The Boeing Company
Santa Susana Field Laboratory
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September 29, 2006

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BOEING

Subject: Comments of The Boeing Company on the Final Report, *The Potential for Offsite Exposures Associated with the Santa Susana Field Laboratory, Ventura County, California,* prepared by the Center for Environmental Risk Reduction, University of California at Los Angeles, California

Dear Dr. Cohen:

The Boeing Company appreciates the opportunity to comment on the Final Draft Report entitled *The Potential for Offsite Exposure Associated with the Santa Susana Field Laboratory, Ventura County, California*. We take the health and well-being of our employees and the community around the Santa Susana Field Laboratory (SSFL) very seriously. We understand and appreciate the considerable effort required to prepare a report of this nature.

Our detailed comments on specific portions of the report are provided in an attachment to this letter. However, Boeing has a number of general concerns and comments regarding the overall approach taken in preparing the report, which are set forth below. Taken as a whole, these concerns seriously question the validity of the report's conclusions. The basis for this position is provided in the detailed comments in the attachment.

First, Boeing has numerous concerns related to the methodology and use of data in the report. The report includes many worst-case assumptions and conservative toxicity factors, which result in overly inflated dose ratios. Multiple conservative assumptions, when compounded, result not in a worst-case scenario but one that is highly improbable, if not impossible, and which does not represent potential risk for any single individual or group of individuals. Such overly inflated dose ratios may cause the reader to incorrectly conclude that the SSFL poses an unacceptably high risk, when in reality the actual risk is much lower and in many cases may be at or near zero. Thus, the result is a study that will be prone to misinterpretation and constitute a disservice to the reader.

Second, the report fails to acknowledge numerous conclusions that state and federal agencies have made concerning SSFL and the surrounding communities.

- The Agency for Toxic Substances and Disease Registry (ATSDR) wich funded this study, reached the following conclusion, after completing their own study:

  "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."[1]

  The UCLA report utilized essentially the same environmental data base used by the ATSDR study, yet it reached very different conclusions without explaining the basis for such a departure.

- Other regulatory agencies have made the following statements to address concerns regarding the health of the community surrounding SSFL:

  "These analyses suggest that people living near the SSFL are not at increased risk for developing cancers associated with radiation exposure."[2]

  "EPA is not aware of any current contamination from the SSFL that poses an unacceptable risk to the community."[3]

  "Three studies of cancer incidence in the vicinity of SSFL were reviewed...the combined evidence from all three does not indicate an increased rate of cancer in the regions examined. The results do not support the presence of any major environmental hazard."[4]

Third, the report bases its analysis on the maximum values of a small number of environmental positive detects for soil and water and ignores the totality of the environmental database that is comprised of mostly non-detects, thereby providing inaccurate and misleading portrayals of potential exposure issues. For example, Figure 4-3 of the report presents a map of groundwater contaminants detected above health-based standards. The map shows the concentration of carbon

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[1] *Preliminary Site Evaluation – Santa Susana Field Laboratory (SSFL), Ventura County, California,* CERCLIS No. CAD074103771, Agency for Toxic Substances and Disease Registry, December 3, 1999.

[2] *Cancer Incidence Near the Santa Susana Field Laboratory (1978-1989),* California Department of Health Services, March 27, 1992.

[3] *SSFL Work Group – Fourth Quarter Report for Calendar Year 1998,* U.S. Environmental Protection Agency, May 1999.

[4] *Rocketdyne Inquiry – Summary of Findings and Report,* Cal/EPA Department of Toxic Substances Control, August 1999.

tetrachloride at nine times the California Maximum Concentration Level. However, this representation is misleading because it fails to indicate that of the 895 offsite analyses conducted for this chemical, there were only 2 off-site detections (see Table 7 of ATSDR's 1999 evaluation). Identifying two detections, while failing to mention 893 non-detections, is not a fair and accurate portrayal of the groundwater data. The use of maximum detects to calculate dose ratios is a poor surrogate for estimating community exposures using the entire body of relevant data.

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Fourth, the report also ignores crucial facts concerning the question of past exposures. 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." Modeling results show that TCE concentrations rapidly decline with distance from the site (to approximately 2 $\mu g/m^3$ at just 1 mile). Approximately 89% of TCE emissions from rocket engine testing/degreasing occurred before 1967. Before 1967, less than twenty residents resided in the census tract encompassing most of the 1- mile area surrounding SSFL. Yet, the study inexplicably lists elevated dose ratios at eleven "receptor locales," some of which are located 5 to 10 miles from SSFL. The report also incorrectly uses the large exhaust rates for large LOX-kerosene engines to estimate emissions from the much smaller hydrazine engines. This has resulted in an over-estimate of hydrazine emissions by at least 100-fold.

Fifth, the report ignores the fact that background levels of some chemicals and radionuclides are found in all soils. The report fails to subtract background from off-site measurements prior to comparing to health based standards. Consequently, off-site measurements of background chemicals and radionuclides are incorrectly identified as contamination from SSFL.

Sixth, the report does not adequately establish exposure pathways. Transport of specific contaminants should be traced from an identified SSFL source, through an air or water transport medium to a receptor (local resident). Specific effects on the food chain, if any, should be identified. Exposure modes should be established (e.g. inhalation, ingestion, dermal contact, etc.). Temporal changes in populated areas should be assessed. Finally, the likelihood of occurrence of the postulated exposure pathways needs to be quantified. Only, then can a realistic risk assessment be performed.

Seventh, the report repeatedly claims that assessing health risk impacts was not possible and beyond the scope of the study. Yet the report presents dose ratios based on overly conservative estimates of exposures, and then draws conclusions about public health significance.

Extensive environmental investigations have been ongoing for many years with regulatory agency review and approval. Until this report, the data have shown that neighboring communities have not been adversely impacted by SSFL operations. We have an extensive network of groundwater wells both on and offsite and have been monitoring these wells for 20 years. Based on our testing of known domestic wells in the vicinity of SSFL, we believe offsite receptors are not being exposed to contaminants in drinking water resulting from SSFL operations. Groundwater quality monitoring data show a few sporadic detections, all of which are either below health-based primary drinking water standards, are attributed to well owner activity, are naturally occurring, or are inconclusive as to source of contaminant. We have years of extensive environmental data and we stand behind it.

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The Boeing Company appreciates your thorough consideration of all of our comments and looks forward to their incorporation in the final report. Should you have any questions concerning these comments, please contact Blythe Jameson at 818/466-8793.

Sincerely,

Phil Rutherford

for Thomas D. Gallacher
Director
SHEA & Remediation Programs

Enclosure: Boeing's Comments on UCLA's Report "Potential for Off-site Exposures Associated with the Santa Susana Field Laboratory, Ventura County, California", September 29, 2006

cc:

The Honorable Barbara Boxer, United States Senator
The Honorable Dianne Feinstein, United States Senator
The Honorable Tom McClintock, California State Senator
The Honorable Sheila Kuehl, California State Senator
The Honorable Lloyd Levine, California State Assembly Member
The Honorable Fran Pavley, California State Assembly Member
The Honorable Keith Richman, California State Assembly Member
The Honorable Audra Strickland, California State Assembly Member
The Honorable Michael Antonovich, Los Angeles County Supervisor
The Honorable Greig Smith, Los Angeles City Council Member
The Honorable Judy Mikels, Ventura County Supervisor

The Honorable Linda Parks, Ventura County Supervisor
The Honorable Glen Becerra, Mayor Pro Tem, City of Simi Valley
Ms. Laura Behjan, City of Simi Valley
Mr. Burt Cooper, Agency for Toxic Substances and Disease Registry
Mr. Mike Lopez, Project Manager, Department of Energy
Mr. Gary Butner, Department of Health Services, Radiologic Health Branch
Mr. Watson Gin, Deputy Director, Department of Toxic Substances Control
Mr. Allen Elliott, National Aeronautics and Space Administration
Mr. John Beach, Environmental Protection Agency, Region IX
Mr. Jonathan Bishop, Executive Officer, Los Angeles Regional Water Quality Control Board
Mr. Michael Levy, State Water Resources Control Board
Mr. Michael Villegas, District Executive Officer, Ventura County Air Pollution and Control District
Mr. Brendan Huffman, President, Valley Industry and Commerce Association
Ms. Arlene Levin, Eastern Research Group
Ms. Carol Henderson, Bell Canyon Association
Mr. Gary Brennglass, Executive Director, Brandeis-Bardin Institute
Mr. John Fitzpatrick, Sr. Project Manager, Centex Homes
Ms. Sheila Rozsa, Mountain View Estates
Mr. Randy Wheeler, President, Runkle Ranch
Mr. Luis Porga, Summit Mobile Homes
Ms. Rorie Skei, Santa Monica Mountains Conservancy
Mr. Tim Miller, Sage Ranch

SHEA-104330

Boeing's Comments on UCLA's Report

"The Potential for Off-site Exposures Associated with the Santa Susana Field Laboratory, Ventura County, California"

September 29, 2006

The Boeing Company
Santa Susana Field Laboratory

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General Comments on "The Potential for Off-site Exposures Associated with Santa Susana Field Laboratory, Ventura County, California"

No.	General Comments
G-1	There are numerous concerns related to the methodology and use of data in the UCLA report. Taken as a whole, these concerns reduce the confidence in the validity of the report's conclusions. The report fails to acknowledge numerous conclusions that state and federal agencies have made concerning SSFL and the surrounding communities.
G-2	The report utilized essentially the same environmental data base used by the Agency for Toxic Substances and Disease Registry (ATSDR) in their 1999 study (http://www.atsdr.cdc.gov/HAC/PHA/santa/san_toc.html), that concluded: • *"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."*
G-3	This report is being published as a UCLA report, not as a government or ATSDR report. ATSDR provided federal funding for the report but did not review the draft and has yet to comment on its technical basis.
G-4	The report fails to acknowledge many important, publicly-available, SSFL related documents including the 2003 DOE Environmental Assessment of ETEC (http://apps.em.doe.gov/etec/eadownload.pdf), the 2005 DOE Historical Site Assessment of Area IV (http://www.boeing.com/aboutus/environment/santa_susana/hsa.html), and the 2005 follow-on Rocketdyne Worker Health Study (http://www.boeing.com/aboutus/environment/santa_susana/healthstudy.html).
G-5	The report fails to communicate the EPA's conclusion (http://apps.em.doe.gov/etec/EPAFS.PDF) following the Off-Site Multimedia Study of Brandeis-Bardin, that … • *"The radionuclides do not pose a threat to human health and the environment."*

No.	General Comments
G-6	The report fails to communicate the conclusion of EPA's 2003 Hazard Ranking Assessment (http://apps.em.doe.gov/etec/EPA-HRS.pdf) which stated that … • *"The site does not qualify for further remedial site assessment under CERCLA"* • *"Radionuclides associated with historic Area IV research are not present at concentrations significantly above background in the soils surrounding residential communities."* EPA based these findings upon the same environmental data as UCLA had available to them.
G-7	The report fails to acknowledge EPA's conclusions following its own 2000-2001 surveys of 11 prior radiological facilities which stated … • *"Previous DOE/Boeing surveys sampled in appropriate and representative locations"* • *"Measurements made in previous surveys were accurate"* • *"EPA concurs with the conclusions made by the Department of Energy (DOE) and Boeing Rocketdyne about the locations and levels of residual radioactivity"* • *"Residual radioactivity does not exceed DOE and Nuclear Regulatory (NRC) established limits for unrestricted use."*
G-8	The report references three cancer incidence studies performed by the Department of Health Services (DHS), but fails to communicate DHS's and DTSC's conclusions, which were …. *"These analyses suggest that people living near the SSFL are <u>not</u> at increased risk for developing cancers associated with radiation exposure."* "Cancer Incidence Near the Santa Susana Field Laboratory (1978-1989)", California Department of Health Services, March 27, 1992. *"Three studies of cancer incidence in the vicinity of SSFL were reviewed ..... the combined evidence from all three does <u>not</u> indicate an increased rate of cancer in the regions examined. The results do <u>not</u> support the presence of any major environmental hazard."* "Rocketdyne Inquiry – Summary of Findings and Report", Cal/EPA Department of Toxic Substances Control", August 1999.
G-9	The report bases its analysis on the maximum values of a small number of environmental positive detects for soil and water and ignored the totality of the environmental database that is comprised of mostly non-detects. Using maximum detects to calculate dose ratios is a poor surrogate for estimating community exposures.

No.	General Comments
G-10	Background has not been subtracted from soil measurements before comparison to "health based standards" for naturally occurring radionuclides such as potassium-40, thorium, radium and uranium. Soil concentrations of these naturally occurring radionuclides will always exceed standards based on 1-in-a-million risk level since these radionuclides represent a 1-in-thousand risk level in clean, non-contaminated soil.
G-11	The report ignores crucial facts concerning past exposures. The report 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." Modeling results show that TCE concentrations rapidly decline with distance from the site (to approximately 2 $\mu g/m^3$ at just 1 mile). Approximately 89% of TCE emissions from rocket engine testing/degreasing occurred before 1967. Before 1967, less than twenty residents resided in the census tract encompassing most of the 1-mile area surrounding SSFL. Yet, the report lists dose ratios at eleven "receptor locales," some of which are located 5 to 10 miles from SSFL.
G-12	The report incorrectly uses the large exhaust rates for large LOX-kerosene engines for the much smaller hydrazine engines. This has resulted in an over-estimate of hydrazine emissions by at least 100-fold.
G-13	Many incorrect, overly conservative assumptions were made that could have been corrected with information or data if UCLA had communicated with Boeing more during the conduct of the study.
G-14	Based on our testing of known domestic wells in the vicinity of SSFL, we believe offsite receptors are not being exposed to contaminants in drinking water resulting from SSFL operations. Groundwater quality monitoring data show a few sporadic detections, all of which are either below health-based primary drinking water standards, are attributed to well owner activity, are naturally occurring, or are inconclusive as to source of contaminant.
G-15	The report repeatedly claims that assessing health risk impacts was not possible and beyond the scope of the study. Yet the report presents dose ratios based on overly conservative estimates of exposures, and then draws conclusions about public health significance.
G-16	The report fails to establish a pathway between a source at SSFL and locations of off-site receptors. It ignores the fact that background levels of some chemicals and radionuclides are found in all soils. Hence, it does not subtract background from off-site measurements prior to comparing with health based standards. Consequently off-site measurements are incorrectly identified as contamination from SSFL.

Comments on Radiological Topics in "The Potential for Off-site Exposures Associated with Santa Susana Field Laboratory, Ventura County, California"

No.	Section	Radiological Comments
R-1	General	The report cites incorrect data, e.g., the report cites cesium-137 for one soil sample at Ahmanson at 10 times the actual value.
R-2	General	The report questions sampling programs that were reviewed and approved by the EPA, DTSC, DHS and RWQCB.
R-3	General	The report uses incorrect drinking water limits (MCLs), airborne limits, and soil preliminary remediation goals (PRGs).
R-4	General	The report misinterprets data, e.g., fails to subtract uranium activity from gross alpha activity before comparison to MCLs.
R-5	General	The report makes erroneous comparisons of non-background-subtracted, naturally occurring radionuclides (potassium-40 and thorium) to health based standards. The report therefore concludes that non-contaminated soil exceeds health based standards and must therefore be contaminated by SSFL. Clean soil containing naturally occurring radionuclides has a risk of approximately 1-in-a-thousand and "health based standards" used by UCLA have a risk of 1-in-a-million. Therefore the report would reach the same erroneous conclusion for any non-contaminated soil.
R-6	General	The report uses <u>average</u> backgrounds as "comparison" levels. This is statistically incorrect, since random sampling of clean soil will falsely identify 50% of the soil as contaminated.
R-7	General	Specific comments below tend to be repetitive because the report itself is excessively repetitive.
R-8	General	Boeing strongly disagrees that a comprehensive off-site monitoring program for radionuclides is warranted. Extensive radiological off-site monitoring over 50 years, and especially during the last 15 years, has failed to detect any offsite contamination at levels that could be a threat to human health. State agencies have concluded that there are no increased cancer rates in the community as a result of SSFL operations.
R-9	Chapter 1, Page ii, Title	Correct the spelling of "fo" to "for."
R-10	Chapter 1, Page 2, Line 4	The Office of Environmental Health Hazard Assessment (OEHHA) is incorrectly referred to as the "Office of Environmental Health & Human Affairs."

No.	Section	Radiological Comments
R-11	Chapter 1, Page 2, last line	Change "Rocketdyne Propulsion & Power Division" to "Directed Energy Systems."
R-12	Chapter 1, Page 5	Figure 1-3 is missing. Figure 1-5 is incorrectly repeated on this page.
R-13	Chapter 1, Page 8, Section 1.4, Line 1	Redundant ATSDR.
R-14	Chapter 1, Page 10, Paragraph 2	*"Sampling was deficient with respect to the sampled media for the Bell Canyon Study and the number of areas sampled for the BBI/SMMC study. For example proper monitoring protocols - such as grid spacing of samples - were not followed (EPA 2002)"*[1] EPA, DTSC, RWQCB, DHS, a Brandeis consultant, and community activists all reviewed, contributed, and approved the BBI/SMMC work plan and took split samples that confirmed Boeing's results. It is difficult to understand how the report can summarily dismiss McLaren/Hart's BBI/SMMC study as being deficient. EPA, DTSC, and DHS participated in the Bell Canyon sampling and took split samples. The location and type of most samples were chosen by Bell Canyon residents since this was a resident requested survey. Since both studies were performed in the 1990s it would have been difficult to follow EPA protocols written in 2002. There are many different sampling protocols, all of which can achieve the same objective. Simply because new protocols are written in 2002, does not invalidate all surveys and survey protocols performed prior to that date. The sampling strategy employed in the McLaren-Hart studies of 1993 and 1995 included a grid-based sampling strategy.
R-15	Chapter 1, Page 10, Footnote 1.10	*"Only four sites were sampled in the 1993 McLaren-Hart study. Sampling was deficient with respect to the … number of areas sampled for the BBI/SMMC study"* This statement is incorrect. Eight background locations, 19 Brandeis Bardin locations, and 8 Santa Monica Mountains Conservancy locations were sampled for a total of 35. This incorrect statement should be removed from the report.

[1] Quotes from the UCLA report are given in italics

No.	Section	Radiological Comments
R-16	Chapter 1, Page 10, Paragraph 2, Line 13	*"… despite detections of plutonium-238, cesium-137 and strontium-90 significantly above background (McLaren-Hart 1995) re-sampling was only conducted 2 years after the initial detection and only tritium was assessed in this second round of monitoring"* Re-sampling was conducted exactly one year following the release of the first report and 124 additional study area samples and 40 additional background samples were analyzed for cesium-137, strontium-90, gamma emitting radionuclides, isotopic plutonium, isotopic uranium, and isotopic thorium. ("Additional Soil and Water Sampling at the Brandeis-Bardin Institute and Santa Monica Mountain Conservancy", McLaren/Hart, January 19, 1995). The second round of sampling did not confirm the prior detections of plutonium-238. Two locations, close to the SSFL boundary, had detectable cesium-137 at 0.13 pCi/g higher than local background and detectable strontium-90 at 0.051 pCi/g higher than local background. Both of these values are approximately twice local background but well below the EPA-quoted U.S. background of 0.7 pCi/g. Tritium was also detected in soil at less than the drinking water standard. No other radionuclides were detected above background at any other locations. The EPA stated in a fact-sheet following the BBI/SMMC sampling that these low levels of radionuclides are less than the 1-in-a-million cancer risk level (EPA Update, July 1995). This incorrect statement should be removed from the report.
R-17	Chapter 1, Page 10, Paragraph 2, Line 14	*"Given the deficiencies in the above studies, the study team is concerned that the extent of contamination in these offsite areas was incompletely mapped"* The EPA stated in a fact-sheet following the BBI/SMMC sampling that these low levels of radionuclides are less than the 1-in-a-million cancer risk level (EPA Update, July 1995). EPA stated that, *"EPA has determined that the radionuclides do not pose a threat to human health or the environment."* The EPA analyzed split samples taken at Bell Canyon and confirmed Boeing data that showed Bell Canyon radionuclide levels were less than the local background levels determined in the BBI/SMMC sampling project.
R-18	Chapter 1, Page 10, Paragraph 3, Line 7	*"… lack of air monitoring data for ... radionuclides … and potential for non-detection of significant concentrations in past monitoring programs due to detection limits of monitoring devices."* Air monitoring in Area IV of SSFL has been ongoing since the 1950s to the present day. These data have been reported in the Annual Site Environmental Reports that were given to UCLA. Comparisons to DHS data for the rest of California show a remarkable similarity in temporal trends that can be correlated to the buildup and termination of US/USSR nuclear weapons tests in the 1950s and 1960s. SSFL air monitors have been able to detect nuclear events on the other side of the planet, including Chinese weapons tests in the 1970s and 1980s and the Chernobyl accident in April 1986. In contrast, these same sensitive detectors have not detected any abnormal increase in airborne radionuclide content from SSFL operations.

No.	Section	Radiological Comments
R-19	Chapter 2, Page 15, last paragraph, final sentence	The sentence should be clarified. It correctly refers to airborne NESHAPS (40 CFR 61) limits based on 10 millirem/year, but then refers to EPA emission standards (??) based on 4 millirem/year. It is the drinking water standards of 40 CFR 141 that are based on 4 millirem /year. The report needs to state here what standards it uses for radionuclides in soil. The report claims to use EPA Region 9 Residential Soil Screening Levels (RSSLs) for soil. These are presumably chemical limits. In contrast, the report uses in Appendix N, Table N-1, radionuclide agricultural preliminary remediation goals (PRGs) at the 10^{-6} risk level. Why does the report use residential health based standards for chemicals and much more restrictive agricultural health based standards for radionuclides?

No.	Section	Radiological Comments
R-20	Chapter 2, Page 16, Line 3	*"Offsite monitoring studies have revealed the presence of offsite contamination (Appendix H) suggesting that contaminants have migrated away from the SSFL area. Offsite contaminants that were detected above health based standards include, but are not limited to, radionuclides (tritium, potassium-40, radium-226/-228, thorium228/-232, plutonium-238, cesium-137) … "* Tritium was discovered in a single groundwater well (RD-34A) 10 feet north of the SSFL boundary in 1989. The maximum concentration found in this well was ~7,000 pCi/L. This did not exceed the health based MCL for water of 20,000 pCi/L. Currently, analysis of water from this well is ~2,000 pCi/L, and the well is now on Boeing-owned land. No other offsite wells have detectable tritium. The only location with alleged cesium-137 soil contamination was just to the north of the SSFL Area IV boundary and was detected during the BBI/SMMC sampling program (see comments on Chapter 1, page 10). EPA stated that, *"EPA has determined that the radionuclides do not pose a threat to human health or the environment."* This location is now Boeing-owned land. One location just to the north of the SSFL boundary had detectable, but low levels of plutonium-238 during the 1992 BBI/SMMC sampling project, however subsequent sampling, in the same location two years later failed to confirm any detectable plutonium-238. The land is now Boeing-owned land. The report lists "health based standards" for radionuclides in Table N-1 of Appendix N. These health based standards are, for the most part, taken from the EPA Preliminary Remediation Goals (PRGs) using default agricultural soil scenario and a 10^{-6} cancer risk level (http://epa-prgs.ornl.gov/radionuclides/). Potassium-40, radium-226/-228, and thorium-228/-232 are naturally occurring radionuclides and together with uranium and its decay products result in approximately 40 millirem/year of background radiation exposure from clean non-contaminated soil. Using the linear-non-threshold model of radiation risk, this approximates to about 1-in-a-thousand lifetime fatal cancer risk. Since the EPA PRGs (UCLA's "health-based standards") are based on a 1-in-a-million cancer risk, any clean soil will exceed health based standards. It is therefore a meaningless exercise to compare gross, non-background-subtracted values for naturally occurring radionuclides in soil with EPA PRGs. If UCLA analyzed soil in Westwood it would reach the same false conclusion … that UCLA soil contains radionuclides that exceed health based standards and therefore must be contaminated by SSFL.
R-21	Chapter 2, Page 22, Line 4	The NRC license that is referred to as being terminated on September 27, 1996 was Special Nuclear Material License, SNM-21. It applied only to the Rockwell International Hot Laboratory and was not a reactor license.

No.	Section	Radiological Comments
R-22	Chapter 2, Page 23, Footnote 2.8	*"Offsite areas have had limited sampling and radiological characterization of surface water owing, in part, to the intermittent surface water flows from SSFL"* All NPDES outfalls are monitored for radioactivity whenever there is flow according to the NPDES permit requirements. We are uncertain about the intent of this statement. Surface water releases from SSFL can only be monitored when there is surface water flow to measure. Surface water flow occurs only during and following rainfall events.
R-23	Chapter 2, Page 23, Line 10	*"… available data do suggest that radionuclides have been detected off site and that there has been migration of radionuclides (Appendix H). Various studies concerning the presence of radionuclides on site and off site are consistent with the general conclusion that radionuclides from Area IV have migrated to offsite areas."* These general and far-reaching statements are not supported by the data, and provide an incorrect and misleading impression of widespread contamination in the community that is a health concern. This is absolutely incorrect. See the rebuttals to specific allegations elsewhere in these comments.
R-24	Chapter 2, Page 23, Line 16	*"Strontium-90 and tritium were detected in BBI soils at concentrations above background levels; plutonium-238 and cesium-137 were detected in BBI soils above background levels and health based standards"* Two locations, close to the SSFL boundary, had detectable cesium-137 at 0.13 pCi/g higher than local background and detectable strontium-90 at 0.051 pCi/g higher than local background. Both these values are approximately twice local background but well below the EPA-quoted U.S. background of 0.7 pCi/g. One location just to the north of the SSFL boundary had detectable, but low levels of plutonium-238 during the 1992 BBI/SMMC sampling project, however subsequent sampling, in the same location two years later failed to confirm any detectable plutonium-238. Tritium was also detected in soil at less than the drinking water standard. The EPA stated in a fact-sheet following the BBI/SMMC sampling that these low levels of radionuclides are less than the 1-in-a-million cancer risk level (EPA Update, July 1995). EPA stated that, *"EPA has determined that the radionuclides do not pose a threat to human health or the environment."* This location is now Bowing-owned land.

No.	Section	Radiological Comments
R-25	Chapter 2, Page 23, Line 19	*"radium-226/-228 and strontium -90 were detected in northwest NPDES surface releases above MCLs (McLaren-Hart 1993, 1995:Rockwell 1987)."* Radium-226/-228 analyses were not conducted or reported at all in the McLaren-Hart 1993 or 1995 studies. This incorrect statement should be removed from the report.
R-26	Chapter 2, Page 23, Line 21	*"Potassium-40, thorium-228/-232 and tritium were detected in Bell Canyon soils above health based standards (Ogden, 1998)."* This statement is incorrect. Potassium-40 and thorium-228/-232 are naturally occurring radionuclides and together with uranium and its decay products result in approximately 40 millirem/year of background exposure from clean non-contaminated soil. Using the linear-non-threshold model of radiation risk, this approximates to about 1-in-a-thousand cancer risk. Since the EPA PRGs (UCLA's "health-based standards") are based on a 1-in-a-million cancer risk, any clean soil will exceed health based standards. It is therefore a meaningless exercise to compare gross, non-background-subtracted values for naturally occurring radionuclides in soil with EPA PRGs. If UCLA analyzed soil in Westwood, it would reach the same false conclusion … that UCLA soil contains radionuclides that exceed health based standards and therefore must be contaminated by SSFL. The health based standard for tritium in soil is identified by the report in Table N-1 Appendix N is 6.01 pCi/g. We do not know the source of this number. The EPA PRG for a 10^{-6} cancer risk for residential soil (Bell Canyon is a residential neighborhood) is 2.28 pCi/g. The EPA PRG for a 10^{-6} cancer risk for agricultural soil (Bell Canyon is not farmland) is 0.16 pCi/g. A total of twenty four samples were analyzed in Bell Canyon, including residential backyards, common areas, and the buffer area between Bell Canyon and SSFL. Tritium in soil ranged from -0.04 to 0.3 pCi/g of soil with an average of 0.11 pCi/g. Thirteen of these samples were non-detects. Detection limits ranged from 0.08 to 0.1 pCi/g. All these samples were well below the UCLA health based standard of 6.01 pCi/g and the EPA PRG for a 10^{-6} cancer risk for residential soil of 2.28 pCi/g. Reanalysis was performed on the 11 detectable samples by taking a second aliquot from each of the original samples and performing a second azeotropic distillation and liquid scintillation count. Ten of the 11 samples were non-detects with only 1 sample above the detection limit. In conclusion, potassium-40, thorium-228/-232 and tritium were not detected in Bell Canyon soils above health based standards. This incorrect statement should be removed from the report.

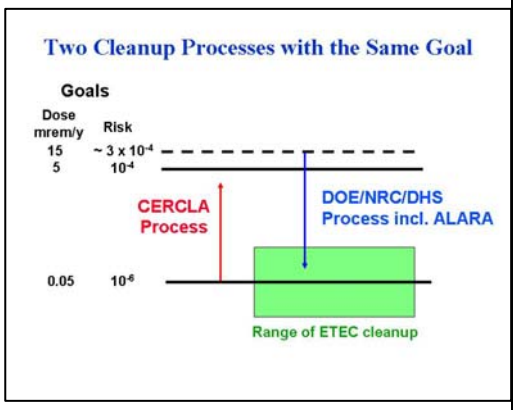
No.	Section	Radiological Comments
R-27	Chapter 2, Page 23, Line 22	*"Cesium-137, potassium-40, and thorium-228/-232 were detected in Ahmanson Ranch soils above health based standards (Klinefelder, 2000)."* This statement is incorrect. Cesium-137 detected in Ahmanson soil and reported by Kleinfelder was <0.014, 0.085, 0.14, 0.032, 0.12 and <0.035 pCi/g. Each of these samples is well within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study in 1995. Net (or background-subtracted) concentrations should be compared to health-based standards. Comparing gross (non-background subtracted) data to health based standards is a meaningless comparison. Clearly the cesium-137 measured at Ahmanson is consistent with local background cesium-137 and not from SSFL operations. The net cesium-137 is not above health based standards. Potassium-40 and thorium-228/-232 are naturally occurring radionuclides and together with uranium and its decay products result in approximately 40 millirem/year of background exposure from clean, non-contaminated soil. Using the linear-non-threshold model of radiation risk, this approximates to about 1-in-a-thousand cancer risk. Since the EPA PRGs (UCLA's "health-based standards") are based on a 1-in-a-million cancer risk, any clean soil will exceed "health based standards." It is therefore a meaningless exercise to compare gross, non-background-subtracted values for naturally occurring radionuclides in soil with EPA PRGs. If UCLA analyzed soil in Westwood it would reach the same false conclusion … that UCLA soil contains radionuclides that exceed health based standards and therefore must be contaminated by SSFL. Potassium-40 and thorium-228/-232 were all within the background range identified in the Kleinfelder report. This incorrect statement should be removed from the report.
R-28	Chapter 2, Page 23, Line 23	*"Cesium-137 was detected above health based standards in Canoga Park soils (Lawrence Livermore National Lab, 1997)."* This statement is incorrect. Thirty four of 35 samples taken at the Rocketdyne Recreation Center had cesium-137 that ranged from 0.016 to 0.21 pCi/g, all within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study in 1995. One sample had a value of 0.27 pCi/g. The 95th percentile of the McLaren-Hart cesium-137 background is 0.21 pCi/g. Assuming a normal distribution, one would therefore expect 2.5 % of samples to exceed the two-sided 95th percentile. One sample out of 35 (or 2.9%) at the Recreation Center exceeded the 95th percentile which is almost exactly what one would expect for a statistical normal distribution. The conclusion of the investigator was that "… levels of cesium-137 observed in these soil samples are within the range of background cesium-137 …" This incorrect statement should be removed from the report.

No.	Section	Radiological Comments
R-29	Chapter 2, Page 23, Line 27	*"In June and July of 1978, radiological surveys were conducted of the Rockwell International Facilities in Canoga Park and SSF (EG&G, 1979). Gamma emitters were not detected above background levels in surface water channels originating from the property. Given that the half life for certain gamma emitters is relatively short (e.g. cobalt-60 has a ~5.3 day half-life), such short lived radionuclides would have decayed long before the above monitoring."* This statement is factually incorrect and misleading. The survey referred to, was a gamma exposure mapping project using sensitive helicopter mounted radiation detectors. Cobalt-60 does not have a 5.3 day half-life, it has a 5.3 year half-life. Furthermore, other typical fission products and neutron activation products have even longer half-lives such that any contamination hypothetically released decades ago would still be readily detectable today if it had occurred. Such gamma emitting fission products, activation products, transuranics and fuel materials, include sodium-22 (2.6 years), europium-154 (8.6 years), europium-152 (13.5 years), cesium-137 (30 years), americium-241 (432 years), uranium-235 (700 million years), and thorium-232 (14 billion years). The report's attempt to question the usefulness of gamma exposure surveys to detect contamination is based on erroneous information. This incorrect statement should be removed from the report.
R-30	Chapter 5, Page 77, Paragraph 4, Line 1	*"Soil contamination by … cesium-137 was also detected south of SSFL at Bell Canyon and Ahmanson Ranch properties."* Cesium-137 detected in Ahmanson soil and reported by Kleinfelder was <0.014, 0.085, 0.14, 0.032, 0.12 and <0.035 pCi/g. Each of these samples is well within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study in 1995. Clearly the cesium-137 measured at Ahmanson is consistent with local background and not from SSFL operations. The report has used an incorrect maximum cesium-137 value of 0.32 pCi/g (sample S-4) from the Kleinfelder report of Ahmanson Ranch. The original lab data and Table 16 for sample S-4 gives a correct value of 0.032 pCi/g for cesium-137. The maximum cesium-137 detected at Ahmanson Ranch is therefore 0.14 pCi/g (sample S-3). The maximum cesium-137 value of 0.18 pCi/g measured in Bell Canyon in 1998 is within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study in 1995. Neither Ahmanson Ranch nor Bell Canyon has cesium-137 that is above background. This incorrect statement should be removed from the report.

No.	Section	Radiological Comments
R-31	Chapter 5, Page 78, Figure 5-1	The maximum cesium-137 at Ahmanson is not 0.32 but 0.14 pCi/g (see above). This maximum value is well within the range of background of <0.03 to 0.213 pCi/g determined in the McLaren-Hart study in 1995. The Ahmanson cesium-137 call-out should be removed from Figure 5-1. One location just to the north of the SSFL boundary had detectable, but low levels of plutonium-238 during the 1992 BBI/SMMC sampling project. However subsequent sampling, in the same location two years later failed to confirm any detectable plutonium-238. The BBI plutonium-238 call-out should be removed from Figure 5-1.
R-32	Chapter 5, Pages 79-80	*"Contaminants that were found in areas of potential exposure include … cesium-137 and plutonium-238 … these contaminants were found above health based standards in a number of locations including residential and recreational areas immediately north and south of the facility … cesium-137 was detected south of SSFL at the Ahmanson Ranch … cesium-137 and plutonium-238 … were detected north of SSFL albeit on border property, since purchased by Boeing."* Cesium-137 detected in Ahmanson soil and reported by Kleinfelder was <0.014, 0.085, 0.14, 0.032, 0.12 and <0.035 pCi/g. Each of these samples is well within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study in 1995. Clearly the cesium-137 measured at Ahmanson is consistent with local background cesium-137 and not from SSFL operations. The report has used an incorrect maximum cesium-137 value of 0.32 pCi/g (sample S-4) from the Kleinfelder report of Ahmanson Ranch. The original lab data and Table 16 for sample S-4 gives a correct value of 0.032 pCi/g for cesium-137. The maximum cesium-137 detected at Ahmanson Ranch is therefore 0.14 pCi/g (sample S-3). One location just to the north of the SSFL boundary had detectable, but low levels of plutonium-238 during the 1992 BBI/SMMC sampling project. However, subsequent sampling in the same location two years later failed to confirm any detectable plutonium-238. The land is now Boeing-owned land. This incorrect statement should be removed from the report.

No.	Section	Radiological Comments
R-33	Chapter 5, Page 80, Line 9	*"Background ranges for cesium-137 and plutonium-239 were averaged soil radiation levels in East Ventura and West LA Counties. However as these background concentrations were derived from Ogden, given the inadequacy of the background sample locations, comparison to these background levels may not accurately represent the extent of radionuclide contamination."* Cesium-137 backgrounds were derived from the McLaren-Hart study of BBI/SMMC in 1995. The work-plan and background locations were approved by the EPA, DTSC, DHS, and RWQCB as well as community activists. UCLA has provided no valid basis to question the adequacy of background data. The report has not identified plutonium-239 as a radionuclide detected offsite, so we do not understand the statement on plutonium-239 background. This incorrect statement should be removed from the report.
R-34	Chapter 6, Page 86, Paragraph 3, Line 1	*"Contaminants found above health based standards in Bell Canyon include … the man-made radionuclide thorium-228 … each of these contaminants was found above health based standards at SSFL … thorium-228 has been detected onsite in Area IV groundwater."* Thorium-228 is not man-made. It is the decay product of thorium-232, a naturally occurring radionuclide found in all soils and rocks. Consequently it is found in all groundwater and in the food chain. The local thorium-228 background ranges from 0.11 to 1.6 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. thorium-228 background ranges from 0.1 to 3.4 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum thorium-228 in Bell Canyon was incorrectly reported by UCLA as 1.8 pCi/g. It is in fact 1.3 pCi/g (Ogden 1998 Report). Bell Canyon thorium-228 is therefore well within both local and US background. This incorrect statement about thorium-228 in Bell Canyon should be removed from the report.
R-35	Chapter 6, Page 93, Paragraph 2, Line 1	*"Two offsite monitoring studies reported offsite soil contamination in areas south and north of SSFL (Ogden 1998, and McLaren-Hart 1993, 1995). Contaminants detected in above health based standards in these studies included … potassium-40, thorium-228 and -232, tritium, cesium-137, plutonium-238, radium-226 and -228, and strontium-90."* This statement is incorrect. See detailed comments below for each radionuclide and for each location in Appendix H, Tables H-8 and H-9. This incorrect statement should be removed from the report.

No.	Section	Radiological Comments
R-36	Chapter 8, Section 8.2	This section is devoted to a repetition of the 1989 Dempsey review of the SSFL radiological monitoring program. All the criticisms of the program were either addressed, corrected, or refuted in a Rockwell report, N001SRR140115, "Recent Reviews of Rocketdyne Environmental Monitoring Program" June 28, 1991. This document also contains two additional independent reviews of the program which in general refute the Dempsey criticisms. ATSDR and UCLA were provided with a copy of this report, but UCLA has declined to acknowledge or even reference this report. The following addresses the issue of filtered vs. unfiltered water. Water with low turbidity (low suspended solids) has been shown to have no statistical difference between filtered and unfiltered samples (EPA groundwater study[1], DHS groundwater study[2], and Boeing surface water studies). Water with high turbidity (high suspended solids, muddy water) does result in significant differences in gross alpha activity (Boeing groundwater study[3]). However, subsequent uranium isotopic analysis has demonstrated that the uranium content of the suspended solids accounts for the difference. When uranium is subtracted from the gross alpha (as EPA protocols require) then alpha MCLs are met. Inspection of the uranium isotopic ratios also demonstrates that the uranium is naturally occurring and not enriched or processed. 1. "Rocketdyne Technical Support/Field Oversight - Groundwater Split Sampling Report", prepared by Tetra Tech for EPA, Region 9, June 23, 1998. 2. "Ahmanson Ranch Groundwater Sampling of June 2003", Department of Health Services Radiologic Health Branch. 3. "SSFL Groundwater Monitoring Report for SSFL – Second Quarter 2006", Hailey & Aldrich, September 2006
R-37	Chapter 8, Page 115, Section 8.2, last paragraph	Past statements that 99.99% percent of radioactivity has been removed are not inconsistent with the recent detects of tritium at ~100,000 picocuries per liter in groundwater. Area IV of SSFL had contained more than 100 million curies of radioactivity at various times in its history. The approximate inventory today is 30 curies in sealed calibration sources and 3 curies in radioactive waste, thus a better estimate of the removal fraction is 99.99997%. Maximum tritium recently measured is 0.0000001 curies per liter or 0.0000004 curies per gallon. The areal extent of radioactively contaminated groundwater is very limited. It would take 60 million gallons of groundwater contaminated at this level to equal the amount of tritium in one tritium exit sign (24 curies). Clearly, the report has made an inappropriate comparison.

No.	Section	Radiological Comments
R-38	Chapter 8, Page 119, Section 8.5	This section discusses the imagined controversy between the nuclear industry's dose-based cleanup standards and the EPA's risk-based standards. SSFL is not unique and is using processes and limits that are consistent with the rest of the nuclear industry in the U.S. The Department of Energy (DOE) and the Environmental Protection Agency (EPA) have different processes to achieve the same goal which is to protect human health and the environment. Both the DOE and the EPA have specific clean-up authority. The DOE is responsible for the closure and clean-up of ETEC facilities at SSFL and has federal authority for the clean-up of radiological contamination. As chair of the SSFL Workgroup, the EPA was involved with the site until December 2003. However, the EPA is not responsible for regulatory oversight of the clean-up at ETEC. ETEC is not a listed Superfund site because EPA's Hazard Ranking System determined there was no risk to the surrounding community. Both agencies have remediation processes in place to achieve clean-up for chemical and radioactive materials which are protective of human health and the environment. The processes are different but the goal is the same: • To define clean-up standards, DOE uses the term "dose" while EPA uses "risk." Dose simply refers to the personnel exposure needed to determine risk. • EPA uses the Superfund process to determine clean-up standards at other sites. This process begins with the lowest possible risk-based clean-up standard, which is then increased based on specific site conditions. • DOE begins with a higher dose-based clean-up standard (which is still fully protective of human health) then remediates the site to levels which are As Low As Reasonably Achievable (ALARA).  • For example, EPA uses a starting risk level ($1x10^{-6}$) and then evaluates technical feasibility to determine a final clean-up risk level. At some Superfund sites, EPA has agreed to final risk levels of $3x10^{-4}$, which is the starting point for DOE clean-up at ETEC. • Post remedial sampling to date shows the DOE cleanups at SSFL are within (and occasionally less than) the EPA's risk management range ($1x10^{-4}$ to $1x10^{-6}$). The DOE and EPA have different processes to achieve the same end result which is protective of human health and the environment. At SSFL, post remedial sampling at radiological clean-up sites shows the implementation of the DOE process is protective of human health and the environment.

No.	Section	Radiological Comments
R-39	Chapter 8, Page 119, Section 8.5	This section references the various cancer incidence studies performed by the Department of Health Services. The DHS and DTSC conclusions based on these studies are … The Department of Health Services (DHS) [1] stated that, *"These analyses suggest that people living near the SSFL are <u>not</u> at increased risk for developing cancers associated with radiation exposure."* An independent expert panel hired by the Department of Toxic Substances Control (DTSC)[2] stated that, *"Three studies of cancer incidence in the vicinity of SSFL were reviewed ..... the combined evidence from all three does <u>not</u> indicate an increased rate of cancer in the regions examined. The results do <u>not</u> support the presence of any major environmental hazard."* 1. "Cancer Incidence Near the Santa Susana Field Laboratory (1978-1989)", California Department of Health Services, March 27, 1992. 2. "Rocketdyne Inquiry – Summary of Findings and Report", Cal/EPA Department of Toxic Substances Control", August 1999. This section also references UCLA worker health studies published in the late 1990s. At the time the UCLA studies were released, current and former employees raised many questions about the results of the study. In order to address employee questions, Rocketdyne and the UAW initiated the Follow-on Rocketdyne Worker Health Study in 1999. A group of outside experts, making up the Science Committee, were chosen to oversee the study, and the International Epidemiology Institute (IEI) was selected to conduct the follow-on study. The IEI Research Team and the Science Committee presented the study results to employees and retirees on April 7-8, 2005. The IEI Research team found no consistent or credible evidence that employment at Rocketdyne had adversely affected worker mortality. The Science Committee likewise concluded that, based on the results of the study, • The Rocketdyne workforce had a much lower overall mortality than the rate observed in the California population • There is no evidence that working conditions caused increased mortality in the Rocketdyne workforce Additional information may be found at http://www.boeing.com/aboutus/environment/santa_susana/healthstudy.html.

No.	Section	Radiological Comments
R-40	Chapter 9, Page 124, Section 9.2.2	*"A comprehensive offsite monitoring of radionuclides is warranted given the recent detection of tritium at levels as high as 83,000 pCi/L in new groundwater wells. Some radionuclides to monitor include: tritium, cesium-137, strontium-90, radium-226-228, plutonium-228, thorium-230, and uranium-235."* Doubtless further offsite monitoring will be conducted as required by various stakeholders, however Boeing strongly disagrees that a comprehensive off-site monitoring program is warranted. The report has misinterpreted, mischaracterized, mis-compared and mis-analyzed almost all the offsite data that it has reported in this study. Detailed comments on all the radionuclides mentioned above have been made in the appropriate sections especially in the comments for Appendix H,Tables H-8 and H-9. Boeing's position is that extensive radiological off-site monitoring over 50 years, and especially during the last 15 years, has failed to detect any offsite contamination at levels that could conceivably be a threat to human health. State agencies have concluded that there are no increased cancer rates in the community. On-site tritium in groundwater has been identified and bounded by clean wells in a localized area in Area IV, and has traveled no more than several hundred feet from the source in 30 years. Tritium has remained on-site and no offsite wells have had tritium detection confirmed. No other man made radionuclide has been detected in groundwater (and none are cited in the UCLA report). On-site groundwater is not used for drinking water. The presence of localized tritium is not sufficient cause to initiate a comprehensive off-site radiological monitoring program
R-41	Appendix H, Page H10, Table H-7, Row 6	Why is 49.3 pCi/L identified as exceeding the standard of 50 pCi/L for well RS-28? This incorrect data comparison should be removed from row 6 of Table H-7. The title of the table is Radiological Contaminants Onsite (Area IV), Sodium Disposal Facility, Radioactive Material Disposal Facility and NPDES Outfalls 003-008. Yet only one soil sample at the RMHF and 5 groundwater well samples in 1989 are identified as being contaminated. No contaminated samples were identified in the Sodium Disposal Facility, any NPDES Outfalls, or any other wells in any other year.
R-42	Appendix H, Page H10, Table H-8, Row 1	The concentration reported for radium-266/-228 at NPDES outfall 002 is actually the concentration for tritium at <500 pCi/L (non-detect). This was a reporting/transcription error by Rockwell in the original quarterly report. This incorrect data comparison should be removed from row 1 of Table H-8.

No.	Section	Radiological Comments
R-43	Appendix H, Page H10, Table H-8, Row 2	The report does not provide a reference for the thorium-228 background of 0.38 pCi/g. The local thorium-228 background ranges from 0.11 to 1.6 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. thorium-228 background ranges from 0.1 to 3.4 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum thorium-228 in Bell Canyon was incorrectly reported as 1.8 pCi/g. It is in fact 1.3 pCi/g (Ogden 1998 Report). Bell Canyon thorium-228 is therefore well within both local and US background. This incorrect data comparison should be removed from row 2 of Table H-8.
R-44	Appendix H, Page H10, Table H-8, Row 3	The report does not provide a reference for the thorium-230 standard of 3.49 pCi/g. The local thorium-230 background ranges from 0.2 to 4.2 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. thorium-230 background ranges from 0.12 to 3.8 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum thorium-230 in Bell Canyon is 1.4 pCi/g (Ogden 1998 Report). Bell Canyon thorium-230 is therefore well within both local and US background. The report's claim that a maximum concentration of 1.4 pCi/g exceeds a standard of 3.49 pCi/g appears to be in error. This incorrect data comparison should be removed from row 3 of Table H-8.

No.	Section	Radiological Comments
R-45	Appendix H, Page H10, Table H-8, Row 4	The report does not provide a reference for the thorium-232 standard of 0.37 pCi/g. The local thorium-232 background ranges from 0.15 to 1.5 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. thorium-232 background ranges from 0.10 to 3.4 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum thorium-232 in Bell Canyon is 1.5 pCi/g (Ogden 1998 Report). Bell Canyon thorium-232 is therefore within both local and U.S. background. This incorrect data comparison should be removed from row 4 of Table H-8.
R-46	Appendix H, Page H10, Table H-8, Row 5	The report does not provide a reference for the tritium standard of 0.01 pCi/g. A standard of 0.01 pCi/g is less than the detection capability of radiochemistry laboratories including EPA laboratories. The health based standard for tritium in soil is identified by UCLA in Table N-1 Appendix N is 6.01 pCi/g. UCLA does not provide the source of this number. The EPA PRG for a 10^{-6} cancer risk for residential soil (Bell Canyon is a residential neighborhood) is 2.28 pCi/g. The EPA PRG for a 10^{-6} cancer risk for agricultural soil (Bell Canyon is not farmland) is 0.16 pCi/g. The maximum tritium detection in Bell Canyon was 0.35 pCi/g which is well below the health based standard EPA PRG of 2.28 pCi/g for a 10^{-6} cancer risk for residential soil (Bell Canyon is a residential neighborhood). This incorrect data comparison should be removed from row 5 of Table H-8.
R-47	Appendix H, Page H10, Table H-8, Row 6	The report does not provide a reference for the uranium-234 standard of 15 pCi/g. The local uranium-234 background ranges from 0.14 to 1.9 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. uranium-234 background ranges from 0.12 to 3.8 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum uranium-234 in Bell Canyon is 1.0 pCi/g (Ogden 1998 Report). Bell Canyon uranium-234 is therefore within both local and U.S. background. The report's claim that a maximum concentration of 1.0 pCi/g exceeds a standard of 15 pCi/g appears to be in error. This incorrect data comparison should be removed from row 6 of Table H-8.

No.	Section	Radiological Comments
R-48	Appendix H, Page H10, Table H-8, Row 7	The report does not provide a reference for the uranium-235 standard of 0.205 pCi/g. The local uranium-235 background ranges from non-detect to 0.1 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. uranium-235 background ranges from 0.006 to 0.17 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum uranium-235 in Bell Canyon is 0.07 pCi/g (Ogden 1998 Report). Bell Canyon uranium-235 is therefore well within both local and U.S. background. The report's claim that a maximum concentration of 0.07 pCi/g exceeds a standard of 0.205 pCi/g appears to be in error This incorrect data comparison should be removed from row 7 of Table H-8.
R-49	Appendix H, Page H10, Table H-8, Row 8	The report does not provide a reference for the uranium-238 standard of 4.46 pCi/g. The local uranium-238 background ranges from 0.18 to 1.7 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. uranium-238 background ranges from 0.12 to 3.8 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum uranium-238 in Bell Canyon is 1.1 pCi/g (Ogden 1998 Report). Bell Canyon uranium-238 is therefore well within both local and U.S. background. The report's claim that a maximum concentration of 1.1 pCi/g exceeds a standard of 4.46 pCi/g appears to be in error. This incorrect data comparison should be removed from row 8 of Table H-8.

No.	Section	Radiological Comments
R-50	Appendix H, Page H10, Table H-8, Row 9	The report does not provide a reference for the potassium-40 background of 12.9 pCi/g. The local potassium-40 background ranges from 1.6 to 23.2 pCi/g as reported in the McLaren-Hart study of 1995 and the Area IV Radiological Characterization Survey, Aug. 15, 1996. The Ahmanson potassium-40 ranged from 8.3 to 23 pCi/g, consistent with local background. This incorrect data comparison should be removed from row 9 of Table H-8.
R-51	Appendix H, Page H10, Table H-8, Row 10	Cadmium-109 was incorrectly identified by gamma spectroscopy for the following reasons. Although cadmium can be used as a neutron absorber, it was not widely used at SSFL. The SRE used boron as a neutron absorber in internal control rods. The SNAP reactors all used external neutron reflectors made out of beryllium to control the neutron flux. Radioactive cadmium-109 is produced by neutron activation of stable cadmium-108. Cadmium-108 represents only 0.9% of cadmium metal, thus relatively little cadmium-109 would be produced compared to nine other much shorter half-lived cadmium radioisotopes. The half life of cadmium-109 is only 1.3 years, thus it decays relatively rapidly. For instance, in the 40 year period since the Sodium Reactor Experiment was shutdown, cadmium-109 (if it had been produced in the SRE) would have decayed by a factor of $(0.5)^{(40/1.3)} = 0.00000000055$. Thus, the alleged 2.8 pCi/g observed in the soil sample would have to have been at a concentration of 2.8 / 0.00000000055 = 5,100,000,000 pCi/g, 40 years ago. No contaminants have ever been observed at SSFL at these elevated levels Cadmium-109 is easily mis-identified by gamma spectroscopy since it emits a gamma ray with an energy at 88 keV, very similar to Pb-212 and Pb-214, both of which have gammas at energies of 87 and 90 keV. Pb-214 (lead-214) is a decay product of U-238, and Pb-212 (lead-212) is a decay product of Th-232. Typical levels of U-238 and Th-232 in soil are approximately 1-2 pCi/g each, and decay products such as Pb-212 and Pb-214 are at similar levels because of secular equilibrium. We therefore suspect that Pb-212 and Pb-214 were mis-identified as Cd-109 by the radiochemistry laboratory. EPA maintains an online preliminary remediation goal (PRG) calculator which can be used to derive PRGs for any isotope including Cd-109. Using this tool, the 10^{-6} risk level PRG for Cd-109 for residential soil is 33.2 pCi/g. At one time Ahmanson Ranch was planned for residential development. Thus even if the cadmium-109 detects had been real, they would have been below the health based standard. This incorrect data comparison should be removed from row 10 of Table H-8.

No.	Section	Radiological Comments
R-52	Appendix H, Page H10, Table H-8, Row 11	The report's claims that the radium-226 range of 0.82 to 2.2 pCi/g exceeds the drinking water standard of 5 pCi/g appears to be in error. Radium-226 is a decay product of naturally occurring uranium-238, and would be in secular equilibrium with its parent. Its immediate precursor is thorium-230. This incorrect data comparison should be removed from row 11 of Table H-8.
R-53	Appendix H, Page H10, Table H-8, Row 12	The report does not provide a reference for the thorium-228 background of 0.38 pCi/g. The local thorium-228 background ranges from 0.11 to 1.6 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. thorium-228 background ranges from 0.1 to 3.4 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum thorium-228 in Ahmanson Ranch was 0.9 pCi/g. (Kleinfelder 2000 Report). Ahmanson Ranch thorium-228 is therefore well within both local and U.S. background. This incorrect data comparison should be removed from row 12 of Table H-8.
R-54	Appendix H, Page H11, Table H-8, Row 13	The report does not provide a reference for the thorium-232 background of 0.37 pCi/g. The local thorium-232 background ranges from 0.15 to 1.5 pCi/g (Area IV Radiological Characterization Survey, Aug. 15, 1996). The U.S. thorium-232 background ranges from 0.1 to 3.4 pCi/g (Myrick, T. E. "Determination of Concentrations of Selected Radionuclides in Surface Soils in the U.S.", Health Physics, Vol 45, No. 3, pp 631-642.). The maximum thorium-232 in Ahmanson Ranch was 0.97 pCi/g. (Kleinfelder 2000 Report). Ahmanson Ranch thorium-232 is therefore well within both local and U.S. background. This incorrect data comparison should be removed from row 13 of Table H-8.

No.	Section	Radiological Comments
R-55	Appendix H, Page H11, Table H-8, Row 14	The report has used an incorrect maximum cesium-137 value of 0.32 pCi/g (sample S-4) from the Kleinfelder report on Ahmanson Ranch. The original lab data and Table 16 for sample S-4 gives a correct value of 0.032 pCi/g for cesium-137. The maximum cesium-137 detected at Ahmanson Ranch is therefore 0.14 pCi/g (sample S-3). The maximum cesium-137 value of 0.14 pCi/g is well within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study of BBI/SMMC in 1995. This incorrect data comparison should be removed from row 14 of Table H-8.
R-56	Appendix H, Page H11, Table H-8, Rows 15 thru 21	Boeing is not aware of the source of the data presented for gross alpha in groundwater at Ahmanson Ranch. Boeing is aware of groundwater sampling performed by the Department of Health Services Radiologic Health Branch and reported in "Ahmanson Ranch Groundwater Sampling of June 2003." In this report, DHS provides data for the same wells, P-1 through P-6 and M-1. Per EPA drinking water protocols, uranium activity was measured and subtracted from the gross alpha data. The resulting net gross alpha data for all samples met the 15 pCi/L drinking water standard. The DHS concluded *"Based on the wells tested at the Ahmanson Ranch property by RHB in June 2003, no evidence was found that the Ahmanson Ranch property ground water has been impacted by man-made radioactive contamination, or that radioactivity had migrated from the SSFL site to the Ahmanson Ranch groundwater."* This incorrect data comparison should be removed from row 15 of Table H-8.

No.	Section	Radiological Comments
R-57	Appendix H, Page H11, Table H-9, Rows 1 to 4	Boeing does not recognize the 0.11 pCi/g value used for cesium-137 background, neither does the report provide a source. The cesium-137 background established in the McLaren Hart study of BBI/SMMC (Table 38, 1995 report) from which these soil data are taken is, Range <0.03 to 0.213 pCi/g Mean 0.087 pCi/g St. Deviation 0.062 pCi/g 5th to 95th percentile <0.03 to 0.21 pCi/g The 0.11 pCi/g value used in the report is close to the McLaren-Hart mean value of 0.087 pCi/g. Therefore, if 0.11 pCi/g is intended to represent the mean, individual soil sample measurements should not be compared to a mean, since for a normal distribution, 50% of measurements of non-contaminated soil will exceed the mean, and 50% will be less than the mean. This is therefore a meaningless comparison. A common parametric statistical comparison would be to compare individual soil samples to a 95th percentile level. However, even this procedure suffers from the likelihood of 2.5% of non-contaminated samples being identified as contaminated when they are not, i.e., false positives. For this reason, there are several non-parametric methodologies to compare distributions of a set of sampled data to the distribution of a set of background data. This is what Mclaren-Hart did, and this is what the MARSSIM protocols recommend. Using non-parametric statistical tests to compare background distributions to sampled area distributions, McLaren-Hart determined that only one area (Building 4059 watershed) was contaminated with cesium-137 with the following statistics, Range <0.077 to 0.385 pCi/g Mean 0.20 pCi/g St. Deviation 0.08 pCi/g 5th to 95th percentile 0.04 to 0.36 pCi/g Thus the mean cesium-137 was approximately twice that of local background. The EPA stated in a fact-sheet following the BBI/SMMC sampling that these low levels of radionuclides are less than the 1-in-a-million cancer risk level (EPA Update, July 1995). EPA stated that, *"EPA has determined that the radionuclides do not pose a threat to human health or the environment."* This incorrect data comparison should be removed from rows 1-4 of Table H-9.

No.	Section	Radiological Comments
R-58	Appendix H, Page H11, Table H-9, Rows 5 to 6	Boeing does not recognize the 0.02 pCi/g value used for plutonium-238 background, neither does the report provide a source. The plutonium-238 background established in the McLaren Hart study of BBI/SMMC (page 8-45, 1993 report) from which these soil data are taken is, Range <0.008 to 0.13 pCi/g Mean 0.029 pCi/g 95th percentile 0.10 pCi/g The locations of the two samples identified in the 1992 sampling (1993 report) as exceeding background were re-sampled in 1994. All plutonium-238 re-samples were reported as non-detect (1995 report). Thus the presence of plutonium-238 was not confirmed. This incorrect data comparison should be removed from rows 5-6 of Table H-9.
R-59	Appendix H, Page H11, Table H-9, Row 8	The value quoted, <500 pCi/L, is a non-detect tritium result and should not be compared to a strontium-90 limit. This was a reporting/transcription error by Rockwell in the original quarterly report. This incorrect data comparison should be removed from row 8 of Table H-9.
R-60	Appendix H, Page H12, Table H-9, Rows 11 to 12	See comment for Appendix H, Page H11, Table H-9, rows 1 to 4. This incorrect data comparison should be removed from rows 11-12 of Table H-9.
R-61	Appendix H, Page H12, Table H-9, Row 14	The report interprets 5.1 +/- 5.7 pCi/L as exceeding a standard of 8 pCi/L. The measured value of 5.1 is less than 8. When the error of the analysis, +/- 5.7, is a similar order of magnitude to the measured value, then the result lacks sufficient precision to be meaningful. This incorrect data comparison should be removed from row 14 of Table H-9.
R-62	Appendix H, Page H12, Table H-9, Row 15	The report interprets 3.6 +/- 2.8 pCi/L as exceeding a standard of 5 pCi/L. The measured value of 3.6 is less than 5. This incorrect data comparison should be removed from row 15 of Table H-9.
R-63	Appendix H, Page H12, Table H-9, Row 16	The report interprets 3.4 +/- 3.8 pCi/L as exceeding a standard of 5 pCi/L. The measured value of 3.4 is less than 5. When the error of the analysis, +/- 3.8, is a similar order of magnitude to the measured value, then the result lacks sufficient precision to be meaningful. This incorrect data comparison should be removed from row 16 of Table H-9.

No.	Section	Radiological Comments
R-64	Appendix H, Page H12, Table H-9, Row 17	Boeing does not recognize the 0.11 pCi/g value used for cesium-137 background, and the report does not provide a source. The cesium-137 background established in the McLaren Hart study of BBI/SMMC (Table 38, 1995 report) from which these soil data are taken is, Range <0.03 to 0.213 pCi/g Mean 0.087 pCi/g St. Deviation 0.062 pCi/g 5th to 95th percentile <0.03 to 0.21 pCi/g 34 of 35 samples taken at the Rocketdyne Recreation Center had cesium-137 that ranged from 0.016 to 0.21 pCi/g, all within the range of local cesium-137 background of <0.03 to 0.213 pCi/g established by the McLaren-Hart study in 1995. One sample had a value of 0.27 pCi/g. The 95th percentile of the McLaren-Hart cesium-137 background is 0.21 pCi/g. Assuming a normal distribution, one would therefore expect 2.5 % of samples to exceed the two-sided 95th percentile. One sample out of 35 (or 2.9%) at the Recreation Center exceeded the 95th percentile which is almost exactly what one would expect for a statistical normal distribution. The conclusion of the investigator was that "… levels of cesium-137 observed in these soil samples are within the range of background cesium-137 …" This incorrect data comparison should be removed from row 17 of Table H-9.
R-65	Appendix H, Page H12, Table H-9, Row 18	The report interprets 14 +/- 4 pCi/L as exceeding a standard of 15 pCi/L. The measured value of 14 is less than 15. This incorrect data comparison should be removed from row 18 of Table H-9.

No.	Section	Radiological Comments
R-66	Appendix N, Table N-1, MCL column	Boeing disagrees with the report's maximum contaminant Levels (MCLs) for radionuclides in drinking water. In addition to the more common MCLs for gross alpha, gross beta, tritium, strontium-90, radium-226/-228, and total uranium, MCLs for most beta/gamma and alpha emitting radionuclides are published by the EPA in "Radionuclides Notice of Data Availability – Technical Support Document" Tables III-3 and III-4, and the Federal Register, Vol. 65, No. 78, pp 21605 to 21614. Based on these references, the MCL for various radionuclides should be, Cadmium-109 600 pCi/L not 9.52 pCi/L Cesium-137 200 pCi/L not 1.57 pCi/L Cobalt-60 100 pCi/L not 3.03 pCi/L Iodine-129 1.0 pCi/L not 0.32 pCi/L Iodine-131 3.0 pCi/L not 1.05 pCi/L Plutonium-238 15 pCi/L not 0.36 pCi/L Plutonium-239 15 pCi/L not 0.35 pCi/L Plutonium-240 15 pCi/L not 0.56 pCi/L Potassium-40 There is no published limit Radium-226 plus radium-228 5 pCi/L not 0.000823 and 0.0458 pCi/L respectively Strontium-90 8 pCi/L not 0.852 pCi/L Thorium-228 15 pCi/L not 0.4 pCi/L Thorium-230 15 pCi/L not 0.5 pCi/L Thorium-232 15 pCi/L not 0.5 pCi/L Total uranium 30 μg/ml not 0.66, 0.67, 0.68, and 0.74 pCi/L for uranium-233, -234, -235, and -238 respectively These should be corrected in table N-1.
R-67	Appendix N, Table N-1, Ambient Air column	Some of the report's airborne limits are incorrect. Derived air concentrations guides (DCGs) are published in the NRC's 10 CFR 20 Appendix B, Table 2. Cesium-137 is 2×10^{-10} μCi/ml not 2×10^{-7} μCi/ml Cobalt-60 is 5×10^{-11} μCi/ml not 5×10^{11} μCi/ml Radium-228 is 2×10^{-12} μCi/ml Thorium-228 is 2×10^{-14} μCi/ml not 6×10^{-13} μCi/ml Thorium-230 is 2×10^{-14} μCi/ml not 6×10^{-13} μCi/ml Thorium-228 is 4×10^{-15} μCi/ml not 6×10^{-13} μCi/ml Uranium-233 is 5×10^{-14} μCi/ml not 6×10^{-14} μCi/ml Uranium-234 is 5×10^{-14} μCi/ml not 6×10^{-14} μCi/ml These should be corrected in table N-1.

No.	Section	Radiological Comments
R-68	Appendix N, Table N-1, Residential Soil Screening Level column	The majority of the soil values used in the report are actually EPA preliminary remediation guides (PRGs) for agricultural soil using a 1-in-a-million risk level, yet the column is titled residential soil. The chemical values are, we believe, residential levels. It might be appropriate to put residential levels in addition to agricultural levels for both radionuclides and chemicals. The 6.1 pCi/g value for cesium-137 does not fit the pattern, and appears to be the EPA/NRC Memorandum of Understanding (MOU)[1] that is equivalent to the residential PRG at the 1-in-10,000 risk level. The report does not provide a source. Boeing does not know where UCLA derived the 6.01 pCi/g value for tritium. The residential 10^{-6} EPA PRG is 2.28 pCi/g and the agricultural 10^{-6} EPA PRG is 0.16 pCi/g. 1. "Memorandum of Understanding between the Environmental Protection Agency and the Nuclear Regulatory Commission – Consultation and Finality on Decommissioning and Decontamination of Contaminated Sites", October 2002
R-69	Appendix Q, Page 2, Item 6	Item 6 incorrectly claims that cesium-137 and strontium-90 were detected at the Rocketdyne Shooting Range and the orange groves at the Santa Monica Mountains Conservancy. The McLaren-Hart study of BBI/SMMC (1995) concluded that that cesium-137 and strontium-90 at these locations were at background levels.

No.	Section	Radiological Comments
R-70	Appendix R, Section R-4 and Table R-8	The report's off-site assessment of exposure to radionuclides is flawed, as shown in the specific, detailed comments made above for Appendix H and Appendix N. High dose ratios (exceeding 1.0) are calculated for the following radionuclides … **Radium-226/-228 in Surface Water** A non-detect tritium value of <500 pCi/L is used for a radium-266/-228 value. Incorrect MCLs are used in Appendix N. **Potassium-40 in Soil at Ahmanson** Potassium-40 is naturally occurring, not a contaminant-of-concern, and is typical of background. The health based standard for potassium-40 is identified by UCLA as 0.0445 pCi/g in soil. This is the EPA PRG for agricultural soil at a 10^{-6} risk level. Gamma spectroscopy cannot even detect these low levels of potrassium-40. Typical lab minimum detectable activity (MDA) for potassium-40 is 1 pCi/g. The foods we all eat contains between 1 and 10 pCi/g of potassium-40. The human body contains 1.5 pCi/g of potassium-40. Salt substitute contains 400 pCi/g of potassium-40. The report's dose assessment, based on EPA's concept of radiation risk, is flawed. **Plutonium-228 in BBI Soil** Plutonium-228 was not confirmed during the second round of sampling by McLaren-Hart at BBI/SMMC in 1994. Boeing now owns the land. **Strontium-90 in Surface Water** A non-detect tritium value of <500 pCi/L is used incorrectly for a strontium-90 measurement. Incorrect MCLs are used in Appendix N.

Comments on Risk Assessment Topics in "The Potential for Off-site Exposures Associated with Santa Susana Field Laboratory, Ventura County, California"

No.	Section	Risk Assessment Comments
RA-1	Chapter 1, Page 1, paragraph 1	The UCLA report lists 6 objectives. Some of these were not addressed (e.g., assess the present level of contamination) and others (e.g., to identify potential significant exposure pathways) were expanded to include conclusions (e.g., comments on significance of risks and comments on proposed cleanup levels, see comments on Chapter 8) that are beyond the stated objectives and scope of this study.
RA-2	Chapter 1, page 1, paragraph 2	The report lists several types of meetings, site visits, etc., used by the report's authors. At the start of the project, Boeing hosted a tour and several meetings with UCLA and ERG in order to provide documentation and to answer questions. Boeing also offered to be available on a continual basis during the project to answer questions and help to interpret data. Following these initial interactions, communication from UCLA during the subsequent years was limited to non-existent. It is clear from some of the incorrect assumptions made (identified below) regarding SSFL operations and collected data, that the report would have benefited from a more continual dialogue between UCLA and Boeing.
RA-3	Chapter 1, page 2, paragraph 2	The report states here (and in numerous other places in the text) that it was not possible to conduct quantitative dose reconstruction and health risk assessment. Yet, the conclusions of the report draw conclusions regarding the significance (i.e., risk) of the 'ranked' exposures. This appears to be beyond the objective and scope of this evaluation. Furthermore the conclusions are not supported by the data.
RA-4	Chapter 1, page 2, paragraph 5	The company references are out of date. The Boeing Company is the surviving company and Rocketdyne is now part of Pratt & Whitney
RA-5	Chapter 1, page 4, paragraph 4	The references used in the report are outdated (1985, 1987). The current RFI program for the site is evaluating approximately 50 former Solid Waste Management Units (SWMUs) and Areas of Concern (AOC). It would be more appropriate to reference the more recent documents that were provided.
RA-6	Chapter 1, page 6, paragraph 2	The community description focuses on data after 1980, yet the report concludes (correctly) that the majority of testing and chemical use was before 1970. The 1970 census information should be discussed and the exposure potential should reflect the sparse population around the facility during the heavy periods of rocket engine testing.

No.	Section	Risk Assessment Comments
RA-7	Chapter 1, page 8, paragraph 2	The report lists community concerns, yet they are not critically evaluated. Epidemiological researchers know that long lists of varied health concerns are typical, but most are not related to the types of potential exposures evaluated in this study. The concerns are presented without any evaluation regarding where and when these individuals may have lived near SSFL, risk factors for community ailments, etc.
RA-8	Chapter 1, page 9, paragraph 1	It is understandable that the report relies upon the only information available on community activities. However, that information must be critically evaluated with the same effort as other data.
RA-9	Chapter 1, page 10, paragraph 2	The report criticizes (without providing any details) the 1998 Bell Canyon study. This work was performed at the request of the community. Multiple regulatory agencies as well as members of the public were present during the sampling. The purpose of the study was to sample those matrices that were most likely to be contaminated from site operations. Creek sediment and hillside soils were collected and analyzed. A sufficient number of NPDES surface water samples existed and therefore were not part of this sampling program and were therefore not required in the Bell Canyon project
RA-10	Chapter 1, page 10, paragraph 3	One of the data limitations identified is the lack of air monitoring data. While there is on-site air monitoring data for radionuclides (see other comment) there are other mechanisms of evaluating the same issue. Surface soil sampling from the hills surrounding the SSFL has been performed and clearly indicates that airborne dispersion of metals or dioxin (both persistent in the environment) has not occurred, i.e., there is no pattern to the data. The report needs to consider these data in drawing conclusions regarding the potential for off-site airborne exposures.
RA-11	Chapter 1, page 11	The table does not list the recent epidemiological study on SSFL workers released in 2004. This study provides a more sophisticated and complete evaluation of radiological doses and potential chemical exposures at SSFL. Since the air dispersion modeling presented in the report concludes that the highest airborne concentrations were on-site, the evaluation of the long-term health of on-site SSFL workers would be of value.
RA-12	Chapter 1, page 12, paragraph 1	The report cites Appendix H as providing a critical evaluation of the monitoring data. However, this Appendix only presents those data where chemicals are reportedly detected. The entire database for the SSFL is not represented. The accepted practice in the field of risk assessment is to evaluate the entire body of data and not just the maximum concentrations in order to determine if exposures may have occurred and are significant. The report should evaluate the entire data set before drawing conclusions regarding which chemicals may be present in environmental media. For example, there are many cases where a single detect is followed by years of non-detect samples and where soil results have not been able to be reproduced by subsequent sampling in the same location.

No.	Section	Risk Assessment Comments
RA-13	Chapter 1, page 12, last bullet	The report consistently compares detected concentrations to 'regulated health standards'. However, there is an important step missing that is required by risk assessment guidance, both federal and state (e.g., DTSC 1997, "Selecting Inorganic Constituents as Chemicals of Potential Concern at Hazardous Waste Sites" or USEPA 1992 – RAGS). That is the comparison of detected concentrations to naturally occurring background and the determination that the presence of the chemical is contamination, not background. This step is missing from the report's evaluation. The evaluation for potential off-site contamination must include the evaluation of background concentrations.
RA-14	Chapter 1, page 12, last paragraph	The UCLA report states that the analysis served as the basis for assessment of locations where exposures could be above tolerable levels. Not only is this contrary to the purpose and the stated methodology employed in this evaluation (see comment above where text states that this should not be done) but these conclusions are misleading because they are based on an incomplete interpretation of the characterization and site operations data.
RA-15	Chapter 1, page 13, paragraph 1	The report consistently interprets the data in the off-site monitoring reports as documenting contamination. This conclusion falls short of the report's stated methodology which is to perform a critical evaluation of the data. For example, one sample in the backyard of a homeowner in Bell Canyon, where there were oil stains in the backyard, had an elevated lead concentration. A duplicate sample collected inches away from the initial sample did not have lead above background. The report concluded that this not only represents contamination, but contamination from SSFL. The report has not provided the evaluation it states it has and the interpretation of the off-site data needs to be re-evaluated in order for the exposure ranking (presented later in the report) to be valid.
RA-16	Chapter 2, page 14, paragraph 2	The ranking of SSFL-chemicals was based upon an incorrect evaluation and interpretation of the SSFL monitoring data. The evaluation did not include any prevalence data, i.e., in how many samples was the chemical detected. A chemical detected once in one sample is handled the same as a chemical detected in hundreds of samples. A critical review of the entire SSFL monitoring data needs to be performed in order for the ranking to have meaning.
RA-17	Chapter 2, page 15, third bullet and footnote 2.1	The SSFL background database for chemicals includes sample locations selected and approved by multiple regulatory agencies and members of the public. In 2005, this same database was re-evaluated and the final databases published that same year. The samples in that database are representative of the SSFL and surrounding area and do take into consideration geologic soil type. Each location was visited by a DTSC geologist and risk assessor to ensure that the background dataset represented non-impacted areas. The report's authors should have relied upon this database when making decisions about the prevalence of contamination. The comparison to background step must be performed and the ranking of SSFL chemicals and potential exposures need to be based upon this correct evaluation.

No.	Section	Risk Assessment Comments
RA-18	Chapter 2, page 16, paragraph 1	The list of off-site contaminants is based on a faulty and incomplete evaluation of the data. The evaluation must include a review of the entire off-site data set and a comparison to background concentrations in order to be valid. The list of chemicals listed as off-site contaminants is incorrect.
RA-19	Chapter 2 page 16, Table 2-1	The table provides a list of potentially-exposed populations and a time-frame in the last 2 columns. The list is not consistent with the report's own conclusions regarding potential receptors for the potential migration pathways. For example, Santa Susana Knolls is listed for the air pathway but is not downwind of the SSFL based on the wind rose data. In addition, surface water from SSFL does not drain to the Santa Susana Knolls, yet this area is also listed in the table as a potentially-exposed receptor.
RA-20	Chapter 2, page 17, paragraph 3	The ranking scores presented in the report are adjusted by site-specific factors to arrive at SSFL-associated COCs. These are presented in Appendix M. In Table M-1 of this appendix, only 12 of the first 30 chemicals listed have been found in a significant number of soil or sediment samples to suggest that they are site-related. The remainder of these chemicals is listed based on limited or no detections in the thousands of soil samples collected at SSFL (chlorinated pesticides for example). Table M-3 attempts to couple these SCRAM rankings with SSFL emission rates. The emission rates are, in some cases, based on a faulty evaluation and assumptions. Most notably, the estimate of hydrazine emissions is based on several Industrial Hygiene measurements (not described in the text) and coupled with a rocket engine exhaust flow/volume that is for a kerosene-LOX engine with a power rating of several hundred thousand pounds of thrust. The hydrazine engines typically tested were of a power level in the hundreds to thousands of pounds, therefore, these hydrazine emission estimates are wrong by at least 3 orders of magnitude. Hydrazine is listed as the top chemical in order of ranking in Table M-3. It is unclear why the report's authors used incorrect assumptions regarding the size of the hydrazine engines when, had they requested the data, it would have been provided to them.
RA-21	Chapter 2, page 18, Table 2-2	This table lists toxicological parameters that are not appropriate to use in the ranking of potential exposures over long time periods. The listing of LD-50's and sub-chronic criteria is only relied upon when more appropriate data (long-term toxicity testing) is not available. Although each of these criteria is explained in the notes to the table, there is no information on how these criteria are used in the evaluation.
RA-22	Chapter 2, page 19, equations	The equations to determine ranking are based either on the number of samples above the MCL or maximum concentration. This type of evaluation ignores the entire data set of SSFL monitoring data. The ranking would be the same for a chemical with 10 concentrations above the MCL out of 10 samples and another chemical with 10 concentrations above the MCL out of 1000 samples. This type of faulty logic cannot lead to reliable conclusions. The report needs an evaluation described in Chapter 1 (to critically evaluate the monitoring dataset) and to include these results in the ranking process.

No.	Section	Risk Assessment Comments
RA-23	Chapter 2, page 20, Table 2-3	The listing of some chemicals under the "water" column is unclear. Are these detections in surface water or groundwater? For example, the number of detections of metals in groundwater above a background level is very few at the SSFL. This is the same for dioxin and there are no detections of PCBs in groundwater. However, PCBs are listed in water.
RA-24	Chapter 2, page 22, Table 2-6	The table lists only 2 epidemiology studies. The most recent study of SSFL workers, which has a more sophisticated and completed evaluation of radiological dose and potential chemical exposure seems to have been ignored. It is unclear why the more recent evaluation was not considered when the modeling presented in the report predicts that the highest airborne concentrations of chemicals on the SSFL site is where workers would be located and potentially exposed.
RA-25	Chapter 2, page 23, paragraph 2	Annual Site Environmental Reports for each year back to the late 1950's were provided. These reports provide the results of environmental monitoring for radionuclides on and around SSFL. The statement that there is a lack of these reports is incorrect. The report's authors were provided not only with the documents given to ATSDR, but the list of all documents provided.
RA-26	Chapter 2, page 24, paragraph 2	Extensive on-site monitoring of airborne radioactivity was performed and reported in the annual site reports.
RA-27	Chapter 2, page 24, paragraph 2	Hydrazine monitoring was performed by collecting industrial hygiene samples (incorrectly used in the appendix to estimate hydrazine emissions). This monitoring, adjacent to hydrazine use areas, provides a more conservative measure of airborne concentrations than any off-site measurements where concentrations would be lower.
RA-28	Chapter 2, page 24, paragraph 2	The report comment, *'considering how often hydrazine was used'* gives an inaccurate impression that hydrazines were the most common rocket engine fuel. The fuel purchasing summary for SSFL, quoted in other sections, lists hydrazine behind kerosene and hydrogen, which together make up over 95% of the rocket fuel used at SSFL. The report should put the use of hydrazine in the proper context.
RA-29	Chapter 2, page 24, paragraph 2	The overall paragraph is written to give the impression that the SSFL monitoring program was below industry standards. In fact, the air program met regulatory requirements. Other industries were not performing air monitoring in the 1950's and 1960's, the period when rocket engine testing was at its maximum. In the 1990's, when additional air emission reporting requirements were imposed by regulation (e.g., AB2588), Rocketdyne complied and provided emission estimates for its emission sources. In addition, emission testing of kerosene-LOX rocket engines was performed in the 1990s to develop better estimates of rocket engine emissions. The report inaccurately communicates a perspective of the SSFL air monitoring program that is not supported by the facts.

No.	Section	Risk Assessment Comments
RA-30	Chapter 2, page 25, paragraph 1	The listing of fuel use at SSFL without any reference to years used and quantity is misleading. This data was provided to the report's authors by Boeing. It gives the incorrect impression that fuels like beryllium were used as much as kerosene. The report should accurately reflect fuel usage at the SSFL.
RA-31	Chapter 3, page 29, paragraph 1	The UCLA report correctly states that 88% of the rocket engine testing at SSFL occurred before 1965. However, this information is not tied to the neighboring population discussion presented in a previous chapter. The report states in a later chapter that in order for exposures to have occurred, there must be a receptor present. During the period before 1965, there were few, if any, receptors in close proximity to the SSFL in the direction of the prevailing winds.
RA-32	Chapter 3, page 31, paragraph 1	The description of surface water pathways at SSFL is incorrect. Surface water flowing past outfall 001 does not flow to outfall 002,
RA-33	Chapter 3, page 31, paragraph 4	The UCLA report lists TCA as a major airborne evaporative emission (46%) yet it is not a major contaminant in groundwater, soil or surface water, so the monitoring data do not support such a major use of, or exposures to, this chemical.
RA-34	Chapter 3, page 32, table 3-4	TCE constitutes approximately 75% of the total airborne emissions. Other sources are very small in comparison. Yet, the report's ranking is not consistent with these known facts. Therefore, the report needs to evaluate the ranking process to be consistent with both the known facts about chemical use and the extensive monitoring data base.
RA-35	Chapter 3, page 36, paragraph 1	The UCLA report states that the purpose of the air dispersion model is to identify areas of potential exposure concern. Yet, in later chapters, the report attempts to draw more quantitative conclusions about which exposures at what locations could be above acceptable levels. These conclusions appear to be inconsistent with the stated purpose of the report and the methodologies employed, and described, for the chemical rankings and the air dispersion modeling.
RA-36	Chapter 3, page 36, paragraph 2	The text identifies that diurnal variation in wind direction is important. In fact, the wind rose data show that the north-west and south east wind directions are generally associated with daytime and nighttime, respectively. Since some rocket engine testing (especially in the 1960's) and much of the activity at the site occurred at night, these diurnal wind patterns need to be considered.
RA-37	Chapter 3, page 37, paragraph 1	The text states that the UCLA team made observations about wind patterns at the SSFL during site visits. However, the number of such visits were not specified. The project records suggest that only 3 or 4 visits were made to the site. These are a small number of visits upon which to base conclusions applying to over 50 years of operation.

No.	Section	Risk Assessment Comments
RA-38	Chapter 3, page 41, paragraph 2	The air dispersion modeling grid is 1,000 m and 100 m closer to the site. The location of these grid nodes can be supposed for the 1,000 m grid based on the figures provided in the report, however the 100 m grid is not provided. In order to evaluate the air dispersion modeling, the concentrations at each of the grid locations should be provided.
RA-39	Chapter 3, page 41, first bullet	Although the modeling during the daytime hours suggests that it does not make a difference, the report incorrectly assumes that rocket engine testing was grouped towards the end of the day. The test stands were very busy with scheduled tests for various programs that needed to be completed. Testing hours were all day (and for some periods of time 24 hours a day) in order to get all the testing completed. The report should reflect this instead of relying on inaccurate assumptions.
RA-40	Chapter 3, page 54, paragraph 3	The use of the maximum annual TCE usage is an incorrect and unrealistic assumption upon which to base exposure ranking. What is the value of the ranking if the exposures are based on assumptions that did not take place? TCE use would have been highest during the time period when the most testing took place. However, there were also TCE recovery systems put into place which would have decreased the amount of TCE going into the air. Even if the average TCE usage was used instead of the maximum, this would still be an overestimate of TCE emissions, because it ignores actual facility recycling practices that were put into place. In order for the report to provide potential exposure rankings that are meaningful, then actual facility practices need to be incorporated into their assumptions.
RA-41	Chapter 4, page 66, paragraph 3	The comment that the facility is gated but easily accessible does not reflect facility operations over the years. The facility fence was regularly monitored by security. While hikers have entered the southern open zone, they would have had to cross a second fence to enter any of the active areas of the SSFL. The southern open space has not been used for industrial activities and so any trespassers would not be contacting contamination.
RA-42	Chapter 4, page 70, paragraph 3	The inclusion of data from groundwater wells far from the site in this evaluation ignores the totality of groundwater monitoring data. The inclusion of these distant off-site wells (and also some off-site soil results) represents a faulty logic that any contamination found must be attributable to SSFL. There are many sources of both industrial and urban pollution. Yet these other sources were not considered in this evaluation. The report needs to evaluate off-site contamination in light of both the overall SSFL monitoring database as well as other potential sources of off-site contamination as part of the ranking and exposure evaluation process.

No.	Section	Risk Assessment Comments
RA-43	Chapter 5, page 78, paragraph 1	The list of criteria for identification of off-site contamination in soil and sediment is missing an important component … a source on SSFL. The RFI project at SSFL has collected thousands of samples and analyzed for all the chemicals that were used at the various SWMUs/AOCs on the site. Assuming a chemical was used on-site, the report needs to evaluate potential migration pathways that could have resulted in an off-site concentration of a particular contaminant and follow that pathway to determine if a source at SSFL is present. This process is basic to the risk assessment paradigm practiced by EPA and the state. The RFI data is sufficient to identify these sources and the exclusion of this evaluation renders the conclusions invalid. It is recommended that the report evaluate each detected off-site result and determine if there is a legitimate source at SSFL and pathway for that contamination before including it in the off-site exposure analysis.
RA-44	Chapter 5, page 79, paragraph 2	The discussion of NDPA appears to be based on a misinterpretation of the analytical results. A review of the analytical results indicates that all NDPA samples contain a "U" qualifier, which indicates that the sample results were non-detect for NDPA. If the researchers stand by their interpretation of the NDPA results, it would be useful if they cited a specific reference to the report where such results are presented.
RA-45	Chapter 5, page 80, paragraph 1	The evaluation process used to determine if contamination is present relies solely on comparison to health-based criteria. Risk assessment procedures, as published by both the federal and state governments, include the step of evaluating results against the naturally occurring background in order to exclude those naturally occurring concentrations from the evaluation. For example, it is known that heavy metals and dioxin are naturally occurring in soil. Any potential inclusion of these compounds in the off-site evaluation must first consider this background comparison. The report should follow standard risk assessment practices and include this background evaluation in its assessment.
RA-46	Chapter 5, page 85, paragraph 2	The report states that absolute exposures and health risks cannot be determined. Therefore, consistent with previous statements, estimates of potential health impacts cannot be made.
RA-47	Chapter 5, page 86, paragraph 1	The report compares only concentrations to health-based standards without the required comparison to background. (See previous comments on this topic.)
RA-48	Chapter 5, page 86, paragraph 2	The report speculates about off-site exposures to surface water running through community gardens. There are several issues the report fails to consider that makes this type of exposure unlikely. These are: (1) the water to the community garden flows through Dayton Canyon and the only contaminant found was perchlorate, (2) the water for these gardens is likely to be imported water not creek water, (3) these streams only have water when it rains which is only a few days each year and (4) there is no evidence that intermittent creek water is used for local community crops.

No.	Section	Risk Assessment Comments
RA-49	Chapter 6, page 88, letter A	The speculation of horse path dust suspension ignores the data collected in Bell Canyon (from the most likely locations for chemical migration) in creek sediment and on hillsides. There is no evidence of soil contamination in Bell Canyon and this scenario ignores the data.
RA-50	Chapter 6, page 90, paragraph 1	The report correctly states (for groundwater) that transport routes must first be clearly identified to establish if there is a connection between on-site and off-site groundwater. The report sets the criteria correctly but fails to follow it. The entirety of the groundwater monitoring database needs to be considered, including clean wells on the periphery of the SSFL. Instead, any finding of contamination in any nearby well is assumed to be related to SSFL.
RA-51	Chapter 6, page 90, paragraph 3	The UCLA report consistently uses the maximum concentrations of a chemical detected in soil or groundwater, to estimate the potential off-site exposures. This ignores the overall monitoring database for soil and groundwater. The use of the maximum results in a ranking which is flawed, and conclusions about the significance of exposures which are unfounded. For example, groundwater monitoring for most wells includes multiple years of data. All this available data should be used to understand if contamination is present and if exposures can occur.
RA-52	Chapter 6, page 92, paragraph 4	The report incorrectly states that no sampling was performed downstream of the SRE. Both the McLaren/Hart reports of 1992 and 1994 present key off-site sampling results for areas north of SSFL. These data should be reviewed and incorporated for a complete and accurate understanding of the potential for off-site contamination
RA-53	Chapter 6, page 92, paragraph 4	This paragraph begins with the statement “Given the lack of surface water data” which gives the impression of limited monitoring. The NPDES data, collected at outfalls all around the SSFL, provide a conservative understanding of the potential for chemicals to migrate from the site. Once corrected for naturally occurring surface water concentrations of metals and dioxins, the NPDES data can be used.
RA-54	Chapter 6, page 93, paragraph 2	Again, the process of evaluating (ranking) potential exposures has ignored the step of comparing soil sampling results to the regulatory-approved background concentrations for SSFL. (See multiple previous comments)
RA-55	Chapter 6, page 95, paragraph 1	The report describes the evaluation process as using highly conservative assumptions that provide an upper exposure range for relative ranking. If relative ranking was all that the report provided, this would serve as the basis for further quantitative evaluation of those pathways in a quantitative risk assessment. However, the report goes beyond its own stated limitations and draws conclusions about the significance of these potential exposures. In order for the report to be consistent with its own process and stated limitation, these types of conclusions should be removed.

No.	Section	Risk Assessment Comments
RA-56	Chapter 6, page 95, paragraph 2	An example of the unrealistic assumptions used in the report is that hydrazine emissions, already mistakenly overestimated by at least 100-fold, are assumed to occur each year at the highest estimated single year emission rate. The relative ranking provided in the report can not be reliably interpreted when such unrealistic assumptions, not reflecting site operations, are utilized in their process.
RA-57	Chapter 6, page 95, paragraph 2	The report's evaluation seems to combine (although not clearly stated) potential off-site chemical exposures from anywhere off-site and then draws conclusions (see Tables) about soil versus air versus surface water-related exposures. One of the standards of practice in risk assessment is that exposures must be related to realistic human activity. The various potential off-site exposures, for differing locations, and differing time periods, cannot be combined and assigned to an individual receptor. It is unclear how it is useful to rank combined exposures that cannot possibly occur.
RA-58	Chapter 6, page 96, paragraph 1	The UCLA report states in an earlier chapter that dose reconstruction was not possible, yet in this section, quantitative estimates of dose are calculated. The report is inconsistent and should be edited to remove these quantitative dose estimates and remain consistent with its intent and process of only ranking potential off-site exposures.
RA-59	Chapter 6, page 97, paragraph 2	The report uses (incorrectly) the single point estimate of risk of 1 in 1,000,000 to calculate acceptable doses for comparison to the estimated off-site doses (a quantitative process that the report stated could not be done, yet for some reason is done). This use of a single point estimate is not consistent with EPA guidance (correctly described in the UCLA report on page 119) where the risk range of 1 in 10,000 to 1 in 1,000,000 should be considered in any risk management process.
RA-60	Chapter 6, page 97, paragraph 4	This entire paragraph provides a description of the use of dose ratios to predict the potential for health effects. This type of evaluation is inconsistent with the study objectives and methodology.
RA-61	Chapter 6, page 99, paragraph 2	There is a regulatory agency-approved, SSFL-specific soil background database for chemicals, which could be used to correctly evaluate off-site concentrations.
RA-62	Chapter 6, page 100, number 2	An example of the unrealistic conclusions made in the UCLA report includes the evaluation of arsenic contamination off-site, when it is naturally occurring and there is no SSFL source identified relative to this off-site detection.
RA-63	Chapter 6, page 100, number 4	An example of the unrealistic conclusions made in the UCLA report includes the residential exposure to hydrazine which is based on an assumption known to overestimate potential exposures by 100-fold. This conclusion greatly exaggerates potential exposure.

No.	Section	Risk Assessment Comments
RA-64	Chapter 6, page 100, number 5	An example of the unrealistic conclusions made in the UCLA report includes the residential exposure to lead that is based on a single sample that was not confirmed by an agency co-located sample (previously discussed in comments).
RA-65	Chapter 8	The text makes many comments about the inadequacy of the monitoring data and provides recommendations for data needs. These comments reiterate prior EPA observations on a very limited portion of the entire SSFL sampling program. These observations cannot be interpreted to be relevant to the entire SSFL sampling and monitoring database.
RA-66	Chapter 8, Page 117, Paragraph 3	The report incorrectly identifies surface water runoff from the site entering Woolsey and Black Canyons.
RA-67	Chapter 8, page 118, paragraph 1	The report seems to conclude that there is contamination in the Chatsworth reservoir caused by SSFL. A review by the researchers of both the LADWP report of soil sampling from that location (which concludes that no chemical or radiological contamination exists in the reservoir), as well as the lack of surface water pathways from active portions of the site to the former reservoir, would lead to a different and more accurate conclusion.
RA-68	Chapter 8, page 120, paragraph 2	This paragraph begins with the statement that assessing health impacts is beyond the scope of the UCLA study. Yet, in previous sections they present dose ratios that compare predicted doses to acceptable levels and then draw conclusions about health significance.
RA-69	Chapter 9	The conclusions and recommendations in this section should be reviewed in light of the comments presented above, a complete review of the SSFL monitoring and sampling database, and the stated objective and limitation of the report.
RA-70	Appendix C	The list of chemicals has duplicates and chemical names that are incorrect. For example, the Aroclor listings should include Aroclor 1260 and these chemicals are listed again (incorrectly) as PCBs. Also, many of the chemicals on the list (e.g. pesticides) are not chemicals used at SSFL.
RA-71	Appendix H	This monitoring data compendium is only a listing of the detected concentrations. The report should re-evaluate the monitoring data and consider these detects in light of location, potential pathways, and the entire database of non-detect and compliant analysis results. The list provided in this appendix does not represent the potential for off-site contamination or exposure. For example, the list begins with detections of beryllium. These samples were collected inside test chambers and do not represent ambient or off-site levels.

No.	Section	Risk Assessment Comments
RA-72	Appendix M	As noted in a previous comment, the chemical rankings have included chemicals that were not used at the site and are not considered site-related. For example, of the first 30 chemicals listed in Table M-1, only 12 are consistently found in soil at SWMUs/AOCs and are considered site-related contamination. The report needs to review the entire SSFL monitoring and sampling dataset in order to correctly identify those chemicals with a potential for off-site exposures.
RA-73	Appendix S	Over 85% of the rocket engine tests at SSFL occurred before 1965 and 95% of the overall testing was either kerosene-LOX or hydrogen-LOX. Yet, the off-site evaluation does not take into account where populations were located during this time when the exposure rankings were done. It is contrary to risk assessment procedures to combine historic releases with a current population pattern. This needs to be corrected in the ranking.
RA-74	Appendix S	The evaluation of fuel usage at SSFL is incorrect. For example, the text states (page S-10) that older kerosene fuels could have had higher metal concentrations. These fuels must meet specifications that are set by the government. While metal levels may have varied, they could be higher or lower. Another example is the incorrect use of kerosene-LOX rocket engine exhaust parameters (at hundred of thousands pounds of thrust) for the evaluation of hydrazine engines typically ranging from below a hundred to thousands of pounds of thrust. These incorrect assumptions cause an overestimation of hydrazine emissions of at least 100-fold. Other incorrect assumptions are that: (1) beryllium controls were not in place for solid fuel engine testing (the samples the UCLA report cites were collected inside large water-filled test chambers to control emissions), (2) the TCE use estimates are based on the LOX dome of a kerosene-LOX engine volume of approximately 30 gallons and an average of 3 TCE flushings per engine, not 50 to 100 gallons per engine flush, and (3) an assumption that half the TCE was emitted into the air even though recovery systems were installed in the 1960s which would have reduced TCE emissions to the air.

Comments on Groundwater Topics in "The Potential for Off-site Exposures Associated with the Santa Susana Field Laboratory, Ventura County, California"

No.	Section	Groundwater Comments
GW-1	Chapter 3 Section 3.2.4 Page 26 1st Paragraph	*"It is noted that the VCAPCD reported that no TCE was detectable in the air stream effluent from these towers. However the UCLA study team did not receive documentation of the effectiveness of stripping treatment and the associated impact on groundwater remediation."*[1] In this instance, the report discounts analytical test results by the authorized agency and instead refers to documentation that it did not receive as to system effectiveness. It is unclear how the documentation might have been used nor is it clear from whom the documentation was requested.
GW-2	Chapter 4 Section 4.2 Page 68 Paragraph 2	*"General groundwater and surface water flow patterns are shown in Figure 4-2."* Figure 4-2 does not appear to show any groundwater flow patterns. The bold lines shown on the figure are surface water divides.
GW-3	Chapter 4 Section 4.2.1 Page 70 Paragraph 1	"*Groundwater extractions have been limited to the northeast quadrant of the SSFL since the early 1980s*" This statement is inaccurate. Groundwater has been extracted from wells located throughout the SSFL as described in numerous quarterly & annual reports. A table summarizing the extraction wells throughout the SSFL can be found in the GRC, 2000 reference that is identified in Chapter 10 of the report.
GW-4	Chapter 4 Section 4.2.2 Table 4-1 Pages 71-72	Table 4-1 shows specific contaminants have been detected above health standards at specific locations. This table contains factual errors. A letter dated 2/1/2005 was written informing Ms. Arlene Levin of ERG of these errors, but no corrections to the report have been made. Furthermore, the report neglects to discuss the principles of both false positive and false negative results. The concepts of both false positives and negatives can be found in EPA documents (SW-846 and National Functional Guidelines for Organic Data Review). A number of entries are one-time results (i.e., false positives) that have not been reproduced through the subsequent collection and analysis of numerous samples collected over time.

[1] Quotes from the UCLA report are given in italics

No.	Section	Groundwater Comments
GW-5	Chapter 4 Section 4.3.1 Table 4-2 Pages 75	This table lists offsite "domestic" wells and infers that they are contaminated by adding a general quote for select wells. Based on our testing of known domestic wells in the vicinity of SSFL, we believe offsite receptors are not being exposed to contaminants in drinking water resulting from SSFL operations. Groundwater quality monitoring data show a few sporadic detections, all of which are either below health-based primary drinking water standards, are attributed to well owner activity, are naturally occurring, or are inconclusive as to source of contaminant. Additionally, one well (identified as 25 on the table) lists perchlorate results. Subsequent to the reported detect, weekly sampling of the well for a period of one year has shown perchlorate to be non-detect at each and every sampling event (as noted in the Montgomery Watson Harza 2003b report cited in Chapter 10 of the report).
GW-6	Chapter 6 Section 6.2.1 Figure 6-3 & Table 6-1 Page 91	Figure 6-3 and Table 6-1 identifies locations of contaminated off-site wells. One well (RD-56) is located on-site, reported detections in other wells are false positives (OS-5, RD-59, Bathtub well #1), as the reported detections have not been reproduced through the subsequent collection and analysis of samples over time. (See previous letter to ERG dated 2/1/05).
GW-7	Chapter 6 Section 6.2.1.2 Page 92, 2nd paragraph	*"Surface water from the Area I TTF discharged into the Perimeter Pond…"* This statement is inaccurate. Surface water runoff from the TTF did not discharge into the Perimeter Pond.
GW-8	Chapter 6 Section 6.4.1 Page 100 List Item No. 6	"*Potential residential exposure to perchlorate via chronic ingestion of groundwater and area-grown crops in areas east of SSFL"* There have been no confirmed detections of perchlorate in samples collected from groundwater from off-site, including springs/seeps. Therefore, this exposure pathway should be deemed incomplete. Additionally, a sample from the fruit of a citrus tree from Orcutt Ranch was collected and analyzed for perchlorate by the DTSC and was found to be free of perchlorate.
GW-9	Chapter 7 Section 7.2 Page 106 paragraph 2 Section 7.3.2 Page 114 paragraph 1	"*DNAPL dissolution is expected to be slow and most of the DNAPL that reaches groundwater may still be harbored in fractures."* *"These calculations suggest that roughly 3,000 to 56,000 gallons of TCE now reside in an aqueous and dissolved state and the remainder is DNAPL."* DNAPL dissolution timeframes can and have been estimated for conditions at the SSFL as outlined in previous reports (Montgomery Watson, 2000a) and show that nearly all DNAPL would dissolve away within 50 years. Collection and analysis of thousands of rock core samples drilled at and near sources have revealed only one or two locations where DNAPL may still be present.

No.	Section	Groundwater Comments
GW-10	Chapter 7 Section 7.3.1 Page 112 paragraphs 1- 2	"*TCE will diffuse 20 times more slowly than it would in the absence of sorption."* The approach used in the report did not correctly apply the governing equations (Fick's first and second laws) for estimating diffusion into the sandstone. Correct application of the governing equations shows that diffusion into the SSFL sandstone would be about 1.5 times greater using the numbers developed by UCLA than that presented in the MW and MWH work. Furthermore, a higher sorption coefficient enhances the diffusive flux because it increases the concentration gradient.
GW-11	Chapter 8 Section 8.4 Page 118 paragraph 1	*"Continued groundwater remediation via pump and treat should decrease the dispersion of contaminants emanating from the SSFL subsurface. Therefore, exposure estimates based on the current level of contamination are likely to overestimate the risks."* This is an inaccurate description of the physical transport processes of solutes in the groundwater system. Decreasing dispersion will actually cause an increase in concentration. However, it is recognized that the author(s) may be using the term dispersion loosely.
GW-12	Chapter 8 Section 8.4 Page 118 Footnote 8-3 Chapter 9 Section 9.2.2 Page 124 Footnote 9-2	The report infers that the Chatsworth Reservoir is contaminated and that SSFL may be the source of groundwater contamination at the former Hughes facility and thus the Chatsworth Reservoir. TCE sample results from the 2004 DWP report (cited in Chapter 10 of the report) were non-detect, so it is unclear how a link between the SSFL and the Chatsworth Reservoir can even be made. There is no attempt made in the report to correlate Chatsworth Reservoir results to SSFL results. Additionally, footnote 9-2 correctly concludes that contamination near this area is the result of activities at the former Hughes Aircraft Company site.
GW-13	Appendix E Table E-1 Page E-1	There were no scientists killed at the TTF in 1994.
GW-14	Appendix H Tables H-4, H-5 and H-6	See previous comments regarding the reported one-time, non-repeatable, false positive detections.
GW-15	Appendix K Page K-1 4th & 5th paragraphs	See previous comments regarding the lack of confirmed detections in samples from off-site wells. Also, a reference is made to OS-14 as an on-site well. To the best of our knowledge, no such well exists.
GW-16	Appendix K Table K-1 Page K-2	This table is erroneously titled and largely not supported by the actual sampling results. The table lists many wells where a long history of sampling shows that they have not been impacted by SSFL-related chemicals.

Comments on Surface Water Pathways in "The Potential for Off-site Exposures Associated with Santa Susana Field Laboratory, Ventura County, California"

No.	Section	Surface Water Comments
SW-1	Chapter 4, Page 66, section 4.1.1, line 3	*"There are two NPDES outfalls (Figure 4-1): NPDES 001 (Perimeter Pond) and NPDES 002 (R2A) located near the undeveloped area south of SSFL and upstream of the residential area of Bell Canyon (and Bell Creek) (Rockwell International, 1987; Boeing, 2003)."*[1] NPDES Outfalls 001 and 002 are located in the undeveloped portion just south of SSFL and upstream of the residential area of Bell Canyon. Perimeter Pond and R2A are located upstream of these Outfalls and are identified as NPDES Outfalls 011 and 018, respectively as identified in the 2004 NPDES Permit issued by the Los Angeles Regional Water Quality Control Board.
SW-2	Chapter 4, Page 68, Figure 4-2	The bold lines that are identified as groundwater flows are actually surface water divides.
SW-3	Chapter 4, Page 71, Table 4-1	Item 24. Lead in the UCLA report was reported at 45 μg/L on 5/15/95. The actual value as reported in past SSFL NPDES reports was 16 μg/L.
SW-4	Chapter 4, Page 71, Table 4-1	Item 26. Lead in the UCLA report was reported at 16 μg/L. This value is in error. The correct value is 45 μg/L, as noted in Item 27.
SW-5	Chapter 8, Section 8.3, Page 117, Last paragraph	*Woolsey and Black Canyons are of particular concern as storm water collects runoff from the SSFL's former LOX plant (Areas I and II landfills) and exits at outfall 009 which drains into these canyons (RWQCB 2006). The drainage flows through these areas, through Sage Ranch - an area of past agricultural operations, and where a shooting range is located and into the Chatsworth Reservoir and the Arroyo Simi."* The description of storm-water runoff is inaccurate. The surface water from the former LOX plant flows in a westerly direction exiting at Outfall 009. As such this water does not flow into either Woolsey or Black Canyon nor to the Chatsworth Reservoir. It should also be noted that the 2004 LADWP report detected no contaminants in Chatsworth Reservoir. This fact was cited in Chapter 10 of the report.

[1] Quotes from the UCLA report are given in italics

Comments on Air Pathway Analysis in "Potential for Off-site Exposures Associated with Santa Susana Field Laboratory, Ventura County, California"

No.	Section	Air Comments
A-1	General	The emissions inventory of rocket engine tests is the basis for the ground level concentrations in the exposure analysis. Emissions are used as the input data for the air dispersion modeling to simulate the outdoor concentrations at various distances from the facility. If the emissions data is inaccurate or incorrect, assumptions have been made in estimating an emissions inventory, and the result will be elevated ground level concentrations of chemicals and exposure analyses. The emissions data is significantly higher than that reported by Boeing to agencies during the 1955-1990 periods, particularly for TCE, TCA, and rocket engine testing (RET) emissions. Inaccurate assumptions used in the estimation of RET, TCE, and TCA emissions have lead to higher emissions used in the UCLA Report. According to the report, "the use of TCE for cleaning of rocket engines (engine flushing) was the largest source of toxic organic emissions." It represented two-thirds of the total facility emissions between 1955 and 1990 depicted in the UCLA report. However, the report's TCE emission calculations are significantly higher than those reported by CH2M Hill (1993) and GRC (1988a-b). These sources assert 50 percent lower TCE emissions and could have been used thereby significantly lowering the inventory and exposure analysis results. Additionally, TCE emissions from "other cleaning activities," are unusually high in the inventory. For RET, the UCLA report indicates that an average of several booster tests was used to calculate organic and metal emissions, based on an ABB Environmental Services, Inc., 1992 air sampling report. However, the UCLA report excluded sampling results from other RETs, including sustainer and RS-27 engines. The sustainer and RS-27 emissions results reported by ABB are significantly lower than the average booster results. A more realistic approach to the RET emissions calculations would be to incorporate the sustainer and RS-27 results in the emissions inventory. The UCLA report assumed that RET emissions were 100 percent from boosters from 1955 to 1990. In fact, a broad mixture of engines was tested during that period. The inventory could have included equal emissions from the three RETs air samples by ABB: one-third from sustainers, one-third from boosters, and one-third from RS-27. Ignoring much of the ABB sampling data from the sustainer and RS-27 tests does not create an accurate RET emissions inventory. Finally, TCA emissions are significantly over-reported by assuming equal emissions annually between 1955 and 1990. In fact, TCA was a replacement chemical for TCE as TCE was phased-out. Overall, an inaccurate emissions inventory has significant outcomes for not only the emissions inventory but also resulting in higher ground level concentrations used in the standard exposure analysis.

No.	Section	Air Comments
A-2	Chapter 3, page 24	Change to "SSFL is NOT located within the SCAQMD." SSFL is within the VCAPCD.
A-3	Chapter 3, Page 24, 1st paragraph	Add the word "permitted" to the sentence: "*Various SSFL activities since the commencement of operations at the facility have resulted in* permitted *releases of air toxics to the atmosphere.*"[1]
A-4	Chapter 3, Page 26, Section Title	*"3.2.3. Thermal Treatment Facility (1958 to Present)."* Change Present to 1990 as there is no discussion in the text after 1990.
A-5	Chapter 3, Page 27, last paragraph	*"(See Appendix S for a complete emission inventory)"* A review of Appendix S found emission estimates of organics and metals, however, there are no detailed calculations or methodology of how emissions were derived. For example Table S-3 shows organic emissions over a 36 year period, however, no emission factors are given.
A-6	Chapter 3, Page 31, paragraph 3	There are no Appendices S1, S2, or S3 in the document; only Appendix S which lacks the detailed emission calculations.
A-7	Chapter 3, Page 31, paragraph 4	The report indicates that TCA has the second highest specific compound emissions. However, TCA is not a reactive organic compound.
A-8	Chapter 3, Page 32, Table 3-4	Table 3-4, "Cumulative 1955-1990 Toxic Organic and Heavy Metal Emissions," uses emission data only from boosters. Data from sustainer and RS-27 engines were not included.
A-9	Chapter 3, Page 32, paragraph 1	"*Annual emissions of TCA from 1955 to 1990 were assumed to be equal to that reported for 1990."* This is an incorrect gross assumption as TCA was used as a later substitute for TCE as it was a non-reactive organic compound with less toxicity. Very little TCA was therefore used in the early years.
A-10	Chapter 3, Page 33, first bullet	*"Note that Rocketdyne applied lower emission factors in estimating the 1990 inventory than for the 2002 inventory, so the actual change in toxic metal emissions over the 1990-2002 remains uncertain."* Rocket engine testing emission factors are specific to the type of engines tested in a particular year. The emissions inventories from 1990-2002 are correct.

[1] Quotes from the UCLA report are given in italics

No.	Section	Air Comments
A-11	Chapter 3, Page 33, second bullet	Boeing did not use TCE or TCA in 2002.
A-12	Chapter 3, Page 34	The 1990-2002 toxic emission inventory data was neither partial nor incomplete. This data was approved by VCAPCD. Emissions data changed significantly due to reduced RET, changes to processes, and regulatory changes requiring the discontinued use of TCA.
A-13	Chapter 3, Page 42, Paragraph 3	*"All CALPUFF simulations were accomplished using a source specific "unit emission rate" of 1milligram a second."* The unit emission rate should be 1 gram a second not milligram. Other parts of the document refer to grams per second so this sentence is probably a mistake.
A-14	Appendix I, Page I7, Table TI-1	This table indicates that sources modeled as point sources used the following parameters: Stack Height: 0 m Stack Temperature: 273 K Stack diameter: 1 m Stack exit velocity: 0 m/s The parameters used do not correctly represent the type of emissions release. Using a stack temperature of 273K (32°F) is too low. Rocket engine testing is a turbulent activity and will cause a plume of pollutants. Depending on the size of the rocket, this plume can reach several hundred feet into the air resulting in significantly more dispersion in the atmosphere than modeled in the report. The exhaust from the engine is also at a significantly higher temperature than 273K. The higher exhaust temperature will also result in more dispersion in the atmosphere. Stripping towers use an aeration technique. This also results in emissions being released with some vertical velocity resulting in more dispersion in the atmosphere.
A-15	Appendix I, Page I8, Table I-2	The information for hour 13 is missing from this table.

No.	Section	Air Comments
A-16	Appendix S, page S-10, Table S-9.	*"ABB Environmental Services, Inc. conducted air sampling of kerosene-combusted rocket engine exhaust to analyze for toxic organic and toxic heavy metal combustion byproducts. Air emission samples were taken from several types of rocket engine exhaust (e.g. booster and sustainer.) Table S-9 lists the average measured emission rate of toxic organics and heavy metals from MA5 and MA5A booster rocket engine tests (ABB Environmental Services, Inc. 1992.)"* The emissions inventory did not include the air sampling results from the sustainer or RS-27 which had significantly lower emissions.
A-17	Appendix S, page S-11, 2nd paragraph	The emissions rates are directly proportional to the air volumetric flow rate of the exhaust plume. The air flow rate is a function of the type of engine being tested. Assuming that the air flow rate is constant at 2.56×10^4 m^3/s is a very conservative assumption. The volumetric flow rate is a function of the type of engine being tested. A better solution would be to use separate rates based on the type of rocket engine being tested, e.g., booster or sustainer.
A-18	Appendix S, page S-12, paragraph 3.	The basis for the assumption of the worst-case beryllium emissions from liquid kerosene rocket test operations is flawed. The use of a factor of 10 for beryllium emissions from liquid rocket engines as compared to solid rocket propellant engines is neither correct nor substantiated. This was acknowledged in UCLA's own study which went on to state *"This may be physically unrealistic*…" As such, this factor should not have been used.
A-19	Appendix S, page S-12, paragraph 4	Figure S-1 does not contain the annual kerosene usage rates.
A-20	Appendix S, page S-12, Footnote 3	It is a grossly conservative assumption to use the average kerosene fuel usage rate of 213 kg/s for all rocket engine testing. This value is for the boosters. Instead, the sustainer and the RS-27 fuel usage rates should have been incorporated into the calculations.
A-21	Appendix S, page S-13, Footnote 4	The website referred to, http://www.epa.gov/ttn/chief/le/benzene/benz_apa.pdf, is non-existent.
A-22	Appendix S, page S-13, Footnote 4	Footnote 4 indicates that using the EPA emission factor of 0.002 lb benzene emitted/lb kerosene results in emissions that are comparable to benzene emissions generated in the inventory. In fact, when using EPA's benzene emission factor, emissions are 50% less (34.7 tons) than the UCLA benzene emissions (54 tons). Therefore, this would seem to suggest that the methodology is in question.
A-23	Appendix S, page S-14, Paragraph 1	There is no basis or documentation to validate the used of a 0.15% multiplier for determining hydrazine, MMH, and UDMH emissions

No.	Section	Air Comments
A-24	Appendix S, page S-14, Footnote 6	*"Analysis of records (CH2M Hill, 1993) suggests 50 to 100 gallons of TCE, on average was applied per engine flush."* The initial assumption of 50 to 100 gallons was an estimate based on the average of all engines tests. To use the maximum of 100 gallons TCE per engine flush is an over estimate. Assuming an average of 75 gallons TCE per flush is more appropriate and would reduce the number of gallons of TCE by 25%. This significantly reduces the facility emission inventory.
A-25	Appendix S, page S-14, Paragraph 6	It is an incorrect assumption that equal amounts of TCE and IPA would be used for cleaning the same engine. TCE is a more aggressive solvent than IPA so less TCE would be needed.
A-26	Appendix S, page S-15, Paragraph 1	*"Combining the above uses, the total estimated TCE consumed was 1.16 million gallons. Note that this is nearly twice the 530,000 gallons reported by CH2M Hill (1993)..."* The 1.16 million gallons of TCE estimated is a gross over estimate because it assumes uniform testing. It does not account for variability in TCE use based on engine size tested, e.g., sustainers, verniers, boosters, RS-27. 530,000 gallons may be a better estimate because it is consistent with both the CH2M Hill and GRC reports cited in the text. This would reduce TCE engine flushes to 1,598 tons cumulatively from 1955-1990 and would reduce overall facility emissions significantly.
A-27	Appendix S, page S-16, Paragraph 1	Methyl chloroform and TCA are the same chemical (both have CAS # 71-55-6.) The report double counts their use here and in Table S-7. Remove one or the other.
A-28	Appendix S, page S-16, Paragraph 1	*"Since no documentation of the history of emissions of these two chemicals could be found, the annual methyl chloroform and TCA emission rates reported in the TRI documents were used as the annual emission rates of these chemicals from 1955 to present. Emission of methyl chloroform or TCA could have been significantly greater or lower in earlier years"* TCA is a substitute for TCE. During the years of TCE usage, there was no TCA usage since TCE was being used. Therefore the TCA estimation is a gross over-estimation. Also as noted in A-28, TCA and Methyl chloroform are the same compound. To identify them as separate compounds for the purpose of calculating emission rates is inaccurate.
A-29	Appendix S Page S18, last paragraph	As noted in comment A-28, Methyl chloroform and TCA are the same compounds. Therefore the evaporative losses of 673 tons and 641 tons are grossly overestimated due to double counting of TCA & methyl chloroform. Also as noted in comment A-29 the basis of calculating TCA usage is flawed since TCA would only have been used in the time period for which TCE was phased out.

No.	Section	Air Comments
A-30	Appendix T, Page T7, Table T-4	This table uses the maximum daily receptor concentration to calculate the maximum total lifetime inhalation dose. This is incorrect, since the receptor would not be exposed to this concentration for their entire lifetime. The annual average concentration should have been used (per EPA Document No. 454/R-92-109, "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources," October 1992). The annual average concentration predicted by air dispersion modeling is typically 1/5th of the predicted maximum daily concentration. The Inhalation Cancer Potency Factor for TCE is incorrect. According to the latest published values by OEHHA, the Inhalation CPF for Trichloroethylene is 7.0E-3.