Field Screening for Shallow Gas in Cass County, North Dakota

Fred J. Anderson and Brian N. Hall

2010

The investigation of shallow natural gas occurrences within existing groundwater wells in Cass County, North Dakota was conducted over an eight, non-consecutive day period from May 18 to August 19, 2009. A total of 271 well sites were visited prior to the field component of this investigation. Of these, 107 wells were successfully located and visited. A total of 146 observation wells, assumed to be in a group development, was revisited to verify that the original data set was correct. Prior to the field component of this investigation, 187 wells sites, consisting of historic and existing observation and stock water wells, were selected to be visited in the field to (1) determine the actual existence of the well, (2) to verify its location, and (3) perform FID-screener detector (FID) field screening for possible shallow natural gas occurrences. 107 well sites were verified to have a groundwater observation well at their prescribed point and were subsequently field screened. 49 wells were not found at their prescribed locations in the field and were presumed abandoned or destroyed. 27 wells were not visited due to access and/or time constraints.

Each of the wells were field screened for the presence of combustible gases using a portable FID calibrated to methane (100 ppm). A small amount of air was collected at the top of well casing (TOC) and just above the groundwater/air interface (GWI). After field screening a water level reading within the well was collected using an electric well tape. Of the 101 existing wells field screened, 20 wells returned positive FID responses ranging from 0.4 to 5,620 ppm as methane (Figure 1). 81 of the wells showed no response (i.e., a 50 ppm air methane instrument reading during field screening at the TOC and GWI). It has been observed in the field that it is more likely to detect methane at the GWI or higher up in the air column within a given well. It has been less typical to actually detect methane emanating from the TOC. The occurrence of FID responses are located in the northeast and easternmost parts of the county, coincident with the Page and West Fargo Aquifers, respectively. Individual private, irrigation, or municipal water supply wells were not considered as a part of this investigation.

FID field screening is not a substitute analytical tool. It must be used in conjunction with additional analytical methods and procedures. A positive FID instrument response indicates that the presence of methane is highly likely at the well since the instrument is selectively sensitive to methane and is calibrated specifically to a predetermined concentration of methane in air. However, excessive moisture and low oxygen levels or high values of carbon dioxide can influence FID response. A confirmatory gas analysis is required to determine and quantify the absolute presence and concentration of methane and other hydrocarbons that may be present in conjunction with FID screening results. The presence of methane was confirmed in 20 of the screened existing wells presented here to aid in the selection of future candidate observation well locations and to assist in conducting additional sampling and analysis and potentially focus future field investigative and exploration efforts.

Figure 1. Graph depicting the relative relationship and absolute maximum value of FID-screener detector (FID) instrument response from selected wells in Cass County. FID results for each well are presented in order of field screen occurrence from top to bottom. Values shown are three reported from the groundwater-air interface (GWI) or at TOC. The concentration of methane typical in commercial natural gas is highlighted by the vertical green line at 70%.

Geologic Symbols

- Existing observation well with a positive FID-screener detector (FID) instrument response (in parts per million (ppm) as methane, at the top of casing (TOC) and/or the ground-water/air interface (GWI)).
- Well presumed abandoned or destroyed.
- Existing observation well, no FID response at TOC and/or the GWI.
- Historical observation well location. No existing well at well site location visited. Well presumed abandoned or destroyed.
- Wells sites not visited during this investigation.
- Wells sites not visited during this investigation.
- Other Features
  - Water - Intermittent
  - Water - Permanent
  - Irrigated Field
  - Interstate Highway
  - Unpaved Road

Explanation

- Existing observation well with a positive FID-screener detector (FID) instrument response (in parts per million (ppm) as methane, at the top of casing (TOC) and/or the ground-water/air interface (GWI)).