Health Impact Reports Summary
Oil & Gas Well Exposure
2015 - 2017
Counselor Chapter
New Mexico

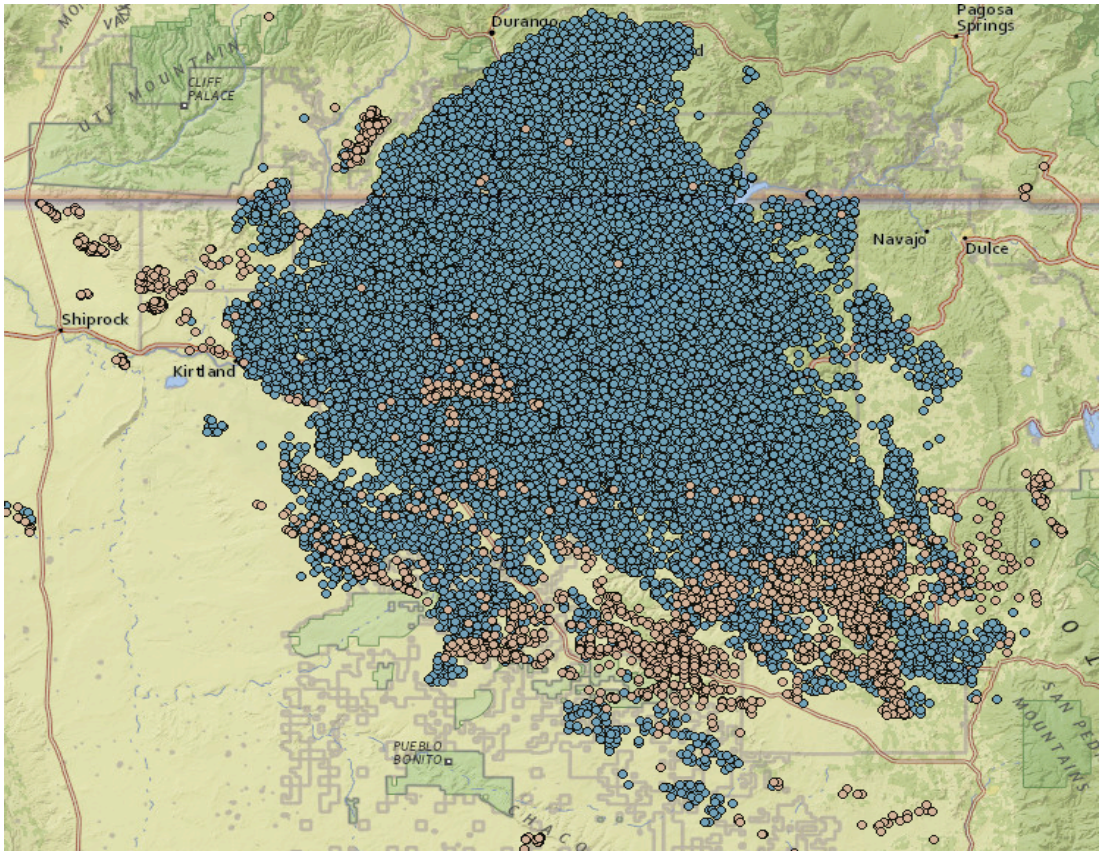

Image from *Energy*

2015 Counselor Chapter President, Harry J. Willeto:

" Nobody listens. It's getting worse. Don't know what to do. Don't know who will help. BLM is just bringing all this out here."

" Do something about these problems in this area – safety problems, health risks need to be addressed. We need to have someone listen to us, to our concerns."

Contents

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Executive Summary

Since 2015, the Navajo Nation Chapters of Counselor, Nageezi, Ojo Encino and Huerfano, have experienced increasing levels of health and safety impacts from the development of over 370 oil wells on thousands of acres of lands, leased by the Farmington Field Office of Bureau of Land Management (BLM-FFO), and in close proximity to chapter facilities, schools and homes. Currently, the BLM-FFO is conducting an Environmental Impact Study (EIS) on hydraulic fracturing impacts in the Mancos Shale/Gallup formation that is scheduled to be completed in 2018.

Counselor Chapter has taken steps to hold meetings for members and the public to both inform people about the potential risk of exposure to oil and gas operations as well as the health impacts from contaminated air and water to both humans and livestock. In 2015, the Counselor Chapter passed the following Resolution:

Resolution of Counselor Chapter
Counselor, New Mexico
#COUN-2015-03-_____

"Furthermore, Counselor Chapter requests assistance to secure funding to conduct health impact assessments, baseline water and soil testing and air quality monitoring for the impacted acres."

Eleven (11) Navajo Chapter subdivisions in the Eastern Agency have passed similar resolutions that state, in part:

1. The Chapter is against all pending and future federal fluid mineral BLM leases within Navajo Eastern Agency areas (or other lease sales which could directly or indirectly impact Eastern Agency Areas) until a reasonable revenue sharing mechanism is developed, the new Farmington Field Office Resource Management Plan Amendment is developed, and a full understanding of potential environmental and health impacts of horizontal hydraulic fracturing is developed: and
6. The Chapter shall cooperate with other chapters, the Navajo Nation, and federal entities to better understand potential environmental and health impacts of horizontal hydraulic fracturing activities that could affect Navajo communities.

Resolutions passed by:
Becenti Chapter, Counselor Chapter, Huerfano Chapter, Lake Valley Chapter, Nageezi Chapter, Ojo Encino Chapter, Olijato Chapter, Pueblo Pintado Chapter, Torreon/Star Lake Chapter, Whitehorse Lake Chapter and Whiterock Chapter

All the above Chapters are located in the BLM Farmington Field Office Resource Management Plan-Amendment, Mancos Shale/Gallup EIS boundaries with the exception of Olijato Chapter.

The 2016 Health Impact Reports and this 2017 Summary are the preliminary steps in preparing a full Health Impact Assessment, (HIA) for BLM–FFO and are being conducted currently by resident volunteers and community health workers with the assistance of additional organizations. *This work is independently funded and is citizen driven.*

Part One: What is a Health Impact Assessment (HIA)

Preface

HIA is used to evaluate objectively the potential health impacts of a project or policy before it is built or implemented. ***HIA can provide recommendations to increase positive health outcomes and minimize adverse health outcomes.*** *The HIA framework is used to bring potential public health impacts and considerations to the decision-making process for plans, projects, and policies that fall outside of traditional public health arenas, such as transportation and land use. - Centers for Disease Control*

Public health researchers have developed the Health Impact Assessment (HIA) approach to improve the accessibility and utility of existing scientific knowledge as it applies to program and policy development and decision-making by state and federal agencies.

Part Two: Chapter Health and Safety Concerns related to Oil-Gas

Flaring along US 550 across from Lybrook Community School

2015

Counselor, Torreon, Ojo Encino pass Resolutions.
Over new 350 wells approved

Wells move closer to towns and start causing health and safety problems

2015-2016

Community members experience unsafe roads, dust, air pollution and accidents from heavy tanker & truck traffic

Wastewater pits are used by livestock causing mortality

2016

Polluted surface water causes health problems in local livestock
Deformed lambs born in Counselor and unable to survive are reported in the Farmington Daily Times

Public Health concerns discussed at Counselor Chapter Meeting on May 23, 2016

Chapter speakers outlined health concerns in the Counselor area followed by a community discussion of health problems, a presentation on the benefits of an HIA, and a description of the 3-step process a community follows in preparing the initial health impact reports:

1. Identification of the health problem(s)
2. Collecting data and supporting information about the health problem(s)
3. Making recommendations to ensure a better outcome and resolution of the health problem(s)

Chapter Health & Safety Concerns reported by members at Counselor Meeting on 5/23,2016

Number of Attendees 33

Health Related

CANCER Cases reported – 2* ASTHMA Cases reported - 2

General Health (Weakness, Fatigue, Weight loss/gain, Dizziness) – 1
Eyes, Ears, Nose & Throat (Irritation, Hearing, Smell, Sinus, Nose bleeds) - 2
Respiratory/Cardiac (Coughing, Shortness of breath, Difficulty breathing, Chest pain) - 3
Gastro-Intestinal (Nausea, Vomiting, Abdominal pain, Appetite loss, Diarrhea, Bleeding) - 2
Reproductive (Pregnancy issues, Birth defects, Low birth weight/APGAR) - 1
Neurological (Headaches, Falling, Tremors, Numbness, Memory loss, Concentration) - 3
Psychological (Sleeping difficulty, Irritability, Anxiety, Depression, Anger, Stress) - 2

Safety Related

Accidents - 2
Traffic Safety (Speeding, Dust, Unsafe driving) - #2 complaint (> 10)
Road Damage – #1 complaint (>20)
Odor from Well Sites (Air quality) - 6
Wastewater from Wells (Water quality & Livestock illness) - 3
Noise from Well Sites - 1
Light Pollution from Well Sites - 1
Lack of Education on Fracking Risks- 2

* The Counselor Chapter Health Representative reported 13 cases of cancer in 2015-2016 and 10 deaths due to cancer in that period. Counselor-Nageezi population is 1,731 people.

The Navajo Nation Mortality Report (October 27, 2016) shows **cancer as the second leading cause of death** with 506 total cases on the Navajo Nation, population 300,048, (2010) accounting for 12.7% of all deaths. The Eastern Agency, which comprises the portion of the Navajo Nation in New Mexico, has the **leading number of cancers**, followed by Western Agency, Northern Agency, Chinle and Ft. Defiance.

The most prevalent cancer types reported in the Navajo nation are stomach, pancreatic, colorectal, breast, liver, prostate and lung cancer.
("Navajo Nation Mortality", presented 10/27/2016, David Foley, Navajo Epidemiology Center)

Cancer costs escalate as patients' progress from the diagnosis stage through surveillance, treatment, continuing and terminal stages. Surveillance, Epidemiology and End Results

(SEER) data collected from a 1991-2003 Medicare cost analysis on 60,000 cancer patients found the following median costs:

Diagnosis Period: $650/month (up to 6 months)
Treatment Stage (Chemo and radiological therapies): $2,680 to $9,360/month
Continuing and Terminal Stages: $10,600 to $13,400/month

Patients nationally pay approximately 21.6% of their care costs, with "out of pocket" costs generally exceeding 25% of annual income of low-income beneficiaries of Medicare. Medicare is the primary insurer for 97% of Navajos in New Mexico over age 65. 40 % of Navajo households in the state report less than $25,000 in income annually. (2010 US Census)

Chapter Health Concerns over High Ozone levels in San Juan Basin

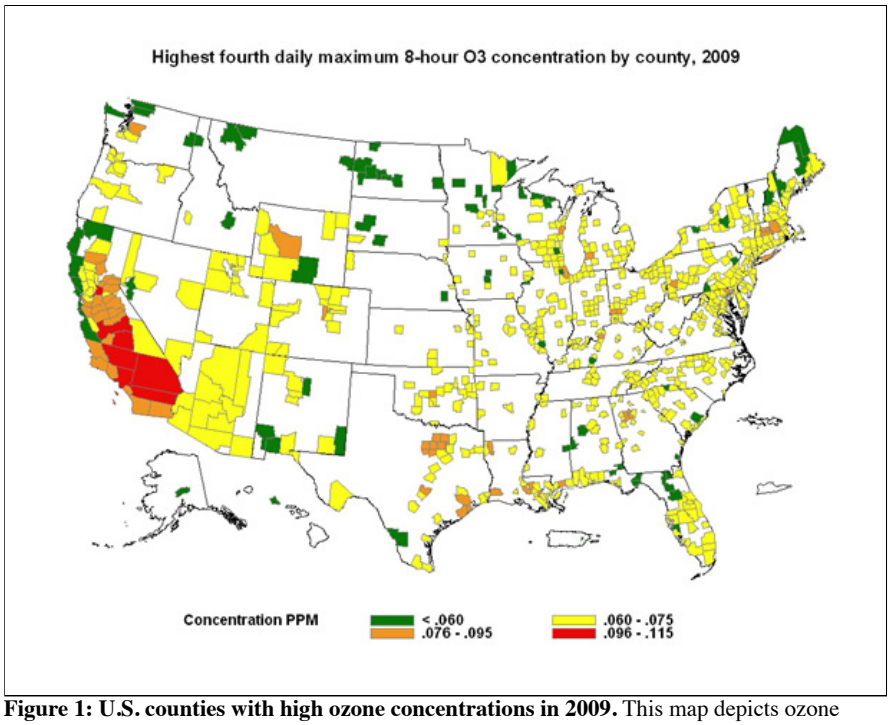


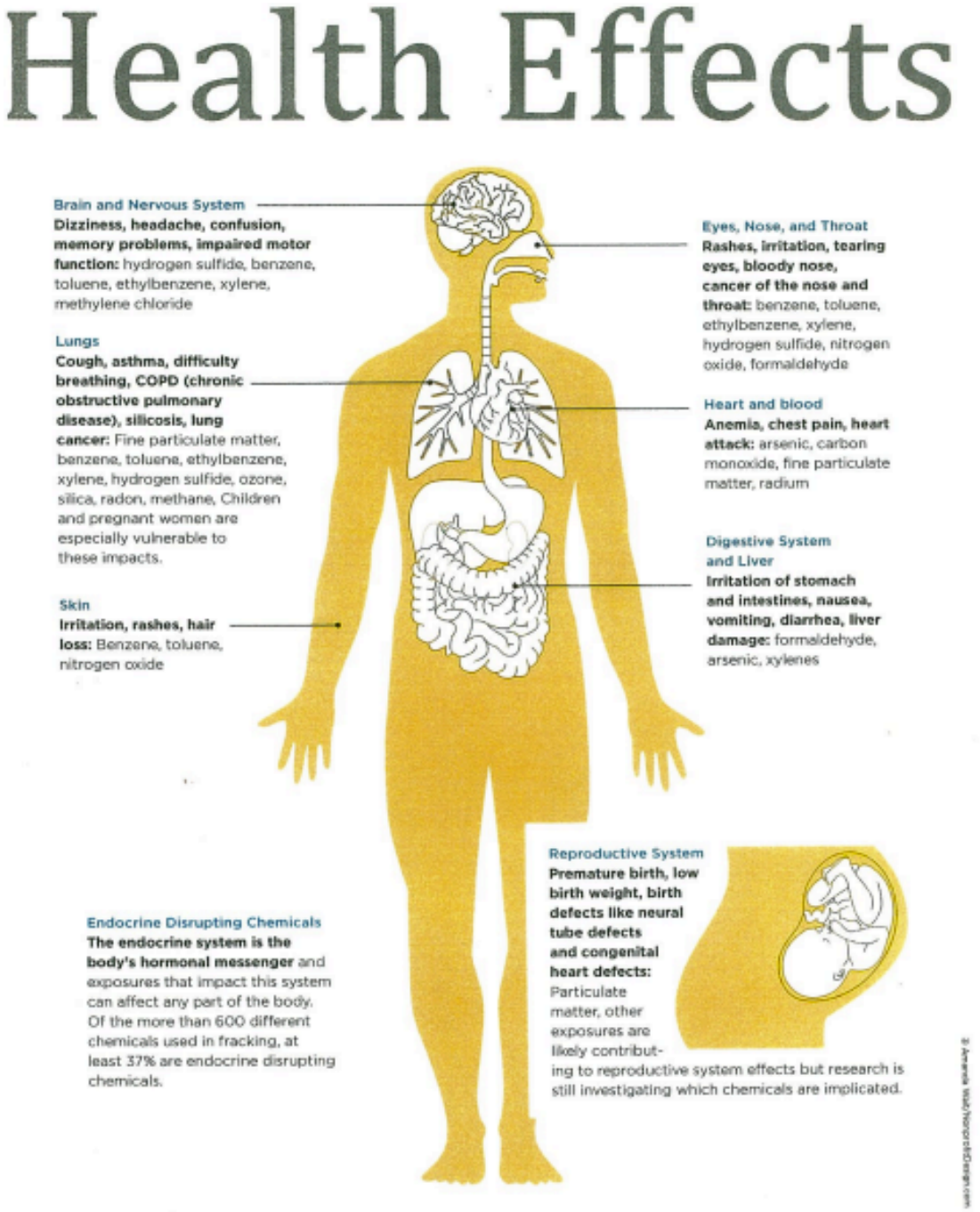
Figure 1: U.S. counties with high ozone concentrations in 2009. This map depicts ozone

High ozone and methane levels in the San Juan Basin, reported in the media, have been an ongoing source of public concern. Ozone (O_3) is a highly reactive gas and is both a natural and a man-made product that occurs in the Earth's upper atmosphere (the stratosphere) and lower atmosphere (the troposphere). Depending on where it is in the atmosphere, ozone affects life on Earth in either good or bad ways.

Stratospheric ozone is formed naturally through the interaction of solar ultraviolet (UV) radiation with molecular oxygen (O2). The "ozone layer," approximately 6 through 30 miles above the Earth's surface, reduces the amount of harmful UV radiation reaching the Earth's surface. Tropospheric or ground level ozone – what we breathe – is formed primarily from photochemical reactions between two major classes of air pollutants, volatile organic compounds (VOC) and nitrogen oxides (NOx).

When inhaled, *ozone* can damage the lungs. Relatively low amounts of *ozone* can cause chest pain, coughing, shortness of breath and, throat irritation. It may also worsen chronic respiratory diseases such as asthma as well as compromise the ability of the body to fight respiratory infections. ("*Health Effects of Ozone in the General Population*", US EPA)

Health impacts of BTEX and other Oil and Gas Emissions



This image indicates the common symptoms and health impacts known to be linked to chemicals associated with unconventional oil and gas development, including some of the chemicals captured in air samples as part of this project.

Health impacts due to proximity to oil and gas wells are being studied with greater frequency and specificity to local communities impacted by oil development.
The impacts of Benzene, Tolune, Ethylbenzene and Xylene (BTEX) emissions have been shown to have negative health outcomes and some substitution of less toxic fracturing chemicals have been made by some oil companies. BTEX emissions are released during the flaring period of gases from oil wells that can last up to 75 days or more.

BTEX emission exposure has been repeatedly cited[1] as a leading cause of life-threatening birth defects in infants born to mothers exposed to benzene in their first trimester of pregnancy. Birth defects include congenital heart defects (CHDs), neural tube defects (NTDs), and pre-term and low weight birth.

([1] EHP Birth Outcomes and Maternal Residential Proximity to Natural Gas Development in Rural Colorado, McKenzie et al, Vol. 122, April 2014)

Health & Safety Concerns reported at Counselor BLM Meeting on September 28, 2016

At the BLM scoping meeting in Counselor, FFO Manager, Richard Fields, and Realty Specialist, Mark Ames, heard dozens of residents, organization representatives and chapter officials speak in opposition to more leasing of Tribal land or BLM land for oil development citing: contaminated water, air pollution, traffic danger, public safety problems and health concerns of residents.

Major concerns from the community heard by BLM:

- WPX new storage facility explosion and fire that destroyed 36 storage tanks and caused the evacuation of 55 local residents and extensive damage to private property located closest to the accident site, as well as extensive release of chemicals and pollutants, as yet unidentified, into the Tri-Chapter communities' air and water over a 5 day period while the fire burned out of control.
- Constant danger from speeding over sized oil company tankers and trucks to local drivers, to children getting off school buses and walking home and to local livestock near or crossing rural roads.
- Oil company employees taking off-road short cuts through properties and causing surface damage
- Lack of fencing around waste water pits that attract livestock and wildlife
- Lack of public notice of flaring periods and no resident protection from flaring emissions, flaring for 75 days instead of 7-14 days (BLM regulation)
- Impact of air emissions on children, teachers and staff at local Lybrook Community School on Highway 550 (Enrollment: 116 children K-8th Grade)
- Lack of communication to the public regarding air quality alerts, safety of community drinking water or sudden road closures due to oil company activities

Different members of the Counselor Health Impact Assessment committee spoke about:

- Need for well site emission monitoring in the affected chapter communities
- Water testing for contaminants in public drinking water and livestock ponds
- Health impacts from fracking in different organs and areas of the human body

- Scientific studies on infant mortality and birth defects caused by exposure to oil field air pollution and other contaminants
- Psychological impacts of continuous human exposure to the noise[2], smells, vibration and night lighting of nearby well sites ([2] "Public health implications of environmental noise associated with unconventional oil and gas development", Hays, J. et al, Elsevier STOTEN-21420, 2016)
- Impacts to spiritual life of residents whose local sacred and ceremonial sites have been destroyed by oil development activities
- Increase in cases of cancer, asthma and respiratory illness in the affected Chapter communities

The BLM's Environmental Assessment report (EA) reported "Findings Of No Significant Impact" (FONSI) to the surrounding communities, water, air, land or sacred sites. This finding was repeatedly challenged by chapter members' testimony at the BLM meeting.

At Home Health Concerns collected 10/1/16

Resident A
My grandson has asthma and he uses an inhaler. In middle of December he got worse. He has to go into Albuquerque where he got more medicine. They moved back to Mesa and he's still taking the medicine. His mom had to take him to the hospital yesterday. Sandoval County is taking care of the road all the way to the highway. When they fix the road the next two days the diesels ruin it. It's bad. Sometimes my throat gets bad and I think that's what it is, the dust.

Resident B
"Some of them when they drill they go out this way and they go fast. Other than that the sign has NO WPX Traffic and that helps. I have to talk to my parents cause the locations close to their house. The sheep come out and some of these oil field workers go through here; they don't slow down.

Resident C
I was just thinking since the last two years we have cancer. Escalating. And the death. I'm concerned. The older people. Sometimes when you drive through that valley you can smell. It gets you tired. Your eyes are watery. It takes time to recover from all that. Sometimes you just sit for a couple of days and you just don't feel like getting up. We're breathing in whatever it is that chemical in those wells. I don't know what it is, but.... It's like we created a monster.

Resident D
Yes it bothers me. My lambs are being born deformed. My family, father, sister have medical issues. It really smells. The people that are doing the work must have no sympathy for us because we're sick. I went to the chapter house one time where they were having a meeting and I voiced my concern. The drillers are all over the place. You can't just let the cattle go free. They might go to the site and eat some of the dirt, grass, or whatever it is that's there. I think whatever they're doing right now needs to stop. Even nearby they can frack and drill beside allotments, near my homesite. They told me they can even drill right

next door. The road is getting really busy. Trucks go really fast and it's really dangerous.

Part Three: HNDA data research model on Fracking and Diné Cultural Values

Hózhóógó na'adá is a process of discussion, a Diné - centered lens, for participants to assess their personal and interpersonal values in relation to ancient Hózhóógó na'adá philosophy, principles and values. They will discuss the question: "Given the pros, cons, good and bad regarding the fracking situation of our region, how does this impact the overall health and wellbeing of our communities?"
Facilitator: Dr. Herbert Benally.

Dr. Benally is fluent in both Navajo and English and reads and writes Navajo. He is very familiar with the use of his model in this research and evaluation technique.

An initial presentation and discussion with members opposed to fracking has been conducted at Counselor. A second presentation and meeting for members in favor of fracking has yet to be scheduled, but will take place in Counselor in 2017.

Part Four: Drinking Water and Air Quality Monitoring Data Collection

Drinking Water Analysis in the Counselor-Nageezi area
Hall Environmental Analysis Laboratory, Albuquerque, NM, a New Mexico state certified water-testing lab, conducted a baseline analysis of 4 sites in November 2016.

Water Quality Monitoring Sites and Results

- Sampling of 3 public drinking water facilities in Counselor, Lybrook and Nageezi (October, 2016) conducted by Eric Patterson, Taos Water Sentinels
- Sampling of 2 livestock ponds in Counselor-Nageezi area (one was too dry for testing)

CW1 (Lybrook Mission)
Water samples taken from public water faucet.
CW2 (Christ of all Nations)
Water samples taken from public water faucet.
CW3 (Counselor Chapter House)
Water samples taken from kitchen faucet

- No detected contaminants that violate any EPA water regulatory standards.
- The water in all 3 CW samples (CW1, CW2 and CW3) show no *e. Coli*
- Total dissolved solids (TDS) are flagged and are high in CW2 (621 mg/L) and are over 600 in ALL three CW samples. 500 mg/L is the EPA secondary regulatory limit. This means that although the water is potable, it does not meet this non-enforceable standard for TDS. When this water dries, it leaves a crusty, white, salty residue that is un-desirable in terms of taste. Impact on pipes, surfaces and for cooking
- High sodium, sulfates and overall alkalinity are also high in all 3 samples along with Conductivity (1000 µmhos/cm), but not at levels that make the water unsafe

LP1 – Harvey Livestock Pond sample

- Total dissolved solids are lower (256 mg/L)
- Alkalinity is within regulatory limits

Conclusion: Residents can continue using these water supplies for drinking and livestock use. The tests were limited to checking for *E. coli,* Total Coliform, Anions, Conductivity, Metals, Diesel, Gasoline, Volatiles, Alkalinity and Total Dissolved Solids. Testing at active drilling sites is recommended.

Air Quality Analysis in Counselor-Nageezi area

(Testing done by ALS Environmental and additional analysis done by Mark Chernaik, Ph.D., staff scientist at Environmental Law Alliance Worldwide.)

Air Sampling #1

Two toxic substances were detected at the two sites collected on October 14, 2016, relatively modest levels of ethyl acetate and toluene. The levels of ethyl acetate in the two samples (21 μg/m^3 and 24 μg/m^3) are not of a health or environmental significance because of the low toxicity of this chemical.

The levels of toluene in the two samples (19 μg/m^3 and 72 μg/m^3) are also not of a health or environmental significance and are below relevant health-based standards, such as the acute Reference Exposure Level of 37,000 μg/m^3 and the chronic Reference Exposure Level of 300 μg/m^3 developed by the California Office of Environmental Health Hazard Assessment (OEHHA). http://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary

However, these two toluene levels are unusually high. A 2013 survey of air quality in more than 100 locations across the United States found daily arithmetic mean concentrations of toluene ranging from 0.073 μg/m^3 to 19.0 μg/m^3, implying that there is some anthropogenic source of toluene in the samples (at least for the second sample which has a toluene level of 72 μg/m^3). https://www.atsdr.cdc.gov/toxprofiles/tp56-c6.pdf).

Air Sampling #2

Three air samples were collected in the early morning of April 18th along Highway 550. One sample was collected along Highway 550 at mile marker 100 north of the Lybrook School (Report P1701856); a second sample was collected along Highway 550, at mile marker 107.5, approximately ½ mile south of the highway near the San Juan and Rio Arriba county line (Report P1701857); and a third sample was collected along Highway 550 at the intersection of CR 7900. The levels of contaminants are indicated in Rows 9-11 of the attached spreadsheet – Community monitoring of Greater Chaco (4 May 2017).xls.

Hydrogen Sulfide

Hydrogen sulfide was detected in the sample collected along Highway 550 at mile marker 100 north of the Lybrook School at a level of 7.6 μg/m^3.

Hydrogen sulfide is commonly emitted by natural gas wells because raw natural gas is commonly contaminated by hydrogen sulfide.

Hydrogen sulfide is a gas that possesses a potently offensive odor of rotten eggs. Long-term exposure to hydrogen sulfide is associated with an elevated incidence of respiratory infections, irritation of the eye and nose, cough, breathlessness, nausea, headache, and mental symptoms, including depression. The California OEHHA has established a chronic reference exposure level for hydrogen sulfide of 10 µg/m3 (for preventing effects on the respiratory system) and an acute reference exposure level for hydrogen sulfide of 42 µg/m3 (for preventing headache, nausea, and physiological responses to odors). The U.S. EPA reference concentration for hydrogen sulfide is 2 µg/m3 (for preventing nasal lesions of the olfactory mucosa).

The level of hydrogen sulfide detected in the sample collected north of the Lybrook School exceeds the U.S. EPA reference concentration for hydrogen sulfide, but is below the California OEHHA has established a chronic reference exposure level for hydrogen sulfide. If hydrogen sulfide levels of 7.6 µg/m^3 north of Lybrook school generally prevail, then these levels may pose some risk to human health.

D-limonene

D-limonene was detected in all three samples in levels ranging from 330 µg/m^3 to 430 µg/m^3. The levels of D-limonene do not pose a risk to human health.

D-limonene is derived from citrus fruits and it would be unusual for there to be detectable levels of D-limonene along a rural highway in northern New Mexico.

However, D-limonene is being increasing used a hydraulic fracturing additive, replacing the use of xylene, which is more toxic. One industry – Flotek Industries – has been promoting the use of D-limonene in the oil & gas industry:

"Flotek Industries, Inc. (NYSE: FTK – News) introduced its Xylene replacement products, including its FC-PRO-XR product line, at the Independent Petroleum Association of America Mid-Year Meeting in Colorado Spring.

Flotek's line of solvents is based on citrus chemistry, specifically the Company's technical grade d-limonene, a double-bonded hydrocarbon produced from the skins of oranges. Laboratory and commercial validations show that d-limonene – an environmentally safe and renewable compound – is as effective as Xylene and other BTEX-type solvents in eviscerating pollutants that stifle production in oil and gas wells."[1]

Fugitive emissions of D-limonene as a result of its use at oil & gas wells would be a plausible explanation for its presence in all three samples.

A-pinene

α-pinene was detected in all three samples in levels ranging from 72 µg/m^3 to 95 µg/m^3. The levels of α-pinene do not pose a risk to human health.

A-pinene is a principle constituent of turpentine and it would be unusual for there to be detectable levels of α-pinene along a rural highway in northern New Mexico. Turpentine is a commonly used industrial solvent used to clean hydrocarbons that foul equipment. Fugitive emissions of turpentine as a result of its use at oil & gas wells would be a plausible explanation for the presence of α-pinene in all three samples.

Toluene

Toluene was detected in all three samples in levels ranging from 28 $\mu g/m^3$ to 57 $\mu g/m^3$. This continues a trend from October and November of 2016 in which toluene was detected in each of five samples collected in the same general area at levels ranging from 19 $\mu g/m^3$ to 99 $\mu g/m^3$. The levels of toluene do not pose a risk to human health.

Toluene is used in the oil & gas industry as a component of a solvent for removing paraffin build-up from the interior walls of pipes.

Fugitive emissions of toluene as a result of its use at oil & gas wells would be a plausible explanation for its presence in all eight samples collected in the general area.

Propane

Propane was detected in all three samples in levels ranging from 48 $\mu g/m^3$ to 62 $\mu g/m^3$. The levels of propane do not pose a risk to human health.

Propane is not ordinarily found at detectable levels (above 2 parts per billion) in ambient air unless there is local source of propane emissions.[2] Propane is a natural gas liquid and is a significant constituent of raw natural gas. Fugitive emissions of propane from oil & gas wells that are venting significant quantities of VOCs would be a plausible explanation for its presence in all three samples.

Conclusion: Residents should be informed about the risks of exposure to Hydrogen Sulfide and try to reduce their outdoor time at the Lybrook School and at the well site at MM100 on Highway 550. Residents affected by the fumes and odors identified in the air samples, should notify their medical providers that they are being exposed to these substances regularly, as well as report any symptoms they may be experiencing.

The company operating the well should be notified and it should take steps to lower the release of Hydrogen Sulfide to regulatory levels.

Lab results are available upon request.