



SUMMARY OF COMMENTS ON DRAFT REGIONAL MONITORING PROGRAM.

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Overview: The draft attempts to set out guidelines for groundwater monitoring in areas of oil and gas well stimulation, doing so on both an “area-specific” and “regional” scale. The draft proposes groundwater monitoring plan requirements, proposes an approach to define and establish baseline water quality within the monitoring zones, and proposes analytes to be assayed for in collected groundwater samples, sampling protocols, and testing and reporting requirements. Unfortunately, while the overall structure and approach of the draft is commendable, many key details are left unconsidered or poorly addressed. A summary of those concerns are listed below.

1. **Of critical concern is the fact that many important aspects of the “Regional” monitoring program are poorly defined, including the definition of “region” itself.** How small an area, for example, can constitute a “region”? How big an area can a single “region” embrace? Can a single region embrace more than 1 aquifer? More than 10? More than 100? Is there any limit on the total volume of potentially potable underground water present before the single “region” must be divided into multiple “regions”? Is there a minimum number or minimum density of oil and/or gas production wells that specifies a “region”? Is there a maximum density? How many working, idle and/or abandoned oil/gas production wells can be present within a single “region”? Is there a maximum density beyond which the “region” must be divided into two or more “regions”? Is there any limit to how many Underground Injection Control (UIC) wells can be present within a single region (or limit on the density of such wells)? Is there any limit to how much produced water and/or waste stream fluids can be injected into a single “region”? **None of these questions are “academic” or trivial, since they directly relate to the number of potential groundwater contamination sources in an “region” and thus the degree of threat to the aquifer(s) within that “region”.**
2. Answers to all the questions above will help in formulating a response to yet another unanswered question posed by the vague definition of “region”. **Nowhere in the draft is there any formula or calculation or even rationale that would specify the minimum number of groundwater monitoring wells required for a “region”.** Since “region” size, total well number, injection waste volumes, geology, aquifer characteristics etc will vary from region to region, there should be some rationale presented to determine the minimum number of groundwater monitoring wells needed. Will that number be determined relative to the number or density of oil/gas wells in the “region”? Relative to the number or density oil or gas wells to undergo stimulation? Relative to the number or density of UIC wells?

Relative to the volume of liquid waste injected underground through those UIC wells? Relative to the volume of groundwater that must be monitored within that “region”? **The rationale should be presented and thoroughly explained.**

3. Little information was given regarding the placement of UIC wells relative to groundwater monitoring wells. **Placement of all future UIC wells should be considered in this draft proposal. Ideally, all UIC wells would be required to be placed somewhere between the “stimulated” oil/gas well and the “downgradient” monitoring well(s).** If an UIC well is placed “downgradient” of a monitoring well, contamination associated with waste liquids injected through the UIC well would most likely go undetected. Proper placement of the UIC well is critical to effective groundwater monitoring efforts, and thus should be considered in this draft proposal.
4. Section 2.1.2 of the draft proposal states, “*an area-specific groundwater monitoring plan applies only to the stimulation well(s)*”. Limiting groundwater monitoring only to “stimulated” wells would severely limit the value of the groundwater monitoring effort. Nearby working, idle and/or abandoned oil/gas wells... as well as UIC wells in the “area”... could also negatively impact the groundwater quality in the aquifer and should be monitored. In light of this reality, **all oil and gas wells and all associated UIC wells in the “monitoring area” should be monitored, even if it requires placement of additional monitoring wells.**
5. Section 2.1.3 of the draft proposal states, “*Following well stimulation, area-specific groundwater monitoring well shall be placed on a semi-annual monitoring schedule*”. **No scientific rationale for monitoring groundwater only twice per year is presented. In fact, however, a logical, data-based rationale for defining the time interval between monitoring events can be developed.** Using groundwater flow measurements, the minimum “transit time” for a pollutant to travel from a “source point” (a stimulated oil or gas well or stimulation zone, for example) to monitoring point (a monitoring well) can be estimated. That “transit time” (duration) can then be set as the **maximum** time interval between monitoring events. Additionally, while Section 2.1.3 of the draft requires that groundwater samples must be collected *before* and *following* well stimulation, it is curiously silent about monitoring *during* well stimulation. **Since well stimulation can occur multiple times over the course of many weeks, it seems reasonable to require that groundwater sampling also be undertaken *during* the well stimulation when multiple stimulation events over many weeks occur.** One might require, for example, that groundwater monitoring be undertaken every 2 weeks during a prolonged well stimulation protocol spanning more than a total of 4 weeks.

6. As presented in Section 2.1.1 for “area-specific” monitoring, *“At a minimum, one upgradient and two downgradient monitoring wells will be required for each protected aquifer that is penetrated by the stimulated well”*. It may be that 3 wells per aquifer is sufficient, but no scientific basis for that conclusion is presented. Neither does there appear to be any consideration given to the size of the aquifer or the volume of water it contains. As was pointed out for the “regional” monitoring scheme, **without presenting some kind of rationale for determining how many monitoring wells are needed the decision to use “one upgradient and two downgradient” monitoring wells appears arbitrary**, if not logically groundless. Three monitoring wells may in fact be the perfect number, but some logical rationale for that needs to be presented.
7. In Section 2.1.3 (Sampling and Testing Requirements) for “area-specific” groundwater monitoring, the draft states (in 2.1.3 Part 5) that *“groundwater samples shall be analyzed using current applicable U.S. EPA-approved analytical methods”*, and then proceeds to cite a number of minerals, salts, metals, radionuclotides, hydrogen sulfide, and a list of various organics that might be present in hydraulic fracturing fluids, produced water, UIC well fluids etc. **Nowhere in Part 5, however, does the draft address at what concentration levels the assays will be undertaken. Will all analytes, for example, be assayed for at the parts per million level? The parts per trillion level?** This should either be specified here or in an addendum attached to the draft.

Furthermore, while the list of analytes presented in Part 5 admirable, there are some omissions that stand out. What of **halogenated hydrocarbons** and solvents used in drilling, stimulation and/or well production? Other common chemicals (such as **alcohols, glycols, and biocides**) are (as stated in Section 2.1.3 Part 6) only to be included for assay *“if concentrations of the analytes listed in part 5 change between sampling events... then additional laboratory analysis shall be conducted”*, but that hardly seems reasonable. Since those chemicals are routinely used in well stimulation and production (and thus can also appear in the UIC well injection fluids), they **should be include in the analyte assay list in Part 5**.

Finally, the idea of “change” between sampling events (as stated in Section 2.1.3 Part 6) as a trigger for broadening the analyte analysis seems needlessly arbitrary. Change to what degree? **It is far better to specify the minimum level of “change” that will trigger “additional laboratory analysis”**. Any change beyond 10% of the **initial** sampling value, for example, could be used to automatically trigger additional testing.

8. Also conspicuously absent from the draft document is an answer to the following question. **What happens if contamination of groundwater is found? Is the State Water Board legally bound to immediately contact**

the State and Federal EPA so that any applicable action can be undertaken as quickly as possible? There should be no “grace period” for reporting groundwater contamination.

9. Unfortunately, it is unclear that “regional” groundwater monitoring will assay for exactly the same set of analytes as is specified for “area-specific” monitoring. If indeed the “regional” groundwater monitoring plan will assay for exactly the set of analytes, that should simply be stated in the draft to clarify the ambiguity. If, however, the “regional’ groundwater monitoring plan will assay for a different set of analytes (or assay at a different concentration range), that too should be clearly stated and all analytes to be tested for listed as they are in Section 2.1.3 Part 5.
10. The responsibility for groundwater monitoring under the program laid out by this draft vs monitoring which might be carried out by the GAMA (Groundwater Ambient Monitoring and Assessment) program, as suggested in Section 4.2 “Surface Activity Effects” of the draft, seems ambiguous. According to Sec. 1.0 (page 3) of the draft, oil and gas well operators will conduct, and thus be directly responsible for, groundwater monitoring. Logically that would include monitoring groundwater present under produced water ponds (which generally also contain chemicals far more toxic than water) and groundwater near UIC wells associated with the oil or gas production wells. If there is a logical reason for excluding oil and gas well operators from monitoring produced water ponds or UIC wells in an “area-specific” monitoring plan, the draft should present that argument.
11. As stated in Section 1.0, regional groundwater monitoring programs will be implemented by the State Water Resources Control Board (State Water Board). Does that mean that the oil and gas well operators are absolved of legal and financial responsibility for carrying out groundwater monitoring on a “regional” scale? If so, this is unacceptable, and for a number of reasons. First, the activities of the oil and gas companies are the major reason this gigantic groundwater monitoring program is necessary in the first place. They reap the profit, so they must bear the cost of monitoring. Second, it seems as though a “long term” plan in the draft is to shift from “area-specific” to “regional” groundwater monitoring. If that is the case, then the cost of groundwater monitoring shifts from oil/gas operator-financed “area-specific” monitoring to taxpayer-financed monitoring via the State Water Resources Control Board. The oil and gas well operators should either pay: (i) the full cost of “regional” groundwater monitoring, or (ii) some clearly defined and publically/legislatively debated per cent of the total cost.
12. Other, less pressing concerns are provided in comments to the draft, which I have sent along with this document. Thank you for reviewing my comments. Sincerely and respectfully, Dr. Steven White