack of convenient testing facilities.
- Expand analysis and policy recommendations beyond DCOs to include foster homes caring for infants and children that use a private water well for drinking water. Children served by residential facilities or foster homes may be more exposed than those at DCOs because they reside in the facilities up to 24 hours a day, seven days a week, and have additional exposure potentials from bathing, showering, toothbrushing, and other activities of daily life.

Recommendations

Illness or death from drinking contaminated groundwater is completely preventable. The Texas Legislature or relevant state agencies should act to close regulatory gaps and promote public health efforts to protect infants and young children from being exposed to groundwater contamination in child care settings. Recommendations for accomplishing this goal include the following:

1. During the initial licensing application as well as during the renewal process for licensed, registered, and listed CCOs, direct CCR to obtain the source of drinking water (e.g., public drinking water, private water well, purchased consumer water, other). This nonregulatory update to CCR's current process would allow for an accurate count of CCOs using private water wells to better inform policy decisions and public health efforts. It would also provide a mechanism to identify CCOs for distributing resources or other potential public health initiatives. A deadline of one year should be set to implement this process update. If cost is a barrier to implementing this recommendation, the Texas Legislature should provide funding or help identify and direct existing funding for this update.
2. Direct DSHS or another appropriate state agency or partner to develop voluntary guidance for child care providers on health-based well water safety. This guidance should include when to test well water, which constituents should be tested, and what to do if a value exceeding a drinking water MCL is found. Recommendations for water testing should include nitrates and coliform bacteria, at a minimum, as exposure to these contaminants may potentially result in acute health risks. While nonregulatory in nature, this health-based guidance could be used by CCR or other state agencies or partners to define best practices for how water from a private

water system can be maintained in a safe and sanitary way. A deadline of two years should be set to avoid a delay in establishing health-based best practices. If cost is a barrier to implementing this recommendation, the Texas Legislature should provide funding or help identify and direct existing funding for developing this guidance.

3. Commission CCR or another appropriate state agency or partner to evaluate the data on drinking water sources collected by CCR to determine how many children may be consuming drinking water from private water wells at CCOs. The evaluation should consider known areas where groundwater samples have exceeded MCLs, action levels, or HALs. A report with general findings from the evaluation should be made available within two years of the date that licensing and renewal forms were updated to include drinking water sources. At a minimum, CCR should include water source as a field in the Texas Open Data Portal HHSC Daycare and Residential Operations Data [45]. If cost is a barrier to implementing this recommendation, the Texas Legislature should provide funding or help identify and direct existing funding for completing this evaluation.
4. If the evaluation finds that children attending CCOs may be consuming unregulated drinking water from private water wells, the Texas Legislature should act to ensure that relevant state agencies take action to protect children from potentially harmful constituents in groundwater using the evaluation to inform policy decisions. See Appendix A for a list of regulatory and nonregulatory options to consider for enhancing the protection of children's health against exposure to harmful groundwater constituents.
5. Require all CCOs to test water from drinking water faucets for lead based on following guidance from U.S. EPA's 3Ts Program [73]. Children under the age of six are at greatest risk for health problems caused by lead exposure [31]. If lead levels exceed state or federal lead action levels, require that water used for drinking, cooking, or making formula be treated to reduce lead to below action levels, or that an alternative source of drinking water with levels below the action level be used. Water filtration pitchers with filters certified to remove lead may be considered as a low-cost, readily available water treatment option. TCEQ's LTSCC Program can assist CCOs [74].

The intent of these recommendations is to:

- Strengthen protection of children's health in Texas from potentially harmful groundwater contaminants.
- Ensure that current rules and regulations in Texas promote the health, safety, and welfare of children attending CCOs.
- Support Texas CCOs in keeping children safe through clear guidance and actionable rules relating to the use of private water wells.

Anticipated Benefits

The primary benefit of preventing or reducing exposure to contaminated water from private water systems is protecting the health and safety of children and staff in CCOs. If a CCO is operated out of a home, health benefits would extend to household members (i.e., members of the public). Examples of additional benefits include the potential for reduced liability to CCR, CCOs, or additional stakeholders if a child became seriously ill as a result of exposure due to unclear or unactionable regulations, as well as healthcare cost savings for children who may suffer from adverse health effects resulting from exposure to contaminated groundwater.

TGPC GWI Subcommittee

TGPC GWI Subcommittee members include, but are not limited to:

- Texas Commission of Environmental Quality (TCEQ);
- Texas Water Development Board (TWDB);
- Railroad Commission of Texas (RRC);
- Texas Department of State Health Services (DSHS);
- Texas Department of Agriculture (TDA);
- Texas State Soil and Water Conservation Board (TSSWCB);
- Texas Alliance of Groundwater Districts (TAGD);
- Texas A&M AgriLife Research (AgriLife Research);
- Bureau of Economic Geology of The University of Texas at Austin (UTBEG);
- Texas Department of Licensing and Regulation (TDLR);
- Texas Parks and Wildlife Department (TPWD);
- Texas Tech University (TTU);
- Texas A&M AgriLife Extension Service (AgriLife Extension); and,
- United States Geological Survey (USGS).

The primary goals of the TGPC GWI Subcommittee are to:

- Facilitate interagency communication for assessment programs addressing groundwater contamination;
- Coordinate and assist member agencies with monitoring programs for:
  - Ambient groundwater conditions;
  - Pesticides; and,
  - Emerging contaminants or constituents of concern;
- Support the intent of the *Texas Groundwater Protection Strategy* (https://www.tceq.texas.gov/downloads/groundwater/publications/as-188-texas-groundwater-protection-strategy.pdf) by:
  - Reviewing published data reports, and evaluating data independent of published reports, to assist in the determination of the effectiveness of existing regulatory programs and to identify potential groundwater contaminants not addressed by existing regulatory programs;
  - Developing recommendations for consideration by the TGPC to address potential groundwater contamination identified through monitoring and data review; and,
  - Developing white papers on the groundwater issues listed in their biannual *Activity Plan* which summarize the best available scientific data on a specific groundwater issue, identify areas where there is insufficient scientific data to thoroughly assess the issue, evaluate the effectiveness of existing regulatory programs to address the issue, and provide recommendations or policy options to the TGPC regarding the issue.

The above recommendations or policy options represent the opinion of the TGPC GWI Subcommittee and do not necessarily reflect the views and policies of each participating organization. The United States Geological Survey (USGS) may have contributed scientific information only.

For more information about this white paper, please contact the TGPC (https://tgpc.texas.gov/contact-us/).

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Appendix A. Additional Possible Regulatory and Nonregulatory Actions to Enhance the Protection of Children's Health.

Below is a list of regulatory and nonregulatory actions to further consider for protection of children's health against exposure to harmful levels of groundwater contaminants. The most protective regulatory actions would be those that ensure CCOs do not expose children to water from private water wells that contain, or may contain, harmful levels of groundwater constituents. Untested private water wells should be assumed to have the potential to contain groundwater contaminants. A combination of regulatory and nonregulatory actions may increase protection for children.

Possible regulatory actions (by relevant state agency):

I. CCR

i. Update child care minimum standards rules to require that CCOs who use private water wells or other unregulated water systems for drinking water, or for preparing formula or food, test the water annually in accordance with state guidance or recommendations by their local public health departments and make these results available to CCR. If contaminants are found in the annual test results, the CCO must **either** a) treat the water so it does not exceed MCLs, **or** b) use U.S. Food and Drug Administration (FDA) regulated consumer drinking water for drinking and preparing formula or food for infants and children. Minimum standards could allow the use of U.S. FDA-regulated consumer water in place of testing so that a CCO could opt out of water testing. Recommendations for water testing should include nitrates and coliform bacteria, at a minimum, as exposure to these contaminants may result in potentially acute illnesses.

- Pros: This is the most protective policy option to ensure that children in licensed child care facilities are not exposed to ingesting unsafe levels of contaminants in drinking water from private water wells used by CCOs.
- Cons: This may add costs to CCOs who have not independently met testing requirements, who choose to purchase consumer drinking water to avoid water testing, or who must treat water that exceeds MCLs for contaminants. This may add additional enforcement efforts to CCR staff, which may infer costs. This may require additional efforts from local or regional health or environmental departments to consult on local water quality and provide testing recommendations, though this is likely to fit into the scope of the existing missions and expertise of these departments.

ii. Require CCOs that do not take the protective measures listed in the above bullet provide written notification to parents or guardians in an appropriate language that the water has not been tested for contaminants using best practice guidance prior to providing care. CCR may wish to provide a standard template for such a notice to ensure accurate messaging reaches parents.

- Pro: This would be regulatory but potentially free for CCOs, as testing would not be mandatory. It is anticipated that this would encourage testing and provide useful health and safety information to parents.
- Cons: Parents may not understand what the notification means, or they may be limited in their CCO options. Children may still be exposed if there is groundwater contamination. In addition, this rule would be difficult to enforce.

iii. Require owners and operators of a CCO using a private water well for drinking water to complete mandatory well water safety education (one clock hour of continuing education credit) that has been created or approved by HHSC or DSHS.

- Pros: This would increase CCO owner and operator knowledge and awareness of well water safety and recommended best practices for preventing potentially harmful exposures to contaminated groundwater. This could also complement requirements for testing.
- Cons: This could add costs for CCR or another appropriate state agency or partner to create and update mandatory training if it were offered at no cost to CCOs through CCR, DSHS, or another state partner. If it was not offered at no cost, mandatory education is anticipated to add minimal cost (under $20) for CCOs in addition to the time required to attend the class. However, increasing awareness does not ensure that action will be taken to prevent exposures.

II. DSHS

i. Add home-based CCOs to the list of cottage industries overseen by the CPD or establish a new program within the CPD specifically for investigating well water safety in CCOs.

- Pros: CPD could require testing of the water supply similar to the requirements of cottage industries that produce consumable products. This would ensure that children are not exposed to unsafe levels of contaminants in drinking water from private water wells used by CCOs.
- Cons: It would impose a greater burden of time and costs on all home-based CCOs to apply as a cottage industry when it is likely that only a portion of them use water from private water wells. Significant costs are expected for CPD to develop new programs or enforce new regulatory standards. Also, this option may exclude small non-home-based CCOs.

ii. Require water source testing and inspection for any CCO using a private water well as part of the sanitation codes for businesses serving food.

- Pros: This would help ensure that children are not exposed to unsafe levels of contaminants in drinking water from private water wells used by CCOs.
- Cons: While CCOs are required to have drinking water available, they are not required to provide cooked food, and thus many would not fit into the existing or reasonable definition of a business serving food. Small CCOs or home-based programs may not offer cooked food to children. The costs to DSHS in inspecting and enforcing this action could be substantial since it would require physical inspection.

III. Texas Legislature

i. Mandate private well water testing for common constituents prior to ownership transfer of the property.

- Pros: This would ensure that testing was done when a property ownership transfer occurred, increasing the new owner's knowledge of the quality of their well water. This would impact the general public in addition to CCOs. Precedence exists for such laws in other states [56].
- Cons: This would not ensure that testing results are shared with renters or that measures to address the contamination are taken. It would only increase awareness for those purchasing properties. If the groundwater is contaminated, this may impact prospective buyers' interest in the property.

ii. Modify Section 26.408 of the TWC to include provisions for notifying tenants and the owner of potentially impacted properties in cases of groundwater contamination. This would ensure notification to any CCOs operating from a rental property.

iii. Update Texas Property Code Section 5.008(b)9 to include in the seller's disclosure of property conditions that they have knowledge of a notification from a state or federal agency that the property may be impacted by nearby groundwater or other contamination.

Potential non-regulatory actions:

I. CCR could add a definition of "safe and sanitary" to the minimum standard that includes testing for primary water contaminants or defining it as meeting voluntary guidelines set by the state. This is technically nonregulatory, but it would have impacts on the interpretation of existing rules. This could result in costs to CCOs since testing and treating would be required to meet the definition. Same pros and cons as potential regulatory action I.i. above.

II. State agencies and relevant organizations could collaborate to develop and distribute free resources for CCOs and families relating to well water safety in child care settings that are appropriate for selected regulatory and/or nonregulatory initiatives. The outreach plan could be informed by the data captured by CCR's application and renewal process, if this recommendation was implemented. If recommendations for testing are implemented, the state could work to reduce or help fund testing costs for CCOs. This may be accomplished through cooperation between state agencies to utilize existing funding from relevant programs or partnerships with state laboratories, depending on the number of CCOs served by private water wells.

III. An appropriate state agency or partner could create and host a geospatial tool for local and regional public health or environmental departments that combines water quality data from multiple sources (e.g., TCEQ, RRC, TWDB, USGS, etc.) to increase the local health and/or environmental department's capacity for assisting CCOs in determining the most appropriate water testing (and treatment) recommendations specific to their location.

IV. Texas could participate in the "Be Well Informed" web application ([66] which is hosted and maintained by the Environmental Council of the States in partnership with the participating government agencies) to help CCOs interpret water test results. This would provide an additional avenue for outreach and education to CCOs for understanding well water testing results. Benefits would extend beyond CCOs to the public. Minimal costs and effort to Texas agencies are anticipated as there is no cost to participate. However, the funding pathway for the tool is not known, so it may not exist in perpetuity. Twelve states were participating as of September 2024.

Appendix B. Approach for determining the proximity of DCOs to known groundwater contamination.

DSHS estimated the number of DCOs located in areas with known groundwater contamination. The analysis was conducted to answer the questions:

- How many DCOs are located in counties with contaminated aquifers?
- How many DCOs are located in counties without information on groundwater quality?

The four steps below were followed:

1. Obtaining data

DSHS downloaded data on DCOs from the Texas Open Data Portal for HHSC CCL Daycare and Residential Operations Data [67]. The database includes the location of DCOs in Texas.

DSHS used the TWDB website to find water supply boundaries [68]. DSHS also used the TWDB website to obtain the geographic location of major [69] and minor [70] aquifers in Texas.

DSHS identified instances of groundwater quality data in exceedance of state or federal MCLs or HALs using available data from the TWDB Groundwater Database [71]. The dataset pulled from this database was filtered to include information on water wells with groundwater quality data and results in exceedance of state or federal MCLs or HALs. For the current analysis, DSHS focused on aquifers containing the following substances in exceedance of these levels: arsenic, manganese, fluoride, gross alpha, nitrates and nitrites, radium, radon, and perchlorate. This data is a subset of the data contained in the TWDB Groundwater Database.

2. Preparation of datasets

DSHS reviewed (cleaned) each dataset to ensure county and aquifer names were accurate and consistent with each other and with the information from the other datasets.

3. Linking DCO data with contaminant well data

DSHS identified 200 DCOs that do not receive water from public water supplies because they are located outside of public water service boundaries and serve less than 25 children. Therefore, DSHS reasoned that these DCOs have the potential to rely on groundwater for drinking water. DSHS also assumed that the DCOs are obtaining water from aquifers with sample results in exceedance of MCLs or HALs.

Using R Statistical Software and the “sf” package [72, 75], DSHS conducted a spatial join of DCOs with all major and minor aquifers. When several aquifers exist at different depths in a given location, it is uncertain which aquifer a DCO’s hypothetical well may be completed in. To account for this uncertainty, DSHS considered all aquifers below a DCO for the analysis. This can potentially overestimate the number of DCOs counted as being in the same aquifer and county as a sample exceeding the MCL or HAL for a contaminant.

This method allowed for the identification of DCOs that are in the same county with an aquifer containing sample results in exceedance of MCLs or HALs. This method also allowed DSHS to determine the number of DCOs located in areas without groundwater sampling data.

4. Statistical analysis

DSHS analyzed datasets using R Statistical Software and the “sf” package for spatial analysis [72, 75].

For each contaminant dataset, the well coordinates were used to create a spatial feature in R. DSHS then created spatial joins with major aquifer and minor aquifer shapefiles, such that each well with intersecting aquifers is joined to the well dataset. The county field was already included in the well dataset.