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ENVIRONMENTAL PROTECTION

Los Angeles Regional Water Quality Control Board

January 29, 2018

Mr. Mark Hardyment
Burbank-Glendale-Pasadena Airport Authority
2627 Hollywood Way
Burbank, California 91505

SUBJECT: **REVIEW OF DRAFT AND FINAL HUMAN HEALTH RISK ASSESSMENT**

SITE/CASE: **HOLLYWOOD BURBANK AIRPORT REPLACEMENT TERMINAL**
2801 NORTH HOLLYWOOD WAY, BURBANK, CALIFORNIA, 91505
(SCP NO. 104.0674A, SITE ID NO. 2040502)
ASSESSOR'S PARCEL NUMBERS (APNs): 2466-011-914, 2466-011-916

Dear Mr. Hardyment:

The California Regional Water Quality Control Board, Los Angeles Region (Regional Board) is the public agency with primary responsibility for the protection of groundwater and surface water quality for all beneficial uses within major portions of Los Angeles County and Ventura County, including the above-referenced Site.

TECHNICAL REPORTS

We received the following documents, submitted for our review:

- *Human Health Risk Assessment* ("Draft HHRA") dated July 17, 2017, prepared by Geosyntec Consultants.
- *Final Human Health Risk Assessment* ("Final HHRA") dated December 21, 2017, prepared by Geosyntec Consultants.

BACKGROUND

The Site is located at 2801 North Hollywood Way in Burbank, California (Site) (Figure 1). The Site was formerly occupied by the Lockheed Martin Corporation (Lockheed) Plant B-6 site (B-6 Plant) between approximately 1941 and 1997. Operations at the Site included aircraft part cleaning and painting, tooling, welding, and machining. Chemicals used at the Site include aircraft fuels, biocides, descalers, fuel oils, gasoline, paints, solvents, acids, caustics, plastic resins and hardeners. Between 1989 and 1996, approximately 6,000 tons of soil impacted by metals, total petroleum hydrocarbons, and volatile organic compounds were removed. The Site was issued a soil closure in 1996.

The property was acquired by the Burbank-Glendale-Pasadena Airport Authority (Airport Authority) in 1997 under eminent domain. A modern 355,000-square-foot 14-gate airport terminal, parking and utility support structures (replacement terminal complex) is planned in an area referred to as the "Adjacent Property" (Figure 1). The Adjacent Property is approximately 49 acres and is adjacent to an existing airport runway and north of an existing passenger terminal at the Hollywood Burbank Airport in the City of Burbank, California. The replacement terminal complex is planned for the properties with Assessor's Parcel Numbers (APNs) 2466-011-914 and 2466-011-916.

The Airport Authority's planned construction activities involve selective regrading, trenching, and building the new terminal complex. Prior to initiating construction, the Airport Authority wanted to obtain recent data and document the findings in a HHRA to evaluate potential human health risk to construction workers during development and workers/users of the new terminal complex following development. A Soil and Soil Vapor Investigation Work Plan (Work Plan) was prepared by Geosyntec, technical consultant for the Airport Authority, to facilitate the collection of recent data in support of a HHRA. The Work Plan was approved by the Regional Board on December 12, 2016, and a corresponding field investigation was performed in February and March 2017.

Data collection in support of the field investigation and HHRA included soil vapor samples collected from 55 locations from depths of approximately 5 and 15 feet below ground surface (bgs) (Figure 2). In areas where a basement was projected to be constructed, soil vapor samples were collected at 25 feet bgs. The soil vapor samples were analyzed for volatile organic compounds (VOCs) by US EPA Method 8260B. Soil samples were collected at 3, 8, 15, and 25 (basement locations only) feet bgs from 89 locations at the Site (Figure 2). The soil samples were analyzed for the following:

I. California Administrative Manual (CAM) 17 metals by US Environmental Protection Agency (EPA) Method 6010B/7471A
II. Total Petroleum Hydrocarbons (TPH) quantified as diesel and motor oil (TPHd and TPHmo, respectively) by US EPA Method 8015M
III. Polycyclic aromatic hydrocarbons (PAHs) by US EPA Method 8270C SIM
IV. Polychlorinated biphenyls (PCBs) by US EPA Method 8082
V. Select soil samples from soil vapor borings were collected for physical parameter analysis, such as permeability, porosity, grain size, dry bulk density and fractional organic carbon.

The results from the field investigation served as the primary basis for the Draft HHRA. The Draft HHRA was reviewed by the Office of Environmental Health Hazard Assessment in a memorandum (OEHHA memo) dated November 20, 2017 (attached). The Draft HHRA was revised based on editorial comments in the OEHHA memo to produce the Final HHRA, but the results remained the same in both documents. The findings from the Draft HHRA and Final HHRA are presented below.

HHRA FINDINGS

The findings from the Draft HHRA and Final HHRA indicate the following:

1. For an airport worker, the calculated cancer risk and noncancer hazard index (HI) are at or below *de minimis* (10^{-6}) levels. Because the calculated cancer risk and noncancer HI to an on-site airport worker are below the *de minimis* levels, the risk and hazard to an occasional airport worker would also be *de minimis* levels. As such, the cancer risk and non-cancer hazard for airport workers is below typically acceptable levels.

2. For a construction worker, the calculated cancer risk is well below the *de minimis* level. The HI is at the acceptable target level equivalence of 1.0 used by Cal-EPA and USEPA. Because the calculated cancer risk and noncancer HI to a construction worker are below and at the *de minimis* levels, the risk and hazard to an off-site employee or worker during construction activities would also be below *de minimis* levels. As such, the cancer risk and non-cancer hazard for construction workers is below typically acceptable levels.

3. Prior to the initiation of construction of the replacement terminal complex, a Soil Management Plan (SMP) will be prepared by Geosyntec to confirm additional protection of human health during construction activities.

REGIONAL BOARD APPROVAL

The Regional Board approves the Draft HHRA and Final HHRA with the following comments and requests:

1. In regards to the second bullet on page 16 of the OEHHA memo, "*LA RWQCB should decide on the need for additional sampling, e.g. hexavalent chromium, organochlorine pesticides, and soil vapor*", the Regional Board did not find a need for additional sampling based on the results of the Draft and Final HHRA documents which assess human health risk from soil and soil vapor exposure to a maximum depth of 25 feet bgs. The risk from soil includes the soil ingestion, contact, and inhalation pathways, while the risk from soil vapor includes the vapor intrusion pathway. In addition, historical data and site use history for the portion of the former Lockheed B-6 Plant that includes the Adjacent Property were examined to conclude that no additional sampling is required.

2. Following the review of the results of the field investigation, Draft HHRA, OEHHA memo, and Final HHRA, the Regional Board considers the Adjacent Property compatible for the construction of and operation of an airport replacement passenger terminal and associated facilities (replacement terminal complex).

3. The Regional Board shall be notified of any changes to a building or parking location that will cause the location to exceed 25 feet in depth bgs. Soil and soil vapor deeper than 25 feet bgs was not assessed as part of the Draft and Final HHRA for the Adjacent Property. Changes in building or parking depth greater than 25 feet bgs may require additional soil/soil vapor sample collection and risk analysis to assess the risk to human health at the deeper building or parking location.

4. If buildings are planned for the southern portion of Area D-DU3 and F-DU1 (Figure 2), where no soil vapor samples were collected (only soil samples to a maximum depth of 15 feet bgs), the Airport Authority shall immediately contact the Regional Board and discuss the need for collecting additional soil/soil vapor samples for risk characterization in those areas.

5. A Soil Management Plan (SMP) shall be submitted to the Regional Board for review and approval prior to the start of construction activities. The SMP shall address future soil excavation activities and describe the methods for managing impacted soil encountered during excavation and redevelopment activities. The SMP shall address the following:

a. Excavation, management, transportation of excavated soil
b. Erosion and sediment (E&S) controls
c. Collection and analysis of confirmatory soil samples
d. Placement and disposal of the excavated soil

6. A Covenant and Environmental Restriction on Property ("land use covenant" or "deed restriction") shall be recorded for the Site to prohibit uses other than those permissible as an airport terminal complex, including sensitive uses such as homes, schools, or day care facilities.

If you have any questions or concerns related to this project, please contact Ms. Nicole Alkov (Case Manager) at (213) 576-6677 or nicole.alkov@waterboards.ca.gov.

Sincerely,

Samuel Unger

Samuel Unger, P.E.
Executive Officer

Enc.: Figure 1 – Adjacent Property Site Map
Figure 2 – Soil and Soil Vapor Sample Locations
Figure 3 – Soil Vapor Sample Locations and Replacement Terminal Complex
OEHHA Memo dated November 20, 2017

cc: Mr. Ravi Arulanantham, Geosyntec Consultants (RArulanantham@Geosyntec.com)
Mr. Robert Cheung, Geosyntec Consultants (RCheung@Geosyntec.com)
Ms. Liaht Rosenstein, Lockheed Martin Corporation (Liaht.Rosenstein@lmco.com)
Ms. Anita Fang, LARWQCB (Xiao-Xue.Fang@Waterboards.ca.gov)
Mr. Gary Riley, EPA Region IX (Riley.Gary@epa.gov)

Legend

Replacement Passenger Terminal Project
(2801 No. Hollywood Way, Burbank, Ca.)

Imagery Source: Google Earth Pro, February 2016

N

0 360 Feet

Adjacent Property
Hollywood Burbank Airport

Replacement Passenger Terminal Project
Burbank California

Geosyntec consultants

WR2211

June 2017

Figure 1

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Legend

Approximate Collocated Soil and Soil Vapor Sample Location

▲ Soil (3', 8', 15') & Soil Vapor (5', 15')

▲ Soil (3', 8', 15', 25') & Soil Vapor (5', 15', 25')

Approximate Soil Vapor Sample Location

● 5', 15'

● 5', 15', 25'

■ Approximate Soil Sample Location (3', 8', 15')

N

0 300 Feet

Soil and Soil Vapor Sampling Locations
Hollywood Burbank Airport

Replacement Passenger Terminal Project
Burbank California

Geosyntec consultants

Figure 2

WR2211 | June 2017

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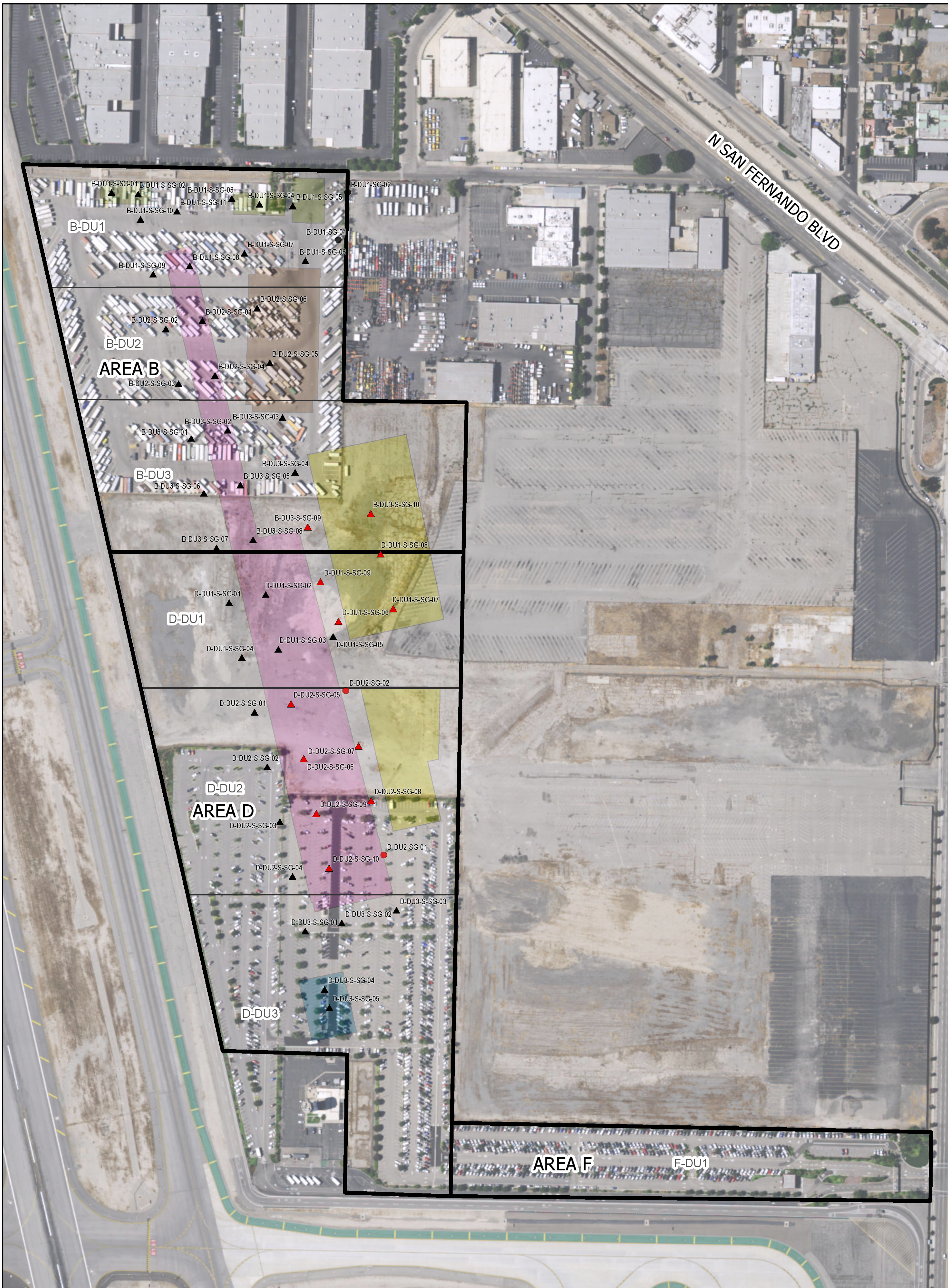

Legend

Approximate Collocated Soil and Soil Vapor Sample Location

- ▲ Soil (3', 8', 15') & Soil Vapor (5', 15')
- ▲ Soil (3', 8', 15', 25') & Soil Vapor (5', 15', 25')

Approximate Soil Vapor Sample Location

- ● 5', 15'
- ● 5', 15', 25'

—— Soil Sample Decision Units

Proposed Terminal Complex Layout

- Terminal Building
- ARFF Building
- Support Building
- Public Parking
- Employee Parking

N

0 300 Feet

Soil Vapor Sample Locations
Hollywood Burbank Airport

Replacement Passenger Terminal Project
Burbank California

Geosyntec consultants

WR2211	July 2017	Figure 3

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MEMORANDUM

TO: Ms. Nicole Alkov
Engineering Geologist
Site Cleanup Program, Unit II
Los Angeles Regional Water Quality Control Board
320 West 4th Street, Suite 200
Los Angeles, CA 90013

FROM: Hristo Hristov, M.D., Ph.D., M.Env.Sc.
Integrated Risk Assessment Branch
Office of Environmental Health Hazard Assessment

DATE: November 20, 2017

SUBJECT: Review of Human Health Risk Assessment Hollywood Burbank Airport Replacement Passenger Terminal, Burbank-Glendale-Pasadena Airport Authority 2627 Hollywood Way, Burbank, California 91505

SWRCB # R4-16-035 **OEHHA #** 880439-00

Document Reviewed (Italicized text is quoted from the request or from the documents provided for review.)

As per your request, I reviewed the Human Health Risk Assessment Hollywood Burbank Airport Replacement Passenger Terminal, Burbank-Glendale-Pasadena Airport Authority, 2627 Hollywood Way, Burbank, California 91505, prepared by Geosyntec Consultants (Geosyntec) and dated 17 July 2017.

Scope of the Review

This review is intended to deliberate on the risk and hazard results for the airport personnel and for the construction workers involved in building the new terminal at the site.

Limitations

An adequate sampling strategy, sample handling, and sample analysis are pre-requisites for an accurate characterization of the site contamination. The Office of Environmental Health Hazard Assessment (OEHHA) was not involved in the characterization, remediation or post-remedial sampling activities at this site. Accordingly, my comments and conclusions are contingent upon the adequacy of the site characterization and upon the correctness, completeness and representativeness of the information provided in the reviewed report.

OEHHA did not review the initially provided approximately 15,000 pages of analytical data, including quality control, calibration curves, etc. The analytical data (approximately 1,500 pages) provided later (7/27/2017), were merely reviewed for consistency with the data shown in tables in the report and used in the human health risk assessment.

Background Information

A new terminal is planned to be built on the Adjacent Property of approximately 49 acres located directly next to the north/south airplane runway and north of the existing passenger terminal of the Hollywood Burbank Airport. The Adjacent Property occupies parts of the former Lockheed Plant B-6 site where over 80 manufacturing and support buildings and infrastructure were demolished between 1990 and 1995. The site underwent several investigations and was remediated. Groundwater at the site was found at 250 ft bgs (below ground surface) and moving in a predominantly southeastern direction. Considering data in recent TetraTech reports, Geosyntec determined that groundwater contaminants would not result in health risks to the airport employees and to construction workers. Geosyntec prepared a Work Plan (approved by the Regional Water Board on 12 December 2016) to direct collection of representative soil and soil vapor samples for the whole site divided for this purpose into three separate areas with each area further subdivided into decision units. A total of 140 ISM (incremental sampling methodology) soil samples were collected from 3, 8, and 15 ft bgs. Discrete samples were also collected from 15 and 25 ft bgs at locations where basements were planned. Soil vapor sampling was performed at 55 points from 5 and 15 ft bgs. 16 additional soil vapor samples were collected at planned basement locations. The samples were analyzed for chemicals used at the former plant and previously identified at the site. The resulting analytical data were evaluated to determine the maximum concentration for each retained contaminant of potential concern (COPC) to be followed as input into the screening level human health risk assessment that is the subject of this review.

General Comments

On the Sampling

Comment 1. The performed soil and soil vapor sampling is consistent with the Work Plan. The work plan and the report do not provide information on the following:

- P. 9 indicates that at future terminal basements discrete soil samples were collected from 15' and 25' below ground surface (bgs). No information was provided to OEHHA regarding the location of basements in the terminal. The location of the samples relative to the basement locations should be verified by LA RWQCB. It should be noted, that changes in the building plans, e.g., resulting in construction of a basement at a different non-sampled location may compromise the results of this risk assessment. LA RWQCB should take the necessary actions to prevent potential health impact resulting from such construction plan changes.

- Organochlorine pesticides (OCPs) were sampled from the unpaved area only (1 discrete surface sample from Area B and 4 discrete surface samples from Area D). OCPs are known for low solubility, extreme hydrophobicity, sorption, and persistence, and tendency to volatilize. A redistribution through dry and wet deposition may have occurred over the rest of the site (paved at the time of sampling but possibly unpaved at the time of OCPs use). LA RWQCB should decide on the representativeness of those samples and on the need for additional sampling.

- No soil vapor samples were collected at Area F and the southern part of Area D-DU3. LA RWQCB needs to make a decision on the adequacy of the existing sampling and on the need for additional sampling.

On the Analytical Data

Comment 2. The laboratory analytical reports consists of soil data for metals, total petroleum hydrocarbons (TPHs), polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and pesticides summarized in 4 tables. Another table presents a statistical summary of chemicals analyzed in soil. The data presented in the tables generally agree with the analytical reports with few exceptions that should not impact the results of the risk assessment since the latter is based on the maximum measured concentrations. Zinc was found in blanks (at 1.38 mg/kg) for the sets collected from 3' and 8' bgs. This sample contamination is not expected to significantly bias the risk results.

The collected soil vapor data also follow the results shown in the analytical laboratory reports. Separate tables summarize the soil vapor data and provide a statistical summary of soil vapor data.

On the Contaminants of Potential Concern (COPCs)

The analysis of the soil samples identified: 13 metals; TPHs (total petroleum hydrocarbons) as Motor Oil and as Diesel; Aroclor-1254; 9 PAHs (polycyclic aromatic hydrocarbons); and DDT.

Comment 3. P. 10, Section 3.1.3 Soil Sampling Results states *“The concentrations of metals detected in soil appear to be associated with naturally occurring background concentrations.”*

The report does not present any table, discussion or reference to support such determination. I identified the “*Kearney Foundation Special Report, 1996. Background Concentrations of Trace and Major Elements in California Soils, Division of Agriculture and Natural Resources, University of California. March”* in the report reference list and presumed that the background data ranges from this reference were used to make that determination. However, the analytical results show Zinc at a maximum concentration of 1,400 mg/kg, exceeding its maximum background concentration of 236 mg/kg (according to the Kearney Foundation document). Concentrations for 12 other metals were found to be at or below the background concentrations in the cited reference. It should be noted that Zn and the 12 other metals were followed in the risk assessment. I recommend that Geosyntec provide a table and discussion to support the above statement and to make it transparent. Alternatively, the methods described in DTSC, 1997 can be followed to determine whether the metals at this site are at background concentrations.

Comment 4. Pp. 6-7, and p. 12 provide a brief discussion to support a conclusion regarding the type of chromium at the site and to validate the type of chromium analysis. According to the report, *“The results of the chromium investigation in AOC 12 and AOC 13 indicate a lack of significant concentrations of hexavalent chromium and that the predominant form of chromium reported in soil is trivalent chromium. The concentrations of hexavalent chromium in 3 of 30 soil samples found during the Lockheed 2014 investigation are an order of magnitude below the industrial screening level of 6.3 mg/kg (Regional Screening Level; USEPA, 2017a). Based upon the results for soil samples collected in the two AOCs within the Adjacent Property, the Regional Board issued a letter in 2015 finding that Lockheed was not required to conduct further investigations as to those areas. (Regional Board, 2015). Therefore, no further soil sampling for hexavalent chromium was performed…”*

The hexavalent chromium was not followed in the risk assessment. It should be noted that the above determination was based on discrete sampling obtained from 3 locations from 2 areas of concern only (the report refers to 33 samples collected between 10 and 100 ft bgs). Since OEHHA was not involved in the site characterization, I cannot provide a qualified opinion on the representativeness of those results to the whole site. Hexavalent chromium is a carcinogen important to the total risk evaluation. CalEPA does not support exclusion of COPCs on a basis of comparison to a screening level. Such exclusion underestimates the cumulative risk and the hazard index. LA RWQCB should decide on the need for further investigation of the hexavalent chromium contamination based on their knowledge of the site. Hexavalent chromium should be followed in the risk assessment unless defensible reasons supporting its exclusion are provided.

Comment 5. P. 11 states *"…arsenic was not selected and not evaluated in the HHRA because the maximum concentration of arsenic in soil is 2.08 mg/kg, which is considered within background levels in Southern California soils."* This decision needs to be explained since the rest of the metals (except hexavalent chromium) were followed in the risk assessment, although also considered to be present at background levels.

Comment 6. The report does not contain a table showing the selected COPCs. Adding a table showing supporting information for the inclusion/exclusion of the COPCs would add the necessary transparency.

On the Conceptual Site Model (CSM)

The CSM presented on Fig. 4 correctly depicts the complete pathways for the two exposure scenarios, namely future airport worker (also representative of passenger), and future construction worker (also representative of maintenance worker) (p. 14). The potential for exposure to future off-site worker through inhalation of particles originating on site is evaluated on the basis of the risk results from the two scenarios considered in this report.

On the Human Health Risk Assessment

Per p. 13, *"The HHRA is based on a Tier 1 approach, where the maximum concentrations of detected chemicals are compared to non-site-specific health protective screening levels (e.g., DTSC-based screening levels [DTSC-SLs] or USEPA regional screening levels [RSLs])."* Geosyntec also modified and derived screening levels, especially for VOCs under construction worker scenario.

On the Exposure Assessment

Comment 7. Notes under pp. 14 and 17 refer to *"current configuration of 9/80(8 days at 9 hours per day, 1 day at 8 hours per day every 2 weeks [one day off])."* Based on Geosyntec e-mail dated 10/02/2017, *"A 9/80 work schedule entails working for 9 hours for 8 days and 8 hours for 1 day for a total of 80 hours over 9 days (9/80) every 2 weeks. For this 9/80 work schedule, assuming a typical average 2-week vacation per year (work 50 weeks per year), an employee works 2,000 hours per year (80 hours every 2 weeks for 25 weeks = 80 hours * 25 weeks) or 225 days per year (9 days every 2 weeks for 25 weeks = 9 days * 25 weeks). … the employee receives 1 work day off every other week **AND** is off every weekend (Saturday and Sunday)."* It should be noted that the risk assessment results may not apply if an employee works under a different schedule, e.g., not having regular weekends off.

On the Toxicity Assessment

Comment 8. According to p. 15, *"The currently available toxicity values (**Table 10**) for the COPCs are the OEHHA (2017) and the USEPA Integrated Risk Information System (IRIS) (USEPA, 2017b) and are used to derive screening levels presented in the following sections. In cases where the toxicity criteria for noncancer hazards are available from either OEHHA or USEPA, the more conservative criterion was selected."*

The toxicity values shown in Table 10 do not follow the above *"the more conservative"* condition for all COPCs. The table should be corrected, as follows:

Benzo(a)pyrene – The oral(dermal) slope factor should read 2.9E+00 $(mg/kg\text{-}d)^{-1}$ (OEHHA, 2016). The URF should read 1.1E-03 $(\mu g/m^3)^{-1}$ (OEHHA, 2016);

Benzo(g,h,i)perylene – The chronic oral(dermal) RfD should read 3.0E-04 mg/kg-d based on Benzo(a)pyrene consistent with the screening level shown in Table 14;

Benzo(k)fluoranthene - The oral(dermal) slope factor should read 1.2E+00 $(mg/kg\text{-}d)^{-1}$ (OEHHA, 2016). The URF should read 1.1E-04 $(\mu g/m^3)^{-1}$ (OEHHA, 2016);

Beryllium – The RfC should read 7.0E-03 $\mu g/m^3$ (OEHHA, 2016);

Chrysene - The oral(dermal) slope factor should read 1.2E-01 $(mg/kg\text{-}d)^{-1}$ (OEHHA, 2016). The URF should read 1.1E-05 $(\mu g/m^3)^{-1}$ (OEHHA, 2016). The chronic oral(dermal) RfD should read 3.0E-04 mg/kg-d based on benzo(a)pyrene (per Table 10 reference). The RfC should read 2.0E-03 $\mu g/m^3$ based on benzo(a)pyrene (per Table 10 reference);

Indeno(1,2,3-cd)pyrene - The oral(dermal) slope factor should read 1.2E+00 $(mg/kg\text{-}d)^{-1}$ (OEHHA, 2016). The URF should read 1.1E-04 $(\mu g/m^3)^{-1}$ (OEHHA, 2016). The chronic oral(dermal) RfD should read 3.0E-04 mg/kg-d based on benzo(a)pyrene (per Table 10 reference). The RfC should read 2.0E-03 µg/m^3 based on benzo(a)pyrene (per Table 10 reference);

Mercury - The chronic oral(dermal) RfD should read 1.6E-04 mg/kg-d (OEHHA, 2016). The RfC should read 3.0E-02 µg/m^3 (OEHHA, 2016);

Nickel - The URF should read 2.6E-04 (µg/m^3)$^{-1}$ (OEHHA, 2016);

I used the toxicity values cited above in my derivations of screening levels for the airport worker, and subchronic reference concentrations consistent with the Regional Screening Levels (RSLs) User's Guide (US EPA, 2017) in the derivation of screening levels for the construction worker scenario.

On the Risk Characterization

The cancer risk and non-cancer hazard were calculated by dividing the maximum measured soil or soil vapor concentration for each COPC by the corresponding screening level followed by multiplying the quotient by 1.0E-06 for carcinogens and by 1 for non-carcinogens. The total incremental lifetime cancer risks and the hazard indices were calculated as a sum of the incremental lifetime cancer risks, and the hazard quotients, respectively for each chemical under each scenario.

Airport Worker Scenario

Risk and Hazard Due to Contaminants in Soil

Comment 9. The measured maximum soil concentrations were used to estimate the cancer risk and non-cancer hazard due to exposure through ingestion, dermal contact, and inhalation of particles. The maximum soil concentrations, the Cancer and Non-cancer Screening Levels (DTSC, 2017; US EPA, 2017), and the resulting cancer risk and non-cancer hazard are shown in Table 14 of the report. I recalculated the screening levels using the RSL Calculator (US EPA, 2017) for the COPCs identified in comments 5 and 8 above by using the more conservative toxicity values, and the exposure factors per DTSC, 2014. The calculated screening levels and the estimated risk and hazard are shown in Table 1.

Table 1. Screening Levels, Risk and Hazard for Some COPCs in Soil

Chemical	Maximum Soil Concentration, mg/kg	Cancer Screening Level, mg/kg	Non-Cancer Screening Level, mg/kg	Cancer Risk	Non-Cancer Hazard
Benzo(a)pyrene	0.013	0.44	135.0	3.0E-08	0.0001
Benzo(g,h,i)perylene	0.029	NC	136.0	NC	0.0002
Benzo(k)fluoranthene	0.024	1.1	135.0	2.0E-08	0.0002

Beryllium	0.26	6,950.0	2,210.0	4.0E-11	0.0001
Chrysene	0.021	10.6	135.0	2.0E-09	0.0002
Indeno(1,2,3-cd)pyrene	0.016	1.1	135.0	1.0E-08	0.0001
Mercury	0.21	NC	4.45	NC	0.05
Nickel	8.11	64,100.0	11,100.0	1.0E-10	0.0007
Arsenic	2.08	2.27	4.25	9.0E-07	0.49

Notes:
NC Non-carcinogen or no data

Comment 10. To address the exposure of the airport worker to ingestion, dermal contact and inhalation of particles pathways, the available maximum soil vapor data were converted to soil data using the DTSC, 2011a, Appendix E partitioning equation. The conversion is based on a rewritten equation and may yield additional uncertainty. The conversion results are shown in Table 2 below.

Table 2. Maximum Soil Vapor Concentrations Converted to Soil Concentrations

Chemical	Maximum Soil Vapor Concentration, C_v, μg/m^3	Converted Soil Concentration, C_s, mg/kg
Benzene	5.91E+01	1.33E-04
Carbon tetrachloride	2.02E+02	6.95E-05
1,1-Dichloroethene	6.51E+01	2.19E-05
Ethylbenzene	1.05E+02	3.65E-04
Methylene chloride	9.91E+02	1.90E-03
Tetrachloroethene	2.48E+03	1.56E-03
1,1,2-Trichloro-1,2,2-trifluoroethane	4.79E+02	5.59E-05
1,1,1-Trichloroethane	2.93E+01	1.46E-05
Trichloroethene	1.22E+03	1.08E-03
Trichlorofluoromethane	6.57E+01	1.06E-05

The converted soil concentrations were compared to soil cancer and non-cancer screening levels calculated by the RSL Calculator (US EPA, 2017) (using the more conservative toxicity criteria, OEHHA, 2016, and exposure parameter values, DTSC, 2014). The cancer and non-cancer screening levels, and the resulting cancer risk and non-cancer hazard quotients are shown in Table 3 below:

Table 3. Screening Levels, Cancer Risk and Non-Cancer Hazard Due to VOCs in Soil

Chemical	Converted Soil Concentration, mg/kg	Cancer Screening Level, mg/kg	Non-Cancer Screening Level, mg/kg	Cancer Risk	Hazard Quotient
Benzene	1.33E-04	1.43E+00	46.0	9.3E-11	0.000003
Carbon tetrachloride	6.95E-05	4.28E-01	248.0	1.6E-10	0.0000003

1,1-Dichloroethene	2.19E-05	NC	352.0	NC	0.00000006
Ethylbenzene	3.65E-04	2.54E+01	20,500.0	1.4E-11	0.00000002
Methylene chloride	1.90E-03	2.41E+01	2,480.0	7.9E-11	0.0000008
Tetrachloroethene	1.56E-03	2.65E+00	342.0	5.9E-10	0.000005
1,1,2-Trichloro-1,2,2-trifluoroethane	5.59E-05	NC	28,100.0	NC	0.000000002
1,1,1-Trichloroethane	1.46E-05	NC	7,200.0	NC	0.000000002
Trichloroethene	1.08E-03	6.04E+00	18.7	1.8E-10	0.00006
Trichlorofluoromethane	1.06E-05	NC	350,000	NC	3.0E-11
			Total	1.0E-09	7.0E-05

Notes:
NC Non-carcinogen or no data

The total excess lifetime cancer risk (sum of the total risk from Table 1, Table 3, and the total risk from the remaining COPCs, see Table 14 of the report) of 1.0E-06, and the hazard index (sum of the hazard indexes from Table 1, Table 3, and the hazard index from the remaining COPCs, see Table 14 of the report) of 0.73 are below the levels typically acceptable under industrial/commercial scenario (risk of 1.0E-05 and hazard of 1.0).

The soil concentration of lead, 15.9 mg/kg is about 20 times lower than the lead soil screening level for industrial worker of 320 mg/kg implying that no significant health impact is expected due to exposure to lead.

Risk and Hazard Due to Contaminants in Soil Vapor Inhaled Indoors

Geosyntec estimated soil vapor screening levels (Table 12) by applying the DTSC, 2011a default attenuation factor of 0.0005 (future commercial buildings) to the indoor air screening levels derived by DTSC, 2017 and US EPA, 2017. The maximum soil vapor concentrations were further compared to the derived soil vapor screening levels to estimate a total excess lifetime cancer risk of 1.0E-06 and hazard index of 0.008 (Table 16 of the report), both below the levels typically acceptable under industrial/commercial scenario (risk of 1.0E-05 and hazard of 1.0).

Total Risk and Hazard for Airport Worker

Comment 11. The total excess lifetime cancer risk of 2.0E-06 and the hazard index of 0.74 are below the levels typically acceptable under industrial/commercial scenario (risk of 1.0E-05 and hazard of 1.0).

Construction Worker Scenario

On the Risk and Hazard Due to Contaminants in Soil

Comment 12. According to p. 16, *"For a construction worker, soil DTSC-SLs were calculated based on the same methods used to calculate DTSC-SLs for a commercial* *worker, but with exposure parameters specific to a construction worker following DTSC guidance (DTSC, 2014).”*

I used the RSL Calculator for the construction worker scenario updated with the exposure parameters shown in DTSC, 2014, with subchronic toxicity values where available (US EPA, 2017), and considered the toxicity values (per comment 8 above). The derived cancer and non-cancer soil screening levels and the cancer risk and non-cancer hazard are shown in Table 4 below.

Table 4. Screening Levels, Risk and Hazard for All COPCs in Soil

Chemical	Maximum Soil Concentration, mg/kg	Cancer Screening Level, mg/kg	Non-Cancer Screening Level, mg/kg	Cancer Risk	Non-Cancer Hazard
Background					
Antimony	1.58	NC	1.36E+02	NC	0.01
Barium	197.0	NC	1.60E+04	NC	0.01
Beryllium	0.26	1.28E+02	2.89E+01	2.03E-09	0.01
Chromium III	11.0	NC	2.02E+04	NC	0.0005
Cobalt	9.27	3.41E+01	7.76E+01	2.72E-07	0.12
Copper	16.1	NC	3.39E+03	NC	0.005
Mercury	0.21	NC	8.03E+00	NC	0.03
Molybdenum	1.02	NC	1.70E+03	NC	0.0006
Nickel	8.11	1.18E+03	7.47E+02	6.87E-09	0.01
Vanadium	32.6	NC	3.74E+02	NC	0.09
Arsenic	2.08	1.30E+01	1.12E+00	1.6E-07	**1.86**
			Subtotal	5.0E-07	**2.15**
Site Contamination					
Aroclor 1254	0.057	3.88E+00	3.34E+00	1.47E-08	0.02
Benzo(a)pyrene	0.013	2.91E+00	6.78E+00	4.47E-09	0.002
Benzo(g,h,i)perylene	0.029	NC	3.51E+01	NC	0.0008
Benzo(k)fluoranthene	0.024	7.10E+00	6.78E+00	3.38E-09	0.0035
Chrysene	0.021	7.10E+01	6.78E+00	2.96E-10	0.003
DDT	6.3	4.99E+01	1.18E+02	1.26E-07	0.05
Fluoranthene	0.012	NC	1.17E+04	NC	0.000001
Indeno(1,2,3-cd)pyrene	0.016	7.10E+00	6.78E+00	2.25E-09	0.002
1-Methylnaphthalene	0.011	2.94E+02	8.19E+03	3.74E-11	0.000001
2-Methylnaphthalene	0.014	NC	4.68E+02	NC	0.00003
Pyrene	0.013	NC	3.51E+04	NC	0.0000004
TPH as Diesel	85.0	NC	9.48E+01	NC	0.90
TPH as Motor Oil	190.0	NC	5.51E+04	NC	0.003
Zinc	1400.0	NC	1.02E+05	NC	0.01
			Subtotal	1.0E-07	0.99

	Total	6.0E-07	**3.14**

Notes:
NC Non-carcinogen or no data
Bold Exceeded acceptable risk or hazard

The total incremental lifetime cancer risk of 6.0E-07 is well below the typically acceptable level of 1.0E-05 for construction workers. The hazard index of 3.14 exceeds the typically acceptable level of 1.0. It should be noted, however, that the background contaminants, especially arsenic are the major contributors to both cancer risk and non-cancer hazard. The risk and hazard due to site contamination are below the levels typically acceptable for construction workers. LA RWQCB should decide on the need for construction worker protection, e.g., protective equipment due to exposure to arsenic.

Comment 13. Geosyntec incorrectly used the industrial/commercial soil screening level for lead of 320 mg/kg (DTSC, 2017) to compare to the maximum site lead concentration of 15.9 mg/kg (Table 15). No discussion was provided in the document. I run the DTSC Modified Adult Lead Model (DTSC, 2011b) to derive a site soil screening level of 46 mg/kg. According to the model, there is a 0.1% probability that the fetal lead blood concentration due to exposure to the maximum soil lead concentration measured at the site will exceed the target lead blood concentration increase of concern of 1 µg/dL.

On the Estimation of Cancer Risk and Non-cancer Hazard to Construction Workers from Measured Soil Vapor Concentrations

The risk and hazard to volatile organic compounds (VOCs) were estimated from soil vapor data collected at the site. In the absence of published soil vapor screening levels, Geosyntec derived site-specific soil vapor screening levels and compared them to the maximum VOC concentrations to estimate the risk and hazard.

Appendix A presents the derivation of site-specific soil vapor screening levels for a construction worker scenario. It contains a description of two models, reference list and two tables. The VOC Emissions Model serves to derive emission rates, while the X/Q model presents the derivation of a dispersion factor. Combining the results of those two models allows the derivation of air concentrations corresponding to the soil vapor concentrations measured at the site. However, a different approach was followed by Geosyntec.

The provided appendix is poorly presented, confusing and lacks details to allow reproduction of the results shown in tables.

Comment 14. There is no description of the steps followed in the calculation of those site-specific soil vapor screening levels.

Comment 15. The VOC emission model described by Geosyntec was replaced by the Volatilization Factor (VF) model (US EPA, 1996). No description of the VF model is provided in the appendix, although Table A-1 presents the parameters used to derive VFs for the VOCs measured in the site soil. The equation used to estimate the VFs shown under the table applies to industrial/commercial workers (US EPA, 2002). Instead, the consultant should have used the equation estimating subchronic volatilization factor for construction worker shown in section 4.9.6 of the Region 9 RSLs User's Guide (US EPA, 2017) and Eq. 5-14 (US EPA, 2002). In addition, the values for constants A, B, and C used to calculate the dispersion factor Q/C (p. 3 of the appendix) apply to industrial/commercial workers. The values applicable to construction worker are shown in Eq. 5-15 of the Supplemental Soil Screening Guidance (US EPA, 2002) and in the Region 9 User's Guide (US EPA, 2017). Accordingly, the VFs for the soil vapor COPCs presented in the first column of Appendix Table A-2 are incorrect.

Comment 16. P. 2 of the appendix shows an equation for estimating the total solute concentration CT. No reference is provided for the model and no derivation or reference is shown for the CT term. I was not able to match or reproduce this equation from the soil matrix partitioning equations derived by Feenstra et al., 1991 (DTSC, 2011a).

Comment 17. According to the remaining text on p. 2, *"The soil concentration term (ρb x soil concentration) in the US EPA soil equation* (in fact, DTSC, 2011a, Appendix E, according to Mr. R. Cheung, teleconference 10/10/2017) *was replaced by the total solute concentration associated with measured soil vapor concentrations."* That DTSC, 2011a partitioning equation was also used to derive a conversion factor (CFsoil-sv) equation shown under Table A-1 (e-mail from Mr. R. Cheung, Geosyntec, dated 10/12/2017). The CFsoil-sv conversion factor's derivation was not shown and I was not able to derive it from the DTSC, 2011a equation. Clear explanation of the derivation of the presented equations is needed.

Comment 18. Table 17 presents the maximum VOC concentrations, the derived construction worker cancer and non-cancer screening levels and the calculated risk and hazard. The screening levels are the soil vapor RBCs shown in Table A-2 of the appendix. The note under Table 17 refers to those construction worker screening levels as *"Ambient air screening levels calculated the same methodologies as DTSC's Recommended Screening Levels in Ambient Air but with default exposure parameters for a constructions worker…"* Measured soil vapor concentrations cannot be directly compared to ambient air concentrations. The note is confusing and needs to be revised or clarified.

To make the review of this section possible, the consultant needs to:

- Clearly describe the steps in the derivation of soil vapor screening levels;

- Eliminate the description of models and equations not used in this derivation;
- Provide references for all equations and derivation of the converted equations, e.g., for the CFsoil-sv;
- Provide support for all input parameter values.

The approach presented by Geosyntec is intended to estimate the cancer risk and non-cancer hazard due to inhalation of VOC gases in ambient air but omits the estimation of risk and hazard to construction worker due to exposure through ingestion of, dermal contact with, and inhalation of VOCs absorbed to particles.

I chose to address all the complete exposure pathways for the construction worker by:

1. Converting the maximum soil vapor concentrations measured at the site to soil concentrations using the DTSC, 2011a, Appendix E rewritten equation (Table 2 above);

2. Calculating the VFs for the VOCs in soil vapor (US EPA, 2017; US EPA, 2002)

Table 5. VFs for the VOCs in Soil Vapor

Chemical	VF, m^3/kg
Benzene	1.28E+03
Carbon tetrachloride	5.16E+02
1,1-Dichloroethene	4.01E+02
Ethylbenzene	2.01E+03
Methylene chloride	8.80E+02
Tetrachloroethene	8.37E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	3.51E+02
1,1,1-Trichloroethane	5.92E+02
Trichloroethene	8.09E+02
Trichlorofluoromethane	3.11E+02

3. Deriving the cancer and non-cancer total screening levels (combining the soil ingestion, dermal contact, and inhalation of particles and vapors in ambient air pathways) by following the RSL construction scenario equations (US EPA, 2017). To address subchronic exposure under the construction scenario, subchronic non-cancer toxicity values were applied, if available. The VFs calculated in step 2 were substituted in the derivation of screening levels for inhalation of vapors.

Table 6. Cancer and Non-cancer Total Soil Screening Levels

Chemical	SLs-c, mg/kg	SLs-nc, mg/kg
Benzene	7.30	144.27

Carbon tetrachloride	2.78	110.88
1,1-Dichloroethene	NC	79.33
Ethylbenzene	90.90	1,070.86
Methylene chloride	79.76	973.15
Tetrachloroethene	2.74	116.35
1,1,2-Trichloro-1,2,2-trifluoroethane	NC	66,199.53
1,1,1-Trichloroethane	NC	11,486.17
Trichloroethene	21.95	4.18
Trichlorofluoromethane	NC	1,087.83

Notes:
SLs-c Total soil screening concentration, cancer
SLs-nc Total soil screening concentration, non-cancer
NC Non-carcinogen or no data

4. The values for cancer risk and non-cancer hazard were calculated by dividing each converted soil concentration (Table 2) by the corresponding cancer and non-cancer screening level (Table 6), then multiplying the resulting quotient by 1.0E-06 for carcinogens, and by 1 for non-carcinogens. The total incremental lifetime cancer risk and the hazard index were calculated as a sum of the cancer risk and hazard quotient for each chemical.

Table 7. Cancer Risk to Construction Worker Due to the VOCs in Soil

Chemical	C_s, mg/kg	SLs-c, mg/kg	Cancer Risk
Benzene	1.33E-04	7.30	1.8E-11
Carbon tetrachloride	6.95E-05	2.78	2.5E-11
1,1-Dichloroethene	2.19E-05	NC	NC
Ethylbenzene	3.65E-04	90.90	4.0E-12
Methylene chloride	1.90E-03	79.76	2.4E-11
Tetrachloroethene	1.56E-03	2.74	5.7E-10
1,1,2-Trichloro-1,2,2-trifluoroethane	5.59E-05	NC	NC
1,1,1-Trichloroethane	1.46E-05	NC	NC
Trichloroethene	1.08E-03	21.95	4.9E-11
Trichlorofluoromethane	1.06E-05	NC	NC
		Total	7.00E-10

Notes:
Cs Soil concentration converted from measured maximum soil vapor concentration
SLs-c Total soil screening concentration, cancer
NC Non-carcinogen or no data

Table 8. Non-cancer Hazard to Construction Worker Due to the VOCs in Soil

Chemical	Cs, mg/kg	SLs-c, mg/kg	HQ
Benzene	1.33E-04	144.27	9.21E-07
Carbon tetrachloride	6.95E-05	110.88	6.27E-07

1,1-Dichloroethene	2.19E-05	79.33	2.76E-07
Ethylbenzene	3.65E-04	1,070.86	3.41E-07
Methylene chloride	1.90E-03	973.15	1.95E-06
Tetrachloroethene	1.56E-03	116.35	1.34E-05
1,1,2-Trichloro-1,2,2-trifluoroethane	5.59E-05	66,199.53	8.45E-10
1,1,1-Trichloroethane	1.46E-05	11,486.17	1.27E-09
Trichloroethene	1.08E-03	4.18	2.58E-04
Trichlorofluoromethane	1.06E-05	1,087.83	9.78E-09
		Hazard Index	0.0003

Notes:
Cs Soil concentration converted from measured maximum soil vapor concentration
SLs-c Total soil screening concentration, non-cancer
HQ Hazard Quotient

The total risk and hazard index calculated are below the levels typically acceptable under construction scenario (risk of 1.0E-05 and hazard of 1.0).

It should be noted that the above total screening levels are health (risk and hazard) – based and are derived for the purpose of estimating the risk and hazard. The soil screening levels are limited by each contaminant soil saturation concentration calculated using the corresponding supporting equation (US EPA, 2017), and are derived as the lower of the health-based and the saturation concentration. The resulting concentrations may be used to screen site contamination. The estimated soil saturation concentrations, C_{sat} for the site-related VOCs are shown in the table below:

C_{sat} for the VOCs in Soil Vapor

Chemical	C_{sat}, mg/kg
Benzene	1.97E+03
Carbon tetrachloride	4.46E+02
1,1-Dichloroethene	1.17E+03
Ethylbenzene	4.94E+02
Methylene chloride	4.45E+03
Tetrachloroethene	1.75E+02
1,1,2-Trichloro-1,2,2-trifluoroethane	5.61E+02
1,1,1-Trichloroethane	6.84E+02
Trichloroethene	7.80E+02
Trichlorofluoromethane	9.00E+02

Total Risk and Hazard for Construction Worker

The soil contaminants determined by Geosyntec to be of background origin are the major contributors to cancer risk and non-cancer hazard for construction workers. The hazard quotient for arsenic exceeds the typically acceptable level for non-cancer hazard.

The risk and hazard due to the non-volatile site-related contaminants are lower than typically accepted levels.

The total risk and Hazard Index due to site-related VOCs are negligible.

Conclusions

- Specific parts of the report are poorly presented, confusing and lack details to allow reproduction of the results shown in tables. Missing discussions, support, and/or references make the report difficult to review. LA RWQCB should decide on the need for report revision to make it understandable to the lay reader.

- LA RWQCB should decide on the need for additional sampling, e.g., hexavalent chromium, organochlorine pesticides, and soil vapor.

- The estimated risk and hazard consider all included COPCs. Several COPCs are assumed to be of background origin. LA RWQCB should decide on discarding or retaining those COPCs while making a decision on the need for construction workers' protection, i.e., exposure due to arsenic.

- Changes in the construction of a basement location to a different, non-sampled location may require additional sampling to assess the risk to human health at the new basement location.

- The results of this risk assessment may not be valid for an airport employee working under a schedule other than the "9/80 work schedule" used in this risk assessment.

- Using the maximum soil and soil vapor concentrations, I estimated the cancer risk and non-cancer hazard, and found them to be below the typically acceptable levels for the airport workers.

- Using the maximum soil and soil vapor concentrations, I estimated the cancer risk and found it to be below the typically acceptable level for construction workers. The Hazard index exceeds the acceptable level of 1. However, the major hazard contributor, arsenic, is considered to be of background origin.

Please do not hesitate to contact me at (916) 322-8364 or by e-mail at hhristov@oehha.ca.gov, if you have any questions related to this review.

Memorandum reviewed by:

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