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RE: Huasna Valley Oil Project (Excelaron) CUP DRC2009–00002

Dear Mr. McKenzie:

Here are my comments on the draft Environmental Impact Report (EIR) for the Excelaron (Mankins) Conditional Use Permit – Huasna Valley Oil Exploration and Production Project, Conditional Use Permit (CUP) DRC2009–00002.

As was the case with the EIRs for SunPower's project in the Carrizo Valley, I've not given each and every file in the draft EIR for the Excelaron project even a cursory inspection. Thus, there's the possibility that some of my comments are relevant to materials in the draft EIR that I did not find. That stated, I trust that you and others professionally acquainted with the entire draft EIR will be able to fit my comments into the sections where they may be relevant.

Here I first focus on the deficiencies in this draft EIR on the toxicity and safety aspects of hydrogen sulfide (H2S). Then, I offer more general remarks on the draft EIR. These touch on: splitting the CUP into an exploration and – if economically viable – production phase; the problem of getting production quantities of oil to a refinery; the need for an Energy Return on Energy Invested analysis; odors from H2S in the long term; the deficiencies in the maps in the draft EIR.

Deficiencies of the draft EIR with Regard to Hydrogen Sulfide

Hydrogen sulfide (H2S): a gas perhaps unique in its toxicity. I'm a retired chemist. I've not had experience with H2S in a setting of exploration or production of fossil fuels, although I've seen many of the warning signs about the presence of H2S at the entrances to oil and gas fields.   However, I've had extensive experience with H2S in a chemical laboratory.

That experience involved perhaps the most rigorous academic course I've ever been involved with — a quantitative-analysis course of some twenty economically important metals. The basis for the separation and quantitative determination of these metals involved routine use of hydrogen sulfide. But, that use only occurred in a laboratory fume hood. If one could smell the H2S, one knew there was a problem with the hood and stopped the procedure until the hood was repaired.

Hydrogen sulfide is uniquely toxic. The professor for my course summarized it succinctly (and often): " First it smells bad. Then it smells good. Then you don't smell it and you're in trouble." One H2S Safety Factsheet states the toxicity this way:

> "Hydrogen sulfide has a very low odor threshold, with its smell being easily perceptible at concentrations well below 1 part per million (ppm) in air. The odor increases as the gas becomes more concentrated, with the strong rotten egg smell recognisable [sic] up to 30 ppm. Above this level, the gas is reported to have a sickeningly sweet odor up to around 100 ppm. However, at concentrations above 100 ppm, a person's ability to detect the gas is affected by rapid temporary paralysis of the olfactory nerves in the nose, leading to a **loss of the sense of smell.** [bolding in the original; my underlining] This means that the gas can be present at dangerously high concentrations, with no perceivable odor. Prolonged exposure to lower concentrations can also result in similar effects of olfactory fatigue. This unusual property of hydrogen sulfide makes it extremely dangerous to rely totally on the sense of smell to warn of the presence of the gas [my underlining]."

The draft EIR on Hydrogen Sulfide and Workers' Safety. I've found no obvious difficulty in the draft EIR with regard to hazards and safety of H2S concerning workers at the project site. So, for instance, in the Project Description at page 2-24 one finds:

> "**2.3.2.4 Hydrogen Sulfide Contingency Planning**. The potential for and quantity of hydrogen sulfide (H2S) in the gas and oil is unknown at this time, although it is expected that the composition of the gas would be similar to historical production (i.e., low levels of H2S). An H2S contingency plan would be developed to address issues such as safety equipment, personnel responsibilities, first aid, and evacuation. This is a requirement of DOGGR prior to drilling. This plan would address employee safety and issues in the event of H2S exposure [my emphasis].
>
> "If gas intended for production was found to be sour [footnote 9] the well would be idled and either abandoned or the proposed project would be modified, including all revisions necessary to handle sour gas. These types of modifications would require review and additional permitting by the County.

> "Temporary H2S detection equipment would be included as part of a contingency plan associated with drilling. H2S detection equipment would monitor the drilling rig environment during the drilling of the test wells and be removed after the test wells are installed, assuming that the same formations would be penetrated. This temporary equipment would include H2S monitors on the drilling rig and breathing air packs at the rig and in the safety trailer."

The Draft EIR on Hydrogen Sulfide and Residents' Safety. Note well above that "this plan would address employee safety … ." But, what about the safety of people living and working in the vicinity of the project site? It's in that important subject that I find the draft EIR deficient.

Inspection of Appendix K (List of Preparers) and Appendix L (Persons and Agencies Contacted) suggests a reason for this deficiency. No summary for a Preparer or information on a Person or Agency Contacted hints at any acquaintance with the hazards of H2S except at a drilling site. And, two County agencies that certainly must have knowledge of H2S are not listed in Appendix L — The County Air Pollution Control Board (APCD) and the County Public Health Services.

Appendix L does show that two members of California's Department of Conservation, Division of Oil, Gas, and Geothermal Resources (DOGGR) were contacted. But, the draft EIR does not reflect DOGGR's safety recommendations for people living or working in the vicinity of oil drilling and production operations.

DOGGR literature relevant to this situation is mentioned in the draft EIR in the "Hazards and Hazardous Materials" section at page 4.9-11.

> "… DOGGR publishes [an] … instruction [manual] related to … drilling wells in an H2S environment (M10)."

Manual M10 is available online and can be downloaded from a DOGGR web page. At page 12 (16 of 46 Acrobat pages) of Manual M10 one can find a short "Contingency plan," which reads in its entirety:

> "The locations of all structures within the exposed areas should be noted on a map. It is essential that all occupied buildings be marked and a list compiled of the number and names of the occupants and their telephone numbers. Contact with these people should start once drilling begins, to explain the hazards and the fact that evacuation might be necessary if an emergency develops. Procedures to notify these persons in an emergency should be worked out before drilling begins.
>
> "Because of high–pressure dispersion, the probability of a lethal concentration of H2S extending beyond a 1-mile radius is unlikely, except on a dead-calm day with a tremendous release of heavily concentrated vapors.

> *"Livestock.* Livestock must be moved out of pastures in hazardous zones before a drill stem test is made. Animals are overcome quickly by poisonous gases."

These three paragraphs are revealing and useful for making a number of points about H2S in general and about H2S specifically in the context of Excelaron's proposal on the westerly ridge of the Huasna Valley. But first we need to understand another property of H2S.

How Hydrogen Sulfide moves when released. Hydrogen sulfide is a gas slightly heavier than air — its molecular weight is 34, compared with atmospheric nitrogen at 28 and oxygen at 32. This heavier-than-air property means that when H2S is released from a point source (a well-head, for example), the leading edge of the wave or "spill" will flow out and down, tending to hug the ground. Specifically, the wave will tend to flow from hills into valleys, constantly finding its way from one point to the next lower point.

But, the "slightly" in "slightly heavier than air" is important, too. Consider H2S at 34 and carbon dioxide – CO2 – at molecular weight 44. Everybody's had experience with "dry ice" – solid CO2 – and what happens when its vapors are "poured" or released into room-temperature air. The cold gaseous CO2 flows down, creating a "mist," — condensed water vapor produced by the sudden cooling from the cold CO2.

This misting phenomenon allows one to view the suddenly high concentration of CO2. The mist can swirl up and eddy around as the still air containing the water vapor is disrupted. Then, the mist disappears as the temperature gradient equalizes.

Hydrogen sulfide behaves in a way similar to this mist — even the softest zephyr will cause the H2S plume to move slightly up and across a ridge line or to spill over a saddle into an adjoining watershed. But, unlike the mist, the plume of hydrogen sulfide is completely invisible.

Hydrogen Sulfide movement away from the Excelaron project site. What happens if an H2S release should occur on a broad expanse of flat land, in a valley, or on a hilly location above one or more valleys? DOGGR's Manual M10 presents the first of these three cases (pages 16 through 18 of 46) in a short discussion of "Radius of Exposure," together with two illustrative nomograms illustrating how to estimate how far from a point release of a certain amount of H2S one must be in order to breathe levels of H2S of 100 ppm or less. (Recall from the fact sheet quoted above that 100 ppm is the concentration at which humans tend to rapidly lose the ability to smell H2S.)

— But, this "Radius of Exposure" approach applies only on level land like the classic productive oil fields in western Kern County, stretching from south of Taft through McKittrick and north through the Belridge field. The Radius approach and M10's nomograms don't hold in a valley like along the Salinas River at San Ardo or in Price Canyon north of Pismo Beach.

Excelaron's proposal for the "Huasna Valley" is the third case — on a hilly ridge, above one or more valleys. "Section 4.14 Water Resources" of the draft EIR describes the surface water situation at page 4.14-3 (3/18):

> "The project site has a number of ephemeral and intermittent tributaries that flow into the Huasna Creek and Huasna River. The Huasna Creek and the Huasna River flow into Twitchell Reservoir … ."

And, Figure 4.4-2B at page 4.4-31 (31/58) in "Section 4.4 Biological Resources" is the best map that I've found in the draft EIR showing these ephemeral tributaries and their drainages in the close vicinity of the project site.

Certainly any H2S released at the Shipping Site will flow down the next drainage to the east of that which the access route climbs to get to the project site. And, gas from Pad 2 may tend to descend the drainage that the access road climbs, providing that none surmounts the saddle of unknown height that occurs between the two north-trending drainages.

The general statement quoted above on the flow of the "ephemeral and intermittent tributaries" indicates that, in general, the project site drains to the Huasna Valley. But, that's not adequate, given the vagaries of zephyrs carrying H2S around a knob or over a saddle or ridge.

The draft EIR does not contain adequate material to be able to gain any sort of confidence on how H2S released from the two proposed Well Pads may flow. (See my general comments below about the deficiencies of the draft EIR regarding maps.) Using the map and satellite views of Google Maps, the perspective view supplied by Google Earth, and the topographical map generated with the "Gaia GPS" app installed on an iPad, I was able to do a bit more than guess about where around the proposed project site various organisms will be impacted by H2S releases.

Using these three tools I became moderately comfortable with an analysis that the two Well Pad sites are situated on the Huasna Valley side of a northwest – southeast trending ridge, with a prominent nob existing above and between the two at an elevation of about 400 meters. Thus, I'm comfortable with the possibility that H2S released from Pads 1 and 2 can spill to the southwest into a watershed trending southeast, then south, and emptying in an arm of the Twitchell Reservoir. I do not have adequate tools to determine if there are habitations or merely old drill pads in this watershed.

Detailed analysis of Manual M10's Contingency plan. Now let's return to the Contingency plan of DOGGR's Manual M10. Let's start with a condensation of the second of the three paragraphs:

> "… the probability of a lethal concentration of H2S extending beyond a 1-mile radius is unlikely, except on a dead-calm day with … release of … concentrated vapors [my emphasis]."

Rephrasing: on a dead-calm day, lethal concentrations may extend beyond a 1-mile radius. And, given that we're dealing with narrow and steep drainages here, not flat radii, those killing concentrations may extend well beyond one mile.

Calm early mornings, often before and extending well after sunrise and at any time of year, are the most worrisome. These are times that people are likely to be and thus unable to quickly take immediate action when H2S gas may invade.

Now, let's update the first of the three paragraphs of Manual M10, which was written in 1997. Again, the emphases are mine:

> "The locations of all structures within the exposed areas should be noted on a map. It is essential that all occupied buildings be marked and a list compiled of the number and names of the occupants and their telephone numbers. Contact with these people should start once drilling begins, to explain the hazards and the fact that evacuation might be necessary if an emergency develops. Procedures to notify these persons in an emergency should be worked out before drilling begins."

This gets us to the crux of the matter; the final EIR should require a list containing all of the following points and more.

— The exposed area should be delineated. Given the complex topography and the vagaries of the movements of H2S, this will not be an easy task. I won't venture on how many miles the area should extend in various directions from the proposed project site. Doing that is the job of an experienced professional micro-meteorologist.

— All buildings that are only sometimes-occupied must be identified, as well. If there are habitations which are occupied only seasonally, owners and all possible occupants need to be searched out and identified. This task may be long, arduous, and require considerable first-rate detective work.

— It's mandatory to get in touch and thoroughly educate all these people well before drilling begins. In fact, this should be a condition of approval for the first phase of the project.

— All now-routine means (e-mails, cell phones, …) of communicating with anyone who may be in the exposed area must be added to the list.

— Given that noise from drilling operations have been identified as a significant and unavoidable Class I impact, one needs to thoroughly identify, design, and install foolproof ways to alert all people within the exposed area that a visual and sound alarm has gone off at the drilling site(s). Multiple remotely triggered visual and aural alarm systems should be installed in each dwelling within the exposed area, regardless of how often it may be inhabited.

— Particular attention should be paid on how to alert agricultural field workers, again by foolproof methods, who may be tending row crops and grazing animals in the agricultural fields within the exposed area.

Last, the short third paragraph of the contingency plan of DOGGR's Manual M10:

> "*Livestock.* Livestock must be moved out of pastures in hazardous zones before a drill stem test is made [link added]. Animals are overcome quickly by poisonous gases."

Perhaps the best way to deal with this problem is to fashion a condition of approval that no grazing animals will be quartered within the exposed area during the lifetime of whatever project may be approved.

It's important to note that H2S can poison all living creatures, not just humans and livestock. This includes red-legged frogs – an endangered species – and California quail, an abundant species and California's State bird. It certainly includes higher and lower plants as well, though I've not looked into this broad topic in preparing these comments.

Hydrogen Sulfide Spills and Oil Spills. A useful way to think about H2S safety and toxicity is that these issues run strictly parallel to Impact # BIO.7 (see "Biological Resources" at pages 4.4-44 and following). The "Impact Description" at the top of page 4.4-44 reads:

> "A rupture or leak from oil wells, storage tanks, pipelines, or other oil field related infrastructure during operation of Pads 1 and 2 and the Shipping Site … has potential to impact jurisdictional stream and drainage features and associated aquatic species."

This description covers spillages of liquid crude oil. It can just as well cover leakage or spillage of gaseous H2S, except that this toxic gas has the potential to impact all terrestrial species as well as just the aquatic ones mentioned above.

The box at the top of page 4.4-44 also shows that the preparers of this draft EIR have concluded that Impact # BIO.7 is a Class I impact. I expect that when a corresponding section on release of H2S has been added to the final EIR, the preparers will conclude that this is also a Class I significant and unavoidable impact.

Historical Inertia and the Unexpected. Early in these comments on the deficiency of the draft EIR to address problems of H2S safety and toxicity, I speculated that perhaps the preparation team had no one with the experience to recognize and comment on this problem. (Recall, too, that there did not appear to be any outreach to the Air Pollution Control District or to the County Health Department.)

There's another possible reason why this draft EIR doesn't cover matters of H2S safety and toxicity beyond employee safety issues. This is one of historical inertia. So, for instance, in the section on "Hazards and Hazardous Materials" at page 4.9-4, find:

> "According to DOGGR, there is no information available on the potential for H2S in the Huasna field (DOGGR 2008); however, based upon historical production (see section 2.0, Project Description) the H2S levels should be low (less than 10 ppm) [my emphases]."

And, in section 2.0, the "Project Description," at page 2-24, one finds, as quoted already:

> "The potential for and quantity of hydrogen sulfide (H2S) in the gas and oil is unknown at this time, although it is expected that the composition of the gas would be similar to historical production (i.e., low levels of H2S) [my emphasis]."

I've not found any discussion in the draft EIR about historical levels of H2S found in past drilling in the vicinity of Huasna Valley. But, even if such materials were presented and all levels were low, I'll contend that it's much more prudent to expect the unexpected. Should Phase I – the exploration phase of this project – be permitted, we should anticipate that high levels of H2S will be released from each of the four drillings.

Indeed, we must learn to expect the unexpected nowadays. The 2010 Macondo disaster and the 2011 Fukushima disaster are just two recent cases where we've found ourselves in deep trouble by not anticipating the unexpected. I've recounted to both the Planning Commission and the Board of Supervisors in the last few months, after the Fukushima disaster, that I've become a student of Nassim Nicholas Taleb's Black Swan Theory. Taleb's theory is one we need to put into practice everywhere, including in San Luis Obispo county, precisely because it deals with expecting the unexpected, like encountering much greater levels of hydrogen sulfide when drilling than ever before have been found around here.

More General Comments on the Draft EIR

Splitting the CUP into two. At the end of Section 5.0, the "Alternatives Analysis" section, at page 5-61, one finds:

> "Given the uncertainties associated with the project moving to the full production phases (Phase II and Phase IV), an alternative phasing and permitting approach could be to issue a separate Conditional Use Permit (CUP) for Phases I and III only. If the Phase I activities determine that full development of the reservoir is economically viable, the County could review the final design of the permanent facilities, the effectiveness of the Phase I mitigation measures, and other considerations as part of a second Conditional Use Permit (CUP) covering Phases II and IV [my emphasis]."

My inclination is that this is excellent and prudent approach. Let's learn about what problems drilling four exploratory wells may produce, specifically with regard to the sulfur contents of any economically useful materials the wells may yield. And, as is pointed out on page 5-62:

> "Another benefit to this split permitting approach is that it would allow the County to determine the effectiveness of many of the proposed mitigation measures prior to approving the full development of the Huasna Oil Field."

Certainly the development of a foolproof warning system to alert people in the vicinity of the project site of any problem with H2S will have to be thoroughly in place before the first drilling begins. But, it's unrealistic to expect a perfect system upon first test. At the end of Phase I, however, the alarm system should be nigh on to perfect. Pausing then and doing a full assessment of this important aspect of the project makes excellent sense.

Getting production quantities of oil to a refinery. Splitting the CUP into two can also defer resolving the difficult problem of getting production quantities of crude to a refinery. If a CUP consisting of only Phases I and III should be approved during the winter of 2011-2012, and if that winter is much drier than that of 2010-2011, then Excelaron may be able to use the currently proposed passage through the Porter Ranch to HY 166 for long enough to complete Phase I.

However, given that the route through the Porter Ranch that's currently proposed passes down a major arm of Twitchell Reservoir reaching deep into the Huasna Valley, it's folly to think that this route can be used full-time 52 weeks of every year of a multi-year production operation. (For one map of the mainly underwater route now proposed, see Figure 4.2-3 at page 4.2-10 of the "Agricultural Resources" section of the draft EIR.)

The "Alternatives Analysis" section of the draft EIR spends six pages (5-10 through 5-15) on building a pipeline to transport production quantities of oil. I emerged from a fast reading of these pages thinking that this alternative is crazy, especially since I didn't find any discussion of earthquakes in the Alternatives section and it's not yet clear which refinery may accept any Huasna Valley crude.

The Alternatives Analysis section also devotes three short paragraphs and a figure to the possibility of a new road to the Porter Ranch — see page 5-9. This makes sense only if a new road will avoid that portion of the currently proposed route that may be under water for many months of any year. Looking at Figure 5-4 on page 5-9 I don't believe that's the case.

What makes most sense in the long term is a route to HY 166 that water levels in Twitchell reservoir will never threaten to submerge. But, that will be a major undertaking, one that can be planned during the preparation of a new draft EIR for a production phase of the project.

Energy Return on Energy Invested (EROI) Analyses. The final EIRs for both SunPower's and First Solar's solar projects in the Carrizo Plain contained sections devoted to climate change and greenhouse gas (GHG) emissions. The draft EIR for the Excelaron – Huasna Valley project contains no such section. I find this puzzling on two counts. First, I'm under the impression that the California Environmental Quality Act (CEQA) now requires such analyses. Second, this project requires fossil energy to obtain fossil energy, unlike the renewable energy projects in the Carrizo.

It's becoming increasingly routine to do accounting in terms of units of energy rather than in units of currency. Doing such an energy accounting makes perfect sense with regard to how the Excelaron project will impact climate change and GHG emissions. The more energy gained for the energy expended, the more attractive the project will be. The formal term for this sort of energy-in – energy-out analysis is an Energy Returned on Energy Invested (EROI) analysis.

The prospect that any product gained might be used for tarring roads introduces a novel aspect to an EROI for a fossil fuel energy project (novel to me, at least). Any asphalt that the proposed project may yield, to the extent that it's used in roadbuilding, can be regarded as energy deferred from quick combustion.

This asphalt might be regarded as carbon sequestered, like wood used to build furniture is carbon sequestered. The time-scales may be different, but, to the extent that the asphalt may have a twenty-year lifetime on a street or highway, then most get recycled back into more roadbed, the durations of sequestration may approach each other until ultimately microorganisms or fire (or both) will yield CO2.

Splitting the CUP into an exploration phase possibly to be followed by a production phase will produce an ERoEI analysis which will certainly show for the former that much more energy will be expended than returned. But such results must be routine in exploration for fossil fuels. Any final EIR for a CUP that only addresses Phases I and III can clearly state that the energy balance of this EIR may be altered, perhaps dramatically, if exploration should result in many years of high-volume production.

I expect to find a section in the final EIR for this project that addresses climate change and GHG emissions. If there's not one there, I'll expect to find a written explanation why it's not needed.

Odors from Hydrogen Sulfide in the Long Term. On the evening of 12 July I attended Excelaron's presentation in the new Galaxy theater in Atascadero. I had occasion after the presentation to talk with Arthur Halleran, Chief Executive Officer of United Hunter Oil and Gas Corp, a participant in the joint venture that's proposed Excelaron's drilling in the Huasna Valley.

I asked Halleran why one should encounter less H2S when extracting hydrocarbons from the Monterey shale formation around the Huasna Valley than has been apparent for years from the Price Canyon extraction from the same geologic formation. Halleran's answer had two parts: that the Price Canyon project is old and pretty well played out; that the seals in the pumps in the Price Canyon wells are worn out, thus allowing H2S to escape.

In these comments I've not addressed chronic odors caused by long-term low-level escape of H2S. But, Halleran's comments on H2S in Price Canyon suggests two important conditions of approval that should be part of a CUP involving hydrocarbon production from any well in the Huasna Valley watershed.

I've aware that current residents of the Huasna Valley have expressed worries that H2S odors may adversely affect their property values. Halleran's response suggests that this problem is one that may not appear until perhaps twenty years from start of production, as production plays out from a new field found as a result of permitting this CUP. And, the second part of his reply suggests that the current operator of the Price Canyon field regards it as uneconomical to rebuild the pumps that are responsible for the chronic H2S odors emanating from that field.

An impartial third-party should monitor chronic levels of H2S in the Huasna Valley throughout the life of any production phase of this project. Excelaron should cover the costs of this monitoring project.

If and when H2S levels should exceed pre-defined levels for some specified amount of time, Excelaron or the operators of any production field at that time must be required to fully repair the conditions responsible for those excessive H2S levels. Should the operator not be able to do that within a specified period of time, production should be ceased and the field retired in accordance with the procedures established in the final version of Phase III contained in this draft EIR.

<u>The Inadequacies of the Maps in the draft EIR</u>. Perhaps I'm spoiled by the superb maps that were in all versions of the EIRs for the two solar projects in the Carrizo Plain. But, I found the maps in this draft EIR to be thoroughly inadequate. Here are some suggestions for improvements.

— Include topographic maps for the project site and neighborhood. One shouldn't have to spend time fooling around with such software as Google Earth or Gaia GPS to figure out what's going on with slopes, saddles, ridges, nobs, etc.

— Specify in the Contents section which Figures are maps. The draft EIR has some but not all specified. Indeed, I'd like to see all maps split out of the list of figures and identified in a list of maps, right alongside the lists of tables and figures.

— All maps should contain scales! One shouldn't have to use a ruler held on one's computer screen or on a printout to gage the scale of any map.

As always, I'll be happy to expand upon any comment above. Or, to try to clear up any question any reader may have. Please get in touch with me if I may be able to help in these regards.

Stephen W. Ela