Comments on the study entitled, "The Potential for Offsite Exposures Associated with Santa Susana Field Laboratory, Ventura County, California"

As a toxicologist with extensive training and experience in human health risk assessment, I was retained by The Boeing Company to prepare the following comments. I did so independently of The Boeing Company. I hold degrees in Environmental Health, Public Health, and Toxicology and completed post-doctoral training as a National Research Council Research Associate at Wright-Patterson Air Force Base. Prior to assuming my current position as Program Director, Environmental Health Science, University of South Carolina Beaufort, I served as an industrial hygienist at the Georgia Tech Research Institute and a consulting toxicologist at TERRA, Inc. in Tallahassee, FL. I have co-authored the chapter entitled, "Toxic Effects of Solvents and Vapors," in the 6th and 7th editions of the highly regarded text, *Casarett and Doull's Toxicology, The Basic Science of Poisons.* In 2003, I was selected by The National Center for Environmental Health, Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry as one of about 70 "emerging leaders" in Environmental Public Health from across the United States.

I appreciate the opportunity afforded the public for comment on the study entitled, "The Potential for Offsite Exposures Associated with Santa Susana Field Laboratory (SSFL), Ventura County, California." First, I wish to acknowledge the study's authors who expended considerable effort to conduct *"A more in-depth evaluation of exposure pathways…,"* as recommended in ATSDR's Draft Preliminary Site Evaluation released in 1999. ATSDR's evaluation failed to identify a public health hazard to the communities surrounding SSFL and stated that exposures via all pathways (i.e., air, water and soil) were likely of insufficient magnitude to result in adverse human health effects. It further indicated future exposures of any health consequence were unlikely. The following statements were excerpted from the ATSDR evaluation:

> Air Pathway**:** *Based on the distance from the onsite release sources to offsite residential areas, the predominant wind directions, the meteorological conditions at the site, and the rapid dispersion and degradation of oxidants in air, it is unlikely that offsite residents have been, or currently are being exposed to chemicals and radionuclides at concentrations that would result in adverse human health effects.*
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> Ground and Surface Water Pathway: *Based on our preliminary review of the available data, there is no indication that residents living near the SSFL have been exposed, or are currently being exposed to chemicals or radionuclides in ground water or surface water at levels that would result in adverse human health effects. Based on the discontinuation of TCE use and the effectiveness of the ground water treatment system, it is unlikely that future exposure to chemicals or radionuclides will occur.*
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> Soil and Sediment Pathway**:** *Based on our preliminary review of the available data, ATSDR has no indication that persons in the community surrounding the*

SSFL have been, or are currently being exposed to chemicals or radionuclides in soil or sediment from the SSFL at levels that would result in adverse human health effects.

Conclusions: *In this preliminary evaluation of available data and information, ATSDR has not identified an apparent public health hazard to the surrounding communities because people have not been, and are currently not being exposed to chemicals and radionuclides from the site at levels that are likely to result in adverse health effects.*

and

Changes in site operations, such as reduced frequency of rocket engine testing, discontinuation of trichloroethylene use, and shut down of nuclear operations make it unlikely that future exposures to the offsite community will occur.

Because the conduct of the present study was a recommendation of ATSDR's evaluation, it is noteworthy that it leaves the reader with quite the opposite impression – that completed exposure pathways exist for numerous chemical and radiological contaminants found offsite in sufficient concentrations to pose an unacceptable health risk. Regardless of the study's intent, this is the message it conveys. Unfortunately, no effort is made in the present study to reconcile it with that published by ATSDR just 6 years earlier. This raises an obvious question – what data have been collected or modeled to invalidate the above excerpted statements made by a government agency that consistently applies the precautionary principle and whose self-described mission is to *"…serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances"*? In this regard, it is noteworthy that the overwhelming majority of monitoring data compiled and evaluated in the present study was collected prior to 1999 and was thus available to ATSDR when formulating its conclusions. Seemingly, the authors of the present study would be obliged to discuss their study in the context of that of ATSDR, especially considering that it was conducted in response to recommendations made in ATSDR's preliminary evaluation and is an ATSDR-funded initiative.

Due to insufficient data, neither ATSDR's evaluation nor the present study conducted quantitative, site-specific exposure and risk assessments for offsite receptors. In the case of the present study, however, the absence of data does not justify giving credence to an array of potential exposure scenarios regardless of their probability of occurrence, or in the event they did occur, how insignificant the added health risks might be. In fact, the study does so despite what amounts to a lack of empirical evidence for any fully completed exposure pathway for any of the numerous "chemicals of concern." Nonetheless, dose ratios (DRs) were calculated in what can only be described as a screening-level risk assessment apt to mislead those not technically astute enough to differentiate hypothetical from real risk or recognize the study represents the application of the precautionary principle run amuck. Indeed, much of the problem stems from the

numerous worst-case assumptions freely integrated into dosage calculations that when examined relative to inherently conservative toxicity factors, result in grossly inflated DRs. Such DRs create the false impression that a particular exposure scenario may pose an unacceptably high risk, when in reality, the actual risk is much lower and in many cases at or near zero. In other words, multiple conservative assumptions, when compounded, result not in a worst-case scenario but one that is highly improbable, if not impossible, and pertains to no single individual or group of individuals. Therefore, the implementation of a worst-case strategy has resulted in a study that can be likened to "throwing stuff at a wall to see what sticks," rather than an attempt to determine those exposure pathways that are complete and the real risk, if any, associated with them. We are thus left with a study prone to misinterpretation that will be cited in support of the argument that chemicals and/or radionuclides emanating from SSFL are a plausible explanation for every past, present and future illness and untimely death of unknown etiology.

The present study makes no attempt to hide its extreme conservatism, though in this case admitting to the problem is not the first step in its solution. What is done is done and the best approach now is to minimize the potential for the report to misrepresent the risk posed by SSFL before its finalization. To this end, an additional section should be drafted and added to Chapter 8.0 that fully discusses the conservatism that pervades the study and the implications that compounded conservatism has on the relevance of the report for any one individual or group of individuals. The study should also consider the possibility that overly inflated DRs are an ill-conceived means of providing a relative ranking of potential doses for various receptor locations of concern. In this regard, it is important that the study acknowledge the likelihood of health effects occurring with a DR greater than one depends in large part on the margin of safety inherent in the toxicity constant used in its derivation. This necessitates that great care be taken in ranking or prioritizing based on DR comparisons since differences may stem from varying degrees of certainty with which a toxicity constant can be accurately derived rather than any real difference in the inherent toxicity of the chemicals being compared. This is one reason why one can not necessarily equate the extent to which a DR exceeds one with the level of risk the chemical might pose. This point is particularly relevant given that DRs were derived with an upper-bound as high as 21,000 (i.e., inhalation route for TCE in groundwater), a DR which might be alarming less one realizes the unlikelihood of the exposure scenario and the many unvalidated assumptions on which it is based. Such problems can be avoided in the future if similar studies are treated less like academic exercises and more as a means of allaying the fears of those least likely to incur unusually high risks and focusing concern on those who warrant it.

With these goals in mind, the study should have attempted to characterize the full distribution of exposure levels in the population as accurately as possible, rather than defaulting to the worst case. Doing so would admittedly have been more difficult, but also more informative. For example, the study suggests that historical exposure to TCE emissions from rocket engine testing/degreasing is a potential concern for many lifelong residents living in eleven "receptor locales." However, 89% of TCE emissions from rocket engine testing/degreasing occurred pre-1967 at a time when less than twenty

residents resided in the census tract encompassing most of the 1 mile area surrounding SSFL. Given the precipitous decline in modeled TCE air concentrations with increasing distance from SSFL (concentrations were ~ 2 $\mu g/m^3$ just 1 mile from the site), chronic exposure to TCE emissions would not theoretically result in even one excess cancer based on population estimates and California's TCE inhalation unit risk factor of 2E-6 $(\mu g/m^3)^{-1}$. Nonetheless, the study lists an average DR associated with TCE emissions from rocket engine testing/degreasing of 308 (range: 30 to 1942) for the eleven "receptor locales," some of which are located 5 to 10 miles from SSFL. As such, the study is likely to be unnecessarily alarmist to residents of those "receptor locales" for which a worst-case scenario suggests elevated risks. Another example of the study's bent to portraying exposure issues in a bad light is found in Figure 4-3, which presents a map of groundwater contaminants detected above health-based standards. The map reports that the concentration of carbon tetrachloride was nine times the California MCL, but fails to indicate that of the 895 offsite analyses conducted for the chemical, there were only 2 offsite detections (see Table 7 of ATSDR's 1999 evaluation).

In addition to the suggestion that a section devoted solely to the study's conservatism be added, it would be helpful if the theoretical risks inferred by numerous DRs well in excess of one were discussed in a broader context using a comparative risk analysis approach whenever possible. For example, a slide was presented at a February 2006 SSFL Workgroup Meeting showing annual average SSFL emissions (1955-2000) relative to those of Los Angeles and Ventura counties in 1990-1993. The slide indicated that with the exception of hydrazine, SSFL was responsible for a miniscule fraction of the hazardous air pollutants emitted (< 5% in the case of TCE). Therefore, any association between air emissions from SSFL and disease rates would be confounded by other sources impacting the "receptor locales" surrounding the site. Such information would suggest that SSFL emissions are at best, a minimal contributor to one's overall risk, thereby allowing the study's results to be placed into proper perspective. This is important given the pending release of a report on cancer incidence surrounding SSFL. Given its worst-case approach, the present study is incapable of providing realistic exposure data to explain differences in cancer incidence rates. The absence of such data explains the epidemiological study's reliance on residential distance from SSFL as a surrogate measure of exposure. The use of such a surrogate will result in almost certain exposure misclassification that can lead to a substantial overestimation or underestimation of the association of the exposure with the cancers under study. As such, it is alone sufficient to cast doubt upon the study as a reliable indicator as to whether SSFL has posed a cancer risk to nearby residents. If the February 2006 presentation on cancer incidence near SSFL is indicative of the soon-to-be-released epidemiological study, findings suggest historical exposures from SSFL have not posed a considerable cancer risk. Based on the February presentation, very few of the 36 risk ratios (RRs) graphically presented appeared significantly elevated. Furthermore, only three of the 36 reported RRs were in excess of two and all three occurred among Hispanics, very few of whom lived near SSFL when emissions were at their highest. Thus, it appears as though the results of the soon-to-be-released epidemiological study will be largely consistent with the conclusions of ATSDR's preliminary evaluation and fail to support the level of concern for past exposures conveyed by the present study.

Again, I appreciate the opportunity to provide the above commentary and hope that it is viewed as intended - constructive rather than confrontational.

Respectfully,

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