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March 15, 2000

Mr. James Davis
City Engineer
9770 Culver Blvd.
City of Culver City, CA 90232
fax 310-253-5626

RE: Vista Pacifica Development

Dear Mr. Davis;

I am writing to respond to various comments that you have received from reviewers in connection with the safety and overall technical adequacy of the Vista Pacifica project, proposed for former oilfield areas within and overlooking your city. I am sorry that the hearing of March 13 wherein I hoped to make a presentation to your council was postponed to a date when I have a long-term committment to be overseas; I would very much appreciate the opportunity to be present and answer any questions that your officials might have if it were possible to postpone the meeting until April 10. Meanwhile I here offer and update (and will post on the web at

<http://www.stanford.edu/~meehan/class/mitjan2000/davis.htm>), this letter presenting my conclusions, which are based on my experience, going back to the 1970s, of the particular hazards that can arise in the the Inglewood oilfield area.

First, for those interested in some background information on the history of problems in the Inglewood oilfield, I suggest a possible visit to the material which I developed in connection with a seminar which I presented at M.I.T. in January, web site at <http://www.stanford.edu/~meehan/class/mitjan2000/webpage1.htm>

POTENTIAL GAS HAZARDS BENEATH THE PROPOSED VISTA PACIFICA DEVELOPMENT

This issue relates to the potential hazard of gas migration which could affect both existing neighborhoods and new houses in the Vista Pacifica development. To put the gas issue in perspective, note that annual gas production in the Inglewood field is on the order of a billion cubic feet, with individual wells in the Vista Pacifica area producing thousands to millions of cubic feet per month.

Responding to my previously stated concern with future gas migration the City review consultant (Bing Yen Associates [BYA] 2/11/2000) focusses almost entirely on an issue of secondary interest, a matter that I did not raise, namely that of whether the developer plans to carry out procedures for well closure within the development boundaries recommended by the Uniform Building Code.

The BYA review indicates that the gas migration hazard can be otherwise neglected because the Culver City has no sophisticated special regulations dealing with this hazard beyond the nominal requirements of the building code.

My view is that the hazard in the Inglewood Field has less to do with well abandonment than with impacts of secondary recovery operations which have been shown to force waste and gas toward the ground surface regardless of the presence of old wells, whether properly abandoned or not.

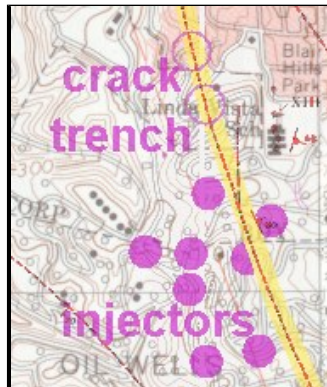


Figure 1. Map showing some of the injector wells just to the south of the Vista Pacifica area. The Castle fault is shown in yellow

The BYA reviewer's dismissal of the significance of injector wells as close as 400 ft. from property line, and his claim that there are no similarities between conditions at Baldwin Hills, Fairfax, and Vista Pacifica are neither documented nor referenced. In fact injection wells at the Vista Pacifica site are actually closer to the proposed new houses than wells at Baldwin Hills and Fairfax were to the areas of disastrous damage to the Baldwin Hills Reservoir and Ross Store.

The BYA reviewer represents the views of another independent reviewer, E.D. Michaels, as expressing no concern with gas issues. Evidently the reviewer has not seen or ignores Michaels' 11/23/99 report expressing explicit concern over methane gas problems. (Incidentally, Michaels' and my work reaching similar conclusions on this issue were carried out without awareness of each others' involvement or opinions.)

POTENTIAL FOR OILFIELD-INDUCED REACTIVATION OF CRACKS AND FAULTS BENEATH THE PROPOSED VISTA PACIFICA HOUSES.

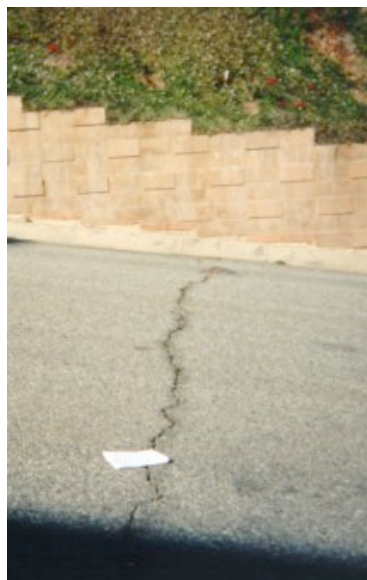
I refer here to the potential for reactivation of known faults due to oil field operations, including withdrawal and reinjection of fluids in the oil field beneath and adjoining the project.

In general ground movement is proportional to the volume of fluids and gases which have been moved in and out of the underlying oilfield. There is no question that the quantities of oil, gas, and waste brine involved in this section of the field is large. The most recent survey evidence, from the 1970s shows that the development area has sunk several feet since the 1920s, and it

seems likely, considering the intensified activity of the past few years, that the ground movements have accelerated in the area of the Vista Pacifica project since the 1970s. However the developer has not made any ground surveys or estimates of recent ground behavior though this would appear to be a reasonable requirement.

In this connection I have noted active ground cracking on Wrightcrest Drive, figure 2 below. This almost certainly represents activation of extensions of the well-known "Castle Fault" which passes beneath some of the proposed new houses. Note from the map, figure 1, that the crack is just north of the project and that active injection wells are just to the south of it. It is likely that the same cracking effect exists beneath the area of proposed houses, though not observable in the eroded and graded terrain in the project area. Note also from the map above that the Lettis trench which identifies the Castle fault as actually present in the project along the same alignment.

Since the early 1980s oil field extraction and water injection operations have been expanded into and adjoining the project area. The nearest injection well to the Wrightcrest Drive crack site (#118) was placed in operation in late 1995 and is currently injecting at a rate of about 50,000 bbl/mo. Injection pressures (400-550 psi) in relatively shallow producing zones (e.g. Vickers Zone at 1500 feet) are similar to those associated with thousands of feet of ground cracking which led to failure of the Baldwin Hills Reservoir on the southeast side of the oil field. These pressures exceed calculable fracture pressures and were considered by the USGS, as well as ourselves, as probable causes of ground failure at Baldwin Hills. This issue remains unaddressed in the environmental and geotechnical studies provided, including the BYA review which simply dismisses without attribution the potential as "not widely accepted".



*Figure 2. Ground crack, Wrightcrest Drive,
1999*

STRONG EARTHQUAKE SHAKING AND POTENTIAL SLOPE INSTABILITY

City reviewers (L.A.County, Bing Yen Associates) make it clear that they have not reviewed, and take no responsibility, for the developers geotechnical test results, on which all stability reviews, including the county's, are based. However one other independent reviewer, Mr. Michaels, points out that the developer's geotechnical tests have been misinterpreted in a such a way to lead to undue assurances of slope stability safety. I agree with Mr. Michaels. Hence the City has only two independent reviews of the fundamental data provided; Neither review supports the conclusions of the developer.

In general creation of the lots on the project has required the use of steep slopes, exceeding 2:1 in places, with minimal toe setbacks. Fills are being placed on steep slopes exceeding 2:1. These slopes abut private lots and a school. If these conditions meet code, it is only by the slightest of margins, and using debatable data that no independent reviewer has checked or endorsed. Under the circumstances, it seems to me that extra assurances can and should be be reasonably demanded under the provisions of the code calling for discretionary review by the responsible building official.

Neither of the city reviewers (L.A.County, Bing Yen Associates) have been willing to respond to my straightforward request that they provide estimates of the amount of ground movement that is likely to occur in the 0.53g earthquake that the developer's consultants themselves have estimated as possible at the site. As I have previously indicated slope movements on the order of six inches, which I submit as a reasonable estimate for the 0.5g earthquake, have served routinely as a basis for "total loss" claims following California earthquakes.

In my opinion assessment of the fiscal and public safety of this risk on local government, adjoining properties, and future homeowners remains incomplete without a "blue ribbon" level of review by independents. The reviews presented to the City to date ignore several important pieces of evidence and have, in effect, distanced themselves from the safety of the project.

Sincerely,
(Signed and sent by fax and mail, 3/15/00)
Richard L. Meehan
RCE 18512

ANNOTATED REFERENCES:

1. Meehan, RL; Hamilton, DH (April 23, 1971): "Ground Rupture in the Baldwin Hills," Science. 172, no. 3981, 333-344. This report describes the role of oil drilling and water re-injection in causing the Baldwin Hills Dam collapse.

2. Meehan, RL (1984): *The Atom and the Fault*, The MIT Press, Boston. This book discusses the evaluation of geologic fault hazards.
3. Meehan, RL; Jelks, Lauren (May 1987): "The Battered Exclusion: Who Pays How Much For Landslides?" For the Defense. This paper explains how insurance losses resulting from ground failures and earthquakes may be passed on to local government.
4. Meehan, RL; Cotton, WR (November 3, 1987): "Geotechnical Analysis and Mitigation Alternatives of the Big Rock Mesa Landslide, Malibu, Los Angeles County, California," American Geophysical Union, 1987 Fall Meeting, 68, no. 44, 1285-1286. This paper explains how ground rupture hazards actually were passed on to Los Angeles County.
5. Meehan, RL; Hamilton, DA (Spring 1992): "Cause of the 1985 Ross Store Explosion and Other Gas Ventings, Fairfax District, Los Angeles," *Engineering Geology Practice in Southern California*. 20. This report describes how water-flooding operations can lead to methane hazards
in and around oil fields.
5. Meehan, RL; Karp, L.B. (May 1994): "California Housing Damage Related to Expansive Soils," *Journal of Performance of Constructed Facilites*, ASCE. This paper has been used by professionals throughout California as a basis for determining what constitutes acceptable ground movement for residential housing.