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CHEMICALS USED IN OIL AND NATURAL GAS DEVELOPMENT AND DELIVERY IN NEW MEXICO

Analysis and Comments

February 8, 2006

Introduction

This project was designed to explore the health effects of the products and chemicals used in drilling, fracturing ("frac'ing"), and recovery of oil and natural gas. It provides a glimpse at the pattern(s) of possible health hazards for those living in proximity to oil and gas development. In the process of researching the literature, we discovered that drilling companies have access to hundreds of products, the components of which are in many cases unavailable for public scrutiny. This spreadsheet addresses only those chemicals and products for which there is evidence that they are or have been used in New Mexico, and for which there were data about their health effects. We make no claim that this list is complete.

The products and chemicals included on this list were compiled from the Tier II reports sent to the state of New Mexico from Halliburton Energy Services, Inc., BJ Services Company, USA, and Schlumberger Technology Corporation. Information about the chemicals contained in the products listed on the Tier II reports, but not included in the reports, came from a variety of sources -- primarily MSDS sheets.

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1. The four most common adverse health effects for the chemicals in the spreadsheet are skin/sense organ toxicity, respiratory problems, neurotoxicity and gastrointestinal/liver damage.

2. Only a fraction of the chemicals used by the natural gas industry is covered in this spreadsheet. For example, in the course of our investigations, we discovered a list of 910 "frac'ing" products and chemicals compiled by the Canadian government.

3. This spreadsheet provides no clues to the volumes of material injected underground during natural gas development. However, typical drilling and stimulation activities use up to 150,000 to 500,000 gallons or more of fluid at each frac'ing. What chemicals constitute these liquids, and at what concentrations, is unknown.

4. This spreadsheet provides only a hint of the combinations and permutations of mixtures possible and the possible aggregate exposure.

7. Materials Safety Data Sheets (MSDS) are designed to provide information to protect those who handle, ship, and use the product(s). The sheets are also designed to protect emergency response crews in case of accidents or spills. The data in the MSDSs do not take into consideration the health impacts resulting from chronic or long-term, continual, and/or intermittent exposure.

8. The MSDSs are often sketchy and provide health effects information for only one or two chemicals in a product. In the case of mixtures, the health effects warnings are often not chemical specific.

9. Several reasons led to the lack of data about the health effects of some of the products and chemicals on the spread sheet:

We found no health effect data for a particular chemical or product.
Some product labels have no ingredients listed.
Some product labels provide only a general heading such as "plasticizer", "cross-linker" etc.
Some product labels state only "proprietary" or provide only the name of one or two ingredients plus "proprietary".

10. The Tier II reports are very limited in the information they offer about the products listed. Only one chemical is provided for each product, and it is often not the most dangerous ingredient. Many of the products contain multiple ingredients of varying degrees of toxicity, which is not indicated in the reports.

11. Of the 184 products on the spreadsheet, we could not find any information about the ingredients on 97 (53%), except for what was listed on the TIER II reports for their storage sites. Of these 97 products, 73 (75%) were from Halliburton, 23 (24%) were from BJ Services, and 1 (1%) was from Borden Chemicals.

12. Considering that information on 53% of the products was very limited, the following analysis of the health effects of the chemicals in the spreadsheet is likely to be an underestimation of the actual effects.

The following figures are based on the data in the Chemicals Used in Oil and Natural Gas Development and Delivery in New Mexico Spreadsheet. They are presented to define a pattern of the possible toxicity of the chemicals and products that are being used.

Of the 144 chemicals on the list:

* 67% are skin/sensory organ toxicants
* 66% are respiratory toxicants
* 55% are gastro-intestinal/ liver toxicants
* 38% are neurotoxicants
* 36% are cardio/vascular/blood toxicants
* 35% are kidney toxicants
* 31% are immune system toxicants
* 29% are reproductive toxicants

* 24% are carcinogens
* 23% are developmental toxicants
* 19% are endocrine disruptors
* 19% are wildlife toxicants
* 18% result in other disorders
* 14% cause mutations

Of the 47 (33%) of the chemicals on the list that are soluble, or miscible:

* 91% are skin and sensory organ toxicants
* 87% are respiratory toxicants
* 83% are gastro-intestinal/liver toxicants
* 60% are neurotoxicants
* 55% are cardiovascular toxicants
* 51% are kidney toxicants
* 40% are immune system toxicants
* 36% result in other disorders
* 34% are reproductive toxicants
* 30% are wildlife toxicants
* 28% are developmental toxicants
* 26% are endocrine disruptors
* 23% cause mutations
* 19% cause cancer

Of the 26 (18%) of the chemicals on the list that can vaporize:

* 100% are skin and sensory organ toxicants
* 92% are gastro-intestinal/liver toxicants
* 88% are respiratory toxicants
* 81% are neurotoxicants
* 69% are kidney toxicants
* 69% are cardiovascular/blood toxicants
* 63% are reproductive toxicants
* 58% are developmental toxicants
* 38% are wildlife toxicants
* 38% are carcinogens
* 38% are immune system toxicants
* 27% cause mutations
* 27% are endocrine disruptors
* 19% result in other disorders

Comments

Many of the chemicals on this list have been tested for lethality and acute toxicity. The majority have never been tested for low dose, long term effects that may not be expressed until long after exposure. Nor have adequate ecological studies been done. For example, most of the chemicals have not been tested for their effects on terrestrial wildlife or fish, birds, and invertebrates. It is

reasonable to assume that the health endpoints listed above could very well be seen in wildlife, domestic animals, and pets.

The products labeled as biocides are among the most lethal in the spreadsheet, and with good reason. Bacterial activity in well casings, pipes and joints can be highly corrosive, costly, and dangerous. Nonetheless, when these products return to the surface through the retrieval process they pose a significant danger to workers and those living near the well and evaporation ponds.

The chemicals that can volatilize are some of the most hazardous and show the greatest percentage of health effects. All of the chemicals in this category cause skin/eye/ or sense organ damage. Three quarters or more of the chemicals cause damage to the nervous system, gastrointestinal system/liver and/or respiratory system. If these chemicals are returned to the surface for evaporation, they can cause significant damage to wildlife, as well as human living or working downwind from them.

The use of respirators, goggles and gloves is advised on many of the MSDSs for the products on this list. This indicates serious, acute toxicity problems that are not being addressed in the recovery process when the chemicals come back to the surface. It raises concern over possible hazards posed to those living in proximity to well pads as the chemicals evaporate or penetrate water and soil.

Industry claims that 70% of the material it injects underground is retrieved. While the fate of the remaining 30% is unknown, the recovered product is placed in holding pits on the surface and allowed to evaporate. This results in many highly toxic chemicals being released into the air, as well as being dispersed into local surface waters. The condensed residues remaining in the pits are taken off-site and re-injected in the ground posing concerns for aquifers. However, at some locations, because of regional differences in geology and technology, 100% of the material remains underground.

After development ceases on the well pad and the well goes into production, the evaporation pits containing highly concentrated, lethal residues are bulldozed over. It is impossible to predict how long the buried chemicals will remain in place. Chemicals that are highly persistent could migrate into underground water resources.

Prior to use, these products must be shipped to and stored somewhere in our counties before being transported to the well site. They pose a hazard on our highways, roads, and rail systems, as well as to people living and working near the storage facilities.

Recently, in our efforts to get lists of the chemicals or products used or stored for natural gas development, we were told that the information may no longer be available because it could aid and abet terrorists. The fact that these chemicals are considered so dangerous underlines how important it is to be aware of their presence in our watersheds. The necessity for full disclosure cannot be emphasized enough if we are to protect our watersheds and public health. Proper monitoring of air and water cannot be designed without knowing what to look for.

Some of the chemicals on the list, such as citric acid or polysaccharide, are frequently found in the environment or household products and generally do not cause harm. Polysaccharides are found in almost all plant material and are often defined as complex sugars of which there are vast numbers. However, they appear in this spreadsheet because they are an ingredient and are included on the MSDS sheet for the product with warnings attached, such as "may cause eye, skin and respiratory irritation..." However, there is no way to know whether the polysaccharide has been modified to become toxic.

Other chemicals, such as citric acid, can be toxic when encountered in high concentration, or, perhaps, during certain exposures (such as inhalation versus skin contact). Because only a small percentage of the total composition of most of the products in this spreadsheet is available, we cannot say for certain whether such chemicals are harmless in their application. Under the present system, there are not enough data to determine the safety of products that contain mixtures of relatively "benign" ingredients and unknown chemicals, when the actual percentage composition is not provided.

As we have added products to the spreadsheet the percentages of toxic effects occasionally shifted. Changes such as this will continue as more products and chemicals are entered into the database. Thus far, despite small increases or decreases in percentage, the top four health effects of concern have remained the same. They are skin and sensory organ, gastro-intestinal/liver, and respiratory, and neurological system damage.