Spills, Emissions, and Health

Spills of hydrofracturing fluids have sickened animals who drank the water or were exposed to related airborne pollutants. These issues have been described in at least one peer-reviewed paper (Bamberger and Oswald (2012) which is summarized below. The chemicals dissolved in the treatment or return waters have been described in other sections of this blog. Some of the organic components in the return fluids, specifically benzene and methyl chloride which are known to have deleterious health impact, have high vapor pressures and will fractionate into the air from uncapped waste ponds, especially if those ponds are being aerated to encourage bacterial decomposition of the organic components. This is the pathway by which benzene can get into the air and sicken. A good, quantitative, EPA discussion is available here.

**Bamberger and Oswald (2012)**


This paper addresses animal deaths and stillbirths associated with spills of hydrofracture fluids. Three cases are described:

(1) An initially unfenced 4.5 acre return water impoundment was built near to but topographically above two homes that were also within 2 miles of 25 shale gas wells. Home B (HB) developed well water odor. Home A (HA) noted first a decrease in flow of its well and spring water sources, and then a dramatic increase in the flow that was concomitant with a decreased in water quality and the emplacement of the impoundment. There was a leak from impoundment into a stream, and a malfunction in the wastewater impoundment aeration system that resulted in a raw sewage smell that sickened families in both homes. An 18 yr old horse died of acute liver failure due to toxicity. The vet suspected heavy metal poisoning. A 2 yr old Boer goat aborted 2 kids. A boxer dog produced a stillborn pups and a pup with cleft palate that later died. Subsequently the dog produced a litter with 7 still borne pups and the others in the 15 pup litter were born without normal hair. A child in HB became sick of As poisoning, lost 1 yr of school, and recovered after family discontinued use of well water. Well tests indicated no As. HB family showed dramatic increases in phenol, a metabolite of benzene. A testing lab indicated results consistent with exposure to 0.5 to 2 ppm benzene in air. The families experienced extreme fatigue, headaches, nosebleeds, rashes, loss of smell and hearing. HB child had difficulty breathing. HB evacuated and recovered, except for family member who returned daily for few hours to tend the farm. HA members did not move and experienced increasingly sever symptoms.

(2) Of 96 cattle, 60 were in a pasture that watered from a creek. Twenty one of these 60 cattle died; 16 of the 39 remaining failed to breed. The heath of cattle in the other pastures that watered from other sources was unchanged. There were 190 active gas wells within 5 miles of property (11 horizontal and 26 deep vertical). No spill was reported. Cause of death and breeding failure is unknown.
Typically 1 or 2 animals were lost from heard of 33 every few years from illness of accident. The family used well water; the animals watered from a spring-fed creek that fed a pond. A 1 acre impoundment and a 1/3 acre mud pit were built 350 ft and uphill from the water well and 200 ft from the spring-fed creek. The wastewater impoundment and the mud pit each developed 2-ft tears. Two dark spots of burned grass developed in an adjacent 20-acre pasture and there was ankle-deep water in a 1/3 acre portion of this pasture. Fearing cows drank from this pasture flooding, farmer voluntarily quarantined his heard. The impoundment water contained dissolved Ca, Fe, Mg, K, Na, Sr, F, Cl, SO4, and Br. Two calves lost in calving. In a 2nd calving 11 of 17 calves were stillborn. An ill calf had E.coli septicemia. Two Calves had low liver vitamin E and selenium. It is noted that SO4 can increase bioavailability of Se. Now the farmer has 26 head rather than 33, and has lost 40-50 acres of hayfields. No compensation was given and no toxicology tests were performed on the live cattle.

The authors suggest (in part):

- Need full disclosure of what happened in accidents. Nondisclosure agreements are an impediment to getting the information needed.
- Need testing of air and water before and after drilling. Routes of exposure were mostly through ingesting spilled waters, but airborne benzene exposure is implicated.
- Max Contamination Levels (MCLs) need to be determined for many compounds, with special attention to endocrine disrupters.
- Spills with health impacts should trigger full toxicology testing with costs borne by companies.

Comments

To me these are sensible suggestions. It’s in everyone’s interest to identify the causes of apparent gas-production-related health impacts. We need to know what the causes of negative health impacts are so remedies can be sought and precautions taken.

From what I can gather the impacts to human health (rashes, etc) appear to be related to air born chemicals (perhaps/probably As) from storage ponds that are being aerated. To a considerable degree it appears that the industry/regulators have responded to minimize impacts of this kind and the kinds described above. For example, in Pennsylvania fluids are now under closed loop containment and there are no longer open pits that can leak harmful volatiles like benzene (see Arthur and Cole, 2014 Elements, 10(4), p257-264). Also barriers are placed under pads so any spillage is contained. My understanding is that such requirements are in the proposed NYS regulations. If they are, they should be. Also, it should be noted that companies are researching more benign (green) additives.

Health impact from spills is a serious matter, and companies should treat each possible health impact as an opportunity to learn how to improve procedures to that the chance of future health impacts are minimized. Regulations and the laws should be constructed to encourage this goal. Endocrine disrupters that can impact the hormone system in mammals are of concern in the cases described and they are found in low doses in thousands of products (wikipedia). One that is mentioned in connection to hydrofracturing is 2-Butoxyethanol, a solvent used in many products including windex and the oil spill...
dispersant used in the Deepwater Horizon oil spill (Wikipedia). There is controversy over whether we know enough about endocrine disrupters to label them as a health hazard (wikipedia).