Air Monitor P570

A Cultural, Spiritual and Health Impact Assessment

Of Oil Drilling Operations in the Navajo Nation area of
Counselor, Torreon and Ojo Encino Chapters

July 15, 2021

Prepared by Counselor Health Impact Assessment - K'é Bee Hózhǫǫgo Iiná Silá Committee

Counselor Health Impact Assessment (HIA) - K'é Bee Hózhǫǫgo Iiná Silá (KBHIS) Committee

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Special Acknowledgements

Dr. Lorenda Belone and her graduate students, UNM School of Medicine
Melissa Gonzales, Ph.D., UNM School of Medicine
Eric Patterson, Taos Water Sentinels
Shannon Romeling, M.S., Amigos Bravos
Franklin Sage, Ph.D., Director, Diné Policy Institute, Diné College

Funding Organizations

Con Alma Health Foundation, Center for Health, Environment & Justice (CHEJ), Rainforest Action Network (RAN), and Sierra Club

Bridging the Cultural, Spiritual and Health Impacts of Oil Drilling

David Tsosie, Ed.D.

The Holy Surface Earth People (Diné) have always tried to follow the many traditional teachings that have been shared with them by the Holy People since time immemorial. These teachings have been passed down from one generation to another and have for centuries established the parameters for the relationship that has been maintained by the Diné people. Our elders tell about the stories of the creation when the Holy People came into the White World/Glittering World. They placed the sacred mountains, the rivers, the plants, the animals, the birds, and all life forms in their proper places and environment. They ordained, through songs and prayers, the earth and universe to embody Nitsahakees (thinking), the water and the sacred mountains to embody Nahata (planning), the air and vegetation to embody Iina' (life), the fire, light, and offering sites of variegated sacred stones to embody Sihasin (wisdom). These became the fundamental tenets established to follow an order of thinking, being the foundation of planning, and life, being the foundation of wisdom. These tenets became an integral part of our life pattern where all important events have first to be thought out, then planned, then they all become part of life process, and from here, wisdom is attained to guide the future generation.

More importantly, the Diné Traditional Law mandates that the teachers of traditional laws, values and principles must be respected and honored if the people and the government are to persevere and thrive and that their participation and contributions of the traditional values and principles of Diné life way will ensure growth of the Navajo Nation. Additionally, the Diné Natural Law emphasizes that:

1. The four sacred elements of life, air, light/fire, water and earth/pollen in all forms must be respected, honored and protected for they sustain life;
2. All creation, from Mother Earth and Father Sky to the animals, those who live in water, those who fly, and plant life have their own laws and rights to exist; and
3. We, the Diné, have a sacred obligation and duty to respect, preserve and protect all that was provided for us and that we were designated as the steward of these relatives and must acknowledge them thorough our use of the sacred gifts of language and thinking.

It is important to note that Mother Earth and Father Sky are part of us as Diné and we are part of Mother Earth and Father Sky; thus, we must treat this sacred bond with love and respect without exerting dominance. The love, respect and honor that is shown to our natural environment is displayed by following the proper protocols of making offerings at sacred sites requesting permission to only take what is needed and to place them back with prayers and songs.

There are ceremonial stories of how many of these elements were placed into the earth and sky to be part of the cosmic order. If they were excessively removed, there would be devastating consequences. One story tells of the destruction of the monsters and evil forces that came upon the people after they came into the Glittering World. Monster Slayer and Born for the Water

brought about the destruction of all the evil forces/energies that were annihilating the people living in the Glittering World. After all of these evil forces were destroyed, they were placed into the earth and sky and it was declared that they should never be disturbed.

After the obliteration of the evil forces, the people lived in a peaceful environment for a long time. One day some of the people noticed a change in the environment and called on the Holy People for guidance. The Holy People discussed the situation and asked the Early Twilight Dawn deity to assist in correcting the disharmony that had come into the environment. To restore order and harmony, the Twilight Dawn deity gathered all of the sacred mineral people at Dziil Na oodilii (El Huerfano). After much discussion, it was decided to send all of the mineral people into the earth to restore order and become caretakers. It was then agreed among the Holy People that minerals can only be taken out of the earth with prayers, songs, and offerings. After their use, minerals will be placed back into the earth with prayers, songs and offerings. There would be devastating consequences if large quantities of minerals were taken out of the earth without following the proper protocols.

We have seen these devastating effects in how they have brought certain health complications and illness like cancer, respiratory problems, and other sicknesses among our people.
Under the leadership of the late Dr. Larry Emerson, a study titled Hazho Nadaii was started to examine problems and issues through a Diné Lens, meaning looking at problems and issues by incorporating Diné traditional stories and teachings to address how some of these complications could be dealt with. It was through this initiative that the Counselor Health Impact Assessment – Hozhogo'na'da Committee started looking at the concerns of communities around oil drilling activities and the use of fracking to acquire more oil. We undertook a two-phase approach to looking at the problem oil drilling operation in the three Chapters of Counselor, Torreon, and Ojo Encino (the Tri-Chapter).

Since 2015, the residents of Counselor Chapter have voiced concerns about sudden and unusual health symptoms experienced from breathing polluted air around oil wells near their homes and roads. The Chapter communicated those concerns in a 2015 Resolution to the Navajo Tribal Council and requested a Health Impact Assessment (HIA) be conducted before further oil operations were permitted. In January 2018, the Navajo Nation Human Research Board approved a two-part Health Impact Assessment: Part One - to conduct air sampling and voluntary health surveys in Counselor Chapter, and Part Two – K'é Bee Hózhǫǫgo Iiná Silá - the continuation of Hazho Nadaii – a traditional survey taken by residents from Counselor and two neighboring chapters, Ojo Encino and Torreon.

The first phase of the Health Impact Assessment (HIA) examines the changes that intensive oil drilling has made to the air quality of Counselor Chapter, and identifies related health symptoms reported by chapter residents.
The second phase of the Assessment, K'é Bee Hózhǫǫgo Iiná Silá (KBHIS) is a survey tool and model that seeks to identify degrees of concern felt by the individual regarding the familial, community, cultural, and environmental impacts from current oil drilling and the threat of expanded land leasing facing these three Diné communities.

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I. Introduction - Is the Open Air Safe?

Counselor Chapter is a rural, sparsely populated, high desert area, with tree-covered mesas and pinion-juniper forests and grasslands. There are an estimated 700 residents and many live in small familial clusters in the Cross Roads and Cornfields areas in the central area of the Chapter. The Chapter House, Lybrook Community School, and the Lybrook Ministries are located on the Chapter's northern boundary of US Highway 550, approximately 35 miles north of Cuba. The northern half of the 70,771-acre chapter is a heavily developed gas and oil area with more than 400 oil wells, industrial wastewater ponds, storage tanks, pipeline infrastructure, and a network of dirt access roads for oil company workers across the community.

For over five years, Counselor leaders and residents have reported their concerns to tribal, state and federal agencies and taken actions to identify the multiple impacts of this industrial development within the community. A young father-to-be spoke at a Chapter meeting on May 23, 2016 with these words: "How is our younger generation going to survive? Is the open air going to be safe? Will it cause birth defects or not?" This report attempts to answer these questions and many others, and to reveal how little is yet known about oil development's ultimate impacts on human health and the environment.

Points to bear in mind regarding local impacts of well emissions:

- Emissions from over 400 gas and oil drilling sites in Counselor Chapter are significantly increasing the reported respiratory health symptoms of residents that mirrors results of national health studies.
- Continued and cumulative exposure to elevated levels of toxic gases, particularly formaldehyde, from nearby well operations can lead to chronic respiratory effects and cancer[1].
- Lease sales for oil development are proposed in the adjacent chapters of Torreon and Ojo Encino raising concerns that similar health, safety and cultural impacts will be felt in those communities.
- Exposures to emissions do not occur evenly over time, but spike in intensity periodically.
- The extent to which people are exposed to toxins is determined by the concentrations of emissions vented and leaked, combined with weather conditions.
- There is now an abundance of information about shale gas and oil site emissions and their potential to do harm to the health of residents who live within 5 miles of well operations, but almost no data on the Checkerboard Area of the Navajo Nation.

[1] Southwest Pennsylvania Environmental Health Project Report: "Counselor Chapter Air Quality Assessment Results: Particulate Matter (PM2.5) and Volatile Organic Compounds (VOCs)", August 3, 2018

Getting Started: Health Impact Assessment Checklist

Free, Prior and Informed Consent: Have Counselor residents been provided the information they need by state, tribal or federal agencies before leasing their land for development?

	NOT PROVIDED	INCOMPLETELY ADDRESSED	ADDRESSED WELL
Attention to concerns of residents		X BLM-BIA meetings w/ no explanation of potential harms or permanent effects	
Listing of chemicals emitted and at what concentrations	X Not Provided		
How often will emissions occur and at what times of day	X Not Provided		
Projected exposure within a mile of site – daytime and nighttime at peak level	X Not Provided		
Radioactive material present	X Not Provided		
Air monitoring plan specified			X Counselor HIA Monitoring Project w/ EHP
Warning system in place for times of planned or unplanned high releases for those within a mile	X WPX explosion and 5 day fire (July 2016) is one of many examples of need for evacuation plan/response		
Blowdown emissions addressed	X Not Provided		
Emissions from flares estimated	X Not Provided		
Sufficient distance from schools, day cares and other sensitive locations	X Lybrook School has 31+ wells located within 2 miles of the property		
HEALTH IMPACTS			
Chronic and episodic exposure effects on children addressed	X Not Provided		
Exposure effects on fetal development addressed	X Not Provided		
Effects of PM2.5 addressed			X Counselor HIA monitoring w/ EHP analysis
Effects of VOCs addressed			X Counselor HIA Monitoring w/ EHP analysis

QUESTIONS OFFICIALS OUGHT TO ANSWER BEFORE GOING FORWARD WITH SHALE GAS OR OIL DECISIONS IN NEW MEXICO

Public agencies - Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), Navajo Nation EPA, NM Energy, Minerals & Natural Resources Department – at the federal, tribal, and state level – should address the health concerns raised in this report and establish Conditions of Approval or prohibit certain industrial operations in inhabited areas to protect the public from harm. In order to protect public health, it is necessary to know whether dangerous levels in pollutants will occur in a developing area and what health effects may occur in the short or long-term.

This Health Impact Assessment helps organize information needed to start answering critical questions:

1) What chemicals are being emitted or leaked? 2) Are people being exposed to harmful levels of emissions? 3) What is the local air quality? 4) What health effects from chemical exposures have been determined? 5) How can your agency mitigate or remove existing or potential harms?

II. Chemical Exposure in Counselor

The complete list of chemicals being used in oil drilling operations in Counselor is unknown. Of the 75 toxic substances tested for in four 24-hour samples, a total of 8 toxic chemicals were detected. Results (Appendix 2) found formaldehyde at 4 sites, at elevated levels (greater than 0.003 ppm) that carry recommended actions to reduce exposure for local residents. Other detected chemicals:

2-Propanol
Acetone
Chloromethane
Dichlorodifluoromethane
Hexane
Methylene chloride
Trichloroethene

Certain classes of particles and chemical agents have well known health effects that have been documented by the Occupational Safety and Health Administration (OSHA), American Cancer Society, Agency for Toxic Substances & Disease Registry (ATSDR) and in scientific journals, medical reports, clinical studies and media articles[2].

The presence of these chemicals makes it likely that other commonly used chemicals at well sites are present at different stages of operations.

[2] "Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking" (5th Ed., 2017) Physicians for Social Responsibility, Concerned Health Professionals of NY.

Chemicals Detected, Methods of Exposure and Associated Symptoms

2-Propanol – Inhalation; exposure can cause headache, dizziness, nausea, respiratory depression and coma. (Highly flammable)
https://www.google.com/search?source=hp&ei=qw49XKyHKo2_jgT7kIf4Bw&q=2-propanol+hazards&oq=2-&gs_l

Acetone – Inhalation; exposure can irritate eyes, nose and throat, and cause dry, red, cracked skin. (Highly flammable)
https://www.ccohs.ca/oshanswers/chemicals/chem_profiles/acetone.html

Chloromethane & Dichlorofluoromethane – Skin contact: exposure can cause severe irritation and chemical burns to eyes.
https://www.msdsonline.com/2015/02/20/dichloromethane-methylene-chloride-hazards-safety-information/

Hexane – Inhalation: short-term exposure affects the nervous system and causes headaches, dizziness and nausea. Chronic exposure can lead to severe damage to the nervous system, dermatitis and irritation of the eyes and throat. (Solvent)
https://www.msdsonline.com/2014/11/19/understanding-the-hazards-of-hexane/

Methylene chloride – Inhalation and Skin contact: exposure may cause mental confusion, dizziness, nausea, and headache. Continued exposure can cause eye and respiratory irritation. Skin contact may cause irritation or chemical burns. (Solvent)
https://www.osha.gov/Publications/osha3144.html

Trichloroethylene (TCE) – BANNED in food and pharmaceutical industry since 1980s - Skin contact: exposure may cause fetal toxicity and causes effects on the nervous system related to hearing, seeing, balance and heartbeat, also liver and kidney damage. (Non-flammable)
https://www.edf.org/health/banning-high-risk-uses-trichloroethylene-tce

Formaldehyde – Inhalation: exposure can cause cough, sore throat, nosebleeds and eye irritation. It can cause cancer of the nose and throat and is harmful for people with asthma, bronchitis or other breathing conditions.
https://www.cancer.org/cancer/cancer-causes/formaldehyde.html

Facilities of Concern

Gas & Oil Wells & Pipelines (Components & Maintenance using solvents and flammables):

- Tanks, pipelines, equipment and other quantifiable descriptions of pollution sources on well pads, including amount of gas moved through pipelines, type of engines, horsepower of engines, pipeline pressure, diameter of pipeline, and any safety procedures followed: **Not described to public**

- Mobile tankers and wastewater on site that have potential to contaminate area: **Not described to public**

Table 1. Counselor Land Use within ½ mile to 1-mile radius of gas and oil wells

Parcel Category	1/2 Mile Radius	1 Mile Radius
Grazing Land	X	
Residential	X	
Health Clinic	X	
Public Water well		X
Church	X	
Ministry complex	X	
Oil Refinery	X	

Setbacks

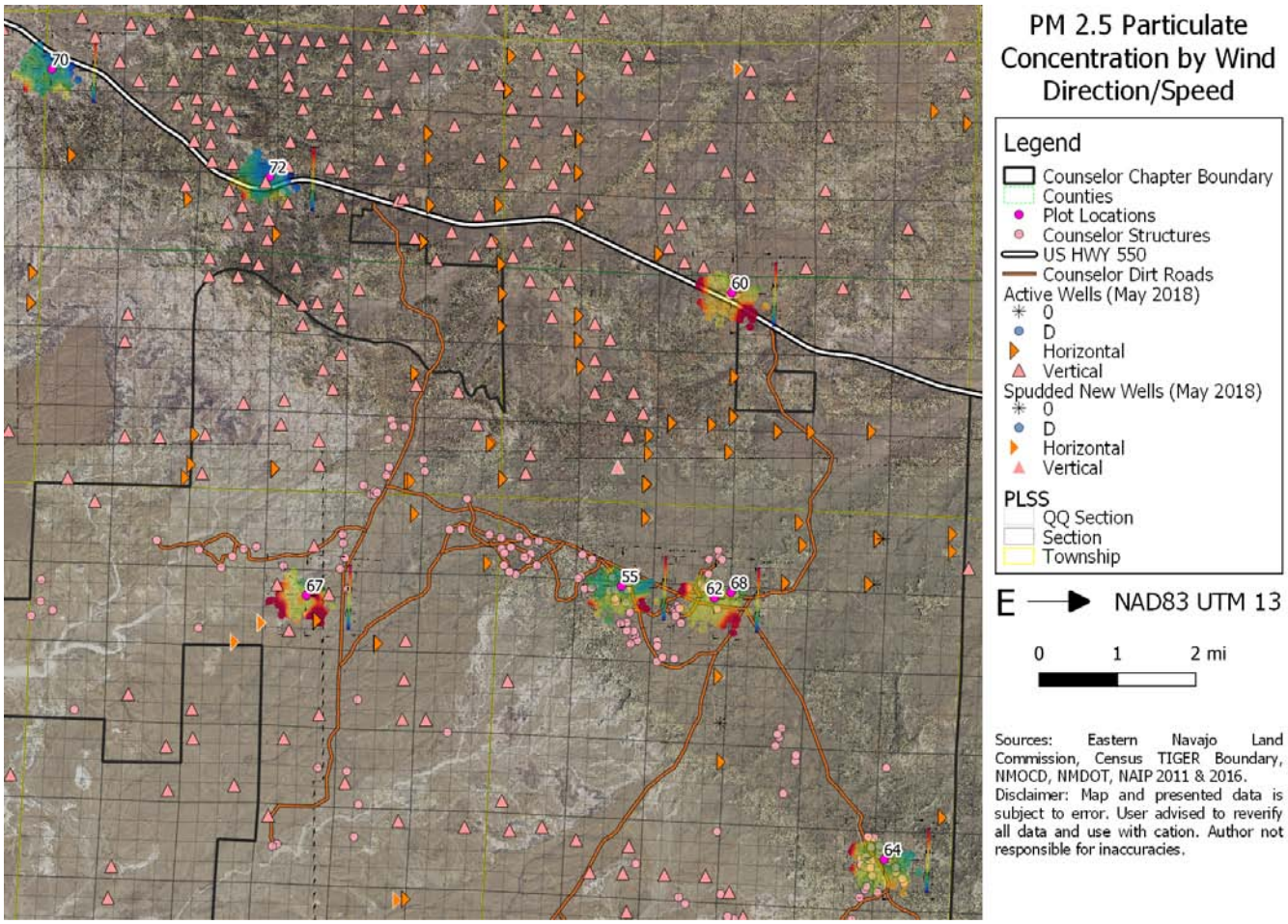

Figure 1: Map of Structures in Counselor NM showing oil wells and 8 air monitor sites

Gas and oil wells are in close proximity to residences and other structures in the areas leased for development. There is no fixed setback distance from well pad to residential structure, school, or business. Setbacks vary from 330 feet (or less if the well is an older vertical well) to 660 feet. The majority of the 700 residents in Counselor live within 1 mile of one or more wells, pipelines, and/or other gas and oil infrastructure. Colorado now requires a 1000' setback while medical professionals have estimated that a "diluted dose" of continuous emissions is attained with a residential setback of 6,600'[3] from large well sites, compressor stations, storage areas or processing plants.

Photo by Teresa Seamster

Figure 2: Partially developed area near Heart Mesa (near Cross Roads) leased for future oil drilling.

Residents are concerned about drilling on lands within the chapter that have not been developed before. New pollution sources have significant cumulative impacts on residents. Additional gas and oil wells will add to whatever air pollution is already present. Each permit to drill additional wells should be evaluated by what it *adds* to current impacts on local air quality, not only what emissions it produces itself.

New Mexico Gas and Oil Emissions Inventory show High NOx and S2O Levels

A national oil and gas inventory by ENVIRON for 2018 was estimated by growing the 2002 inventory using factors derived from resource management plans produced by the Bureau of Land Management and regional forecasts made by the Energy Information Administration. Methodologies were developed that could be applied consistently across the western region, without overlooking the variability in local production characteristics, control requirements and inventory thresholds. Application of these methodologies resulted in the addition of almost 120,000 tons of NOx emissions to the 2002 Western Regional Air Partnership (WRAP) emission inventory. New spatial surrogates were generated based on well locations to appropriately distribute these emissions.

[3] www.environmentalhealthproject.org (Recommendations for Mitigation of UOGD to Protect Public Health)

Additional effort was made to estimate emissions in new development areas without base year emissions. The resulting approach incorporated the most complete information available on the anticipated oil and gas development in the western US region to produce an inventory that predicts a doubling of non-point oil and gas NOx emissions between 2002 and 2018. Emissions for each formation were calculated as the product of the formation specific emission factor and the number of wells drilled in the formation in 2002. The emissions for that formation were then allocated to the counties that intersected the formation based on the fraction of the wells drilled that were drilled in each county's portion of the formation.

The state total drill rig NOx and SO2 emissions that resulted from this procedure are shown in Table 2. The adjustments made to the emission factors are apparent in these results. While significantly more wells were drilled in the State of Wyoming than in New Mexico, the emissions in New Mexico are higher than in Wyoming. This occurs because many of the Wyoming wells were drilled quickly and to a shallow depth, as commonly occurs for the Powder River Basin CBM wells. In contrast, the wells in New Mexico were, on average, drilled deeper and took longer to drill. (See Western Regional Air Partnership Technical Support System https://views.cira.colostate.edu/tss/Results/Emissions.aspx).

Table 2. State total drill rig emissions.

State	Wells Drilled	NOx (tons)	SO2 (tons)
New Mexico	932	6,645	1,444
Total in US:	*6,088*	*21,536*	*3,706*

New Mexico has drilled slightly > than 15% of the total US rigs and generates > 30% of the Nitrogen Oxide emissions and almost 39% of the Sulfur Dioxide emissions for the US.

Sulfur Dioxide (SO2): Levels of this emission are not routinely reported to the public or highlighted as a health risk in publicly available county air quality or health statistics. At high concentrations SO2 can cause life-threatening accumulation of fluid in the lungs (pulmonary edema). Symptoms caused by lower concentrations may include coughing, shortness of breath, difficult breathing and tightness in the chest. A single exposure to a high concentration can cause a long-lasting condition like asthma.[4]

III. Harmful Emissions

Current Regional Air Quality

2018 American Lung Association AQI Report:
San Juan County – High Ozone Days: Grade C

[4] See EPA Integrated Risk Information System: https://www.epa.gov/so2-pollution/sulfur-dioxide-basics#effects

San Juan County – Particulate Matter Pollution: INC (incomplete state monitoring for PM)
San Juan County - Groups at risk (Lung Cancer, COPD, Asthma, etc)

Navajo Nation Environmental Protection Agency (NNEPA) Air Quality Control Program conducted air monitoring of measured criteria air pollutant levels in Counselor from April 14, 2016 to May 18, 2017. Data were downloaded monthly and quality checks (QC) done on the gaseous analyzers and particulate sampler. The observed 1-hour NO_2 and SO_2 did not exceed primary NAAQS; observed 8-hour maximum O_2 and daily 24-hr. PM_{10} did not exceed NAAQS, with generally good to moderate readings. (See Appendix 3) Note: No comparisons were made with other locations in the chapter nor were monitoring distances from active wells reported.

Average and High Periods of Exposure in Counselor

Many of the chemicals released at gas and oil wells can have respiratory effects and increase asthma rates for adults and children. Some chemicals emitted can affect reproduction and infant mortality and disabilities. The National Environmental Pubic Health Tracking Network: (https://www.cdc.gov/nceh/tracking/).

Exposures from gas and oil wells are not constant. There are several variable contributors to individual exposure:

1. There will be more emissions during a time when gas is being vented or going through a full pipeline as compared to when little or no gas is.
2. The content of the emissions varies by the area of shale that the gas was released from. For instance, some gas may have more Hydrogen Sulfide than others; other sources may have more Radon or Radium.
3. The weather (temperature, wind, and cloud cover) will affect whether a well's emissions will disperse quickly away or whether it will stay in close proximity.
4. The topography will affect how much emissions a home might receive. Counselor has many mesas and arroyos that can either block air currents from home sites or trap air contaminants around residences for periods of time. Large flat open areas predominate the area and strong winds can quickly carry toxins from well sites to structures. Some of the most polluted air has been found in these open areas.

Photo by Teresa Seamster

Figure 3: Winter flaring (2018) near Corn Fields residential area in Counselor

Exposures vary over time. If you average the exposure level over the year or month or day, you will miss the high (and more dangerous) periods of exposure. For instance, over a **24-hour period the average particulate exposure was 29 ug/m3** but there was a period just before dawn that was **398 ug/m3** that was high enough to cause an asthma attack.

IV. Counselor Chapter Air Monitoring Results (2018)

The Counselor HIA Committee, under the guidance of the Environmental Health Project (EHP), conducted community air quality monitoring in the spring of 2018. Data were collected from eight indoor and outdoor residential and public locations in Counselor from mid-April to the end of May. These results have been compared to other results that EHP has reviewed in communities near shale gas and oil operations in New York, Ohio, California and Pennsylvania. (Note: Indoor results were reported to the residents living at the 8 locations and are not part of this community report.)

Outdoor Speck monitors were deployed during the week of April 8 to April 15 and were located an average of 30' to 50' away from the side of the house closest to the nearest oil well. All monitors were retrieved between 32 to 45 days later and sent to the Environmental Health Project in New Haven, Connecticut, for data analysis.

- Analysis found that large-scale changes (peaks) in air quality averaged 2-4 peaks per day and lasted from 21-28 minutes per peak exposure
- Time between peaks varied from 6 to 13 hours (the median for similar oil field communities sampled by EHP is 8.5 hours)
- The level of $PM_{2.5}$ generally recorded between peak times, was considerably higher in 75% of the sites (six out of eight locations) compared to the median found in similar communities nationally

With higher than average $PM_{2.5}$ levels, residents living near a source of air pollution are at greater risk for developing or worsening respiratory or cardiovascular diseases. Further, some air contaminants cause neurological effects or are carcinogenic.

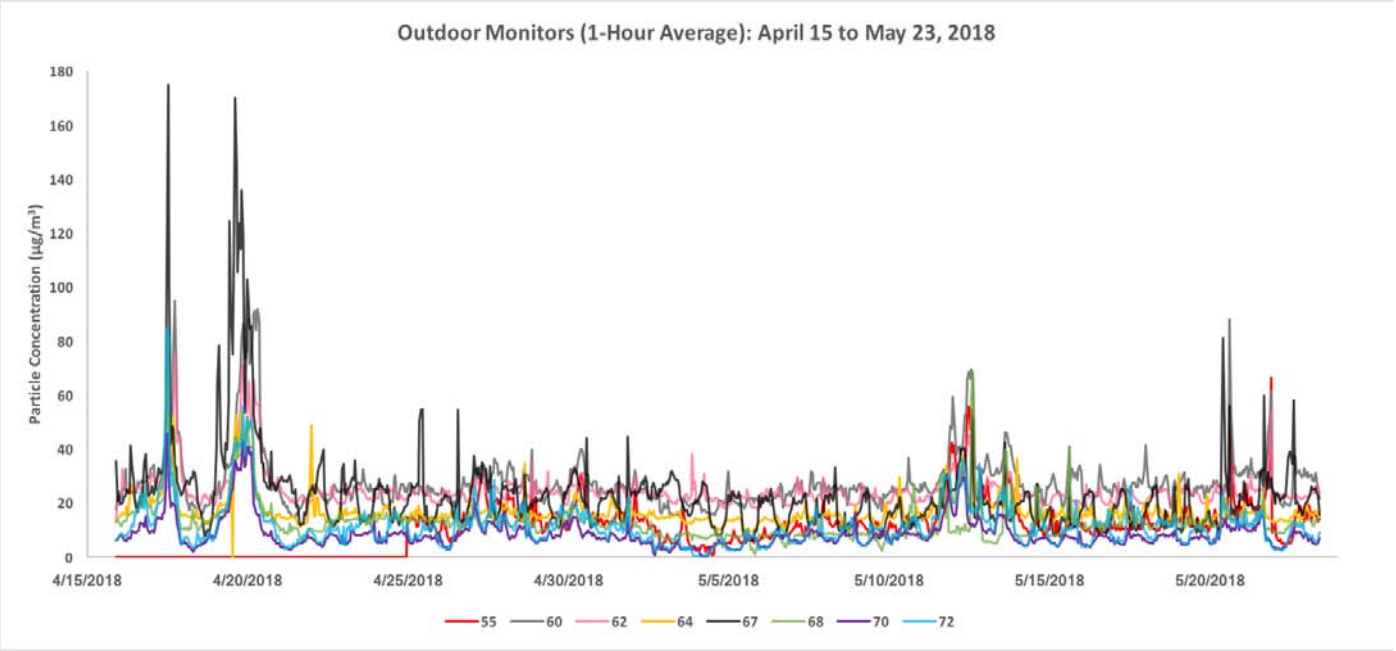

Figure 4: $PM_{2.5}$ Results from 32-Day monitoring period. Monitor numbers correlate to colors.

Figure 4 shows the results from eight outdoor Speck monitors placed in the community for 32 days. Significantly, there were many times when peaks in $PM_{2.5}$ (particulate matter in the air that are 2.5 microns in size) exposure occurred simultaneously at various locations, most notably on April 17, 2018 and April 19, 2018. When a source of air pollution is nearby, these conditions could cause increased exposure for residents. Chemicals from the source may combine with the particulate matter and travel to the deep regions of the lungs to cause respiratory problems or gain access to other parts of the body through blood-gas exchange.

Additional Outdoor Air Testing in Counselor

Volatile Organic Compounds (VOCs) samples were also collected at four of the eight Speck monitor sites. Sampling was conducted from May 29 to May 30, 2018 for a 24-hour period using four summa canisters and four sets of Radiello absorbing cartridges (hydrogen sulfide) and formaldehyde badges. The samples were tested for 75 chemicals. Three VOCs were detected on May 23, 2018 and seven on May 30, 2018. No Hydrogen Sulfide was detected but Formaldehyde was found at all locations. For all other chemicals identified there is a threshold to consider action. In this one sample, all chemicals were found at levels below what would cause immediate health concerns except Formaldehyde.

There are some 600 chemicals that can be used in the production of gas and oil, and sites can use different types of chemicals and combinations. However, there are several common pollutants such as VOCs, $PM_{2.5}$, and formaldehyde. EHP uses these 3 as "indicators" because scientists have measured and estimated the amounts of these chemicals emitted from oil/gas well sources. If these indicators are present in air samples, it is likely that other chemicals of concern are present.

Table 3: Elevated levels of Formaldehyde were found at all four locations

May 23, 2018	May 30, 2018
Acetone	2-Propanol
Chloromethane	Acetone
Dichlorodifluoromethane	Chloromethane
	Dichlorodifluoromethane
	Hexane
	Methylene chloride
All PEL- permissible exposure limits	Trichloroethene
	All PEL
Formaldehyde*	Formaldehyde*
0.0090 ppm	0.0070 - 0.0097 ppm
Take action at 0.003 ppm	Take action at 0.003 ppm

Previous Air Quality Testing in Counselor at Operational Well Sites

October 14, 2016
Two samples were collected at entrances to active wells along US 550 in Counselor and both showed levels of Toluene ((19µg/m3 and 72 µg/m3). These levels are under relevant health-based standards (acute 8 hour chronic reference exposure level) however **these levels of Toluene are unusually high**.

A 2013 survey of air quality in more than 100 locations nationally found daily "mean concentrations" of Toluene lower than in Counselor ranging from 0.073 - 19µg/m3.

April 18, 2017
Three air samples were collected at entrances to active wells along US 550 at 1) mile marker 100 north of Lybrook School; 2) at mile marker 107.5 south of the San Juan and Rio Arriba County line; and 3) at the intersection of US 550 and County Road 7900. Hydrogen sulfide was detected at mile marker 100 closest to the Lybrook School at a level of **7.6µg/m3**. (See ALS Lab results in Appendix 1)

Hydrogen sulfide is a gas that has a potently offensive odor of rotten eggs and exposure to it is associated with an elevated incidence of respiratory infections, eye and nose irritation, coughing, breathlessness, nausea, headache, and mental symptoms including depression. The US EPA reference concentration level (RL) is **2µg/m3.**

The level detected exceeded the RL but was below the Office of Environmental Human Health (OEHHA) California chronic reference level for hydrogen sulfide. **But if levels of 7.6µg/m3 generally are reached then these levels can pose a human health risk for students and staff at Lybrook School**. (Mark Cherniak, PhD., Environmental Law Alliance Worldwide)

EHP Analysis of Counselor Air Monitoring Results

After air-monitoring results were obtained, the Counselor HIA Committee consulted with Environmental Health Project specialists: Celia Lewis, Ph.D., and Sujit Joginpally, M.D.

1. How does Counselor compare with other communities being monitored by EHP?
Six (6) out of the eight (8) monitored locations in Counselor Chapter recorded levels between 10 to 25 micrograms/meter^3, with only 2 locations reading at Baseline PM2.5 levels in other communities are generally below 10 micrograms/meter^3. the lower average PM2.5 level. Also, the total particle count over the 32-day monitoring period was at or above average levels of accumulated PM2.5 for other states.

2. Are Counselor's PM2.5 levels considered high?
Yes, because they are higher than average PM2.5 levels recorded at similar distances from oil wells in communities in New York, Ohio, California and Pennsylvania. Counselor is the first community in a southwestern state to be monitored by the Environmental Health Project.

3. What are some reasons for Counselor's higher levels of PM 2.5 and Formaldehyde?
Many homes in Counselor are located closer than a mile to one or more operating oil and gas wells. The recommended setback distance between occupied structures and wells is now 6600', or 1¼ mile. Many homes are "downwind" of wells that emit Volatile Organic Compounds (VOCs) and Formaldehyde (which can be formed from methane emissions in the presence of sunlight). Counselor has areas of open plains with numerous homes situated where the wind tends to blow towards the houses from a nearby pollution source. On sunny days with no wind, pollutants will rise quickly upward away from houses. On cloudy days with no wind, pollutants more slowly and mix with the air very slowly keeping emissions closer to the ground and more hazardous for residents. On windy days, pollutants from nearby wells can reach downwind homes nearby before chemicals can disperse.

Photo by Samuel Sage

Figure 5: Summa Canister monitoring Volatile Organic Chemicals (VOCs) at Counselor Chapter House in May 2018.

EHP analyzed results for PM2.5 at eight residences/locations in the Counselor area. In the bar charts below, each **blue dot** represents the average results for outdoor air levels at one home. The red bar marks the average (median) of all results compiled by EHP outside New Mexico.

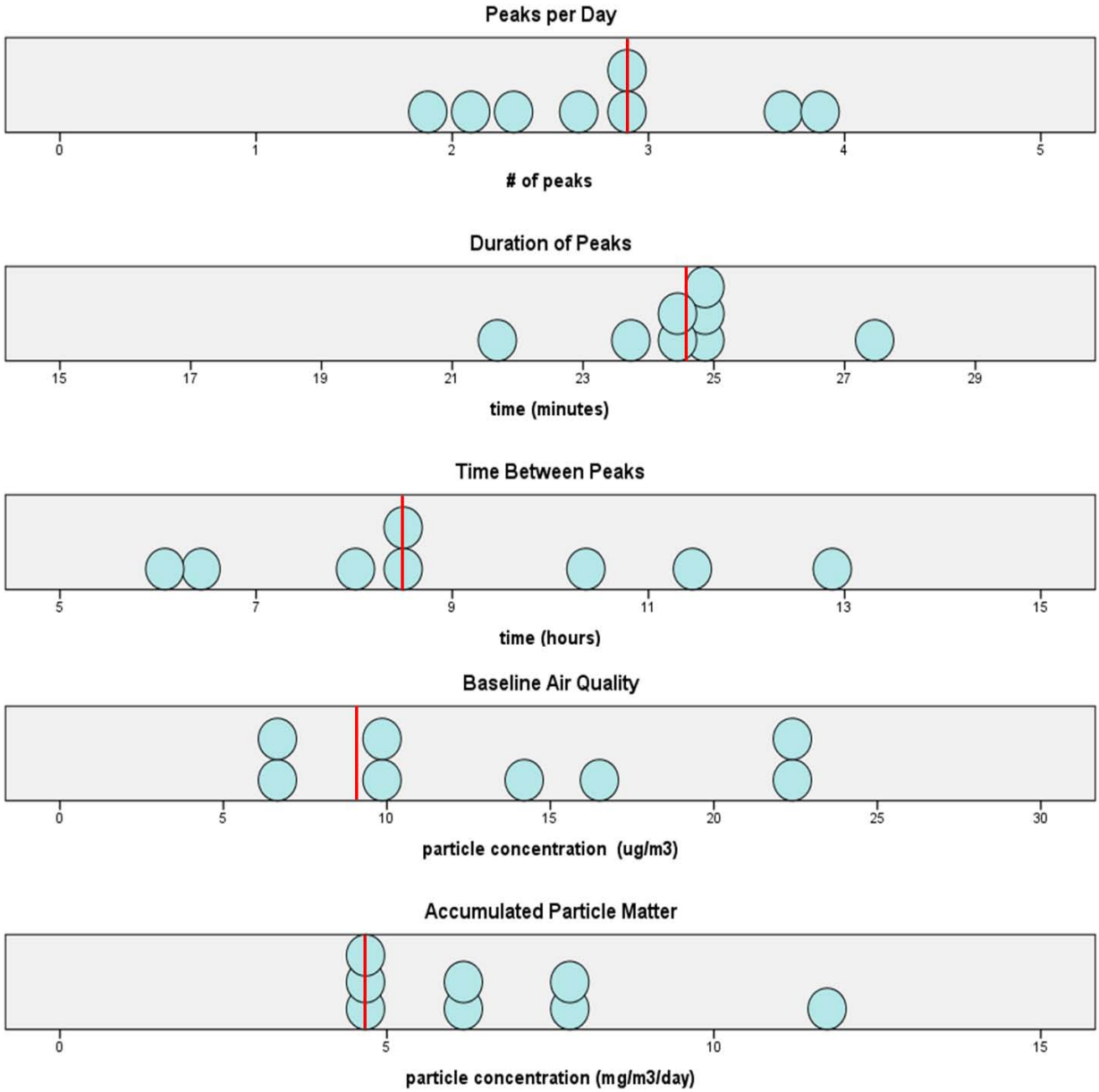

Figure 6: The range of results of $PM_{2.5}$ monitoring for five components measured Peaks per day, Duration of peaks, Time between peaks, Baseline air quality and Accumulated particle matter using Speck monitor data.

The results are shown in relation to the national data reviewed to date by EHP. The majority of locations in Counselor had higher particle concentration (ug/m^3) in their Baseline Air Quality and higher Accumulated Particle Matter (mg/m^3/day) than in similar locations monitored in other states.

Comparisons of Wind Speed and Direction on Individual Site Air Pollution

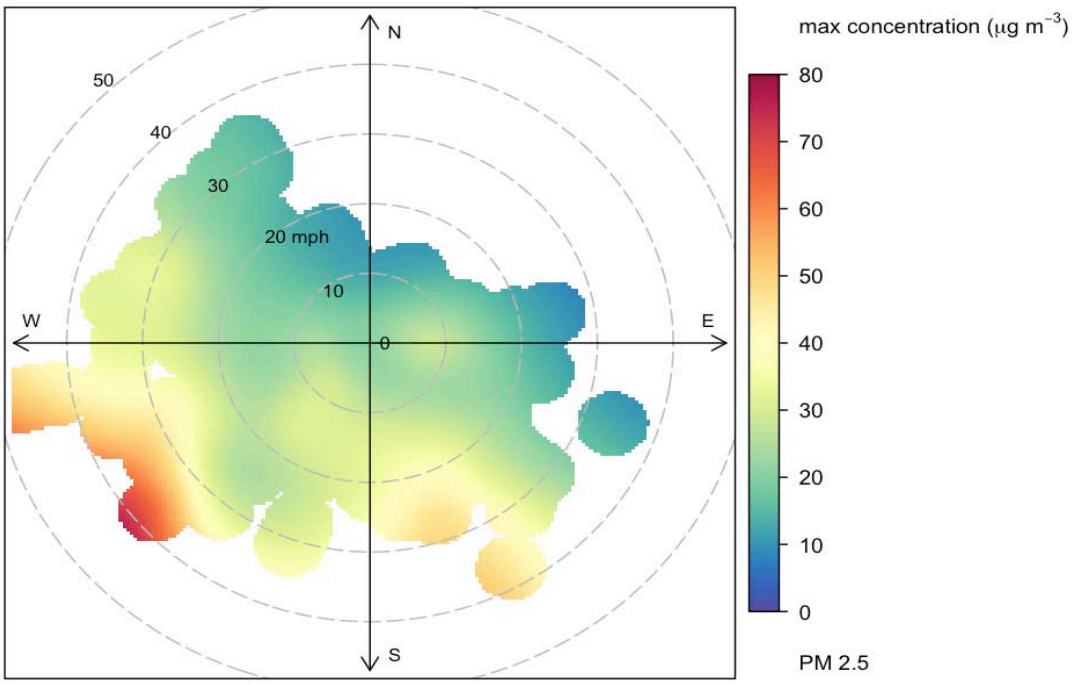

Figure 7: Counselor East (CE1) P568

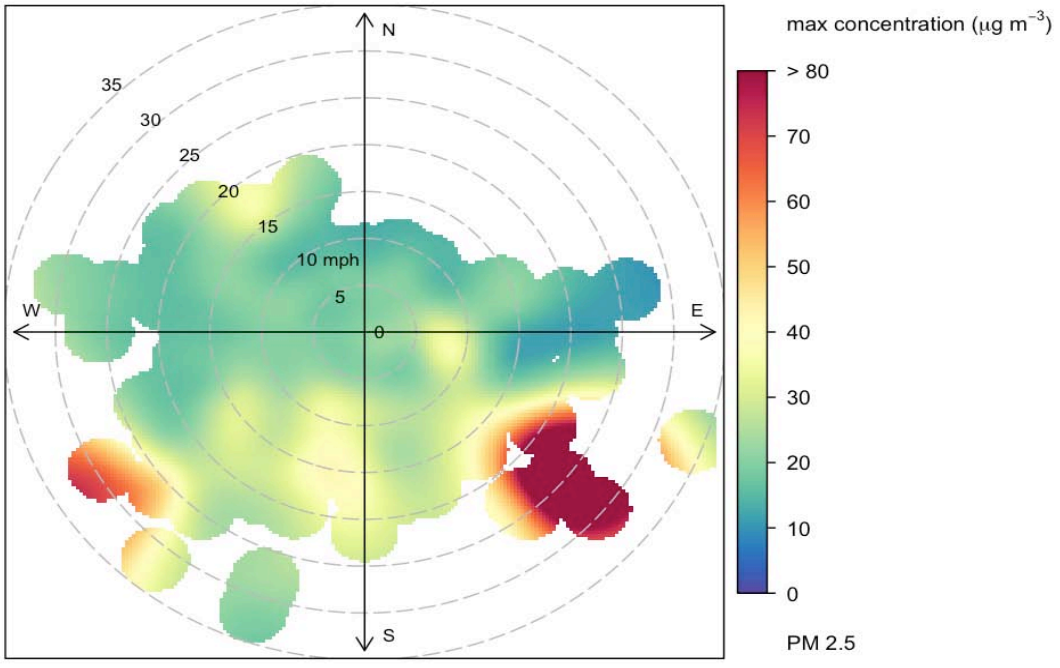

Figure 8: Counselor East (CE3) P555

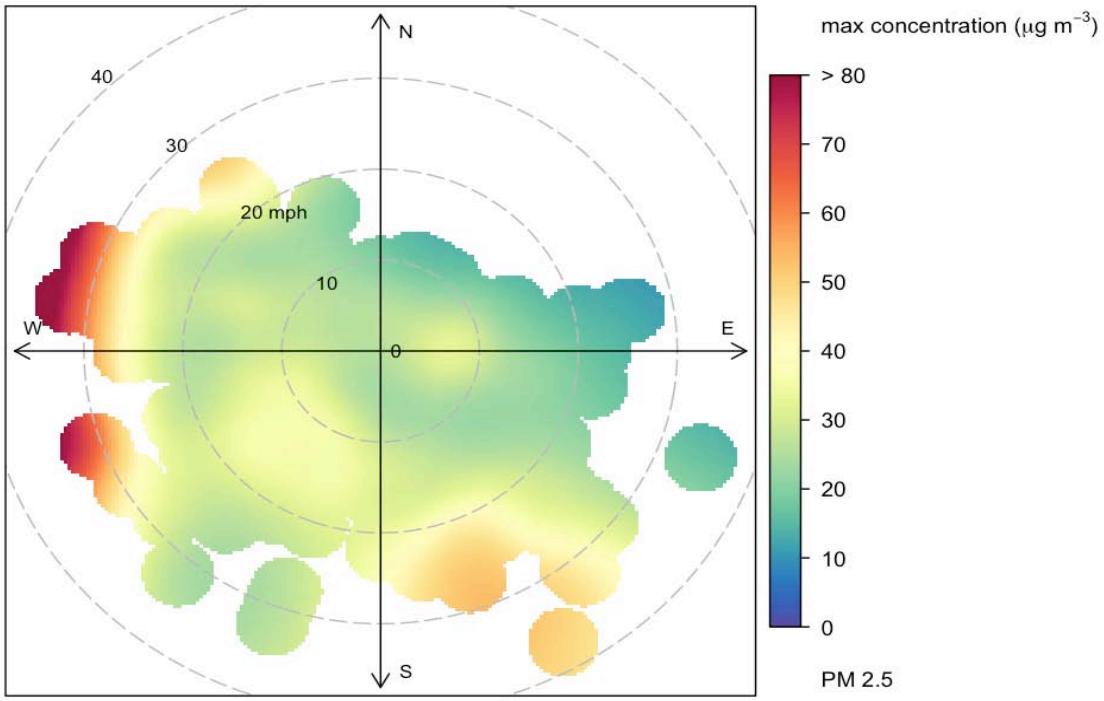

Figure 9: Counselor East (CE4) P564

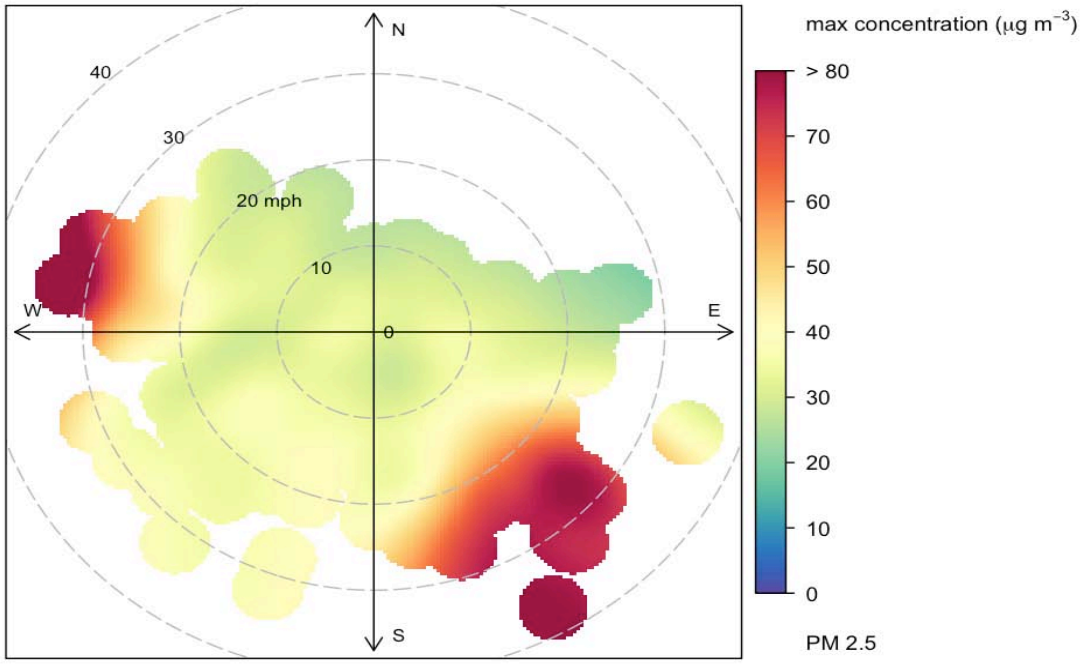

Figure 10: Counselor East (SE8) P562

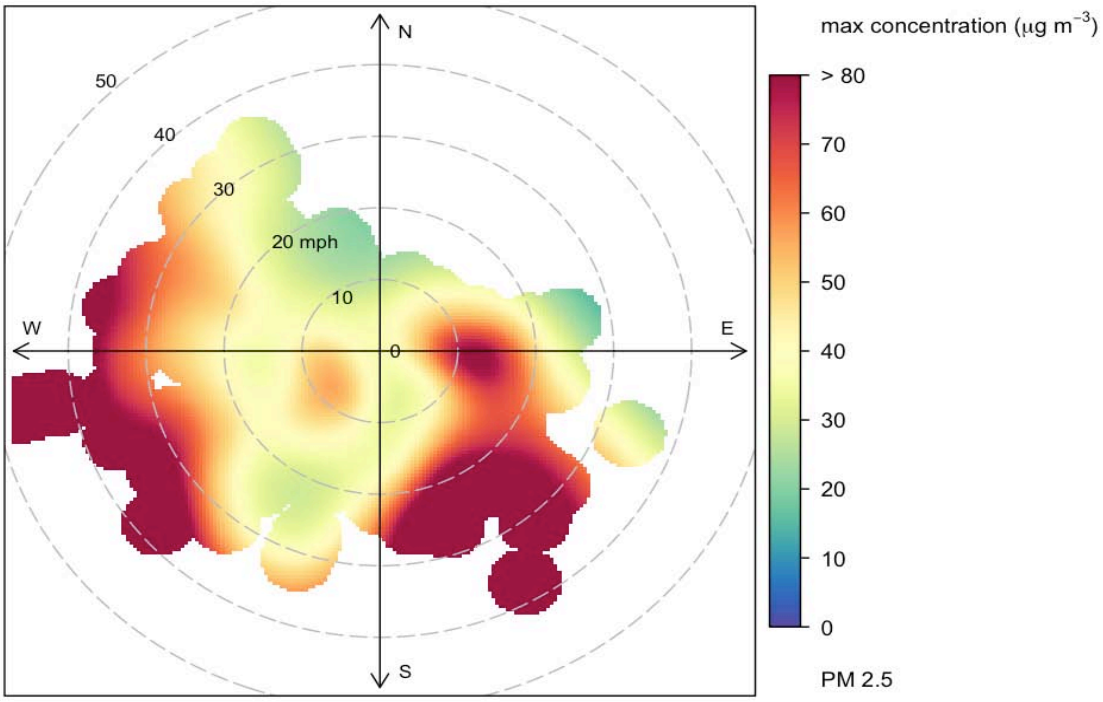

Figure 11: Counselor West (CW5) – highest recorded $PM_{2.5}$ levels P567

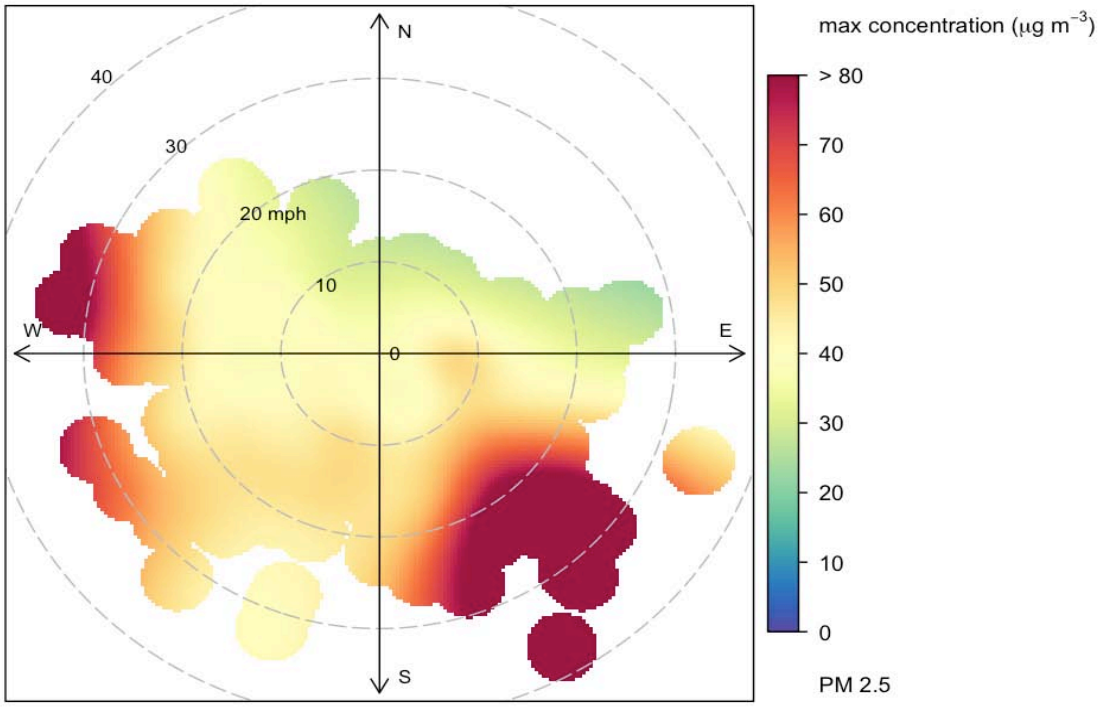

Figure 12: Counselor Highway (CCH6) P560

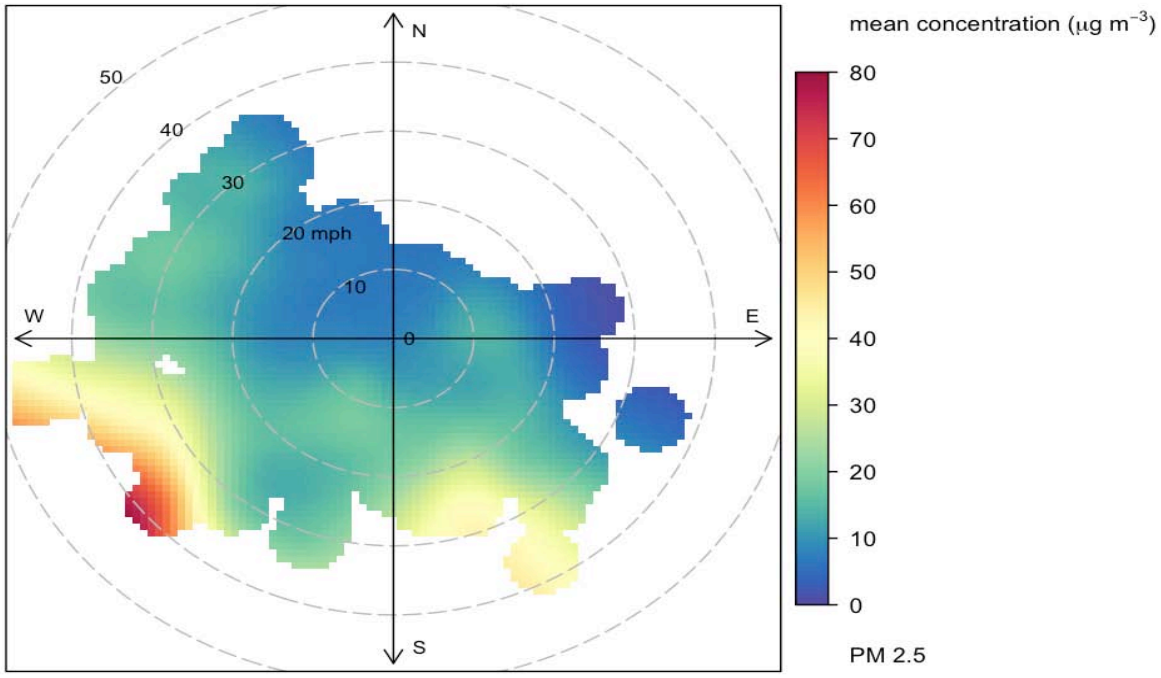

Figure13: Counselor Highway (CH7) – lowest recorded $PM_{2.5}$ levels P572

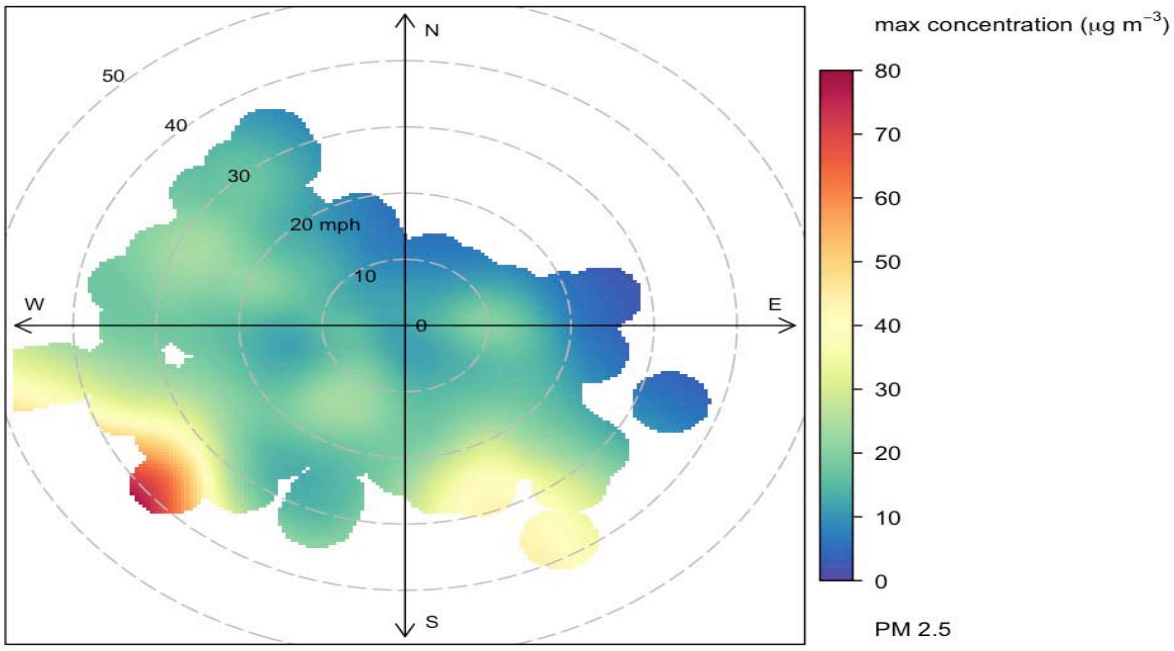

Figure 14: Counselor Highway (CH9) P570

Figures 7 -14 are Counselor monitoring sites. EHP's Particulate Matter Impact App pairs the Speck PM monitor results with local weather data to show which weather conditions bring higher levels of PM2.5 to each residence. If you take a closer look at Speck P567 you can see how wind direction and wind speed influence the PM 2.5 concentrations.

Each location shows s different level of exposure when paired with the weather app. Hazardous levels were reached on a few days in late April and early May when the weather was calm, cold, cloudy and snowy, keeping particulate matter and chemical emissions closer to the ground for longer periods of time.

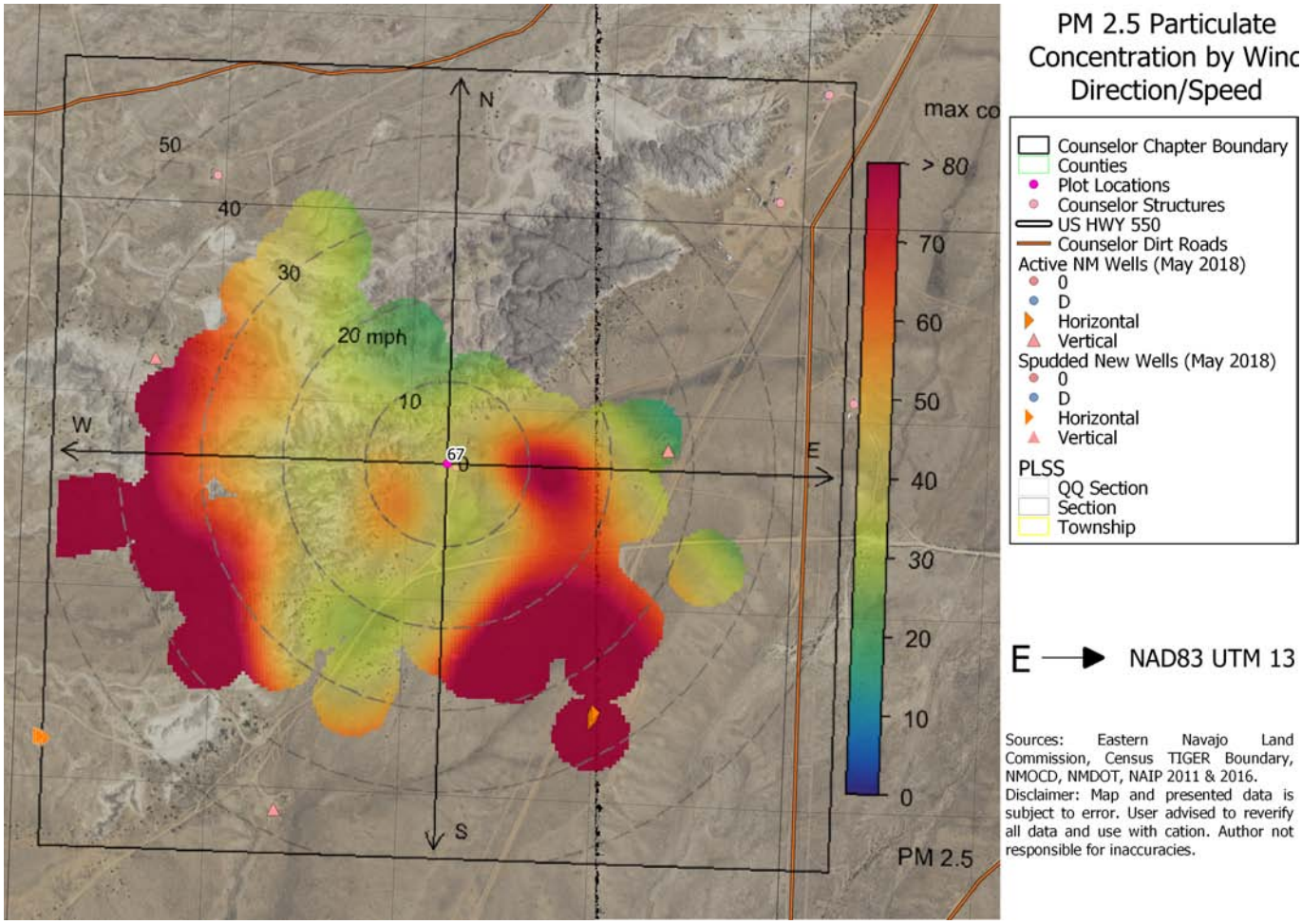

Figure 15: Close up Map of Location Speck PS67 with highest levels of PM 2.5

#67 Close up Map shows the wind speed, direction and intensity of PM 2.5 – ranging from lowest (blue) to yellow-green (which indicates the EPA level of PM 2.5 at 35 ug/m3, which can impact the respiratory health of individuals), to red (the highest level of exposure and hazardous to human health).

At this particular site, PM 2.5 concentrations exceeding a hazardous level of 80 ug/m3 occurred from south-southwest at 30-50 mph, southeast at 20-40 mph, and east at 10-20 mph. The image above displays three important aspects of the outdoor Speck monitoring results: the direction from which the highest levels of PM2.5 come from; the intensity of the PM2.5 measurements; and the wind conditions at the times of exposure. In the image, the Speck monitor is located in the center where the lines cross. The endpoints of the lines represent the cardinal directions of North, South, East, and West with North at the top. The *intensity of PM2.5* levels is shown in the range of colors from blue (low exposure) to red (high exposure). The concentric circles represent the wind speed, with low wind speed near the center and higher wind speeds further out.

Significance of Exposure

1) The episodic **intense peak exposures produced from oil/gas well emissions may only last for a few minutes to an hour in Counselor. But, such exposures can cause acute health symptoms**, even though the total exposure averaged over a 24-hour period appears acceptable and falls within a limit below a current threshold to consider action to prevent immediate health impacts.

2) Weather plays a significant role in both the number and duration of peak exposures. The period chosen to conduct air sampling fell during the spring when high winds and low precipitation is normal in Counselor. Such conditions are not conducive to sampling for air pollutants that remain in the local area and are closer to the ground (and the monitors) on calm days with either cloud cover or rain and snow events. **Testing throughout the year would yield different and more accurate results.**

3) **Evidence of exposure to hazardous levels of VOC concentrations is very short lived in the bloodstream and blood samples must be taken within hours of a symptom or time of suspected exposure.** Most communities have no facility that can provide this highly specialized blood test and residents who cannot take time to take a sample are unable to provide this crucial evidence if they try to file a formal complaint. The complaints recorded in the health section of this report have all been made in person to an HIA Committee member conducting the health survey or to a Counselor Chapter representative.

V. Counselor Chapter Health Impact Assessment (HIA)

Background

Counselor Chapter initiated the Health Impact Assessment in 2016 with a series of brief Health Impact Reports, written to document the oil well impacts being reported to chapter staff. Residents who attended chapter meetings and commented at public hearings held by Bureau of Land Management and the Navajo Nation, contributed their concerns about fracking, air pollution, traffic, accidents and illness to these reports. After several presentations to the Oil Conservation Division (EMNRD) and the Air Quality Bureau (NMED), in 2016-2017, a loosely organized committee formed in Counselor to start a formal HIA and do a community air quality study with the assistance of the Southwest Pennsylvania Environmental Health Project.

Sampling Strategy

The study focused on Counselor as the most heavily developed chapter with the highest number of active wells in the Tri-Chapter area of Counselor, Ojo Encino and Torreon. Participants in the study were landowners who lived within one mile of an active well and who volunteered to have a pair of Speck monitors placed inside and outside their home for a 32-45 day period to gather data on indoor and outdoor quality. After air sampling was completed and preliminary results released to the chapter, community residents were asked if they wanted to participate in a written health survey.

Community Health Survey

The purpose of the research, the health survey and Informed Consent forms were explained and provided to all participants. Confidentiality and the Rights as a Volunteer Participant were reviewed. A 28-question survey, listing 20 medical symptoms most commonly reported by people living near oil well operations, was completed by residents at each of the eight (8) air quality monitoring sites as well as by 57 attendees of chapter meetings in July and August of 2018 and 14 additional chapter residents who submitted survey forms directly to chapter staff following community events such as the Wellness Walk in May of 2018.

A total of 80 respondents represent 11.4 % of the population (700) of Counselor.

80 respondents were asked to indicate if they lived “near” (within 5 miles or within sight, hearing or smell) any of the following drilling or gas and oil infrastructure with the following responses:
Well Pad: 67 yes, 13 no (84% live near a well pad)
Pipeline: 53 yes, 27 no (66% live near a pipeline)
Processing Plant (refinery): 1 yes, 79 no
None lived near a Wastewater pond: 0 yes, 80 no
None lived near a Compressor station: 0 yes, 80 no

Respondents then recorded all the health symptoms they experienced in the past year since drilling began near their home.

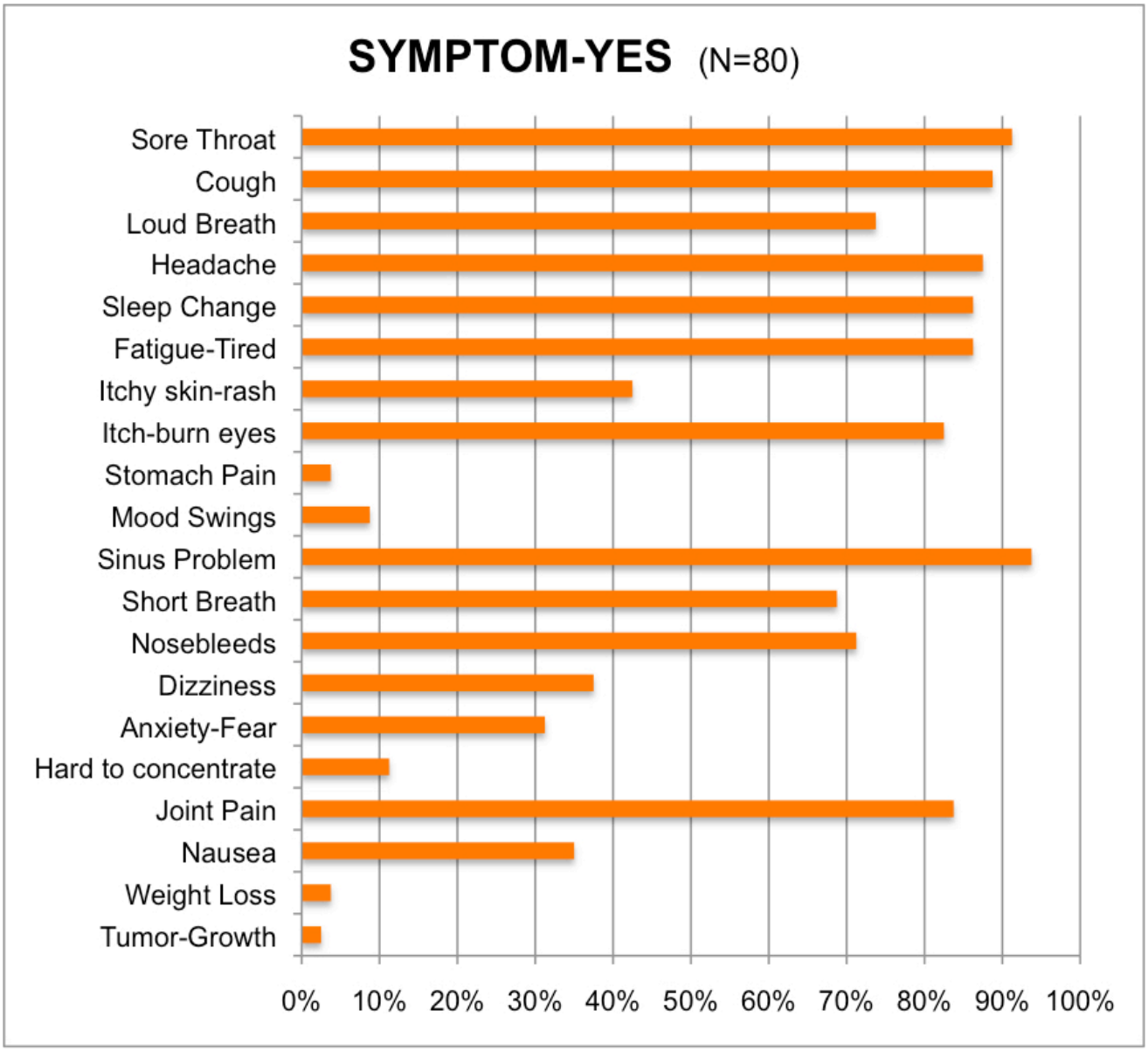

Figure 16: 20 recorded health issues with highest recorded symptom**:** Sinus Problem

Highest Recorded Symptoms:

- > 90% reported sinus problem (discharge, obstruction and pain)[5] and irritated/sore throat

[5] "Associations between Unconventional Natural Gas Development and Nasal and Sinus, Migraine Headache, and Fatigue Symptoms in Pennsylvania". Aaron W. Tustin, et al, *Environ Health Perspect* DOI: 10.1289/EHP281.

- 80% reported cough, headaches, itching/burning of eyes, joint pain, fatigue & sleep disturbance
- > 70% reported nosebleeds and wheezing (loud breathing)
- > 60% reported shortness of breath
- 42% reported itching of skin/rash
- > 30% reported dizziness, nausea and feelings of anxiety/fear
- 11% reported difficulty in concentrating
- Other less reported (< 10%) symptoms: mood changes, stomach pain, weight loss or tumors/growths
- Four Counselor health survey respondents who did not live near wells reported either no health symptoms (2 respondents), 2 symptoms (1 respondent) or 3 symptoms (1 respondent), as contrasted with the average of 11 or more symptoms reported by residents who live near wells.

Survey Results and Comparison with National Database

Over 60% of health survey respondents reported they experienced 11 out of a total of 20 listed symptoms. This a greater number of health symptoms reported by Counselor residents compared to other residents living next to gas and oil wells. The same 20 symptoms, surveyed by EHP nationally in similar communities, were reported by less than 50% of the respondents for any given symptom. Example: > 88% of Counselor respondents experienced sinus problems, sore throat and cough compared to the average of <60% of respondents in Washington County.

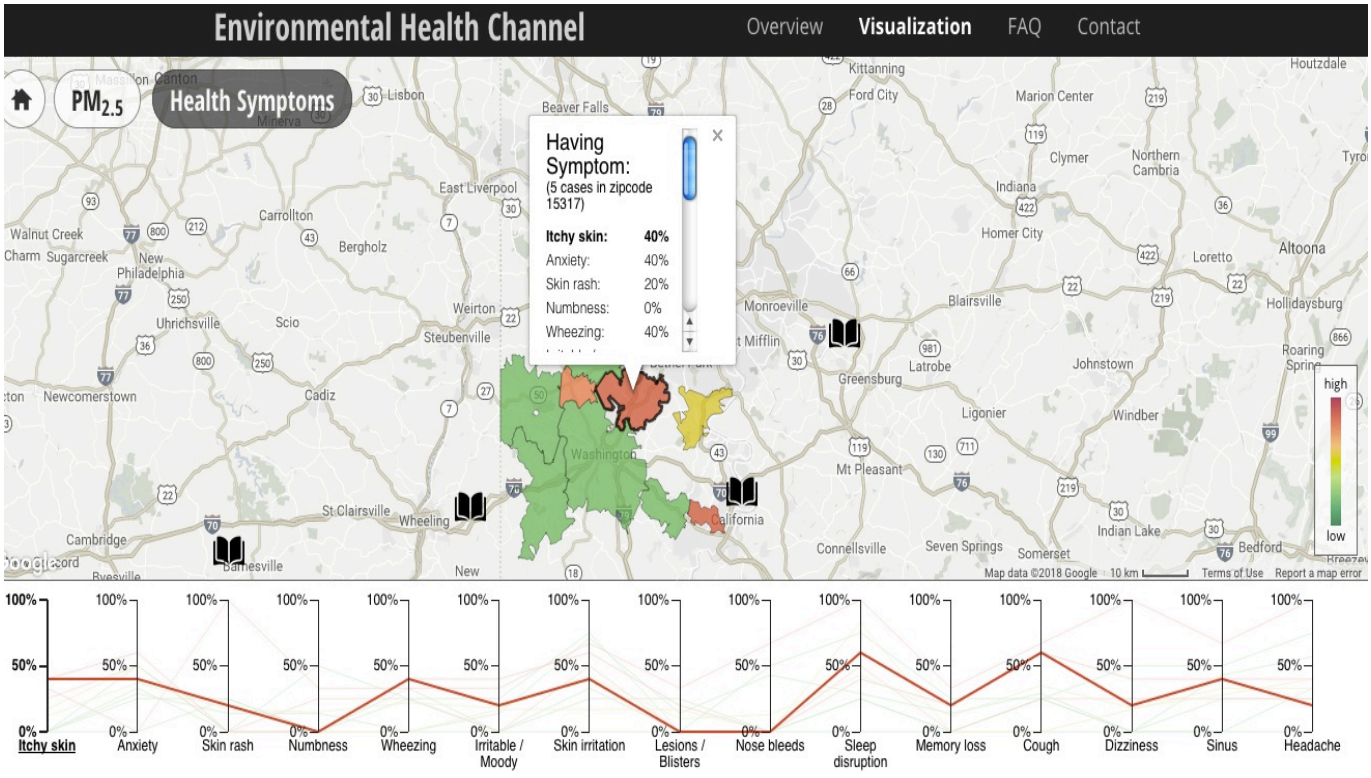

Figure 17: Environmental Health Channel screen shot of Health Symptoms recorded from residents in Washington County, Pennsylvania.

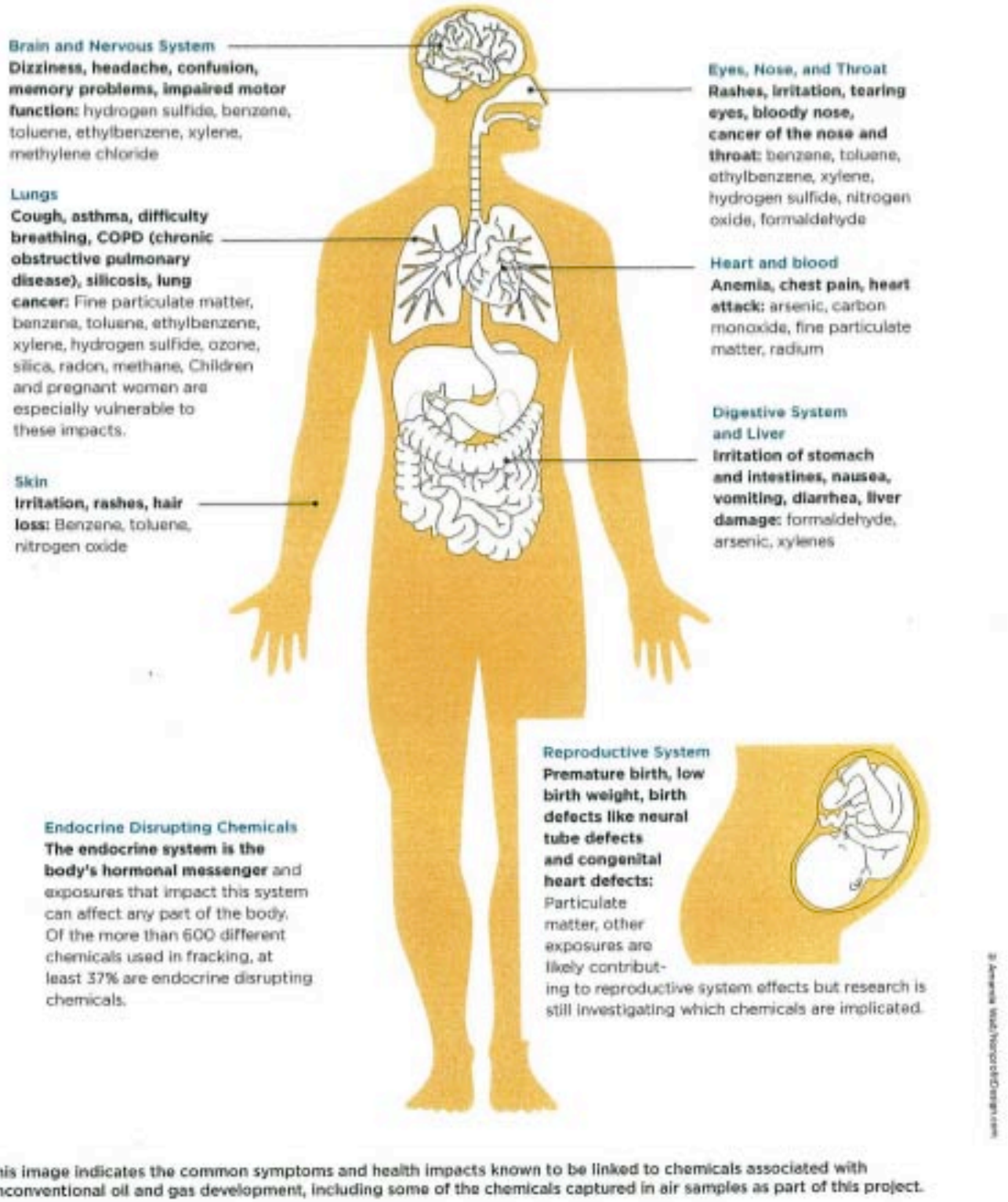

Figure 18: Counselor Health Survey included a body graphic so respondents could draw circles around parts of the body where they experienced symptoms. 100% of 57 respondents who chose to complete this page circled the head, 92% circled the lungs and 40% circled the skin.
(Graphic courtesy of Coming Clean, Inc.)

VI. SUMMARY OF RESULTS

Potential Childhood and Birth Outcomes Due to Exposure to Well Emissions

The majority of locations sampled in Counselor had higher particle concentration (ug/m^3) in their Baseline Air Quality and higher Accumulated Particle Matter (mg/m^3/day) than in similar locations monitored in other states. Newborns and young children are especially sensitive to well emissions and highly at risk. Exposing them to burning hydrocarbons from gas and oil well emissions puts them at greater risk than adults for both short- and long-term health effects.

Six large, well-conducted studies have been published on the effects of shale gas and oil development activity and birth outcomes. The studies found a range of overlapping outcomes associated with proximity to well pads, including low birth weight, low APGAR scores, prematurity, and neural tube defects. [6]

Children do not respond to emissions as though they are little adults. Instead:

- Children have higher respiratory rates and as a result children exposed to air contaminants breathe in more toxics per pound of body weight than adults.
- Children accumulate more toxics in their bodies than adults. Their bodies are still maturing and they cannot metabolize some toxicants as well as adults. They don't detoxify as efficiently.
- Children spend more time engaged in vigorous activity outside, increasing their exposures.
- Children's brains are still developing. Many toxic agents are known to interfere with developmental processes within the brain.

Children under the age of 9 years make up approximately 31% of the population of Counselor. Their well-being and future health and development is the highest rated concern of Counselor residents.

Health Effects from Exposure to Volatile Organic Compounds (VOCs)

VOCs, present at gas and oil wells, are a varied group of compounds that can range from having no known health effects to being highly toxic**. Short-term exposure can cause eye and respiratory tract irritation, headaches, dizziness, visual disorders, fatigue, loss of coordination, allergic skin reaction, nausea, and memory impairment or inability to concentrate.** Long-term effects include loss of coordination and damage to the liver, kidney, and central nervous system.

---

[6] Hu, Howard, James Shine, and Robert O. Wright. "The Challenge Posed to Children's Health by Mixtures of Toxic Waste: The Tar Creek Superfund Site as a Case Study." *Pediatric Clinics of North America* 54, no.1 (February 2007): 155-175, x. doi: 10.1016/j.pcl.2006.11.009.

The above symptoms caused by episodic exposure to VOCs were recorded by > 80% of Counselor residents that participated in the health surveys conducted from May through August 2018 by the Counselor HIA Committee.

Further air quality testing and voluntary on site blood sampling from residents, for VOC levels, is needed to determine the actual degree of individual exposure and potential harm.

VII. Community Recommendations

Mitigation Measures Recommended for Community Health and Safety

The Counselor HIA Committee has worked closely for several years with the residents of Counselor and in 2018 with the Environmental Health Project (EHP), a public health organization working at the forefront of the nation-wide response to health impacts from unconventional oil and gas development (UOGD)

Based on 1) written comments, resolutions and memorials from Navajo Chapters and other elected leaders and representatives from the Navajo Nation and New Mexico Legislature; 2) results from the air monitoring project conducted by the Counselor HIA Committee; 3) health surveys completed by the Counselor Chapter; 4) and national research conducted by organizations and academics that have published in peer-reviewed literature, this report recommends the following mitigation measures to protect public health:

1. The most effective method to prevent toxic exposures for nearby residents is to trap emissions at the source. Emissions should be contained on all polluting equipment including wellheads, tanks, compressors, and pipeline valves.

2. Continuously monitor air emissions at UOGD sites for volatile organic compounds (VOCs), formaldehyde and fine particulate matter ($PM_{2.5}$). Monitoring should provide minute-by-minute data and the data should be analyzed to show the frequency, intensity and duration of peak emissions in addition to long term averaged exposures. These peak periods can cause dangerously high exposures for residents, especially children and individuals with pre-existing conditions, and are important health data for medical diagnosis.

3. Continuously monitor for VOCs, formaldehyde and PM at nearby schools, daycares, nursing homes where health-sensitive individuals are located. Develop emergency plans for these locations in the event of high exposure scenarios.

4. Provide indoor air filters for residents within 1⁄2 mile of UOGD sites. Include the provision of replaceable filters and maintenance for the indoor air equipment.

5. Establish a setback distance minimum of 1/2 mile (2640 feet) from smaller shale gas facilities, such as wells, that emit 100 to 500 grams/hour.

6. Establish a setback distance minimum of 1 1⁄4 mile (6600 feet) for gas processing plants and large compressor complexes whose emissions exceed 1000 grams/hour.

7. Require windbreaks around UOGD sites that are located on plateaus, plains or other geographic areas that do not provide physical barriers between sites and residential areas.

In addition:

- Complete the recommended steps on the HIA Assessment Checklist to adequately inform community residents of all the known and unknown risks they are being asked to assume.
- Perform an in-depth air emission projection to establish the local population health risk to cumulative effects before additional wells are drilled.
- Require best practices to ensure that effective emissions control measures are kept up to date.
- ALERT residents via the Chapter ALERT website of large emission events.
- Put emergency plans in place in case of evacuation.
- Institute a monitoring strategy at well sites and key public locations and make the data public on the Chapter website.
- Institute a health-monitoring registry at the local Indian Health Clinic to include short- and long-term effects.
- Facilitate voluntary blood sampling by providing "on-site" facility (within a one-hour drive) that can test exposed individuals for VOC levels and monitor symptoms and treatments.

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2. 2017 Letter from Navajo President Russell Begaye to BLM-Farmington Field Office Director
3. 2017 New Mexico Legislature HM70: https://www.nmlegis.gov/Legislation/Legislation?chamber=H&legtype=M&legno=70&year=17
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5. Southwest Pennsylvania Environmental Health Project Report: "Counselor Chapter Air Quality Assessment Results: Particulate Matter (PM2.5) and Volatile Organic Compounds (VOCs)", August 3, 2018
6. 2017 "Compendium of Scientific, Medical, and Media Findings Demonstrating Risks and Harms of Fracking" (5th Ed.) Physicians for Social Responsibility
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10. "An Exploration of the Literature on the Health Status of Four Counties in New Mexico and the Reporting of Epidemiological Findings", Presentation to the Tri-Chapter and Diné-Centered Research and Evaluation Working Groups, Albuquerque, NM. 2017. Dr. Lorenda Belone, K. Begay, C. Keams, F. Pacheco, E. Tallsalt, K. White.
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12. Shonkoff, Seth B.C. et al. 2016. Hazard Assessment of Chemical Additives used in Oil Fields that reuse Produced Water for Agricultural Irrigation, Livestock Watering and Groundwater Recharge in the San Joaquin Valley. Technical Report. PSE Healthy Energy, EESA Lawrence Berkeley National Lab, Ecological Engineering Research Program, University of the Pacific.
13. Southwest Pennsylvania Environmental Project Action Guide: "Fracking Risks in Your Community: Measuring, Monitoring, and Mitigating."2017. www.environmentalhealthproject.org
14. "Warning Signs -Toxic Air Pollution Identified at Oil and Gas Development Sites, Results from Community Air Monitoring Reveal Chemicals Linked to Health Hazards". 2014. http://comingcleaninc.org/warningsigns
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APPENDICES

Appendix 1
ALS Environmental: Report #1806078, NCP-Navajo Community Project (QC sample results and case narrative) June 18,2018. Pgs. 1-25; ALS Environmental: Report 18051137. June 13, 2018. Pgs.1-12.
Appendix 2
Southwest Pennsylvania Environmental Health Project Report: "Counselor Chapter Air Quality Assessment Results: Particulate Matter (PM2.5) and Volatile Organic Compounds (VOCs)", (August 3, 2018) pgs. 1-14
Appendix 3
Navajo Nation Environmental Protection Agency Air Quality Control Program "Ambient Air Monitoring, Counselor, NM" (April 14, 2016-May 18, 2017) pg. 1-2
Appendix 4
New Health Issues for Counselor – Produced Water & Water Monitoring

ACRONYMS

US EPA	United State Department of Environmental Protection
ATSDR	Agency for Toxic Substances and Disease Registry of the Centers for Disease Control and Prevention
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limits
REL	Recommended exposure limit $\mu g/m^3$
	Micrograms per cubic meter→ air quality measurement
ppm	parts per million
ppb	parts per billion

Part 2 –Tri-Chapter Cultural Survey

I. K'é Bee Hózhǫǫgo Iiná Silá: Harmonized Life Exists with Positive Relationship

Dinétah - The Place of Emergence of Diné People

The Navajo Nation Chapters of Counselor, Ojo Encino, and Torreon, which together form the Tri-Chapter Council, is situated in Dinétah, the place of emergence of Diné people. Diné people have lived in Dinétah since time immemorial, caring for the land as instructed by the Holy People. Archaeological evidence of Diné people living in Dinétah dates to at least 1500 AD, but Diné oral histories establish Diné presence in the region far earlier, since "remote pre-Columbian times".[1]

In 1984, John Redhouse (Diné) described Dinétah as follows:

> "The Navajos have lived in what is now northwestern New Mexico for a long time. They call it Dinetah or "among The People" (see Map 1).
>
> They moved into this area shortly after the Anasazis (The Ancient Ones) moved out and migrated to the Rio Grande River valley and points west.
>
> Even the U.S. Bureau of Land Management acknowledges that the Navajos have continuously inhabited this region for at least the past 485 years.
>
> Navajo land tenure in Dinetah then is based on a record of documented historical fact and continued human activity rather than legal theory or anthropological conjecture.
>
> According to their oral tradition, the Navajos emerged into this world from the womb of Mother Earth and that this is the fourth world of their existence as a Holy People. The land they chose was virtually uninhabited, saved for a few isolated Pueblos; notably Hopi, Zuni, and Acoma. But the Pueblos were sedentary and the Navajos were semi-nomadic so land use conflicts were few between the two people sharing a common environment.
>
> The new Navajo province was bounded roughly by the La Plata Mountains and Mt. Blanca in southern Colorado, Mount Taylor in west central New Mexico, and the San Francisco Peaks in northern Arizona, and was further delineated by the Rio Grande, San Juan, Colorado, and Little Colorado rivers. The four sacred mountains and the four sacred rivers marked the exterior boundaries of the emergent Navajo Nation and Dinetah symbolized the eastern door into this fourth world. Indeed the origin and destiny of the Navajo people lies within this spiritual

perimeter and its hallowed soil is protected by an inner and outer ring of sovereign immunity".[2]

In addition to the coordinates laid out by Redhouse, it is important to place Dibé Nitsaa (Mt. Hesperus, named Big Sheep Mountain by the Dine) to the north. In the context of Diné lifeways and oral history, north stands for continued reverence, reflection and respect.

How Dinétah Became a Checkerboard

Throughout the research process for this report, we learned about many of the social, cultural, and environmental disruptions and disrespectful behaviors that are occurring in the Tri-Chapter region because of oil and gas extraction on federal, state, private, Indian allotted, and tribal trust lands. These disruptions are rooted in the reduction and fragmentation of the Diné land-base, insofar as it impedes the ability of local communities to manage and care for their lands collectively.

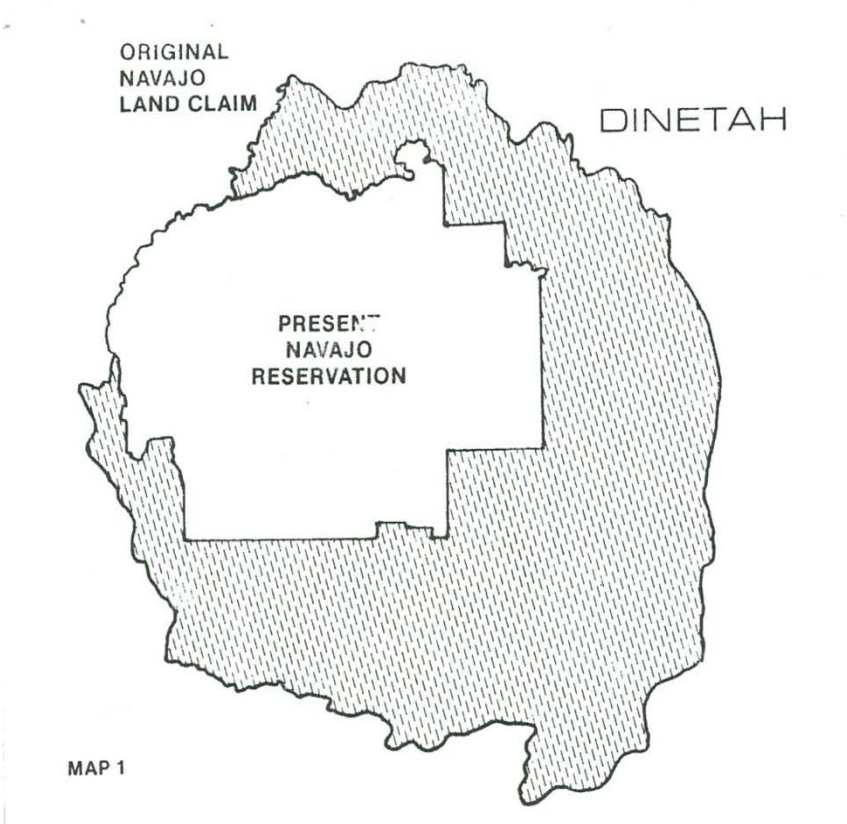

Figure 1 – Map of Dinétah by John Redhouse.[3]

Diné relations with the land, air, water, and all life were disrupted by colonization – first, by Spanish colonization, and next, by American colonization.

American settlers used several tactics to break up Diné land relations in Dinétah and across Diné Bikeyah (Diné territory bound by the Six Sacred Mountains, see below), eventually resulting in the formation of a "checkerboard" pattern of land jurisdiction throughout what is now Eastern Navajo Agency.

"Checkerboard" refers to a pattern of land jurisdiction where land has been surveyed and divided into individual surface and subsurface tracts that are owned and administered by distinct parties. In Dinétah, these parties include a variety of federal, state, tribal, and private actors (see figure 2). Many land parcels on the checkerboard are "split estate", meaning that the surface land and subsurface mineral estate are owned or managed by a different party. Due to this jurisdictional configuration, Diné communities throughout Eastern Navajo Agency have limited say regarding oil and gas development and other infrastructure projects in their communities. The results of the Tri-Chapter Cultural Survey indicate that this limited decision-making power over the collective land base is harmful to the continuation of Diné cultural practices in the region, including making offerings at sacred sites, collecting medicinal plants, and maintaining K'é and social cohesion (see Sections 3 and 4).

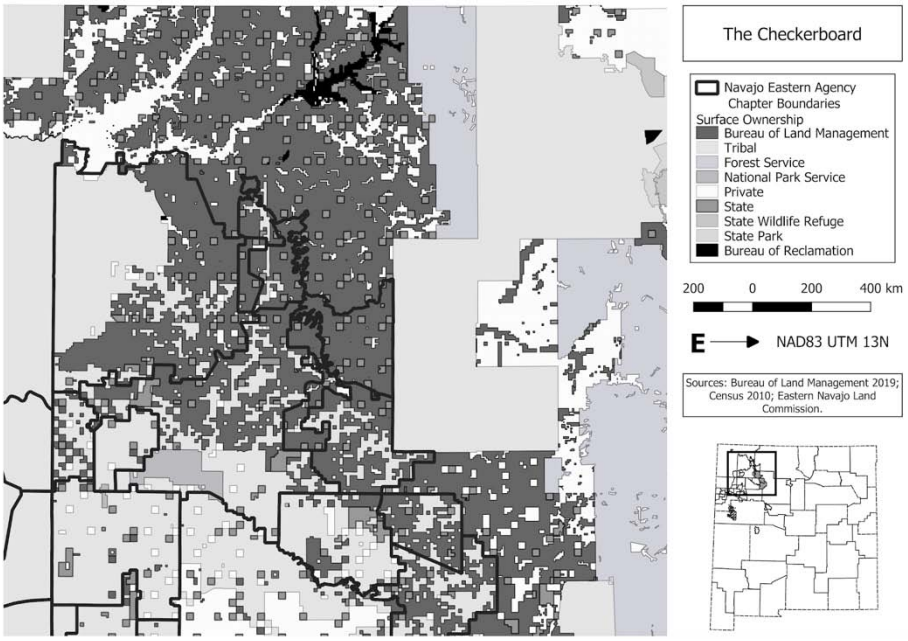

Figure 2 – Map of checkerboard land jurisdiction in Dinétah. Map by Brandon Velivis.

The making of the checkerboard was a complicated process. In this report, we outline this process in broad strokes to underscore that:

a) The current configuration of land ownership and administration in Dinétah is the result of a violent process of land theft.
b) These lands are still the homelands of Diné people.
c) The proper care for and good relations with these lands is important to the wellbeing of Diné people.[4]

Processes that Contributed to Checkerboarding:

Small Reservation — The 1868 Treaty between the United States and the Navajo Nation established a Navajo Reservation that was but a small part of Diné territory. It did not include Dinétah or any of the lands in what is presently Eastern Navajo Agency. Upon signing of the United States-Navajo Treaty, many Diné people returned from forced internment at Hwéeldi (Fort Sumner) to their previous homes East of the newly established Navajo Reservation to live in Dinétah, on what the United States now claimed was "public domain". The Navajo Reservation was gradually enlarged via Executive Order to its present-day size.

Homesteading — Through various Homesteading Acts (1862-1976), the United States encouraged settlers to move West by granting male heads of household 160-acre plots of land on the condition that they occupy the land for five years and make "improvements" to it. The first Homesteading Acts conveyed surface and subsurface rights to the homesteader, but by 1909, the federal government began reserving subsurface rights to itself for the extraction of coal and other substances. Settlers used the Homesteading Acts to establish homes in Dinétah. By the 1870s, there was considerable tension and conflict over land and resources between settlers and Diné people living in Dinétah.

Railroad Grants — In 1866, Congress chartered the Atlantic & Pacific Railroad Company to build a railroad from Springfield, Missouri to California. For forty miles on either side of the planned line, the Atlantic & Pacific was granted alternate sections of 640 acres of surface land (the federal government retained mineral rights below these tracts). Most of this grant was forfeited in 1886 after eastern portions of the rail line were built, but it remained valid between Albuquerque to California – thus, throughout a large section of Diné territory. Lands held by the Atlantic & Pacific were eventually sold to other railroad companies, including the Aztec Land & Cattle Company, the Atchison Topeka & Santa Fe, the Santa Fe Pacific Railroad Company, and the New Mexico & Arizona Land Company. These companies leased and sold surface land in Dinétah to private entities, primarily for livestock and grazing. The leasing of railroad grants was another way in which white

	settlers gained increasing control over the range in Dinétah in the 19th and early 20th centuries.
Allotment	The General Allotment Act (Dawes Act) of 1887 transformed land tenure in Dinétah, east of the 1868 Treaty Reservation. Approximately 4,000 (≈ 160 acre) allotments were made to Diné people (typically male "heads of household") between 1906 and 1944. About 3,900 allotments were in northwestern New Mexico and the rest in Arizona. For approximately 2,500 of these allotment patents, the federal government erroneously retained for itself the mineral rights, and Diné people had to file suit against the Department of the Interior to have these rights restored (see *Mescal v. United States* 1983). Across the country, allotment resulted in enormous territorial dispossession for Indigenous peoples. Indigenous land holdings in the United States decreased from 138 million acres to 48 million acres between 1887, when allotment began, and 1934, when it ended.
E.O. 709	In 1907, in response to growing calls and advocacy by Diné people, President Roosevelt signed Executive Order 709, which extended the Navajo Reservation into Dinétah, bringing about one million acres of land in present-day San Juan and McKinley Counties into tribal trust status. Shortly after, another Executive Order, 744, amended a typographical error in 709, which had erroneously extended the Navajo Reservation into the Jicarilla Apache Reservation. As per Executive Order 709 and 744, the allotment of parcels to individual Diné people continued in this area. The Executive Order addition did not affect existing rights in the area, so settlers also continued to lease lands from railroad companies. In 1908, Congress passed a law that allowed for Reservation lands added by Executive Order to be restored to the "public domain" once allotment had been completed in the area. President Roosevelt thus reverted twenty-six townships in the 709/744 area to the "public domain".
E.O. 1284	In 1911, President Taft's administration deemed the allotment process to have been sufficiently completed in the 709/744 area, even though less than 50% of the Diné people eligible for allotments had had the opportunity to claim a parcel. With Executive Order 1284, President Taft restored the entire 709/744 area to the "public domain". This left approximately 2,500 Diné allotments floating in a sea of federally claimed and privately claimed lands, forming a checkerboard.[5]
NM Statehood	In 1912, New Mexico became a state within the United States. The United States government, which claimed to own most of the land in the area, granted New Mexico one square mile of surface and subsurface land per township, totaling over 13 million acres across the state. This land was to be held in trust by the state for the benefit of public schools, universities, and other public institutions. In present-day Dinétah, parcels of state land are intermixed with federal, private, tribal trust, and allotment land. Broadly

speaking, these processes – railroad construction and railroad grants, homesteading, allotment, executive order additions and subtractions, and New Mexico statehood – contributed to the formation of a checkerboard in Dinétah and the gradual diminishment of Diné landholdings. Every step of the way, Diné people have fought to hold onto and regain their lands, including through land exchanges and land consolidation initiatives. This fight is still in process.

Tsé Biyah Anii'áhí (Chaco Canyon) is part of Dinétah. In 1907, President Roosevelt established Chaco Canyon National Monument, bringing over 20,000 acres into protective status. The monument was enlarged in 1928 and turned into a National Park, managed by the United States National Park Service, in 1980. When the monument was established, some Diné people who were living in the area were forced to move while others' allotments were cancelled.

Tsé Biyah Anii'áhí – Chaco Canyon

Diné people respect Tsé Biyah Anii'áhí (Chaco Canyon). It is a sacred site.

According Diné people, the architecture at Chaco Canyon was built by the Anáásazí. We look at Anáásazí as an ancient holy people with wisdom. Anáásazí people have a level of energy that is very important to the environment. They represent a group of people who knew about the natural environment.

The Anáásazí left a legacy that has ceremonial connection to the Diné people as well as other Indigenous peoples living within proximity to Tsé Biyah Anii'áhí, a connection that is feared, respected, and honored in many of our traditional ceremonies. There is a great spiritual energy at Tsé Biyah Anii'áhí, and Diné people approach it with caution and respect. Some Diné people never visit the site.

Protecting, honoring, and revering Tsé Biyah Anii'áhí goes far beyond the canyon itself, but also the vast landscape that surrounds it.

II. Introduction to the K'é Bee Hózhǫǫgo Iiná Silá Model

By David J. Tsosie, Ed. D.

The model K'é Bee Hózhǫǫgo Iiná Silá is translated as "harmonized life exists with positive relationship". It is based on the original four sacred mountains (dził) and the life concepts associated with each mountain. Dził (mountain) is interpreted to mean our strength (dziil) supporting the stories of the mountains having been alive at one time. Due to some unforeseen event, they became confused and had to be redirected using prayers, songs, and mountain tobacco. Once they were refocused, they were ordained with prayers and songs and placed in the four directions to be the strength and guiding beacon for the Holy Earth-Surface-People who were to eventually come into the area.

The sacred mountain to the east is Sis Naajiní (Mount Blanca) was ordained with prayers and songs and fastened with a bolt of lightning. The Holy People dressed it with different vegetation, animals, birds, and placed the Early Twilight Dawn Boy and Girl, Crystal Boy, and Crystal Girl to be the caretaker. They also assigned a perfect white shell for positive thoughts and thinking. Thus, when you arise early in the morning you go out facing the east and offer a prayer thinking about your goals for the day.

To the south is Tsoodził (Mount Taylor), which the Holy People ordained with prayers and songs and placed different vegetation, animals, birds, and Folding Blue Sky Boy and Girl and One-Turning-Turquoise Boy and One-Turning-Corn Girl to be the caretaker. They fastened the mountain to the earth with a metal bolt and blanketed it with turquoise and assigned Nahat'á or planning. Following your thinking, you implement these into a plan as to how you will achieve them.

The sacred mountain to the west is Dook'o'ooslííd (Mount Humphrey), which was ordained with prayers and songs and filled with different vegetation, animals, birds, and placed Twilight Dusk Boy and Girl and White Corn Boy and Yellow Corn Girl to be the caretaker. It was not stable, so they fastened it down with a sunbeam and blanketed it with abalone shell and assigned Iiná or life. The aim was that whatever you thought of and planned can be applied to your life ways.

The sacred mountain to the north is Dibé Nitsaa (Mount Hesperus) was also ordained with prayers and songs and different vegetation, animals, and birds. There were Darkness Boy and Girl and Corn Pollen Boy and Corn Beetle Girl assigned to be the caretaker of the mountain. With the mountain not being stable, it was fastened to the earth with a rainbow. The life concept that was assigned to the mountain was Sih Hasin or wisdom/sharing. As the last of the original four sacred mountains, it represented wisdom and sharing as one's life achievement and a possession of knowledge to be shared with the generations that were to follow.

The four mountains are also representative of a Hogan with Sis Naajiní embracing the white shell and Nitsáhákees to the east; Tsoodził embracing the south with turquoise and Nahat'á; Dook'o'ooslííd embracing the west with abalone shell and iiná; and Dibé Nitsaa embracing the north with black jet stone and Sih Hasin. The two mountains (Huerfano Mesa and Gobernador Knob) were added later in the northeastern direction and were designated to represent Sodizin/naalyéhé and Sin/nitł'íz, the materialistic and spiritual existences. It also represented the doorway and chimney of a Hogan.

The doorway facing east to welcome the early sun rays into the Hogan to connect with the fire that exists in the middle of the Hogan. It also welcomes people who will visit and the Holy People whenever there is a traditional ceremony. The chimney serves as an outlet for the prayers to travel to our father sky. The fire is addressed as grandfather and grandmother and is representative of the collection of knowledge of both the male and female energy. It is where all knowledge of life and our connection to the cosmic order emanates from and it gives us life.

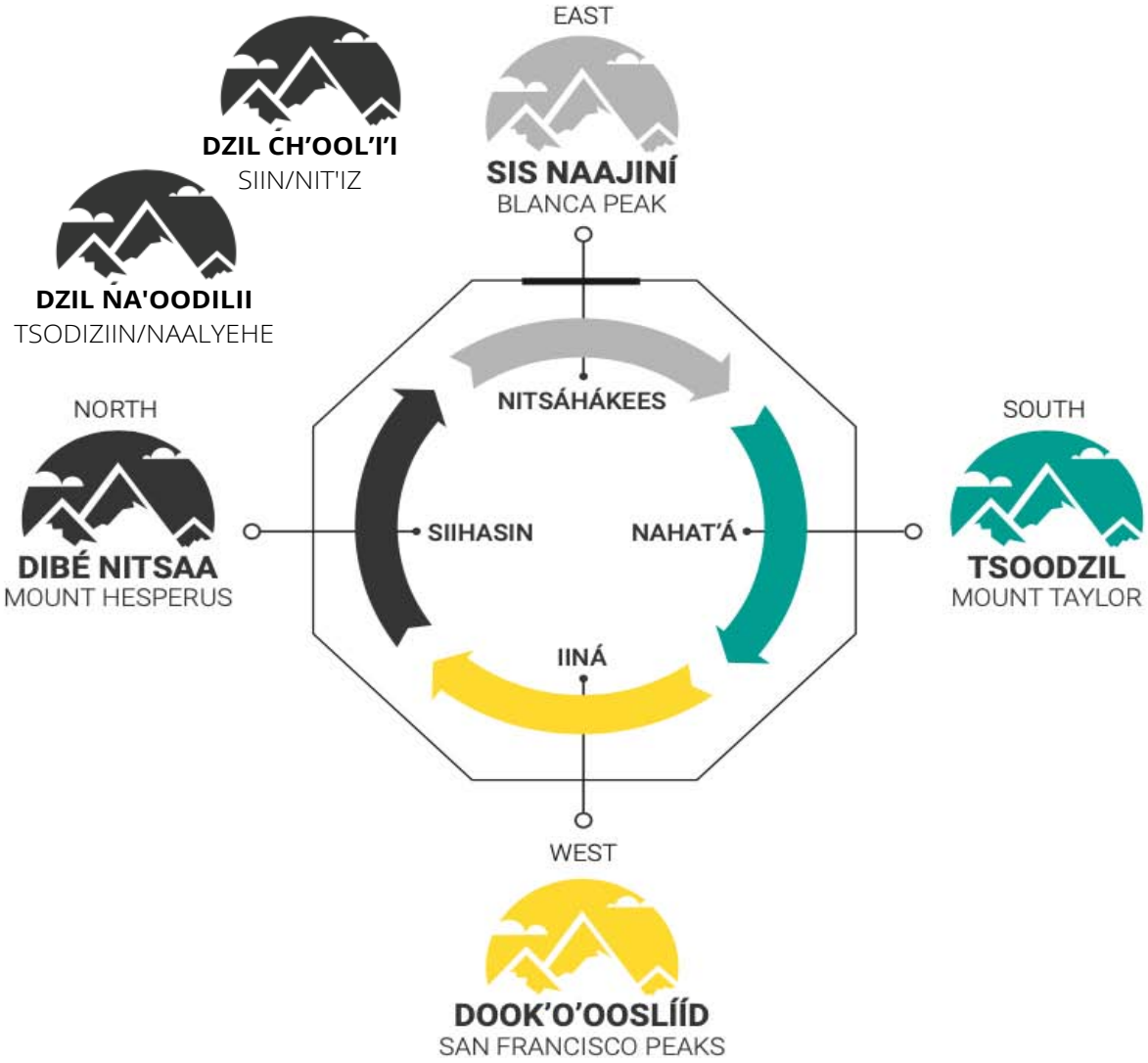

Figure 3 – Visual representation of K'é Bee Hózhǫǫgo Iiná Silá model. Image created by Diné Center for Research and Evaluation (DCRE)

III. Cultural Survey - Kinship and Relation to the Environment

The Meaning of K'é

The concept of K'é Bee Hózhǫǫgo Iiná Silá centers on the Diné traditional belief that K'é is the restoration of a meaningful social structure of the Diné people. When you are brought into this world you are born into four clan systems: your mother's clan, your father's clan, your maternal grandfather's clan, and your paternal grandfather's clan. There may be four to six clans that may be associated to any of the four clans that you were born into. Therefore, you will eventually have many relatives through any of the four clans that you are made of. You will come to find out that you have relatives that live on the opposition side of the Reservation whom you have never met just by introducing yourself through the four clans you represent. The introduction will follow a certain order, meaning that you introduce yourself with your mother's clan first because that represents your physical existence, your father's clan next because that represents your mental being, your maternal grandfather's clan because it reflects your materialistic belonging, and last is your paternal grandfather's clan since it signifies your spiritual posture.

The importance of K'é is referenced in the Fundamental Law, enacted by the Navajo Nation Council through the passage of Resolution CN-69-02 on November 02, 2002. This law has always been instrumental in addressing many of the issues encountered by the Medicine People and "these laws have not only provided sanctuary for the Diné Life Way but has guided, sustained and protected the Diné as they journeyed upon and off the sacred lands upon which they were placed since time immemorial". Our way of life and the relationship that we have with our natural environment is predicated on this law. The Diyin Diné Bitsąądęę Beenahaz'áanii (Diné Customary Law 1 N.N.C. § 204) states that:

> "It is the right and freedom of the people that the sacred system of K'é, based on the four clans of Kiiyaa'áanii, Todích'iínii, Honagháahnii and Hashtł'ishnii and all descendent clans be taught and preserved".

This relationship of K'é, according to our traditional Medicine People, extends beyond us as Diné to our environment as stipulated in Subsection 5E of Nahasdzáán dóó Yádiłhił Bitsąądęę Beenahaz'áanii (Diné Natural Law 1 N.N.C. § 205), which states:

> "Mother Earth and Father Sky is part of us as the Diné and the Diné is part of Mother Earth and Father Sky; the Diné must treat this sacred bond with love and respect without exerting dominance for we do not own our mother and father".

K'é Hwiinidzin is the act of K'é. It is a feeling, a thought process, without any words spoken. It is thinking about K'é and our relationships. While K'é is a noun, Hwiinidzin is a verb. It is an active process. K'é Hwiinidzin is a process of establishing or restoring harmony and balance in all of the Great Spirits' creation. This means the environment *and* the people.

This belief is prevalent in many of our ceremonial prayers and songs. We have been taught that the Earth is our Mother, and the Sky is our Father and we acknowledge their existence through prayers and songs and ask for their protection. Many of our prayers align with the Earth and Sky
by reciting that their feet are our feet, their legs are our legs, their body is our body, and their mind is our mind. Through these prayers, our physical, mental, and spiritual existences are renewed because we believe that the earth and sky renew themselves during the four seasonal cycles: the spring and fall equinoxes and the summer and winter solstices. Thus, through the different ceremonies that are performed we are also renewed.

Purpose of Cultural Survey

The Counselor Citizens Health Impact Assessment Committee recognized that in order to fully understand how recent Mancos shale extraction has affected the Diné communities of Counselor, Ojo Encino, and Torreon, it would be necessary to supplement the methodologies employed in the HIA (Part I).

As described in Part I, the HIA revealed crucial information about air quality and health symptoms experienced by residents. The HIA was also able to compare this information to other communities living in proximity to unconventional oil and gas development. However, because there are unique and sovereign aspects to Diné culture, epistemology, and spirituality, only a Diné-centered research methodology that employs Diné concepts, such as K'é, could begin to map broader social, cultural, spiritual, and economic impacts of oil and gas development for these communities. This research methodology understands Diné wellbeing holistically, as composed of relations among human and nonhuman relatives and the natural environment across generations.

Survey Methodology

The cultural survey was conducted in the Navajo Nation Chapters of Counselor, Ojo Encino, and Torreon. The survey was designed by Dr. Herbert Benally with input from the Committee and analyzed by Dr. David J. Tsosie.

Surveys were conducted in Diné Bizaad, with English translations available. 136 adult participants were selected randomly in each of the three Chapters. A total of 5,440 responses were given to 40 wide-ranging survey questions. Out of the 40 questions, 16 that directly related to the impacts from oil and gas development were selected for further analysis and community discussion.

Survey Questions and Summary of Responses:

Area of Knowledge	Survey Question	Percentage of Strong Agreement Among 136 Respondents
Nitsa□ha□kees - East (Thinking) ***Restore balance***	Our local leaders have spoken out against drilling and no one at the tribal, state or federal level, including BLM and BIA, has listened	104 or 74%
	Despite communities objecting, the drilling continues	110 or 81%
	People were misinformed when they agreed to permits, they thought was for testing, not drilling	109 or 79%
Nahat'a□ - South (Planning) ***Planning for a meaningful consultation***	Our effort to pass on a healthy and prosperous environment to our children is being broken	113 or 83%
	The peace of the people has been disrupted as a result of drilling & fracking	115 or 85%
Iina□ – West (Lifeway) ***Protect wellbeing***	The oil companies have no respect for land, people & life	117 or 86%

	Actions by oil companies have divided families/community	115 or 85%
	Since oil companies made their presence here, all life is continually changing for the worse	112 or 82%
	The behavior of oil companies in getting a permit to drill shows their lack of concern for the community	113 or 83%
	Monies from oil companies for right to drill divided many families	112 or 82%
Sih Hasin – North (Wisdom and Sharing) ***Assure environmental justice***	Because the land is being ruined, it will not be able to sustain an economy	113 or 83%
	The insensitivity of oil & fracking companies toward our community leads to mental- & physical hardship	109 or 80%

	The oil companies know the community is in financial need and inappropriately entice landowners with money	112 or 82%
	Oil companies do not respect sovereignty or Navajo Nation law	117 or 86%
Sodizin dóó Sin (Prayer and Song) ***Establish spiritual connection***	What I believe to be sacred is being destroyed by drilling	115 or 85%
	Rare herbs that can help with health are disappearing since the drilling started	84 or 62%

Table 1 – Survey questions and summary of responses.

IV. Analysis of Findings and Major Community Concerns

When analyzed through the K'é Bee Hózhǫǫgo liná Silá lens, the report authors found that a major disruption of K'é is occurring in the Chapters because of increased oil and gas development.

To understand the complex social and cultural impacts of oil and gas extraction in the Tri-Chapter region, some context on allotment lands is necessary. While much of the region's oil and gas extraction occurs on federal and state lands, a fair amount also occurs on allotment lands, and it is extraction on allotment lands that has most divided the community. In Eastern Navajo Agency, Diné allotment owners have the right to lease their land for oil and gas extraction. For a lease agreement to proceed, shareholders representing at least 51% ownership in the allotment must agree to the lease. Oil and gas extraction on allotment lands in Eastern Navajo Agency is overseen by the Bureau of Indian Affairs, the Federal Indian Mineral Office, and the Bureau of Land Management – all agencies within the Department of the Interior,

which falls under the auspices of the Secretary of the Interior. Allotment owners receive oil and gas royalties through their Individual Indian Money accounts. Diné people are often at a disadvantage vis-à-vis oil and gas companies when it comes to negotiating lease terms, and as the results of the Tri-Chapter Cultural Survey show (see Section 2), this process is often far from transparent. In the Tri-Chapter region, there are few employment opportunities and 1 out of 1.6 residents live under the poverty line, so many families rely on income generated by oil and gas extraction.

Survey respondents showed a high level of agreement (80-86% agreement) on 13 out of 16 questions regarding negative impacts of oil and gas development. Respondents showed a majority level of agreement on the remaining 3 questions (62-79% agreement). This level of agreement about the negative impacts of oil and gas development is a significant finding that demands further attention and highlights the importance of tribal consultation and listening to local community voices when informing federal, State of New Mexico, and Navajo Nation agency decisions.

From the beginning of Mancos shale extraction in the Tri-Chapter area around 2010, with heightened development taking off in 2014, residents have been concerned about many issues. These problems have gone almost totally unaddressed by federal and state governments and oil companies despite repeated requests by residents and Chapter governments. These concerns include:

- Dangerous and impassable local roads conditions and travel delay due to industrial traffic, oversized oil equipment, accidents, speeding, large road debris and heavy equipment, and infrastructure building.
- Air, land, and water pollution due to construction, drilling, pipeline spills and leaks, and fracking and flaring emissions.
- Lack of emergency protocols to protect community safety in the case of an incident.
- Lack of meaningful consultation with local communities to protect public safety or preserve cultural and historical values.
- Greatly increased traffic and well accidents with injuries, evacuations, loss of animal life and significant environmental damage.
- Misinformation or insufficient information given by oil companies to residents about:
    - Protecting the shared roads, ceremonial sites, medicinal plants, and lands of the community from impacts.
    - Allocation and amount of royalty payments.
    - Strategies to resolve family divisions over leasing issues.
    - Average lifetime of a Mancos shale well and period of profitable extraction of minerals and royalty payments.
    - Conditions of approval and lease stipulations as they affect allotment landowners regarding access, roads, nighttime lighting, security, accident cleanups, fencing, water contamination.

- Personal safety impacts on residents of drilling activities, including emissions, noise, light pollution, noxious fumes and odors, irresponsible or dangerous field crew behavior
- Responsibility for cut fences, off-road driving, livestock injury or death.

V. Community Feedback Sessions

In 2020 and 2021, the Committee held five community feedback sessions in the Tri-Chapter region. One presentation was given to the Tri-Chapter Council, one to Counselor Chapter, one to Torreon Chapter, and two to Ojo Encino Chapter. Due to public health guidelines, these community feedback sessions were held virtually via Zoom and over the phone. A community feedback form was also circulated.

Public comments recorded from these meetings showed close agreement with the survey questions. Residents also articulated additional concerns related to harm connected with local oil and gas development. Four specific themes emerged from these community feedback meetings:

- Feeling caught in a bind: Recent Mancos shale development has caused tensions in families who co-own interest in allotments. Some residents expressed that they did not want to lease their allotments but felt pressure from their family members to sign leasing agreements due to economic limitations. The lack of meaningful economic opportunities in the region further constrains individual choices regarding leasing decisions.
- Requests for community education and legal assistance: Residents expressed a need for access to more information about their legal rights as individuals, as allotment owners, and as tribal members. Residents also expressed a need for more information about the actual and potential impacts of oil and gas extraction.
- Confusion: The maze of federal, state, and tribal regulations regarding oil and gas extraction has not been made clear to residents. Community members do not know who to contact if something goes wrong, or if they simply have a question. Agencies are often not forthcoming with information to residents.
- Fatigue: The Tri-Chapter community has been dealing with the myriad environmental, public health, social, and cultural impacts of oil and gas extraction for a long time, with accelerated development since 2014. Residents are tired and feel disempowered because they notice that very little changes even when they speak up.

> *"How do all the others handle it? How do you deny your signature [on a lease]? We all know it is not good [oil and gas] – bad for health, bad for land, bad for livestock – but who do we ask for help?*
>
> -Torreon Chapter Resident, Vivian Mitchell during the May 13, 2021, Community Feedback Meeting

VI. Recommendations to Federal, State, and Tribal Agencies to Mitigate the Negative Impacts of Oil and Gas Development and Ensure a Just Transition

Based on the Cultural Survey findings, community meetings, and feedback sessions, the report authors make the following policy recommendations:

A) Free, Prior, and Informed Consent and Meaningful Consultation
Uphold the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Any land management decisions, including decisions regarding oil and gas development, must be informed by meaningful consultation and processes of Free, Prior, and Informed Consent.[6]

B) Modify Federal and State Revenue Sharing
Implement measures to ensure that royalties generated from developing federal and State mineral estates within Navajo Nation Chapter boundaries are directed to mitigate the effects of extraction in Diné communities and improve collective Diné life in the area.[7]

C) Establish Road Maintenance Fund and Safety Measures
Require oil and gas operators in the region to pay into a road maintenance fund that will assist Navajo Nation Department of Transportation, Counties, the Bureau of Land Management, the State of New Mexico, and other jurisdictions in maintaining local roads. Place traffic safety signs to indicate speed limits and other safety rules for oil and gas traffic.

D) Ensure Transparency and Transfer of Complete Information in Lease Agreements with Allotment Owners
The Committee's research indicates that approximately 80% of residents surveyed are concerned that many individual Indian mineral owners were inadequately informed or misinformed about what exactly they were agreeing to when they gave their consent to lease their fraction of an allotted mineral estate. This has led to preventable conflict within impacted communities, as well as regret and sadness on the part of some allottees who feel they were coerced into signing something that they did not fully understand at the time. BLM and BIA, along with the Federal Indian Mineral Office, should work with Eastern Navajo Agency Chapters and oil and gas operators to develop protocols that would ensure that during leasing negotiations, all co-owners of an allotted mineral estate are fully informed about the lease terms, including potential drilling operations, potential harmful impacts of drilling, and potential for revenue fluctuation.

E) Protect Cultural Resources Through Consultation, Inventories, and Ethnographic Studies
In consultation and collaboration with impacted communities and Tribes, ensure that cultural resource surveys and ethnographic studies are conducted prior to any leasing and permitting decisions, and that any harmful direct, indirect, or cumulative impacts to cultural resources are prevented or mitigated. Specifically, BLM, BIA, the New Mexico State Land Office, the Federal Indian Mineral Office, and/or any leasing entity should work with Diné experts and the Navajo Nation Historic Preservation Department to conduct an archaeological survey of previously un-surveyed proposed lease parcels that lie within Chapter boundaries and/or traditional Diné

homelands; Verify results of previous archaeological surveys in the area; and Conduct a Traditional Cultural Properties (TCP) inventory of the entire leasing project area.

There are several land jurisdictions involved in sales of lease parcels (private, BLM, State, and Navajo Nation tribal trust and allotment) and inventory methods must satisfy the regulatory needs of all jurisdictions. As part of the TCP inventory, required ethnographic investigations (oral histories) must be conducted with community members, usually elders, who remember the lands and how they were traditionally used and are currently being used.[8]

F) Fund Restoration of Sacred Sites

In collaboration with Navajo Nation Historic Preservation Department and, if applicable, the State Historic Preservation Office, develop a restorative justice process to address any desecration of community sacred sites in the Tri-Chapter area by the oil and gas industry that has already taken place.

G) Ensure that Reclamation Meets Community Needs

The Committee's research indicates that a high percentage of residents perceive that the landscape is being degraded by oil and gas development, and that important vegetation and medicinal plants have been disappearing since Mancos shale development began. Residents are concerned that the land will not sustain future generations. Mitigation and reclamation measures in the Tri-Chapter area have been insufficient for protecting important ecosystems and cultural resources. Reclamation of active well pads and abandoned wells must be fully implemented. State and federal agencies must ensure sufficient bonding requirements to cover reclamation costs when oil and gas infrastructure is abandoned.[9]

H) Uphold and Implement Principles of Environmental Justice Consistent with Executive Orders 12898 and 13990

Executive Orders 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations") ("Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis") each lay out important principles of environmental and climate justice that federal agencies must uphold.

I) Appoint a Neutral Ombudsman to Assist Families and Communities

Appoint a Diné Ombudsman or Peacemaker (bilingual in English and Diné Bizaad) to assist families and individuals in navigating resource disputes that arise from co-owning fractionated interests in allotments. The Ombudsman would also help residents understand their legal rights and responsibilities.

J) Just Transition

Invest in efforts toward a just transition to democratized, equitable, clean renewable energy and community infrastructure to assure the health, wealth, and wellness of impacted communities. Support local food sovereignty and retrain the coal and oil and gas workforce for a green economy. A just transition will safeguard water, land, soil, air, climate, and livelihoods, and create new economic opportunities in the Tri-Chapter area.

VII. Restoring K'é

The devastation being experienced by the Tri-Chapter communities due to the oil drilling and fracking activities is far-reaching, meaning it is affecting the land, water, air and the people. The most harmful effect has been the cultural and spiritual degradation. The Diné people have always relied on the cultural teachings of the elders and medicine people to maintain harmony in their lives. An important element of that is the relationship that is established and maintained. It is an expected norm that determines the functioning of the social order of the Diné people and how they should treat one another in order to be a positive functioning community member.

However, this has been disrupted and, in some cases, it has been eroded altogether by the oil drilling and fracking activities. K'é is the most important attribute that holds the Diné society together. It is through K'é that they communicate, assist one another whenever ceremonies are held, and communicate with their natural environment through different ceremonial events. Subsequently, the use of K'é has been diminished by the oil companies to an extent that even families and close relatives can no longer depend on each other.

The spiritual connection to the land and the environment has also been compromised. The elders explained that we have connections to all things that are a part of the cosmic order. They believe that all things possess a bii'istxiin and they are all renewed at certain times of the season. The bii'istxiin is interpreted to mean the living spirit, which is made of both the male and female energy. These living spirits can be diminished or destroyed all together by the negative force that invades their surroundings. Our communication with these natural elements bił ałch'i'hánedzih (we make spiritual connection with it) and nihi k'ineegish (it makes a spiritual connection with us). Also, bił ałch'i' háneedzih (we speak to it) and nihich'í' hánádzih (it speaks to us). This form of communication is very vibrant at sacred sites and can be perceived as a portal to the Spirit World to make connections with the Holy People.

All communities on the Diné Nation have local sacred sites that are used by local community members for offerings to make spiritual connection to their land. The Tri-Chapter communities are no different. Some of the elders and medicine people have expressed concerns that Spiritual Sites (Naazhiin, Shashjaa', Tsénaajiin, Anáásazí Kits'iil, Yoo'tsoh Dziil, and Sisnáát'eeł) have been disrupted beyond their usefulness. Some of these sites have been used to make offerings for rain during extreme drought conditions. Others have been used as sites to conduct protection prayer ceremonies or ceremonies to express an appreciation for all the wonderful blessings that have been bestowed upon families. These sacred sites are equivalent to some of the Holy Doctrines or Sanctuaries that are jealously guarded against any sacrilegious encroachment. Our belief is that anytime some of these sacred sites are desecrated our prayers and songs cannot connect with spiritual places to make our prayers complete. This can have an emotional or psychological impact on the people wondering if their prayers and songs that they have offered have been received or if they will be answered.

This disruption has also been felt by the Herbal Medicinal People to an extent that they can no longer be found. Our elders told stories of the origin of the different herbs in the dark, blue, yellow, and white world and how they were to be used in conjunction with the different ceremonies created by the Holy People. In the white world, the Holy People talked about placing the different herbs in the four directions and what the medicinal herbs will be used for. They also assigned a spirit to each medicinal plant and made them alive to be gifted to bring a cure to patients. Our elderlies have told us about how these medicinal herbs move around from one place to another always looking for a peaceful environment. With the polluted environment left by the oil companies, many of these herbs have left the area looking for a place that is pristine so they can absorb their healing strength from a clean environment.

The process of restoring K'é and healing the environment for spiritual cohesiveness is a much broader endeavor than an individual prospect. Most of the medicine people conduct prayers for an individual or a family. However, a process of this magnitude has to be a unified community effort involving all three Chapter communities. We still have medicine people who are knowledgeable of making an offering for a complicated issue at one of the four sacred mountains surrounding our land. It would entail an offering of our sacred mineral stones with prayers and songs for both the restoration of the land and K'é and for a continuing healing. It may require a Beauty Way ceremony that could last a couple days with a four-day period of reverence.

We end with the words of Land and Water Protector Robert Tohe, who always practiced K'é Hwiinidzin:

"Indigenous people see the earth as a living entity – our mother. Before we extract something from the earth, we always ask, 'Why is it here? Was it put here for a reason? Is it meant to be used by humans, or should it be left alone as part of nature?' If we can recognize the interconnectedness of all things, we'll be OK."

ENDNOTES

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[1]Klara Kelley and Harris Francis, A Diné History of Navajo Land, (Tucson, University of Arizona Press,2019). Kelley and Francis describe how archaeological knowledge has tended to perpetuate a "late arrival" stereotype about Diné people. This stereotype, Kelley and Francis argue, rests on shaky scientific grounds and ignores an abundance of Diné oral and traditional history that establishes Diné presence in Navajoland far earlier than most non-Native archaeologists acknowledge.

[2] John Redhouse, *The Leasing of Dinetah: An Eastern Navajo Odyssey*, Roots of Navajo Relocation Series (Albuquerque, New Mexico: Redhouse/Wright Productions, 1984). P.1-2.

[3] John Redhouse, *The Leasing of Dinetah*, 1984, p.2.

[4] For more detailed accounts of this process, including Public Land Orders, authorized land exchanges from 20th century to the present, and past attempts at consolidating the checkerboard, see David Brugge, *A History of the Chaco Navajos*, Reports of the Chaco Center, Number Four (Albuquerque, New Mexico: Division of Chaco Research, National Park Service, Department of the Interior, 1980); Sonia Grant, *Patchwork: Land, Law, and Extraction in the Greater Chaco*, (Doctoral Dissertation, University of Chicago, 2021); Stanford Mosk, *Land Tenure Problems in the Sante Fe Railroad Grant Area* (Berkeley and Los Angeles: University of California Press, 1944); John Redhouse, *The Leasing of Dinetah*, 1984; "Navajo Nation Council Resolution CO-47-12" (2012).

[5] In 1982, the Navajo Nation sued the State of New Mexico, the U.S. government, and several companies to get the 709/744 area back. When a federal district court dismissed the case on procedural grounds, the Navajo Nation appealed to the 10th Circuit. The 10th Circuit ultimately ruled that the Navajo Nation's claim to title of the land could not be adjudicated because it fell outside the statute of limitations for the Indian Claims Commissions Act of 1946. The claim itself still stands. See Navajo Tribe v New Mexico et al. For more detail on the case see Sonia Grant, *Patchwork*, 2021; Richard Hughes, "Indian Law," *New Mexico Law Review* 18 (1988); "Navajo Nation Council Resolution CO-47-12" (2012).

[6] Articles 19 and 32(2) of UNDRIP are especially pertinent here.

[7] See "Study of Royalty Revenues generated in 2013-2014", Ojo Encino Chapter Comment Letter Re: BLM January 2017 Lease Sale, Page 14/26; and Velivis, Brandon. 2019. "Matrix Exposed: Oil/Gas Development Analysis as a Means of Differential Cultural Matrix Examination". Professional Paper in Community Economic Development. Pennsylvania State University.

[8] See National Register Bulletin 38 – Guidelines for Traditional Cultural Properties

[9] See Center for Applied Research, 2021, "An Analysis Of The Adequacy Of Financial Assurance Requirements For Oil And Gas Infrastructure Located On State Trust And Private Lands In New Mexico", https://www.nmstatelands.org/wp-content/uploads/2021/05/NM-Assurance-Assessment-May-FINAL.pdf ; Carbon Tracker. 2020. "Billion Dollar Orphans: Why Millions of Oil and Gas Wells Could Become Wards of the State." October 1, 2020. https://carbontracker.org/reports/billion- dollar-orphans/.