

**REVIEW OF U.S. EPA, OFFICE OF RESEARCH AND DEVELOPMENT,
INVESTIGATION OF GROUND WATER CONTAMINATION NEAR PAVILLION,
WYOMING**

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- As a geologist with the Ohio Division of Oil and Gas Resources Management (Division), I have reviewed the draft report of U.S. EPA regarding the “Investigation of Ground Water Contamination Near Pavillion, Wyoming.” As a professional geologist at the Division for 23 years with experience and expertise in conducting several hundred alleged groundwater contamination cases in Ohio, I see many deficiencies and concerns with this draft U.S. EPA report. The list of deficiencies and concerns are as follows:
 1. There is huge lack of geological and hydrogeological information within this report. When conducting a groundwater investigation of this magnitude, local geology and hydrogeology must be presented and evaluated to accurately determine the impacts geology and hydrogeology play in the role of identifying pathways for migration of contamination. There are no local geologic maps (which should include at minimum: structural, isopach, stratigraphic, and facies maps), detailed localized geological cross sections, groundwater flow maps, potentiometric surface maps, or aquifer or aquitard identification.
 2. No information of water well construction, condition and age of water wells, and historic aquifer development in this area.

3. Total lack of evaluation or determination of naturally-occurring hydrocarbons in shallow geologic reservoirs. If they exist, they need be evaluated.
4. Failure to evaluate historic oil and gas operations and the potential of legacy oil and gas contamination causes. Typically, historic legacy oil and gas contamination problems are well known in most developed oil and gas plays and need to be thoroughly evaluated in any groundwater contamination case.
5. There was no evaluation of historic and current oil and gas well construction methods, cementing practices, detailed review of hydraulic fracturing practices, and other completion methods.
6. U.S. EPA did preliminary evaluations of cement bond logs on some oil and gas wells in the area. This evaluation is fundamentally flawed as determinations of actual “channelization of cement” or free pipe was not made in the interpretations. First generation acoustic cement bond logs (CBLs) are inherently a poor method for cement determination and does not give an accurate picture of the cement job in the oil and gas well. In my evaluation of the cement bond logs examples that are presented in this report, U.S. EPA did not consider the normal issues (microannulus, poor cement bonding, gas-cut cement, or free pipe) inherent to first generation cement bond logging evaluation. These issues need to be address prior to obtaining accurate determinations. When evidence of “poor cement bonding”, “gas-cut cement”, or “free pipe” is identified, then the first generation CBLs must be re-run under pressure to determine whether a “microannulus” in the cement sheath exists or channelization of the cement exists. A “microannulus” in the cement closes under pressure and is not capable of transmitting fluid movement like channelization of cement. Today, this problem is eliminating by using second generation cement bond logging tools which map a complete 360 degree of the cement sheath and accurate determination of cement tops and cement conditions.

7. The presences of BTEX (Benzene, Toluene, Ethylbenzene, and Xylene) compounds are known naturally-occurring compounds in commercial and non-commercial hydrocarbons reservoirs and occasionally in aquifers. I see no geochemical analyses by U.S. EPA of oil and gas production brines or other hydrocarbon fluid production to evaluate natural BTEX compounds already present in the reservoirs. To assume these compounds came from additives inherent to hydraulic fracturing is truly flawed science! Additionally, water sampling should have been done in the same aquifers outside of the Pavillion natural gas field in order to determine actual aquifer background conditions.
8. The entire U.S. EPA draft report and study almost totally relied upon chemistry determinations and really is lacking in the in depth scientific investigation that needed to be conducted on this site. This study needs to apply the scientific method test to this report.

It is interesting that the U.S. EPA report references the Ohio DNR, Division of Mineral Resources Management's Expert Panel Bainbridge Investigation Report (see U.S. EPA reference) as an investigation example. What they failed to mention is the use the scientific method in the Bainbridge Report to test the hypothesis. The Bainbridge Expert Panel Report states the following as their method for testing their hypothesis:

"The power and the beauty of the scientific method lie in the requisite hypothesis testing by the original investigator and the re-testing of the hypothesis by subsequent investigators. The scientific method is an informal set of rules for formulating questions, making observations, developing hypotheses, and then testing the hypotheses by experimentation and further observation. Responding to a period when standards for admission of expert testimony in trials were lax, in 1993 the U.S. Supreme Court in *Daubert v. Merrel Dow Pharmaceuticals, Inc.* held that under Rule 702 of the Federal Rules of Evidence, scientific knowledge presented as testimony must be derived by the scientific method and that evidentiary reliability is to be based on scientific validity. Under the *Daubert* ruling, the judge is given the responsibility of gatekeeper to make the preliminary evaluation as to whether the reasoning and methodology underlying the expert testimony is scientifically valid or reliable (Foster and others, 1993). In essence the gatekeeper's role is to determine whether experts used valid scientific

reasoning and principles to reach their conclusions and to screen out expert opinions based on conjecture and speculation (Blauvelt, 1999).”

CONCLUSIONS

The U.S. EPA Investigation of Ground Water Contamination near Pavillion, Wyoming is clearly lacking in the demonstration of the scientific method. A more thorough geologic and hydrogeologic investigation is warranted.