INTEROFFICE MEMORANDUM
February 3, 2015

TO: **Jim Karas – Director of Engineering** SK for Jim Karas

VIA: **Sanjeev Kamboj – Engineering Manager** SK
Daphne Chong - Toxicologist DC

FROM: **Ted Hull – Senior Air Quality Engineer** TH

SUBJECT: **Review of Addendum to the Health Risk Assessment for Lehigh Southwest Cement, BAAQMD Plant #17, Application #26247**

SUMMARY: I have reviewed the modeling and health risk results from the October 2014 Health Risk Assessment Addendum (HRA Addendum) for Lehigh Southwest Cement prepared by AMEC Environment & Infrastructure, Inc. and submitted to the BAAQMD on October 29, 2014. The addendum was prepared in response to public comments and supersedes the findings of the HRA previously submitted to the BAAQMD on February 3, 2014 (2013 HRA). Based on the data provided in Lehigh's submittal and the exceptions outlined in this report, I have concluded that the proposed stack modifications allow the facility to operate at a capacity of 1,600,000 tons/yr of clinker production with potential toxic risk values that are below the public notification levels of significance established by the BAAQMD for the Hot Spots program and is in compliance with BAAQMD Regulation 9-13-303. Furthermore, the demonstration was made that Lehigh would not (at actual production rates) have exceeded notification thresholds during the two years preceding the startup of the new kiln stack; when those years are averaged with sixty eight years going forward with the new stack configuration at maximum permitted capacity.

BACKGROUND: The 2013 HRA was prepared in order to demonstrate that modifications to the exhaust systems of the Cement Kiln and Clinker Cooler would allow the facility to operate at its full permitted production capacity of 1,600,000 tons per year of clinker without exceeding the notification thresholds established under the Air Toxics "Hot Spots" Information and Assessment Act (a maximum increased cancer risk of 10.0 in a million and hazard indices of 1.0 or less). This demonstration is required to comply with BAAQMD Regulation 9-13-303. The proposed modifications were submitted to the BAAQMD under Permit Application #26247 and include the replacement of the current 34 stack kiln vent system with a single 15 ft. diameter 295 ft. tall kiln stack; and the replacement of the current 10 stack clinker cooler vent system with a single 116 ft. tall stack. The conclusion of the 2013 HRA review by the BAAQMD was that the proposed stack modifications allow the facility to operate at a capacity of 1,600,000 tons/yr of clinker production with potential toxic risk values that are below the public notification levels of significance established by the BAAQMD for the Hot Spots program. The BAAQMD issued an Authority to Construct for the stack modifications on 06/18/14.

Following the BAAQMD review of the 2013 HRA, public comments were received that put the findings in question. Comments included the following substantive issues:

1. Meteorological data from an offsite source was improperly used in the 2008 Comprehensive Emission Inventory Report (CEIR) for wind gust data used to estimate fugitive dust emissions from stockpiles and roadways.
2. A five day operating schedule was used in fugitive PM emission calculations for plant roadways to coincide with the plant work schedule. However, part of the roadway emissions are from wind erosion not dependent on any traffic.
3. The basis for estimating benzene emissions from the cement kiln was flawed due to a BAAQMD error in interpreting source test results.

The HRA Addendum addresses these issues as follows:

1. Lehigh used wind speed/wind gust data from their on-site meteorological station to recalculate emissions from wind erosion.
2. As of 2009, the quarry only operated five days per week, and this operating schedule was taken into account in wind erosion calculations. It is now assumed that all plant sections, including the quarry, operate 7 days/week, and thus the wind erosion calculations have been revised accordingly
3. The benzene emission rate from the kiln was corrected.

The findings of the HRA Addendum report were verified by the BAAQMD through separate, independent AERMOD modeling runs. Source locations and parameters were checked, a new receptor grid was created, and an alternate methodology for assigning risk values to modeled pollutant concentrations was employed. BAAQMD model runs were refined to include changes to the emission rates of some toxic air contaminants from the kiln due to additional source test results.

EMISSIONS: With the exception of Arsenic, Benzene, Hexavalent Chromium, Mercury, and Nickel emissions from the cement kiln, the toxic air contaminant (TAC) emissions used by the BAAQMD in the evaluation are from the AMEC/Lehigh HRA Addendum and represent the facility TAC emissions at a clinker production rate of 1,600,000 tons/yr. Table 1 below shows the differences in the modeled values for the cement kiln used by AMEC/Lehigh and BAAQMD. All BAAQMD values are based on source test averaging.

Table 1: Exceptions to AMEC/Lehigh HRA Addendum Emissions Values

Compound	Annual (lb/yr)		Hourly (lb/hr)	
	AMEC/Lehigh	BAAQMD	AMEC/Lehigh	BAAQMD
Arsenic	0.87	2.20	1.10E-04	1.01E-03
Benzene	16,160	16,268	2.33E+00	2.89E+00
Hex Chromium	0.45	2.29	4.87E-05	3.84E-04
Mercury	88.00	99.29	1.10E-02	1.74E-02
Nickel	7.60	32.15	9.46E-04	5.91E-03

It should also be noted that significant changes were made to the modeled values of TACs in the Fugitive source group, which includes dust emissions from wind erosion and on-site vehicle traffic. The change in emissions is three part as follows:

1. The wind speed/wind gust data originally used in the 2008 CEIR was found to be faulty and was replaced with data from the on-site meteorological station at Lehigh. This generally increased calculated wind erosion emissions due to higher wind gust data.
2. The operating schedule used to estimate PM emissions from the quarry was changed from 5 days/week to continuous operation as noted above. This also increases the calculated emissions in the source group.
3. Half detection values for hexavalent chromium (CR+6) were replaced with zero for compounds for which analytical testing returned non-detect for all samples analyzed*. This removed CR+6 from eight of the thirteen sampled materials that were originally modelled with CR+6 emissions. This refinement to the HRA is in accordance with AB2588 "Hot Spots" Inventory Guidelines Appendix D "Source Testing: Summary of Requirements for Measurements and Alternatives", which states that only substances present in detectable quantities are to be included in the inventory.

* *Previously, all stock piled materials and roadway dust samples that contained chromium in any form were assumed to contain hexavalent chromium at half the detection value if CR+6 was not otherwise detected.*

MODELING:
The AERMOD air dispersion computer model was used to estimate annual average and maximum 1-hour average ambient air concentrations for receptors in the area of the source. Model runs were made with onsite surface meteorological data and local land use data for calendar year 2006 and a one year period that includes portions of 2010 and 2011. Cloud cover data for the same time periods was taken from the San Jose International Airport ASOS station. Upper air data for the same time periods was taken from the closest representative NWS station that met the USEPA required 90% data recovery rate, the Oakland International Airport station. Land use parameters including surface roughness length, albedo, and Bowen ratio were evaluated using the USEPA AERSURFACE tool. Completed AERMET meteorological sets used in the model were prepared by BAAQMD meteorology staff. The model is referenced in NAD 83 UTM coordinates and uses terrain data from San Mateo and Santa Clara West 10m NED files. The model assumes rural land use. Source emissions were modeled either as individual emissions points (point sources); or as aggregations of fugitive emissions from a number of related sources (volume sources). Source parameters were provided by AMEC/Lehigh.

RISK ASSESSMENT: TAC emissions entered into the model were adjusted for toxicity and assumed exposure levels; to derive a risk based emission factor adjustment for each receptor category. Using this approach, the model calculates increased Cancer Risk (in terms of chances in a million), Chronic Hazard Index (HI), and Acute HI directly. Dose and risk values for each category were obtained using the HARP 1.4f computer program. Cancer and chronic noncancer risk estimates include exposure from both inhalation and oral pathways. The Chronic and Acute hazard indices (HI) are based on the highest impacted targets organ systems for each category. For Chronic HI, the most impacted organ system is Respiratory, while for Acute HI it is the Immune system.

Estimates of residential risk assume potential exposure to annual average TAC concentrations occur 24 hours per day, 350 days per year, for a 70-year lifetime. Cancer risk adjustment factors (CRAFs) were used to calculate all cancer risk estimates. The CRAFs are age-specific weighting factors used in calculating cancer risks from exposures to infants, children and adolescents, to reflect their anticipated special sensitivity to carcinogens. The estimated maximum potential health impacts found by BAAQMD modeling are presented in Table 2 below.

Note: The Chronic and Acute Reference Exposure Levels (RELs) for Benzene were revised by OEHHA in 2014. The REL is the air concentration or exposure level (for a specified exposure duration) at or below which adverse non-cancer health effects are not anticipated to occur in the general human population. Therefore, the lower the REL, the more hazardous the compound is assumed to be. Benzene RELs were changed as follows: Acute, from 1,300 ug/m^3 to 27 ug/m^3; Chronic, from 60 ug/m^3 to 3 ug/m^3. The HRA Addendum uses the new Benzene RELs.

Table 2: Modeled Impacts – New Kiln Stack, Maximum Permitted Production

Receptor Type	Cancer Risk	Non-cancer Hazard Index (HI)	Max. Acute Non-cancer HI
MEI	9.9 in a million	0.15	N/A
PMI	N/A	N/A	0.45

As shown in Table 2, the maximally exposed individual (MEI) receptor is below the AB2588 notification levels (10.0 in a million, 1.0 HI) for Cancer Risk and Chronic HI. The point of maximum impact (PMI) receptor for Acute HI is below the notification level (1.0).

Table 3: Summary of Impacts

Receptor	NAD 83 UTM Coordinates		Health Impact[3]	Impacts From Each Component				Total Risk Value
	Easting (x)	Northing (y)		Kiln	Clinker Cooler	Group DC[4]	Group FUG[5]	
Residential: Maximum (MEI)[1]	581,533	4,130,691	Cancer	0.18	0.41	5.52	3.76	**9.87**
			Chronic	0.001	0.002	0.046	0.098	**0.148**
Off-site Worker:	581,007	4,131,621	Cancer	0.01	0.04	0.41	0.41	**0.87**
			Chronic	0.001	0.002	0.025	0.077	**0.104**
Highest Offsite (PMI)[2]	581,810	4,130,215	Acute	0.01	0.00	0.32	0.13	**0.45**

Notes:
1. Highest residential receptor is located at the top of Voss Avenue.
2. Highest offsite 1-hour (Acute HI) impact area is near the water towers near the eastern boundary of the Lehigh property.
3. Health impacts are: Cancer Risk in a Million, Chronic HI, and Acute HI.
4. Group DC primarily consists of emissions associated with stack emissions from dust collectors.
5. Group FUG primarily consists of fugitive dust emissions from the facility.

ALTERNATE SCENARIO:
In addition to the demonstration that the modified cement kiln and clinker cooler stacks will enable Lehigh to operate at full permitted capacity going forward, AMEC also included a scenario that includes 2-years at the current configuration combined with 68 years at the new configuration (for 70 years of total residential exposure). This evaluation shows that cancer risk at the MEI (resident) is below 10.0 in a million when higher short term impacts are averaged with a longer period of reduced impacts due to better dispersion from the new stack configuration. Shorter term averages for chronic HI (1-year) and acute HI (1-hour) consider only the "current configuration", which is the kiln and clinker cooler stack configurations that existed prior to the completion of the new stacks.

The BAAQMD's evaluation, which includes higher emissions rates for some key pollutants as shown above in Table 1, finds that at actual production rates for the 2-years preceding the new stack installation and the maximum permitted rate thereafter, the facility would not exceed Hot Spots notification levels.

CONCLUSION: Dispersion modeling by AMEC (on behalf of Lehigh) and by the BAAQMD demonstrates that modifications to the cement kiln and clinker cooler exhaust systems as described in Permit Application #26247 will allow the Lehigh Southwest Cement Plant to operate at production capacity of 1,600,000 tons per year of clinker without exceeding the notification thresholds established under the Air Toxics "Hot Spots" Information and Assessment Act. Furthermore, modeling shows that the calculated health risks associated with emissions of toxic air contaminants from the kiln including Benzene, Hexavalent Chromium, Mercury, and Nickel are significantly mitigated by the proposed new exhaust stack configuration. Whereas under the current configuration the kiln accounts for approximately 70% of the potential cancer risk to the highest residential receptor, the cancer risk from the kiln is reduced to approximately 2% with the proposed new exhaust stack.

IMAGES: The following images show AERMOD modeling results depicting Cancer Risk to the highest residential and worker receptors (Images #1 and #2) and the Acute and Chronic HI at the PMI and MEI (Images #3 and #4).

Image 1: Residential Cancer Risk in a Million

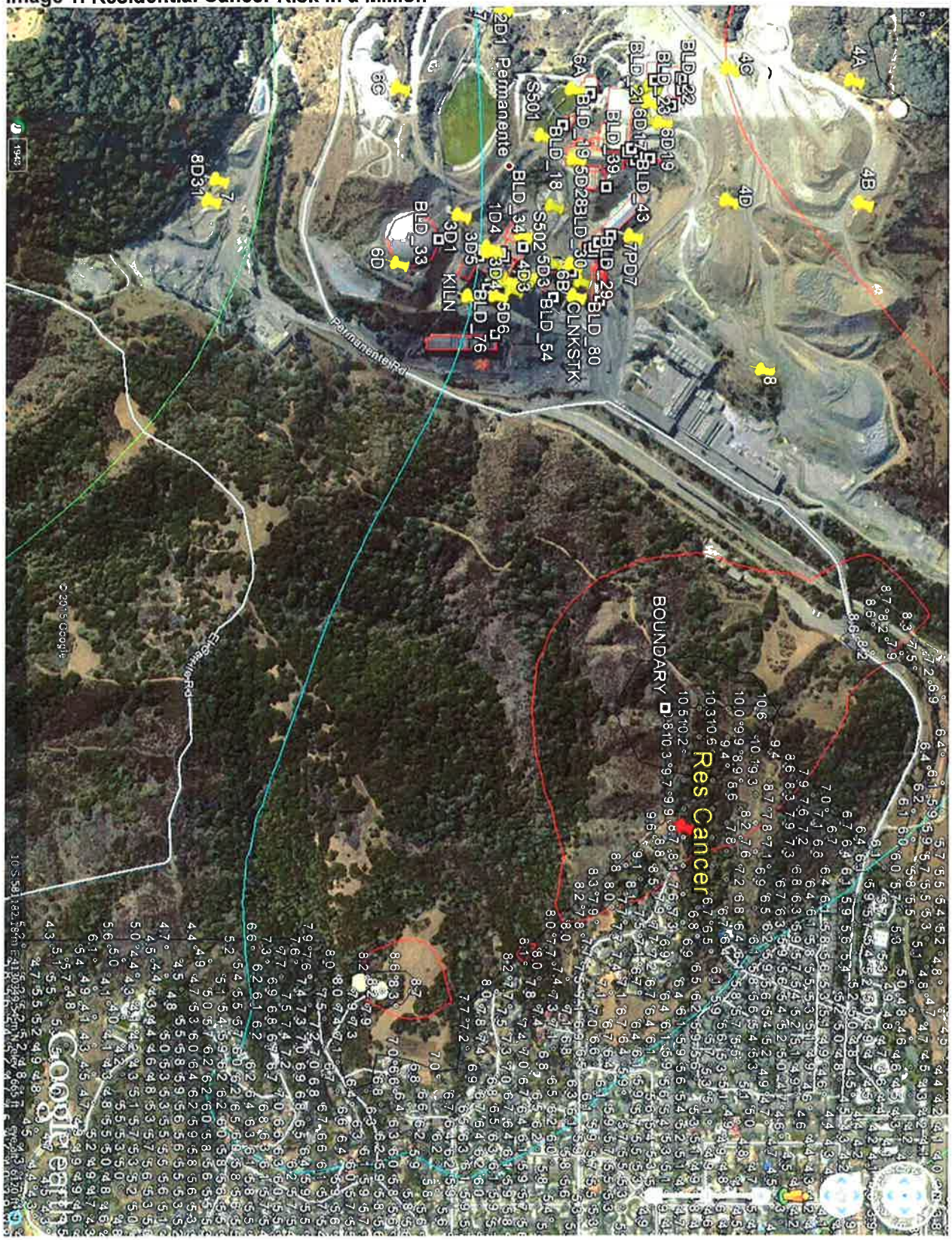

Image 2: Off-site Worker Cancer Risk in a Million

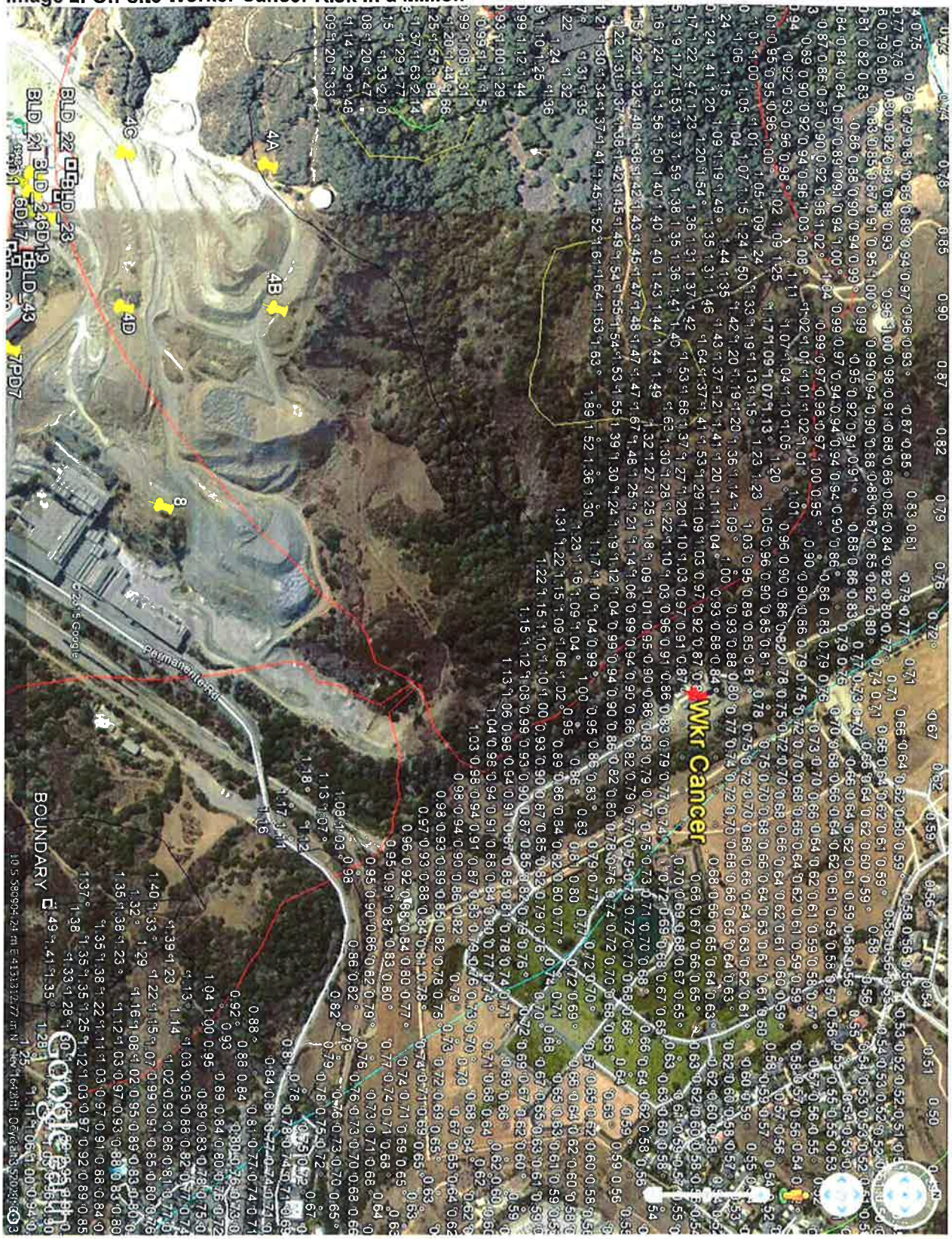

Image 3: Acute HI, PMI

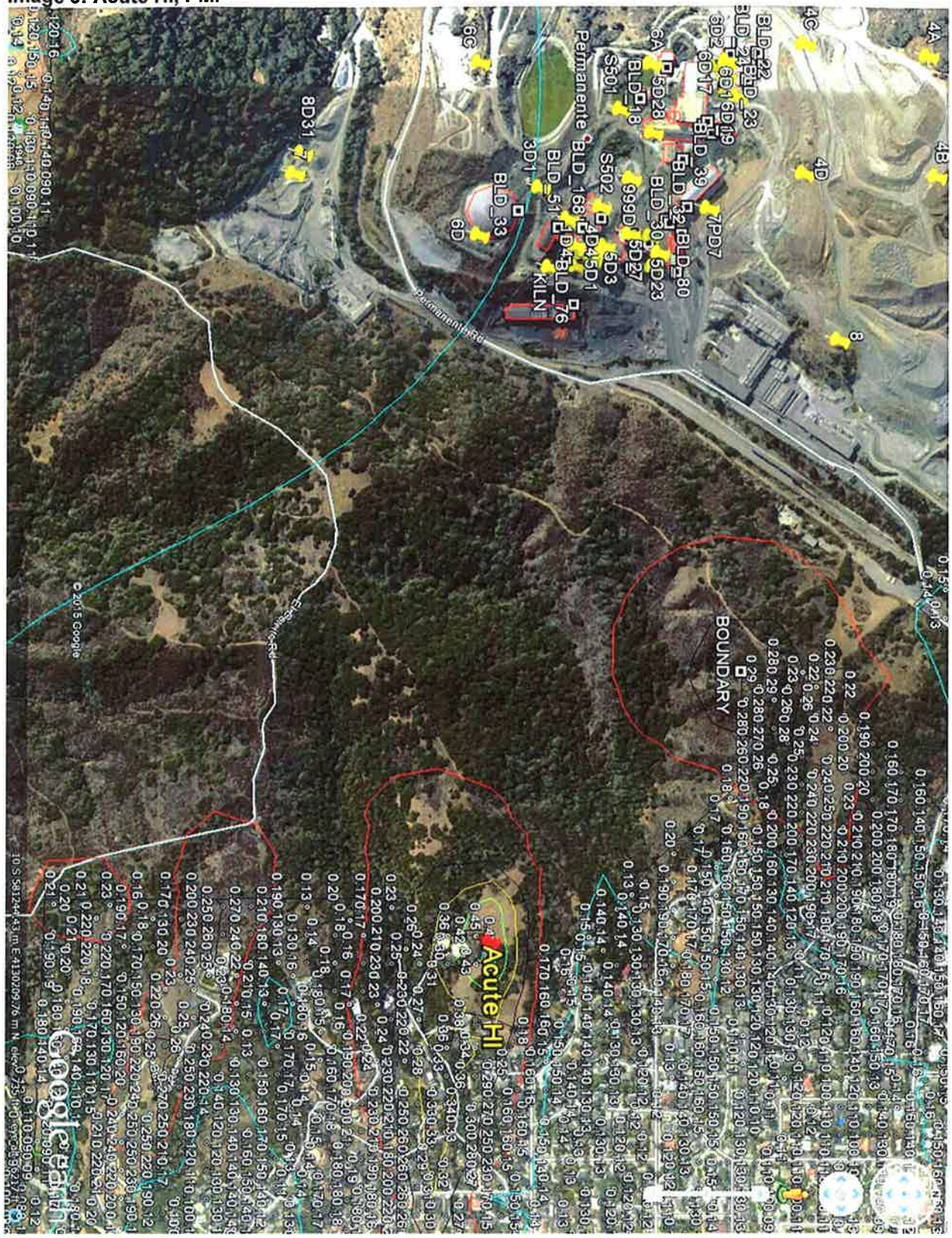

Image 4: Chronic HI, MEI