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Addendum to Health Risk Assessment
Evaluation of Toxic Air Contaminant Impacts
AB2588 Air Toxics Hot Spots Program

for

Lehigh Southwest Cement Company, Plant #17

Facility Address:
24001 Stevens Creek Blvd.
Cupertino, CA 95014

Submitted to:
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May 2013

Addendum to Health Risk Assessment for:

Lehigh Southwest Cement Company (Plant #17)

A: EXECUTIVE SUMMARY:

Because production rates at this facility fluctuate and because the emission rates of some toxic compounds are no longer consistent with those used in the 2011 Health Risk Assessment (HRA), staff has prepared an addendum to the analysis. The addendum provides an estimate of the upper limit of production at which the facility can operate with a reasonable assurance that the AB2588 notification levels are not exceeded. Cancer risk to the maximally exposed receptor was linked to the clinker production rate of the kiln to obtain a scalable value. Refinements to the emission rates of key pollutants are included in the estimate.

The HRA determined that the primary pollutants of concern at Lehigh were benzene, hexavalent chromium, and mercury; therefore these three pollutants are the focus of this analysis. Since the completion of the HRA, process changes have significantly reduced emissions of mercury. Also, source testing has shown that emissions of benzene are not consistent from test to test and should be averaged for more accuracy. Accounting for these factors, cancer risk is now the driving risk factor (the reduction in mercury having substantially lowered the acute HI). Scaling to a maximum cancer risk of 10.0 in a million, the corresponding maximum clinker production rate was determined to be **1,116,071 tons/yr**.

B. BACKGROUND:

District staff and the California Environmental Protection Agency's (Cal/EPA's) Office of Environmental Health Hazard Assessment (OEHHA) reviewed a Health Risk Assessment (HRA) submitted on behalf of the Lehigh Southwest Cement Company (Cupertino) for the Air Toxics "Hot Spots" Information and Assessment Act (Assembly Bill 2588, AB2588, Connelly, 1987) program. See Appendix A. The HRA was conducted by AMEC Geomatrix using approved modeling and risk calculation procedures and was submitted to the BAAQMD for approval on March 30, 2011. The Environmental Protection Agency's AERMOD dispersion model (a refined model) was used in combination with actual meteorological data representative of the area around Lehigh. All meteorological data used in the model was collected and processed by the District. Model inputs were based on emissions provided by Lehigh and approved by the District. Health risk values were calculated using the CARB Hotspots Analysis and Reporting Program (HARP) Version 1.4a.

The findings of the HRA were as follows:

Maximum Cancer Risk:	9.1 in a million
Maximum Chronic Hazard Index:	0.12
Maximum Acute Hazard Index:	1.5*

* The Acute Hazard Index (HI) is above the BAAQMD action level for public notification (cancer risk of 10 in a million and hazard indexes of one). However, the highest modeled values were found to occur infrequently and in areas where human exposure is unlikely to occur. The highest actual receptor had a HI less than 1.0.

Based on these findings, it was determined that the facility was below the AB2588 notification levels (10.0 in a million and 1.0 HI chronic/acute) for Cancer Risk, Chronic HI, and Acute HI (as noted). The approved HRA was based on the toxic air contaminant (TAC) emissions associated with a clinker production rate of 951,790 tons per year. Final approval of the analysis was published by the District on November 8, 2011 (see Appendix C). The approved HRA is the baseline for the scaled risk estimates included in this addendum.

C. ASSUMPTIONS AND SCALING METHODOLOGY:

The risk-based production rate includes refinements to the emission rates of benzene, hexavalent chromium, and mercury. Refinements were made in accordance with the following findings:

- The risk drivers identified in the 2010/2011 HRA are benzene and hexavalent chromium for cancer; and mercury for chronic/acute hazard indexes.
- Benzene and mercury emissions are primarily from the kiln, while hexavalent chromium is emitted primarily from cement processing and storage operations and to a lesser extent from the kiln.
- The updated benzene emission rate is based on the average of all recent District-approved benzene emission source tests of Lehigh's cement kiln, where the kiln is fired using the current fuel (coke).
- Four benzene emission source tests were done from 2009-2012.
- One of the tests was not used, since the clinker production rate was not known.
- Using the average of all available source tests is reasonable, since the benzene emission rate is variable in the clinker and in Lehigh's process.
- The hexavalent chromium emission rate is declining based on actual recent source test data.
- The mercury emission rate is declining based on actual recent CEM data.

TAC emissions in terms of clinker production were estimated using the following assumptions:

1. The average benzene emission rate from the kiln for the years 2009, 2011, and 2012 is 4,666.2 lb/yr (source test).
2. The current hexavalent chromium emission rate from the kiln is 0.318 lb/yr (2012 source test).
3. The current mercury emission rate from the kiln is 118.7 lb/yr (2012 CEM data).
4. The average clinker production rate for the years 2009, 2011, and 2012 is 999,774 tons per year.
5. The 2012 clinker production rate was 1,127,500 tons per year.
6. The baseline clinker production rate is 951,790 tons per year (HRA).
7. In the HRA, the kiln accounts for 55.7% of cancer risk at the MEI (residential), while dust collectors and fugitive sources make up the remainder (44.3%).
8. After adjustment for new emission factors the cancer risk ratio becomes 52.8% (kiln) and 47.3% (other). The adjusted ratio is assumed to remain the same for the purpose of the scaling exercise.
9. Emissions of all existing TACs evaluated in the HRA are assumed to be scalable with the production rate.

Based on the above assumptions, the adjusted emission factors for benzene, hexavalent chromium, and mercury are as follows:

Benzene:	4.67 E-03 lb/ton clinker (4,666.2 lb / 999,774 tons)
Hexavalent Chromium:	2.82 E-07 lb/ton clinker (0.318 lb / 1,127,500 tons)
Mercury:	1.05 E-04 lb/ton clinker (118.7 lb / 1,127,500 tons)

Applying these emission factors to the HRA baseline clinker production rate and replacing the values in the risk model changes the MEI cancer risk from 9.1 in a million to 8.53 in a million (4.50 from the kiln and 4.03 from dust collectors and fugitive sources). The overall cancer risk factor (CRF) at the MEI in terms of clinker production is then:

CRF = (8.53 in a million) / (951,790 tons/yr clinker)
= *8.96 E-06 CR in a million/ton/yr of clinker*

For a maximum cancer risk of 10.0 in a million, the corresponding maximum clinker production rate (CPR) would be:

CPR = (10.0 CR in a million) / (8.96 E-06 CR in a million / ton/yr of clinker)
= 1,116,071 tons/yr of clinker

D. CONCLUSION:

This addendum is intended to provide some short-term flexibility to allow Lehigh to demonstrate that it is below AB 2588 notification levels at production rates that exceed the production rate used in the HRA. Since the maximum clinker production rate was calculated based on a specific set of assumptions, it should be used with caution and only as long as the assumptions are valid.

E. RECOMMENDATIONS:

Based on the findings of this Addendum to the HRA for Lehigh Southwest Cement Company, the BAAQMD makes the following recommendations:

1. The BAAQMD should use 1,116,071 tons/yr of clinker production as the current upper limit for demonstrating compliance with Regulation 9-13-303.
2. Lehigh and the BAAQMD should use 1,116,071 tons/yr of clinker production as a loose guideline for discussing near term permit limits or ongoing compliance with Regulation 9-13-303.
3. If Lehigh seeks a higher clinker production rate than 1,116,071 tons/yr, then Lehigh should refine and resubmit the HRA to demonstrate that it can continue to be below the Air Toxics “Hot Spots” notification thresholds.

APPENDIX A

Air Toxics Hot Spots Program Overview

The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588, Connelly, 1987) established a formal regulatory program for site-specific air toxics emissions inventory and health risk quantification that is managed by California air districts. Under this program, a wide variety of industrial, commercial, and public facilities are required to report the types and quantities of toxic substances their facilities routinely release into the air. The goals of the Air Toxics Hot Spots Program are to collect emissions data, to identify facilities with potential for localized health impacts, to ascertain health risks, to notify nearby residents of risks that are determined to warrant such notification, and to reduce significant risks.

There are five steps to implementing the ATHS program. Guidelines have been developed for all five steps to establish a consistent, science-based, methodology for implementing the program. The five steps are briefly described as follows:

- Air Toxics Emissions Inventory: Subject facilities are required to prepare and submit a comprehensive emissions inventory plan followed by a toxics emissions inventory report. Each facility's emissions inventory must be updated on a periodic basis (in order to reflect changes in equipment, materials, and production levels at the facility).
- Prioritization: Each facility is prioritized for potentially significant health impacts based on the quantity and toxicity of emissions, and the proximity of nearby residents and workers.
- Health Risk Assessment: Facilities that are determined to be "high priority" are required to prepare a comprehensive HRA. The air district and Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA) review the HRA.
- Public Notification: If the health risks resulting from the facility's emissions exceed action levels established by the air district, the facility is required to perform notification to all exposed persons regarding the results of the HRA. The BAAQMD has established a cancer risk of 10 in a million and a noncancer Hazard Index of 1.0 as ATHS public notification levels.
- Risk Reduction: If the health risks resulting from the facility's emissions exceed significance levels established by the air district, the facility is required to conduct an airborne toxic risk reduction audit and develop a plan to implement measures that will reduce emissions from the facility to a level below the significance level within five years. The BAAQMD has established a cancer risk of 100 in a million and a noncancer Hazard Index of 10 as ATHS mandatory risk reduction levels.

APPENDIX B

BAAQMD HRA Review

INTEROFFICE MEMORANDUM

October 26, 2011

TO: **Plant File, Lehigh Southwest Cement** **Via:** **Brian Bateman**
Scott Lutz

FROM: **Ted Hull**

SUBJECT: **Review of Revised AB2588 Health Risk Assessment (March 2011) for Lehigh Southwest Cement, BAAQMD Plant #17.**

SUMMARY: I have reviewed the modeling and health risk results from the Revised AB2588 Health Risk Assessment for Lehigh Southwest Cement prepared by AMEC Geomatrix and submitted to the BAAQMD on March 30, 2011. Based on the source mass emissions and release point characteristics provided in the report, I agree with their conclusion that the current and projected health risks from stationary sources at Lehigh are below the public notification levels of significance established by the BAAQMD for the AB2588 Toxic Hot Spots program.

The results of the AMEC report were checked through separate, independent AERMOD modeling runs. Source locations and parameters were verified, a new receptor grid was created, and an alternate methodology for assigning risk values to modeled pollutant concentrations was employed. In addition, refined modeling runs were performed in an effort to more accurately represent the plume characteristics from the kiln stacks. The focus of the review was the current (2011) emissions scenario, which includes a reduction of Mercury emissions from the Calcining Kiln resulting from a recent process modification.

EMISSIONS: Toxic air contaminant (TAC) emissions used by the BAAQMD to verify the HRA are based on 2010 production and were provided in the AMEC report. The difference between 2010 and 2011 emissions is a reduction of Mercury emissions from the Kiln from a recently implemented sorbent injection operation. Mercury emissions have been reduced from 546 lb/yr and 0.129 lb/hr to <u>261 lb/yr and 0.064 lb/hr</u>. The reduction of Mercury is verifiable and has been made a condition of the permit to operate

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. Cloud cover data for the same time period was were taken from the San Jose International Airport ASOS station. Upper air data for the same time period was taken from the closest representative NWS radiosonde station that met the USEPA required 90% data recovery rate, the Oakland International Airport radiosonde station. Land use at the facility was divided into 5 sectors: 347°-50°, 50°-230°, 230°-273°, 273°-312°, and 312°-347°. 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). The largest contributing source, the Kiln consists of 32 separate stacks, 30 of which are capable of operating at any given time. For simplicity, the Kiln was modeled as a single stack, with the actual dimensions and flow characteristics of one of the 32 Kiln stacks. All pollutant flow was assigned to this single point source. This is a conservative approach because the modeled plume rise does not benefit from the buoyancy that a much larger volume of heated gas would have.

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 1.4a 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 Developmental organ 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 of 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 1 below.

Table 1: 2011 Modeled Impacts

Receptor Type	Cancer Risk	Non-cancer Hazard Index (HI)	Max. Acute Non-cancer HI
MEI	9.1 in a million	0.120	N/A
PMI	N/A	N/A	1.5

As shown in Table 1, 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. However, the point of maximum impact (PMI) receptor for Acute HI is above the notification level (1.0).

DISCUSSION OF ACUTE HI: As stated above, the PMI for the Acute HI is above the notification level. However, this modeled value occurs for one hour around midnight on a rugged, uninhabited ridge top just outside the Lehigh property line, so it is highly improbable that any actual health impact would occur. For the modeled scenario as discussed above, a total of 10 hours (out of 8,760) have at least one receptor that has an Acute HI above 1.0. All of these instances occur between the hours of 10:00pm and 7:00am and are not in locations that are likely to be occupied during those hours, if at all. All receptors over 1.0 are in rugged terrain near the plant boundary.

Additional Scenarios:
The Kiln is by far the largest contributor to the Acute HI. As previously discussed, the one stack methodology used to model the Kiln generates conservative risk estimates due to reduced plume rise. Therefore, additional modeling was performed in an attempt to refine the results. Two valid alternate scenarios were modeled as discussed below.

In the first alternate scenario, all 32 stacks associated with the Kiln baghouses were included and placed in the model in approximation of their actual locations. The parameters for each of these stacks was kept the same as the originally modeled one stack scenario, but the total emissions to each of them was 1/32 of the total. This scenario has no impact on plume rise, but does spread the emissions out somewhat.

In the second alternate scenario, stacks within 3 diameters of each other were combined to create a virtual stack handling the combined flow rates of the actual stacks, but with diameter adjustments to retain the same exhaust velocity. Based on the actual stack configuration, the 32 actual stacks were combined to become 14 virtual stacks. This method has a positive effect on plume rise due to the greater amount of heated gas now in consideration. This is an accepted technique for combining plumes of nearby stacks.

A summary of the results of the different modeling scenarios for Acute HI impacts is given in Table 2 below.

Table 2: Alternate Acute HI Scenarios – Kiln Stack Configuration

Number of Stacks	Stack Diameter (actual/virtual)	Fraction of Total Flow per Stack	Acute HI at PMI	Total hrs/yr Acute HI > 1.0
1 (initial scenario)	actual	1/30	1.5	10
32 (first alt.)	actual	1/30	1.4	7
14 (second alt.)	virtual	1/14	1.2	3

As demonstrated in Table 2 above, the two modeling refinements made for the Kiln result in successive decreases to the Acute HI at the PMI and to the total number of hours per year that the HI is above 1.0. This adds further evidence that the potential for actual human exposure to an Acute HI impact at or above 1.0 is very remote.

APPENDIX C

BAAQMD Final HRA Approval