Air Quality Technical Analysis Report

Review of Submittals Supporting the Holcim (US) Inc. Tires Combustion Proposal

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1. Introduction

Holcim Cement Company (Holcim) is proposing to use tires as fuel in their Trident cement kiln. Montana Department of Environmental Quality (DEQ) is in the process of preparing an Environmental Impact Statement (EIS) to identify potential impacts from the proposed project.

Holcim is currently authorized to burn natural gas, coal, petroleum coke, or any combination of these as a fuel for the kiln. The permit application requests the mid-kiln combustion of whole waste tires for up to 15 percent of the total fuel heat input to the kiln (on a Btu basis). Burning tires for fuel will change the amount and composition of air contaminant emissions from the cement kiln stack and may affect the concentration of contaminants in the cement kiln dust (CKD).

1.1 Objective

The objective of this Air Quality Technical Analysis Report is to report on the third-party review of Holcim's tire-burning emissions estimates and air quality impact analyses. Lorenzen Engineering, Inc. has worked with DEQ and DEQ's risk assessment contractor throughout the EIS process. The results and conclusions presented in this report have been discussed with other members of the EIS team.

This report is intended to supplement material that is already part of the public record and does not repeat information available in the original documents. Holcim has estimated the total emissions from the kiln using the current fuel mix, the total potential emissions using tires as a supplemental fuel, and the change in emissions due to tire combustion. Holcim has also prepared and submitted computerized air dispersion modeling results to show ambient air contaminant concentrations resulting from the cement plant.

1.2 Materials Reviewed

Holcim has been working with DEQ since 2001 to obtain a Montana air quality permit alteration allowing them to proceed with their tire-burning proposal. In January 2004, Holcim compiled all of the relevant application submittals into a single document titled *"Application for Alteration to Air Quality Permit #0982-10"* (ref. 1). The compilation provides a clear record of information submitted by Holcim and decisions made regarding the proposed project. This report will refer to the permitting compilation (ref. 1) rather than referring to earlier submittals.

Holcim submitted additional information regarding emissions inventory and air dispersion modeling during the EIS review process. The additional submittals are included as appendices to this report. Expanded emissions inventories are included in Appendices A and B. A comparison of Holcim's estimated emissions and source test data is contained in Appendix C. Appendix D is Holcim's final modeling report. Holcim provided the modeling files electronically and they were verified as part of the review process. Holcim's final modeling results have been used to generate illustrative figures for this report.

1.3 Organization of Report

This technical analysis report includes a critical review of the contaminant emissions information provided by Holcim both in the original permit application materials and in subsequent submittals. It examines the source of emissions information and the methodology used to estimate emissions from the Trident kiln. Emissions estimates from the current fuel mix and the proposed fuel mix are included in this report.

Dispersion modeling review in this report includes evaluation of the choice of model, applicability of the meteorological data and treatment of terrain features. The report also includes graphical representations of the modeling results.

The Air Quality Technical Analysis Report is organized in the following main sections:

1. Introduction
2. Data Adequacy Review
3. Review of Emissions Inventory Methods
4. Criteria Pollutant Emissions Inventory
5. Hazardous and Toxic Air Pollutant Emissions Inventory
6. Air Dispersion Modeling Review
7. Conclusions and Recommendations
8. References

2. Data Adequacy Review

The first step in the EIS air quality analysis was review of the project file and all information submitted in support of the permit application. The purpose of this data adequacy review was to determine whether sufficient information existed in the project file for a complete evaluation of impacts from the tire-burning proposal.

Following the data adequacy review, DEQ requested additional information from Holcim to be used to complete the EIS. Scoping comments relating to air quality were also reviewed and information has been included in this report to address these comments.

2.1 Emissions Inventory Data Adequacy Review

Holcim submitted emissions inventory information for criteria pollutants, hazardous air pollutants (HAPs) and other toxic air pollutants that are commonly related to tire burning in kilns.

2.1.1 Criteria Pollutant Emissions Inventory

Holcim submitted emissions estimates for total kiln criteria pollutant emissions as well as emission changes resulting from the tire-burning proposal. Gaseous criteria air pollutants are carbon monoxide (CO), sulfur dioxide (SO_2), ozone and nitrogen dioxide (NO_2). Lead (Pb) and particulate matter smaller than 10 microns (PM_{10}) are solid or particulate phase criteria pollutants. Volatile organic compounds (VOC) are regulated because they lead to the formation of ozone in the atmosphere.

The criteria pollutant emissions inventory was found to be adequate for EIS review and no additional information was requested. Criteria pollutant emissions are regulated through Montana's air quality permitting process. Holcim has conducted emissions tests on the cement kiln stack, as required by DEQ, to determine the emissions of criteria air pollutants. Emissions from the Trident facility have been estimated by DEQ and Holcim and are included in Holcim's proposed pre-construction permit #0982-11 (ref. 2).

2.1.2 HAP and Air Toxic Emissions Inventory

Holcim estimated HAPs emissions from tire burning for use in their health risk assessment (ref. 1). The HAPs and air toxics information was also used in DEQ's subsequent risk study titled, "*Human Health and Ecological Risk assessment of Kiln-Related Emissions at the Holcim Trident Cement Plant* (ref. 3)."

The risk assessment considers all HAPs as chemicals of potential concern (COPCs) (ref. 3). Holcim added zinc to the risk assessment calculations, even though it is not a HAP and is exempt from consideration under Montana regulations. Holcim chose to include zinc because it is a known constituent in tires and was noted as a potential concern by the interested public (ref. 1).

Holcim initially estimated only the incremental increase in HAP emissions resulting from the addition of tires to the kiln fuel stream. Although the original emissions inventory produced conservative estimates of the emissions increase, it did not provide information about the total

HAP emissions from the kiln. Through the data adequacy review, it became clear that additional inventory information would be needed for a complete review of the change in plant emissions resulting from the proposed project. Scoping comments indicated that the public was interested in the emissions resulting from all kiln raw material feeds as well as coal, coke and tire combustion. In addition to mined limestone, silica and shale, Holcim uses recycled glass as a silica source and recycled smelter slag as an iron source.

Based on public comment and review of reference materials, DEQ determined that a risk assessment based only on the incremental change in emissions is not adequate. In a health consultation prepared for a similar project in Colorado, the U.S. Department of Health and Human Services Agency for Toxic Substances and Disease Registry (ATSDR) reached the same conclusion (ref. 4). ATSDR reviewed the risks from that project and found that the regulatory agency "had analyzed stack test data with and without the burning of tires at other cement kilns and calculated the percent change in emissions." In their report, ATSDR stated, "It is not the percent of change that is significant – it is the dose of a particular chemical that is important. … We do not agree with the comparative risk methodology used in the report to determine if the stack emissions would adversely affect public health (ref. 4)."

DEQ requested that Holcim provide an emissions inventory to include total kiln emissions, including emissions from tire burning. In response, Holcim developed an emission inventory for the kiln emissions using all currently permitted fuels and kiln feeds. The existing inventory (without tires) is referred to as the "baseline" inventory and is included in Appendix A of this report. Appendix A also includes a memo provided by Holcim explaining the emissions inventory procedures.

The baseline inventory represents potential emissions from currently allowed kiln fuels and feeds. It contains estimated emissions from use of coal and coke as fuel, with recycled glass used as a source of silicate in the kiln feed. Holcim provided two versions of the baseline inventory, one with a typical production rate of 315,000 tons of clinker per year and one with the maximum allowable production rate of 425,000 tons of clinker per year. The baseline emissions inventory is based on the 425,000-ton allowable production rate.

Holcim also provided a "cumulative" emissions inventory using allowed kiln raw material feeds and using tires as 15% of the total fuel stream. The cumulative emissions inventory and accompanying memo are included in Appendix B of this report. The cumulative emission inventory includes estimated emissions from the use of coal, coke and tires as fuel, and all approved kiln feed materials. The cumulative inventory represents the maximum potential emissions of HAPs from the kiln with the use of tires as fuel. The cumulative emissions inventory is based on a maximum annual production rate of 425,000 tons of clinker.

Following submittal of the baseline and cumulative emissions inventories, the EIS team concluded that the HAPs emissions inventory information was adequate for the EIS review.

2.2 Additional Information Provided by Holcim

In addition to the revised emissions inventories, DEQ requested that Holcim provide the following information to allow the EIS team to fully evaluate the emissions inventory. All the data was provided and was used in the air quality technical analysis.

- Design and operation information for the particulate control equipment for the Trident kiln,
- HAP stack test results for the Holcim kiln.
- Coal analyses for the Holcim coal fuel.
- Petroleum coke analyses for the Holcim coke fuel.
- Analyses of the emissions from adding recycled glass to the kiln.
- Chemical analyses of the smelter slag used for iron-substitute in the kiln.

The EIS team concluded that the additional submittals provide adequate information for a full EIS review.

2.3 Dispersion Modeling Adequacy Review

Computerized air dispersion modeling was used to estimate the impacts of the plant emissions on ambient concentrations of air contaminants. The adequacy review includes evaluation of the dispersion model selection, based on the criteria established in EPA's Guideline on Air Quality Models. The choice and quality of meteorological data was reviewed to determine its applicability to the air quality impact area.

In their October 2001 submittal, Holcim used EPA's Industrial Source Complex (ISC3) model to model the changes in kiln emissions resulting from tire burning. During the next few years, EPA worked on establishing the AERMOD model as a preferred model for air quality permit application modeling. In May 2002, Holcim submitted revised kiln modeling using the then-current version of AERMOD. In February 2003, Holcim submitted additional modeling including the cement kiln dust (CKD) handling sources as well as the kiln in the AERMOD model. When EIS review began in January 2004, EPA had updated the AERMOD model and the version used by Holcim was no longer available (see www.epa.gov/ttn/scram). As a result, DEQ requested that Holcim perform the additional modeling using the most current AERMOD version.

DEQ requested that Holcim model the total baseline emissions and the total cumulative emissions from the facility. Previous HAPs modeling had only included the incremental change in emissions from tire burning. DEQ also requested that Holcim extend the modeling impact grid beyond the original 10 km radius around the plant. The additional modeling request made it necessary for Holcim to update the modeling files to the latest version of EPA's recommended model. Holcim provided the modeling files in electronic format so they could be duplicated and used as needed during the EIS review. Following submission of the additional modeling, the EIS team concluded that the modeling data is adequate for a complete EIS review.

3. Review of Emissions Inventory Methods

Holcim estimated criteria pollutant and HAPs emissions from the Trident kiln using a variety of methodologies. Kiln criteria pollutant emissions were obtained from source tests and existing permit limits. Estimates of HAP emissions are much harder to develop because the emissions are small, difficult to test, and less data is available. Holcim gathered a database of source tests from other cement kilns using tires as fuel and used the data to estimate HAPs from the Trident kiln.

The emissions inventory review will include a review of the methodology used by Holcim to arrive at their emissions estimates. The HAPs emissions estimation methodology will be reviewed in detail because of the uncertainty associated with HAPs emissions estimates. The assumptions and calculations used to account for the effects of kiln upsets on emissions are described in detail in Section 3.3.

3.1 Emissions Estimation Methodology

Common methods of determining emissions from an existing or proposed facility or process are listed below. Discussion of the appropriateness of using each approach for criteria pollutant and HAPs follows.

- Use of EPA emission factors.
- Calculation of material balance for a specific compound.
- Use of source test data from similar sources.
- Source testing of an existing source or permitted process.
- Continuous emissions monitoring system (CEMS).

EPA has developed emission factors for numerous industries and processes that produce air pollution. The emission factors are contained in EPA's Compilation of Air Pollutant Emission Factors, commonly referred to as AP-42. The Introduction to AP-42 discusses the relative reliability of the emissions estimate methodologies listed above (ref. 5).

AP-42 Section 11.6 contains criteria pollutant emission factors for portland cement kilns as well as total particulate matter (PM) emission factors for various material handling operations throughout the process. AP-42 also contains HAPs and air toxics emission factors for 26 particulate compounds (including metals) and 44 gaseous compounds. The factors in AP-42 are appropriate for estimating emission from traditional fuels such as coal and natural gas but may not be appropriate for kilns using tire-derived fuel (TDF). The EPA AP-42 emission factors have been used for reference in establishing the emissions inventory for the proposed project.

A material balance (or mass balance) approach may provide reliable average emission estimates for specific sources. In general, material balances are appropriate for use in situations where a high percentage of material is lost to the atmosphere. Calculation of emissions through mass balance is frequently used for estimation of SO_2 emission, based on a number of simplifying assumptions (ref. 5). Sulfur content of fuel is readily measured, and SO_2 emissions are estimated based on an assumption that all of the sulfur in the fuel is oxidized. Mass balance calculations for

trace contaminants such as gaseous and particulate phase HAPs are not feasible due to the small amounts of these contaminants in the fuel stream and the gas stream.

Holcim has used source test data from similar sources to develop an extensive database for emissions from cement kilns burning tires or TDF. The datasets are shown in the emissions inventories in Appendix A and Appendix B. Holcim used the source test database primarily for development of HAP emissions factors, but also used it as a reference source for criteria pollutant estimates.

Holcim has performed source tests on the Trident cement kiln for criteria pollutants including CO, NO_2, SO_2 and PM_{10}. They are also operating continuous emissions monitoring systems (CEMS) for NO_2 and SO_2. The source tests and CEMS provide the most reliable emissions information, but are limited to the baseline case. Changes in criteria pollutant emissions due to tire burning have been estimated from other sources.

3.2 Tire-burning Emissions Inventory Database

Typically, emission inventory development relies heavily on AP-42 as the primary source of emission factors. As Holcim stated in the permit application, AP-42 does not specifically address emissions from Portland cement kilns using TDF in the fuel mix. Therefore, Holcim needed to obtain emission factors for HAPs from TDF combustion from other sources. The approach Holcim took to developing the TDF emission factors was similar to the approach used by EPA in developing the AP-42 emission factors.

Holcim relied largely on source test data from other sources to estimate HAPs emissions from the proposed project. In developing the emissions inventory for the cement kiln while burning tires, Holcim compiled source test data from a number of cement kilns. The sources had been tested while burning tires or TDF as part of the fuel stream. Many of the sources in the database also performed baseline testing without tires during the same testing period.

The source test database used for this analysis included 13 source tests from 11 kilns using tires or TDF for a portion of the fuel. The database includes both baseline tests (without TDF) and cumulative tests (with TDF). TDF use ranged from 7% to 33% of the fuel, on a heat basis. The baseline fuels used were coal, coal and coke, coal and oil, coal and waste oil, and coal and hazardous waste. The data set included tests from seven dry process kilns and four wet process kilns. TDF was reported to be in the form of chipped tires for six of the tests, whole tires for four of the tests, and not specified in the other test reports. According to the permit application, the emissions inventory did not include any facility that exactly matched the Trident kiln's operating parameters [long, wet kiln; coal/coke baseline fuel; mid-kiln introduction of whole tires; tires as 15 heat-percent of fuel mix; electrostatic precipitator (ESP) emission control] (ref. 1). Nonetheless, the emissions testing data set contains a large number of samples and provides enough information to ensure that a conservative emissions estimate has been developed.

Holcim has developed the emissions inventory for their tire-burning proposal in a manner similar to that used by EPA to develop the AP-42 emission factors. When developing emission factors for use in AP-42, EPA compiled source test data from numerous source tests at Portland cement plants (ref. 7). EPA converted all the source test results to units of pound per ton of clinker. EPA

used 71 stack tests, dated from 1971 to 1992 to develop the emissions factors in the current version of AP-42 Section 11.6. EPA rated the source tests based on available knowledge about the tests and the sources. After discarding tests with low quality ratings, EPA averaged the remaining results to develop the AP-42 emission factors.

Holcim took a more detailed approach to analyze the tire-burning stack test data set, including all the tests with available data for each compound. Data sets with more than two data points allowed calculation of an upper 95% confidence limit (UCL) for the data set, which was used to project emissions at Trident. For data sets with less than two data points, the maximum data point was used to project emissions at Trident. For data sets where the 95% UCL exceeded the maximum data point, the maximum point was used to project emissions at Trident. More detailed information about the method used to process the source test data can be found in Holcim's permit application (ref. 1) and the memos in Appendices A and B.

Holcim used a methodology similar to EPA's for standardizing the source test results. Instead of standardizing the test results based on clinker production Holcim standardized the source test results based on fuel usage. This is an appropriate basis for comparison because the primary source of HAPs from the kiln is from fuel combustion, and Holcim was attempting to isolate the impacts from changing the fuel mix.

Source testing has been performed on the Holcim Trident kiln for most of the criteria pollutants and some of the HAP compounds. The testing was performed with the kiln operating under currently permitted conditions without using tires as fuel. Montana's air quality regulations do not allow Holcim to conduct a test burn with tires until they obtain an air quality permit allowing them to burn tires. Therefore, it is not possible to obtain source-specific emission test data for the Trident kiln while burning tires.

Holcim has performed source tests on the Trident stack to measure emissions of 13 HAPs, copper (a non-HAP) and dioxins/furans. Data from Holcim's site-specific stack tests has been used to verify the emissions estimates obtained through the database. Holcim has submitted a table comparing stack test results, database projected emission rates and AP-42 emission rates. The table and a memo explaining the data are contained in Appendix C.

Holcim's database projected cumulative emissions are all higher than the Trident source test data. The database values are close enough to the test results to provide confidence in the analysis, but are high enough to provide conservative estimates of emissions. The database projected cumulative emissions are comparable to values calculated using AP-42 emission factors. This comparison provides confidence that the database-projected emission rates for other HAPs are within an acceptable range.

3.3 Estimating Emissions from Kiln Upsets

Holcim developed a methodology for estimating potential HAP emissions from tire combustion during Trident kiln upsets. An upset is assumed to cause the ESP to be off-line and particulate phase HAP emissions are assumed to be uncontrolled until the ESP is back online. The duration of an average upset was estimated based on the duration of upset events that occurred during 2000 and 2001. The average duration of an upset was 13.2 minutes, but DEQ has recommended

that the duration of an upset be set to 30 minutes in an hour for the analysis of short term impacts from upsets (ref. 1)

The total annual duration of upset conditions was estimated based on the average of the hours of upsets that occurred during 2000 and 2001. The kiln experienced 110 hours of upsets during 2000 and 53 hours of upsets during 2001, resulting in an average of 81.6 hours of upsets over the two-year period. The number and duration of upsets has been reduced since 2001, partially due to the use of a continuous opacity monitoring system (COMS) on the kiln stack.

Assumed upset conditions were used to develop an 'upset multiplier' for each HAP. The upset multiplier for a 1-hour averaging period is different from the upset multiplier for the annual averaging period. The upset multiplier is applied to the modeled impact to produce a conservative ambient concentration value for use in the risk assessment. The upset multipliers have not been applied to the emissions estimates discussed later in this report.

DEQ and Holcim have assumed an ESP collection efficiency of 99.4%. When the ESP is not running, the particulate matter control efficiency is assumed to drop from 99.4% to 0%. ESP efficiency for particulate matter control is reviewed in Section 4.4 of this report. Control efficiency for gaseous emissions (other than SO_2) is always 0% because the ESP does not control gaseous emissions.

Emission rates provided in the emissions inventory are controlled emission rates. The following equation is used to determine the uncontrolled kiln emission rate for particulate matter.

controlled rate = uncontrolled rate * (100% - 99.4%)
uncontrolled rate = controlled rate / (100% - 99.4%)
uncontrolled rate = controlled rate * 166.67

The particulate matter hourly upset multiplier (UM_1) to account for a ½ hour upset during the hour is calculated as follows:

UM_1 = [controlled rate * ½ hr + uncontrolled rate * ½ hr] / (1 hr)
= controlled rate * .5 + (controlled rate * 166.67 * .5)
= controlled rate * 83.8

The particulate matter annual upset multiplier (UM_A) to account for 81.6 hours of upset during a year is calculated as follows:

UM_A = [controlled rate * (8760 hr – 81.6 hr) + uncontrolled rate * 81.6 hr] / (8760 hr)
= [controlled rate * 8678.4 hr + controlled rate * 166.67 * 81.6 hours] / (8760 hr)
= controlled rate * 2.54

The particulate HAP emissions that are controlled by the ESP include volatile metals, semi-volatile metals, non-particulate metals, inorganic compounds and organic compounds (ref. 1).

<u>Volatile metals</u>: Mercury

An ESP upset only affects the particulate portion of the volatile metal emissions while the gaseous portion of the volatile metal emissions remains the same. Mercury is assumed to be 5%

particulate phase and 95% gaseous phase when it reaches the ESP. The upset multipliers for mercury are calculated as follows:

UM_1 = gaseous emissions + particulate emissions * 83.8
= (95% * controlled emission rate) + (5% * controlled rate * 83.8)
= 5.14 * controlled rate

UM_A = gaseous emissions + particulate emissions * 2.54
= (95% * controlled rate) + (5% * controlled rate * 2.54)
= 1.08 * controlled rate

<u>Semi-volatile metals</u>: antimony, lead, cadmium, selenium and zinc (non-HAP)
<u>Non-volatile metals</u>: chromium, arsenic, nickel, manganese

Holcim assumed the semi-volatile and non-volatile metals are 100% particulate matter and are controlled by the ESP. An ESP upset will affect the total emissions of these metals, and the appropriate upset multipliers are as follows:

UM_1 =100% * controlled rate * 83.8
UM_A =100% * controlled rate * 2.54

<u>Inorganic HAPs</u>: hydrogen chloride, hydrogen fluoride

Holcim assumed 95% of the hydrogen chloride and hydrogen fluoride emissions are gaseous and 5% are particulate matter. Therefore the upset multipliers for these compounds will be the same as for mercury.

<u>Organic HAPs</u>: dioxin/furan (TCDD eq.)

Holcim assumed 80% of the dioxin/furan emissions are gaseous phase and 20% are particulate phase. Therefore, 20% of the dioxin/furan emissions are particulate phase and would be affected by an ESP upset. The upset multipliers for dioxin/furan are calculated as follows:

UM_1 = gaseous emissions + particulate emissions * 83.8
= (80% * controlled rate) + (20% * controlled rate * 83.8)
= 17.6 * controlled rate

UM_A = gaseous emissions + particulate emissions * 2.54
= (80% * controlled rate) + (20% * controlled rate * 2.54)
= 1.31 * controlled rate

The ESP does not control emissions of gaseous HAPs. Emissions of these HAPs are not affected by ESP upsets. The upset multipliers for gaseous pollutants are equal to one (1.0).

4. Criteria Pollutant Emissions Inventory

This section will evaluate the estimated criteria pollutant emissions changes resulting from use of tires as fuel. Criteria pollutant emissions are regulated through Montana's air quality permitting process. Maximum potential emissions from the Trident facility while using tire-derived fuel (ref. 1) are listed in Table 1.

TABLE 1
Potential Annual Kiln Criteria Pollutant Emissions

Pollutant	Baseline Emission Rate tons/year	Cumulative Emission Rate tons/year
SO_2	543	543
NOx	6,868	6,868
CO	121	310
PM_{10}	164	164
VOC	6	6
Lead	0.15	0.15

Source: Holcim, 2004

Fuel combustion is the primary source of criteria pollutants. CO is emitted as a result of incomplete combustion of carbon in fuel. Combustion of tires as fuel in the kiln is expected to cause an increase in CO emissions. VOCs can be emitted as a result of unburned fuel or can be formed in the combustion process.

Combustion causes the formation of NOx emissions due to oxidation of nitrogen in the combustion air and in the fuel. VOC and NOx emissions are not expected to increase as a result of tire burning. In fact, NOx has been show to decrease significantly as a result of replacing a portion of the coal or coke fuel with tires.

SO_2 is formed as a result of the oxidation of sulfur in the fuel during the combustion process. Because tires have lower sulfur content than coal, SO_2 emissions are expected to decrease when a portion of the fuel is replaced with tires.

4.1 Carbon Monoxide

Holcim has estimated that kiln CO emissions will increase significantly as a result of tire burning. Holcim estimates that addition of tires to the fuel mix would increase potential kiln CO emissions from 121 to 310 tons per year. During the permit review process, Holcim increased the estimated CO emissions beyond the value presented in the original permit application. The Holcim permit application states: "Analysis of available CO test data from other facilities shows that when combusting tires, some facilities realize an increase in CO emissions while some facilities realize a decrease in CO emissions. However, more recent data from facilities with wet kilns indicates that tire combustion may result in a significant increase in CO emissions (ref. 1)."

Review of the literature and available source test data shows a mix of results and interpretations on the CO emissions issue. The data shows that combustion of TDF does not consistently lead to an increase in CO emissions, but combustion of whole tires can cause an increase in CO

emissions. Because Holcim is proposing combustion of whole tires, an estimated increase in CO emissions is appropriate. Holcim's baseline CO emission rate for the Trident kiln is 0.769 pounds per ton of clinker (lb/ton). The proposed allowable CO emission rate for the kiln is 1.461 lb/ton, which is equivalent to a concentration of 200 parts per million (ppm) in the stack gas. The AP-42 CO emission factor for wet process cement kilns is 0.12 lb/ton, based on a single source test result (ref. 6). The AP-42 emission factor has a rating of D, indicating that it is not a well-supported emission factor.

The estimated increase of 189 tons per year exceeds the Prevention of Significant Deterioration (PSD) significant increase level of 100 tpy. Therefore, the proposed tire-burning project is subject to PSD requirement for Best Available Control Technology (BACT) review. Holcim has submitted a top-down CO BACT analysis to meet the PSD requirements. DEQ has reviewed and approved the BACT analysis.

4.2 Sulfur Dioxide

No increase in sulfur dioxide emissions is projected from the tire-burning project. Studies have shown that sulfur oxide emissions are reduced as a result of burning tires in kilns (ref. 8). SO_2 emissions from cement kilns are generated from oxidation of sulfur compounds in the raw materials and from sulfur in the fuel. The alkaline nature of the cement provides for direct absorption of SO_2 into the product, thereby mitigating the quantity of SO_2 emissions in the exhaust stream. Depending on the process and the source of the sulfur, SO_2 absorption ranges from about 70 % to more than 95 % (ref. 6). Estimated SO_2 control efficiency for Holcim's Trident kiln is 87% (ref. 2).

The amount of SO_2 generated in the kiln is proportional to the SO_2 content of the fuel burned. Holcim has provided DEQ with sulfur content information for their coal and petroleum coke fuel sources (ref. 11). According to the analysis attached to Holcim's air quality pre-construction permit #0982-10, petroleum coke has a sulfur content of 5.3% by weight (ref. 2). Sulfur content of the coal delivered to the Holcim plant is generally less than 1% by weight (ref. 11). Sulfur content of tires ranges from 1 to 3 percent by weight (ref. 8). Holcim's SO_2 permit limit is 124 pounds per hour (lb/hr) and will not change as a result of the proposed action.

In the permit application (ref. 1), Holcim provided a review of the potential SO_2 emissions from a range of cement kilns. Emissions were broken down into categories, including dry kilns, wet kilns, kilns burning whole tires, kilns burning TDF with coal and coke as baseline fuels, and kilns burning TDF with coal as the baseline fuels. Overall, the kiln emissions showed an 18% reduction in SO_2 emissions due to substitution of 10-20% of the fuel with tires. SO_2 emissions from dry kilns showed an increase of 20%, while SO_2 emissions from wet kilns showed a decrease of 32%. Use of whole tires inserted at mid-kiln showed a 2% increase in SO_2 emissions, based on a very small number of test results (ref. 1).

4.3 Nitrogen Oxides

Substitution of tires and TDF for baseline fuels consistently causes a reduction in NOx emissions (ref. 8). Total NOx emissions for all the tests in the database showed lower NOx emissions on a production basis than the NOx allowed at Holcim. The data summarized in the air quality permit application shows that the NOx emissions were reduced by 23% for all kilns, and were reduced

in every category. The proposed permit would limit the allowable NOx emissions to 1350 lb/hr, on a 1-hour average basis. Holcim operates a NOx continuous emissions monitor and reports the hourly readings to DEQ.

4.4 Particulate Matter and ESP Efficiency

Particulate matter emissions from the Holcim kiln are controlled by an ESP and will not be affected by the tire-burning proposal. The air quality permit limits kiln particulate matter emissions to 0.77 lb/ton clinker (ref. 2). The source test data set showed that the PM_{10} emissions were reduced or unchanged by the use of tires for fuel (ref. 1).

An evaluation of Holcim's ESP efficiency is included in the EIS review for two reasons. The review must establish whether the particulate control equipment at Holcim is generally comparable to the control equipment for sources in the emissions inventory database. This is important because it helps determine whether the database is applicable to the Trident kiln. Second, the collection efficiency of the Trident kiln was evaluated to determine the validity of calculations included in the permit application materials. DEQ and Holcim have assumed an ESP collection efficiency of 99.4% (ref. 1). This value was used to estimate the amount of particulate HAPs, primarily metals, present in the CKD.

Holcim provided the following description of the ESP used on the Trident kiln:

> *Trident's Electrostatic Precipitator is a Wheelabrator-Frye unit and was installed in 1972. The precipitator is one chamber wide and two fields deep in the direction of gas flow, creating two individual collecting cells. Each individual collecting cell contains 79 collecting plates spaced 10" apart, creating 78 gas passages. Collecting plates that measure 30' tall and 14.5' wide, are formed by nine strip plates that are suspended from a common beam at the upper end and are stabilized by a shock bar at the lower end. These shock bars are individually struck by tumbling hammers during each cleaning cycle. Rigid discharge electrode grids are suspended in each gas passage and are cleaned by a lift-and-drop hammer system. The electrical energization for this unit is supplied through two Westinghouse Transformer /rectifier sets. Both units are rated at: 1 phase, 60 hertz, 480 primary volts, 267 primary amps, 45 kV, 2000 mA (communication from Holcim).*

The electrostatic precipitation process consists of three fundamental steps: (1) particle charging, (2) particle collection, and (3) removal of the collected dust from the collection plates. Once a particle is charged, it migrates toward the collection surface. An indicator of particle movement toward the collection electrode is called the particle migration velocity.

Specific collecting area (SCA) is a parameter used to compare ESPs and roughly estimate their collection efficiency. SCA is the total collector plate area divided by gas volume flow rate (ref. 9). The Holcim ESP has two fields in series. Gas from the kiln passes through the first field where it is cleaned. The gas from the first field is further cleaned in the second field before exiting the stack.

The total collection area for each field in the Holcim ESP is 67,860 square feet (ft^2), and the gas flow rate through the ESP is 170,265 actual cubic feet per minute (acfm). SCA for each field is equal to 398 ft^2/1000 acfm. According to EPA's ESP reference, an SCA of 400 ft^2/1000 acfm is a medium SCA value. Therefore, one field of the Holcim ESP provides a medium SCA. Use of two fields in series increases the SCA to 800 ft^2/1000 acfm, compared to a 'large' SCA value of 900 ft^2/1000 acfm. This SCA comparison indicates that the Holcim 2-field ESP is a medium to high efficiency ESP.

The Handbook of Air Pollution Control Engineering and Technology (ref. 10) provides typical migration velocities for various ESP applications. The listed migration velocity for a wet process cement kiln is 0.33 to 0.37 feet per second (fps). Efficiency of a precipitator under ideal conditions can be estimated using the Deutsch-Anderson Equation (ref. 10):

$$E = 1 - e^{(-wA/Q)}$$

Where: E = collection efficiency of the precipitator
A = the effective collecting plate area of the precipitator (ft^2)
Q = gas flow rate through the precipitator (acfs)
e = base of natural logarithm = 2.718
w = migration velocity (ft/s)

Based on the above equation, the efficiency of a single field of the Holcim ESP would be greater than 99.9%. This calculation does not account for the variables including re-entrainment and rapping. The use of two fields in series provides additional particulate removal.

Based on this rough analysis, it is clear that the Holcim ESP efficiency is comparable to other ESPs used in the cement industry. Particulate emission control, including particulate metals, is expected to be equivalent to the particulate control at the facilities from which the emission estimates were made. Holcim's assumption of 99.4% control efficiency for the ESP is found to be valid and appropriately conservative.

5. Hazardous and Toxic Air Pollutant Emissions Inventory

Combustion sources can emit trace amounts of HAPs including organic compounds and hazardous metals compounds. The HAPs can either be a portion of the unburned fuel or raw material, or can be generated during combustion. Holcim's baseline and cumulative emissions inventory identified and quantified HAPs that have a potential to increase as a result of the tire-burning project. Methodology used to develop the emission inventory was reviewed in Section 3 of this report. This section addresses emissions estimates for specific HAPs.

The EIS team has recommended that DEQ adjust the allowable emissions increases in the Holcim permit based on review of the additional information submitted in support of the EIS. The original proposed permit limits were based on the estimates of the incremental increase in emissions from tire burning and did not reflect a comparison of the baseline and cumulative emissions estimates.

The original emission estimates, and the baseline and cumulative emissions are shown in Table 2, Section 5.4. The baseline emissions inventory refers to the emissions from the cement kiln without tires as a fuel supplement. Baseline kiln fuels are coal and petroleum coke. The Trident kiln is permitted to burn natural gas, but Holcim has no plans to use natural gas fuel. Emissions of criteria and HAPs from natural gas would be lower than emissions from other fuels.

Baseline kiln emissions also include the emissions from kiln feed. The primary kiln feed is limestone from the Holcim quarry. There are no alternative sources of calcium for the kiln. Silica is needed for the cement process and is mined on-site. Holcim has the option to use post-consumer recycled glass for the silica source in the kiln. Baseline and cumulative kiln emissions include recycled glass emissions. During the EIS review, it came to light that Holcim uses smelter slag as a source of iron in the cement raw materials mix. No additional emissions or changed emissions have been identified as a result of slag use.

5.1 Incremental HAPs Increase from Burning Tires

The initial emissions inventory is reviewed here because it was used by DEQ to establish the allowable HAP emission rates in the draft air quality permit (ref. 2). The purpose of Holcim's original emission inventory was to determine worst-case potential impacts from the addition of tires to the kiln fuel stream. Holcim gathered emissions test data from cement kilns that used whole tires and TDF as part of the fuel stream. Emissions data were contained in at least one of the tests for 165 different compounds or groups of compounds. Of the compounds in the testing database, 65 were HAPs as defined in the list of HAPs identified in Section 112(b) of the federal Clean Air Act.

Each pollutant-specific potential increase was determined by identifying the emissions test with the greatest increase between the with-tire and without-tire cases. If the test results showed that the with-tire case was higher than the without-tire case, the difference was listed as positive. If the test results showed that the with-tire case was lower than the without-tire case, the difference was listed as negative.

Holcim initially reported only the emission rate change for each HAP but not the entire kiln emission. Holcim tabulated the emissions differences for the source tests that had data for both the baseline case and the cumulative case. They selected the highest increase and reported it as the maximum predicted increase of that pollutant. This approach is highly conservative and meets the needs of the air permitting requirements.

5.2 Expanded Emissions Inventory

Holcim produced both a baseline emission inventory and a cumulative emission inventory using the entire database. In this case, the data was not limited to source test reports containing both baseline and cumulative emissions for a particular pollutant. The baseline data for each HAP was evaluated to establish an appropriate baseline emission factor. Likewise, the cumulative (with tires) data for each HAP was evaluated to establish an appropriate cumulative emission factor. This approach resulted in a larger number of data points available for many of the HAPs.

Holcim is permitted to use recycled glass as a kiln feed and the glass emissions are included in the baseline and cumulative inventories. None of the database source tests are known to include recycled glass. The glass was accounted for by adding the estimated potentia1 emissions from glass to both inventories. When Holcim applied for the permit to allow the use of recycled glass, they completed a screening level risk assessment. Estimated HAPs emissions resulting from the glass were as follows:

Chromium (total), uncontrolled: 9.6 lb/yr
Chromium (total), controlled by ESP, 99.4% control: 0.0576 lb/yr
Di-n-Butylphthalate: 0.272 lb/yr
Butylbenzylphthalate: 0.053 lb/yr

5.3 Recommended Adjustments in Emissions Inventory

Emissions estimates for some of the pollutants were adjusted based on the emissions inventory review. Each emissions inventory change is discussed below.

Formaldehyde

Holcim used the database to estimate emissions of formaldehyde from the kiln with and without tire fuels. Four stack test results were available for the baseline inventory and five stack tests were available for the cumulative inventory. The original increase estimate showed a formaldehyde increase of 2.18 lb/hr or 9.55 tons per year (tpy). Comparison of the baseline and cumulative inventories, however, indicated a decrease in formaldehyde emissions of 4.74 lb/hr. This wide discrepancy in the formaldehyde emissions values triggered further review.

Examination of the database showed that the formaldehyde stack test results varied widely. Emissions from the four stack tests used to estimate the baseline emissions were 7.36, 0.026, 1.23, and 0.21 lb/hr. The value of 7.36 lb/hr appears to be an outlier and is not consistent with other data. Statistical evaluation of the baseline formaldehyde emissions data with the outlier removed showed that the 95% UCL value would be 1.24 lb/hr.

The data set for the cumulative emissions case ranged from 0.0054 lb/hr to 2.4 lb/hr, with a 95% UCL value of 1.56 lb/hr. The estimated increase due to burning tires is the difference between the cumulative and baseline emissions estimates, or 0.32 lb/hr.

Dioxin/Furan

Dioxin/furan limits are expressed as 2,3,7,8-tetrachlorodibenzo-p-dioxin equivalent (TCDD eq.). Table 2 includes dioxins/furans under the TCDD group heading. The TCDD eq. baseline value is based on Holcim's 2000 stack test, corrected from actual to maximum potential production using a ratio of the potential and actual production rates. The TCDD cumulative value assumes a 60% increase for tires, based on review of data. Dioxin/furan emissions estimates are included in the emissions inventory but are not carried forward into the risk assessment.

DEQ has determined that both the baseline and cumulative risk assessment analyses should be based on the PC-MACT regulatory dioxin/furan limit. Dioxin and furan emissions are regulated under the PC-MACT rules. PC-MACT sets the dioxin/furan emissions limit for all fuels at 0.2 ng/dscm toxicity equivalent quotient (TEQ) for temperatures above 400 degrees F (ref. 12). Using the maximum kiln production and projected kiln flow rate, the allowed dioxin/furan emissions are 7.66 E-09 g/sec TEQ at Trident (ref. 1).

Mercury

Data used by Holcim to develop the highest possible increase in emissions due to tire burning yielded a high mercury emissions increase estimate. The estimated maximum potential increase in mercury as a result of burning tires was estimated to be 1.02E-2 lb/hr or 89 lb/yr. Comparison of the baseline and cumulative emission inventories shows a lower potential increase. The comparison is shown in Table 2.

Using the database analysis, Holcim estimated that baseline mercury emissions would be 4.21E-2 lb/hr (369 lb/yr). The cumulative mercury emissions from the database were 1.42E-2 lb/hr (124 lb/year), a reduction of 245 lb/yr. This discrepancy in the emissions data indicated that further review of the mercury data was warranted.

The emissions database includes ten stack tests for both baseline and cumulative mercury emissions. The data set includes one test where the baseline mercury emissions were 1.31E-01 lb/hr, while the cumulative emissions were 6.99E-06 lb/hr. Both these values are outside the range of all other test data, and have been eliminated from the analysis. The statistical analysis has been repeated using only nine stack test results. The adjusted baseline 95% UCL emission rate is 1.16E-02 lb/hr (102 lb/yr) and the adjusted cumulative 95% UCL emission rate is 1.57E-02 lb/hr (137 lb/yr). The mercury increase from burning tires is estimated to be 35 lb/yr, which is a 34% increase over the adjusted baseline emission rate of 102 lb/yr.

The adjusted mercury increase of 34% is comparable to results found at other facilities. For example, the ATSDR study in Colorado (ref. 4) showed an increase of 29% mercury while burning 19.2% tires. The EIS review has resulted in a recommendation that DEQ change the allowable mercury increase in the permit from the current 89 lb/yr to 35 lb/yr.

Manganese

Holcim's original emissions increase estimate for manganese was 7.9E-02 lb/hr. The manganese emissions in the baseline and cumulative emissions inventories were 1.02E-02 lb/hr and 4.18E-02 lb/hr respectively. The difference between the baseline and cumulative emissions rates was 3.16E-02 lb/hr, which is equivalent to 277 lb/yr. The EIS review has resulted in a recommendation that DEQ change the allowable manganese increase in the permit from the current 691 lb/yr to 277 lb/yr.

Other Compounds

The EIS review resulted in the following recommended emission inventory changes for compounds that were present in one case but not the other.

- Acrolien, dimethyl phthalate: recommend using the baseline value for the cumulative value
- 4-nitrophenol: recommend using the cumulative value for the baseline value

5.4 Summary of HAPs Emission Estimates

The scoping comments included questions about the differences in emissions between cement kilns burning whole tires and TDF. The database used to estimate HAPs emissions included both TDF and whole tires as fuel. No differences in the emissions were noted between the two fuel types. Questions were also raised about the emissions differences between wet process cement kilns and dry process cement kilns. Holcim has addressed the differences in the permit application materials as they relate to criteria pollutants (ref. 1). No apparent differences were noted in the HAPs emissions database between the two kiln types.

Scoping comments indicated concerns about the age and condition of tires being burned in the kiln. In particular, there was a concern about tires containing pesticides, presumably from the tire piles being sprayed to control mosquitoes. It is not possible to isolate every variable while burning tires for fuel in cement kilns, but the breadth of the database provides some assurance that most variables are present. The database of kiln emissions tests spans more than a decade and includes tests from kilns in several states. It is expected that a wide range of tire ages and conditions were used in the source tests and any differences in emissions are reflected in the test results.

All of the HAPs emissions estimates have been compiled in Table 2 for comparison purposes. HAPs for which the source test results were below the detection limit are excluded from the table. Changes in the emissions inventory for formaldehyde, mercury etc., as discussed above, are included in Table 2.

The column titled "original" is Holcim's initial estimate of the emissions increase due to tire burning. The "baseline" and "cumulative" columns are the total kiln emissions. The values in the "difference" column are calculated by subtracting the baseline value from the cumulative value. A negative difference indicates that a decrease in emissions of that pollutant is predicted.

TABLE 2
Estimated Kiln HAP Emissions

Compound	Original lb/hr	Baseline lb/hr	Cumulative lb/hr	Difference lb/hr
Acetaldehyde	-4.09E-01	4.77E-01	6.79E-02	-4.09E-01
Acrolien		1.12E-02	1.12E-02	
Trichloroethene	2.78E-03	3.72E-04	3.15E-03	2.78E-03
Antimony	5.13E-06	3.43E-04	3.48E-04	5.13E-06
Arsenic	7.15E-05	5.79E-04	3.87E-04	-1.92E-04
Benzene	2.10E-01	1.05E-00	8.62E-01	-1.92E-01
Beryllium	8.17E-06	1.70E-04	1.28E-04	-4.23E-05
Bis (2-ethylhexyl)phthalate	1.17E-02	4.90E-02	6.07E-02	1.17E-02
Bromomethane (Methyl Bromide)	-1.66E-03	4.93E-03	3.27E-03	-1.66E-03
1,3 Butadiene/Butadiene	-2.29E-03	3.54E-03	9.11E-03	5.57E-03
2-Butanone (MEK)	-7.08E-05	1.02E-03	9.49E-04	-7.16E-05
Butylbenzylphthalate*		6.05E-05	6.05E-05	
Cadmium	5.01E-04	1.04E-03	4.02E-04	-6.36E-04
Carbon Disulfide	-1.12E-01	1.30E-01	1.83E-02	-1.12E-01
Carbon Tetrachloride		ND	3.82E-04	3.82E-04
Chlorine	1.24E-01	6.02E-01	7.25E-01	1.24E-01
Chlorobenzene	6.56E-04	7.75E-03	7.85E-03	1.02E-04
Chloromethane (Methyl chloride)	5.31E-03	4.97E-02	2.06E-02	-2.91E-02
Chromium (total)*	1.09E-05	1.51E-03	1.14E-03	-3.67E-04
Chromium 6	5.11E-05	2.76E-04	1.48E-04	-1.29E-04
Cobalt	-3.94E-04	8.47E-04	4.52E-04	-3.95E-04
Di-n-Butyphthalate*		1.53E-03	1.53E-03	
1,4 Dichlorobenzene	8.57E-03	1.53E-03	1.01E-02	8.55E-03
Dichloromethane	-2.71E-02	4.49E-02	3.10E-01	2.65E-01
Dimethyl Phthalate		2.13E-03	2.13E-03	
2,4-Dinitrophenol		1.15E-02	1.70E-03	-9.84E-03
Ethylbenzene	1.43E-01	2.22E-01	3.41E-01	1.19E-01
Chloroethane (ethyl chloride)		3.26E-03	ND	
Formaldehyde	2.18E-00	1.24E-00	1.56E-00	3.19E-01
Hydrogen chloride	5.98E-01	7.28E-01	7.66E-01	3.82E-02
Hydrogen fluoride	1.22E-02	2.24E-02	3.47E-02	1.22E-02
Lead	1.48E-02	1.45E-02	1.47E-02	2.41E-04
Manganese	7.89E-02	1.02E-02	4.18E-02	3.16E-02
Mercury	1.02E-02	1.16E-02	1.56E-02	4.05E-03
4-Methyl phenol	-1.41E-03	6.46E-03	5.04E-03	-1.42E-03
Methylene chloride	2.26E-01	4.18E-02	2.02E-01	1.60E-01
Naphthalene	1.85E-02	6.53E-02	5.26E-02	-1.27E-02
Nickel	1.84E-03	1.79E-03	2.27E-03	4.74E-04
Nitrobenzene	1.13E-04	1.54E-03	1.66E-03	1.12E-04
4-Nitrophenol		ND	3.28E-02	
Phenol	-3.85E-02	1.06E-01	6.76E-02	-3.86E-02
Phosphorus	9.05E-04	3.35E-03	4.26E-03	9.08E-04
Selenium	-3.97E-07	8.63E-03	5.37E-03	-3.26E-03
Styrene	2.68E-01	2.71E-01	5.39E-01	2.68E-01
1,1,1 Trichloroethane	7.22E-04	1.84E-04	1.46E-03	1.27E-03
Toluene	1.10E-00	1.32E-00	2.00E-00	6.78E-01
Vinyl chloride	8.41E-03	1.07E-02	1.91E-02	8.40E-03

Compound	Original lb/hr	Baseline lb/hr	Cumulative lb/hr	Difference lb/hr
Xylenes, total	7.50E-01	9.78E-01	1.59E-00	6.13E-01
Zinc	1.43E-02	5.45E-01	2.16E-01	-3.29E-01
TCDD Eq.	2.41E-07	8.46E-10	1.35E-09	5.08E-10
Total PCBs	1.84E-04	4.43E-04	4.17E-04	-2.58E-05
PAH- Total	1.89E-02	8.63E-02	6.41E-02	-2.23E-02
PAH-Non-carcinogenic totals	2.79E-04	2.09E-02	1.13E-02	-9.64E-03
PAH-Carcinogenic totals	1.87E-02	6.54E-02	5.28E-02	-1.26E-02

Note: ND indicates that the compound concentration was found to be lower than the detection limit of the test.

6.0 Air Dispersion Modeling Review

Holcim has submitted air dispersion modeling to predict the impacts of the proposed tire-burning project on ambient concentrations of criteria pollutants and HAPs. Holcim submitted the final modeling for tire combustion on May 10, 2004. The modeling memo for the revised modeling is included in Appendix D. Holcim provided DEQ with electronic modeling input and output files for use in the EIS review.

6.1 AERMOD Modeling System

Holcim's final modeling of the Trident plant was performed using EPA's AERMOD model. The following is a brief description of the AERMOD modeling system provided on EPA's website: "The AERMOD is actually a modeling system with three separate components: AERMOD (AERMIC Dispersion Model), AERMAP (AERMOD Terrain Preprocessor), and AERMET (AERMOD Meteorological Preprocessor). AERMOD includes a treatment of dispersion in the presence of intermediate and complex terrain that improves on that currently in use in ISCST and other models, yet without the complexity of the Complex Terrain Dispersion Model-Plus (CTDMPLUS). To the extent practicable, the structure of the input or the control file for AERMOD is the same as that for the ISCST3. At this time, the AERMOD contains the same algorithms for building downwash as those found in the ISCST3 model. The AERMET is the meteorological preprocessor for the AERMOD. Input data can come from hourly cloud cover observations, surface meteorological observations and twice-a-day upper air soundings. Output includes surface meteorological observations and parameters and vertical profiles of several atmospheric parameters. The AERMAP is a terrain preprocessor designed to simplify and standardize the input of terrain data for the AERMOD. Input data include receptor terrain elevation data. The terrain data may be in the form of digital terrain data that is available from the U.S. Geological Survey. Output includes, for each receptor, location and height scale, which are elevations used for the computation of air flow around hills (see www.epa.gov/ttn/scram)."

Holcim performed the final modeling using AERMOD version 03273, AERMET Version 03273 and AERMAP version 03107. EPA sets the version number for each model version based on the year and Julian day of issue. Montana DEQ has reviewed and approved Holcim's choice of models. DEQ and Holcim have agreed that additional revisions of the AERMOD modeling will not be required if EPA updates the AERMOD model during the EIS review process.

6.2 AERMET Meteorological Data Processing

The AERMET program creates the meteorological input file for AERMOD using cloud cover data, surface meteorological data and upper air data. National Weather Service (NWS) surface meteorological data can be substituted for on-site data in the event there are no on-site data to use. If the on-site profiles of wind or temperature are missing, AERMET uses NWS data to create the profile of wind and/or temperature. No surface temperature, wind direction or wind speed data were missing from the Holcim data set. AERMET used the Great Falls, Montana NWS surface data only for cloud cover values.

Upper air observations are made by the NWS using radiosonde technology. The closest upper air station to the Trident site is at the Great Falls airport. The radiosonde is a small, expendable instrument package that is suspended below a 6-foot (2-meter) wide balloon filled with hydrogen

or helium. As the radiosonde rises at about 1,000 feet/minute (300 meters/minute), sensors on the radiosonde measure profiles of pressure temperature and relative humidity. These sensors are linked to a battery powered radio transmitter that sends the sensor measurements to a ground receiver.

The AERMOD model requires hourly surface meteorological data parameters. Holcim's meteorological monitoring station was located on the Holcim property 1228 feet (374 meters) southwest of Holcim's cement kiln stack (ref. 1). DEQ has reviewed Holcim's meteorological station siting and data collection methods and has approved the meteorological data set for use in compliance modeling.

The meteorological sensors were located at the same elevation as the kiln exhaust. Elevation at the Holcim meteorological station was 4,132 feet above mean sea level (ft msl) and the height of the meteorological tower was 33 ft (10 meters). Elevation of the wind speed and wind direction sensors was therefore 4,165 ft msl. Elevation at the kiln stack base is 4,035 ft msl, and the kiln stack height is 130 ft, resulting in a kiln stack exhaust elevation of 4,165 ft msl (ref. 1).

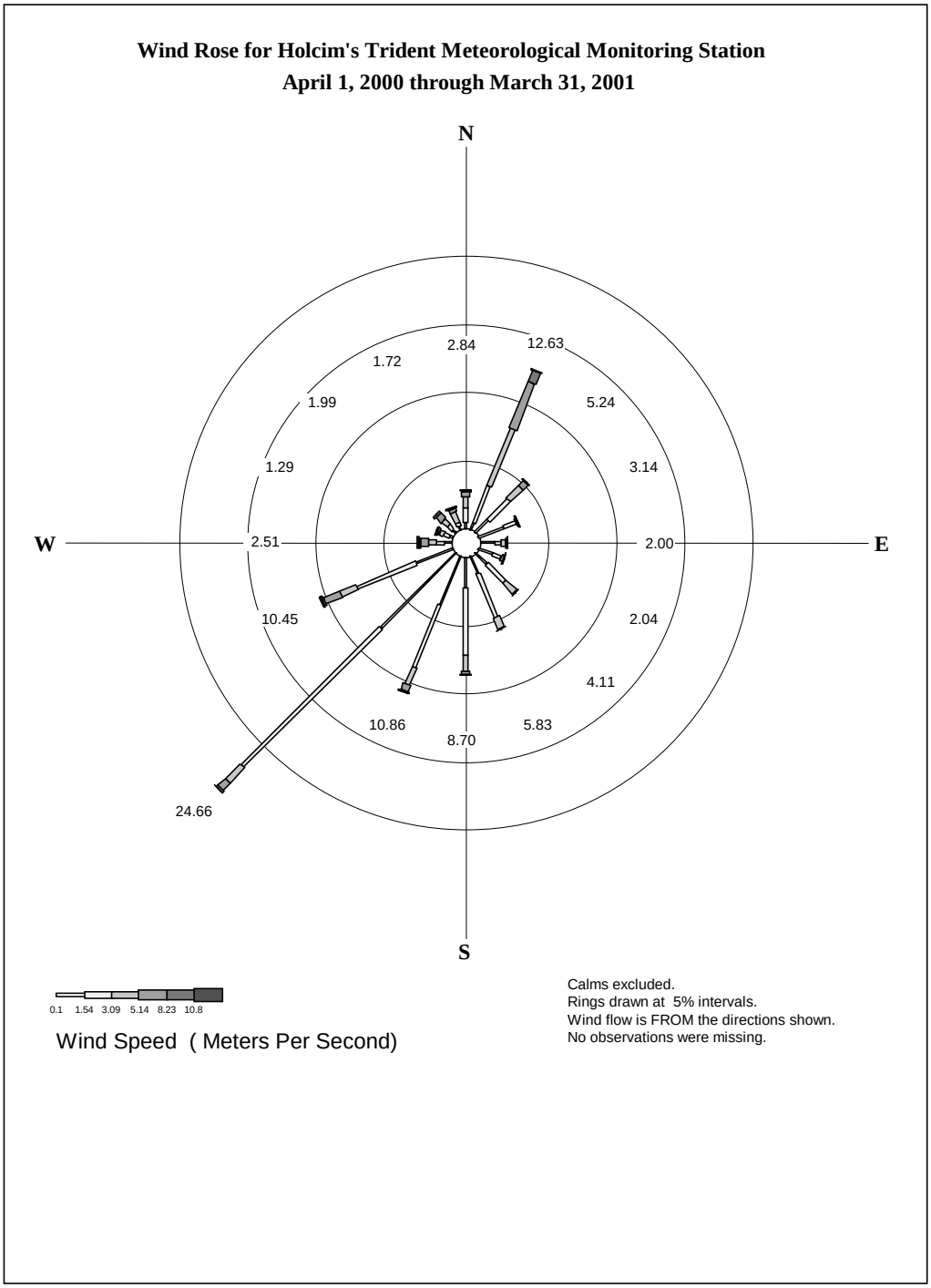
Bluffs along the west bank of the Missouri River across from the Holcim facility rise to elevations of nearly 4,500 ft msl. The hills east and southeast of the facility are also 4,500 ft or higher. Wind patterns recorded at Holcim's meteorological station show that this confining terrain causes the wind to follow the Missouri River in a southwest-northeast orientation. Figure 1 is a wind rose showing the monitored wind patterns at the Holcim location. The wind rose shows the frequency of winds from each of 16 cardinal directions (north, north-northeast, northeast, etc.). The length of each "petal" indicates the frequency of winds blowing from that direction. As described in the legend, the bands in the petals indicate the frequency of the listed wind speeds.

The wind rose for the Holcim site shows a strong southwest-northeast orientation of the wind pattern, as would be expected due to the topography of the monitoring site. As shown in Figure 1, 25% of the hourly average wind directions were from the southwest and 13% of the hourly average wind directions were from the north-northeast. The strongest (highest velocity) winds were from the north-northeast, as shown by the relatively large dark section at the end of the north-northeast petal of the wind rose. The dark section indicates wind speeds greater than 10.8 meters per second (m/s) or 24 miles per hour (mph).

6.3 Sources and Modeling Parameters

The air dispersion modeling protocol for the final modeling is described in detail in Holcim's modeling memo in Appendix D. Holcim modeled the kiln criteria pollutant and HAP emissions. They also modeled CKD fugitive dust sources including silo loading, silo unloading and the CKD monofill. The kiln is a point source with a vertical stack and a buoyant high-temperature plume. The CKD sources are fugitive dust sources released near ground level and at ambient temperature. Emissions from the CKD sources have little momentum and do not impact receptors far beyond the plant boundary. CKD emissions are particulate matter and may contain trace amounts of HAPs. Partitioning of HAPs into the CKD was described in detail in the permit application materials (ref. 1). The partitioning can be viewed in Section 6.4 of this report.

FIGURE 1
Wind Rose for Holcim's Trident Meteorological Monitoring Station



Source: Lorenzen Engineering, Inc.

Downwash caused by influences of buildings on the kiln plume were modeled using EPA procedures and software. Downwash results from wake effects as the plume encounters buildings and can result in higher pollutant concentrations in the building wake. AERMOD was run with EPA's regulatory default options.

Compliance with the ambient air quality standards requires that sources evaluate the impacts of other sources that could potentially affect the same area. Holcim's criteria pollutant compliance demonstration did not include modeling of other sources. As part of the EIS review, industrial sources located within 30 miles (50 km) of the Holcim plant have been identified and are listed in Table 3. EPA's facility emissions web site (see www.epa.gov/air) was used to identify emissions sources in Gallatin County. Neighboring Madison and Broadwater Counties each have one industrial emission source, both of which are located more than 50 km from the Holcim site.

TABLE 3
Gallatin County Industrial Emissions Sources

Facility Name	Location	Type of Source	Actual Emissions[1]	
Luzenac America	Sappington	Talc Processing Plant	CO – 0.94 tpy VOC – 0.19 tpy PM_{10} – 9.67 tpy	NOx – 3.23 tpy SO_2 – 0.15 tpy
Luzenac America	Three Forks	Talc Processing Plant	CO – 4.3 tpy VOC – 0.52 tpy PM_{10} – 32.2 tpy	NOx – 10.5 tpy SO_2 – 0.24 tpy
Montana State University	Bozeman	Central Heating Plant	CO – 0.51 tpy VOC – 0.88 tpy PM_{10} – 1.92 tpy	NOx – 20.0 tpy SO_2 – 0.09 tpy
JTL Group	Belgrade	Portable Aggregate Crushing and Screening Plant	CO – 42.5 tpy VOC – 19.8 tpy PM_{10} – 40.0 tpy	NOx – 3.12 tpy SO_2 – 24.4 tpy

(1) Reported emissions obtained from EPA's air data web site for the most recent available year, 1999.

Table 3 lists actual emissions reported to DEQ and ultimately to EPA. EPA maintains emissions data for reference years to allow comparison of source data. The most recent year of data available from EPA is 1999.

The EIS review concluded that there is no need to model the off-site sources because their emissions are not expected to measurably impact the Holcim peak impact receptors. Emissions from industrial emissions sources in Gallatin County are quite low and are not expected to impact the same terrain as the Holcim emissions. The primary source of emissions from talc processing and aggregate crushing is fugitive particulate matter. NOx and CO are generated from burning natural gas and/or diesel for heating.

6.4 Modeling Receptors

AERMOD uses receptors with location and elevation programmed into the modeling files. Location is denoted with Universal Transverse Mercator (UTM) coordinates. UTM coordinates are oriented north/south and east/west with coordinates in units of meters. Modeling receptors are typically placed in a grid pattern. Smaller grid spacing provides more refined modeling results, but requires a large amount of computer resources. Upon completion of initial modeling, it is customary to add a refined receptor grid at very close spacing around highest impact

receptors. Figures 2 and 3 are surface maps showing the modeling receptor grids. Holcim used the following modeling grids in their final modeling analysis:

- **Property Boundary Receptors**. Receptors located along the Holcim property boundary at a spacing of approximately 50 meters, shown in Figure 2.
- **Fine Receptor Grid**. Receptors extend at least 2.5 km in all directions from the cement plant at a spacing of 100 meters, shown in Figure 2.
- **5-km Grid**. Receptors extend from the fine receptor grid out to a distance of 5 km from the plant at a spacing of 250 meters. The inner edge of the 5-km grid is visible on Figure 2.
- **10-km Grid**. Receptors extend from the 5-km grid out to a distance of 10 km from the plant at a spacing of 500 meters.
- **Refined Grid**. Receptors surrounding the points of highest impact from the fine grid and boundary modeling. Spacing of the refined grids is 50 meters. The largest refined grid is located northwest of the kiln location along the Missouri River bank. A smaller refined grid is located on the northeast plant boundary. Refined receptors can be seen in Figure 2.
- **Expanded Grid**. Holcim has provided an expanded modeling grid extending 33 km west, 39 km east, 50 km south and 32 km north of the plant. The expanded grid has a spacing of 2,500 meters and is shown on Figure 3.

Figure 2 shows the terrain and receptors within approximately 3 km of the cement kiln stack. Location of the kiln stack is indicated on the figure. The surface map in Figure 2 was created using the receptor elevation data from the AERMOD input files. Figure 2 shows that there are no receptors located within the Holcim property boundary.

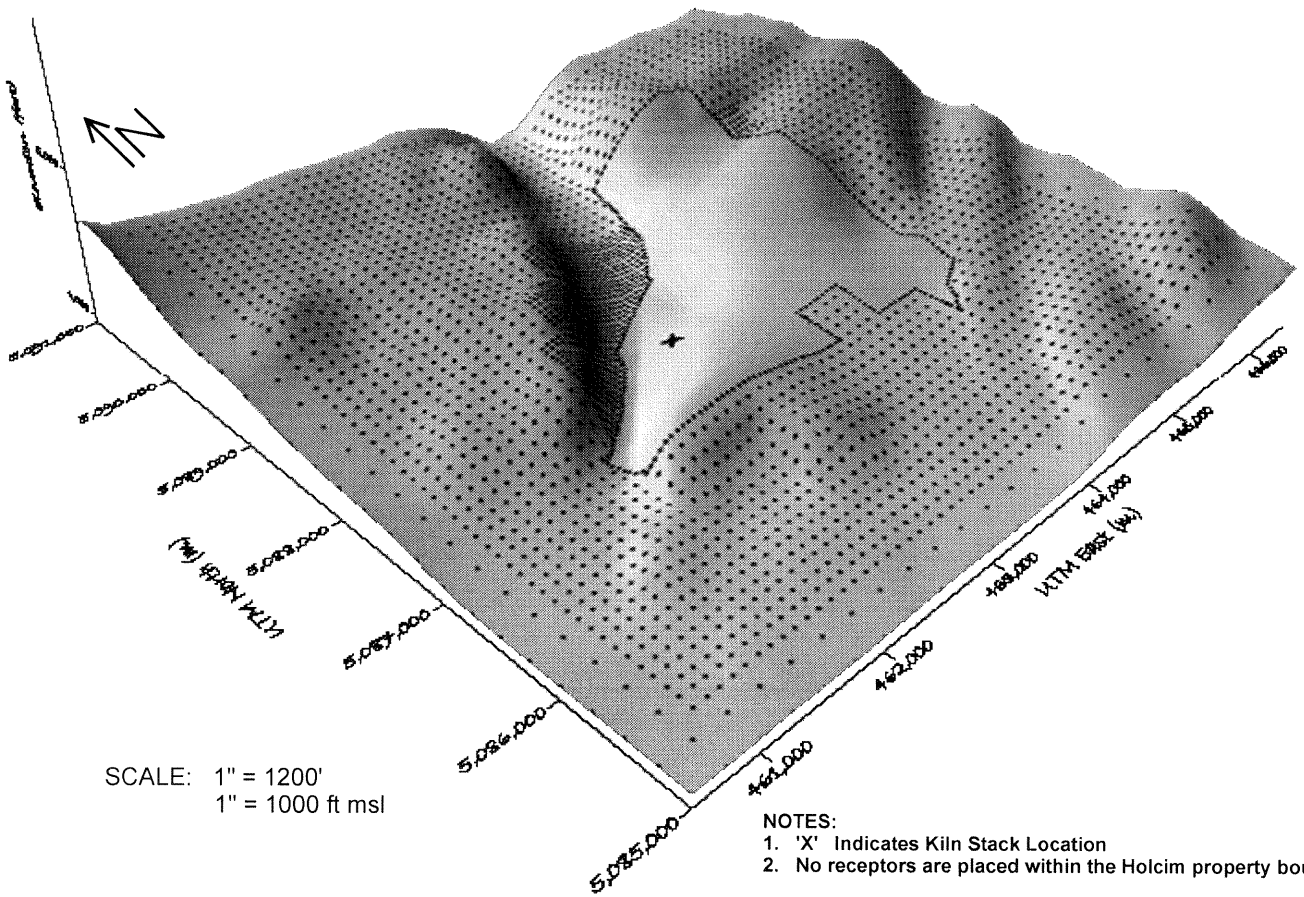
Figure 3 is a surface map of the entire expanded modeling domain. Approximate locations of towns and the Holcim site are shown for reference. Elevations for the surface map are the elevations used in the AERMOD modeling. The modeling receptor grid has been overlain onto the surface map to show the extent of the modeling.

During the EIS review, receptors were added along the Madison, Jefferson and Gallatin Rivers upstream of Trident and along the Missouri River downstream of Trident. DEQ's risk assessment contractor used the concentrations at the river receptors to calculate aquatic impacts for the risk assessment. Results at various river receptors are shown on Figure 2-2 of the risk assessment report (ref. 3).

6.5 Summary of Modeling Results

Modeling results for criteria pollutant impacts were not changed by any of the findings of the EIS review. Holcim demonstrated compliance with all ambient standards. Results of their modeling are summarized in Appendix D. The EIS review did not result in changes to any criteria pollutant emission rates or modeling parameters. Therefore the criteria pollutant modeling results are unchanged. Peak modeled impacts of criteria pollutants occur at or near the Holcim property boundary. Modeled impacts drop off with distance from the source, so compliance only needs to be demonstrated at the point of peak impact.

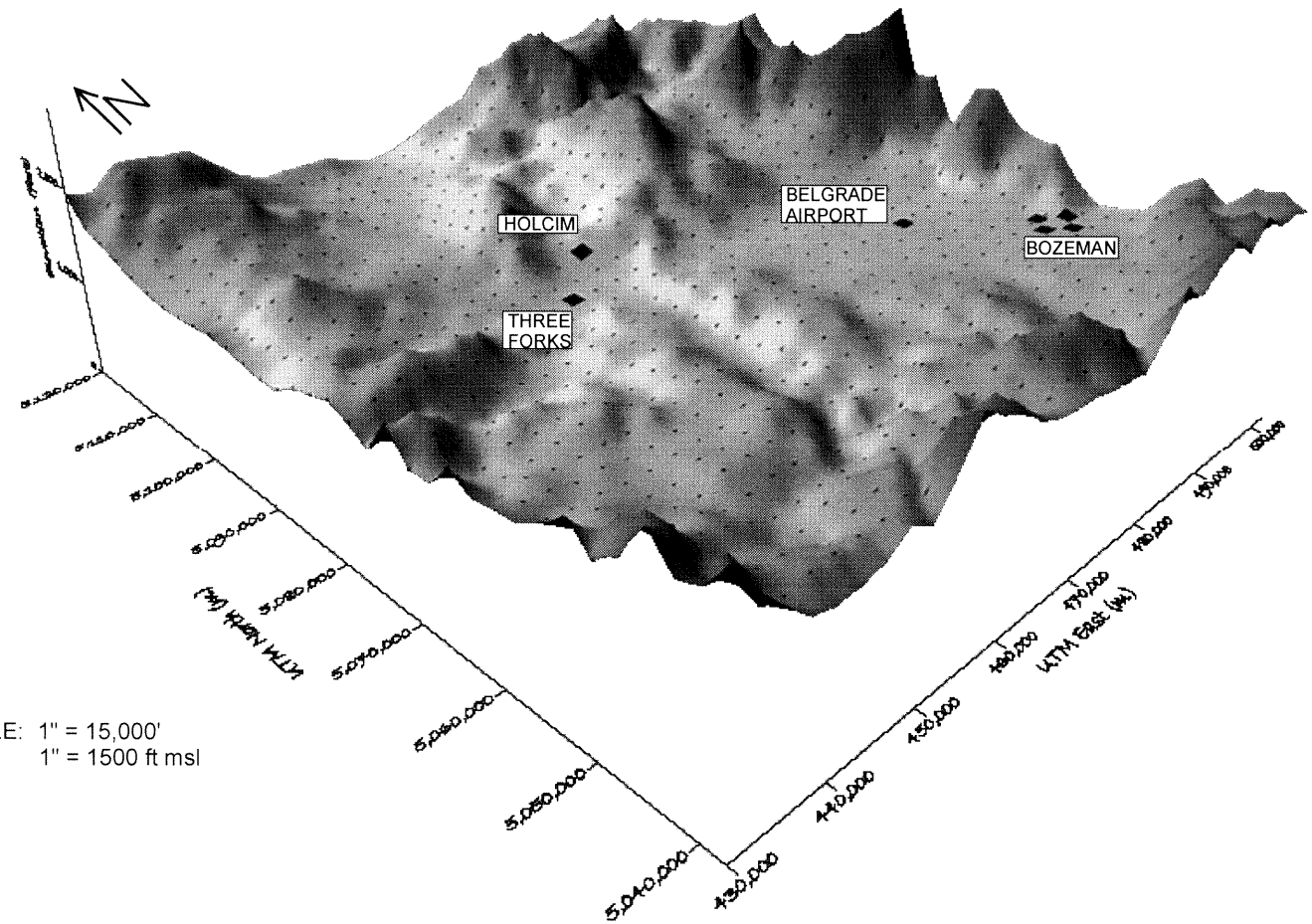
FIGURE 2
Fine Receptor Grid and Boundary Receptors
Overlain on Terrain Surface



SCALE: 1" = 1200'
1" = 1000 ft msl

NOTES:
1. 'X' Indicates Kiln Stack Location
2. No receptors are placed within the Holcim property boundary.

FIGURE 3
Expanded Modeling Terrain
and Receptor Grid



SCALE: 1" = 15,000'
1" = 1500 ft msl

HAPs modeling results are more complex than the criteria pollutant results. The risk assessment required concentration information at a variety of receptor locations in addition to the point of highest impact. The scoping comments showed that there is interest in knowing the HAP pollutant impacts at population centers such as Bozeman.

Ambient concentrations of pollutants emitted from both the kiln and the CKD sources were modeled in separate modeling runs for each pollutant to determine peak impacts. Ambient concentrations of pollutants emitted only from the kiln were determined from a single model run using only the kiln source. Kiln emissions were modeled to develop a dispersion coefficient for each modeling receptor. The dispersion coefficient is a ratio of the ambient concentration and the emission rate. It is denoted by X/Q and expressed in units of micrograms per cubic meter per gram per second [($\mu g/m^3$)/(g/s)].

Figure 4 shows annual average concentration isopleths and Figure 5 shows 1-hour average concentration isopleths. The isopleths represent lines of equal concentration or equal dispersion coefficient. The figures are graphic representations of the ambient concentrations resulting from modeling an emission rate of 1.0 gram per second (g/s) from the kiln over the extended modeling domain. Modeling results from a single source will follow the same pattern for every pollutant.

The isopleths in Figure 4 illustrate how annual average impacts decrease from a peak X/Q of 0.29 ($\mu g/m^3$)/(g/s) at the boundary of the facility to less than 0.001 ($\mu g/m^3$)/(g/s) at receptors in Belgrade and Bozeman. The annual impact pattern closely resembles the pattern from the wind rose. The X/Q value is used as shown in the following example:

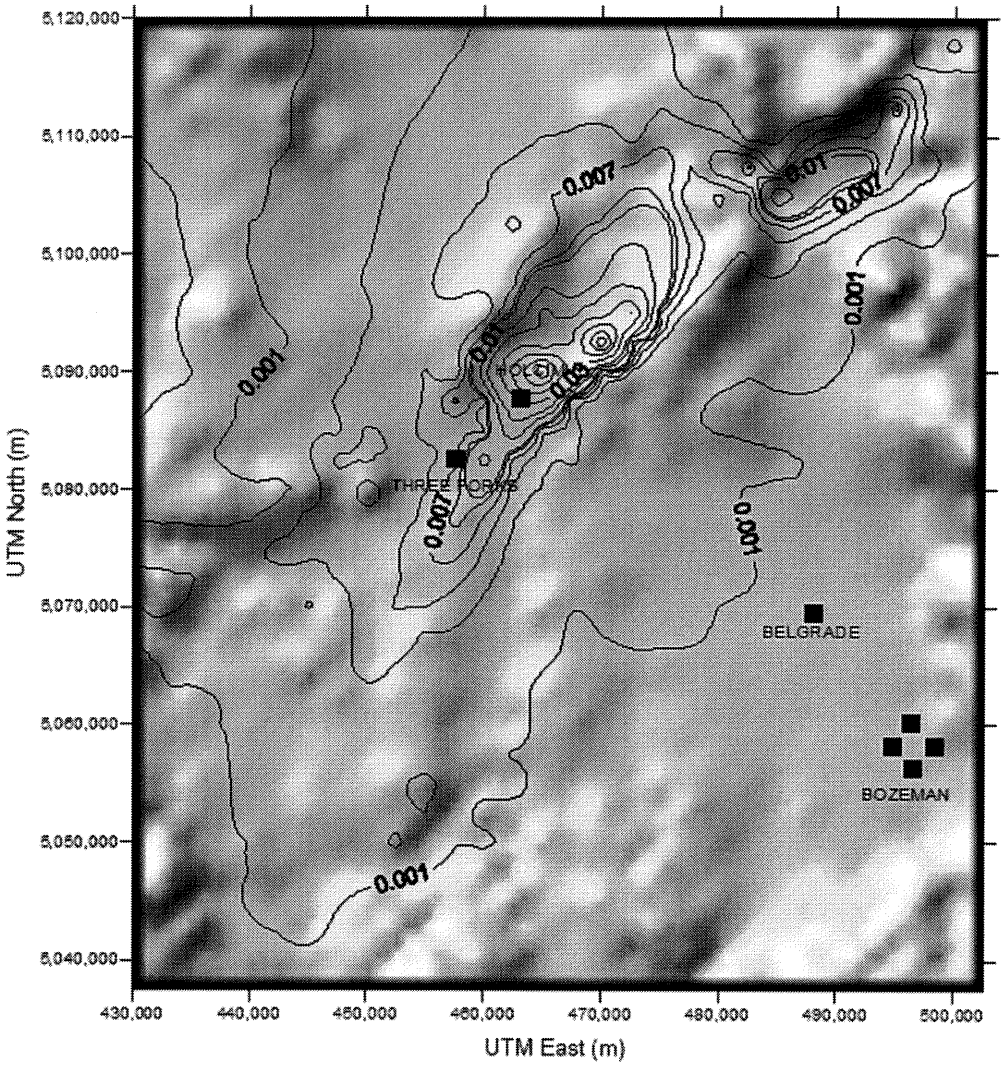
Cumulative mercury emission rate: 1.97E-03 g/s
Annual X/Q at Bozeman: 0.0005 ($\mu g/m^3$)/(g/s)
Annual Mercury Impact at Bozeman:
1.97E-03 g/s * 0.0005 ($\mu g/m^3$)/(g/s) = 9.85E-07 $\mu g/m^3$
Peak Annual X/Q at Plant Boundary: 0.29 ($\mu g/m^3$)/(g/s)
Peak Annual Mercury Impact at Plant Boundary:
1.97E-03 g/s * 0.29 ($\mu g/m^3$)/(g/s) = 5.71E-04 $\mu g/m^3$

Figure 5 shows the peak 1-hour impacts at each receptor over the period of a year. Peak 1-hour impacts occur when the wind is blowing toward the impacted receptor. Therefore the pattern of the isopleths in Figure 5 is more rounded and does not closely match the pattern of the wind rose. The difference between peak 1-hour impacts at the plant boundary and at distance receptors is not as great as for the annual averaging period. Impacts decrease from a peak X/Q of 17.92 ($\mu g/m^3$)/(g/s) at the boundary of the facility to 0.11 ($\mu g/m^3$)/(g/s) at receptors in Bozeman.

Expanded terrain modeling does not include impacts from CKD dust sources. Fugitive dust sources have low buoyancy and impact receptors in the immediate vicinity of the plant. Impacts of these sources on distant receptors would be negligible and they were excluded from the expanded terrain modeling to limit model run time.

N

FIGURE 4
Annual Average Dispersion Coefficients
Overlain on Shaded Relief

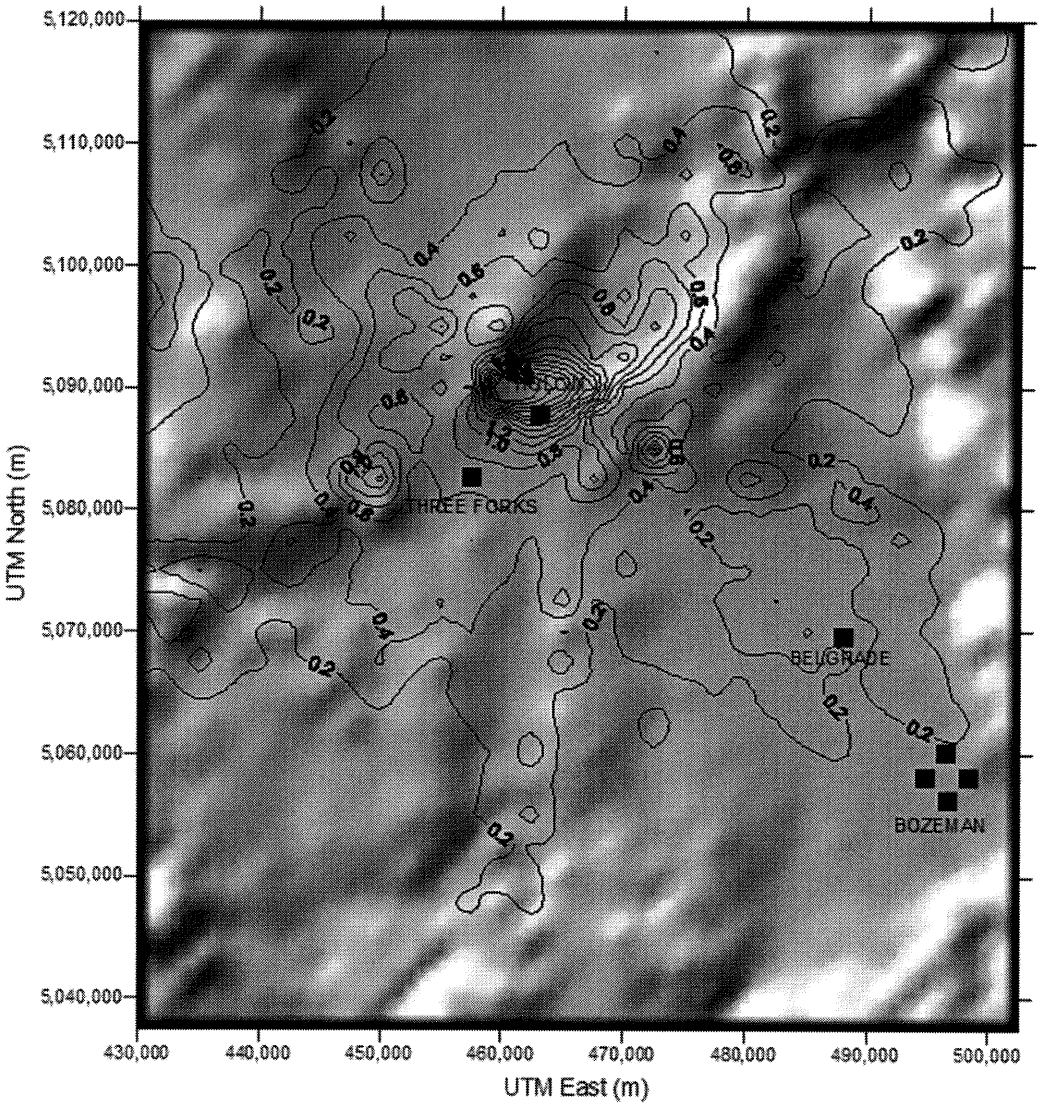


SCALE: 1" = 13,750'

NOTES:
1. Isopleths are lines of equal concentration.
2. Peak annual dispersion coefficient near boundary is 0.29 (ug/m3)/(g/s).
3. Annual average dispersion coefficient at Bozeman is 0.0005 (ug/m3)/(g/s).

N

FIGURE 5
Peak 1-hour Average Dispersion Coefficients
Overlain on Shaded Relief



SCALE: 1" = 13,750'

NOTES:
1. Isopleths are lines of equal concentration.
2. Peak 1-hour dispersion coefficient near boundary is 17.92 (ug/m3)/(g/s).
3. Peak 1-hour dispersion coefficient at Bozeman is 0.11 (ug/m3)/(g/s).

Table 4: Peak Model Results

Modeling Results at Peak Receptor
(ug/m³)/(g/s)
Annual 0.29355
1-hour 17.91829

Compound	425 Base	Cumulative	Particulate	Upset Multiplier	Amount to CKD (g/s)		Amount to Kiln (g/s)		Annual Peak (ug/m3)		Upset Mult.	1-hour Peak (ug/m3)	
	g/s	g/s	%	Annual Only	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Kiln (1-hr)	Baseline	Cumulative
Acetaldehyde	6.01E-02	6.55E-03	0%	1.00	0.00E+00	0.00E+00	6.01E-02	6.55E-03	1.76E-02	2.51E-03	1	1.08E+00	1.53E-01
Acrolein	1.41E-03	1.41E-03	0%	1.00	0.00E+00	0.00E+00	1.41E-03	1.41E-03	4.15E-04	4.15E-04	1	2.53E-02	2.53E-02
Trichloroethene	4.68E-05	3.97E-04	0%	1.00	0.00E+00	0.00E+00	4.68E-05	3.97E-04	1.37E-05	1.16E-04	1	8.39E-04	7.11E-03
Antimony	4.32E-05	4.38E-05	100%	2.54	7.20E-03	7.31E-03	1.10E-04	1.12E-04	3.34E-05	3.41E-05	83.8	6.49E-02	6.59E-02
Arsenic	7.29E-05	4.87E-05	100%	2.54	1.22E-02	8.12E-03	1.85E-04	1.24E-04	5.97E-05	3.82E-05	83.8	1.10E-01	7.32E-02
Benzene	1.33E-01	1.09E-01	0%	1.00	0.00E+00	0.00E+00	1.33E-01	1.09E-01	3.90E-02	3.19E-02	1	2.38E+00	1.95E+00
Beryllium	2.15E-05	1.61E-05	100%	2.54	3.58E-03	2.69E-03	5.46E-05	4.10E-05	1.68E-05	1.26E-05	83.8	3.22E-02	2.42E-02
Bis (2-ethylhexyl)phthalate	6.18E-03	7.65E-03	0%	1.00	0.00E+00	0.00E+00	6.18E-03	7.65E-03	1.81E-03	2.25E-03	1	1.11E-01	1.37E-01
Bromomethane (Methyl Bromide)	6.21E-04	4.12E-04	0%	1.00	0.00E+00	0.00E+00	6.21E-04	4.12E-04	1.82E-04	1.21E-04	1	1.11E-02	7.39E-03
1,3 Butadiene/Butadiene	4.46E-04	1.15E-03	0%	1.00	0.00E+00	0.00E+00	4.46E-04	1.15E-03	1.31E-04	3.37E-04	1	8.00E-03	2.06E-02
2-Butanone (MEK)	1.29E-04	1.20E-04	0%	1.00	0.00E+00	0.00E+00	1.29E-04	1.20E-04	3.77E-05	3.51E-05	1	2.30E-03	2.14E-03
Butylbenzylphthalate*	7.62E-06	7.62E-06	0%	1.00	0.00E+00	0.00E+00	7.62E-06	7.62E-06	2.24E-06	2.24E-06	1	1.37E-04	1.37E-04
Cadmium	1.31E-04	5.07E-05	100%	2.54	2.18E-02	8.44E-03	3.33E-04	1.29E-04	1.03E-04	3.97E-05	83.8	1.97E-01	7.61E-02
Carbon Disulfide	1.64E-02	2.31E-03	0%	1.00	0.00E+00	0.00E+00	1.64E-02	2.31E-03	4.82E-03	6.78E-04	1	2.94E-01	4.14E-02
Carbon Tetrachloride	4.82E-05	4.82E-05	0%	1.00	0.00E+00	0.00E+00	4.82E-05	4.82E-05	1.41E-05	1.41E-05	1	8.63E-04	8.63E-04
Chlorine	7.58E-02	9.14E-02	0%	1.00	0.00E+00	0.00E+00	7.58E-02	9.14E-02	2.23E-02	2.68E-02	1	1.36E+00	1.64E+00
Chlorobenzene	9.76E-04	9.89E-04	0%	1.00	0.00E+00	0.00E+00	9.76E-04	9.89E-04	2.87E-04	2.90E-04	1	1.75E-02	1.77E-02
Chloromethane (Methyl chloride)	6.27E-03	2.60E-03	0%	1.00	0.00E+00	0.00E+00	6.27E-03	2.60E-03	1.84E-03	7.62E-04	1	1.12E-01	4.65E-02
Chromium (total)*	1.90E-04	1.44E-04	100%	2.54	3.17E-02	2.40E-02	4.83E-04	3.66E-04	1.49E-04	1.13E-04	83.8	2.85E-01	2.16E-01
Chromium 6	3.46E-05	1.86E-05	100%	2.54	5.81E-03	3.10E-03	8.86E-05	4.73E-05	2.73E-05	1.46E-05	83.8	5.23E-02	2.80E-02
Cobalt	1.07E-04	5.70E-05	100%	2.54	1.78E-02	9.50E-03	2.71E-04	1.45E-04	8.35E-05	4.47E-05	83.8	1.60E-01	8.56E-02
Di-n-Butyphthalate*	1.93E-04	1.93E-04	0%	1.00	0.00E+00	0.00E+00	1.93E-04	1.93E-04	5.67E-05	5.67E-05	1	3.46E-03	3.46E-03
1,4 Dichlorobenzene	1.93E-04	1.27E-03	0%	1.00	0.00E+00	0.00E+00	1.93E-04	1.27E-03	5.66E-05	3.73E-04	1	3.45E-03	2.26E-02
Dichloromethane	5.66E-03	3.91E-02	0%	1.00	0.00E+00	0.00E+00	5.66E-03	3.91E-02	1.66E-03	1.15E-02	1	1.01E-01	7.00E-01
Dimethyl Phthalate	2.68E-04	2.68E-04	0%	1.00	0.00E+00	0.00E+00	2.68E-04	2.68E-04	7.86E-05	7.86E-05	1	4.80E-03	4.80E-03
2,4-Dinitrophenol	1.45E-03	2.14E-04	0%	1.00	0.00E+00	0.00E+00	1.45E-03	2.14E-04	4.27E-04	6.29E-05	1	2.60E-02	3.84E-03
Ethylbenzene	2.80E-02	4.30E-02	0%	1.00	0.00E+00	0.00E+00	2.80E-02	4.30E-02	8.21E-03	1.26E-02	1	5.01E-01	7.71E-01
Chloroethane (ethyl chloride)	4.11E-04	4.11E-04	0%	1.00	0.00E+00	0.00E+00	4.11E-04	4.11E-04	1.21E-04	1.21E-04	1	7.36E-03	7.36E-03
Formaldehyde	1.56E-01	1.96E-01	0%	1.00	0.00E+00	0.00E+00	1.56E-01	1.96E-01	4.58E-02	5.76E-02	1	2.80E+00	3.52E+00
Hydrogen chloride	9.16E-02	9.66E-02	5%	1.08	9.66E-02	1.02E-01	9.66E-02	1.04E-01	2.90E-02	3.05E-02	5.14	8.45E+00	8.89E+00
Hydrogen fluoride	2.83E-03	4.37E-03	5%	1.08	2.98E-03	4.60E-03	3.06E-03	4.70E-03	8.96E-04	1.38E-03	5.14	2.60E-01	4.02E-01
Lead	1.82E-03	1.85E-03	100%	2.54	3.04E-01	3.09E-01	4.64E-03	4.71E-03	1.43E-03	1.45E-03	83.8	2.74E+00	2.78E+00
Manganese	1.29E-03	5.27E-03	100%	2.54	2.14E-01	8.78E-01	3.27E-03	1.34E-02	1.01E-03	4.13E-03	83.8	1.93E+00	7.92E+00
Mercury	1.46E-03	1.97E-03	5%	1.08	1.54E-03	2.07E-03	1.57E-03	2.12E-03	4.61E-04	6.23E-04	5.14	1.34E-01	1.81E-01
4-Methyl phenol	8.14E-04	8.35E-04	0%	1.00	0.00E+00	0.00E+00	8.14E-04	8.35E-04	2.39E-04	1.86E-04	1	1.48E-02	1.14E-02
Methylene chloride	5.27E-03	2.54E-02	0%	1.00	0.00E+00	0.00E+00	5.27E-03	2.54E-02	1.55E-03	7.47E-03	1	9.43E-02	4.58E-01
Naphthalene	8.23E-03	6.63E-03	0%	1.00	0.00E+00	0.00E+00	8.23E-03	6.63E-03	2.42E-03	1.95E-03	1	1.48E-01	1.19E-01
Nickel	2.26E-04	2.86E-04	100%	2.54	3.77E-02	4.76E-02	5.75E-04	7.27E-04	1.77E-04	2.24E-04	83.8	3.40E-01	4.29E-01
Nitrobenzene	1.95E-04	2.09E-04	0%	1.00	0.00E+00	0.00E+00	1.95E-04	2.09E-04	5.71E-05	6.13E-05	1	3.49E-03	3.74E-03
4-Nitrophenol	4.13E-03	4.13E-03	0%	1.00	0.00E+00	0.00E+00	4.13E-03	4.13E-03	1.21E-03	1.21E-03	1	7.40E-02	7.40E-02
Phenol	1.34E-02	8.51E-03	0%	1.00	0.00E+00	0.00E+00	1.34E-02	8.51E-03	3.93E-03	2.50E-03	1	2.40E-01	1.53E-01
Phosphorus	4.22E-04	5.37E-04	100%	2.54	7.04E-02	8.95E-02	1.07E-03	1.37E-03	3.30E-04	4.22E-04	83.8	6.35E-01	8.06E-01
Selenium	1.09E-03	6.77E-04	100%	2.54	1.81E-01	1.13E-01	2.77E-03	1.72E-03	8.53E-04	5.30E-04	83.8	1.63E+00	1.02E+00
Styrene	3.41E-02	6.79E-02	0%	1.00	0.00E+00	0.00E+00	3.41E-02	6.79E-02	1.00E-02	1.99E-02	1	6.12E-01	1.22E+00
1,1,1 Trichloroethane	2.32E-05	1.84E-04	0%	1.00	0.00E+00	0.00E+00	2.32E-05	1.84E-04	6.82E-06	5.40E-05	1	4.16E-04	3.29E-03
Toluene	1.66E-01	2.52E-01	0%	1.00	0.00E+00	0.00E+00	1.66E-01	2.52E-01	4.86E-02	7.38E-02	1	2.98E+00	4.51E+00
Vinyl chloride	1.35E-03	2.41E-03	0%	1.00	0.00E+00	0.00E+00	1.35E-03	2.41E-03	3.96E-04	7.07E-04	1	2.42E-02	4.31E-02
Xylenes, total	1.23E-01	2.01E-01	0%	1.00	0.00E+00	0.00E+00	1.23E-01	2.01E-01	3.62E-02	5.89E-02	1	2.21E+00	3.59E+00
Zinc	6.87E-02	2.72E-02	100%	2.54	1.14E+01	4.54E+00	1.75E-01	6.93E-02	5.39E-02	2.13E-02	64	1.03E+02	4.09E+01
TCDD Eq.	7.66E-09	7.66E-09	20%	1.31	9.58E-09	9.58E-09	1.00E-08	1.00E-08	2.94E-09	2.94E-09	17.8	2.41E-08	2.41E-08
Total PCBs	5.58E-05	5.26E-05	0%	1.00	0.00E+00	0.00E+00	5.58E-05	5.26E-05	1.64E-05	1.54E-05	1	1.00E-03	9.42E-04
PAH- Total	1.09E-02	8.07E-03	0%	1.00	0.00E+00	0.00E+00	1.09E-02	8.07E-03	3.19E-03	2.37E-03	1	1.95E-01	1.45E-01
PAH-Non-carcinogenic totals	1.09E-02	8.05E-03	0%	1.00	0.00E+00	0.00E+00	1.09E-02	8.05E-03	3.19E-03	2.36E-03	1	1.95E-01	1.44E-01
PAH-Carcinogenic totals	6.38E-06	1.80E-05	0%	1.00	0.00E+00	0.00E+00	6.38E-06	1.80E-05	1.87E-06	5.28E-06	1	1.14E-04	3.22E-04

7. Conclusions and Recommendations

This Technical Analysis Report summarized activities performed as part of the EIS air quality review process. The review process began with a data adequacy review and reading of public scoping comments related to air quality. Additional information has been added to the technical analysis and will be included in the EIS to respond to concerns raised during public scoping. DEQ has requested that Holcim provide additional emissions inventory and modeling information to provide adequate data for the EIS process.

Holcim provided the additional information and analyses that DEQ requested, all of which is included as appendices to this report. The technical analysis included evaluation of Holcim's emission inventory methodology and results. The methodology used to develop emission factors from the source test database was found to be consistent with EPA practices. The criteria pollutant emissions inventory was found to be adequate for EIS review and no additional information was requested.

The emissions inventory review identified a number of HAPs emissions estimates that needed reevaluation, as described in this report. Changes in the levels of formaldehyde to be used in the risk assessment were recommended. The review also identified limits in the draft air quality permit that needed to be reevaluated. The permit contains limits for the additional amounts of the following pollutants as a result of tire burning: cadmium, hexavalent chromium, lead, arsenic, beryllium, manganese, mercury and PAHs. Recommendations were made for changing the permit limits for mercury and manganese.

Review of the modeling protocol showed that the choice of model, meteorological data and source parameters were appropriate. Public comments have indicated that expansion of the modeling domain would provide useful information. DEQ requested that Holcim review the modeling to expand the modeling domain. Because the AERMOD version for previous modeling was no longer available, Holcim updated the modeling using the most current version of the model. Modeling results have been reviewed and found to be appropriate. The results have been presented graphically in this report to help clarify the modeling process.

Appendix A: Baseline Emissions Inventory

(Attached document, titled "Baseline Emissions Analysis for Combustion of Permitted Solid Fuels", was originally submitted by Holcim to DEQ on April 30, 2004.)

Holcim Trident Plant

Baseline Emissions Analysis for Combustion of Permitted Solid Fuels
April 30, 2004

Background:

On behalf on Holcim (US) Inc. (Holcim), Bison Engineering, Inc. (Bison) has prepared an analysis of baseline air emissions from the Trident plant while burning currently permitted solid fuels. This analysis provides information to support an Environmental Impact Statement (EIS) being prepared by the Montana Department of Environmental Quality (MDEQ). The EIS is being prepared in conjunction with a proposed air quality permit to allow combustion of tires as fuel in the Holcim Trident Cement Kiln. Holcim previously provided an analysis of cumulative emissions for the Trident kiln while combusting a combination of tires and permitted solid fuels.

This analysis utilizes the initially submitted database of source testing data compiled for the air permit application for combusting tires as a fuel. Instead of focusing on the incremental emission changes projected to result from the addition of tires to the current fuel mix as required by MCA 75-2-215 and ARM 17.8.770, this analysis uses the database to project the baseline emissions considering currently permitted solid fuels at Trident. Two baseline emission cases are projected: representative actual emissions and maximum allowable emissions.

The database contains emission data from cement plants across the country that have been tested for specific pollutants of concern before and after combusting tires as a fuel. As outlined in the Compilation of Air Permit Application Submittals for Tires Combustion (compilation document, submitted to the DEQ on January 22, 2004) (see Appendix 4, Table 3-3), data from ten cement plants were compiled in the database and used to project a worst-case estimate of the change in emissions (from the addition of tires to the permitted fuel mix) for the human health risk analysis. Emission data was compiled for 77 compounds of potential concern; this data set primarily focused on available emissions data for the hazardous air pollutants (HAPs) designated by the Federal Clean Air Act. The database was used to conservatively project the incremental emission change due to tire combustion.

Methodology:

The methodology used in projecting baseline emissions from the Trident kiln is similar to that used in the air permit application. As explained in the compilation document, Section 7.3, emissions data before and after combusting tires was converted into pounds per million Btu (lbs/MMBtu) based on heat input to that cement kiln. The original analysis for the air permit application evaluated the difference between

emissions values (in lbs/MMBtu) before and after tires combustion and scaled this emissions change to the Trident kiln based on its maximum heat input at full production.

For this baseline analysis, the emissions before tire combustion in lbs/MMBtu are similarly scaled to Trident based on heat input to the kiln. Two cases are addressed: representative actual emissions and maximum allowable emissions. Representative actual emissions are scaled based on the 1999-2000 average clinker production level of 315,754 tons/year (this value can be found in the compilation document in Section 3.1.1). The years 1999-2000 were selected to be consistent with the air permit application and because they are representative of Holcim's recent operations.

To determine maximum allowable emissions, the amount of clinker production allowed by Trident's current air quality permit (425,000 tons/year) is used to scale the emissions to the Trident kiln. In both cases, the clinker production level is converted to kiln heat input as described in Appendix 4, Section 3.2 of the compilation document.

A spreadsheet for each case is presented that calculates emissions data in both tons/year and gram/second (g/sec) units for each emissions test. Data for each pollutant are then entered into summary spreadsheets for further analysis.

The "summary total spreadsheet" lists all evaluated pollutants in the database, presents the average and maximum data point for each pollutant, and provides the individual data points calculated from each emission test.

The "HAPs Summary spreadsheet" lists all of the evaluated HAPs, the source test data from individual emissions tests, and average and maximum data points (and the statistical information for each data set).

Included in the "polycyclic aromatic hydrocarbons (PAHs) spreadsheet" are the PAH compound data from each emissions test and a "grouping" of compounds based on carcinogenicity.

HAPs Summary:

"The HAPs Summary spreadsheet" lists the evaluated HAP pollutants alphabetically along with their CAS#. For each pollutant, the average and high point for the baseline emissions data set is presented along with the count of data points in the data set. The data set average and standard deviation are used in a t-distribution (sometimes called a student t-distribution) to predict the 95% upper confidence limit (UCL) for that pollutant.

The HAPs Summary spreadsheet uses the following equation to calculate the 95% UCL:

95% UCL = Data set average + t-statistic(standard deviation)/(sample count)$^{0.5}$

Where: t-statistic is for a one tailed test at $t_{0.95}$.

Once the 95% UCL is calculated, the value to be used in the dispersion modeling/risk assessment analyses is the 95% UCL, or if the 95% UCL exceeds the maximum data point, the highest data point in the set is used.

The baseline emissions for dioxins and furans is copied from Appendix 14 in the compilation document. This value reflects the PC-MACT emissions limit for the Trident kiln, which applies regardless of the fuels being combusted in the kiln.

PAHs:

The "PAHs spreadsheet" sums the appropriate compounds for those designated as carcinogens and those contributing to non-cancer hazard. For purposes of emissions factor development, EPA has identified 16 PAH compounds for measurement; seven are designated as carcinogens and the remaining nine contribute to non-cancer hazard. The baseline emissions spreadsheet follows this approach by summing the following PAH compounds for determination of cancer risk and non-cancer hazard:

Cancer risk: Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene.

Non-cancer hazard: Naphthalene, Acenaphthene, Acenaphthylene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene.

Because compound specific toxicity data was available, naphthalene was separated out from the non-cancer PAHs and addressed as a separate compound for risk assessment analyses.

The PAHs spreadsheet sums the carcinogenic and non-cancer compounds for further analysis in the HAPs summary spreadsheet.

Comparison with Emissions Test Data:

An additional spreadsheet comparing actual emissions test data for key pollutants of concern from the Trident kiln to the projected baseline emissions numbers for those pollutants is also presented. This spreadsheet facilitates direct comparison of actual measured values from the Trident kiln stack to the database projections. Results provide confidence that database projections are conservative for use in health risk and environmental analyses.

Summary:

The baseline emissions spreadsheet evaluates emissions data for non-criteria pollutants from ten cement plants, and analyzes that data for use in predicting baseline emissions of non-criteria pollutants from the Trident kiln when combusting currently permitted fuels. Two baseline cases are evaluated (representative actual production,

and maximum allowable production). Similar to the approach used in the air quality permit application, the estimated baseline emissions are conservatively predicted by using the maximum data point or, where appropriate, the 95% UCL from the baseline emissions database. Actual emissions test data for select pollutants of concern is also presented to demonstrate the conservatism built into these analyses.

Holcim (US) Inc.
Trident Plant: Tire as Fuel Project
HAP Emissions Study
Inactive PTE Emissions Analysis - HAPs Summary

Note: ND = Not detected

Table 9	Pollutant	Inactive Average (g/sec)	Inactive High Point (g/sec)	Count	Average (g/sec)	Standard Deviation	T-Statistic	MDL Input Emissions Level (LEL)	Input Over MDL LEL or Statistical High Point (g/sec)	Holcim - Clarksville, MO (g/sec)	Salt Creek Cement, UT (g/sec)	Holcim (US) Inc. (HIL) TDF (g/sec)	Holcim - Midlothian, TX (g/sec)	Lehigh Portland Cement Company - Union Bridge, MD (g/sec)	Lehigh Hanson - Leamington Cement, Ontario, Canada (g/sec)	Holcim - Holcim, CA (g/sec)	California Portland Cement, Colton, CA (g/sec)	Holcim - Lucerne Valley, CA (g/sec)	Lehigh Hanson - Leamington Cement, Ontario, Canada (g/sec)	HMT Cement @ 11 % TDF (g/sec)	HMT Cement @ 11 % TDF (g/sec)	Holcim (US) Inc. (HIL) TDF (g/sec)
75-07-0	Acetaldehyde	4.07E-02	8.01E-02	1	8.01E-02				8.01E-02								8.01E-02	ND				
107-02-8	Acrolein	1.41E-02	1.41E-02	1	1.41E-02				1.41E-02								1.41E-02					
79-06-1	Acrylamide	4.88E-05	4.88E-05	1	4.88E-05				4.88E-05								4.88E-05					
Compound	Antimony	2.80E-05	4.32E-05	3	2.80E-05	2.46E-05	2.353	5.80E-05	4.32E-05				ND				ND	1.97E-05		4.32E-05	4.32E-05	
Compound	Arsenic	3.88E-05	8.88E-05	3	3.88E-05	4.05E-05	2.353	7.38E-05	7.88E-05		ND	ND			2.08E-05	2.17E-05	ND	3.43E-05	2.78E-05	3.03E-05	8.88E-05	ND
71-43-2	Benzene	6.60E-03	3.61E-01	3	6.60E-03	6.60E-03	1.353	1.32E-01	1.32E-01			4.14E-03	3.61E-01	3.64E-02	7.98E-03	4.55E-03	4.06E-02	ND	4.06E-02			4.14E-02
100-44-7	Benzyl chloride	ND	ND	0													ND					
Compound	Beryllium	1.21E-05	2.38E-05	3	1.21E-05	9.96E-06	2.353	2.76E-05	2.38E-05	ND			ND		2.20E-05	2.38E-05	ND	3.04E-07	ND	1.77E-05	1.77E-05	
111-44-4	Bis (2-chloroethyl) ether	ND	ND	0								ND										ND
117-81-7	Bis (2-ethylhexyl)phthalate	6.18E-05	6.18E-05	3	6.18E-05	8.02E+00	6.314	6.18E-05	6.18E-05			6.18E-05										6.18E-05
75-25-2	Bromoform	ND	ND	0								ND										ND
74-83-9	Bromomethane (Methyl Bromide)	6.21E-04	6.21E-04	3	6.21E-04	9.00E+00	6.314	6.21E-04	6.21E-04			6.21E-04					ND					6.21E-04
106-99-0	1,3 Butadiene/Butadiene	4.48E-04	4.48E-04	3	4.48E-04	8.98E+00	6.314	4.48E-04	4.48E-04			4.48E-04	ND				ND					4.48E-04
75-45-6	2-Butanone (MEK)	1.39E-04	1.39E-04	3	1.39E-04	8.02E+00	6.314	1.39E-04	1.39E-04			1.39E-04										1.39E-04
Compound	Cadmium	8.97E-05	3.60E-04	11	8.97E-05	7.36E-05	1.812	1.31E-04	1.61E-04		7.30E-05	8.19E-05	ND	5.87E-05	1.34E-04	3.60E-04	4.27E-05	4.05E-05	5.87E-05	1.94E-04	1.94E-04	8.19E-05
75-15-0	Carbon Disulfide	1.64E-02	1.64E-02	2	1.64E-02	8.02E+00	6.314	1.64E-02	1.64E-02			1.64E-02										1.64E-02
56-23-5	Carbon Tetrachloride	ND	ND	0								ND					ND					ND
7782-50-5	Chlorine	7.88E-02	7.88E-02	1	7.88E-02				7.88E-02				7.88E-02									
108-90-7	Chlorobenzene	2.13E-04	2.88E-04	4	2.13E-04	3.34E-04	2.353	8.79E-04	8.79E-04			2.24E-04					2.13E-04		1.02E-03			2.24E-04
67-66-3	Chloroform	ND	ND	0								ND					ND		ND			ND
74-87-3	Chloromethane (Methyl chloride)	4.88E-03	6.37E-03	3	4.88E-03	2.37E-03	2.353	9.34E-03	6.37E-03			6.37E-03		1.12E-03			ND					6.37E-03
Compound	Chromium (total)	1.30E-04	3.79E-04	10	1.30E-04	9.11E-05	1.833	1.98E-04	1.00E-04		ND	1.30E-04	3.36E-04	2.79E-04	ND	8.27E-05	5.00E-05	2.35E-05	2.21E-05	1.43E-04	1.43E-04	1.30E-04
Compound	Cobalt	1.19E-05	4.12E-05	4	1.19E-05	1.07E-05	2.353	2.46E-05	8.46E-05						4.32E-07		4.12E-05	2.21E-05	2.78E-05			
Compound	Cobalt	3.60E-05	1.07E-04	3	3.60E-05	1.43E-05	2.353	1.98E-04	1.07E-04						8.46E-05				1.07E-04			
107-06-2	1,2-Dichloroethane (EDC)	ND	ND	0								ND										ND
75-09-2	Dichloromethane	1.88E-04	1.88E-04	3	1.88E-04	8.02E+00	6.314	1.88E-04	1.88E-04			1.88E-04										1.88E-04
106-46-7	1,4 Dichlorobenzene	1.09E-04	1.09E-04	1	1.09E-04				1.09E-04			ND					1.09E-04					ND
91-94-1	3,3-Dichlorobenzidine	ND	ND	0								ND										ND
107-06-2	1,2 Dichloroethane (EDC)	ND	ND	0								ND							ND			ND
75-09-2	Dichloromethane	6.40E-03	6.40E-03	3	6.40E-03	8.02E+00	6.314	6.40E-03	6.40E-03			6.40E-03										6.40E-03
78-87-5	1,2-Dichloropropane	ND	ND	0								ND					ND					
542-75-6	1,3 Dichloropropene	ND	ND	0								ND										ND
131-11-3	Dimethyl Phthalate	2.84E-04	2.84E-04	3	2.84E-04	8.02E+00	6.314	2.84E-04	2.84E-04			2.84E-04										2.84E-04
51-28-5	2,4-Dinitrophenol	1.46E-05	1.46E-05	3	1.46E-05	9.22E+00	6.314	1.46E-05	1.46E-05			1.46E-05										1.46E-05
121-14-2	2,4-Dinitrotoluene	ND	ND	0								ND										ND
106-47-8	Ethylbenzene	2.98E-03	3.38E-03	4	2.98E-03	1.91E-03	2.353	2.98E-03	3.38E-03			1.12E-03	3.32E-03				2.38E-04					1.12E-03
75-00-3	Chloroethane (ethyl chloride)	4.11E-04	4.11E-04	3	4.11E-04	8.02E+00	6.314	4.11E-04	4.11E-04			4.11E-04					ND					4.11E-04
50-00-0	Formaldehyde	2.70E-01	3.38E-01	4	2.70E-01	4.39E-01	2.353	7.84E-01	7.84E-01						3.38E-01	3.38E-01	1.90E-01	ND	3.88E-03			
110-54-3	Hexane (n-hexane)	ND	ND	0								ND										ND
67-63-3	Hexachlorobenzene	ND	ND	0								ND					ND					ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	0								ND										ND
67-72-1	Hexachloroethane	ND	ND	0								ND										ND
7647-01-0	Hydrogen chloride	6.24E-02	1.40E-01	9	6.24E-02	4.04E-02	2.132	8.18E-02	8.18E-02				ND				2.88E-02	2.30E-02	1.90E-01	6.80E-02	6.80E-02	
7664-39-3	Hydrogen fluoride	2.86E-02	2.86E-02	1	2.86E-02				2.86E-02								2.86E-02					
78-93-1	Isophorone	ND	ND	0								ND										ND
Compound	Lead	1.38E-03	2.98E-03	11	1.38E-03	1.11E-03	1.812	1.92E-03	1.88E-03	1.79E-03	ND	1.47E-03	ND	1.01E-03	8.88E-04	8.78E-04	3.10E-04	3.48E-05	8.82E-04	2.98E-03	2.98E-03	1.47E-03
Compound	Manganese	8.04E-04	7.81E-03	9	8.04E-04	2.26E-04	1.860	1.38E-03	1.38E-03				7.80E-04		1.42E-03	2.94E-04	3.49E-04	1.90E-04	9.38E-04	1.61E-03	1.81E-03	
Compound	Mercury	2.37E-05	1.09E-07	10	2.37E-05	8.07E-05	1.833	2.31E-05	2.31E-05	4.27E-04			2.30E-04	1.08E-05	1.08E-02	1.04E-04	9.83E-04	8.90E-05	2.46E-05	8.98E-04	6.32E-04	
108-10-1	4-Methyl-2-Pentanone (MIBK)	ND	ND	0								ND										ND
108-44-8	4-Methyl phenol	8.14E-03	8.14E-03	3	8.14E-03	8.02E+00	6.314	8.14E-04	8.14E-04			8.14E-04										8.14E-04
75-09-2	Methylene chloride	3.88E-03	6.88E-03	8	3.88E-03	2.88E-03	2.132	5.37E-03	5.37E-03			6.88E-03	2.94E-04	2.17E-04					2.88E-04			2.88E-03
91-20-3	Naphthalene	5.04E-03	8.44E-03	7	5.04E-03	4.38E-03	1.943	8.22E-03	8.22E-03		8.88E-04	8.44E-03	7.38E-03				3.38E-03	7.14E-04	8.88E-04			8.44E-03
Compound	Nickel	1.32E-04	3.04E-04	9	1.32E-04	1.13E-04	1.860	2.38E-04	2.38E-04		ND		3.04E-04	1.28E-04	8.38E-04	4.44E-05	1.69E-04	1.31E-05	6.38E-05	1.87E-04	1.87E-04	
98-95-3	Nitrobenzene	1.88E-04	1.88E-04	3	1.88E-04	8.02E+00	6.314	1.88E-04	1.88E-04			1.88E-04										1.88E-04
100-02-7	4-Nitrophenol	ND	ND	0								ND										ND
88-75-5	2-Nitrophenol	ND	ND	0								ND										ND
87-86-5	Pentachlorophenol	ND	ND	0								ND										ND
127-18-4	Tetrachloroethylene	ND	ND	0															ND			
108-95-2	Phenol	1.34E-02	1.34E-02	3	1.34E-02	8.02E+00	6.314	1.34E-02	1.34E-02			1.34E-02										1.34E-02
Compound	Phosphorus	4.32E-04	4.32E-04	1	4.32E-04				4.32E-04						ND		4.32E-04					
Compound	Selenium	9.70E-04	1.38E-03	9	9.70E-04	8.38E-04	2.918	1.40E-03	1.38E-03				ND	1.38E-03	1.38E-03	1.70E-03	ND	1.94E-07	ND	8.97E-04	8.97E-04	
108-42-6	Styrene	1.16E-02	2.41E-02	3	1.16E-02	1.20E-02	2.353	4.46E-02	2.41E-02			2.00E-02	2.41E-02				ND					4.08E-04
79-34-5	1,1,2,2 Tetrachloroethane	ND	ND	0								ND					ND					ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	0								ND					ND					ND
71-55-6	1,1,1 Trichloroethane	3.30E-05	3.30E-05	3	3.30E-05	8.02E+00	6.314	3.30E-05	3.30E-05			3.30E-05					ND		ND			3.30E-05
79-00-5	1,1,2 Trichloroethane	ND	ND	0								ND					ND					ND
79-01-6	Trichloroethylene	ND	ND	0															ND			
95-95-4	2,4,5-Trichlorophenol	ND	ND	0								ND										ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	0								ND										ND
108-88-3	Toluene	6.70E-03	3.61E-01	8	6.70E-03	1.14E-01	2.132	1.88E-01	1.88E-01			7.51E-03	2.61E-01	6.11E-03			7.03E-03					7.51E-03
108-05-4	Vinyl acetate	ND	ND	0								ND										ND
75-01-4	Vinyl chloride	7.53E-04	1.55E-03	3	7.53E-04	6.97E-04	2.353	1.63E-03	1.55E-03			4.70E-04					ND		1.30E-03			4.70E-04
1330-20-7	Xylenes, total	4.47E-03	1.44E-01	4	4.47E-03	6.98E-03	2.353	1.38E-01	1.38E-01			1.49E-03	1.44E-01				1.34E-03					1.49E-03
Compound	Zinc	3.19E-03	1.84E-01	12	3.19E-03	7.89E-03	1.796	5.87E-03	5.87E-03	2.94E-03	6.91E-04	1.84E-03	6.31E-04		7.03E-04	3.60E-03	4.88E-04	6.38E-04	2.78E-03	2.78E-03		1.84E-03
1746-01-6	TCDD Eq *	7.60E-09	7.60E-09	0					7.60E-09													
1336-36-3	Total PCBs	1.90E-05	8.88E-05	3	1.90E-05	3.15E-05	2.353	7.38E-05	8.88E-05						7.08E-07		9.88E-05		1.90E-05			
	PAH-Non-carcinogenic total	1.22E-03	4.06E-03	7	1.22E-03	1.80E-03	1.943	3.54E-03	3.04E-03		6.04E-05	4.04E-03	ND		1.88E-03	3.08E-04	ND	1.72E-05	6.88E-04			4.04E-03
	PAH-Carcinogenic total	1.79E-04	6.38E-04	5	3.37E-04	3.00E-04	2.132	7.88E-04	6.38E-04			ND	ND		8.01E-07	6.38E-04		7.77E-05	8.80E-05			ND

* TCDD Eq. is the equivalent PB-MWT Unit

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
	Pollutant	Projected Average	Projected High Point	Holnam-Clarksville, MO	Ash Grove-Durkee, OR	Holnam/Ideal-Seattle, WA (14% TDF)	Boxcrow-Midlothian, TX	Lehigh Portland Cement Company-Union Bridge, MD	1990 RMC Lonestar-Davenport, CA	Southwestern-Victorville, CA	California Portland-Colton, CA	Mitsubishi-Lucerne Valley, CA	1992 RMC Lonestar-Davenport, CA	1997 Dundee @ 15 % TDF	1997 Dundee @ 21 % TDF	Holnam/Ideal-Seattle, WA (11% TDF)
10	Dibenz(a,h)anthracene*	8.07E-06	1.01E-05			ND			1.01E-05	ND		2.42E-05	ND			ND
11	Dibenzofuran	1.09E-03	1.36E-03		8.47E-05	1.36E-03										1.33E-03
12	Dichlorobenzene	ND	ND										ND			ND
13	Dichloromethane	2.07E-02	3.91E-02			2.24E-03										3.91E-02
14	Dimethyl Phthalate	ND	ND			ND										ND
15	Di-N-Butyphthalate	ND	ND			ND										ND
16	Ethyl Toluene	8.32E-02	8.32E-02				8.32E-02									
17	Ethylbenzene	1.33E-02	8.12E-02			7.86E-04	8.12E-02				9.90E-04					9.76E-06
18	Ethynylmethylbenzene	ND	ND				ND									ND
19	Fluoranthene	9.75E-06	2.77E-04			2.50E-04			4.48E-06	4.61E-06		1.27E-06	7.00E-06			2.77E-04
20	Fluorene	9.96E-06	1.96E-04			1.96E-04	ND				ND	1.50E-06	3.63E-06			1.95E-04
21	Formaldehyde	7.34E-02	3.02E-01						4.21E-02	6.75E-04	2.00E-02	2.22E-03	3.02E-01			
22	Hexachlorobenzene	ND	ND			ND										ND
23	Hexachlorobutadiene	ND	ND			ND					ND					ND
24	Hexachlorocyclopentadiene	ND	ND			ND										ND
25	Hexachloroethane	ND	ND			ND										ND
26	Hydrogen Chloride	6.66E-02	1.06E-01				ND				7.63E-02	1.83E-02	1.05E-01	6.17E-02	6.92E-02	
27	Hydrogen fluoride	4.37E-03	4.37E-03								4.37E-03					
28	Indeno(1,2,3-cd)pyrene*	1.14E-06	3.39E-06			ND			3.39E-06	3.52E-06		2.42E-06	ND			ND
29	Iron	8.82E-03	1.69E-02		2.90E-03		4.08E-03		1.25E-02				1.69E-02			
30	Isophorone	ND	ND			ND										ND
31	Lead	1.18E-03	3.96E-03	1.33E-03	ND	1.03E-03	ND	3.96E-03	4.36E-04	4.59E-06	1.08E-04	1.20E-05	6.20E-04	1.76E-03	2.72E-03	1.09E-03
32	Limonene	ND	ND				ND									
33	Magnesium	3.84E-03	6.39E-03						1.30E-03				6.39E-03			
34	Manganese	2.21E-03	1.36E-02				7.10E-04		8.04E-04	2.66E-04	3.75E-04	2.94E-06	4.96E-04	1.55E-03	1.35E-02	
35	Mercury	1.01E-03	4.52E-03	4.33E-04			1.77E-04	9.68E-04	8.81E-07	1.40E-03	1.82E-03	3.26E-06	4.52E-03	4.99E-04	6.22E-04	
36	Methyl Indene	9.94E-02	9.94E-02				9.94E-02									
37	Methylene Chloride	9.75E-01	3.91E-02			2.24E-03	4.88E-03	1.10E-03					1.48E-03			3.91E-02
38	Methylstyrene	6.21E-04	6.21E-04				6.21E-04									
39	Molybdenum	1.04E-04	1.76E-04						3.17E-06				1.76E-04			
40	Naphthalene	3.92E-03	1.03E-02		2.19E-04	4.42E-03	1.03E-02				6.10E-03	6.71E-06	1.40E-03			4.97E-03
41	Nickel	1.74E-04	6.71E-04		ND		2.66E-04	2.26E-04	5.71E-04	1.52E-06	5.46E-06	2.06E-06	6.76E-06	1.25E-04	2.46E-04	
42	Nitrobenzene	2.09E-04	2.09E-04			2.09E-04										ND
43	N-Nitrosodiphenylamine	ND	ND			ND										ND
44	NOX	5.56E+01	5.56E+01	5.56E+01												
45	PAH	6.86E-06	2.06E-05						2.06E-05	4.88E-06	ND	6.02E-07	1.19E-05			
46	Particulate Matter	1.29E+00	1.80E+00	6.64E-01										1.22E+00	1.80E+00	
47	Pentachlorophenol	ND	ND			ND										ND
48	Pentadiene	3.79E-02	3.79E-02				3.79E-02									
49	Perchloroethylene	ND	ND										ND			
50	Phenanthrene	5.55E-04	1.38E-03		8.47E-05	1.38E-03	ND					9.33E-06	2.36E-05			1.32E-03
51	Phenol	6.49E-03	8.51E-03			8.51E-03										4.47E-03
52	Phosphorous	5.37E-04	5.37E-04						ND		5.37E-04					
53	Pyrene	9.56E-06	1.98E-04			1.86E-04						4.54E-07	2.09E-05			1.98E-04
54	Selenium	3.39E-04	9.89E-04				ND	9.89E-04	7.54E-06	8.68E-06	ND	7.36E-07	ND	4.07E-04	6.22E-04	
55	Silicon	8.38E-02	1.61E-01						6.22E-03				1.61E-01			
56	Styrene	2.27E-02	6.79E-02			8.92E-05	6.79E-02				ND					4.82E-05
57	Sulfur Dioxide	5.86E+01	5.86E+01	5.86E+01												
58	Thallium	1.41E-05	1.41E-05				1.41E-05									
59	Titanium	3.96E-04	6.17E-04						1.74E-04				6.17E-04	ND		
60	Toluene	8.27E-02	3.98E-01			1.31E-03	3.98E-01	6.74E-03			8.77E-03					5.06E-04
61	Total Hydrocarbons	1.62E+01	1.62E+01	1.62E+01												
62	Trichlorobenzene	ND	ND										ND			
63	Trichloroethylene	ND	ND										ND			
64	Vanadium	2.81E-05	5.52E-05		ND		ND		1.07E-06				5.52E-05			
65	Vinyl Acetate	ND	ND			ND										ND
66	Vinyl Chloride	1.36E-03	2.41E-03			ND					3.09E-04		2.41E-03			ND
67	Xylenes, Total	8.14E-02	2.39E-01			2.56E-03	2.39E-01				4.31E-03					6.51E-04
68	Zinc	1.23E-02	8.98E-02	2.41E-03	9.07E-04	3.03E-02	6.21E-04		2.06E-04	1.40E-03	1.71E-03	8.37E-05	1.06E-03	2.96E-03	5.92E-03	9.99E-02
69	Zirconium	1.71E-06	1.71E-06						1.71E-06				ND			
70	TCDD Eq. *	7.66E-09	7.66E-09													
71	Total PCBs	2.65E-06	5.26E-05						2.39E-05		5.26E-05		3.06E-06			
72	PAH-Non-carcinogenic totals	6.62E-04	2.19E-03		8.47E-05	2.19E-03	ND		1.64E-05	1.29E-04	ND	1.62E-05	4.21E-05			2.16E-03
73	PAH-Carcinogenic totals	6.86E-06	2.06E-05			ND	ND		2.06E-05	4.88E-06		6.34E-07	1.19E-05			ND
74	* TCDD Eq. is the calculated PC-MACT Limit															

Appendix B: Cumulative Emissions Inventory

(Attached document, titled "Cumulative Emissions Analysis for Combustion of Tires and Permitted Solid Fuels", was originally submitted by Holcim to DEQ on March 3, 2004.)

Holcim Trident Plant

Cumulative Emissions Analysis for Combustion of Tires and Permitted Solid Fuels

Background:

On behalf on Holcim (US) Inc. (Holcim), Bison Engineering, Inc. (Bison) has prepared an analysis of cumulative air emissions from the Trident plant while burning tires as fuel in conjunction with currently permitted solid fuels.

This analysis further utilizes the initially submitted database of source testing data compiled for the air permit application for combusting tires as a fuel. Instead of focusing on the incremental emission changes projected to result from the addition of tires to the current fuel mix, this analysis uses the database to conservatively project the cumulative emissions considering both tires and currently permitted solid fuels at Trident.

The database contains emission data from cement plants across the country that have been tested for specific pollutants of concern before and after combusting tires as a fuel. As outlined in the Compilation of Air Permit Application Submittals for Tires Combustion (compilation document, submitted to the DEQ on January 22, 2004) (see Appendix 4, Table 3-3), data from ten cement plants were compiled in the database and used to project a worst-case estimate of the change in emissions (from the addition of tires to the permitted fuel mix) for the human health risk analysis. Emission data was compiled for 77 compounds of potential concern; this data set primarily focused on available emissions data for the hazardous air pollutants (HAPs) designated by the Federal Clean Air Act. The database was used to conservatively project the incremental emission change due to tire combustion.

Methodology:

The methodology used in projecting cumulative emissions from the Trident kiln is similar to that used in the air permit application. As explained in the compilation document, Section 7.3, emissions data before and after combusting tires was converted into pounds per million Btu (lbs/MMBtu) based on heat input to that cement kiln. The original analysis for the air permit application evaluated the difference between emissions values (in lbs/MMBtu) before and after tires combustion and scaled this emissions change to the Trident kiln based on its maximum heat input at full production.

For this cumulative analysis, the emissions after tire combustion in lbs/MMBtu were similarly scaled to Trident based on maximum heat input to the kiln. This data was presented in both tons/year and gram/second (g/sec) units for each emissions test. Data for each pollutant were then entered into summary spreadsheets for further analysis.

The "summary total spreadsheet" lists all evaluated pollutants in the database, presents the average and maximum data point for each pollutant, and provides the individual data points calculated from each emission test.

The "HAPs Summary spreadsheet" lists all of the evaluated HAPs, the source test data from individual emissions tests, and average and maximum data points (and the statistical information for each data set).

Included in the "polycyclic aromatic hydrocarbons (PAHs) spreadsheet" are the PAH compound data from each emissions test and a "grouping" of compounds based on carcinogenicity.

HAPs Summary:

"The HAPs Summary spreadsheet" lists the evaluated HAP pollutants alphabetically along with their CAS#. For each pollutant, the average and high point for the cumulative emissions data set is presented along with the count of data points in the data set. The data set average and standard deviation are used in a t-distribution (sometimes called a student t-distribution) to predict the 95% upper confidence limit (UCL) for that pollutant.

The HAPs Summary spreadsheet uses the following equation to calculate the 95% UCL:

95% UCL = Data set average + t-statistic(standard deviation)/(sample count)$^{0.5}$
Where: t-statistic is for a one tailed test at $t_{0.95}$.

Once the 95% UCL is calculated, the value to be used in the dispersion modeling/risk assessment analyses is the 95% UCL, or if the 95% UCL exceeds the maximum data point, the highest data point in the set is used.

The cumulative emissions for dioxins and furans is copied from Appendix 14 in the compilation document. This value reflects the PC-MACT emissions limit for the Trident kiln, which applies regardless of the fuels being combusted in the kiln.

PAHs:

The "PAHs spreadsheet" sums the appropriate compounds for those designated as carcinogens and those contributing to non-cancer hazard. For purposes of emissions factor development, EPA has identified 16 PAH compounds for measurement; seven are designated as carcinogens and the remaining nine contribute to non-cancer hazard. The cumulative emissions spreadsheet follows this approach by summing the following PAH compounds for determination of cancer risk and non-cancer hazard:

Cancer risk: *Benz(a)anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(a,h)anthracene, Indeno(1,2,3-cd)pyrene.*

Non-cancer hazard: *Naphthalene, Acenaphthene, Acenaphthylene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene.*

Because compound specific toxicity data was available, naphthalene was separated out from the non-cancer PAHs and addressed as a separate compound for risk assessment analyses.

The PAHs spreadsheet sums the carcinogenic and non-cancer compounds for further analysis in the HAPs summary spreadsheet.

Summary:

The cumulative emissions spreadsheet evaluates emissions data for non-criteria pollutants from cement plants combusting tires as fuel, and analyzes that data for use in predicting cumulative emissions from the Trident kiln when combusting tires in addition to other permitted fuels. Similar to the approach used in the air quality permit application, the estimated cumulative emissions are conservatively predicted by using the maximum data point or, where appropriate, the 95% UCL from the cumulative emissions database.

Holcim (US) Inc.
Trident Plant: Tires as Fuel Project
HAP Emissions Study
Cumulative Emissions Analysis - Total Summary Note: ND = Not detected

Holcim Trident Potential MMBtu/year	2,426,750	Baseline MMBtu/hr	949	285	258	443	145	444	498	198	640	422	356	356	258
Holcim Trident Potential Production,	425,000	TDF MMBtu/hr	942	288	258	393	145	420	482	192	655	422	368	363	258

Pollutant	Projected Average (g/sec)	Projected High Point (g/sec)	Holnam-Clarksville, MO (g/sec)	Ash Grove-Durkee, OR (g/sec)	Holnam/Ideal-Seattle, WA (14% TDF) (g/sec)	Boxcrow-Midlothian, TX (g/sec)	Lehigh Portland Cement Company-Union Bridge, MD (g/sec)	1990 RMC Lonestar-Davenport, CA (g/sec)	Southwestern-Victorville, CA (g/sec)	California Portland-Colton, CA (g/sec)	Mitsubishi-Lucerne Valley, CA (g/sec)	1992 RMC Lonestar-Davenport, CA (g/sec)	1997 Dundee @ 15 % TDF (g/sec)	1997 Dundee @ 21 % TDF (g/sec)	Holnam/Ideal-Seattle, WA (11% TDF) (g/sec)
1 Acetaldehyde	4.28E-03	8.55E-03								8.55E-03	8.90E-09				
2 Acrolein	ND	ND								ND					
3 Trichloroethene	3.07E-04	3.87E-04								3.87E-04					
4 1,1,1 Trichloroethane	1.17E-04	1.84E-04			8.35E-05					1.84E-04		ND			1.14E-04
5 1,1,2 Trichloroethane	ND	ND			ND					ND					ND
6 1,1,2,2 Tetrachloroethane	ND	ND			ND					ND					ND
7 1,2 Dibromoethane (EDB)	ND	ND			ND										ND
8 1,2 Dichloroethane (EDC)	ND	ND			ND							ND			ND
9 1,2,4-Trichlorobenzene	ND	ND			ND					ND					ND
10 1,2-Dichlorobenzene	ND	ND			ND										ND
11 1,2-Dichloropropane	ND	ND			ND					ND					
12 1,3 Butadiene/Butadiene	4.63E-04	1.15E-03			1.87E-04	ND				1.15E-03					8.03E-05
13 1,3 Dichloropropene	ND	ND			ND										
14 1,3-Dichlorobenzene	ND	ND			ND										ND
15 1,4 Dichlorobenzene	1.27E-03	1.27E-03			ND					1.27E-03					ND
16 2,4,5-Trichlorophenol	ND	ND			ND										ND
17 2,4,6-Trichlorophenol	ND	ND			ND										ND
18 2,4-Dinitrophenol	ND	2.14E-04			ND										2.14E-04
19 2,4-Dinitrotoluene	ND	ND			ND										ND
20 2-Butanone (MEK)	9.28E-05	1.20E-04			1.20E-04										8.60E-05
21 2-Methyl Napthalene	1.30E-03	1.48E-03			1.48E-03										1.12E-03
22 2-Methyl Phenol	ND	ND			ND										ND
23 2-Nitrophenol	4.74E-03	4.78E-03			4.78E-03										4.70E-03
24 3,3-Dichlorobenzidine	ND	ND			ND										ND
25 4,6-Dinitro-2-methylphenol	ND	ND			ND										ND
26 4-Methyl Phenol	5.28E-04	5.35E-04			5.35E-04										3.80E-04
27 4-Methyl-2-Pentanone (MIBK)	ND	ND			ND										ND
28 4-Nitrophenol	3.30E-03	4.13E-03			2.48E-03										4.13E-03
29 Acenaphthalene	8.56E-05	1.71E-04			1.71E-04						4.48E-07	2.81E-06			1.88E-04
30 Acenaphthylene	1.90E-06	2.62E-06			ND	ND					2.62E-09	1.17E-06			ND
31 Aliphatic Compounds (lb/MMBtu)	ND	ND													
32 Aluminum	6.71E-03	1.86E-02				1.06E-03		4.56E-04				1.86E-02			
33 Anthracene	2.30E-06	8.33E-06			ND			6.29E-06	8.33E-06		5.54E-07	1.81E-06			ND
34 Antimony	2.95E-06	4.38E-06				ND				ND	2.19E-06		4.38E-06	4.38E-06	
35 Arsenic	2.69E-06	6.67E-06		2.54E-06	ND	ND		1.12E-06	6.68E-06	ND	1.08E-06	6.40E-06	6.16E-06	6.67E-06	ND
36 Barium	4.19E-04	7.97E-04		ND		ND		6.97E-05				7.97E-04	4.14E-04	3.97E-04	
37 Benzaldehyde	2.22E-02	2.22E-02				2.22E-02									
38 Benzene	5.22E-02	2.89E-01			4.00E-02	2.89E-01	3.90E-02	3.38E-02	1.09E-02	4.17E-02	7.62E-05	5.03E-02			1.43E-02
39 Benzo(a)anthracene*	1.97E-06	4.38E-06			ND			2.03E-06	4.38E-06		2.13E-07	2.38E-07			ND
40 Benzo(a)pyrene*	1.56E-06	4.21E-06			ND	ND		4.21E-06	4.68E-07		3.88E-09	ND			ND
41 Benzo(b)fluoranthene*	5.60E-06	5.60E-06			ND						5.60E-06	ND			ND
42 Benzo(g,h,i)perylene	1.91E-06	5.71E-06			ND			5.71E-06	1.33E-06		3.17E-09	ND			ND
43 Benzo(k)fluoranthene*	1.26E-06	1.26E-06			ND						1.26E-06	ND			ND
44 Benzoic Acid	ND	ND			ND										ND
45 Benzyl chloride	ND	ND								ND					
46 Beryllium	7.96E-06	1.75E-05	ND			ND		1.13E-05	3.61E-06	ND	5.28E-07	ND	1.70E-05	1.75E-05	
47 Bis (2-chloroethoxy)methane	ND	ND			ND										ND
48 Bis (2-chloroethyl) ether	ND	ND			ND										ND
49 Bis (2-Ethylhexyl)phthalate	6.23E-03	7.65E-03			7.65E-03										4.81E-03
50 Boron	5.32E-04	5.32E-04				5.32E-04									
51 Bromoform	ND	ND			ND										ND
52 Bromomethane (Methyl Bromide)	2.46E-04	4.12E-04			4.12E-04					2.11E-04					1.13E-04
53 Butyl Benzyl Phthalate	ND	ND			ND										ND
54 Cadmium	3.76E-05	6.96E-05		2.54E-05	1.95E-05	ND	6.94E-05	1.04E-05	1.09E-05	3.22E-05	6.71E-05	1.09E-05	5.34E-05	6.49E-05	4.94E-05
55 Carbon Disulfide	1.50E-03	2.31E-03			2.31E-03										5.86E-04
56 Carbon Monoxide	2.44E+01	2.44E+01	2.44E+01												
57 Carbon Tetrachloride	4.73E-05	4.82E-05			4.84E-05					ND					4.82E-05
58 Chloride	ND	ND													
59 Chloride (lb/hr)	2.38E-02	2.38E-02		2.38E-02											
70 Chlorine	9.14E-02	9.14E-02				9.14E-02									
71 Chlorobenzene	3.95E-04	1.11E-03			5.17E-06					3.97E-04		1.11E-03			2.32E-05
72 Chloroethane (Ethyl chloride)	ND	ND			ND					ND					ND
73 Chloroform	ND	ND			ND					ND		ND			ND
74 Chloromethane (Methyl chloride)	1.81E-03	2.60E-03			2.60E-03		1.79E-03			ND					1.04E-03
75 Chromium (total)	9.53E-05	2.64E-04		ND	1.01E-04	7.82E-05	1.15E-04	3.32E-05	5.61E-05	7.17E-05	5.55E-05	3.23E-05	1.25E-04	1.44E-04	2.59E-04
76 Chromium 6	9.82E-06	2.04E-05						5.24E-06		2.05E-05	4.27E-06	9.18E-06			
77 Chrysene*	6.02E-07	9.10E-07			ND						2.95E-07	9.10E-07			ND
78 Cobalt	4.54E-05	6.70E-05						3.37E-05				6.70E-05			
79 Copper	2.91E-04	6.43E-04		3.38E-04	3.88E-04	5.97E-05		7.96E-05				2.49E-04			6.43E-04

Appendix C: Emissions Factor Comparison

(Attached document, titled "Combustion of Tires and Permitted Solid Fuels, Comparison of Cumulative Emissions with Site-specific Emissions Test Data, was originally submitted by Holcim to DEQ on March 3, 2004.)

Holcim Trident Plant
Combustion of Tires and Permitted Solid Fuels
Comparison of Cumulative Emissions with Site-specific Emissions Test Data

On March 3, 2004, Bison Engineering, Inc. (Bison), on behalf of Holcim, provided a projection of cumulative air emissions from the Trident plant while burning tires as fuel in conjunction with Trident's currently permitted solid fuels.

In support of the projected cumulative emissions, Bison has prepared a spreadsheet that compares the projected emissions with actual emissions testing data from the Trident plant. The purpose of this spreadsheet is to provide assurance that projections of cumulative emissions from the Trident kiln, when burning tires and other permitted solid fuels, are reasonable.

The spreadsheet provides emissions test data for 14 hazardous air pollutants (HAPs), including dioxins/furans, and one non-regulated compound. The test data for 2002-2003 has been averaged and compared to the cumulative emission projections from the emissions database in Trident's permit application. Dioxins/furans emissions data for 2000, 2002 and 2003 is averaged and compared with the Portland Cement Maximum Achievable Control Technology (PC-MACT) emissions limit applicable to the Trident cement kiln.

As a secondary measure of proving the projected emissions are representative, another column has been added in the table to provide a calculated emissions level, based on maximum production at Trident (425,000 tons clinker/year), using EPA AP-42 emissions factors. These factors are presented on a pounds of pollutant per ton of clinker produced basis. The factors used were for kilns with electrostatic precipitator control devices, unless only data for a fabric filter-controlled kiln was available. Unlike the permit application emissions database, which contains emissions tests from ten cement plants, many of the AP-42 emissions factors are based on one emissions test. Further, the fuels combusted during the emission test(s) were not identified in the AP-42 factor references.

Data for polycyclic aromatic hydrocarbons (PAHs) are compiled from emissions test results and the database, and then standardized to EPA's list of 16 PAH compounds (listed in the previous cumulative emissions submittal). Some data sets had emissions data for all 16 compounds, while others had fewer compounds measured and/or detected.

A comparison of emissions test data with the projected cumulative emissions demonstrates that the projection methodology produces values that encompass test data (as expected); further, some margin is provided for emissions that may result from the combustion of tires. Review of the cumulative emissions package previously provided shows that many of the HAPs covered in this comparison, on average, will decrease when tires are added to the fuel mix. Nonetheless, this comparison should provide assurance to the reader that cumulative emissions have been conservatively estimated for use in evaluating potential cumulative environmental impacts of the Trident kiln when combusting tires.

Holcim Trident Plant
Combustion of Tires and Permitted Solid Fuels
Emissions Test Data Comparison with Cumulative and Baseline Projections for COPCs

Pollutant	Holcim (Trident) Test Data			Database Projected Baseline[g] Emissions (lbs/hr)	Database Projected Baseline[h] Emissions (lbs/hr)	Database Projected Cumulative Emissions (lbs/hr)	AP-42[c] Emissions (lbs/hr)
	2003 Test Data[a] (lbs/hr)	2002 Test Data[b] (lbs/hr)	Average 2002-03 Test Data (lbs/hr)				
HAPs							
Antimony	1.28E-04		1.28E-04	3.43E-04	2.55E-04	3.48E-04	
Arsenic	8.13E-05	2.55E-04	1.68E-04	5.79E-04	4.30E-04	3.87E-04	6.31E-04
Benzene	1.90E-01	3.20E-01	2.55E-01	1.06E+00	7.84E-01	8.70E-01	1.50E-01
Beryllium	1.79E-05		1.79E-05	1.71E-04	1.26E-04	1.28E-04	3.20E-05
Cadmium	8.87E-05	3.70E-04	2.29E-04	1.04E-03	7.72E-04	4.03E-04	4.03E-04
Chromium (total)	9.20E-04	8.90E-04	9.05E-04	1.50E-03	1.12E-03	1.14E-03	3.73E-04
Cobalt	3.43E-04	4.37E-04	3.90E-04	8.50E-04	6.30E-04	4.53E-04	
Hydrogen Chloride	1.50E-01		1.50E-01	7.30E-01	5.42E-01	7.67E-01	2.38E+00
Lead	1.94E-03	1.29E-02	7.42E-03	1.45E-02	1.07E-02	1.47E-02	3.44E-02
Manganese	1.59E-03	3.47E-03	2.53E-03	1.02E-02	7.58E-03	4.18E-02	4.17E-02
Mercury (total)	1.85E-03	3.40E-03	2.63E-03	4.22E-02	3.13E-02	1.42E-02	1.07E-02
Nickel	4.28E-04		4.28E-04	1.79E-03	1.33E-03	2.27E-03	
PAHs[d]	1.96E-02		1.96E-02	8.64E-02	6.42E-02	6.41E-02	3.71E-02
Non-regulated							
Copper	5.26E-04	8.47E-04	6.87E-04	1.56E-02	1.16E-02	4.31E-03	2.57E-01

HAPs with PC-MACT Emissions Limits					
Dioxins/Furans	2003 Test Data[a,e]	2002 Test Data[b,e]	2000 Test Data[a,f]	Average 2001-03 Test Data	PC-MACT Limit
(ng/dscm)	1.65E-03	3.61E-04	4.20E-03	2.07E-03	2.00E-01

[a] Testing on approx. 65/35% coal/coke fuels.
[b] Testing on approx. 75/25% coal/coke fuels.
[c] AP-42 Table 11.6-19, calculated at maximum production.
[d] PAHs include EPA group of 16 compounds.
[e] D/F test results as 2378-TCDD TEQ in nanograms/dscm @ 7% oxygen.
[f] Testing on approx. 82/18% syncoal/coke fuels.
[g] Using 425,000 tons clinker/year production limit.
[h] Using 315,754 tons clinker/year average production for 1999-2000.

Appendix D: Final Dispersion Modeling Protocol and Report

(Attached document, titled "Permit Application for Tires Combustion Dispersion Modeling Protocol and Report (updated)", was originally submitted by Holcim to DEQ on May 10, 2004.)

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Air Resources Management Bureau

Holcim (US) Inc. Trident Plant

Permit Application for Tires Combustion
Dispersion Modeling Protocol and Report (updated)
May 10, 2004

1.0 Introduction

This dispersion modeling protocol and report provides a third update of air dispersion modeling conducted in support of the Holcim Trident plant tires combustion air quality permit application. At the request of the Montana Department Environmental Quality (MDEQ), this latest round of modeling used the most up-to-date version of the AERMOD Model.

Previous modeling work was provided in support of the air permit application for tires combustion based on the models available at that time. The previous modeling work completed in support of the air permit application for tires combustion is described in the Compilation of Application Submittals for Tires Combustion (compilation document), dated January 2004. DEQ issued a completeness determination for the previous modeling submission on February 12, 2003.

The current modeling approach and outcome are explained in more detail in the following paragraphs. Modeling results are carried into a human health risk assessment (HRA) and screening level ecological risk assessment (SLERA) presented under separate cover. The compliance demonstration with ambient air quality standards presented in the compilation document has also been updated with the latest modeling results and is presented in Section 3.0.

2.0 Dispersion Modeling Protocol

The analytical method used for analysis of ambient air quality impacts from the proposal to combust tires in the Holcim Trident cement kiln was dispersion modeling as outlined by 40 CFR 51.166(l), which specifies the types of models to be used for PSD applications. Modeling discussed within this submittal was conducted in general accordance with the methodology outlined in the *New Source Review Workshop Manual.* Although the *New Source Review Workshop Manual* is a draft, rather than a final document, the methodology is widely used and accepted. This document and the guidance found in Appendix W of 40 CFR 51, Guideline on Air Quality Models, were used as references. In addition, recent EPA guidance on recommended air quality models was utilized in modeling work following the initial permit application submittal.

2.1 Model Selection

The dispersion model used to evaluate ambient air quality impacts from the Trident facility is the AMS/EPA Regulatory Model (AERMOD). The April 21, 2000, *Federal*

Register contains a proposed rule that when adopted will make AERMOD the recommended model for situations similar to those currently addressed using the ISC3 model. In addition, the Seventh Conference on Air Quality Modeling selected AERMOD as the recommended model for complex terrain. In order to follow the most current EPA air dispersion modeling guidelines, AERMOD was selected as the appropriate model for this modeling demonstration.

In the May 31, 2002 permit application submittal, AERMOD was used to characterize impacts of the Trident plant on ambient air quality (see compilation document for further discussion of the modeling protocol and report). MDEQ approved the use of AERMOD for modeling impacts of the Trident kiln in an August 26, 2002 letter.

AERMOD is appropriate for point, volume, and/or area sources; surface, near-surface, and elevated releases; rural or urban areas; simple and complex terrain; transport distances over which steady-state assumptions are appropriate (up to 50 km); and continuous toxic air emissions. AERMOD's regulatory default option includes the use of terrain elevation data, stack-tip downwash and building wake effects, and sequential date checking, and does not permit the use of the model in a screening mode. The regulatory option does not employ pollutant half-life or decay options except in the case of an urban source of sulfur dioxide where a four-hour half-life is applied. AERMOD processes sequential meteorological data to estimate concentrations for averaging times from one hour to the total period of meteorological data input.

AERMOD is designed to accept input data prepared by two specific pre-processor programs: AERMET and AERMAP. AERMET processes meteorological data that is available from the National Weather Service (NWS) through the National Climatic Data Center (NCDC), or from on-site data collection. AERMAP processes digital elevation data available from several different sources, including the U.S. Geological Survey (USGS) digital elevation model (DEM) files.

The AERMOD program and the two pre-processors AERMET and AERMAP have all been updated since the 5/31/02 permit application submittal. This round of dispersion modeling utilized the latest source code for AERMOD (Version 03273), AERMET (Version 03273), and AERMAP (Version 03107) which was provided by BEE-Line Software.

2.2 Meteorological Input Data

The AERMOD model requires hourly meteorological data. AERMET is designed to accept NWS 1-hour surface observations, NWS twice-daily upper air soundings, and any data that may be collected from an on-site meteorological measurement system. These data are processed in three steps. The first step extracts data from the archive data files (NWS and local file format) and performs various quality assessment checks. The second step merges all available surface and upper air data (both NWS and on-site). These merged data are stored together in a single file. The third step reads the merged meteorological data and estimates the boundary layer parameters needed by AERMOD. AERMET writes two files for input to AERMOD: a file of hourly boundary

layer parameter estimates and a file of multiple-level (when the data are available) observations of wind speed and direction, temperature, and standard deviation of the fluctuating components of the wind direction.

To address the model requirements for hourly meteorological data, two data sources were used. First, Holcim collected on-site hourly meteorological data at the Trident site (462,770 Easting, 5,087,572 Northing, Zone 12) from April 1, 2000, through March 31, 2001. Second, since the on-site station did not collect cloud cover or upper air data, NWS data from the nearest station with that data (Great Falls, Montana) was used. As specified by the AERMET documentation, the NWS upper air data was obtained from the NCDC where it had been compiled in TD 6301 U.S. Rawinsonde (AIRS) 6201 fixed-length records format. The NWS surface data was obtained from NCDC in TD 9956 DATSAV3 format output in 3280 fixed records variable-length record format.

The reformatted NWS data were combined with the local wind speed, wind direction, temperature, temperature difference, standard deviation of wind direction, and solar radiation data. Data at the MDEQ-approved on-site meteorological station were measured at a height of 9 meters, except for solar radiation, which was measured at a height of 5 meters and temperature, which was measured at both 2 meters and 9 meters. The meteorological data were recorded using a Campbell Scientific data logger.

For processing of the on-site data collected on the Trident plant site, hours of missing data were substituted according to the procedures specified in *Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models*, by Dennis Atkinson and Russell F. Lee, dated July 7, 1992. The data had only one significant period of missing data, which was due to a 10-hour power failure on December 16 and 17, 2000. For that period, linear interpolation was used to derive the appropriate temperature, and data from the previous day were substituted for wind and solar radiation. One hour of apparently erroneous data (April 26, 2000, 0100) was treated as a missing hour and substituted accordingly. In addition, 73 hours that showed slightly negative solar radiation values were changed to zero. An electronic file containing the meteorological data used in the model was provided in the January 31, 2002 application submittal.

According to the AERMOD output file, 1.7 percent of the hours were missing; investigation of the input meteorological data revealed that the NWS Great Falls upper air data had several days that were missing sounding data. No attempt was made to provide substitute values for the missing upper air data because of the small percentage of missing hours.

Seasonally characteristic values for surface roughness, Bowen ratio, and albedo obtained from EPA recommendations contained in the AERMET User's Guide were selected and incorporated into AERMET. AERMET created the surface and profile meteorological data files for AERMOD model execution.

An analysis of the meteorological data shows that winds are predominantly from the southwest and, to a lesser extent, from the north-northeast and from the southwest through the southeast. A wind rose illustrating wind direction and velocity frequency is provided as Appendix 5 in the compilation document.

2.3 Terrain Data

AERMAP processes terrain elevation data available from various sources in two different formats. The acceptable types of elevation data include the 7.5-minute Digital Elevation Model (DEM) files prepared by the USGS and the 1-degree (3 arc-second) format produced by the Defense Mapping Agency (DMA). Each 7.5-minute DEM file corresponds to a single 1:24,000-scale USGS quadrangle map. The 1-degree files correspond to the east or west half of a USGS 1:250,000-scale topographic map.

Two domain areas were calculated and used for this modeling demonstration. One domain covered the MDEQ-recommended 10 kilometer (km) receptor grid, and additional receptors located at the Holcim houses, along the Missouri River and County Road, at the nearest residence, and at the Three Forks School. A second domain was calculated for the large receptor grid that encompasses the Gallatin Valley. The smaller domain required twenty-four 7.5 minute DEM files and the large domain required an additional 106 (130 total) 7.5 minute DEM files. The larger domain required for this extended receptor grid extended 60 km to the west, 65 km to the east, 70 km to the south, and 60 km to the north.

All 7.5 minute DEM files were obtained from Micropath (www.micropath.com) and were processed by the BeeLine software overlay to the "chopped" format expected by the AERMAP preprocessor. The following is a list of the one hundred thirty 7.5 minute DEM files that were required for the modeling demonstrations.

45110C6.DEM EMIGRANT, MT
45110C7.DEM DAILEY LAKE, MT
45110C8.DEM LEWIS CREEK, MT
45111C1.DEM THE SENTINEL, MT
45111C2.DEM HIDDEN LAKE, MT
45111C3.DEM GALLATIN PEAK, MT
45111C4.DEM LONE MOUNTAIN, MT
45111C5.DEM FAN MOUNTAIN, MT
45111C6.DEM ENNIS, MT
45111C7.DEM EIGHTMILE CREEK, MT
45111C8.DEM VIRGINIA CITY, MT
45112C1.DEM ALDER, MT
45112C2.DEM LAURIN CANYON, MT
45110D6.DEM PRAY, MT
45110D7.DEM BIG DRAW, MT
45110D8.DEM FRIDLEY PEAK, MT
45111D1.DEM MOUNT BLACKMORE, MT
45111D2.DEM GARNET MOUNTAIN, MT
45111D3.DEM BEACON POINT, MT
45111D4.DEM WILLOW SWAMP, MT
45111D5.DEM CHERRY LAKE, MT
45111D6.DEM ENNIS LAKE, MT
45111D7.DEM LEONARD CREEK, MT
45111D8.DEM RAMSHORN MOUNTAIN, MT
45112D1.DEM COPPER MOUNTAIN, MT
45112D2.DEM SHERIDAN, MT
45110E6.DEM CHIMNEY ROCK, MT
45110E7.DEM BALD KNOB, MT
45110E8.DEM MOUNT ELLIS, MT
45111E1.DEM WHEELER MOUNTAIN, MT
45111E2.DEM GALLATIN GATEWAY, MT
45111E3.DEM RUBY MOUNTAIN, MT
45111E4.DEM CHERRY CREEK CANYON, MT
45111E5.DEM BEAR TRAP CREEK, MT
45111E6.DEM NORRIS, MT
45111E7.DEM MALTBYS MOUND, MT
45111E8.DEM POTOSI PEAK, MT
45112E1.DEM NOBLE PEAK, MT
45112E2.DEM OLD BALDY MOUNTAIN, MT
45110F6.DEM HOPPERS, MT
45110F7.DEM BOZEMAN PASS, MT
45110F8.DEM KELLY CREEK, MT
45111F1.DEM BOZEMAN, MT
45111F2.DEM BOZEMAN HOT SPRINGS, MT
45111F3.DEM ANCENEY, MT
45111F4.DEM MADISON PLATEAU, MT
45111F5.DEM NORRIS NE, MT
45111F6.DEM WILLOW CREEK RESERVOIR, MT
45111F7.DEM HARRISON, MT
45111F8.DEM PONY, MT

45112F1.DEM MANHEAD MOUNTAIN, MT
45112F2.DEM WATERLOO, MT
45110G8.DEM SADDLE PEAK, MT
45111G1.DEM MISER CREEK, MT
45111G2.DEM BELGRADE, MT
45111G3.DEM MANHATTAN, MT
45111G4.DEM MANHATTAN SW, MT
45111G5.DEM THREE FORKS SE, MT
45111G6.DEM WILLOW CREEK, MT
45111G7.DEM SAPPINGTON, MT
45111G8.DEM JEFFERSON ISLAND, MT
45112G1.DEM WHITEHALL, MT
45112G2.DEM VENDOME, MT
45110H6.DEM WILSALL, MT
45110H7.DEM SEDAN, MT
45110H8.DEM SACAGAWEA PEAK, MT
45111H1.DEM FLATHEAD PASS, MT
45111H2.DEM HORSESHOE CREEK, MT
45111H3.DEM NIXON GULCH, MT
45111H4.DEM LOGAN, MT
45111H5.DEM THREE FORKS, MT
45111H6.DEM MILLIGAN CANYON, MT
45111H7.DEM NEGRO HOLLOW, MT
45111H8.DEM DOHERTY MOUNTAIN, MT
45112H1.DEM BLACK BUTTE, MT
45112H2.DEM DRY MOUNTAIN, MT
46110A6.DEM COTTONWOOD RESERVOIR, MT
46110A7.DEM WALLROCK, MT
46110A8.DEM HATFIELD MOUNTAIN, MT
46111A1.DEM BLACKTAIL MOUNTAIN, MT
46111A2.DEM MAUDLOW, MT
46111A3.DEM ROY GULCH, MT
46111A4.DEM LOMBARD, MT
46111A5.DEM PLUNKET LAKE, MT
46111A6.DEM RADERSBURG SW, MT
46111A7.DEM WILLOW SPRINGS, MT
46111A8.DEM DUNN CREEK, MT
46112A1.DEM WILSON PARK, MT
46112A2.DEM RATIO MOUNTAIN, MT
46110B6.DEM WOLF HILL, MT
45110G6.DEM GOBBLERS KNOB, MT
45110G7.DEM GRASSY MOUNTAIN, MT
46110B7.DEM SIXTEEN NE, MT
46110B8.DEM SIXTEEN, MT
46111B1.DEM FRANCIS, MT
46111B2.DEM SIXMILE MOUNTAIN, MT
46111B3.DEM DEER PARK, MT
46111B4.DEM TOSTON, MT
46111B5.DEM PARKER, MT
46111B6.DEM RADERSBURG, MT
46111B7.DEM DEVILS FENCE, MT
46111B8.DEM TACOMA PARK, MT
46112B1.DEM BOULDER EAST, MT
46112B2.DEM BOULDER WEST, MT
46110C6.DEM HAMEN, MT
46110C7.DEM RINGLING, MT
46110C8.DEM BLACK BUTTE MOUNTAIN, MT
46111C1.DEM BATTLE MOUNTAIN, MT
46111C2.DEM SULPHUR BAR CREEK, MT
46111C3.DEM LIPPERT GULCH, MT
46111C4.DEM HOLKER, MT
46111C5.DEM TOWNSEND, MT
46111C6.DEM GIANT HILL, MT
46111C7.DEM CROW CREEK FALLS, MT
46111C8.DEM ELKHORN, MT
46112C1.DEM WICKES, MT
46112C2.DEM MOUNT THOMPSON, MT
46110D6.DEM CASTLE TOWN, MT
46110D7.DEM MANGER PARK, MT
46110D8.DEM CATLIN SPRING, MT
46111D1.DEM ALKALI LAKE, MT
46111D2.DEM MOUNT EDITH, MT
46111D3.DEM GURNETT CREEK EAST, MT
46111D4.DEM GURNETT CREEK WEST, MT
46111D5.DEM TOWNSEND NE, MT
46111D6.DEM WINSTON, MT
46111D7.DEM CASEY PEAK, MT
46111D8.DEM CLANCY, MT
46112D1.DEM JEFFERSON CITY, MT
46112D2.DEM CHESSMAN RESERVOIR, MT

2.4 Receptor Network

For this modeling evaluation, three Cartesian grid systems were generated around the Holcim property boundary:

- An MDEQ-recommended 10 km grid;
- A fine or "hotspot" grid for compliance demonstration; and
- A large grid covering the Gallatin Valley to evaluate predicted concentrations at some distance from the Trident plant.

The 10 km grid followed MDEQ modeling requirements specified in "Requirements for Submitting Air Dispersion Modeling Analysis" (12/04/02), with receptors spaced as follows:

- 50 m spacing along the facility fenceline.
- 100 m spacing from the proposed fenceline out to 1.0 km.
- 250 m spacing from 1.0 km to 3.0 km.
- 500 m spacing from 3 km to 10 km.

This receptor grid was used to identify the approximate locations of the highest annual and hourly predicted concentrations. Once these locations were identified for each of the averaging periods, a fine, "hotspot" grid was developed with 50 meter receptor spacing. The fine grid looked for higher concentrations in the vicinity of maximum impact receptors identified in the 10 km grid modeling.

A third receptor grid covering the entire Gallatin Valley was developed to demonstrate that predicted concentrations decline with distance from Trident. This receptor grid covered the large area described in Section 2.3 above and provides receptors in and around the population centers in the Gallatin Valley. Because of the large area, receptor spacing was set at 2.5 km to provide for reasonable model processing times.

An additional set of receptors was also modeled to address locations modeled in previous permit application submittals. These additional receptors are located within the Holcim property boundary along the public roads and at the company-owned homes. Receptors were also placed at the nearest offsite residence, along the Missouri River, and at the Three Forks School.

AERMAP was used to calculate the necessary hill height scale factors to pair with the base elevation for each of the receptor locations. The base elevations of the receptors, buildings, and sources were calculated by the Bee-Line software from data in the DEM files using linear interpolation of four adjacent points. The uniform horizontal spacing in the DEM files is 30 meters.

2.5 Building Effects

Building influences on stacks were considered by incorporating the EPA-developed software Building Profile Input Program with Plume Rise Model Enhancements (BPIP-PRIME) and the downwash algorithms in the model. The stack height used in the dispersion modeling was the actual stack height, which was less than the Good Engineering Practice (GEP) stack height default value of 65 meters. The source code for BPIP-PRIME was provided by BEE-Line software.

Nine buildings and 28 tanks representing the significant structures at Trident were included in the model analysis. The BPIP program uses actual building dimensions to calculate projected building widths, along the flow distance from the stack to the center of the upwind face of the projected buildings, and the across-flow distance from the stack to the center of the upwind face of the projected buildings.

2.6 Source and Emissions Data

HAPs Modeling

Four sources including the cement kiln stack, cement kiln dust (CKD) silo loading, CKD silo unloading, and CKD monofill were modeled for determination of hazardous air pollutants (HAPs) impacts on the surrounding ambient environment. The source parameters are shown in Table 2.6-1 below:

Table 2.6-1: Source Parameters

Point Source Parameters		
Parameter	**Trident Cement Kiln**	
UTM X (km)	463.075	
UTM Y (km)	5,087.789	
Base Elevation (m)	1,229.4	
Stack Height (m)	39.62	
Exit Temperature (K)	435.93	
Exit Velocity (m/s)	11.0	
Stack Diameter (m)	3.05	
Volume Source Parameters		
Parameter	**Silo Load**	**Silo Unloading**
UTM X (km)	463.083	463.084
UTM Y (km)	5087.785	5087.784
Base Elevation (m)	1,230.3	1,230.7
Release Height (m)	18.29	7.62
Horizontal Dimension (m)	0.07	0.07
Vertical Dimension (m)	4.25	1.77
Area Source Parameters		
Parameter	**CKD Monofill**	
UTM X (km)	463.454	
UTM Y (km)	5087.901	
Base Elevation (m)	1245.9	
Release Height (m)	1.52	
Easterly Length (m)	222.2	
Northerly Length (m)	992.4	
Angle from North	50	

An additional source, the end of kiln source, was not modeled because emissions rates were several orders of magnitude below the other sources and were inconsequential in comparison to the other sources in the model.

Emissions data for HAPs is provided under separate cover for baseline (both representative actual and maximum allowable production cases) emissions, and for cumulative emissions under maximum allowable kiln production. For HAPs predicted to be accumulated in CKD, emissions data were calculated in spreadsheets provided on

CD. Since the predicted emissions from the CKD were very small, it was necessary to scale up the emissions from the CKD sources by one million in order to model these substances. Subsequently, the predicted model concentrations have been reduced by dividing by one million.

Criteria Pollutant Compliance Demonstration

As with the prior modeling submission, to assess compliance of the Trident kiln with ambient air quality standards for criteria pollutants, modeling of the kiln stack was completed with a one gram per second (g/sec) emissions rate. Projected emissions rates with tires combustion (g/sec) were multiplied by the modeled impacts of the kiln stack to assess compliance with National and Montana Ambient Air Quality Standards (NAAQS and MAAQS).

Table 2.6-2 presents maximum emission rates for PM_{10}, SO_2 and NO_x based on the emission limitations in Air Quality Permit #0982-10, which are projected to remain the same for use of tire-derived fuel. Emission rates for CO, VOC and lead are estimated based on source test data and standard emission factors. Combustion of tires as fuel increases only the CO rate, which has been adjusted to reflect this fuel. These emission rates encompass the following assumptions:

- All of the particulate matter emitted has an aerodynamic diameter of 10 microns or less;
- Maximum clinker production is 425,000 tons per 12-month period; and,
- The kiln operates at full potential, that is, 8760 operating hours per 12-month period.

Table 2.6-2: Emissions Rates for Trident with Tires as Fuel

Pollutant	Emission Rates[a]			
	lb/ton clinker	(lb/hr)	(g/sec)	(tpy)
PM_{10}	0.77	37.4	4.71	164
SO_2		124	15.6	543
NO_x		1,568	197.6	6,868
CO	1.46	70.8	8.92	310
VOC	0.027	1.30	0.165	6
Lead	0.00071	0.034	0.004	0

[a]Maximum clinker production is assumed to be 425,000 tons per 12-month period. Continuous operation (8760 hours per year) is assumed.

3.0 Model Results

Results of the three AERMOD model runs, the runs with the 10 km receptor grid, the "fine" receptor grid, and the Gallatin Valley analysis, are documented on CDs included with this submittal. Results from the 10 km receptor and fine grids were used in the compliance demonstration for both NAAQS and MAAQS described below and in determining health and ecological risk. Model outputs for pollutants accumulating in CKD and for the remaining HAPs were input into the HRA and SLERA using the approach outlined in the compilation document.

Model results for the maximum impact receptors for each averaging period using a 1g/sec emissions rate are presented in Table 3.0-1. These data were combined with emissions rates in Table 2.6-2 to determine maximum impacts for comparison with ambient air quality standards. Model outputs for HAPs accumulating in CKD were carried directly into the HRA and SLERA. For the remaining HAPs, their emissions rate was multiplied by the 1 g/sec modeling output to determine the maximum predicted impact.

Table 3.0-1: Maximum Modeled Impacts

Period	Model Rank	Predicted Concentration (ug/m^3)	Easting (m)	Northing (m)
ANNUAL	1ST	0.294	465025	5089123.5
1-HR	2ND	12.662	462500	5088150
3-HR	2ND	4.772	462550	5088250
8-HR	2ND	3.081	462200	5087800
24-HR	2ND	1.674	465025	5089123.5

Depending on the form of the standard, the highest or second highest predicted concentrations were selected for comparison to the NAAQS and MAAQS after the addition of the appropriate background concentrations. The predicted concentrations and the NAAQS and MAAQS are shown in Table 3.0-2. These predicted concentrations include the AERMOD predicted values and the MDEQ background values.

The SO_2 1-hour MAAQS is to be compared to the 19th highest 1-hour concentration. Bee-Line software precludes the selection of the 19th highest, so, to simplify the modeling exercise, the 10th highest 1-hour concentration has been conservatively substituted for the 19th highest.

Predicted concentrations of NO_2 were determined as described in the compilation document; the annual NO_2 analysis used the ambient ratio method (ARM) and the NO_2 1-hour average used the ozone limiting method (OLM). Copies of ozone data from

Devil's Slide, Utah that were used in the OLM calculations are provided in Appendix 6 of the compilation document.

Table 3.0-1 shows that the predicted concentrations of criteria pollutants are all within the applicable NAAQS and MAAQS. It should be noted that ozone is modeled as VOC emissions and thus the predicted concentrations are of VOCs, which serve as a conservative estimate of ozone.

The MAAQS for lead is based on a 90-day average, while the NAAQS is based on a calendar quarter average. The tenth highest predicted 1-hour concentration has been selected for comparison with the NAAQS calendar quarter average and the MAAQS rolling 90-day average. This very conservative estimate shows that predicted lead concentrations are well within the standards.

Table 3.0-2: Predicted Concentrations Compared with Standards

Pollutant	Average Period	Background Concentration ($\mu g/m^3$)	Model Predicted Concentration ($\mu g/m^3$)	Model Predicted Concentration with Background ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	MAAQS ($\mu g/m^3$)
Carbon Monoxide (CO)	1-hour	1,725	113	1838	40,000[a]	26,450[a]
	8-hour	1,150	27	1177	10,000[a]	10,350[a]
Lead (Pb)	90-day	N/A	0.033[b]	0.033[b]	---	1.5
	quarterly	N/A	0.033[b]	0.033[b]	1.5	---
Nitrogen Dioxide (NO_2)	1-hour	75	2,372	404[c]	---	564[a]
	annual	6	58	49.5[c]	100	94
Ozone (O_3) (as VOC)	1-hour	N/A	2	2	235[d]	196[a]
Sulfur Dioxide (SO_2)	1-hour	35	130	165	---	1,300[e]
	3-hour	26	74	100	1,300[a]	---
	24-hour	11	26	37	365[a,f]	262[a,g]
	annual	3	5	8	80[a]	52[a]
Particulate Matter (PM_{10})	24-hour	30	8	38	150[h,i]	150[h,i]
	annual	8	1	9	50[j]	50[j]

[a] Not to be exceeded more than once per year.
[b] Tenth high 1-hour predicted concentration value used for conservative comparison with standard.
[c] These values obtained from the ozone limiting method procedure.
[d] Standard attained when expected number of days per calendar year with maximum hourly averages above standard are equal to or less than one.
[e] Not to be exceeded more than eighteen times in twelve months.
[f] Standard based on calendar day.
[g] Standard based on 24 consecutive hours.
[h] Standard attained when expected number of days per calendar year with maximum 24-hour averages above standard are equal to or less than one.
[i] Standard is average of expected exceedances for three consecutive years.
[j] Standard is average of expected means for three consecutive calendar years.
Note that predicted ozone concentrations are actually predicted concentrations of volatile organic compounds (VOCs).
Na: not applicable.

3.1 Model Files

AERMOD modeling files are being provided to MDEQ on CD. Model run parameters and a listing of AERMOD files is available in Table 3.1-1.

Table 3.1-1
Model Run Parameters

Parameter	Selected Value
AERMOD	
Control option	Regulatory default
Averaging periods	1hour 8 hour 3 hour 24 hour Period (annual)
Half-life/decay	No half-life No decay
Flagpole receptors	None
Source groups	CKDBase: Baseline potential, no tires at 425,000 tpy CKDPTE: Cumulative potential with tires at 425,000 tpy BASE315: Baseline actual, no tires at 315,754 tpy
Emission units	Default value: $\mu g/m^3$
Emission rate flag	None, no hourly emission file
Deposition	None
Receptors	Cartesian grids with 100 to 1000 meter spacing to define hot spots Cartesian grids at 50 meter spacing for hot spots Cartesian grids at 2,500 meter spacing for Gallatin Valley Discrete at 50 meter spacing and corners along fence line and roads and at homes within the fence line
Terrain	130 7.5 minute DEM files:
Boundaries	Fence line 9 plant buildings 28 silos, tanks, or stockpiles
Output options	Highest and second highest concentrations 10th highest for 1-hour average (Gram-sec only) At each receptor for each selected averaging period

Table 3.1-1 Continued **Model Run Parameters**	
AERMET	
Surface file	NWS data from Great Falls Station #000727750 Latitude: 111.22 West; longitude: 47.27 North Time zone adjustment: 0 (same zone as modeled area) Time period: 4/1/2000 to 3/31/2001 Sensor height: 6.1 m Format: NCDC 3280 (TD 9956), variable length abbreviated blocking factor: 1 (1 logical record per physical record)
Upper air file	NWS data from Great Falls Station #00004102 Latitude: 111.22 West; longitude: 47.27 North Time zone adjustment: 7 (relative to Greenwich time) Time period: 4/1/2000 to 3/31/2001 NCDC format: NCDC 6201 (TD 6301) 2876 character fixed Length blocking factor: 1 (1 logical record per physical record)
On-site file	Trident station: default #99999 Latitude: 111.48 West; longitude: 45.94 North Time zone adjustment: 0 (same zone as modeled area) Time period: 4/1/2000 to 3/31/2001 Sensor height: 10 m Format: (4(I2,1X),F9.1,F7.1,F10.1,F8.1,9X,F9.1,7X,F9.1) Selected parameters: month, day, year, hour, sensor height, wind speed, wind direction, standard deviation of wind direction, temperature, solar radiation
File preparation	Wind direction sectors: 1 Wind direction sector: 0 to 360 degrees Location: 77.72 W 40.89 N Time zone adjustment: 7 (relative to Greenwich) Method: substitute NWS data & randomize NWS wind directions NWS instrument height: wind 6.1 meters Frequency: seasonal

Season	Albedo	Bowen	Roughness
spring	0.300	5.000	0.300
summer	0.280	6.000	0.300
autumn	0.280	10.00	0.300
winter	0.450	10.00	0.150

Table Table 3.1-1 Continued **Model Run Parameters**		
AERMAP		
Calculations	Hill heights for receptors and elevations for sources, buildings, silos and stockpiles, and receptors calculated from DEM files	
Domains	EIS-10km:	Longitude 111.005 Latitude 45.755 to Longitude 111.745 Latitude 46.245, Zone 12
	EIS-Fine:	Longitude 111.005 Latitude 45.755 to Longitude 111.745 Latitude 46.245, Zone 12
	EIS-Large:	Longitude 110.635 Latitude 45.260 to Longitude 112.240 Latitude 46.490, Zone 12

The model input and output files are shown in Table 3.1-2.

Table 3.1-2

Model Input and Output Files

File Name	Description
B29HNM00.SFC B29HNM00.pfl	Holcim meteorological files for input to AERMOD (output of AERMET for input to AERMOD)
*.pip *.so	Building data input to BPIP-PRIME Building dimension data output by BPIP-PRIME (input to AERMOD)
DEQ.*	AERMAP files for the initial receptor grid configuration
EIS-Fine.*	AERMAP files for the fine receptor grid configuration
EIS-Large.*	AERMAP files for the Large receptor grid configuration
*.map *.mot *.rcf *.scf	AERMAP file for input to AERMOD List file associated with *.map file Receptor elevations and hill height scales obtained from DEM data Source elevations obtained from DEM data

EIS-10km_00_GRAM-SEC.* EIS-10km_00_ANTIMONY.* EIS-10km_00_ARSENIC.* EIS-10km_00_BERYLIUM.* EIS-10km_00_CADMIUM.* EIS-10km_00_CHROM-6.* EIS-10km_00_CHROMTOT.* EIS-10km_00_COBALT.* EIS-10km_00_D-F.* EIS-10km_00_HCL.* EIS-10km_00_HF.* EIS-10km_00_LEAD.* EIS-10km_00_MANGANES.* EIS-10km_00_MERCURY.* EIS-10km_00_NICKEL.* EIS-10km_00_PHOSPHOR.* EIS-10km_00_SELENIUM.* EIS-10km_00_ZINC.*	AERMOD input and output files for the initial receptor grid configuration with the surrogate emission rate of 1 g/sec.
EIS-Fine_00_GRAM-SEC.* EIS-Fine_00_ANTIMONY.* EIS-Fine_00_ARSENIC.* EIS-Fine_00_BERYLIUM.* EIS-Fine_00_CADMIUM.* EIS-Fine_00_CHROM-6.* EIS-Fine_00_CHROMTOT.* EIS-Fine_00_COBALT.* EIS-Fine_00_D-F.* EIS-Fine_00_HCL.* EIS-Fine_00_HF.* EIS-Fine_00_LEAD.* EIS-Fine_00_MANGANES.* EIS-Fine_00_MERCURY.* EIS-Fine_00_NICKEL.* EIS-Fine_00_PHOSPHOR.* EIS-Fine_00_SELENIUM.* EIS-Fine_00_ZINC.*	AERMOD input and output files for the fine receptor grid configuration with the surrogate emission rate of 1 g/sec.
EIS-large_00_GRAM-SEC.*	AERMOD input and output files for the large receptor grid configuration with the surrogate emission rate of 1 g/sec.
*.dta *.lst *.usf	AERMOD input data files AERMOD output list files AERMOD output summary files