

Hazard Assessment Articles

Natural Gas Operations from a Public Health Perspective

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ABSTRACT

The technology to recover natural gas depends on undisclosed types and amounts of toxic chemicals. A list of 944 products containing 632 chemicals used during natural gas operations was compiled. Literature searches were conducted to determine potential health effects of the 353 chemicals identified by Chemical Abstract Service (CAS) numbers. More than 75% of the chemicals could affect the skin, eyes, and other sensory organs, and the respiratory and gastrointestinal systems. Approximately 40–50% could affect the brain/nervous system, immune and cardiovascular systems, and the kidneys; 37% could affect the endocrine system; and 25% could cause cancer and mutations. These results indicate that many chemicals used during the fracturing and drilling stages of gas operations may have long-term health effects that are not immediately expressed. In addition, an example was provided of waste evaporation pit residuals that contained numerous chemicals on the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Emergency Planning and Community Right-to-Know Act (EPCRA) lists of hazardous substances. The discussion highlights the difficulty of developing effective water quality monitoring programs. To protect public health we recommend full disclosure of the contents of all products, extensive air and water monitoring, coordinated environmental/human health studies, and regulation of fracturing under the U.S. Safe Drinking Water Act.

Key Words: drilling, health, hydraulic fracturing, natural gas, ozone, pollution.

INTRODUCTION

Over the past two decades, in an effort to reduce dependence on imported fossil fuels, the U.S. government has supported increased exploration and production of

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Natural Gas Operations

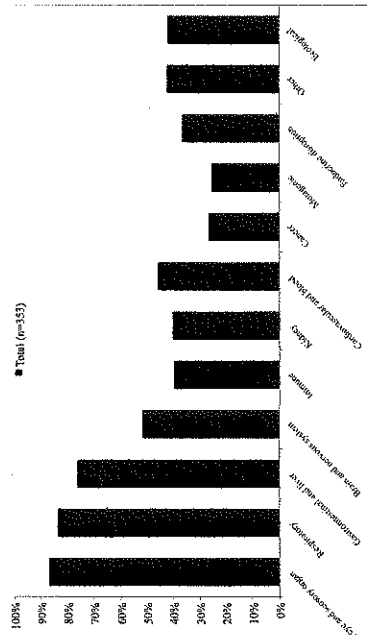


Figure 2. Profile of possible health effects of chemicals with CAS numbers used in natural gas operations.

they be inhaled, but also ingested and absorbed through the skin, increasing the chance of exposures.

Drilling Chemicals

The profile for the 22 drilling chemicals identified from the well blow-out in Wyoming are shown in Figure 4. The profile was unique in the following ways. All

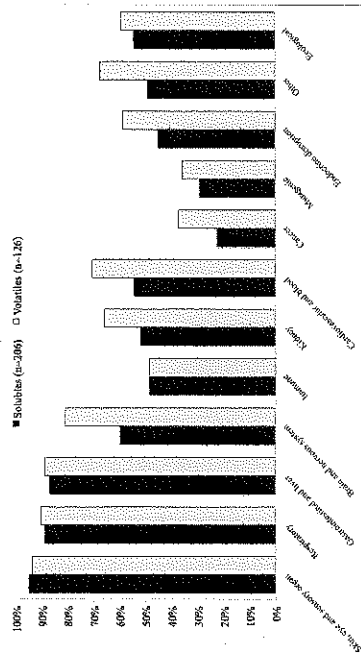


Figure 3. Profile of possible health effects of soluble and volatile chemicals with CAS numbers used in natural gas operations.

Table 2. Chemicals with CAS numbers that have 10 or more adverse health effects.

Chemical	CAS #	Number of products
(2-HE) Ethylene glycol monobutyl ether	111-76-2	22
2,2'-Nitroethane	102-71-6	3
2-Ethylhexanol	104-76-7	7
5-Chloro-2-methyl-4-isothiazolin-3-one	26172-55-4	2
Acetic acid	1186-52-3	1
Acrolein	107-02-8	1
Acrylamide (2-propenamide)	79-06-1	6
Acrylic acid	79-10-7	2
Ammonia	7664-41-7	3
Ammonium chloride	12125-02-9	2
Ammonium nitrate	6484-52-2	2
Aniline	62-53-3	1
Benzyl chloride	100-44-7	2
Boric acid	10043-35-3	4
Cadmium	7440-43-9	1
Calcium hypochlorite	7778-54-3	1
Chlorine	7782-50-5	1
Chlorine dioxide	10049-04-4	2
Dibromoacetonitrile	3252-43-5	1
Diesel 2	68765-94-6	19
Diethanolamine	111-42-2	4
Diethylenetriamine	111-40-0	1
Dimethyl formamide	68-12-2	1
Epidian	25068-38-6	1
Ethanol	64-17-5	8
Ethyl mercaptan	75-08-1	1
Ethylbenzene	100-41-4	7
Ethylene glycol	107-21-1	17
Ethylene oxide	75-21-8	2
Ferrous sulfate	7720-78-7	1
Formaldehyde	50-00-0	4
Formic acid	64-18-6	8
Fuel oil #2	68476-30-2	9
Glutaraldehyde	111-30-8	11
Glyoxal	107-22-2	2
Hydrodesulfurized kerosene	64742-81-0	1
Hydrogen sulfide	7783-06-1	1
Iron	7439-89-6	3
Isobutyl alcohol (2-methyl-1-propanol)	78-83-1	3
Isopropanol (propan-2-ol)	67-63-0	47
Kerosene	8008-28-6	3
Light naphthenic distillates, hydrocracked	64742-53-6	2

Table 2. Chemicals with CAS numbers that have 10 or more adverse health effects. (Continued)

Chemical	CAS #	Number of products
Mercaptosuccinic acid	68-11-1	2
Methanol	67-56-1	74
Methylene bis(thiocyanate)	6317-18-6	2
Monoethanolamine	141-43-5	5
NaHCO ₃	144-55-8	5
Naphtha, petrokau medium aliphatic	64742-88-7	2
Naphthalene	91-20-3	18
Natural gas condensates	68919-39-1	1
Nickel sulfate	7786-81-4	1
Parformaldehyde	30525-89-4	2
Petroleum distillate/naphtha	8002-05-9	7
Petroleum distillate/naphtha	8030-30-6	1
Phosphonium, tetraakis(hydroxymethyl) sulfate	55566-30-8	2
Propane-1,2-diol	57-55-6	6
Sodium bromate	7789-38-0	1
Sodium chlorite (chlorous acid, sodium salt)	7758-19-2	1
Sodium hypochlorite	7681-52-9	1
Sodium nitrate	7631-99-4	3
Sodium nitrite	7632-00-0	3
Sodium sulfite	7757-83-7	1
Styrene	100-42-5	1
Sulfur dioxide	7446-09-5	1
Sulfuric acid	7664-93-9	1
Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione (Dazomet)	533-74-4	3
Titanium dioxide	13463-67-7	2
Tributyl phosphate	126-73-8	1
Triethylene glycol	112-27-6	1
Urea	57-13-6	3
Xylene	1330-20-7	11

however, provide some guidance by pointing out four types of chemicals that are used in a relatively high number of products. These include (1) the silicas, which appear frequently as product components; (2) potassium based chemicals, which are also found in numerous products, although with relatively low toxicity; (3) petroleum derived products, which take on many different forms (including some without CAS numbers), and some of which are toxic at low concentrations and might be detected with diesel or gasoline range organics tests; and (4) the alcohols for which new detection technology is being developed, and because they are among the chemicals with the most health effects.