FOR IMMEDIATE RELEASE: June 22, 2020

Kinder Morgan Sued for Violations of Federal Safe Drinking Water Act

Attorneys for Trinity Edwards Springs Protection Association (TESPA), acting on behalf of Blanco County landowners whose sole source of drinking water was contaminated, have today filed suit in federal court against the Permian Highway Pipeline LLC (PHP) and its managing partner, Kinder Morgan.

This case is brought forward for alleged violations of the federal Safe Drinking Water Act (SDWA) which protects "underground sources of drinking water" by prohibiting the injection of "contaminants" into underground drinking water.

That is exactly what occurred on March 28, 2020, when Kinder Morgan's PHP constructors made serious errors as they attempted to drill under the Blanco River and pumped 36,000 gallons of "AMC Gel" drilling fluid into the aquifer.

The plume of drilling fluid moved away from the drilling site and a few days later contaminated the fresh drinking water of Dr. Teri Albright, Dr. Milton Shaw, Max and Paula Fowler, and Mary Harris. The mud-colored water that began flowing from their groundwater wells on March 31 was rendered unfit for human consumption.

To date, the companies have made no effort to clean up the contamination in the aquifer. TESPA seeks to force defendants to clean up the contamination and further seeks an injunction to prohibit the use of this product anywhere between Blanco to Wimberley to Kyle.

Jim Blackburn, TESPA board president and renowned Texas environmental attorney, sums up the legal action as this: "We filed the suit because Kinder Morgan has polluted the groundwater and infringed upon property rights, two critical issues held dear by Texans. The company was repeatedly asked to route their pipeline away from the unique karst geological region of the Texas Hill Country where groundwater provides the sole source of drinking water to many homeowners and communities. Kinder Morgan ignored these pleas and then failed to competently construct this project — violating the trust our politicians and state agencies gave them and, in the process, violating common law and federal law. Kinder Morgan earned this lawsuit."

(more)

Jeff Mundy is the attorney for the families and the organizations trying to protect the drinking water supply on which thousands of people in the Blanco River Valley depend for their sole source of drinking water. Mr. Mundy points out that Kinder Morgan told the public in its press releases, and told the Texas Railroad Commission, that the drilling fluid mix contained only Bentonite clay and water and was "inert" and "non-hazardous."

However, Section 11 of the Safety Data Sheet (SDS) for the AMC Gel drilling fluid mix clearly states, **"On the basis of epidemiological data, the material is regarded as carcinogenic to humans. There is sufficient data to establish a causal association between human exposure to the material and the development of cancer."**

This statement in the SDS appears to be based on two additives, Acrylamide and Silica, both recognized as human carcinogens by the Occupational Safety and Health Administration (OSHA) and the International Agency for Research on Cancer (IARC).

Subsequent laboratory tests of the AMC Gel mix found it to contain several metals such as Aluminum, Arsenic, Barium, Chromium, Lead, Manganese and other metals, five of which are Class 1 human carcinogens according to IARC.

"There is no safe level of exposure to human carcinogens according to OSHA and IARC," Mr. Mundy stated. "We are fighting for justice for these families already impacted, and for the families downstream who are at risk from any further attempts to use this cocktail of carcinogens in our water."

David Baker, executive director of WVWA and longtime Hill Country clean water advocate, expressed the feelings of many, "Injecting carcinogens into our sole source of drinking water is about as bad as it can get. WVWA and TESPA stand firm with the private landowners. By defending their rights to clean water, we are defending the property rights of thousands who rely on these karst aquifers for life. We will defend what is ours."

Mr. Blackburn added, "This case shines a bright light on the need for more comprehensive protection of the karst region of Texas with its unique groundwater resources and springs that flow into the Blanco, Guadalupe, Llano, Colorado, Sabinal, Nueces, Frio, Devils and San Antonio river systems. We had to file this lawsuit because this karst region is not receiving adequate protection. If it continues to be abused as Kinder Morgan has done, we will lose it, and that would be a tragedy of the grandest scale."

The lawsuit filed by TESPA contains specific requests for injunctive relief from the Court, including the requirement for Kinder Morgan, PHP, and all other responsible parties …

• to immediately cease operations and implement appropriate steps to prevent any further illegal discharges of fluids, pollutants and contaminants into underground sources of drinking water;

(more)

• to immediately remove and remediate the fluids, pollutants and contaminants that have been discharged into underground sources of drinking water in Blanco County.

Further, the lawsuit requests penalties or fines appropriate under the applicable federal statutes to be paid to the federal government, which can range up to $57,317 per violation, per day.

Patrick Cox, PhD, executive director of TESPA and seasoned defender of Hill Country resources, compares the threat of a fine for Kinder Morgan to the threat of losing underground drinking water resources for Texas Hill Country residents. “Any fine that could be levied under the legal limits of the statute is just the cost of doing business for Kinder Morgan,” said Dr. Cox. “But the threat of groundwater contamination strikes a primal fear into the hearts of all who depend on these freshwater aquifers as their sole source of drinking water. Those of us who live here understand the dire need to protect this irreplaceable resource. We will not let this threat abide on our watch.”

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Media Contacts:
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Attached documents:
Albright TESPA Complaint File Stamped*
AMC Gel Safety Data Sheet
EPA on the Safe Drinking Water Act

Attached images:
Map PHP Blanco River bore site in proximity to affected homes and wells
Map Caves and Karst with Permian Pipeline
Water Sample images:

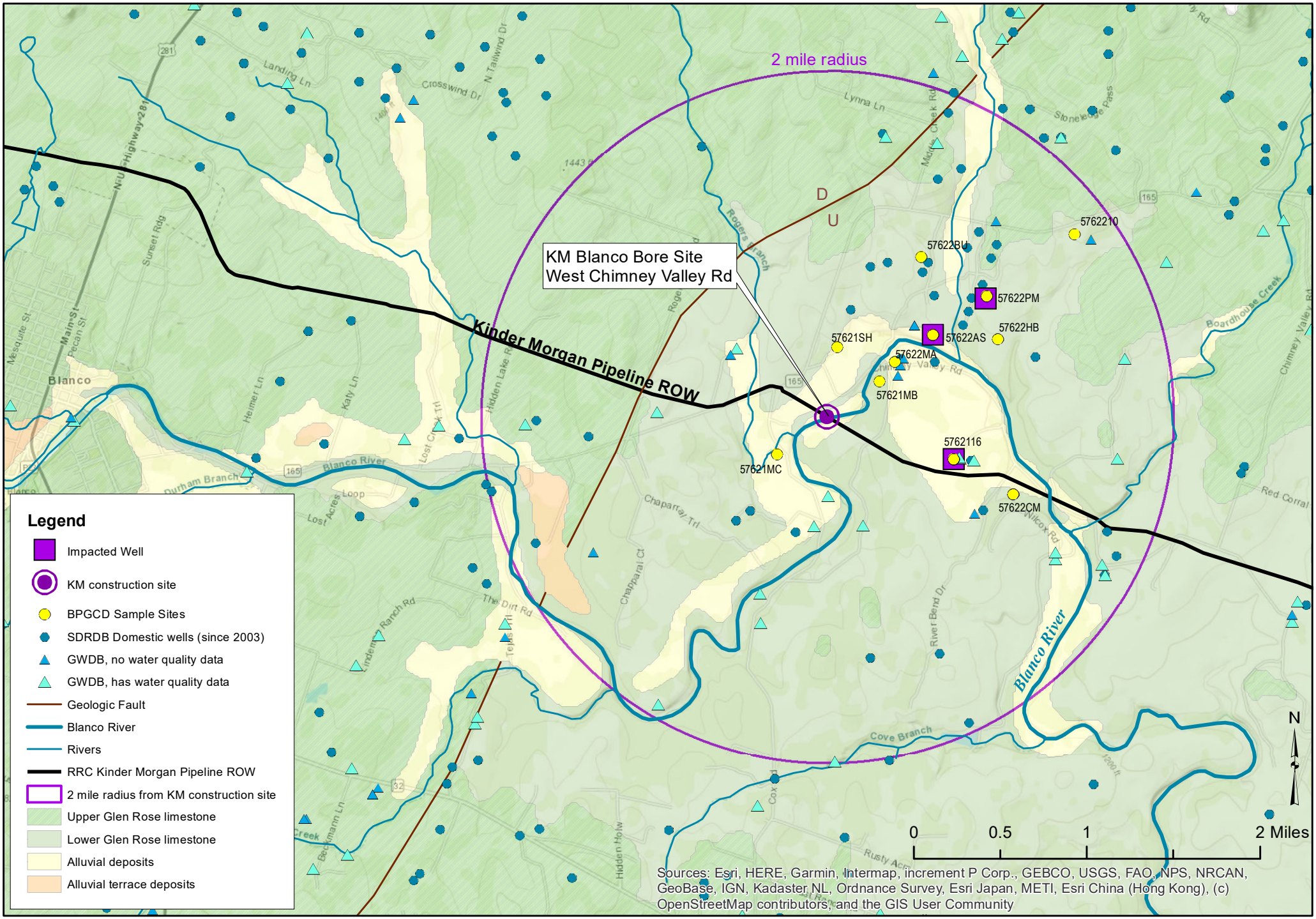
- March 31, 2020, mud-colored jars of water from Albright home
- June 7, 2020, 10-weeks later, milky undrinkable water from the Albright home

Helpful links:
TESPAtexas.org
WimberleyWatershed.org

*A link to the file-stamped Complaint filed by TESPA on June 22, 2020, in the United States District Court, Western District of Texas, Austin Division, is also available on the TESPA and WVWA websites.)

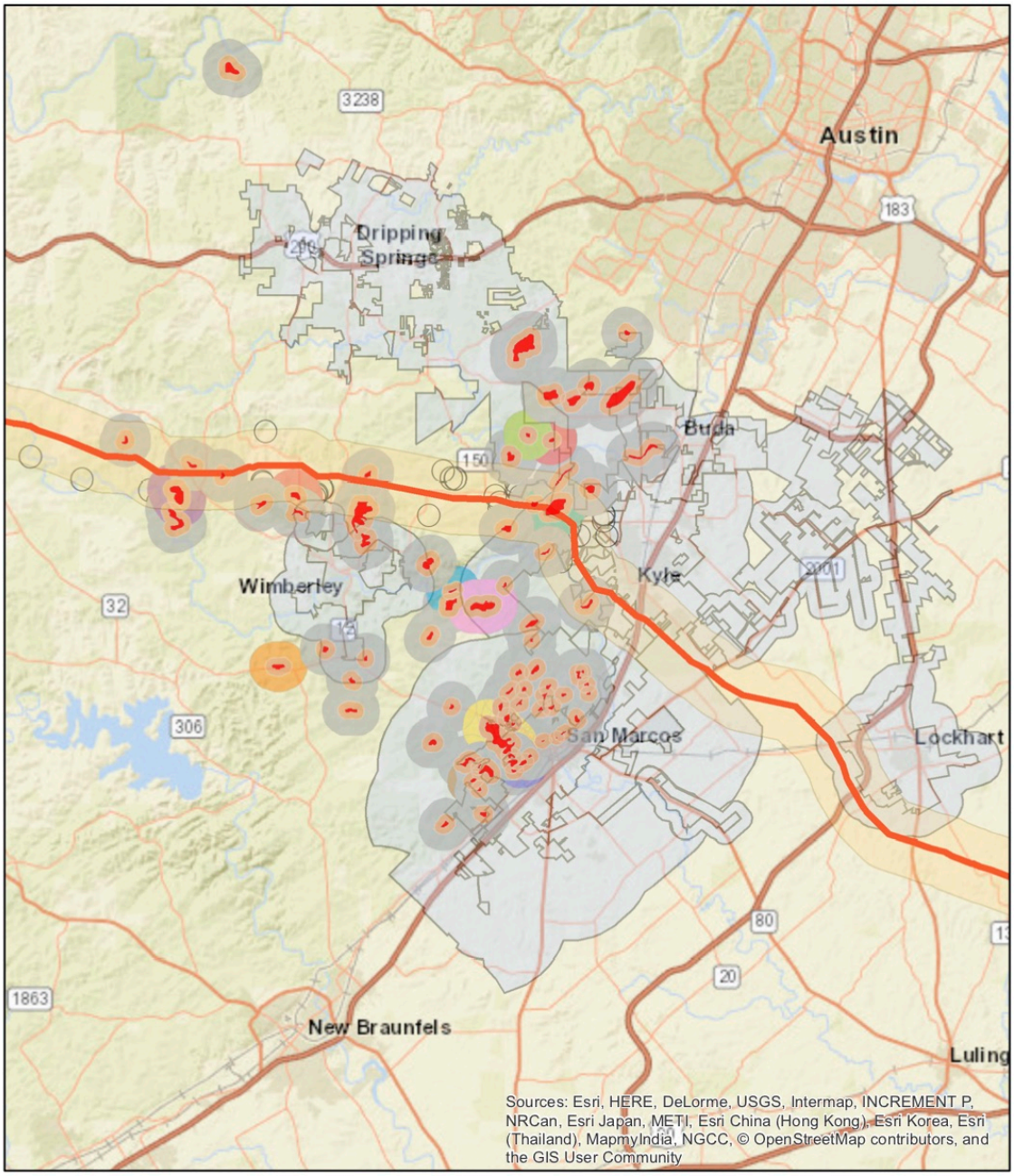
March 31, 2020, mud-colored jars of water from Albright home

June 7, 2020, 10-weeks later, milky undrinkable water from the Albright home



Basemap: Domestic wells drilled since 2003 from Texas Water Development Board (TWDB) Submitted Drillers Reports database (SDRDB), Water quality sites from TWDB Groundwater database (GWDB)
Impacted wells and bore site location estimated from field visits, Surface geology and faults from TNRIS Geologic Atlas of Texas 250k data, Blanco Pedernales GCD (BPGCD) sample site locations provided by BPGCD staff. Rivers from USGS 100k Hydrography, Kinder Morgan Pipeline route from Railroad Commission Pipelines shapefile.
Map courtesy of Wimberley Valley Watershed Association, 4/15/2020

Caves and Karst Map with Permian Pipeline



Caves

0 5 10 20 Miles

This is a verified route from landowners who are helping Braun & Gresham to pinpoint the actual route Kinder-Morgan will not provide.

This imprecise route is drawn at the centerline of the pipeline buffer and is not accurate.

cave_blobs

Texas Speleological Survey Data

Jurisdiction

Understanding the Safe Drinking Water Act

SAFE DRINKING WATER ACT • 1974-2004 • PROTECT OUR HEALTH FROM SOURCE TO TAP

The Safe Drinking Water Act (SDWA) was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply.

The law was amended in 1986 and 1996 and requires many actions to protect drinking water and its sources—rivers, lakes, reservoirs, springs, and ground water wells. (SDWA does not regulate private wells which serve fewer than 25 individuals.)

SDWA authorizes the United States Environmental Protection Agency (US EPA) to set national health-based standards for drinking water to protect against both naturally-occurring and man-made contaminants that may be found in drinking water. US EPA, states, and water systems then work together to make sure that these standards are met.

Millions of Americans receive high quality drinking water every day from their public water systems, (which may be publicly or privately owned). Nonetheless, drinking water safety cannot be taken for granted.

There are a number of threats to drinking water: improperly disposed of chemicals; animal wastes; pesticides; human threats; wastes injected underground; and naturally-occurring substances can all contaminate drinking water.

Likewise, drinking water that is not properly treated or disinfected, or which travels through an improperly maintained distribution system, may also pose a health risk.

Originally, SDWA focused primarily on treatment as the means of providing safe drinking water at the tap. The 1996 amendments greatly enhanced the existing law by recognizing source water protection, operator training, funding for water system improvements, and public information as important components of safe drinking water. This approach ensures the quality of drinking water by protecting it from source to tap.

All public water systems must have at least 15 service connections or serve at least 25 people per day for 60 days of the year.

Drinking water standards apply to water systems differently based on their type and size:

Community Water System (there are approximately 54,000) - A public water system that serves the same people year-round. Most residences including homes, apartments, and condominiums in cities, small towns, and mobile home parks are served by Community Water Systems.

Non-Community Water System - A public water system that serves the public but does not serve the same people year-round. There are two types of non-community systems:

Non-Transient Non-Community Water System (there are approximately 20,000) - A noncommunity water system that serves the same people more than six months per year, but not year-round, for example, a school with its own water supply is considered a non-transient system.

Transient non-community water system (there are approximately 89,000) - A non-community water system that serves the public but not the same individuals for more than six months, for example, a rest area or campground may be considered a transient water system.

1996 SDWA Amendment Highlights:

Consumer Confidence Reports All community water systems must prepare and distribute annual reports about the water they provide, including information on detected contaminants, possible health effects, and the water's source.

Cost-Benefit Analysis US EPA must conduct a thorough cost-benefit analysis for every new standard to determine whether the benefits of a drinking water standard justify the costs.

Drinking Water State Revolving Fund States can use this fund to help water systems make infrastructure or management improvements or to help systems assess and protect their source water.

Microbial Contaminants and Disinfection Byproducts US EPA is required to strengthen protection for microbial contaminants, including Cryptosporidium, while strengthening control over the byproducts of chemical disinfection. The Stage 1 Disinfectants and Disinfection Byproducts Rule and the Interim Enhanced Surface Water Treatment Rule together address these risks.

Operator Certification Water system operators must be certified to ensure that systems are operated safely. US EPA issued guidelines in February 1999 specifying minimum standards for the certification and recertification of the operators of community and non-transient, noncommunity water systems. These guidelines apply to state Operator Certification Programs. All states are currently implementing EPA-approved operator certification programs.

Public Information & Consultation SDWA emphasizes that consumers have a right to know what is in their drinking water, where it comes from, how it is treated, and how to help protect it. US EPA distributes public information materials (through its Safe Drinking Water Hotline, Safewater web site, and Water Resource Center) and holds public meetings, working with states, tribes, water systems, and environmental and civic groups, to encourage public involvement.

Small Water Systems Small water systems are given special consideration and resources under SDWA, to make sure they have the managerial, financial, and technical ability to comply with drinking water standards.

Source Water Assessment Programs Every state must conduct an assessment of its sources of drinking water (rivers, lakes, reservoirs, springs, and ground water wells) to identify significant potential sources of contamination and to determine how susceptible the sources are to these threats.

Roles and Responsibilities:

SDWA applies to every public water system in the United States. There are currently more than 170,000 public water systems providing water to almost all Americans at some time in their lives. The responsibility for making sure these public water systems provide safe drinking water is divided among US EPA, states, tribes, water systems, and the public. SDWA provides a framework in which these parties work together to protect this valuable resource.

US EPA sets national standards for drinking water based on sound science to protect against health risks, considering available technology and costs. These National Primary Drinking Water Regulations set enforceable maximum contaminant levels for particular contaminants in drinking water or required ways to treat water to remove contaminants. Each standard also includes requirements for water systems to test for contaminants in the water to make sure standards are achieved. In addition to setting these standards, US EPA provides guidance, assistance, and public information about drinking water, collects drinking water data, and oversees state drinking water programs.

The most direct oversight of water systems is conducted by state drinking water programs. States can apply to US EPA for "primacy," the authority to implement SDWA within their jurisdictions, if they can show that they will adopt standards at least as stringent as US EPA's and make sure water systems meet these standards. All states and territories, except Wyoming and the District of Columbia, have received primacy. While no Indian tribe has yet applied for and received primacy, four tribes currently receive "treatment as a state" status, and are eligible for

primacy. States, or US EPA acting as a primacy agent, make sure water systems test for contaminants, review plans for water system improvements, conduct on-site inspections and sanitary surveys, provide training and technical assistance, and take action against water systems not meeting standards.

To ensure that drinking water is safe, SDWA sets up multiple barriers against pollution. These barriers include: source water protection, treatment, distribution system integrity, and public information. Public water systems are responsible for ensuring that contaminants in tap water do not exceed the standards. Water systems treat the water, and must test their water frequently for specified contaminants and report the results to states. If a water system is not meeting these standards, it is the water supplier's responsibility to notify its customers. Many water suppliers now are also required to prepare annual reports for their customers. The public is responsible for helping local water suppliers to set priorities, make decisions on funding and system improvements, and establish programs to protect drinking water sources. Water systems across the nation rely on citizen advisory committees, rate boards, volunteers, and civic leaders to actively protect this resource in every community in America.

Protection & Prevention:

Essential components of safe drinking water include protection and prevention. States and water suppliers must conduct assessments of water sources to see where they may be vulnerable to contamination. Water systems may also voluntarily adopt programs to protect their watershed or wellhead, and states can use legal authorities from other laws to prevent pollution. SDWA mandates that states have programs to certify water system operators and make sure that new water systems have the technical, financial, and managerial capacity to provide safe drinking water. SDWA also sets a framework for the Underground Injection Control (UIC) program to control the injection of wastes into ground water. US EPA and states implement the UIC program, which sets standards for safe waste injection practices and bans certain types of injection altogether. All of these programs help prevent the contamination of drinking water.

US EPA sets primary drinking water standards through a three-step process:

First, US EPA identifies contaminants that may adversely affect public health and occur in drinking water with a frequency and at levels that pose a threat to public health. US EPA identifies these contaminants for further study, and determines contaminants to potentially regulate. Second, US EPA determines a maximum contaminant level goal for contaminants it decides to regulate. This goal is the level of a contaminant in drinking water below which there is no known or expected risk to health. These goals allow for a margin of safety . Third, US EPA specifies a maximum contaminant level, the maximum permissible level of a contaminant in drinking water which is delivered to any user of a public water system. These levels are enforceable standards, and are set as close to the goals as feasible. SDWA defines feasible as the level that may be achieved with the use of the best technology, treatment techniques, and other means which US EPA finds (after examination for efficiency under field conditions) are available, taking cost into consideration. When it is not economically or technically feasible to set a maximum level, or when there is no reliable or economic method to detect contaminants in the water, US EPA instead sets a required Treatment Technique which specifies a way to treat the water to remove contaminants.

Setting National Drinking Water Standards:

US EPA sets national standards for tap water which help ensure consistent quality in our nation's water supply. US EPA prioritizes contaminants for potential regulation based on risk and how often they occur in water supplies. (To aid in this effort, certain water systems monitor for the presence of contaminants for which no national standards currently exist and collect information on their occurrence). US EPA sets a health goal based on risk (including risks to the most sensitive people, e.g., infants, children, pregnant women, the elderly, and the immuno-compromised). US EPA then sets a legal limit for the contaminant in drinking water or a required treatment technique—this limit or treatment technique is set to be as close to the health goal as

feasible. US EPA also performs a cost-benefit analysis and obtains input from interested parties when setting standards. US EPA is currently evaluating the risks from several specific health concerns, including: microbial contaminants (e.g., *Cryptosporidium*); the byproducts of drinking water disinfection; radon; arsenic; and water systems that don't currently disinfect their water but get it from a potentially vulnerable ground water source.

Funding and Assistance:

US EPA provides grants to implement state drinking water programs, and to help each state set up a special fund to assist public water systems in financing the costs of improvements (called the drinking water state revolving fund). Small water systems are given special consideration, since small systems may have a more difficult time paying for system improvements due to their smaller customer base. Accordingly, US EPA and states provide them with extra assistance (including training and funding) as well as allowing, on a caseby- case basis, alternate water treatments that are less expensive, but still protective of public health.

Compliance and Enforcement:

National drinking water standards are legally enforceable, which means that both US EPA and states can take enforcement actions against water systems not meeting safety standards. US EPA and states may issue administrative orders, take legal actions, or fine utilities. US EPA and states also work to increase water systems. understanding of, and compliance with, standards.

Public Information:

SDWA recognizes that since everyone drinks water, everyone has the right to know what's in it and where it comes from. All water suppliers must notify consumers quickly when there is a serious problem with water quality. Water systems serving the same people year-round must provide annual consumer confidence reports on the source and quality of their tap water. States and US EPA must prepare annual summary reports of water system compliance with drinking water safety standards and make these reports available to the public. The public must have a chance to be involved in developing source water assessment programs, state plans to use drinking water state revolving loan funds, state capacity development plans, and state operator certification programs.

For More Information:

To learn more about the Safe Drinking Water Act or drinking water in general, call the Safe Drinking Water Hotline at 1-800-426-4791, or visit US EPA's Office of Ground Water and Drinking Water web site: *www.epa.gov/safewater*.

AMC GEL

AMC

Chemwatch Hazard Alert Code: **3**

Chemwatch: **42071**
Version No: **11.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **07/07/2017**
Print Date: **02/02/2018**
L.GHS.AUS.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	AMC GEL
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Drilling fluid compound; viscosifier.

Details of the supplier of the safety data sheet

Registered company name	**AMC**
Address	216 Balcatta Rd Balcatta WA 6021 Australia
Telephone	+61 8 9445 4000
Fax	+61 8 9445 4040
Website	www.amcmud.com
Email	amc@imdexlimited.com

Emergency telephone number

Association / Organisation	**Not Available**
Emergency telephone numbers	1800 039 008 or +61 3 9573 3112,+800 2436 2255 +613 9573 3112
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	0	
Toxicity	1	
Body Contact	0	
Reactivity	0	
Chronic	3	

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

Poisons Schedule	Not Applicable
Classification [1]	Carcinogenicity Category 1A, Specific target organ toxicity - repeated exposure Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	

SIGNAL WORD	**DANGER**

Hazard statement(s)

H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.

Precautionary statement(s) Response

P308+P313	IF exposed or concerned: Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
1302-78-9	>94	bentonite
9003-05-8	<0.5	acrylamide homopolymer
497-19-8	<0.5	sodium carbonate
14808-60-7	1-6	silica crystalline - quartz

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: ▸ Wash out immediately with fresh running water. ▸ Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. ▸ Seek medical attention without delay; if pain persists or recurs seek medical attention. ▸ Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: ▸ Flush skin and hair with running water (and soap if available). ▸ Seek medical attention in event of irritation.
Inhalation	▸ If fumes or combustion products are inhaled remove from contaminated area. ▸ Lay patient down. Keep warm and rested. ▸ Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. ▸ Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. ▸ Transport to hospital, or doctor. ▸ If dust is inhaled, remove from contaminated area. ▸ Encourage patient to blow nose to ensure clear breathing passages.

	▸ Ask patient to rinse mouth with water but to not drink water. ▸ Seek immediate medical attention.
Ingestion	▸ Immediately give a glass of water. ▸ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered a significant fire risk, however containers may burn.
HAZCHEM	Not Applicable

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Clean up waste regularly and abnormal spills immediately. ▸ Avoid breathing dust and contact with skin and eyes.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Polyethylene or polypropylene container. ▸ Check all containers are clearly labelled and free from leaks.
Storage incompatibility	Silicas: ▸ react with hydrofluoric acid to produce silicon tetrafluoride gas ▸ react with xenon hexafluoride to produce explosive xenon trioxide ▸ reacts exothermically with oxygen difluoride, and explosively with chlorine trifluoride (these halogenated materials are not commonplace industrial materials) and other fluorine-containing compounds ▸ may react with fluorine, chlorates ▸ are incompatible with strong oxidisers, manganese trioxide, chlorine trioxide, strong alkalis, metal oxides, concentrated orthophosphoric acid, vinyl acetate ▸ may react vigorously when heated with alkali carbonates.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	silica crystalline - quartz	Silica - Crystalline	Not Available	Not Available	Not Available	Not Available
Australia Exposure Standards	silica crystalline - quartz	Quartz (respirable dust)	0.1 mg/m3	Not Available	Not Available	Not Available
Australia Exposure Standards	silica crystalline - quartz	Quartz (respirable dust)	0.1 mg/m3	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
bentonite	Montmorillonite	30 mg/m3	330 mg/m3	2,000 mg/m3
sodium carbonate	Sodium carbonate	7.6 mg/m3	83 mg/m3	500 mg/m3
silica crystalline - quartz	Silica, crystalline-quartz; (Silicon dioxide)	0.075 mg/m3	33 mg/m3	200 mg/m3

Ingredient	Original IDLH	Revised IDLH
bentonite	Not Available	Not Available
acrylamide homopolymer	Not Available	Not Available
sodium carbonate	Not Available	Not Available
silica crystalline - quartz	Not Available	Not Available

MATERIAL DATA

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
Personal protection	
Eye and face protection	▸ Safety glasses with side shields ▸ Chemical goggles. ▸ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.
Skin protection	See Hand protection below
Hands/feet protection	The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present. ▸ polychloroprene.
Body protection	See Other protection below
Other protection	▸ Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent] ▸ Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. ▸ Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. ▸ Overalls. ▸ P.V.C.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
AMC GEL

Material	CPI
NATURAL RUBBER	C
NITRILE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:001, ANSI Z88 or national equivalent)

If inhalation risk above the TLV exists, wear approved dust respirator.
Use respirators with protection factors appropriate for the exposure level.

- Up to 5 X TLV, use valveless mask type; up to 10 X TLV, use 1/2 mask dust respirator
- Up to 50 X TLV, use full face dust respirator or demand type C air supplied respirator
- Up to 500 X TLV, use powered air-purifying dust respirator or a Type C pressure demand supplied-air respirator
- Over 500 X TLV wear full-face self-contained breathing apparatus with positive pressure mode or a combination respirator with a Type C positive pressure supplied-air full-face respirator and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Bentonite clay (powder) varying in colour from grey to various shades of brown, insoluble in water.

Physical state	Divided Solid	**Relative density (Water = 1)**	Not Available
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Applicable
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Applicable	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Applicable
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Applicable
Vapour pressure (kPa)	Not Applicable	**Gas group**	Not Available
Solubility in water (g/L)	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	Not Applicable	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual. Effects on lungs are significantly enhanced in the presence of respirable particles. Overexposure to respirable dust may produce wheezing, coughing and breathing difficulties leading to or symptomatic of impaired respiratory function.
Ingestion	The material has **NOT** been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.
Skin Contact	The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting. Open cuts, abraded or irritated skin should not be exposed to this material
Eye	Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.
Chronic	On the basis of epidemiological data, the material is regarded as carcinogenic to humans. There is sufficient data to establish a causal association between human exposure to the material and the development of cancer. Toxic: danger of serious damage to health by prolonged exposure through inhalation. The health hazards associated with bentonite, kaolin, and common clay, which are commercially important clay products, as well as the related phyllosilicate minerals montmorillonite, kaolinite, and illite, have an extensive literature. Fibrous clay minerals, such as sepiolite, attapulgite, and zeolites, have a separate literature. Chronic symptoms produced by crystalline silicas included decreased vital lung capacity and chest infections. Lengthy exposure may cause silicosis a disabling form of pneumoconiosis which may lead to fibrosis, a scarring of the lining of the air sacs in the lung. Overexposure to respirable dust may cause coughing, wheezing, difficulty in breathing and impaired lung function. Chronic symptoms may include decreased vital lung capacity, chest infections Repeated exposures, in an occupational setting, to high levels of fine- divided dusts may produce a condition known as pneumoconiosis which is the lodgement of any inhaled dusts in the lung irrespective of the effect.

AMC GEL	**TOXICITY**	**IRRITATION**
	Not Available	Not Available
bentonite	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: >2000 mg/kg[1]	Not Available
	Inhalation (rat) LC50: >50 mg/l1 h[1]	
	Oral (rat) LD50: >2000 mg/kg[1]	
	Oral (rat) LD50: >5000 mg/kg[1]	
acrylamide homopolymer	**TOXICITY**	**IRRITATION**
	Inhalation (rat) LC50: 5.7125 mg/l/30M[2]	Eye: slight
	Oral (rat) LD50: >2000 mg/kg[2]	
sodium carbonate	**TOXICITY**	**IRRITATION**
	dermal (rat) LD50: >2000 mg/kg[2]	Eye (rabbit): 100 mg/24h moderate
	Inhalation (guinea pig) LC50: 0.4 mg/l/2h[2]	Eye (rabbit): 100 mg/30s mild
	Oral (rat) LD50: 2800 mg/kg[2]	Eye (rabbit): 50 mg SEVERE

	Skin (rabbit): 500 mg/24h mild

silica crystalline - quartz	TOXICITY	IRRITATION
	Not Available	Not Available

Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*

BENTONITE	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. No significant acute toxicological data identified in literature search. for bentonite clays: Bentonite (CAS No. 1302-78-9) consists of a group of clays formed by crystallisation of vitreous volcanic ashes that were deposited in water. The expected acute oral toxicity of bentonite in humans is very low (LD50>15 g/kg).
ACRYLAMIDE HOMOPOLYMER	Sensitisation (guiea pig): 0% (0/20) OECD 406
SILICA CRYSTALLINE - QUARTZ	**WARNING:** For inhalation exposure ONLY: This substance has been classified by the IARC as Group 1: **CARCINOGENIC TO HUMANS** The International Agency for Research on Cancer (IARC) has classified occupational exposures to **respirable** (<5 um) crystalline silica as being carcinogenic to humans . This classification is based on what IARC considered sufficient evidence from epidemiological studies of humans for the carcinogenicity of inhaled silica in the forms of quartz and cristobalite.

Acute Toxicity	⊘	**Carcinogenicity**	✔
Skin Irritation/Corrosion	⊘	**Reproductivity**	⊘
Serious Eye Damage/Irritation	⊘	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	✔
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✘ *– Data available but does not fill the criteria for classification*
✔ *– Data available to make classification*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
AMC GEL	Not Available	Not Available	Not Available	Not Available	Not Available

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
bentonite	LC50	96	Fish	19000mg/L	4

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
acrylamide homopolymer	Not Available	Not Available	Not Available	Not Available	Not Available

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
sodium carbonate	LC50	96	Fish	300mg/L	4
	EC50	48	Crustacea	=176mg/L	1
	EC50	96	Algae or other aquatic plants	242mg/L	4
	NOEC	16	Crustacea	424mg/L	4

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
silica crystalline - quartz	Not Available	Not Available	Not Available	Not Available	Not Available

Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

DO NOT discharge into sewer or waterways.
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
acrylamide homopolymer	LOW	LOW
sodium carbonate	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
acrylamide homopolymer	LOW (LogKOW = -0.8074)
sodium carbonate	LOW (LogKOW = -0.4605)

Mobility in soil

Ingredient	Mobility
acrylamide homopolymer	LOW (KOC = 10.46)
sodium carbonate	HIGH (KOC = 1)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. ▸ **DO NOT** allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ Recycle wherever possible or consult manufacturer for recycling options. ▸ Consult State Land Waste Management Authority for disposal.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO
HAZCHEM	Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

BENTONITE(1302-78-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

ACRYLAMIDE HOMOPOLYMER(9003-05-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

SODIUM CARBONATE(497-19-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Hazardous Substances Information System - Consolidated Lists	Australia Inventory of Chemical Substances (AICS)

SILICA CRYSTALLINE - QUARTZ(14808-60-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards	Australia Inventory of Chemical Substances (AICS)
Australia Hazardous Substances Information System - Consolidated Lists	International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (bentonite; silica crystalline - quartz; acrylamide homopolymer; sodium carbonate)
China - IECSC	N (acrylamide homopolymer)
Europe - EINEC / ELINCS / NLP	N (acrylamide homopolymer)
Japan - ENCS	N (bentonite)
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory* *N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Ingredients with multiple cas numbers

Name	CAS No
bentonite	1302-78-9, 11004-12-9, 10043-07-9, 115628-71-2, 12198-92-4, 12199-69-8, 135945-01-6, 37320-72-2, 52623-66-2, 850872-77-4, 67479-91-8, 89382-86-5, 90989-60-9, 85049-30-5, 97862-66-3, 84776-12-5, 70131-50-9, 90989-59-6
sodium carbonate	497-19-8, 7542-12-3, 1314087-39-2, 1332-57-6
silica crystalline - quartz	14808-60-7, 122304-48-7, 122304-49-8, 12425-26-2, 1317-79-9, 70594-95-5, 87347-84-0, 308075-07-2

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

DR. TERI ALBRIGHT	§	
DR. MILTON SHAW	§	
MAX FOWLER	§	
PAULA FOWLER	§	
TRINITY EDWARDS SPRINGS	§	
PROTECTION ASSOCIATION	§	
Plaintiffs	§	
	§	CAUSE NUMBER: 1:20-cv-00651
v.	§	
	§	
PERMIAN HIGHWAY PIPELINE LLC	§	
and KINDER MORGAN TEXAS	§	
PIPELINE LLC,	§	
Defendants	§	

PLAINTIFFS' ORIGINAL COMPLAINT

INTRODUCTION

Earth Without Water

Imagine earth without water. The soil, with no water in it and nothing growing on it, would be lifeless, dead, collapsed into dust, sand, clay or rock….

Now imagine the air without water. Clouds provide a buffer from the heating power of the sun. Without them it would pour down with no mercy…. There would be no sweet scents, since moisture is what conveys smells….

If, instead of commanding it, we could conceive of ourselves as a partner or an intelligent component of water's own rain and storage cycle, it might encourage us to be more respectful of what water can do and more careful of the way we utilize it.

With water, we thrive. Without water, there is no life. We must learn to value, conserve, and take care of the water we have.[1]

[1] https://owlcation.com/stem/The-Importance-of-Water-to-Life

NATURE OF THE CASE

1. Defendants pumped 36,000 gallons of drilling fluid containing at least seven different Class 1 probable human carcinogens into the aquifer near Blanco, Texas.

2. Defendants have not cleaned up the contamination.

3. There is no safe level of exposure to human carcinogens.

4. Contaminating the aquifer on which people depend for water along the Blanco River Valley is not acceptable to the conscience of the community or the law.

5. This case is brought against Defendants for alleged violation of the federal Safe Drinking Water Act, 42 U.S.C. §§ 300h to 300h–8, which protects "underground sources of drinking water."

6. The Safe Drinking Water Act prohibits the injection of "contaminants" into the "underground sources of drinking water."

7. "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water. 42 U.S.C. § 300f(6).

8. On March 28, 2020, workers attempting to drill under the Blanco River made serious errors and as a consequence pumped 36,000 gallons of "AMC Gel" drilling fluid in the aquifer.

9. The plume of drilling fluid moved away from the drilling site under the river and contaminated home water wells a mile to mile and a half away ruining the drinking water of Dr. Teri Albright, Dr. Milton Shaw, Max and Paula Fowler, and others.

10. The AMC Gel Safety Data Sheet from the manufacturer of the product is attached. See, Exhibit 1

11. The Safety Data Sheet for AMC Gel drilling fluid states it contains two Class 1 human carcinogens, Acrylamide and Silica, which were injected into the aquifer, which is an

"underground source of drinking water," which supplies water to Plaintiffs' homes, as well as area public water supplies.

12. Later testing of this AMC Gel product by the lab at the Lower Colorado River Authority found this material contained numerous undisclosed noxious metals, several of which also are probable human carcinogens.

13. Once providing pristine water, among the best in the State of Texas, Plaintiffs' home water wells remain cloudy months later from the injection of drilling fluid.

14. Defendants have made no effort to clean up the pollution they created.

15. The Defendants have not delineated the size of the plume or all areas impacted by the plume.

16. The plume remains in the aquifer.

17. The plume presents a continuing danger of contamination to this underground source of drinking water upon which 10,000 people depend.

18. This case is brought by homeowners for damages for violations of the federal Safe Drinking Water Act, as well as Texas state law causes of action.

19. Further, plaintiff TESPA seeks forward-looking injunctive protections on a broader scale to protect the aquifer, which is an "underground source of drinking water," which is supposed to be strictly protected, before it suffers more and greater irreparable damage.

PLAINTIFFS

20. Plaintiff, Dr. Teri Albright, is a resident of Blanco County, Texas. Dr. Albright owns property with a drinking water well, owns the groundwater under her property, and is a member of TESPA.

21. Plaintiff, Dr. Milton Shaw, is a resident of Blanco County, Texas. Dr. Shaw owns property with a drinking water well, owns the groundwater under his property, and is a member of TESPA.

22. Plaintiff, Max Fowler, is a resident of Blanco County, Texas. Mr. Fowler owns property with a drinking water well, owns the groundwater under his property, and is a member of TESPA.

23. Plaintiff, Paula Fowler, is a resident of Blanco County, Texas. Ms. Fowler owns property with a drinking water well, owns the groundwater under her property, and is a member of TESPA.

24. Plaintiff, Trinity Edwards Springs Protection Association is a Texas non-profit with its principal place of business in Hays County, Texas. TESPA has members in Blanco and Hays counties with drinking water wells, and ownership of their groundwater.

DEFENDANTS

25. Defendant, Permian Highway Pipeline, LLC is a Delaware corporation with its principal place of business in Houston, Harris County, Texas. It may be served through its registered agent for service of process: Capital Corporate Services, Inc., 206 E. 9th Street, Suite 1300, Austin, Texas 78701-4411.

26. Defendant, Kinder Morgan Texas Pipeline, LLC is a Delaware corporation with its principal place of business in Houston, Harris County, Texas. Kinder Morgan is the managing partner of the Permian Highway Pipeline project. It may be served through its registered agent for service of process: Capital Corporate Services, Inc., 206 E. 9th Street, Suite 1300, Austin, Texas 78701-4411.

VENUE

27. The events giving rise to this action occurred in Blanco County, Texas, which is in the Austin Division of the Western District of Texas. Therefore, venue is proper in this court pursuant to 28 U.S.C. § 1391.

PERSONAL JURISDICTION
OUT OF STATE INCORPORATED DEFENDANTS

28. The Court has specific jurisdiction as the events made the basis of this action occurred in Blanco County, Texas, which is this division, and general jurisdiction as the corporations have their principal places of business in this state. *See, Bristol-Myers Squibb Co. v. Superior Court of California, San Francisco County*, --- U.S.---, 137 S. Ct. 1773, 1779–80, 198 L. Ed. 2d 395, 2017 WL 2621322 (2017).

SUBJECT MATTER JURISDICTION

29. This Court has original jurisdiction over this matter brought pursuant to the federal Safe Drinking Water Act, 42 U.S.C. §§ 300h to 300h–8.

30. Plaintiffs bring this action pursuant to the federal Safe Drinking Water Act, "SDWA" which allows for enforcement through a "citizen suit" such as this case and provides the basis for federal question jurisdiction. 42 U.S.C. § 300j-8.

31. "The district courts shall have original jurisdiction of all civil actions arising under the Constitution, laws, or treaties of the United States." 28 U.S.C. § 1331.

32. Plaintiffs have issued the necessary citizen suit notices of intent to sue and have waited more than sixty days to file this litigation as required by 42 U.S.C. § 300j-8(b)(1)(A). Exhibit 2.

33. This Court has jurisdiction to grant declaratory relief concerning violations of the Safe Drinking Water Act pursuant to 28 U.S.C. §§ 2201 and 2202 of the Declaratory Judgment Act.

34. This Court has supplemental jurisdiction of the state law causes of action as they arise out of the same event. 28 U.S.C. § 1367(a).

FACTS APPLICABLE TO ALL CAUSES OF ACTION

35. Kinder Morgan Texas Pipeline, LLC and Permian Highway Pipeline, LLC, hereafter "Kinder Morgan," are constructing a 42-inch diameter, 430-mile long, high pressure major natural gas transmission pipeline, typically called the "Permian Highway Pipeline" or "PHP," through the Central Texas Hill Country.

36. This pipeline is one of the largest natural gas transmission pipelines in the entire State of Texas.

37. The pipeline route in Blanco County seeks to cross the Blanco River at two locations.

38. At these two river crossing locations, Defendants planned to use horizontal directional drilling ("HDD") to drill under the river to avoid the need for an open cut on the surface.

39. Boring under a river, rather than open cutting across the surface, is often undertaken in the pipeline industry in an attempt to avoid additional regulatory oversight and Clean Water Act permits required from the United States Army Corps of Engineers.[2]

40. The site of this discharge is the "disappearing" stretch of Blanco River at a location where the river water drains into the aquifer.

41. This water flows into the aquifer and then later moves back above surface into the Blanco River.

42. The location of this injection of drilling fluid under the Blanco River and adjacent aquifer is part of the Edwards Aquifer Contributing/Drainage Zone.[3]

43. This area is unique in the State of Texas due to the pristine water that permeates this karst region.

[2] Plaintiffs do not agree with this interpretation of the Clean Water Act.
[3] https://www.edwardsaquifer.org/eaa/history/jurisdiction/

"A Karst Aquifer

The Edwards Aquifer's geological structure is that of limestone karst. In particular, it consists of Edwards limestone. This highly permeable limestone means that large amounts of water can be held within the aquifer. In addition to permeability, there are several faults. Water going into the aquifer will find its way into the crevices, which dissolves the limestone. To understand this, sand aquifers are permeable, but have small pores for water to enter. Aquifers made of limestone, such as the Edwards Aquifer, have larger pores for water to go through and remain. Water often makes these limestone pores even larger, creating more room for the storage of subterranean water.[4]

Source of Drinking Water
The Edwards Aquifer is not just a source for rivers and springs, it is an important source of drinking water for the people living in the area where the aquifer lies. The state of Texas is home to 3 of the USA's top ten largest cities. One of those cities is San Antonio, home to 1,492,510 people. Located near San Antonio is the capital of Texas, Austin. The city of Austin has a population of 947,890 people. At least 2 million people depend on the Edwards Aquifer for their water supply. At one time, the Edwards Aquifer was the only source of water that San Antonio received its drinking water. The aquifer continues to be a source of drinking water for millions of people in Central Texas.[5]"

- The World Atlas, What is the Edwards Aquifer?

44. As of 2019, the Texas Railroad Commission reports that 469,737[6] miles of pipeline are in operation in Texas.

45. This pipeline is the largest constructed to date in this state at 42" diameter and moving over 2+ billion cubic feet and millions of dollars of value of gas a day.

46. Defendants decided to be the first to build a major pipeline where others would not and moved forward aggressively as the first to put in a major transmission pipeline through this geologically sensitive karst area of pristine waters of the Blanco River Valley between Blanco to Wimberley to Kyle, Texas.[7]

4 https://www.worldatlas.com/articles/what-is-the-edwards-aquifer.html

5 https://www.worldatlas.com/articles/what-is-the-edwards-aquifer.html

6 https://www.rrc.state.tx.us/pipeline-safety/reports/texas-pipeline-system-mileage/

7 https://rrc.texas.gov/about-us/resource-center/research/gis-viewers/

47. On March 31, 2020, Dr. Teri Albright turned on her kitchen sink and the water went from previously crystal clear to mud color. Then, the same happened to the nearby Fowler's home water.

48. Others in this same area have been impacted.

49. The size of the drilling fluid plume is unknown at this time.

50. Kinder Morgan has acknowledged the milky discharge in the water at the Albright/Shaw's home and Fowler's home is from the drilling fluid from their boring activity.

51. The homeowners reported the cloudy/milky discharge in the water left a greasy film on the kitchen sink and their skin, which persisted even using soap and scrubbing.

52. The contamination persists in the aquifer at this time.

53. Defendants explained the event in a statement to the Texas Railroad Commission as follows.

> "*On Saturday, March 28, Permian Highway Pipeline (PHP) experienced an underground drilling fluid loss during construction in Blanco County, Texas. The drilling fluid is comprised of bentonite clay and water. Bentonite is a naturally occurring, non-hazardous, non-toxic clay. We strive for zero incidents and minimal operations have been suspended while the team evaluates the cause of the loss and determines the best path forward. We are working with affected landowners to address their needs. We are also consulting with our karst expert and the local water district manager to determine the best way to mitigate any current and future impacts. All of the appropriate regulatory agencies have been notified."*

54. In their statement to the Texas Railroad Commission and public press releases, Defendants concealed the whole truth about what they injected into the aquifer.

THE DRILLING FLUID – AN ADMITTED HUMAN CARCINOGEN

55. The workers were using a drilling fluid product called "AMC Gel."

56. The AMC Gel Safety Data Sheet in Section 11, Toxicological Information, expressly states: "***On the basis of epidemiological data, the material is regarded as carcinogenic to humans. There is sufficient data to establish a causal association between human exposure to the material and the development of cancer.***" See, Exhibit 1 (emphasis added).

57. This statement in the Safety Data Sheet appears to be based on two additives, Acrylamide and Silica.

58. "The International Agency for Research on Cancer (IARC) classifies acrylamide as a **"probable human carcinogen." (emphasis in original).** The National Cancer Institute explains: The National Toxicology Program's Report on Carcinogens considers acrylamide to be reasonably anticipated to be a human carcinogen, based on studies in laboratory animals given acrylamide in drinking water. However, toxicology studies have shown that humans and rodents not only absorb acrylamide at different rates, they metabolize it differently as well."[8]

59. Silica is an additive in the mix and the International Agency for Research on Cancer, commonly known as "IARC", creator of the classification system, classifies silica as a Class 1, human carcinogen.[9]

60. Bentonite, apparently the major constituent component of the AMC Gel, is not a benign, inert material as Kinder Morgan portrayed in the public media. Attached to the Notice of Intent as just a recent example is a study of Bentonite by *Masoudi, et al*., Journal of Toxicology & Industrial Health, Vol. 36, Issue 1, Feb. 25, 2020.

8 https://www.cancer.gov/about-cancer/causes-prevention/risk/diet/acrylamide-fact-sheet

9 https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100C-14.pdf

THE LCRA TEST RESULTS OF AMC GEL

61. Further, Defendants made a sample of the AMC Gel available to Plaintiffs for testing.

62. Kinder Morgan made some AMC Gel available to Plaintiffs' consultants for testing, which was sent to the Lower Colorado River Authority, hereafter "LCRA," lab for testing.

63. The LCRA is well respected and widely used by water quality professionals, water districts, and regular citizens to test water quality.

64. LCRA's test results received on June 18, 2020, on the sample of AMC Gel diluted to approximate the concentration of mix in the drilling fluid as it would be at the release point from the drill bit found the following metals present in the AMC Gel sample:

Aluminum 146 mg/L
Arsenic 0.0484 mg/L
Barium 10.3 mg/L
Beryllium 0.0472 mg/L
Cadmium 0.00155 mg/L
Chromium 0.0604 mg/L
Copper 0.240 mg/L
Lead 0.0986 mg/L
Manganese 3.07 mg/L
Nickel 0.0460 mg/L
Selenium <0.00500 mg/L
Silver <0.00100 mg/L
Thallium 0.00198 mg/L
Zinc 0.197 mg/L

65. The following materials found in the AMC Gel, but not disclosed on the Safety Data Sheet or Kinder Morgan's statements to the public and enforcement agencies, also are human carcinogens as determined by IARC, the foremost recognized authority on cancer research in the world.

66. Arsenic is a Group 1/Class 1 probable human carcinogen.[10]

[10] https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html

67. Beryllium is a Group 1/Class 1 probable human carcinogen.[11]

68. Chromium VI such as hexavalent chromium is Group 1/Class 1 probable human carcinogen.[12] The specific form of the chromium in the AMC Gel was not identified by LCRA in its test result.

69. Nickel is a Group 1 probable human carcinogen.[13]

70. ***Arsenic is identified in recent research by Evans, et al., as one of the most guilty culprits in 100,000 or more cancers annually due to drinking water, which meets EPA drinking water standards***.[14] Here, the Arsenic as measured at the point of release/injection into the aquifer was approximately 4x the EPA drinking water standards. Evans and co-authors concluded, "Overall, state- and national-level cumulative cancer risks due to carcinogenic water contaminants are similar in magnitude to the risks reported for carcinogenic air pollutants. Thus, improving water quality at the tap and investing in measures for source water protections represent opportunities for protecting public health and decreasing potential disease incidence due to environmental pollution."

NO SAFE LEVEL OF EXPOSURE TO CARCINOGENS

71. There is no safe level of exposure to a carcinogen.

[11] https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html

[12] https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html

[13] https://www.cancer.org/cancer/cancer-causes/general-info/known-and-probable-human-carcinogens.html

[14] https://www.cell.com/heliyon/pdf/S2405-8440(19)35974-2.pdf?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2405844019359742%3Fshowall%3Dtrue

72. Former Assistant Surgeon General of the United States Richard Lemen has testified:

> Lemen testified:
> Q: And isn't it true that this principle that we don't know of any safe level of exposure is true for any carcinogen?
> A: At the present time, we aren't able to identify the carcinogenic compounds, what is safe and what is not safe. And that is true pretty much across the board for things that cause cancer.
> Q: So for anything on this list of carcinogens that we'll talk about later, your answer is true that if it is on the list of carcinogens, it's not just asbestos, it's the entire list that you would say we know of no safe level of exposure to it, correct?
> A: Basically that's correct.
> Q: Even if it's used even today day-in and day-out in industrial and consumer products?
> A: That's correct....
>
> *Bostic v. Georgia-Pac. Corp.*, 439 S.W.3d 332, 340 (Tex. 2014)(fn. 28), *see also, Bonnette v. Conoco, Inc.*, 837 So. 2d 1219, 1232 (La. 2003).

73. The *Bostic* court was analyzing a different issue than presented here, and which is not in issue in this case, which exposures to a carcinogen in personal injury case could be held to be a "substantial factor" in causation of a plaintiff's cancer, where he was exposed to numerous different asbestos-containing products. This case does not present personal injury claims or similar product liability causation issues.

74. ***The Supreme Court of Arkansas specifically held related to exposures to Arsenic, "With reference to general causation, arsenic is a potent cancer promoter in adults and a complete carcinogen in the fetus (Waalkes 2004). There is no safe level of exposure to a carcinogen.*** The difference between a low dose of arsenic and a high dose is the amount of cancer it causes in the exposed population. The acute short-term exposure to arsenic overwhelms the body's defense systems and there is resulting injury to the body. The arsenic leaves the body but only after the damage is done."

Green v. Alpharma, Inc., 373 Ark. 378, 391, 284 S.W.3d 29, 39 (2008)(emphasis added).

75. "And as far as I know, there is no safe level of exposure to a carcinogen. What we do with our quantitative risk activity is try to define the level which we consider to carry with it a so-called acceptable level of risk, is a very low risk; but I don't know of any-well, any evidence that there is a threshold for cancer effects. So then the answer to your question is that any exposure is going to increase the risk. The higher the exposure, the higher the risk...." *Beck v. Koppers, Inc.*, 3:03 CV 60 P D, 2006 WL 270260, at *8 (N.D. Miss. Feb. 2, 2006)

76. Best management practices in public health, industrial hygiene, and general medicine emphasize that a person's exposure to carcinogens should be kept "***as low as reasonably attainable***," also known as "***ALARA***," or also termed "***at the lowest as technologically feasible level***."

77. The Supreme Court of the United States has confirmed this best management practice is OSHA's Cancer Policy. ***"Wherever the toxic material to be regulated is a carcinogen, the Secretary has taken the position that no safe exposure level can be determined and that § 6(b)(5) requires him to set an exposure limit at the lowest technologically feasible level that will not impair the viability of the industries regulated."*** *Indus. Union Dep't, AFL-CIO v. Am. Petroleum Inst.*, 448 U.S. 607, 613, 100 S. Ct. 2844, 2849, 65 L. Ed. 2d 1010 (1980)(emphasis added).

78. There was no amount of this drilling fluid that was or is permited to be discharged into this underground source of drinking water.

79. There are methods of boring that are called "dry boring," which do not need to use products such as this AMC Gel.

80. Thus, exposure at "***lowest technologically feasible level that will not impair the viability of the industries regulated"*** is zero for the use of this product in the Blanco to Wimberley to Kyle

segment of this pipeline as there are acceptable alternatives that can be utilized without the use of this product.

81. Prior to Defendants the contamination event, plaintiff homeowners drank water from this aquifer from their water wells without treatment as it was excellent quality.

82. In addition to the impacted homeowners, this action is brought in the public interest to pursue exactly what is recommended in the Evans study above. This action seeks to protect source water through enforcement of the SDWA for the past violation, and to seek forward-looking protection through enjoining the use of this and other similar carcinogenic drilling fluid materials in areas in which there is potential for it to contaminate sources of drinking water.

THE BORING EVENT GONE WRONG

83. The Defendants injected the drilling fluid while attempting to bore a pathway for their pipeline under the Blanco River.

84. The Blanco River does not have a impervious "bottom" at this location.

85. The water in the Blanco River in this area flows from the surface below ground through porous rock, cracks, faults, fissures, and voids out into the aquifer. Hence, this area is known as the "disappearing segment" of the Blanco River.

86. In horizontal directional drilling, "HDD," a comparatively small pilot hole is drilled underground at a shallow angle of attack and comes back to the surface hundreds of yards, or more, away.

87. Then, progressively larger boring tools are used in multiple passes back and forth over the several hundred yards to ream open the diameter of the bore until the opening is sufficiently wide to accommodate the 42" diameter high pressure pipeline Defendants sought to install in the hole

bored under the river. Just to be very clear, it goes from surface, below ground below the river, then back upward to the surface on the opposite side.

88. The HDD equipment looks somewhat similar to a small oil drilling rig turned on its side at an angle.

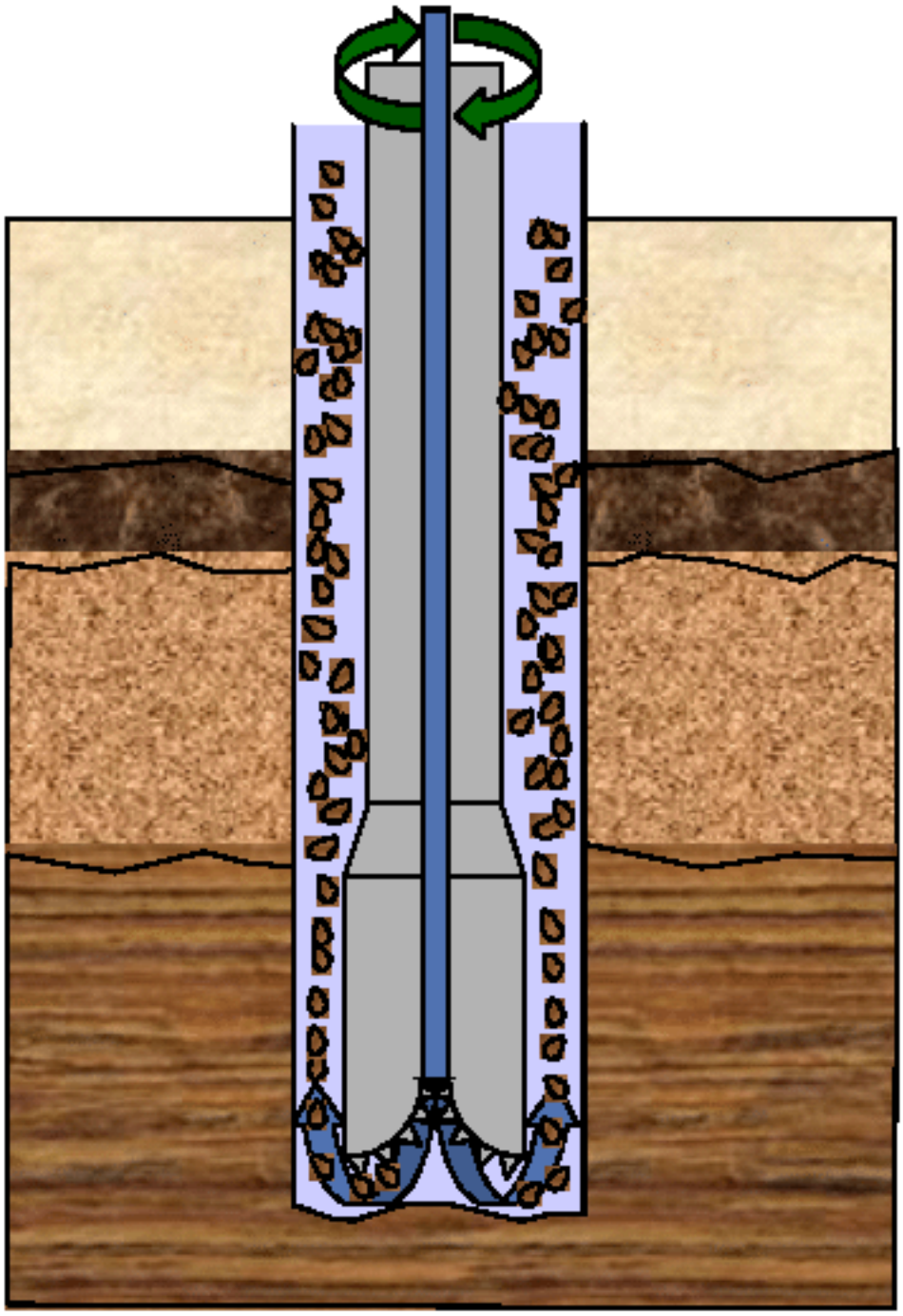
89. This HDD bore hole meets the definition of a "**well**", which is defined as: "***Well means***: A bored, drilled, or driven shaft whose depth is greater than the largest surface dimension; or, a dug hole whose depth is greater than the largest surface dimension; or, an improved sinkhole; or, a subsurface fluid distribution system." 40 C.F.R. § 144.3

90. If allowed to proceed to bore under this river, the danger to the water is present with each pass of which there would be multiple passes to ream the hole out to sufficiently large diameter to fit the 42" diameter pipeline.

91. The HDD works similar to an oil drilling rig pumping drilling fluid, also often called "mud," under pressure to pass through the interior of the drill pipe and out the front end through the drill bit which cuts the pathway.

92. The fluid then is supposed to pass between the exterior of the drill bit and pipe along the wall of the bore back to the surface where it carries the cuttings back to the surface.

93. Here is a graphic illustrating the general pattern of the flow of drilling fluid and illustrating how it flows back towards the surface against the bore wall, the karst in this area.



94. Without the sufficient wall strength or resistance in this karst zone to contain the drilling fluid, the HDD method here failed to contain the fluid pumped out of the drill bit.

95. Thus, the drilling fluid flowed into the soft surrounding structure of the karst permeated with water into a near surface layer of water of the aquifer, which then flowed to the Plaintiffs' home water wells within the next few days.

96. The Albright/Shaw and Fowler water wells are approximately one mile to one a half miles away from the release point of the drilling fluid.

97. The act of boring/drilling under the Blanco River was the proximate cause of the injection of 36,000 gallons of drilling fluid into the aquifer, which contaminated the water which supplied the Plaintiffs' homes with drinking water.

98. There was no authorization, and could be no authorization, to permit the Defendants' injection of this drilling fluid into this "Underground Source of Drinking Water."

99. The drillers who normally work in this area drill water wells, which similarly are shallow and go into this water filled karst. They know that the karst will make drilling fluid/mud difficult to impossible to contain, so they do not use any drilling fluid such as AMC Gel in drilling in this area.

100. Drillers drilling a water well in this area use plain water and a food grade surfactant safe for human ingestion.

101. Rather than seeking out drillers familiar with "best management practices" to protect the waters in this area, Defendants proceeded as if they were drilling in West Texas or South Texas, which do not have this karst hydrogeology.

102. What remains unknown is why when the drilling operation lost fluid pressure, they continued to pump more and more and more drilling fluid into the aquifer until they had pumped 36,000 gallons by their own self-reported account.

103. Such acts constitute the failure to exercise ordinary care that a reasonably prudent person in the same or similar circumstances would have exercised.

104. Such failure was a proximate cause of the injection of 36,000 gallons of drilling fluid into the underground source of drinking water, and the plume impacting and destroying the previously high quality water at the homes.

105. Water from the faucets at the Albright home on March 31, 2020:

106. 

107. Water from the faucets at the Fowler Home in April 2020:

108. Water from the well at the Albright Home on June 14, 2020, shows that the contaminants remain in the aquifer.

109. The size or exact location of the underground plume of contaminated aquifer has not been delineated at this time.

110. ***All facts are incorporated by reference into each cause of action.***

111. All causes of action are pled cumulatively and also in the alternative.

112. Plaintiffs reserve their right to an election of remedies.

CAUSE OF ACTION 1
ALL PLAINTIFFS
SAFE DRINKING WATER ACT
UNAUTHORIZED INJECTION OF CONTAMINANTS
INTO "UNDERGROUND SOURCES OF DRINKING WATER"

113. The SDWA was enacted to protect the nation's drinking water by regulating public water supply systems to ensure they meet minimum national standards to protect public health. 42 U.S.C. §§ 300f *et seq*.

114. The purpose of the SDWA also specifically is to prevent underground injection which endangers underground sources of drinking water. The EPA has prepared a helpful overview summary of the SDWA.[15]

115. This Court has jurisdiction to grant declaratory relief concerning violations of the Safe Drinking Water Act pursuant to 28 U.S.C. §§ 2201 and 2202, of the Declaratory Judgment Act.

116. Plaintiffs seek a determination that Defendants through their agents violated the SDWA due to injecting 36,000 gallons drilling fluid, which are "contaminants," into an "underground source of drinking water" without authorization or a permit.

117. This contaminant, the drilling fluid, may pose health risks to humans and underground sources of drinking water as there are at least seven different probable human carcinogens in this mixture and there is no safe level of exposure to carcinogens.

118. Part C of the SDWA, 42 U.S.C. § 300h-300h-8, created the Underground Injection Control ("UIC") program, which is overseen by the EPA and may be implemented in part by the states, who can create their own UIC program subject to EPA approval.

[15] https://www.epa.gov/sites/production/files/2015-04/documents/epa816f04030.pdf

119. The UIC program protects potential and actual underground sources of drinking water from contamination by underground injection wells. *See* H.R. Rep. No. 1185, 93rd Cong., 2d Sess. (1974), reprinted in 1974 U.S. Code Cong. & Admin. News, pp. 6454, 6480 (UIC program is intended "to assure that drinking water sources, actual and potential, are not rendered unfit for such use by underground injection of contaminants.").

120. The federal UIC program requires all States to submit a UIC program to EPA for approval. 40 C.F.R. 144.1(e).

121. Once a state program is established, the SDWA provides that all underground injections are unlawful and subject to penalties unless authorized by a permit or rule. 40 C.F.R. § 144.1(e).

122. "Any underground injection, except into a well authorized by rule or except as authorized by permit issued under the UIC program is prohibited. The construction of any well required to have a permit is prohibited until the permit has been issued." 40 C.F.R. § 144.11 (entitled Prohibition of Unauthorized Injection).

123. EPA has classified five types of underground injection wells that may be permitted. 40 C.F.R. 144.6.

124. A horizontal drilling borehole for pipeline installation under a river is not among the types of UIC wells that can be authorized to inject fluids into the aquifer as Defendants did.

125. The SDWA prohibition is clear: "No owner or operator shall construct, operate, maintain, convert, plug, abandon, or conduct any other injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, if the presence of that contaminant may cause a violation of any primary drinking water regulation under 40 CFR part 142 or may otherwise adversely affect the health of persons." 40 C.F.R. § 144.12(a).

126. "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water. 42 U.S.C. § 300f(6).

127. Defendants engaged in underground injection, which "means the subsurface emplacement of fluids by well injection." 42 U.S.C. § 300h(d)(1)(A).

128. 40 C.F.R. § 144.3 provides definitions, several of which are provided here for ease of reference.

Aquifer means a geological "formation," group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

Drilling mud means a heavy suspension used in drilling an "injection well," introduced down the drill pipe and through the drill bit.

Formation fluid means "fluid" present in a "formation" under natural conditions as opposed to introduced fluids, such as "drilling mud."

Ground water means water below the land surface in a zone of saturation.

Injection well means a "well" into which "fluids" are being injected.

Injection zone means a geological "formation" group of formations, or part of a formation receiving fluids through a "well."

Permit means an authorization, license, or equivalent control document issued by EPA or an approved State to implement the requirements of this part, parts 145, 146 and 124. "Permit" includes an area permit (§ 144.33) and an emergency permit (§ 144.34). Permit does not include UIC authorization by rule (§ 144.21), or any permit which has not yet been the subject of final agency action, such as a "draft permit."

Underground injection means a "well injection."

Underground source of drinking water (USDW) means an aquifer or its portion:

(a) (1) Which supplies any public water system; or

(2) Which contains a sufficient quantity of ground water to supply a public water system; and
(i) Currently supplies drinking water for human consumption; or
(ii) Contains fewer than 10,000 mg/l total dissolved solids; and

(b) Which is not an exempted aquifer.

USDW means "underground source of drinking water."

Well means: A bored, drilled, or driven shaft whose depth is greater than the largest surface dimension; or, a dug hole whose depth is greater than the largest surface dimension; or, an improved sinkhole; or, a subsurface fluid distribution system.

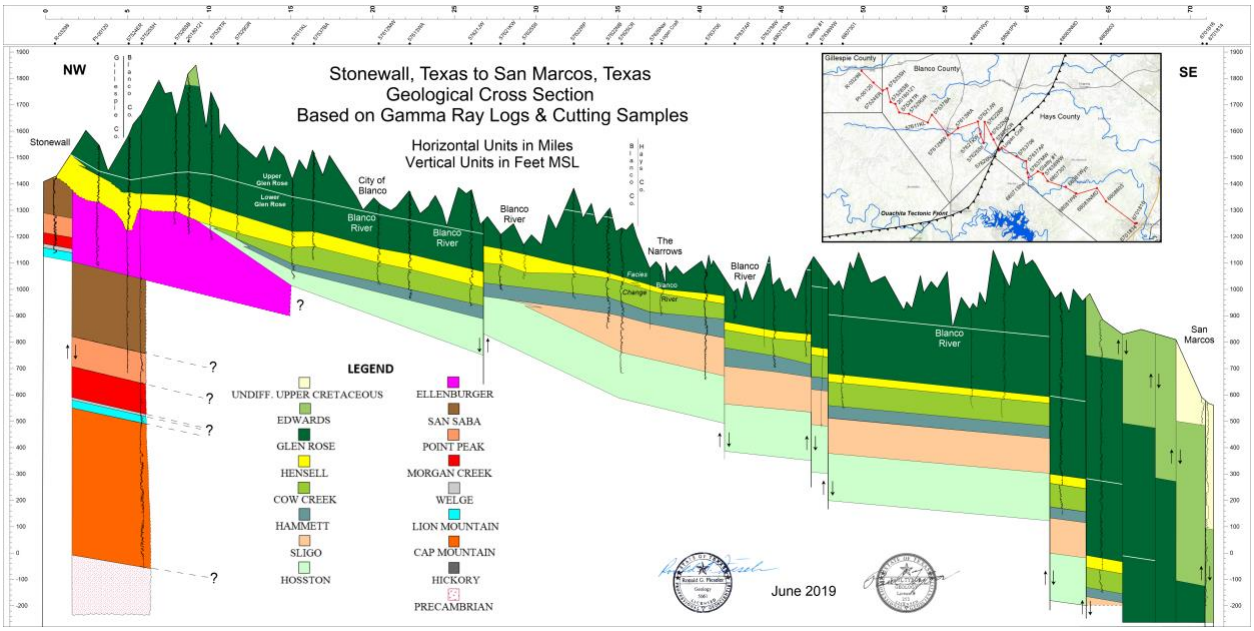
Well injection means the subsurface emplacement of fluids through a well.

129. Defendants' activity does not fall within the defined narrow exclusion to the definition of underground injection. 42 U.S.C. § 300h(d)(1)(B).

130. Defendants injected contaminants into the Glen Rose, Hensell, and/or Cow Creek formations of the Trinity aquifer.

131. Homeowner plaintiffs drinking water wells most likely draw from Cow Creek formation of the Trinity aquifer which is an "underground source of drinking water" as defined by the Safe Drinking Water Act program.

132. Many other private drinking water wells and public water supply wells draw from Glen Rose, Hensell, and/or Cow Creek formations of the Trinity aquifer. This injection of drilling fluid occurred just to the west (left) of the Blanco/Hays County line on the graphic below illustrating a cross-section of the aquifer in this area.



133. The location of Defendants' injection and homeowner plaintiffs' wells is in a highly karstic area riddled with near surface faults, voids and other permeable pathways which allowed the injected contaminants to be forced out of the borehole, into the aquifer, and to the drinking water wells.

134. The EPA has not approved any exempted aquifers or portions of exempted aquifers in Blanco or Hays counties pursuant to the procedures set forth in 40 C.F.R. § 144.7.

135. The EPA has not exempted the Glen Rose, Hensell, and/or Cow Creek formations of the Trinity aquifer or any portions of these aquifers pursuant to the procedures set forth in 40 C.F.R. § 144.7.

136. To the contrary, the location of this illegal underground injection of drilling fluid into the Blanco River and adjacent aquifer is part of the Edwards Aquifer Contributing/Drainage Zone.[16]

137. This area is unique in the State of Texas due to the pristine water that permeates this karst region.

16 https://www.edwardsaquifer.org/eaa/history/jurisdiction/

138. There was no authorization, and could be no authorization, to permit the Defendants' injection of this drilling fluid into this "Underground Source of Drinking Water."

139. Such failure was a proximate cause of the injection of 36,000 gallons of drilling fluid into the underground source of drinking water, and the plume impacting and destroying the pristine quality water at the homes.

140. Defendants conducted underground injection activity within the meaning of the SDWA.

141. Defendants injected drilling fluids containing contaminants, namely AMC Gel, which contains acrylamide, silica, bentonite, arsenic, lead, and other carcinogens and contaminants through a well into an underground source of drinking water.

142. Defendants injected contaminants into the aquifer forming a moving underground plume that may move further threaten to contaminate other drinking water wells.

143. Defendants violated the SDWA which prohibits any unauthorized "injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, which the presence of that contaminant may … adversely affect the health of persons." 42 U.S.C. § 300h(b)(1)(A).

144. The violation of the SDWA is ongoing because the contaminants injected by the Defendants remain in the aquifer.

145. Each day that the contaminants injected by the defendants remain in the aquifer is a new violation.

146. The Defendants' violation of the SDWA presents an imminent and substantial endangerment to an underground source of drinking water upon which thousands of people rely as their sole source of drinking water.

TEXAS STATE LAW

CAUSES OF ACTION

CAUSE OF ACTION 2 – NEGLIGENCE

147. All facts are incorporated by reference.

148. It is axiomatic that "negligence" means failure to use ordinary care, that is, failing to do that which a person of ordinary prudence would have done under the same or similar circumstances or doing that which a person of ordinary prudence would not have done under the same or similar circumstances.

149. The use of drilling fluid to bore under the Blanco River was the proximate cause of the injection of 36,000 gallons of drilling fluid into the aquifer, which supplied the Plaintiffs' homes with drinking water.

150. The drillers who normally work in this area drilling shallow wells such as water wells know that the karst will make drilling fluid/mud difficult to impossible to contain, so they do not use any in drilling in this area.

151. Drillers drilling a water well in this area use plain water and a food grade surfactant safe for human ingestion.

152. In contrast, Defendants boldly decided to be the first to put in a major gas transmission pipeline through this geologically sensitive area of pristine waters.

153. Rather than seeking out drillers familiar with "best management practices" to protect the waters in this area, Defendants acted like they were drilling an oil well, which are conspicuously absent from this area and in so doing, chose to use drilling fluid containing carcinogens and metals.

154. What remains unknown is why when the driller lost fluid pressure, they continued to pump more and more and more drilling fluid into the aquifer until they had pumped 36,000 gallons by their own self-reported account.

155. Such acts constitute the failure to exercise ordinary care that a reasonably prudent person in the same or similar circumstances would have exercised.

156. Such failure was a proximate cause of the injection of 36,000 gallons of drilling fluid into the underground source of drinking water, and the plume impacting and destroying the water quality at the homes.

157. As further evidence of what a reasonable person under the same or similar circumstances could and would do, after this event, Defendants have changed to using "dry" boring methods in the zone between Blanco to Wimberley to Kyle.

158. So, a much less dangerous to water quality alternative was and is very feasible.

159. Similarly, the City of Austin constructed a major underground pipeline to move water from Water Treatment Plan 4 on the banks of Lake Travis to connect into the City's water pipeline network approximately seven miles away. The City of Austin was able to construct that pipeline in a highly karstic zone by going deeper below the geologic level with karst including several endangered species. That boring project created an opening approximately 8' in diameter and seven miles long. Such method used by the City of Austin did not result in drilling fluid being released or injected into the aquifer.[17]

[17] https://tunnelingonline.com/water-texas-challenges/

160. Alternatively, another method known as the "direct pipe" method uses a cutter that contains essentially all fluids and pushes it back to the surface through the pipe which is pulled behind the cutter.[18]

161. Thus, Defendants' decisions constitute negligence, which was a proximate cause of the event and the contamination of Plaintiffs' home water wells and the damages resulting from that contamination.

CAUSE OF ACTION 3

NEGLIGENCE AS A MATTER OF LAW – TEXAS LAW

162. All facts are incorporated by reference.

163. In this case, Defendants are negligent as a matter of law for violation of the Safe Drinking Water Act as already set forth.

164. Defendants' project of building this major transmission pipeline undeniably is subject to regulation, rules, and standards set by the Texas Railroad Commission, among several local, state, and federal agencies.

165. Further, and in the alternative, Defendants are negligent as a matter of law for violation of Texas Railroad Commission Rule 3.8(b), which provides: "(b) No pollution. No person conducting activities subject to regulation by the commission may cause or allow pollution of surface or subsurface water in the state." 16 Tex. Admin. Code 3.8.

166. "Negligence per se is a tort concept whereby a legislatively imposed standard of conduct is adopted by the civil courts as defining the conduct of a reasonably prudent person." *Carter v. William Sommerville & Son, Inc.*, 584 S.W.2d 274, 278 (Tex. 1979). A plaintiff thereby establishes

[18] https://www.youtube.com/watch?v=3FfYmOAHyms&t=299s

a breach of a legal duty based on a violation of a statute that was designed to prevent an injury to that class of persons to which the plaintiff belongs. *Id.*" *Chavez Yanez v. WWGAF, Inc.*, SA-19-CV-01065-DAE, 2020 WL 2527941, at *5 (W.D. Tex. May 18, 2020).

167. "In a negligence per se case, the jury is not asked to determine if the defendant acted as a reasonably prudent person would have acted under the same or similar circumstances. Instead, the statute itself provides what a reasonably prudent person would have done. Unless an excuse for the statutory violation is offered, the jury decides only whether the statute was violated and, if so, whether the violation was a proximate cause of the injury." *In re Associated Truss Co.*, 05-18-00896-CV, 2018 WL 6695739, at *3 (Tex. App.—Dallas Dec. 20, 2018, no pet.).

168. Texas Railroad Commission Rule 3.8 is designed to prevent the "injury" i.e. contamination of all water, but most certainly protects drinking water as among the most critical protections.

169. Defendants' violation of this rule constitutes negligence as a matter of law, which was a proximate cause of the event and Plaintiffs' damages.

CAUSE OF ACTION 4

HOMEOWNERS ONLY

TRESPASS – TEXAS LAW

170. All facts alleged are incorporated by reference.

171. The plume of drilling fluid injected by Defendants into the aquifer entered the groundwater below Plaintiffs' land without consent of the owner, which constitutes trespass as defined by Texas law.

172. "[A] landowner has a right to exclude others from groundwater beneath his property…." *Edwards Aquifer Auth. v. Day,* 369 S.W.3d 814, 830 (Tex. 2012).

173. "'Trespass' means an entry on the property of another without having consent of the owner. To constitute a trespass, entry upon another's property need not be in person but may be made by causing or permitting a thing to cross the boundary of the property below the surface of the earth. Every unauthorized entry upon property of another is a trespass, and the intent or motive prompting the trespass is immaterial." *FPL Farming Ltd. v. Envtl. Processing Sys., L.C.,* 383 S.W.3d 274, 282 (Tex. App.—Beaumont 2012), rev'd, 457 S.W.3d 414 (Tex. 2015)(approving this jury instruction by the trial court, but reversing on other grounds and not reaching substantive question on subterranean trespass in that case).

174. If Defendants somehow argue they had a permit which authorized their conduct to inject the drilling fluid into the aquifer, which they do not and cannot, such permit does not constitute an excuse or justification authorizing the trespass onto Plaintiffs' land or the water beneath it.

175. In the up and down appeals of *FPL Farming Ltd. v. Envtl. Processing Sys., L.C.*, the Supreme Court of Texas noted in its 2011 opinion:

> "As a general rule, a permit granted by an agency does not act to immunize the permit holder from civil tort liability from private parties for actions arising out of the use of the permit. This is because a permit is a "negative pronouncement" that "grants no affirmative rights to the permittee." *Magnolia Petroleum Co. v. R.R. Comm'n,* 141 Tex. 96, 170 S.W.2d 189, 191 (1943). A permit removes the government imposed barrier to the particular activity *311 requiring a permit. As the Amarillo Court of Appeals aptly stated: "[O]btaining a permit simply means that the government's concerns and interests, at the time, have been addressed; so, it, as a regulatory body, will not stop the applicant from proceeding under the conditions imposed, if any." *Berkley,* 282 S.W.3d at 243."

FPL Farming Ltd. v. Envtl. Processing Sys., L.C., 351 S.W.3d 306, 310–11 (Tex. 2011).

176. In the event PHP can somehow prove it had a permit for an injection well, it still is not relieved of the consequences of its conduct. In a case of groundwater pollution resulting from injection well activity, the Supreme Court of Texas held:

> "…the Railroad Commission's determination of the propriety of the permit has no effect on the propriety of the permittee's potentially tortious actions…." "Of course, statutory remedies may

> preempt common law actions or other standards that may set the bar for liability in tort, but a permit is not a get out of tort free card."
>
> *FPL Farming Ltd. v. Envtl. Processing Sys., L.C.*, 351 S.W.3d 306, 311 (Tex. 2011)

177. Indeed, even the Texas Water Code chapter regarding injection well permitting provides: "The fact that a person has a permit issued under this chapter does not relieve him from any civil liability." Tex. Water Code § 27.104.

178. Additionally, the Texas Administrative Code Section 305.122(c) governing TCEQ permits states that: "The issuance of a permit does not authorize any injury to persons or property or an invasion of other property rights, or any infringement of state or local law or regulations." *See also, FPL Farming Ltd. v. Envtl. Processing Sys., L.C.*, 351 S.W.3d 306, 312 (Tex. 2011).

179. The trespass by Defendants' plume was and is a proximate cause of substantial damages to Plaintiffs' use and enjoyment of their home and land, as well as a financial injury to the value of their water property rights as recognized by Texas Water Code, chapter 36 and "the water estate" as recognized by the Supreme Court of Texas in *Day* similar to a "mineral estate."

CAUSE OF ACTION 5

HOMEOWNERS' ONLY

NUISANCE – TEXAS LAW

180. All facts alleged are incorporated by reference.

181. "A 'nuisance' is a condition that substantially interferes with the use and enjoyment of land by causing unreasonable discomfort or annoyance to persons of ordinary sensibilities attempting to use and enjoy it,…" *Holubec v. Brandenberger*, 111 S.W.3d 32, 37 (Tex. 2003). *See also, Yuen v. Triple B Services LLP*, CV H-18-3277, 2019 WL 3069791, at *8 (S.D. Tex. July 8, 2019), report

and recommendation adopted sub nom., *Yuen v. Triple B Services, LLP*, 4:18-CV-3277, 2019 WL 3388321 (S.D. Tex. July 26, 2019).

182. Defendants' plume of drilling fluid containing human carcinogens deprived the Plaintiffs for many weeks of any usable source of water other than bottles of water to drink, bathe, and cook. Now, Plaintiffs are installing rainwater collection systems and trucking in freshwater, which is dependent on the rainfall of Texas, which is unpredictable at best, or the expense of trucking in bulk potable water at $0.10/gallon.

183. Thus, Defendants' plume of drilling fluid in the aquifer contaminating Plaintiffs' water wells constitutes a nuisance and must be remedied through injunctive relief by the Court ordering Defendants to clean up the pollution in such a manner that the well water becomes usable again, and will remain usable, not subject to the plume moving back every time a new major rain event moves water below the Plaintiffs' wells.

CAUSE OF ACTION 6

TESPA ONLY – INJUNCTIVE RELIEF SOUGHT

PUBLIC NUISANCE

184. All facts, and the laws underlaying the other causes of action, are incorporated by reference for the Court's consideration of this cause of action to enjoin a "public nuisance" created by Defendants.

185. The plume of drilling fluid remaining in the aquifer uncontained and unremediated is like a pack of vicious dogs roaming about and the only question is who will they attack next?

186. This unrestrained plume, the cocktail of carcinogens, drifting aimlessly about, constitutes a "public nuisance." TESPA seeks injunctive relief from the Court to remedy the public nuisance.

187. What constitutes a public nuisance is widely varying as is the relief afforded to remedy it.

A public nuisance is a condition amounting to "an unreasonable interference with a right common to the general public." *Cox v. City of Dallas*, 256 F.3d 281, 289 (5th Cir. 2001) (citing Restatement (Second) of Torts § 821B(1) (1979)); *see also Jamail v. Stoneledge Condo. Owners Ass'n*, 970 S.W.2d 673, 676 (Tex. Civ. App–Austin 1998, no pet.). Unreasonable interference may involve: (1) conduct that significantly interferes with "the public health, the public safety, the public peace, the public comfort or the public convenience," (2) conduct that "is proscribed by a statute, ordinance or administrative regulation," or (3) conduct that is continuing or "produced a permanent or long-lasting effect, and, as the actor knows or has reason to know, has a significant effect upon the public right." Restatement (Second) of Torts § 821B(2)(a)–(c) (1979); *see also Cox*, 256 F.3d at 289. Two remedies available for public nuisance actions are damages and injunctions. *Cox*, 256 F.3d at 291. Public nuisance claims are traditionally derived from common law, which was later supplanted by statutorily defined public nuisances. Restatement (Second) of Torts §§ 821B(b)–(c). Actions based on public rights derived from common law are likely governed by state law even when adjudicated by federal courts. *See City of Philadelphia v. Beretta U.S.A. Corp.*, 277 F.3d 415, 421 (3d Cir. 2002) ("[P]ublic nuisance is a matter of state law, and it is not the role of a federal court to expand state law."); *Erie R.R. Co. v. Tompkins*, 304 U.S. 64, 78, 58 S.Ct. 817, 82 L.Ed. 1188 (1938) ("Except in matters governed by the Federal Constitution or by acts of Congress, the law to be applied in any case is the law of the state ... There is no federal general common law.").

*10 In order to have standing to enjoin a public nuisance, the plaintiff must either: (1) have the right to recover damages (2) have authority as a public official or public agency representing the state or apolitical subdivision, or ***(3) have "standing to sue as a representative of the general public, as a citizen in a citizen's action."*** Restatement (Second) of Torts § 821C (1979).

Friends of Lydia Ann Channel v. Lydia Ann Channel Moorings, LLC, 2:19-CV-00148, 2020 WL 1434706, at *9–10 (S.D. Tex. Mar. 24, 2020)(Judge Jack, presiding)(emphasis added).

ADDITIONAL PLEADING

ON THE STANDING OF TESPA

188. TESPA has "associational standing" to bring this action.

189. Supplemental pleading is provided here to demonstrate the "associational standing" of Plaintiff TESPA.

190. TESPA has members directly impacted by the water pollution made the basis of this action Dr. Albright, Dr. Shaw, the Fowlers, and Mary Harris, who are members of TESPA and who seek damages in this action for the pollution of their home water supply due to actions of the

Defendants. TESPA does not seek damages for them. However, TESPA also has members in the area not yet impacted by the plume, but who are risk for the plume spreading to their water wells and it may move to public water supply intakes and contaminate springs and Hill Country waters.

191. TESPA seeks injunctive relief mandating containment and remediation of the plume to protect these members, as well other members down gradient, as Defendants have made no effort to date to clean up the pollution they created. Further, TESPA seeks forward looking injunctive relief to prevent a similar event from occurring which may adversely impact members such as prohibiting the use of drilling or boring practices which may again release more drilling fluid that may impact the water supply to its members. As such, TESPA has "associational standing" to participate in this action.

192. An association has standing to bring suit on behalf of its members when (1) its members would otherwise have standing to sue in their own right, (2) the interests it seeks to protect are germane to the organization's purpose, and (3) neither the claim asserted nor the relief requested requires the participation in the lawsuit of each of the individual members. *Hunt v. Wash. State Apple Adver. Comm'n,* 432 U.S. 333, 343 (1977); *Tex. Ass'n of Bus.,* 852 S.W.2d 440, 447 (Tex. 1993).

193. Just this month, June, 2020, the Supreme Court of the United States restated the rule as, "An association may file suit 'to redress its members' injuries, even without a showing of injury to the association itself.' (citation omitted) All Article III requires is that a member 'would otherwise have standing to sue in their own right' and that 'the interests [the association] seeks to protect are germane to the organization's purpose.' " *Thole v. U. S. Bank N.A,* — U.S. —, 2020 WL 2814294, at *15 (June 1, 2020). TESPA handily meets the *Thole* standard. Besides meeting

this simpler *Thole* standard, TESPA also meets the older three prong test and offers a summary of that standard here to quiet any possible question.

194. Applying the same three prong test, the Austin Court of Appeals found that a similar group seeking to protect water quality, the Save Our Springs Alliance, met the requirement for associational standing trying to protect water quality that impacted its members. "The SOS Alliance's petition alleges that its members are residents of Travis and Hays counties who are concerned with water quality in the Edwards Aquifer and Barton Springs Watershed. Under *Groves*, individual members living in the affected area have standing to sue. The interest that the SOS Alliance seeks to protect by this suit—water quality in the Edwards Aquifer and Barton Springs Watershed—unquestionably reflects the organization's expressed purpose." *Save Our Springs Alliance, Inc. v. Lowry*, 934 S.W.2d 161, 163 (Tex. App. 1996)(orig. proceeding)(internal citation omitted).

The First Prong: The Members of TESPA Have Standing to Sue in Their Own Right

195. The association must show that its members "have standing to sue in their own right". *Tex. Ass'n of Bus.*, 852 S.W.2d at 447 explains that the first prong of the associational standing test "should not be interpreted to impose unreasonable obstacles to associational representation.... [T]he purpose of [the first prong] is simply to weed out plaintiffs who try to bring cases, which could not otherwise be brought, by manufacturing allegations of standing that lack any real foundation."

196. Associational standing is not based on an association's direct, independent standing; it is derived from the standing of the individual members of the association. *See Warth v. Seldin,* 422 U.S. 490 (1975)(explaining that "[e]ven in the absence of injury to itself, an association may have standing solely as the representative of its members"); *see also*, *Hunt,* 432 at 340 – 42 (rejecting

contention that the association lacked standing because challenged statute had no impact on the association—the Washington State Apple Advertising Commission—but only upon Washington apple growers and dealers). To hold that only an association directly aggrieved possesses standing is inconsistent with the concept of associational standing articulated by the United States Supreme Court. *See, Hunt* 432 U.S. at 340. The fact that the association does not possess direct, independent standing is not relevant to a determination of associational standing so long as the three prongs of the associational standing test are met. *See id.*

Second Prong: The interests it seeks to protect are germane to the organization's purpose.

197. This action is well within the express purposes of TESPA. The Certificate of Formation contains TESPA's stated purpose. "Section 5.01. The Corporation is organized exclusively for charitable and educational purposes as defined in Section 501(c)(3) of the Internal Revenue Code, including, but not limited to, research, development and publication of proposals to protect the health of the Trinity Aquifer, Edwards Aquifer, their groundwater, and Hill Country artesian springs including the San Marcos Springs in San Marcos, Texas. These activities include monitoring and protecting endangered and threatened species in the San Marcos Springs and other Hill Country artesian springs; increasing public awareness and understanding of environmental issues in and around Hill Country artesian springs including the San Marcos Springs, such as the hydrologic connectivity of the Trinity Aquifer system and the Edwards Aquifer system via geologic faulting, through media and other educational programs; participating in common law or statutory based litigation designed to further these activities; researching and publishing information about these issues to inform the public; and reviewing and commenting upon existing practices which may or do impact these issues."

Third Prong: (3) neither the claim asserted nor the relief requested requires the participation in the lawsuit of each of the individual members.

198. In this action, homeowners impacted by the water pollution are parties seeking damages. TESPA seeks injunctive relief, especially on a larger geographic scale, which does not require its other members, in accordance with its mission statement to protect the water in this area. *See Tex. Ass'n of Bus.*, 852 S.W.2d at 448 (recognizing associational standing under third prong when association sought only prospective relief and did not need to prove the individual circumstances of its members to obtain that relief); *see also Hunt*, 432 U.S. at 343–44.

199. TESPA does not seek damages for itself or its members, but in the alternative to, or in addition depending on the injunctive relief crafted by the Court, TESPA seeks penalties payable to the federal government, which is permitted for a non-profit public interest group in a "citizen suit." The penalties are warranted and recoverable as the Defendants have made no effort to clean up the pollution they created. TESPA seeks relief on a larger scale for the plume that remains in the aquifer uncontained and unremediated like a modern day remake of "The Blob" meandering about drifting towards unsuspecting wells of other members and public water intakes.

200. Defendants' disregard for public water sources certainly warrants severe punishment appropriate to impose a "sting" on a multi-billion construction project to motivate it to clean up the mess it made and to serve as a deterrent to assure protection of water quality in the future.

201. Thus, TESPA has "associational standing" to bring this action.

RELIEF REQUESTED

202. Plaintiffs seek a declaration that Defendants violated the Safe Drinking Water Act.

203. Plaintiffs seek penalties under the Safe Drinking Water Act wholly payable to the United States government. The Court should impose the maximum penalties of $57,317 per day of

violation under the Safe Drinking Water Act and all other available penalty and punishment provisions available.

204. The homeowner Plaintiffs seek damages under the state law causes of action for:

(1) reduced property value;

(2) damages to the "water estate," which is property recognized in *Edwards Aquifer Auth. v. Day*, 369 S.W.3d 814, 830 (Tex. 2012) as property separate from the surface estate, just as the mineral estate is separate from the surface estate;

(3) damages for unreasonable discomfort or annoyance to persons of ordinary sensibilities attempting to use and enjoy their property under the nuisance cause of action; and,

(4) pre-judgment and post-judgment interest.

205. All Plaintiffs seek reasonable and necessary attorneys' fees, expert witness fees, and costs, including fees and costs through appeals to the Fifth Circuit and Supreme Court of the United States, if appeals are taken, as allowed by 42 U.S.C. § 300j-8(d).

INJUNCTIVE RELIEF

206. There is no adequate remedy at law for Plaintiffs to clean up the pollution Defendants have decided to leave in place other than perhaps leaving taxpayers with the burden under CERCLA. Thus, Plaintiffs request the Court to use its injunctive powers to assess the feasibility of clean up and issue orders for cleanup of the contamination as determined by feasibility analysis.

207. The plume presents an ongoing risk of contamination to other area drinking water wells and supplies if not remediated.

208. Injunctive relief is sought to require Defendants to use construction methods that will not cause further contamination of the underground sources of drinking water through the future use

of drilling fluid in construction or operations in this area. Defendants are already using "dry" boring methods in this zone from Blanco to Wimberley to Kyle, so they certainly are capable of doing without drilling fluid for their construction activities in this area.

209. Plaintiffs request an injunction prohibiting the use of ALL similar fluids. Plaintiffs request the Court to take judicial notice of the Biological Opinion issued by the United States Fish & Wildlife Service[19] which prohibits how equipment is filled with gas, diesel, or oil to protect water resources. Surely, the use of 10's of 1,000's of gallons of drilling fluid should also be included in the standards imposed by the USFWS Biological Opinion.

210. Damages and even the ostensibly substantial penalties under the Safe Drinking Water Act are of little to no consequence to this behemoth multi-billion project and the conglomerate in charge of building it and later operating it moving millions of dollars of product per day through it.

211. Thus, there is "no adequate remedy at law," and the Court sitting in equity needs to exercise its powers to protect the public from future threats and dangers to the public water supply posed by the conduct of Defendants.

212. The Court should also consider that besides this incident of injecting 36,000 gallons of drilling fluid in the drinking water and making no attempt to clean it up, Defendants have cut a water supply line owned by SAWS,[20] the San Antonio Water System, and shockingly, lost a box with radioactive material in the Pedernales River, which was recovered 13 miles downstream.[21]

[19] See, City of Austin, et al. v. Permian Highway Pipeline, et al. already pending in this district and before the Court to consider issues arising from enforcement of the Endangered Species Act.

[20] https://haysfreepress.com/2020/05/27/kinder-morgan-pipeline-ruptures-saws-water-project/

[21] https://www.kxan.com/news/texas/camera-with-radioactive-material-missing-after-truck-swept-away-in-pedernales-river-floodwaters/

The Court should consider that Defendants are displaying a pattern of wanton and reckless conduct endangering and posing real threats and dangers to drinking water supplies in this area. Thus, Plaintiffs respectfully request the Court to protect the community from the dangers to the drinking water supply.

213. Drilling in the geological region of the Blanco River Valley, Cypress Creek Watershed, and Wimberley Valley above Jacob's Well, where the route of the PHP pipeline is set to go is inherently rife with the potential for further events of this type to the point that some hydrogeologists see a recurrence of this pollution event to be a near certainty as this activity marches onward towards Wimberley, unless substantially changed and improved management practices are implemented.

214. These parties ask the Court to craft injunctive relief after hearing from expert witnesses and parties on how to protect this sole source of drinking water on which an estimated 10,000 people depend in the immediate Blanco River valley from Blanco to Wimberley to Kyle, and up to two million people in the Edwards Aquifer area.

215. Plaintiffs request the Court to halt further construction of this pipeline between Kyle and Blanco and requests that Kinder Morgan work with the Court, TESPA and its hydrogeologists to find an alternative route that does not involve this type of risk to sole source aquifers and water supply reservoir for an even broader array of municipalities, or develop substantially improved construction and future operation "best management practices" that will protect the water quality in this incredibly sensitive region.

216. As the plume contains seven or more Class 1 human carcinogens and also causes persistent excessive turbidity, the plume presents an "*endangerment*" that is "*imminent and substantial*" as

provided in the 2018 EPA updated policy guidance paper to assist with consistency of enforcement of the Safe Drinking Water Act.[22]

217. Quoting from the EPA's 2018 Updated Guidance on Emergency Authority[23] – Remedial Actions may include:

- issuing orders as necessary to protect the health of persons who are or may be users of such system (including travelers), including orders that require:

- - the provision of alternative water supplies, at no cost to the consumer, by persons who caused or contributed to the endangerment (e.g., provision of bottled water, installing and maintaining treatment, drilling of new well(s), connecting to an existing PWS).
- - information about actual or impending emergencies (e.g., if standard information gathering tools like SDWA Section 1445 would not result in an expeditious response or may not apply in a certain case).
- - public notification of hazards (e.g., door-to-door, posting, newspapers, electronic media).
- - an investigation to determine the nature and extent of the contamination in the environment.
- - a survey to identify PWSs, private supply wells or ground water monitoring[40]
- - monitoring of regulated or unregulated potential or identified contaminants.
- - development of a feasibility study to assess potential remedial actions to abate an endangerment.
- - an engineering study proposing a remedy to eliminate the endangerment and a timetable for its implementation.

- - control of the source of contaminants that may be contributing to the endangerment, including by halting disposal.
- - cleanup of contaminated soils endangering an USDW.

• commencing a civil action for appropriate relief including a restraining order, or a temporary or permanent injunction. The injunction may require the PWS owner or operator, UIC well owner or operator, or the responsible party to take steps to abate the hazard.

[22] https://www.epa.gov/sites/production/files/2018-09/documents/updatedguidanceonemergencyauthorityundersection1431sdwa.pdf

[23] https://www.epa.gov/sites/production/files/2018-09/documents/updatedguidanceonemergencyauthorityundersection1431sdwa.pdf

218. Some additional specific requests for injunctive relief:

- an injunction requiring Kinder Morgan, PHP, and all other responsible parties, to immediately cease operations and implement appropriate steps to prevent the ongoing illegal discharges of fluids, pollutants and contaminants into underground sources of drinking water, waters of the United States, and the environment;
- an injunction requiring Kinder Morgan, PHP, and all other responsible parties, to immediately remove and remediate the fluids, pollutants and contaminants that have been discharged into underground sources of drinking water, waters of the United States, and the environment;
- penalties or fines appropriate under the applicable federal statutes to be paid to the federal government, which range up to $57,317 per violation, per day depending on the statute;

- and, all other relief to which Plaintiffs may show themselves entitled under the law and evidence, and as the Court may deem just.

Respectfully submitted,

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ATTORNEY FOR TESPA

Exhibit 1

AMC GEL

AMC

Chemwatch Hazard Alert Code: **3**

Chemwatch: **42071**
Version No: **11.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **07/07/2017**
Print Date: **02/02/2018**
L.GHS.AUS.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	AMC GEL
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Drilling fluid compound; viscosifier.

Details of the supplier of the safety data sheet

Registered company name	**AMC**
Address	216 Balcatta Rd Balcatta WA 6021 Australia
Telephone	+61 8 9445 4000
Fax	+61 8 9445 4040
Website	www.amcmud.com
Email	amc@imdexlimited.com

Emergency telephone number

Association / Organisation	**Not Available**
Emergency telephone numbers	1800 039 008 or +61 3 9573 3112,+800 2436 2255 +613 9573 3112
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	0	
Toxicity	1	
Body Contact	0	
Reactivity	0	
Chronic	3	

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

Poisons Schedule	Not Applicable
Classification [1]	Carcinogenicity Category 1A, Specific target organ toxicity - repeated exposure Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	
SIGNAL WORD	DANGER

Hazard statement(s)

H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.

Precautionary statement(s) Response

P308+P313	IF exposed or concerned: Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
1302-78-9	>94	bentonite
9003-05-8	<0.5	acrylamide homopolymer
497-19-8	<0.5	sodium carbonate
14808-60-7	1-6	silica crystalline - quartz

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: • Wash out immediately with fresh running water. • Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. • Seek medical attention without delay; if pain persists or recurs seek medical attention. • Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: • Flush skin and hair with running water (and soap if available). • Seek medical attention in event of irritation.
Inhalation	• If fumes or combustion products are inhaled remove from contaminated area. • Lay patient down. Keep warm and rested. • Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. • Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. • Transport to hospital, or doctor. • If dust is inhaled, remove from contaminated area. • Encourage patient to blow nose to ensure clear breathing passages.

	▸ Ask patient to rinse mouth with water but to not drink water. ▸ Seek immediate medical attention.
Ingestion	▸ Immediately give a glass of water. ▸ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered a significant fire risk, however containers may burn.
HAZCHEM	Not Applicable

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Clean up waste regularly and abnormal spills immediately. ▸ Avoid breathing dust and contact with skin and eyes.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Polyethylene or polypropylene container. ▸ Check all containers are clearly labelled and free from leaks.
Storage incompatibility	Silicas: ▸ react with hydrofluoric acid to produce silicon tetrafluoride gas ▸ react with xenon hexafluoride to produce explosive xenon trioxide ▸ reacts exothermically with oxygen difluoride, and explosively with chlorine trifluoride (these halogenated materials are not commonplace industrial materials) and other fluorine-containing compounds ▸ may react with fluorine, chlorates ▸ are incompatible with strong oxidisers, manganese trioxide, chlorine trioxide, strong alkalis, metal oxides, concentrated orthophosphoric acid, vinyl acetate ▸ may react vigorously when heated with alkali carbonates.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	silica crystalline - quartz	Silica - Crystalline	Not Available	Not Available	Not Available	Not Available
Australia Exposure Standards	silica crystalline - quartz	Quartz (respirable dust)	0.1 mg/m3	Not Available	Not Available	Not Available
Australia Exposure Standards	silica crystalline - quartz	Quartz (respirable dust)	0.1 mg/m3	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
bentonite	Montmorillonite	30 mg/m3	330 mg/m3	2,000 mg/m3
sodium carbonate	Sodium carbonate	7.6 mg/m3	83 mg/m3	500 mg/m3
silica crystalline - quartz	Silica, crystalline-quartz; (Silicon dioxide)	0.075 mg/m3	33 mg/m3	200 mg/m3

Ingredient	Original IDLH	Revised IDLH
bentonite	Not Available	Not Available
acrylamide homopolymer	Not Available	Not Available
sodium carbonate	Not Available	Not Available
silica crystalline - quartz	Not Available	Not Available

MATERIAL DATA

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
Personal protection	
Eye and face protection	▸ Safety glasses with side shields ▸ Chemical goggles. ▸ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.
Skin protection	See Hand protection below
Hands/feet protection	The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present. ▸ polychloroprene.
Body protection	See Other protection below
Other protection	▸ Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent] ▸ Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. ▸ Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. ▸ Overalls. ▸ P.V.C.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
AMC GEL

Material	CPI
NATURAL RUBBER	C
NITRILE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:001, ANSI Z88 or national equivalent)

If inhalation risk above the TLV exists, wear approved dust respirator.
Use respirators with protection factors appropriate for the exposure level.

- Up to 5 X TLV, use valveless mask type; up to 10 X TLV, use 1/2 mask dust respirator
- Up to 50 X TLV, use full face dust respirator or demand type C air supplied respirator
- Up to 500 X TLV, use powered air-purifying dust respirator or a Type C pressure demand supplied-air respirator
- Over 500 X TLV wear full-face self-contained breathing apparatus with positive pressure mode or a combination respirator with a Type C positive pressure supplied-air full-face respirator and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Bentonite clay (powder) varying in colour from grey to various shades of brown, insoluble in water.

Physical state	Divided Solid	**Relative density (Water = 1)**	Not Available
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Applicable
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Applicable	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Applicable
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Applicable
Vapour pressure (kPa)	Not Applicable	**Gas group**	Not Available
Solubility in water (g/L)	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	Not Applicable	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	‣ Unstable in the presence of incompatible materials. ‣ Product is considered stable.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual. Effects on lungs are significantly enhanced in the presence of respirable particles. Overexposure to respirable dust may produce wheezing, coughing and breathing difficulties leading to or symptomatic of impaired respiratory function.
Ingestion	The material has NOT been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.
Skin Contact	The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting. Open cuts, abraded or irritated skin should not be exposed to this material
Eye	Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.
Chronic	On the basis of epidemiological data, the material is regarded as carcinogenic to humans. There is sufficient data to establish a causal association between human exposure to the material and the development of cancer. Toxic: danger of serious damage to health by prolonged exposure through inhalation. The health hazards associated with bentonite, kaolin, and common clay, which are commercially important clay products, as well as the related phyllosilicate minerals montmorillonite, kaolinite, and illite, have an extensive literature. Fibrous clay minerals, such as sepiolite, attapulgite, and zeolites, have a separate literature. Chronic symptoms produced by crystalline silicas included decreased vital lung capacity and chest infections. Lengthy exposure may cause silicosis a disabling form of pneumoconiosis which may lead to fibrosis, a scarring of the lining of the air sacs in the lung. Overexposure to respirable dust may cause coughing, wheezing, difficulty in breathing and impaired lung function. Chronic symptoms may include decreased vital lung capacity, chest infections Repeated exposures, in an occupational setting, to high levels of fine- divided dusts may produce a condition known as pneumoconiosis which is the lodgement of any inhaled dusts in the lung irrespective of the effect.

	TOXICITY	IRRITATION
AMC GEL	Not Available	Not Available
bentonite	dermal (rat) LD50: >2000 mg/kg[1] Inhalation (rat) LC50: >50 mg/l1 h[1] Oral (rat) LD50: >2000 mg/kg[1] Oral (rat) LD50: >5000 mg/kg[1]	Not Available
acrylamide homopolymer	Inhalation (rat) LC50: 5.7125 mg/l/30M[2] Oral (rat) LD50: >2000 mg/kg[2]	Eye: slight
sodium carbonate	dermal (rat) LD50: >2000 mg/kg[2] Inhalation (guinea pig) LC50: 0.4 mg/l/2h[2] Oral (rat) LD50: 2800 mg/kg[2]	Eye (rabbit): 100 mg/24h moderate Eye (rabbit): 100 mg/30s mild Eye (rabbit): 50 mg SEVERE

		Skin (rabbit): 500 mg/24h mild
silica crystalline - quartz	TOXICITY Not Available	IRRITATION Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

BENTONITE	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. No significant acute toxicological data identified in literature search. for bentonite clays: Bentonite (CAS No. 1302-78-9) consists of a group of clays formed by crystallisation of vitreous volcanic ashes that were deposited in water. The expected acute oral toxicity of bentonite in humans is very low (LD50>15 g/kg).
ACRYLAMIDE HOMOPOLYMER	Sensitisation (guiea pig): 0% (0/20) OECD 406
SILICA CRYSTALLINE - QUARTZ	**WARNING:** For inhalation exposure ONLY: This substance has been classified by the IARC as Group 1: **CARCINOGENIC TO HUMANS** The International Agency for Research on Cancer (IARC) has classified occupational exposures to **respirable** (<5 um) crystalline silica as being carcinogenic to humans . This classification is based on what IARC considered sufficient evidence from epidemiological studies of humans for the carcinogenicity of inhaled silica in the forms of quartz and cristobalite.

Acute Toxicity	⊘	**Carcinogenicity**	✔
Skin Irritation/Corrosion	⊘	**Reproductivity**	⊘
Serious Eye Damage/Irritation	⊘	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	✔
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✘ *– Data available but does not fill the criteria for classification*
✔ *– Data available to make classification*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
AMC GEL	Not Available	Not Available	Not Available	Not Available	Not Available
bentonite	LC50	96	Fish	19000mg/L	4
acrylamide homopolymer	Not Available	Not Available	Not Available	Not Available	Not Available
sodium carbonate	LC50	96	Fish	300mg/L	4
	EC50	48	Crustacea	=176mg/L	1
	EC50	96	Algae or other aquatic plants	242mg/L	4
	NOEC	16	Crustacea	424mg/L	4
silica crystalline - quartz	Not Available	Not Available	Not Available	Not Available	Not Available

Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

DO NOT discharge into sewer or waterways.
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
acrylamide homopolymer	LOW	LOW
sodium carbonate	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
acrylamide homopolymer	LOW (LogKOW = -0.8074)
sodium carbonate	LOW (LogKOW = -0.4605)

Mobility in soil

Ingredient	Mobility
acrylamide homopolymer	LOW (KOC = 10.46)
sodium carbonate	HIGH (KOC = 1)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. ▸ DO NOT allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ Recycle wherever possible or consult manufacturer for recycling options. ▸ Consult State Land Waste Management Authority for disposal.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO
HAZCHEM	Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

BENTONITE(1302-78-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

ACRYLAMIDE HOMOPOLYMER(9003-05-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

SODIUM CARBONATE(497-19-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Hazardous Substances Information System - Consolidated Lists

Australia Inventory of Chemical Substances (AICS)

SILICA CRYSTALLINE - QUARTZ(14808-60-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards

Australia Hazardous Substances Information System - Consolidated Lists

Australia Inventory of Chemical Substances (AICS)

International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (bentonite; silica crystalline - quartz; acrylamide homopolymer; sodium carbonate)
China - IECSC	N (acrylamide homopolymer)
Europe - EINEC / ELINCS / NLP	N (acrylamide homopolymer)
Japan - ENCS	N (bentonite)
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory* *N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Ingredients with multiple cas numbers

Name	CAS No
bentonite	1302-78-9, 11004-12-9, 10043-07-9, 115628-71-2, 12198-92-4, 12199-69-8, 135945-01-6, 37320-72-2, 52623-66-2, 850872-77-4, 67479-91-8, 89382-86-5, 90989-60-9, 85049-30-5, 97862-66-3, 84776-12-5, 70131-50-9, 90989-59-6
sodium carbonate	497-19-8, 7542-12-3, 1314087-39-2, 1332-57-6
silica crystalline - quartz	14808-60-7, 122304-48-7, 122304-49-8, 12425-26-2, 1317-79-9, 70594-95-5, 87347-84-0, 308075-07-2

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

Exhibit 2

The Mundy Firm PLLC

4131 Spicewood Springs Rd, Suite O3
Austin, Texas 78759
512-334-4300
E-Mail: jeff@jmundy.com

April 8, 2020

Via U.S. Certified Mail/RRR

Permian Highway Pipeline, LLC
1001 Louisiana St. Ste. 1000
Houston, Texas 77002-5089

Via U.S. Certified Mail/RRR

Kinder Morgan Texas Pipeline LLC
1001 Louisiana St. Ste. 1000
Houston, Texas 77002-5089

RE: Notice of Intent to Sue Permian Highway Pipeline, LLC and Kinder Morgan Texas Pipeline LLC for Violations of the Safe Drinking Water Act, the Clean Water Act, and the Resource, Conservation, and Recovery Act

To the Responsible Regulatory Agencies, and to Kinder Morgan and PHP,

Please be advised that Dr. Teri Albright, Dr. Milton Shaw, Ms. Paula Fowler, Mr. Max Fowler, and the Trinity Edwards Springs Protection Association (TESPA) on behalf of its members including the Wimberley Valley Watershed Association provide notice of their intent to file suit in federal court against Permian Highway Pipeline, LLC and Kinder Morgan Texas Pipeline LLC, hereafter both referred collectively as "Kinder Morgan" for violations:

1. of 42 U.S.C. §300h(b)(1)(A), the Safe Drinking Water Act, for unauthorized "injection activity in a manner that allows the movement of fluid containing any contaminant into underground sources of drinking water, [which] the presence of that contaminant may … adversely affect the health of persons." ;

2. of 42 U.S.C. § 6972(a)(1)(A) and (B), the Resource, Conservation, and Recovery Act commonly referred to as "RCRA", for creating an imminent and substantial endangerment to public health;

3. of 33 U.S.C. §§ 301, 402, and 404, the Clean Water Act, "CWA", for discharge of pollutants into waters of the United States in violation of the terms and conditions of

United States Army Corps of Engineers Nationwide Permit #12 and/or without a permit.

4. state law claims under the laws of the State of Texas including but not limited to nuisance, trespass, negligence, and gross negligence.

On or about March 28-29, 2020, personnel building the Permian Highway Pipeline in Blanco County, Texas, attempted to bore under the Blanco River in Blanco County, Texas. Rather than drilling a contained hole, they bored into the aquifer and released a plume of drilling fluid into the aquifer contaminating the sole source of well water for the area. The water wells of two homes approximately 1 and 1.5 miles away became filled with a cloudy/milkly contaminate within one day. The contamination persists. The homeowners report the cloudly/milkly discharge in the water leaves a greasy film on the kitchen sink and skin, which persists even using soap and scrubbing.

The size of the plume is unknown at this time. However, Kinder Morgan has acknowledged the milky discharge in the water is from the plume of drilling fluid from their boring activity. Kinder Morgan is the managing partner of the Permian Highway Pipeline project. The MSDS sheet provided by Kinder Morgan is attached.[1]

Please note that MSDS clearly and unequivocally warns the drilling "gel" is a Class 1a, human carcinogen. The MSDS does not specify which component is the carcinogen, although silica is a component and the International Agency for Research on Cancer, commonly known as "IARC", creator of the classification system, classifies silica as a Class 1, human carcinogen.[2] Bentonite, apparently the major constituent component of the AMC Gel is not a benign, inert material as Kinder Morgan is portraying in the public media. Attached as just a recent example is a study of Bentonite by Masoudi, et al., Journal of Toxicology & Industrial Health, Vol. 36, Issue 1, Feb. 25, 2020.

According to Kinder Morgan:

> *On Saturday, March 28, Permian Highway Pipeline (PHP) experienced an underground drilling fluid loss during construction in Blanco County, Texas. The drilling fluid is comprised of bentonite clay and water. Bentonite is a naturally occurring, non-hazardous, non-toxic clay. We strive for zero incidents and minimal environmental impact on all our construction projects. At this time, drilling operations have been suspended while the team evaluates the cause of the loss and determines the best path forward. We are working with affected landowners to address their needs. We are also consulting with our karst expert and the local water district manager to determine the best way to mitigate any current and future impacts. All of the appropriate regulatory agencies have been notified.*

[1] SDS for "AMC Gel" Safety Data Sheet, the Australian term analogous to our MSDS, Material Safety Data Sheet.

[2] https://monographs.iarc.fr/wp-content/uploads/2018/06/mono100C-14.pdf

The site of this discharge is the "disappearing" stretch of Blanco River at a location where the river water drains into the aquifer. This water flows into the aquifer and then moves back above surface into the Blanco River.

As a matter of law, the polluted water is an underground source of drinking water under the Safe Drinking Water Act, but also is a water of the United States under the Clean Water Act when as reappears in the Blanco River. This connectivity has been proven by hydrogeology dye trace studies, thus indicating that this discharge has impacted both an underground source of drinking water and a water of the United States.

Drilling in the geological region of the Blanco River Valley, Cypress Creek Watershed, and Wimberley Valley, where the route of the PHP pipeline is set to go is inherently rife with the potential of further events of this type to the point that some hydrogeologists see a recurrence of this pollution even to be a near certainty as this activity marches onward towards Wimberley, unless substantially changed and improved management practices are implemented.

These parties ask you as the guardians of the public water supply to please exercise your authority and discretion to protect these waters, which are the sole source of drinking water for an estimated 20,000 or more citizens in the Blanco River Valley. The parties will request the federal court to halt further construction of this pipeline and requests that Kinder Morgan work with TESPA and its hydrogeologists to find an alternative route that does not involve this type of risk to sole source aquifers and water supply reservoir for an even broader array of municipalities.

This notice is sent to you as required by the federal statutes under which Plaintiffs intend to proceed.

These citizen suit provisions include:

- Section 304 of the Clean Air Act (CAA);
- Section 505(a)(2) of the Clean Water Act (CWA);
- Section 1449(a)(2) of the Safe Drinking Water Act (SDWA);
- Section 11(g)(1)(A) of the Endangered Species Act (ESA);
- Section 105(g)(2)(A) of the Marine Protection, Research, and Sanctuaries Act (MPRSA, aka Ocean Dumping Act);
- Section 7002(a)(2) of the Resource Conservation and Recovery Act (RCRA);
- Section 20(a)(2) of the Toxic Substances Control Act (TSCA);
- Section 310(a)(2) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); and
- Section 326(a)(1)(B) or (C) of the Emergency Planning and Community Right-to-Know Act (EPCRA).

Among the specific allegations for which TESPA will seek remedies in federal court include, but are not limited to:

1. violation of Section §300h(b)(1)(A) of the Safe Drinking Water Act by injecting fluids through a well into an underground source of drinking water without a permit. Sections 300j-8(a)(1)(A) and (B) provide that "any person may commence a civil action on his own behalf against any person…who is alleged to be in violation of any requirement prescribed by or under this subchapter."

2. violation of Section 7003 of the Resource Conservation and Recovery Act (RCRA) by disposing of solid waste into an underground source of drinking water, thereby creating an imminent and substantial endangerment to the public, *e.g*, it contaminated drinking water supplies; RCRA authorizes citizen suits to be brought for alleged violations of any permit, standard, regulation, condition, requirement, prohibition, or order effective pursuant to the Act. 42 U.S.C. § 6972(a)(1)(A). RCRA also authorizes citizen suits to be brought against any person who "has contributed to or who is contributing to the past or present handling, storage, treatment, transportation, or disposal of any solid or hazardous waste which may present an imminent and substantial endangerment to health or the environment[.]" 42 U.S.C. § 6972(a)(1)(B).

3. violation of Sections 301 and Section 404 of the Clean Water Act by violating the terms and conditions of its authorization under U.S. Army Corps of Engineers Nationwide Permit 12 under which it was constructing this pipeline. Nationwide 12 does not allow the discharge of drilling fluid (a pollutant) from a point source into waters of the United States. 33 U.S.C. 1365 allows an action against who is alleged to be in violation of (A) an effluent limitation or standard under this chapter or (B) an order issued by the Administrator or a State with respect to such a standard or limitation.

4. violation of Sections 301 and Section 402 of the Clean Water Act for discharging pollutants from a point source into waters of the United States without a permit. 33 U.S.C. 1365 allows an action against who is alleged to be in violation of (A) an effluent limitation or standard under this chapter or (B) an order issued by the Administrator or a State with respect to such a standard or limitation.

Remedies sought

The homeowner plaintiffs seek actual damages including, but not limited to, the costs to seek an interim clean water supply to their homes, all costs for cleanup, filtration equipment, remediation of the water under their property, decrease property values, attorneys' fees and costs, and punitive damages for trespass and gross negligence in amount sufficient to deter future recurrences of a similar event on this property or another. Further, all Plaintiffs seek:

- an injunction requiring Kinder Morgan, PHP, and all other responsible parties, to immediately cease operations and implement appropriate steps to prevent the ongoing illegal discharges of fluids, pollutants and contaminants into underground sources of drinking water, waters of the United States, and the environment;

- an injunction requiring Kinder Morgan, PHP, and all other responsible parties, to immediately remove and remediate the fluids, pollutants and contaminants that have been discharged into underground sources of drinking water, waters of the United States, and the environment;

- penalties or fines appropriate under the applicable federal statutes to be paid to the federal government, which range up to $57,317 per violation, per day depending on the statute; and,

- attorneys' fees and costs of court.

As provided in the provisions above, RCRA, SDWA and CWA all allow for citizen suits to be filed for violation of statutory and regulatory prohibitions. These acts all allow actions against the "person" violating the act. The notice period under the SDWA and CWA is 60 days. The notice period under RCRA is 90 days. At the end of those respective periods, Plaintiffs intend to file suit unless appropriate and adequate resolution and safeguards have been reached with Kinder Morgan, PHP, all other responsible parties, and the involved regulatory authorities.

Respectfully,

Jeffery Mundy
Attorney for Plaintiffs

Copies to:

Via U.S. Certified Mail/RRR
Permian Highway Pipeline, LLC
Through its Registered Agent:
Capitol Corporate Services, Inc.
206 E. 9th St., Suite 1300
Austin, Texas 78701

Via U.S. Certified Mail/RRR
Kinder Morgan Texas Pipeline LLC
Through its Registered Agent
Capitol Corporate Services, Inc.
206 E. 9th St., Suite 1300
Austin, Texas 78701

Via U.S. Certified Mail/RRR
Andrew Wheeler, Administrator Environmental Protection Agency
William J. Clinton Bld., Mail Code 1101A
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Via U.S. Certified Mail/RRR
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Via U.S. Certified Mail/RRR
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Environmental Protection Agency, Region 6
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Via U.S. Certified Mail/RRR
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Ryan D. McCarthy
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Washington D. C. 20310-0101

Via U.S. Certified Mail/RRR
Col. Kenneth N. Reed
U.S. Army Corp of Engineers
Fort Worth District
819 Taylor Street
Fort Worth, Texas 76102

AMC GEL

AMC

Chemwatch Hazard Alert Code: **3**

Chemwatch: **42071**
Version No: **11.1.1.1**
Safety Data Sheet according to WHS and ADG requirements

Issue Date: **07/07/2017**
Print Date: **02/02/2018**
L.GHS.AUS.EN

SECTION 1 IDENTIFICATION OF THE SUBSTANCE / MIXTURE AND OF THE COMPANY / UNDERTAKING

Product Identifier

Product name	AMC GEL
Other means of identification	Not Available

Relevant identified uses of the substance or mixture and uses advised against

Relevant identified uses	Drilling fluid compound; viscosifier.

Details of the supplier of the safety data sheet

Registered company name	**AMC**
Address	216 Balcatta Rd Balcatta WA 6021 Australia
Telephone	+61 8 9445 4000
Fax	+61 8 9445 4040
Website	www.amcmud.com
Email	amc@imdexlimited.com

Emergency telephone number

Association / Organisation	**Not Available**
Emergency telephone numbers	1800 039 008 or +61 3 9573 3112,+800 2436 2255 +613 9573 3112
Other emergency telephone numbers	Not Available

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture

HAZARDOUS CHEMICAL. NON-DANGEROUS GOODS. According to the WHS Regulations and the ADG Code.

CHEMWATCH HAZARD RATINGS

	Min	Max
Flammability	0	
Toxicity	1	
Body Contact	0	
Reactivity	0	
Chronic	3	

0 = Minimum
1 = Low
2 = Moderate
3 = High
4 = Extreme

Poisons Schedule	Not Applicable
Classification [1]	Carcinogenicity Category 1A, Specific target organ toxicity - repeated exposure Category 1
Legend:	*1. Classified by Chemwatch; 2. Classification drawn from HSIS ; 3. Classification drawn from EC Directive 1272/2008 - Annex VI*

Label elements

Hazard pictogram(s)	
SIGNAL WORD	DANGER

Hazard statement(s)

H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.

Precautionary statement(s) Prevention

P201	Obtain special instructions before use.
P260	Do not breathe dust/fume/gas/mist/vapours/spray.

Precautionary statement(s) Response

P308+P313	IF exposed or concerned: Get medical advice/attention.
P314	Get medical advice/attention if you feel unwell.

Precautionary statement(s) Storage

P405	Store locked up.

Precautionary statement(s) Disposal

P501	Dispose of contents/container in accordance with local regulations.

SECTION 3 COMPOSITION / INFORMATION ON INGREDIENTS

Substances

See section below for composition of Mixtures

Mixtures

CAS No	%[weight]	Name
1302-78-9	>94	bentonite
9003-05-8	<0.5	acrylamide homopolymer
497-19-8	<0.5	sodium carbonate
14808-60-7	1-6	silica crystalline - quartz

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye Contact	If this product comes in contact with the eyes: • Wash out immediately with fresh running water. • Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids. • Seek medical attention without delay; if pain persists or recurs seek medical attention. • Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact	If skin or hair contact occurs: • Flush skin and hair with running water (and soap if available). • Seek medical attention in event of irritation.
Inhalation	• If fumes or combustion products are inhaled remove from contaminated area. • Lay patient down. Keep warm and rested. • Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures. • Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask device, or pocket mask as trained. Perform CPR if necessary. • Transport to hospital, or doctor. • If dust is inhaled, remove from contaminated area. • Encourage patient to blow nose to ensure clear breathing passages.

	▸ Ask patient to rinse mouth with water but to not drink water. ▸ Seek immediate medical attention.
Ingestion	▸ Immediately give a glass of water. ▸ First aid is not generally required. If in doubt, contact a Poisons Information Centre or a doctor.

Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5 FIREFIGHTING MEASURES

Extinguishing media

- There is no restriction on the type of extinguisher which may be used.
- Use extinguishing media suitable for surrounding area.

Special hazards arising from the substrate or mixture

Fire Incompatibility	None known.

Advice for firefighters

Fire Fighting	▸ Alert Fire Brigade and tell them location and nature of hazard. ▸ Wear breathing apparatus plus protective gloves in the event of a fire.
Fire/Explosion Hazard	▸ Non combustible. ▸ Not considered a significant fire risk, however containers may burn.
HAZCHEM	Not Applicable

SECTION 6 ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

See section 8

Environmental precautions

See section 12

Methods and material for containment and cleaning up

Minor Spills	▸ Clean up waste regularly and abnormal spills immediately. ▸ Avoid breathing dust and contact with skin and eyes.
Major Spills	▸ Clear area of personnel and move upwind. ▸ Alert Fire Brigade and tell them location and nature of hazard.

Personal Protective Equipment advice is contained in Section 8 of the SDS.

SECTION 7 HANDLING AND STORAGE

Precautions for safe handling

Safe handling	▸ Avoid all personal contact, including inhalation. ▸ Wear protective clothing when risk of exposure occurs.
Other information	▸ Store in original containers. ▸ Keep containers securely sealed.

Conditions for safe storage, including any incompatibilities

Suitable container	▸ Polyethylene or polypropylene container. ▸ Check all containers are clearly labelled and free from leaks.
Storage incompatibility	Silicas: ▸ react with hydrofluoric acid to produce silicon tetrafluoride gas ▸ react with xenon hexafluoride to produce explosive xenon trioxide ▸ reacts exothermically with oxygen difluoride, and explosively with chlorine trifluoride (these halogenated materials are not commonplace industrial materials) and other fluorine-containing compounds ▸ may react with fluorine, chlorates ▸ are incompatible with strong oxidisers, manganese trioxide, chlorine trioxide, strong alkalis, metal oxides, concentrated orthophosphoric acid, vinyl acetate ▸ may react vigorously when heated with alkali carbonates.

SECTION 8 EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

OCCUPATIONAL EXPOSURE LIMITS (OEL)

INGREDIENT DATA

Source	Ingredient	Material name	TWA	STEL	Peak	Notes
Australia Exposure Standards	silica crystalline - quartz	Silica - Crystalline	Not Available	Not Available	Not Available	Not Available
Australia Exposure Standards	silica crystalline - quartz	Quartz (respirable dust)	0.1 mg/m3	Not Available	Not Available	Not Available
Australia Exposure Standards	silica crystalline - quartz	Quartz (respirable dust)	0.1 mg/m3	Not Available	Not Available	Not Available

EMERGENCY LIMITS

Ingredient	Material name	TEEL-1	TEEL-2	TEEL-3
bentonite	Montmorillonite	30 mg/m3	330 mg/m3	2,000 mg/m3
sodium carbonate	Sodium carbonate	7.6 mg/m3	83 mg/m3	500 mg/m3
silica crystalline - quartz	Silica, crystalline-quartz; (Silicon dioxide)	0.075 mg/m3	33 mg/m3	200 mg/m3

Ingredient	Original IDLH	Revised IDLH
bentonite	Not Available	Not Available
acrylamide homopolymer	Not Available	Not Available
sodium carbonate	Not Available	Not Available
silica crystalline - quartz	Not Available	Not Available

MATERIAL DATA

Exposure controls

Appropriate engineering controls	Engineering controls are used to remove a hazard or place a barrier between the worker and the hazard. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.
Personal protection	
Eye and face protection	▸ Safety glasses with side shields ▸ Chemical goggles. ▸ Contact lenses may pose a special hazard; soft contact lenses may absorb and concentrate irritants.
Skin protection	See Hand protection below
Hands/feet protection	The selection of suitable gloves does not only depend on the material, but also on further marks of quality which vary from manufacturer to manufacturer. Where the chemical is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application. Experience indicates that the following polymers are suitable as glove materials for protection against undissolved, dry solids, where abrasive particles are not present. ▸ polychloroprene.
Body protection	See Other protection below
Other protection	▸ Employees working with confirmed human carcinogens should be provided with, and be required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area. [AS/NZS ISO 6529:2006 or national equivalent] ▸ Employees engaged in handling operations involving carcinogens should be provided with, and required to wear and use half-face filter-type respirators with filters for dusts, mists and fumes, or air purifying canisters or cartridges. ▸ Prior to each exit from an area containing confirmed human carcinogens, employees should be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers must be identified with suitable labels. ▸ Overalls. ▸ P.V.C.
Thermal hazards	Not Available

Recommended material(s)

GLOVE SELECTION INDEX

Glove selection is based on a modified presentation of the:
"Forsberg Clothing Performance Index".
The effect(s) of the following substance(s) are taken into account in the ***computer-generated*** selection:
AMC GEL

Material	CPI
NATURAL RUBBER	C
NITRILE	C

* CPI - Chemwatch Performance Index
A: Best Selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to Dangerous Choice for other than short term immersion
NOTE: As a series of factors will influence the actual performance of the glove, a final selection must be based on detailed observation. -
* Where the glove is to be used on a short term, casual or infrequent basis, factors such as "feel" or convenience (e.g. disposability), may dictate a choice of gloves which might otherwise be unsuitable following long-term or frequent use. A qualified practitioner should be consulted.

Respiratory protection

Particulate. (AS/NZS 1716 & 1715, EN 143:2000 & 149:001, ANSI Z88 or national equivalent)

If inhalation risk above the TLV exists, wear approved dust respirator.
Use respirators with protection factors appropriate for the exposure level.

- Up to 5 X TLV, use valveless mask type; up to 10 X TLV, use 1/2 mask dust respirator
- Up to 50 X TLV, use full face dust respirator or demand type C air supplied respirator
- Up to 500 X TLV, use powered air-purifying dust respirator or a Type C pressure demand supplied-air respirator
- Over 500 X TLV wear full-face self-contained breathing apparatus with positive pressure mode or a combination respirator with a Type C positive pressure supplied-air full-face respirator and an auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode
- Respirators may be necessary when engineering and administrative controls do not adequately prevent exposures.
- The decision to use respiratory protection should be based on professional judgment that takes into account toxicity information, exposure measurement data, and frequency and likelihood of the worker's exposure - ensure users are not subject to high thermal loads which may result in heat stress or distress due to personal protective equipment (powered, positive flow, full face apparatus may be an option).
- Published occupational exposure limits, where they exist, will assist in determining the adequacy of the selected respiratory protection. These may be government mandated or vendor recommended.
- Certified respirators will be useful for protecting workers from inhalation of particulates when properly selected and fit tested as part of a complete respiratory protection program.
- Use approved positive flow mask if significant quantities of dust becomes airborne.
- Try to avoid creating dust conditions.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Bentonite clay (powder) varying in colour from grey to various shades of brown, insoluble in water.

Physical state	Divided Solid	**Relative density (Water = 1)**	Not Available
Odour	Not Available	**Partition coefficient n-octanol / water**	Not Available
Odour threshold	Not Available	**Auto-ignition temperature (°C)**	Not Applicable
pH (as supplied)	Not Applicable	**Decomposition temperature**	Not Available
Melting point / freezing point (°C)	Not Available	**Viscosity (cSt)**	Not Applicable
Initial boiling point and boiling range (°C)	Not Available	**Molecular weight (g/mol)**	Not Applicable
Flash point (°C)	Not Applicable	**Taste**	Not Available
Evaporation rate	Not Applicable	**Explosive properties**	Not Available
Flammability	Not Applicable	**Oxidising properties**	Not Available
Upper Explosive Limit (%)	Not Applicable	**Surface Tension (dyn/cm or mN/m)**	Not Applicable
Lower Explosive Limit (%)	Not Applicable	**Volatile Component (%vol)**	Not Applicable
Vapour pressure (kPa)	Not Applicable	**Gas group**	Not Available
Solubility in water (g/L)	Immiscible	**pH as a solution (1%)**	Not Applicable
Vapour density (Air = 1)	Not Applicable	**VOC g/L**	Not Available

SECTION 10 STABILITY AND REACTIVITY

Reactivity	See section 7
Chemical stability	▸ Unstable in the presence of incompatible materials. ▸ Product is considered stable.
Possibility of hazardous reactions	See section 7
Conditions to avoid	See section 7
Incompatible materials	See section 7
Hazardous decomposition products	See section 5

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Inhaled	Inhalation of dusts, generated by the material during the course of normal handling, may be damaging to the health of the individual. Effects on lungs are significantly enhanced in the presence of respirable particles. Overexposure to respirable dust may produce wheezing, coughing and breathing difficulties leading to or symptomatic of impaired respiratory function.
Ingestion	The material has NOT been classified by EC Directives or other classification systems as "harmful by ingestion". This is because of the lack of corroborating animal or human evidence.
Skin Contact	The material is not thought to produce adverse health effects or skin irritation following contact (as classified by EC Directives using animal models). Nevertheless, good hygiene practice requires that exposure be kept to a minimum and that suitable gloves be used in an occupational setting. Open cuts, abraded or irritated skin should not be exposed to this material
Eye	Although the material is not thought to be an irritant (as classified by EC Directives), direct contact with the eye may cause transient discomfort characterised by tearing or conjunctival redness (as with windburn). Slight abrasive damage may also result.
Chronic	On the basis of epidemiological data, the material is regarded as carcinogenic to humans. There is sufficient data to establish a causal association between human exposure to the material and the development of cancer. Toxic: danger of serious damage to health by prolonged exposure through inhalation. The health hazards associated with bentonite, kaolin, and common clay, which are commercially important clay products, as well as the related phyllosilicate minerals montmorillonite, kaolinite, and illite, have an extensive literature. Fibrous clay minerals, such as sepiolite, attapulgite, and zeolites, have a separate literature. Chronic symptoms produced by crystalline silicas included decreased vital lung capacity and chest infections. Lengthy exposure may cause silicosis a disabling form of pneumoconiosis which may lead to fibrosis, a scarring of the lining of the air sacs in the lung. Overexposure to respirable dust may cause coughing, wheezing, difficulty in breathing and impaired lung function. Chronic symptoms may include decreased vital lung capacity, chest infections Repeated exposures, in an occupational setting, to high levels of fine- divided dusts may produce a condition known as pneumoconiosis which is the lodgement of any inhaled dusts in the lung irrespective of the effect.

	TOXICITY	IRRITATION
AMC GEL	Not Available	Not Available
bentonite	dermal (rat) LD50: >2000 mg/kg[1] Inhalation (rat) LC50: >50 mg/l1 h[1] Oral (rat) LD50: >2000 mg/kg[1] Oral (rat) LD50: >5000 mg/kg[1]	Not Available
acrylamide homopolymer	Inhalation (rat) LC50: 5.7125 mg/l/30M[2] Oral (rat) LD50: >2000 mg/kg[2]	Eye: slight
sodium carbonate	dermal (rat) LD50: >2000 mg/kg[2] Inhalation (guinea pig) LC50: 0.4 mg/l/2h[2] Oral (rat) LD50: 2800 mg/kg[2]	Eye (rabbit): 100 mg/24h moderate Eye (rabbit): 100 mg/30s mild Eye (rabbit): 50 mg SEVERE

		Skin (rabbit): 500 mg/24h mild
silica crystalline - quartz	TOXICITY Not Available	IRRITATION Not Available
Legend:	*1. Value obtained from Europe ECHA Registered Substances - Acute toxicity 2.* Value obtained from manufacturer's SDS. Unless otherwise specified data extracted from RTECS - Register of Toxic Effect of chemical Substances*	

BENTONITE	Asthma-like symptoms may continue for months or even years after exposure to the material ceases. This may be due to a non-allergenic condition known as reactive airways dysfunction syndrome (RADS) which can occur following exposure to high levels of highly irritating compound. No significant acute toxicological data identified in literature search. for bentonite clays: Bentonite (CAS No. 1302-78-9) consists of a group of clays formed by crystallisation of vitreous volcanic ashes that were deposited in water. The expected acute oral toxicity of bentonite in humans is very low (LD50>15 g/kg).
ACRYLAMIDE HOMOPOLYMER	Sensitisation (guiea pig): 0% (0/20) OECD 406
SILICA CRYSTALLINE - QUARTZ	**WARNING:** For inhalation exposure ONLY: This substance has been classified by the IARC as Group 1: **CARCINOGENIC TO HUMANS** The International Agency for Research on Cancer (IARC) has classified occupational exposures to **respirable** (<5 um) crystalline silica as being carcinogenic to humans . This classification is based on what IARC considered sufficient evidence from epidemiological studies of humans for the carcinogenicity of inhaled silica in the forms of quartz and cristobalite.

Acute Toxicity	⊘	**Carcinogenicity**	✔
Skin Irritation/Corrosion	⊘	**Reproductivity**	⊘
Serious Eye Damage/Irritation	⊘	**STOT - Single Exposure**	⊘
Respiratory or Skin sensitisation	⊘	**STOT - Repeated Exposure**	✔
Mutagenicity	⊘	**Aspiration Hazard**	⊘

Legend: ✘ *– Data available but does not fill the criteria for classification*
✔ *– Data available to make classification*
⊘ *– Data Not Available to make classification*

SECTION 12 ECOLOGICAL INFORMATION

Toxicity

	ENDPOINT	TEST DURATION (HR)	SPECIES	VALUE	SOURCE
AMC GEL	Not Available	Not Available	Not Available	Not Available	Not Available
bentonite	LC50	96	Fish	19000mg/L	4
acrylamide homopolymer	Not Available	Not Available	Not Available	Not Available	Not Available
sodium carbonate	LC50	96	Fish	300mg/L	4
	EC50	48	Crustacea	=176mg/L	1
	EC50	96	Algae or other aquatic plants	242mg/L	4
	NOEC	16	Crustacea	424mg/L	4
silica crystalline - quartz	Not Available	Not Available	Not Available	Not Available	Not Available

Legend:	*Extracted from 1. IUCLID Toxicity Data 2. Europe ECHA Registered Substances - Ecotoxicological Information - Aquatic Toxicity 3. EPIWIN Suite V3.12 (QSAR) - Aquatic Toxicity Data (Estimated) 4. US EPA, Ecotox database - Aquatic Toxicity Data 5. ECETOC Aquatic Hazard Assessment Data 6. NITE (Japan) - Bioconcentration Data 7. METI (Japan) - Bioconcentration Data 8. Vendor Data*

DO NOT discharge into sewer or waterways.
May be harmful to fauna if not disposed of according to Section 13 and legislative requirements. [AMC]

Persistence and degradability

Ingredient	Persistence: Water/Soil	Persistence: Air
acrylamide homopolymer	LOW	LOW
sodium carbonate	LOW	LOW

Bioaccumulative potential

Ingredient	Bioaccumulation
acrylamide homopolymer	LOW (LogKOW = -0.8074)
sodium carbonate	LOW (LogKOW = -0.4605)

Mobility in soil

Ingredient	Mobility
acrylamide homopolymer	LOW (KOC = 10.46)
sodium carbonate	HIGH (KOC = 1)

SECTION 13 DISPOSAL CONSIDERATIONS

Waste treatment methods

Product / Packaging disposal	Legislation addressing waste disposal requirements may differ by country, state and/ or territory. Each user must refer to laws operating in their area. ▸ DO NOT allow wash water from cleaning or process equipment to enter drains. ▸ It may be necessary to collect all wash water for treatment before disposal. ▸ Recycle wherever possible or consult manufacturer for recycling options. ▸ Consult State Land Waste Management Authority for disposal.

SECTION 14 TRANSPORT INFORMATION

Labels Required

Marine Pollutant	NO
HAZCHEM	Not Applicable

Land transport (ADG): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Air transport (ICAO-IATA / DGR): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Sea transport (IMDG-Code / GGVSee): NOT REGULATED FOR TRANSPORT OF DANGEROUS GOODS

Transport in bulk according to Annex II of MARPOL and the IBC code

Not Applicable

SECTION 15 REGULATORY INFORMATION

Safety, health and environmental regulations / legislation specific for the substance or mixture

BENTONITE(1302-78-9) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

ACRYLAMIDE HOMOPOLYMER(9003-05-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Inventory of Chemical Substances (AICS)

SODIUM CARBONATE(497-19-8) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Hazardous Substances Information System - Consolidated Lists
Australia Inventory of Chemical Substances (AICS)

SILICA CRYSTALLINE - QUARTZ(14808-60-7) IS FOUND ON THE FOLLOWING REGULATORY LISTS

Australia Exposure Standards
Australia Hazardous Substances Information System - Consolidated Lists
Australia Inventory of Chemical Substances (AICS)
International Agency for Research on Cancer (IARC) - Agents Classified by the IARC Monographs

National Inventory	Status
Australia - AICS	Y
Canada - DSL	Y
Canada - NDSL	N (bentonite; silica crystalline - quartz; acrylamide homopolymer; sodium carbonate)
China - IECSC	N (acrylamide homopolymer)
Europe - EINEC / ELINCS / NLP	N (acrylamide homopolymer)
Japan - ENCS	N (bentonite)
Korea - KECI	Y
New Zealand - NZIoC	Y
Philippines - PICCS	Y
USA - TSCA	Y
Legend:	*Y = All ingredients are on the inventory* *N = Not determined or one or more ingredients are not on the inventory and are not exempt from listing(see specific ingredients in brackets)*

SECTION 16 OTHER INFORMATION

Other information

Ingredients with multiple cas numbers

Name	CAS No
bentonite	1302-78-9, 11004-12-9, 10043-07-9, 115628-71-2, 12198-92-4, 12199-69-8, 135945-01-6, 37320-72-2, 52623-66-2, 850872-77-4, 67479-91-8, 89382-86-5, 90989-60-9, 85049-30-5, 97862-66-3, 84776-12-5, 70131-50-9, 90989-59-6
sodium carbonate	497-19-8, 7542-12-3, 1314087-39-2, 1332-57-6
silica crystalline - quartz	14808-60-7, 122304-48-7, 122304-49-8, 12425-26-2, 1317-79-9, 70594-95-5, 87347-84-0, 308075-07-2

Classification of the preparation and its individual components has drawn on official and authoritative sources as well as independent review by the Chemwatch Classification committee using available literature references.

The SDS is a Hazard Communication tool and should be used to assist in the Risk Assessment. Many factors determine whether the reported Hazards are Risks in the workplace or other settings.

Definitions and abbreviations

PC—TWA: Permissible Concentration-Time Weighted Average
PC—STEL: Permissible Concentration-Short Term Exposure Limit
IARC: International Agency for Research on Cancer
ACGIH: American Conference of Governmental Industrial Hygienists
STEL: Short Term Exposure Limit
TEEL: Temporary Emergency Exposure Limit。
IDLH: Immediately Dangerous to Life or Health Concentrations
OSF: Odour Safety Factor
NOAEL :No Observed Adverse Effect Level
LOAEL: Lowest Observed Adverse Effect Level
TLV: Threshold Limit Value
LOD: Limit Of Detection
OTV: Odour Threshold Value
BCF: BioConcentration Factors
BEI: Biological Exposure Index

Article

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Effects of bentonite nanoparticles inhalation on lung tissue and blood antioxidant indices in a rat model

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Abstract

Bentonite is an inorganic clay material that is often easily dispersed as fine particles by air and water circulation, and most people are exposed to different concentrations of bentonite particles. Therefore, the inhaled effects of bentonite nanoparticles (BNPs) were studied in Wistar rats. Seventy-five rats were divided into five groups of 15: four exposure groups (0.1, 0.5, 2, and 10 mg/m^3 of BNPs) and one control group. The rats were exposed for 30, 60, and 90 days to BNPs for 5 days a week (6 h/day) in whole-body inhalation chambers. Blood samples were collected to measure the levels of antioxidant activity of the contents such as total antioxidant capacity (TAC) and malondialdehyde (MDA). X-ray diffraction and scanning electron microscopy were used to identify nanoparticles. The results showed no significant difference in the effect of nanoparticles on levels of TAC and MDA in the studied groups based on the concentrations of nanoparticles. However, the level of MDA increased significantly with extending exposure time; there was a significant increase in the level of MDA content 90 days postexposure compared to 30 days postexposure at concentrations of 0.5, 2, and 10 mg/m^3. Histopathological examination showed that inhalation exposure of rats to BNPs led to different histopathologic responses in the lung tissue, such as inflammatory infiltration, granulomatous inflammation, acute neutrophilic reaction in the early stages, and lung fibrosis. At the lowest concentration, BNPs have low or no toxicity, and inhalation of these nanoparticles at low concentrations does not affect the levels of MDA and TAC content. However, increased concentration and exposure time caused correspondingly greater increases in MDA and more damage to lung tissue.

Keywords

Inhalation exposure, bentonite nanoparticles, lung tissue, malondialdehyde, total antioxidant capacity

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Introduction

Nowadays, with the development of science and technology, various materials are used for industrial and consumer products. These materials may have beneficial or harmful effects on human health and living organisms. With the expansion of nanotechnology industrialization, the use of nanoparticles has also increased in modern technologies (Kumar Teli et al., 2010; Whitesides, 2005).

Clay nanoparticles are natural substances that belong to the family of crystalline calcareous

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minerals. Bentonite nanoparticles (BNPs) are also a kind of smectic nanocomposite. They have tetrahedral and octahedral aluminosilicate sheets (Abdou et al., 2013; Banat et al., 2000; Bereket et al., 1997). In recent years, these nanoparticles are used extensively in various industries including electronics, agriculture, food packaging, clothing, pharmaceuticals, cosmetics, sports equipment, medicine, and drug delivery and water purification as hydrocarbon adsorbents (Sirait et al., 2017; Verma et al., 2012). Studies show that millions of tons of bentonite, montmorillonite, and kaolin nanoparticles are used in the ceramic industry (Kryuchkova et al., 2016). The penetration of nanomaterials into various intracellular and extracellular portions, such as the epithelium and mesothelioma cells, is confirmed using electron microscopy (Elsaesser and Howard, 2012). There are certain systems in the body that deal with the damage caused by reactive oxygen species (ROS), which are known as the oxidant defense system. These antioxidant systems are called total antioxidant capacity (TAC). The antioxidant system can prevent the production of ROS, repair the damages caused by radical activity, increase the excretion of damaged molecules, and minimize cell mutations caused by damage from free radicals (Cochranc, 1997; Halliwell and Gutteridge, 1990; Sies, 1993; Uttara et al., 2009; Valko et al., 2006; Wu et al., 2006). Malondialdehyde (MDA) is one of the most important determinants of lipid peroxidation and can be used as a marker to measure oxidative stress levels (Lykkesfeldt, 2007).

Exposure to factors such as environmental pollutants, particles and nanoparticles, drugs, toxins, anesthetic gases, and different rays causes a state called oxidative stress, which can be the basis for more than 100 types of illnesses (Juranek and Bezek, 2005; Malekirad et al., 2005a, 2005b). Nanomaterials, including nanoclay particles such as BNPs, can have unwanted effects on human health (Warheit et al., 2010). Because of the lack of information on the effect of nanoparticles special BNPs on health, this study investigated the effects of BNPs concentration and exposure time on lung damage and levels of antioxidant contents (MDA and TAC) in Wistar rats.

Materials and methods

Bentonite nanoparticles

Pale-yellow BNP powder was purchased from Sigma-Aldrich (Saint Louis, Missouri, USA). Table 1 presents the physiochemical properties of the nanoclays used in the present study. The characteristics of BNPs were determined using scanning electron microscopy (SEM) and X-ray diffraction (XRD) analyses. SEM is a powerful magnification instrument for studying the morphological structure of adsorbents, and XRD is a rapid analysis for identifying crystalline material and also for providing information on the dimensions of the nanoparticles (Mahmoud et al., 2016).

Table 1. The physiochemical properties of the nanoparticles used in the present study.

Characterization	Amount
Formula	$H_2Al_2O_6Si$
Appearance (form)	Powder
Bulk density	600–1100 kg/m^3
CAS no.	1302-78-9
Formula weight	180.1 g/mol

Animals and exposure intervals

Seventy-five male Wistar rats (mean body weight: 250 $\pm$ 20 g) were purchased from the Center for Empirical Medicine Research of Birjand, Iran University of Medical Sciences. The animals were approximately 8 weeks old. The rats were housed in polypropylene cages under standard maintenance conditions, including 12-h light and 12-h dark cycle, relative temperature of 22 $\pm$ 2°C, 40–60% humidity, and easy access to water (plastic bottle with screw lid) and complete food (standard food, Javaneh-Khorasan, Mashhad, Iran). The rats were randomly divided into 5 groups of 15 animals (4 exposure groups and 1 control group). The animals were exposed to 0.1, 0.5, 2, and 10 mg/m^3 concentrations of nanoparticles for 6 h/day, 5 days/week for 30, 60, and 90 days in whole-body inhalation chambers. The control group (unexposed) received fresh air during the same exposure period. Five rats from each group were randomly euthanized 30 days postexposure, five animals were euthanized 60 days postexposure, and five animals were euthanized 90 days postexposure (30, 60, and 90 days exposure, $n = 5$). This research project was approved at 2018 by the Ethical Committee of Birjand University of Medical Sciences with ethical coded: Ir.bums. REC. 1397.7.

Inhalation exposure

Seamless plastic dishes measuring 36 × 40 × 55 cm^3 were used to construct chambers equipped with three control valves to expose the rats to BNPs powder.

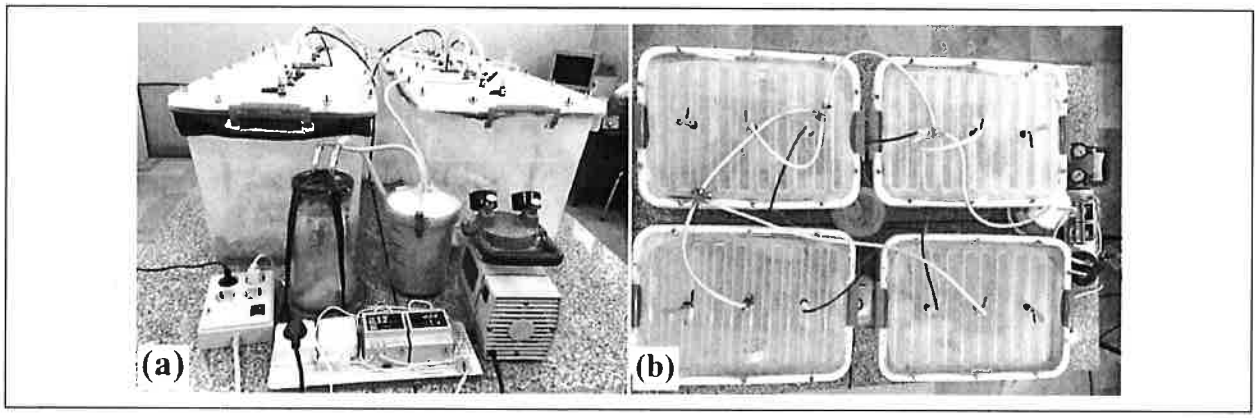

Figure 1. Exposure chambers. (a) Side view of air pump connection, dish containing nanoparticles, equalization, and control circuit. (b) Connection of the series of exposure chambers.

The dust flow was brought into the chambers by one of the valves, and by another valve, clean air entered the chambers. Another valve was used for sampling. The dust concentrations were made by an air pump (model GM-0.50 Diaphragm Vacuum Pump, Holliston, Massachusetts, USA) inside a dish containing BNPs powder. In order to equalize the dust flow, it was entered into an equalization dish and then led through the interface hoses into the chambers. Dust flow measurements inside the chambers were performed by an aerosol generation system (TSI Model 8520-dust track, flow rate = 0.001–100 mg/m^3, Shoreview, Minnesota, USA). The in vivo inhalation toxicity inhalation in this study was conducted according to the OECD testing guideline TG 413 (OECD, 2018). The concentration of the dust inside the chambers was adjusted with control valves. Figure 1 shows the chambers for nanoparticles exposure of the rats.

Oxidative stress assay

At this stage, 5 cc of heart blood samples were taken, and after centrifugation with the speed of 15,000 r/min for 20 min (Kubota, Model KN-70, Kyoto, Japan), their plasma was collected in microtube by sampler and stored in −20°C. TAC was measured using the ferric reduction of antioxidant power (FRAP) method. The basis of FRAP measurement is the reduction of ferric ions by reducing antioxidant activity in the presence of a representative of tripyridyl-s-triazine (TPTZ) resulting in a Fe^{2+}-TPTZ blue complex, which was measured in mmol/l by a spectrophotometer at the wavelength of 593 nm. Also, the amount of MDA was determined by adding 200 µl/ml of 67% thiobarbituric acid and 600 µl/ml of 1% phosphoric acid to 100 µl of sample. The sample was heated in a boiling water bath (90–100°C) for 45 min. Then, 800 µl of 1-butanol was added to samples, and after centrifugation (5000 r/min for 20 min), the absorbance was measured in µmol/l by an EPOCH (USA) spectrophotometer at the wavelength of 532 nm. Also, 1,1,3,3 tetraethoxypropane at different concentrations was used as MDA standard (Benzie and Strain, 1996; Kei, 1978; Uchiyama and Mihara, 1978).

Lung tissue assay

After the exposure periods, the rats were anesthetized using diethyl ether and euthanized humanely, and the lungs of the rats were carefully removed from the body. The lungs were fixed in 10% buffered formalin. Then, paraffin parasagital sections (5-µm thickness) were prepared and stained by hematoxylin–eosin for histological analysis. Finally, the samples were examined under a light microscope (40, 100, and 400×) (Olympus, Model CX31, Philippines).

Statistical analysis

SPSS software (version 22, IBM, Chicago, USA) was used to perform the statistical calculations. The data and results of the experiments were expressed as mean ± SD. Analysis of variance and multiple Duncan tests were used for statistical evaluation. *P*-value less than 0.05 was considered statistically significant.

Results

Characteristics of BNPs

SEM analysis. Figure 2 displays the morphological structure of BNPs used in this study as shown by SEM. As can be observed in the figure, BNPs are

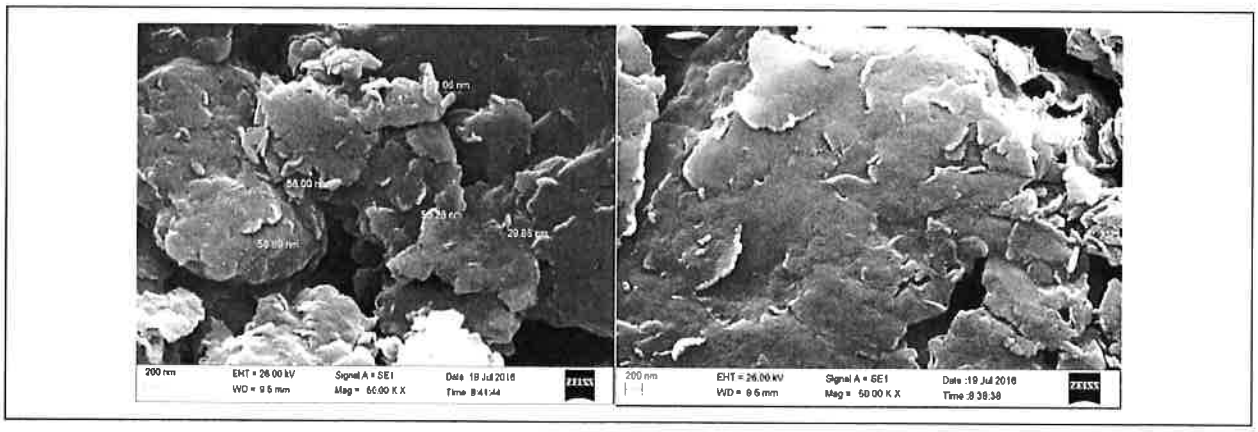

Figure 2. Scanning electron microscopic images of bentonite nanoparticles.

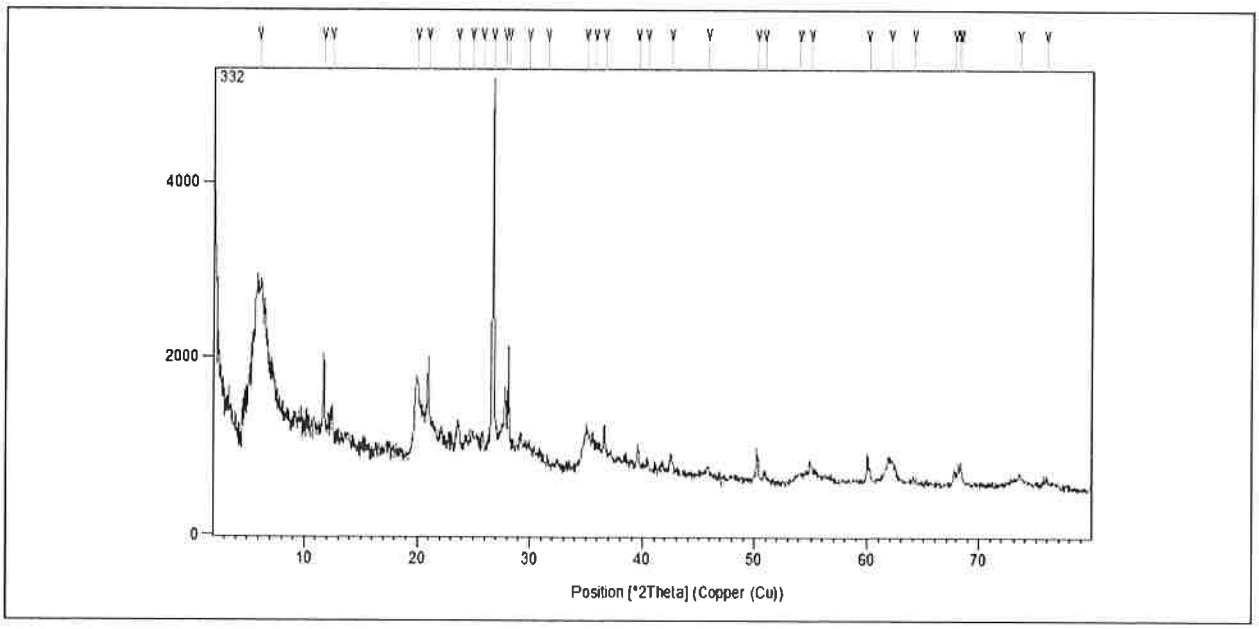

Figure 3. X-Ray powder diffraction pattern of the bentonite nanoparticles.

nanosheets that are arranged in layers. The thickness of each of the sheets is about 29–70 nm.

XRD analysis. The XRD analysis of BNPs is shown in Figure 3. As it is clear from the figure, the medium and sharp peaks of BNPs are $2\theta = 6.05°$ and $2\theta = 26.71°$, respectively. This is in accordance with the nanostructures of particles. To calculate the size of nanoparticles based on XRD spectrum graph data, the Debye–Scherrer equation (equation (1)) was used (Bhatia et al., 2017).

$$D = \frac{k\lambda}{\beta \cos\theta} \quad (1)$$

where D denotes diameter of particles, β shows peak width of the diffraction peak profile at half-maximum height resulting from small crystallite size (full width at half maximum), θ is angle of diffraction, and λ is equal to 1.54 Å.

The size of the nanoparticles was calculated to be 77.43 nm according to the calculations of the Scherrer equation.

Oxidative stress assay

The levels of TAC content 30, 60, and 90 days post-exposure are shown in Figure 4. The results of the effect of BNPs on the level of TAC content of male rats at 0.1, 0.5, 2, and 10 mg/m^3 concentrations of

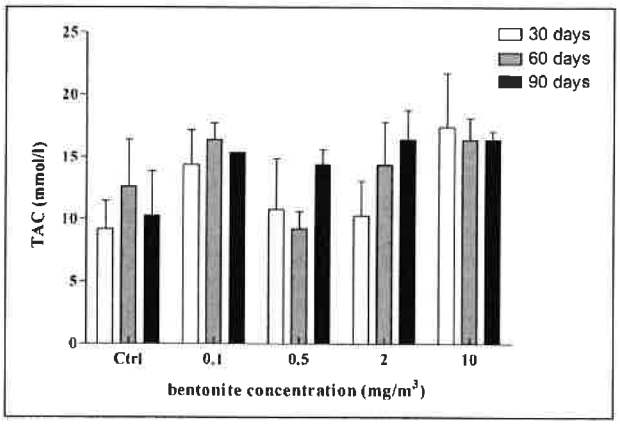

Figure 4. Levels of TAC content after inhalation exposure to bentonite nanoparticles. Values are mean ± SD of five animals/group. TAC: total antioxidant capacity; BNPs: bentonite nanoparticles.

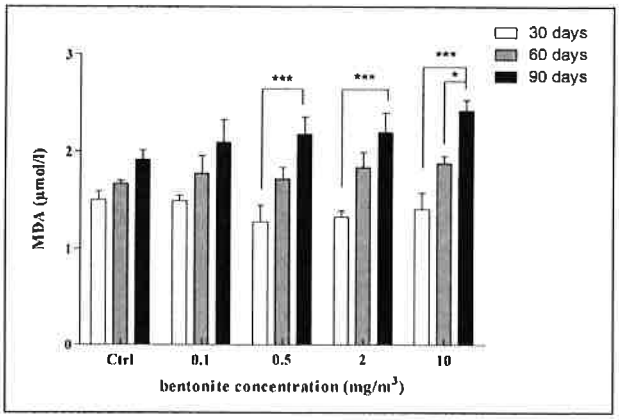

Figure 5. Levels of MDA content after inhalation exposure of bentonite nanoparticles. Values are mean ± SD of five animals/group. *$p < 0.05$; ***$p < 0.001$, versus same exposure concentration groups. MDA: malondialdehyde; BNPs: bentonite nanoparticles.

nanoparticles 30, 60, and 90 days postexposure showed that the level of TAC content had increased. However, no significant differences were observed in any exposure concentrations and groups ($p > 0.05$). Also, there was no significant difference in the levels of TAC content after the three postexposure times between the five study groups.

Comparison of the levels of MDA content between the inhaled BNPs exposure groups at concentrations of 0.1, 0.5, 2, and 10 mg/m^3 and the control group 30, 60, and 90 days postexposure is shown in Figure 5. There was no significant difference in the levels of MDA content between the five groups after 30, 60, and 90 days of inhalation exposure ($p > 0.05$). With regard to the level of MDA content based on the exposure times, there was a significant increase in the level of MDA content 90 days postexposure compared to 30 days postexposure at the concentrations of 0.5, 2, and 10 mg/m^3 ($p < 0.001$). Also, there was a significant difference in the level of MDA content in the group exposed to 10 mg/m^3 concentration of BNPs between 60 days and 90 days postexposure ($p = 0.002$).

Lung tissue assay

The histological effects of BNPs at the concentrations of 0.1, 0.5, 2, and 10 mg/m^3 inhaled for 30, 60, and 90 days on lung tissue of rats were investigated. The histopathological examinations showed that the inhalation exposure of rats to BNPs caused histopathological alterations in the lung tissues of the five groups such as inflammatory lesions, macrophage accumulation, acute neutrophilic reaction, granulomatous inflammation, and pulmonary fibrosis. Exposure in different groups increased the rate and severity of histopathological changes compared to the control group.

Figure 6 shows the accumulation of macrophages over different exposure times at the highest studied concentration of BNPs. Relatively low accumulation of macrophages was observed in the alveolar duct within 30 days postexposure (see Figure 6(b)). Sixty days postexposure, these changes were characterized by the accumulation of abundant macrophages inside and in the alveolar duct, and after 90 days of exposure, these changes were more pronounced (see Figure 6(c) and (d)).

Figure 7 presents granuloma formation in the 10 mg/m^3 concentration of BNPs at different exposure times. Granulomatous inflammation intensified with increased exposure time, such that 90 days postexposure, granulomatous inflammation was accompanied by an increase in alveolar septal thickening due to inflammation and fibrosis (see Figure 7(d)). Figure 8 exhibits the changes in pulmonary fibrosis in the 10 mg/m^3 concentration of bentonite nanoparticles over different times of exposure. Fibrosis was accompanied by an increase in the thickness of the alveolar septal wall, low lymphocytes infiltrations and macrophages in the alveolar duct within 30 days (see Figure 8(b)). Sixty days postexposure, moderate fibrosis in the alveolar duct was noted, which was more severe in some places (see Figure 8(c)). Ninety days postexposure, severe fibrosis in the alveolar duct, increased thickness of the alveolar septal wall, and the presence

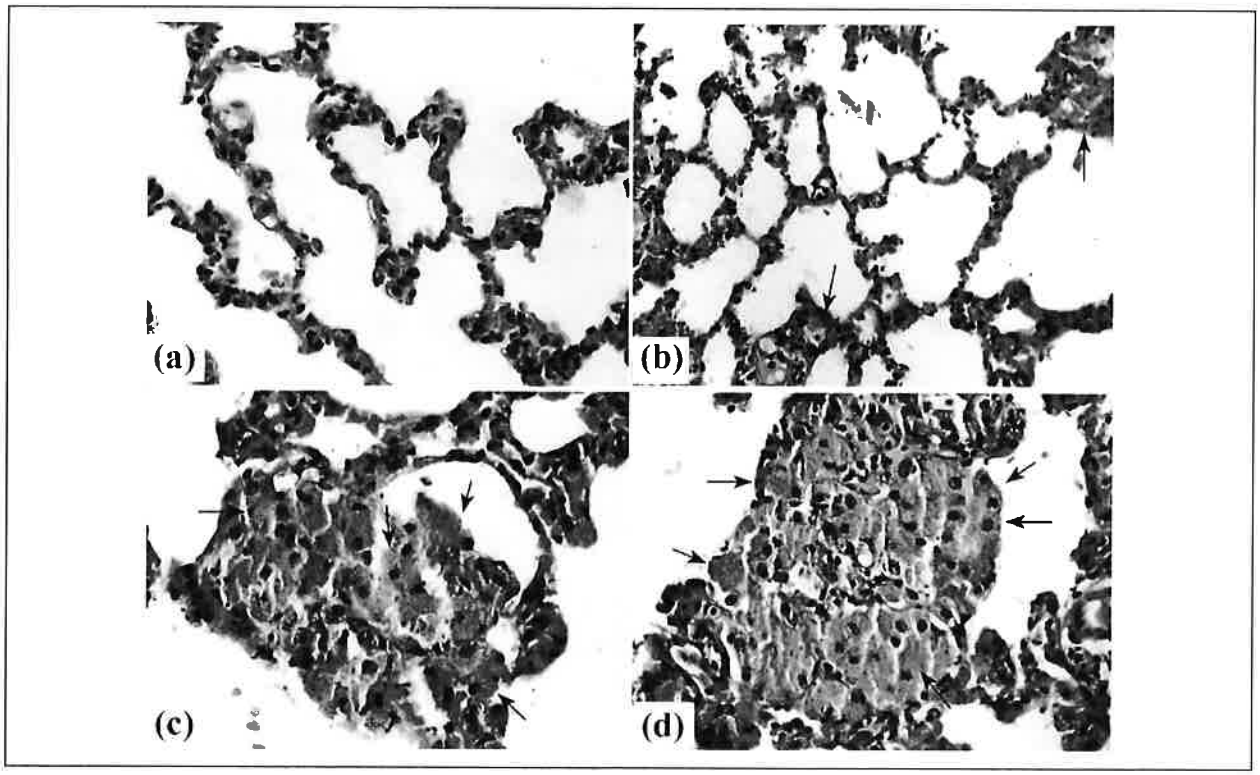

Figure 6. Macrophage accumulation (arrows). (a) Control group, (b) 30 days postexposure, the presence of a small number of macrophages in the inside and the alveolar duct, (c) 60 days postexposure, the accumulation of macrophages was high and mainly in the alveolar region and a small amount in the alveolar duct, and (d) 90 days postexposure, many macrophages in the alveolar region and the alveolar duct (10 mg/m^3 of BNPs, H&E staining, ×400). BNPs: bentonite nanoparticles; H&E: hematoxylin–eosin.

of a small necrotic area were observed (see Figure 8(d)). Acute neutrophilic reactions were observed among the exposed groups 30 days postexposure. However, 60 and 90 days after exposure, acute neutrophilic reaction was not observed among the exposed groups. Figure 9 shows acute neutrophilic reaction in the 30-day exposure period at the highest concentration of BNPs. Neutrophils were a sign of reaction and were not observed in the samples obtained 60 and 90 days postexposure. Also, granulomatous inflammation in the lymph node of the lung tissue was detectable with foreign body giant cells (Figure 10).

Discussion

Because of the widespread (adverse) effect of nanoparticles especially long-term exposure on health, the effect of BNPs concentration and exposure time on levels of antioxidant contents (TAC and MDA) and lung damage in Wistar rats was investigated. According to Figures 2 and 3 and also the Scherrer equation, the BNPs are nanosheets of less than 100-nm thickness. Also two peaks in the XRD analysis ($2\theta = 6.05°$ and $2\theta = 26.71°$) are related to montmorillonite aluminum silicate and quartz peaks, respectively (Shahwan et al., 2010; Vieira et al., 2010).

According to Figure 4, BNPs did not affect the TAC level of rats at all concentrations and exposure times. However, MDA levels increased with extending exposure time, which was significant. There was a significant increase in the level of MDA content 90 days postexposure compared to 30 days postexposure at concentrations of 0.5, 2, and 10 mg/m^3 and a significant difference in the exposure group at 10 mg/m^3 concentration of BNPs between 60 days and 90 days postexposure indicating increased oxidative stress. In a study conducted by Kryuchkova et al. (2016) on the effect of clay nanoparticles on *Paramecium caudatum*, the results showed that 10 mg/ml of clay nanoparticles had no significant effect on levels of MDA during 24 h (increase of 3–6%). They also reported that these nanoparticles had low or no toxicity at the considered concentration and did not change the

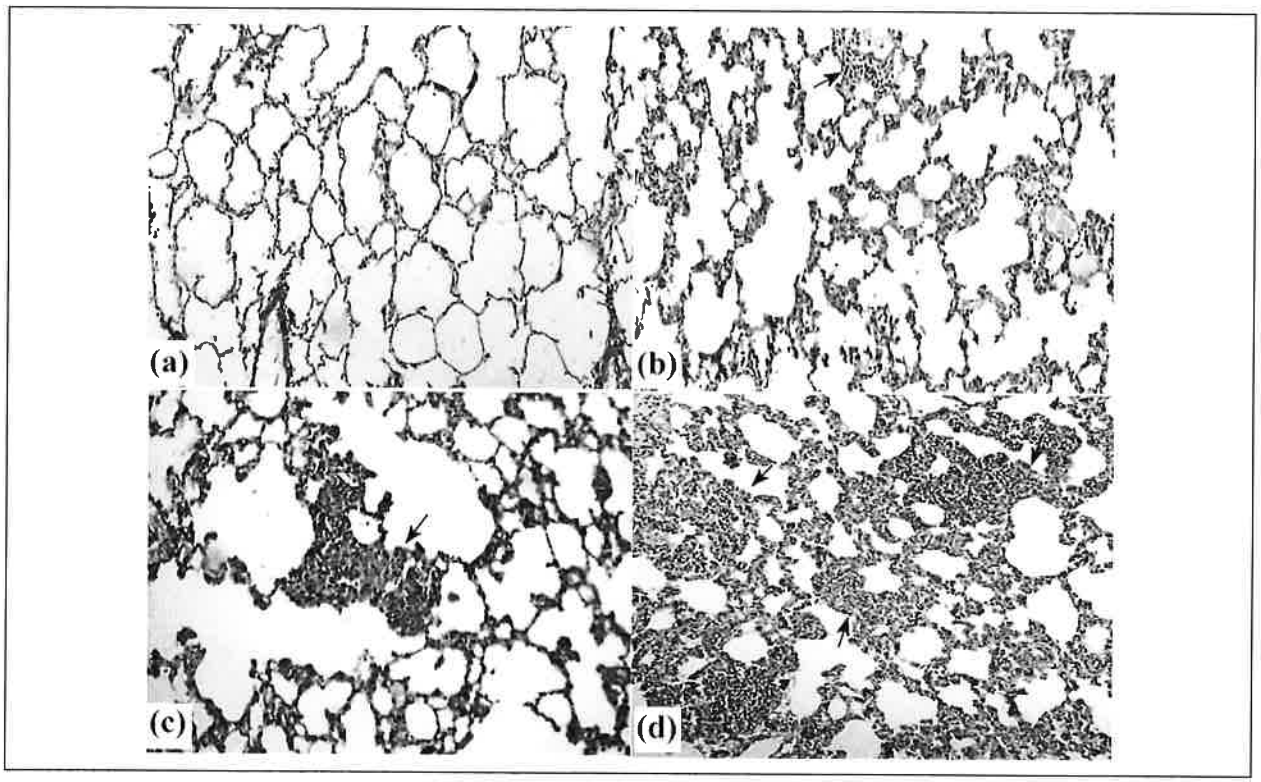

Figure 7. Granuloma formation (arrows). (a) Control group, (b) 30 days postexposure, primary granuloma reaction, (c) 60 days postexposure, granulomatous inflammation in the central region and scattered macrophage accumulation, and (d) 90 days postexposure, there was granulomatous inflammation, along with an increase in the thickness of the alveolar septal wall and fibrosis (10 mg/m^3 of BNPs, H&E staining, ×100). BNPs: bentonite nanoparticles; H&E: hematoxylin–eosin.

oxidative stress level (Kryuchkova et al., 2016). Regarding a study conducted by Maisanaba et al. (2014) on the effect of clay mineral nanoparticles on antioxidant enzymes of male Wistar rats with 40 mg/kg/day oral exposure, it was reported that clay nanoparticles had no effect on the levels of MDA in the liver and kidneys. As a result, these nanoparticles did not play a role in changing levels of oxidative stress (Maisanaba et al., 2014). In another similar study by Shi et al. (2006), it was found that oral exposure to montmorillonite nanocomposite had no effect on the levels of superoxide dismutase, glutathione peroxidase, and MDA parameters of the liver and blood serum of broiler chickens (Shi et al., 2006). In a study performed by Zhang et al. (2010), the toxicity and oxidative stress caused by two types of bentonite particles in human B lymphoblast cells at concentrations of 30, 60, 120, and 240 μg/ml were investigated in vitro for 6 h. The results showed that increased concentration of bentonites particle enhanced cytotoxic effects and oxidative stress in human B lymphoblastic cells (Zhang et al., 2010).

Some of studies have attributed the effect of nanoparticles on living organism cells to characteristics such as the diameter, shape, size, and nature of nanoparticles (Carretero et al., 2013; Moudgil and Roberts, 2001). Many minerals can be beneficial or toxic depending on the dose or exposure time (Gomes and Silva, 2007). Also, studies on BNPs confirm that increased dosage and exposure times of nanoparticles may have negative effects on health (Carretero et al., 2013). In another study conducted by Yuwen et al. (2013), the inhalation effects of BNPs on genetic damage and lipid peroxidation were investigated. The results showed that over exposure to these mineral substances could lead to detectable genetic damages and lipid peroxidation, which may be affected by exposure to various concentrations of organic BNPs (Huang et al., 2013). However, other studies on the effect of bentonite showed that these particles are not toxic to humans, and this mineral has been approved as a food additive in different countries such as Australia (Maisanaba et al., 2015).

In the present study, after necropsy and study of histopathologic changes in the lung tissue of the rats

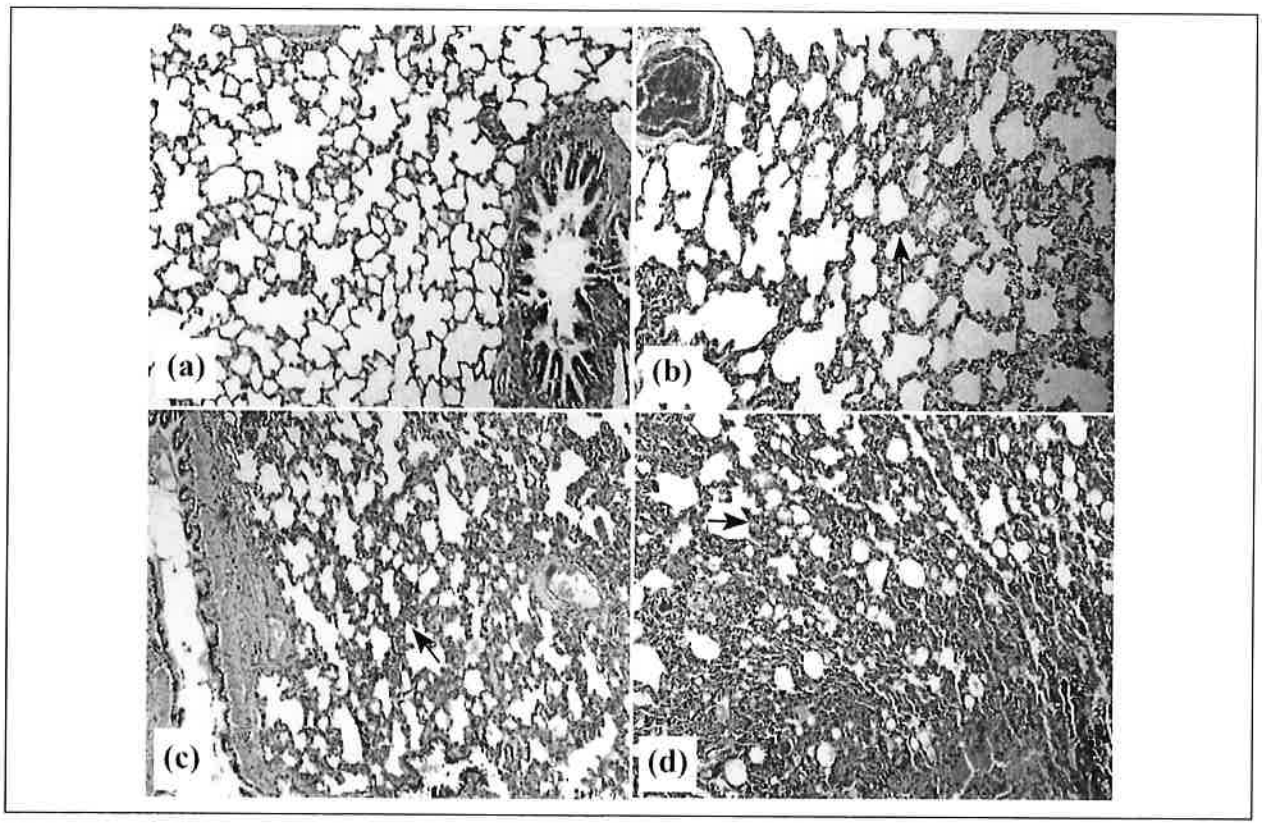

Figure 8. Pulmonary fibrosis (arrows). (a) Control group, (b) 30 days postexposure, fibrosis and increased thickness in the alveolar duct and low infiltration of lymphocytes and macrophages in the alveolar duct, (c) 60 days postexposure, the presence of moderate fibrosis in the alveolar duct which is more severe in some places, and (d) 90 days postexposure, severe fibrosis in the alveolar duct, increased thickening in the alveolar duct, and the presence of a small necrotic cavity (10 mg/m^3 of BNPs, H&E staining, ×40). BNPs: bentonite nanoparticles; H&E: hematoxylin–eosin.

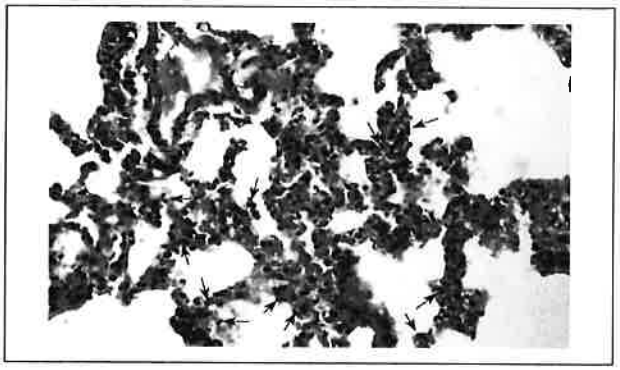

Figure 9. Acute neutrophilic reaction. Neutrophil infiltration (arrows) is observed in the alveolar duct (10 mg/m^3 of BNPs, 30 days postexposure, H&E staining, ×100). BNPs: bentonite nanoparticles; H&E: hematoxylin–eosin.

Figure 10. Granulomatous inflammation in the lymph node with foreign body giant cells (10 mg/m^3 of BNPs, 90 days postexposure, H&E staining, ×100). BNPs: bentonite nanoparticles; H&E: hematoxylin–eosin.

exposed to the inhalation of BNPs, it was shown that these nanoparticles caused different alternations. Also, the results of this study and its histological observations confirm that BNPs caused less tissue damage at low concentrations, while high concentrations of BNPs had a greater effect on lung tissue; in other words, the effect of BNPs on lung tissue was dose-dependent. The results also indicated that lung

damage in short-term exposure was mild, and with extending the duration of exposure, the severity and extend of damage to the lung increased. The histopathological examinations in this study showed that the inhalation exposure of rats to BNPs caused histopathological alterations such as inflammatory lesions, macrophage accumulation, acute neutrophilic reaction, granulomatous inflammation, and pulmonary fibrosis in the lung tissues. The adverse health effects of nanoparticles are increasingly dependent on their specific characteristics, including the composition of particles, electrostatic charge, and the reactivity associated with biological systems (Oberdörster et al., 2005; Powers et al., 2006).

Regarding to the results of the present study, pulmonary pathological changes depend on the concentration and duration of exposure to clay nanoparticles. Long-term exposure to BNPs can lead to pulmonary inflammation, fibrosis, pneumonia, and other diseases of the lung (Elmore, 2003; Maisanaba et al., 2015; Maxim et al., 2016). Other studies have also shown that inhalation of these nanoparticles results in pulmonary fibrosis, which can be transformed into lung cancer or mesothelioma (Carretero et al., 2013). These pathologic changes are similar to those of other mineral aluminosilicate nanoparticles, including montmorillonite, sepiolite, talc, and kaolin (Gibbs, 1990; Gibbs and Pooley, 1994). In a study conducted by Bolton et al. regarding the effects of inorganic silicate nanoparticles, dust exposure at a concentration of 10 mg/m^3 for 12 months on lung tissue showed that all groups exposed to nanoparticles had macrophages which containing dust throughout the alveolar regions of the lung are associated with an increase in the thickness of the alveolar septal wall and interstitial fibrosis (Bolton et al., 1986). The results of the study performed by Navin et al. on effects of clay nanoparticle toxicity on in vitro human epithelial A549 cells showed a small but significant level of cell cytotoxicity in A549 cells exposed to 25 µg/ml of BNPs, cloisite, and hydrophilic bentonite. Also, at higher concentrations, cell growth ability depended on exposure time and concentration with a maximum loss of cellular concentration at the highest concentration (250 µg/ml) (Verma et al., 2012). In a study by Gibbs and Pooley on the pathological examination of lung tissue, long-term exposure to montmorillonite mineral nanoparticles led to pneumoconiosis and interstitial collections of dust-laden macrophages with slight fibrosis (Gibbs and Pooley, 1994). In a study conducted by Warheit et al., histopathological evaluation of rat lung tissue showed that exposure to sepiolite nanoclays led to inflammation and lung damage after 24 h of exposure. Nanoparticles of sepiolite after 3 months of exposure also caused multinucleated giant cell accumulation, increased alveolar duct thickness, and increased lung changes (Warheit et al., 2010). Also, Gibbs et al. (1992) investigated the effect of talc mineral particles on lung tissue. They characterized the pathological characteristics of individuals exposed to the inhalation of talc and reported the accumulation of macrophages containing mineral nanoparticles, various degrees of fibrosis, along with giant cells (Gibbs et al., 1992). Research on the lung toxicity of kaolin inorganic nanoparticles in rats has shown that these nanoscale minerals can be fatal at very high concentrations (Zhu and Njuguna, 2014). Also, inhalation of kaolin nanoparticles by workers caused pulmonary fibrosis (Churg and Wiggs, 1985; Dougherty et al., 1985; Johnson et al., 1986). Animal studies assessing the potential toxicity of BNPs are relatively limited. However, the existing studies show that exposure to BNPs at high concentrations and prolonged exposures can directly or indirectly have adverse effects on the lungs (Maxim et al., 2016).

Conclusion

Inhalation of BNPs does not affect the levels of MDA and TAC at low concentrations. However, during long-term exposure and at higher concentrations, BNPs increase the level of MDA as a result of increased oxidative stress. Histological results showed that the absorption of BNPs causes different alternations including lung inflammation, macrophage accumulation, granuloma formation, acute neutrophilic reaction, and pulmonary fibrosis in exposed groups compared to the control group. By increasing the concentration and exposure time of BNPs, more severe damages to lung tissues can be observed. Given the toxicity of these nanomaterials to health, further studies are suggested to predict these nanoparticles on other tissues and body fluids at other concentrations and exposure times.

Authors' note

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