

Appendix A

Peer Reviewer Comment Letter

Summary of Peer Reviewer Comments for the Hydraulic Fracture Study: PXP Inglewood Oil Field

Prepared for

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FINAL REPORT



Context

In May, 2012, the authors of this report were selected by the County of Los Angeles (the "County") and Plains Exploration & Production Company ("PXP") as peer reviewers for the *Hydraulic Fracturing Study: PXP Inglewood Oil Field* prepared by Cardno-ENTRIX (the "consultant"). This report and peer review resulted from the Baldwin Hills CSD litigation Settlement Agreement.

Based on the direction provided in Term 13 of the Settlement Agreement, the objective of the peer review is to review the work of the independent consultant and provide advice to the consultant and a final evaluation to the County and PXP in order to provide an accurate and verifiable study:

The peer reviewer will be provided with access to all the data and materials provided to the independent expert. The peer reviewer shall agree to keep all proprietary information confidential. If the peer reviewer determines that the study is materially inadequate, incomplete or inaccurate, it shall so advise PXP's consultant who will complete the study as reasonably recommended by the peer reviewer and provide the revised study to the peer reviewer within 90 days. Upon acceptance by the peer reviewer, the study and all supporting material, including comments by the peer reviewer, shall be forwarded to the County, DOGGR, the Regional Water Quality Control Board ("RWQCB"), CAP and Petitioners and be available to the public, with any proprietary information redacted.

In June, 2012, we began the process of reviewing the data used to develop the study, evaluating reports drafts and conducting a two day visit the site to get a perspective on the site context. What follows is a summary of the iterative process of review, advice and evaluation that led to the completion of the final study. Upon completion of the review, we both feel, based on information provided us and our own experience, that the report is adequate, complete and accurate and reflected thoughtful consideration for our comments and suggestions.

Process

We received the report draft of the study on July 14th, 2012 in compliance with the Settlement Agreement. We were also provided access to all data, research and reports used to assemble this draft at this time. We completed an initial review of the draft and the background material and developed comment and advice. These comments were communicated over a period of weeks rather than as one single response as we worked independently and then in coordination with each other and the contractor. This process allowed a number of key points to be refined based on effective criticism. The consultant responded by providing a revised

draft for our review and advice. From this draft, we provided further advice and comment. The final study therefore reflects this iterative peer review process rather than a single review and response that typify journal peer review. Ultimately, the final report is more responsive to our input than may have been otherwise.

Throughout this process, we strived to offer thoughtful and timely input into the evaluation and provide advice to the consultant on ways to improve the study and ultimately to consider whether the report was materially adequate, complete and accurate. In this memo, we tried to be cognizant of this charge and summarize the process, advice and evaluation.

Evaluation of the Draft Reports

Overall Impression: For the first draft of the report, both of us concluded that the report's organization was overly complex which might have made it difficult for a general audience to understand. We found ourselves losing some key concepts due to the flow. We suggested that certain chapters be combined and that the flow reflect a time relationship. This request led the consultant to produce a second draft reflecting the reorganization. The number of chapters went from 11 to 7 in total. With this consolidation and reorganization, the second draft was far more understandable for the non-technical reader.

The major consolidations involved creating a chapter called "Environmental Effects Monitored in Conjunction with Hydraulic Fracturing Tests" by combining two chapters that split the environmental effects into two parts. Also, the overall discussion of hydraulic fracturing was taken from two chapters to one covering "past, present and future." Finally, a single regulatory chapter captured both the regulatory framework of various jurisdictions and public concerns with operations that were originally two separate chapters. This new report structure carries to the final version.

The study benefits from the tremendous amount of available data. Given the field's long history of production, there is a significant amount of data available to assess the geological and operating conditions at the field. In addition to the historic data, the current operator conducted two fully-monitored hydraulic fracturing operations and two high-rate gravel packs. Other available data includes a number of reports on geological characterization, environmental evaluations, potential community impacts, and regulations. The draft report did a reasonable job presenting a summary of this vast database. We offered some suggestions of ways to streamline the material presented to enhance readability.

Completeness: Both the first and revised draft were quite comprehensive and for the most part complete. A few areas found to be lacking in the first draft included the following:

1. Given the relevance of fluid migration to this topic, we felt that the consultant needed to expand the discussion of hydraulic connectivity given in the first draft. In the revised draft, the discussion was combined into one clear section discussing this important topic.
2. The first draft was lacking a truly representative geological cross section of the field along with a geologic map. A sequence of cross sections providing a better visualization and a geologic map of the field appeared in the revised draft.
3. Being that our experience is primarily in the northeastern USA and Canada, we thought that a better discussion was needed on how this field compares to those outside of California where many of these issues have arisen.
4. Many figures lacked scales, adequate figure captions, and legends. In the revised draft, these items were improved. Annotation was added to the remaining figures for the final report.
5. We suggested a revised discussion of induced seismicity to include the relevance of the 1983 Coalinga earthquake to potential hydraulic fracturing in the, deeper thrust-faulted, pre-Pliocene units of the Inglewood field in light of similar geologic settings and regional stress regimes. This was included in section 4.5.5.

Also, there were a few key resources were not included in the draft that, if included, could help the reader understand the issues involved with hydraulic fracturing including Frolich 2012, Myers 2012, NRC earthquake study 2012, USGS 2012, and Warner 2012. Most of our suggested references were incorporated into the revised draft and many of these references were used to respond to our concerns above.

Adequacy: As mentioned, the draft report was extremely comprehensive. There were a few areas that we did not feel were completely adequate:

1. The diagrams showing the geologic structure at the field are difficult to understand and interpret. We requested that these should be redone or the text should be expanded to explain the visual. The final draft accomplishes this.
2. The oil fields of California and this field particularly are not similar to the fields of either Texas or the northeast. This distinction needed to be adequately explained to put the discussion of environmental issues in context. The revised draft did a much better job of this.
3. The regulatory section initially did not focus on the key elements of California in a way that made it clear to us how operations are regulated. The revised draft

combined sections and brought California front and center making this much easier to follow.

Accuracy: We did not find any major inaccuracies in either draft though there were some specific statements that were either inaccurate or contradictory and needed revision. Also, there were a few statements that lacked supporting evidence and could be questioned for accuracy. We requested that these statements be corrected or supporting evidence be provided. In response to our comments the author corrected statement in revised draft or provided a rationale for leaving the text as is that satisfied our inquiry.

Topic-Specific Report Comments

In addition to the numerous typographical edits and suggestions, there were some topic-specific comments that we spent considerable time reviewing. These topics include geology, induced fractures, seismicity, environmental issues, and regulation.

Geology: We had some issues with the readability of the diagrams for non-technical audiences. The first draft included one diagram which did not convey the complexity of the field as described by the work of Elliot and others (2009). The final version includes all three of their cross sections and the description. This helps to explain the geological conditions in the field much better and helps put the 3D visualizations in context. Blade-like features in the subsurface of several of the diagrams were unexplained and easily misinterpreted as fracture orientation. These features actually represent the distribution of proppant for the hydraulic fracturing stages. The final draft clarifies this with better legends.

Induced Hydraulic Fractures: We had some trouble understanding the discussion of the height and orientation of the induced hydraulic fractures from the two Nodular Shale tests. We suggested clarification of height of induced fractures to read height of zone of induced fractures. This change was made in the final draft.

Seismicity: In addition to the comment on page three, we requested some discussion of how the operator designs the surface infrastructure for hydraulic fracturing to mitigate the impact of a seismic event similar to what occurred at Coalinga. The final draft includes a description of the required standards for structures and other surface equipment.

Environmental Issues: The report covered the environmental issues typically identified with hydraulic fracturing but these issues were spread among a few chapters. We suggested that they be combined into one chapter.

One issue that we commented on was the potential for fluid migration. The first draft did approach this topic but we felt that a clearer description needed to be included regarding why

the geology limited fluid movement. In the revised report, the information presented and the flow of the discussion better explains why the lack of hydraulic connectivity minimizes the potential for fluid migration off of the site.

Since air emissions releases are of concern, the air quality section needs to be as comprehensive as possible. The draft report covered this topic well in three different chapters. We suggested that this might be more effective if most of this information could be condensed into the environmental effects chapter. This was accomplished in the reorganization of the revised draft.

There are a number of issues with hydraulic fracturing that are actually common to any oilfield operation regardless of the completion method. This includes many of the community impacts such as traffic and noise. The Baldwin Hills CSD EIR covers many of these common issues. Though we did not suggest that this study repeat the contents of the EIR, we felt that some reference should refer the reader to the appropriate EIR documents.

Regulation: The first draft covered regulations but we felt that the section should be reorganized so California regulation was covered first and that comparisons with other jurisdictions be made to California. Upon revision, the new regulation section accomplishes this effectively. The comparison table with the New York SGEIS is particularly useful to identify specific issues such as spill containment that were identified as important issues in the New York process.

Concluding Comments and Final Report Evaluation

Through the iterative review process, our comments, questions and criticisms were integrated into study in ways that, we feel, improved the final product. As peer reviewers, it is not our charge to become coauthors but to offer suggestions for improvement based on our expertise. In the end, the work remains that of the authors.

As the endpoint of the peer review process, the County and PXP has asked us to make a determination as specified in the Settlement Agreement:

“If the peer reviewer determines that the study is materially inadequate, incomplete or inaccurate, it shall so advise PXP’s consultant”

On September 30, 2012 we received from the consultant the final report for review and acceptance. Upon review, we both feel, based on information provided us and our own experience, that the report is adequate, complete and accurate and reflected thoughtful consideration for our comments and suggestions. This document serves as our final advice to the consultant, the County and PXP.

The Reviewers:

John P. Martin, Ph.D.

John is the founder of JPMartin Energy Strategy LLC which provides strategic planning, resource evaluation, project management and government/public relations services to the energy industry, academic institutions and governments. Prior to forming JPMartin Energy Strategy LLC in 2011, John spent 17 years working on energy research and policy issues at the New York State Energy Research and Development Authority and developed a series of projects targeting oil and gas resources, renewable energy development and environmental mitigation. He currently serves on the USDOE's Unconventional Resources Technical Advisory Committee. While at NYSERDA, he co-directed the Governor's Carbon Capture and Sequestration (CCS) Working Group, an interagency committee organized in 2007 to address CCS issues and served as point person on a series of technical studies looking at all aspects of hydraulic fracturing and multiwell pad development. John regularly lectures and publishes on such diverse topics as the shale resources development, carbon capture and sequestration, compressed-air energy storage, renewable energy resource development, and research policy. Prior to joining NYSERDA, he worked in academia, consulting and regional planning. He holds a Ph.D. in Urban and Environmental Studies, an M.S. in Economics and a B.S. in Geology, all from Rensselaer Polytechnic Institute. He also holds an M.B.A. from Miami University and completed graduate work in mineral economics at West Virginia University.

Peter D. Muller, Ph.D., C.P.G.

Independent consulting geologist specializing in structural geology, geologic mapping, and geologic data analysis. Presently researching subsurface migration of fluids in the northern Appalachian Basin and the relationship to hydraulic fracturing. Senior Geologist with Alpha Geoscience (2010-2012) concentrating on shale gas development in NY and PA. Professor of geology at the State University of New York at Oneonta (1983-2009; Chair 1999-2003) teaching courses in structural geology, map and field geology, engineering geology, mineral resources, waste management, physical geology, and environmental science. Worked as a staff geologist for Dames and Moore Consultants (1973-1975) and the Maryland Geological Survey (1980-1982). Peter received his BS in geology from Bucknell University (1971) and PhD in geology from Binghamton University (1980). He has extensive geological field experience in a wide range of settings, both domestic and international, and has published peer-reviewed research (articles and maps) on the structure, petrology, and tectonics of the Maryland Piedmont, the Adirondack Mountains of New York, and the Ruby and Blacktail ranges of southwest Montana.