Hi Dante,

Per your request, I have briefly reviewed the revised "Baseline Risk Assessment Report" for the Del Amo Superfund site, prepared by URS for Shell Oil and DOW Chemical Companies (dated May 19, 2005). Overall, the authors appear to have incorporated most of the comments that have previously been discussed at a number of risk assessment meetings held between the companies and regulatory agencies dating back to 2000.

My primary concern with the revised Baseline Risk Assessment (BRA) is the emphasis on modeling to represent indoor air concentrations at the Del Amo site. Neither the Johnson and Ettinger Model (JEM, 1991) or the Dominant Layer Model (DLM, 1999) have been validated, at least not to the same degree as other EPA models that I am familiar with (e.g. Air Dispersion models). While EPA often has little choice but to use the JEM model, typically conservative assumptions are used to err on the side of safety in the absence of certainty.

The authors of the BRA promulgate the view that the model is accurate and EPA default assumptions (in the Vapor Intrusion Guidance) may be overly conservative. Given this view, the authors then set out to refine the model to make it more "realistic". The net result are risk estimates that may reflect a best estimate of exposure but it is less clear whether these modeling predictions represent an upper-bound estimate of exposure/risk consistent with Superfund risk assessment guidelines.

My general comments on the BRA appear below.

"Most Representative Risk Characterization". The approach for selecting "most representative" indoor air concentrations (Appendix H) is not recommended. The decision matrix forces the user to choose between either indoor modeled or measured air concentrations as being "most representative" for each contaminant and for each building. The resulting indoor risk estimates (where contaminant-specific risks are added together) is a combination of both modeled and measured air values.

This does not appear to be technically justified. Indoor measured and modeled data are fundamentally different. Indoor air measurements reflect actual exposures to an air pollutant under current conditions whereas the indoor modeled values (if accurate), reflect incremental exposures due to the vapor intrusion pathway. I would prefer that both modeled and measured data sets be summarized in the main body of the report; and, risk estimates reflecting both data sets be presented separately in Figure 22. Combining different data sets is not only technically flawed, it makes it nearly impossible to compare different parcels with the same risk metric or yardstick.

Separating the two data sets and presenting independent estimates of risk, one based on modeled air and one based on measured air, will also eliminate the need to develop criteria that attempt (unsuccessfully in my opinion) to identify the "most representative" data (see Appendix H). Also, it is not clear what the authors actually mean by "representative". The term is not defined, but appears to be used in a manner that is inconsistent with EPA exposure/risk assessment guidelines.

Modeled versus Measured Indoor Data. The authors have done a good job with evaluating subsurface data in terms of calibrating the vapor intrusion model, but I would like to see greater attention paid to the air measurements, to provide a more balanced reporting of the data. Indoor air measurements were conducted on three separate occasions, under representative conditions (the HVAC systems were operating in most if not all cases), and away from potential indoor sources as determined by building walk-throughs and vapor monitoring instruments. These data have not been the focus of the risk assessment yet they offer the most direct measurements for evaluating worker exposures.
Similar to the background evaluation for inorganics, indoor air results should also be statistically evaluated to determine if trends exist that are linked to subsurface contamination. Do indoor levels of benzene differ spatially across the site? For example, do the indoor benzene levels correlate with subsurface contamination (e.g., NAPL areas) or show any other spatial trend? Do indoor benzene levels, for those buildings that were identified as using benzene related products, differ statistically from buildings that were not identified as having an indoor source?

Outdoor air results for benzene also appear to be relatively high. It is unclear whether these outdoor air results were influenced by site contamination. If I am not mistaken, outdoor air samples were collected at the intakes for the HVAC systems, not at upwind background locations. How do the outdoor air measurements for benzene compare to South Coast Air Quality Management District monitoring station data?

**Attenuation Factors.** The attenuation factor (alpha) is estimated as the ratio of contaminant vapor concentration in the building to the vapor concentration present at the source. To derive this ratio, the Johnson and Ettinger Model (JEM, 1991) and the Dominant Layer Model (DLM, 1999) were used. Both models account for certain key chemical and physical factors that influence vapor transport from the contaminant source into a building. The primary difference between the models is that the DLM also incorporates a biodegradation assumption for BTEX unlike the more familiar JEM approach.

I do not feel qualified to critically comment on the attenuation factors that were incorporated in the fate and transport modeling for indoor air impacts. However, it is worth noting that even without the assumption of biodegradation, the site-specific attenuation factors are outside the recommended range in EPA's draft Vapor Intrusion Guidance (EPA 2002). For shallow soil gas, the attenuation factors that are presented in EPA's Vapor Intrusion Guidance range from 2E-3 to 2E-4 depending on soil type. These attenuation factors predict that soil gas concentrations will be reduced by a factor of 500 (1/2E-3) to 5000 (1/2E-4) as vapors move from the subsurface into buildings.

The attenuation factors that were derived for shallow soils using the JEM (with no BTEX biodegradation assumption) are 8E-5 and 4E-5 for residential and commercial buildings, respectively. These alpha values predict that the soil gas concentrations will be reduced by a factor of 10,000 (1/8E-5) for residences and 30,000 (1/4E-5) for commercial buildings. Since these site-specific attenuation factors are outside the range recommended in EPA's Vapor Intrusion Guidance, some additional discussion appears warranted. Specifically, what site-specific inputs to the model were incorporated that lead to these less conservative alpha values?

The attenuation factors that were derived for shallow soils using the DLM (assuming BTEX biodegradation) are 1E-6 and 5E-7 for residential and commercial buildings, respectively. In other words, the soil gas concentrations are predicted to be reduced by a factor of 1,000,000 for residential buildings and 2,000,000 for a commercial buildings as the vapors move from the subsurface and infiltrate indoors. In this case, the decrease in vapor concentrations that is predicted as vapors are transported from the subsurface into buildings is similar to the the decrease in vapor concentrations that one might predict for outdoor air (not indoor air), using conventional EPA modeling techniques.

Since the vapor intrusion modeling is not validated (there has been no attempt to corroborate indoor air levels with subsurface soil gas concentrations), and the predictions deviate several orders of magnitude from EPA's draft Vapor Intrusion Guidance, the results using the DLM model in particular, should be viewed with caution.

It is difficult to reconcile the DLM numbers with an upper-bound estimate of human exposure. Previously, the responsible parties had included modeling predictions using both Tier 1 (using JEM) and Tier 2 (using DLM). However, in this revision, only the estimates for the Tier 2 are presented. Thus, the reader loses some important contextual information that was available in previous drafts. It is recommended that both sets of estimates be provided in the revised risk assessment.

**Air Exchange Rate for Commercial Buildings.** Air exchange is considered the principle mechanism for diluting indoor air contaminant concentrations in residences that are naturally ventilated. The air exchange rate is expressed in terms of air changes per hour (i.e., h^-1). The air exchange rate for residences refers to the number of times in an hour that a volume of air equal to the building volume is replaced by outdoor air.
For commercial buildings, the air exchange rate is generally applied to rooms in a building (e.g., office, copy room, storage room etc.). This differs from residences, in that air exchange for a particular room will be a function of both recycled air and outdoor air. The percent makeup air for a particular room is unlikely to be 100% outdoor air. Consequently, the air exchange rate that is presented in Table F-6 (0.9 air exchanges per hour) likely overstates the degree of indoor dilution because it assumes that the air exchange is entirely with outdoor air, and does not account for recycled air from other portions of a building. This is a not a health-protective assumption. EPA has recently hired an HVAC engineer, Tony Zimmer. I recommend that you contact Tony (513-841-4370) regarding the appropriateness of using an indoor air exchange rate of 0.9 per hour as a dilution factor for commercial buildings.

Also, please check with Tony regarding the appropriateness of applying the California Energy Commission (CEC 2001) guidelines, as the ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) guidelines may be more appropriate. As an aside, it is questionable whether the CEC guidelines would be applicable to existing buildings at Del Amo because most of the buildings that occupy the industrial park were built before 2001.

Please note that the assumption that engineering controls (i.e. HVAC systems) will be present in commercial buildings, and functioning properly may not be entirely consistent with the evaluation of a no-action alternative in a baseline risk assessment. However, since the risk assessment does also consider the residential scenario (where no engineering and institutional controls are assumed), this is probably a reasonable assumption, though not necessarily a health-protective assumption.

**Update to Toxicity Values and possible impacts on the Risk Estimates.** It has been nearly 5 years since the last version of the Del Amo risk assessment was submitted to EPA and the State for review. It is recommended that the authors review the toxicity values that were incorporated in the BRA with a more current list. For those chemicals, for which new information may lead to a different predicted risk at the site (e.g. Naphthalene), it is recommended that the changes to toxicity values be noted and discussed qualitatively or semi-quantitatively in the uncertainty section of the report.

**Risk Levels and Parcel Discussion.** Risk estimates for any parcel that is at or above one in a million (10^-6) excess lifetime cancer risk should be discussed in the risk characterization section. One in a million is EPA's point of departure. Any parcel-specific estimate above this risk level will require a risk management decision so it is important to discuss these risks in the body of the report.

**Sections Not Reviewed.** Due to time constraints, the following items were not included in my review:
- exposure point concentrations
- background comparison statistics for inorganics
- toxicity summaries