eki environment & water

577 Airport Blvd. Suite 500
Burlingame, CA 94010
(650) 292-9100
ekiconsult.com

REVISED DRAFT – 18 July 2018

Mr. Jonathan Kusel, Ph.D.
Executive Director
Sierra Institute for Community and Environment
4438 Main Street
P.O. Box 11
Taylorsville, California 95983

Subject: Screening Level Human Health Risk Assessment
Crescent Mills Property
15690 Highway 89, Crescent Mills, California
(EKI B80024.00)

Dear Mr. Kusel,

EKI Environment & Water Inc. ("EKI") (formerly known as Erler & Kalinowski, Inc.) has prepared this Screening Level Human Health Risk Assessment ("SLHHRA") for the Crescent Mills Property at 15690 Highway 89, Crescent Mills, California (the "Site") (Figure 1). This SLHHRA includes an evaluation of potential human health risks during and after redevelopment of the Site using published screening levels and available soil and groundwater data for the Site.

It is EKI's understanding that the Sierra Institute for Community and Environment ("Sierra Institute") intends to redevelop the Site into an integrated wood products campus that will likely include a 3 megawatt ("MW") bioenergy facility; a wood chip processing, storage, and drying operation; and a dried and packaged firewood operation. The Site has a land use zoning of heavy industry. It is EKI's understanding that the United States Environmental Protection Agency Region 9 ("EPA") staff in the Brownfields Program is providing regulatory oversight for the Site. This document was prepared in general accordance with the Department of Toxic Substances Control's ("DTSC's") SLHHRA guidelines (DTSC, 2016), as recommended by EPA staff.

PURPOSE

The purpose of this memorandum is to assess human health risks for potentially exposed populations on-Site during construction and after redevelopment, based on intended future use.

SLHHRA METHODOLOGY

A description of the methodology used to evaluate human health risks at the Site, including a description of potentially exposed populations and potentially complete exposure pathways and the published screening levels used to evaluate available soil and groundwater for the Site, is provided below.

Published risk-based screening levels provide a quick and cost-effective way to evaluate available environmental data when the screening levels are based on similar potentially exposed populations to the ones relevant to a site.

Site Shallow Soil Dataset

Available shallow soil data for the Site were compiled from the: (1) *Targeted Site Investigation Report for the Crescent Mills Industrial Site* ("TSI Report"), *15690 Highway 89, Crescent Mills, California*, dated 28 April 2017 and prepared by Geosyntec (Geosyntec, 2017) and (2) *Additional Site Characterization Results for Southern Portion of Crescent Mills Industrial Site, 15690 Highway 89, Crescent Mills, California*, dated February 2018 and prepared by Sierra Streams Institute (Sierra Streams, 2018) (see Figure 2 and Tables 1 to 4). Shallow soil samples include samples collected up to 10 feet below ground surface ("bgs"), which is consistent with the San Francisco Bay Regional Water Quality Board ("SFRWQCB's") Environmental Screening Levels ("WB-ESLs")[1]. Soil sample data were used to evaluate the direct soil contact exposure pathways (i.e., incidental soil ingestion, dermal contact, and inhalation of particulates). The soil dataset includes a combination of discrete samples, multi-incremental samples, and 5-point composite samples.

The detected concentrations in the Site soil dataset were then compared to the selected screening levels, which are described below in the subsection titled "Selection of Soil Screening Levels". Chemicals with maximum concentrations above the screening criteria were identified as potential chemicals of concern ("PCOCs"). Representative concentrations (i.e., an estimate of the upper confidence limit ("UCL") of the mean concentration) were calculated for PCOCs if the soil dataset for that PCOC included at least 8 analyses and 4 detections. Representative concentrations were calculated for

[1] *Environmental Screening Levels*, prepared by the SFRWQCB, and dated February 2016, Revision 3.

PCOCs using ProUCL[2] (version 5.1.002). Statistical summaries of the Site PCOCs are tabulated below in Table B.

Site Shallow Groundwater Dataset

Available shallow groundwater data for the Site were compiled from the TSI Report (Geosyntec, 2017) (see Figure 2 and Table 5). According to the TSI Report (Geosyntec, 2017), groundwater in this area is encountered from approximately 5 to 10 feet bgs.

Potentially Exposed Populations

Based on the proposed land use and redevelopment plan for the Site, potentially exposed future populations to PCOCs in soil include:

- During redevelopment:
    - Construction workers involved in earthwork and subsurface construction activities, which may involve excavation within shallow soil. Potentially complete exposure pathways include soil ingestion, dermal contact with soil, and inhalation of particulates or vapors. No direct contact with groundwater is anticipated for construction workers because the Site will be filled before redevelopment and deep excavations (i.e., below the water table) are not anticipated during redevelopment.
- After redevelopment (it is assumed that the Site will be capped with hardscape and/or clean fill):
    - Industrial workers that would occupy potential future building(s) and work primarily indoors.[3] The only potentially complete exposure pathway is inhalation of vapors that migrate indoors from soil and/or groundwater. It is assumed that a municipal water supply source will provide water for future Site use. If the municipal water supply source is not of sufficient capacity for future Site use and groundwater is needed as a water supply source for the Site, the SLHHRA will be updated at that time.
    - Maintenance workers, who are employed full-time at the Site for 250 days per year over a period of 25 years. For 10 days per year, it is assumed that maintenance workers will dig into native soil (i.e., below the fill) to plant or maintain vegetation, or to install or repair sprinkler lines, electrical conduits, and

[2] The statistical software ProUCL was obtained from U.S. EPA's website: https://www.epa.gov/land-research/proucl-software.
[3] This scenario is more conservative and, therefore, protective of outdoor workers that only perform above ground surface tasks.

other subsurface utilities or improvements. For the remaining 240 days per year, maintenance workers will perform activities that are limited to outdoor above-ground work. While digging under the fill, potentially complete exposure pathways include soil ingestion, dermal contact with soil, and inhalation of particulates or vapors. No direct contact with groundwater is anticipated for maintenance workers because deep excavations (i.e., below the water table) are not anticipated after redevelopment. The only potentially complete exposure pathway is inhalation of vapors while doing maintenance activities above the fill.

Secondary potentially exposed future populations, such as visitors, vendors, and delivery personnel, are on-site for limited periods of time with very low exposure frequencies and their risks related to the Site are expected to be significantly less than estimated risks for the on-site workers described above.

Selection of Soil Screening Levels

Consistent with DTSC Note 4, DTSC-Modified Screening Levels ("DTSC-SLs") (DTSC, 2018) and U.S. EPA Regional Screening Levels ("RSLs")[4] (U.S. EPA, 2018) will be used to evaluate human health risks for industrial workers. Using these screening levels is very conservative because they include exposure pathways that are not complete for the Site's industrial workers (i.e., soil ingestion, dermal contact, and inhalation of particulates) as it is assumed that the Site will be capped with hardscape and/or clean fill. Because DTSC-SLs and RSLs do not include soil screening levels for a construction worker scenario, San Francisco Bay Regional Water Quality Board ("SFRWQCB's") Environmental Screening Levels ("WB-ESLs")[5] (SFRWQCB, 2016) will be used to evaluate human health risks for construction workers.

There are no published screening levels for maintenance workers. One option is to use the screening levels for the construction worker scenario, as it is equivalent for carcinogens and is more conservative in the case of non-carcinogens. The other option is to use U.S. EPA's online RSL calculator[6] for outdoor workers to estimate goals for maintenance workers. The U.S. EPA's online RSL calculator and exposure assumptions for maintenance workers shown in Table A below were used along toxicity data for PCOCs listed in DTSC's *Human Health Risk Assessment Note 3* (DTSC, 2018) to estimate goals for maintenance workers.
Table A below presents the exposure assumptions for the potentially exposed populations, which are based on the exposure assumption used to develop the respective

[4] U.S. RSLs will be used when a DTSC-SL is not listed for a specific PCOC.
[5] *Environmental Screening Levels*, prepared by the SFRWQCB, and dated February 2016, Revision 3.
[6] https://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search

screening levels:

Table A: Exposure Assumptions for Potentially Exposed Populations

Factor	Construction Worker[7]	Industrial Worker[8]	Maintenance Worker[5]
Exposure Duration (year)	1	25	25
Exposure Frequency (days/year)	250	250	10 (Excavation[(a)]) 240 (No Excavation)
Exposure Time (hours/day)	8	8	8
Body Weight (kg)	80	80	80
Surface Area Soil Exposure (cm^2)	3,527[(b)]	3,527[(b)]	3,527[(b)]
Adherence Factor (mg/cm^2)	0.8	0.12 0 (Capped Site)	0.8 (Excavation) 0 (No Excavation)
Soil Ingestion Rate (mg/day)	330	100 0 (Capped Site)	330 (Excavation) 0 (No Excavation)
Particulate Emission Factor (m^3/kg)	1.44E+06	1.36E+09 0 (Capped Site)	1.44E+06 (Excavation) 0 (No Excavation)

(a) Based on best professional judgement.

(b) Value based on weighted average of mean values for head, hands, and forearms.

Selection of Groundwater Screening Levels

Because DTSC-SLs and RSLs do not include groundwater screening levels for workers, WB-ESLs[9] will be used to evaluate human health risks for industrial workers. As indicated above, the only potentially complete exposure pathway for industrial workers is inhalation of vapors (i.e., inhalation of volatile PCOCs present in groundwater). The exposure of construction and maintenance workers to outdoor vapors coming from groundwater is significantly less than that of industrial workers, so only an evaluation for industrial workers will be performed.

[7] Based on WB-ESL Construction Worker.
[8] Based on RSL Composite Worker and DTSC-SL Commercial/Industrial Worker.
[9] Based on shallow groundwater vapor intrusion ESLs for commercial/industrial workers.

CONSTRUCTION AND MAINTENANCE WORKERS SOIL EVALUATION RESULTS FOR THE SITE

Maximum concentrations of PCOCs in soil in the Site soil dataset were directly compared to the Construction Worker soil ESLs and the estimated DTSC-SLs for Maintenance Workers. As shown in the table below, PCOCs detected in soil samples collected within the Site above the Construction Worker ESLs and/or DTSC-SLs for Maintenance Workers include arsenic, total petroleum hydrocarbons as diesel ("TPHd"), and 2,3,7,8-tetrachlorodibenzo-p-dioxin Toxic Equivalent ("2,3,7,8-TCDD TEQ").

Table B: Statistical Summary of PCOCs for Construction and Maintenance Workers in Site Soil

PCOC/Site Soil Data	Arsenic	TPHd - SG	TPHd - NSG	2,3,7,8-TCDD TEQ (pg/g)
Number of Samples	49	17	55	36
Frequency of Detection	94%	88%	47%	100%
Minimum Concentration (mg/kg)	1.3	1.1	0.6 J	0.61
Maximum Concentration (mg/kg)	130	1,600	1,600	170
Representative Concentration (mg/kg)	**22.2 - 48.7**[(a)]	604	205	20.4 - 60.4[(a)]
Site Background (mg/kg)	9.8[(b)]/4.7[(c)]	--	--	--
ESL for Construction Workers (mg/kg)	0.98	880	880	150
Estimated DTSC-SL for Maintenance Workers (mg/kg)	3	22,000	22,000	150

J = Estimated value mg/kg = milligrams per kilogram NSG = no silica gel cleanup
pg/g = picograms per gram SG = with silica gel cleanup

(a) The ProUCL software recommended a slightly lower UCL than the lower value of the range, but indicated that a nonparametric UCL would be more appropriate. The range of nonparametric UCLs is shown herein.
(b) From 0 to 3 feet bgs.
(c) Greater than 3 feet bgs.

Arsenic

The maximum arsenic concentration in the Site soil dataset is 130 milligrams per kilogram ("mg/kg") (shallow composite sample LP-SC03) and the second highest concentration is 65 mg/kg (shallow composite sample LP-SC02), which are above the Construction Worker

ESL of 0.98 mg/kg, the DTSC-SL for Maintenance Workers of 3 mg/kg, and the Site's background concentrations (see Figure 3[10]). Therefore, based on the available data, arsenic in soil is considered to pose a risk to future construction and maintenance workers. This risk can be mitigated with HAZWOPER trained construction workers and with the creation of clean utility corridors during redevelopment.

Nonetheless, if a specific area of the Site is shown to be within the Site's arsenic background concentration (e.g., by calculating the UCL with a smaller dataset that includes only sampling locations within that specific area), then HAZWOPER trained construction workers and creation of clean utility corridors would not be necessary in that area.

TPHd

The maximum TPHd concentration in the Site soil dataset is 1,600 mg/kg (shallow composite sample DU-8), which is above the Construction Worker ESLs of 880 mg/kg. The representative concentrations of TPHd with and without silica gel cleanup (604 mg/kg and 205 mg/kg, respectively) are below the Construction Worker ESL. Therefore, based on the available data, TPHd in soil does not pose a significant risk to future construction and maintenance workers.

2,3,7,8-TCDD TEQ

The maximum 2,3,7,8-TCDD TEQ concentration in the Site soil dataset is 170 pg/g (shallow composite DU-1), which is above the Construction Worker ESL and DTSC-SL for Maintenance Workers of 150 pg/g. The representative concentration of 2,3,7,8-TCDD TEQ is below the Construction Worker ESL and DTSC-SL for Maintenance Workers. Therefore, based on the available data, 2,3,7,8-TCDD TEQ in soil does not pose a significant risk to future construction and maintenance workers.

Additional PCOCs to Consider

The following table shows PCOCs that were not detected above laboratory reporting limits, but that had elevated reporting limits, so it is unclear if they pose a risk to future construction workers because some of the reporting limits (35%) were above the Construction Worker ESL.

[10] The areas of the Site that exceed the arsenic background levels are shown in orange on Figure 3. These areas are based on the area represented by each sample.

Table C: Statistical Summary of Additional Non-Detect PCOCs

PCOC/Site Soil Data	Benzo(a)pyrene
Number of Samples	34
Frequency of Detection	0%
Minimum Reporting Limit (mg/kg)	0.005
Maximum Reporting Limit (mg/kg)	11
Number of Samples with Reporting Limit above 1.6 mg/kg	12 (35%)
ESL for Construction Workers (mg/kg)	1.6
Estimated DTSC-SL for Maintenance Workers (mg/kg)	12

INDUSTRIAL WORKERS SOIL EVALUATION RESULTS FOR THE SITE

As indicated above, the only potentially complete exposure pathway for industrial workers is inhalation of vapors (i.e., inhalation of volatile PCOCs). Similar to the evaluation performed for construction and maintenance workers, maximum concentrations of volatile PCOCs in soil in the Site soil dataset were directly compared to the RSLs and DTSC-SLs for industrial workers. No volatile PCOCs were detected above the applicable screening levels. Therefore, based on the available data, volatile PCOCs in soil are not considered to pose a risk to future industrial workers.

INDUSTRIAL WORKERS GROUNDWATER EVALUATION RESULTS FOR THE SITE

No volatile PCOCs were detected above laboratory reporting limits in groundwater samples collected from the Site (see Table 5). Therefore, based on the available data, volatile PCOCs in groundwater are not considered to pose a risk to future construction, industrial, and maintenance workers.

CONCLUSIONS

The primary risk driver for potentially exposed future populations under existing Site conditions is arsenic. The calculated representative concentration of arsenic in soil is 22.2 to 48.7 mg/kg, which is approximately 3 times greater than the Site-specific arsenic background concentration in the upper 3 feet of soil of 9.8 mg/kg, as reported in the TSI Report (Geosyntec, 2017).

DISCUSSION OF HHRA RESULTS IN CONTEXT WITH FUTURE SITE REDEVELOPMENT PLANS

The Plumas County Planning Department has advised that future structures at the Site have foundation elevations that are at least 1 to 2 feet above the current ground surface due to flooding concerns. Because of this, it is anticipated that the portions of the Site that will be redeveloped and accessible to future industrial workers will be covered with at least 1 to 2 feet of clean fill and/or be covered with hardscape. Access would be restricted to portions of the Site that would not be redeveloped at this point in time. In the context of future redevelopment plans for the Site, potential exposure pathways for future industrial workers would be incomplete. Therefore, the only potentially exposed future populations would be earthwork construction workers and maintenance workers.

Based on the SLHHRA results, future earthwork construction workers who would potentially contact impacted Site soil would require Occupational Safety and Health Administration ("OSHA") Hazardous Waste Operations and Emergency Response Standard ("HAZWOPER") training. Earthwork and redevelopment activities would include grading, trenching, digging of footings and foundations, and installation of subsurface utilities. This type of work is typically performed by several different contractors. Thus, future earthwork construction workers are unlikely to be exposed to chemicals as frequently or for as long a duration as assumed in exposure assumptions used in the selected screening criteria.

Clean utility corridors and a visible delineation marker of when native impacted soil is encountered are engineering control methods that can be employed at the Site to cut off potential exposure pathways for future maintenance workers.

Development and implementation of potential institutional and engineering controls might require an evaluation of potential remedial alternatives for the Site, preparation of a remedial action work plan with a soil management plan, an operation and maintenance, and other requirements as deemed appropriate by EPA staff.

Please call if you have any questions.

Very truly yours,

EKI ENVIRONMENT & WATER, INC.

Joy Su, P.E.
Project Manager

Earl James, P.G.
Vice President

cc: Camille Swezy, Sierra Institute for Community and Environment

EMBEDDED TABLES

Table A	Exposure Assumptions for Potentially Exposed Populations
Table B	Statistical Summary of PCOCs for Construction and Maintenance Workers in Site Soil
Table C	Statistical Summary of Additional Non-Detect PCOCs

ATTACHED TABLES

Table 1	Analytical Results for Metals in Soil
Table 2	Analytical Results for PAHs, TPH, and VOCs in Soil
Table 3	Analytical Results for Anti-Stain Agents and PCBs in Soil
Table 4	Analytical Results for Dioxins and Furans in Soil
Table 5	Analytical Results for TPHg and VOCs in Groundwater

FIGURES

Figure 1	Site Map
Figure 2	Sampling Locations
Figure 3	Arsenic in Soil above Background Levels

REFERENCES

DTSC, 2016. Human Health Risk Assessment (HHRA) Note 4 – Screening Level Human Health Risk Assessment, 26 October 2016.

DTSC, 2018. Human Health Risk Assessment (HHRA) Note 3 – DTSC-Modified Screening Levels (DTSC-SLs), June 2018.

Geosyntec, 2017. Targeted Site Investigation Report for the Crescent Mills Industrial Site, 15690 Highway 89, Crescent Mills, California, 28 April 2017.

SFRWQCB, 2016. Environmental Screening Levels, February 2016, Revision 3.

Sierra Streams Institute, 2018. Additional Site Characterization Results for Southern Portion of Crescent Mills Industrial Site, 15690 Highway 89, Crescent Mills, California, February 2018.

U.S. EPA, 2018. Regional Screening Levels (RSLs) – Generic Tables, May 2018.