Dr. William H. Schlesinger's Comments on BLM's Draft EIS

Final Comments on Draft Environmental Impact Statement Related to Water Quality

29 March 2002

Bureau of Land Management
Paul Beels (Project Manager)
1425 Fort Street
Buffalo, Wyoming 82834

Dear Mr. Beels:

I write with comments on the "Draft Environmental Impact Statement and Draft Planning Amendment for the Powder River Basin Oil and Gas Project" (WY-070-02-065), as prepared by the Bureau of Land Management.

First, let me say that I am an academic scientist with 25 years of experience in studying environmental chemistry and plant-soil relationships, primarily in arid and semiarid regions. I have field experience in the deserts of California, New Mexico and Nevada, and have published more than 130 scientific papers and a major textbook (*Biogeochemistry*, Academic Press, 1997) on environmental chemistry. I am certified as a senior ecologist by the Ecological Society of America, and president-elect of that society for 2003-2004.

I have read the entire EIS and examined the appendices submitted with it. At first glance, the document appears comprehensive—recognizing potential impacts inasmuch as allowed by the available data. In general, however, I am struck by the lack of data obtained from the existing coal bed methane (CBM) gas wells. The 12,077 existing wells, with their associated reservoirs and outflows, represent a large, replicated experiment that should have provided ample opportunity to answer most of the questions that I will pose below. The absence of data on these issues casts serious doubt on the credibility of the estimated impacts of the proposed expansion of the CBM well network.

Let me treat these individually:

1) Table 3.2 provides some analyses of water pumped from existing CBM wells. While data are provided for some potentially toxic elements (viz. As, Ba and Se), they are notably lacking in the analysis for others (e.g., Hg) which have high concentrations in many coals. Given that these data are means of many samples, not weighted by volume, it was impossible for me to check the cation-anion balance

of these waters to see if some major constituents might have been overlooked. Minor constituents could be problematic if they are concentrated due to evaporation (see # 2 below). Was the water from any existing well subject to a full analysis, including all potential trace, toxic elements?

2) The proposed project depends heavily on the storage of water in local reservoirs near each well. These waters will be concentrated by surface evaporation (estimated to be 53%; p. 2-27) from the reservoir; indeed, this process is anticipated to be important to the reduction of the volume of water from CBM wells. If a substantial volume of water is lost from these reservoirs by evaporation, then the salt content of the remaining waters will increase. In subsequent evaluations of the effects of CBM water, it is not the concentrations measured in fresh well-waters (e.g., table 3.2) that are relevant; rather, it is the concentrations that are found in containment ponds, where these waters are concentrated by evaporation. It is noteworthy that there seem to be no data on the concentration in ponds associated with existing CBM wells. What is the concentration of As, Ba, Se, and other elements in these waters? What is the Sodium Adsorption Ratio (SAR), electrical conductivity (EC), and pH of these waters? I suspect that the SAR will increase disproportionately, owing to the precipitation of Ca and Mg minerals during evaporation, while Na ions remain in solution.

3) While I found no data for the SAR of the water actually contained in ponds associated with CBM wells, if the SAR of these waters is elevated, then the soils beneath these ponds may be dispersed, minimizing the infiltration of waters that are held in the ponds. Page 2-27 indicates that 10% of the contained water is expected to infiltrate, potentially reducing the amount of water that might escape to surface runoff. The 10% value is poorly documented, and should this percentage be lower, greater runoff is expected. Again, it is unfortunate that there are no field data on the infiltration capacity or water balance of existing CBM well containment ponds, nor any indication whether the initial rates of infiltration are sustained over several years.

4) The report includes a comparison of the mean SAR of CBM waters compared to the average properties of several surface waters in the region. However, since most organisms respond to extreme, rather than average, conditions, the most meaningful analysis will compare the effect of adding CBM water during times of minimum flow of the natural streams. Indeed, sagebrush is responsive to even small changes in the pH of surface soils and is known to be intolerant of alkaline (Choudhuri 1968) and acid (Gallardo and Schlesinger 1996) soils.

5) A wealth of literature from arid and semiarid lands shows how vegetation responds to changes in the availability of surface waters (e.g., Schlesinger and Jones 1984). The addition of water from CBM wells will convert normally ephemeral surface streams to conditions of permanent flow. We can anticipate that this will encourage a proliferation of vegetation—both native and exotic. Here again, no advantage has

been taken to study these effects of existing CBM wells. It is noteworthy that sagebrush is responsive to small changes in soil moisture (Campbell and Harris 1977) and known to be intolerant of flooding (Ganskopp 1986), so that changes in soil moisture content in areas it now dominates could lead to dramatic changes in the cover of vegetation.

6) The EIS assumes a "conveyance loss," (sometimes also known as "transmission loss") of 80% when CBM waters travel in surface drainages leading to higher-order streams. This value is attributed (p. 4-42) to two unpublished reports on the fate of water from CBM wells in the region of the current EIS. If conveyance losses are less than the postulated 80%, then a greater proportion of the CBM water will pass through the local drainages, reaching the main streams carrying surface discharge from the region.

I could not find good field studies specific to the region of impact, but studies from other arid and semiarid regions show "first-mile" transmission losses of 2% (western Kansas, Jordan 1977), 4.66% (northwestern India, Sharma and Murthy 1994), 7.25% (southwestern Saudia Arabia, Walters 1990), and 17.4% (southeastern Arizona, Lane et al. 1971). Most of these data are derived from studies of the fate of floodwaters in initially dry stream channels of ephemeral streams—not to the conveyance loss in streams with perennial flow. Since the conveyance loss under continuous flow would be expected to be lower, let's say that a value of 5%/mile applies to streams that would receive runoff from CBM wells in this area of Wyoming. The 80% conveyance loss anticipated in the EIS would be applicable only if the waters travel at least 16 miles before joining a major drainageway. Clearly water from CBM wells is likely to reach major regional rivers.

References:

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Ganskopp, D.G. 1986. Tolerances of sagebrush, rabbitbrush, and greaswood to elevated water tables. Journal of Range Management 39: 334-337.

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Sharma, K.D. and J.S.R. Murthy. 1994. Estimating transmission losses in an arid region—a realistic approach. Journal of Arid Environments 27: 107-112.

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Summary Comments:

The EIS recognizes most of the hydrologic processes involved in the disposal of the water produced from CBM wells, but it fails to provide adequate data on the likely magnitude of those processes, including infiltration, evaporation and runoff, nor estimates of the quality of the water that is delivered to major perennial drainagways. The effects of this water on the receiving ecosystems are very likely to be much greater than indicated by simple mixing models of mean streamwater conditions. Changes in the flow of water will have enormous impacts on ecosystem properties of the ephemeral streams of this region. Throughout the report, little advantage was taken to study the existing CBM wells, which provide a natural laboratory to answer all of these questions.

Sincerely,

William H. Schlesinger

James B. Duke Professor, Biogeochemistry And Dean