

TEDX

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Crosby 25-3 Well – Windsor Energy, Park County Wyoming

Analysis of Products Used for Drilling

February 25, 2008

Introduction

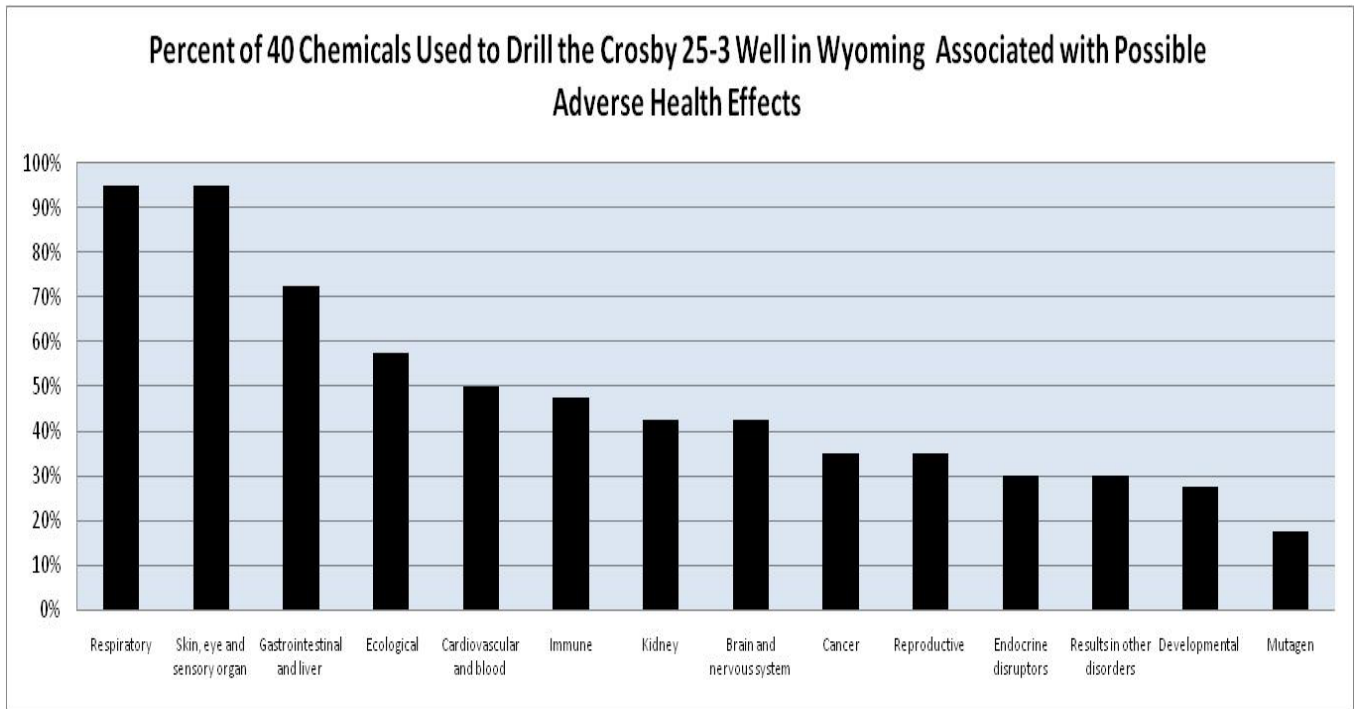
This analysis was designed to explore the health effects of the products and chemicals used in drilling a natural gas well, Crosby 25-3, northwest of Clark, Park County, Wyoming. This well was directionally drilled with a total vertical depth of 8,038 feet. Natural gas, petroleum condensate, and drilling fluids were accidentally released from the ground adjacent to the well. The release occurred over a period of about 58 hours between 11 and 13 August 2006 and resulted in surface soil impacts in an area estimated to cover approximately 25,000 square feet.¹

This analysis provides a glimpse at the pattern(s) of possible health hazards for those living in the region. We were able to do this analysis because we were provided the Materials Safety Data Sheets (MSDS) for the products in use at the time of the blowout, and through information provided in the Terracon Remedial Investigation Work Plan – Final Draft, dated July 2, 2007, or information disclosed in the Terracon Remedial Investigation Work Plan – Amended Draft, dated September 14, 2007. We make no claim that this list of products is complete.

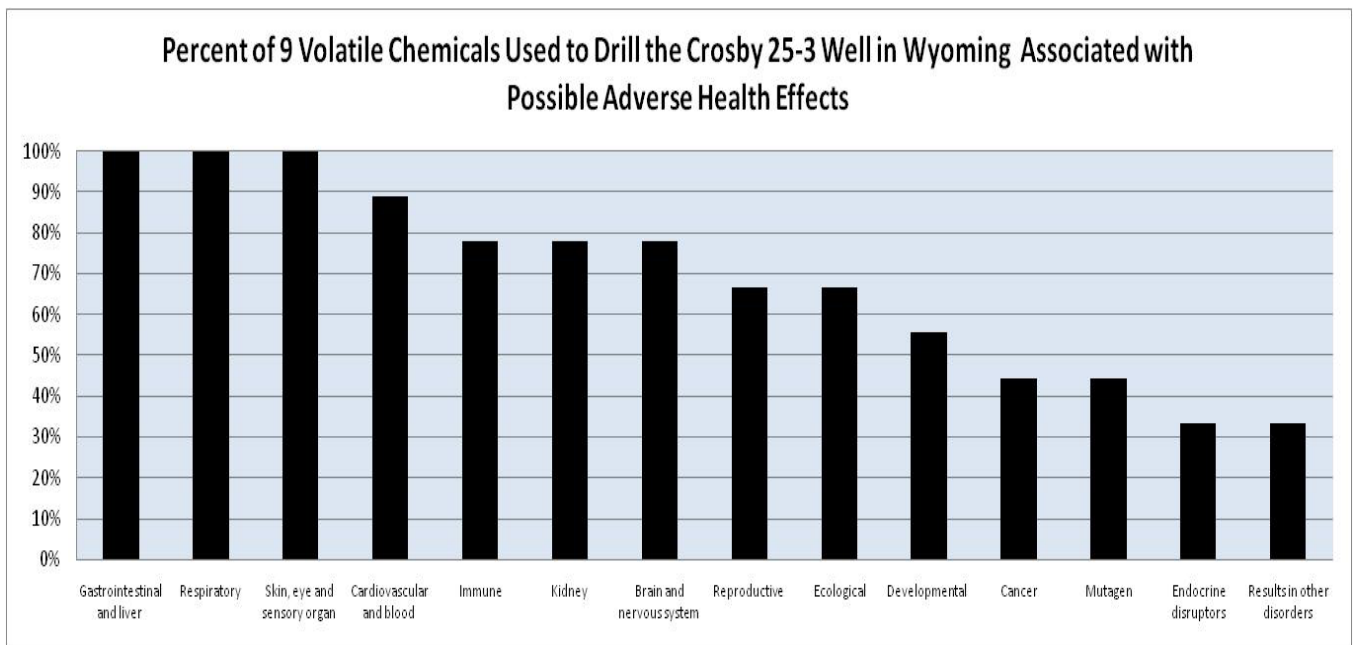
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1. Our list consists of 40 products used in natural gas drilling. These products contain 40 chemicals.
 2. All of the products have adverse health effects. Twenty have one to three possible health effects, and 80% have between four and fourteen possible health effects. Two products have 14 adverse health effects.
 3. Upon plotting the percent of chemicals in each health category, a pattern emerged of the possible health effects for the 40 chemicals. The four categories with the highest exposure risk are (1) respiratory system; (2) eyes, skin, and sensory organs; (3) gastrointestinal tract and liver; and (4) ecological effects².

¹ Monitoring Report, April 2007, Prepared by Terracon Consulting Engineers and Scientists.

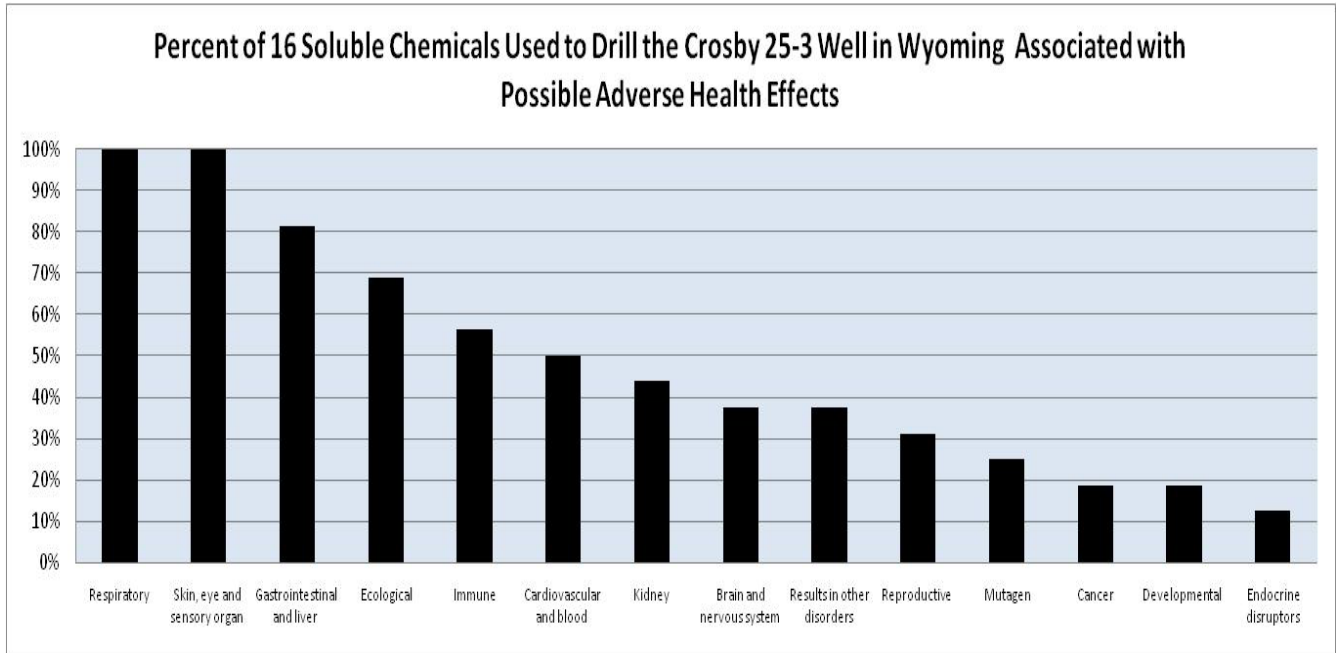
² Ecological effects can include invertebrates, fish, amphibians, and birds.



4. Nine (23%) chemicals were volatile. The four categories with the highest exposure risk are (1) gastrointestinal tract and liver; (2) respiratory system; (3) eyes, skin, and sensory organs; and (4) the cardiovascular and blood.



5. Sixteen (40%) chemicals were water soluble. The four categories with the highest exposure risk are (1) respiratory system; (2) eyes, skin, and sensory organs; (3) gastrointestinal tract and liver; and (4) ecological effects.



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

- (a) Some products list no ingredients.
- (b) Some products provide only a general description of the content, such as “plasticizer”, “polymer” etc.
- (c) Some products list some or all of the ingredients as “proprietary”.
- (d) No health effect data were found for a particular chemical or product.

7. All of the information about the composition of the products on the list comes from either the MSDS for that product, information disclosed in the Terracon Remedial Investigation Work Plan – Final Draft, dated July 2, 2007, or information disclosed in the Terracon Remedial Investigation Work Plan – Amended Draft, dated September 14, 2007. The information on the MSDSs is limited to only those chemicals that are required by law to be disclosed. Ingredients are often labeled as “no hazardous ingredients” even when there are significant health effects listed on the MSDS. The information disclosed by the Terracon report lists chemicals included in the products, but there is no indication if that information is the complete composition of the product.

8. Some of the citations used to establish the health effects of the chemicals on this list are old, dating back to the 1970’s and 80’s. In several cases data were derived from abstracts, not the full report or manuscript. In other cases, citations were taken from toxic chemical databases, such as TOXNET, Chem ID, etc. Many reports submitted to the US Environmental Protection Agency by the manufacturer to register a chemical are not accessible. In some cases it is impossible to track

down any health effect for a chemical, especially when the manufacturer provides no Chemical Abstracts Service (CAS) number

9. A number of chemicals can be toxic when encountered in high concentrations, 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 on this list 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.

For Further Consideration

MSDSs are designed to inform those who handle, ship, and use the product(s) about the products’ physical and chemical characteristics, and its direct/immediate health effects to prevent injury. The sheets are also designed to inform emergency response crews in case of accidents or spills. The data in the MSDSs do not generally take into consideration the health impacts resulting from chronic or long-term, continuous, and/or intermittent exposure. Many products that have MSDSs have not gone through a rigorous and extensive scientific peer-review process that would permit conclusions to be drawn about "safe" and/or "hazardous" exposure levels.

The use of respirators, goggles and gloves is advised on many of the MSDSs for 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 also raises concern over possible hazards posed to those living in regions where gas production is taking place.

The product manufacturers are responsible for the MSDSs, which are based on a form provided by the Occupational Safety Health Administration (OSHA). OSHA provides no review or approval of the sheets, which are often sketchy and may provide health effects information for only one or two chemicals in a product. In many cases the chemicals listed equal less than 100% of the product. In the case of mixtures, the health effects warnings are often not chemical-specific.

Some of the chemicals on this list have been tested for lethality and acute toxicity based on short-term contact looking for possible ecological damage. The tests are done to find out how long it would take to kill 50% of the organisms within a predetermined time limit, such as 24, 48, or 96 hours. The results of these tests are presented as the lethal concentration (LC50) or lethal dose (LD50). The tests are used for precautionary label notations in order to reduce immediate harmful effects on “non-target” organisms such as invertebrates, algae, beneficial insects, fish, etc. in the food web. These tests are not intended to provide information about long-term exposure effects and they do not exclude the fact that other health effects can occur.

Comments

Health Effects

We found adverse health effects for all the chemicals on this list. This is true even though MSDSs for five of the products stated that they contained no hazardous substances. All of the MSDSs for these products contained information that the ingredients were eye or skin irritants or toxicants, 80% were respiratory toxicants, 40% were dangerous to wildlife, and one was a gastrointestinal toxicant.

In general, the volatile chemicals have more adverse health effects associated with them than the soluble chemicals. Not only are they more toxic, but in the area of skin and sensory organ toxicity, gastrointestinal and liver, and the respiratory system toxicity, 100% of them cause harm.

The soluble chemicals are associated with more adverse health effects than the total number of chemicals. While they do not show as high a percentage of effects as the volatile chemicals, between 80% and 100% can cause harm to the same systems as listed above.

Prior to use, these products must be shipped to and stored somewhere 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.

Full Disclosure

While this list was compiled primarily from MSDS information, it is still far from a complete picture of what is in use. The limitations of MSDS data are outlined above. Also, this list provides only a hint of the combinations and permutations of mixtures possible and the possible aggregate exposure. Each drilling and fracturing incident is custom designed depending on the geology, depth, and resource available. The chemicals and products used, and the amounts or volumes used can differ from well to well. The only way to get a realistic picture of what is being introduced into our watersheds and air is for a complete record of information of the specific well site (state, county, township, section, etc.), the formulation of chemicals and products used at each stage, the quantity of each product (weight and/or volume), total volume injected and recovered, and the depths at which material/mixtures were injected and recovered, the composition of the recovered liquids and those liquids and solids removed from site. This needs to be public information. From the data in this list, we know for certain that a great deal more than water and soap is being used to drill a natural gas well.