11260 Pyrites Way
Suite 125
Rancho Cordova, CA 95670-4481
Tel: 916-355-3341
Fax: 916-355-6145
Christopher.Fennessy@Aerojet.com

December 4, 2012

Ms. Janice Heple
Community Advisory Group
4507 Marion Court
Sacramento, CA 95822

RE: Responses to Community Advisory Group Comments on the Final Boundary Operable Unit (OU-6) Remedial Investigation and Risk Assessment
Aerojet Superfund Site, Sacramento County, California

Dear Ms. Heple:

Aerojet would like to thank the Community Advisory Group for reviewing the Boundary Operable Unit (OU-6) Remedial Investigation and Risk Assessment Report. We have worked with the U.S. Environmental Protection Agency (USEPA); State of California, Department of Toxic Substances (DTSC); and State of California, Regional Water Quality Control Board (RWQCB) to prepare the attached responses to your comments. In addition to these responses, we have included a CD-Rom that contains Appendix M from the Remedial Investigation Report. This Appendix includes all analytical data used in the Boundary Operable Unit (OU-6) Remedial Investigation and Risk Assessment.

If you have any specific questions or comments regarding this submittal, please contact Chris Fennessy at (916) 355-3341 (e-mail Christopher.Fennessy@Aerojet.com).

Sincerely,

Peter Kvam
Program Coordinator

cc: CM Fennessy, Aerojet (no CD-Rom)
Mr. Gary Riley, USEPA (no CD-Rom)
Mr. Steven Ross, DTSC (no CD-Rom)
Mr. Alexander MacDonald, RWQCB (no CD-Rom)
C.S. Goulart, Aerojet (letter only)
File

Aerojet Document Control # SR10132247CL

Responses to Community Advisory Group Comments

Volume I: Remedial Investigation Report
Volume II: Human Health and Ecological Risk Assessment for the

Boundary Area Operable Unit
Aerojet Superfund Site, Sacramento County, California

Community Advisory Group (CAG) Comments

General Comments

Comment 1. **The AJ CAG recommends the issues below be addressed before approving the RI and the Feasibility Study (FS) so that human health risks are more adequately estimated in the Remedial Investigation and Risk Assessment at the Aerojet Superfund Site, and so that the subsequent feasibility study can be more meaningful. We would like written responses to our comments from the US EPA and the State.**

Response: Comment noted. Aerojet is providing responses to the CAG comments.

Specific Comments

Comment 1. **Note that this AJ CAG review was not comprehensive. Thus, if we did not raise an issue about something, it does not mean that we tacitly agree. We may also have additional comments/issues that will be brought up when the proposed plan is up for public comments.**

Response: Comment noted.

Comment 2. **The CAG is concerned that the proposed soil gas to indoor air attenuation factor of 0.001 (RI Section 3.1.1.1 and RI Table 3.1-1) is not sufficiently conservative to represent residential buildings. EPA's Vapor Intrusion Database: Evaluation and Characterization of Attenuation Factors for Chlorinated Volatile Organic Compounds and Residential Buildings, shows that an attenuation factor of 0.001 is sufficient to cover only about 20 to 40% of existing residential structures, depending on the database screen used (EPA, 2012; Available at http://www.epa.gov/oswer/vaporintrusion/documents/OSWER_2010_Database_Report_03-16-2012_Final.pdf, See Table 8 and Figures 17 to 20). A soil gas to indoor air attenuation factor of about 0.3 (range of 0.097 to 0.6) would be required to include 95% of existing residential structures (see Table 8). The relatively coarse soils on much of the Boundary OU site would also tend to decrease the attenuation of vapors from soil gas to indoor air. Attenuation of vapors from soil gas to indoor air would likely be greater where ground**

water is deep but less where ground water is shallow. While these estimates are for existing residential structures, as new construction ages it will also develop foundation cracks and other points of entry for vapors from the soil below.

These empirical studies by EPA show less attenuation of vapors from soil gas into indoor air than the default DTSC soil gas to indoor air attenuation factor of 0.001, e.g. 1E-03, used in the RI. The CAG recommends using multiple lines of evidence to establish soil gas to indoor air attenuation factors that are protective of at least 90% of the residential structure population to calculate Soil Vapor RI Screening Levels (RISL). The CAG has raised this issue at previous CAG meetings.

Also note that the U.S. EPA's Vapor Intrusion Database shows that a groundwater to indoor air attenuation factor of 1E-04 is protective of only about 50% of the population (Figure 5, Data Set 2). A soil gas to indoor air attenuation factor of about 1E-03 would be required to be protective of about 90% of the population (EPA, 2012, Figure 9, Data Set 2).

Response: The comment concerns the use of the attenuation factor of 0.001 to derive the soil vapor (SV) RISL. This factor is the DTSC recommended attenuation factor for future buildings when evaluating the soil gas to indoor air pathway. As this was used for the investigative phase, the Agencies considered the attenuation factor appropriate. The use of the CAG recommended attenuation factor of 0.1 for soil gas to indoor air is overly conservative and not called for at this time. The BOU human health risk assessment used site-specific attenuation factors calculated using J&E modeling for the indoor air pathway analysis.

The SV RISL was developed to provide a screening tool to assess whether sufficient data had been collected to assess the lateral and vertical extent of impacts at source sites. Specifically, the RISLs assisted in making decisions on the need to conduct additional step-out samples to bound the risk of the detected VOCs. Using a risk-based screening number helped to ensure sufficient data were collected to complete the risk evaluations.

The use of the attenuation factor was considered conservative as the soil gas depth use for soil gas to indoor air are generally based on depth of five feet below ground surface (bgs). The majority of the soil gas samples collected during the BOU RI were from 10 feet bgs or deeper.

Regarding the CAG's concern of vapor intrusion into residential structures, the risk of vapor intrusion is primarily from groundwater. Aerojet is proposing institutional controls for the groundwater plumes underlying the Aerojet site.

Controls for vapor intrusion would be required in areas where the TCE concentration in groundwater exceeds 5 µg/L plus a 100-foot buffer. Aerojet does not see a need to adjust the attenuation factor at this time.

Comment 3. **Since AJ used a soil gas to indoor air attenuation factor (of 0.001) that studies by US EPA show to be overly optimistic to calculate Soil Vapor RISL, the CAG has concerns with the Soil Vapor RISLs shown in Table 3.1-1. The CAG recommends that these be recalculated with attenuation factors that are protective of at least 90% of the population as shown in the EPA's 2008 study or use multiple lines of evidence to establish soil gas to indoor air attenuation factors for the site.**

Response: See the Response to Comment 2.

Comment 4. **The proposed soil gas to indoor air attenuation factor of 0.001 is also not protective of residences or businesses with occupied basements. Unless basements will be prohibited, the CAG recommends AJ use an attenuation factor that is protective of human health for structures that may contain basements.**

Response: See the Response to Comment 2.

Comment 5. **There are also several other reasons why the CAG does not concur with Soil Vapor Remedial Investigation Screening Levels (Soil Vapor RISL) for the protection of indoor air:**

a) AJ proposed developing RISLs using the lowest of either the USEPA Region IX ambient air Preliminary Remediation Goal (PRG) or California Human Health Screening Levels (CHHSLs) for indoor air. The RISLs for the BOU were originally developed in 2005, before *Regional Screening Levels* (RSLs) were published by USEPA in February 2009 (BOU RI, page 3-2).

The PRGs are obsolete and have been replaced by Regional Screening Levels (RSLs). EPA states that the Region 9 PRG Table should no longer be used for contaminant screening of environmental media because it has been replaced with more current RSLs (see http://www.epa.gov/region9/superfund/prg/).

Response: The RI used the most conservative values available at the time the reports were completed. The PRGs, and now the RSLs, is a "living" document and is updated approximately twice a year. Given the time required to prepare the large OU-wide reports (approximately six months), it is difficult to continually revise the document to the most recent screening levels. For this reason,

Aerojet has discussed with the agencies the need to "freeze" the values at some point in the process to complete the report.

However, the updated RSLs are not ignored, the most current toxicity criteria is incorporated at the time the risk assessments are prepared. The human health risk assessment was completed later than when the RISLs were developed for the field investigations.

An analysis was completed and presented in the uncertainty section of the revised human health risk assessment for the BOU demonstrating the effect of using revised toxicity criteria/screening levels. The changes in the RSLs that have a significant increase or decrease on the risk are addressed in the uncertainty section of the human health risk assessment. The most recent TCE toxicity change was reviewed as part of the Final BOU HHERA and included in an uncertainty section.

Additionally, every five years the EPA conducts a review (Five-Year Review Report) where the remedy effectiveness is evaluated. This includes assessing changes in toxicity information on COCs. But is should be noted that for many compounds RSLs have also decreased from the original PRGs used. Currently, the IOU RI/FS is in preparation and will use the most recent May 2012 RSLs. This report will not include updated RSLs that may be released in November or December as it would delay the submittal of the document by months.

b) **The toxicity criteria for 1,4-dioxane have changed. Since residential air RSLs for 1,4-dioxane is about 50% lower than PRGs, and since residential soil and industrial soil RSLs for 1,4-dioxane are about a log order lower than PRGs, the CAG recommends that AJ use the most recent RSLs for 1,4-dioxane.**

Response: See Response to Comment 5a. Additionally, due to the high solubility of 1,4-dioxane in water, this compound has been detected infrequently in the soil vapor samples.

c) **The CAG does not agree with the screening levels for N-Nitrosodimethylamine (NDMA). The US EPA considers NDMA to be a mutagen. The residential air RSLs for NDMA (6.9E-05 ug/m3) is about half of the ambient air PRG (1.4E-04 ug/m3). The residential soil RSL for NDMA (2.3E-03 mg/kg) is about one fourth of the residential soil PRG (9.5E-03 mg/kg). The Tap water RSL (4.2E-04 ug/L) is also about one third of the Tap Water PRG (1.3E-03 ug/L). See comment 5a above. Again, the US EPA states that Region 9 PRGs are obsoletet and thus should no longer be used for screening risk assessment. The**

CAG recommends current RSLs for NDMA be used as the RISL and be used in calculating Soil gas RISL for Boundary OU.

Response: See Response to Comment 5a.

d) **Trichloroethylene (TCE): The CAG does not agree with the RI Soil gas Screening level of 961 ug/m3 TCE. The CAG is concerned that the protective Soil vapor screening level is far lower than the soil vapor SL used in the RI. EPA published new toxicity criteria for TCE September 28, 2011 (See http://www.epa.gov/IRIS/subst/ 0199.htm#refinhal), and has also published updated RSLs for TCE (See http://www.epa.gov/region9/superfund/prg/). EPA now classifies TCE as a mutagen. The residential air RSL (0.43 ug/m3) for TCE is less than half of the Cal-Modified PRG of 0.96 ug/m3 used by AJ. See comment 5a. The CAG recommends AJ use the residential air screening level of 0.43 ug/m3 for TCE and a soil vapor to indoor air attenuation factor which is protective of a least 90% of the population to establish indoor air screening levels. AJ should use the updated EPA toxicity criteria and RISLs in establishing screening levels for the RI and FS, and in the Human Health Risk Assessment (HHRA).4**

Response: DTSC's Health and Ecological Risk Office (HERO) conducted an evaluation to determine if the soil vapor screening level of 961 µg/m3 and the groundwater screening level of 5 µg/L were conservative enough to ensure the revised toxicity data would not result in additional areas requiring remedy, which were not originally identified in the RI.

HERO's evaluation concluded the following

- Soil vapor - The RISL for soil vapor used in the RI for TCE (961 $\mu g/m^3$) was based off of the previous EPA Indoor Air Screening Level of 0.96 $\mu g/m^3$ with an attenuation factor of 0.001 applied. HERO used default Johnson and Ettinger (J&E) residential parameters (with the new TCE toxicity criteria) to estimate the risk and hazard associated with TCE in soil vapor at 961 $\mu g/m^3$. The results of this evaluation indicate that even with the new TCE toxicity criteria, the incremental cancer risk is not above 1×10^{-6} and the HQ is 0.4.

- Groundwater – The RI assumed a conservative depth to groundwater of 30 feet and retained any location where TCE was present in groundwater at a concentration $\geq$ 5 µg/L for further evaluation in the FS. HERO used the updated J&E spreadsheet and determined that using default settings, 30-foot depth to groundwater, and a TCE concentration equal to 5 µg/L, the incremental cancer risk is 5×10^{-7} and the HQ is 0.15.

Therefore, the TCE evaluation conducted in the BOU RI and risk assessment were sufficiently conservative to be in line with the recently released IRIS TCE toxicity data.

Also, see Response to Comment 5a.

e) **US EPA has also established an adult-based oral slope factor of 4.6E-02 per mg/kg/day for TCE, which is about 8-times higher than the previous oral slope factor. US EPA has established new Residential Soil RSL of 0.91 mg/kg to address incidental ingestion, dermal exposure concerns. The EPA has established a risk-based soil screening level of 1.6E-04 mg/kg TCE for the protection of groundwater. The CAG recommends that current RSLs be incorporated into the RI.**

Response: See Response to Comment 5d.

f) **EPA IRIS has now established a chronic oral RfD of 0.0005 mg/kg/day TCE and a chronic Inhalation RfC of 2 ug/m3 TCE, which is 5-times lower than the previous RfC. One of the sensitive non-cancer endpoints that led to this RfC was fetal heart defects caused by a 3-week exposure of pregnant rats to TCE.**

Response: Comment noted.

1) **Since women have to be considered in the workforce in California, the RI screening level for trench and construction workers needs to be revised to protect trench workers from exposure to TCE.**

Response: Aerojet has institutional controls in place on the facility that requires notice to the Aerojet Environmental Engineering Group prior to excavation. Based on the area of excavation, requirements for appropriate health and safety and materials management procedures for excavations are be required. The requirements would address measures to protect pregnant construction workers from TCE exposure. All workers working in areas with potential exposure to hazardous chemicals are required to be OSHA trained and knowledgeable using appropriate safety measures.

2) **Since a 3-week gestational exposure to TCE resulted in fetal heart defects in rats, a relatively short gestational exposure of pregnant women to levels of TCE exceeding the RfC poses a risk of fetal heart defects. Since women are likely to be present in residential, commercial and construction worker exposure scenarios in California, and since relatively short exposures could result in**

these non-cancer effects, the CAG recommends that AJ adopt the TCE RfC as a not to exceed value for indoor air, to ensure that this screening level is protective against fetal heart defects and immune system affects (EPA, 2011, IRIS, Trichloroethylene).

Response: Comment noted.

g) The CAG recommends that the RI also incorporate the No Significant Risk Levels (NSRL) of 14 micrograms TCE per day for oral exposure and 50 micrograms TCE per day for inhalation exposure for purposes of Proposition 65. This amendment to the Title 27, California Code of Regulations section 25705(b)(1) was approved on June 18, 2012 and becomes effective on July 18, 2012 (See http://www.oehha.ca.gov/prop65/law/TCEadopt_062012.html).

Response: Similar to the RSLs, this update postdates the submittal of the BOU RI Report and HHERA. See Response to Comment 5a.

h) The above very significant changes in toxicity criteria need to be addressed in the RI and HHRA. The CAG recommends that AJ use updated RSLs for chemicals that are more health protective than the obsolete PRGs used by AJ. For example, the lower residential air RSL, lower commercial/industrial air RSLs and lower RfC for TCE will influence risk estimates for indoor air and for trench workers. The CAG recommends that soil gas RISLs be updated with the current EPA toxicity criteria and indoor air screening levels for TCE and other contaminants as well as the more conservative soil gas to indoor air attenuation factors characterized by EPA. These changes are needed to ensure that soil gas screening levels are protective of human health.

Response: See Response to Comment 2, 5a, and 5d.

i) AJ needs to use RSLs based on current toxicity criteria at the time of each revision of the RI/FS, not the obsolete values for calculating RISLs. Otherwise the RI will underestimate risk at the site. The CAG has discussed several of these concerns at previous AJ CAG meetings and thus far, AJ has not resolved our on-going concerns.

Response: See Response to Comment 2, 5a, and 5d.

Comment 6. The CAG does not agree with using soil screening levels based on obsolete toxicity criteria.

a) Table 3.1-3: The CAG recommends that AJ use the more health protective of current RSLs (available at http://www.epa.gov/region9/ superfund/prg/) and current CHHSLs (available at http://oehha.ca.gov/risk/chhsltable.html) to calculate Remedial Investigation Screening Levels (RISL). Obsolete PRGs and CHHSLs should not be used to calculate RISL.

Response: See Response to Comment 2, 5a, and 5d.

b) AJ should use the current residential soil CHHSL for lead of 80 mg/kg not the 150 mg/kg used in the RI/FS.

Response: See Response to Comment 5a. A discussion on the change in the CHHSL for lead was included in Section 7.0 (Uncertainty Section) of the HHERA. Aerojet also evaluated the lower lead detections in the FS. The majority of the soil samples detected in this range are in areas that are retained with a recommended remedy or were removed as part of previous excavation activities.

There are a few isolated lead detections between 80 and 150 mg/kg in soil samples. However, as the Blood Lead Model that is used to derived the CHSSL of 80 mg/kg in soil is a probabilistic model, and guidance for probabilistic lead models like the Integrated Exposure Uptake Biokinetic (IEUBK) for children and LeadSpread model for adults recommend use of average site lead concentrations as input (not maximum values, or even 95 percent UCL EPC upper bound concentrations), the finding of a few isolated sample results that exceed a level of 80 mg/kg in soil may typically be discounted.

c) AJ should use the current residential soil RSL for chromium VI of 0.29 mg/kg, not the obsolete PRG of 30.1 mg/kg.

Response: See Response to Comment 5a.

d) AJ should use the current residential soil RSL for nitrosodimethylamine (NDMA) of 0.0023 mg/kg, not the obsolete PRG of 0.01 mg/kg for this contaminant. The residential soil RISL should be 2.3 ug/kg NDMA not 9.5 ug/kg NDMA.

Response: See Response to Comment 5a.

Comment 7. **Appendix M: The Groundwater Analytical Data is blank. The CAG cannot evaluate the risk of contaminants in groundwater to human health via: 1) vapor intrusion to indoor air and 2) vapor intrusion to**

construction/trench workers. AJ needs to provide the groundwater data including the concentration of contaminants in groundwater and depth to groundwater so that the human health risks of each of these exposure pathways can be evaluated.

Response: Attached is a copy of the groundwater database on a compact disc.

Comment 8. **The CAG is concerned that the MCL for TCE is not protective of human health. The EPA's new tapwater carcinogenic SL of 0.44 ug/L TCE and the new non-cancer SL of 2.6 ug/L TCE are far lower than the MCL of 5 ug/L TCE. Due to the higher oral cancer slope factor, and lower oral RfD now estimated for TCE, the CAG recommends the RI and HHRA use the noncarcinogenic SL of 2.6 ug/L TCE as a more health protective screening level for tapwater until the TCE MCL is updated. This lower screening level for TCE in tapwater is needed to at least be health protective against noncancer effects, including fetal heart defects and immune effects.**

Response: The ARAR used for evaluating TCE in groundwater is the California Public Health Goal (PHG), which is 1.7 µg/L.

Comment 9. **Upgradient Contaminant Plumes: The RI/FS is insufficient because AJ has not ensured that the upgradient contaminant source plumes coming from the Island OU are addressed before they migrate into the Boundary OU. For example, RI Figure 6.6-11 shows elevated levels of TCE in groundwater migrating from the Island OU into Boundary OU East of Chem Plant 2. AJ is attempting to intercept the contaminants as they progress across and through the Boundary OU. However, until the upgradient contaminant plumes, including in the Island OU, have been addressed, there is no way to ensure that the high levels of mobile groundwater contaminants in Island OU will not continue to migrate down gradient into OU5, OU6, etc. should containment/remediation efforts be curtailed or reduced in the future due to responsible parties declaring bankruptcy, lack of future funding to continue extraction/treatment, and/or changes in political will to finance the extraction wells and other engineering controls/treatment technologies. Just as there are currently attempts to roll back social security and other benefits, if the economy worsens or political climate shifts, there may also be attempts to roll back or defund expensive extraction/treatment systems that are assumed to prevent up gradient contaminants from migrating into Boundary OU and other down gradient regions.**

The CAG agrees that the clean up needs to start somewhere. However, the CAG has concerns with the assumption of the RI that upgradient mobile contaminants, including in Island OU will be addressed. This may be the

plan, but until the upgradient contaminants have been remediated, the possibility will exist that regulatory failure might occur and contaminants could migrate downgradient into this OU. AJ should address this issue.

Response: Currently, Aerojet is in the process of preparing the IOU RI Report. This document is expected to be submitted at the end of this calendar year. In addition, Aerojet has been working with the agencies on the proposed groundwater flow and fate and transport modeling to evaluate remedies for the IOU groundwater source areas. Regardless, as mentioned above, institutional controls will be required in area where TCE in groundwater poses a potential vapor intrusion risk. Also see Response to Comment 5d,f,1.

Comment 10. **The RI / HHRA is not sufficient for evaluating potential school sites for several reasons including:**

a) AJ did not use currently toxicity criteria to develop screening levels and evaluate human health risks.

Response: See Response to Comments 2, 5a and 5d.

b) AJ did not adjust for early life exposures to mutagenic contaminants.

Response: This pathway was not specifically addressed; future risk assessments will consult EPA's *Supplemental Guidance for Assessing Susceptibility for Early-Life Exposure to Carcinogens.*

c) AJ did not evaluate the potential for contaminants in upgradient source areas, including the Island OU, to continue to migrate into these sites to impact groundwater, surface water, soil gas and indoor air vapor (See CAG comment 9 above). The evaluation of a school site needs to ensure that contaminants are not present and do not have the potential to migrate on to or beneath a school site. It is not appropriate to assume that a contaminant plume and source upgradient of a potential school site will be addressed independently from the evaluation of the school site. Elevated levels of contaminants including TCE are already migrating down gradient in groundwater from Island OU into Boundary OU and these have not been addressed.

Response: See Response to Comment 9. Aerojet's community development plans have taken into account the location of future residential areas and schools based on the findings of the BOU RI. In addition, the California Department of Education has a School Site Approval Procedure (SFPD 4.01 (Rev 2/08)). The procedure includes the completion of Phase I Environmental Site Assessments or Preliminary Endangerment Assessments that would evaluate possible

impacts from the selected site. These would be completed using the toxicity values available at that point in time. This process is overseen by the DTSC.

Comment 11. **Perchlorate Exposure through the Home-Gardening Pathway: The CAG has concerns with the US EPA response regarding the quantitative evaluation of exposure to perchlorate via the home gardening pathway.**

a) The CAG presented an estimated perchlorate exposure by the home gardening pathway at the March 2012 AJ CAG meeting. The data of Yu, Canas, Cobb, Jackson and Anderson (2004) show that perchlorate in soil at 100 ppb is concentrated 2412-fold in lettuce leaves at 2 weeks and 7537-fold (from 100 ppb to 753,784 ppb) at 4 weeks. This experiment involved growing lettuce in 100 g of sand with 100 ppb (100 ug/kg) perchlorate. Lettuce would be grown for more than 4 weeks before harvest but since perchlorate was depleted from soil thereafter, the 4 week value seems to be the best estimate of perchlorate uptake by lettuce leaves. This study provided a baseline for estimating uptake of perchlorate from soil into leafy vegetables. This study also showed higher uptake of perchlorate by cucumber leaves when the nutrient solution was diluted, likely indicating that nitrate competes with perchlorate for uptake by the plant.

Response: Regarding perchlorate, while a potentially complete pathway, homegrown produce was not quantitatively evaluated, as significant land preparation, including the addition of topsoil and amendments with such as peat moss, compost, store-bought garden soil, and/or other types of nutrients, would be required for backyard gardening. Moreover, the mechanisms by which chemicals in soil are transferred into plants is not well understood making it difficult to develop mathematical models to predict the fate and transport of chemicals from soil to plants as demonstrated by the comments provided by the CAG.

Due to the considerable amount of uncertainty in quantitatively evaluating this pathway, many regulatory agencies have chosen not to routinely include this pathway in site-specific HHRAs for most chemicals (Human-Exposure-Based Screening Numbers Developed to Aid Estimation of Cleanup Costs for Contaminated Soil; Cal/EPA, 2005, as demonstrated by the CAG comments below. Therefore, a qualitative evaluation of this pathway was provided for human health.

b) Based on the findings of a 7537-fold bioconcentration of perchlorate from soil to lettuce leaves (Yu et al. 2004), and assuming the consumption of one 200 gram wet weight (12 gram dry weight) salad per day by a 70 kg adult, the CAG estimated that soil at the proposed

60 ug/kg perchlorate clean up goal for the protection of groundwater would result in an oral exposure of 0.07745 mg/kg perchlorate per day. This exceeds the oral RfD of 0.0007 mg/kg-day perchlorate by 111-fold, e.g. represents a non-cancer hazard of 111 for perchlorate alone.

Response: See Response to Comment 10a.

c) **US EPA provided a paper by Voogt and Jackson (2010) that measured the uptake of perchlorate in lettuce leaves when this plant was grown in a hydroponic solution containing increasing levels of a constant ratio of perchlorate (ClO4-) and iodine (I) or a constant ratio of perchlorate and iodate (IO3-). The results showed that under these conditions, perchlorate uptake by outer lettuce leaves increased linearly as the concentration of perchlorate and iodine was increased in the hydroponic solution. The levels of nitrate (NO3-) was held constant in all treatments. This paper showed a 292 to 294-fold bioconcentration of perchlorate into lettuce leaves from the levels in hydroponic solution, e.g. water. However the perchlorate in hydroponic solutions was competing for plant uptake both with nitrate and with iodine or iodate. Furthermore, the RI screening level of 60 ug/kg proposed by AJ is for soil not for water.**

The study by Voogt and Jackson does not seem applicable to the question of addressing home gardening exposures to perchlorate due to plant uptake of perchlorate contamination in soil at the AJ site. This paper seems to be applicable to the management of perchlorate contaminated fertilizers, as it states in the abstract: "These results suggest that if lettuce is grown using fertilizers containing both ClO4- and I-, then the final ratio of It/ClO4 in the leaves will be essentially equal to the ratio in the fertilizer but lower if the I is supplied as IO3-. Therefore, the impact of the consumption of lettuce containing ClO4- may be mitigated if the lettuce is grown using fertilizer with an appropriate amount of I to maintain the existing ration of serum I to total goitrogen load (TGL)." As stated on page 12196 of Voogt and Jackson (2010), "Results of this study can not easily be extrapolated to field grown lettuce, because the soil matrix may affect the availability of I- and IO3- ions due to transformation and/or sequestration."

Response: See Response to Comment 10a.

d) **Regarding the reasoning presented by EPA at the May 2012 AJ CAG meeting that clean fill soil would be imported to the site and would cover the site, thereby reducing exposure to perchlorate: The CAG is not aware of a proposal for the entire Boundary OU site to be covered**

with a durable cap of soil or other materials to prevent human and ecological exposure to contaminants in soil. Normally capping soil impacted with immobile contaminants would also require a land use covenant with long-term monitoring to ensure that the cap is maintained and exposure to impacted soils is prevented (DTSC, 2010; Proven Technologies and Remedies Guidance Remediation See Chapter 8; Available at http://dtsc.ca.gov/SiteCleanup/upload/OCP_022610_final.pdf). However, perchlorate is not immobile, since it can migrate to deeper soil/groundwater and can potentially be drawn to surface soil by evaporation of water in summers. If the EPA ensured that at least 2 feet of clean import fill soil was brought in to the site, the CAG considers that it might be reasonable to assume that the imported topsoil to the site could dilute perchlorate in soil near the surface by up to 2-fold. Since gardeners commonly dig into the soil and often do deep tilling, which would mix the perchlorate impacted soil into the surface soil, the CAG considers that no more than a 2-fold dilution of perchlorate in soils could be assumed with out extensive validation studies. With a 2 fold dilution, soils cleaned up to the 60 ug/kg perchlorate clean up goal for the protection of groundwater, would be diluted to approximately 30 ug/kg perchlorate. Even this level of perchlorate, with a 7537-fold concentration from soil to lettuce leaves would result in a Hazard Quotient of 55 for individuals eating one large salad per day. The CAG considers that this Hazard markedly exceeds the threshold hazard of 1.

Response: See Response to Comment 10a.

e) **EPA recognized that perchlorate exposure via ingestion of plants be considered as an exposure route to ecological species in the RI. DTSC recommended using the regression for soil to plant uptake when considering the exposure of ecological species. EPA concurred with this recommendation. If EPA recognized that this ecological pathway needed to be considered for ecological health, why would it not be considered for human health?**

Response: For the BOU, the estimated uptake of perchlorate from soil to plants, was done for ecological as noted; however, a different data set (monocot and dicot plants, not lettuce) were used. If perchlorate concentrations at a specific site appears to be an issue for human health then the need for a site-specific soil to plant BAF would be discussed with the Agencies for use in the human health and ecological risk evaluations.

f) **As discussed at the May AJ CAG meeting, once the cleanup at the site had been approved, there are plans to allow soil/sand/gravel and other surface material to be moved off the site to other locations for unrestricted use. The CAG was not previously informed of these plans. Since surface soil/materials from this AJ and other OU might be used for, or as an amendment in play boxes, day care centers, garden plots, lawns, residential commercial landscaping and other uses, the human exposure pathway for these materials needs to be considered to ensure that human health is also protected at off site locations receiving this fill. If soil/surface materials could be removed from OU6 or other AJ OU, AJ needs to ensure that the materials being exported from AJ sites do not pose a threat to unrestricted residential use, to sensitive receptors, e.g. infants and pregnant women, as well as to the ingestion of contaminants via the home-gardening produce pathway. Otherwise, individuals at other locations in Sacramento County and many other counties could be adversely affected by exposure to contaminants exported from the AJ site. The CAG cannot endorse AJ's plan to allow unrestricted use of these site soils without establishing an agreed-upon soil cleanup value for perchlorate.**

Response: Aerojet and the Agencies are working hard to ensure all impacted soils are identified and remediated where risk is unacceptable. Remedial action objectives, including one for perchlorate, will be determined during preparation of the remedial action plans. These remedial action objectives will be based upon toxicity data available at the time the plans are prepared.

Comment 12. **With the exception of comment 11f, the CAG has made many of the above points orally at CAG meetings over the last year or more. Yet it is not clear if all of the recommendations by the CAG are being addressed. For example, the CAG made comments over a year ago that the RI/FS should use the more health protective EPA/IRIS toxicity criteria for 1,4-dioxin. Similarly, the CAG made comments at the December 2011 CAG meeting that the RI/FS should use the more health protective EPA/IRIS toxicity criteria for TCE that was released September 28, 2011 and RSLs that were updated November 2011. We would like to emphasize the importance of keeping our members informed and do not consider it an unreasonable request.**

Response: Comment noted.

Comment 13. **We would like to receive a copy of the Draft Final RI and Final FS so we would be able to review and provide any additional comments.**

Response: Aerojet has provided the final versions of the requested documents to the CAG.