

Brief Overview of Oil and Gas Field Chemicals and Monitoring

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Contaminants from oil and gas development

Hazardous Materials in Coalbed Methane Fracturing Fluids

Chemical Type	Harmful Constituents	Potential Health Effects
Gelling Agents with diesel (hydrocarbon gel)	Benzene Ethyl Benzene M, O, P-Xylene Toluene Methyl Tert-Butyl Ether	Known cancer causing agent Probable cancer causing agent
Biocides	Polynuclear Aromatics and Polycyclic Organics	Both are probable cancer causing agents and possible cancer causing agent
Surfactants	Glycol Ether	
Clay Stabilizers	Methanol	
Crosslinkers	Formic Acid Ammonium Chloride Zirconium Nitrate and Sulfate	
Buffers	Acetic Acid	
Acidizing Treatment	Methanol	

Produced Water/Brine/Salt Water Drilling Muds Production Pit and Tank Sludges

May Contain:

- Volatile Organics (VOC) such as benzene, ethyl benzene, toluene, xylenes
- Polynuclear Aromatic Hydrocarbons (PAH)
- Heavy Metals such as arsenic, barium, cadmium, chromium, lead, mercury, selenium, vanadium, zinc
- Radioactivity such as RA 226 and RA 228

Natural Gas Dehydration

- is the removal of water vapor from natural gas (method: glycol dehydration)

WASTES:

- benzene air emissions
- contaminated water
- regeneration condensate
- spent glycol
- reboiler and filter sludge
- spent desiccant and filter media
- naturally occurring radioactive material (NORM)

Major Hazardous Components:

Benzene, a known human cancer-causing agent

NORM: RA 226, RA 228

Natural Gas Sweetening

- is the removal of acid gases, hydrogen sulfide (H_2S) and carbon dioxide from natural gas (methods: amine and iron sponge)

WASTES:

- amine, benzene and H_2S air emissions
- spent amine and iron sponge
- H_2S sludge and liquids
- amine filter media and sludge
- naturally occurring radioactive material (NORM)

Major Hazardous Components:

Benzene, a known human cancer-causing agent

NORM: RA 226, RA 228

Amine

Combustion Emissions

Sources:

- Diesel, gasoline and natural gas-fired compressors and engines; natural gas flaring

May Contain:

- carbon monoxide
- nitrogen oxides
- sulfur oxides
- ozone
- uncombusted hydrocarbons
- particulate matter
- products of incomplete combustion

What contaminants to look for

Volatile Organic Compounds using GC/MS

Analyte Name	Analyte Name	Analyte Name
Dichlorodifluoromethane Chloromethane Vinyl Chloride	1,1,1-Trichloroethane (TCA) Carbon Tetrachloride Benzene	1, 1, 1, 2-Tetrachloroethane Ethylbenzene m,p-Xylenes
Bromomethane Chloroethane Trichlorofluoromethane	1,2-Dichloroethane (EDC) Trichloroethene (TCE) 1,2-Dichloropropane	o-Xylene Styrene Bromoform
1, 1-Dichloroethene Acetone Iodomethane (Methyl Iodide)	Dibromomethane Bromodichloromethane cis-1,3-Dichloropropene	1, 1, 2, 2-Tetrachloroethane 1, 2, 3-Trichloropropane trans-1,4-Dichloro-2-butene
Carbon Disulfide Methylene Chloride trans-1,2-Dichloroethene	4-Methyl-2-pentanone (MIBK) Toluene trans-1,3-Dichloropropene	1, 3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene
1,1-Dichloroethane Vinyl Acetate cis-1,2-Dichloroethene	1,1,2-Trichloroethane Tetrachloroethene (PCE) 2-Hexanone	1,2-Dibromo-3-chloropropane (DBCP)
2-Butanon(MEK) Bromochloromethane Chloroform	Dibromochloromethane 1,2-Dibromoethane (EDB) Chlorobenzene	

Semi-Volatile Organics Using GC/MS

Analyte Name	Analyte Name	Analyte Name
3-Nitroaniline Acenaphthene	3,3'-Dichlorobenzidine Chrysene Bis(2-ethylhexyl) Phthalate	Hexachloroethane Nitrobenzene Isophorone
2,4-Dinitrophenol Dibenzofuran 4-Nitrophenol	Di-n-octyl Phthalate Benzo(b)fluoranthene Benzo(k)fluoranthene	2-Nitrophenol 2,4-Dimethylphenol bis(2-Chloroethoxy)methane
2,4-Dinitrotoluene Diethyl Phthalate Fluorene	Benzo(a)pyrene Indeno(1,2,3-cd)pyrene Dibenz(a,h)anthracene	2,4-Dichlorophenol 1,2,4-Trichlorobenzene Naphthalene
4-Chlorophenyl Phenyl Ether 4-Nitroaniline 2-Methyl-4,6-dinitrophenol	Benzo(g,h,i)perylene	4-Chloroaniline Hexachlorobutadiene 4-Chloro-3-methylphenol
N-Nitrosodiphenylamine 4-Bromophenyl Phenyl Ether Hexachlorobenzene	Phenol Bis(2-chloroethyl)Ether 2-Chlorophenol	2-Methylnaphthalene 1,Methylnaphthalene Hexachlorocyclopentadiene
Pentachlorophenol Phenanthrene Anthracene	1,3-Dichlorobenzene 1,4-Dichlorobenzene 1,2-Dichlorobenzene	2,4,6-Trichlorophenol 2,4,5-Trichlorophenol 2-Chloronaphthalene
Carbazole Di-n-butyl Phthalate Fluoranthene	Benzyl alcohol Bis(2-chloroisopropyl) Ether 2-Methylphenol	2-Nitroaniline Dimethyl Phthalate Acenaphthylene
Pyrene Butyl Benzyl Phthalate Benz(a)anthracene	Acetophenone N-Nitrosodi-n-propylamine 4-Methylphenol	2,6-Dinitrotoluene

Heavy Metals

- Arsenic
- Barium
- Cadmium
- Chromium
- Lead
- Mercury
- Selenium
- Silver

Monitoring Equipment for Oil and Gas Contaminants

VOCs

- ppbRAE is a hand-held PID Monitor capable of detecting total non-methane volatile organic compounds (VOCs) in the parts per billion (ppb) range (RAE Systems, Inc.)
- Vacuum canisters to provide a breakdown of the specific VOCs in ambient air

Hydrogen Sulfide and Sulfur Compounds

- Jerome Hydrogen Sulfide Analyzer 631-XE detects hydrogen sulfide at 0.003 ppm (3 ppb)
- Vacuum canisters for sulfur chemicals in ambient air

Mercury

- Lumex Mercury Meter RA-915 can detect mercury at a level of 2 ng/m³

Regulation of Contaminants

State Oil and Gas Regulatory Agencies

- Set criteria for pit waste, pit clean-up and land farming of waste

State Environmental Agencies

- Have regulations concerning water discharge, air emissions, radioactivity

Environmental Protection Agency Region 6

- Human Health Specific Screening Levels (2004-2005) for: residential soil, industrial indoor worker, industrial outdoor worker, ambient air and tap water.

Agency for Toxic Substances and Disease Registry

- Minimal Risk Levels

Louisiana

- Toxic Air Pollutant Ambient Air

Texas

- Texas Effects Screening Levels