Evaluating Environmental Reports and Regulatory Proposals

John Veil

410-212-0950

john@veilenvironmental.com

www.veilenvironmental.com

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Topics for Discussion

- How to evaluate reports, research, and regulatory proposals
- Did the author
  - choose appropriate data sources
  - make proper assumptions
  - conduct suitable analyses
- Examples

The First IPEC - 1994

- I was invited by Kerry Sublette to give an introductory lecture at a new conference he had founded (International Petroleum Environmental Conference – IPEC)
- My lecture was “Analysis of Environmental Regulatory Proposals: It’s Your Chance to Influence Policy”
- This reflected work I was doing for DOE on reviewing EPA reports and permits that affected the oil and gas industry
- I explained that I reviewed documents with a critical eye toward making sure that
  - the right or best data were used to address the question
  - The assumptions made by the authors were legitimate and were clearly spelled out
  - The types of analyses (equations, formulas, models, etc) were appropriate

The 24th IPEC - 2017

- I have attended all of the previous 23 IPECs and have made dozens of presentations there over the years
- I decided to return to the original topic and present new material with current examples

Environmental Documents – U.S.EPA

- In the development of its environmental regulations and reports, the EPA collects data, makes certain assumptions, and analyzes the data. The data may be technical or economic in nature, but the general approach is the same.
- Data are collected from published reports, from State regulatory agencies, through analyses conducted for EPA by contractors, and from the regulated community
- Before EPA receives the data, some assumptions have usually been made by the generators of the raw data that influence the way that data set is presented and perceived
- EPA assembles the data and adds a second level of assumptions

EPA Documents (2)

- Typically, EPA must combine multiple data sets generated by different sources and representing different sectors of the regulated community and different geographic regions
- After making its own assumptions, EPA performs some type of analysis, statistical or otherwise, to support its regulatory proposal
- If any component of this process is inappropriate, misleading, or misunderstood, the final result may be inaccurate
- Depending on the magnitude and number of individual errors, the final conclusion can be substantially different from a conclusion using more appropriate data, assumptions, and analysis

Implications and Impacts

- When the conditions of a proposed regulation have an economic impact on another party, the affected party is wise to review and critique all components of the analysis. In a national rulemaking, the economic stakes are usually high.
- It is the responsibility of the regulated community to examine and critique the data, assumptions, and analysis that go into a regulator's conclusion
- In most cases, the regulated community has a much more extensive and intimate knowledge of the activities being regulated than does the regulator
- Most major industry groups, including the oil and gas industry, have historically devoted extensive resources to reviewing and commenting upon significant EPA rulemakings

Overview of the Approach

- Read documents
- Make notes and comments
- Evaluate the data used as well as other data sources that were not used
  - Intentional
  - Unintentional – unknown to the author
- Look for any assumptions made by the author
  - Clearly stated
  - Not stated or misleading
- Review the analytical methods used by the author
  - Appropriate choice
  - Proper calculations
- Verify that the conclusions are supported by the rest of the report
  - Could they be interpreted in an alternate way?

Data

- What data are used?
- How are data displayed or referenced in the document?
- Is there an explanation for why those data were selected?
- Are there other sets of data that could be added to the data set or be substituted for the existing data?
  - If so, is it obvious why the author did not use those data?
- Are the data used relevant to answering the question at hand?
- How are outlier data points treated?
- Are units consistent and clearly identified?
- How are the data characterized (average, mean, median, standard deviation, min/max, quartiles, etc)?
- How is uncertainty addressed?

Assumptions

- Did the author state most/all of the assumptions they used?
- Are these clear and easy to follow?
- Are the assumptions reasonable/justifiable?
- Do you think that alternate assumptions would lead to a more accurate outcome?
- Are terms defined? If so, are the definitions realistic?

Analysis

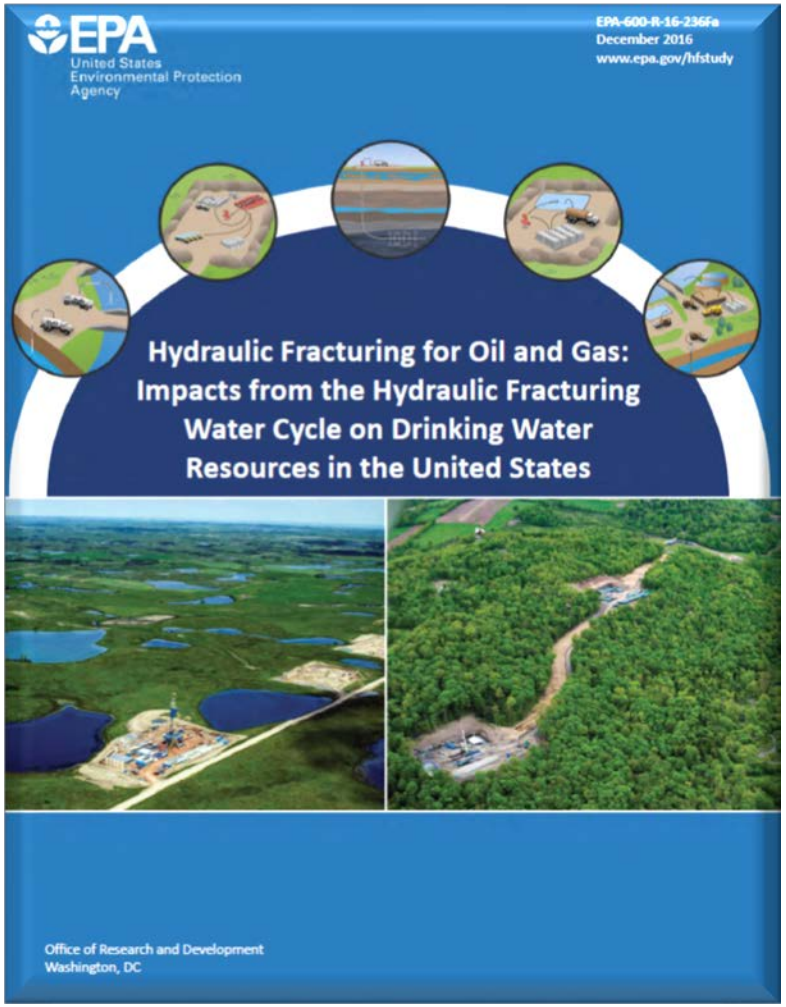
- What types of analysis were used in the document?
  - Simple equations
  - Complex models
- Are these analytical choices appropriate to answer the question?
- Are there sufficient data of reasonable quality to conduct a legitimate analysis?
  - QA/QC on data sets
- Do the analyses require an excessive number of assumptions?
- Are the analytical results likely to reasonable reflect reality?

Other

- Are data and “factual” statements referenced to other published work?
- Are those references reasonably current and relevant?
  - Are alternate references better?
- Does the author have an obvious slant or agenda they are trying to promote?
- Do final conclusions reflect the information presented in the document?
  - Can it pass the “red-face test”?

Example 1 – EPA Hydraulic Fracturing Study

- In 2009, Congress urged EPA to study the relationship between hydraulic fracturing and drinking water in the United States.



Final Report – December 2016

- The final HF study is a long (>1,200 pages) and comprehensive effort that attempts to identify the potential of activities in the hydraulic fracturing water cycle to affect drinking water resources
- Consists of three documents -- an executive summary, the main assessment report, and a separate document containing appendices. Each of these is a large document, with a combined length of more than 1,200 pages.
- I read all three reports and prepared comments on the report for a client
- Portions of the report have exceptional value as current compilations of data and will serve as an excellent resource for future researchers and policy-makers
  - However the report does have various issues with data, assumptions, analysis, and portrayal of results

Comments Relating to Data

- EPA used FracFocus data from 2011 to 2013. The types of chemicals used in later years and the numbers of submittals to FracFocus changed notably since 2013. EPA may not be using currently relevant data.
- The large number of chemicals on EPA's lists as well as other lists that have been compiled by fracking opponents can be misleading and are often made part of anti-fracking literature. In reality, for any given frac job, a much small number of chemicals is used.
- EPA gave three case examples to highlight suggested drinking water contamination from HF (Dimock, PA; Pavillion, WY; and Kern County, CA). Upon close examination of the facts and interpretations, none of these are clear-cut examples that indict oil and gas operations.
- EPA notes that the amount of produced water from a well varies and depends on several factors. However, its discussion is limited to unconventional formations. EPA does not discuss produced water from conventional formations. Hundreds of thousands of U.S. wells produce from conventional formations.

Comments Relating to Data (2)

- EPA presents information about the extent of roadspreading as a means of managing or disposing produced water. EPA cited a report published by the American Petroleum Institute in 2000.
- The API (2000) data were collected in a survey during 1996 that looked at 1995 data. That information is now over 20 years old. Many changes to oil and gas regulations and management practices have been made since then, such that those volumes are unlikely to be representative any longer.
- Several northern states continue to allow produced water from conventional wells to be applied to roads under certain conditions. Generally flowback and produced water from fractured wells is not allowed to be applied to roads.

Comments Relating to Assumptions

- EPA defines drinking water resources as: *"any body of groundwater or surface water that now serves, or in the future could serve, as a source of drinking water for public or private use."* However, it is unrealistic to open the door infinitely wide to allow any water source that could potentially be used at any time in the future. This unreasonably broadens EPA's scope.
- EPA suggests that wells are frequently refractured – they are not, at least not during the years when the study was being prepared.

Comments Relating to Assumptions (2)

- EPA correctly notes that spills of chemicals do not have equal impacts on surface and ground water supplies. The concept of varying levels of risk and using a risk assessment protocol to evaluate that risk is very important. Often it is not accepted or understood by members of the public or opponents to oil and gas. In their minds, any spill is a catastrophe.
- EPA data show that spills of chemicals and mixed frac fluids can occur, but they are uncommon. When spills do occur, they most often reach soils where the spills are cleaned up leaving minimal opportunities to affect drinking water. EPA was unable to identify any cases in which spills impacted ground water resources.

Comments Relating to Analysis

- Table F-3 in Appendix F is an interesting attempt by EPA to generate estimates of treatment performance by combining limited data from a variety of literature sources. However, the resulting numbers do not reflect real data.
  - Percent removal by different technologies
  - Influent concentrations of chemicals in different fields
  - Resulting concentrations following treatment
  - It is likely that those performance levels will be cited by future authors without the recognition that the values were generated with lots of assumptions and uncertainties
- This creates a dangerous precedent and does not reflect reality

Comments Relating to Analysis (2)

- EPA indicates that certain chemicals were found in drinking water resources (presumably in surface water samples). The presence of those chemicals by itself poses no particular risk, however. It is the presence of those chemicals at concentrations exceeding a toxicity threshold that is the key factor. EPA has not documented that the chemicals were found at concentrations exceeding a toxicity threshold at a point where the water is actually withdrawn for drinking water purposes.

Comments Relating to Portrayal of Results

- After several years of effort, EPA released a draft version of the HF study in June 2015. One of the most widely cited conclusions from that study was: *"We did not find evidence that these mechanisms have led to widespread, systemic impacts on drinking water resources in the United States. ….. The number of identified cases, however, was small compared to the number of hydraulically fractured wells."*
- EPA states in the Conclusion chapter of the final 2016 report: "*Overall, we conclude activities in the hydraulic fracturing water cycle can impact drinking water resources under some circumstances. Impacts can range in frequency and severity, depending on the combination of hydraulic fracturing water cycle activities and local- or regional-scale factors."*
- This is a reasonable statement, but persons with different viewpoints may interpret this language in different ways because the text included several qualitative words or terms.
- Change in tone of language in final
  - Timing - end of Obama Administration

Other Applications

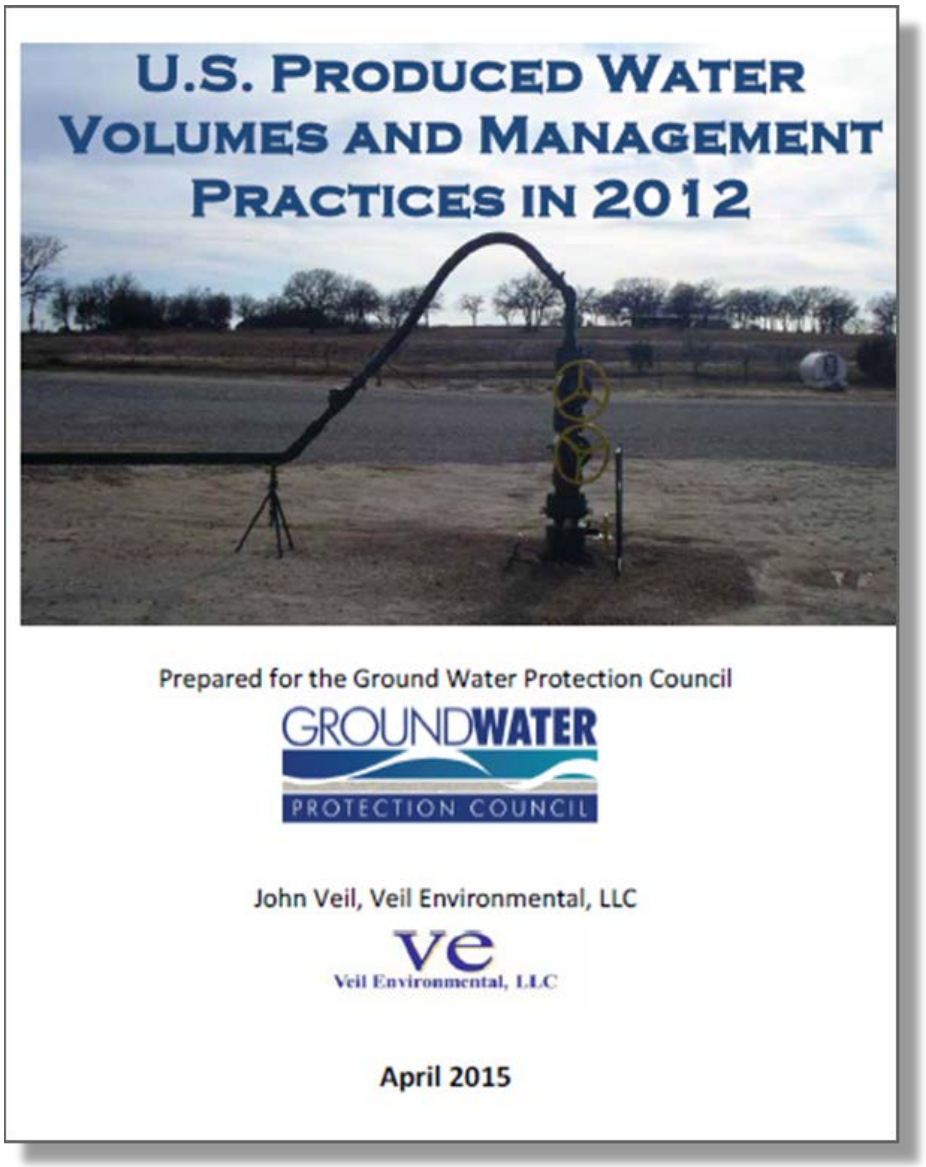
- Expert witness work
  - Review documents prepared by opposition
  - Assist your client's lawyer in finding flaws in opposition case
- Preparation of your own reports
  - Follow the same approach to make the reports as strong as possible and able to withstand scrutiny
- Peer reviewing manuscripts for scientific journals
- Misleading media efforts
  - Gasland flaming faucet scene

Expert Witness

- I cannot talk about details or identities of my clients in this presentation
- The case involved underground injection practices
- The organization filing the lawsuit against my client hired an expert witness who had served in that capacity many times
  - The person knew oil and gas issues, but was not an expert on injection
- I was hired to review that “expert’s” written material and conclusions about injection practices
- I found many flaws in data, assumptions, and analysis
- I prepared a rebuttal report for my client and sat for a deposition by the opponent’s lawyer
- Case was settled prior to trial

Following the Approach in My Own Reports

- 2015 produced water report done for the Ground Water Protection Council
- Collected data from oil and gas and environmental agencies in 31 states.
  - They had differing degrees of data detail and quality
- In order to compile data from all sources, I needed to fill in many gaps and use assumptions and extrapolations
  - These were explained as clearly as possible in the text



Requests for Data

- Produced water, oil, and gas volume data

Type of Hydrocarbon	# Wells Producing Primarily That Type of Hydrocarbon	Total Volume of Produced Water Brought to Surface (bbl/year)	Volume of Hydrocarbon Produced (bbl/year or Mmcf/year)
Crude oil from conventional formations			
Natural gas from conventional formations			
Crude oil from unconventional formations			
Natural gas from unconventional formations			
Other			
Total			

Requests for Data (2)

- Produced water management data

Management Practice	# Wells Using That Practice	Total Volume of Produced Water Managed by That Practice (bbl/year)	Percentage of Produced Water Managed by That Practice
Injection for enhanced recovery			
Injection for disposal			
Surface discharge			
Evaporation			
Offsite commercial disposal			
Beneficial reuse			
Other			

Texas Example from Produced Water Report

- Texas generates 35% of all U.S. produced water, but the Railroad Commission was unable to give me many details on how the water is managed (could not distinguish between water injected for enhanced recovery and for disposal)
  - I examined several different data sources
  - The difference between the highest and lowest estimates was about 60 million bbl. For the Texas total volume, that was just a fraction of a percent difference. But compared to the total produced water volumes from many other states, 60 million bbl was a significant volume.

Data Source	Total Injected Volume (bbl/yr)
Questionnaire provided by RRC	7,435,659,156
H-10 Database – query for fluid type volumes (includes Salt Water, Fresh Water, Fracture Water Flow Back, Steam, and Other fluids)	7,435,586,803
Same as above, but omit Other fluids	7,377,220,312
H-10 Database – query for injection volumes	7,437,897,785
Separate Vendor-Compiled Database	7,421,046,425

Texas Example (2)

- Had to make various assumptions to allocate total injected volume
- While preparing a similar 2009 study, the person who managed the UIC program for the RRC at that time (he has since retired) provided an estimate that 32% of the produced water was injected into a non-producing formation for disposal and 18% was injected into a producing formation for disposal. The remaining 50% was injected for enhanced recovery.
- In the absence of having any conclusive data, I combined the 32% and 18% to give 50% going to disposal, leaving 50% going to enhanced recovery
- That allocation was applied for Texas and several other states in the study
- This method may not have given a highly precise answer, but when the assumptions are made clearly, it allows other readers to evaluate how the results were derived

California Example

- California Division of Oil, Gas, and Geothermal Resources (DOGGR) provided produced water generation and management data
- The statewide total produced water volume for 2012 was reported as 3,074,584,714 bbl
- DOGGR reported a managed water volume of 3,152,280,602 bbl, which was larger than the produced water generated volume (3,074,584,714 bbl)
  - Most of that volume was injected for enhanced recovery
- The amount of water needed for water flooding and steam flooding (common in some California fields) exceeded the amount of available produced water. As a result, other sources of water were used to supplement the produced water. This caused the discrepancy in numbers.

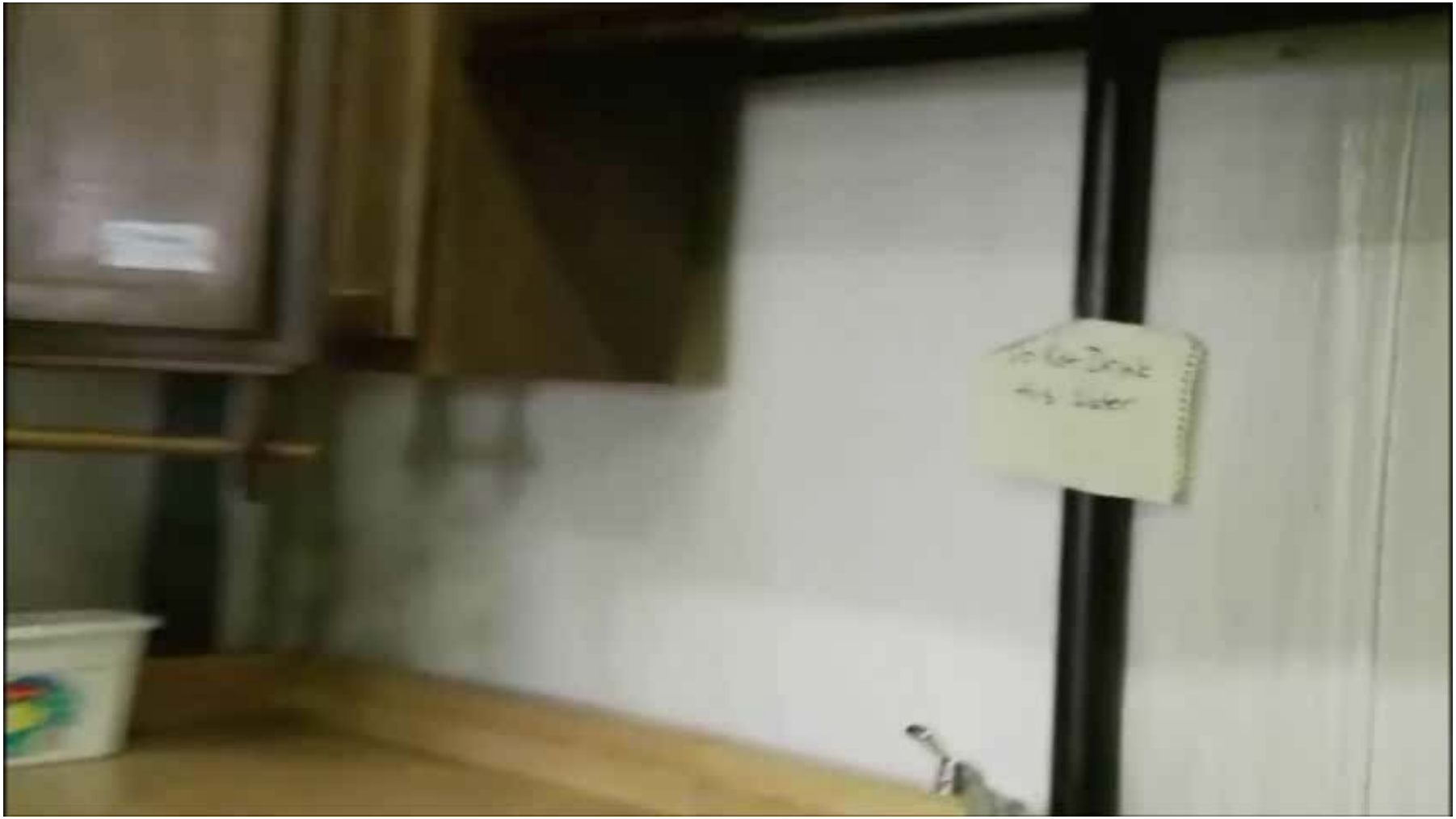
California Example (2)

- To balance the produced water generated with the produced water managed, the volume injected for enhanced recovery was reduced with the differential volume being considered as makeup water from another source
- These assumptions were stated clearly in the report so readers could understand how the final numbers were derived
- A similar situation was found in the data provided by several other states

Peer Review Process

- Most scientific journals require that manuscripts get reviewed by other “peers”
  - Ironically, authors are asked to provide names of potential reviewers
- I have reviewed numerous manuscripts and often found
  - Poor choices of data
  - Failure to acknowledge or use legitimate data (particularly in other “grey literature”
  - Failure to provide clear explanations of assumptions made and why they were made
  - Overly complicated analyses (modeling) to develop conclusions
  - Reliance on modeling results that may contradict real-world situations
- When an author uses poor terminology or is sloppy in writing introductory material, it raises questions about whether the data, assumptions, and calculations are sloppy too

Misleading Media Material - Excerpt from Gasland Movie



Final Thoughts

- Environmental reports, permits, and other documents are abundant and important
- When documents do not use good data, valid and clearly stated assumptions, and appropriate analyses, they can result in less-than-accurate conclusions that may cause significant financial implications to the industry or unintended environmental impacts
- While many documents are intended to be unbiased, some documents prepared by advocacy groups (on both sides) are often slanted to promote an agenda
- Thorough review and critique of documents can help to avoid “bad science” or “fake news”