National UIC Technical Workgroup
Final Work Product #3

MEMORANDUM

Date: July 30, 1998

Subject: National UIC Technical Workgroup Assistance for Directing the Class V Study on Type 5X14, Type 5X15, and Type 5X16 Injection Wells

From: Paul Osborne, Workgroup Chair
Nathan Wiser, Workgroup Co-Chair

To: Anhar Karimjee
Regulatory Implementation Branch (4606)

The national UIC technical workgroup has reviewed the May 7, 1998, drafts of three papers developed to help determine if additional regulations may be necessary to properly govern solution mining injection wells (type 5X14), in-situ fossil fuel recovery wells (type 5X15), and spent brine injection wells (type 5X16). We appreciate your request for our assistance in this important national endeavor. The papers, as written, require substantially more emphasis on current management techniques and the inherent risk each type of well poses. Also, each paper would benefit from visual aids, such as diagrams, maps, or flow charts. What follows are specific comments to focus each of these paper's direction to include these important concepts so as to ultimately address the larger question of the Class V study, namely, whether additional rule- making is necessary to protect underground sources of drinking water from potential contamination by these three specific types of injection wells. A full description of the current regulatory controls imposed by the various agencies in each State is the most critical shortfall in each paper.

Solution Mining Injection Wells (Type 5X14)

The May 7, 1998, draft paper compares these wells to Class II wells. There is little resemblance between injection wells used for mining conventional mines (type 5X14) and wells used to inject for oil and gas production (Class II). This comparison does little to address the risks posed by solution mining wells and, in fact, detracts from the overall objective of the paper. The paper attempts to draw the conclusion that a solution mining well project may be converted to a petroleum storage project requiring Class II wells. In this comparison, the solution mining project to begin with is likely to be a salt solution mining project utilizing Class III wells, not type 5X14 wells. Thus, the argument that type 5X14 wells, with lower regulatory standards, would ultimately become Class II wells, is not likely. It is more likely that Class III wells would become Class II wells, after salt solution activities are finished. Type 5X14 wells are used to inject for the purpose of extracting heavy metal-bearing solution associated with metals mining, not salt mining. A metals mine will nearly always have far too many faults and artificial penetrations to make petroleum storage unattractive since containment of the petroleum product would be difficult to establish.

Throughout the draft paper, the authors cite solution mining operations which actually utilize Class III injection wells while referring to them as type 5X14. Hence, the data which is drawn upon for risk, chemical analyses, often are actually chemical analyses of Class III injectate. It is imperative that the correct types of fluid be used for referencing the inherent risk posed by the injectate entering type 5X14 wells. The injectate in type 5X14 injection wells will normally be corrosive in nature, since in-situ leaching of metals from host rock is the mining activity associated with these injection wells. We recommend that the paper contain a side-by-side comparison of actual chemical analyses of type 5X14 injectate and any corresponding health- based standards established for the same constituents. This exercise will illustrate the inherent chemical riskiness of the injectate.

The same inaccurate classification of wells which are actually Class III wells as type 5X14 injection wells leads to vastly inflated estimates of the universe of these wells in the country. For example, there are approximately 20,000 solution mining wells located in Texas are regulated by the Texas Railroad Commission as Class III wells, yet the draft paper includes them as solution mining wells in Attachment A, which could be used to infer that they are type 5X14 wells. We recommend that the authors extract the known universe of Class III wells from their collection of solution mining wells in order to arrive at a more accurate well count for type 5X14 injection wells. After conducting this exercise, a distribution map displaying the results would be useful.

There are no schematic figures in the May 7, 1998, draft paper. We believe that figures showing typical type 5X14 well citing and construction, in relation to an overall mining project, will help to clarify to the paper's audience where type 5X14 injection wells fit into a project involving solution mining of conventional mines.

We suggest that the authors contact the New Mexico Environmental Department (NMED). Region 5 has had discussions with NMED that indicated that there was at least one solution mining project that involved an aquifer exemption. Despite the exemption, the project was either impacting or nearly impacting a USDW. Apparently it was a pilot project that was permitted by NMED as a class V experimental technology site. It suffered financial problems, and was abandoned literally with a few minutes notice. NMED has been working to deal with the situation. We suggest that the authors include a discussion of the failures in this project with an eye toward how any problems may have been prevented under the jurisdiction of the UIC program.

The discussions in the May 7, 1998, draft paper, under "Secondary Impacts", contains some incorrect information regarding the Copper Range solution mining project. First, the Federal Railroad Administration (FAR) inspected the tracks numerous times, and concluded that all tracks and bridges were adequate for the use intended. Second, the Ontonogon Fault does **not** underlie Lake Superior, based on a detailed study performed by the United States Geological Survey (USGS). Third, the use of explosives in the mining would have no impact on the containment of fluids in the mine, according to studies by the USGS, Michigan Department of Environmental Quality (now Michigan Department of Environment Quality (MDEQ)), EPA, and the Department of Energy. A full review of potential secondary impacts was performed in a preliminary Environmental Analysis of the proposed project. This analysis showed that few if any secondary impacts were likely.

A critical area in the paper needs further amplification: the information regarding the present regulatory requirements imposed by the various agencies involved in governing solution mining of conventional mines. A comprehensive table showing the specific requirements imposed in each State, by the relevant agency, would be quite helpful to determine if adequate controls exist to protect against endangerment. The existing Table 2 is a first attempt at this, but it fails to provide much specific information, and is poorly organized.

The authors may be well served by traveling to Regions 5 and 8 to look at records available in these offices. There are copious amounts of literature to review containing more accurate information about type 5X14 injection wells in these offices, and requesting them under the Freedom of Information Act may be cumbersome, expensive, and time-consuming for the Regional staff. On the other hand, direct interviews with those Regional staff involved with these projects in the Regions may glean much helpful information for finalizing this paper.

Experts on type 5X14 wells that may be willing to assist the authors include: Richard Ohrbom, NMED (505) 827-0219

In-Situ Fossil Fuel Recovery Wells (Type 5X15)

The May 7, 1998, draft needs to better focus the overall coal gasification and oil shale retorting processes into a series of reactions, utilizing a discrete chemical reaction for each of the process steps in order to present a clearer understanding of the overall process and which part(s) of the process present the highest risk. For instance, the introduction of air via the type 5X15 injection well is the oxygen source which combines with the carbon in the coal or shale to produce CO_2. These chemical steps in the overall process, coupled with specific physical steps (such as air injection, rubblization, retorting, etc.) will allow the reader to better understand the limited role played by actual injection activities. Rather, the risks posed by the active recovery process can be more accurately focussed on the portions that are traditionally outside the scope of the UIC program, such as burning and retrieving product gases. The paper would be better if the more toxic by-product chemicals could be more directly linked to specific chemical process steps in each of the two processes.

The draft would benefit from inclusion of schematic drawings and flow charts depicting the overall process, showing the role of injection wells in both coal gasification and shale retorting. In addition, this may be a convenient way to display the source of the myriad risky chemical and physical processes presenting endangerment. Also, a map showing the known locations of these projects would be very helpful.

The draft needs to emphasize the importance of both the proper pre-construction steps and proper plugging and abandonment of the various discrete underground appurtenances associated with both the underground coal gasification and oil shale retorting processes. The document describes several groundwater contamination cases, but fails to discuss what would have prevented the contamination. For the initial construction of the oil shale retort, dewatering efforts may be important to assure that the shale is isolated from groundwater prior to startup of the actual retort construction. Proper steps taken to cleanse and seal off the underground features, such as the retort (oil shale retorting), underground pipes (coal gasification), and any attendant wells, is a requisite part of the final stage of the processes.

The authors should either correct the draft paper's reference to the Department of Energy's Rock Springs, Wyoming site as being a Superfund site, or else delete the discussion altogether. The site was not declared a Superfund site and a decision of no further action was made.

The all-important discussion in the draft paper about the current regulatory controls existing at the State level, is lacking completeness and coherence. It appears that the authors investigated whether each given State has rules governing in-situ fossil fuel recovery wells, but attempted no analysis of whether (1) the rules were adequate by themselves, or (2) whether there exist additional rules governing the other aspects of in-situ fossil fuel recovery. This needs extensive documentation. The audience reading this paper need to know which of the various stages involved in the in-situ recovery of the fossil fuel is regulated, and if so, what requirements are imposed. Given the several cases of contamination described in the draft, one wonders whether the overall processes are properly governed. There are at least seven incidents of ground water contamination described (including one in Australia), yet it is not known what contribution, if any, type 5X15 injection wells had in the contamination. A larger question may ultimately be asked when the Class V study is completed: should the injection wells alone be regulated, or should the overall process be regulated, and if so, what authority does the UIC program have to govern this?

The experts on type 5X15 wells that may be willing to assist the authors have largely left the State agencies at this point. Paul Osborne in Region 8 has files that would be useful, and he may be able to provide a link to some of the now-retired State employees as contacts.

Spent Brine Return Flow Wells (Type 5X16)

The May 7, 1998, draft makes several comparisons to Class III wells, which operate under conditions which are very different from those associated with the mining operations utilizing type 5X16 injection wells. The Class III salt solution mining wells inject fresh water into a very non-porous, often dry rock formation to dissolve the salt and create a lixiviant. The type 5X16 injection wells re-inject the remnant brine taken from connate water in porous formations containing commercial quantities of inorganic ions such as magnesium, bromine, or boron. Thus, the process utilizing type 5X16 wells amounts to a system designed primarily for fluid mass balance rather than the Class III wells which are designed purely for mining purposes. The overall mining process extracting ions from a connate brine does not require injection wells a priori, since the product ions have already been removed. On the other hand, Class III wells are obligatorily needed for mining the salt resources. In fact, the most relevant comparison may be to Class I wells, since the spent brine is essentially a waste fluid from an industry. Indeed, there may be residual waste constituents in the spent brine which do not originate in the connate water, such as added ammonia resulting from bromine extraction. The comparison in the draft should either be made much clearer, or it should be deleted altogether.

Further, the draft compares type 5X16 wells to Class II wells, emphasizing how both well types return unwanted waste fluids generated from exploitation of underground resources. This comparison, while following a reasonable logic, sidesteps the very important distinction that Class II wells are associated with a completely different part of the Safe Drinking Water Act (i.e. §1425 for primacy States, and §1421(b)(2) in direct implementation States), and a very different regulated community. The fact that the Safe Drinking Water Act separated wells associated with oil and gas production from other underground injection wells is of significance. It does not seem appropriate to compare type 5X16 wells to Class II wells within the context of the Class V study, since Congress explicitly dictated special treatment for Class II wells, but did not do so for any other type of injection well. The Class V study, rather, should focus on the inherent risk posed by type 5X16 wells.

The draft would be improved if both schematic diagrams and process flow charts were included to depict the generation of the spent brine, and to show how the spent brine is typically injected. A map showing the national distribution of these wells would also be helpful. Further, a side-by- side comparison of the chemical analytical results from waste fluids injected into type 5X16 wells were juxtaposed with any correlative health-based standard. For instance, although the authors specify that arsenic may be present in spent brine, they do not acknowledge that concentrations of arsenic above 5.0 mg/l would define the waste as hazardous. This exercise would focus the paper on the risk of chemical toxicity of the spent brine.

The description of current regulatory requirements is inadequate to determine if these wells are properly managed throughout the nation. It would be useful to describe what types of specific requirements are imposed in each State with type 5X16 injection wells, beyond the sampling requirements in Region 5 and an unspecified mechanical integrity requirement in Arkansas. This would allow the reading audience to see how consistent type 5X16 injection wells are currently regulated, in terms of specific requirements. A useful format for such comparison would be to make a table, similar to those in draft papers on type 5X14 and type 5X15 wells, containing the specific regulatory controls in each State in the country.

Experts on type 5X16 wells that may be willing to assist the authors include: Gary Looney, Arkansas Oil and Gas Commission (501) 862-4965

cc: Connie Bosma