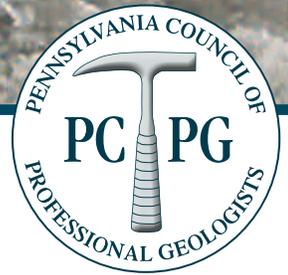


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OIL/NATURAL GAS WELL SITE

A Professional Geologist (PG) characterizes the baseline hydrogeology to design and permit an oil or natural gas well drilling site (well site) and investigates any potential environmental issues.

- A team of professionals including a PG interprets numerous data sets often using mapping software to identify a potential well site. The data collected can include surface geology, topography, floodplains, water bodies, water wells, cultural features and regulatory setback requirements.
- A PG reviews and evaluates geotechnical borings, soil samples, wetland areas and any water sources at risk, if any, to prepare an Erosion and Sedimentation (E&S) permit which is required before constructing a well site. A PG may also assist with slope stability issues when construction activities encounter water drainage from seeps or springs.
- To obtain a permit to drill, a geologist evaluates the underlying rock strata along with a drilling engineer to pick the depth that various casings will be placed to separate and isolate the well from fresh water, underground coal mining, and other oil/gas bearing strata including storage zones. Typically, three to four steel casings of increasingly narrower diameter are cemented in place prior to drilling to a target zone.
- A water supply or pre-drill survey is conducted to document private/public water wells, springs, and ponds within a predetermined radius (PA's radius is 2500 ft.) of a well site.
- At least one sample is collected from every water supply approximately three to six months prior to drilling and analyzed for methane, dissolved gasses and other chemical indicators of water quality to establish a baseline water chemistry dataset. If necessary, isotopic gas analysis may be added.
- The PG reviews and evaluates the predrill sampling data for trends and patterns including any anomalous results. The info is then collated and submitted to the state regulatory agency.
- Sometimes elevated levels of naturally occurring parameters are found pre-drill that exceed primary and/or secondary maximum contaminant levels set by regulatory agencies and homeowners are advised of the safety hazard (if any) along with suggestions for remedial action.
- The pre-drill water survey and sampling is repeated prior to returning to that well site if all drilling is not completed in one continuous time period.
- Any water supply complaints are thoroughly investigated by a PG and reported to the Department of Environmental Protection (DEP) within the designated regulatory timeframe, currently 24 hours in PA.
- The PG may perform an on-site mechanical evaluation, resample to compare with the pre-drill baseline data and/or run a pumping test if the complaint is a water quantity (yield) issue.



Marcellus Shale hydraulic fracture treatment, Western PA. The liner under all the equipment would contain any accidental spills so the groundwater won't be impacted.



Drilling pad and pipeline construction, Marcellus Shale, Western PA. Rock lined ditches and filter sock around the perimeter contain any water and soil runoff from the site.

- If the complaint pertains to a gas migration issue, the PG also evaluates all well construction details, including the water well and nearby gas wells for potential leakage pathways. In some instances, a detailed isotopic analysis of the gas chemistry is conducted to determine the origin of the gas.
 - The PG evaluates other well site conditions such as the location and distance to the drill site, full timeline of the drilling compared to when the water well issues began, and downhole problems reported during drilling to determine the cause of any water supply issue.
 - Other data that might be needed include rainfall and climate info, historical aerial photos, pertinent literature along with other possible contaminant sources such as septic tanks, farm manure runoff, mining, unauthorized dumps and any new industrial facilities or activities in the area to get a total hydrogeologic picture.
- The PG evaluates and characterizes all the relevant geologic data and rock properties like porosity and permeability to identify potential pathways for contamination and/or gas migration.
 - Although not a common occurrence, a PG also investigates surface spills or releases of fluids at well sites and other facilities. Sufficient soil and/or water data to delineate the affected area is collected and evaluated then the PG helps to develop a remediation or treatment plan for the impacted area.
 - The PG prepares a full report of any investigation and sends it to the DEP which includes the data, analyses and conclusions from the investigation.

The PG typically works with engineers (production, drilling, completion, well plugging and civil), chemists, geochemists, construction specialists, soil scientists, biologists, remediation specialists, land personnel, permitting professionals, attorneys and property owners.

Work Resources:

Computers, investigative reports, GIS/mapping, hydrologic modeling & analysis software.

Work Environment:

Office and field work. Field work may entail irregular or evening/weekend hours, visiting property owners, and working in varying outdoor conditions throughout the year.

Helpful Skills & Experience:

Attention to detail, research skills, landowner relations, DEP negotiations, ability to explain technical material to non-technical personnel, grasp of legal issues, familiarity with water well components and operations, geochemistry evaluations, oil & gas operations and permitting processes.

Tools of the Trade:

Methane meters, pumping equipment, flow meters, water level gauges, pH and conductivity meters, water/soil sampling equipment and chain of custody documentation.