RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Alternative Fuels Project

Tarmac America, LLC
Pennsuco Complex
Dade County, Florida

Project No. 0250020-031-AC

Electronic Copy Submitted: June 3, 2011
Hardcopy Submitted: June 6, 2011

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June 2, 2011

Via E-Mail and U.S. Mail

Jeff Koerner
Permitting/Compliance Administrator
Division of Air Resource Management
Department of Environmental Protection
2600 Blair Stone Road
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jeff.koerner@dep.state.fl.us

RE: Tarmac America, LLC, Pennsuco Complex
Dade County, Florida
Alternative Fuels Project
Response to Request for Additional Information
Project No. 0250020-031-AC

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AIR REGULATION

Dear Jeff:

On behalf of Tarmac America, LLC, (Tarmac) we would like to thank you and your staff for meeting with Tarmac representatives on April 6th, April 19th, and May 11th to discuss the above-referenced alternative fuels project being proposed for the Pennsuco Complex. We appreciate your review and consideration of the air permit application for this project submitted on April 20th and the following are our responses to the request for additional information dated May 12, 2011.

I should stress, as we have stressed in our meetings,that Tarmac, as part of its worldwide commitment to reduce its reliance on fossil fuels, does not take this project lightly and is fully committed financially to bring this project to reality. The use of alternative fuels, while providing significant environmental benefits, has the potential to degrade the quality of cement product and undermine the structural integrity of the cement kiln. As such, Tarmac views these materials with great caution and intends to implement the project in an organized and coordinated manner. The system design and the parties involved will include one of the world's most respected kiln system designers, FL Smidth, which has a wealth of knowledge in the potential success and downfalls of introducing alternative fuels to modern cement kilns.

Tarmac is committed to providing the Department information from around the world that demonstrates alternative fuels have the potential to replace fossil fuels and maintain, if not improve, the environmental impact including air emissions from cement kilns. Since the initial application submittal, we have continued our search for additional information to bolster the data and studies already provided that we believe shows the effect on air emissions from the use of alternative fuels. This information search will continue over the next few weeks as the search involves review of literature from around the world in various languages and requires dedicated and persistent efforts.

As the literature shows, alternative fuels for cement kiln production is not a new concept and has been in practice for at least 40 years. Please note that while we introduce in the section below information related to cement kilns that burn hazardous waste, we only submit this information for an extreme comparison and I reiterate that Tarmac has no intention, whatsoever, to use hazardous waste and <u>is not requesting in any manner to use hazardous materials or wastes</u>. Tarmac's project is consistent with the growing trend for the replacement of global warming fossil fuels with non-hazardous alternative fuel material previously discarded and presumed worthless. While the United States lags behind most other developed countries to use alternative fuels, this project pushes against that barrier. As in these other countries, we foresee that coal and other fossil fuels should soon be considered the alternative fuel.

Based on your May 12th letter, we have listed each request identified in your April 29th e-mail that was attached to that letter, as well as each request identified in May 6th e-mail from the Miami-Dade County Department of Environmental Resources Management (DERM) that was also attached to that letter. We have numbered each of the requests sequentially, and following each request, we have included our responses.

The information provided below references Attachments A, B, and C that are enclosed and that are part of this submittal. Attachment A includes materials analysis information. Attachment B includes comparative emissions data. Attachment C is a revised version of the initial application that includes updated and corrected information. We are providing an electronic version of these attachments today and will submit hard copies at our next meeting scheduled for Monday, June 6, 2011.

We hope that this information is helpful and responsive to the requests. Again, however, if you have any questions or need additional information, please let us know. On behalf of Tarmac we appreciate your commitment to this project and the efforts to review and interpret the large amount of information submitted in support of the project.

We hope that the responses are adequate to ensure a complete application. Thank you for your attention to this matter and your review of these responses. We hope that the information is helpful and provides the needed detail. As stated above, if you have any questions or need additional information, please let us know.

Sincerely,

Max Lee, Ph.D., P.E.
President
Koogler and Associates, Inc.

PE No. 58091

6/3/11
DATE

Enclosures (original and three copies)

cc: *Via E-Mail Only*
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Preliminary Statement

Alternative fuels have been used in cement kilns for more than 40 years. Documentation of this use is extensive, and the U.S. EPA and European Union continue to promote the use of alternative fuels.[1],[2] In conjunction with the Department's review of the information provided to address the questions in the RAI, it should be noted that most of the rules referenced, and much of the data cited are related to the burning of hazardous materials in cement kilns, a long-standing practice in the U.S., Canada and several European Countries. This information is presented because it demonstrates that cement kilns can effectively control air emissions from the combustion of non-traditional fuel—even where the materials combusted are classified as hazardous and/or toxic. This is not to imply that Tarmac proposes or desires to burn hazardous or toxic materials; to be clear, Tarmac does not. The materials presented herein are referenced only because of their availability and because they demonstrate the efficacy of cement kilns for combusting materials that represent a "worst-case scenario" (from a fuel content perspective), with no additional pollution control.

The gas exhaust emissions derive from the physico-chemical reactions of the raw materials and the fuel. The main constituents of the exhaust gases from a cement kiln are nitrogen from the combustion air; CO_2 from calcination of $CaCO_3$ and combustion of fuel; water vapor from the combustion process and from the raw materials; and excess oxygen. The pollutants of concern for hazardous and non-hazardous fuels are as follows:[2]

Organic compounds
Nitrogen Oxides
Sulfur Dioxide
Carbon Monoxide
Particulate matter
Polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD and PCDFs)
Metals and their compounds
Hydrogen fluoride
Hydrogen chloride

We believe that the impact the use of alternative fuels may have on emissions of these pollutants is thoroughly addressed in the application and additional information provided below, and that this information provides reasonable assurance to the Department that Tarmac's use of alternative fuels will comply with current permitted emission limits, and not result in an increase of emissions of PSD pollutants above the thresholds requiring PSD review.

Requests from the Florida Department of Environmental Protection

1. For each alternative fuel, what are the following values?

Response:

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[1] EPA Cement Sector Report, Trends in Beneficial Use of Alternative Fuels and Raw Materials. October 2008.
[2] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010 http://eippcb.jrc.ec.europa.eu

We have provided analytical results that are typical for these materials in Attachment A. Additional information is included below and provides context for the materials analyses data provided in Attachment A. We fully understand the Department's interest in the fuel characteristics and the effect that the combustion of the fuel might have on emissions from the kiln. While some characteristics of the proposed alternative fuels could be different than those of coal and petroleum coke or other typical fossil fuels, those differences do not necessarily correspond to changes in air pollutant emission rates as explained below. Moreover, Tarmac will use fuels with appropriate combustion properties and constituent levels that will ensure a quality clinker product while meeting the applicable emission limits.

A. All materials:

(1) Heating value –

Response:

Tarmac operates its kiln to produce consistent quality clinker, which generally requires that fuels used have a heat content of 5,000 Btu/lb or greater. The heat content must be great enough to provide the heat needed for the chemical reactions to occur. The physical design of the kiln (e.g., size of the combustion zones, rate of gas flow) is such that lesser-heat-content fuels are not able to be effectively burned to provide the necessary heat. Of even greater importance is the consistency of the heat content in combination with consistency of the moisture content. Both properties affect the heat input to the process and the chemical reaction rates and extent of reaction. As such, the Department has assurance that Tarmac will carefully select fuels that will provide consistent heat input.

(2) Moisture –

Response:

Lower moisture in the fuels is desired as moisture diminishes the net heat output of the fuel, i.e., the heat content of the fuel must first be spent to evaporate the moisture before outputting heat to the system. Therefore, for operational efficiency, Tarmac desires that the moisture content of all fuel average less than 30 percent. Similar to heat content, of equal importance is the consistency of the moisture content. A primary goal of the combustion process is consistent, controlled combustion. Highly variable moisture causes heat input fluctuations that not only can negatively impact the product but also damage the kiln. Therefore, the Department has assurance that Tarmac will carefully select and combust fuels having a consistent, relatively low moisture content. Moisture, as with traditional fuels, is unregulated and not a significant determining factor of air pollutant emission rates.

(3) Density -

Response:

Each fuel's physical properties affect the burnability of the fuel. The volatility and the particle size of the fuel affect how the fuel can be used. In the primary burner of the kiln (i.e., front end of the kiln), the fuel must be finely shredded, pulverized or in a form which ensures immediate combustion and an intense flame. In the calciner, the fuel types can be of greater size and variable volatility without affecting the combustion process unlike the primary burner. In the calciner, fuel particle size will typically be less than a 4-inch nominal size while the front end fuels must be smaller and typically less than a 0.5- inch nominal diameter.

(4) Volatiles –

Response:

The volatility of fuels is a factor in the combustion process; thus, Tarmac must closely monitor this parameter for the operational reasons discussed above. Because fuel volatility affects thermal distribution, this factor restricts the rate and amount of each fuel input.

(5) Ash –

Response:

The ash composition of fuels is important for clinker quality and is monitored to predict the clinker quality and composition. Regarding the role of ash in particulate matter emissions, a cement kiln is unlike an industrial or utility boiler or municipal solid waste (MSW) or waste-to-energy (WTE) facility, in which the sole source of particulate to the particulate matter control device is the ash from the fuel. In a cement kiln, particulate matter can be derived from the fuel, but particulate matter is most significantly derived from the raw materials. As stated in the application, the particulate matter loading from fuels is typically less than 10 percent of the total mass loading to the baghouse. As such, the potential increase of PM emissions from the ash content of the alternative fuels is within the 12 to 14 percent error of EPA Test Method 5, which is the appropriate method for quantifying PM emissions.[3],[4] Moreover, particulate matter emissions do not proportionally increase with ash content because the efficiency of a baghouse, such as the one at Tarmac, is increased with particulate loading. As well, U.S and European studies show that particulate matter emission rates are typically unaffected by use of alternative fuels.[5],[6]

(6) Sulfur –

Response:

Sulfur is of great importance to the successful operation of the cement kiln as the ratio of sulfur to alkali is critical to prevent kiln buildup. Kiln buildup is the excessive amount of condensed solids within kiln that occur due to chemistry from out-of-balance chemical ratios of alkalis (i.e., sodium and potassium), sulfur, and chlorine. The following equation, known as the sulphate modulus, shows the relationship of the three primary components that affect kiln buildup.

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[3] Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III. Stationary sources Specific Methods. Section 3.16 EPA/600/4-77/027b

[4] Lanier, S.; Hendricks, C. Reference Method Accuracy and Precision (ReMAP): Phase I. February 2001. ASME International.

[5] Attachment B, Lafarge Sugarcreek, MO and Lafarge, Whitehall, PA facilities alternative fuel testing.

[6] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, Figures 1.23 and 1.24, http://eippcb.jrc.ec.europa.eu

$$M = \left(\frac{\frac{SO_3}{80}}{\left(\frac{K_2O}{94} + \frac{Na_2O}{62} \right)} - \left(\frac{0.5 \times Cl}{35.5} \right) \right) = 0.8..to..1.25$$

where: chemical amounts are in units of mass.

If this balance is not maintained, buildup deposits in the preheater tower of condensed alkali chlorides (potassium and sodium chlorides) and further buildup will come from alkali sulfates. Buildups can clog the preheater tower within minutes of a severe chemical imbalance and require the shut down of the kiln. Given these operational constraints, the typical sulfur content of the proposed materials and raw materials must be closely monitored. Because the sulfur content of raw materials is not affected by the proposed project, the Department has assurance that Tarmac will only introduce alternative fuels to the kiln such that overall sulfur input is within its preexisting range.

Given these operational constraints, fuels are monitored for sulfur content, along with the raw materials. The fuel sulfur content for both traditional and alternative fuels has been shown to not significantly impact SO_2 emissions.[7],[8],[9],[10] This is evidenced by the current Best Available Control Technology applied to all Florida kilns is the inherent natural alkaline scrubbing of sulfur by the alkaline raw materials input to the kiln. As well, the Title V permit of Tarmac limits sulfur dioxode emissions to 0.5 lb per ton of clinker and 320 lb/hr without any limit of the coal or petroleum coke sulfur content. Where petroleum coke can readily contain up to 7 percent sulfur. Furthermore, the efficiency of sulfur capture is affected by the sulfur modulus in which the balance of sulfur, chlorine and alkalis must be maintained to prevent sulfur condensation (i.e., buildup) in the kiln.

Sulfur compounds in raw materials are present mainly as sulphates (for example, calcium sulphate $CaSO_4$) or as sulphides (i.e. pyrite or marcasite FeS_2). Sulphates in the raw materials are thermally stable up to temperatures of 1200 °C, and will thus enter the sintering zone of the rotary kiln where they are decomposed to produce SO_2. Inorganic and organic sulfur compounds introduced with the fuels will be subject to the same internal cycle as sulphates in the raw materials - consisting of thermal decomposition, oxidation to SO_2 and reaction with alkalis or with calcium oxide. With this closed internal cycle, all the sulfur introduced as sulphates via fuels or via raw material will leave the kiln chemically incorporated in clinker, and will not give rise to gaseous SO2 emissions

However, sulphides (and also organic sulfur compounds) in raw materials enter the preheater tower and are decomposed and oxidised at 400 to 600 °C to produce SO_2 as the raw materials are

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[7] EPA Report No. 600/R-97-115 entitled "Air Emissions From Scrap Tire Combustion"

[8] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, Figures 1.32, http://eippcb.jrc.ec.europa.eu

[9] 76 Fed. Reg. 28318, 28322 (May 17, 2011)

[10] National Policy on High Temperature Thermal Waste Treatment and Cement Kiln Alternative Use, Cement Production Technology, Report No. 66011-02; Issue 2, Dr. Kare Helge Karstensen

heated by the exhaust gases in the preheater tower. At these temperatures, not enough calcium oxide has been thermally generated and present in the gas stream and thus not available to react with the sulphide-generated SO_2. Therefore, in a dry preheater kiln about 30% of the total sulphide input may leave the preheater section as gaseous SO_2.[10]

In summary, SO_2 emissions are to a large extent determined by the sulphide content of the raw materials, and not by the fuel composition.

(7) Chlorine –

Response:

As stated above, the ratio of sulfate and chloride to alkali must be maintained at 0.8 to 1.25 in the sulphate modulus for proper operation of the kiln. The bulk of alkali input to the cement kiln is from raw materials, and alkali levels are low in the limestone from the Tarmac quarry. Therefore, the chlorine content of all fuels and raw materials used must be monitored. The chlorine content of fuels used in the Tarmac kiln is process-limited so as to ensure good clinker quality and limit kiln degradation. Therefore, the Department has assurance that Tarmac will not use alternative fuels in a manner that causes chlorine input to deviate from its existing range.

Regarding dioxin/furan (D/F) emissions, EPA requires compliance with the dioxin and furan limit by continuously monitoring the baghouse inlet temperature, as is required under the Portland cement NESHAP (40 CFR 62, subpart LLL). EPA has long recognized that the predominate factor affecting D/F emissions from a cement kiln is the temperature of gases at the inlet to the control device.[12] Moreover, as EPA found when establishing the MACT floor for hazardous waste burning kilns, fuel type does not have an impact on D/F formation because D/F is formed post-combustion.[13] This is consistent with EPA's recent affirmance that "burning alternative fuels . . . does not appreciably affect cement kilns' HAP emissions."[14],[15] as well, review of U.S, European and Australian kiln emissions of D/F shows no difference in D/F emissions in comparing conventional and alternative fuels.[16],[17],[18]

(8) Fluorine –

Response:

Typical fluorine data of alternative fuels are provided in Attachment A. Fluorine input to the kiln is from both raw materials and fuels. As discussed in depth in the application, the emissions of hydrogen fluoride (HF) from cement kilns have been shown to be low and not of significant concern. This is apparent by EPA's review of HAPs in the Portland Cement NESHAP that determined HF to not be a regulated pollutant. HF emissions measurements of German kilns in

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[12] 63 Fed. Reg. 14182, 14196 (Mar. 24, 1998)

[13] 64 Fed. Reg. 52828, 52876 (Sep. 30, 1999)

[14] 76 Fed. Reg. 28318, 28322 (May 17, 2011)

[15] FDEP technical Evaluation, 0530021-031-AC draft permit.

[16] "Air Emissions Summary for Portland Cement Pyroprocessing". Portland Cement Association.R&D SN3048

[17] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, Table 1.38, http://eippcb.jrc.ec.europa.eu

[18] Dioxin and The Cement Industry in Australia. Technical Note. Cement Industry Federation. July 2002.

2004 showed most measures below detection (0.04 to 0.06 mg/Nm^3) and all values less than 0.5mg/Nm^3 (0.6 ppm).[19] In contrast, other industries such as aluminum smelters are regulated for HF emissions. HF is extremely acidic and because of the alkaline nature of the raw materials and product, the very high dust loading in the kiln acts to provide an excellent scrubbing method. Fluoride input to the kiln from either fuel or raw materials is either captured in clinker or reacted to calcium fluoride (CaF_2) which is thermally stable in the burning process. HF emissions data are provided for several kilns in Attachment B. Note that flouride impacts the quality of cement and is readily analyzed as excess amounts of fluoride in cement are detrimental above 0.25 %.[20]

(9) Mercury –

Response:

Tarmac must comply with its Title V air permit limit on mercury emissions, which is 229 pounds per year. Compliance with the limit is determined based on the conservative assumption that all input mercury is emitted. Mercury input is required in the Title V permit to be determined by material sampling and analysis, and material/fuel consumption amounts, regardless of the type of fuel used. This requirement for sampling and analysis will apply to alternative fuels used at the facility. As a practical matter, the recently revised Portland cement NESHAP requires the future installation of continuous emission monitors for mercury emissions to demonstrate compliance.

B. Tire-derived fuel, reject roofing shingles and clean woody biomass: arsenic, cadmium, chromium, copper, and lead.

Response:

This information is provided in Attachment A. Table 4 shows that the values for copper, chromium and arsenic are similar if not lower than the values for coal.

C. Non-chlorinated agricultural plastics: pesticides

Response:

Documentation is provided in Attachment A of the extremely efficient destruction of pesticides in cement kilns.[21] Given the high destruction efficiency and the fact that agricultural film is currently burned in the open fields in Florida, the attached analyses[23] demonstrate that there should be no concern with use of agricultural plastics as a fuel.

Tarmac also would like to note that the thermal characteristics of cement kilns are such that when operated to achieve the combustion necessary to produce consistent quality clinker,

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[19] Environmental Data of the German Cement Industry 2009. VDZ. Page 30.

[20] Javed I, Bhatty. "Role of Minor Elements in Cement Manufacture and Use". PCA R&D Serial No. 1990

[21] Karstensen, K.H., et al., "Environmentally Sound Destruction of Obselete Pesticides in Developing Countries using Cement Kilns." Environmental Science and Policy. 2006. pg 577-586.

[23] Final Report Gadsden County FY2008-2009 Special Project (DEP Grant Agreement No S0427). SWIX submitted to Florida DEP

organic compounds present in fuels are similarly destroyed. . It is reported[24] that for the destruction (99.99+%) of non-halogenated organic compounds, a temperature in excess of 1830°F for two seconds and an oxygen concentration of 2 percent or more is required. The USEPA Toxic Substance Control Act (TSCA) specifies that for the incineration of PCBs (99.9999% destruction), a temperature of 2200°F, a residence time of two seconds, and an oxygen concentration of 2-3 percent is required.[25] Further related to the thermal destruction of PCBs, laboratory data from the University of Dayton Research Institute[26] demonstrates that PCB-type compounds are 99.99+ percent destroyed at temperatures in excess of 1830°F with a residence time of two seconds and an oxygen concentration of 2-3 percent. Finally, the European Directive on Hazardous Waste Incineration (1994) requires a temperature in excess of 1560°F for two seconds for the incineration (99.99+% destruction) of non-chlorinated organic wastes.[1]

The thermal characteristics of precalciner cement kilns, as reported in numerous documents,[1,2,10,21,27 for example] are:

- The gas temperatures and material temperatures in cement kilns are extremely high (see below),
- The gas residence time at the primary burner is at temperatures in excess of 2000°F on the order of ten seconds. At the calciner, the temperature reaches 2200 °F and averages 2000°F for 3 second. As well, the gas resides in the preheater for 10 seconds at steadily changing temperatures from 1800 to 600 °F. The residence time of materials introduced at the feed end of the kiln is on the order of thirty minutes,
- There is extreme turbulence in the kiln assuring complete mixing of all combustible material,
- Metals, with the exception of volatile metals, are fixed in the clinker structure and become part of the finished cement,
- There are no by products as all ash is incorporated in the clinker,
- Combustion in a cement kiln takes place under oxidizing conditions with the oxygen content of gases leaving the kiln typically in the range of 2-3 percent, and
- The heating value of organic materials is recovered as energy, thus reducing the consumption of nonrenewable fossil fuel.

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[24] Mantus, E.K; Kelly, K.E.; Pascoe, G.A.; *All Fired Up – Burning Hazardous Waste in Cement Kilns,* Environmental Toxicology International, December, 1992.

[25] Karstensen, K.H., *Can Cement Kilns be used for PCB Disposal?,* SINTEF (undated)

[26] Rubey, W.A.; Dellinger, B., et al, *High-Temperature Gas – Phase Formation and Destruction of Polychlorinated Dibenzofurans,* Chemosphere, Vol. 14, No. 10, pp 1483-94, 1985.

[31] C Committee on the Medical Effects of Air Pollutants, Use of Substitute Fuels on Cement Kiln (Advice on Level of Substitution), COMEAP/2008/08.

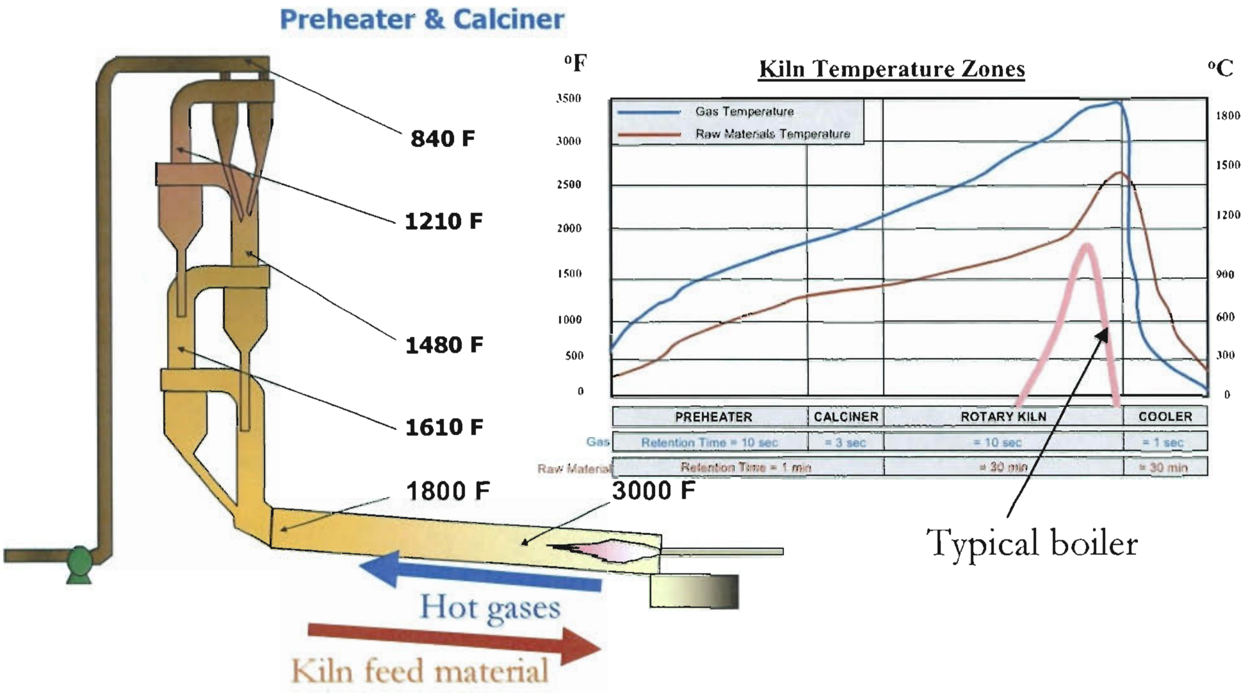

Figure 1. Temperature-Time Profile of Preheater/precalciner cement Kiln.

Regarding the temperatures throughout the preheater/calciner and kiln of a typical preheater-calciner cement plant, like the Tarmac facility, Figure 1 pictorially shows the temperature profile of the gas and material stream. It should be noted that the temperature of the feed material entering the kiln from the preheater is in the range of 1650°F; a temperature demanded by the calcination temperature of calcium carbonate.

From a temperature of 1650°F, the material temperature increases through the calcining zone and transition zone of the kiln and ultimately must reach a temperature of approximately 2650°F in the sintering zone. The temperature of the gas stream necessary to produce this material temperature is between 3,000-3,500°F in the sintering zone and decreases to approximately 2000°F at the back of the kiln where the gases leave the kiln and enter the preheater. In the preheater, the combustion gases from the kiln enter at approximately 2000°F and exit at around 700°F. Cumulatively, the gas temperature in the kiln exceeds 2000°F for approximately ten seconds, peaking at near 3500°F. As stated above, the combustion conditions within the kiln take place under oxidizing conditions with the oxygen content of the gas stream leaving the kiln (and entering the preheater) typically at 2-3 percent.

The temperature conditions, the residence times and the oxygen concentrations typical in preheater-type cement kilns greatly exceed the guidelines/regulations referenced previously for assuring that organic compounds are adequately destroyed in a combustion process.

2. For your baseline actual emissions, what was the annual heat input rate used?

Response:

To determine baseline actual emissions, the annual emissions for each of the years 2005 through 2010 were considered. These are the years of complete operation of the new kiln system. In calculating annual emissions for each year, the actual annual heat input for the unit was used in the calculation. For example, for 2005 emissions, 4,322,812 mmBtu/year was used. For 2006 emissions, 4,786,366 mmBtu/year was used. And for 2007, 3,647,384 mmBtu/year was used. Those heat input rates were then used in calculating annual emission rates for each of the pollutants in tons per year. Consistent with Rule 62-210.370, F.A.C., a 24-month period was then selected for each pollutant's emissions. Given that the data were gathered on a calendar year basis, these values were reviewed and the highest two consecutive annual rates were averaged. For example, 1682.3 and 1757.1 ton/year of NOx for 2005 and 2006, respectively were averaged to 1719.7 ton/yr. This is shown on pages 38-39 of the Appendix to the initial air permit application.

3. For the projected actual emissions, why did you use the average annual heat input rate for 5 years? Since this is lower than that used for the baseline, it looks like emissions decrease for all of the materials, but this is unrelated to the project. I recommend estimating projected actual emissions by using the same annual heat input rate, which more clearly presents emissions "changes" caused by the use of these alternative fuels.

Response:

Based on the projected economics for the industry, the annual average production selected to predict future emissions was the annual average for the 2005 to 2010 value. We believe this estimate to be a conservative assessment of the projected actual emissions and to adequately represent the average production expected for the next 5 years. References to the economic outlook can be provided if needed. As mentioned above and as allowed by the definition of baseline actual emissions in Rule 62-210.370, F.A.C., the highest 24-month period was selected from the past 10 years for the baseline.

In addition, short-term emission factors are included in each of the tables, reflecting estimated emissions for fuels. While the application accurately reflects a decrease in future annual emissions compared to the baseline emissions due to a lower annual heat input rate, a comparison of short-term emission factors may also be relevant for determining whether the use of the alternative materials would cause an emissions increase. For example, Table 4 on page 40 of the application compares the short-term coal emission factor reflective of coal emissions over the past five years with an emissions factor for engineered fuel. Similarly, Table 7 on page 43 of the application includes a comparison of the short-term coal emission factor based on an average of the last five years of operation to a short-term emissions factor for tire-derived fuel. Multiplying the short-term emission rates for coal and for each alternative fuel by the same annual heat input rate is simply a calculation - the real comparison becomes a comparison of short-term emission rates. The short-term emission rates are already compared in the application. Notwithstanding this comparison of short-term emission rates for purposes of the application, consistent with Rules 62-210.370 and 62-212.300(1)(e), F.A.C., for a period of five years following the change, the applicant would be required to calculate and maintain records of annual emissions, in tons per year on a calendar basis, to determine whether the emissions are higher than the baseline emissions. The Department's rules do not require a comparison of short-term emission rates in determining whether PSD is triggered.

As discussed in the next response, we have gathered additional information since the time of the application in support of the expected similar if not reduced emissions from these alternative fuels in comparison to coal.

4. We will go through 50+ documents provided on the CD, but so far we have only found "qualitative" statements regarding emissions from firing these individual materials rather than "quantitative" emissions data. Although, the IPP "engineered fuel" shows promise and low emissions (from unspecified plants). Can you guide us to specific documents that will provide more "quantitative" emissions data (reasonable assurance) for firing each of the fuels?

Response:

We have identified quantitative emissions data that would be relevant for consideration by the Department for the following facilities:

U.S. Cement Kilns

Lafarge's Sugar Creek, Missouri Plant

The Lafarge Sugarcreek precalciner kiln was recently tested for a comprehensive comparative emissions evaluation between typical fossil fuels and alternative fuels. The review of the data by the Missouri Department of Natural Resources (MDNR) determined that emissions from alternative fuels were similar to emissions from typical fossil fuels and that there was no significant correlation between the alternative fuel parameters and emissions. (see draft letter from MDNR to Lafarge in Attachment B). Attachment B also includes the emissions data provided by MDNR and a set of graphics of the same data for another form of comparison.

Lafarge Whitehall, Pennsylvania Plant

Attachment B includes comprehensive comparative emissions test results for testing of fossil fuel and plastic derived fuel (post-consumer recycled plastic that is collected from public sources, sorted, and processed into a fuel feedstock). The summary of the test report concludes the following:

> The results of the testing, described in the following report, indicate that the emissions of the various classes of compounds listed above are generally equivalent between the baseline and PDF test conditions. While the emission rate of a few of the individual constituents in any class of compounds increased between the baseline and the PDF test condition, the emission rates for other constituents in each class were consistent or decreased between the baseline and PDF test conditions. In most cases, the increase or decrease was not significant.

St. Mary Cement, Charlevoix, Michigan Plant

Attachment B includes comparative test results for testing of shingles. This information was provided for permit, 1210465-020-AC. The results show all emissions of NOx, SO_2, and CO are reduced when burning shingles compared to coal.

Rugby Cemex Plant in United Kingdom

Two Cemex kilns in the UK have recently achieved 100 percent fuel replacement with alternative fuels, South Ferriby and Rugby. The Cemex Rugby cement plant achieved 100 percent alternative fuel replacement using an engineered fuel called Climafuel. Climafuel covers a wide range of waste materials including residues from Municipal Solid Waste and industrial / trade waste, which has been processed to recover metal, glass and plastics and remove stones and other non-combustibles. The comparative emissions monitoring using Climafuel and other alternative fuels, shows the following results:

Table 1. Rugby Cemex Cement Plant in UK- Emissions Comparison data

Company	Facility	Location	Kiln Type	Pollutants	Sample Type	Baseline 1 Emissions	Baseline 2 Emissions	Alternative Fuel Emissions	Alternative Fuel Emissions	Emissions Limits
CEMEX	Rugby Plant	Warwickshire, UK	Dry	PM	CEM	4 mg/Nm³	5 mg/Nm³	7 mg/Nm³	6 mg/Nm³	55 mg/Nm³
				NO_x	CEM	349 mg/Nm³	353 mg/Nm³	378 mg/Nm³	317 mg/Nm³	800 mg/Nm³
				CO	CEM	82 mg/Nm³	83 mg/Nm³	82 mg/Nm³	131 mg/Nm³	200 mg/Nm³
				SO_2	CEM	35 mg/Nm³	1 mg/Nm³	3 mg/Nm³	1 mg/Nm³	600 mg/Nm³
				VOC/TOC	CEM	6 mg/Nm³	5 mg/Nm³	2 mg/Nm³	3 mg/Nm³	75 mg/Nm³
				HCl	CEM	0.4 mg/Nm³	1.0 mg/Nm³	1.7 mg/Nm³	1.7 mg/Nm³	10 mg/Nm³
						Pet Coke and 6 tph tyres	Pet Coke and 30% Climafuel	Pet coke and 53% Climafuel and 12% Tires	Pet coke and 65% Climafuel	
						Climafuel (a shredded, dry waste material that would typically consist of household refuse, screened paper, cardboard, wood, carpet, textiles and plastics.)				

Note, as in many European countries, the baseline fuel for comparison is not a typical 100 percent fossil fuel but rather reflects fuels the kiln has operated on in the recent past. For example, the Rugby plant operated with baseline fuels for testing under two scenarios (1) Pet coke and tires, and (2) Pet coke, tires and 30% Climafuel. Thus a comparison of emissions is not based on only fossil fuels but the fuels that are currently permitted fuels. The results of Mix 1 and Mix 2 showed generally lower emissions compared to the baseline. The study concluded that the trial mixes result in improved overall environmental impacts, and this was accepted by the UK environmental agency.

United Kingdom Environmental Agency - Summary of Cement Kiln Emissions

Similar to the other European countries, the use of alternative fuels has been increasing over recent years in the United Kingdom (UK) as evidenced by the Rugby Plant discussed above. The Waste Incineration Directive (Directive 2000/76/EC of the European Parliament and Council on the incineration of waste) has encouraged the shutdown of the few remaining wet or semi-dry kilns in the UK and as such the recently built precalciner modern kilns have the flexibility to burn the maximum amount of alternative fuels because the kilns have combustion and pollution control systems designed for alternative fuels.

The summary of studies by the UK Environmental Agency[31] concluded the following regarding the use of secondary liquid fuels (SLF), tires, and refuse-derived fuel (RDF):

- the burning of SLF, Cemfuel®, tires, and RDF can lead to a reduction in total emissions from cement kilns.

- Under normal operation, there is negligible impact on the risk to human health from the use of any of the substitute fuels.

European Commission - Summary of Cement Kiln Emissions

The European Commission, under a directive of the European Parliament and of the Council, created a summary report of the emissions data from cement kilns in over 23 European countries. The report provides summaries of the relative emissions differences from firing a broad range of alternative fuels at replacement rates of greater than 40 percent heat input to the kiln. A review of the summaries suggests the following comparison of emissions. The data values from tables in the report were estimated to generate the following table.

Table 2. European Kilns Pollutant Emissions

Pollutant		0% substitution	40% substitution		Change of Emissions
PM		0.0183 gr/dscf	0.0091 gr/dscf		50%
SO_2		80.6 ppm	62.8 ppm		78%
NO_x		499.9 ppm	283.9 ppm		57%
TOC		16.7ppm	14.7 ppm		88%

* Summary based on review of tables.[32]

Additional tables in this document show similar emissions of other pollutants including dioxin/furans and mercury when firing with or without alternative fuels. About 90 percent of the kilns represented in the summaries are dry process kilns with most recirculating cement kiln dust (CKD), similar to the Tarmac kiln. Note that the study did not provide a similar comparison of carbon monoxide emissions.

Hazardous Waste Burning Kilns

The European Directive on Hazardous Waste Incineration (1994) recognizes that the combustion of hazardous materials in a cement plant is both a viable solution for waste treatment and for energy recovery.[33] In France, the European Directive was translated into a law (1996) which imposes environmental controls on cement kilns burning hazardous waste materials[1] and in the U.S., the Environmental Protection Agency has developed standards for burning hazardous wastes in boilers and industrial furnaces (including cement kilns) (1991).[34]

The following discussion is provided only for illustrative purposed for comparison of emissions of conventional fuels to hazardous waste fuels. As mentioned previously, Tarmac is not

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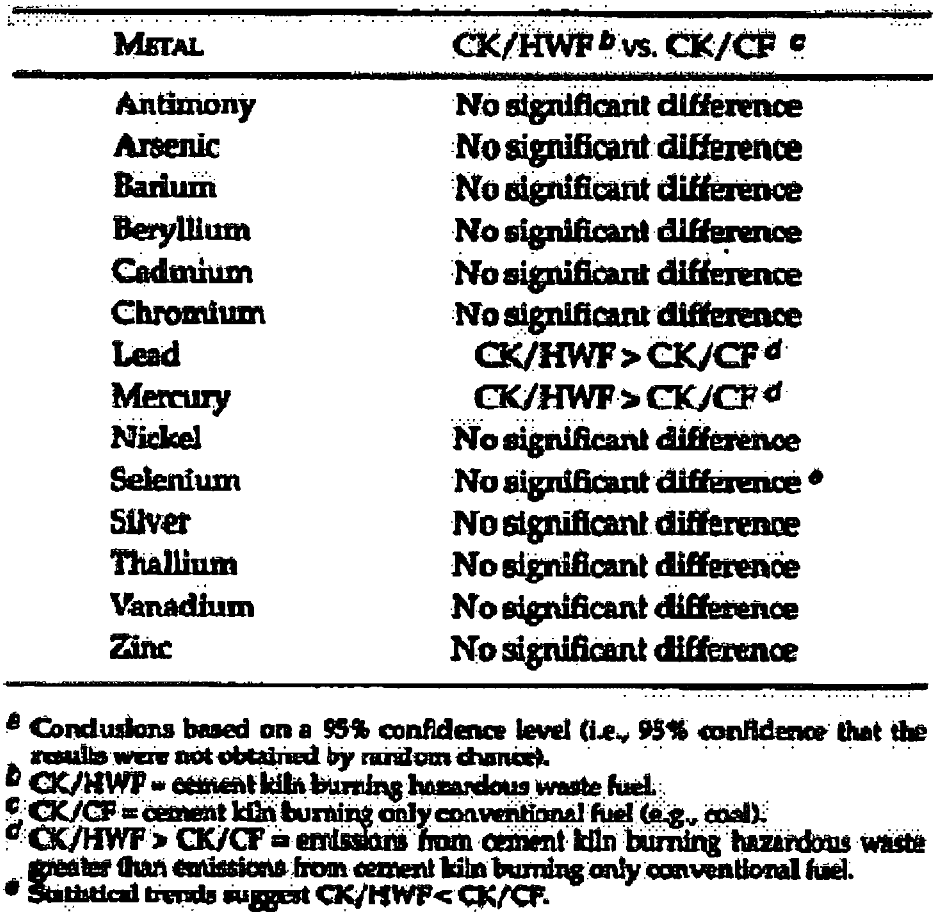
[32] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, Tables 1.24, 1.32,1.25, 1.38, http://eippcb.jrc.ec.europa.eu

[33] International Cement Review, *Burning Issues,* February, 2000.

[34] 40 CFR 266, Subpart H

requesting to use hazardous wastes or materials for fuel. A comprehensive review was conducted for such comparative emissions data. This study provides in depth information on comparative emissions for a broad range of pollutants. For example, the following table shows comparison of metal emissions.

Table 3. Comparison of Kilns Metal Emissions – Conventional and Hazardous Waste



METAL	CK/HWF[b] vs. CK/CF[c]
Antimony	No significant difference
Arsenic	No significant difference
Barium	No significant difference
Beryllium	No significant difference
Cadmium	No significant difference
Chromium	No significant difference
Lead	CK/HWF > CK/CF[d]
Mercury	CK/HWF > CK/CF[d]
Nickel	No significant difference
Selenium	No significant difference[e]
Silver	No significant difference
Thallium	No significant difference
Vanadium	No significant difference
Zinc	No significant difference

[a] Conclusions based on a 95% confidence level (i.e., 95% confidence that the results were not obtained by random chance).
[b] CK/HWF = cement kiln burning hazardous waste fuel.
[c] CK/CF = cement kiln burning only conventional fuel (e.g., coal).
[d] CK/HWF > CK/CF = emissions from cement kiln burning hazardous waste greater than emissions from cement kiln burning only conventional fuel.
[e] Statistical trends suggest CK/HWF < CK/CF.

This table shows that there is no significant difference in metal emissions when burning hazardous waste compared to conventional fuels except for lead and mercury. As explained in the air permit application, lead emissions are not expected to increase based on the alternative fuels being proposed by Tarmac. Moreover, there is virtually no possibility that PSD would be triggered due to lead emissions from this project. In addition, as explained above and in the air permit application, mercury emissions are limited to 229 pounds per year and are expected to be reduced in the future due to the new Cement MACT standards. Mercury emissions are monitored through materials analysis, so Tarmac will be able to confirm that mercury emissions are not increased to a level that would trigger PSD review.

Typical emissions from such hazardous waste burning kilns is provided in Attachment B. The Lafarge Harleyville and Holly Hill, South Carolina Plants recent emissions data is provided with the permitted rates. Recent comparative data is not available as the kiln, like other hazardous waste burning kilns only burns mixtures of fuels with hazardous waste and compliance testing is performed under worst-case scenarios to establish limits in accordance with the Boiler and Incinerator Furnace Rule. These kiln systems in South Carolina have been operating with fuels comprised of non-hazardous and hazardous waste for many years.

5. With regard to CCA-treated wood, is there a document you provided that discusses the fate of copper, chromium and arsenic in a pre-heater/pre-calciner kiln and emissions rates?

Response:

Kilns in Australia, Norway, Canada, Germany and Switzerland allow the burning of treated wood including CCA-treated wood in cement kilns.[35,36,37,38,39,40] The operations at Australian kilns using up to 10 percent CCA wood showed no effect on air emissions.[35] As well, the Norwegian kiln Brevik has been burning CCA-treated wood for many years.[37] A study of Canadian kilns using CCA-treated wood showed that the chromium levels in the resulting clinker significantly deteriorated the clinker quality such that chromium was the limiting factor on the use of CCA-treated wood and not emissions (confirming that the metals are bound up in the clinker and not released into the atmosphere).[38],[39]. Based on the results of the study, CCA-treated wood was recommended to be limited to 13 kg per ton of clinker based on chromium input of 7.5 kg/ton of CCA-treated wood (0.75 %w/w Cr). Given this constraint, the use of pure CCA-treated wood is impractical.

In regards to estimation of the expected emissions from the Tarmac operation, the capture efficiency of metals in the clinker as well as the level of input metals from ingredients and fuels should be considered.

As shown in the following table, most metals are well retained in the clinker. The retention of metals in the clinker is such that the components of CCA-treated wood can be evaluated with regard to potential air emissions. The German Cement Works Association published a comprehensive study of the emissions of metals for German kilns as shown below. Note that 93 percent of German production is from dry preheater and precalciner kilns that generally recirculate CKD and use 58 percent alternative fuels.[40] The capture efficiency of metals in the clinker whether originating from raw materials (e.g., limestone, bauxite, flyash) or fuel (e.g., coal, petcoke, oil, CCA-treated wood) should be similar.

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[35] Development of design criteria for integrated treatment technologies for thermal processing of end-of-life CCA-treated timber products – Vol 2. PN04.2012.Australian Govt. Forest and Wood Products Research and Development Corp.

[36] Guidelines Disposal of Wastes in Cement Plants, October 2005. Swiss Agency for the Environment, Forest, and Landscapes SAEFL.

[37] Personal Communication, Kyle Ulmer, Koogler and Associates, Inc. and Per Brevik-Director of Alternative Fuel for the Holcim Norcem 6 Plant in Brevik, Norway. Email dated 5/25/2011.

[38] Bernardin, G. 1995. St. Lawrence Cement. Proceedings of the CITW Life Cycle Assessment Workshop. June 20-21. Canadian Institute of Treated Wood, Ottawa, Ont.

[39] Millette, L. and A. Auger. 1997. Integrated management of used treated wood. Paper presented at the Workshop on Utility Poles - Environmental Issues. Madison Wisconsin, Oct. 13 and 14, 1997.

[40] VDZ, Deutsche Zementindustrie, "Environmental Data of the German Cement Industry 2009."

With regard to CCA-treated wood and potential emissions of metals, the concentration of arsenic, copper and chromium in CCA-treated wood is typically 0.4 pounds per cubic foot, whereas the concentration of As and Cr can range from 0.2 to 2.5 pounds per cubic foot in the various product blends of CCA-treated wood. The typical density of treated wood is 35 lbs/cubic foot.[41] Although copper is not a hazardous air pollutant we have included the emissions estimate of copper. It should be noted that research has shown that copper, even when experimentally spiked, does not affect D/F emissions in cement kilns.[42]

As a hypothetical example of possible potential emission of metals, if one presumes a very high input rate of CCA-treated wood to the kiln of 5 tons per hour and presumes a maximum metal input of 2.5 lb/cf of Cu, Cr, or As, this input would equate to an 714 pounds per hour of As, Cr, or Cu. Given this extremely high presumed input and a 0.0005% emissions factor for arsenic and chromium from fuels (see Table 5 below for the reference control factor), the worst-case potential hourly emissions would be 0.004 pounds per hour and presuming continuous annual operation (8760 hr/yr) the annual emissions would be 31 pounds per year of Cu, Cr, or As. As noted above, the chromium impacts clinker quality and would make an input of 5 ton/hour to the Tarmac kiln impractical. Due to operational constraints and expected levels of chromium in the wood, realistically the maximum amount of CCA-treated wood that could be used at a time would be approximately 0.25 ton/hour, resulting in 1.55 pounds per year of Cu, Cr, or As emissions.

Based on the data collected for the materials analysis provided in Attachment A, a more realistic estimate of metal emissions is provided below in Table 4 for the highest concentration for the range of materials expected to be used by Tarmac. The maximum annual input of heat to the kiln is shown as 5,375,000 mmbtu/yr based on 2.15 mmton of clinker and 2.5 mmbtu required per ton of clinker.

Table 4 provides comparison of coal and petroleum coke as the typical fossil fuels. As well, coal can be obtained from various sources such that two databases of information were applied for comparison to the alternative fuels (note TDF, biomass and shingles) for which metals information was requested. Similar analysis of metals should be expected for the other alternative fuels. The results clearly show that fossil fuel can contain significant amounts of metals and result in higher metal emissions.

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[41] (http://www.floridacenter.org/publications/Ma0650892.pdf)

[42] Lanier, W.S., Stevens, F.M., Springsteen, B.R., Seeker, W.R., 1996. PCDD/PCDF Compliance Strategies for the HWC MACT Standards. In: International Conference on Incinerator and Thermal Treatment Technologies, May. Savannah, Georgia.

Table 4. Metal Emissions Comparison: Fossil Fuels versus Alternative Fuels

TARMAC, 0250020-031-AC, Request for Additional Information,
Response Information 5/24/2011

Annual Maximum Input to Kiln[1]: 5,375,000 MMBTU

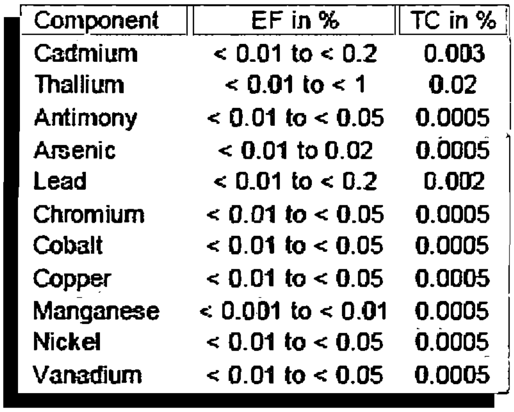
Fuel Type	Compound	U. Kentucky Database Coal versus Alternative Fuel	USGS Database Coal versus Alternative Fuel
TDF	Arsenic	-1.396 lb/yr	-4.538 lb/yr
	Chromium	-0.028 lb/yr	-0.227 lb/yr
	Copper	-0.354 lb/yr	-0.521 lb/yr
Other Biomass (potentially including CCA-treated wood)	Arsenic	-1.263 lb/yr	-4.405 lb/yr
	Chromium	0.331 lb/yr	0.132 lb/yr
	Copper	1.268 lb/yr	1.101 lb/yr
Shingles	Arsenic	-1.401 lb/yr	-4.543 lb/yr
	Chromium	-0.025 lb/yr	-0.223 lb/yr
	Copper	-0.272 lb/yr	-0.440 lb/yr

(1) Based on 2.15 mmton clinker/yr, 2.5 mmbtu/ton clinker produced
(2) See Table 5. Percent by weight of metal input that is emitted from fuel metal.
(3) Shingels copper concentration assumed equal to TDF. Both are petroleum products.
(4) University of Kentucky (website)
(5) USGS (website) - http://energy.er.usgs.gov/coalqual.htm#submit

Conventional Fuel Type	Compound	Emission Factor[2] (%)	Heat Content (BTU/lb)	Compound Concentration (ppm)	Annual Emissions (lb/yr)
Coal (U. Kentucky Database)	Arsenic	0.0005%	13,000	680	1.406
	Chromium	0.0005%	13,000	103.8	0.215
	Copper	0.0005%	13,000	199	0.411
Coal (USGS Database)	Arsenic	0.0005%	13,000	2200	4.548
	Chromium	0.0005%	13,000	200	0.413
	Copper	0.0005%	13,000	280	0.579

Alternative Fuel Type	Compound	Emission Factor[2] (%)	Heat Content (BTU/lb)	Compound Concentration (ppm)	Annual Emissions (lb/yr)
TDF	Arsenic	0.0005%	14,000	5	0.010
	Chromium	0.0005%	14,000	97	0.186
	Copper	0.0005%	14,000	30	0.058
Other Biomass (potentially including CCA-treated wood)	Arsenic	0.0005%	6,400	34	0.143
	Chromium	0.0005%	6,400	130	0.546
	Copper	0.0005%	6,400	400	1.680
Shingles	Arsenic	0.0005%	5,800	1	0.0046
	Chromium	0.0005%	5,800	41	0.190
	Copper	0.0005%	5,800	30[3]	0.139

Table 5. German Cement Works Association – Metals Emissions/Retention



Component	EF in %	TC in %
Cadmium	< 0.01 to < 0.2	0.003
Thallium	< 0.01 to < 1	0.02
Antimony	< 0.01 to < 0.05	0.0005
Arsenic	< 0.01 to 0.02	0.0005
Lead	< 0.01 to < 0.2	0.002
Chromium	< 0.01 to < 0.05	0.0005
Cobalt	< 0.01 to < 0.05	0.0005
Copper	< 0.01 to < 0.05	0.0005
Manganese	< 0.001 to < 0.01	0.0005
Nickel	< 0.01 to < 0.05	0.0005
Vanadium	< 0.01 to < 0.05	0.0005

Table 5-4: Emission factors (EF, emitted portion of the total input) and transfer coefficients (TC, emitted portion of the fuel input) for rotary kiln systems with cyclone pre-heater

The issue of treated wood other than CCA-treated wood has been well studied and considered by many agencies to be acceptable material for fuels in cement kilns[43], including States within the U.S. For example, materials at the Lafarge Sugarcreek, Missouri can include treated woods. Note the State of Missouri has adopted a policy[44] that states:

> *Railroad ties and utility poles may be used as an alternative fuel in certain high temperature combustion chambers such as cement kilns or power plant boilers. Any operation of this type would need temperatures of sufficient nature for the destruction of certain hazardous compounds. Any fuel usage would have to be permitted by the [Missouri Department of Natural Resources] Air Pollution Control Program.*

Several tests have been conducted to demonstrate the effectiveness of cement kilns for destroying organic compounds such as those in treated wood. The tests referenced herein were conducted to demonstrate the effectiveness of cement kilns for combusting hazardous wastes and to demonstrate compliance with the various hazardous waste regulations affecting the tested kilns. These data are reported herein to demonstrate the effectiveness of cement kilns for combusting organic materials; however, it must be remembered that treated wood is not a hazardous material.

Two other things to note regarding the tests reported herein are that (1), they are representative of dry process cement plants and (2), that the Principal Organic Hazardous Compounds (POHCs) selected to demonstrate the combustion efficiency of the kilns during the referenced tests are compounds selected because they are extremely difficult to thermally decompose; e.g., chlorinated compounds such PCB-type materials, methylene chloride or 1,1,1-trichloroethane.

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[43] Lang, Th., 2004. PCDD/PCDF/Furan data from Holcim. Holcim Group Support Ltd., Corporate Industrial Ecology, Im Schachen, 5113 Holderbank, Switzerland

[44] *Railroad Ties and Utility Poles,* Solid Waste Management Program Fact Sheet, Missouri Dept. of Natural Resources, October, 2007.

Reference 24 reports the results of trial burns conducted on dry process cement plants in the 1980s and 1990s with chlorinated organic compounds or PCB-type compounds used as the POHC. For the several plants reported, the Destruction Removal Efficiencies (DREs) exceeded 99.995 percent and the DREs for PCB-type materials exceeded 99.9999 percent. The plants reported were both U.S. plants and cement plants in Europe. And, for one series of tests, the POHC was introduced at the feed end (the cold end) of the kiln and in that case, the DREs of chlorinated organic compounds exceeded 99.996 percent.

Reference 45 reports that burns with PCB oil in Norway in the 1980s and 1990s resulted in DREs in excess of 99.9999 percent and that the trial burns conducted on cement plants in Canada resulted in PCB destruction in excess of 99.9999 percent. In a 1988 EPA report[46], test results from eight kilns in the U.S., two kilns in Canada and one in Sweden are summarized. In these tests, the predominate wastes were chlorinated organic compounds, aromatic compounds and metal containing oil. EPA's primary conclusion from the study was that DREs in excess of 99.99 percent or greater can be achieved in properly operated kilns. In another document, EPA[47] reports that industrially used treated wood can be burned in an industrial incinerator or boiler.

For illustrative purposes of potential emissions at the Tarmac facility, the use of creosote-treated wood at Tarmac could theoretically represent up to 385 mmBTU per hour based on a maximum heat input rate to calciner of the kiln. Treated woods would not be a practical fuel at the primary burner given the large particle size that treated wood would be processed and the lower btu content of such wood. Based on an estimated heating value of 7250 BTU per pound, a heat input rate of 385 mmBTU per hour will represent a fired rate of about 26.5 tons of treated woods per hour. At a firing rate of 26.5 tons per hour and a typical creosote fraction of 3.4 percent, the creosote input to the kiln will be 1803 pounds per hour. Assuming a conservative DRE of 99.99 percent based on the information provided herein, a maximum creosote emission rate of 0.18 pounds per hour (0.79 ton per year at operation of 8760 hr/yr) could be expected. In the kiln stack gas (at the typical stack flow of 350,000 dscfm), this increase in emissions of organic compounds will represent an increase in the THC concentration in the stack gas of less than 0.02 ppm.

Given the results illustrated above, the organic emissions would not be significantly impacted by the organic composition of treated wood. The discussions above of metal content of fuels demonstrate a similar control for treated wood metals. As well, the chlorine composition of treated wood, as discussed above, would be similar to other fuels.

6. For the CCA-treated wood, what are the expected concentrations of copper, chromium, and arsenic in the materials that the plant would receive?

Response:

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[45] Karstensen, K.H., *Can Cement Kilns be used for PCB Disposal?*, SINTEF (undated)

[46] USEPA, *Project Summary – Hazardous Waste Combustion in Industrial Processes; Cement and Line Kilns*, EPN/600/S2-87/095, February, 1988.

[47] USEPA, *Creosote, Pentachlorophenols, and Organic Arsenicals: Amendment to Notice of Intent to Cancel Registrations*, Federal Register 51: 1334-1348

See the response to No. 6 above. CCA-treated wood is typically composed of 0.4 pound per cubic foot for As and Cr (http://www.floridacenter.org/publications/Ma0650892.pdf).

7. Since Tarmac is a recognized world-wide cement company, can you provide any emissions data for firing these alt. materials in Tarmac kilns around the world?

Response:

While Tarmac uses alternative fuels in some of its kilns in other countries, no air emissions testing was required and therefore no air emissions test data are available.

8. The CO emissions estimates … as you mentioned in your email.

Response:

Please see Attachment C for revised pages of the application. These revisions include an additional change to the application to address the allowance to use alternative fuels in the primary burner of the kiln. The application is provided in electronic format in MS Word with changes highlighted.

9. Application states that the engineered fuel will consist of: one or more of the requested alt. materials and "other non-hazardous materials to meet a fuel design specification that allows Tarmac to ensure it will meet regulatory limits as discussed in the regulatory analysis section and quality control purposes".

    A. What are the "other" materials likely to consist of?

Response:

The other materials would likely consist of secondary materials from commercial, industrial, agricultural, institutional, or residential sectors. The engineered fuel will be designed to be of known and controllable composition to ensure that all regulatory limits are met and a good quality clinker is produced.

    B. Are the "regulatory limits" the EPA "legitimacy criteria"?

Response:

No. The application is referring to compliance with the emission limits and standards included in the current Title V permit.

10. Will all of these materials be added to the pre-calciner portion of the kiln system?

Response:

Not necessarily. Tarmac may add the materials in the front end of the kiln system, as described in Attachment C.

11. Will the mechanical feed dump to the pre-heater tower?

Response:

The mechanical feed system will feed into the calciner. The injection to the front end of the kiln cannot be a mechanical feed system as the material must be blown into the main burner to ensure appropriate flame intensity and consistency.

12. Can you give us separate "ballpark" cost estimates on the mechanical feed, the pneumatic feed and other ancillary equipment for our write-up?

Response:

There is a significant capital investment involved greater than $5 million.

13. The application requests permanent installation of the feed systems, but is also requests 90 to 180 days of shakedown for each initial firing of an alt. fuel. Typically, a shakedown period is necessary to ensure that the physical equipment is properly installed and functioning. I believe the application also states that the kiln will comply with all conditions in the Title V permit. So, what is the purpose of the shakedown for each material?

Response:

As stated in the air permit application and as noted in this request, a shakedown period is necessary to ensure that the new equipment is properly installed and functioning as each new alternative fuel is introduced. While Tarmac expects to be in compliance with all of the permitted emission limits during the shakedown period, it is possible that upsets could occur. Operational experience with each alternative fuel is also needed to help minimize emissions. Recognition of this shakedown period in a permitting note would help ensure a common understanding that the first three to six months of operation after an alternative fuel is introduced may not be representative of future operations.

Requests from Miami-Dade County Department of Environmental Resources Management (DERM)

14. Without conducting a trial burn on each of the alternate fuel materials, the true impact on emissions, in particular with relation to the types and levels of air emissions, is unknown. It is our opinion that a construction permit similar to the one that would be issued to the CEMEX, Brooksville plant for trial burn of multiple alternate fuels would give a better perspective on the emissions and issues at the Titan plant when using the proposed alternative fuels.

Response:

The Department's rules do not require a trial burn prior to the use of alternative fuels. A trial burn does not, in fact, give a better perspective on emissions. Air emissions data from a number of similar facilities using similar fuels would provide a better guide as to expected emissions compared to coal, which can then be used to determine whether (1) emission limits can be met and (2) PSD thresholds will be exceeded. For example, CO emissions from trial tests of tires at Tarmac were higher in the first few months after tires were introduced as a fuel compared to historical emission levels. After Tarmac gained experience in operating the tire injection system for over six months, combustion improved and CO emissions were lower. Short term trials simply do not reflect long-term expected emissions.

15. Furthermore, issuing a permanent permit (as opposed to a permit to conduct trial burns for the alternate fuels) at this time does not allow the department to make changes based on measured emissions impacts during actual burning of the alternate fuels.

Response:

If the use of alternative fuels were to result in a significant net emissions increase of a PSD pollutant, then New Source Review would be triggered and a new air construction permit would be required based on the Department's rules. Additionally, if the use of any alternative fuel results in emissions that exceed the permitted limits in violation of the permit (on a consistent basis following the initial shakedown period), then Tarmac would not be allowed to continue using the fuel. The Department has the authority to reopen a permit for cause and could do so to eliminate authorization to use a particular fuel if necessary and appropriate.

16. The application provides a generic description of each of the proposed alternative fuel materials with a general discussion of constituents and values for moisture and heat content. However, the estimated emissions for each of the proposed alternative fuels uses one of two emission factors, i.e., either the emissions factor for coal or for whole tires which are the fuels currently burned at the Titan cement plant. Specifically, the emissions factor for the coal burned at Titan was used to estimate emissions for the following proposed alternative fuels - coal (non-specific), engineered fuel, agricultural byproducts, carpet-derived fuel, clean cellulosic biomass, "other" cellulosic biomass and pre-consumer paper. Also, the emissions factor for whole tires burned at Titan was used to estimate emissions for shingles (manufacturer rejects), agricultural film and tire-derived fuel (including tire fluff). It is our opinion that using emission factors for coal or whole tires in place of site-specific, real test burn results is not an appropriate or accurate surrogate method of quantifying emissions while burning the proposed alternate fuels, and does not provide reasonable assurance that use of the proposed alternative fuels does not result in a significant net emissions increase.

Response:

See responses to Nos. 4, 14, and 15 above.

17. It is our understanding that for PSD applicability purposes, past actual emissions must be compared with future actual emissions. It is our opinion that obtaining specific emissions data such as emission factors, etc., during a trial burn is more accurate and reliable than simply using assumed and unverified emission factors for certain alternative fuels when calculating future actual emissions. The DERM therefore supports requiring initial trial burn(s) with the new alternative fuels that are being proposed in order to have reasonable assurance.

Response:

See response to No. 4, 14, and 15 above. A trial burn does not in fact provide more accurate or reliable data.

18. The applicant requests authorization for on-site processing of the alternative fuels including grinding up to 75,000 tons per year although the "grinding of any fuel materials is not expected to be needed as the fuel supplier will be required to deliver sized materials". The applicant states that alternative fuel materials, up to 200,000 tons per year, are to be supplied in a manner suitable for mechanical and/or pneumatic injection into the pyroprocessing system, and requests authorization to grind up to 75,000 tons per year. That amount accounts for almost 40% of the 200,000 tons per year total being proposed, and contrary to the quoted statement from Titan's application, is a significant amount of grinding. DERM does not see the need for authorization to grind 75,000 tons per year which creates another source of air emissions at the facility. DERM has concerns regarding the increased dust and fugitive emissions that would result from the proposed on-site grinding.

Response:

The applicant has requested authority to grind up to 75,000 tons per year, and all emission limits are achievable. There should be no concern with fugitive emissions based on the information provided in the application. Please see page 18 of the initial application submittal. Tarmac does not intend to grind all alternative fuels and views the option to grind as only a once-in-a-while need. The permit should not, however, be more restrictive than necessary. If the conditions of the permit are being met, then authority to grind up to 75,000 tons per year should be granted. Tarmac plans for materials to be processed offsite and delivered to the facility ready to burn. Thus, Tarmac only foresees a very limited need to grind. A typical example for the need to grind would be for biomass that is found to be not finely ground enough and that clogs the injection system. Instead of reloading the material to haul trucks, hauling the material offsite, unloading, processing and reloading the materials, Tarmac prefers to simply re-grind that material on-site. This on-site grinding will allow materials to be immediately grinded which will limit the decay and loss of heat content that would otherwise occur over the time needed to ship the material offsite.

19. DERM has concerns regarding the potential increase of toxic air emissions that would result from the processing of alternative fuels such as engineered fuels, carpet derived fuels and other biomass fuels. For example, the applicant describes the proposed "other cellulosic biomass" as including "... copper-chromium-arsenic (CCA) treated wood, creosote-treated wood, construction and demolition debris not meeting the definition of clean C&D wood, particle board ...". Also, pressure treated wood, railroad ties and telephone poles may be creosote treated wood, which contains up to 15% creosote, a known carcinogen. The applicant may also accept pentachlorophenol treated wood or biomass treated with other chlorinated compounds. Due to these concerns DERM would request that Titan work with their vendors and suppliers to develop a protocol to eliminate all treated wood. Burning these treated lumber materials raises the issue of the potential for toxic emissions.

Response:

The applicant specifically requests authority to use treated wood as a fuel. Hazardous air pollutant emissions from a cement kiln are regulated under 40 CFR 63 Subpart LLL, which establishes emission limits reflected in Tarmac's Title V air permit. These limits must be met while using alternative fuels, including treated wood. Also, please see response to DEP question No. 5 above.

20. The application states that the design capacity of both the mechanical and the pneumatic feed systems are expected to be 15 tons per hour. In addition, the applicant requests authorization to add the proposed alternative fuels "... alone or in any combination." DERM has concerns related to the alternative fuel feed rate and compliance testing with respect to the requirement to test under representative operating conditions. Without a trial burn to obtain a maximum rate at which an alternative fuel can be injected, it will not be possible to establish representative conditions for compliance testing purposes.

Response:

The alternative fuels will be injected at various rates, and multiple fuels could be used at any time. For most pollutants, continuous emissions monitoring systems (CEMS) will be used to ensure compliance with applicable emission limits set forth in the current Title V permit. Mercury emissions are determined through materials analysis performed on a routine basis, and compliance with the limit for dioxin and furans is continuously determined through temperature readings. The annual particulate matter (PM) testing would be performed under worst-case fuel conditions, and beginning in 2013 continuous emissions monitoring will be used to determine compliance with the PM emission limit. As mentioned above, trial burns not needed to establish "representative conditions" for testing purposes.

21. DERM proposes to include permit conditions requiring periodic reports on the status of the project, to be submitted to the compliance authority, to include equipment installation, alternate fuels delivered, upcoming co-firings, etc.

Response:

Tarmac submits quarterly emission reports, annual emission reports and fees, and annual certifications of the facility compliance status for all permit conditions. Notification of initiation of construction of the materials handling equipment will be submitted. Notification of any stack tests will also be provided. Records of construction are maintained. Records of monthly fuel usage are kept on file . As part of the annual emission reports, annual usage data by fuel type is provided to the Department and DERM. Therefore, no additional permit conditions are necessary or appropriate. DERM has the authority to inspect the facility and maintained records at all times.

22. Additionally, conditions requiring systematic sampling of the various alternative fuels should be included in the permit.

Response:

No new conditions requiring additional sampling and analysis of the fuels used are appropriate or necessary. As explained above, the constituents of alternative fuels have limited effects on air emission rates. Also, for most pollutants, continuous emissions monitoring systems (CEMS) will be used to ensure compliance with applicable emission limits set forth in the current Title V permit. Mercury emissions are determined through materials analysis performed on a routine basis, and compliance with the limit for dioxin and furans is continuously determined through temperature readings.

23. DERM proposes to include a permit condition such as "The permittee shall not exceed any permitted emissions limit, even during the 90 to 180 day shakeout period" should be included in the permit.

Response:

This condition is acceptable.

24. Titan has numerical emissions limits for PM, PM10, SO_2, NOx, CO, VOC, mercury and Dioxin/Furans, with existing CEMS for all these pollutants with the exception of PM, mercury and D/Fs. Yet, the applicant states "... if co-firing results in emissions exceeding permit limits, the co-firing will immediately cease". The application does not explain how emissions of PM, Hg or D/Fs are to be monitored such that any exceedances of those pollutant emissions would be identified in real time, and co-firing immediately ceased. This information is needed.

Response:

As explained in the application and in attached Appendix B, PM emissions are not expected to increase as a result of the proposed alternative fuels. PM will be measured with periodic stack tests until 2013 when compliance will be determined using CEMS. In addition, opacity is a surrogate for PM emissions, and opacity is continuously monitored with a continuous opacity monitor (COM). Compliance with the mercury limit is determined through sampling and analysis. Because the mercury limit is an annual limit, there should be no concerns with short-term compliance. Compliance with the dioxin and furan limit is determined by continuously monitoring the baghouse inlet temperature, as is required under the Cement NESHAP because EPA has long since recognized that the predominate factor affecting D/F emissions is the temperature of gases at the inlet to the control device. 63 Fed. Reg. 14182, 14196 (Mar. 24, 1998). Moreover, as EPA found when establishing the MACT floor for hazardous waste burning kilns, fuel type does not have an impact on D/F formation because D/F is formed post-combustion. 64 Fed. Reg. 52828, 52876 (Sep. 30, 1999). This is consistent with EPA's recent affirmance that "burning alternative fuels . . . does not appreciably affect cement kilns' HAP emissions." 76 Fed. Reg. 28318, 28322 (May 17, 2011).[48], [49]

25. Detailed information about the chemical composition of the various alternative fuel types to have a better understanding of the materials to be burned is required.

Response:

Please see the response to No. 1 above.

26. Information explaining the screening process for rejection of any shipment of alternative fuels for quality assurance purposes, for example a list of unacceptable materials, procedures to identify and dispose such materials, is needed.

Response:

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[48] FDEP technical Evaluation, 0530021-031-AC draft permit.

[49] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, Table 1.38, http://eippcb.jrc.ec.europa.eu

Tarmac will enter into contracts with its suppliers of alternative fuels, just as it does with its suppliers of typical fossil fuels. It is Tarmac's responsibility to accept shipments of fuels or not based on the terms of those contracts. Ultimately it is Tarmac's responsibility to use only authorized fuels and to ensure compliance with the emission limits in the Title V permit. If Tarmac attempted to use a fuel that is not authorized by its permit or if Tarmac used a fuel that resulted in air emission rates in excess of its permitted limits, it would be in violation of its permit. Tarmac must certify annually under oath whether each permit term and condition was met over the last year, including the conditions regarding authorized fuels, through the Responsible Official's annual Title V compliance certification. This certification can be used to confirm that only appropriate fuels are being used. An air construction permit is not the appropriate permit to address disposal of materials that might be rejected.

If necessary, the permit could clarify that the following materials would not be used as fuels:

- Hazardous waste
- Radioactive waste
- Medical waste
- Untreated explosives
- Un-segregated municipal solid waste
- Anatomical hospital wastes
- Bio-hazardous wastes

27. A plan for introducing the proposed alternate fuels, e.g., whether each fuel be introduced individually or in combination with another alternative fuel, is needed.

Response:

The pneumatic and mechanical feed systems will be used to introduce the alternative fuels. Each listed alternative fuel will be added individually or in combination with other fuels. The timing of when each individual fuel is introduced will be up to the applicant and not based on a set schedule. The current Title V permit for the Pennsuco Complex appropriately limits the maximum 24-hour and annual production rates for clinker production rather than limit individual fuel feed rates. As long as the emission limits are being met and a quality clinker can be made, alternative fuels will be utilized to the maximum extent possible. When using alternative fuels, individually or in combinations, Tarmac must ensure that it meets the applicable emission limits while making a quality product. Tarmac must also ensure that the kiln is not damaged as a result of using alternative fuels. Like all cement kiln operations, Tarmac will gradually introduce alternative fuels, alone or in combinations, to learn the behavior of the fuel/fuel combination and its effect on emissions, the quality of the product, and the kiln system structure.

28. An explanation of the meaning and intent of the "90 to 180 day shakeout period for each fuel" is needed.

Response:

See the response to No. 13 above.

29. Detailed information as to where in the process each of the proposed alternative fuels will be introduced, the method of injection, the temperature range in that area, and the anticipated mixture of alternative fuels that will be burned at any given time independently or simultaneously with each other is needed.

Response:

Tarmac plans to inject the materials in the back end of the kiln where currently approximately 60 percent of fuel firing is conducted. The temperature ranges throughout a dry-process kiln are well known and established for proper operation. Such conditions are fixed parameters based on the design of the kiln. Please see response to question No. 27 above. Tarmac may also inject materials into the front end of the kiln – see the response to question No. 10 above.

30. Information regarding the proposed maximum feed rate for each alternative fuel is needed, for example, as included in the CEMEX, Brooksville plant pre-draft permit.

Response:

The current Title V permit for the Pennsuco Complex appropriately limits the maximum 24-hour and annual production rates for clinker production rather than limit individual fuel feed rates. As long as the emission limits are being met and a quality clinker can be made, alternative fuels will be utilized to the maximum extent possible.

Attachment A: Material Range of Parameter Values

AttA pesticide destruction.pdf
AttA 0250020-031-AC RAI.xls
AttA Ag Film Final Report S0427.pdf

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Review

Environmentally sound destruction of obsolete pesticides in developing countries using cement kilns

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ABSTRACT

The accumulation and inadequate management of obsolete pesticides and other hazardous chemicals constitutes a threat for health and environment, locally, regionally and globally. Estimates indicate that more than 500,000 tonnes of obsolete pesticides are accumulated globally, especially in developing countries. FAO has been addressing this issue and disposed of approximately 3000 tonnes of obsolete pesticides in Africa and the Near East since the beginning of the 1990s. These pesticide wastes have mainly been shipped to Europe for high-temperature combustion in dedicated incinerators, a treatment option usually not available in developing countries.

High temperature cement kilns are however commonly available in most countries and have shown to constitute an affordable, environmentally sound and sustainable treatment option for many hazardous chemicals if adequate procedures are implemented. Cement kilns have been used for disposal of obsolete pesticides in developing countries earlier but no study has been able to verify the destruction efficiency in an unambiguous way. Lessons learned from earlier experiences were used to carry out a test burn with two obsolete insecticides in a cement kiln in Vietnam. The destruction efficiency was measured to be better than 99.9999969% for Fenobucarb and better than 99.9999832% for Fipronil and demonstrated that the hazardous chemicals had been destroyed in an irreversible and environmental sound manner without new formation of dioxins, furans, hexachlorobenzene or PCBs, a requirement of the Stockholm Convention on POPs.

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1. Introduction

The accumulation and inadequate management of obsolete pesticides and other hazardous chemicals constitute a threat to health and environment, locally, regionally and globally. Estimates indicate that more than 500,000 tonnes of obsolete pesticides are accumulated globally, especially in developing countries (FAO, 2001a). FAO has been addressing this issue and disposed of approximately 3000 tonnes in more than ten countries in Africa and the Near East since the beginning of the 1990s (FAO, 2001b), less than 1% of the existing stocks.

A considerable amount of the accumulated obsolete pesticides are persistent organic pollutants (POPs) that possess toxic properties, resist degradation, bio-accumulate and are transported, through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems (Vallack et al., 1998; Jones and de Voogt, 1999). Organochlorine pesticide residues have been detected in air, water, soil, sediment, fish, and birds globally even more than one decade after being banned and it's reasonable to believe that contaminated sites and stockpiled waste still represent locally and regionally important on-going primary source inputs of hazardous compounds to the global environment (Brevik et al., 2004).

The Arctic, where subsistence living is common, is a sink region for POPs. Norwegian and Canadian researchers find more POPs in Polar bear on the remote North Atlantic island Svalbard than on the mainland America and there is currently a great concern in Norway about a 5–10 times increase in the POPs concentration in fish and other animals in the Barents Sea the last 10–15 years (Gabrielsen et al., 2004). POPs have shown to interfere with hormone function and genetic regulation, and myriad dysfunctions can be induced by low-dose POPs exposure during development (De Vito and Birnbaum, 1995; McDonal, 2002; Godduhn and Duffy, 2003; WHO, 2003; Gupta, 2004; Jobling et al., 2004).

Several international conventions aim to protect human health and the environment by requiring Parties to take measures to reduce or eliminate releases of POPs from intentional production and use, from stockpiles and wastes and from unintentional release. The Aarhus Protocol (UNECE, 1998) covers 16 POPs, 11 of which are pesticides, which are aldrin, dieldrin, endrin, chlordane, DDT, heptachlor, hexachlorobenzene (HCB), mirex, chlordecone, lindane, and toxaphene. The Stockholm Convention on POPs (UNEP, 2001) covers for the time being 12 compounds or groups of compounds, which are polychlorinated biphenyls (PCB), polychlorinated dibenzo-p-dioxins and dibenzo-furans (PCDD/Fs) and 9 of the same pesticides as the Aarhus Protocol, except chlordecone and lindane.

There is currently no reliable information available of what quantities these POPs constitute on a global level but these conventions acknowledge that there is an urgent need for environmentally sound disposal and that developing countries and countries with economies in transition need to strengthen their national capabilities on sound management of hazardous chemicals (UNEP, 2001). One of the intentions of the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes is to stimulate local treatment of hazardous wastes and to avoid shipment across borders (Basel Convention, 1989).

Pesticide wastes from clean up in Africa have so far been shipped to Europe for high-temperature combustion in dedicated incinerators at an average cost of US$ 3500 per tonnes (FAO, 1999; Science in Africa, 2002). Apart from being costly, this practise also involves environmental risks due to long transport distances and it does not contribute with needed capacity building on hazardous waste management in the affected countries. High temperature incineration is usually absent as a dedicated technology option in developing countries but high temperature cement kilns are however common in most countries and can constitute an affordable, environmentally sound and sustainable treatment alternative to export (Karstensen, 1998a,b, 2001a,b, 2004). The only treatment option for organic hazardous wastes in Norway the last 25 years has been co-processing in cement kilns (Viken and Waage, 1983; Benestad, 1989; Karstensen, 1998a).

The Stockholm Convention has mandated the Basel Convention (2006) to develop technical guidelines for environmentally sound management of wastes consisting of or contaminated with POPs. An important criterion for environmentally sound destruction and irreversible transformation is to achieve a sufficient destruction efficiency (DE) or destruction and removal efficiency (DRE). A DRE value greater than 99.9999% is required for POPs in the United States (US) (Federal Register, 1999). The DRE consider emissions to air only while the more comprehensive DE is also taking into account all other out-streams, i.e. products and liquid and solid residues.

The Basel Convention technical guidelines consider ten technologies to be suitable for environmentally sound destruction/disposal of POPs (Basel Convention, 2006). The most common among these are hazardous waste incineration and cement kilns, which also constitute the largest disposal capacity. The remaining eight technologies have comparatively low capacities (some are still at laboratory scale), are technically sophisticated and currently not affordable by many developing countries (UNEP, 2004). A thorough and objective comparison between these technologies on aspects like sustainability, suitability, destruction performance, robustness, cost-efficiency, patent restrictions (availability), competence requirements and capacities is needed.

2. Cement production and co-processing of hazardous wastes

Portland cement is made by heating a mixture of calcareous and argillaceous materials to a temperature of about 1450 °C. In this process, partial fusion occurs and nodules of so-called clinker are formed. The cooled clinker is mixed with a few percent of gypsum, and sometimes other cementitious materials, and ground into a fine meal—cement (Duda, 1985; IPPC, 2001). In the clinker burning process, which is primarily done in rotary kilns, it is essential to maintain kiln charge temperatures of approximately 1450 °C and gas temperatures in the main flame of about 2000 °C. The cement industry is today widely distributed throughout the world and produced in 2003 approximately 1940 million tonnes of cement (Cembureau, 2004). When new plants are built in emerging markets and developing countries, usually the best available techniques (BAT) applies (IPPC, 2001; Karstensen, 2006b).

Cement kilns have proven to be effective means of recovering value from waste materials and co-processing in cement kilns is now an integral component in the spectrum of viable options for treating hazardous industrial wastes, mainly practised in developed countries (Balbo et al., 1998). A cement kiln possess many inherent features which makes it ideal for hazardous waste treatment; high temperatures, long residence time up to eight seconds, surplus oxygen during and after combustion, good turbulence and mixing conditions, thermal inertia, counter currently dry scrubbing of the exit gas by alkaline raw material (neutralises acid gases like hydrogen chloride), fixation of the traces of heavy metals in the clinker structure, no production of by-products such as slag, ashes or liquid residues and complete recovery of energy and raw material components in the waste (Chadbourne, 1997).

Numerous tests in developed countries have demonstrated that there is essentially no difference in the emissions or the product quality when waste materials are used to replace the fuels and ingredients needed to produce cement clinker (Lauber, 1982, 1987; Branscome et al., 1985; Garg, 1990; Karstensen, 1994; Chadbourne, 1997). Mac Donald et al. (1977) carried out test burns with hazardous chlorinated hydrocarbons containing up to 46% chlorine in a wet cement kiln in Canada and concluded that "all starting materials, including 50% PCBs, were completely destroyed" and "that all chlorinated hydrocarbon wastes may be used in cement kilns without adverse effect on air pollution levels". Similar tests with chlorinated and fluorinated hydrocarbons conducted in a wet kiln in Sweden showed that the DRE of PCBs were better than 99.99998% and that there were no change in product quality or any influence on process conditions with a chlorine input up to 0.7% of the clinker production (Ahling, 1979). Viken and Waage (1983) carried out test burns in a wet kiln in Norway feeding 50 kg PCBs per hour, showing a DRE better than 99.9999% and no traces of PCB in clinker or dusts could be detected. Benestad (1989) carried out studies in a dry cement kiln in Norway in 1983 and 1987 and concluded that "the type of hazardous waste used as a co-fuel does not influence the emissions" and that the destruction of PCB was better than 99.9999%. Suderman and Nisbet (1992) concluded from a study in Canada that there is "no significant difference in stack emissions when 20–40% of the conventional fuel is replaced by liquid wastes".

3. Disposal of obsolete pesticides and POPs in developing countries using cement kilns—lessons learned

Despite the obvious need, surprisingly few studies have reported results from obsolete pesticide and POPs destruction using cement kilns in developing countries.

3.1. *Malaysia*

The German development aid organisation GTZ carried out the first reported disposal operation with obsolete pesticides using a cement kiln in Malaysia in the middle of the 1980s (Schimpf, 1990). Solid and concentrated liquid pesticides were dissolved in kerosene and fuel oil in a 5 m^3 storage tank with an agitator and fed through the main burner into the kiln. A mixture of 2,4-D and 2,4,5-T were destroyed in the main flame of the kiln. Before, during and after the disposal, dust samples were taken from the electro static precipitator (ESP) and analysed for PCDD/Fs. No PCDD/Fs where detected, but the report does not provide any information of the quantification limits for PCDD/Fs, nor any information about the amounts of pesticides destroyed, the concentration of the active ingredients, the feed rate into the kiln or the DE/DRE.

3.2. *Pakistan*

A total of 17,000 l of nine different organophosphates and three different organochlorine pesticide mixtures were destroyed in a cement kiln in Pakistan by the US Aid in 1987 (Huden, 1990). Waste pesticides were pumped from a tank truck and injected at an average rate of 294 l/h for the organophosphates and 46 l/h for the organochlorines. The injector achieved fine atomisation using compressed air and was tested successfully with diesel fuel. The "cocktail" of pesticides, however, contained sludge's that settled to the bottom of the tank truck, causing viscosity to fluctuate depending on temperature and degree of agitation. These unanticipated conditions caused a variety of problems. The kiln met the standards for dust emission but not the DRE requirement or the HCl emissions limit. Products of incomplete combustion (PIC) were examined using gas chromatography mass spectrometry (GC–MS) but were not detected. Analyses of solid process samples, raw meal feed, and clinker and ESP dust showed no detectable pesticides.

3.3. *Tanzania*

Mismanagement of large quantities of 4,6-dinitro-o-cresol (DNOC) during several years in the 1980s and 1990s caused serious environmental and ecological damages to the wildlife in Lake Rukwe in west Tanzania. DNOC belongs to the group of nitro-compounds and is classified to be highly hazardous (group Ib) in accordance to the WHO (2002) classification and is highly toxic to fish and explosive in its dry form. GTZ carried out a test burn with 1:1 DNOC/diesel-mixture in a cement kiln west of Dar-Es-Salaam in 1996 (Schimpf, 1998). A series of technical problems led to delays, especially during the testing phase and the composition of the exit gas concentration of CO, CO_2, O_2, NO_x and the temperature fluctuated during the test burn but no DNOC residues were detected in the clinker or the filter dust. Approximately 57,500 l of 20% DNOC were co-processed in the kiln within a period of about 7 weeks. The 400 old DNOC drums were melted and recycled as iron for construction purposes. The cost of the disposal was estimated to be approximately 4300 US$ per tonne of DNOC, a cost lying in the "upper range of normal disposal costs" according to Schimpf (1998). This way of calculating the disposal cost seems however to be dubious—the total project cost, 245,000 US$ over 4 years, is divided on the 57 tonnes of pesticides disposed.

3.4. *Poland*

In a Polish test burn reported by Stobiecki et al. (2003) different mixes of 12 obsolete pesticides and POPs were introduced into a cement kiln (no details about the process type or operating conditions) over a period of 3 days. The different pesticide mixtures were blended into three batches with light heating oil and constituted 11.5%, 29.4% and 30.5% of pesticides, respectively. The mixes were fed through the main flame together with the coal in an introduction rate of approximately 400 kg/h over three different periods and the results was compared to baseline conditions, i.e. when coal only was used as a fuel. None of the pesticides were detected in the exit gas (detection limit between 1 and 0.02 $\mu g/m^3$) or in the clinker (detection limit between 0.05 and 0.001 mg/kg). Physical and chemical testing of clinker gave normal and similar results for all conditions. The PCDD/Fs emissions were 0.009 ng I-TEQ/N m^3 with coal only and 0.015, 0.053 and 0.068 ng I-TEQ/N m^3 when feeding the three fuel mixes with pesticides, respectively.

3.5. *Lessons learned*

None of the described projects were able to demonstrate the destruction efficiency, an important criterion for the evaluation of environmentally sound destruction/disposal (Basel Convention, 2006), but also important for achieving acceptance for this treatment option among various stakeholders.

The absence of PCDD/Fs in the ESP dust in the GTZ project in Malaysia is not enough to verify the destruction performance, nor did it provide information of the quantification limits for PCDD/Fs. There is however no reason to believe that 2,4-D and 2,4,5-T were not safely destroyed in the main flame but the DE/DRE should have been established.

For the purpose of the test burn in Pakistan it might have been wise to insist on using a uniform, higher grade waste pesticide and restricting the test to one compound in each pesticide group. Uncertainty of availability of the ideal test candidate, likely long haul transport, and need to get on with the job, forced the team into a truly real case waste disposal situation, the complexity of which did not become apparent until they were well committed and could not turn back (Huden, 1990). Better early sampling of candidate pesticides could have told the team more of what was ahead as well as determined a better choice of pesticides for the test burn. The choice of laboratory is of course also important. The concentration of pesticides in the feed was too low to measure the DE/DRE, probably due to a combination of low active ingredient and low feed rate. Further on, in selecting a cement plant for waste co-processing, the power supply reliability is essential. The actual plant was plagued by many power interruptions. When designing the waste injection and delivery system, the team expected to work with free flowing liquids but received sludge which caused numerous problems. The waste products should have been blended in a dedicated tank, equipped with an agitator and fed to the fuel line equipped with a cut-off valve. The important public relations issue was according to Huden (1990) not given enough attention. To assume that a potentially touchy subject best be kept quiet, is dangerously naive. The press, community leaders and labour unions can quickly turn into enemies when they are not informed of the intent of such an undertaking. With proper care, popular acceptance is much more likely than not, particularly when the benefit of participating in risk reduction can be understood.

The kiln chosen for the disposal operation of DNOC in Tanzania (Schimpf, 1990) was obviously not the best choice and illustrates clearly the necessity of performing a proper technical feasibility study prior to the kiln selection. The kiln broke down regularly during the disposal operation, the refractory of the kiln was damaged, the outer wall of the satellite cooler burned through, the power fluctuated and the raw meal feed was disrupted. There was no sampling of DNOC in the exit gas, i.e. no possibility to demonstrate the DE/DRE. To measure DNOC in ESP dust and clinker, and CO_2, O_2 and NO_x in the exit gas is not sufficient. The project experienced resistance from the plant employees and showed clearly the necessity of transparency, information and good communication with involved parties.

Stobiecki et al. (2003) analysed the stack gas and the clinker for the 12 obsolete pesticides fed to the kiln but did not, for unknown reasons, report the DE/DRE.

4. Test burn with obsolete pesticides in a Vietnamese cement kiln

Lessons learned from the described projects established the basis for a joint test burn project with the Vietnamese authorities and Holcim Cement Company. The objective was to investigate if their cement kiln in the South of Vietnam was able to co-process and destroy obsolete pesticides/hazardous wastes in an irreversible and environmental sound manner, i.e. with no influence on the emissions when fossil fuel was partly replaced by hazardous waste. Information about the test burn was disseminated well in advance to all relevant stakeholders and the actual test burn was inspected by scientists from universities and research institutes in Vietnam. Several conditions had to be fulfilled prior to the test burn:

- Project supervision and evaluation by third party experts.
- Independent stack gas sampling and analysis by an accredited company.
- An environmental impact assessment (EIA) following the Vietnamese requirements had been successfully completed (Decision 155, 1999; HCMC, 2002).
- The transport and the handling of the hazardous waste should comply with the hazardous waste management regulation in Vietnam, Decision 155 (1999).
- The emission levels should comply with the Vietnamese emission limit values in the standard TCVN 5939-1995 and TCVN 5940-1995 (Decision 155, 1999; Karstensen et al., 2003a).
- The cement kiln process had been evaluated to be technical and chemical feasible for co-processing of hazardous wastes.
- Power and water supply had been evaluated to be stable and adequate.

- The hazardous waste receiving, handling, storage and introduction process had been evaluated to be stable, safe and robust.
- All involved staff and subcontractors had received adequate information and training and the project objective had been communicated transparently to all stakeholders.
- Emergency and safety procedures had been implemented, i.e. personal protective gear should be used and fire extinguishing and equipment/material for cleaning up spills should be available.
- Procedures for stopping waste feed in the event of an equipment malfunction or other emergency had been implemented and the set points for each operating parameter that would activate feed cut-off had been specified.

4.1. *Cement plant description*

The cement plant is located about 300 km west of Ho Chi Minh City, in Hon Chong, Kien Giang Province and produces cement clinker in a new dry suspension preheater rotary cement kiln equipped with a precalciner, a best available techniques plant (IPPC, 2001). The kiln rotates with a speed of 3.5 rounds per minute, is 4.6 m in diameter, 72 m long with a 110 m high double string five-stage preheater tower and produces approximately 4400 tonnes of clinker per day.

The gas flows in the system provides combustion air to the main burner and the precalciner, and is primarily taken from cooling air in the clinker cooler which ensures maximum heat recovery. Under normal operation, the exit gas from the preheater is directed through a conditioning tower to the raw material mill and the coal mill for drying purpose. A small portion of the gas (8%) can be directed to a by-pass system to reduce build-up of chlorine and alkalis if needed. After drying, the gas is de-dusted in high efficiency ESP before entering the main stack.

The production process is monitored and controlled through an advanced control system with continuous on-line monitoring of the following parameters: the kiln inlet gas is analysed for temperature, O_2, CO and NO_x; the preheater outlet gas for temperature, O_2, CO and NO_x and the stack outlet gas for temperature, O_2, CO, CO_2, NO, NO_2, SO_2, HCl, NH_3, H_2O and volatile organic carbon (VOC). The main stack is 122 m high and approximately 4 m in diameter.

4.2. *Obsolete pesticides used in the test burn*

The greatest challenge in the first phase of the project was to identify a local available obsolete pesticide which could fit the purpose of being a suitable test burn candidate and avoid the trouble Huden (1990) faced in Pakistan.

A solvent-based insecticide mix with two active ingredients, 18.8% Fenobucarb and 2.4% Fipronil, was identified at an international pesticide company in Dong Nai Province. The insecticide had expired, was deemed unusable and approximately 40,000 l was stored in 200 steel drums waiting for a suitable treatment option. The active ingredients of the insecticide were solved in cyclohexanone and aromatic solvents. The concentration was regarded to be sufficient to be able to demonstrate the necessary DE/DRE of 99.99%. Fenobucarb has a molecular weight of 207.3 with the sum molecular formula $Cl_2H_{17}NO_2$ (Fig. 1).

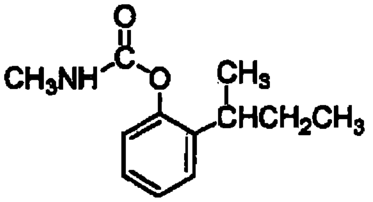

Fig. 1 – Chemical structure of Fenobucarb.

Fipronil has a molecular weight of 437.2 with the sum molecular formula $Cl_2H_4Cl_2F_6N_4OS$ and contain 16.2% chlorine and 26.06% fluorine (Fig. 2). Fenobucarb and Fipronil contain 6.7% and 12.8% nitrogen, respectively.

Both Fenobucarb and Fipronil are sold as active ingredients in separate insecticide formulations and they are potent insect killers, with different mechanisms and reaction time. Both active ingredients are classified by the World Health Organisation to be moderately hazardous (class II) on their scale from extremely to slightly hazardous (WHO, 2002). The insecticides were also considered to be representative of other obsolete pesticide and hazardous waste streams needing a treatment option in Vietnam and would as such constitute an illustrative example (Quyen et al., 1995; DoSTE, 1998; Hung and Thiemann, 2002; Karstensen et al., 2003a,b; Minh et al., 2004; World Bank, 2004). The other requirement, which was based on the lessons learned from the earlier studies, was the need of having sufficient amounts and concentration of a homogeneous compound.

The insecticide mix was a free flowing liquid with a viscosity similar to water and easy to pump through a separate channel in the main burner, a three channel burner feeding anthracite coal only under normal operations. The product had been screened through 0.25 mm sieve and no settlements, particles or polymerization or degradation of the active ingredient were observed. The Plant Protection Department in Ho Chi Minh City confirmed that the product was homogenous and contained 18.8% Fenobucarb and 2.4% Fipronil. Quantitative and qualitative analysis is usually done by high pressure liquid chromatography with ultra violet detection or by gas chromatography with electron capture detection (Kawata et al., 1995; Vilchez et al., 2001).

A 16 m^3 steel tank for receiving, blending and feeding of the insecticide mix was build and connected to the light fuel oil pumping system with automatic dosage and switch off/on through the main control system. The tank was equipped with a diaphragm pumping system and was placed in a bunded concrete construction for spill recovery. The insecticide mix was pumped from the tank through stainless steel pipes

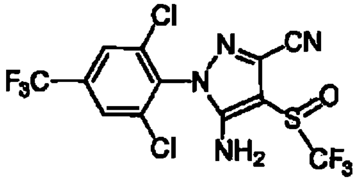

Fig. 2 – Chemical structure of Fipronil.

through a calibrated flow meter and into the main flame together with coal.

The transport of the 200 steel drums with insecticide was carried out by 10 trucks and organised by the owner. The emptying of the insecticide drums were done manually with a steel lance, chemical resistant hose and a diaphragm pump connected directly to the feeding tank and was carried out by trained personnel. Safety during transportation, handling and transfer had the highest priority and due care was demonstrated during the course of the test. Personnel were equipped with personnel protective gear including organic vapour cartridge face masks. Preventive measures were in place in case of exposure, spillage and fire. All installations and drums were earthed. Empty drums were taken back to the owner in Dong Nai by the same trucks.

4.3. *Outline of the test burn*

The entire test was conducted over 2 days, 16 and 17 October 2003, starting first day with a baseline study with coal feeding only and then the test burn the second day were parts of the coal was substituted by the insecticide mix. The plant was run both days in a normal mode, i.e. whit the kiln gases directed through the raw mill for drying purpose.

The sampling of solid process samples, i.e. raw meal, clinker, fine coal, and dust from the ESP was carried out by trained plant staff. An Australian independent test company accredited according to EN ISO/IEC 17025 was hired to carry out the stack gas sampling. They subcontracted other accredited laboratories in Australia and Europe to do the chemical analysis.

The insecticide mix was introduced to the kiln starting with 1000 l per hour (l/h), increasing to 2000 l/h 6 h before the stack sampling started in order to stabilise test conditions. During the stack sampling campaign, 2030 l of insecticide mix was fed to the kiln per hour and all together 39,500 l were destroyed in less than 20 h. After emptying, tank and pipes were cleaned with light fuel oil and fed to the kiln.

4.4. *Process and sampling conditions during testing*

Two hundred and ninety-two tonnes per hour of raw meal was fed to the preheater and 179 tonnes/h of clinker was produced during the test. Feeding of coal to the secondary precalciner burner was stable at 13 tonnes/h both days; the coal feed to the main primary burner was reduced by 1.5 tonnes from 7 to 5.5 tonnes/h when the insecticide mix was introduced to compensate for the heat input of the solvent.

The coal feed to the main burner was not reduced sufficiently during the test burn due to an analysis error of the heat content of the insecticide mix. Measurements prior to the test had shown a calorific value of 22.5 MJ but during the test it was realised that this had to be wrong because the temperature of the kiln increased. This was confirmed by new analysis after the test burn when the calorific value of the insecticide mix was measured to be 36.6–38.1 MJ/kg (due to the aromatic solvents). Fine coal is by comparison 30 MJ/kg, i.e. the coal feed to the main burner should have been reduced by 2.5 tonnes to balance the heat requirement of the kiln.

4.5. *Emissions results and discussion*

4.5.1. *Destruction efficiency of the insecticides*

To make sure that Fenobucarb and Fipronil was not a PIC normally found in the stack emissions, Fenobucarb and Fipronil were also analysed in the samples taken during the baseline test. Both DE and DRE were measured during the test. The DE is calculated on the basis of mass of the insecticide fed to the kiln, minus the mass of the remaining insecticide in the stack emissions, in the clinker and the ESP dust, divided by the mass of the insecticide within the feed, according to the following equation:

$$\mathrm{DE} = \frac{W_{\mathrm{in}} - W_{\mathrm{out}}}{W_{\mathrm{in}}} \times 100$$

where W_{in} is the mass of Fenobucarb and Fipronil entering the kiln and W_{out} is the mass exiting the stack gas and through the clinker and ESP dust. The actual cement plant does not produce any liquid effluents. The DRE considers emissions to air only.

The introduction of 2030 l/h insecticide amounts to 362 kg pure Fenobucarb and 46.2 kg pure Fipronil per hour when corrected for the density, 0.95 (kg/l). No Fenobucarb or Fipronil were detected in the clinker, the ESP dusts (the detection limit was 2 ng/g) or in the exit gas (the detection limit was 21 and 14 ng/m^3, respectively). The DE/DRE is calculated on the basis of the material volumes produced and an average stack gas volume of 484,800 normal cubic metre per hour (N m^3/h) corrected to 10% oxygen (Table 1).

The US EPA regulation would require a DRE of 99.99% for these insecticides; no DE demonstration is however required (Federal Register, 1999). There is no requirement for demonstrating the DE/DRE in the Vietnamese regulation.

4.5.2. *Result of organic compounds*

Sampling for PCDD/Fs, PCBs, and polyaromatic hydrocarbons (PAHs), HCB, Fenobucarb and Fipronil was performed in accordance with US EPA Method 23 (Federal Register, 2000). This method has been proven to be effective for the sampling of a wide range of semi-volatile organic compounds from combustion systems, including PCBs, PAHs, HCB and pesticides. The XAD-2 resin was spiked prior to sampling with isotopically labelled PCDD/Fs surrogate standards. In the laboratory, PCDD/F, PAH and PCB recovery standards were added to the sample components. The filter, resin and impinger solutions were extracted with organic solvents and the extract purified by chemical treatment and solid phase chromatographic techniques. Analysis of PCDD/Fs was performed using high-resolution gas chromatography with high resolution mass spectrometry in accordance with US EPA

Table 1 – Fenobucarb and Fipronil in the stack (ng/m^3)

	Baseline	Test burn	DRE test burn (%)	DE test burn (%)
Fenobucarb	<18	<21	>99.999997	>99.9999969
Fipronil	<12	<14	>99.999985	>99.9999832

Calculated DE and DRE

Method 8190 (Federal Register, 2000). The total toxic equivalents (TEQs) for 2,3,7,8-substituted PCDD/F congeners were calculated using international toxic equivalency factors (TEFs).

The method of extraction and purification of PAHs and PCBs are based on US EPA Methods 3540 (Soxhlet extraction of solid phase), 3510 (liquid/liquid extraction of aqueous phase), 3630 (SiO_2 gel column) and 3640 (GPC) (Federal Register, 2000). PAHs were analysed using high-resolution gas chromatography with low-resolution mass spectrometry. Analysis of PCBs was performed using high-resolution gas chromatography with high-resolution mass spectrometry determining "dioxin-like" PCB congeners with the TEF scheme provided by WHO 1998 (Federal Register, 2000). HCB and the insecticides were determined directly from the solid and liquid phase extracts (US EPA Methods 3540 and 3510) using high-resolution gas chromatography with low-resolution mass spectrometry (Federal Register, 2000). Sampling and analysis of VOC was performed in accordance with the US EPA Method 18 (Federal Register, 2000).

This was the first time PCDD/Fs were measured in an industrial facility in Vietnam. There is currently no PCDD/F emission limit value for cement kilns but hospital waste incinerators have an ELV of 1 ng I-TEQ/N m^3. No 2,3,7,8-substituted PCDD/Fs could be quantified.

HCB is currently not subject to common regulatory monitoring in cement plants but may be a requirement under the Stockholm Convention in the future. HCB was below the detection limit both days. The PAH emission was low and independent of the insecticide disposal. There is currently no ELV for PAH or HCB in Vietnam (Table 2).

VOC and benzene were measured in the stack both days and were found in low concentrations, less than 4% and 13% of the current ELV, respectively. Emissions of VOC and benzene are usually due to volatilisation of hydrocarbons in the raw materials when heated in the preheater and is normal in cement production.

Of the PAHs measured, only fluorene, phenanthrene and fluoranthene were identified in low concentrations in the baseline test and only phenanthrene was identified in low concentration during the test burn. Naphthalene could not be quantified in any of the samples as it was found to be a contaminant in the XAD-2 resin.

All the dioxin-like PCBs was below the detection limit. There is currently no ELV for PCBs in Vietnam. PCBs are not commonly monitored on a regular basis in cement plants but will be a requirement under the Stockholm Convention in the future.

4.5.3. *Result of acids and gases*

Hydrogen fluoride and ammonia were measured to be below the detection limit both days and hydrogen chloride was well below the emission limit value. Sampling and analysis were performed in accordance with US EPA Method 26A (Federal Register, 2000). Even if the insecticide contained both chlorine and fluorine, the emissions were not affected (Table 3).

Table 2 – Concentration of PAH, HCB, benzene and VOC (dry gas at 273 K, 101.3 kPa and 10% O_2)

	Baseline	Test burn	ELV Vietnam
∑PAH (μg/m^3)	1.6	0.49	–
HCB (ng/m^3)	<31	<35	–
Benzene (mg/m^3)	2.2	3.2	80
VOC (mg/m^3)	17	26	200

Table 3 – Gaseous compounds (mg/N m^3)

	Baseline	Test burn	ELV Vietnam
HCl	2.1	2.4	90
HF	<0.21	<0.23	4.5
NH_3	<1.0	<0.44	45
CO	99	131	225
O_2 (%)	5.24	5.21	–
SO_2	1.8	2.0	225
NO_2	21	40	–
NO	760	1220	–
NO_x expressed as NO_2	1180	1910	1000

The result for CO was well below the current emission limit value of 225 mg/N m^3 and independent of the insecticide disposal. Carbon monoxide can arise from any organic content in the raw materials and, occasionally, due to the incomplete combustion of fuel. The contribution from the raw materials will be exhausted with the kiln gases. Control of CO is critical in cement kilns when ESP is used for particulate abatement. If the level of CO in the ESP rises, typically to 0.5% by volume then the ESP electrical system is automatically switched off to eliminate the risk of explosion. The oxygen content measured during the test is within the normal range in cement kilns. Oxygen and carbon dioxide concentrations were monitored in accordance with US EPA Method 3A and carbon monoxide in accordance with US EPA Method 10 (Federal Register, 2000).

The result of SO_2 was less than 1% of the emission limit value (225 mg/N m^3) and independent of the insecticide disposal. Ninety-nine percentages of the sulphur oxides emitted from cement kilns is in the form of SO_2 and originates mainly from sulphides and organically bound sulphur in fuels and raw materials (Oss and Padovani, 2003).

The reason for the high NO_x levels during the test burn was due to high heat input through the main flame due to wrong information about heat content of the insecticide mix prior to the test. The coal feed was approximately 1 tonne higher than required. The easy burnability of the solvent of the insecticide mix compared to hard coal probably caused a more intense flame in the main burner as well as added 31 kg of nitrogen per hour. The consequence of this inadequate compensation was higher temperature in the kiln and higher NO_x levels. The NO_x level was however higher than the ELV also under the baseline measurements (under investigation). The result confirms what most studies have concluded with earlier, that more than 90% of the NO_x emissions from cement kilns are NO, the rest is NO_2 (Oss and Padovani, 2003).

NO and NO_2 concentrations were monitored in accordance with US EPA Method 7E and sulphur dioxide concentrations in accordance with US EPA Method 6C (Federal Register, 2000).

4.5.4. *Results of solid particles and metals*

The concentration of dust was 33 and 20 mg/N m^3 for the baseline test and the test burn, respectively, i.e. independent of the insecticide destruction. The ELV in Vietnam is

Table 4 – Metal concentration in $\mu g/N\ m^3$

	Baseline	Test burn	ELV
As	<5.4	<2.7	4500
Cd	0.71	0.74	450
Co	<0.54	<0.27	
Cr	1.7	4.3	
Cu	<1.1	0.71	9000
Hg	4.7	0.33	
Mn	12	14	
Ni	1.6	1.8	
Pb	<4.3	<2.2	4500
Sb	<3.3	<1.6	11250
Sn	71	38	
Tl	<2.7	<1.4	
V	<0.65	0.82	
Zn	13	2.7	13500

100 mg/N m^3. Sampling of solid particles was conducted in accordance with US EPA Method 5 (Federal Register, 2000).

The analysis results of arsenic, cadmium, cobalt, chromium, copper, mercury, manganese, nickel, lead, antimony, tin, thallium, vanadium and zinc are given in Table 4. Vietnamese ELVs are given for arsenic, cadmium, copper, lead, antimony and zinc and all the results were in compliance. The sources of heavy metals to a cement kiln are raw materials and fuels and will be site specific. The emission levels uncovered in this test are low and not influenced by the insecticide destruction. The results of tin are probably due to contamination or interferences in the analytical technique used in the laboratory. Sampling and analysis of metals were performed in accordance with US EPA Method 29 (Federal Register, 2000). Hg was analysed by cold vapour atomic absorption spectroscopy (CV-AAS), the other metals by using inductively coupled argon plasma emission spectroscopy–mass spectrometry (ICP–MS).

4.5.5. *Solid samples and product quality*

Raw meal, fine coal, ESP dusts and clinker were sampled every second hour during the 2 days and analysed for main and trace inorganic components as well as insecticides. The results showed no effect of the insecticide disposal. The clinker had an average concentration of chlorine of 18 and 19 mg/kg under baseline and test burn conditions, respectively; the fluorine was <0.40 mg/kg for all samples. All the dusts produced by the ESP are recovered and reintroduced back to the process, i.e. no residues or waste is produced.

Ordinary quality testing was performed on clinker, cement and concrete produced the 2 days and comprised fineness of the cement, loss of ignition, water demand, initial and final setting time and the strength of the concrete after 1, 3, 7 and 28 days. The results were within normal ranges and showed that the product quality was unaffected by the introduction of the insecticide.

5. Discussion

Already in the 1970s the pesticide industry knew by practise that even persistent compounds were completely destroy at combustion temperatures around 1000 °C and a few seconds retention time (Karstensen, 2006a). Laboratory studies and thermodynamic calculations confirm this. A cement kiln possess many inherent features which makes it ideal for hazardous chemicals treatment; high temperatures up to 2000 °C in the main flame, several seconds residence time, surplus oxygen, good turbulence and mixing conditions.

Some of the early projects carried out by GTZ and US Aid might have assumed that any cement kiln would qualify to destroy obsolete pesticides. Even though all cement kilns needs high temperature to produce clinker, not all are necessarily suited for hazardous waste destruction without upgrading or modification. The feasibility has to be assessed case by case, and will depend on technical, chemical and environmental conditions, waste and raw material composition, location, infrastructure, policy and regulation, permit conditions, competence, acceptability etc. (Karstensen, 1998a,b; Karstensen, 2001a,b).

A feasible cement kiln will together with environmentally sound management and operational procedures, adequate safety arrangements and input control secure the same level of environmental protection in developing countries as in the EU and the US. As clearly illustrated in this study—instead of representing a threat to environment and health and causing problems for the owner, the hazardous insecticide was safely destroyed in a local cement kiln at same time as non-renewable fossil fuel was saved. The cost savings of using a local cement kiln will be considerable compared with other treatment options, also export, and can contribute to make developing countries self reliant with regards to hazardous waste treatment. Building of hazardous waste incinerators imply large investments and high running costs and is normally not affordable to developing countries.

The test burn demonstrated the best destruction efficiency ever demonstrated; 10,000 times better than required by the US regulation, the most stringent in the world today. Except for the NO_x emissions, all the test results were in compliance with the Vietnamese regulation. The results of the PCDD/F measurements are in line with the results of a study on POPs emission from cement kilns conducted by the World Business Council for Sustainable Development (Karstensen, 2004, 2006b)—a study evaluating around 2200 PCDD/F measurements and concluding that co-processing of hazardous waste does not seem to influence or change the emissions of POPs from modern BAT cement kilns.

6. Conclusion

Continued accumulation and inadequate management of obsolete pesticides and POPs constitute a threat to health and environment, especially in developing countries. High-temperature combustion has shown to be the best way to destroy most of these chemicals but only a few projects utilising high temperature cement kilns have been reported and none has prior to this test been able to verify the destruction efficiency under developing country conditions.

The test burn conducted with two hazardous insecticides in a cement kiln in Vietnam demonstrated the best destruction efficiency ever measured. All the test results, except for the NO_x, were in compliance with the most stringent regulations. This was the first time PCDD/Fs, PCBs and HCB were measured in an industrial facility in Vietnam and all the results were below the detection limits. This proved that the destruction had been complete and irreversible, and in full compliance with the requirements of the Stockholm Convention of being environmentally sound, i.e. not causing any new formation of PCDD/Fs, HCB or PCBs.

Environmentally sound disposal of hazardous chemicals is costly if export or new disposal facilities are considered and may not be affordable to many developing countries. Cement kilns are however commonly available in most countries and modern best available techniques kilns are nowadays primarily built in emerging markets. A feasible cement kiln can constitute an affordable, environmentally sound and sustainable treatment option for many hazardous chemicals if adequate procedures are implemented.

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The Potential of using Cement Kilns for Environmentally Sound Destruction of Obsolete Pesticides in Developing Countries

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Abstract

The accumulation and bad management of obsolete pesticides and other hazardous chemicals constitutes a threat for health and environment, locally, regionally and globally. Estimates indicate that more than 500,000 tons of obsolete pesticides are accumulated globally, especially in developing countries. Many of the accumulated obsolete pesticides are persistent organic pollutants POP's that possess toxic properties, resist degradation, bio-accumulate and are transported, through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems.

Several international environmental conventions aim to protect human health and the environment through measures which will destroy and irreversible transform stockpiled hazardous chemicals and reduce and/or eliminate emissions and discharges. These conventions acknowledge that there is an urgent need for environmentally sound destruction of hazardous chemicals and that developing

countries need to strengthen their national capabilities for safe management and disposal.

The Food and Agriculture Organization of the United Nations has been addressing this issue and disposed of approximately 3,000 tons of obsolete pesticides in more than 10 countries in Africa and the Near East since the beginning of the 1990's. The hazardous wastes has mainly been shipped to Europe for high-temperature incineration in dedicated facilities, a practise which does not stimulate development of local solutions and capacity building; it is also reasonable to anticipate that this approach involves higher costs and increased risks for accidents and spill.

The pesticide manufacturing industry started already in the 1970's to look into possible treatment options for obsolete pesticides and pesticide wastes and combustion was soon considered to be the best method. However, high temperature incineration is usually not available as a treatment option in developing countries. High temperature cement kilns however, are commonly available in most countries and has shown to constitute an affordable, environmentally sound and sustainable treatment option for many hazardous wastes if adequate procedures are implemented.

Cement kilns has been used for destruction of obsolete pesticides in developing countries on several occasions but so far not being able to verify the destruction performance in an unambiguous way. Such verification is established in a test burn, which is the only way to prove that the cement kiln is suitable for the purpose. The projects failed mainly due to improper technical preparation.

The lessons learned from these experiences were used to carry out a test burn with two toxic and obsolete insecticides in Vietnam in 2003. The destruction and removal efficiency was measured to be better than 99.999985% and demonstrated that

co-processing of hazardous chemicals can be done in an irreversible and environmental sound manner in a local cement kiln under developing country conditions. The Stockholm Convention on persistent organic pollutants (POP's) requires "*complete destruction and irreversible transformation*" of POP's and POP's waste as well as minimisation and avoidance of emissions of dioxins, furans, PCB's and Hexachlorobenzene during disposal. The test burn showed that all these compounds were below the detection limit and that the destruction had been complete and irreversible, i.e. no new formation of dioxins, furans or PCB's.

Keywords: Obsolete Pesticides; POP's; Environmentally Sound Destruction; Developing Countries; Cement Kilns.

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1. Introduction

The accumulation and bad management of obsolete pesticides and other hazardous chemicals constitutes a threat to health and environment, locally, regionally and globally. Estimates indicate that more than 500,000 tons of obsolete pesticides are accumulated globally, especially in developing countries (FAO, 2001a). The Food and Agriculture Organization (FAO) of the United Nations has been addressing this issue and disposed of approximately 3,000 tons in more than 10 countries in Africa and the Near East since the beginning of the 1990's (FAO, 2001b). This means less than 1% of the accumulated amounts in a period of more than 10 years; if we anticipate a slower but continued accumulation in the years to come and approximately the same speed of disposal, this problem will "never" be solved. In addition to the clean up of obsolete pesticides, the world will also need funds and facilities for environmentally sound destruction of the persistent organic pollutants POP's covered by the Aarhus Protocol (UNECE, 1998) and the newly ratified Stockholm Convention on POP's (UNEP, 2001).

Despite the fact that FAO (1999) has recommended that local destruction solutions for obsolete pesticide stocks should be supported as and when appropriate, pesticide waste from Africa has so far mainly been shipped to Europe for high-temperature incineration in dedicated facilities at an average cost of $3,500 per ton (Science in Africa, 2002). This practise involves high costs, considerable environmental risks due to long transport distances and doesn't provide the necessary capacity building on hazardous waste management in the affected developing countries.

A considerable amount of the accumulated obsolete pesticides are persistent organic pollutants that possess toxic properties, resist degradation, bio-accumulate and are transported, through air, water and migratory species, across international boundaries and deposited far from their place of release, where they accumulate in terrestrial and aquatic ecosystems (Jones and de Voogt, 1999; Vallack et al., 1998). Organochlorine pesticide residues have been detected in air, water, soil, sediment, fish and birds globally even more than one decade after being banned and it's reasonable to believe that contaminated sites and mixed stockpiled waste still represent locally and regionally important on-going primary source inputs of hazardous compounds to the global environment (Brevik et al., 2004).

Several international environmental conventions aim to protect human health and the environment through measures which will destroy and irreversible transform stockpiled hazardous chemicals and reduce and/or eliminate emissions and discharges of pesticides and persistent organic pollutants. Of special relevance is the Aarhus Protocol, the Stockholm Convention which entered into force 17 May 2004 and the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes (Basel Convention, 1989) which aims to stimulate local treatment of hazardous wastes.

The Aarhus Protocol on Persistent Organic Pollutants covers 16 POP's, 11 of which are pesticides, which are Aldrin, Dieldrin, Endrin, Chlordane, DDT, Heptachlor, Hexachlorobenzene, Mirex, Chlordecone, Lindane, and Toxaphene. The Stockholm Convention on Persistent Organic Pollutants covers for the time being 12 POP's, which are Polychlorinated Biphenyls (PCB), Poly-chlorinated dibenzo-p-dioxins and dibenzo-furans (PCDD/Fs) and 9 of the same pesticides as the Aarhus Protocol, except Chlordecone and Lindane. Using the precautionary approach, the Stockholm Convention also enables the listing of new targets as threats are recognized. There is currently no reliable information available of what quantities these chemicals constitute on a global level, but it is reasonable to anticipate far more than the 500,000 tons accumulated obsolete pesticides.

These conventions acknowledge that there is an urgent need for environmentally sound disposal of the hazardous chemicals and that developing countries and countries with economies in transition, in particular the least developed among them, need to strengthen their national capabilities on sound management of chemicals (UNEP, 2001).

The preferred disposal option for these hazardous chemicals, high temperature incineration, is usually absent as a dedicated technology option in developing countries. However, high temperature cement kilns are common and available in most developing countries and can constitute an affordable, environmentally sound and sustainable treatment alternative.

Huge resources have been spent in recent years to investigate emerging and hopefully non-controversial and non-polluting technologies (UNEP, 2004). Unfortunately, many of the "emerging" technologies have low capacities (some are still in laboratory scale), are technically sophisticated and currently not affordable by many developing countries. A thorough and objective comparison with the state of the art technology on aspects like sustainability, suitability, performance, robustness, cost-efficiency, patent restrictions (availability), competence requirements and capacities is today urgently requested by nations struggling to get rid of these hazardous chemicals.

POP's have been shown to interfere with hormone function and genetic regulation and in animal studies, myriad dysfunctions can be induced (manifested later in life) by low-dose POP's exposure during development. The ubiquity of POP's in biological tissue makes all organisms subject to developmental exposure (WHO, 2003; Godduhn and Duffy, 2003; Jobling et al., 2004; Gupta, 2004; McDonal, 2002; DeVito and Birnbaum, 1995). The Arctic, where subsistence living is common, is a sink region for POP's and the arctic peoples now insist in action. Norwegian and Canadian researchers find more POP's and PCB's in Polar bear on the remote North Atlantic island Svalbard than on the mainland America and there is currently a great concern in Norway about a 5-10 times increase in the POP's concentration in fish and other animals in the Barents sea the last 10-15 years (Gabrielsen et al., 2004).

To be able to implement the objectives of the conventions there will be a huge need for capacity building and cost efficient and environmentally sound destruction options primarily in developing countries. In Norway, cement kilns have been the only treatment option for organic hazardous wastes since 1980 and this has shown to be an environmentally sound and cost-efficient solution (Viken and Waage, 1983; Benestad, 1989). This paper provides an overview of thermal destruction in general and the possibilities of using local cement kilns in particular.

2. Thermal destruction

Combustion is a combination of pyrolysis and oxidation. Pyrolysis is a chemical change resulting from heat alone and involves the breaking of stable chemical bonds, often resulting in molecular rearrangement. Oxidation is the gross reaction of an organic species with oxygen and requires relatively low activation energies (Niessen, 1995). For efficient combustion, oxidation should be the dominant process, with pyrolysis occurring either incidentally to the oxidation or to put a material into a better physical form for oxidation. To combust hazardous wastes effectively, pyrolysis must be efficient and complete before oxidation of the molecular chemical by-products can occur.

To achieve a complete thermal destruction, sufficient temperature, oxygen supply, residence time and mixing conditions are needed (Brunner 1993; Dempsey and Oppelt, 1993). Both dedicated hazardous waste incinerators and cement kilns can achieve a complete thermal destruction of mixed hazardous wastes, but normally cement kilns have higher temperature and longer residence times than incinerators (Freeman, 1997). This is why cement kilns are ideal; flame and kiln gas temperatures up to 2,000°C and long residence times up to 8 seconds ensures complete pyrolysis and surplus oxygen ensures complete oxidation (Freeman, 1997).

Combustion temperature and residence time needed for mixed hazardous wastes cannot be readily calculated and are often determined empirically. Some common solvents such as alcohols and toluene can easily be combusted at lower temperatures, while other more complex organic halogens require more stringent conditions such as the United States Environmental Protection Agency (US EPA) Toxic Substances Control Act (TSCA) PCB incineration criteria of 2 seconds residence time at 1,200°C and 3% excess oxygen in the stack gas (Federal Register, 1999) or the European Council Directive 2000/76/EC on the Incineration of Waste criteria of 1100°C for at least two seconds if more than 1 % of halogenated organic substances are incinerated (Council Directive, 2000).

Combustion and other forms of thermal treatment have, over the years, been adopted as proven technologies to dispose of hazardous waste, municipal solid waste, and medical waste regulated under the Resource Conservation and Recovery Act RCRA and toxic substances under the Toxic Substances Control Act TSCA (Lee et al., 2000; Dempsey and Oppelt, 1993). Pesticides constitute a considerable part of the compounds regulated under the TSCA (Ferguson and Wilkinson, 1984).

2.1 Thermal destruction of pesticide wastes, POP's and other hazardous chemicals

Pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Pests are living organisms that occurs where they are not wanted or that cause damage to crops or humans or animals.

Though often misunderstood to refer only to insecticides, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests (Pesticide Manual, 1997).

The pesticide manufacturing industry started early to look into possible management and treatment options for obsolete pesticides and pesticide wastes and in the 1970's and 1980's a number of research and demonstration studies were conducted to identify the best disposal options for pesticides and pesticide wastes. Combustion was soon considered to be the best method and several key research projects confirmed this in pilot and commercial available incinerators (Ferguson and Wilkinson, 1984).

In a study comparing chemical and thermal methods for disposal of 20 pesticide chemicals Kennedy et al. (1969) concluded that incineration is superior to chemical methods for the destruction of pesticides and that most pesticide compounds are destroyed effectively by burning at temperatures 800°C to 1000°C (Atkins, 1972).

In 1977 the US Air Force incinerated 8.7 million liters of Agent Orange and the destruction efficiency was estimated to be at least 99.99% (Ackerman et al., 1978).

General Electric incinerated 6,000 liters of 20% liquid DDT formulations with temperatures ranging from 870°C to 980°C and retention time of up to 4 seconds achieving destruction efficiency better than 99.99% (Leighton and Feldman, 1975).

DDT and 2,4,5-T formulations constituting 20% of the solid input were destroyed in a municipal sewage sludge incinerator with an average temperature ranging from 600°C to 690°C and destruction efficiencies from 99.95% to 99.99% (Whitmore, 1975).

The University of Dayton achieved destruction efficiencies exceeding 99.99% at 2 seconds retention time for DDT, DDE, Diazinon, Endrin, Hexachlorobenzene, Kepone, Mirex and Pentachloronitrobenzene in an incinerator operating at 900°C (Duvall and Rubey, 1976).

The Midwest Research Institute carried out pilot studies on thermal decomposition of Aldrin, Atrazine, Captan, DDT, Malathion, Mirex, Picloram, Toxaphene and Zineb in 15 liquid and solid formulations and the destruction efficiencies generally exceeded 99.99% over a range of temperatures and retention times; 950°C to 1100°C, 1.2 and 6 seconds (Ferguson et al., 1975).

In a study for the US Army, TRW Systems investigated the thermal destruction efficiencies of Chlordane, 2,4-D, DDT, Dieldrin, Lindane and 2,4,5-T at a temperature of 1000°C and 0.4 second retention time. The destruction efficiencies exceeded 99.99% (Shih et al., 1975).

The Los Alamos National Laboratory investigated for US EPA the thermal destruction efficiencies of Pentachlorophenol at a temperature of 980°C and 2.5 second retention time. The destruction efficiencies exceeded 99.99% (Stretz and Vavruska., 1983).

In a review of incineration options for pesticide wastes, Oberacker (1988) lists ranges of pesticide formulations of DDT, Aldrin, Picloram, Malathion, Toxaphene, Atrazine, Captan, Zineb, Mirex, Herbicide orange (including dioxins and furans), PCP, Kepone and Chlordane and their thermal destruction efficiencies in different incineration tests. The exceptions to the rule of achieving destruction efficiencies better than 99.99% was when the pesticide concentration was very low (created problems with the analytical detection limits), when solids were not properly mixed, when products of incomplete combustion (PIC's) appeared or in cases were the temperature were deliberately reduced to determine the operational bounds of effective performance. Potential problems with certain heavy metals and compounds like bromine and iodine were questioned in the review. Some metals were included in the incinerator tests, including lead, zinc, arsenic, chromium and others, without creating any problems.

In 1989 Oberacker investigated the incinerability of Ethylene di-bromide (EDB), Dinoseb and 2,4,5-T. The EDB molecule contains approximately 85% bromine by weight and earlier studies had resulted in visible bromine gas emissions from the incinerator stack when EDB was incinerated. This problem was solved completely in the US EPA test burn by adding 10% dilute sulphuric acid. Approximately 75,000 liters of an EDB/ ethylene dichloride and carbon tetra chloride mixture and 20,000 liters of an EDB/ chloropicrin formulation were incinerated and all compounds achieved destruction efficiencies better than 99.9999%. No bromine was detected in the stack, detection limit of 4-5 $\mu g/m^3$. Two Dinoseb formulations were incinerated at a feeding rate of up to 180 liters per hour, achieving destruction efficiencies better than 99.999%. The test results for 2,4,5-T was not ready when the article was written but EPA was confident that incineration was feasible.

In a study by Oberacker et al. (1992) the air emissions and residues from open burning of used pesticide bags contaminated with Thimet and Atrazine in farm field conditions were characterised. While the amounts of particulates were high, the toxic releases appeared small in terms of posing any significant health or environmental risk.

The US EPA also carried out a number of studies on industrial organic hazardous wastes in different incinerators and the following compounds were found to be incinerable to the 99.99% or better destruction level: PCB's, Toluene, Tetrachloroethylene, Trichloro-ethylene, Carbon tetrachloride, Naphtalene, Chloroform, Methylene chloride, Methyl ethyl chloride, Phenol, Benzene, Butyl benzyl phthalate, Chlorobenzene, 1,1,1-Trichloro-ethane, Aniline, Benzyl chloride, Diethyl-phthalate, Phthalic anhydride, Amines, Chlordane, Chlorobenzenes, Chloromethane, Chlororethanes, Cresols, Dimethyl phenol, Dodecanol, Hexachlorobutadiene, Isocyanates, Methylene bromide, Methyl pyridine and Phosgene gas (Oberacker, 1988).

The incinerability of pesticides and hazardous wastes were also investigated in different high temperature production processes, like brick kilns, cement kilns, oil furnace process, blast furnace, lime kilns, glass kilns etc. The conclusion of the study showed a limited potential for the use of most of these facilities for pesticide treatment, with the exception of cement kilns (Hall et al., 1983).

2.1.1 Cement production and co-processing of hazardous wastes

In short, cement is made by heating a mixture of calcareous and argillaceous materials, usually in huge rotary kilns, to a temperature of about 1450°C. In this process, partial fusion occurs and nodules of so-called cement clinker are formed. The cooled clinker is mixed with a few percent of gypsum, and sometimes other cementitious materials, and ground into a fine meal – cement. In the clinker burning process it is essential to maintain a kiln charge temperature of approximately 1450°C. Also, the clinker needs to be burned under oxidising conditions (Integrated Pollution Prevention and Control, 2001; Duda, 1985).

Fuel and wastes fed through the main burner will be decomposed under oxidising conditions in the primary flame burning zone at temperatures up to 2,000°C and a retention time up to 8 seconds. Fuel and waste fed to the secondary burner, preheater or precalciner will be burnt at temperatures between 800°C and 1,200°C. Cement kilns are equipped with either electro static precipitator (ESP's) or fabric filters, or both, for particulate matter control. Acid gas pollution control devices are not used at cement kilns (except for SO_2 in some instances) since the raw materials are highly alkaline and provide acid gas control.

3. Destruction of obsolete pesticides and POP's in developing countries using cement kilns

Several pilot projects have been using cement kilns for disposal of obsolete pesticides and POP's in developing countries the last 20 years.

3.1.1 Malaysia

The German Deutsche Gesellschaft fuer Technische Zusammenarbeit (GTZ) carried out the first reported disposal operation with obsolete pesticides using a cement kiln in Malaysia in the middle of the eighties (Schimpf, 1990). The cement plant had a dry rotary kiln with a diameter of 4.3 meter and a length of 73 meter. The plant was equipped with electrostatic precipitator and produced 3,800 tons of clinker per day.

Solid and concentrated liquid pesticides were dissolved in kerosene and fuel oil in a 5 m^3 storage tank with an agitator and feeded through the main burner into the kiln. A mixture of 2,4-D and 2,4,5-T were destroyed in the main flame of the kiln.

Before, during and after the combustion, dust samples were taken from the ESP and analysed for PCDD/F. No PCDD/F's where found (Schimpf 1990).

Unfortunately, the report provides no information about the amounts of pesticides destroyed, the concentration of the active ingredients, the feed rate into the kiln or the destruction and removal efficiency. The cost for the plant modification, i.e. the introduction system, was estimated to be 12,000 USD (Schimpf 1990).

3.1.2 Pakistan

A total of 17,000 litre of 9 different organophosphates and 3 different organochlorines pesticides mixtures were destroyed in a cement kiln in Pakistan by the US Aid in 1987 (Huden, 1990).

The cement plant was a modern, 4-cyclone, preheater dry process plant built in 1986 with a clinker production of 2,000 tons per day. The plant used fuel oil with an approximate heating value of 45 MJ/kg and a sulphur content of 2.9 percent. Fuel oil was fed to the kiln through a Pillard burner at a rate of 7.3 tons per hour. The inside diameter of the kiln was 4.3 meter and the length 78 meter. Air from the raw material crushing and blending operation was combined with the kiln gases and exhausted to an electrostatic precipitator. The outlet of the electrostatic precipitator was connected to a 35 meter high stack. The average volumetric flow rate was measured to be approximately 204,000 Nm^3/hour.

Stack gases were sampled and analyzed to determine particulates, chlorides, oxides of sulphur and carbon monoxide emissions. The results met post-1990 standards of the Environment Protection Agency of Punjab. Products of incomplete combustion PIC's were examined via GC/MS, but no PIC's were detected. Analyses of process samples, raw meal feed, and clinker and ESP dust showed no detectable pesticides.

Feasibility decision of the test burn assumed that sufficient quantity (a minimum of 12,000 litres) of one organophosphate and one organochloride pesticide would be made available. For the purposes of the test burn it was essential to have a product of reasonable quality that had an active ingredient close to the original formulation but not less than 25% and of a viscosity close to that of water. Early sample analysis, however, indicated poor quality, with an active ingredient in the zero to 10% range and high viscosity. In order to work with a sufficient quantity the team realised that a "cocktail" of various organophosphates and organochlorines was inevitable. This, of course, added innumerable unknowns and analytical and process challenges to the task.

All the collected pesticides had been sampled and analysed for active ingredient and other physical characteristics beforehand, and declared fit for use. They represented best available grades within a reasonable transport radius from the plant.

The pesticide delivery system was designed for free flowing liquids. Waste pesticides were pumped from a tank truck and injected at an average rate of 294 litres per hour for the organophosphates and 46 litres per hour for the organochlorines. The injector achieved fine atomisation using compressed air and was tested successfully with diesel fuel. The "cocktail" of pesticides, however, contained sludges that settled to the bottom of the tank truck, causing viscosity to fluctuate depending on temperature and degree of agitation. These unanticipated conditions caused a variety of problems.

The kiln met RCRA standards for particulate concentrations (183 mg/m^3) but DRE requirements and HCl emissions limits were not met.

3.1.3 Tanzania

Mismanagement of large quantities of 4,6-Dinitro-o-Cresol (DNOC) during several years in the 1980s and 1990s caused serious environmental and ecological damages to the wildlife in Lake Rukwe in west Tanzania. DNOC belongs to the group of nitro-compounds and is classified to be highly hazardous (group lb) in accordance with the WHO (2002) classification. The insecticide is highly toxic to fish and is explosive in its dry form.

The German GTZ initiated a clean up project in 1993 were DNOC firstly was transferred from rusty and leaking drums into new and chemical resistant containers and brought to a central storage place (Schimpf, 1998). The Ministry of Agriculture was the formal owner of the DNOC and was responsible for the administrative processing within Tanzania. It filed an official application for incineration of the DNOC in the cement plant to the Ministry of Environment in 1992. The incineration permit was issued by the National Environmental Management Council and the Chief Government Chemist four years later, in 1996.

A test burn with 1:1 DNOC/diesel-mixture was performed in the Twiga Portland Cement kiln west of Dar-Es-Salaam in 1996. The cement plant had three dry preheater kilns of different sizes, and kiln 3 was assumed to be suitable for incinerating the DNOC (Schimpf, 1998). Clinker and filter dust samples were taken before, during and after the test run. The samples were analysed at two laboratories for DNOC residues. A heated measuring probe sampled flue gas 70 metres up in the stack and measured CO, CO_2, O_2, NO_x and the temperature continuously. The composition of the flue gas and the temperatures fluctuated. During the test burn no DNOC residues were detected in the clinker or the filter dust (Schimpf 1998).

A waste introduction system was designed and consisted of a high-pressure pump resistant to chemicals, storage and mixing steel tank with a capacity of 4,4 m^3 with integrated filter system and all the necessary safety components. This waste introduction system was placed in a 20-foot container and installed in a steel drip tray so that any possible leaks of the contents of the tank could be caught in the tray. The DNOC was diluted with 50% diesel oil in the tank to a concentration of below 10% active ingredient and then fed automatically and continuously directly into the flame at high pressure via the fuel lance. The calorific value of the DNOC/diesel-mixture was measured to be 46 MJ/kg and the mixture was pumped at a rate of 320-350 litres per hour, with a diaphragm pump through the oil lance into the kiln. The fuel oil was fed at a rate of 3300-3500 litres per hour (Schimpf 1998).

Approximately 57,500 litres DNOC 20% were incinerated in kiln 3 within a period of about 7 weeks. The DNOC was diluted with the same quantity of diesel oil, thus, altogether, approximately 115,000 litres DNOC-diesel were introduced into the cement kiln and incinerated. The 400 old DNOC drums were melted and recycled as iron for construction purposes.

A series of technical problems led to delays, especially during the testing phase. The kiln "*broke down*" regularly during the incineration of the DNOC due to several problems. The refractory of the kiln was damaged, the outer wall of the satellite cooler burned through, the power fluctuated and went down now and then and the raw meal feed was disrupted (Schimpf 1998).

At the beginning, during the preparatory phase, the workers at the cement plan viewed the activities of the team very sceptically. Directly before the start of the test run there was a "strike" by the workforce, they wanted to prevent the incineration. After discussions with the union leader, it turned out that the responsible liaison officer commissioned by the management had not carried out his tasks and the workers had not been informed correctly of the proposed measure. Their behaviour altered as soon as the representatives responsible for the project explained the project and the task of the waste introduction system to the workers in an information session. After this the negative attitude changed to support (Schimpf 1998).

The cost for the disposal was estimated to be approximately 4,300 US$ per ton of DNOC, a cost lying in the "*upper range of normal disposal costs*" according to Schimpf. However, the cost estimate included the entire project, i.e. 245,000 US$ over four years, covering collection and safeguarding measures, transport, field costs, new containers and personal protection equipment, construction of the waste introduction system with pumps, flow meters etc., diesel oil for dilution of the DNOC, cost for analysis, personnel and travel.

3.1.4 Poland

In a Polish test burn recently reported by Stobiecki et al. (2003) different mixes of 12 obsolete pesticides and POP's were introduced into a cement kiln (no details about the process type or operating conditions) over a period of three days.

The different pesticide mixtures were blended into three batches with light heating oil. Batch 1 constituted 10 tons with a total pesticide content of 11.5% and 2.3% active ingredients of the following pesticides: Methoxychlor, γ-HCH, α-HCH, Fenitrotion, Fention, DDT, Endosulfan and Dichlorobenzene. Batch 2 constituted a total pesticide content of 29.4% and 6% active ingredients of the following pesticides:

Methoxychlor, DNOC, DDT, Endosulfan, γ-HCH, α-HCH, Dichlorobenzene and Esfenwalerat. Batch 3 constituted a total pesticide content of 30.5% and 6.4% active ingredients of the following pesticides: Metoxychlor, Fenitrotion, DNOC, γ-HCH, α-HCH, DDT, Carbosulfan, Deltametrine, Endosulfan, Dichlorobenzene and Esfenwalerat. The heating value of the three batches was 44,545, 43,193 and 42,968 kJ/kg respectively.

The mixes were fed through the main burner together with the coal in an introduction rate of approximately 400 kg/h over three different periods and the results was compared to baseline conditions, i.e. when coal only was used as a fuel. None of the pesticides were detected in the exit gas (detection limit between 0.02 and 1 $\mu g/m^3$) or in the clinker (detection limit between 0.001 and 0.05 mg/kg). Physical and chemical testing of clinker gave normal and similar results for all conditions. The PCDD/F emissions was 0.009 ng I-TEQ/Nm^3 with coal only and 0.015, 0.053 and 0.068 ng I-TEQ/Nm^3 when feeding the three alternative fuel mixes with pesticides respectively.

3.2 Planned but not completed disposal operations

Some projects have planned or investigated the possibility of using a local cement kiln for obsolete pesticide destruction in developing countries but have been forced to halt due to public perception, opposition or technical constraints.

In 1997 the Danish Government decided to support a project involving the collection and treatment of obsolete pesticides spread around in Mozambique. The over all intention of the project was to clean up the country by disposing the obsolete pesticides in a local cement kiln and to transfer capacity and to leave behind a permanent facility for future sound organic hazardous waste disposal (Jannerup, 1998). Almost 1,000 tons of pesticides where collected throughout the country and stored intermediately in special transport containers. A central waste receiving, storage and treatment station was built close to the cement plant Cimentos de Mozambique in Matola. The intention was to upgrade the cement kiln and to destroy those organic obsolete pesticides which fulfilled the incineration criteria. Materials containing heavy metals or unidentified material were out of scope. However, NGOs in South Africa and the community of Matola started to oppose and question the intentions of the project. The media mentioned the project badly, it became controversial and it was decided to put the disposal into a standstill. When Mozambique was hit by a flood in February 2000 the waste station in Matola was affected and the authorities wanted to commence with the disposal. A review team assessed the situation and it became soon evident that the project preparation had not been satisfactory and that the cement kiln were not feasible to dispose of highly chlorinated pesticides due to various reasons (Karstensen, 2000). Cimentos de Mozambique had also received bad mention in the media and feared for their market shares. Finally in July 2000, the cement kiln upgrading was stopped and the pesticides exported to Europe.

In the period from 1989 until 1993 114 tons of obsolete pesticides were disposed of secretly in Nepal by spreading over land or pouring into rivers. A plan to dispose of the pesticides in the Hetauda and Jaljale cement factory in 1998 was halted due to negative perceptions, lack of technical understanding and high cost estimates. Still 74 tons of expired pesticides are waiting for disposal in warehouses in Kathmandu, Nepalganj and Amlekhganj, whereof 36 tons are persistent organic pesticides (Nepali Times, 2004).

The feasibility of using a local cement kiln for obsolete pesticide destruction was investigated in a NATO clean up project in Moldova (Karstensen, 2004b). An inventory of obsolete pesticides and POP's had been performed under the enabling activities related to the implementation of the Stockholm Convention in Moldova and showed that approximately 1,700 tons of more that 150 different formulations are stored in nearly 360 locations around the country (POP's Inventory, 2003). The cement plant, a dry production process with a four stage suspension preheater, located north of Rezina town and west of the river Dnestr was evaluated. The NATO feasibility study however, recommended not to continuing with the cement kiln option due to cost and possible time constraints. Various technical changes were recommended, which under the current market situation would be difficult to defend financially by the cement company.

3.3 Lessons learned from the demonstration projects

The absence of PCDD/F's in the ESP dust in the first GTZ operation in Malaysia is ensuring but certainly not enough to verify the performance of a cement kiln. However, there is no reason to believe that the 2,4-D and 2,4,5-T were not safely destroyed in the main flame of the kiln but the DRE should have been established.

For the purpose of the pilot and demonstration burn in Pakistan it might had been wise to insist on using a uniform, higher grade waste pesticide and restricting the burn to one compound in each pesticide group, as had been intended. Uncertainty of availability of the ideal test candidate, likely long haul transport, and need to get on with the job, forced the team into a truly real case waste disposal situation, the complexity of which did not become apparent until they were well committed and could not turn back. Better early sampling of candidate pesticides could have told the team more of what was ahead as well as determined a better choice of pesticides for the burn. The choice of laboratory is of course also important. Huden (1990) speculated that the concentration of pesticides in the feed was too low for instrumentation to measure a DRE of 99.99%, probably due to a combination of low active ingredient and low feed rate. Had it been possible to feed a higher concentration to the kiln, the desired DRE could have been demonstrated instrumentally. Further on, in selecting a cement plant for waste disposal, the power supply reliability is essential. The actual plant was plagued by many power interruptions. When designing the waste injection and delivery system, the team expected to work with free flowing liquids but received sludge which caused numerous problems. The waste products should have been blended in a dedicated tank, equipped with an agitator and fed to the fuel line equipped with a cut-off valve. The team was affected by management changes in some of the ministries; the acceptance and easy approval process at the feasibility stage did not automatically guarantee approval from the new generation of bureaucrats. Agreements in principle should have been formalised early so that promises once made represented institutional instead of individual commitment. According to Huden, the important public relations issue was given short shrift. To assume that a potentially touchy subject best be kept quiet, is dangerously naive. The press, community leaders and labour unions can quickly turn into enemies when they are not informed of the intent of such an undertaking. With proper care, popular acceptance is much more likely than not, particularly when the benefit of participating in risk reduction can be understood.

Obviously, the kiln chosen for the disposal operation of DNOC in Tanzania (Schimpf 1990) was not the best choice. The kiln broke down regularly during the disposal operation, the refractory of the kiln was damaged, the outer wall of the satellite cooler burned through, the power fluctuated and the raw meal feed was disrupted. There was no sampling of DNOC in the exit gas, i.e. no possibility to determine the destruction and removal efficiency of DNOC in the kiln. To measure DNOC in ESP dust and clinker is not sufficient; the exit gas is the most important. The measurement of CO_2, O_2 and NO_x in the exit gas does not give any information about the DRE. The project clearly showed the necessity of transparency, information and good communication with all involved parties.

The planned upgrading and disposal in the cement kiln in Mozambique failed due to proper preparation and lack of public information and awareness raising. Competence, good communication and transparency are certainly the key.

Obviously, some of the described projects may have assumed that any cement kiln would be suited for the purpose. Even though all cement kilns needs high temperature to produce cement, not all are necessarily suited without upgrading or modifications. The feasibility has to be assessed case by case, and will depend on technical, chemical and environmental conditions, waste and raw material composition, location, infrastructure, acceptability etc. (Karstensen, 1998 a and b; Karstensen 2001 a and b).

4. Test burn with obsolete pesticides in Vietnam

Approximately 10,000 tons of dioxin-contaminated soil stemming from herbicide spillage during the Vietnam War and more than 225 tons of 200 different obsolete pesticides and 1.7 million containers are currently accumulated in more than 100 locations in Vietnam (Karstensen et al., 2003b).

The only option for treatment of hazardous wastes in Vietnam is currently smaller static incinerators or the mobile incinerator of Ministry of Defence (Karstensen et al., 2003a). Both options imply discontinuous incineration with low capacity and at lower temperatures. As many of these devices would not comply with international recognised performance standards we wanted to investigate if a local cement kiln could be used. A joint project with representatives of the authorities and the cement plant owner was initiated were the objective was to carry of a test burn to investigate if the cement kiln was able to co-process hazardous wastes in an irreversible and environmental sound manner, i.e. with no influence on the emissions when fossil fuel was partly replaced by hazardous waste.

The clinker production is performed in a dry suspension preheater cement kiln equipped with a precalciner. The kiln is 4.6 meter in diameter, 72 meter long with a 110 meter high double string 5-stage preheater tower and produces approximately 4,400 tonnes of cement clinker per day. The kiln is fired with coal through two burner systems, the main burner and the precalciner, 7 tons and 13 tons per hour respectively. The normal fuel is anthracite coal with an average calorific value of 30 mega joule/kg.

A solvent-based insecticide with two active ingredients, 18.8% Fenobucarb and 2.4% Fipronil, was identified to be a suitable test burn candidate as it contained aromatic molecules with chlorine and fluorine.

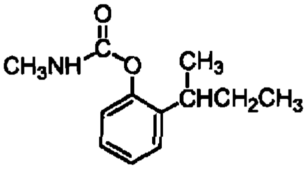

Fig. 1 Chemical structure of Fenobucarb.

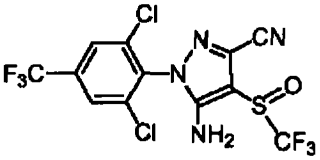

Fig. 2 Chemical structure of Fipronil.

The insecticide had expired and approximately 40,000 litres was stored in Dong Nai Province North of Ho Chi Minh City in 200 steel drums waiting for a sound disposal solution. The heat content of the insecticide was approximately 30% higher than the coal used by the cement plant. A steel storage and feeding tank for the insecticide was built at the plant and the tank was connected to the light fuel oil pumping system with automatic dosage and switch off/on through the main control system. The insecticide was pumped into the main flame together with coal through a three channel burner. The test burn was conducted over two days, 16 and 17 October 2003, starting the first day with a baseline study, i.e. feeding coal only. The second day, insecticide was introduced through the main burner at a rate of approximately 2,000 liters per hour, substituting approximately 2.5 tons of coal per hour. All together 39,500 litre was destroyed in the kiln in less than 20 hours.

The analysis results of stack gas sampling for the two days were compared with the Vietnamese emission limit values (ELV). The insecticide components fed to the kiln, Fenobucarb and Fipronil were not detected in the exit gas or any other sample collected during the test. The destruction and removal efficiency of Fenobucarb was better than 99.999997% and better than 99.999985% for Fipronil. There is no requirement to demonstrate the destruction and removal efficiency in a test burn in Vietnam, but compared to the most stringent requirement in any regulation today, US cement kiln operators would need to demonstrate a DRE of 99.99% for these insecticides. The Stockholm Convention on persistent organic pollutants (POP's) requires "*complete destruction and irreversible transformation*" of POP's and POP's waste as well as minimisation and avoidance of emissions of dioxins, furans, PCB's and Hexachlorobenzene during disposal. All these compounds, and many others, were analysed but all the results were below the detection limit, showing that the destruction had been complete and irreversible, i.e. no new formation of dioxins, furans or PCB's.

Raw meal, clinker, fine coal, electro static precipitator dusts were sampled every second hour during the two days and analysed, showing no effect of insecticide co-processing. Ordinary quality testing was performed on clinker, cement and concrete produced the two days and the results was within normal ranges and showed that the product quality was unaffected by the introduction of the insecticide.

5. Discussion

Less than 1% of the estimated accumulated amounts of obsolete pesticides spread around the globe have been disposed of since the beginning of the 1990's and proves the inability of the strategy chosen to solve the problems. To ship hazardous chemicals long distances to Europe for high temperature incineration in dedicated facilities is not optimal and shows lack of confidence in developing countries. The bad management of hazardous chemicals constitutes a serious threat for health and environment and needs to be dealt with in a cost-efficient and responsible way.

Cement kilns are being used for environmentally sound management of hazardous wastes and chemicals in many countries and testing of cement kiln emissions for the presence of organic chemicals during the burning of hazardous materials has been undertaken since the 1970s, when the practice of combusting wastes in cement kilns was first considered.

Numerous tests around the world have demonstrated that there is essentially no difference in the emissions or the product quality when waste materials are used to replace the fuels and ingredients needed to produce cement clinker (Ahling, 1979; Benestad, 1989; Chadbourne, 1997; Karstensen, 1994; Lauber, 1982 and 1987). Comprehensive emission studies have also been performed when hazardous waste was introduced, and these have generally concluded that no significant differences could be measured between usages of the two fuels (Mac Donald et al., 1977; Suderman and Nisbet, 1992). For example, Branscome et al (1985) observed that "no statistically significant increase in emission rates were observed when the waste fuel (as opposed to coal) was burned".

Studies on dioxin emissions have also come to this conclusion (Abad et al., 2004; Branscome et al, 1985; Lauber, 1987; Garg, 1990; Schumacher et al., 2002). In general, the level of dioxins emitted during the use of conventional fuel was similar to their concentration when hazardous waste was introduced into the kiln. In a study performed for the World Business Council for Sustainable Development data from more than 1,700 PCDD/F measurements from wet and dry kilns, performed under normal and worst case operating conditions, and with the co-processing of a wide range of hazardous wastes fed to both the main burner and to the precalciner shows that most cement kilns can meet an emission limit of 0.1 ng TEQ/Nm^3 (Karstensen, 2004a).

Some of the pilot projects done in developing countries for treatment of obsolete pesticides using cement kilns might have assumed that any kiln would qualify. However, not all kilns are suited without upgrading or modifications and the feasibility should be assessed in case by case. Had only parts of the money spent by the global society looking for emerging technologies been used to establish sound practises for destruction of hazardous chemicals in cement kilns, many developing countries would have been self reliant with regards to hazardous waste treatment today. The test burn in Vietnam demonstrated that the introduced insecticides and all the POP's, i.e. dioxins, furans, PCB's and Hexachlorobenzene were below the detection limit and that the destruction had been complete and irreversible.

Conclusion

The Food and Agriculture Organization of the United Nations (FAO) has been addressing obsolete pesticides and successfully disposed of approximately 3,000 tons in more than 10 countries in Africa and the Near East since the beginning of the 1990's. The obsolete pesticide waste has so far mostly been shipped to Europe for high-temperature incineration in dedicated kilns. This practise involves high costs, considerable environmental risks due to transport and does not ensure adequate capacity building on hazardous waste management in the affected developing countries. Such a solution may solve the immediate risks of the obsolete pesticides but is not in agreement with the intention of the Basel Convention and does not leave any capacity behind.

So far, only a few disposal operations utilising cement kilns are reported. Only one, in Vietnam has been able to verify the destruction and removal efficiency DRE in a test burn, in fact the only way to prove the performance. The test burn clearly demonstrated the suitability of the cement kiln to co-process obsolete pesticides and that a controlled substitution of fossil fuel with hazardous waste is doesn't affect the emissions. The destruction and removal efficiency DRE was measured to be better than 99.999997% for Fenobucarb and better than 99.999985% for Fipronil. These results can be compared with the most stringent regulatory requirements in the world today, namely the USA, were cement kilns combusting hazardous wastes must perform a similar test burn and demonstrate 99.99% destruction and removal efficiency (DRE) for such insecticides.

The Stockholm Convention on persistent organic pollutants (POP's) requires "*complete destruction and irreversible transformation*" of POP's and POP's waste as well as minimisation and avoidance of emissions of dioxins, furans, PCB's and Hexachlorobenzene during disposal. The test burn demonstrated that all these compounds were below the detection limit and that the destruction had been complete and irreversible, i.e. no new formation of dioxins, furans or PCB's. With the With the exception of NO_x, which was slightly higher than the emission limit value all other measured parameters were low compared with international standards and in full compliance with the Vietnamese emission limit values.

Large amounts of hazardous wastes and chemicals constitute a serious threat to health and environment all over the globe and a well operated and suited cement kiln can constitute a sustainable and environmentally sound option for destruction of hazardous chemicals and wastes in many developing countries.

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Response Information to Request for Additional Information letter dated May 12, 2011
Attachment A

Typical Material Analysis Data

		[illegible]	[illegible]	[illegible]	Volatiles (%)	Ash (%)	Sulfur (%)	Chlorine (%)	Fluorine (ppm)	Mercury (ppm)	Arsenic (ppm)	Cadmium (ppm)	Chromium (ppm)	[illegible]	[illegible]	
Engineered Fuel	1	6,000 to 8,000	2 to 11	5	60 to 70	10 to 20	0.1 to 0.25	0.1 & 0.38	--	0.118						
	2	9,900	--	--	--	5.4	0.11	0.16	--	0						
	3	5,500 to 9,500	2.9 to 34	--	--	--	0.1 to 0.2	0.28 to 0.7	--	0.1 to 0.4						
	4	7,200 to 10,100	7	--	--	15 to 16.1	0.4 to 0.51	0.6 to 0.769	--	0.7						
	5	--	--	--	--	--	0.22 to 0.23	--	0.08 to 0.1	<10						
	Min	5,500	2	5	60	5.4	0.1	0.1	0.08	0						
	Max	10,100	34	5	70	20	0.25	0.769	0.1	<10						
	Avg	7,800	18	5	65	12.7	0.175	0.4345	0.09	5						
Agricultural Plastics	6	10,200 to 13,800	--	36 to 46	--	--	--	--	--	--						
	7	17,450	--	56	100	0	0 to 0.08	0	--	--						
	8	12,000 to 19,000	--	--	--	--	--	--	--	0.1 - 0.2						
	9		estimate < 1	--	--	--	--	--	estimate <100	estimate <0.1*						*ethylene purified product
	Min	10,200	<1	36	100	0	0	0	<100	0.1						
	Max	19,000	<1	56	100	0	0.08	0	<100	0.2						
	Avg	14,600	<1	46	100	0	0.04	0	--	0.15						
Agricultural Byproducts	10	6,200 to 9,100	10 to 35	--	--	4.5 to 20	--	--	--	--						
	11	7,500 to 8,500	--	--	69 to 80	0.6 to 13	0.03 to 0.12	--	--	--						
	12	--	30 - 37	--	--	11 to 12	0.3 - 0.35	0.16 - 0.36	--	--						
	13	--	--	--	--	--	--	0.14 - 1	--	0						
	14	--	--	18 to 50*	--	--	--	--	--	--						*(~300 to 800 kg/m3)
	Min	6,200	10	18	69	0.6	0.03	0.14	--	0						
	Max	9,100	37	50	80	20	0.35	1	--	0						
	Avg	7,650	24	34	74.5	10.3	0.19	0.57	--	0						
CDF	15	7,300 to 12,000	0.2 to 0.8	--	61 to70	21 to 25	0.07 to 0.11	0.0052 to 0.0077	--	--						
	16	7,600	--	--	--	2.6	--	0.13	--	--						
	17	--	--	--	--	--	--	--	estimate <100	estimate <0.01						
	18	--	--	25	--	--	--	--	--	--						
	Min	7,300	0.2	25	61	2.6	0.07	0.0052	<100	<0.01						
	Max	7,600	0.8	25	70	25	0.11	0.13	<100	<0.01						
	Avg	7,450	1	25	65.5	13.8	0.09	0.0676	<100	<0.01						
Pre-Consumer Paper	19	7000 to 12000	4	--	84	8	<1	0.073	0.18*	<0.18						*total halogens
	20	1290 to 6880	--	--	--	--	--	--	--	--						
	Min	1,290	4	--	84	8	<1	0.073	0.18	<0.18						
	Max	7,600	4	--	84	8	<1	0.073	0.18	<0.18						
	Avg	4,445	4	--	84	8	<1	0.073	<100	<0.18						
TDF	21	15,688	estimate < 5	--	66	4.2	1.92	0.07	--	--	--	--	--	--	--	
	22	--	--	--	--	--	--	--	--	0.0076	--	--	--	--	--	
	23	16,250	0.62	--	67	4.8	1.23	0.15	10	--	--	6	97		6.5	
	24	--	--	--	--	--	--	--	--	--	<5	<5	<5	<5	<30	
	25	--	--	17 to 51	--	--	1.92	0.15	10	--	--	6, <5	<5	--	51	
	26	14,000	--	--	--	2 - 25	0.9 - 2.1	0.07 - 0.2	--	0.05 - 0.5	2- 4	3.5 - 6	3.2 - 80	30	38 - 65	
	Min	14,000	0.62	17	66	2	0.9	0.07	10	0.0076	2	3.5	3.2	5	6.5	
	Max	16,250	5	51	67	25	2.1	0.2	10	0.5	5	6	97	30	65	
	Avg	15,125	3	34	66.5	13.5	1.5	0.135	10	0.2538	3.5	4.75	50.1	17.5	35.75	
Clean Cellulosic Biomass	27	7,700 to 8,800	13 to 50	20 to 40	31 to 62	6 to 15	0.07 to 0.22	0.026 to 0.37	--	0.1	2 to 34	--	8 to 65	17 to 149	--	
	28	6,900	--	--	--	4.1	--	0.15	--	--	--	10	21	17	151	
	29	--	--	--	--	--	0.01 to 0.2	--	21	0.01 to 0.17	0 to 5	0.06 to 0.9	0.13 to 5.22	--	0.3 to 4.4	
	30	6,400 to 11,500	0 to 71.2	--	54.9 to 94.9	0 to 39.4	0 to 0.88	0 to 1.189	0 to 490	0 to 2	0 to 6.8	0 to 3	0.3 to 130	0.3 to 400	0.2 to 340	
	Min	6,400	0	20	31	0	0	0	0	0.01	0	0	0.13	0.3	0.2	
	Max	11,500	71.2	40	94.9	39.4	0.88	1.189	490	2	34	10	130	400	340	
	Avg	8,950	18.7*	30	62.95	2.2*	0.06*	0.054*	40*	0.1*	17	5	17.8*	20.2*	24.4*	
Other Cellulosic Biomass	31	7,700 to 8,800	13 to 50	20 to 40	31 to 62	6 to 15	--	--	--	--	--	--	--	--	--	
	32	--	--	--	--	0.03 - 8	0.005 - 1.0	0.008	24	0 - 0.6	1.6 - 10	0.3 - 1.38	0.4 - 14.7	1.6 - 130	<1.5 - 20	
	33	7,600 to 10,200	8.4	--	69.8 to 79.4	3.6 to 4	0.01	0.898 to 1.021	--	--	--	--	--	--	--	
	34	3,200 to 8,700	42.9	11.24	42.4 to 80	4.1 to 7.2	0.07 to 0.12	0.035 to 0.065	20 to 50	--	--	--	--	--	--	
	35	--	--	--	--	--	0.015 to 0.2	--	--	0.09 - 1.9	0 - 37	0.13 - 5.12	0.13 - 495	0.01 - 3220	0.33 - 131	
	Min	3,200	8.4	11.24	31	0.03	0.002	0.008	20	0	0	0.13	0.13	0.001	0.33	
	Max	10,200	50	40	80	15	0.2	1.021	50	1.9	37	5.12	495	3220	131	
	Avg	6,700	29	25.62	55.5	7.515	0.101	0.515	35	0.95	18.5	2.625	247.6	1610.0	65.7	
Shingles, Manufacturer Rejects	36	5,800	3	--	--	70	0.8	0.04	--	<0.11	<1	<1.4	41	--	21	
	Min	5,800	3	--	--	70	0.8	0.04	--	<0.11	<1	<1.4	41	--	21	
	Max	5,800	3	--	--	70	0.8	0.04	--	<0.11	<1	<1.4	41	--	21	
	Avg	5,800	3	--	--	70	0.8	0.04	--	<0.11	<1	<1.4	41	--	21	

* mean value based on Phyllis mean value, weighted average

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30 Group untreated wood, Subgroup *, Material * (Average Composition) - http://www.ecn.nl/phyllis/
31 0250014-037-AC, Summary Report submitted February 15, 2011
32 Materials Characterization Paper, In Support of the Final Rulemaking Identification of Nonhazardous Secondary Materials That Are Solid Waste. Biomass - Forest Derived Biomass and Pulp and Paper Residues. Exhibit 3.http://www.epa.gov/epawaste/nonhaz/define/pdfs/biomass-wood-final.pdf
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FINAL REPORT

Gadsden County
FY2008-2009 Special Project
(DEP Grant Agreement No. S0427)

Agriculture Film Collection Project

Prepared For:

Florida Department of Environmental Protection
Tallahassee, FL

Gadsden Board of County Commissioners
Quincy, FL

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Revised July 7, 2010

Agriculture Film Collection Project

Final Report

Gadsden County

DEP Agreement No: S0427

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Project Background:

In 1999 the Southern Waste Information eXchange, Inc. (SWIX) a non-profit 501(c)(3) Florida corporation conducted a Technical Advisory Group (TAG) meeting for the Florida Department of Environmental Protection (DEP) on the recycling and reuse of waste Agricultural Plastic Film Mulch (commonly referred as Ag Film) that is used in the farming of tomatoes, strawberries and other various vegetables. The results from that TAG indicated that at the time there was approximately 25,000,000 pounds (12,500 tons) of waste agricultural plastic film produced in Florida each year. The bulk of this material was reported to be managed via open burning as allowed through Florida Administrative Code 403.707 (2)(e):

> •*(e) Disposal of solid waste resulting from normal farming operations as defined by department rule. Polyethylene agricultural plastic, damaged, nonsalvageable, untreated wood pallets, and packing material that cannot be feasibly recycled, which are used in connection with agricultural operations related to the growing, harvesting, or maintenance of crops, may be disposed of by open burning if a public nuisance or any condition adversely affecting the environment or the public health is not created by the open burning and state or federal ambient air quality standards are not violated.*

The allowance of open burning of the material in the field, though it may save farmers disposal fees, has lead to a disincentive to the recycling of this material. It should also be noted that health and environmental implications to the burning of the material in a non-controlled environment may lead to potential negative environmental and human health impacts.

This project once again examined the issue of the feasibility of recycling waste ag film and specifically focused on identifying the economic and environmental benefits of collecting, processing and recycling this low value plastic material. This project was proposed as a pilot project to specifically identify the financial and technical feasibility of recycling this particular waste stream in Florida, as opposed to the current practices of burning this material in the field or landfilling.

This project was also proposed for the purposes of trying to assist in meeting requirements related to the procurement of products containing recycled materials, provide assistance to Florida manufacturers and businesses, reduce energy use in the State by substituting recycled materials for virgin materials in the manufacture of a new product(s), and provide markets for various recycled materials that might otherwise have to be burnt in the fields or disposed of in landfills or other waste management facilities.

On January 27, 2009, Gadsden County entered into an Agreement with the Florida Department of Environmental Protection (DEP Agreement Number S0427) for completion of the proposed project. Two Hundred and Fifty Thousand dollars for this project was provided in the form of grant assistance by the State of Florida pursuant to Line Item 1819 of the 2008-2009 General Appropriations Act. Appendix A contains a Financial Summary pursuant to DEP payment request requirements.

Project team members specifically mentioned in the Grant Agreement included:

- Gadsden County
- Southern Waste Information eXchange, Inc.

The following contains a brief summary of the project team members.

Gadsden County:

Gadsden County is a small rural county located in the Panhandle of Florida. As of the census of 2000, there were 45,087 people, 15,867 households, and 11,424 families residing in the county. The population density was 87 people per square mile (34/km²). There were 17,703 housing units at an average density of 34 per square mile (13/km²). The racial makeup of the county was 57.14% Black or African American, 38.70% White, 0.23% Native American, 0.26% Asian, 0.02% Pacific Islander, 2.76% from other races, and 0.89% from two or more races. 6.17% of the population were Hispanic or Latino of any race.

There were 15,867 households out of which 32.60% had children under the age of 18 living with them, 44.50% were married couples living together, 22.50% had a female householder with no husband present, and 28.00% were non-families. 23.90% of all households were made up of individuals and 9.50% had someone living alone who was 65 years of age or older. The average household size was 2.69 and the average family size was 3.18.

In the county the population was spread out with 26.40% under the age of 18, 9.50% from 18 to 24, 28.90% from 25 to 44, 23.00% from 45 to 64, and 12.20% who were 65 years of age or older. The median age was 36 years. For every 100 females there were 90.70 males. For every 100 females age 18 and over, there were 86.50 males.

The median income for a household in the county was $31,248, and the median income for a family was $36,238. Males had a median income of $27,159 versus $21,721 for females. The per capita income for the county was $14,499. About 16.40% of families and 19.90% of the population were below the poverty line, including 28.50% of those under age 18 and 16.90% of those age 65 or over.

Southern Waste Information eXchange, Inc.

The Southern Waste Information eXchange, Inc. (SWIX), a non-profit 501(c)(3) Florida corporation formed through a cooperative partnership by Florida State University, the Florida Chamber of Commerce and the Florida Department of Environmental Protection in 1981, has as a primary objective assisting industrial and commercial waste generators with the management solid and hazardous waste.

The SWIX serves as a clearinghouse and repository for industries concerning information on:

- solid and hazardous waste management alternatives;
- pollution prevention approaches;
- market developments for recyclable materials in Florida;
- recycled products which are available to Florida markets;
- the availability of and demand for waste materials;
- waste management services and products; and,
- regulatory information related to solid and hazardous waste management.

Upon execution of the grant agreement with DEP, Gadsden County subsequently entered into a sub agreement with SWIX for completion of the project scope of work.

Project Objectives:

Examine the economic and environmental benefits of collecting and processing waste agricultural film for recycling purposes.

Project Description:

Agricultural film (plastic) mulch is managed at the end-of-life by either by being buried in Class 1 landfills or burned on-site in small piles within agricultural fields. While agricultural film plastic waste does not represent a large fraction of total solid wastes landfilled in the State of Florida, it is a problematic and voluminous waste stream in various counties within the State that generate large quantities of this plastic agricultural mulch. It is also a waste stream that is continuously produced or generated bi-annually for crop production. Lastly, burning of this waste stream in fields could present nuisance problems for residents/businesses that are located downwind from burning locations.

This project was presented as a pilot project to determine the economic and technical feasibility of collecting the plastic film in the fields, processing (baling) it to meet end use market specifications and acceptability, and examine the options for recycling the material into new products and/or back into plastic mulch. A key component of this pilot project was to store the agricultural plastic film in several locations in Gadsden County, Florida to "centralize" the transportation and transfer of this waste to end use markets. It is important to note that a key lesson learned from this process is that these "centralized" storage areas could be applied in those Florida counties that produce large volumes of the material, thus taking advantage of the economic benefits of setting up material storage cooperatives amongst farmers and potential recyclers. Minimizing transportation costs is a very important aspect to this process. It was determined that a rule of thumb for sitting a storage area is that it needs to be within 70 miles of the generation point, other wise transportation costs will make shipping the material uneconomical and disposal may be the better route.

The project included the following tasks/activities:

1. Reviewed national and State of Florida data on agricultural film plastic practices, including existing reuse, recycling and disposal alternatives. This research included identifying individuals and companies/businesses that generate this waste stream in the Gadsden County area and those that offer services related to the reuse, processing, recycling and disposal of this material.

2. Reviewed domestic and foreign markets for agricultural film, including their existing capacities and interests in accepting/purchasing larger quantities of such material, and what specifications they require to accept the material.

3. Based on research and analyses provided as a result of Tasks 1 and 2 above, provided a proposed collection, processing, and pilot recycling program for agricultural plastic film, including setting up collection/storage locations within Gadsden County. Input from this task came from coordination with county officials as well as farming community.

4. Administered the collection and processing of agricultural plastic film from the participating farms and setting up at least at one designated and acceptable storage location in coordination with local officials and private sector service providers.

5. Tracked and analyzed the costs of the collection and processing at the designated site(s), the costs of transfer of collected/processed materials,

and any costs associated with the recycling of the material by end use markets. Compare these costs to material disposal options.

As part of the Grant Scope of work, the above tasks were distributed within 5 project Tasks. A summary of the scope tasks are contained below.

Task 1: Development of Project Timeline:

This task involved the development of a project plan for the collection and processing (baling) of waste agricultural film. This was completed through coordinating several meetings between project partners and local farmers in Gadsden County. For the purposes of this project, team members focused on the generation of Ag Film from the growing of tomatoes. The farming industry in the state of Florida, for the most part, plants two crops of tomatoes every year. The ag film is collected at the end of the growing season (July and December) and then managed either via open burning or landfilling. With regard to landfilling, farmers in the Gadsden County area that send their ag film off for disposal as opposed to burning the material in the field use the Decatur County landfill located in Bainbridge, GA. The tipping fee at this facility is $42 per ton.

The first initial meeting was arranged by Mr. Anthony Powell with Gadsden County Public Works Department. Mr. Powell contacted several key local contacts concerning the Ag Film Project.

In attendance were:

- Herb Plantaleon, Gavgivlo Farms
- Steve Olson, IFAS, University of Florida
- Jason Murray, JWM Farms, LLC
- Rick Van Landingham, Van Landingham Juniper Tomatoes
- Kelly Williams, High Hope Farms
- Kevin Manley, Manley, Inc.
- Anthony Powell, Gadsden County Public Works Department
- Robert Presnell, Gadsden County Public Works Department
- Gene Jones, Southern Waste Information eXchange, Inc.

The purpose of this project team meeting was to outline project goals, develop a timeline with project partner responsibilities and identify waste ag film generation points. All of the team members present indicated a willingness to participate in the project. In fact, they were delighted this project was brought to the county as all of the generators indicated all of their waste ag film is sent to the landfill for disposal.

Several follow-up meeting were held by project team members to proceed with the collection and processing of the ag film and to identify collection points.

The USDA Service Center located in Quincy, Florida was chosen as the first temporary storage facility for taking baled ag film out of the field and serve as collection point for shipping the material to a recycler. As the project evolved two other location were identified as collection storage locations. The Van Landingham Farms and Sunrise Produce. Both of these two additional locations each contained their own respective loading docks. For the USDA facility, Gadsden County Solid Waste supplied a mobile ramp for loading baled ag film on transportation containers. The County also supplied a fork lift and staff at this location. Having a loading dock and forklifts is very key to the success of the program. It was also learned that if the storage area does not have a roof over it, that a forklift designed for a warehouse does not work all that well. Due to rain that was encountered during the month of July, a warehouse forklift will slip and slide on unpaved ground and not provide enough traction to move heavy material around.

Task 2. Identification of Collection Equipment:

This task involved the research and design of waste agricultural film collection equipment and requirements. As part of this task project team members researched collection partners and set locations and dates for collection events. Equipment used for this task was leased or was provided by project team members. This included mobile baling equipment, mobile loading ramp, forklifts and the development of an experimental automated ag film harvester. The baling equipment was supplied by Manley Farms, Sunrise Produce and JWM Farms, LLC. The forklifts were supplied by Sunrise Produce, Van Landingham Farms, Gadsden County and Ring Power Rental. The development and experimental trial of the ag film harvester was provided by inventor Richard Connelly with Conley Steel. Appendix B contains selected photographs showing the equipment used during this project.

Task 3: Implementation of Pilot Program:

This task involved the collection of ag film and maintaining records on the amount of film collected and processed. This Task also involved the development of a marketing plan for promoting the need to attract potential end users/processors/brokers of this waste stream. It is important to note that based on project team member research, only one Florida based end user of waste ag film exists at the time this report was prepared. RKO Industries (http://www.rkoindustries.com), located in Labelle, FL collects and processes waste ag film for a nominal tipping fee of $20 per ton. RKO services the Southwest Florida market and makes plastic railroad ties from the material. RKO was contacted to see if they could use the material collected from this project but due to transportation costs and RKO's ongoing supply of material from their farming clients, they could not commit to accepting material generated from this project.

Project Team members relied on the marketing plan of promoting the need for ag film users as part of this project. To accomplish this task the marketing plan was designed to use advertisements in national trade journals (i.e., Resource Recycling, Solid Waste Association of North America, Recycle Florida Today, Waste News and Recycling Today). The marketing plan also incorporated the use of a display banner that was used at the 2010 Plastics Conference, the 2010 Southeast Recycling Conference and The Pesticide Stewardship Alliance (TSPA) 2010 Conference.

A copy of the Advertisement and Promotional Banner are contained in Appendix C. The promotional items were prepared by the Environmental PR Group who was retained to provide marketing guidance for the project. It is important to note that 3 of the individuals who responded to the promotional pieces expressed an interest in exploring setting up recycling plants in the state of Florida for low value waste plastics like ag film. These companies are Think Plastics Inc., Omx Internationals, LLC and Skyplastic, USA.

Task 4. Data Collection and Preparation

In May of 2009 SWIX retained the services of Hazardous Substance & Waste Management Research, Inc. and Environmental Evaluations, Inc. to help with the review of ag film and affiliated irrigation drip tube from the standpoint of determining if there are health/environmental implications that should be identified. The was done to review if pesticide, herbicide or fungicide residuals on the waste streams could cause a concern from the standpoint of removing the film from the field or processing the film at a recycling facility. Project team members met to discuss a plan of action with regard to the collection and testing of representative samples of the ag film and drip tube. As part of the farming process, ag film is applied to the ground in rows. The film is typically made with low-density polyethylene (LDPE). Under this film plastic is a small irrigation tube made from high-density polyethylene (HDPE). Tomato plants are then inserted in the plastic rows at certain intervals, usually every other foot. Environmental Evaluations developed a Sampling Protocol for both the materials (See Appendix D) after the material had been pulled from the field at the end of the growing season.

Representative samples were collected and sent to Test America for analysis (See Appendix E). The samples were analyzed using Synthetic Precipitation Leaching Procedure (SPLP). The SPLP is an EPA SW-846 analytical method that can be used to determine the concentration of a contaminant that will leach from soil. The following is a summary of the testing process and results.

As indicated previously, SPLP tests were conducted on samples for agricultural film (”grey film” and “Agfilm” in the analytical data), as well as from the black, semiflexible rubber drip tube (“drip tube” and “black rubber” in the analytical data) which conveys irrigation water under the agricultural film. Samples were collected on May 21, 2009 (Table 1) and July 12, 2009 (Table 2). Table 1 and 2 are contained in Appendix F. The SPLP leachate was analyzed by Method 8270C (Semivolatile Compounds by GC/MS), by Method 8141A (Organophosphorus Pesticides), and by Method 8151A (Herbicides).

None of the SPLP samples from “black rubber” or “drip tube” collected on May 21, 2009 or July 12, 2009 contained detectable residues of Organophosphorus Pesticides or of Herbicides. Likewise, none of the SPLP samples from “grey film” or “Agfilm” contained detectable residues of Organophosphorus Pesticides (Method 8141A) or of Herbicides (Method 8151A). Thus, based on the available samples, there does not appear to be an issue regarding significant pesticide leaching or wash-off from the film and the drip tube samples.

Several Semivolatile Compounds were reported by Method 8270C for the May 21 samples and for the July 12 samples from Ag Film and/or the black rubber drip tube, as follows:

- **Diethyl phthalate** is a common chemical plasticizer used to soften industrial materials and many commercial or household products, and its presence is not unexpected. The health-based Florida Groundwater Cleanup Target Level (GCTL) for diethyl phthalate is 5,600 ug/L, compared to the detected value of 14 ug/L in the film sample from May 21, 2009 and 14 ug/L in the drip tube sample from July 12, 2009. Thus, there does not appear to be a significant issue regarding significant diethyl phthalate leaching or washoff from the film or the drip tube samples.

- **Phenol** was detected in one sample from the drip tube on July 12, 2009 at 6.8 ug/L, but not samples from the May 21 sampling event. The reported value was less than the Practical Quantitation Limit (PQL) reported by the laboratory, suggesting significant uncertainty in the numerical result. The Florida Groundwater Cleanup Target Level (GCTL), a level judged by the Florida Department of Environmental protection (DEP) to be safe for unlimited drinking water consumption, is 10 ug/L, based on taste considerations in drinking water, not based upon potential health effects. Thus, there does not appear to be an issue regarding significant phenol leaching or washoff from the film or the drip tube samples.

- A combined value for **3-methylphenol (m-cresol; 3-MP) and 4-methylphenol (p-cresol; 4-MP)** was reported as a total of "3 & 4-methylphenol" in the July 12, 2009 drip tube sample (72 ug/L). The methylphenols are widely used as disinfectants, deodorizers, and pesticides. They are common historical wood preservatives, and it is not clear if their presence is related to intentional use in the agricultural operations or to ancillary sources at the site (e.g., ground contact wood). Both of the reported values are below the Practical Quantitation Limit (PQL), set as a value at which the laboratory is confident that the substance can be accurately quantified. Below that level, presence is deemed to be likely, but the numerical value is judged to be uncertain. The GCTL for 3-MP is 35 ug/L and the GCTL for 4-MP is 3.5 ug/L. The presence and predominance of the isomers should be verified before any decisions were made based on the single detection.

- **4-chloro-3-methylphenol** (*p*-chloro-*m*-cresol) was reported in the May 21, 2009 film sample (9.1 ug/L) and from the July 12, 2009 black rubber sample (16 ug/L). Both values were less than the reported PQL, suggesting significant uncertainty in the numerical result. It is used as a preservative in adhesives, glues and other commercial products, as well as a fungicide and additive in cosmetic products (e.g., eyedrops). The health-based Florida GCTL is 63 ug/L. Thus, there does not appear to be an issue regarding significant 4-chloro-3-methylphenol leaching or washoff from the film or the drip tube samples.

- **Pentachlorophenol** was detected in the film and the drip tube sample on May 21, but not on July 12. The reported concentration from the drip tube analysis (4 ug/L) was considerably below the PQL of 16 ug/L, suggesting significant uncertainty in the numerical result. The grey film reported value of 28 ug/L was well above the PQL. In addition to these detections, pentachlorophenol also was detected in the blank samples, suggesting that it may have been introduced as a laboratory artifact or as a contaminant during the sampling process itself. It is unusual to find pentachlorophenol under normal circumstances, as it has not been available to the general public since the early-1980's. It uses now are restricted to utility poles and railroad timbers. Its presence should be verified before any decisions were made based on the single detection.

No Organophosphorus Pesticides or Herbicides were reported from any sample in this evaluation. Although several Semivolatile substances were detected during SPLP sampling for the film and drip tube samples, these detections were not consistent across the two sampling dates, nor were the values high. Indeed, in several instances the detected and reported values were below the Practical Quantitation Limit, which renders their significance unlikely.

Based on the initial environmental testing and analysis of the ag film and affiliated drip tube, project team members began to collect and bale material from the field. Appendix B contains representative photographs from of the collection and automated ag film harvester process.

Based on collection data it was determined that for every acre of tomatoes planted, that approximately 1,000 lbs of ag film is used during the growing operation. Based on this result, project team members contacted the Florida Department of Agriculture and Consumer Services to research the total acreage of tomatoes planted in Florida each year. Project team members also looked at the total amount of strawberries planted as well because the amount of ag film used in the strawberry growing process is very similar to the tomato growing process. The main difference is typically there is only one planting of strawberries each year.

The Florida Department of Agriculture and Consumer Services (DACS) was contacted to determine estimates on growing data for tomatoes and strawberries. DACS reported that 40,437 acres of tomatoes and 6,538 acres of strawberries were planted for the 2008 reporting period (2006-2007 fiscal year). Using the estimate of 1,000 lbs per acre for ag film generation and the fact that since tomatoes are typically planted in two crops per year this results to nearly 87,412,000 lbs of ag film per year (43,706 tons/year).

Table 3 contains a summary of harvested acres of tomatoes in Florida by county and corresponding ag film production potential. Table 4 contains a summary of harvested acres of strawberries in Florida by county and corresponding ag film production potential. These Tables are provided in Appendix F. This figure of 43,706 tons per year almost doubles the original estimate of 25,000 tons that was determined in 1999. Approximately 90% of this material is disposed of via open burning or landfilling. This is in part due to the fact that this material is highly contaminated with dirt and vegetation at the end of the life cycle, thus making recycling of this material very difficult by traditional plastic recyclers.

With the exception of only one ag film recycler in FL (RKO Industries), the majority of recycling trials of this material have been in the export markets (China, India, and Mexico). There is a growing interest domestically to be able to use this material in traditional recycling operations. In addition, this project has led to interest by the cement kiln industry to look at potentially using this material as a fuel source due to it's high BTU value.

With regard to markets for the material, the project was successful in establishing initial trial export markets for the material. Due to Florida Department of Transportation weight requirements, cargo containers were limited to 27 bales of ag film with a weight not to exceed 44,000 lbs. A bale constructed from the balers used for this project weighed from 1,250 lbs to 1,500 lbs. The dimension of the bales were 40" X 40" X 42". As a result, the containers weighed an average of 42,500 lbs. This applied to not only sea-bearing export cargo containers but 53' domestic tractor trailers as well.

As a result of this project, a total of 765,000 pounds (382.75 tons) of waste ag film and drip tube were collected and sent to end users for this project. In addition, 7,700 pounds (3.85 tons) of loose irrigation pipe was also collected and sent to a local recycler for processing.

Table 5 contains a summary of companies that took container load quantities of ag film plastics as part of this project. Table 6 contains a summary of companies that took sample load quantities of ag film plastics as part of this project. The tables are contained in Appendix F. The material was provided to the end users of the material at no charge. The reason being was due to the amount of dirt and vegetation contamination contained in the material. All the end users picked up transportation fees from the point of generation to the final delivery point. From an end use standpoint, the material destined for foreign export was sent over seas to China, Mexico or India. The material was processed back into PE pellets and then used for injection molding. Since all of the material sent overseas was done so through a plastics export broker, the end use companies that actual processed the waste plastic and the final product end use is not know due to confidentiality reasons. Two of the companies that took the plastic waste in the US, processed the material into PE pellets and also used the material in injection molding. Those two companies were Fresh Pak Corp (http://www.freshpakcorp.com) and Mountain Valley Recycling (http://www.mvrecycling.com). Fresh Pak Corp. manufactures a variety of sustainable plastic packaging products (e.g., Plastic Slip Sheets, Plastic Divider Sheets, Plastic Liner Sheets and Plastic Cap Sheets). Mountian Valley Recycling provides turnkey plastic bag and film recycling services and processes these waste streams back into sustainable resins that can be used to create other useful products.

This project saved farmers an estimated $16,237 in avoided landfill disposal fees (386.6 tons at $42/ton) and transportation cost of $1,769 (17.69 total container loads at $100 per container load to landfill).

With regard to cost estimates for pulling the plastic by hand vs. by using the automated harvester it was determined by research conducted by JWM Farms, LLC that collection cost data indicates that pulling the plastic by hand equates to

$145.85 per acre vs. $255.50 per acre using the harvesting equipment (See Appendix G.) It should be noted that the plastic used during the cost comparison process was weathered plastic and as a result tore very easily during the pulling process, thus resulting in downtime to rethread the ag plastic in the equipment. JWM Farms indicated that had newer plastics been used, the cost per acre using the automated machine would have been lower and could be more competitive with hand pulling of the material. JWM Farms and Connely Steel have agreed to further work post project on this harvester to improve the unit.

Task 5. Technology Transfer:

In an effort to promote the transferability and usefulness of the project, team members developed presentations designed in Power Point (See Appendix H). These presentations were used to promote the projects mission and success around the state in an effort to encourage county's, municipalities and local governments to support transferability of such a program in their community. At the time of this Final Report preparation two presentations had been conducted. One was given at the Southeast Recycling Conference in March of 2010 and one was presented at The Pesticide Stewardship Alliance (TSPA) Conference in February of 2010. In addition project team members plan to present the findings of this project at a future Recycle Florida Today event when and where appropriate. Project team members committed to one presentation for technology transfer purposes, but may conduct other presentations in the future as in-kind services.

Conclusions and Recommendations:

- Research conducted during this pilot project indicates that an estimated 87,412,000 lbs (43,706 tons) of ag film is generated in Florida annually from the growing of tomatoes and strawberries.
- It is estimated that approximately 90% of this material is disposed of via open burning or landfilling.
- DEP should review F.A.C. 403.707 (2)(e) and consider revising the statute in order to encourage farmers to explore recycling options for waste ag film over the open burning and landfilling options. Perhaps a ban on the open burning of waste ag film should be considered at this time.
- DEP and the DACS should consider cooperatively requesting funding assistance through the Solid Waste Management Trust Fund to enhance the development of public and/or private recycling initiatives for waste ag film and associated plastics.

- There is a growing interest domestically to be able to use this material in traditional recycling operations. In addition, this project has lead to interest by the cement kiln industry to look at potentially using this material as a fuel source due to it's high BTU value.

- No Organophosphorus Pesticides or Herbicides were reported from any sample in this evaluation. Although several Semivolatile substances were detected during SPLP sampling for the film and drip tube samples, these detections were not consistent across the two sampling dates, nor were the values high. Indeed, in several instances the detected and reported values were below the Practical Quantitation Limit, which renders their significance unlikely. It may be worthwhile to expand the sampling to multiple examples of each medium (film and tube samples). Additional dates of sampling also would serve a valuable purpose in verifying or refuting the presence of the occasional low level Semivolatiles.

- As a result of this project, a total of 765,000 pounds (382.75 tons) of waste ag film and drip tube were collected and sent to end users for this project. In addition, 7,700 pounds (3.85 tons) of loose irrigation pipe was also collected and sent to a local recycler for processing.

- This project saved farmers an estimated $16,237 in avoided landfill disposal fees (386.6 tons at $42/ton) and transportation cost of $1,769 (17.69 total container loads at $100 per container load to landfill).

- In the absence of viable end use markets for LDPE ag film, the farming community may want to explore the use of biodegradable and compostable agricultural film. The main benefit of this film is that it does not need to be removed after the end of the growing season and has several positive aspects:

    - The environmental impact on the harvest is reduced considerably.
    - Several properties of these types of films are superior to Polyethylene film.
    - The cost of these films are comparable to and in some instances less than Polyethylene film.
    - Farmers obtain advantages such as time saving (reduced expenditure of labor) as well as saving money, since the film does not need to be removed after the harvest.
    - The main ingredients in these films are corn starch and vegetable oil, which are renewable and sustainable resources.

Appendices:

Appendix A: Financial Summary

Appendix B: Selected Project Photos

Appendix C: Marketing Plan Advertisement and Display Banner

Appendix D: Ag Film and Drip Tube Sampling Protocol

Appendix E: Analytical Sampling Results

Appendix F: Tables

Appendix G: Cost Analysis Ag Film Hand Pull vs. Automated Pull

Appendix H: Technology Transfer Documentation

Appendix A:
Financial Summary

FINANCIAL SUMMARY

GRANTEE:	Gadsden County Post Office Box 1799 Quincy, FL 32353-1799	**GRANTEE'S GRANT MANAGER:**	Charlie Chapman
DEP AGREEMENT NO.:	S0427	**PERFORMANCE PERIOD:**	3/17/09-3/16/10
		PERCENT MATCHING REQUIRED:	0%

GRANT EXPENDITURES SUMMARY SECTION
3/17/09- 3/16/10
[Effective Date of Grant through End-of-Grant Period]

Budget Category	Total Project Budget	Expenditures During Grant Period	Ending Grant Balance
Personnel *	$ 20,000.00	$ -	$ 20,000.00
Travel	$N/A	$N/A	$N/A
Contractual Services	$ 230,000.00	$ 230,000.00	$ -
Other Expenses	$N/A	$N/A	$N/A
Indirect Costs	$N/A	$N/A	$N/A
	$ 250,000.00	**$ 230,000.00**	**$ 20,000.00**

* Note: Gadsden County did not bill out for any Personnel Charges related to this project.

Appendix B:
Selected Project Photos

Appendix C:
Marketing Plan Advertisement and Display Banner

Appendix D:
Ag Film and Drip Tube Sampling Protocol

Agricultural (AG) Film Sampling Protocol

AG Film is generally brought from the field to a central location at the edge of the filed prior to being picked up for movement to another area. Ideally the AG Film sample would be collected at that time.

The AG Film at the location at the edge of the field represents the centralized location that is used prior to further film processing.

1. A pre-determined grid, 12 inches by 12 inches, is first placed on a random section of AFG Film.

2. The grid is then bisected into 4 equal quadrants, each area being six inches by six inches.

3. All of the AG Film in the film in the upper left hand section of the six inch by six inch grid is collected and placed in a pre-cleaned glass jar. All of the AG Film in the lower right hand grid is collected and placed in a separate pre-cleaned glass jar. Both jars are labeled as to location of origin and transported to the selected laboratory for analysis.

4. At the laboratory, the contents of jar one are removed and a pre-selected amount of AG Film is placed in a beaker, submerged in de-ionized water, agitated for at least 20 minutes and the supernatant drawn off and analyzed for the selected parameters. This extraction procedure simulates the effect of rainfall on the AG Film and the effect of compounds being washed from the AG Film.

5. At the laboratory, the contents of jar two are removed and a pre-selected amount of AG Film is placed in a beaker and then subjected to Synthetic Precipitation Leaching Procedure (SPLP) extraction. The resultant liquid extracted from the AG Film is then drawn off and analyzed for the selected parameters. This extraction procedure simulates the effect of rain and the film being exposed to normal rain acidity of which may wash compounds from the AG Film.

6. Results of the analysis can be compared to the values in Chapter 62-777, FAC for groundwater to determine if chemical applied in the growing of agricultural products where the AG Film is used can enter the waste stream in sufficient quantities to produce prohibited concentrations.

Agricultural (AG) Drip Tube Sampling Protocol

AG Drip Tube is generally brought from the field to a central location at the edge of the filed prior to being picked up for movement to another area. Ideally the AG Drip Tube sample would be collected at that time.

The AG Drip Tube at the location at the edge of the field represents the centralized location that is used prior to further film processing.

1. A random sample of AG Drip Tube of 12 inches in length is taken from the field.

2. The sample is then cut into 4 equal quadrants, each area being three inches in length.

3. The first three inch quadrant is collected and placed in a pre-cleaned glass jar. All of the last cut AG Drip Tube samples are collected and placed in a separate pre-cleaned glass jar. Both jars are labeled as to location of origin and transported to the selected laboratory for analysis.

4. At the laboratory, the contents of jar one are removed and a pre-selected amount of AG Drip Tube is placed in a beaker, submerged in de-ionized water, agitated for at least 20 minutes and the supernatant drawn off and analyzed for the selected parameters. This extraction procedure simulates the effect of rainfall on the AG Drip Tube and the effect of compounds being washed from the AG Drip Tube.

5. At the laboratory, the contents of jar two are removed and a pre-selected amount of AG Drip Tube is placed in a beaker and then subjected to Synthetic Precipitation Leaching Procedure (SPLP) extraction. The resultant liquid extracted from the AG Drip Tube is then drawn off and analyzed for the selected parameters. This extraction procedure simulates the effect of rain and the film being exposed to normal rain acidity of which may wash compounds from the AG Drip Tube.

6. Results of the analysis can be compared to the values in Chapter 62-777, FAC for groundwater to determine if chemical applied in the growing of agricultural products where the AG Drip Tube is used can enter the waste stream in sufficient quantities to produce prohibited concentrations.

Appendix E:
Analytical Sampling Results

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 640-22887-1

Job Description: Ag Film

For:
Southern Waste Information eXchange, Inc
PO BOX 960
Tallahassee, FL 32302

Attention: Gene Jones

Approved for release.
Tim Preston
Project Manager II
8/11/2009 8:58 AM

Tim Preston
Project Manager II
timothyr.preston@testamericainc.com
08/11/2009

These test results meet all the requirements of NELAC. All questions regarding this test report should be directed to the TestAmerica Project Manager who signed this test report.

TestAmerica Tallahassee Florida Department of Health Certification No. E81005
TestAmerica Savannah Florida Department of Health Certification No. E87052

TestAmerica Laboratories, Inc.
TestAmerica Tallahassee 2846 Industrial Plaza Drive, Tallahassee, FL 32301
Tel (850) 878-3994 Fax (850) 878-9504 www.testamericainc.com

ACCREDITED IN ACCORDANCE WITH nelac

Job Narrative
640-J22887-1

Comments

[illegible] additional comments.

Receipt

All samples were received in good condition within temperature requirements.

GC/MS Semi VOA

No analytical or quality issues were noted.

GC Semi VOA

No analytical or quality issues were noted.

Metals

No analytical or quality issues were noted.

Organic Prep

No analytical or quality issues were noted.

EXECUTIVE SUMMARY - Detections

Client: Southern Waste Information eXchange, Inc Job Number: 640-22887-1

Lab Sample ID Analyte	Client Sample ID	Result / Qualifier		Reporting Limit	Units	Method
640-22887-2	**DRIP TUBE**					
SPLP East						
Phenol		6.8	I	8.0	ug/L	8270C
Diethyl phthalate		14	I	20	ug/L	8270C
4-Chloro-3-methylphenol		16	I	20	ug/L	8270C
3 & 4 Methylphenol		72		20	ug/L	8270C

METHOD SUMMARY

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Description	Lab Location	Method	Preparation Method
Matrix: Solid			
Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	TAL TAM	SW846 8270C	
SPLP Extraction	TAL TAM		SW846 1312
Liquid-Liquid Extraction (Continuous)	TAL TAM		SW846 3520C
Organophosphorous Pesticides (GC)	TAL TAM	SW846 8141A	
SPLP Extraction	TAL TAM		SW846 1312
Liquid-Liquid Extraction (Continuous)	TAL TAM		SW846 3520C
Herbicides (GC)	TAL TAM	SW846 8151A	
SPLP Extraction	TAL TAM		SW846 1312
Extraction (Herbicides)	TAL TAM		SW846 8151A

Lab References:

TAL TAM = TestAmerica Tampa

Method References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

SAMPLE SUMMARY

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
640-22887-1	Ag Film	Solid	07/12/2009 0000	07/16/2009 1018
640-22887-2	Drip Tube	Solid	07/12/2009 0000	07/16/2009 1018

SAMPLE RESULTS

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Client Sample ID: **Ag Film**

Lab Sample ID: 640-22887-1

Client Matrix: Solid

Date Sampled: 07/12/2009 0000

Date Received: 07/16/2009 1018

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method:	8270C	Analysis Batch: 660-82323	Instrument ID:	BSMD5973
Preparation:	3520C	Prep Batch: 660-82182	Lab File ID:	1DG23011.D
Dilution:	1.0	Leachate Batch: 660-82133	Initial Weight/Volume:	500 mL
Date Analyzed:	07/23/2009 1550		Final Weight/Volume:	1 mL
Date Prepared:	07/22/2009 1358		Injection Volume:	1.0 uL
Date Leached:	07/21/2009 1338			

Analyte	DryWt Corrected: N	Result (ug/L)	Qualifier	MDL	PQL
1,3-Dichlorobenzene		2.2	U	2.2	20
N-Nitrosodimethylamine		4.8	U	4.8	20
Phenol		4.8	U	4.8	8.0
1,4-Dichlorobenzene		2.4	U	2.4	20
Hexachloroethane		1.7	U	1.7	20
Bis(2-chloroethyl)ether		5.2	U	5.2	20
1,2-Dichlorobenzene		2.2	U	2.2	20
2,2'-oxybis[1-chloropropane]		4.2	U	4.2	20
N-Nitrosodi-n-propylamine		3.8	U	3.8	20
Nitrobenzene		3.8	U	3.8	20
Hexachlorobutadiene		2.0	U	2.0	20
1,2,4-Trichlorobenzene		2.4	U	2.4	20
Isophorone		2.8	U	2.8	20
Naphthalene		2.6	U	2.6	20
Bis(2-chloroethoxy)methane		4.0	U	4.0	20
Hexachlorocyclopentadiene		2.4	U	2.4	20
2-Chloronaphthalene		3.2	U	3.2	20
Acenaphthylene		3.6	U	3.6	20
Acenaphthene		3.0	U	3.0	20
Dimethyl phthalate		5.0	U	5.0	20
2,6-Dinitrotoluene		1.4	U	1.4	20
Fluorene		3.4	U	3.4	20
4-Chlorophenyl phenyl ether		3.6	U	3.6	20
2,4-Dinitrotoluene		1.8	U	1.8	20
Diethyl phthalate		5.0	U	5.0	20
N-Nitrosodiphenylamine		3.2	U	3.2	20
Hexachlorobenzene		3.4	U	3.4	8.0
4-Bromophenyl phenyl ether		3.4	U	3.4	20
Phenanthrene		2.6	U	2.6	20
Anthracene		2.0	U	2.0	20
Di-n-butyl phthalate		5.0	U	5.0	20
Fluoranthene		2.4	U	2.4	20
Pyrene		2.4	U	2.4	20
Butyl benzyl phthalate		2.4	U	2.4	20
Bis(2-ethylhexyl) phthalate		2.6	U	2.6	12
Chrysene		2.4	U	2.4	20
Benzo[a]anthracene		3.2	U	3.2	20
3,3'-Dichlorobenzidine		3.2	U	3.2	40
Di-n-octyl phthalate		5.0	U	5.0	20
Benzo[b]fluoranthene		3.2	U	3.2	20
Benzo[k]fluoranthene		2.6	U	2.6	20
Benzo[a]pyrene		2.0	U	2.0	8.0
Indeno[1,2,3-cd]pyrene		2.4	U	2.4	20
Dibenz(a,h)anthracene		2.0	U	2.0	20
Benzo[g,h,i]perylene		2.2	U	2.2	20

Client Sample ID: **Ag Film**

Lab Sample ID:	640-22887-1	Date Sampled:	07/12/2009 0000
Client Matrix:	Solid	Date Received:	07/16/2009 1018

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method:	8270C	Analysis Batch: 660-82323	Instrument ID:	BSMD5973
Preparation:	3520C	Prep Batch: 660-82182	Lab File ID:	1DG23011.D
Dilution:	1.0	Leachate Batch: 660-82133	Initial Weight/Volume:	500 mL
Date Analyzed:	07/23/2009 1550		Final Weight/Volume:	1 mL
Date Prepared:	07/22/2009 1358		Injection Volume:	1.0 uL
Date Leached:	07/21/2009 1338			

Analyte	DryWt Corrected: N	Result (ug/L)	Qualifier	MDL	PQL
2-Chlorophenol		4.2	U	4.2	20
2-Nitrophenol		2.4	U	2.4	20
2,4-Dimethylphenol		3.6	U	3.6	20
2,4-Dichlorophenol		3.6	U	3.6	20
2,4,6-Trichlorophenol		3.8	U	3.8	20
4-Chloro-3-methylphenol		3.4	U	3.4	20
2,4-Dinitrophenol		12	U	12	100
4,6-Dinitro-2-methylphenol		3.0	U	3.0	100
Pentachlorophenol		3.0	U	3.0	30
4-Nitrophenol		12	U	12	100
Benzyl alcohol		5.8	U	5.8	20
2-Methylphenol		4.6	U	4.6	20
Benzoic acid		24	U J3	24	100
4-Chloroaniline		4.2	U	4.2	40
2-Methylnaphthalene		3.2	U	3.2	20
2,4,5-Trichlorophenol		4.2	U	4.2	20
2-Nitroaniline		2.8	U	2.8	100
3-Nitroaniline		2.4	U	2.4	100
Dibenzofuran		3.2	U	3.2	20
4-Nitroaniline		2.8	U	2.8	100
3 & 4 Methylphenol		4.8	U	4.8	20
1-Methylnaphthalene		2.6	U	2.6	20

Surrogate	%Rec	Qualifier	Acceptance Limits
2-Fluorophenol	69		29 - 121
Nitrobenzene-d5	82		34 - 130
Phenol-d5	62		25 - 128
2-Fluorobiphenyl	79		36 - 124
Terphenyl-d14	43		14 - 148
2,4,6-Tribromophenol	81		29 - 143

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Client Sample ID: **Drip Tube**

Lab Sample ID: 640-22887-2

Client Matrix: Solid

Date Sampled: 07/12/2009 0000

Date Received: 07/16/2009 1018

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method: 8270C

Preparation: 3520C

Dilution: 1.0

Date Analyzed: 07/23/2009 1620

Date Prepared: 07/22/2009 1358

Date Leached: 07/21/2009 1338

Analysis Batch: 660-82323

Prep Batch: 660-82182

Leachate Batch: 660-82133

Instrument ID: BSMD5973

Lab File ID: 1DG23012.D

Initial Weight/Volume: 500 mL

Final Weight/Volume: 1 mL

Injection Volume: 1.0 uL

Analyte	DryWt Corrected: N	Result (ug/L)	Qualifier	MDL	PQL
1,3-Dichlorobenzene		2.2	U	2.2	20
N-Nitrosodimethylamine		4.8	U	4.8	20
Phenol		6.8	I	4.8	8.0
1,4-Dichlorobenzene		2.4	U	2.4	20
Hexachloroethane		1.7	U	1.7	20
Bis(2-chloroethyl)ether		5.2	U	5.2	20
1,2-Dichlorobenzene		2.2	U	2.2	20
2,2'-oxybis[1-chloropropane]		4.2	U	4.2	20
N-Nitrosodi-n-propylamine		3.8	U	3.8	20
Nitrobenzene		3.8	U	3.8	20
Hexachlorobutadiene		2.0	U	2.0	20
1,2,4-Trichlorobenzene		2.4	U	2.4	20
Isophorone		2.8	U	2.8	20
Naphthalene		2.6	U	2.6	20
Bis(2-chloroethoxy)methane		4.0	U	4.0	20
Hexachlorocyclopentadiene		2.4	U	2.4	20
2-Chloronaphthalene		3.2	U	3.2	20
Acenaphthylene		3.6	U	3.6	20
Acenaphthene		3.0	U	3.0	20
Dimethyl phthalate		5.0	U	5.0	20
2,6-Dinitrotoluene		1.4	U	1.4	20
Fluorene		3.4	U	3.4	20
4-Chlorophenyl phenyl ether		3.6	U	3.6	20
2,4-Dinitrotoluene		1.8	U	1.8	20
Diethyl phthalate		14	I	5.0	20
N-Nitrosodiphenylamine		3.2	U	3.2	20
Hexachlorobenzene		3.4	U	3.4	8.0
4-Bromophenyl phenyl ether		3.4	U	3.4	20
Phenanthrene		2.6	U	2.6	20
Anthracene		2.0	U	2.0	20
Di-n-butyl phthalate		5.0	U	5.0	20
Fluoranthene		2.4	U	2.4	20
Pyrene		2.4	U	2.4	20
Butyl benzyl phthalate		2.4	U	2.4	20
Bis(2-ethylhexyl) phthalate		2.6	U	2.6	12
Chrysene		2.4	U	2.4	20
Benzo[a]anthracene		3.2	U	3.2	20
3,3'-Dichlorobenzidine		3.2	U	3.2	40
Di-n-octyl phthalate		5.0	U	5.0	20
Benzo[b]fluoranthene		3.2	U	3.2	20
Benzo[k]fluoranthene		2.6	U	2.6	20
Benzo[a]pyrene		2.0	U	2.0	8.0
Indeno[1,2,3-cd]pyrene		2.4	U	2.4	20
Dibenz(a,h)anthracene		2.0	U	2.0	20
Benzo[g,h,i]perylene		2.2	U	2.2	20

Client Sample ID: **Drip Tube**

Lab Sample ID:	640-22887-2	Date Sampled:	07/12/2009 0000
Client Matrix:	Solid	Date Received:	07/16/2009 1018

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method:	8270C	Analysis Batch: 660-82323	Instrument ID: BSMD5973
Preparation:	3520C	Prep Batch: 660-82182	Lab File ID: 1DG23012.D
Dilution:	1.0	Leachate Batch: 660-82133	Initial Weight/Volume: 500 mL
Date Analyzed:	07/23/2009 1620		Final Weight/Volume: 1 mL
Date Prepared:	07/22/2009 1358		Injection Volume: 1.0 uL
Date Leached:	07/21/2009 1338		

Analyte	DryWt Corrected: N	Result (ug/L)	Qualifier	MDL	PQL
2-Chlorophenol		4.2	U	4.2	20
2-Nitrophenol		2.4	U	2.4	20
2,4-Dimethylphenol		3.6	U	3.6	20
2,4-Dichlorophenol		3.6	U	3.6	20
2,4,6-Trichlorophenol		3.8	U	3.8	20
4-Chloro-3-methylphenol		16	I	3.4	20
2,4-Dinitrophenol		12	U	12	100
4,6-Dinitro-2-methylphenol		3.0	U	3.0	100
Pentachlorophenol		3.0	U	3.0	30
4-Nitrophenol		12	U	12	100
Benzyl alcohol		5.8	U	5.8	20
2-Methylphenol		4.6	U	4.6	20
Benzoic acid		24	U J3	24	100
4-Chloroaniline		4.2	U	4.2	40
2-Methylnaphthalene		3.2	U	3.2	20
2,4,5-Trichlorophenol		4.2	U	4.2	20
2-Nitroaniline		2.8	U	2.8	100
3-Nitroaniline		2.4	U	2.4	100
Dibenzofuran		3.2	U	3.2	20
4-Nitroaniline		2.8	U	2.8	100
3 & 4 Methylphenol		72		4.8	20
1-Methylnaphthalene		2.6	U	2.6	20

Surrogate	%Rec	Qualifier	Acceptance Limits
2-Fluorophenol	58		29 - 121
Nitrobenzene-d5	79		34 - 130
Phenol-d5	53		25 - 128
2-Fluorobiphenyl	72		36 - 124
Terphenyl-d14	31		14 - 148
2,4,6-Tribromophenol	71		29 - 143

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Client Sample ID: **Ag Film**

Lab Sample ID:	640-22887-1	Date Sampled:	07/12/2009 0000
Client Matrix:	Solid	Date Received:	07/16/2009 1018

8141A Organophosphorous Pesticides (GC)-SPLP East

Method:	8141A	Analysis Batch: 660-82345	Instrument ID:	BSGR
Preparation:	3520C	Prep Batch: 660-82171	Initial Weight/Volume:	500 mL
Dilution:	1.0	Leachate Batch: 660-82133	Final Weight/Volume:	2 mL
Date Analyzed:	07/24/2009 0128		Injection Volume:	4 uL
Date Prepared:	07/22/2009 1119		Result Type:	PRIMARY
Date Leached:	07/21/2009 1338			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	MDL	PQL
Azinphos-methyl		0.0036	U	0.0036	0.020
Bolstar		0.0050	U	0.0050	0.020
Chlorpyrifos		0.0050	U	0.0050	0.020
Coumaphos		0.0050	U	0.0050	0.020
Demeton-O		0.0028	U	0.0028	0.050
Diazinon		0.0050	U	0.0050	0.020
Dichlorvos		0.0030	U	0.0030	0.040
Dimethoate		0.0024	U	0.0024	0.040
Disulfoton		0.0036	U	0.0036	0.040
EPN		0.0030	U	0.0030	0.020
Ethion		0.0020	U	0.0020	0.010
Mocap		0.0020	U	0.0020	0.010
Ethyl Parathion		0.0050	U	0.0050	0.020
Fensulfothion		0.0050	U	0.0050	0.10
Fenthion		0.0050	U	0.0050	0.020
Malathion		0.0050	U	0.0050	0.020
Merphos		0.0019	U	0.0019	0.020
Methyl parathion		0.0022	U	0.0022	0.010
Mevinphos		0.0050	U	0.0050	0.040
Monochrotophos		0.040	U	0.040	0.20
Naled		0.020	U	0.020	0.10
Phorate		0.0040	U	0.0040	0.020
Ronnel		0.0050	U	0.0050	0.020
Stirophos		0.0050	U	0.0050	0.020
Sulfotepp		0.0018	U	0.0018	0.010
Tokuthion		0.0050	U	0.0050	0.020
Trichloronate		0.0050	U	0.0050	0.020

Surrogate	%Rec	Qualifier	Acceptance Limits
Triphenylphosphate	82		16 - 164

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Client Sample ID: **Drip Tube**

Lab Sample ID: 640-22887-2
Client Matrix: Solid

Date Sampled: 07/12/2009 0000
Date Received: 07/16/2009 1018

8141A Organophosphorous Pesticides (GC)-SPLP East

Method:	8141A	Analysis Batch: 660-82345	Instrument ID:	BSGR
Preparation:	3520C	Prep Batch: 660-82171	Initial Weight/Volume:	500 mL
Dilution:	1.0	Leachate Batch: 660-82133	Final Weight/Volume:	2 mL
Date Analyzed:	07/24/2009 0153		Injection Volume:	4 uL
Date Prepared:	07/22/2009 1119		Result Type:	PRIMARY
Date Leached:	07/21/2009 1338			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	MDL	PQL
Azinphos-methyl		0.0036	U	0.0036	0.020
Bolstar		0.0050	U	0.0050	0.020
Chlorpyrifos		0.0050	U	0.0050	0.020
Coumaphos		0.0050	U	0.0050	0.020
Demeton-O		0.0028	U	0.0028	0.050
Diazinon		0.0050	U	0.0050	0.020
Dichlorvos		0.0030	U	0.0030	0.040
Dimethoate		0.0024	U	0.0024	0.040
Disulfoton		0.0036	U	0.0036	0.040
EPN		0.0030	U	0.0030	0.020
Ethion		0.0020	U	0.0020	0.010
Mocap		0.0020	U	0.0020	0.010
Ethyl Parathion		0.0050	U	0.0050	0.020
Fensulfothion		0.0050	U	0.0050	0.10
Fenthion		0.0050	U	0.0050	0.020
Malathion		0.0050	U	0.0050	0.020
Merphos		0.0019	U	0.0019	0.020
Methyl parathion		0.0022	U	0.0022	0.010
Mevinphos		0.0050	U	0.0050	0.040
Monochrotophos		0.040	U	0.040	0.20
Naled		0.020	U	0.020	0.10
Phorate		0.0040	U	0.0040	0.020
Ronnel		0.0050	U	0.0050	0.020
Stirophos		0.0050	U	0.0050	0.020
Sulfotepp		0.0018	U	0.0018	0.010
Tokuthion		0.0050	U	0.0050	0.020
Trichloronate		0.0050	U	0.0050	0.020

Surrogate	%Rec	Qualifier	Acceptance Limits
Triphenylphosphate	73		16 - 164

Client Sample ID: **Ag Film**

Lab Sample ID:	640-22887-1	Date Sampled:	07/12/2009 0000
Client Matrix:	Solid	Date Received:	07/16/2009 1018

8151A Herbicides (GC)-SPLP East

Method:	8151A	Analysis Batch: 660-82824	Instrument ID:	BSGJ
Preparation:	8151A	Prep Batch: 660-82489	Initial Weight/Volume:	500 mL
Dilution:	1.0	Leachate Batch: 660-82133	Final Weight/Volume:	10 mL
Date Analyzed:	08/05/2009 0437		Injection Volume:	1.0 uL
Date Prepared:	07/28/2009 1232		Result Type:	PRIMARY
Date Leached:	07/21/2009 1338			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	MDL	PQL
2,4,5-T		0.010	U	0.010	0.050
2,4-D		0.00075	U	0.00075	0.0025
2,4-DB		0.010	U	0.010	0.050
Dalapon		0.25	U	0.25	1.2
Dicamba		0.0025	U	0.0025	0.012
Dichlorprop		0.010	U	0.010	0.060
Dinoseb		0.010	U	0.010	0.060
MCPA		0.34	U	0.34	1.2
MCPP		0.35	U	0.35	1.2
Pentachlorophenol		0.00085	U	0.00085	0.010
Picloram		0.010	U	0.010	0.050
Silvex (2,4,5-TP)		0.00016	U	0.00016	0.0025

Surrogate	%Rec	Qualifier	Acceptance Limits
2,4-Dichlorophenylacetic acid	60		33 - 120

Client Sample ID:	**Drip Tube**		
Lab Sample ID:	640-22887-2	Date Sampled:	07/12/2009 0000
Client Matrix:	Solid	Date Received:	07/16/2009 1018

8151A Herbicides (GC)-SPLP East

Method:	8151A	Analysis Batch: 660-82824	Instrument ID:	BSGJ
Preparation:	8151A	Prep Batch: 660-82489	Initial Weight/Volume:	440 mL
Dilution:	1.0	Leachate Batch: 660-82133	Final Weight/Volume:	10 mL
Date Analyzed:	08/05/2009 0453		Injection Volume:	1.0 uL
Date Prepared:	07/28/2009 1232		Result Type:	PRIMARY
Date Leached:	07/21/2009 1338			

Analyte	DryWt Corrected: N	Result (mg/L)	Qualifier	MDL	PQL
2,4,5-T		0.011	U	0.011	0.057
2,4-D		0.00085	U	0.00085	0.0028
2,4-DB		0.011	U	0.011	0.057
Dalapon		0.28	U	0.28	1.4
Dicamba		0.0028	U	0.0028	0.014
Dichlorprop		0.011	U	0.011	0.068
Dinoseb		0.011	U	0.011	0.068
MCPA		0.39	U	0.39	1.4
MCPP		0.40	U	0.40	1.4
Pentachlorophenol		0.00097	U	0.00097	0.011
Picloram		0.011	U	0.011	0.057
Silvex (2,4,5-TP)		0.00018	U	0.00018	0.0028

Surrogate	%Rec	Qualifier	Acceptance Limits
2,4-Dichlorophenylacetic acid	87		33 - 120

DATA REPORTING QUALIFIERS

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Lab Section	Qualifier	Description
GC/MS Semi VOA		
	J3	Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria.
	U	Indicates that the compound was analyzed for but not detected.
	I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
GC Semi VOA		
	J3	Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria.
	U	Indicates that the compound was analyzed for but not detected.

QUALITY CONTROL RESULTS

Surrogate Recovery Report

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

Client Matrix: Solid

Lab Sample ID	Client Sample ID	2FP %Rec	NBZ %Rec	PHL %Rec	FBP %Rec	TPH %Rec	TBP %Rec
660-30692-C-1-A MS		50	81	25	44	17	49
660-30753-S-1-A DU		63	84	58	76	28	74

Surrogate	Acceptance Limits
2FP = 2-Fluorophenol	29-121
NBZ = Nitrobenzene-d5	34-130
PHL = Phenol-d5	25-128
FBP = 2-Fluorobiphenyl	36-124
TPH = Terphenyl-d14	14-148
TBP = 2,4,6-Tribromophenol	29-143

Surrogate Recovery Report

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

Client Matrix: Solid SPLP East

Lab Sample ID	Client Sample ID	2FP %Rec	NBZ %Rec	PHL %Rec	FBP %Rec	TPH %Rec	TBP %Rec
640-22887-1	Ag Film	69	82	62	79	43	81
640-22887-2	Drip Tube	58	79	53	72	31	71
MB 660-82182/1-A		77	78	66	83	101	93
LB 660-82133/1-D		78	83	67	87	104	99
LCS 660-82182/2-A		82	93	71	96	101	106

Surrogate	Acceptance Limits
2FP = 2-Fluorophenol	29-121
NBZ = Nitrobenzene-d5	34-130
PHL = Phenol-d5	25-128
FBP = 2-Fluorobiphenyl	36-124
TPH = Terphenyl-d14	14-148
TBP = 2,4,6-Tribromophenol	29-143

Surrogate Recovery Report

8141A Organophosphorous Pesticides (GC)

Client Matrix: Solid SPLP East

Lab Sample ID	Client Sample ID	TPP1 %Rec	TPP2 %Rec
640-22887-1	Ag Film	82	
640-22887-2	Drip Tube	73	
MB 660-82171/1-A			105
LCS 660-82171/2-A		93	
LCSD 660-82171/3-A		98	

Surrogate	Acceptance Limits
TPP = Triphenylphosphate	16-164

Surrogate Recovery Report

8151A Herbicides (GC)

Client Matrix: Solid SPLP East

Lab Sample ID	Client Sample ID	DCPA1 %Rec	DCPA2 %Rec
640-22887-1	Ag Film	60	
640-22887-2	Drip Tube	87	
MB 660-82489/1-A			63
LCS 660-82489/2-A		57	

Surrogate	Acceptance Limits
DCPA = 2,4-Dichlorophenylacetic acid	33-120

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Method Blank - Batch: 660-82182

Method: 8270C
Preparation: 3520C

Lab Sample ID: MB 660-82182/1-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 07/23/2009 1451
Date Prepared: 07/22/2009 1358

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L

Instrument ID: HP 6890/5973
Lab File ID: 1DG23009.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Result	Qual	MDL	PQL
1,3-Dichlorobenzene	1.1	U	1.1	10
N-Nitrosodimethylamine	2.4	U	2.4	10
Phenol	2.4	U	2.4	4.0
1,4-Dichlorobenzene	1.2	U	1.2	10
Hexachloroethane	0.85	U	0.85	10
Bis(2-chloroethyl)ether	2.6	U	2.6	10
1,2-Dichlorobenzene	1.1	U	1.1	10
2,2'-oxybis[1-chloropropane]	2.1	U	2.1	10
N-Nitrosodi-n-propylamine	1.9	U	1.9	10
Nitrobenzene	1.9	U	1.9	10
Hexachlorobutadiene	1.0	U	1.0	10
1,2,4-Trichlorobenzene	1.2	U	1.2	10
Isophorone	1.4	U	1.4	10
Naphthalene	1.3	U	1.3	10
Bis(2-chloroethoxy)methane	2.0	U	2.0	10
Hexachlorocyclopentadiene	1.2	U	1.2	10
2-Chloronaphthalene	1.6	U	1.6	10
Acenaphthylene	1.8	U	1.8	10
Acenaphthene	1.5	U	1.5	10
Dimethyl phthalate	2.5	U	2.5	10
2,6-Dinitrotoluene	0.72	U	0.72	10
Fluorene	1.7	U	1.7	10
4-Chlorophenyl phenyl ether	1.8	U	1.8	10
2,4-Dinitrotoluene	0.91	U	0.91	10
Diethyl phthalate	2.5	U	2.5	10
N-Nitrosodiphenylamine	1.6	U	1.6	10
Hexachlorobenzene	1.7	U	1.7	4.0
4-Bromophenyl phenyl ether	1.7	U	1.7	10
Phenanthrene	1.3	U	1.3	10
Anthracene	1.0	U	1.0	10
Di-n-butyl phthalate	2.5	U	2.5	10
Fluoranthene	1.2	U	1.2	10
Pyrene	1.2	U	1.2	10
Butyl benzyl phthalate	1.2	U	1.2	10
Bis(2-ethylhexyl) phthalate	1.3	U	1.3	6.0
Chrysene	1.2	U	1.2	10
Benzo[a]anthracene	1.6	U	1.6	10
3,3'-Dichlorobenzidine	1.6	U	1.6	20
Di-n-octyl phthalate	2.5	U	2.5	10
Benzo[b]fluoranthene	1.6	U	1.6	10
Benzo[k]fluoranthene	1.3	U	1.3	10

Calculations are performed before rounding to avoid round-off errors in calculated results.

Method Blank - Batch: 660-82182

Method: 8270C
Preparation: 3520C

Lab Sample ID: MB 660-82182/1-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 07/23/2009 1451
Date Prepared: 07/22/2009 1358

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L

Instrument ID: HP 6890/5973
Lab File ID: 1DG23009.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Result	Qual	MDL	PQL
Benzo[a]pyrene	0.99	U	0.99	4.0
Indeno[1,2,3-cd]pyrene	1.2	U	1.2	10
Dibenz(a,h)anthracene	1.0	U	1.0	10
Benzo[g,h,i]perylene	1.1	U	1.1	10
2-Chlorophenol	2.1	U	2.1	10
2-Nitrophenol	1.2	U	1.2	10
2,4-Dimethylphenol	1.8	U	1.8	10
2,4-Dichlorophenol	1.8	U	1.8	10
2,4,6-Trichlorophenol	1.9	U	1.9	10
4-Chloro-3-methylphenol	1.7	U	1.7	10
2,4-Dinitrophenol	6.2	U	6.2	50
4,6-Dinitro-2-methylphenol	1.5	U	1.5	50
Pentachlorophenol	1.5	U	1.5	15
4-Nitrophenol	6.2	U	6.2	50
Benzyl alcohol	2.9	U	2.9	10
2-Methylphenol	2.3	U	2.3	10
Benzoic acid	12	U	12	50
4-Chloroaniline	2.1	U	2.1	20
2-Methylnaphthalene	1.6	U	1.6	10
2,4,5-Trichlorophenol	2.1	U	2.1	10
2-Nitroaniline	1.4	U	1.4	50
3-Nitroaniline	1.2	U	1.2	50
Dibenzofuran	1.6	U	1.6	10
4-Nitroaniline	1.4	U	1.4	50
3 & 4 Methylphenol	2.4	U	2.4	10
1-Methylnaphthalene	1.3	U	1.3	10

Surrogate	% Rec	Acceptance Limits
2-Fluorophenol	77	29 - 121
Nitrobenzene-d5	78	34 - 130
Phenol-d5	66	25 - 128
2-Fluorobiphenyl	83	36 - 124
Terphenyl-d14	101	14 - 148
2,4,6-Tribromophenol	93	29 - 143

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

TCLP SPLPE Leachate Blank - Batch: 660-82182

Method: 8270C
Preparation: 3520C
SPLP East

Lab Sample ID: LB 660-82133/1-D
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/23/2009 1649
Date Prepared: 07/22/2009 1358
Date Leached: 07/21/2009 1338

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L
Leachate Batch: 660-82133

Instrument ID: HP 6890/5973
Lab File ID: 1DG23013.D
Initial Weight/Volume: 500 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Result	Qual	MDL	PQL
1,3-Dichlorobenzene	2.2	U	2.2	20
N-Nitrosodimethylamine	4.8	U	4.8	20
Phenol	4.8	U	4.8	8.0
1,4-Dichlorobenzene	2.4	U	2.4	20
Hexachloroethane	1.7	U	1.7	20
Bis(2-chloroethyl)ether	5.2	U	5.2	20
1,2-Dichlorobenzene	2.2	U	2.2	20
2,2'-oxybis[1-chloropropane]	4.2	U	4.2	20
N-Nitrosodi-n-propylamine	3.8	U	3.8	20
Nitrobenzene	3.8	U	3.8	20
Hexachlorobutadiene	2.0	U	2.0	20
1,2,4-Trichlorobenzene	2.4	U	2.4	20
Isophorone	2.8	U	2.8	20
Naphthalene	2.6	U	2.6	20
Bis(2-chloroethoxy)methane	4.0	U	4.0	20
Hexachlorocyclopentadiene	2.4	U	2.4	20
2-Chloronaphthalene	3.2	U	3.2	20
Acenaphthylene	3.6	U	3.6	20
Acenaphthene	3.0	U	3.0	20
Dimethyl phthalate	5.0	U	5.0	20
2,6-Dinitrotoluene	1.4	U	1.4	20
Fluorene	3.4	U	3.4	20
4-Chlorophenyl phenyl ether	3.6	U	3.6	20
2,4-Dinitrotoluene	1.8	U	1.8	20
Diethyl phthalate	5.0	U	5.0	20
N-Nitrosodiphenylamine	3.2	U	3.2	20
Hexachlorobenzene	3.4	U	3.4	8.0
4-Bromophenyl phenyl ether	3.4	U	3.4	20
Phenanthrene	2.6	U	2.6	20
Anthracene	2.0	U	2.0	20
Di-n-butyl phthalate	5.0	U	5.0	20
Fluoranthene	2.4	U	2.4	20
Pyrene	2.4	U	2.4	20
Butyl benzyl phthalate	2.4	U	2.4	20
Bis(2-ethylhexyl) phthalate	2.6	U	2.6	12
Chrysene	2.4	U	2.4	20
Benzo[a]anthracene	3.2	U	3.2	20
3,3'-Dichlorobenzidine	3.2	U	3.2	40
Di-n-octyl phthalate	5.0	U	5.0	20
Benzo[b]fluoranthene	3.2	U	3.2	20
Benzo[k]fluoranthene	2.6	U	2.6	20

Calculations are performed before rounding to avoid round-off errors in calculated results.

TCLP SPLPE Leachate Blank - Batch: 660-82182

Method: 8270C
Preparation: 3520C
SPLP East

Lab Sample ID: LB 660-82133/1-D
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/23/2009 1649
Date Prepared: 07/22/2009 1358
Date Leached: 07/21/2009 1338

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L
Leachate Batch: 660-82133

Instrument ID: HP 6890/5973
Lab File ID: 1DG23013.D
Initial Weight/Volume: 500 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Result	Qual	MDL	PQL
Benzo[a]pyrene	2.0	U	2.0	8.0
Indeno[1,2,3-cd]pyrene	2.4	U	2.4	20
Dibenz(a,h)anthracene	2.0	U	2.0	20
Benzo[g,h,i]perylene	2.2	U	2.2	20
2-Chlorophenol	4.2	U	4.2	20
2-Nitrophenol	2.4	U	2.4	20
2,4-Dimethylphenol	3.6	U	3.6	20
2,4-Dichlorophenol	3.6	U	3.6	20
2,4,6-Trichlorophenol	3.8	U	3.8	20
4-Chloro-3-methylphenol	3.4	U	3.4	20
2,4-Dinitrophenol	12	U	12	100
4,6-Dinitro-2-methylphenol	3.0	U	3.0	100
Pentachlorophenol	3.0	U	3.0	30
4-Nitrophenol	12	U	12	100
Benzyl alcohol	5.8	U	5.8	20
2-Methylphenol	4.6	U	4.6	20
Benzoic acid	24	U	24	100
4-Chloroaniline	4.2	U	4.2	40
2-Methylnaphthalene	3.2	U	3.2	20
2,4,5-Trichlorophenol	4.2	U	4.2	20
2-Nitroaniline	2.8	U	2.8	100
3-Nitroaniline	2.4	U	2.4	100
Dibenzofuran	3.2	U	3.2	20
4-Nitroaniline	2.8	U	2.8	100
3 & 4 Methylphenol	4.8	U	4.8	20
1-Methylnaphthalene	2.6	U	2.6	20

Surrogate	% Rec	Acceptance Limits
2-Fluorophenol	78	29 - 121
Nitrobenzene-d5	83	34 - 130
Phenol-d5	67	25 - 128
2-Fluorobiphenyl	87	36 - 124
Terphenyl-d14	104	14 - 148
2,4,6-Tribromophenol	99	29 - 143

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Lab Control Sample - Batch: 660-82182

Method: 8270C
Preparation: 3520C

Lab Sample ID: LCS 660-82182/2-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 07/23/2009 1520
Date Prepared: 07/22/2009 1358

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L

Instrument ID: HP 6890/5973
Lab File ID: 1DG23010.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
Phenol	100	59.7	60	33 - 122	
1,4-Dichlorobenzene	100	68.8	69	27 - 130	
N-Nitrosodi-n-propylamine	100	88.3	88	31 - 138	
1,2,4-Trichlorobenzene	100	73.2	73	28 - 110	
Acenaphthene	100	89.7	90	36 - 121	
2,4-Dinitrotoluene	100	99.9	100	37 - 129	
Pyrene	100	98.9	99	31 - 139	
2-Chlorophenol	100	81.1	81	38 - 115	
4-Chloro-3-methylphenol	100	93.0	93	34 - 126	
Pentachlorophenol	100	114	114	19 - 148	
4-Nitrophenol	100	70.9	71	12 - 143	

Matrix Spike - Batch: 660-82182

Method: 8270C
Preparation: 3520C

Lab Sample ID: 660-30692-C-1-A MS
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/23/2009 1913
Date Prepared: 07/22/2009 1358

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L

Instrument ID: HP 6890/5973
Lab File ID: 1DG23018.D
Initial Weight/Volume: 1055 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Sample Result/Qual		Spike Amount	Result	% Rec.	Limit	Qual
Phenol	2.3	U	94.8	26.3	28	33 - 122	J3
1,4-Dichlorobenzene	1.1	U	94.8	53.4	56	27 - 130	
N-Nitrosodi-n-propylamine	1.8	U	94.8	64.0	67	31 - 138	
1,2,4-Trichlorobenzene	1.1	U	94.8	49.5	52	28 - 110	
Acenaphthene	1.4	U	94.8	52.8	56	36 - 121	
2,4-Dinitrotoluene	0.86	U	94.8	75.7	80	37 - 129	
Pyrene	1.1	U	94.8	37.8	40	31 - 139	
2-Chlorophenol	2.0	U	94.8	36.8	39	38 - 115	
4-Chloro-3-methylphenol	1.6	U	94.8	1.6	0	34 - 126	J3
Pentachlorophenol	1.4	U	94.8	39.7	42	19 - 148	
4-Nitrophenol	5.9	U	94.8	5.9	0	12 - 143	J3

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Duplicate - Batch: 660-82182

Method: 8270C
Preparation: 3520C

Lab Sample ID: 660-30753-S-1-A DU
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/23/2009 2009
Date Prepared: 07/22/2009 1358

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L

Instrument ID: HP 6890/5973
Lab File ID: 1DG23020.D
Initial Weight/Volume: 1060 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Sample Result/Qual		Result	RPD	Limit	Qual
1,3-Dichlorobenzene	1.0	U	1.0	NC	26	U
N-Nitrosodimethylamine	2.3	U	2.3	NC	31	U
Phenol	2.3	U	2.3	NC	36	U
1,4-Dichlorobenzene	1.1	U	1.1	NC	31	U
Hexachloroethane	0.81	U	0.80	NC	35	U
Bis(2-chloroethyl)ether	2.5	U	2.5	NC	58	U
1,2-Dichlorobenzene	1.0	U	1.0	NC	30	U
2,2'-oxybis[1-chloropropane]	2.0	U	2.0	NC	23	U
N-Nitrosodi-n-propylamine	1.8	U	1.8	NC	30	U
Nitrobenzene	1.8	U	1.8	NC	21	U
Hexachlorobutadiene	0.95	U	0.94	NC	30	U
1,2,4-Trichlorobenzene	1.1	U	1.1	NC	28	U
Isophorone	1.3	U	1.3	NC	33	U
Naphthalene	1.2	U	1.2	NC	33	U
Bis(2-chloroethoxy)methane	1.9	U	1.9	NC	20	U
Hexachlorocyclopentadiene	1.1	U	1.1	NC	67	U
2-Chloronaphthalene	1.5	U	1.5	NC	22	U
Acenaphthylene	1.7	U	1.7	NC	28	U
Acenaphthene	1.4	U	1.4	NC	35	U
Dimethyl phthalate	2.4	U	2.4	NC	31	U
2,6-Dinitrotoluene	0.68	U	0.68	NC	24	U
Fluorene	1.6	U	1.6	NC	23	U
4-Chlorophenyl phenyl ether	1.7	U	1.7	NC	26	U
2,4-Dinitrotoluene	0.86	U	0.86	NC	32	U
Diethyl phthalate	2.4	U	2.4	NC	49	U
N-Nitrosodiphenylamine	1.5	U	1.5	NC	25	U
Hexachlorobenzene	1.6	U	1.6	NC	31	U
4-Bromophenyl phenyl ether	1.6	U	1.6	NC	26	U
Phenanthrene	1.2	U	1.2	NC	20	U
Anthracene	0.95	U	0.94	NC	21	U
Di-n-butyl phthalate	2.4	U	2.4	NC	29	U
Fluoranthene	1.1	U	1.1	NC	24	U
Pyrene	1.1	U	1.1	NC	42	U
Butyl benzyl phthalate	1.1	U	1.1	NC	41	U
Bis(2-ethylhexyl) phthalate	1.2	U	1.2	NC	26	U
Chrysene	1.1	U	1.1	NC	31	U
Benzo[a]anthracene	1.5	U	1.5	NC	34	U
3,3'-Dichlorobenzidine	1.5	U	1.5	NC	72	U
Di-n-octyl phthalate	2.4	U	2.4	NC	33	U

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Duplicate - Batch: 660-82182

Method: 8270C
Preparation: 3520C

Lab Sample ID: 660-30753-S-1-A DU
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 07/23/2009 2009
Date Prepared: 07/22/2009 1358

Analysis Batch: 660-82323
Prep Batch: 660-82182
Units: ug/L

Instrument ID: HP 6890/5973
Lab File ID: 1DG23020.D
Initial Weight/Volume: 1060 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Sample Result/Qual		Result	RPD	Limit	Qual
Benzo[b]fluoranthene	1.5	U	1.5	NC	32	U
Benzo[k]fluoranthene	1.2	U	1.2	NC	34	U
Benzo[a]pyrene	0.94	U	0.93	NC	24	U
Indeno[1,2,3-cd]pyrene	1.1	U	1.1	NC	38	U
Dibenz(a,h)anthracene	0.95	U	0.94	NC	35	U
Benzo[g,h,i]perylene	1.0	U	1.0	NC	39	U
2-Chlorophenol	2.0	U	2.0	NC	34	U
2-Nitrophenol	1.1	U	1.1	NC	24	U
2,4-Dimethylphenol	1.7	U	1.7	NC	43	U
2,4-Dichlorophenol	1.7	U	1.7	NC	30	U
2,4,6-Trichlorophenol	1.8	U	1.8	NC	22	U
4-Chloro-3-methylphenol	1.6	U	1.6	NC	31	U
2,4-Dinitrophenol	5.9	U	5.8	NC	63	U
4,6-Dinitro-2-methylphenol	1.4	U	1.4	NC	33	U
Pentachlorophenol	1.4	U	1.4	NC	33	U
4-Nitrophenol	5.9	U	5.8	NC	44	U
Benzyl alcohol	2.7	U	2.7	NC	32	U
2-Methylphenol	4.2	I	2.2	NC	33	U
Benzoic acid	11	U	11	NC	66	U J3
4-Chloroaniline	2.0	U	2.0	NC	67	U
2-Methylnaphthalene	1.5	U	1.5	NC	30	U
2,4,5-Trichlorophenol	2.0	U	2.0	NC	28	U
2-Nitroaniline	1.3	U	1.3	NC	49	U
3-Nitroaniline	1.1	U	1.1	NC	57	U
Dibenzofuran	1.5	U	1.5	NC	20	U
4-Nitroaniline	1.3	U	1.3	NC	39	U
3 & 4 Methylphenol	2.3	U	2.3	NC	27	U
1-Methylnaphthalene	1.2	U	1.2	NC	50	U

Surrogate	% Rec	Acceptance Limits
2-Fluorophenol	63	29 - 121
Nitrobenzene-d5	84	34 - 130
Phenol-d5	58	25 - 128
2-Fluorobiphenyl	76	36 - 124
Terphenyl-d14	28	14 - 148
2,4,6-Tribromophenol	74	29 - 143

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Method Blank - Batch: 660-82171

Method: 8141A
Preparation: 3520C

Lab Sample ID: MB 660-82171/1-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 07/24/2009 0013
Date Prepared: 07/22/2009 1119

Analysis Batch: 660-82345
Prep Batch: 660-82171
Units: mg/L

Instrument ID: HP 6890 NPD/NPD
Lab File ID: 1G23R021.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 2 mL
Injection Volume: 4 uL
Column ID: PRIMARY

Analyte	Result	Qual	MDL	PQL
Azinphos-methyl	0.0018	U	0.0018	0.010
Bolstar	0.0025	U	0.0025	0.010
Chlorpyrifos	0.0025	U	0.0025	0.010
Coumaphos	0.0025	U	0.0025	0.010
Demeton-O	0.0014	U	0.0014	0.025
Diazinon	0.0025	U	0.0025	0.010
Dichlorvos	0.0015	U	0.0015	0.020
Dimethoate	0.0012	U	0.0012	0.020
Disulfoton	0.0018	U	0.0018	0.020
EPN	0.0015	U	0.0015	0.010
Ethion	0.0010	U	0.0010	0.0050
Mocap	0.0010	U	0.0010	0.0050
Ethyl Parathion	0.0025	U	0.0025	0.010
Fensulfothion	0.0025	U	0.0025	0.050
Fenthion	0.0025	U	0.0025	0.010
Malathion	0.0025	U	0.0025	0.010
Merphos	0.00096	U	0.00096	0.010
Methyl parathion	0.0011	U	0.0011	0.0050
Mevinphos	0.0025	U	0.0025	0.020
Monochrotophos	0.020	U	0.020	0.10
Naled	0.010	U	0.010	0.050
Phorate	0.0020	U	0.0020	0.010
Ronnel	0.0025	U	0.0025	0.010
Stirophos	0.0025	U	0.0025	0.010
Sulfotepp	0.00092	U	0.00092	0.0050
Tokuthion	0.0025	U	0.0025	0.010
Trichloronate	0.0025	U	0.0025	0.010

Surrogate	% Rec	Acceptance Limits
Triphenylphosphate	105	16 - 164

Calculations are performed before rounding to avoid round-off errors in calculated results.

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22887-1

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 660-82171

Method: 8141A
Preparation: 3520C

LCS Lab Sample ID: LCS 660-82171/2-A	Analysis Batch: 660-82345	Instrument ID:	HP 6890 NPD/NPD
Client Matrix: Water	Prep Batch: 660-82171	Lab File ID:	1G23R022.D
Dilution: 1.0	Units: mg/L	Initial Weight/Volume:	1000 mL
Date Analyzed: 07/24/2009 0038		Final Weight/Volume:	2 mL
Date Prepared: 07/22/2009 1119		Injection Volume:	4 uL
		Column ID:	PRIMARY

LCSD Lab Sample ID: LCSD 660-82171/3-A	Analysis Batch: 660-82345	Instrument ID:	HP 6890 NPD/NPD
Client Matrix: Water	Prep Batch: 660-82171	Lab File ID:	1G23R023.D
Dilution: 1.0	Units: mg/L	Initial Weight/Volume:	1000 mL
Date Analyzed: 07/24/2009 0103		Final Weight/Volume:	2 mL
Date Prepared: 07/22/2009 1119		Injection Volume:	4 uL
		Column ID:	PRIMARY

Analyte	% Rec. LCS	% Rec. LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Diazinon	88	97	37 - 121	10	40		
Ethyl Parathion	125	137	28 - 155	9	34		
Methyl parathion	105	107	38 - 149	2	40		
Ronnel	86	92	30 - 130	6	35		

Calculations are performed before rounding to avoid round-off errors in calculated results.

Method Blank - Batch: 660-82489

Method: 8151A
Preparation: 8151A

Lab Sample ID: MB 660-82489/1-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 08/05/2009 0350
Date Prepared: 07/28/2009 1232

Analysis Batch: 660-82824
Prep Batch: 660-82489
Units: mg/L

Instrument ID: AGILENT GC ECD/ECD
Lab File ID: 1H04J063.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 10 mL
Injection Volume: 1.0 uL
Column ID: PRIMARY

Analyte	Result	Qual	MDL	PQL
2,4,5-T	0.0050	U	0.0050	0.025
2,4-D	0.00038	U	0.00038	0.0012
2,4-DB	0.0050	U	0.0050	0.025
Dalapon	0.12	U	0.12	0.60
Dicamba	0.0012	U	0.0012	0.0060
Dichlorprop	0.0050	U	0.0050	0.030
Dinoseb	0.0050	U	0.0050	0.030
MCPA	0.17	U	0.17	0.60
MCPP	0.18	U	0.18	0.60
Pentachlorophenol	0.00042	U	0.00042	0.0050
Picloram	0.0050	U	0.0050	0.025
Silvex (2,4,5-TP)	0.000080	U	0.000080	0.0012

Surrogate	% Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	63	33 - 120

Lab Control Sample - Batch: 660-82489

Method: 8151A
Preparation: 8151A

Lab Sample ID: LCS 660-82489/2-A
Client Matrix: Water
Dilution: 4.0
Date Analyzed: 08/05/2009 0406
Date Prepared: 07/28/2009 1232

Analysis Batch: 660-82824
Prep Batch: 660-82489
Units: mg/L

Instrument ID: AGILENT GC ECD/ECD
Lab File ID: 1H04J064.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 10 mL
Injection Volume: 1.0 uL
Column ID: PRIMARY

Analyte	Spike Amount	Result	% Rec.	Limit	Qual
2,4,5-T	0.00500	0.020	74	15 - 155	
2,4-D	0.00500	0.00376	75	10 - 166	
Silvex (2,4,5-TP)	0.00500	0.00351	70	25 - 139	

Calculations are performed before rounding to avoid round-off errors in calculated results.

TestAmerica Tallahassee
2846 Industrial Plaza Drive
Tallahassee, FL 32301
Phone (850) 878-3994 Fax (850) 878-9504

Chain of Custody Record

THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler:	Lab PM:	Carrier Tracking No(s):	COC No: 640-
Client Contact: GENE JONES	Phone:	E-Mail:		Page:
Company: SWIX				Job #: 640-22887

Address:
City:
State, Zip:
Phone: 850/386-6280
Email: gene@swix.ws
Project Name:
Site:

Due Date Requested:
TAT Requested (days):
PO #:
WO#:
Project #:
SSOW#:

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	SPLP-8270	SPLP-8141	SPLP-8151	Special Instructions/Note:
			Preservation Code:					
Ag FILM	6/12/09			S	1	1	1	
DRIP TUBE	6/12/09			S	1	1	1	

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* ________ *Months*

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by: E. By	Date/Time:	Company	Received by:	Date/Time: 6/12/09 10:18	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: ∆ Yes ∆ No
Custody Seal No.:
Cooler Temperature(s) °C and Other Remarks:

TAL-8240TA 0108

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

Job Number: 640-22156-1

Job Description: Ag Film

For:
Southern Waste Information eXchange, Inc
PO BOX 960
Tallahassee, FL 32302

Attention: Gene Jones

Approved for release.
Tim Preston
Project Manager II
6/23/2009 1:43 PM

Tim Preston
Project Manager II
timothyr.preston@testamericainc.com
06/23/2009

These test results meet all the requirements of NELAC. All questions regarding this test report should be directed to the TestAmerica Project Manager who signed this test report.

TestAmerica Tallahassee Florida Department of Health Certification No. E81005
TestAmerica Savannah Florida Department of Health Certification No. E87052

TestAmerica Laboratories, Inc.
TestAmerica Tallahassee 2846 Industrial Plaza Drive, Tallahassee, FL 32301
Tel (850) 878-3994 Fax (850) 878-9504 www.testamericainc.com

ACCREDITED IN ACCORDANCE WITH nelac

Job Narrative
640-J22156-1

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

GC/MS Semi VOA
Method 8270C: The method blank for batch 79795 contained Pentachlorophenol above the method detection limit of 1.5ug/L at 2.1ug/L. This target analyte concentration was less than the reporting limit (RL) of 15. Samples 22156-1 and -2 contained Pentachlorophenol at 28 and 4.0 ug/L respectively. Re-extraction and/or re-analysis of samples was not performed, and were flagged with a V qualifier.

No other analytical or quality issues were noted.

GC Semi VOA
No analytical or quality issues were noted.

Metals
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

EXECUTIVE SUMMARY - Detections

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Lab Sample ID Analyte	Client Sample ID	Result / Qualifier		Reporting Limit	Units	Method
640-22156-1	**GREY FILM**					
SPLP East						
Diethyl phthalate		14		9.5	ug/L	8270C
4-Chloro-3-methylphenol		9.1	I J3	9.5	ug/L	8270C
Pentachlorophenol		28	V J3	14	ug/L	8270C
640-22156-2	**BLACK RUBBER**					
SPLP East						
Pentachlorophenol		4.0	I V J3	16	ug/L	8270C

METHOD SUMMARY

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Description	Lab Location	Method	Preparation Method
Matrix: Solid			
Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)	TAL TAM	SW846 8270C	
SPLP Extraction	TAL TAM		SW846 1312
Liquid-Liquid Extraction (Continuous)	TAL TAM		SW846 3520C
Organophosphorous Pesticides (GC)	TAL TAM	SW846 8141A	
SPLP Extraction	TAL TAM		SW846 1312
Liquid-Liquid Extraction (Continuous)	TAL TAM		SW846 3520C
Herbicides (GC)	TAL TAM	SW846 8151A	
SPLP Extraction	TAL TAM		SW846 1312
Extraction (Herbicides)	TAL TAM		SW846 8151A

Lab References:

TAL TAM = TestAmerica Tampa

Method References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

SAMPLE SUMMARY

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Lab Sample ID	Client Sample ID	Client Matrix	Date/Time Sampled	Date/Time Received
640-22156-1	Grey Film	Solid	05/21/2009 0000	05/27/2009 1600
640-22156-2	Black Rubber	Solid	05/21/2009 0000	05/27/2009 1600

SAMPLE RESULTS

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Client Sample ID: **Grey Film**

Lab Sample ID:	640-22156-1	Date Sampled:	05/21/2009 0000
Client Matrix:	Solid	Date Received:	05/27/2009 1600

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method:	8270C	Analysis Batch: 660-79940	Instrument ID:	BSMC5973
Preparation:	3520C	Prep Batch: 660-79795	Lab File ID:	1CF01019.D
Dilution:	1.0	Leachate Batch: 660-79766	Initial Weight/Volume:	1055 mL
Date Analyzed:	06/01/2009 1618		Final Weight/Volume:	1 mL
Date Prepared:	05/29/2009 1519		Injection Volume:	1.0 uL
Date Leached:	05/29/2009 1150			

Analyte	DryWt Corrected: N Result (ug/L)	Qualifier	MDL	PQL
1,3-Dichlorobenzene	1.0	U	1.0	9.5
N-Nitrosodimethylamine	2.3	U	2.3	9.5
Phenol	2.3	U	2.3	3.8
1,4-Dichlorobenzene	1.1	U J3	1.1	9.5
Hexachloroethane	0.81	U	0.81	9.5
Bis(2-chloroethyl)ether	2.5	U	2.5	9.5
1,2-Dichlorobenzene	1.0	U	1.0	9.5
2,2'-oxybis(2-chloropropane)	2.0	U	2.0	9.5
N-Nitrosodi-n-propylamine	1.8	U J3	1.8	9.5
Nitrobenzene	1.8	U	1.8	9.5
Hexachlorobutadiene	0.95	U	0.95	9.5
1,2,4-Trichlorobenzene	1.1	U J3	1.1	9.5
Isophorone	1.3	U	1.3	9.5
Naphthalene	1.2	U	1.2	9.5
Bis(2-chloroethoxy)methane	1.9	U	1.9	9.5
Hexachlorocyclopentadiene	1.1	U	1.1	9.5
2-Chloronaphthalene	1.5	U	1.5	9.5
Acenaphthylene	1.7	U	1.7	9.5
Acenaphthene	1.4	U J3	1.4	9.5
Dimethyl phthalate	2.4	U	2.4	9.5
2,6-Dinitrotoluene	0.68	U	0.68	9.5
Fluorene	1.6	U	1.6	9.5
4-Chlorophenyl phenyl ether	1.7	U	1.7	9.5
2,4-Dinitrotoluene	0.86	U J3	0.86	9.5
Diethyl phthalate	14		2.4	9.5
N-Nitrosodiphenylamine	1.5	U	1.5	9.5
Hexachlorobenzene	1.6	U	1.6	3.8
4-Bromophenyl phenyl ether	1.6	U	1.6	9.5
Phenanthrene	1.2	U	1.2	9.5
Anthracene	0.95	U	0.95	9.5
Di-n-butyl phthalate	2.4	U	2.4	9.5
Fluoranthene	1.1	U	1.1	9.5
Pyrene	1.1	U J3	1.1	9.5
Butyl benzyl phthalate	1.1	U	1.1	9.5
Bis(2-ethylhexyl) phthalate	1.2	U	1.2	5.7
Chrysene	1.1	U	1.1	9.5
Benzo[a]anthracene	1.5	U	1.5	9.5
3,3'-Dichlorobenzidine	1.5	U	1.5	19
Di-n-octyl phthalate	2.4	U	2.4	9.5
Benzo[b]fluoranthene	1.5	U	1.5	9.5
Benzo[k]fluoranthene	1.2	U	1.2	9.5
Benzo[a]pyrene	0.94	U	0.94	3.8
Indeno[1,2,3-cd]pyrene	1.1	U	1.1	9.5
Dibenz(a,h)anthracene	0.95	U	0.95	9.5

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Client Sample ID: **Grey Film**

Lab Sample ID:	640-22156-1		Date Sampled:	05/21/2009 0000
Client Matrix:	Solid		Date Received:	05/27/2009 1600

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method:	8270C	Analysis Batch: 660-79940	Instrument ID:	BSMC5973
Preparation:	3520C	Prep Batch: 660-79795	Lab File ID:	1CF01019.D
Dilution:	1.0	Leachate Batch: 660-79766	Initial Weight/Volume:	1055 mL
Date Analyzed:	06/01/2009 1618		Final Weight/Volume:	1 mL
Date Prepared:	05/29/2009 1519		Injection Volume:	1.0 uL
Date Leached:	05/29/2009 1150			

Analyte	DryWt Corrected: N Result (ug/L)	Qualifier	MDL	PQL
Benzo[g,h,i]perylene	1.0	U	1.0	9.5
2-Chlorophenol	2.0	U J3	2.0	9.5
2-Nitrophenol	1.1	U	1.1	9.5
2,4-Dimethylphenol	1.7	U	1.7	9.5
2,4-Dichlorophenol	1.7	U	1.7	9.5
2,4,6-Trichlorophenol	1.8	U	1.8	9.5
4-Chloro-3-methylphenol	9.1	I J3	1.6	9.5
2,4-Dinitrophenol	5.9	U	5.9	47
4,6-Dinitro-2-methylphenol	1.4	U	1.4	47
Pentachlorophenol	28	V J3	1.4	14
4-Nitrophenol	5.9	U	5.9	47
Benzyl alcohol	2.7	U	2.7	9.5
2-Methylphenol	2.2	U	2.2	9.5
Benzoic acid	11	U	11	47
4-Chloroaniline	2.0	U	2.0	19
2-Methylnaphthalene	1.5	U	1.5	9.5
2,4,5-Trichlorophenol	2.0	U	2.0	9.5
2-Nitroaniline	1.3	U	1.3	47
3-Nitroaniline	1.1	U	1.1	47
Dibenzofuran	1.5	U	1.5	9.5
4-Nitroaniline	1.3	U	1.3	47
3 & 4 Methylphenol	2.3	U	2.3	9.5
1-Methylnaphthalene	1.2	U	1.2	9.5

Surrogate	%Rec	Acceptance Limits
2-Fluorophenol	41	29 - 121
Nitrobenzene-d5	44	34 - 130
Phenol-d5	37	25 - 128
2-Fluorobiphenyl	38	36 - 124
Terphenyl-d14	19	14 - 148
2,4,6-Tribromophenol	47	29 - 143

Analytical Data

Client: Southern Waste Information eXchange, Inc
Job Number: 640-22156-1

Client Sample ID: **Black Rubber**

Lab Sample ID: 640-22156-2
Client Matrix: Solid
Date Sampled: 05/21/2009 0000
Date Received: 05/27/2009 1600

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method: 8270C
Preparation: 3520C
Dilution: 1.0
Date Analyzed: 06/01/2009 1639
Date Prepared: 05/29/2009 1519
Date Leached: 05/29/2009 1150
Analysis Batch: 660-79940
Prep Batch: 660-79795
Leachate Batch: 660-79766
Instrument ID: BSMC5973
Lab File ID: 1CF01020.D
Initial Weight/Volume: 940 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	DryWt Corrected: N Result (ug/L)	Qualifier	MDL	PQL
1,3-Dichlorobenzene	1.2	U	1.2	11
N-Nitrosodimethylamine	2.6	U	2.6	11
Phenol	2.6	U	2.6	4.3
1,4-Dichlorobenzene	1.3	U J3	1.3	11
Hexachloroethane	0.90	U	0.90	11
Bis(2-chloroethyl)ether	2.8	U	2.8	11
1,2-Dichlorobenzene	1.2	U	1.2	11
2,2'-oxybis(2-chloropropane)	2.2	U	2.2	11
N-Nitrosodi-n-propylamine	2.0	U J3	2.0	11
Nitrobenzene	2.0	U	2.0	11
Hexachlorobutadiene	1.1	U	1.1	11
1,2,4-Trichlorobenzene	1.3	U J3	1.3	11
Isophorone	1.5	U	1.5	11
Naphthalene	1.4	U	1.4	11
Bis(2-chloroethoxy)methane	2.1	U	2.1	11
Hexachlorocyclopentadiene	1.3	U	1.3	11
2-Chloronaphthalene	1.7	U	1.7	11
Acenaphthylene	1.9	U	1.9	11
Acenaphthene	1.6	U J3	1.6	11
Dimethyl phthalate	2.7	U	2.7	11
2,6-Dinitrotoluene	0.77	U	0.77	11
Fluorene	1.8	U	1.8	11
4-Chlorophenyl phenyl ether	1.9	U	1.9	11
2,4-Dinitrotoluene	0.97	U J3	0.97	11
Diethyl phthalate	2.7	U	2.7	11
N-Nitrosodiphenylamine	1.7	U	1.7	11
Hexachlorobenzene	1.8	U	1.8	4.3
4-Bromophenyl phenyl ether	1.8	U	1.8	11
Phenanthrene	1.4	U	1.4	11
Anthracene	1.1	U	1.1	11
Di-n-butyl phthalate	2.7	U	2.7	11
Fluoranthene	1.3	U	1.3	11
Pyrene	1.3	U J3	1.3	11
Butyl benzyl phthalate	1.3	U	1.3	11
Bis(2-ethylhexyl) phthalate	1.4	U	1.4	6.4
Chrysene	1.3	U	1.3	11
Benzo[a]anthracene	1.7	U	1.7	11
3,3'-Dichlorobenzidine	1.7	U	1.7	21
Di-n-octyl phthalate	2.7	U	2.7	11
Benzo[b]fluoranthene	1.7	U	1.7	11
Benzo[k]fluoranthene	1.4	U	1.4	11
Benzo[a]pyrene	1.1	U	1.1	4.3
Indeno[1,2,3-cd]pyrene	1.3	U	1.3	11
Dibenz(a,h)anthracene	1.1	U	1.1	11

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Client Sample ID: **Black Rubber**

Lab Sample ID:	640-22156-2	Date Sampled:	05/21/2009 0000
Client Matrix:	Solid	Date Received:	05/27/2009 1600

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)-SPLP East

Method:	8270C	Analysis Batch: 660-79940	Instrument ID:	BSMC5973
Preparation:	3520C	Prep Batch: 660-79795	Lab File ID:	1CF01020.D
Dilution:	1.0	Leachate Batch: 660-79766	Initial Weight/Volume:	940 mL
Date Analyzed:	06/01/2009 1639		Final Weight/Volume:	1 mL
Date Prepared:	05/29/2009 1519		Injection Volume:	1.0 uL
Date Leached:	05/29/2009 1150			

Analyte	DryWt Corrected: N Result (ug/L)	Qualifier	MDL	PQL
Benzo[g,h,i]perylene	1.2	U	1.2	11
2-Chlorophenol	2.2	U J3	2.2	11
2-Nitrophenol	1.3	U	1.3	11
2,4-Dimethylphenol	1.9	U	1.9	11
2,4-Dichlorophenol	1.9	U	1.9	11
2,4,6-Trichlorophenol	2.0	U	2.0	11
4-Chloro-3-methylphenol	1.8	U J3	1.8	11
2,4-Dinitrophenol	6.6	U	6.6	53
4,6-Dinitro-2-methylphenol	1.6	U	1.6	53
Pentachlorophenol	4.0	I V J3	1.6	16
4-Nitrophenol	6.6	U	6.6	53
Benzyl alcohol	3.1	U	3.1	11
2-Methylphenol	2.4	U	2.4	11
Benzoic acid	13	U	13	53
4-Chloroaniline	2.2	U	2.2	21
2-Methylnaphthalene	1.7	U	1.7	11
2,4,5-Trichlorophenol	2.2	U	2.2	11
2-Nitroaniline	1.5	U	1.5	53
3-Nitroaniline	1.3	U	1.3	53
Dibenzofuran	1.7	U	1.7	11
4-Nitroaniline	1.5	U	1.5	53
3 & 4 Methylphenol	2.6	U	2.6	11
1-Methylnaphthalene	1.4	U	1.4	11

Surrogate	%Rec	Acceptance Limits
2-Fluorophenol	56	29 - 121
Nitrobenzene-d5	68	34 - 130
Phenol-d5	51	25 - 128
2-Fluorobiphenyl	57	36 - 124
Terphenyl-d14	32	14 - 148
2,4,6-Tribromophenol	65	29 - 143

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Client Sample ID: **Grey Film**

Lab Sample ID:	640-22156-1	Date Sampled:	05/21/2009 0000
Client Matrix:	Solid	Date Received:	05/27/2009 1600

8141A Organophosphorous Pesticides (GC)-SPLP East

Method:	8141A	Analysis Batch: 660-80091	Instrument ID:	HP 6890 NPD/NPD
Preparation:	3520C	Prep Batch: 660-79793	Lab File ID:	1F02R024.D
Dilution:	1.0	Leachate Batch: 660-79766	Initial Weight/Volume:	500 mL
Date Analyzed:	06/03/2009 0225		Final Weight/Volume:	1 mL
Date Prepared:	05/29/2009 1515		Injection Volume:	4 uL
Date Leached:	05/29/2009 1150		Column ID:	PRIMARY

Analyte	DryWt Corrected: N Result (mg/L)	Qualifier	MDL	PQL
Azinphos-methyl	0.0018	U	0.0018	0.010
Bolstar	0.0025	U	0.0025	0.010
Chlorpyrifos	0.0025	U	0.0025	0.010
Coumaphos	0.0025	U	0.0025	0.010
Demeton-O	0.0014	U	0.0014	0.025
Diazinon	0.0025	U	0.0025	0.010
Dichlorvos	0.0015	U	0.0015	0.020
Dimethoate	0.0012	U	0.0012	0.020
Disulfoton	0.0018	U	0.0018	0.020
EPN	0.0015	U	0.0015	0.010
Ethion	0.0010	U	0.0010	0.0050
Mocap	0.0010	U	0.0010	0.0050
Ethyl Parathion	0.0025	U	0.0025	0.010
Fensulfothion	0.0025	U	0.0025	0.050
Fenthion	0.0025	U	0.0025	0.010
Malathion	0.0025	U	0.0025	0.010
Merphos	0.00096	U	0.00096	0.010
Methyl parathion	0.0011	U J3	0.0011	0.0050
Mevinphos	0.0025	U	0.0025	0.020
Monochrotophos	0.020	U	0.020	0.10
Naled	0.010	U	0.010	0.050
Phorate	0.0020	U	0.0020	0.010
Ronnel	0.0025	U	0.0025	0.010
Stirophos	0.0025	U	0.0025	0.010
Sulfotepp	0.00092	U	0.00092	0.0050
Tokuthion	0.0025	U	0.0025	0.010
Trichloronate	0.0025	U	0.0025	0.010

Surrogate	%Rec	Acceptance Limits
Triphenylphosphate	50	16 - 164

Analytical Data

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Client Sample ID: **Black Rubber**

Lab Sample ID:	640-22156-2	Date Sampled:	05/21/2009 0000
Client Matrix:	Solid	Date Received:	05/27/2009 1600

8141A Organophosphorous Pesticides (GC)-SPLP East

Method:	8141A	Analysis Batch: 660-80091	Instrument ID: HP 6890 NPD/NPD
Preparation:	3520C	Prep Batch: 660-79793	Lab File ID: 1F02R026.D
Dilution:	1.0	Leachate Batch: 660-79766	Initial Weight/Volume: 500 mL
Date Analyzed:	06/03/2009 0315		Final Weight/Volume: 1 mL
Date Prepared:	05/29/2009 1515		Injection Volume: 4 uL
Date Leached:	05/29/2009 1150		Column ID: PRIMARY

Analyte	DryWt Corrected: N Result (mg/L)	Qualifier	MDL	PQL
Azinphos-methyl	0.0018	U	0.0018	0.010
Bolstar	0.0025	U	0.0025	0.010
Chlorpyrifos	0.0025	U	0.0025	0.010
Coumaphos	0.0025	U	0.0025	0.010
Demeton-O	0.0014	U	0.0014	0.025
Diazinon	0.0025	U	0.0025	0.010
Dichlorvos	0.0015	U	0.0015	0.020
Dimethoate	0.0012	U	0.0012	0.020
Disulfoton	0.0018	U	0.0018	0.020
EPN	0.0015	U	0.0015	0.010
Ethion	0.0010	U	0.0010	0.0050
Mocap	0.0010	U	0.0010	0.0050
Ethyl Parathion	0.0025	U	0.0025	0.010
Fensulfothion	0.0025	U	0.0025	0.050
Fenthion	0.0025	U	0.0025	0.010
Malathion	0.0025	U	0.0025	0.010
Merphos	0.00096	U	0.00096	0.010
Methyl parathion	0.0011	U	0.0011	0.0050
Mevinphos	0.0025	U	0.0025	0.020
Monochrotophos	0.020	U	0.020	0.10
Naled	0.010	U	0.010	0.050
Phorate	0.0020	U	0.0020	0.010
Ronnel	0.0025	U	0.0025	0.010
Stirophos	0.0025	U	0.0025	0.010
Sulfotepp	0.00092	U	0.00092	0.0050
Tokuthion	0.0025	U	0.0025	0.010
Trichloronate	0.0025	U	0.0025	0.010

Surrogate	%Rec	Acceptance Limits
Triphenylphosphate	68	16 - 164

Client:	Southern Waste Information eXchange, Inc	Job Number:	640-22156-1

Client Sample ID: **Grey Film**

Lab Sample ID:	640-22156-1	Date Sampled:	05/21/2009 0000
Client Matrix:	Solid	Date Received:	05/27/2009 1600

8151A Herbicides (GC)-SPLP East

Method:	8151A	Analysis Batch: 660-80013	Instrument ID:	AGILENT GC ECD/ECD
Preparation:	8151A	Prep Batch: 660-79777	Lab File ID:	1F02J064.D
Dilution:	1.0	Leachate Batch: 660-79766	Initial Weight/Volume:	500 mL
Date Analyzed:	06/03/2009 0755		Final Weight/Volume:	5 mL
Date Prepared:	05/29/2009 1310		Injection Volume:	2 uL
Date Leached:	05/29/2009 1150		Column ID:	PRIMARY

Analyte	DryWt Corrected: N Result (mg/L)	Qualifier	MDL	PQL
2,4,5-T	0.0050	U	0.0050	0.025
2,4-D	0.00038	U	0.00038	0.0012
2,4-DB	0.0050	U	0.0050	0.025
Dalapon	0.12	U	0.12	0.60
Dicamba	0.0012	U	0.0012	0.0060
Dichlorprop	0.0050	U	0.0050	0.030
Dinoseb	0.0050	U	0.0050	0.030
MCPA	0.17	U	0.17	0.60
MCPP	0.18	U	0.18	0.60
Pentachlorophenol	0.00042	U	0.00042	0.0050
Picloram	0.0050	U	0.0050	0.025
Silvex (2,4,5-TP)	0.000080	U	0.000080	0.0012

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	49	33 - 120

Analytical Data

Client: Southern Waste Information eXchange, Inc　Job Number: 640-22156-1

Client Sample ID: Black Rubber

Lab Sample ID:	640-22156-2	Date Sampled:	05/21/2009 0000
Client Matrix:	Solid	Date Received:	05/27/2009 1600

8151A Herbicides (GC)-SPLP East

Method:	8151A	Analysis Batch: 660-80013		Instrument ID:	AGILENT GC ECD/ECD
Preparation:	8151A	Prep Batch: 660-79777		Lab File ID:	1F02J065.D
Dilution:	1.0	Leachate Batch: 660-79766		Initial Weight/Volume:	500 mL
Date Analyzed:	06/03/2009 0810			Final Weight/Volume:	5 mL
Date Prepared:	05/29/2009 1310			Injection Volume:	2 uL
Date Leached:	05/29/2009 1150			Column ID:	PRIMARY

Analyte	DryWt Corrected: N Result (mg/L)	Qualifier	MDL	PQL
2,4,5-T	0.0050	U	0.0050	0.025
2,4-D	0.00038	U	0.00038	0.0012
2,4-DB	0.0050	U	0.0050	0.025
Dalapon	0.12	U	0.12	0.60
Dicamba	0.0012	U	0.0012	0.0060
Dichlorprop	0.0050	U	0.0050	0.030
Dinoseb	0.0050	U	0.0050	0.030
MCPA	0.17	U	0.17	0.60
MCPP	0.18	U	0.18	0.60
Pentachlorophenol	0.00042	U	0.00042	0.0050
Picloram	0.0050	U	0.0050	0.025
Silvex (2,4,5-TP)	0.000080	U	0.000080	0.0012

Surrogate	%Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	61	33 - 120

DATA REPORTING QUALIFIERS

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Lab Section	Qualifier	Description
GC/MS Semi VOA		
	J3	Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria.
	U	Indicates that the compound was analyzed for but not detected.
	V	Indicates the analyte was detected in both the sample and the associated method blank.
	I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
GC Semi VOA		
	J3	Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria.
	U	Indicates that the compound was analyzed for but not detected.
	L	Off-scale high. Actual value is known to be greater than the value given.
	I	The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

QUALITY CONTROL RESULTS

Surrogate Recovery Report

8270C Semivolatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)

Client Matrix: Solid SPLP East

Lab Sample ID	Client Sample ID	2FP %Rec	NBZ %Rec	PHL %Rec	FBP %Rec	TPH %Rec	TBP %Rec
640-22156-1	Grey Film	41	44	37	38	19	47
640-22156-2	Black Rubber	56	68	51	57	32	65
MB 660-79795/1-A		65	83	54	72	73	72
LCS 660-79795/2-A		64	99	50	85	72	93
LCSD 660-79795/3-A		90	101	76	85	73	91
640-22156-2 MS	Black Rubber MS	59	63	50	58	33	60

Surrogate	Acceptance Limits
2FP = 2-Fluorophenol	29-121
NBZ = Nitrobenzene-d5	34-130
PHL = Phenol-d5	25-128
FBP = 2-Fluorobiphenyl	36-124
TPH = Terphenyl-d14	14-148
TBP = 2,4,6-Tribromophenol	29-143

Surrogate Recovery Report

8141A Organophosphorous Pesticides (GC)

Client Matrix: Solid SPLP East

Lab Sample ID	Client Sample ID	TPP1 %Rec	TPP2 %Rec
640-22156-1	Grey Film		50
640-22156-2	Black Rubber	68	
MB 660-79793/1-A		96L	
LCS 660-79793/2-A			50
LCSD 660-79793/3-A			55
640-22156-1 MS	Grey Film MS		36

Surrogate	Acceptance Limits
TPP = Triphenylphosphate	16-164

Surrogate Recovery Report

8151A Herbicides (GC)

Client Matrix: Solid SPLP East

Lab Sample ID	Client Sample ID	DCPA1 %Rec	DCPA2 %Rec
640-22156-1	Grey Film		49
640-22156-2	Black Rubber		61
MB 660-79777/1-A		75	
LCS 660-79777/2-A		60	
LCSD 660-79777/3-A		56	
640-22156-2 MS	Black Rubber MS	67	

Surrogate	Acceptance Limits
DCPA = 2,4-Dichlorophenylacetic acid	33-120

Method Blank - Batch: 660-79795

Method: 8270C
Preparation: 3520C

Lab Sample ID: MB 660-79795/1-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 06/01/2009 1517
Date Prepared: 05/29/2009 1519

Analysis Batch: 660-79940
Prep Batch: 660-79795
Units: ug/L

Instrument ID: BSMC5973
Lab File ID: 1CF01016.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Result	Qual	MDL	PQL
1,3-Dichlorobenzene	1.1	U	1.1	10
N-Nitrosodimethylamine	2.4	U	2.4	10
Phenol	2.4	U	2.4	4.0
1,4-Dichlorobenzene	1.2	U	1.2	10
Hexachloroethane	0.85	U	0.85	10
Bis(2-chloroethyl)ether	2.6	U	2.6	10
1,2-Dichlorobenzene	1.1	U	1.1	10
2,2'-oxybis(2-chloropropane)	2.1	U	2.1	10
N-Nitrosodi-n-propylamine	1.9	U	1.9	10
Nitrobenzene	1.9	U	1.9	10
Hexachlorobutadiene	1.0	U	1.0	10
1,2,4-Trichlorobenzene	1.2	U	1.2	10
Isophorone	1.4	U	1.4	10
Naphthalene	1.3	U	1.3	10
Bis(2-chloroethoxy)methane	2.0	U	2.0	10
Hexachlorocyclopentadiene	1.2	U	1.2	10
2-Chloronaphthalene	1.6	U	1.6	10
Acenaphthylene	1.8	U	1.8	10
Acenaphthene	1.5	U	1.5	10
Dimethyl phthalate	2.5	U	2.5	10
2,6-Dinitrotoluene	0.72	U	0.72	10
Fluorene	1.7	U	1.7	10
4-Chlorophenyl phenyl ether	1.8	U	1.8	10
2,4-Dinitrotoluene	0.91	U	0.91	10
Diethyl phthalate	2.5	U	2.5	10
N-Nitrosodiphenylamine	1.6	U	1.6	10
Hexachlorobenzene	1.7	U	1.7	4.0
4-Bromophenyl phenyl ether	1.7	U	1.7	10
Phenanthrene	1.3	U	1.3	10
Anthracene	1.0	U	1.0	10
Di-n-butyl phthalate	2.5	U	2.5	10
Fluoranthene	1.2	U	1.2	10
Pyrene	1.2	U	1.2	10
Butyl benzyl phthalate	1.2	U	1.2	10
Bis(2-ethylhexyl) phthalate	1.3	U	1.3	6.0
Chrysene	1.2	U	1.2	10
Benzo[a]anthracene	1.6	U	1.6	10
3,3'-Dichlorobenzidine	1.6	U	1.6	20
Di-n-octyl phthalate	2.5	U	2.5	10
Benzo[b]fluoranthene	1.6	U	1.6	10
Benzo[k]fluoranthene	1.3	U	1.3	10

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Method Blank - Batch: 660-79795

Method: 8270C
Preparation: 3520C

Lab Sample ID: MB 660-79795/1-A
Client Matrix: Water
Dilution: 1.0
Date Analyzed: 06/01/2009 1517
Date Prepared: 05/29/2009 1519

Analysis Batch: 660-79940
Prep Batch: 660-79795
Units: ug/L

Instrument ID: BSMC5973
Lab File ID: 1CF01016.D
Initial Weight/Volume: 1000 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Result	Qual	MDL	PQL
Benzo[a]pyrene	0.99	U	0.99	4.0
Indeno[1,2,3-cd]pyrene	1.2	U	1.2	10
Dibenz(a,h)anthracene	1.0	U	1.0	10
Benzo[g,h,i]perylene	1.1	U	1.1	10
2-Chlorophenol	2.1	U	2.1	10
2-Nitrophenol	1.2	U	1.2	10
2,4-Dimethylphenol	1.8	U	1.8	10
2,4-Dichlorophenol	1.8	U	1.8	10
2,4,6-Trichlorophenol	1.9	U	1.9	10
4-Chloro-3-methylphenol	1.7	U	1.7	10
2,4-Dinitrophenol	6.2	U	6.2	50
4,6-Dinitro-2-methylphenol	1.5	U	1.5	50
Pentachlorophenol	2.1	I	1.5	15
4-Nitrophenol	6.2	U	6.2	50
Benzyl alcohol	2.9	U	2.9	10
2-Methylphenol	2.3	U	2.3	10
Benzoic acid	12	U	12	50
4-Chloroaniline	2.1	U	2.1	20
2-Methylnaphthalene	1.6	U	1.6	10
2,4,5-Trichlorophenol	2.1	U	2.1	10
2-Nitroaniline	1.4	U	1.4	50
3-Nitroaniline	1.2	U	1.2	50
Dibenzofuran	1.6	U	1.6	10
4-Nitroaniline	1.4	U	1.4	50
3 & 4 Methylphenol	2.4	U	2.4	10
1-Methylnaphthalene	1.3	U	1.3	10

Surrogate	% Rec	Acceptance Limits
2-Fluorophenol	65	29 - 121
Nitrobenzene-d5	83	34 - 130
Phenol-d5	54	25 - 128
2-Fluorobiphenyl	72	36 - 124
Terphenyl-d14	73	14 - 148
2,4,6-Tribromophenol	72	29 - 143

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 660-79795

Method: 8270C
Preparation: 3520C

LCS Lab Sample ID:	LCS 660-79795/2-A	Analysis Batch:	660-79940	Instrument ID:	BSMC5973
Client Matrix:	Water	Prep Batch:	660-79795	Lab File ID:	1CF02029.D
Dilution:	2.0	Units:	ug/L	Initial Weight/Volume:	1000 mL
Date Analyzed:	06/02/2009 2201			Final Weight/Volume:	1 mL
Date Prepared:	05/29/2009 1519			Injection Volume:	1.0 uL

LCSD Lab Sample ID:	LCSD 660-79795/3-A	Analysis Batch:	660-79940	Instrument ID:	BSMC5973
Client Matrix:	Water	Prep Batch:	660-79795	Lab File ID:	1CF03031.D
Dilution:	2.0	Units:	ug/L	Initial Weight/Volume:	1000 mL
Date Analyzed:	06/03/2009 2207			Final Weight/Volume:	1 mL
Date Prepared:	05/29/2009 1519			Injection Volume:	1.0 uL

	% Rec.						
Analyte	LCS	LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Phenol	111	89	33 - 122	21	36		
1,4-Dichlorobenzene	191	111	27 - 130	52	31	J3	J3
N-Nitrosodi-n-propylamine	224	119	31 - 138	56	30	J3	J3
1,2,4-Trichlorobenzene	198	105	28 - 110	59	28	J3	J3
Acenaphthene	205	103	36 - 121	64	35	J3	J3
2,4-Dinitrotoluene	208	104	37 - 129	60	32	J3	J3
Pyrene	230	115	31 - 139	61	42	J3	J3
2-Chlorophenol	206	121	38 - 115	52	34	J3	J3
4-Chloro-3-methylphenol	224	118	34 - 126	57	31	J3	J3
Pentachlorophenol	180	97	19 - 148	38	33	J3	J3
4-Nitrophenol	101	74	12 - 143	16	44		

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Matrix Spike - Batch: 660-79795

Method: 8270C
Preparation: 3520C
SPLP East

Lab Sample ID: 640-22156-2
Client Matrix: Solid
Dilution: 1.0
Date Analyzed: 06/01/2009 1659
Date Prepared: 05/29/2009 1519
Date Leached: 05/29/2009 1150

Analysis Batch: 660-79940
Prep Batch: 660-79795
Units: ug/L
Leachate Batch: 660-79766

Instrument ID: BSMC5973
Lab File ID: 1CF01021.D
Initial Weight/Volume: 1055 mL
Final Weight/Volume: 1 mL
Injection Volume: 1.0 uL

Analyte	Sample Result/Qual		Spike Amount	Result	% Rec.	Limit	Qual
Phenol	2.6	U	94.8	46.6	49	33 - 122	
1,4-Dichlorobenzene	1.3	U	47.4	29.5	62	27 - 130	
N-Nitrosodi-n-propylamine	2.0	U	47.4	31.4	66	31 - 138	
1,2,4-Trichlorobenzene	1.3	U	47.4	27.6	58	28 - 110	
Acenaphthene	1.6	U	47.4	27.2	57	36 - 121	
2,4-Dinitrotoluene	0.97	U	47.4	27.3	58	37 - 129	
Pyrene	1.3	U	47.4	29.1	61	31 - 139	
2-Chlorophenol	2.2	U	94.8	61.3	65	38 - 115	
4-Chloro-3-methylphenol	1.8	U	94.8	56.0	59	34 - 126	
Pentachlorophenol	4.0	I	94.8	47.5	46	19 - 148	
4-Nitrophenol	6.6	U	94.8	38.7	41	12 - 143	

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Method Blank - Batch: 660-79793

Method: 8141A
Preparation: 3520C

Lab Sample ID: MB 660-79793/1-A	Analysis Batch: 660-80091	Instrument ID: HP 6890 NPD/NPD	
Client Matrix: Water	Prep Batch: 660-79793	Lab File ID: 1F02R021.D	
Dilution: 1.0	Units: mg/L	Initial Weight/Volume: 500 mL	
Date Analyzed: 06/03/2009 0111		Final Weight/Volume: 1 mL	
Date Prepared: 05/29/2009 1515		Injection Volume: 4 uL	
		Column ID: PRIMARY	

Analyte	Result	Qual	MDL	PQL
Azinphos-methyl	0.0018	U	0.0018	0.010
Bolstar	0.0025	U	0.0025	0.010
Chlorpyrifos	0.0025	U	0.0025	0.010
Coumaphos	0.0025	U	0.0025	0.010
Demeton-O	0.0014	U	0.0014	0.025
Diazinon	0.0025	U	0.0025	0.010
Dichlorvos	0.0015	U	0.0015	0.020
Dimethoate	0.0012	U	0.0012	0.020
Disulfoton	0.0018	U	0.0018	0.020
EPN	0.0015	U	0.0015	0.010
Ethion	0.0010	U	0.0010	0.0050
Mocap	0.0010	U	0.0010	0.0050
Ethyl Parathion	0.0025	U	0.0025	0.010
Fensulfothion	0.0025	U	0.0025	0.050
Fenthion	0.0025	U	0.0025	0.010
Malathion	0.0025	U	0.0025	0.010
Merphos	0.00096	U	0.00096	0.010
Methyl parathion	0.0011	U	0.0011	0.0050
Mevinphos	0.0025	U	0.0025	0.020
Monochrotophos	0.020	U	0.020	0.10
Naled	0.010	U	0.010	0.050
Phorate	0.0020	U	0.0020	0.010
Ronnel	0.0025	U	0.0025	0.010
Stirophos	0.0025	U	0.0025	0.010
Sulfotepp	0.00092	U	0.00092	0.0050
Tokuthion	0.0025	U	0.0025	0.010
Trichloronate	0.0025	U	0.0025	0.010

Surrogate	% Rec		Acceptance Limits
Triphenylphosphate	96	L	16 - 164

Calculations are performed before rounding to avoid round-off errors in calculated results.

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 660-79793

Method: 8141A
Preparation: 3520C

LCS Lab Sample ID: LCS 660-79793/2-A	Analysis Batch: 660-80091	Instrument ID:	HP 6890 NPD/NPD
Client Matrix: Water	Prep Batch: 660-79793	Lab File ID:	1F02R022.D
Dilution: 1.0	Units: mg/L	Initial Weight/Volume:	500 mL
Date Analyzed: 06/03/2009 0136		Final Weight/Volume:	1 mL
Date Prepared: 05/29/2009 1515		Injection Volume:	4 uL
		Column ID:	PRIMARY

LCSD Lab Sample ID: LCSD 660-79793/3-A	Analysis Batch: 660-80091	Instrument ID:	HP 6890 NPD/NPD
Client Matrix: Water	Prep Batch: 660-79793	Lab File ID:	1F02R023.D
Dilution: 1.0	Units: mg/L	Initial Weight/Volume:	500 mL
Date Analyzed: 06/03/2009 0200		Final Weight/Volume:	1 mL
Date Prepared: 05/29/2009 1515		Injection Volume:	4 uL
		Column ID:	PRIMARY

Analyte	% Rec. LCS	LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
Diazinon	63	72	37 - 121	13	40	I	I
Ethyl Parathion	75	85	28 - 155	13	34	I	I
Methyl parathion	40	45	38 - 149	11	40	I	I
Ronnel	36	49	30 - 130	33	35	I	I

Matrix Spike - Batch: 660-79793

Method: 8141A
Preparation: 3520C
SPLP East

Lab Sample ID: 640-22156-1	Analysis Batch: 660-80091	Instrument ID:	HP 6890 NPD/NPD
Client Matrix: Solid	Prep Batch: 660-79793	Lab File ID:	1F02R025.D
Dilution: 1.0	Units: mg/L	Initial Weight/Volume:	500 mL
Date Analyzed: 06/03/2009 0250		Final Weight/Volume:	1 mL
Date Prepared: 05/29/2009 1515		Injection Volume:	4 uL
Date Leached: 05/29/2009 1150	Leachate Batch: 660-79766	Column ID:	PRIMARY

Analyte	Sample Result/Qual		Spike Amount	Result	% Rec.	Limit	Qual
Diazinon	0.0025	U	0.0100	0.00443	44	37 - 121	I
Ethyl Parathion	0.0025	U	0.0100	0.00650	65	28 - 155	I
Methyl parathion	0.0011	U	0.0100	0.00358	36	38 - 149	I J3
Ronnel	0.0025	U	0.0100	0.00387	39	30 - 130	I

Calculations are performed before rounding to avoid round-off errors in calculated results.

Quality Control Results

Client: Southern Waste Information eXchange, Inc

Job Number: 640-22156-1

Method Blank - Batch: 660-79777

Method: 8151A
Preparation: 8151A

Lab Sample ID:	MB 660-79777/1-A	Analysis Batch:	660-80013	Instrument ID:	AGILENT GC ECD/ECD
Client Matrix:	Water	Prep Batch:	660-79777	Lab File ID:	1F02J060.D
Dilution:	1.0	Units:	mg/L	Initial Weight/Volume:	500 mL
Date Analyzed:	06/03/2009 0652			Final Weight/Volume:	5 mL
Date Prepared:	05/29/2009 1310			Injection Volume:	2 uL
				Column ID:	PRIMARY

Analyte	Result	Qual	MDL	PQL
2,4,5-T	0.0050	U	0.0050	0.025
2,4-D	0.00038	U	0.00038	0.0012
2,4-DB	0.0050	U	0.0050	0.025
Dalapon	0.12	U	0.12	0.60
Dicamba	0.0012	U	0.0012	0.0060
Dichlorprop	0.0050	U	0.0050	0.030
Dinoseb	0.0050	U	0.0050	0.030
MCPA	0.17	U	0.17	0.60
MCPP	0.18	U	0.18	0.60
Pentachlorophenol	0.00042	U	0.00042	0.0050
Picloram	0.0050	U	0.0050	0.025
Silvex (2,4,5-TP)	0.000080	U	0.000080	0.0012

Surrogate	% Rec	Acceptance Limits
2,4-Dichlorophenylacetic acid	75	33 - 120

Calculations are performed before rounding to avoid round-off errors in calculated results.

Lab Control Sample/
Lab Control Sample Duplicate Recovery Report - Batch: 660-79777

Method: 8151A
Preparation: 8151A

LCS Lab Sample ID: LCS 660-79777/2-A	Analysis Batch: 660-80013	Instrument ID:	AGILENT GC ECD/ECD
Client Matrix: Water	Prep Batch: 660-79777	Lab File ID:	1F02J061.D
Dilution: 4.0	Units: mg/L	Initial Weight/Volume:	500 mL
Date Analyzed: 06/03/2009 0707		Final Weight/Volume:	5 mL
Date Prepared: 05/29/2009 1310		Injection Volume:	2 uL
		Column ID:	PRIMARY

LCSD Lab Sample ID: LCSD 660-79777/3-A	Analysis Batch: 660-80013	Instrument ID:	AGILENT GC ECD/ECD
Client Matrix: Water	Prep Batch: 660-79777	Lab File ID:	1F02J062.D
Dilution: 4.0	Units: mg/L	Initial Weight/Volume:	500 mL
Date Analyzed: 06/03/2009 0723		Final Weight/Volume:	5 mL
Date Prepared: 05/29/2009 1310		Injection Volume:	2 uL
		Column ID:	PRIMARY

	% Rec.						
Analyte	LCS	LCSD	Limit	RPD	RPD Limit	LCS Qual	LCSD Qual
2,4,5-T	74	70	15 - 155	5	48		
2,4-D	75	70	10 - 166	7	78		
Silvex (2,4,5-TP)	73	71	25 - 139	3	66		

Matrix Spike - Batch: 660-79777

Method: 8151A
Preparation: 8151A
SPLP East

Lab Sample ID: 640-22156-2	Analysis Batch: 660-80013	Instrument ID:	AGILENT GC ECD/ECD
Client Matrix: Solid	Prep Batch: 660-79777	Lab File ID:	1F02J066.D
Dilution: 4.0	Units: mg/L	Initial Weight/Volume:	500 mL
Date Analyzed: 06/03/2009 0826		Final Weight/Volume:	5 mL
Date Prepared: 05/29/2009 1310		Injection Volume:	2 uL
Date Leached: 05/29/2009 1150	Leachate Batch: 660-79766	Column ID:	PRIMARY

Analyte	Sample Result/Qual		Spike Amount	Result	% Rec.	Limit	Qual
2,4,5-T	0.0050	U	0.0100	0.020	74		
2,4-D	0.00038	U	0.0100	0.00739	74	10 - 166	
Silvex (2,4,5-TP)	0.000080	U	0.0100	0.00737	74	25 - 139	

Calculations are performed before rounding to avoid round-off errors in calculated results.

TestAmerica Tallahassee
2846 Industrial [illegible] Drive
Tallahassee, FL 32301
Phone (850) 878-3994 Fax (850) 878-9504

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler:	Lab PM:	Carrier Tracking No(s):	COC No: 640-
Client Contact: GENE JONES	Phone:	E-Mail:		Page:

Company: SOUTHERN WASTE INFORMATION EXCHANGE, INC
Address: P.O. BOX 960
City: TALLAHASSEE
State, Zip: FL 32302
Phone: 800-441-7949
Email:
Project Name: AG FILM
Site: AG FILM

Due Date Requested:
TAT Requested (days): REG.
PO #:
WO#:
Project #:
SSOW#:

Job #: 640-22156

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2SO3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - ph 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)			SPLP-8270, 8141, 8151	Special Instructions/Note:
				Preservation Code:	X	X		
GREY FILM	5/21/09			S			X	
BLACK RUBBER	5/21/09			S			X	

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐ Radiological

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ________ Months

Deliverable Requested: I, II, III, IV, Other (specify)
Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company	Received by:	Date/Time: 5/27/09 1600	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company

Custody Seals Intact: △ Yes △ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks:

Appendix F:
Tables

Table 1

AgFilm Data Summary - SPLP East Samples (May 21, 2009)

Analysis Category	Sample ID	Date	Analyte	Reported Concentration	Units	Reported PQL	Sample Qualifier
Method 8270C			***Semivolatile Compounds by GC/MS***				
	Grey Film	5/21/09	Diethyl phthalate	14	ug/L	9.5	Not Given
			4-chloro-3-methylphenol	9.1	ug/L	9.5	I, J3
			Pentachlorophenol	28	ug/L	14	V, J3
	Black Rubber Drip Tube	5/21/09	Pentachlorophenol	4	ug/L	16	I, V, J3
Method 8141A			***Organophosphorous Pesticides***				
	Grey Film	5/21/09	All results were Below Reported PQL (U)	U		various	
	Black Rubber Drip Tube	5/21/09	All results were Below Reported PQL (U)	U		various	
Method 8151A			***Herbicides***				
	Grey Film	5/21/09	All results were Below Reported PQL (U)	U		various	
	Black Rubber Drip Tube	5/21/09	All results were Below Reported PQL (U)	U		various	

Notes

J3 = Estimated value; value may not be accurate. Spike recovery or RPD outside of criteria.
V = Indicates the analyte was detected in both the sample and the associated method blank.
I = The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.
U = Indicates that the compound was analyzed for but not detected

Table 2

AgFilm Data Summary - SPLP East Samples (July 12, 2009)

Analysis Category	Sample ID	Date	Analyte	Reported Concentration	Units	Reported PQL	Sample Qualifier
Method 8270C			*Semivolatile Compounds by GC/MS*				
	Ag Film	7/12/09	All results were Below Reported PQL (U)	U	ug/L	various	
	Drip Tube	7/12/09	Phenol	6.8	ug/L	8	I
			Diethyl phthalate	14	ug/L	20	I
			4-chloro-3-methylphenol	16	ug/L	20	I
			3 & 4-methylphenol	72	ug/L	20	
Method 8141A			*Organophosphorous Pesticides*				
	Ag Film	7/12/09	All results were Below Reported PQL (U)	U		various	
	Drip Tube	7/12/09	All results were Below Reported PQL (U)	U		various	
Method 8151A			*Herbicides*				
	Ag Film	7/12/09	All results were Below Reported PQL (U)	U		various	
	Drip Tube	7/12/09	All results were Below Reported PQL (U)	U		various	

Notes

I = The reported value is between the laboratory method detection limit and the laboratory practical quantitation limit.

U = Indicates that the compound was analyzed for but not detected

Table 3

Summary of Harvested Acres of Tomatoes in Florida by County and Corresponding Ag Film Production Potential

County	Harvested Acres*	Potential Quantity of Ag Film Production per year (in Pounds)**	% by Weight
Manatee	16,576	33,152,000	40.99%
Collier	5,913	11,826,000	14.62%
Hillsborough	5,522	11,044,000	13.66%
Miami-Dade	3,667	7,334,000	9.07%
Palm Beach	2,684	5,368,000	6.64%
Hendry	1,827	3,654,000	4.52%
Gadsden	919	1,838,000	2.27%
Hardee	202	404,000	0.50%
Jackson	142	284,000	0.35%
Total of all other Counties under 100 acres each of harvested tomatoes	2,985	5,970,000	7.38%
Totals	40,437	80,874,000	100.00%

* Source of Harvested Acres: Florida Department of Agriculture & Consumer Services

** Based on two plantings of tomato crops per year

Table 4

Summary of Harvested Acres of Strawberries in Florida by County and Corresponding Ag Film Production Potential

County	Harvested Acres*	Potential Quantity of Ag Film Production per year (in pounds)	% by Weight
Hillsborough	5,787	5,787,000	88.51%
Okaloosa	71	71,000	1.09%
DeSoto	21	21,000	0.32%
Polk	18	18,000	0.28%
Baker	16	16,000	0.24%
Seminole	11	11,000	0.17%
Alachua	8	8,000	0.12%
Total of all other Counties under 8 acres each of harvested strawberries	606	606,000	9.27%
Total	6,538	6,538,000	100.00%

* Source of Harvested Acres: Florida Department of Agriculture & Consumer Services

Table 5
Summary of Container Loads

Company Name	Market	Amount (lbs)*
East-Terra Supply	Export (China)	210,000
Fresh Pak Corp.	Domestic (TX)	42,500
Manner Resins	Export (India)	127,500
Marpan Recycling	Domestic (FL)	32,000*
Mountain Valley Recycling	Domestic (TN)	127,500
Philadelphia Plastic Recycling, Inc	Export (Mexico)	127,500
Pontin SRL	Export (Romania)	42,500
Universal Commodity Services, Inc.	Export (China)	42,500
Total:		**752,000**

* Amounts rounded to nearest 500 lbs.

** Marpan Recycling took (2) 40 yd. containers of loose material (~32,000 lbs). They also took an additional 7,700 lbs of HDEP irrigation pipe.

Table 6
Summary of Sample Loads

Company Name	Market	Amount (lbs)*
AERT, Inc.	Domestic	Small Sample (5 lbs)
Commercial Plastics Recycling, Inc.	Domestic	Small Sample (5 lbs)
Delta Plastics of the South	Domestic	Small Sample (5 lbs)
GC Renewable Resource Technologies, LLC	Domestic	Small Sample (5 lbs)/ 2 Bales (3,000 lbs)
Omx Internationals LLC	Domestic	Small Sample (5 lbs)
Peninsula Equipment, Inc.	Domestic	Small Sample (5 lbs)/ 2 Bales (3,000 lbs)
Recycle-Tech Corp.	Domestic	Small Sample (5 lbs)/ 1 Bale (1,500 lbs)
Second Wind Logistics, LLC.	Export	Small Sample (5 lbs)
Skyplastic, USA	Domestic	Small Sample (5 lbs)
Sonoco	Domestic	Small Sample (5 lbs)
St Marys Cement Inc	Domestic	Small Sample (5 lbs)
Suwannee American Cement	Domestic	Small Sample (5 lbs)
Think Plastics Inc.	Export	Small Sample (5 lbs)/ 2 Bales (3,000 lbs)
United Plastic, Inc.	Domestic	Small Sample (5 lbs)
WasteZero/PMR	Domestic	Small Sample (5 lbs)/ 2 Bales (3,000 lbs)
Wexford International, LLC	Domestic	Small Sample (5 lbs)
Total:		**13,500**

Appendix G:
Cost Analysis Ag Film Hand Pull vs. Automated Pull

JWM FARMS, LLC
146 BETTSTOWN ROAD
BAINBRIDGE, GEORGIA
39819
PHONE (229)246-8192
229/254-2800
FAX 229/248-0522

Plastic Pulling on 22 acres by hand total was $3,208.77 or $145.85 an acre.

Pulling plastic with machine on 11 acres was $2,810.51 or $255.50 an acre.

Total for all plastic is $6088.96

Appendix H:
Technology Transfer Documentation

Attachment B: Alternative Fuels Emissions Data

AttB Harleyville.xls
AttB Holly Hill.xls
AttB Lafarge – Sugar Creek calcs ver2.xls
AttB LaFarge – Sugar Creek calcs.xlsx
AttB St Marys.xls
AttB – Lafarge Alt fuels projects.pdf
AttB – MDNR Lafarge Alt Fuels.doc
AttB – Lafarge – Whitehall, PA.pdf

Attachment B: Alternative Fuels Emissions Data

AttB Harleyville.xls

TARMAC, 0250020-031-AC, Request for Additional Information, Response Information 5/24/2011

EMISSIONS COMPARISON DATA

HAZARDOUS WASTE BURNING KILN

Company	Facility	Location	Kiln Type	Date Tested	Pollutants	Sample Type	Permitted Limits	Alternate Fuel Emissions	Percent Change	Alternative Fuel Composition	Alternate Fuel Type	Clinker Production	Source	Notes
Lefarge	Harleyville Plant	Harleyville, SC	Dry	10/5-7/2010, 11/5-6/2010	PM		0.23 lb/ton dry feed *	· 0.0450 lb/ton dry feed	–	On average: 11.08 ton/hr coal, 1.15 ton/hr tires, 4.59 ton/hr plastics and 9.5 L/hr oil used for fuel in HCl testing	Plastics	136.1 TPH	1	
					NO_x		4.56 lb/ton clinker	3.12 lb/ton clinker	–			136.1 TPH		
					SO_2		1.71 lb/ton linker	0.090 lb/ton clinker	–			136.1 TPH		
					CO		8.835 lb/ton clinker	6.047 lb/ton clinker	–			136.1 TPH		
					Ni		0.006 lb/mmbtu	6.32*10-6 lb/mm BTU (0.000019 lb/ton clinker)	–			136.1 TPH		
					Cd		0.00040 lb/mmbtu	1.35*10-6 lb/mm BTU (0.0000043 lb/ton clinker)	–			136.1 TPH		
					Cr		0.00074 lb/mmbtu	1.90*10-5 lb/mm BTU (0.000057 lb/ton clinker)	–			136.1 TPH		
					As		0.00017 lb/mmbtu	1.35*10-6 lb/mm BTU (0.0000037 lb/ton clinker)	–			136.1 TPH		
					Pb		0.00500 lb/mmbtu	2.67*10-6 lb/mm BTU (0.00001 lb/ton clinker)	–			136.1 TPH		
					NMVOC		(0.55 lb/ton clinker) 0.34 lb/ton dry feed *	0.110 lb/ton clinker	–			136.1 TPH		
					HCl		0.45 lb/mmbtu	1.86*10-4 lb/mm BTU (0.00059 lb/ton clinker)	–			136.1 TPH		

Sources:

1 **Emission Compliance Test Report**, prepared for Lefarge Building Materials by Air Control Techniques in December 2010

* based 1.6 ton dry feed per ton clinker

Attachment B: Alternative Fuels Emissions Data

AttB Holly Hill.xls

TARMAC, 0250020-031-AC, Request for Additional Information, Response Information 5/24/2011

EMISSIONS COMPARISON DATA

HAZARDOUS WASTE BURNING KILN

Company	Facility	Location	Kiln Type	Date Tested	Pollutants	Sample Type	Permitted Limits	Raw Mill Down Alternate Fuel Emissions	Raw Mill Up Alternate Fuel Emissions	Percent Change	Alternative Fuel Composition	Alternate Fuel Type	Clinker Production	Source	Notes
Holcim	Holly Hill Plant	Holly Hill, SC	Dry	9/29/2009 - 10/02/2009	PM*	Stack	61.0 lb/hr	22.77 lb/hr	22.73 lb/hr	–	Non-hazardous waste fuels may include, but are not limited to rubber, used oil, tires, carbon waste, wood byproducts, etc.	Coal and natural gas, hazardous waste derived fuel, non-hazardous alternate fuel	2,500,000 TPY	1	–
					THC		10 ppmv	5.4 ppmvd	5.59 ppmvd	–					
					DF		0.2 ng TEQ/dscf	0.017 ng TEQ/dscf	-	–					
					As		--	1.64 µg/dscm	0.69 µg/dscm	–					
					Be		–	<0.06 µg/dscm	<0.04 µg/dscm	–					
					Cr		–	2.47 µg/dscm	2.04 µg/dscm	–					
					LVM**		54 µg/dscm	4.14 µg/dscm	2.73 µg/dscm	–					
					Cd		–	0.48 µg/dscm	0.30 µg/dscm	–					
					Pb		--	3.10 µg/dscm	4.27 µg/dscm	–					
					SVM***		180 µg/dscm	3.59 µg/dscm	4.57 µg/dscm	–					
					Hg****		120 µg/dscm	653.4 µg/dscm****	26.3 µg/dscm****	–					
					HCl		86 ppmv	31.4 ppmvd	6.08 ppmvd	–					

*Converted from 0.004 gr/dscf assuming maximum stack flow rate of 1,200,000 acfm (see calculations below)

**Low-voltaile metals (LVM combined As, Be, Cr)

***Semi-volatile matals (SVM combined Cd and Pb)

****Time weighted avarage is 120.365 µg/dscm @ 7% O2 assuming Raw Mill Down is 15% and Raw Mill Up is 85%

Sources:

1 **Emission Compliance Test Report**, prepared for the Holcim, Holly Hill Plant

	Mill On	Mill Off
Max ACFM	1,200,000	1,200,000
Moisture (%)	16.83%	9.06%
Pressure (in Hg)	30.04	29.99
Stack Temp (F)	336.63	411.37
Max DSCFM	664,116.59	662,876.04
PM Concentration (gr/dscf)	0.004	0.004
PM Emissions (lb/hr)	22.77	22.73

Q_(s,dscf)= 〖(Q〗 _(s,acf))(1-B_ws)(((T_std+460))/((T_stack+460)
))(P_stack/29.92)

Attachment B: Alternative Fuels Emissions Data

AttB Lafarge – Sugar Creek calcs ver2.xls

correl PM to production	-0.351	correl Cr to production	0.019	correl Pb to production	0.207	correl D/F to baghouse T	0.122
correl PM to kiln coal	-0.414	correl Cr to kiln coal	0.302	correl Pb to kiln coal	0.006	correl D/F to ASF feed	0.274
correl PM to calc coal	0.121	correl Cr to calc coal	0.416	correl PM to calc coal	-0.056	correl D/F to Cl	0.300
correl PM to baghouse T	0.027	correl Cr to baghouse T	0.231	correl Pb to baghouse T	0.011		
correl PM to baghouse DP	-0.200	correl Cr to baghouse DP	0.007	correl Pb to baghouse DP	0.043		
correl PM to ASF feed	-0.122	correl Cr to ASF feed	-0.261	correl Pb to ASF feed	0.051		

correl D/F to production	0.365	correl Cd to production	0.039	correl Hg to production	-0.385
correl D/F to kiln coal	0.019	correl Cd to kiln coal	-0.078	correl Hg to kiln coal	-0.069
correl D/F to calc coal	0.334	correl Cd to calc coal	-0.315	correl Hg to calc coal	0.349
correl D/F to baghouse T	0.303	correl Cd to baghouse T	0.222	correl D/F to baghouse T	-0.102
correl D/F to baghouse DP	-0.181	correl Cd to baghouse DP	-0.115	correl D/F to baghouse DP	0.128
correl D/F to ASF feed	-0.368	correl Cd to ASF feed	0.196	correl D/F to ASF feed	-0.280

Attachment B: Alternative Fuels Emissions Data

AttB LaFarge – Sugar Creek calcs.xlsx

Attachment B: Alternative Fuels Emissions Data

AttB St Marys.xls

TARMAC, 0250020-031-AC, Request for Additional Information, Response Information 5/24/2011

EMISSIONS COMPARISON DATA

SHINGLES

Company	Facility	Location	Kiln Type	Date Tested	Pollutants	Sample Type	Baseline Emissions	Alternate Fuel Emissions	Percent Change	Alternative Fuel Composition	Alternate Fuel Type	Clinker Production	Source	Notes
St. Mary's Cement		Lansing, MI	Dry		NO_x	CEM	361.32 ppm	341.40 ppm	-5.51%	2.5 TPH Shingles	Shingles		1	
					CO	CEM	1594.75 ppm	1204.85 ppm	-24.45%					
					SO_2	CEM	502.57 ppm	334.22 ppm	-33.50%					
					NO_x	CEM	361.32 ppm	335.93 ppm	-7.03%	3 TPH Shingles				
					CO	CEM	1594.75 ppm	1125.38 ppm	-29.43%					
					SO_2	CEM	502.57 ppm	419.75 ppm	-16.48%					
					NO_x	CEM	361.32 ppm	343.40 ppm	-4.96%	3.6 TPH Shingles				
					CO	CEM	1594.75 ppm	1089.61 ppm	-31.67%					
					SO_2	CEM	502.57 ppm	380.73 ppm	-24.24%					

Sources:

1 ***Report to MDEQ on PTI 238-09***, prepared for MDEQ by St. Mary's Cement

Attachment B: Alternative Fuels Emissions Data

AttB – Lafarge Alt fuels projects.pdf

Using Alternate Fuels at Sugar Creek, Missouri

MORA 2007
10th ANNUAL CONFERENCE
GROWING TO SUSTAIN THE NEXT GENERATION

June 6, 2007

SYSTECH Systech Environmental Corporation

LAFARGE NORTH AMERICA

Welcome. Your presenters are:

Bernie Sabbert, Systech - Technical Sales Representative

Steve Kidwell, Lafarge - Environmental & Public Affairs Manager

Kurt Gerdes, Lafarge - Director Resource Recovery

Who Is Lafarge?

- **World Leader in building materials**

Cement & Roofing	No. 1 Worldwide
Aggregates & Concrete	No. 2 Worldwide
Gypsum	No. 3 Worldwide

- **>70,000 employees worldwide**
- **~15,300 employees in North America**
- **www.lafarge.com**

Who Is Systech Environmental Corporation?

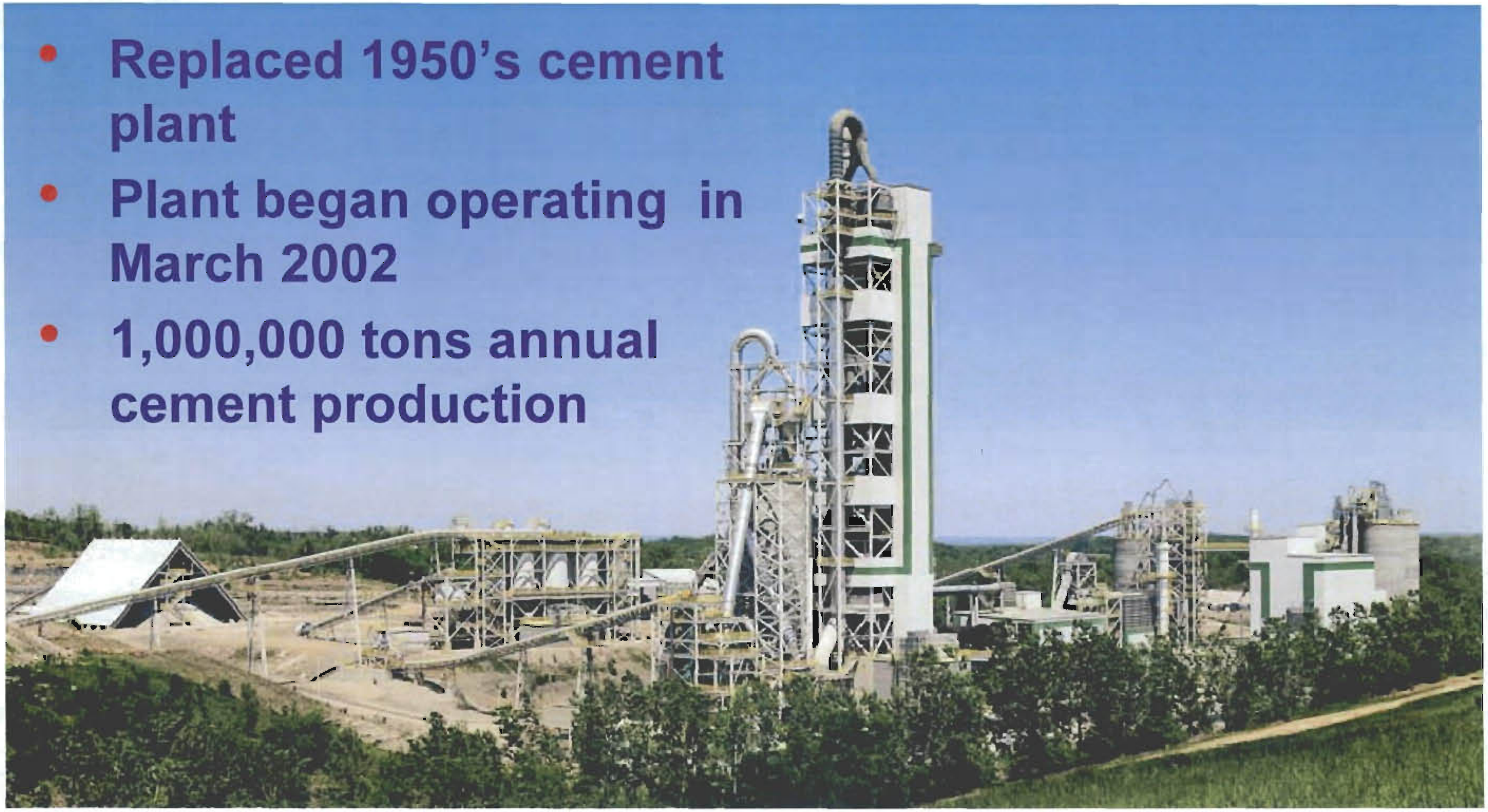
- Wholly owned subsidiary of Lafarge
- Provides fuels and raw materials to Lafarge cement plants
- www.sysenv.com

Systech Provides Various Fuels

Fuel-Quality Waste	(OH and KS)
Scrap Tires	(AL, IL, OK, PA, SC, QC, WA)
Alternate Solid Fuel	(AL, IA, MO*, PA, SC)
Waste Oil	(IA, IL, KS, MD, OH, QC, SC, WA)
Landfill Gas	(MO)

* - *targeted for start-up October 2007*

Sugar Creek Cement Plant



- Replaced 1950's cement plant
- Plant began operating in March 2002
- 1,000,000 tons annual cement production

Systech Environmental Corporation

LAFARGE NORTH AMERICA

CO_2 Emissions/Energy Cost Reduction

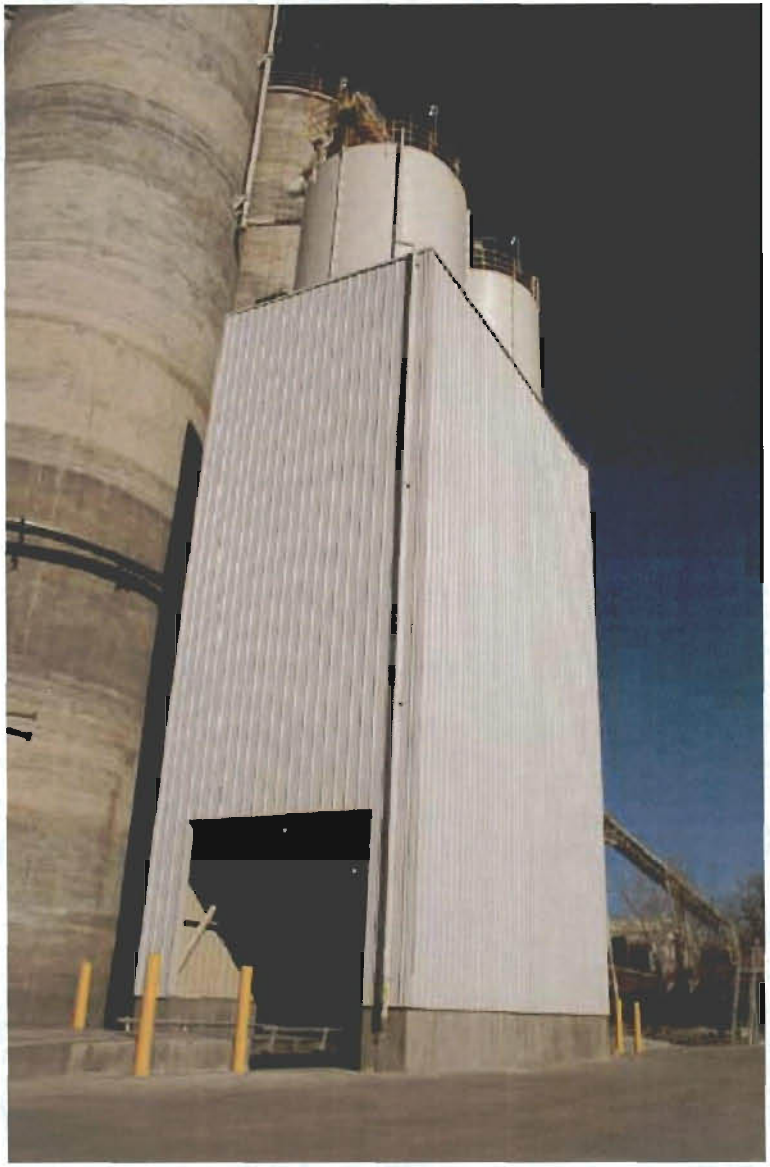
- **Cement Manufacturing – Energy Intensive**
- **Heating limestone liberates CO_2 (calcination)**
- **Lafarge world-wide target of 20% reduction per ton of clinker produced by 2010**
  - Energy efficiency
  - Use of alternate cementitious materials (slag, fly ash)
  - Use of alternate/renewable fuels

Energy Efficiency

- New State-of-the-Art Plant
- Requires 2/3 the energy per ton of clinker compared to the old plant
- Awarded Energy Star Rating by U.S. EPA
- One of only six cement plants in the U.S.

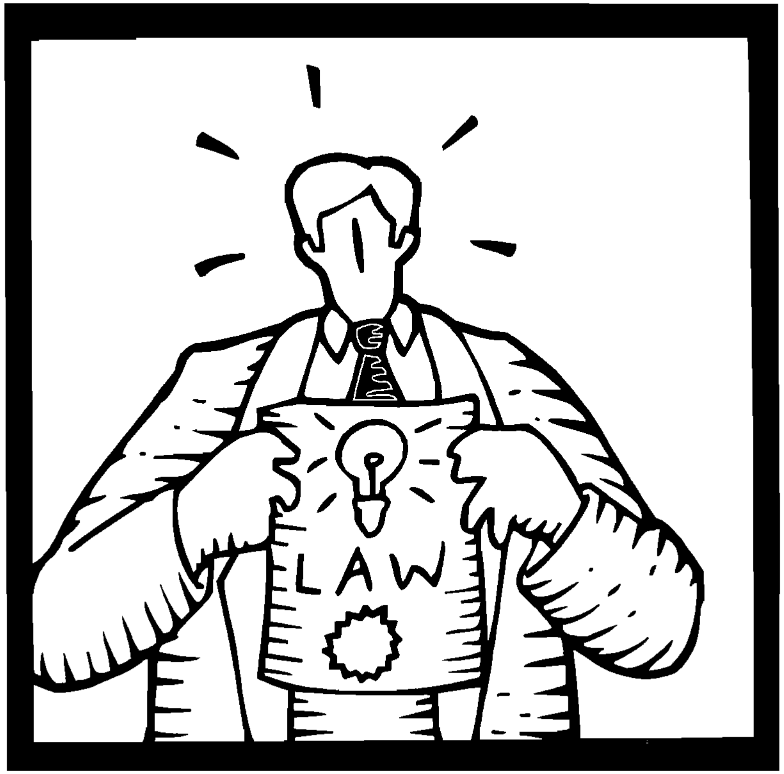
ENERGY STAR

Cementitious Materials



- Sugar Creek now sells a blend of Portland cement and ground blast furnace slag
- Generate less CO_2 per ton of product
- Higher strength and better wear characteristics

Alternate Fuels Permitting (MDNR)



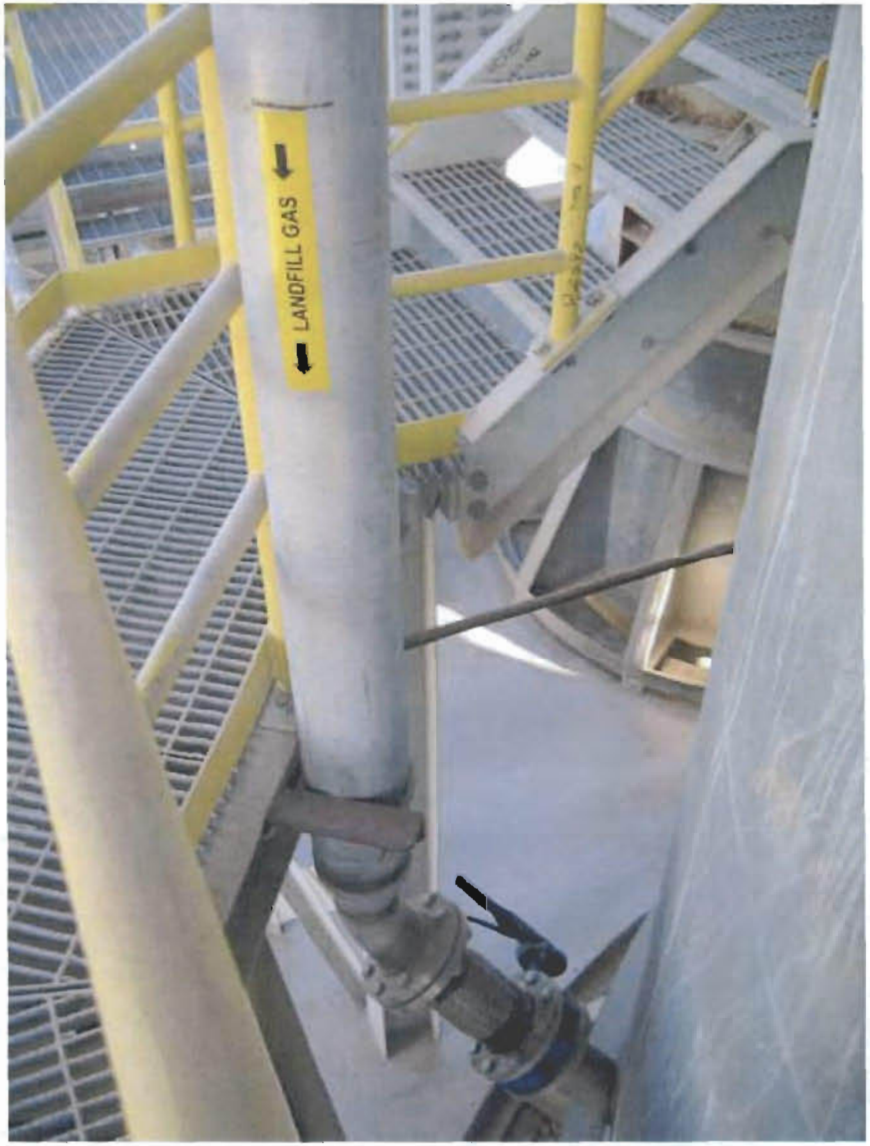
- Process commenced 9/2003
- Permit issued 8/2004
- Existing emission limits unchanged
- Performance testing upon fuel startup

Alternate Fuels Permitted

- TDF
- PDF (non-chlorinated)
- No. 2 and 6 Fuel Oils, Used Oil
- Textile Products
- Animal Meal
- Cellulose Material
- Landfill Gas
- Others on Request

Landfill Gas

- Piped direct from adjacent closed landfills
- First gas flowed to tower burner in August 2005
- Thus far, the gas replaces ~1 ton per hour of solid fuel (8,000 ton/year)
- Negotiating with adjacent active landfill for gas



Environmental Excellence Award

Alternative Solid Fuel (ASF) Project

- Sugar Creek's program will use up to 40,000 tons of ASF per year
- The ASF would otherwise be landfilled
- ASF burns cleaner and produces less CO_2 than coal
- Kiln ash is incorporated into the cement product
- Project will start-up October 2007
- The ASF program has been permitted by the MDNR and encouraged by local governments
- Cost $6M in capital expense


MO-291 Hwy
Proposed ASF Building
Cement Plant
Courtney Road

Example Building – Harleyville Plant

Systech Environmental Corporation

LAFARGE NORTH AMERICA

Alternate Solid Fuels (ASF)

- Cellulose, plastic and textile waste with the following characteristics are desirable and are being pre-qualified now:
  - Non-hazardous
  - Nonreuseable waste materials currently going to landfills
  - Heat value of over 5,000 Btu/lb
  - Initially targeting industrial customers that generate > 200 tons/year

  - Unacceptable materials: metal, food, free liquids, and/or hazardous wastes.

Examples of Alternate Solid Fuels

- Baled shrink wrap
- Auto flooring trim scrap
- Air filter paper
- Plastic film
- Plastic
- Buffer pad scrap
- Waste tissue

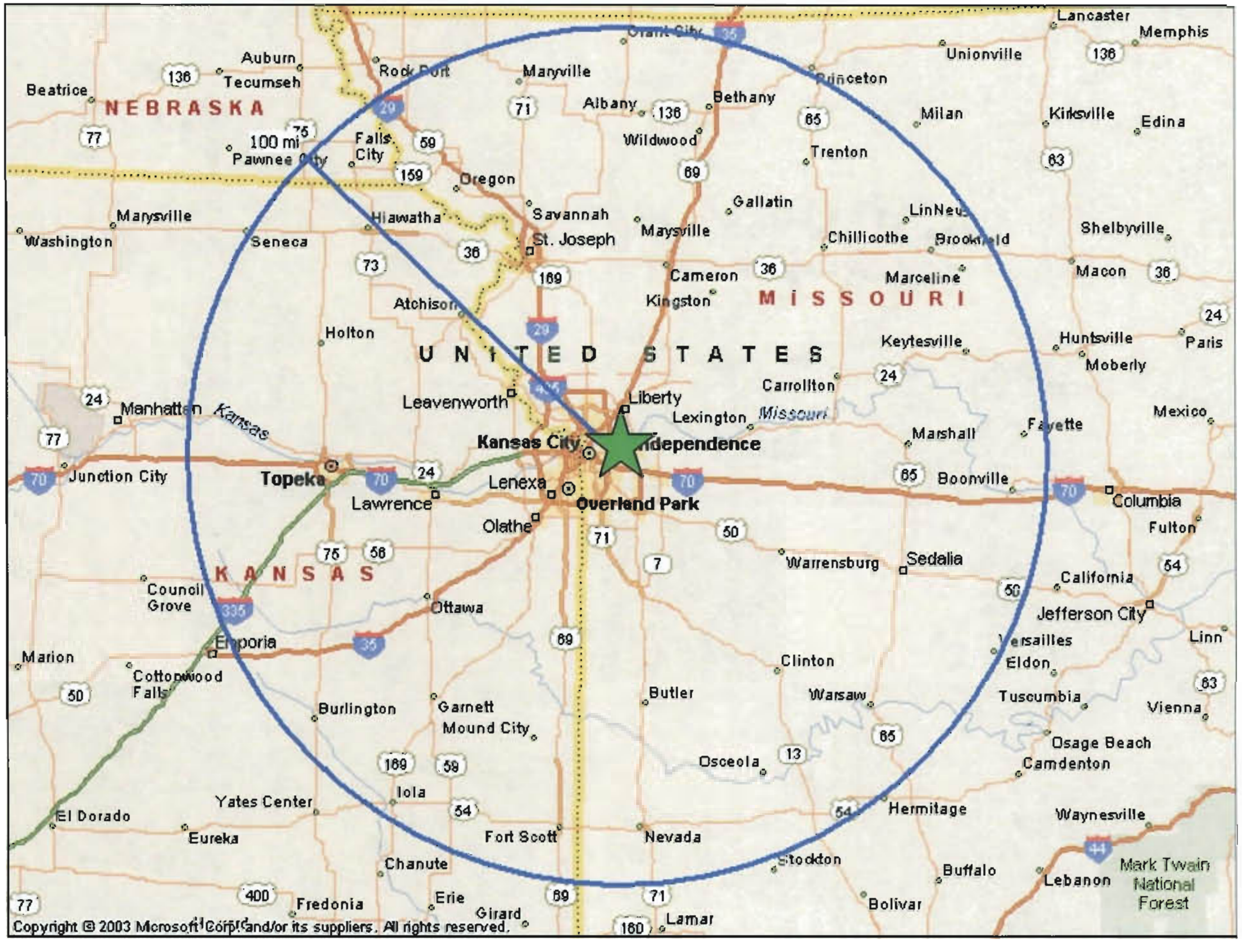
- Paper/Paper stock
- Pre-shredded paper
- Toner chips
- Polyurethane waste
- Rag/Paper rolls
- Tape and label waste
- Polypropylene mats

plastics

textiles

combinations

100 Mile Radius Around Sugar Creek, MO



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SYSTECH Systech Environmental Corporation

LAFARGE NORTH AMERICA

ASF Receiving & Storage

Example of baled plastic

- Material shipped in:
  - roll-off boxes
  - walking floor trailer
  - end dump trailers
  - supersacks
  - Gaylord boxes
  - vans
- Efficiencies gained by utilizing balers and compactors.
- All storage is indoors
- Building allows for storage of 2,250 tons of material

ASF Receiving & Storage

- Hours of Operation – 10 hours/day, 7 days/week
- Employees – 7-10 full-time employees

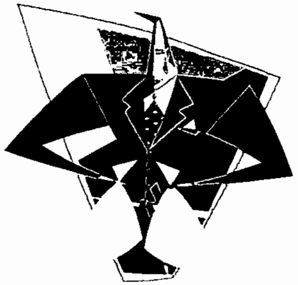
Shredding

- Two-stage shredding capable of processing 7.5 tons/hour
- Materials reduced in sized to less than 2 x 2 inches

Final Storage

- Final storage of 200 tons
- Fire suppression by water deluge

The Approval Process



- **Potential ASF source is identified**
  - A representative sample is pulled (a one gallon resealable baggie)
  - An ASF profile is completed and signed by the generator
  - The sample, profile and any applicable MSDS's are sent to Systech. The lab will do tests Btu/constituents/compatibility/permit parameters.
  - When lab work is completed, reviews are done by Regulatory, Health and Safety, and Lafarge Cement Quality team
  - If all goes through successfully, final negotiations and plans for delivery are finalized.

Profile No. __________ Date Received ____________

SYSTECH Systech Environmental Corporation

Form 1 – Alternate Raw Material & Fuel Qualification - Information

A representative sample accompanies this form

SALES REPRESENTATIVE **Bernie Sabbert** Phone (**816**) **351-9040**
FACILITY LOCATION **Sugar Creek, MO**

A. CONTACT INFORMATION

GENERATOR ______________________ Technical Contact ____________________
Phone ( ) ____________ FAX ( ) ____________ Email ____________________
Address ____
City ______________________________ State __________ Zip __________

MARKETER (if different than Generator)
Company Name ______________________ Business Contact ____________________
Phone ( ) ____________ FAX ( ) ____________ Email ____________________
Address ____
City ______________________________ State __________ Zip __________

B. BYPRODUCT INFORMATION

Byproduct name ____
Process generating byproduct ____
Is the material generated from a superfund site? ____ no ____ yes
Is the byproduct ___liquid ___solid ___ sludge ____ other % free liquid __________
If this byproduct is a liquid or sludge what is the moisture content? _________%
List any known health & safety precautions ______________________________
Exposure limits and carcinogens? _______________________________________
Attach the following if available: TCLP Metals _____ TCLP Organics _____ Other analytical __________
Is a Material Safety Data Sheet (MSDS) available for the waste? Y____ N____ (if Yes, Please attach)
If no, is an MSDS available for the finished product or product constituents? Y____ N____ (If Yes, Please attach)

Define composition by listing the primary constituents and/or material types. (Must total to 100%.)

Material	%	Material	%

C. SHIPMENT INFORMATION

Quantity of byproduct available per month __________ gal. __________ lb. _______ yd^3 _______ ton
Method of shipment: ______________________ Delivery frequency ______________
Anticipated handling problems (e.g., odor, dusty, sticky, large chunks, foreign matter): ______________
Emergency and first aid procedures? ____________________________________

.

Please send this profile with a one (1) quart representative sample, photos, any analyses or other information to:

Systech Environmental Corporation Attn: Chris Thrower
2200 North Courtney Road, Sugar Creek, MO 64050

D. NON-HAZARDOUS WASTE CERTIFICATION

I hereby certify that the byproduct identified in this qualification does not exhibit the characteristic of a hazardous waste or is not a listed hazardous waste as defined in 40 CFR 261.

The undersigned states that they are a duly authorized representative of the generator and that the information and statements included on this questionnaire are true and correct to the best of their knowledge.

Print name ______________________ Title ______________________

Signature ______________________ Date ______________________

Basis for certification ______________________________________

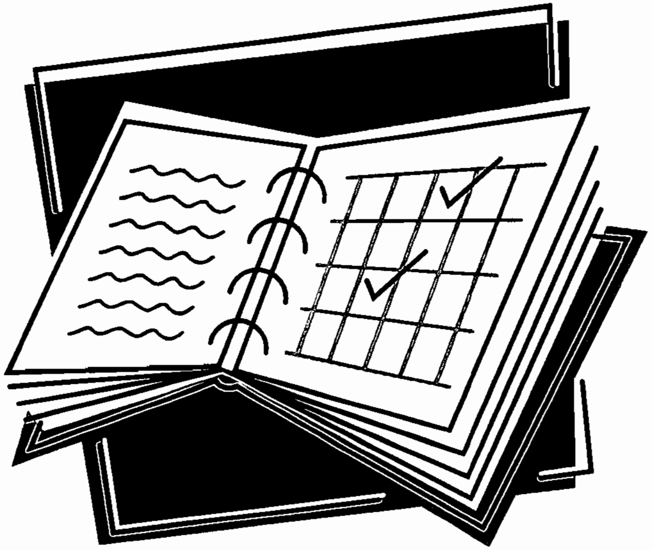
Version 8 – US Sugar Creek May 23, 2007

SYSTECH Systech Environmental Corporation

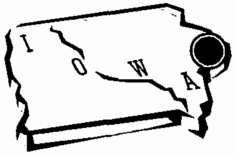
LAFARGE NORTH AMERICA

Proposed Construction Schedule

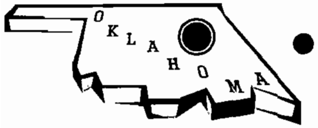
- Order equipment – February ‘07
- Begin building construction – April ‘07
- Receive/install equipment – July ‘07
- System startup – October ‘07



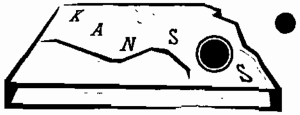
Other Lafarge Alternate Fuel Locations in the Region



- Davenport, Iowa
  - ASF (plastic, paper) off spec oil



- Tulsa, Oklahoma
  - Scrap tires (truck and auto)



- Fredonia, Kansas
  - Hazardous and nonhazardous flammable liquids and sludge

- Joppa, Illinois
  - Scrap tires (auto and truck), off spec oil

In Summary

- **Lafarge's environmental policy commits to increased alternate raw materials and fuels use**
- **This benefits Lafarge, our community, and our environment by:**
  - Increasing our industry's sustainability
  - Decreasing the use of natural resources and fossil fuels
  - Decreasing our fuel and raw material costs
  - Decreasing our CO_2 emissions

Thank you for coming.

Any questions?

Attachment B: Alternative Fuels Emissions Data

AttB – MDNR Lafarge Alt Fuels.doc

Mr. Steven J. Kidwell
Manager, Environmental & Public Affairs
Lafarge North America
2200 N. Courtney Rd.
Sugar Creek, MO 64050

Dear Mr. Kidwell:

Missouri Department of Natural Resources' Air Pollution Control Program (APCP) staff has reviewed the report prepared by AirSource Technologies presenting the results of emission testing conducted from November 12, 2008, to February 9, 2009, at Lafarge's cement kiln in Sugar Creek. AirSource tested the kiln/raw mill stack for multiple pollutants as required by New Source Review Permit # 082004-016B to determine the emissions impact of various blends of Alternate Solid Fuels (ASF) used to replace a portion of normal coal or petroleum coke fuel. The tests would establish various operating parameter ranges within which the pre-heater-pre-calciner kiln system could operate while maintaining compliance with permit emission limits.

Testing continued over an extended period because the scope of work was very large, raw mill off line periods were infrequent, unscheduled maintenance outages occurred, and economic conditions forced other outages. AirSource established baseline emission rates when no ASF was fired and the raw mill was on-line and offline. It then measured emission rates in both raw mill conditions for low, middle and high heat content ASF, each with normal or high chlorine content.

Staff recalculated AirSource's data reduction for selected test runs and substantially agrees with their conclusions. Kiln emissions met all permit emission limits. Staff graphed emission rates and kiln and fuel parameters and calculated correlation coefficients in an attempt to detect relationships between them. Although some of these graphs are suggestive, there were no significant correlations. Lafarge has therefore proposed limits on ASF that represent conditions during testing, and revision of the baghouse inlet temperature limit. APCP largely agrees with these proposals. Baghouse inlet temperature may not exceed 210^{O}C (410^{O}F). ASF combustion rate may not exceed 9.4 metric tons per hour (10.36 T/hr). Lafarge proposed a range of heat content between 7,000 and 13,500 Btu. However, permit condition 8.D does not allow this since the range of heat contents during testing was 7,063 to 13,101 Btu. Neither 7,000 nor 13,500 Btu "fall[s] within the range of Btu values established during testing" therefore the allowable Btu range can be no greater than 7,063 to 13,101.

Lafarge has also requested that APCP remove the limit on ASF chlorine content from its permit. APCP's New Source Review Permit Unit has taken this action in a recent amendment to Lafarge's permit.

If you have any questions concerning this emission test, please contact Peter Yronwode at the Air Pollution Control Program, P.O. Box 176, Jefferson City, MO 65102-0176, or by telephone at (573)-751-4817, or via e-mail at *peter.yronwode@ dnr.mo.gov*. Thank you for your continued cooperation.

Sincerely,

AIR POLLUTION CONTROL PROGRAM

Paul Jeffery
Acting Enforcement/Compliance Section Chief

PJ:pyt
c: KCRO
Source File: 095-0032

Attachment B: Alternative Fuels Emissions Data

AttB – Lafarge – Whitehall, PA.pdf

URS

13 April 2004

Mr. Thomas A. DiLazaro
Air Quality Program Manager
Pennsylvania Department of Environmental Protection
Bethlehem District Office
4530 Bath Pike
Bethlehem, PA 18017

Subject: **Emission Test Report for**
Alternative Fuel Substitution Test
Lafarge North America, Whitehall, PA

Dear Mr. DiLazaro:

On behalf of Lafarge North America, URS is submitting two copies of the Emission Test Report for the Alternative Fuel Substitution Test that Lafarge performed at their plant located in Whitehall, PA. This report provides the results of the emission testing and summarizes the kiln operation during both a baseline condition when Kiln 2 was burning typical fuels and during a test condition when plastic derived fuel (PDF) replaced a portion of the coal/coke fuel.

We assume that you will forward one copy of this report to PADEP in Harrisburg for their review. As indicated below, we are also submitting one copy of this report to Lawler, Matusky, and Skelly Engineers, the consultant representing the local community, for their use.

Please contact either Vince Martin at Lafarge at 610 261-3424 or me at 410 785-7220 extension 186 if you have any questions regarding the test or the report.

Sincerely,

Daniel V Packy

Daniel V. Packy
Project Manager

Attachment

C: Bill Car; Lawler, Matusky, and Skelly Engineers (1 copy)
Vince Martin; Lafarge North America

URS Corporation
13825 Sunrise Valley Drive, Suite 250
Herndon, Virginia 20171
tel: 703.713.1500
Fax: 703.713.1512

Emission Test Report
for
Alternative Fuel Substitution Test
(Kiln #2)
at
Lafarge North America
Whitehall Plant

Prepared for:

Lafarge North America
5160 Main Street
Whitehall, Pennsylvania 18052

Prepared by:

URS Corporation
13825 Sunrise Valley Drive, Suite 250
Herndon, Virginia 20171

April 2004

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*[**Note that the bold, parenthetical text within this document refers to the specific requirements listed in the PADEP Source Testing Manual, Revision 3.3, dated November 2000. Tables and figures appear in sequential order at the end of each section.]*

Signed Statement (2.1.2.6)

By signing below, I hereby certify that to the best of my knowledge, this source test report has been checked for completeness and that the results presented herein are accurate, error-free, legible, and representative of the actual emissions measured during the testing.

Daniel V Packy

04/12/04

Daniel V. Packy, Project Manager
URS Corporation

Date

Robert F Jongleux

04/12/04

Robert F. Jongleux, On-Site Test Supervisor
URS Corporation

Date

Vincent Martin /VINCENT MARTIN

04/12/04

Vincent Martin, Environmental Manager
Lafarge North America – Whitehall Plant

Date

ES EXECUTIVE SUMMARY

Lafarge North America (Lafarge) owns and operates a portland cement manufacturing facility located in Whitehall, Pennsylvania. In November and December 2003, with approval from PADEP, Lafarge conducted a test on one kiln at the facility to verify that Plastic-Derived Fuel (PDF) can be used as an alternative fuel for this kiln. PDF is post-consumer recycled plastic that is collected from public sources, sorted, and processed into a fuel feedstock.

The test consisted of two phases: Phase 1 was designed and performed to identify the optimum feedrate of PDF to the kiln; Phase 2 was designed and performed to assess the operation of the kiln while burning PDF at the optimum feedrate identified during Phase 1. During both phases, the kiln was operated and monitored under both baseline (normal operating) conditions and with the PDF replacing a portion of the fossil fuel fired in the kiln.

Substantial emission monitoring was conducted during both phases of the testing, using EPA and PADEP approved procedures. During Phase 1, continuous emission monitors (CEMs) provided essentially real-time emission data for carbon monoxide, total hydrocarbons, nitrogen oxides, and sulfur dioxide. Lafarge reviewed these emission data during the test to ensure the PDF did not create emissions substantially above the baseline or above the permitted emission rates. During Phase 2, in addition to the ongoing use of the CEMs, a comprehensive slate of sampling was conducted to monitor emissions of four general classes of compounds under both baseline and PDF burning conditions. The sampling measured emissions of

- Particulate matter (total and differentiated by particle size);
- Metals (17 heavy metals, including mercury and hexavalent chromium);
- Anions (hydrogen halides, halogens and cyanide); and
- Organic compounds (including volatile compounds, semi-volatile compounds, polychlorinated dibenzo-dioxins and furans, polychlorinated biphenyls, and polychlorinated aromatic hydrocarbons).

The results of the testing, described in the following report, indicate that the emissions of the various classes of compounds listed above are generally equivalent between the baseline and PDF test conditions. While the emission rate of a few of the individual constituents in any class of compounds increased between the baseline and the PDF test condition, the emission rates for other constituents in each class were consistent or decreased between the baseline and PDF test conditions. In most cases, the increase or decrease was not significant. In all cases, the emissions of currently permitted constituents were less than the current permit limits during both the baseline and PDF test conditions, as well as below triggering thresholds of Prevention of Significant Deterioration (PSD) and New Source Review (NSR). These results indicate that the use of PDF is a viable alternative fuel source for cement kiln operation and does not increase emissions above currently permitted or allowable emission rates.

1.0 INTRODUCTION

This report details the testing procedures and the results for the alternate fuel substitution test at the Lafarge North America (Lafarge) facility located in Whitehall, Pennsylvania. Lafarge operates two dry-process rotary kilns to produce portland cement at this facility. This testing was conducted only on Kiln #2, to verify that Plastic-Derived Fuel (PDF) can be used as an alternative fuel for this kiln. To achieve this goal, a feedrate optimization test (Phase1) was performed to determine an optimal feedrate of PDF while maintaining steady kiln operating conditions. After an optimal feedrate was determined, Phase 2 was performed, consisting of measuring stack emissions using manual testing methods under both normal (baseline) operating conditions and again while the PDF was fed to kiln. During Phase 1 and Phase 2, operating parameters were recorded, and kiln emissions were monitored by the installed NO_x and SO_2 continuous emission monitors (CEMs) as well as by temporary certified carbon monoxide, carbon dioxide, oxygen, and total hydrocarbon (THC) CEMs.

Phase 1 testing occurred on November 24 through 26, 2003, while Phase 2 was conducted from December 2 through 6, 2003. URS Corporation (URS) of Morrisville, North Carolina, performed the manual methods sampling and temporary CEMs measurements under contract to Lafarge. The Project Manager of URS, Mr. Daniel Packy, has overall responsibility for the stack testing project. Facility oversight was provided by the Environmental Manager of Lafarge's Whitehall plant, Mr. Vincent Martin. Table 1-1 shows the source owner/operator and the other testing related contacts.

1.1 Source Description (2.1.1.4)

Kiln 2 (Process 282005) is a Fuller Company Model 84200 that is 195 feet long and 13.5 feet in diameter with a normal clinker capacity of 55-60 metric tons/hour. Pulverized limestone and other raw materials are fed into the preheater and pulverized bituminous coal and coke are introduced as fuel in the combustion end of the kiln. Tire derived fuel is used as supplemental fuel in the preheater. The raw material is heated to 2,600-3,000°F, with preheat temperatures exceeding 1,400°F.

The combustion gases pass through the slowly rotating kilns counter to the flow of the raw materials. As a result, some of the materials are entrained as PM. The PM is captured in baghouses and returned to the kiln feed systems. The Kiln 2 baghouse was manufactured by Allen Sherman Hoffman. Water spray systems between the preheater and the induced draft fan protect the baghouse from excessive temperatures.

Clinker cooler #2 (Process 282007) is a reciprocating grate unit that cools the clinker from the kilns from approximately 2,000°F to 350°F by forcing excess ambient air through the clinker. The kiln cannot use this excess air for combustion, so it is exhausted to the atmosphere. A baghouse controls PM from the clinker cooler. The clinker cooler baghouse #2 is a Fuller Company Model 14Z128. Figure 1-1 **(2.1.1.5)** provides a simple block diagram showing Kiln #2, and the associated air pollution control device, fan and its rated capacity, raw material flow, and effluent flow.

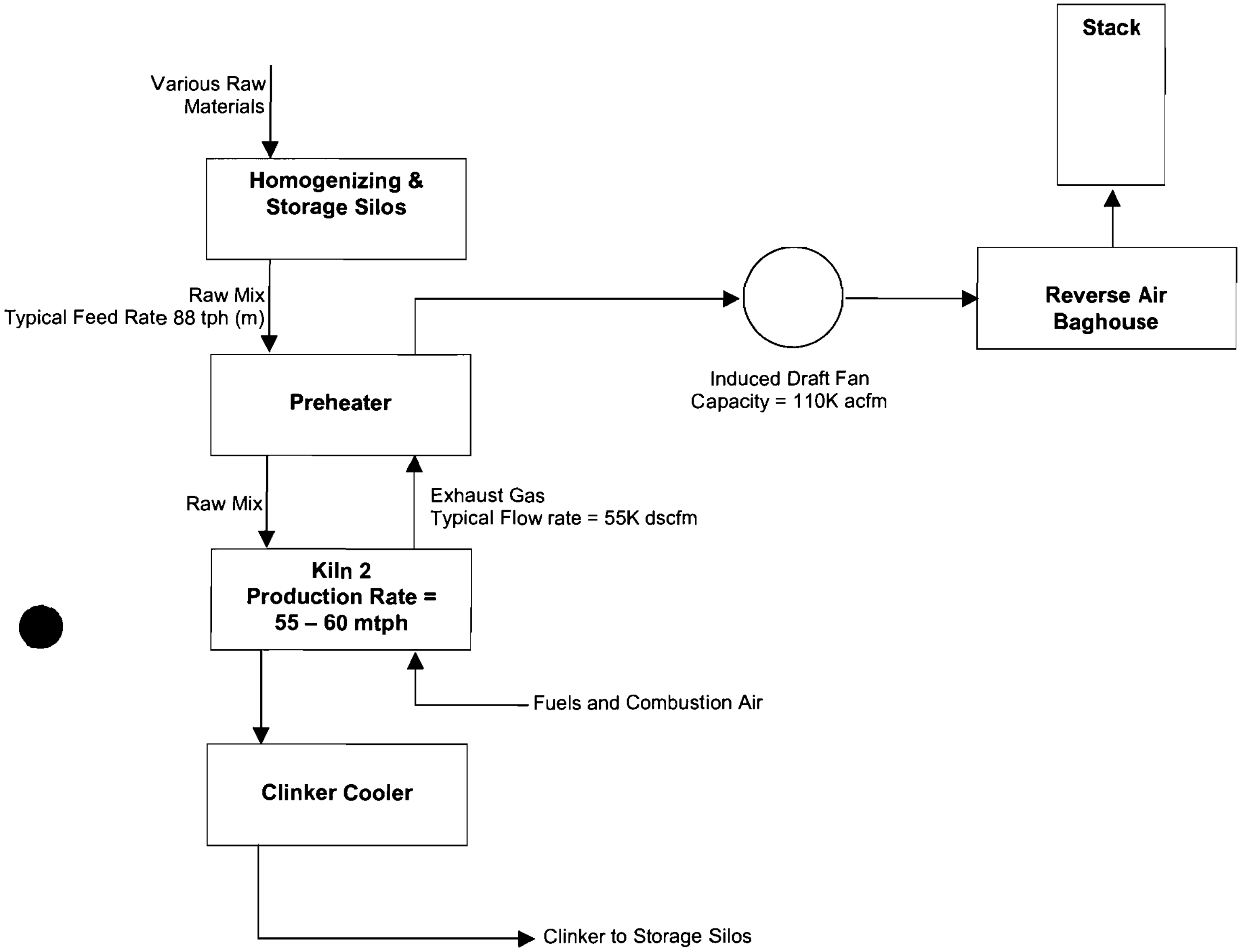


Figure 1-1. Kiln 2 Process Block Diagram

Table 1-1. Testing Contacts

Source Owner/Operator (2.1.1.1)	
Name	Lafarge North America, Whitehall Plant
Mailing Address	5160 Main Street, Whitehall, PA 18052
Contact Person	Vincent Martin, Environmental Manager
Telephone Number	(610) 261-3424
PADEP Registration Number	39-1472 (for installed CEMs)
Emissions Testing Contractor (2.1.1.2)	
Name	URS Corporation
Mailing Address	13825 Sunrise Valley Drive, Suite 250, Herndon, VA 20171
Contact Person	Dan Packy, Project Manager
Telephone Number	(410) 785-7220 x.186
PADEP Registration Number	68-2917 (RTP, NC Measurements Testing Office)
Analytical Laboratories (2.1.1.3) (Under Subcontract to URS Corporation)	
Name	Severn-Trent Laboratories, Inc. (PM, Metals, Hexavalent Chromium, SVOCs, Cyanide)
Mailing Address	5815 Middlebrook Pike, Knoxville, TN 37921
Contact Person	Kevin Woodcock, Project Manager
Telephone Number	(865) 291-3082
PADEP Registration Number	68-576
Name	Air Toxics, Ltd. (VOCs)
Mailing Address	180 Blue Ravine Road, Suite B, Folsom, CA 95630
Contact Person	Betty Chu, Project Manager
Telephone Number	(916) 985-1000
PADEP Registration Number	68-690
Name	Alta Analytical Perspectives (PCDDs/PCDFs, PCBs, and PAHs)
Mailing Address	2714 Exchange Drive, Wilmington, NC 37921
Contact Person	Yves Tondeur, President
Telephone Number	(910) 794-1613
PADEP Registration Number	37-1849
Name	Eastern Research Group, Inc. (Hydrogen Halides and Halogens, Hydrogen Cyanide)
Mailing Address	1600 Perimeter Park Drive, Morrisville, NC 27560
Contact Person	Ray Merrill, Lab Manager
Telephone Number	(919) 468-7887
PADEP Registration Number	68-2666
Name	Enthalpy Analytical, Inc. (PM10, CPM)
Mailing Address	2202 Ellis Road, Durham, NC 27703
Contact Person	Lee Marchman, Lab Manager
Telephone Number	(919) 850-4392
PADEP Registration Number	68-1498

2.0 SUMMARY OF TEST RESULTS

This section summarizes the operating conditions of the kiln and the results of the Phase 2 emission testing. Section 3 presents a discussion and results for the Phase 1 testing.

Figure 2-1 summarizes the overall chronology of Phase 2 of the test, including the time periods for the individual manual method sampling trains. Because of the number of sampling trains required, and the physical limitation of the stack sampling locations, not all of the sampling trains could be used at the same time. Sampling periods were planned and executed with the maximum amount of overlap, given the physical constraints of the system, so that the various measurements best represent similar operating conditions. Both the temporary and permanently installed CEMs operated essentially continuously for the baseline and PDF test conditions, with interruptions limited to calibration periods to verify the instruments were working properly.

Lafarge operated the kiln as consistently as possible during baseline and PDF test conditions. Figures 2-2 through 2-4 present the key operating parameters of raw mix feed rate, total fuel feed rate (calculated as the sum of the coal/coke, tire-drived fuel, and PDF feedrates), and burning zone temperature during both the baseline and PDF test conditions. In each figure, one of the operating parameters is plotted for the entire time of both the baseline and PDF test conditions, with the beginning of both test conditions set as time equal zero. For example, in Figure 2-2, the blue plot indicates the raw mix feed rate for the entire duration of the baseline test condition. The red plot indicates the raw mix feed rate during the entire duration of the PDF test condition. The close overlap of the two plots demonstrate that the kiln was operating consistently during the two operating conditions. Each of the figures show a deviation in the operating parameters that occurred during the PDF test condition. This deviation coincides with a kiln upset because of a pluggage in the system. Near the end of the PDF test period, the operating data also decreases because of another pluggage in the kiln. During these pluggages, the raw mix feed was interrupted and the fuel flow was decreased to bring the kiln back into normal operations as quickly as possible. As a result of the raw mix and fuel flow changes, the burning zone temperature also fluctuated during these periods.

The emission testing results include all of the manual method sampling, the temporary CEMs measurements, and the permanently installed CEMs measurements. Manual method sampling was conducted for the following classes of constituents:

- Particulate matter (total and differentiated by particle size);
- Metals (17 heavy metals, including mercury and hexavalent chromium);
- Organic compounds (including volatile compounds, semi-volatile compounds, polychlorinated dibenzo-dioxins and furans, polychlorinated biphenyls, and polychlorinated aromatic hydrocarbons); and
- Anions (hydrogen halides, halogens and cyanide).

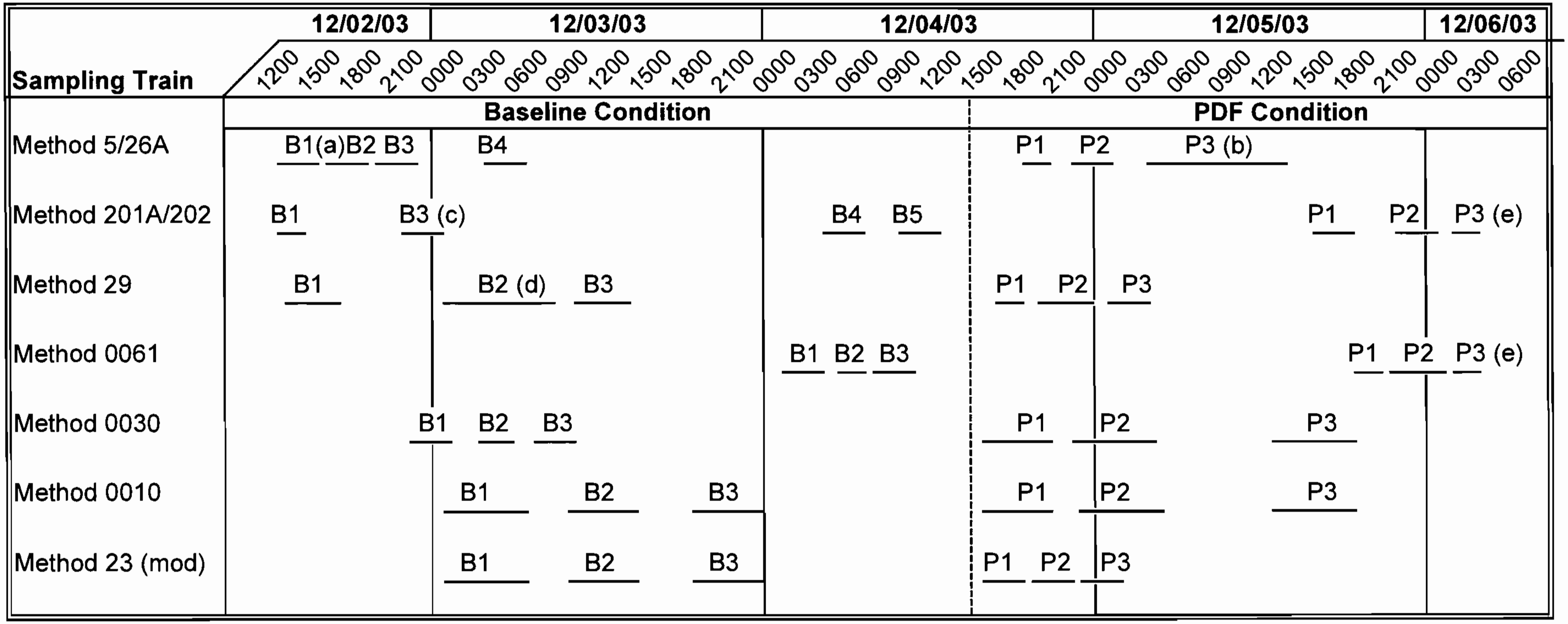
Tables 2-1 through 2-8 present the average results of each of these classes of compounds for both the baseline and PDF test conditions. In these summary tables, only constituents that were detected in at least one sample fraction in a condition are shown. More detailed tables in Section 4 and Appendix D present data for all of the constituents that were included in the emission testing program. Table 2-9 presents the average results for constituents that were measured by the temporary or permanently installed CEMs.

Where applicable, the tables show the facility permit limits for individual constituents. The tables also present the average PDF condition emission rates, expressed as a percent of the permit limit, for comparison. As indicated in the tables, all of the PDF condition emission rates for permitted constituents are less than the allowable limits.

As the tables indicate, the emissions of the various classes of compounds listed above are generally equivalent between the baseline and PDF test conditions. While the emission rate of a few of the individual constituents in any class of compounds increased between the baseline and the PDF test condition, the emission rates for other constituents in each class were consistent or declined between the baseline and PDF test conditions. In most cases, the increase or decrease was not significant. In all cases, the emissions of currently permitted constituents were below the current permit limits during both the baseline and PDF test conditions.

The results of the testing indicate that the use of PDF as an alternate fuel source for the kiln does not substantially impact emissions.

Figure 2-1. Manual Method Sampling Times



B: Baseline
P: PDF

(a) - Baseline Run 1 for Method 5/26A was invalidated due to failed leack check at end of run.
(b) - PDF Run 3 for Method 5/26A was suspended because of kiln feed interruption.
(c) - Baseline Run 3 for Method 201a/202 was invalidated due to inefficient sample recovery.
(d) - Basline Run 2 sampling for Method 29 was suspended due to frozen impingers.
(e) - PDF Runs 3 for Methods 201A/202 and 0061 were stopped before completion of their sampling times due to upset kiln conditions. These runs were approved and validated as good runs by on-site PADEP representatives.

Figure 2-2

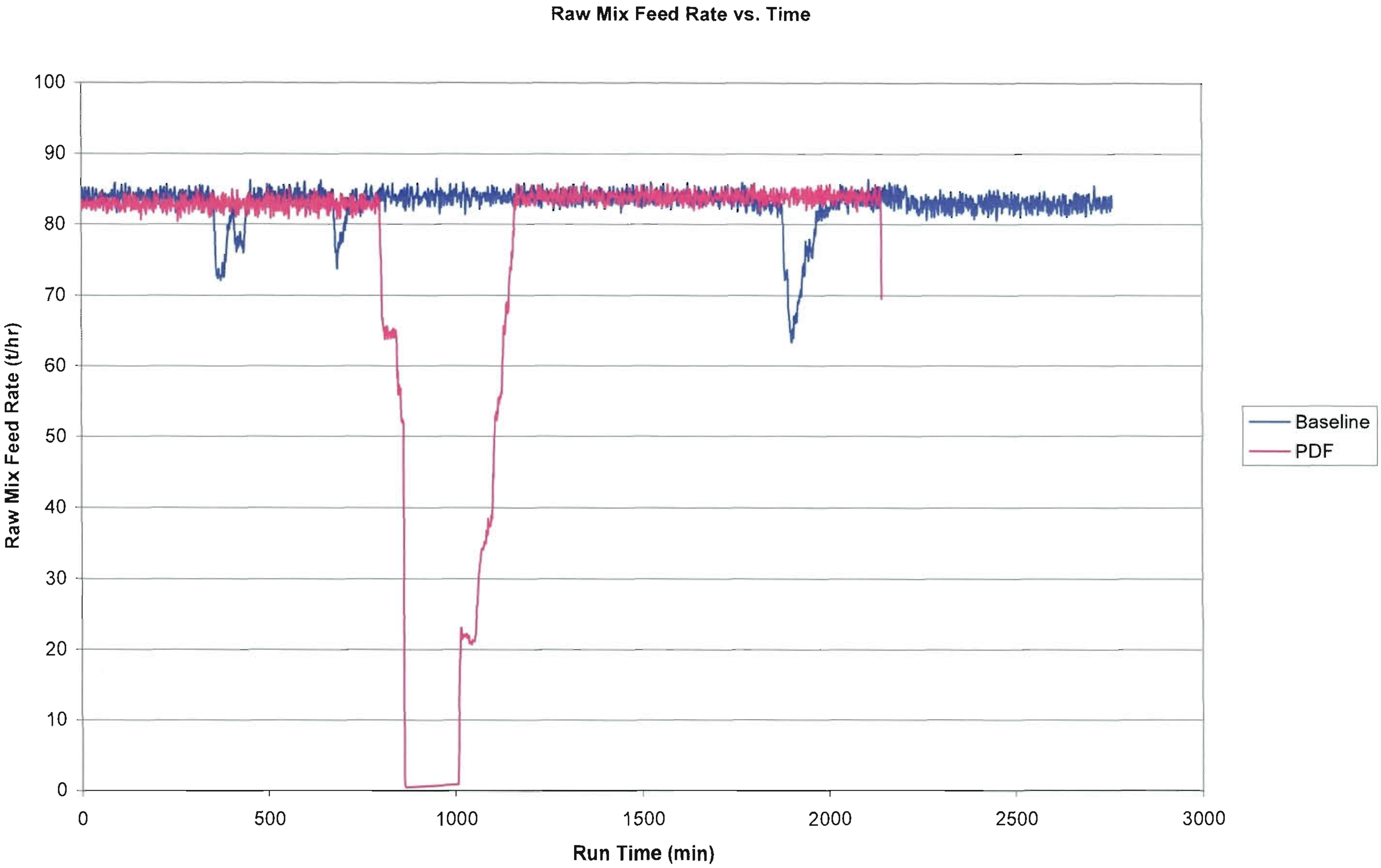

Raw Mix Feed Rate vs. Time
Raw Mix Feed Rate (t/hr)
100
90
80
70
60
50
40
30
20
10
0
0
500
1000
1500
2000
2500
3000
Run Time (min)
Baseline
PDF

Figure 2-3

Total Fuel Energy Feed Rate vs. Time

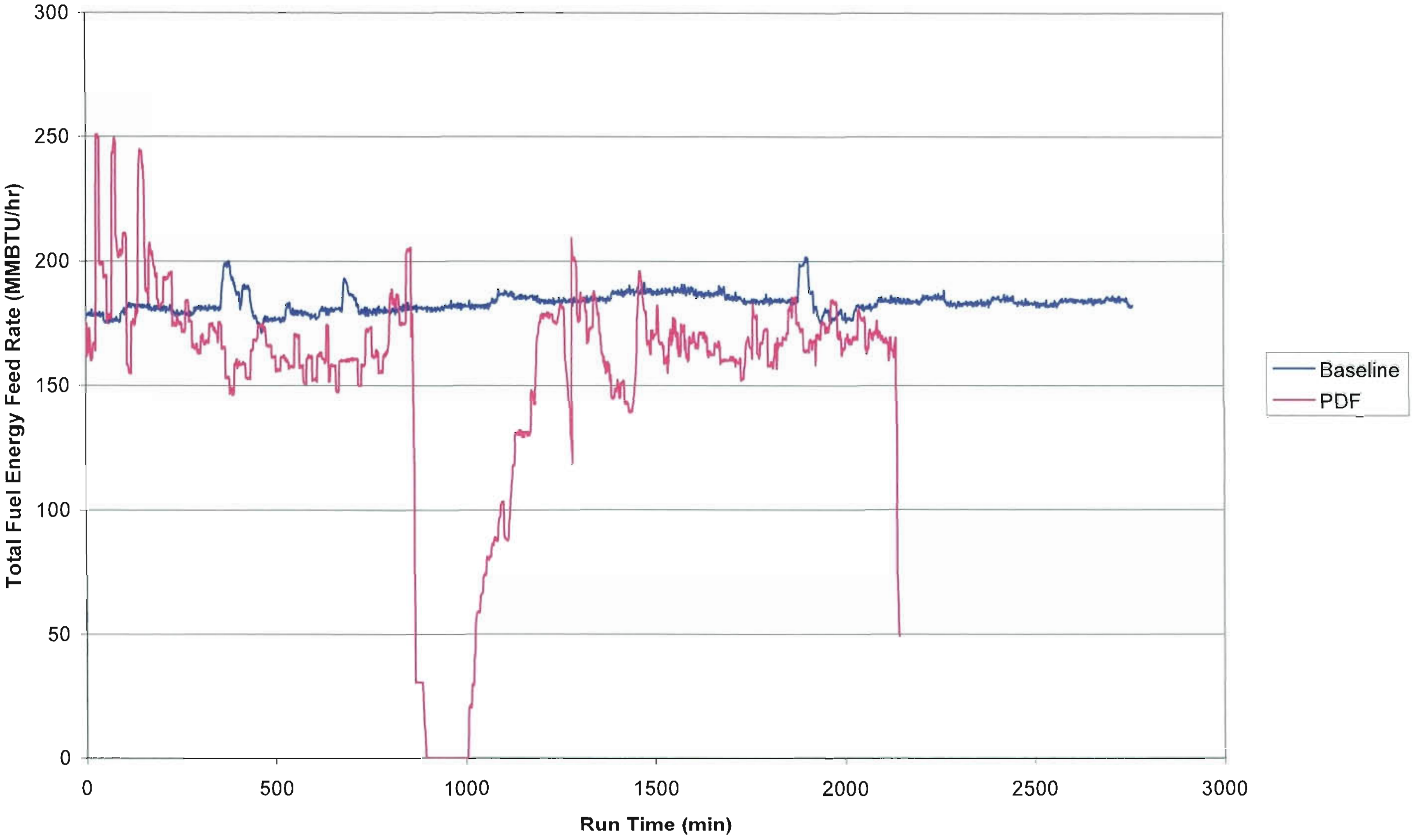


Figure 2-4

Burning Zone Temperature vs. Time

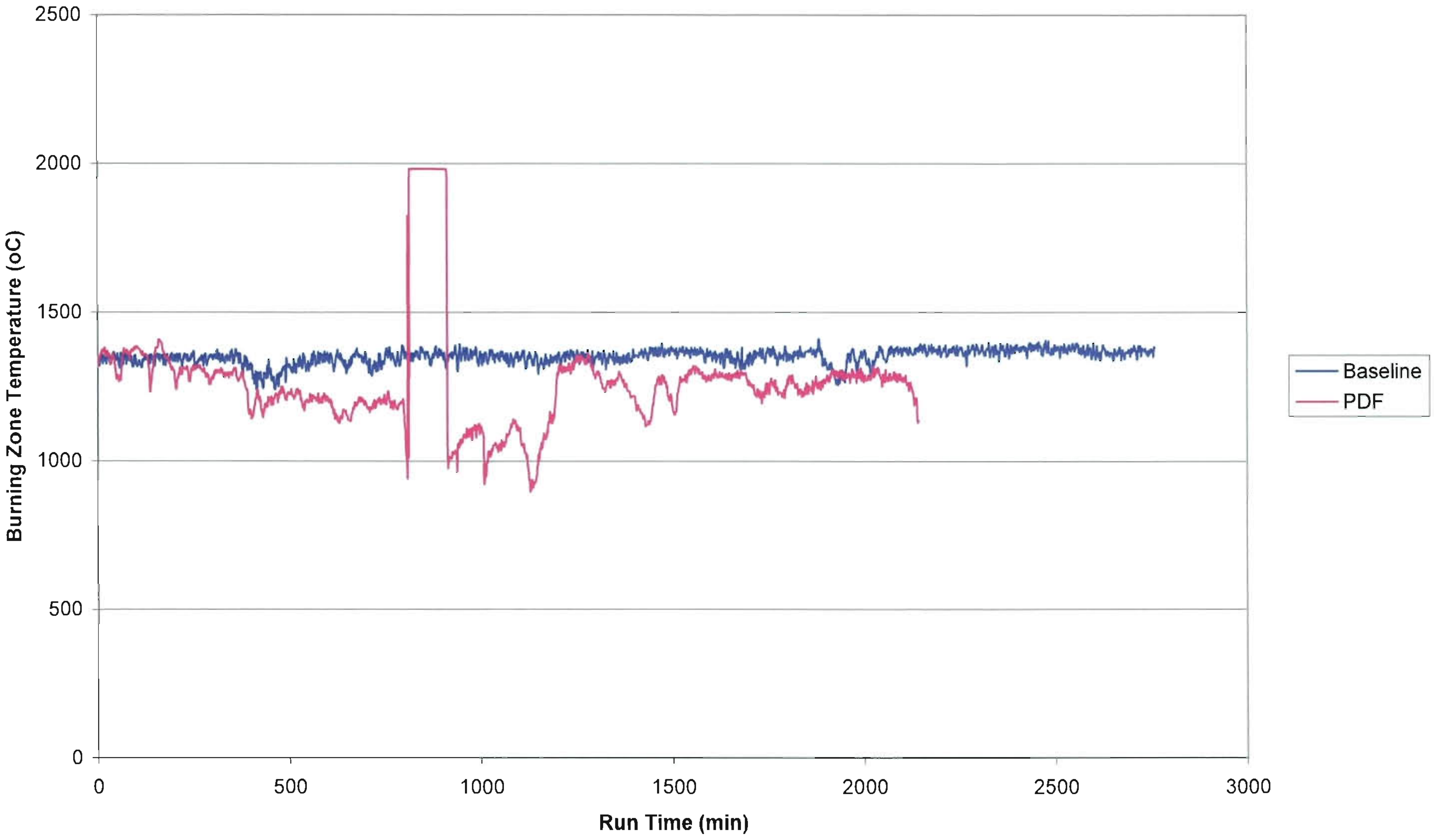


Table 2-1
Summary of Particulate Matter Emissions

	Analyte Detected		Emission Rate			PDF	Annualized Emissions		
Analyte	Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
PM (M5)	yes	yes	1.64	2.15	14.8	14.55%	7.2	9.4	2.2
PM (M201/202 Large)	yes	yes	4.81	3.99	--	--	21.1	17.5	-3.6
PM (M201/202 PM10)	yes	yes	4.45	0.28	--	--	19.5	1.2	-18.3
PM (M201/202 CPM)	yes	yes	47.18	39.68	--	--	206.6	173.8	-32.8

Table 2-2
Summary of Metals Emissions

	Analyte Detected		Emission Rate			PDF	Annualized Emissions		
Analyte	Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
Antimony	yes	yes	0.00086	0.00088	--	--	0.00376	0.00383	0.00008
Arsenic	yes	yes	0.00010	0.00008	0.00151	5.11%	0.00043	0.00034	-0.00010
Barium	yes	yes	0.00086	0.00201	--	--	0.00378	0.00882	0.00504
Cadmium	yes	yes	0.00010	0.00004	0.00525	0.78%	0.00043	0.00018	-0.00025
Chromium	yes	yes	0.00081	0.00052	--	--	0.00356	0.00227	-0.00129
Cobalt	yes	--	0.00011	0.00009	--	--	0.00050	--	--
Copper	yes	yes	0.00093	0.00163	--	--	0.00407	0.00716	0.00308
Lead	yes	yes	0.00011	0.00011	0.07000	0.15%	0.00050	0.00047	-0.00003
Manganese	yes	yes	0.00134	0.00097	--	--	0.00589	0.00425	-0.00164
Mercury	yes	yes	0.00067	0.00328	0.00744	44.15%	0.00295	0.01439	0.01143
Nickel	yes	yes	0.00256	0.00165	0.01890	8.74%	0.01120	0.00723	-0.00397
Selenium	yes	yes	0.00043	0.00153	--	--	0.00186	0.00668	0.00482
Silver	yes	yes	0.00015	0.00012	--	--	0.00065	0.00050	-0.00015
Thallium	yes	yes	0.00500	0.00328	--	--	0.02192	0.01439	-0.00753
Zinc	yes	yes	0.00280	0.00500	0.38689	1.29%	0.01226	0.02192	0.00966
Hexavalent Chromium	--	yes	0.00001	0.00004	0.00135	3.22%	--	0.00019	--

Table 2-3
Summary of Volatile Organics Emissions

CAS Registry Number	Analyte	Analyte Detected		Emission Rate			PDF	Annualized Emissions		
		Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
78-87-5	1,2-Dichloropropane	yes	--	0.00004	--	--	--	0.00020	--	--
78-93-3	2-Butanone (Methyl Ethyl Ketone)	yes	yes	0.00018	0.00016	--	--	0.00080	0.00070	-0.00009
591-78-6	2-Hexanone	yes	yes	0.00020	0.00012	--	--	0.00089	0.00052	-0.00037
107-05-1	3-Chloropropene	yes	yes	0.00006	0.00004	--	--	0.00027	0.00016	-0.00011
108-10-1	4-Methyl-2-pentanone	yes	yes	0.00020	0.00015	--	--	0.00087	0.00064	-0.00022
67-64-1	Acetone	yes	yes	0.00041	0.00043	--	--	0.00178	0.00188	0.00011
107-02-8	Acrolein	yes	--	0.00218	--	--	--	0.00955	--	--
107-13-1	Acrylonitrile	yes	yes	0.00082	0.00058	--	--	0.00359	0.00252	-0.00107
71-43-2	Benzene	yes	yes	0.00959	0.00351	--	--	0.04200	0.01535	-0.02665
74-97-5	Bromochloromethane	yes	yes	0.00013	0.00005	--	--	0.00057	0.00021	-0.00036
74-83-9	Bromomethane	yes	yes	0.00158	0.00028	--	--	0.00693	0.00123	-0.00571
75-15-0	Carbon Disulfide	yes	yes	0.00075	0.00086	--	--	0.00330	0.00379	0.00048
108-90-7	Chlorobenzene	yes	yes	0.00018	0.00009	--	--	0.00078	0.00038	-0.00040
75-00-3	Chloroethane	yes	yes	0.00005	0.00003	--	--	0.00022	0.00014	-0.00008
74-87-3	Chloromethane	yes	yes	0.00154	0.00025	--	--	0.00673	0.00109	-0.00564
74-95-3	Dibromomethane	yes	yes	0.00006	0.00003	--	--	0.00026	0.00014	-0.00012
100-41-4	Ethyl Benzene	yes	yes	0.00009	0.00007	--	--	0.00037	0.00031	-0.00006
75-69-4	Freon 11	yes	yes	0.00004	0.00003	--	--	0.00017	0.00012	-0.00005
75-71-8	Freon 12	yes	yes	0.00005	0.00003	--	--	0.00020	0.00014	-0.00006
74-88-4	Iodomethane	yes	yes	0.00085	0.00036	--	--	0.00374	0.00156	-0.00217
80-62-6	Methyl Methacrylate	yes	--	0.00021	--	--	--	0.00094	--	--
75-09-2	Methylene Chloride	yes	yes	0.00017	0.00032	--	--	0.00074	0.00141	0.00067
100-42-5	Styrene	yes	yes	0.00016	0.00016	--	--	0.00068	0.00071	0.00003
127-18-4	Tetrachloroethene	yes	--	0.00004	--	--	--	0.00019	--	--
108-88-3	Toluene	yes	yes	0.00090	0.00067	--	--	0.00395	0.00293	-0.00102
75-01-4	Vinyl Chloride	yes	yes	0.00006	0.00004	--	--	0.00028	0.00017	-0.00011
108-38-3/106-42-3	m,p-Xylene	yes	yes	0.00024	0.00019	--	--	0.00103	0.00084	-0.00019
95-47-6	o-Xylene	yes	yes	0.00010	0.00008	--	--	0.00042	0.00035	-0.00007

Table 2-4
Summary of Semivolatile Organics Emissions

		Analyte Detected		Emission Rate			PDF	Annualized Emissions		
CAS Number	Analyte	Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
120-82-1	1,2,4-Trichlorobenzene	yes	yes	0.00009	0.00010	--	--	0.00039	0.00043	0.00004
95-50-1	1,2-Dichlorobenzene	yes	yes	0.00012	0.00015	--	--	0.00054	0.00065	0.00011
541-73-1	1,3-Dichlorobenzene	yes	yes	0.00019	0.00024	--	--	0.00085	0.00105	0.00020
106-46-7	1,4-Dichlorobenzene	yes	yes	0.00016	0.00019	--	--	0.00071	0.00085	0.00014
90-13-1	1-Chloronaphthalene	yes	yes	0.00009	0.00011	--	--	0.00040	0.00047	0.00007
606-20-2	2,6-Dinitrotoluene	yes	yes	0.00038	0.00042	--	--	0.00168	0.00183	0.00015
91-58-7	2-Chloronaphthalene	yes	--	0.00006	--	--	--	0.00025	--	--
95-57-8	2-Chlorophenol	yes	yes	0.00107	0.00138	--	--	0.00469	0.00604	0.00135
95-48-7	2-Methylphenol	yes	yes	0.00052	0.00061	--	--	0.00226	0.00267	0.00042
108-39-4&106-44-5	3-Methylphenol & 4-Methylphenol	yes	yes	0.00194	0.00225	--	--	0.00848	0.00985	0.00137
98-86-2	Acetophenone	yes	yes	0.00229	0.00287	--	--	0.01004	0.01255	0.00251
65-85-0	Benzoic acid	yes	yes	0.00712	0.00833	--	--	0.03119	0.03650	0.00531
100-51-6	Benzyl alcohol	yes	yes	0.00282	0.00302	--	--	0.01236	0.01323	0.00087
117-81-7	bis(2-Ethylhexyl) phthalate	yes	yes	0.00234	0.00313	--	--	0.01024	0.01371	0.00348
85-68-7	Butyl benzyl phthalate	yes	yes	0.00013	0.00015	--	--	0.00057	0.00068	0.00011
132-64-9	Dibenzofuran	yes	yes	0.00023	0.00030	--	--	0.00102	0.00133	0.00031
84-66-2	Diethyl phthalate	yes	yes	0.00073	0.00076	--	--	0.00318	0.00334	0.00016
131-11-3	Dimethyl phthalate	yes	yes	0.00007	0.00007	--	--	0.00029	0.00032	0.00003
84-74-2	Di-n-butyl phthalate	yes	--	0.00046	--	--	--	0.00201	--	--
117-84-0	Di-n-octyl phthalate	yes	yes	0.00017	0.00019	--	--	0.00076	0.00083	0.00007
122-39-4	Diphenylamine	yes	yes	0.00008	0.00009	--	--	0.00036	0.00039	0.00003
98-95-3	Nitrobenzene	yes	yes	0.00036	0.00045	--	--	0.00158	0.00198	0.00040
62-75-9	N-Nitrosodimethylamine	yes	yes	0.00021	0.00023	--	--	0.00093	0.00101	0.00008
86-30-6	N-Nitrosodiphenylamine	--	yes	--	0.00008	--	--	--	0.00035	--
108-95-2	Phenol	yes	yes	0.12478	0.15961	--	--	0.54653	0.69910	0.15257

Table 2-5
Summary of Polychlorinated Dibenzo-dioxins and Furans (PCDD/PCDF) Emissions

Analyte	Analyte Detected		Emission Rate				July 2002 Average (gr TEQ/ dscf)	40 CFR 63 Subpart LLL PC MACT Standard (gr TEQ/dscf)	PDF Emission Rate as % of Standard	#39-00011 Permit Limit (lb/hr)	PDF Emission Rate as % of Limit
	Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	Dec 2003 Baseline Average (gr/dscf)	Dec 2003 PDF Average (gr/dscf)					
PCDD/PCDF											
2,3,7,8-TCDD	yes	yes	0.000000002081	0.000000000604	0.000000000004	0.000000000001				--	--
1,2,3,7,8-PeCDD	yes	yes	0.000000005489	0.000000002315	0.000000000010	0.000000000004				--	--
1,2,3,4,7,8-HxCDD	yes	yes	0.000000003219	0.000000001955	0.000000000006	0.000000000004				--	--
1,2,3,6,7,8-HxCDD	yes	yes	0.000000003571	0.000000002227	0.000000000007	0.000000000004				--	--
1,2,3,7,8,9-HxCDD	yes	yes	0.000000003704	0.000000002359	0.000000000007	0.000000000004				--	--
1,2,3,4,6,7,8-HpCDD	yes	yes	0.000000020437	0.000000017769	0.000000000039	0.000000000032				--	--
OCDD	yes	yes	0.000000039462	0.000000044974	0.000000000074	0.000000000081				--	--
										--	--
2,3,7,8-TCDF	yes	yes	0.000000000171	0.000000000083	0.000000000000	0.000000000000				--	--
1,2,3,7,8-PeCDF	yes	yes	0.000000000509	0.000000000276	0.000000000001	0.000000000000				--	--
2,3,4,7,8-PeCDF	yes	yes	0.000000000419	0.000000000260	0.000000000001	0.000000000000				--	--
1,2,3,4,7,8-HxCDF	yes	yes	0.000000000395	0.000000000289	0.000000000001	0.000000000001				--	--
1,2,3,6,7,8-HxCDF	yes	yes	0.000000000353	0.000000000223	0.000000000001	0.000000000000				--	--
2,3,4,6,7,8-HxCDF	yes	yes	0.000000000284	0.000000000243	0.000000000001	0.000000000000				--	--
1,2,3,7,8,9-HxCDF	yes	yes	0.000000000109	0.000000000089	0.000000000000	0.000000000000				--	--
1,2,3,4,6,7,8-HpCDF	yes	yes	0.000000000791	0.000000000593	0.000000000001	0.000000000001				--	--
1,2,3,4,7,8,9-HpCDF	yes	yes	0.000000000135	0.000000000121	0.000000000000	0.000000000000				--	--
OCDF	yes	yes	0.000000000853	0.000000000937	0.000000000002	0.000000000002				--	--
ITEF TEQ (ND=0; EMPC=0)	yes	yes	0.000000006437	0.000000002756	0.000000000012	0.000000000005	0.000000000006	0.000000000087	5.7%	--	--
ITEF TEQ (ND=0; EMPC=EMPC)	yes	yes	0.000000006437	0.000000002756	0.000000000012	0.000000000005	0.000000000006	0.000000000087	5.7%	--	--
ITEF TEQ (ND=DL/2; EMPC=0)	yes	yes	0.000000006481	0.000000002822	0.000000000012	0.000000000005	0.000000000006	0.000000000087	5.8%	--	--
ITEF TEQ (ND=DL/2; EMPC=EMPC)	yes	yes	0.000000006481	0.000000002822	0.000000000012	0.000000000005	0.000000000006	0.000000000087	5.8%	--	--
ITEF TEQ (ND=DL; EMPC=EMPC)	yes	yes	0.000000006504	0.000000002866	0.000000000012	0.000000000005	0.000000000006	0.000000000087	5.9%	--	--

Table 2-5
Summary of Polychlorinated Dibenzo-dioxins and Furans (PCDD/PCDF) Emissions

	Annualized Emissions		
Analyte	**Dec 2003 Baseline Average (tpy)**	**Dec 2003 PDF Average (tpy)**	**Change (tpy)**
PCDD/PCDF			
2,3,7,8-TCDD	0.0000000091	0.0000000026	-0.0000000065
1,2,3,7,8-PeCDD	0.0000000240	0.0000000101	-0.0000000139
1,2,3,4,7,8-HxCDD	0.0000000141	0.0000000086	-0.0000000055
1,2,3,6,7,8-HxCDD	0.0000000156	0.0000000098	-0.0000000059
1,2,3,7,8,9-HxCDD	0.0000000162	0.0000000103	-0.0000000059
1,2,3,4,6,7,8-HpCDD	0.0000000895	0.0000000778	-0.0000000117
OCDD	0.0000001728	0.0000001970	0.0000000241
2,3,7,8-TCDF	0.0000000008	0.0000000004	-0.0000000004
1,2,3,7,8-PeCDF	0.0000000022	0.0000000012	-0.0000000010
2,3,4,7,8-PeCDF	0.0000000018	0.0000000011	-0.0000000007
1,2,3,4,7,8-HxCDF	0.0000000017	0.0000000013	-0.0000000005
1,2,3,6,7,8-HxCDF	0.0000000015	0.0000000010	-0.0000000006
2,3,4,6,7,8-HxCDF	0.0000000012	0.0000000011	-0.0000000002
1,2,3,7,8,9-HxCDF	0.0000000005	0.0000000004	-0.0000000001
1,2,3,4,6,7,8-HpCDF	0.0000000035	0.0000000026	-0.0000000009
1,2,3,4,7,8,9-HpCDF	0.0000000006	0.0000000005	-0.0000000001
OCDF	0.0000000037	0.0000000041	0.0000000004
ITEF TEQ (ND=0; EMPC=0)	0.0000000282	0.0000000121	-0.0000000161
ITEF TEQ (ND=0; EMPC=EMPC)	0.0000000282	0.0000000121	-0.0000000161
ITEF TEQ (ND=DL/2; EMPC=0)	0.0000000284	0.0000000124	-0.0000000160
ITEF TEQ (ND=DL/2; EMPC=EMPC)	0.0000000284	0.0000000124	-0.0000000160
ITEF TEQ (ND=DL; EMPC=EMPC)	0.0000000285	0.0000000126	-0.0000000159

Table 2-6
Summary of Polyaromatic Hydrocarbons (PAHs) Emissions

Analyte	Analyte Detected		Emission Rate			PDF	Annualized Emissions		
	Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
PAHs									
Naphthalene	yes	yes	0.007385	0.008289	--	--	0.0323479	0.0363069	0.0039590
2-Methylnaphthalene	yes	yes	0.001146	0.002002	--	--	0.0050212	0.0087677	0.0037466
Acenaphthylene	yes	yes	0.000042	0.000079	--	--	0.0001835	0.0003457	0.0001622
Acenaphthene	yes	yes	0.000017	0.000005	--	--	0.0000724	0.0000218	-0.0000506
Fluorene	yes	yes	0.000070	0.000010	--	--	0.0003051	0.0000454	-0.0002597
Phenanthrene	yes	yes	0.001415	0.000370	--	--	0.0061992	0.0016222	-0.0045770
Anthracene	yes	yes	0.000119	0.000148	--	--	0.0005224	0.0006489	0.0001265
Fluoranthene	yes	yes	0.000635	0.000276	--	--	0.0027810	0.0012070	-0.0015739
Pyrene	yes	yes	0.000419	0.000214	--	--	0.0018347	0.0009386	-0.0008961
Benz(a)anthracene	yes	yes	0.000024	0.000015	--	--	0.0001053	0.0000668	-0.0000384
Chrysene	yes	yes	0.000044	0.000021	--	--	0.0001931	0.0000938	-0.0000994
Benzo(b)fluoranthene	yes	yes	0.000047	0.000013	--	--	0.0002057	0.0000588	-0.0001469
Benzo(k)fluoranthene	yes	yes	0.000013	0.000004	--	--	0.0000567	0.0000177	-0.0000390
Benzo(e)pyrene	yes	yes	0.000040	0.000011	--	--	0.0001748	0.0000503	-0.0001245
Benzo(a)pyrene	yes	yes	0.000006	0.000004	--	--	0.0000278	0.0000156	-0.0000122
Perylene	yes	yes	0.000002	0.000001	--	--	0.0000067	0.0000042	-0.0000025
Indeno(1,2,3-cd)pyrene	yes	yes	0.000021	0.000005	--	--	0.0000904	0.0000202	-0.0000702
Dibenz(a,h)anthracene	yes	yes	0.000008	0.000002	--	--	0.0000351	0.0000067	-0.0000285
Benzo(ghi)perylene	yes	yes	0.000018	0.000006	--	--	0.0000790	0.0000281	-0.0000509

Table 2-7
Summary of Polychlorinated Biphenyl (PCB) Emissions

Analyte	Analyte Detected		Emission Rate			PDF	Annualized Emissions		
	Baseline	PDF	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
PCBs									
PCB-77	yes	yes	0.00000036596	0.00000006085	--	--	0.000001603	0.000000267	-0.000001336
PCB-81	yes	yes	0.00000002403	0.00000000408	--	--	0.000000105	0.000000018	-0.000000087
PCB-105	yes	yes	0.00000012698	0.00000002734	--	--	0.000000556	0.000000120	-0.000000436
PCB-114	yes	yes	0.00000001367	0.00000000265	--	--	0.000000060	0.000000012	-0.000000048
PCB-118	yes	yes	0.00000025573	0.00000005644	--	--	0.000001120	0.000000247	-0.000000873
PCB-156/157	yes	yes	0.00000000293	0.00000000082	--	--	0.000000013	0.000000004	-0.000000009
					--	--			
Total Mono-PCBs	yes	yes	0.00000330688	0.00000692240	--	--	0.000014484	0.000030320	0.000015836
Total Di-PCBs	yes	yes	0.00000421076	0.00000105820	--	--	0.000018443	0.000004635	-0.000013808
Total Tri-PCBs	yes	yes	0.00016402116	0.00001946649	--	--	0.000718413	0.000085263	-0.000633149
Total Tetra-PCBs	yes	yes	0.00012610229	0.00001523369	--	--	0.000552328	0.000066724	-0.000485604
Total Penta-PCBs	yes	yes	0.00000665785	0.00000156526	--	--	0.000029161	0.000006856	-0.000022306
Total Hexa-PCBs	yes	yes	0.00000023810	0.00000010362	--	--	0.000001043	0.000000454	-0.000000589
Total Hepta-PCBs	yes	yes	0.00000003505	0.00000002447	--	--	0.000000154	0.000000107	-0.000000046
Total Octa-PCBs	yes	yes	0.00000000225	0.00000000177	--	--	0.000000010	0.000000008	-0.000000002
PCB-209	yes	yes	0.00000000042	0.00000000021	--	--	0.000000002	0.000000001	-0.000000001
PCB TEQs (WHO M/H)					--	--			
ND = 0	yes	yes	0.00000000008	0.00000000002	--	--	0.0000000004	0.0000000001	-0.0000000003
ND = 0.5 x DL	yes	yes	0.00000000021	0.00000000006	--	--	0.000000001	0.000000000	-0.000000001

Table 2-8
Summary of Hydrogen Halides/Halogens and Hydrogen Cyanide Emissions

Analyte	Analyte Detected Baseline	Analyte Detected PDF	Emission Rate Dec 2003 Baseline Average (lb/hr)	Emission Rate Dec 2003 PDF Average (lb/hr)	Emission Rate #39-00011 Permit Limit (lb/hr)	PDF Emission Rate as % of Limit	Annualized Emissions Dec 2003 Baseline Average (tpy)	Annualized Emissions Dec 2003 PDF Average (tpy)	Annualized Emissions Change (tpy)
Hydrogen Chloride	yes	yes	2.23	1.64	--	--	9.75	7.20	-2.55
Chlorine	--	yes	--	0.08	--	--	--	0.34	--
Hydrogen Fluoride	yes	--	0.03	--	--	--	0.14	--	--
Hydrogen Cyanide	yes	yes	0.60	0.06	--	--	2.63	0.26	-2.37

Table 2-9
Summary of CEMs Data

Temporary CEMs

					Average			
Condition	**Date**	**Start**	**Date**	**End**	**O2 (%)**	**CO2 (%)**	**CO (ppmd)**	**THC (ppmw)**
Baseline	12/2/2003	2:01:00 PM	12/4/2003	1:15:15 PM	5.17	26.18	3499	15.73
					O2 (lb/hr)	**CO2 (lb/hr)**	**CO (lb/hr)**	**THC (lb/hr)**
					1.55	10.76	915.3	7.03
Condition	**Date**	**Start**	**Date**	**End**	**O2 (%)**	**CO2 (%)**	**CO (ppmd)**	**THC (ppmw)**
PDF	12/4/2003	4:02:06 PM	12/6/2003	4:07:11 AM	5.52	25.33	1262	5.38
					O2 (lb/hr)	**CO2 (lb/hr)**	**CO (lb/hr)**	**THC (lb/hr)**
					1.65	10.41	330.2	2.46

		O2 (tpy)	CO2 (tpy)	CO (tpy)	THC (tpy)
Annualized Emissions	**Baseline**	6.77	47.14	4009	30.79
	PDF	7.23	45.60	1446	10.75
	Change	0.46	-1.54	-2563	-20.03

Plant-Installed CEMs

Condition	Date	Start	Date	End	NOx (lb/hr)	SO2 (lb/hr)
Baseline	12/2/2003	12:20:00 PM	12/4/2003	1:08:00 PM	161.7	166.3
PDF	12/4/2003	3:40:00 PM	12/6/2003	3:42:00 AM	101.5	77.3

		NOx (tpy)	SO2 (tpy)
Annualized Emissions	**Baseline**	708.2	728.4
	PDF	444.6	338.6
	Change	-263.7	-389.8

3.0 FEEDRATE OPTIMIZATION TESTING (PHASE 1)

The Phase 1 Feedrate Optimization testing was designed and conducted to determine the best feedrate of PDF to the kiln while maintaining stable operations and normal emissions. During this phase of the testing, Lafarge established the operating conditions of the kiln at the levels desired to conduct the entire test.

The introduction of PDF to the kiln during the Phase 1 testing was planned to occur under three separate trials:

- Trial 1 was the initial introduction of PDF to the kiln. The purpose of this trial was to verify that the material could be fed to the system while maintaining stable operations.
- Trial 2 was to introduce PDF to the kiln in step-wise increasing feed rates to identify the optimum feedrate.
- Trial 3 was to verify that the optimum feedrate of PDF identified in Trial 2 could be maintained for a longer period.

Temporary CEMs for CO and THC and the permanently installed CEMs for NO_x and SO_2 were used to provide a real-time indication of emissions during Phase 1. Because the results of the emission measurements during this phase of the testing needed to be reviewed on a real-time basis, the emission measurements were limited to the use of CEMs.

Prior to the introduction of PDF in Trial 1, baseline emissions of CO, THC, NO_x, and SO_2 were determined as the kiln operated under normal conditions for a period of two hours on Monday, November 24, 2003. Lafarge then began Trial 1 at approximately 4:00 pm. Lafarge stopped the trial after approximately one hour based on the observations made and the time of day.

Additional baseline data were then collected after Trial 1 was completed and before Trial 2 began on November 25. Additional baseline data were also collected before Trial 3 began and after Trial 4 was completed on November 26.

Trial 2 began on November 25 and lasted approximately 9 hours. During this time the PDF feedrate was varied from 0.5 to 3.0 tons/hour while monitoring the operation of the kiln. Based on the observations made during Trial 2, Lafarge determined that the optimum PDF is approximately 2 tons/hour.

Trial 3 began on November 26. Shortly after the trial began, inconsistencies in the particle size distribution of the PDF used during this trial created some mechanical pluggages in the feed system. Lafarge therefore stopped the trial after one hour.

Lafarge conducted Trial 4 later on November 26 for a period of 4 hours for the same purpose as Trial 3. While there was some variability in the PDF feedrate during this trial, Lafarge attempted to maintain a steady feedrate of approximately 2 tons/hour

The following sub-sections further describe the PDF feedrate, kiln operating conditions, and monitored emissions during this phase of the testing.

3.1 PDF Feedrate

Table 3-1 summarizes the Phase 1 PDF feedrate over the course of the Phase 1 testing. Figures 3-1 and 3-2 show the PDF feedrate during Trials 2 and 4 respectively. The PDF feedrates for Trials 1 and 3 are not shown because these trials were of short duration and the feedrate varied during those periods.

3.2 Kiln Operating Conditions

As stated above, Lafarge maintained the kiln at normal conditions as much as possible during the four Trials of the Phase 1 testing. Figures 3-3 through 3-5 present plots of raw feed, total fuel feedrate, and kiln burning zone temperature versus time for Trial 2, while Figures 3-6 through 3-8 present similar data from Trial 4. The operating data are provided in Appendix F.

3.3 Emission Results

Table 3-2 summarizes the emissions of the CEMs monitored constituents during Phase 1. Average emissions (either concentrations or emission rates, depending on how the CEMs present the results) are provided for the baseline periods before and after Trials 1, 2, and 4 as well as the actual trial periods.

Figures 3-9 through 3-11 present plots of SO_2, NO_x, CO, and THC emissions as measured by the temporary and permanently installed CEMs for Trial 2 while Figures

3-12 through 3-14 present similar data for Trial 4. The CEMs data are provided in Appendix E.

The average results presented in Table 3-2 indicate that the emissions of CEMs monitored constituents during the Phase 1 Trials were equivalent to or below the emissions measured during the Phase 1 baseline periods. Analysis of the CEMs data from the Phase 1 baseline and PDF trial periods indicate that the addition of PDF to the kiln did not substantially increase emissions. Based on these results, Lafarge concluded that Phase 2 testing could begin.

Figure 3-1
Trial #2 PDF Feedrate

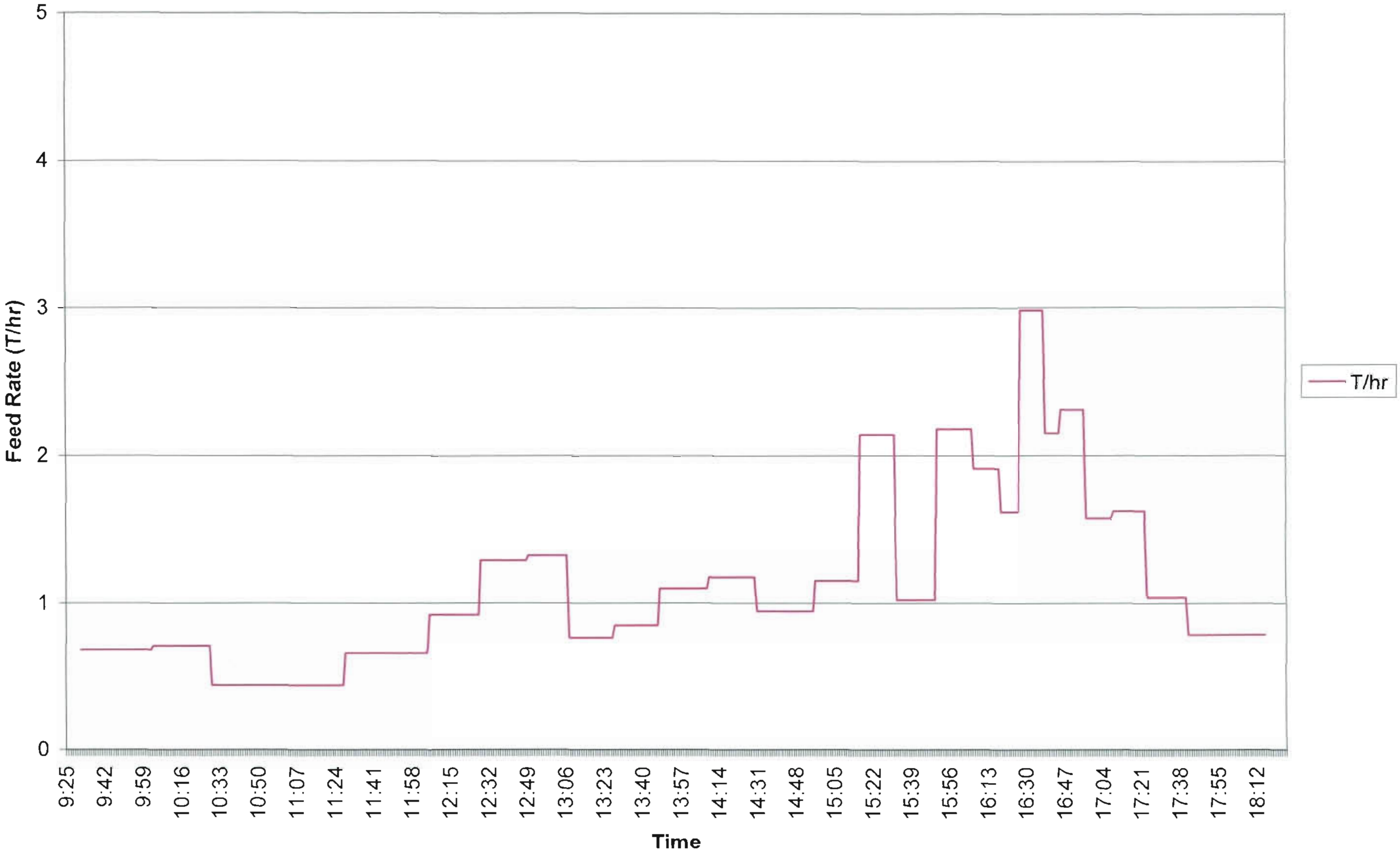


Figure 3-2
Trial #4 Feedrate

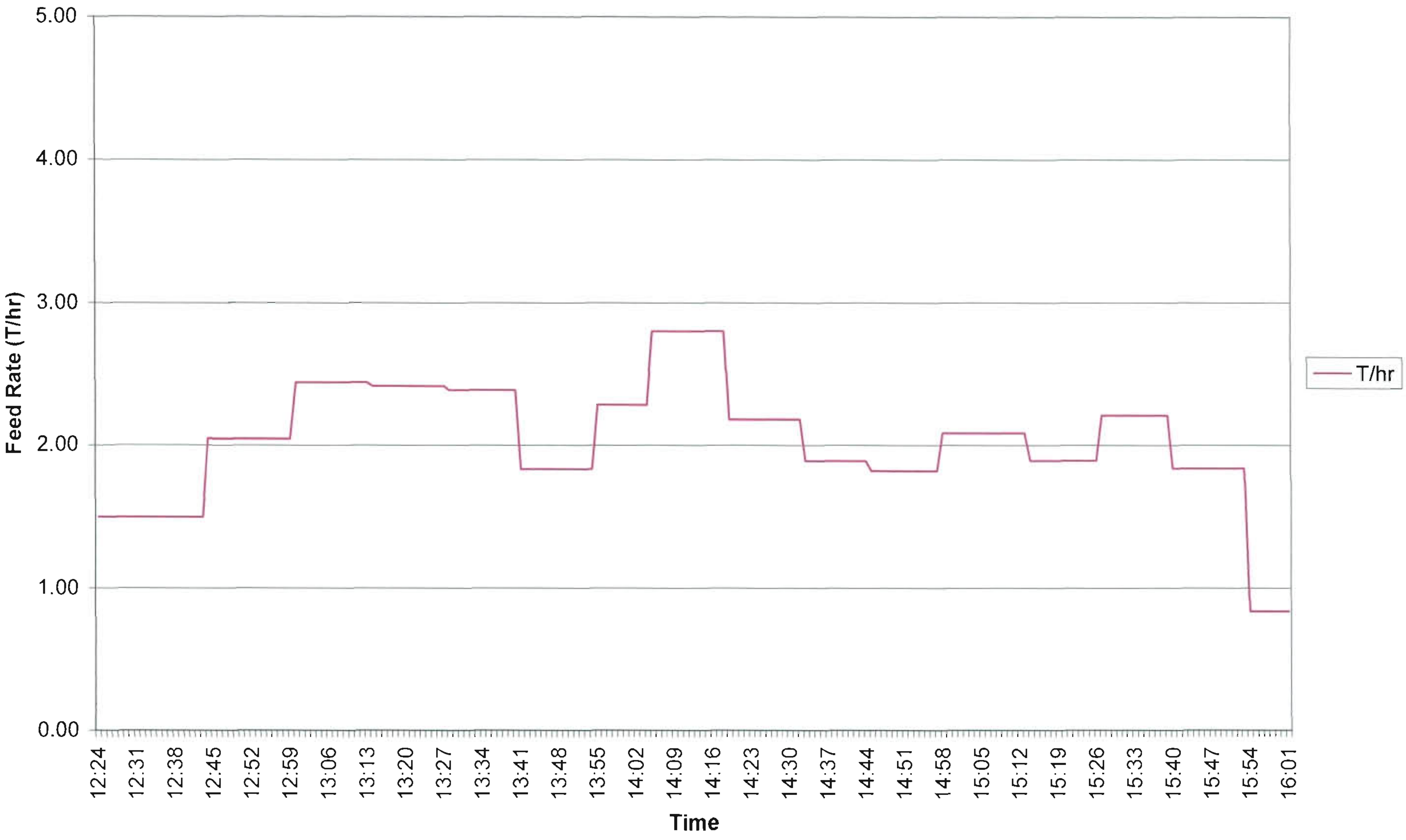


Figure 3-3
Trial #2
Raw Feed vs. Time

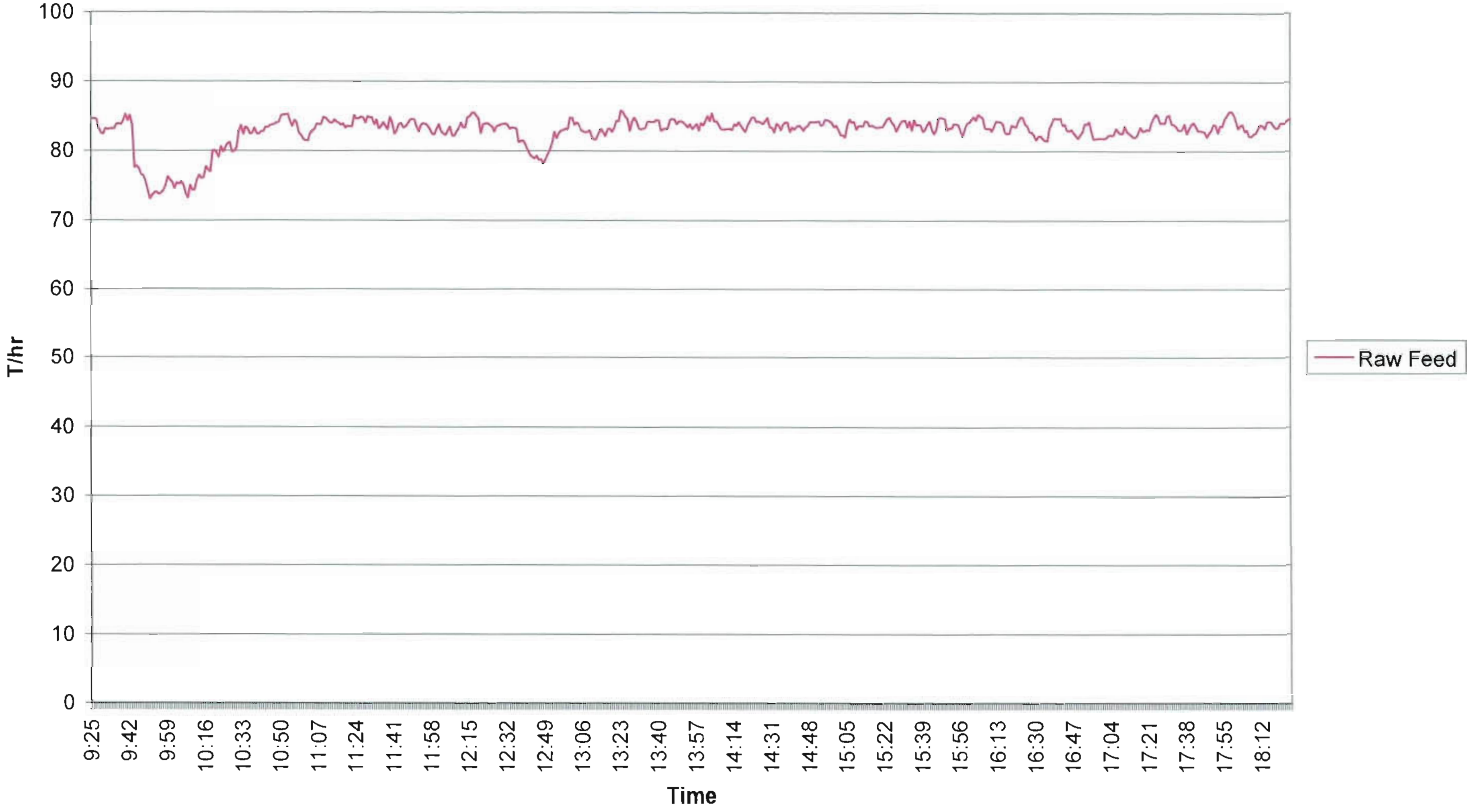


Figure 3-4
Trial #2
Fuel Feedrates vs. Time

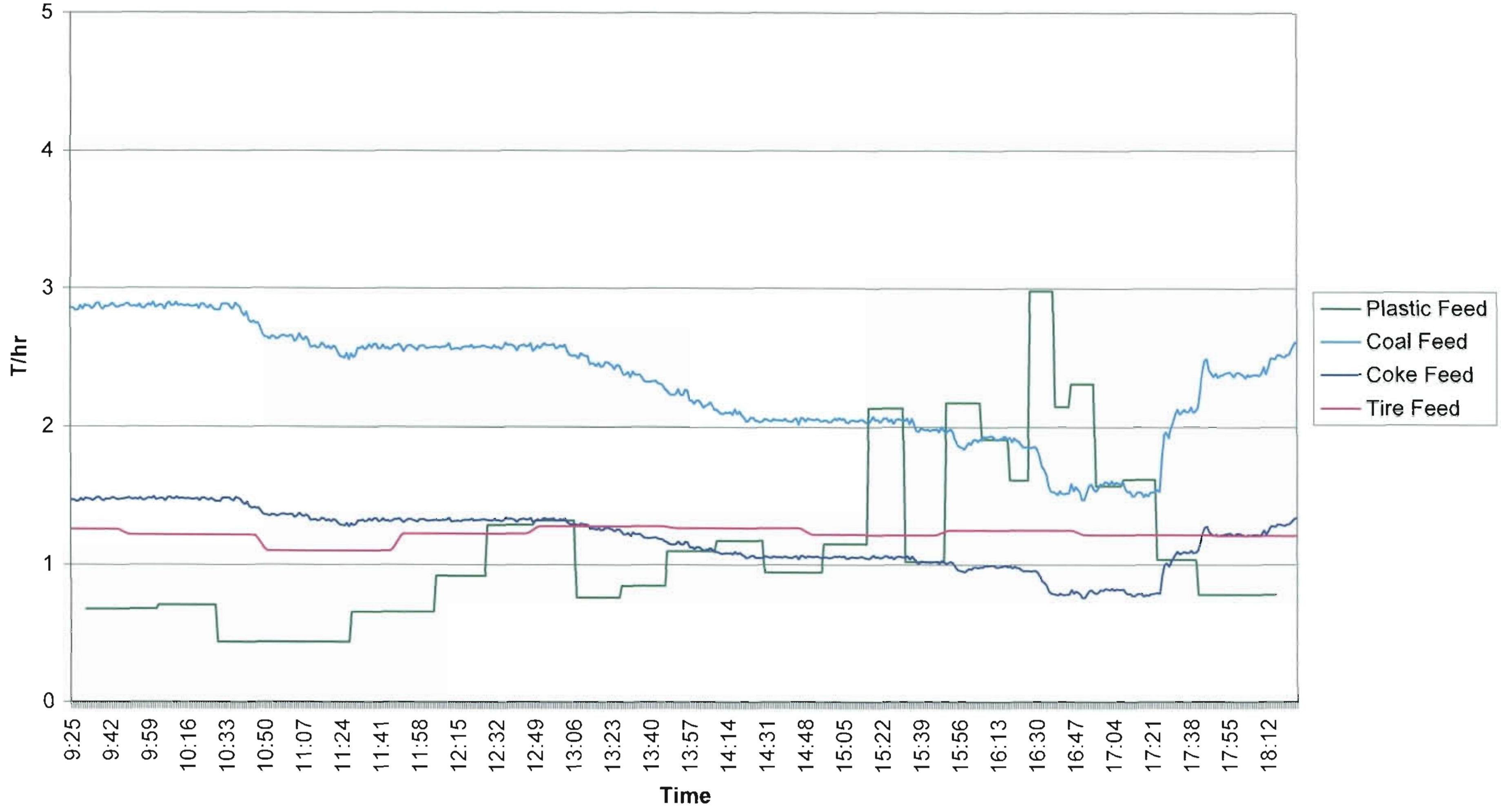


Figure 3-5
Trial #2
Burning Zone Temperature vs. Time

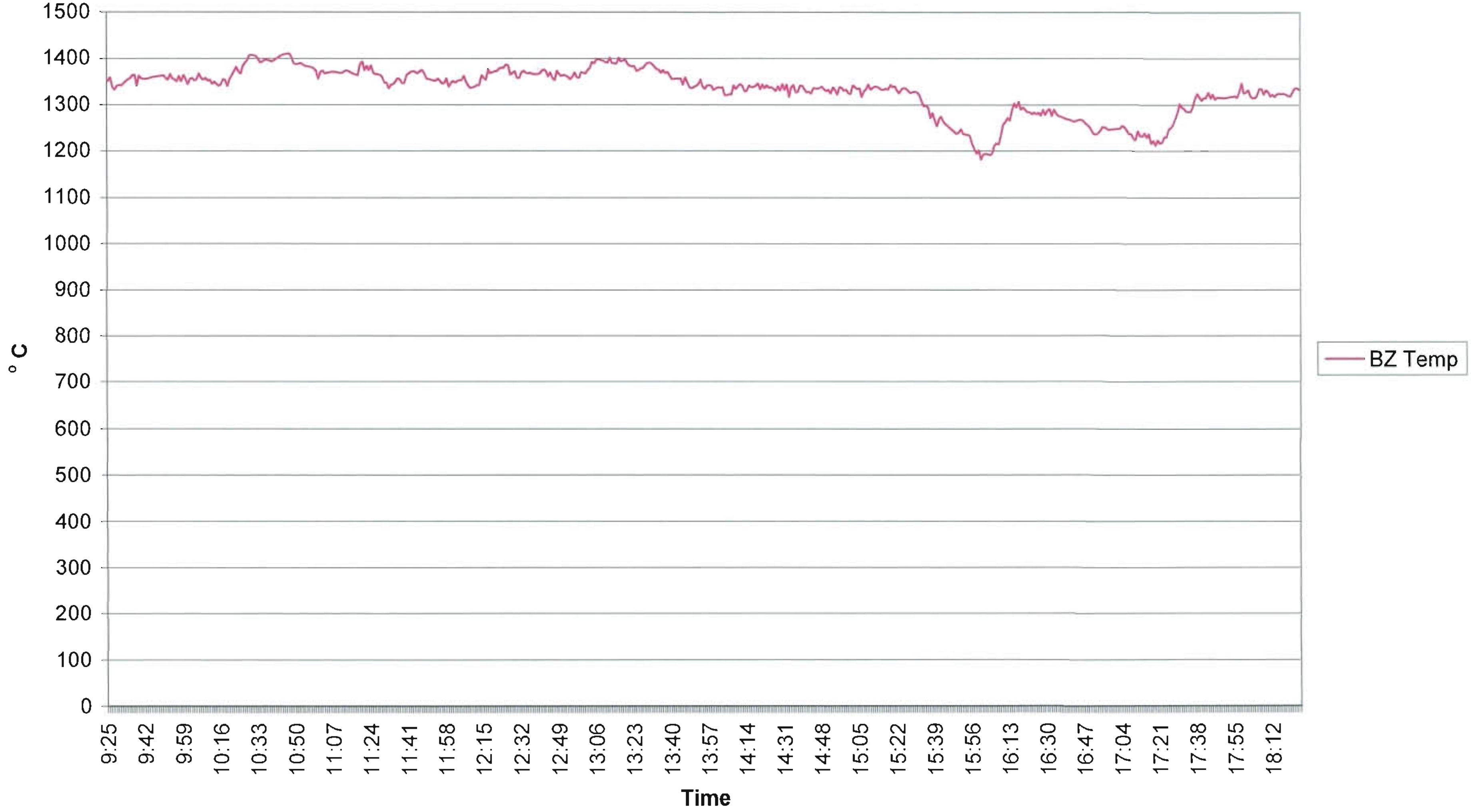


Figure 3-6
Trial #4
Raw Feedrate vs. Time

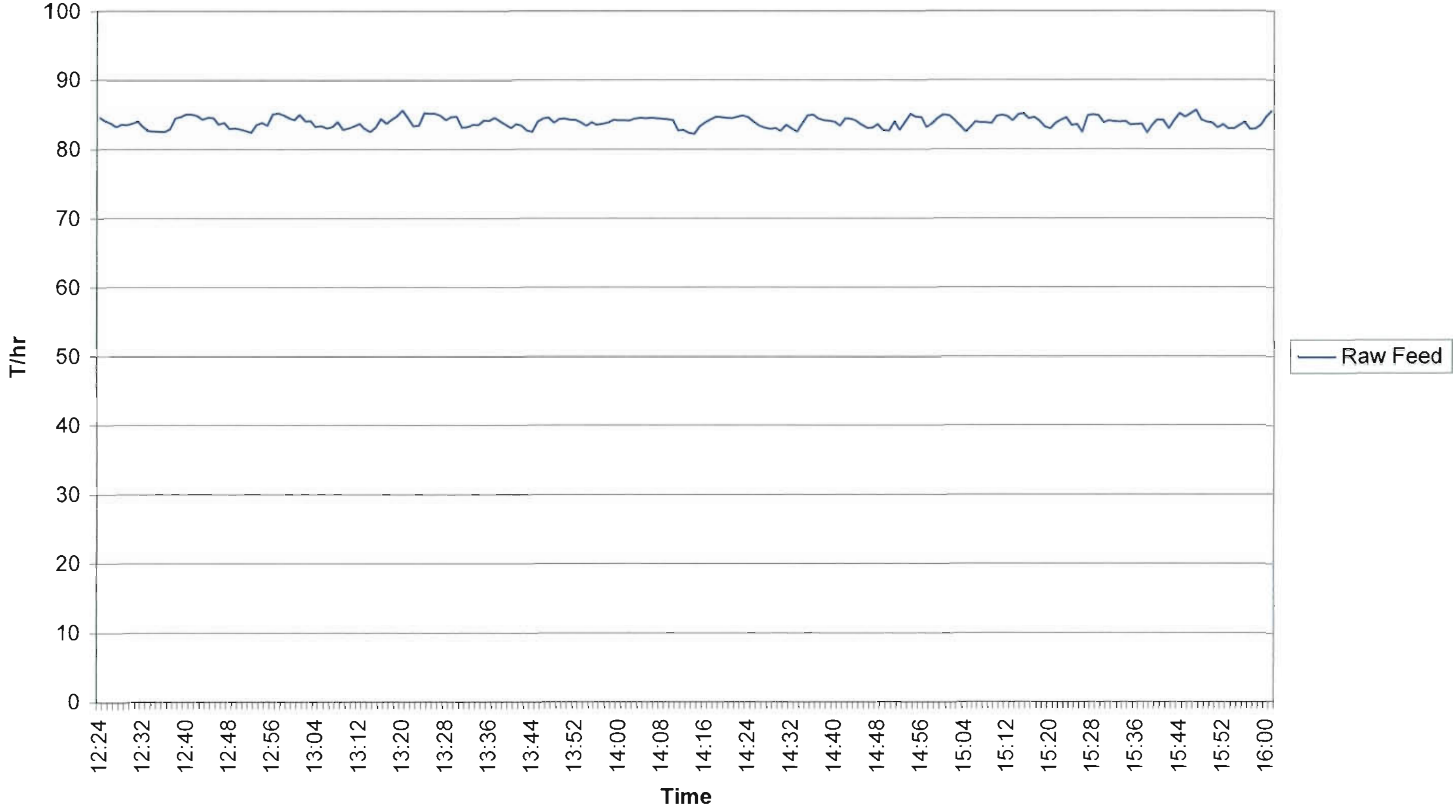


Figure 3-7
Trial #4
Fuel Feedrates vs. Time

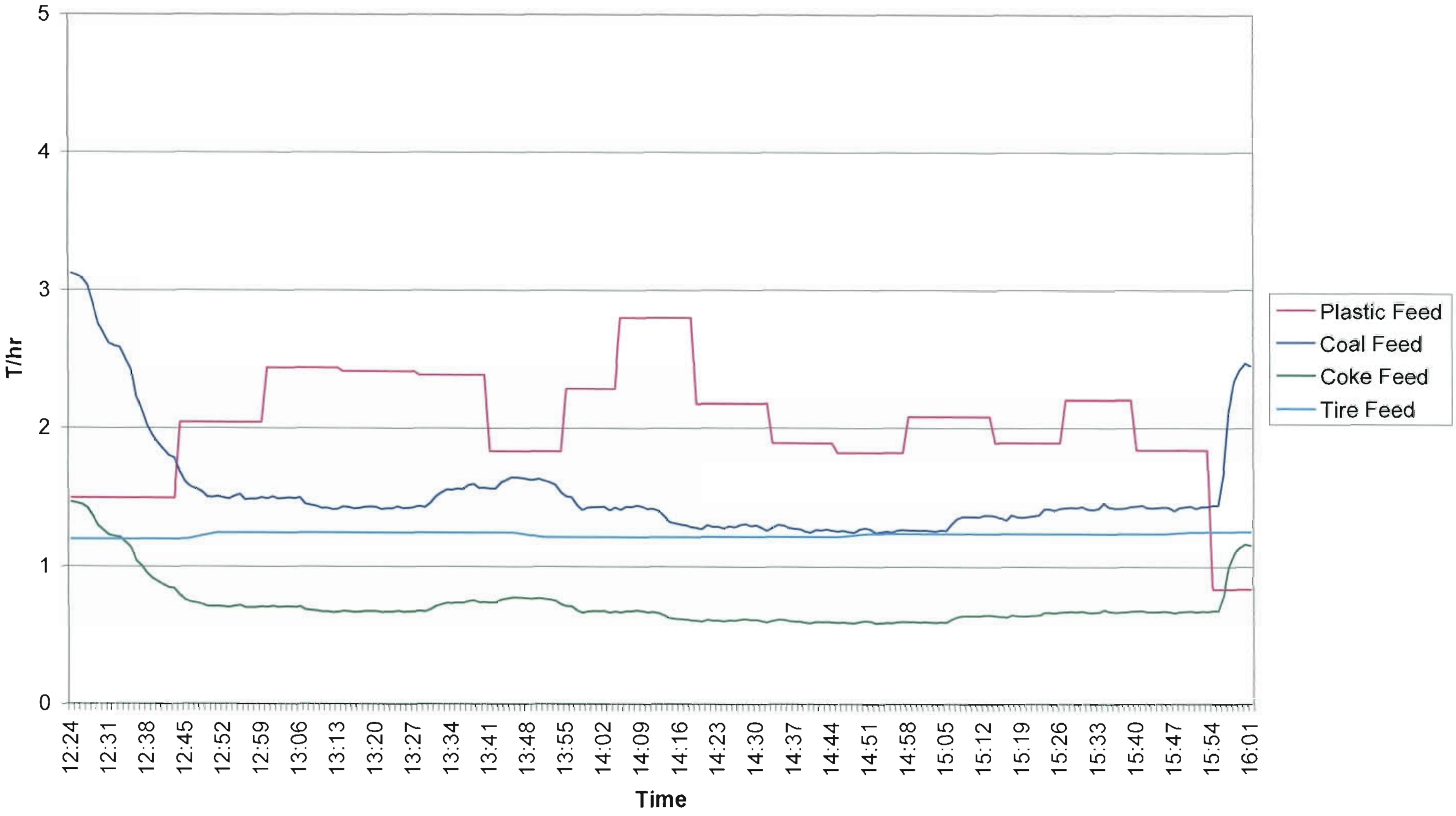


Figure 3-8
Trial #4
Burning Zone Temperature vs. Time

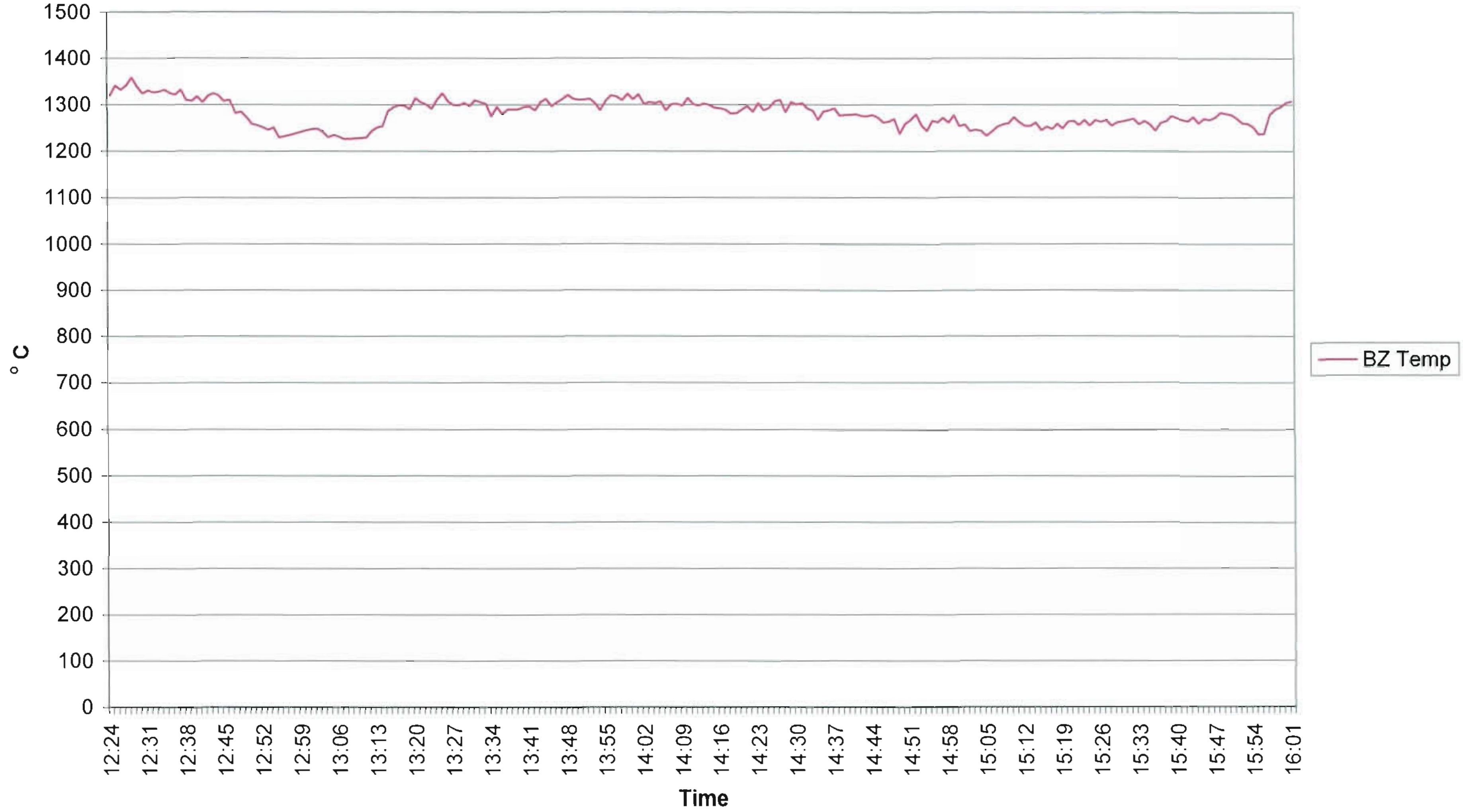


Figure 3-9
Trial #2
NOx and SO2 Emissions vs. Time

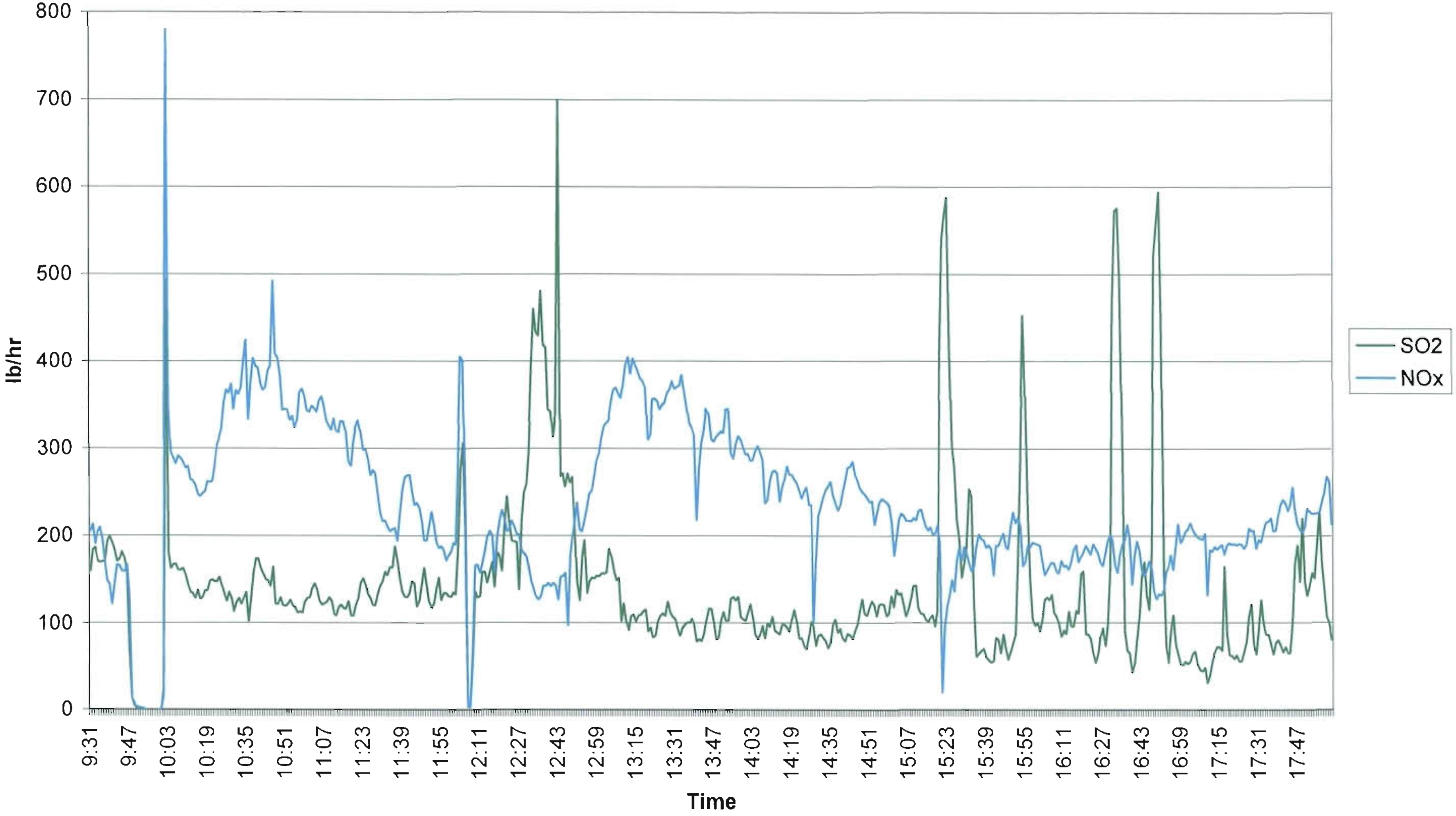


Figure 3-10
Trial #2
CO Emissions vs. Time

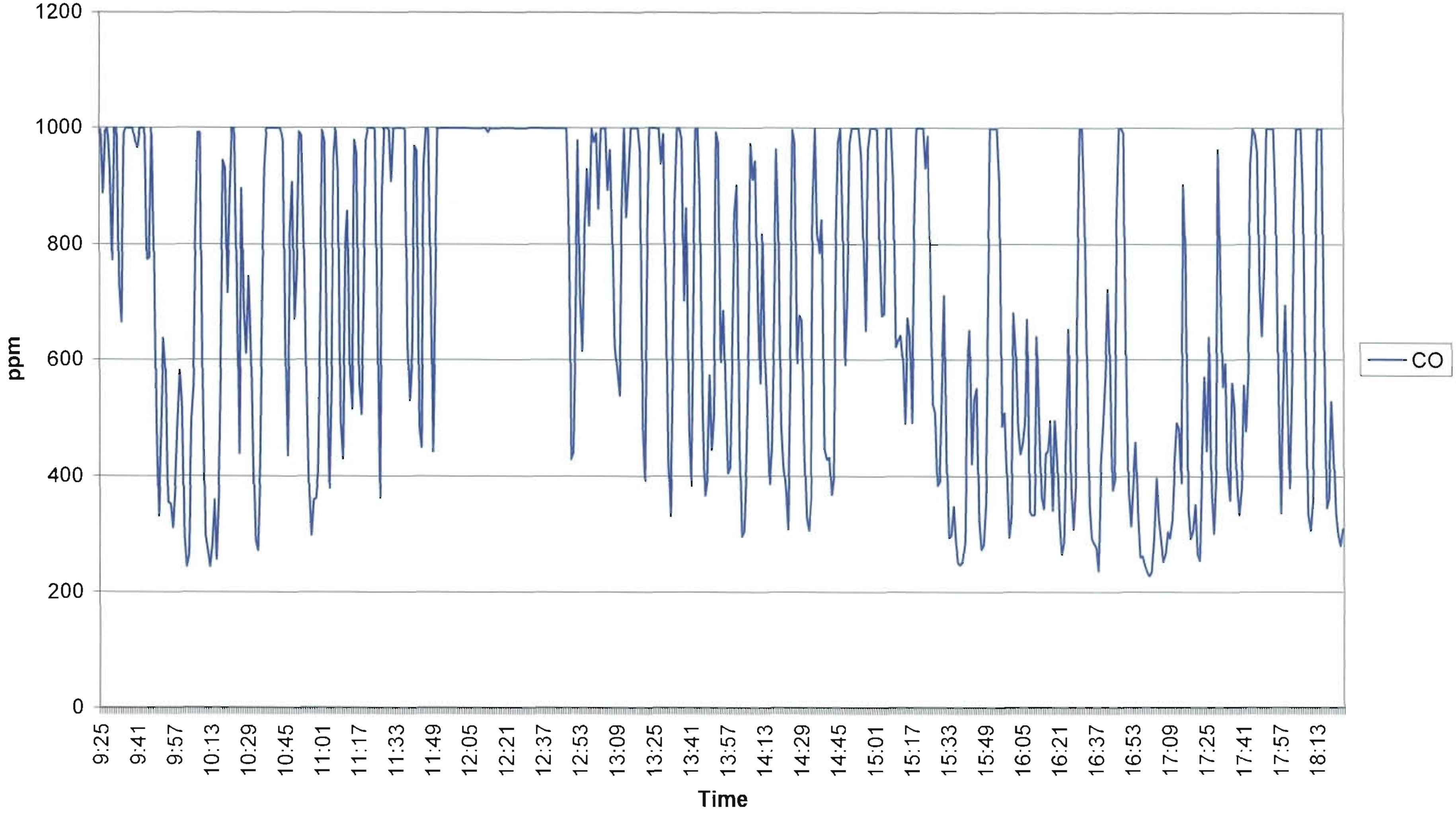


Figure 3-11
Trial #2
THC Emissions vs. Time

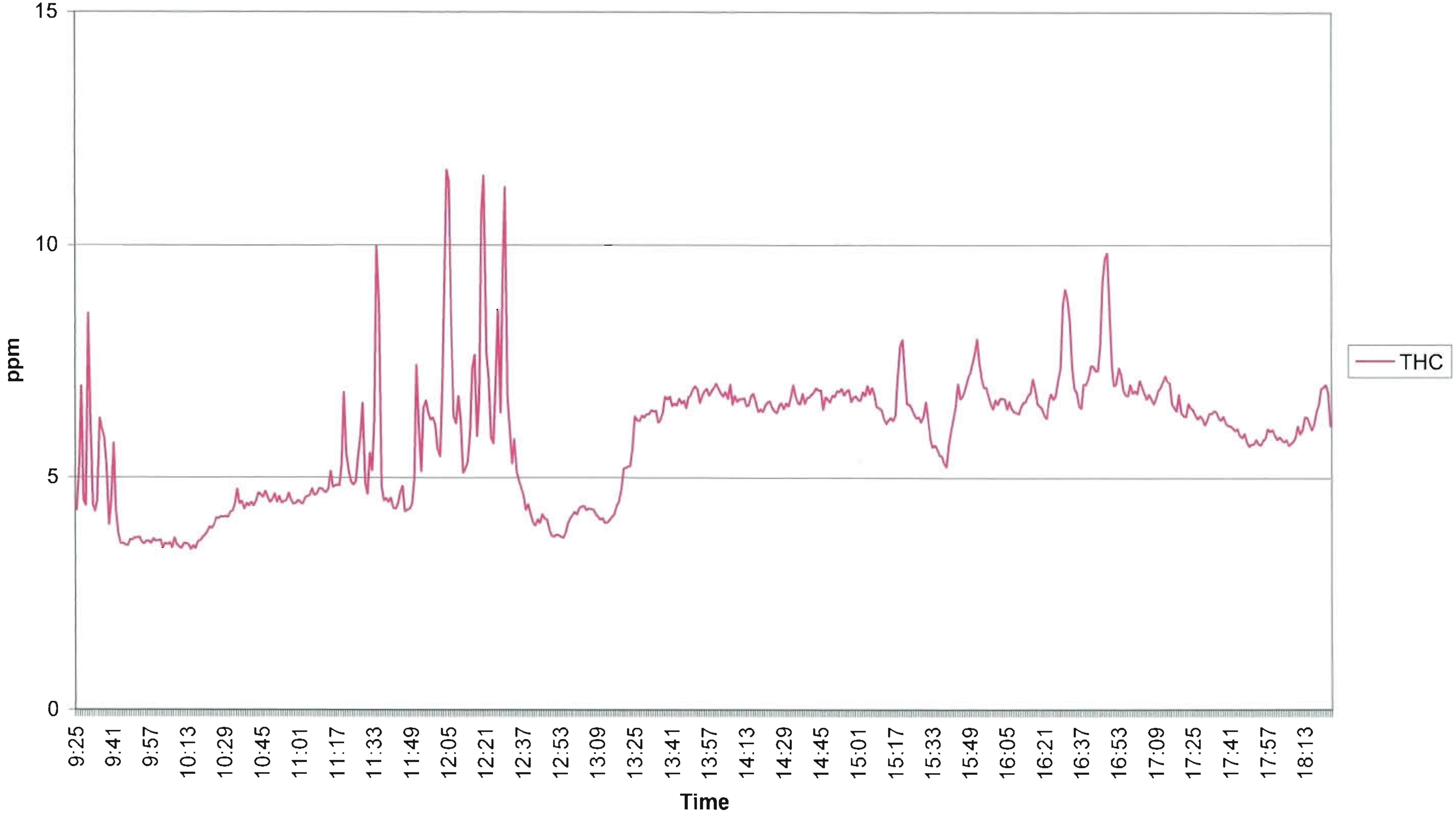


Figure 3-12
Trial #4
NOx and SO2 Emissions vs. Time

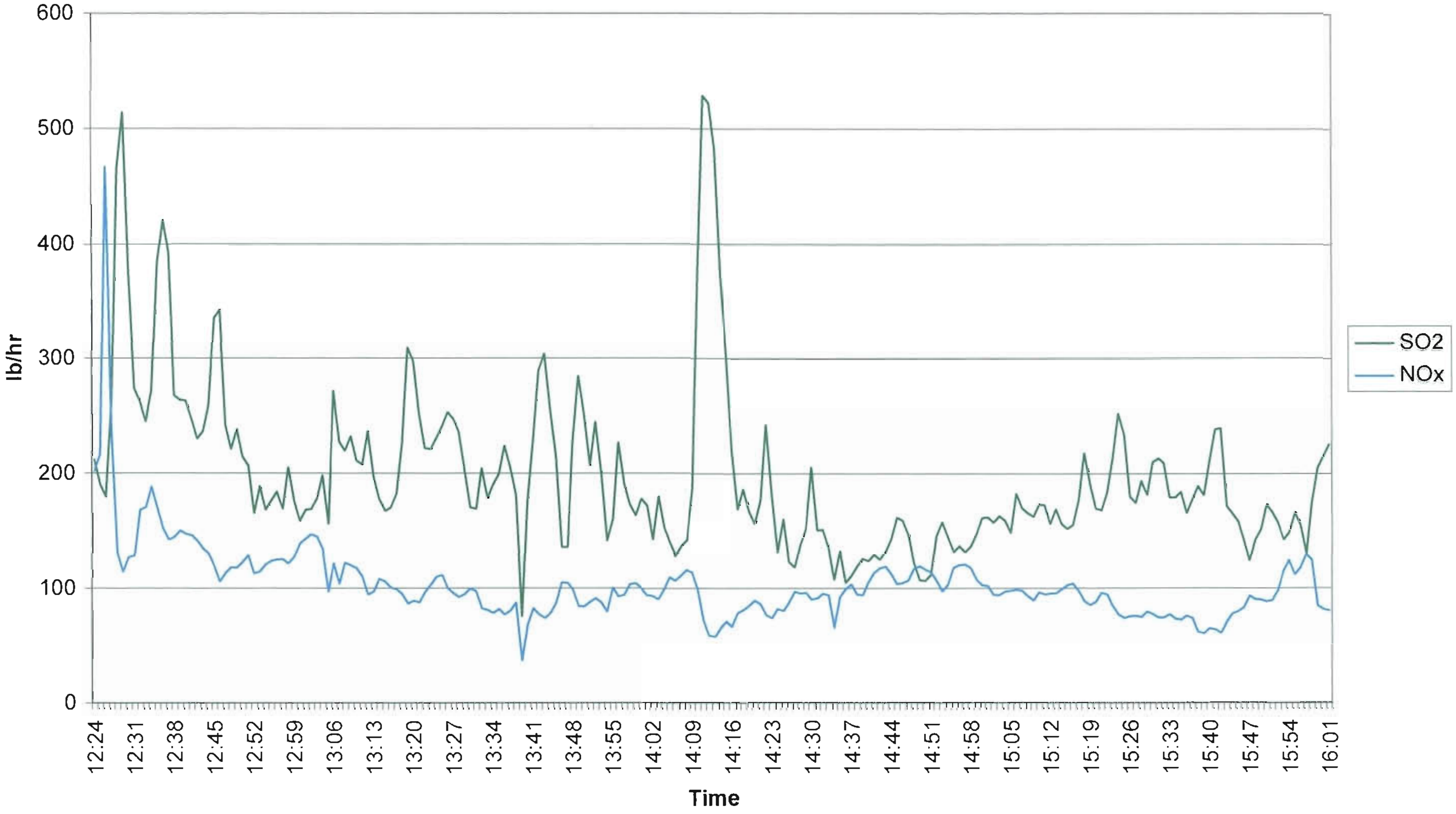


Figure 3-13
PDF Trial #4
CO Emissions vs. Time

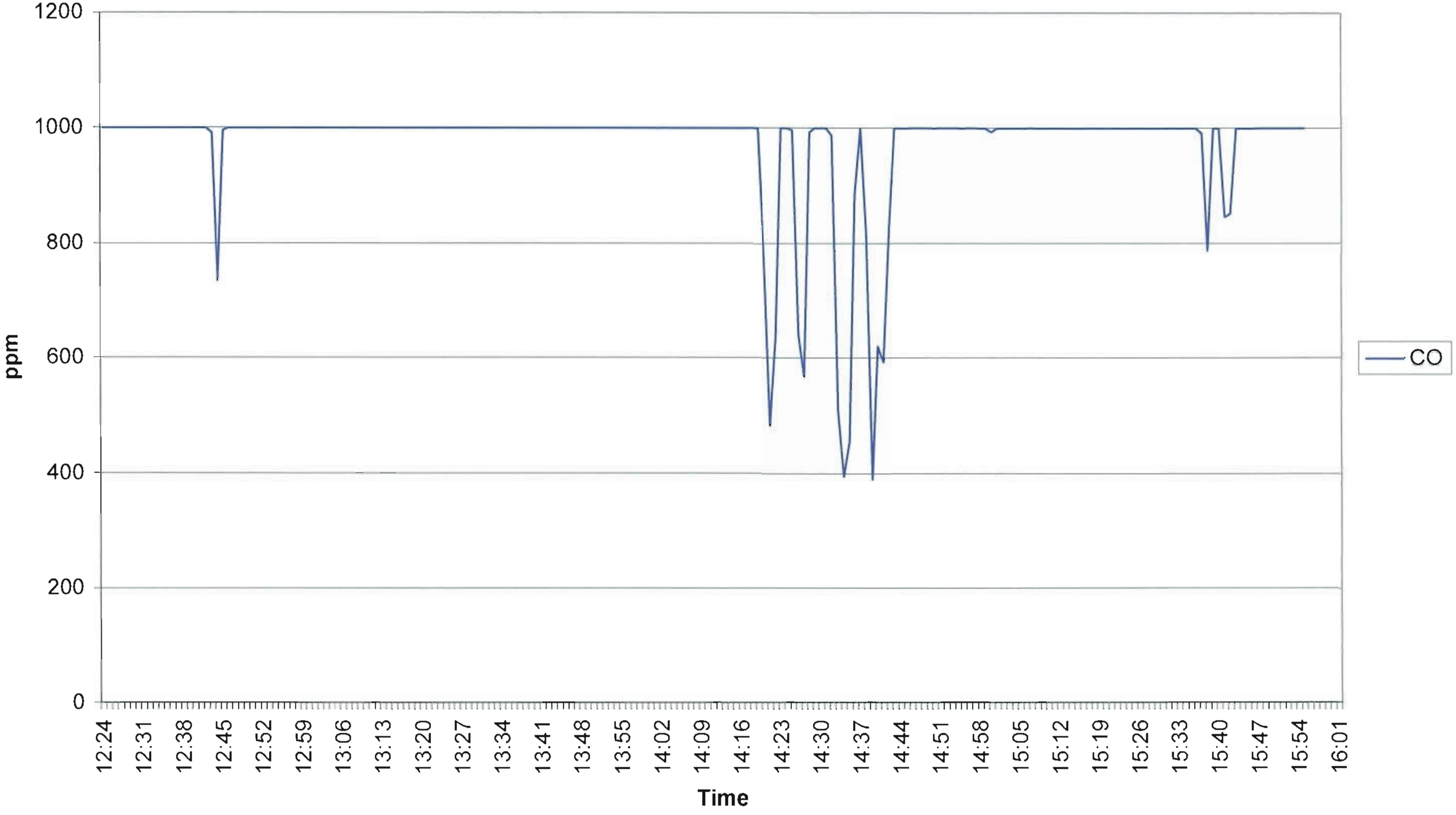


Figure 3-14
Trial #4
THC Emissions vs. Time

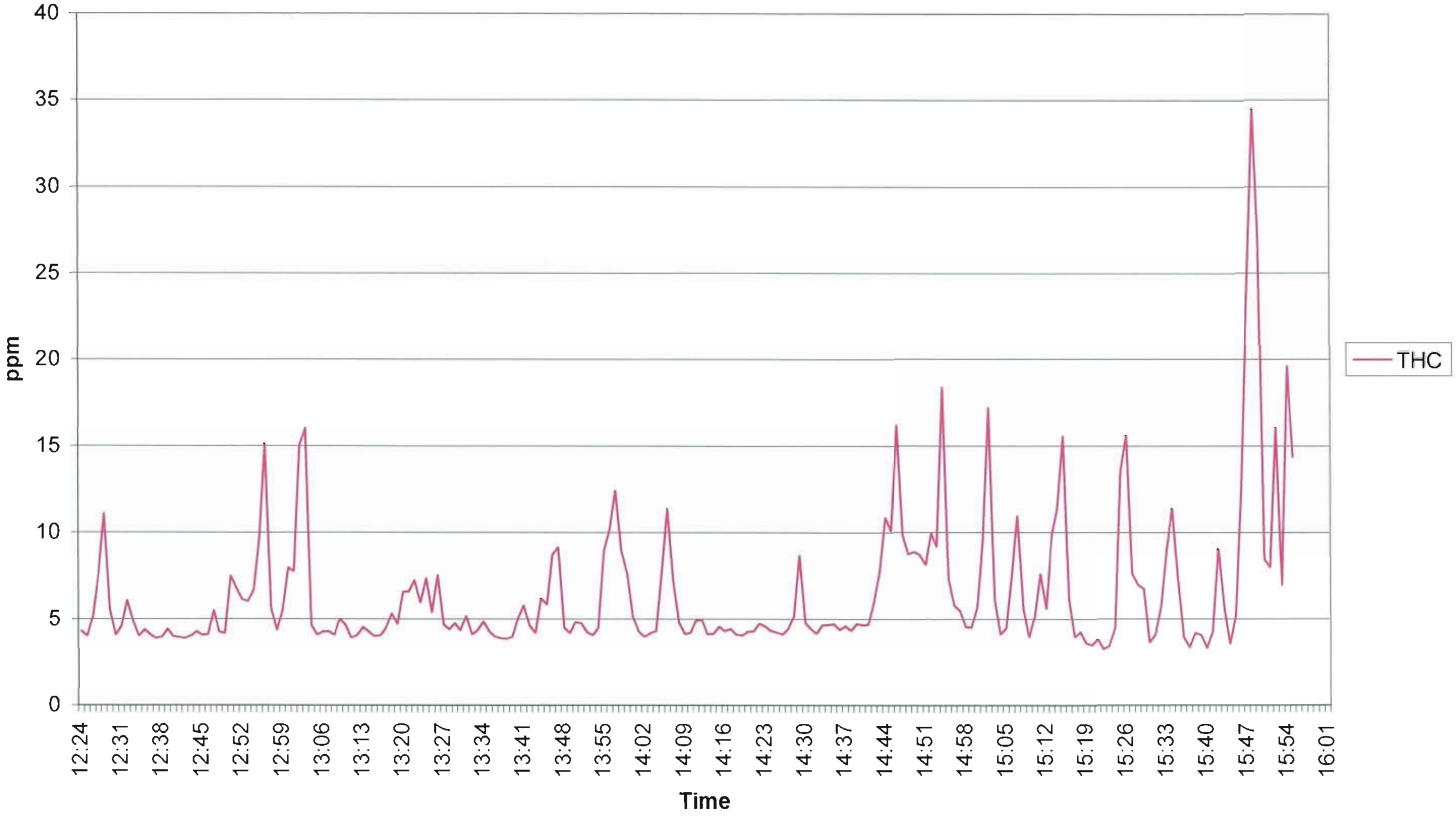


Table 3-1 PDF Feedrate Information (Phase 1)

Box Code	Box Number	Gross (lbs)	Net (lbs)	Time mm/dd 00:00	Burn Time (min)	T/hr	Feeder speed %	Blower speed %	Blower press. Psi	Line p. " WG	Comments
Trial 1											
K8	154	691		11/24/03 16:03	27	0.70	15 to 22	80	5.1	4.5	
K9	18	1119		11/24/03 16:30	22	1.38	40 to 50				Screw feeder keeps choking.
K7	102	1441		11/24/03 16:52	18	2.18	50 to 55				Increasing speed allows us to run it.
K7	100	1275		11/24/03 17:06			55 to 60				
Trial 2											
K7	87	910	800	11/25/03 9:30	32	0.68	25	70	4.5	4.7	Box weight not correct.
K7	86	746	677	11/25/03 10:02	26	0.71	25	75	5.2	5	Vibrator set at 5.
K9	8	1045	952	11/25/03 10:28	59	0.44	25	75	5.2	4.7	Small screw choke at nozzle.
K7	90	965	893	11/25/03 11:27	37	0.66	25	75	5.2	4.6	Hopper choke - vibrator to 6
K7	94	843	778	11/25/03 12:04	23	0.92	28 to 31	75	5.2	4.6	
K9	11	1089	994	11/25/03 12:27	21	1.29	31 to 35	75 to 80	5.2 - 5.9	4.6	
K7	88	995	874	11/25/03 12:48	18	1.32	35	80	5.9	4.6	Vibrator to 6.5
K7	153	639	560	11/25/03 13:06	20	0.76	35	80	5.9	4.6	
K9	23	727	624	11/25/03 13:26	20	0.85	35	80	5.9	4.6	
K7	89	1007	888	11/25/03 13:46	22	1.10	35	80	5.9	4.6	
K7		1006	906	11/25/03 14:08	21	1.17	35	80	5.9	4.6	
K9	12	1030	903	11/25/03 14:29	26	0.95	35	80	5.9	4.6	
K7		941	846	11/25/03 14:55	20	1.15	35	80	5.9	4.6	
K7	42	1383	1255	11/25/03 15:15	16	2.13	35 to 30	80 to 95	5.9 - 8.5	4.6	
K9	21	786	676	11/25/03 15:31	18	1.02	36 to 41	95 to 98	8.5 - 9.1	4.6	Blowback out of screw
K7	43	1389	1278	11/25/03 15:49	16	2.17	42	98	8.5 - 9.2	4.5	hopper slightly choked
K7	85	915	842	11/25/03 16:05	12	1.91	44 to 46	98	8.5 - 9.3	4.5	
K9	27	634	534	11/25/03 16:17	9	1.61	50 to 40	98	8.5 - 9.4	4.5	
K7	103	1315	1205	11/25/03 16:26	11	2.98	28	98	8.5 - 9.5	4.5	Estimated time of blower line leak
K7	96	627	552	11/25/03 16:37	7	2.15	50 to 44	98	8.5 - 9.6	4.5	problem actually determined at 17:07
K9	28	1052	932	11/25/03 16:44	11	2.31	40 to 30	98	8.5 - 9.7	4.5	
K7	84	775	693	11/25/03 16:55	12	1.57	50 to 42	98	8.5 - 9.8	4.5	Spill of boxes on burner floor
K7	91	1050	893	11/25/03 17:07	15	1.62	42 to 38	99	4.4	4.5	Box 37 now into 2 boxes 1 & 2
K9	30	761	687	11/25/03 17:22	18	1.04	35 to 30	99 to 90	4.3	4.5	
K7	92	1145	1007	11/25/03 17:40	35	0.78	30 to 25	90 to 80	3.6-7.5-6.1	4.5 - 4.6	
				11/25/03 18:15							
					average	1.33					
			21249		525	1.10					

Table 3-1 PDF Feedrate Information (Phase 1)

Box Code	Box Number	Gross (lbs)	Net (lbs)	Time mm/dd 00:00	Burn Time (min)	T/hr	Feeder speed %	Blower speed %	Blower press. Psi	Line p. " WG	Comments
Trial 3											
K6	37	1226	1047	11/26/03 9:43	26	1.10	25	70 to 75	4.6 - 5.6	4.6	Spilled box form yesterday
K7	48	1372	1263	11/26/03 10:09	35	0.98	25 to 30	75 to 80	5.6 - 6.25	4.6	Small hopper choke.
K9	29	733	645	11/26/03 10:44	1		40	80	6.25	4.6	K9 Box found with big chunks and rejected.
				11/26/03 10:45							K9 Box 29 plugged the hopper with big chunks.
											Trial suspended to clean out hopper.
Trial 4											
K6	51	1204	1101	11/26/03 12:23	20	1.50	25-35-55	85 to 90	6.6 - 7.6	4.5	
K6	45	1321	1200	11/26/03 12:43	16	2.04	55	90	7.6	4.5	
K6	44	1372	1252	11/26/03 12:59	14	2.43	55	95	8.5	4.5	
K6	50	1352	1239	11/26/03 13:13	14	2.41	55	95	8.5	4.5	
K6	73	1263	1137	11/26/03 13:27	13	2.38	55	95	8.5	4.5	
K6	83	1075	943	11/26/03 13:40	14	1.83	55	95	8.5	4.5	
K6	72	975	837	11/26/03 13:54	10	2.28	55	95	8.5	4.5	
K6	33	1547	1438	11/26/03 14:04	14	2.80	55	95	8.5	4.5	
K6	76	1253	1119	11/26/03 14:18	14	2.18	55	95	8.5	4.5	
K6	82	913	834	11/26/03 14:32	12	1.89	55	95	8.5	4.5	
K6	80	957	870	11/26/03 14:44	13	1.82	55	95	8.5	4.5	Small hopper choke used airlance.
K6	49	1348	1223	11/26/03 14:57	16	2.08	55	95	8.5	4.5	
K6	78	1026	904	11/26/03 15:13	13	1.89	55	95	8.5	4.5	
K6	36	1190	1051	11/26/03 15:26	13	2.20	55	95	8.5	4.5	
K6	52	1067	946	11/26/03 15:39	14	1.84	55	95	8.5	4.5	
K3	120	830	736	11/26/03 15:53	24	0.83	35	95	8.5	4.5	
				11/26.03 16:17							
					average	2.15					
			16830		234	1.96					16 Boxes left on burner floor

Table 3-2. Phase 1 CEMs Emission Summary

Trial	Condition	Start Time	End Time	NO_x lb/hr	SO_2 lb/hr	CO ppmv	THC ppmvw
1	pre-baseline	11/24/03 13:00	11/24/03 16:02	117	179	999	25
	post-baseline	11/24/03 17:07	11/24/03 20:00	212	91	253	4
	PDF Trial	11/24/03 16:03	11/24/03 17:06	52	290	759	35
2	pre-baseline	11/25/03 7:00	11/25/03 9:29	195	174	929	6
	post-baseline	11/25/03 18:16	11/25/03 18:29	318	67	363	7
	PDF Trial	11/25/03 9:30	11/25/03 18:15	228	132	697	6
4	pre-baseline	11/26/03 7:00	11/26/03 9:42	143	201	not avail	not avail
	post-baseline	11/26/03 16:18	11/26/03 17:00	171	257	not avail	not avail
	PDF Trial	11/26/03 12:23	11/26/03 16:17	104	207	970	7

4.0 BASELINE AND FUEL SUBSTITUTION EMISSIONS TESTING (PHASE 2)

In the second phase of testing, Lafarge operated Kiln #2 under normal operating conditions using coal/coke and tire-derived fuel, and conducted stack sampling using both manual methods and CEMs to measure kiln emissions. After this baseline testing was completed, Lafarge operated Kiln #2 PDF feedrate that was identified during the Phase 1 optimization testing. Again, Lafarge conducted stack sampling using both manual methods and CEMs to evaluate and characterize kiln emissions while PDF was used as a substitute fuel for coal. The optimum PDF feedrate determined from the Phase 1 testing was 2 tons/hour. During the PDF test condition, the feedrate of coal/coke was reduced from its baseline feedrate such that the total amount of fuel fed to the kiln was consistent between the baseline and PDF test conditions. (Tire-derived fuel was also fed during both conditions at consistent rates).

The following sub-sections describe the emission testing that was performed during Phase 2 of the test.

4.1 Sample Collection, Handling and Analysis

Detailed descriptions of the sample collection, recovery (including storage conditions and method of transport) and analytical procedures for the various methods are provided in the following sub-sections of this report **(2.1.2.2)**. The test matrix for the manual method sampling conducted during Phase 2 is presented in Table 4-1. This table includes the pollutants that were measured and the applicable sampling and analytical procedures used for the manual methods testing **(2.1.2.2)**. Table 4-2 presents a summary of the sample collection dates and times. Table 4-3 presents a summary of the CEMs measurement methods and analyzers.

4.1.1 Sample Collection

Except as noted in Section 4.2, the emission samples were collected as detailed in the test protocol. Sampling data sheets with the sampling data, including sampling times, locations, identification codes, and other pertinent and specific sample information including calibration, are contained in Appendix G.

4.1.2 Sample Recovery and Storage

After the samples were collected, the sampling trains were taken to the on-site trailer where they were recovered. Sample containers were labeled using preprinted labels at the time the sample was obtained. Following sample collection and recovery, the samples were placed in ice chests and stored on-site under the supervision of the stack testing crew until being transferred to the various laboratories.

4.1.3 Sample Handling and Shipping

The samples were packaged and labeled for shipment using approved shipping containers in compliance with current U.S. Department of Transportation (DOT) dangerous goods regulations. Filters from stack sampling for organic constituents were placed in glass Petri dishes, sealed with Teflon® tape, and placed in individual Ziploc plastic bags in coolers that have not been used for liquid or solid sample storage. Absorbent material or vermiculite was packed between samples to absorb shock and spills incurred during shipment. Ice contained in double plastic bags was added and the coolers taped shut. Chain-of-custody records, and any other shipping and sample documentation were completed and accompanied the sample shipments. The chain-of-custody forms are also provided in Appendix G.

VOST samples were shipped as "Priority One/Overnight" via FedEx from the plant to the laboratory. The remaining samples were placed in the stack crew testing trailer and returned to the URS Measurements Office in Morrisville, NC. Samples for Method 23 and Method 201A/202 were then picked up by those laboratories' couriers. Samples for Method 26 were hand delivered to that laboratory. The remaining samples (Methods 29, 0061, 0010) were sent via FedEx and Airborne Express to the laboratory.

4.1.4 Sample Analysis

Except as noted in Section 4.2, the emission samples were analyzed as detailed in the test protocol. Copies of the summary laboratory reports are provided in Appendix C. Complete reports, including the raw data are provided in Appendix H.

4.2 Deviations of Test Protocol

The following are deviations from the approved test protocol and problems associated with the sampling, recovery, analysis, or source/control device operation.

1. For the Method 26A trains, three impingers were added for all baseline and PDF runs. These impingers included one modified Greenburg-Smith impinger containing 100 mL of 0.1N H_2SO_4 placed after the two acidic impingers; an empty modified Greenburg-Smith impinger placed in between the acidic and basic impingers; and one modified Greenburg-Smith impinger containing 100 mL of 0.1N NaOH placed after the two basic impingers. This modification was made to avoid depletion of the impinger solutions and to avoid carryover from the acidic to basic impingers.

2. For the baseline Run 4 and for all PDF runs, one modified Greenburg-Smith impinger and on Greenburg-Smith impinger, each containing 100 mL of 2% zinc acetate were placed in between the basic impingers and the silica gel impinger. The contents of the zinc acetate impingers were recovered, and analyzed for cyanide by SW-846 Method 9012A by STL Laboratories. This modification was made to improve the sample collection due to the concentration of SO_2 in the emissions.

3. For the PDF runs of the Method 0061 trains, an additional 75 mL of 0.5N KOH were added to the first impinger. This modification was made to ensure the pH remained greater than 8.5 during the sampling as the pH values during the baseline runs were as low as 9 when measured during port changes and at the end of the sampling runs.

4. During PDF Run 3 of the Method 0061 and Method 201A/202 trains, the kiln experienced a process upset involving the pluggage of the preheater tower. Feed to the kiln was stopped and operating conditions were reduced to correct the problem. Stack sampling was stopped and the sampling trains were held. After approximately 30 hours, the upset was still not resolved. The decision was made in the field to recover the sampling trains at that time, with the amount of sample already taken. For the 0061 train, the run was stopped at 68 minutes of the planned 128 minutes. For the 201A/202 train, the run was stopped at 91 minutes of the planned 145 minutes. On-site PADEP personnel approved and validated the runs. The trains were recovered and the samples were submitted for analysis.

4.3 Emissions

The following subsections present a discussion of the emissions from the manual methods sampling, portable analyzers, and plant installed CEMs. A discussion of the results and table of the emissions are included for each parameter. These tables show, by test run and test condition, the detected mass, the calculated emission concentration, corrected to 7% oxygen, and the calculated emission rate, as well as the averages of the emissions for both test conditions. Also shown in these tables is a comparison to previous testing results, when data are available, the facility permit limit, where applicable, and the average PDF emission rate expressed as a percent of the permit limit.

Each of the sampling trains consists of multiple individual sample fractions. For example, one VOST sample run consists of three pairs of sampling tubes, each analyzed individually, plus a condensate sample(s). The convention used to calculate and present results in these tables includes three cases:

Case 1 includes individual runs where all sample fractions contained the mass of the analyte constituent greater than the detection level. In this case, the masses detected were summed and were used to calculate the emission rate.

Case 2 involves individual runs where the sample fractions include both detectable masses and masses that were less the analytical detection limit. In this case, the detection limit was used for the sample fractions that were less the limit, these detection limits were summed with the detected masses to calculate the emission rate.

Case 3 involves individual runs where all of the sample fractions were less analytical detection limit. In this case, the detection limit for each fraction was summed to provide the mass used to calculate the emission rate. For both Case 2 and 3, the emission concentrations and rates are shown with a "<" sign. Columns in each table indicate whether the individual analytes were found at greater than detection limit quantities in any of the sample fractions.

4.3.1 Particulate Matter

Several monitoring methods were used to measure particulate matter (PM) emissions, with each method aimed at monitoring a specific type of PM. Method 5 was included with Method 26A to measure total particulate matter. This method measured all solid PM in the stack gas, without regard to particle size distribution. Methods 201A and 202 were combined in a single sampling train. Method 201A provided an indication of particle size distribution, with separate masses collected for less than and greater than 10um particle size (PM10). Method 202 collected material that was not solid PM in the stack, but that would likely condense into PM after exiting the stack. Table 4-4 presents the results for the various PM sampling methods.

As shown in Table 4-4, the average PM (Method 5) emission rate from the PDF condition is slightly greater than the baseline average emission rate, but still less than the permit limit. The average PM10 and CPM emission rates from the PDF condition decreased slightly from the baseline average emission rates. As allowed by Method 202, chloride and sulfate masses were determined on samples from PDF Runs 1 and 3. These results were used to in the calculation of the CPM results for these samples.

Comparison between the total PM emission rate as measured by Methods 5 and 201A indicate a significant difference in the measured emission rate. This difference is most likely due to the difficulty in inserting and removing the Method 201A sampling probe (with the in-stack cyclone) into the existing sampling ports. Evaluation of the final samples (desiccated filters and dried probe/nozzle rinse beakers) indicates several samples seem to be contaminated with large particles that are possible rust or scale from the sampling port. Although sample gas was not pulled through the sampling train during insertion and removal of the train from the ports, it is possible that some large particles did deposit on the inlet port and were included in the sample. The Method 201A sample results may therefore be biased high.

4.3.2 Metals

As shown in Table 4-5, the average emission rates during the PDF condition of only three metals, barium, mercury, and selenium, showed an increase by at least of factor of two as compared to baseline. As discussed in Section 6.2, the presence of barium and selenium in the filed blank may create a positive bias in the calculated emission rate. The emission rate for mercury is still less than its permit limit. There are no permit limits for barium and selenium.

Barium and Selenium: These metals were detected in all fractions of the sampling trains in all six runs.

Mercury: The back-half results in the PDF runs were greater than their corresponding baseline runs. The results of the other sample fractions were comparable between the baseline and PDF conditions.

4.3.3 Hexavalent Chromium

As also shown in Table 4-5 the average emission rate in the PDF condition was greater than the average emission rate in the baseline condition, but still less than the permit limit. Hexavalent chromium was not detected in the baseline condition, and was detected in PDF condition Runs 1 and 2.

As discussed in Section 4.2, additional volume of impinger solutions was used for the PDF runs. Additionally, approximately 90 cubic feet of sample volume were collected during PDF Runs 1 and 2 (as compared to 65 cubic feet collected during the baseline runs) creating additional volume in the knock-out impinger from the moisture content of the stack. During recovery, the contents of the knockout impinger were therefore recovered into a separate container from the sampling train and submitted for analysis. The knockout impinger and remaining sample train fractions were then analyzed individually in the laboratory, rather than being combined as is commonly done. Hexavalent chromium was detected only in the knockout impinger samples. Evaluation of the mass detected in the knockout impinger indicates that a detectable mass would have been present if the sample fractions would have been combined.

4.3.4 Volatile Organics

As shown in Table 4-6, the average emission rates in the PDF condition were essentially the same as the average emission rates in the baseline condition. Of the 52 target analytes, 28 were detected in at least one sample from either the PDF or the baseline conditions. No target analytes were detected in the PDF condition and not in the baseline condition.

Tentatively Identified Compounds (TICs): The analysis of four analytes (propionaldehyde, formaldehyde, acetaldehyde, and acetonitrile) was done by forward searching for these compounds as TICs. In addition, up to 25 of the largest TICs, if they were present, were reported for each volatile sample. Table 4-7 shows the results of the TIC analyses. No particular TIC, including the forward searched analytes, was identified in every component of a given sampling train, so no emission rates were calculated for the TICs.

4.3.5 Semivolatile Organics

As shown in Table 4-8, the average emission rates in the PDF condition were essentially the same as the average emission rates in the baseline condition. Of the 79 target analytes, only 25 were detected in at least one sample from either the PDF or the baseline conditions. Only one target analyte, N-nitrosodiphenylamine, was detected in the PDF condition and not in the baseline condition. This analyte was detected in only one (Run 3 XAD) of the nine samples collected during the PDF runs.

Tentatively Identified Compounds (TICs): The analysis of seven analytes (2-picoline, 4,4-methylenebis(2-chloroaniline), 5-nitroacenaphthene, a,a-dimethylphenethylamine, dibenz(a,j)acridine, p-phenylenediamine, pronamide, and toluene-2,4-diamine) was done by forward searching for these compounds as TICs. In addition, up to 25 of the largest TICs, if they are present, were reported for each volatile sample. Table 4-9 shows the results of the TIC analyses. No particular TIC, including the forward searched analytes, was identified in every component of a given sampling train, so no emission rates were calculated for the TICs.

4.3.6 PCDD/PCDF, PCB and PAH

As shown in Tables 4-10 through 4-12, the average emission rates in the PDF condition were essentially the same as the average emission rates in the baseline condition. No analyte was detected in the PDF condition that was not detected in the baseline condition. The Total Mono-PCBs showed an increase from baseline, and was detected in all three samples from both test conditions.

4.3.7 Hydrogen Halides/Halogens

As shown in Table 4-13, the average emission rates in the PDF condition were essentially the same as the average emission rates in the baseline condition for chloride and fluoride. Bromide, bromine, and nitrate were not detected in any samples. Chlorine was detected in only one sample (Run 1) from the PDF condition and was not detected in samples from the baseline condition.

4.3.7.1 Cyanide

As also shown in Table 4-13, the average emission rates in the PDF condition were essentially the same as the average emission rates in the baseline condition.

4.4 CEMs

The test matrix for the CEMs is presented in Table 4-3. This table describes the parameters that were measured and the applicable sampling and analytical procedures used (2.1.1.12). As indicated in the table, the CEMs were a combination of temporary instruments used for this test and permanently installed devices that are in continuous use.

4.4.1 Temporary Analyzers

Temporary CEMs were used to monitor emissions of CO, CO_2, THC, and O_2 during Phase 2 to further characterize emissions concurrent with the manual method sampling. VOC analysis was also done during Phase 2. The average CO, CO_2, O_2, THC, and VOC values from the PDF testing were less than the average values from the baseline testing.

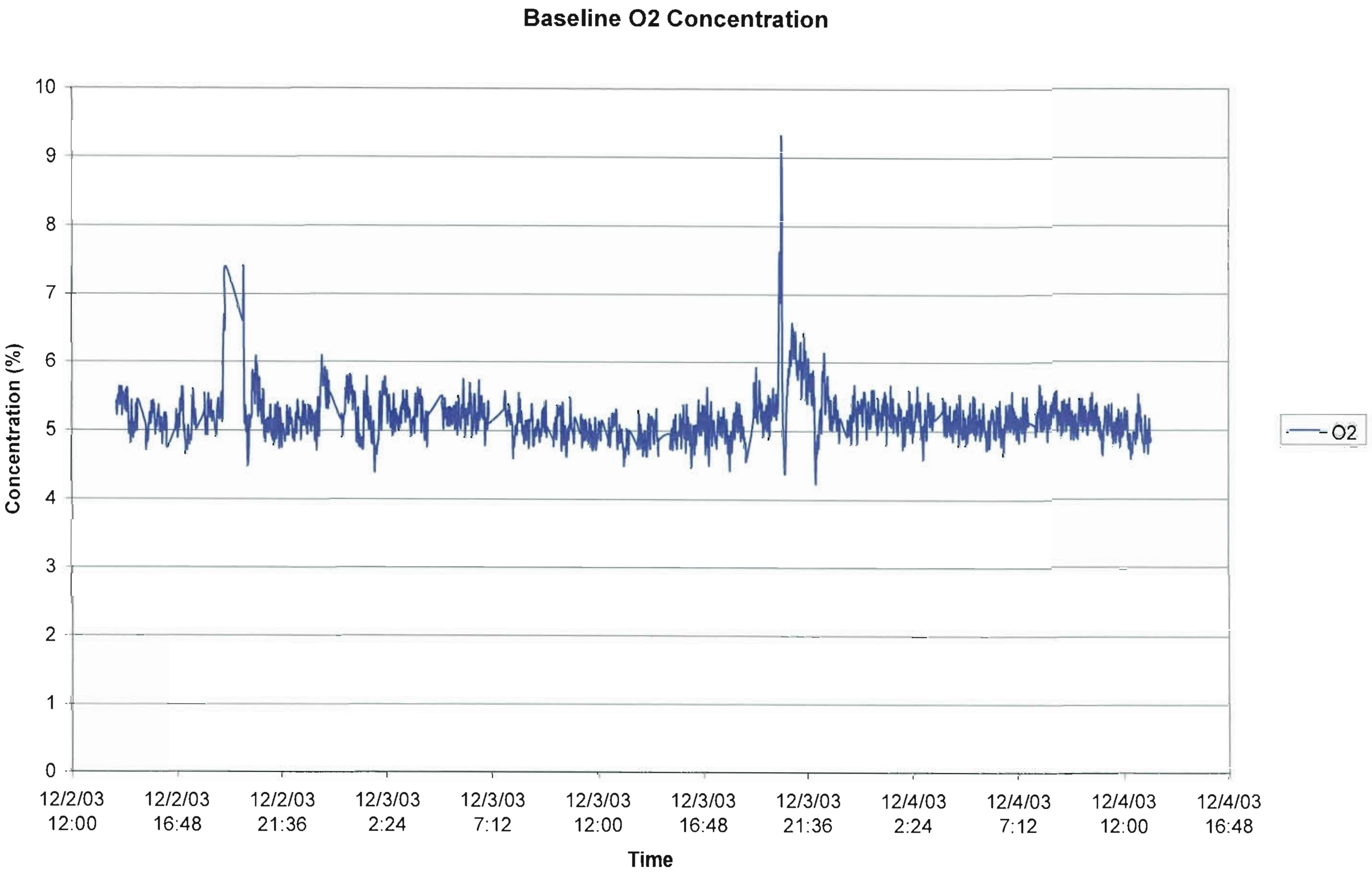
4.4.2 Permanent Analyzers

The permanently installed CEMs for NO_x and SO_2 were also used to measure emissions of those constituents during Phase 2 of the test. The data sets for these instruments are provided in Appendix F.

4.4.3 CEMs Results

Average results for the CEMs were presented in Section 2. Table 4-14 shows more detailed results for the VOC sampling from the six baseline and three PDF runs. The nine run numbers shown in this table are the gas chromatography runs to measure methane and ethane, and were labeled to correspond to the 27 THC runs that occurred during Phase 2. While emissions were monitored continuously for THC, for data recordkeeping purposes, the 27 run numbers were assigned to those time periods in between the continuing calibrations. Figures 4-1 through 4-6 show the O_2, CO_2, CO, THC, NO_x, and SO_2 measurements versus time for the baseline test condition, while Figures 4-7 through 4-12 show the similar measurements versus time for the PDF test condition. The entire data sets, including the quality control results, are provided in Appendix E.

Figure 4-1


Baseline O2 Concentration
10
9
8
7
6
5
4
3
2
1
0
Concentration (%)
12/2/03 12:00
12/2/03 16:48
12/2/03 21:36
12/3/03 2:24
12/3/03 7:12
12/3/03 12:00
12/3/03 16:48
12/3/03 21:36
12/4/03 2:24
12/4/03 7:12
12/4/03 12:00
12/4/03 16:48
Time
O2

Baseline CO2 Concentration

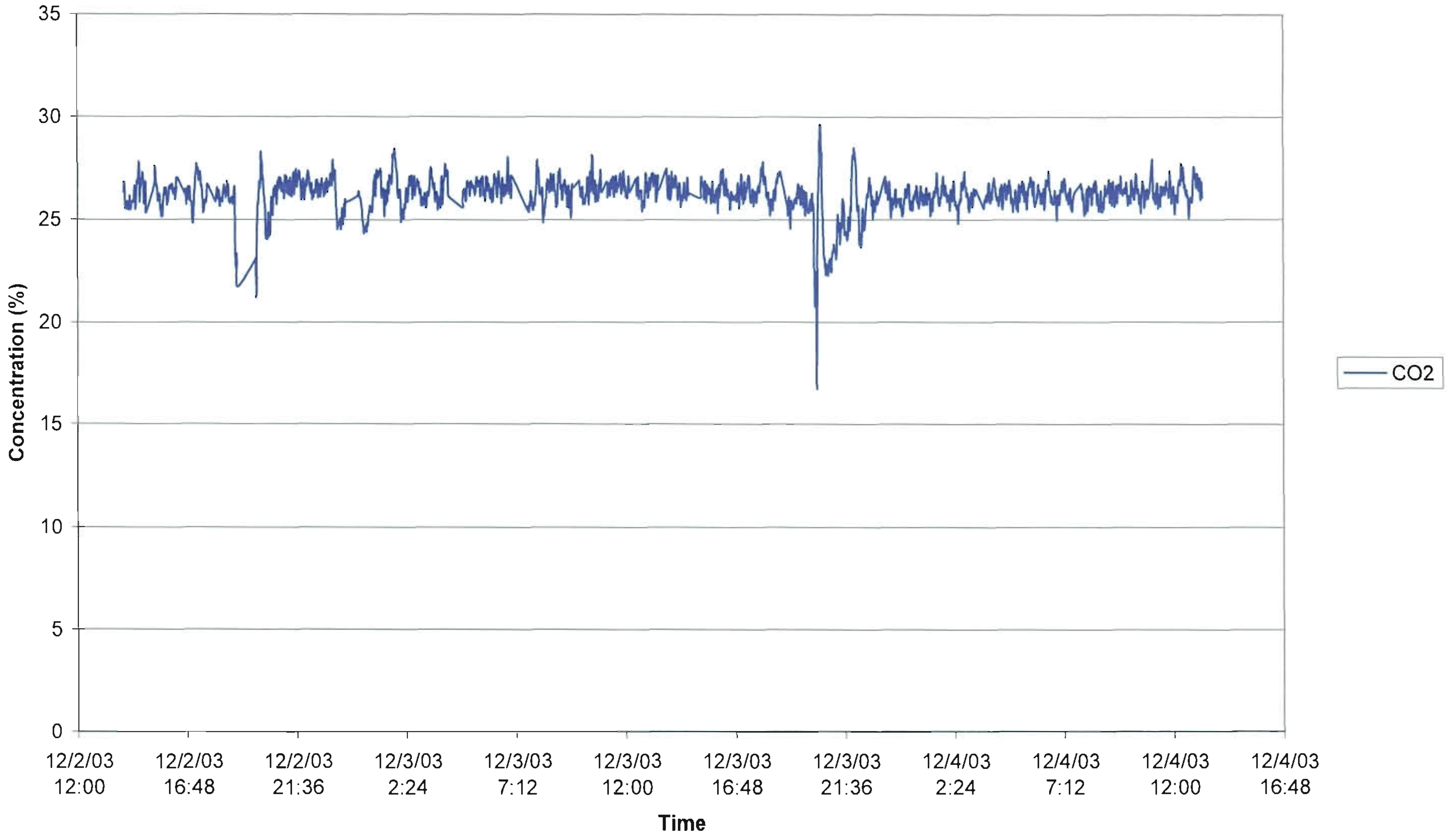
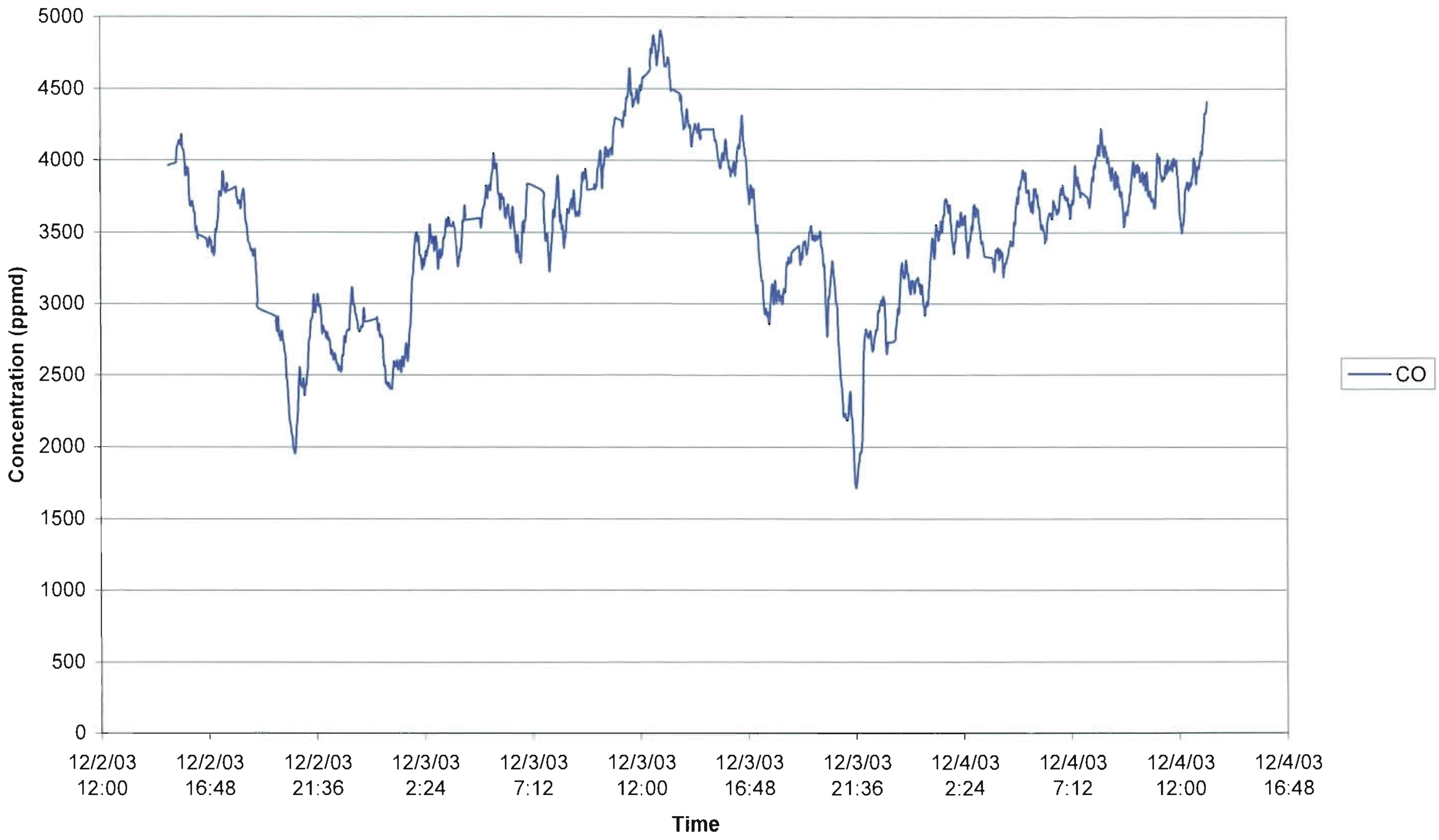


Figure 4-3

Baseline CO Concentration (HRA Basis)



Baseline THC Concentration (HRA Basis)

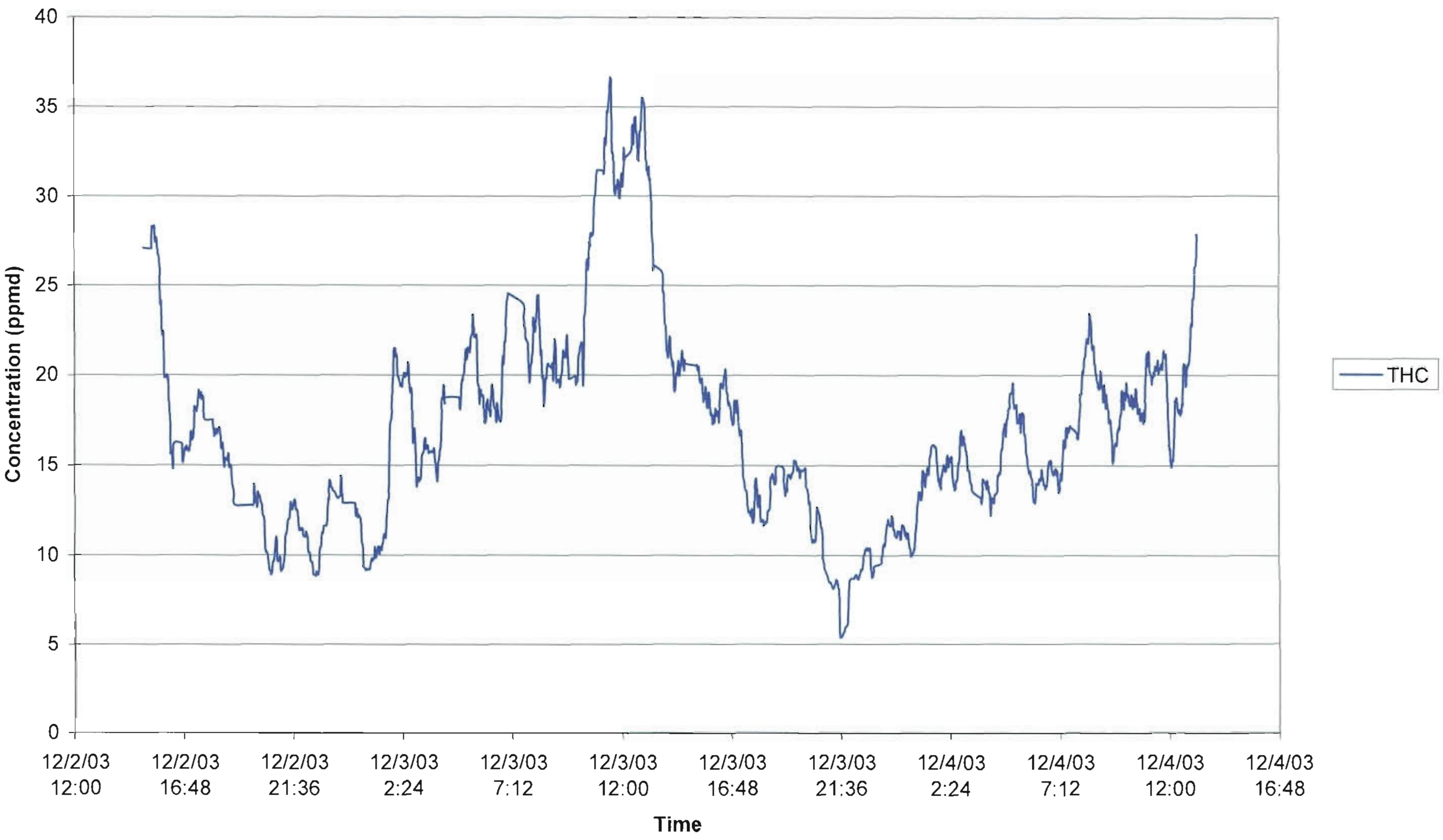
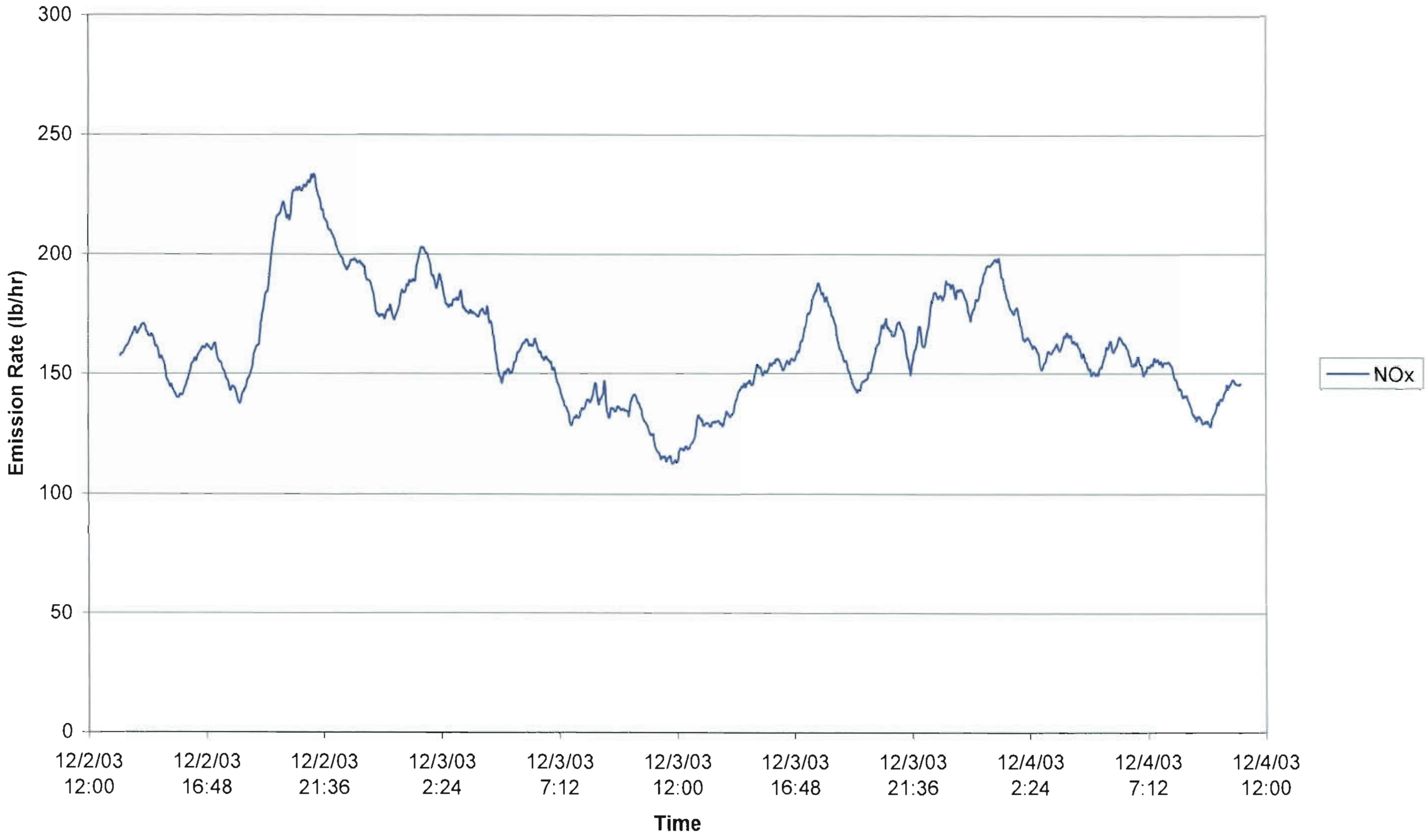


Figure 4-5

Baseline NOx Emission Rate vs. Time (HRA Basis)



Baseline SO2 Emission Rate vs. Time (HRA Basis)

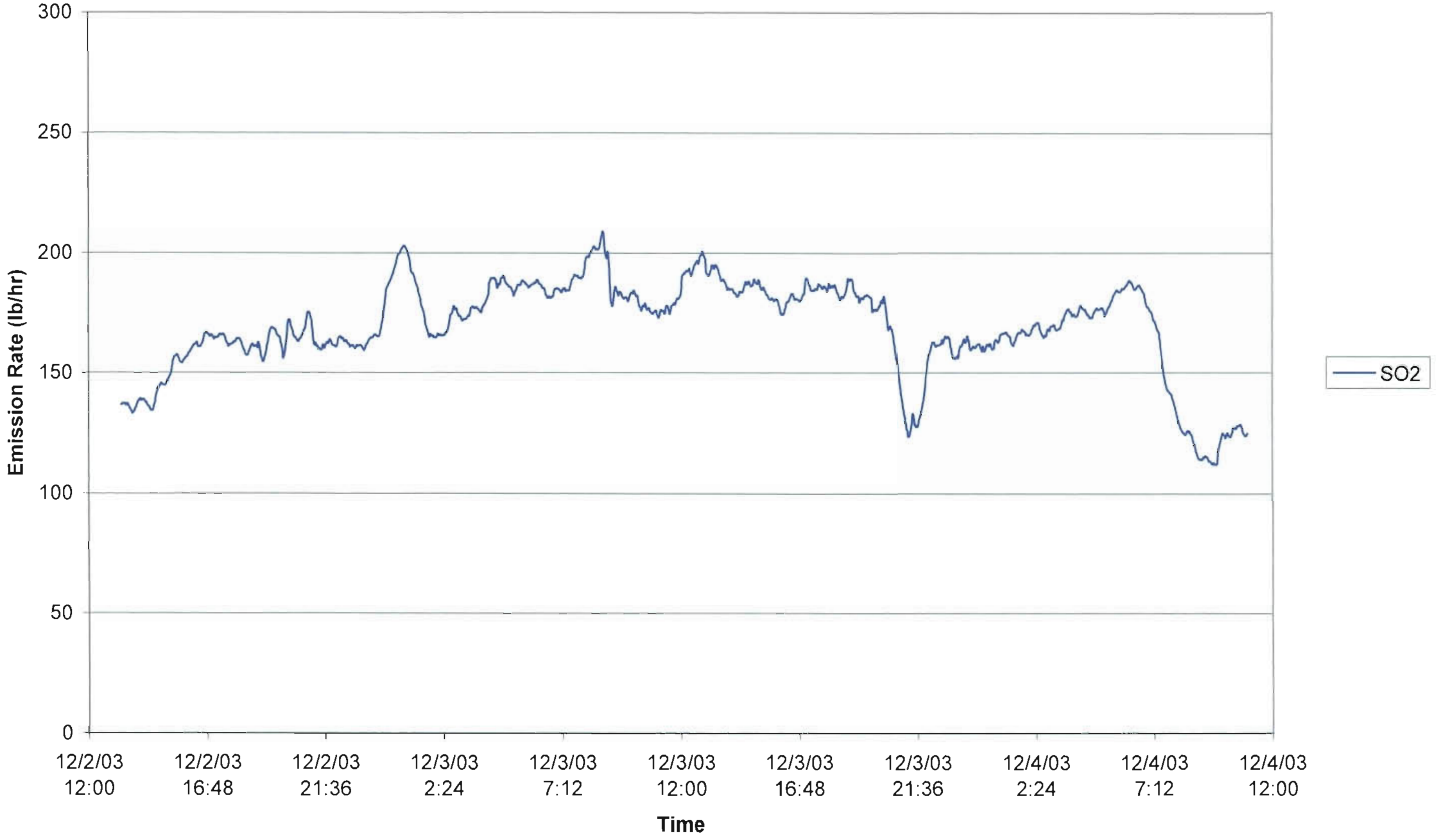
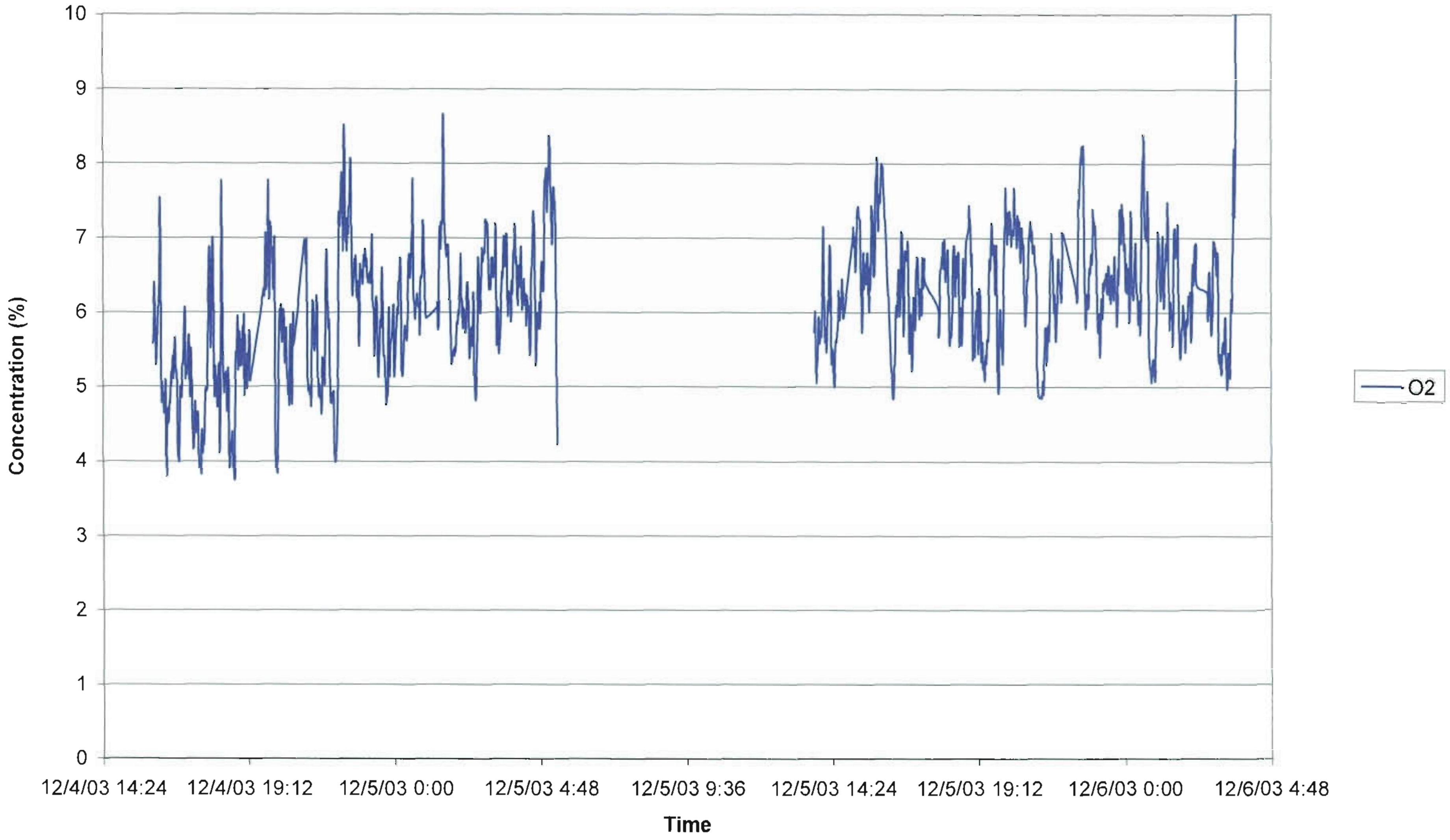


Figure 4-7

PDF O2 Concentration



PDF CO2 Concentration

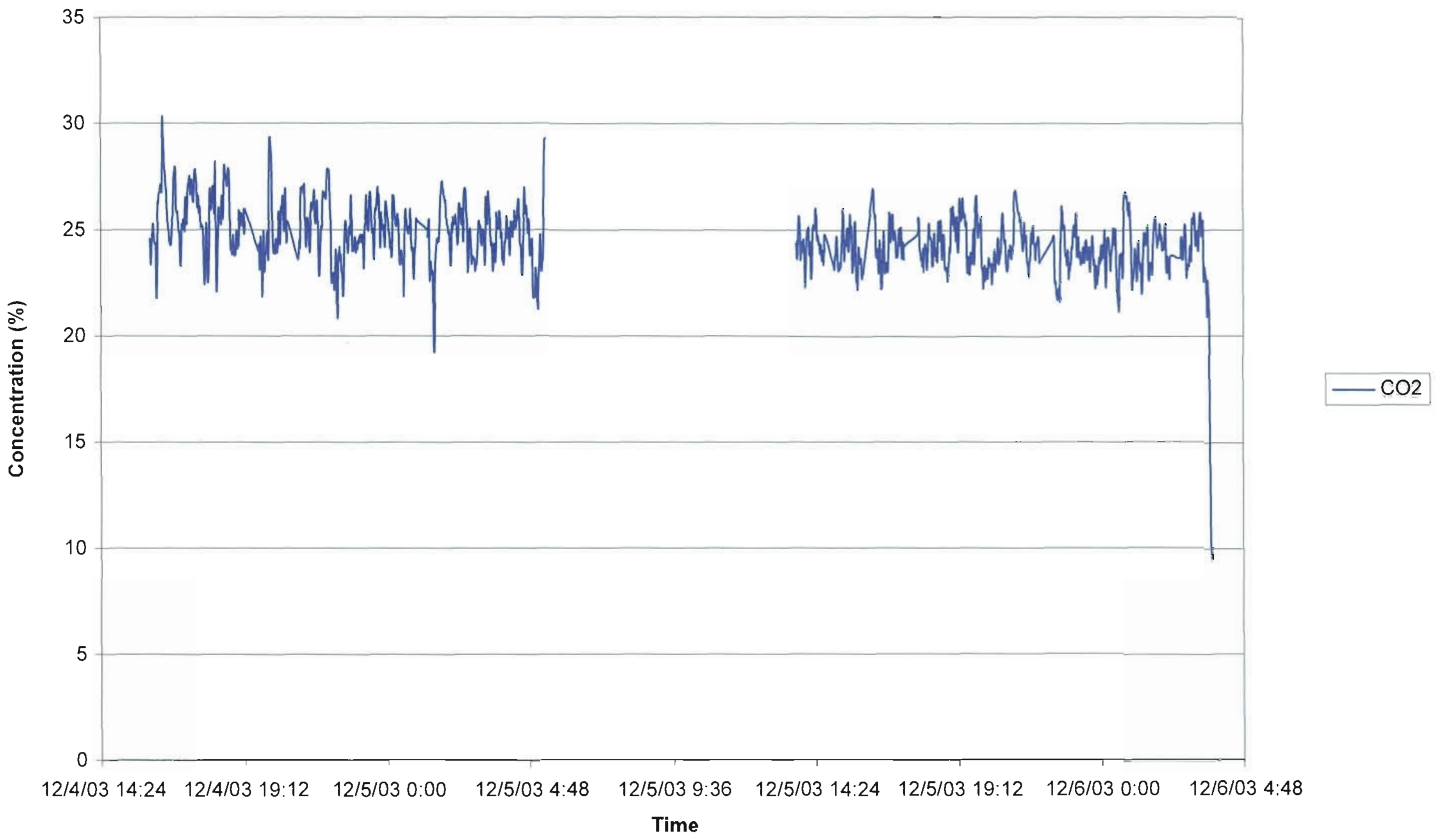


Figure 4-9
PDF CO Concentration (HRA Basis)

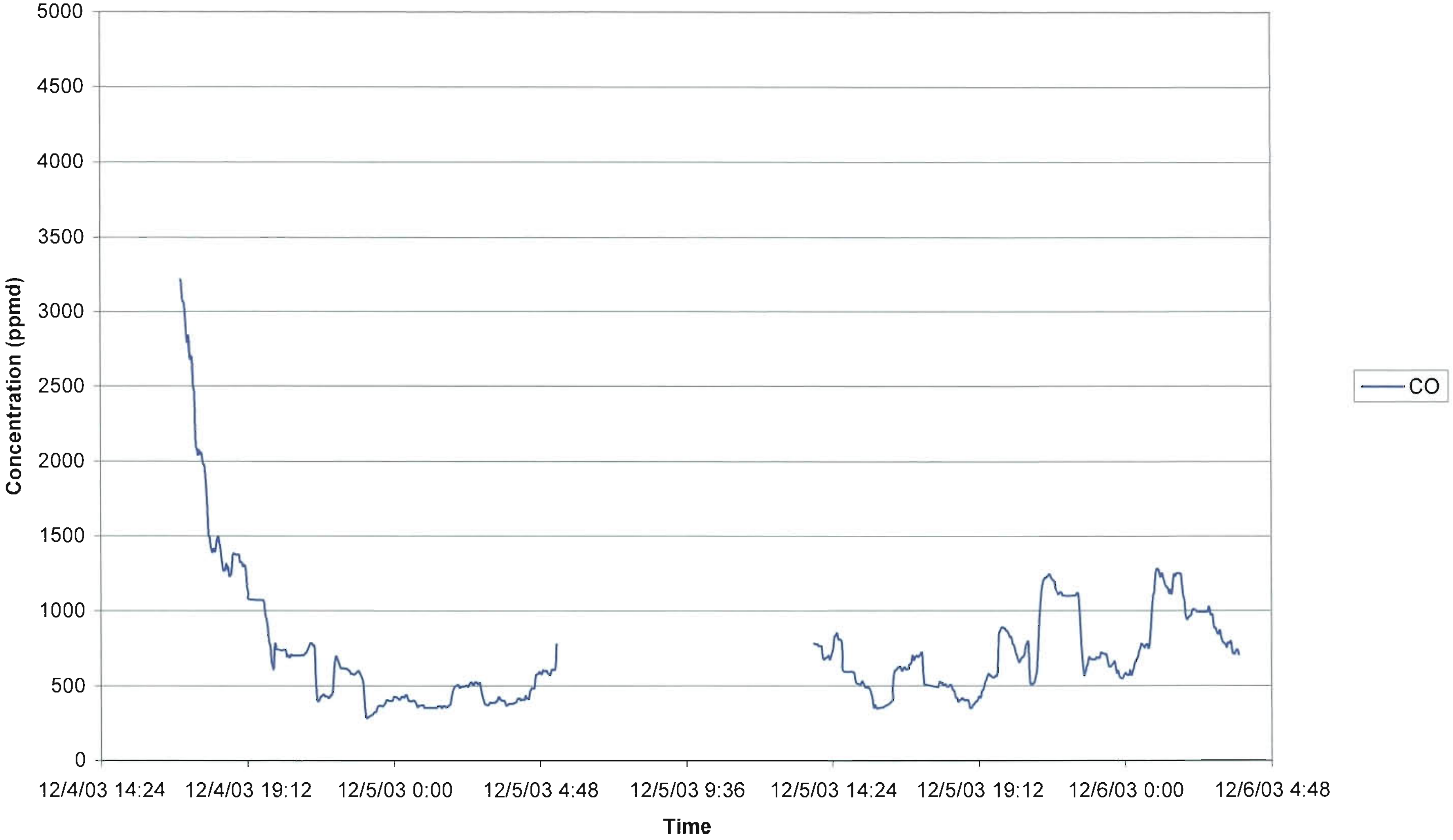


Figure 4-10

PDF THC Concentration (HRA Basis)

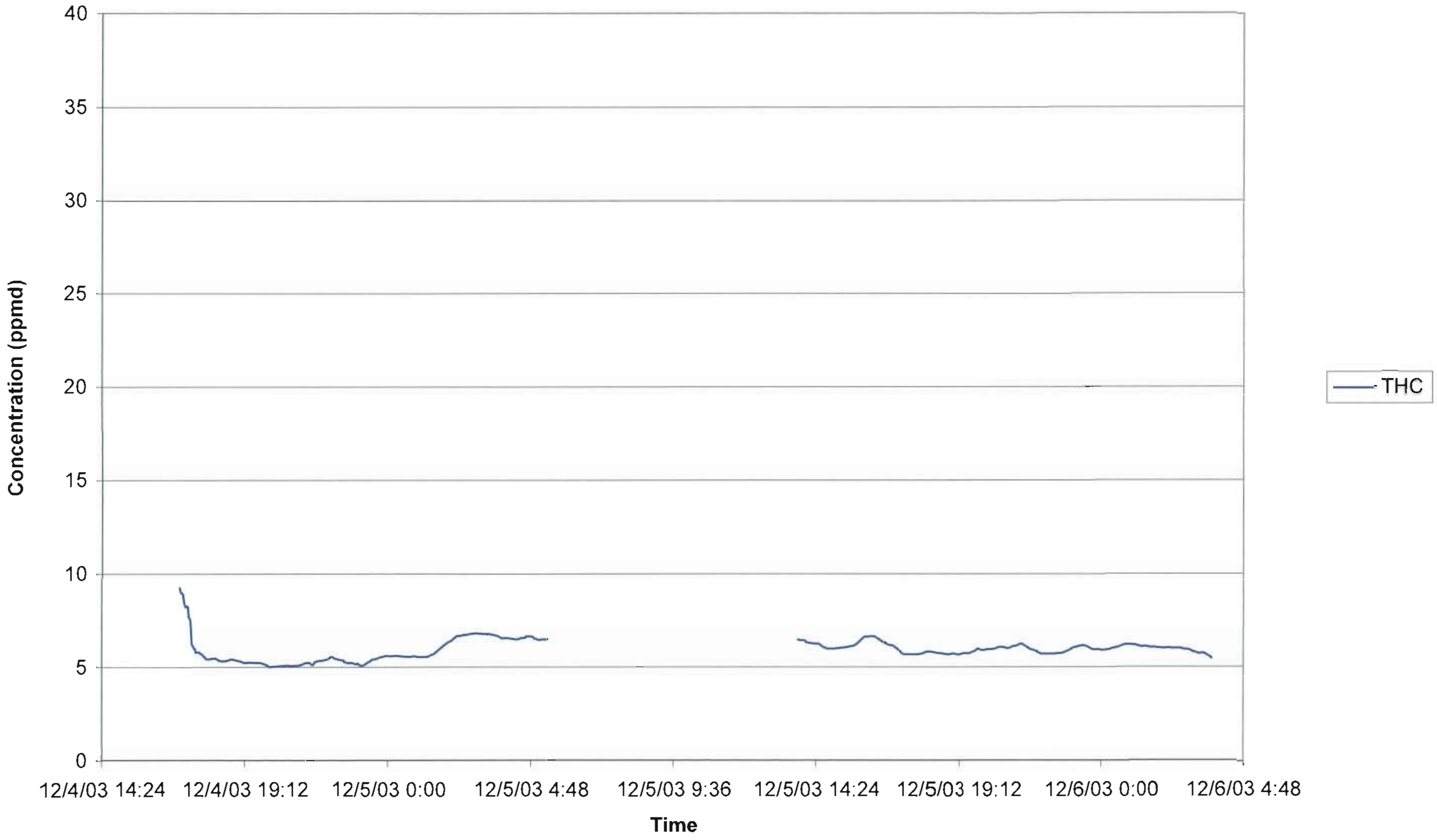


Figure 4-11

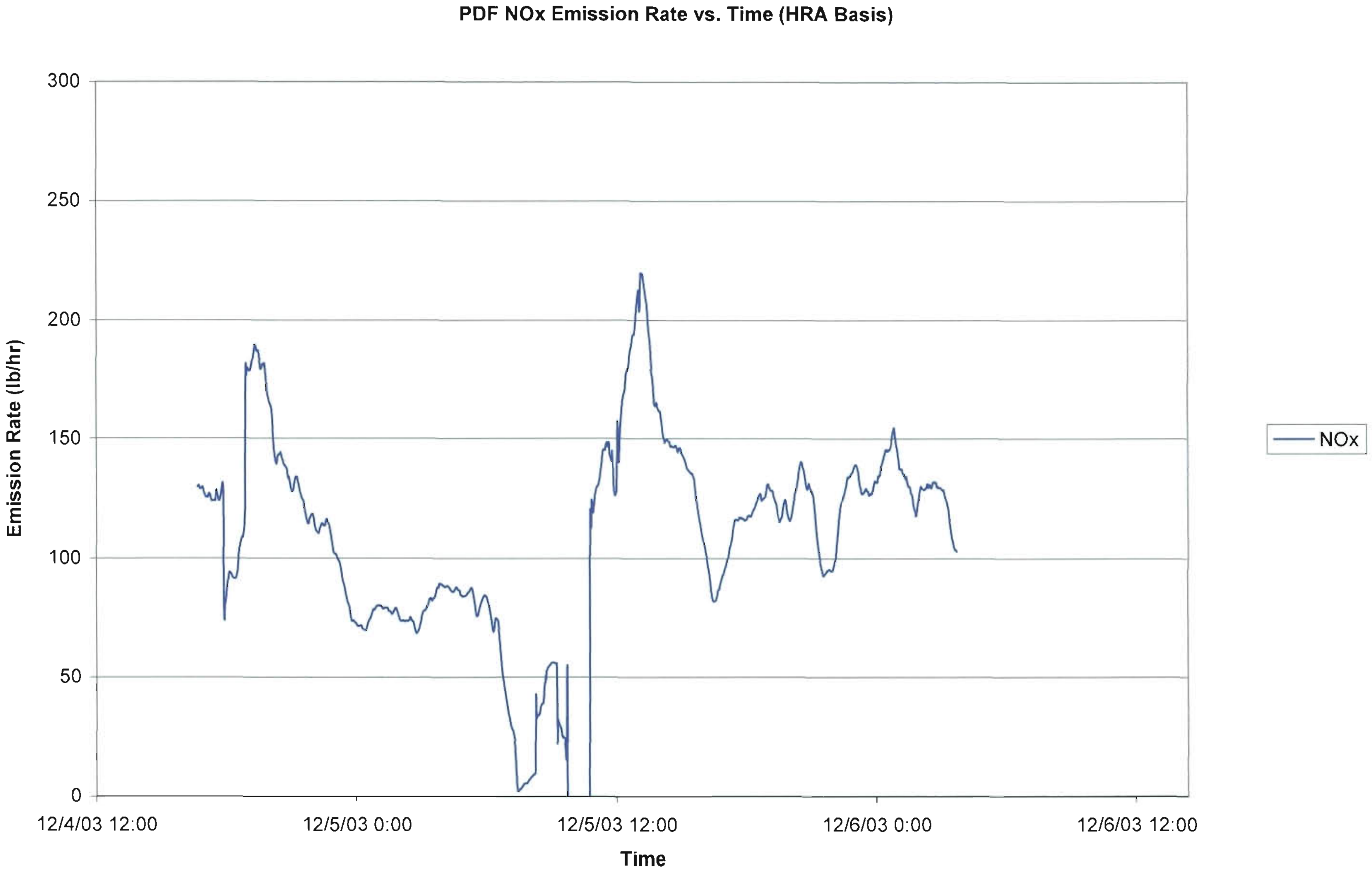

PDF NOx Emission Rate vs. Time (HRA Basis)
300
250
200
150
100
50
0
Emission Rate (lb/hr)
12/4/03 12:00
12/5/03 0:00
12/5/03 12:00
12/6/03 0:00
12/6/03 12:00
Time
NOx

Figure 4-12

PDF SO2 Emission Rate vs. Time (HRA Basis)

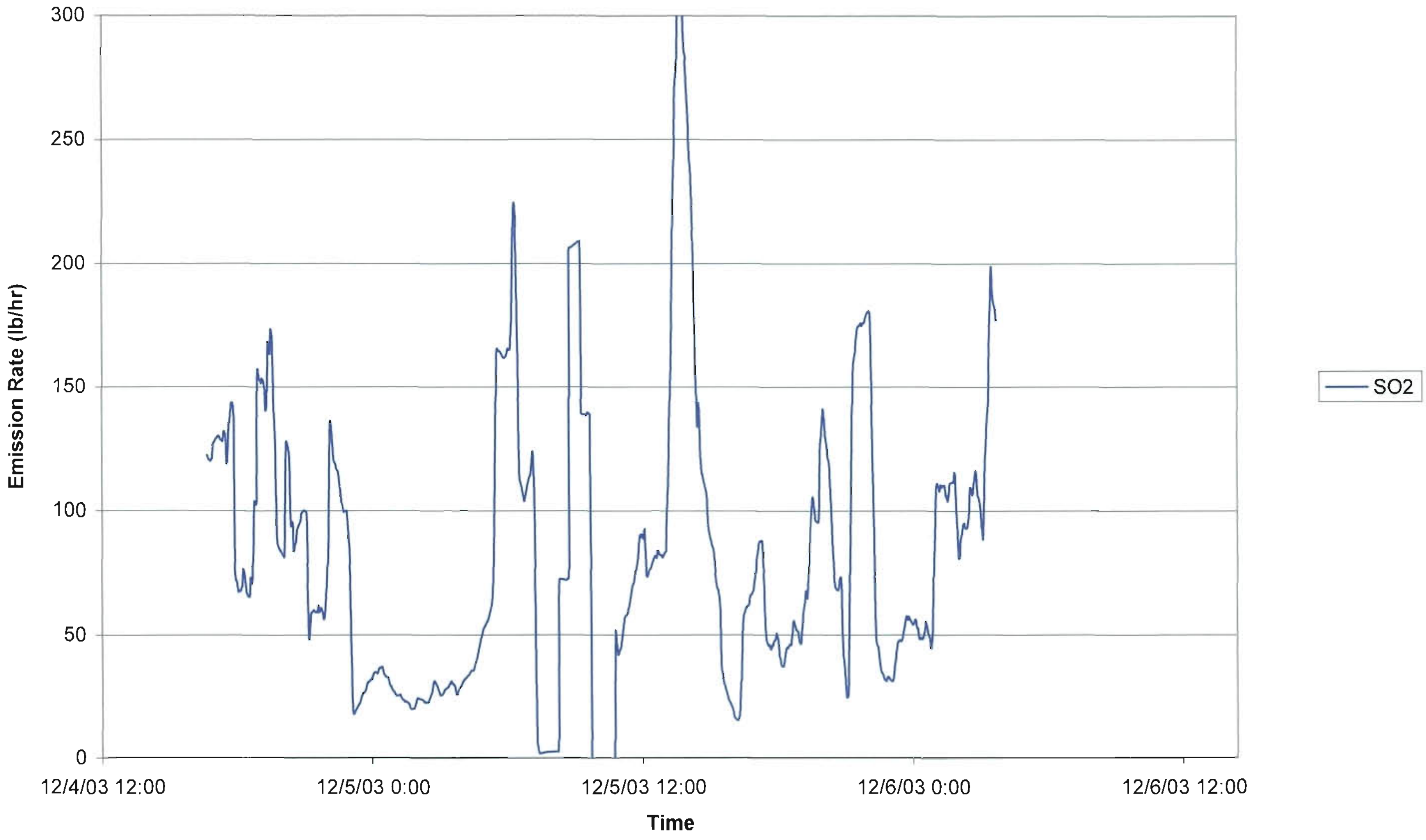


Table 4-1. Sampling and Analytical Matrix

Parameter Measured	Sampling Method	Analytical Method	Laboratory Analysis
Flow	EPA Method 2	EPA Method 2	
Moisture	EPA Method 4	EPA Method 4	
PM	EPA Method 5 (combined with Method 26A)	EPA Method 5	Gravimetric
PM_{10} / CPM (chloride and sulfate)	EPA 201A/202	EPA 201A 202	Gravimetric HPLC
Metals	EPA Method 29	EPA Method 6010B	ICP and CVAAS
Hexavalent Chromium	SW-846 Method 0061	SW-846 Method 7199	IC/PCR
Volatile Organics	SW-846 Method 0030	SW-846 Method 5041/8260B	GC/MS
Semivolatile Organics	SW-846 Method 0010	SW-846 Method 8270C	GC/MS
Dioxins/Furans	EPA Method 23	SW-846 Method 8290	HRGC/HRMS
Polyaromatic Hydrocarbons (PAHs)	EPA Method 5 (mod) (combined with Method 23)	CARB Method 429	HRGC/HRMS
Polychlorinated Biphenyls (PCBs)	EPA Method 5 (mod) (combined with Method 23)	EPA Method 1668A	HRGC/HRMS
Hydrogen Halides / Halogens	EPA Method 26A	EPA Method 26A	IC
Hydrogen Cyanide	EPA Method 26A	CTM 033 SW-846 9012A	IC Colorimetric

Notes:
1. HPLC = high performance liquid chromatography
2. ICP = inductively coupled plasma emission spectroscopy
3. CVAAS = cold vapor atomic absorption spectrophotometry
4. IC/PCR = ion chromatography/post column-reactor
5. GC/MS = gas chromatography/mass spectrometry
6. HRGC/HRMS = high resolution gas chromatography/high resolution mass spectrometry
7. IC= ion chromatography

Table 4-2. Summary of Sampling Collection Dates and Times

Sampling Method	Parameter	Run Number	Start Time		End Time		Comments
			Date	Time	Date	Time	
5 and 26A	Particulate Matter, combined with Hydrogen Halides/Halogens, and Hydrogen Cyanide	Baseline 1	12/2/2003	13:42	12/2/2003	16:32	Invalidated due to failed leak check at end of run.
		Baseline 2	12/3/2003	17:00	12/3/2003	19:19	
		Baseline 3	12/3/2003	20:40	12/3/2003	23:18	
		Baseline 4	12/4/2003	04:35	12/4/2003	07:04	
		PDF 1	12/4/2003	18:56	12/4/2003	21:02	
		PDF 2	12/4/2003	23:00	12/5/2003	01:15	
		PDF 3	12/5/2003	03:53	12/5/2003	14:04	Run suspended from 05:31 to 13:36 due to kiln feed interruption.
201A/202	PM_{10} / CPM	Baseline 1	12/2/2003	12:20	12/2/2003	14:39	
		Baseline 3	12/3/2003	22:00	12/4/2003	00:53	Not a valid run due to inefficient sample recovery.
		Baseline 4	12/4/2003	04:44	12/4/2003	07:13	
		Baseline 5	12/4/2003	10:33	12/4/2003	13:08	
		PDF 1	12/5/2003	15:52	12/5/2003	19:05	
		PDF 2	12/5/2003	21:50	12/6/2003	00:44	
		PDF 3	12/6/2003	02:05	12/6/2003	03:42	Stopped at 91 minutes of sample collection due to upset kiln. The kiln did not reach optimal testing conditions during field efforts and all further testing was aborted. The testing was completed and run 3 was approved by PADEP and validated as a good run.
29	Metals	Baseline 1	12/2/2003	14:16	12/2/2003	17:00	
		Baseline 2	12/3/2003	00:20	12/3/2003	08:43	Run suspended from 00:35 to 06:36 due to frozen impingers.
		Baseline 3	12/3/2003	11:42	12/3/2003	14:20	
		PDF 1	12/4/2003	17:01	12/4/2003	20:11	
		PDF 2	12/4/2003	20:39	12/5/2003	00:15	
		PDF 3	12/5/2003	02:30	12/5/2003	05:05	

Table 4-2. Summary of Sampling Collection Dates and Times

Sampling Method	Parameter	Run Number	Start Time		End Time		Comments
0061	Hexavalent Chromium	Baseline 1	12/4/2003	02:30	12/4/2003	04:40	
		Baseline 2	12/4/2003	05:28	12/4/2003	07:42	
		Baseline 3	12/4/2003	08:20	12/4/2003	11:02	
		PDF 1	12/5/2003	19:50	12/5/2003	21:06	
		PDF 2	12/5/2003	23:20	12/6/2003	01:30	
		PDF 3	12/6/2003	02:26	12/6/2003	03:42	Stopped at 68 minutes of sample collection due to upset kiln. The kiln did not reach optimal testing conditions during field efforts and all further testing was aborted. The testing was completed and this run was approved and validated by PADEP as a good run.
0030	Volatile Organics	Baseline 1	12/2/2003	21:45	12/3/2003	00:42	
		Baseline 2	12/3/2003	02:59	12/3/2003	06:47	
		Baseline 3	12/3/2003	07:25	12/3/2003	10:47	
		PDF 1	12/4/2003	15:40	12/4/2003	18:58	
		PDF 2	12/4/2003	19:45	12/4/2003	22:57	
		PDF 3	12/4/2003	23:36	12/5/2003	02:39	
0010	Semivolatile Organics	Baseline 1	12/3/2003	01:15	12/3/2003	07:09	
		Baseline 2	12/3/2003	10:04	12/3/2003	15:06	
		Baseline 3	12/3/2003	18:31	12/3/2003	23:47	
		PDF 1	12/4/2003	16:02	12/4/2003	21:03	
		PDF 2	12/4/2003	23:47	12/5/2003	05:07	
		PDF 3	12/5/2003	13:27	12/5/2003	18:50	
Mod 23	PCDDs/PCDFs combined with PCBs, and PAHs	Baseline 1	12/3/2003	01:15	12/3/2003	07:07	
		Baseline 2	12/3/2003	10:07	12/3/2003	15:08	
		Baseline 3	12/3/2003	18:33	12/3/2003	23:44	
		PDF 1	12/4/2003	16:04	12/4/2003	21:01	
		PDF 2	12/4/2003	23:45	12/5/2003	05:05	
		PDF 3	12/5/2003	13:29	12/5/2003	18:48	

Table 4-3. CEM Measurement Matrix

Parameter Measured	Instrument	Test Method
THC	URS CEM	EPA 25A
VOCs	URS Gas Chromatograph	EPA Method 18
O_2/CO_2	URS CEM	EPA Method 3A
CO	URS CEM	EPA Method 10
NO_X	Plant installed CEM	EPA Method 7E
SO_2	Plant installed CEM	EPA Method 6C

Table 4-4
PM Emissions

	Baseline Run 1			Baseline Run 2			Baseline Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	73.6	60,225	5.5	73.3	61,942	5.1	72.5	61,427
Analyte	**Detected Mass (g)**	**Emission Conc. (gr/dscf @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (g)**	**Emission Conc. (gr/dscf @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (g)**	**Emission Conc. (gr/dscf @ 7% O_2)**	**Emission Rate (g/hr)**
PM (M5)	0.0179	3.35E-03	8.79E+02	0.0168	3.19E-03	8.52E+02	0.0099	1.85E-03	5.03E+02

	Baseline Run 1			Baseline Run 2			Baseline Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.2	58.7	57,591	5.1	49.8	57,845	5.0	54.0	59,512
Analyte	**Detected Mass (g)**	**Emission Conc. (gr/dscf @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (g)**	**Emission Conc. (gr/dscf @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (g)**	**Emission Conc. (gr/dscf @ 7% O_2)**	**Emission Rate (g/hr)**
PM (M201/202 Large)	0.0554	1.29E-02	3.26E+03	0.0437	1.19E-02	3.04E+03	0.0037	9.24E-04	2.45E+02
PM (M201/202 PM10)	0.0991	2.31E-02	5.84E+03	0.003	8.17E-04	2.09E+02	0.0004	9.99E-05	2.64E+01
PM (M201/202 CPM)	0.08	1.86E-02	4.71E+03	0.4343	1.18E-01	3.02E+04	0.4444	1.11E-01	2.94E+04

M5: 40 CFR 60 Appendix A, Method 5
M201/202: 40 CFR 60 Appendix A, Methods 201A and 202
Large = PM catch > 10 micron
PM10 = PM catch < 10 micron
CPM = Condensible particulate matter

Table 4-4
PM Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.7	71.3	61,449	6.0	73.2	60,381	6.6	68.8	59,241
Analyte	Detected Mass (g)	Emission Conc. (gr/dscf @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (g)	Emission Conc. (gr/dscf @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (g)	Emission Conc. (gr/dscf @ 7% O_2)	Emission Rate (g/hr)
PM (M5)	0.0086	1.70E-03	4.44E+02	0.0144	2.83E-03	7.13E+02	0.0343	7.48E-03	1.77E+03

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	6.3	58.6	62,093	6.6	56.2	64,305	6.4	33.0	60,074
Analyte	Detected Mass (g)	Emission Conc. (gr/dscf @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (g)	Emission Conc. (gr/dscf @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (g)	Emission Conc. (gr/dscf @ 7% O_2)	Emission Rate (g/hr)
PM (M201/202 Large)	0.0039	9.77E-04	2.48E+02	0.0669	1.79E-02	4.59E+03	0.0055	2.47E-03	6.01E+02
PM (M201/202 PM10)	0	0.00E+00	0.00E+00	0.0008	2.14E-04	5.49E+01	0.003	1.35E-03	3.28E+02
PM (M201/202 CPM)	0.2579	6.46E-02	1.64E+04	0.2418	6.45E-02	1.66E+04	0.1909	8.57E-02	2.09E+04

Table 4-4
PM Emissions

	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
Analyte	Baseline	PDF	Baseline Average (g)	PDF Average (g)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
PM (M5)	yes	yes	1.49E-02	1.91E-02	2.80E-03	4.00E-03	7.45E+02	9.77E+02

	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
Analyte	Baseline	PDF	Baseline Average (g)	PDF Average (g)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
PM (M201/202 Large)	yes	yes	3.43E-02	2.54E-02	8.58E-03	7.10E-03	2.18E+03	1.81E+03
PM (M201/202 PM10)	yes	yes	3.42E-02	1.27E-03	8.00E-03	5.20E-04	2.02E+03	1.28E+02
PM (M201/202 CPM)	yes	yes	3.20E-01	2.30E-01	8.26E-02	7.16E-02	2.14E+04	1.80E+04

Table 4-4
PM Emissions

Analyte	Emission Rate Comparison					PDF Emission Rate as % of Limit	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	July 2002 Average (lb/hr)	April 2003 Average (lb/hr)	#39-00011 Permit Limit (lb/hr)		Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
PM (M5)	1.64	2.15	0.60	0.62	14.80	14.6%	7.2	9.4	2.2

Analyte	Emission Rate Comparison					PDF Emission Rate as % of Limit	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	July 2002 Average (lb/hr)	April 2003 Average (lb/hr)	#39-00011 Permit Limit (lb/hr)		Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
PM (M201/202 Large)	4.81	3.99	--	--	--	--	21.1	17.5	-3.6
PM (M201/202 PM10)	4.45	0.28	--	--	--	--	19.5	1.2	-18.3
PM (M201/202 CPM)	47.18	39.68	--	--	--	--	206.6	173.8	-32.8

Table 4-5
Metals Emissions

	Baseline Run 1			Baseline Run 2			Baseline Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.2	82.5	57,569	5.2	89.1	59,020	4.9	89.1	58,991
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
Antimony	9.7	3.68E+00	4.06E-01	9.8	3.44E+00	3.90E-01	9.33	3.21E+00	3.71E-01
Arsenic	<1.22	<4.62E-01	<5.11E-02	<1.21	<4.25E-01	<4.81E-02	<0.9	<3.10E-01	<3.58E-02
Barium	10.6	4.02E+00	4.44E-01	9.8	3.44E+00	3.90E-01	8.5	2.93E+00	3.38E-01
Beryllium	<0.249	--	--	<0.249	--	--	<0.249	--	--
Cadmium	0.83	3.15E-01	3.47E-02	2.13	7.47E-01	8.47E-02	<0.35	<1.21E-01	<1.39E-02
Chromium	14	5.31E+00	5.86E-01	8.8	3.09E+00	3.50E-01	4.3	1.48E+00	1.71E-01
Cobalt	<1.02	<3.87E-01	<4.27E-02	<1.47	<5.16E-01	<5.84E-02	<1.34	<4.61E-01	<5.32E-02
Copper	6.5	2.46E+00	2.72E-01	14.1	4.95E+00	5.60E-01	10.9	3.75E+00	4.33E-01
Lead	<0.9	<3.41E-01	<3.77E-02	1.84	6.46E-01	7.31E-02	<1.1	<3.79E-01	<4.37E-02
Manganese	9.9	3.75E+00	4.14E-01	11.8	4.14E+00	4.69E-01	23.8	8.20E+00	9.46E-01
Mercury	<1.73	<6.56E-01	<7.24E-02	<3.653	<1.28E+00	<1.45E-01	<17.623	<6.07E+00	<7.00E-01
Nickel	33.5	1.27E+01	1.40E+00	33.9	1.19E+01	1.35E+00	18.1	6.23E+00	7.19E-01
Selenium	4.9	1.86E+00	2.05E-01	4.1	1.44E+00	1.63E-01	5.3	1.83E+00	2.11E-01
Silver	1.98	7.50E-01	8.29E-02	1.86	6.53E-01	7.39E-02	<1.15	<3.96E-01	<4.57E-02
Thallium	<48.33	<1.83E+01	<2.02E+00	52.5	1.84E+01	2.09E+00	<67.83	<2.34E+01	<2.69E+00
Zinc	32.9	1.25E+01	1.38E+00	37.1	1.30E+01	1.47E+00	24	8.26E+00	9.53E-01
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.2	64.7	55,148	5.1	67.9	57,259	5.2	70.4	56,996
Hexavalent Chromium	<0.1	<4.83E-02	<5.12E-03	<0.11	<5.03E-02	<5.57E-03	<0.12	<5.33E-02	<5.83E-03

Table 4-5
Metals Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	94.5	63,526	6	96.3	63,895	6.4	94.3	64,344
Analyte	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**
Antimony	9.7	3.23E+00	3.91E-01	10.2	3.49E+00	4.06E-01	9.6	3.45E+00	3.93E-01
Arsenic	<0.96	<3.20E-01	<3.87E-02	<0.82	<2.81E-01	<3.26E-02	<0.82	<2.94E-01	<3.36E-02
Barium	8.2	2.73E+00	3.31E-01	8	2.74E+00	3.19E-01	51.1	1.83E+01	2.09E+00
Beryllium	<0.249	--	--	<0.249	--	--	<0.249	--	--
Cadmium	0.37	1.23E-01	1.49E-02	0.7	2.40E-01	2.79E-02	<0.32	<1.15E-01	<1.31E-02
Chromium	6.6	2.20E+00	2.66E-01	5.7	1.95E+00	2.27E-01	5.2	1.87E+00	2.13E-01
Cobalt	<1.02	--	--	<1.02	--	--	<1.02	--	--
Copper	25.9	8.63E+00	1.04E+00	20.5	7.01E+00	8.16E-01	9	3.23E+00	3.68E-01
Lead	<0.93	<3.10E-01	<3.75E-02	<0.99	<3.39E-01	<3.94E-02	<1.7	<6.10E-01	<6.96E-02
Manganese	7.5	2.50E+00	3.03E-01	8.9	3.05E+00	3.54E-01	16.2	5.81E+00	6.63E-01
Mercury	<45.45	<1.51E+01	<1.83E+00	<39.42	<1.35E+01	<1.57E+00	<25.78	<9.25E+00	<1.06E+00
Nickel	20.7	6.89E+00	8.35E-01	18.8	6.43E+00	7.49E-01	16.2	5.81E+00	6.63E-01
Selenium	35.4	1.18E+01	1.43E+00	11.6	3.97E+00	4.62E-01	4.5	1.62E+00	1.84E-01
Silver	<1.38	<4.60E-01	<5.57E-02	<1.25	<4.28E-01	<4.98E-02	<1.25	<4.49E-01	<5.12E-02
Thallium	<36.43	<1.21E+01	<1.47E+00	<43.73	<1.50E+01	<1.74E+00	31.1	1.12E+01	1.27E+00
Zinc	67.4	2.24E+01	2.72E+00	39.7	1.36E+01	1.58E+00	61.2	2.20E+01	2.50E+00
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	6.7	91.7	61,279	6.5	91.9	60,293	6.5	57.5	61,889
Hexavalent Chromium	<0.77	<2.90E-01	<3.09E-02	<0.525	<1.95E-01	<2.07E-02	<0.11	<6.52E-02	<7.10E-03

Table 4-5
Metals Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
Antimony	yes	yes	9.61E+00	9.83E+00	3.44E+00	3.39E+00	3.89E-01	3.97E-01
Arsenic	yes	yes	<1.11E+00	<8.67E-01	<3.99E-01	<2.98E-01	<4.50E-02	<3.50E-02
Barium	yes	yes	9.63E+00	2.24E+01	3.46E+00	7.92E+00	3.91E-01	9.13E-01
Beryllium	--	--	<2.49E-01	<2.49E-01	--	--	--	--
Cadmium	yes	yes	<1.10E+00	<4.63E-01	<3.94E-01	<1.59E-01	<4.44E-02	<1.86E-02
Chromium	yes	yes	9.03E+00	5.83E+00	3.29E+00	2.01E+00	3.69E-01	2.35E-01
Cobalt	yes	--	<1.28E+00	<1.02E+00	<4.55E-01	--	<5.14E-02	--
Copper	yes	yes	1.05E+01	1.85E+01	3.72E+00	6.29E+00	4.22E-01	7.41E-01
Lead	yes	yes	<1.28E+00	<1.21E+00	<4.55E-01	<4.20E-01	<5.15E-02	<4.88E-02
Manganese	yes	yes	1.52E+01	1.09E+01	5.36E+00	3.79E+00	6.10E-01	4.40E-01
Mercury	yes	yes	<7.67E+00	<3.69E+01	<2.67E+00	<1.26E+01	<3.06E-01	<1.49E+00
Nickel	yes	yes	2.85E+01	1.86E+01	1.03E+01	6.38E+00	1.16E+00	7.49E-01
Selenium	yes	yes	4.77E+00	1.72E+01	1.71E+00	5.80E+00	1.93E-01	6.92E-01
Silver	yes	yes	<1.66E+00	<1.29E+00	<6.00E-01	<4.46E-01	<6.75E-02	<5.22E-02
Thallium	yes	yes	<5.62E+01	<3.71E+01	<2.00E+01	<1.28E+01	<2.27E+00	<1.49E+00
Zinc	yes	yes	3.13E+01	5.61E+01	1.13E+01	1.93E+01	1.27E+00	2.27E+00
Hexavalent Chromium	--	--	<1.10E-01	<4.68E-01	<5.06E-02	<1.83E-01	<5.51E-03	<1.96E-02

Table 4-5
Metals Emissions

Analyte	Emission Rate Comparison					PDF Emission Rate as % of Limit	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	July 2002 Average (lb/hr)	April 2003 Average (lb/hr)	#39-00011 Permit Limit (lb/hr)		Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
Antimony	0.00086	0.00088	--	0.00097	--	--	0.00376	0.00383	0.00008
Arsenic	0.00010	0.00008	0.00041	0.00006	0.00151	5.11%	0.00043	0.00034	-0.00010
Barium	0.00086	0.00201	--	0.00887	--	--	0.00378	0.00882	0.00504
Beryllium	--	--	--	0.00002	--	--	--	--	--
Cadmium	0.00010	0.00004	0.00005	0.00009	0.00525	0.78%	0.00043	0.00018	-0.00025
Chromium	0.00081	0.00052	--	0.00047	--	--	0.00356	0.00227	-0.00129
Cobalt	0.00011	--	--	ND	--	--	0.00050	--	--
Copper	0.00093	0.00163	--	0.00051	--	--	0.00407	0.00716	0.00308
Lead	0.00011	0.00011	0.00016	0.00032	0.07000	0.15%	0.00050	0.00047	-0.00003
Manganese	0.00134	0.00097	--	0.00059	--	--	0.00589	0.00425	-0.00164
Mercury	0.00067	0.00328	0.00128	0.00096	0.00744	44.15%	0.00295	0.01439	0.01143
Nickel	0.00256	0.00165	0.00032	0.00121	0.01890	8.74%	0.01120	0.00723	-0.00397
Selenium	0.00043	0.00153	--	0.00111	--	--	0.00186	0.00668	0.00482
Silver	0.00015	0.00012	--	0.00002	--	--	0.00065	0.00050	-0.00015
Thallium	0.00500	0.00328	--	0.01243	--	--	0.02192	0.01439	-0.00753
Zinc	0.00280	0.00500	0.00494	0.00493	0.38689	1.29%	0.01226	0.02192	0.00966
Hexavalent Chromium	0.00001	0.00004	0.00006	0.00061	0.00135	3.20%	--	--	--

Table 4-6
Volatile Organics Emissions

		Baseline Run 1			Baseline Run 2			Baseline Run 3		
		O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
		5.2	60.2	57,841	5.2	60.9	57,841	5.0	70.7	59,172
CAS Number	Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
630-20-6	1,1,1,2-Tetrachloroethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
71-55-6	1,1,1-Trichloroethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
79-34-5	1,1,2,2-Tetrachloroethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
79-00-5	1,1,2-Trichloroethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
75-34-3	1,1-Dichloroethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
75-35-4	1,1-Dichloroethene	<0.26	--	--	<0.5	--	--	<0.3	--	--
96-18-4	1,2,3-Trichloropropane	<0.26	--	--	<0.5	--	--	<0.3	--	--
106-93-4	1,2-Dibromoethane (EDB)	<0.26	--	--	<0.5	--	--	<0.3	--	--
107-06-2	1,2-Dichloroethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
78-87-5	1,2-Dichloropropane	<0.316	<1.64E-01	<1.82E-02	<0.5	<2.57E-01	<2.85E-02	<0.3	<1.31E-01	<1.51E-02
156-60-5	trans-1,2-Dichloroethene	<0.26	--	--	<0.5	--	--	<0.3	--	--
10061-01-5	cis-1,3-Dichloropropene	<0.26	--	--	<0.5	--	--	<0.3	--	--
10061-02-6	trans-1,3-Dichloropropene	<0.26	--	--	<0.5	--	--	<0.3	--	--
78-93-3	2-Butanone (Methyl Ethyl Ketone)	<1.76	<9.14E-01	<1.01E-01	<1.522	<7.82E-01	<8.68E-02	<1.26	<5.50E-01	<6.33E-02
591-78-6	2-Hexanone	<1.065	<5.53E-01	<6.14E-02	<2.5	<1.28E+00	<1.43E-01	<1.495	<6.53E-01	<7.51E-02
107-05-1	3-Chloropropene	<0.4702	<2.44E-01	<2.71E-02	<0.537	<2.76E-01	<3.06E-02	<0.55	<2.40E-01	<2.76E-02
108-10-1	4-Methyl-2-pentanone	<1.285	<6.67E-01	<7.41E-02	<2.187	<1.12E+00	<1.25E-01	<1.479	<6.46E-01	<7.43E-02
67-64-1	Acetone	4.0403959	2.10E+00	2.33E-01	3.2608953	1.67E+00	1.86E-01	2.7920663	1.22E+00	1.40E-01
107-02-8	Acrolein	<14.3	<7.43E+00	<8.24E-01	<25	<1.28E+01	<1.43E+00	<15	<6.55E+00	<7.53E-01
107-13-1	Acrylonitrile	<7.227266	<3.75E+00	<4.17E-01	<5.11	<2.62E+00	<2.91E-01	<8.387	<3.66E+00	<4.21E-01
71-43-2	Benzene	<33.292	<1.73E+01	<1.92E+00	<121.423	<6.24E+01	<6.92E+00	<87.1995	<3.81E+01	<4.38E+00
74-97-5	Bromochloromethane	<0.8637	<4.48E-01	<4.98E-02	<1.1091	<5.70E-01	<6.32E-02	<1.31	<5.72E-01	<6.58E-02
75-27-4	Bromodichloromethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
75-25-2	Bromoform	<0.26	--	--	<0.5	--	--	<0.3	--	--
74-83-9	Bromomethane	<6.24	<3.24E+00	<3.60E-01	<13.65145	<7.01E+00	<7.78E-01	20.845320	9.10E+00	1.05E+00
75-15-0	Carbon Disulfide	<5.47	<2.84E+00	<3.15E-01	<6.09	<3.13E+00	<3.47E-01	<7.53	<3.29E+00	<3.78E-01
56-23-5	Carbon Tetrachloride	<0.26	--	--	<0.5	--	--	<0.3	--	--
108-90-7	Chlorobenzene	<1.28	<6.65E-01	<7.38E-02	<1.54	<7.91E-01	<8.78E-02	<1.68	<7.34E-01	<8.44E-02

Table 4-6
Volatile Organics Emissions

		Baseline Run 1			Baseline Run 2			Baseline Run 3		
		O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
		5.2	60.2	57,841	5.2	60.9	57,841	5.0	70.7	59,172
CAS Number	Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
75-00-3	Chloroethane	<0.32	<1.66E-01	<1.84E-02	<0.547	<2.81E-01	<3.12E-02	<0.397	<1.73E-01	<1.99E-02
67-66-3	Chloroform	<0.26	--	--	<0.5	--	--	<0.3	--	--
74-87-3	Chloromethane	<9.11	<4.73E+00	<5.25E-01	<14.09635	<7.24E+00	<8.04E-01	15.658138	6.84E+00	7.86E-01
124-48-1	Dibromochloromethane	<0.26	--	--	<0.5	--	--	<0.3	--	--
74-95-3	Dibromomethane	<0.446	<2.32E-01	<2.57E-02	<0.501	<2.57E-01	<2.86E-02	<0.55	<2.40E-01	<2.76E-02
100-41-4	Ethyl Benzene	<0.7	<3.63E-01	<4.03E-02	<0.73	<3.75E-01	<4.16E-02	<0.71	<3.10E-01	<3.57E-02
97-63-2	Ethyl Methacrylate	<1.3	--	--	<2.5	--	--	<1.5	--	--
75-69-4	Freon 11	<0.2176	<1.13E-01	<1.25E-02	<0.4861	<2.50E-01	<2.77E-02	<0.2861	<1.25E-01	<1.44E-02
75-71-8	Freon 12	<0.277	<1.44E-01	<1.60E-02	<0.521	<2.68E-01	<2.97E-02	<0.334	<1.46E-01	<1.68E-02
74-88-4	Iodomethane	<5.125	<2.66E+00	<2.95E-01	<7.015	<3.60E+00	<4.00E-01	<9.54	<4.17E+00	<4.79E-01
80-62-6	Methyl Methacrylate	<1.306	<6.78E-01	<7.53E-02	<2.5	<1.28E+00	<1.43E-01	<1.52	<6.64E-01	<7.63E-02
75-09-2	Methylene Chloride	2.0120469	1.04E+00	1.16E-01	0.3808864	1.96E-01	2.17E-02	1.8886374	8.25E-01	9.48E-02
100-42-5	Styrene	<1.06	<5.50E-01	<6.11E-02	<1.2	<6.16E-01	<6.84E-02	<1.68	<7.34E-01	<8.44E-02
127-18-4	Tetrachloroethene	<0.2538	<1.32E-01	<1.46E-02	<0.5	<2.57E-01	<2.85E-02	<0.3	<1.31E-01	<1.51E-02
108-88-3	Toluene	<6.935629	<3.60E+00	<4.00E-01	<8.353542	<4.29E+00	<4.76E-01	<7.271905	<3.18E+00	<3.65E-01
79-01-6	Trichloroethene	<0.26	--	--	<0.5	--	--	<0.3	--	--
108-05-4	Vinyl Acetate	<1.3	--	--	<2.5	--	--	<1.5	--	--
75-01-4	Vinyl Chloride	<0.3622	<1.88E-01	<2.09E-02	<0.693	<3.56E-01	<3.95E-02	<0.562	<2.45E-01	<2.82E-02
108-38-3/106-42	m,p-Xylene	<1.86	<9.66E-01	<1.07E-01	<1.99	<1.02E+00	<1.13E-01	<2.1	<9.17E-01	<1.05E-01
95-47-6	o-Xylene	<0.78	<4.05E-01	<4.50E-02	<0.8	<4.11E-01	<4.56E-02	<0.81	<3.54E-01	<4.07E-02

Table 4-6
Volatile Organics Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	65.0	63,899	5.3	61.7	63,899	6.3	60.5	58,778
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
1,1,1,2-Tetrachloroethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,1,1-Trichloroethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,1,2,2-Tetrachloroethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,1,2-Trichloroethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,1-Dichloroethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,1-Dichloroethene	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,2,3-Trichloropropane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,2-Dibromoethane (EDB)	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,2-Dichloroethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
1,2-Dichloropropane	<0.29	--	--	<0.2	--	--	<0.2	--	--
trans-1,2-Dichloroethene	<0.29	--	--	<0.2	--	--	<0.2	--	--
cis-1,3-Dichloropropene	<0.29	--	--	<0.2	--	--	<0.2	--	--
trans-1,3-Dichloropropene	<0.29	--	--	<0.2	--	--	<0.2	--	--
2-Butanone (Methyl Ethyl Ketone)	<1.444	<6.99E-01	<8.51E-02	<0.94	<4.80E-01	<5.85E-02	<1.269	<7.05E-01	<7.40E-02
2-Hexanone	<1.158	<5.60E-01	<6.83E-02	<0.871	<4.45E-01	<5.42E-02	<0.659	<3.66E-01	<3.84E-02
3-Chloropropene	<0.336	<1.63E-01	<1.98E-02	<0.212	<1.08E-01	<1.32E-02	<0.302	<1.68E-01	<1.76E-02
4-Methyl-2-pentanone	<1.45	<7.02E-01	<8.55E-02	<1	<5.10E-01	<6.22E-02	<0.867	<4.82E-01	<5.05E-02
Acetone	3.7676073	1.82E+00	2.22E-01	2.3918018	1.22E+00	1.49E-01	3.6187132	2.01E+00	2.11E-01
Acrolein	<14.5	--	--	<10	--	--	<10	--	--
Acrylonitrile	<4.39	<2.12E+00	<2.59E-01	<3.227	<1.65E+00	<2.01E-01	<5.464	<3.04E+00	<3.18E-01
Benzene	<30.851	<1.49E+01	<1.82E+00	<20.5121	<1.05E+01	<1.28E+00	<28.5089	<1.58E+01	<1.66E+00
Bromochloromethane	<0.4396	<2.13E-01	<2.59E-02	<0.229	<1.17E-01	<1.42E-02	<0.44	<2.44E-01	<2.56E-02
Bromodichloromethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
Bromoform	<0.29	--	--	<0.2	--	--	<0.2	--	--
Bromomethane	<1.859	<9.00E-01	<1.10E-01	<2.137	<1.09E+00	<1.33E-01	<2.352	<1.31E+00	<1.37E-01
Carbon Disulfide	<7.73	<3.74E+00	<4.56E-01	<7.38	<3.77E+00	<4.59E-01	<4.322	<2.40E+00	<2.52E-01
Carbon Tetrachloride	<0.29	--	--	<0.2	--	--	<0.2	--	--
Chlorobenzene	<0.77	<3.73E-01	<4.54E-02	<0.412	<2.10E-01	<2.56E-02	<0.81	<4.50E-01	<4.72E-02

Table 4-6
Volatile Organics Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	65.0	63,899	5.3	61.7	63,899	6.3	60.5	58,778
Analyte	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**
Chloroethane	<0.329	<1.59E-01	<1.94E-02	<0.2067	<1.05E-01	<1.29E-02	<0.194	<1.08E-01	<1.13E-02
Chloroform	<0.29	--	--	<0.2	--	--	<0.2	--	--
Chloromethane	<2.056	<9.95E-01	<1.21E-01	<1.947	<9.94E-01	<1.21E-01	<1.62	<9.00E-01	<9.44E-02
Dibromochloromethane	<0.29	--	--	<0.2	--	--	<0.2	--	--
Dibromomethane	<0.319	<1.54E-01	<1.88E-02	<0.168	<8.57E-02	<1.04E-02	<0.267	<1.48E-01	<1.56E-02
Ethyl Benzene	<0.57	<2.76E-01	<3.36E-02	<0.423	<2.16E-01	<2.63E-02	<0.63	<3.50E-01	<3.67E-02
Ethyl Methacrylate	<1.45	--	--	<1	--	--	<1	--	--
Freon 11	<0.28	<1.35E-01	<1.65E-02	<0.1835	<9.37E-02	<1.14E-02	<0.1615	<8.97E-02	<9.41E-03
Freon 12	<0.307	<1.49E-01	<1.81E-02	<0.211	<1.08E-01	<1.31E-02	<0.205	<1.14E-01	<1.19E-02
Iodomethane	<2.587	<1.25E+00	<1.53E-01	<1.8831	<9.61E-01	<1.17E-01	<3.6444	<2.02E+00	<2.12E-01
Methyl Methacrylate	<1.45	--	--	<1	--	--	<1	--	--
Methylene Chloride	3.1829434	1.54E+00	1.88E-01	2.2531087	1.15E+00	1.40E-01	1.8460784	1.03E+00	1.08E-01
Styrene	<1.15	<5.56E-01	<6.78E-02	<0.89	<4.54E-01	<5.53E-02	<1.66	<9.22E-01	<9.67E-02
Tetrachloroethene	<0.29	--	--	<0.2	--	--	<0.2	--	--
Toluene	<5.333684	<2.58E+00	<3.14E-01	<4.202270	<2.14E+00	<2.61E-01	<5.614880	<3.12E+00	<3.27E-01
Trichloroethene	<0.29	--	--	<0.2	--	--	<0.2	--	--
Vinyl Acetate	<1.45	--	--	<1	--	--	<1	--	--
Vinyl Chloride	<0.384	<1.86E-01	<2.26E-02	<0.246	<1.26E-01	<1.53E-02	<0.258	<1.43E-01	<1.50E-02
m,p-Xylene	<1.39	<6.73E-01	<8.20E-02	<1.17	<5.97E-01	<7.28E-02	<1.79	<9.95E-01	<1.04E-01
o-Xylene	<0.61	<2.95E-01	<3.60E-02	<0.473	<2.41E-01	<2.94E-02	<0.72	<4.00E-01	<4.20E-02

Table 4-6
Volatile Organics Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
1,1,1,2-Tetrachloroethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,1,1-Trichloroethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,1,2-Trichloroethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,1-Dichloroethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,1-Dichloroethene	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,2,3-Trichloropropane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,2-Dibromoethane (EDB)	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,2-Dichloroethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
1,2-Dichloropropane	yes	--	<3.72E-01	<2.30E-01	<1.84E-01	--	<2.06E-02	--
trans-1,2-Dichloroethene	--	--	<3.53E-01	<2.30E-01	--	--	--	--
cis-1,3-Dichloropropene	--	--	<3.53E-01	<2.30E-01	--	--	--	--
trans-1,3-Dichloropropene	--	--	<3.53E-01	<2.30E-01	--	--	--	--
2-Butanone (Methyl Ethyl Ketone)	yes	yes	<1.51E+00	<1.22E+00	<7.49E-01	<6.28E-01	<8.37E-02	<7.25E-02
2-Hexanone	yes	yes	<1.69E+00	<8.96E-01	<8.29E-01	<4.57E-01	<9.32E-02	<5.36E-02
3-Chloropropene	yes	yes	<5.19E-01	<2.83E-01	<2.53E-01	<1.46E-01	<2.84E-02	<1.69E-02
4-Methyl-2-pentanone	yes	yes	<1.65E+00	<1.11E+00	<8.11E-01	<5.65E-01	<9.11E-02	<6.61E-02
Acetone	yes	yes	3.36E+00	3.26E+00	1.66E+00	1.68E+00	1.86E-01	1.94E-01
Acrolein	yes	--	<1.81E+01	<1.15E+01	<8.93E+00	--	<1.00E+00	--
Acrylonitrile	yes	yes	<6.91E+00	<4.36E+00	<3.34E+00	<2.27E+00	<3.76E-01	<2.59E-01
Benzene	yes	yes	<8.06E+01	<2.66E+01	<3.93E+01	<1.37E+01	<4.41E+00	<1.59E+00
Bromochloromethane	yes	yes	<1.09E+00	<3.70E-01	<5.30E-01	<1.91E-01	<5.96E-02	<2.19E-02
Bromodichloromethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
Bromoform	--	--	<3.53E-01	<2.30E-01	--	--	--	--
Bromomethane	yes	yes	<1.36E+01	<2.12E+00	<6.45E+00	<1.10E+00	<7.29E-01	<1.27E-01
Carbon Disulfide	yes	yes	<6.36E+00	<6.48E+00	<3.09E+00	<3.30E+00	<3.47E-01	<3.89E-01
Carbon Tetrachloride	--	--	<3.53E-01	<2.30E-01	--	--	--	--
Chlorobenzene	yes	yes	<1.50E+00	<6.64E-01	<7.30E-01	<3.44E-01	<8.20E-02	<3.94E-02

Table 4-6
Volatile Organics Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
Chloroethane	yes	yes	<4.21E-01	<2.43E-01	<2.07E-01	<1.24E-01	<2.32E-02	<1.45E-02
Chloroform	--	--	<3.53E-01	<2.30E-01	--	--	--	--
Chloromethane	yes	yes	<1.30E+01	<1.87E+00	<6.27E+00	<9.63E-01	<7.05E-01	<1.12E-01
Dibromochloromethane	--	--	<3.53E-01	<2.30E-01	--	--	--	--
Dibromomethane	yes	yes	<4.99E-01	<2.51E-01	<2.43E-01	<1.29E-01	<2.73E-02	<1.49E-02
Ethyl Benzene	yes	yes	<7.13E-01	<5.41E-01	<3.49E-01	<2.81E-01	<3.92E-02	<3.22E-02
Ethyl Methacrylate	--	--	<1.77E+00	<1.15E+00	--	--	--	--
Freon 11	yes	yes	<3.30E-01	<2.08E-01	<1.63E-01	<1.06E-01	<1.82E-02	<1.24E-02
Freon 12	yes	yes	<3.77E-01	<2.41E-01	<1.86E-01	<1.24E-01	<2.08E-02	<1.44E-02
Iodomethane	yes	yes	<7.23E+00	<2.70E+00	<3.48E+00	<1.41E+00	<3.91E-01	<1.61E-01
Methyl Methacrylate	yes	--	<1.78E+00	<1.15E+00	<8.74E-01	--	<9.82E-02	--
Methylene Chloride	yes	yes	1.43E+00	2.43E+00	6.87E-01	1.24E+00	7.75E-02	1.45E-01
Styrene	yes	yes	<1.31E+00	<1.23E+00	<6.33E-01	<6.44E-01	<7.13E-02	<7.33E-02
Tetrachloroethene	yes	--	<3.51E-01	<2.30E-01	<1.73E-01	--	<1.94E-02	--
Toluene	yes	yes	<7.52E+00	<5.05E+00	<3.69E+00	<2.61E+00	<4.14E-01	<3.01E-01
Trichloroethene	--	--	<3.53E-01	<2.30E-01	--	--	--	--
Vinyl Acetate	--	--	<1.77E+00	<1.15E+00	--	--	--	--
Vinyl Chloride	yes	yes	<5.39E-01	<2.96E-01	<2.63E-01	<1.52E-01	<2.95E-02	<1.76E-02
m,p-Xylene	yes	yes	<1.98E+00	<1.45E+00	<9.68E-01	<7.55E-01	<1.08E-01	<8.63E-02
o-Xylene	yes	yes	<7.97E-01	<6.01E-01	<3.90E-01	<3.12E-01	<4.38E-02	<3.58E-02

Table 4-6
Volatile Organics Emissions

Analyte	Emission Rate			PDF	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
1,1,1,2-Tetrachloroethane	--	--	--	--	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--
1,2,3-Trichloropropane	--	--	--	--	--	--	--
1,2-Dibromoethane (EDB)	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--
1,2-Dichloropropane	0.00005	--	--	--	0.00020	--	--
trans-1,2-Dichloroethene	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--
2-Butanone (Methyl Ethyl Ketone)	0.00018	0.00016	--	--	0.00081	0.00070	-0.00011
2-Hexanone	0.00021	0.00012	--	--	0.00090	0.00052	-0.00038
3-Chloropropene	0.00006	0.00004	--	--	0.00027	0.00016	-0.00011
4-Methyl-2-pentanone	0.00020	0.00015	--	--	0.00088	0.00064	-0.00024
Acetone	0.00041	0.00043	--	--	0.00180	0.00187	0.00008
Acrolein	0.00220	--	--	--	0.00966	--	--
Acrylonitrile	0.00083	0.00057	--	--	0.00363	0.00250	-0.00113
Benzene	0.00972	0.00351	--	--	0.04258	0.01535	-0.02723
Bromochloromethane	0.00013	0.00005	--	--	0.00058	0.00021	-0.00036
Bromodichloromethane	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--
Bromomethane	0.00161	0.00028	--	--	0.00704	0.00123	-0.00581
Carbon Disulfide	0.00076	0.00086	--	--	0.00335	0.00376	0.00041
Carbon Tetrachloride	--	--	--	--	--	--	--
Chlorobenzene	0.00018	0.00009	--	--	0.00079	0.00038	-0.00041

Table 4-6
Volatile Organics Emissions

Analyte	Emission Rate			PDF	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
Chloroethane	0.00005	0.00003	--	--	0.00022	0.00014	-0.00008
Chloroform	--	--	--	--	--	--	--
Chloromethane	0.00155	0.00025	--	--	0.00681	0.00108	-0.00573
Dibromochloromethane	--	--	--	--	--	--	--
Dibromomethane	0.00006	0.00003	--	--	0.00026	0.00014	-0.00012
Ethyl Benzene	0.00009	0.00007	--	--	0.00038	0.00031	-0.00007
Ethyl Methacrylate	--	--	--	--	--	--	--
Freon 11	0.00004	0.00003	--	--	0.00018	0.00012	-0.00006
Freon 12	0.00005	0.00003	--	--	0.00020	0.00014	-0.00006
Iodomethane	0.00086	0.00035	--	--	0.00378	0.00155	-0.00222
Methyl Methacrylate	0.00022	--	--	--	0.00095	--	--
Methylene Chloride	0.00017	0.00032	--	--	0.00075	0.00140	0.00065
Styrene	0.00016	0.00016	--	--	0.00069	0.00071	0.00002
Tetrachloroethene	0.00004	--	--	--	0.00019	--	--
Toluene	0.00091	0.00066	--	--	0.00400	0.00291	-0.00109
Trichloroethene	--	--	--	--	--	--	--
Vinyl Acetate	--	--	--	--	--	--	--
Vinyl Chloride	0.00007	0.00004	--	--	0.00028	0.00017	-0.00011
m,p-Xylene	0.00024	0.00019	--	--	0.00104	0.00083	-0.00021
o-Xylene	0.00010	0.00008	--	--	0.00042	0.00035	-0.00008

Table 4-8
Semivolatile Organics Emissions

CAS Registry Number	Analyte	Baseline Run 1			Baseline Run 2			Baseline Run 3		
		O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
		5.2	199.6	57,841	5.0	204.7	59,172	5.5	205.4	59,729
		Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
95-94-3	1,2,4,5-Tetrachlorobenzene	<2.19	--	--	<2.19	--	--	<2.19	--	--
120-82-1	1,2,4-Trichlorobenzene	<2.14	<3.35E-01	<3.72E-02	<2.48	<3.74E-01	<4.30E-02	<2.48	<3.85E-01	<4.33E-02
95-50-1	1,2-Dichlorobenzene	<2.38	<3.73E-01	<4.14E-02	<3.7	<5.58E-01	<6.42E-02	<3.7	<5.74E-01	<6.46E-02
122-66-7	1,2-Diphenylhydrazine	<1.69	--	--	<1.69	--	--	<1.69	--	--
541-73-1	1,3-Dichlorobenzene	<3.34	<5.23E-01	<5.81E-02	<6.04	<9.11E-01	<1.05E-01	<6.04	<9.37E-01	<1.05E-01
106-46-7	1,4-Dichlorobenzene	<3.07	<4.81E-01	<5.34E-02	<4.87	<7.34E-01	<8.45E-02	<4.87	<7.56E-01	<8.50E-02
90-13-1	1-Chloronaphthalene	<1.89	<2.96E-01	<3.29E-02	<2.69	<4.06E-01	<4.67E-02	<2.69	<4.17E-01	<4.69E-02
134-32-7	1-Naphthylamine	<12.23	--	--	<12.23	--	--	<12.23	--	--
58-90-2	2,3,4,6-Tetrachlorophenol	<3.05	--	--	<3.05	--	--	<3.05	--	--
95-95-4	2,4,5-Trichlorophenol	<4.41	--	--	<4.41	--	--	<4.41	--	--
88-06-2	2,4,6-Trichlorophenol	<3.11	--	--	<3.11	--	--	<3.11	--	--
120-83-2	2,4-Dichlorophenol	<2.89	--	--	<2.89	--	--	<2.89	--	--
105-67-9	2,4-Dimethylphenol	<9.79	--	--	<9.79	--	--	<9.79	--	--
51-28-5	2,4-Dinitrophenol	<29.4	--	--	<29.4	--	--	<29.4	--	--
121-14-2	2,4-Dinitrotoluene	<3.1	--	--	<3.1	--	--	<3.1	--	--
87-65-0	2,6-Dichlorophenol	<2.22	--	--	<2.22	--	--	<2.22	--	--
606-20-2	2,6-Dinitrotoluene	<9.39	<1.47E+00	<1.63E-01	<10.49	<1.58E+00	<1.82E-01	<10.49	<1.63E+00	<1.83E-01
91-58-7	2-Chloronaphthalene	<1.53	<2.40E-01	<2.66E-02	<1.53	<2.31E-01	<2.65E-02	<1.53	<2.37E-01	<2.67E-02
95-57-8	2-Chlorophenol	<15.58	<2.44E+00	<2.71E-01	<34.61	<5.22E+00	<6.00E-01	<34.61	<5.37E+00	<6.04E-01
95-48-7	2-Methylphenol	<10.3	<1.61E+00	<1.79E-01	<15.3	<2.31E+00	<2.65E-01	<15.3	<2.37E+00	<2.67E-01
91-59-8	2-Naphthylamine	<11.81	--	--	<11.81	--	--	<11.81	--	--
88-74-4	2-Nitroaniline	<2.16	--	--	<2.16	--	--	<2.16	--	--
88-75-5	2-Nitrophenol	<4.7	--	--	<4.7	--	--	<4.7	--	--
91-94-1	3,3'-Dichlorobenzidine	<13.1	--	--	<13.1	--	--	<13.1	--	--
5	3-Methylphenol & 4-Methylphenol	<40.7	<6.38E+00	<7.08E-01	<56.3	<8.49E+00	<9.76E-01	<56.3	<8.74E+00	<9.82E-01
99-09-2	3-Nitroaniline	<7.6	--	--	<7.6	--	--	<7.6	--	--
534-52-1	4,6-Dinitro-2-methylphenol	<14.26	--	--	<14.26	--	--	<14.26	--	--
92-67-1	4-Aminobiphenyl	<12.5	--	--	<12.5	--	--	<12.5	--	--

Table 4-8
Semivolatile Organics Emissions

		Baseline Run 1			Baseline Run 2			Baseline Run 3		
		O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
		5.2	199.6	57,841	5.0	204.7	59,172	5.5	205.4	59,729
CAS Registry Number	Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
101-55-3	4-Bromophenyl phenyl ether	<1.57	--	--	<1.57	--	--	<1.57	--	--
59-50-7	4-Chloro-3-methylphenol	<4.12	--	--	<4.12	--	--	<4.12	--	--
106-47-8	4-Chloroaniline	<10.2	--	--	<10.2	--	--	<10.2	--	--
7005-72-3	4-Chlorophenyl phenyl ether	<2.21	--	--	<2.21	--	--	<2.21	--	--
100-01-6	4-Nitroaniline	<5.8	--	--	<5.8	--	--	<5.8	--	--
100-02-7	4-Nitrophenol	<8.1	--	--	<8.1	--	--	<8.1	--	--
98-86-2	Acetophenone	37.8	5.92E+00	6.57E-01	<71.97	<1.09E+01	<1.25E+00	<71.97	<1.12E+01	<1.26E+00
62-53-3	Aniline	<15.25	--	--	<15.25	--	--	<15.25	--	--
92-87-5	Benzidine	<127	--	--	<127	--	--	<127	--	--
65-85-0	Benzoic acid	<147	<2.30E+01	<2.56E+00	<209	<3.15E+01	<3.62E+00	<209	<3.24E+01	<3.65E+00
100-51-6	Benzyl alcohol	<72.5	<1.14E+01	<1.26E+00	<75.7	<1.14E+01	<1.31E+00	<75.7	<1.17E+01	<1.32E+00
111-91-1	bis(2-Chloroethoxy)methane	<1.85	--	--	<1.85	--	--	<1.85	--	--
111-44-4	bis(2-Chloroethyl) ether	<1.96	--	--	<1.96	--	--	<1.96	--	--
108-60-1	bis(2-Chloroisopropyl) ether	<2.43	--	--	<2.43	--	--	<2.43	--	--
117-81-7	bis(2-Ethylhexyl) phthalate	<29.3	<4.59E+00	<5.09E-01	<78.3	<1.18E+01	<1.36E+00	<78.3	<1.22E+01	<1.37E+00
85-68-7	Butyl benzyl phthalate	<2.58	<4.04E-01	<4.49E-02	<3.87	<5.84E-01	<6.71E-02	<3.87	<6.01E-01	<6.75E-02
132-64-9	Dibenzofuran	<3.33	<5.22E-01	<5.79E-02	<7.63	<1.15E+00	<1.32E-01	<7.63	<1.18E+00	<1.33E-01
84-66-2	Diethyl phthalate	19.2	3.01E+00	3.34E-01	<19.1	<2.88E+00	<3.31E-01	<19.1	<2.96E+00	<3.33E-01
131-11-3	Dimethyl phthalate	<1.63	<2.55E-01	<2.83E-02	<1.81	<2.73E-01	<3.14E-02	<1.81	<2.81E-01	<3.16E-02
84-74-2	Di-n-butyl phthalate	<12.1	<1.90E+00	<2.10E-01	<12.11	<1.83E+00	<2.10E-01	<12.11	<1.88E+00	<2.11E-01
117-84-0	Di-n-octyl phthalate	<4.26	<6.67E-01	<7.41E-02	<4.76	<7.18E-01	<8.26E-02	<4.76	<7.39E-01	<8.31E-02
122-39-4	Diphenylamine	<2.1	<3.29E-01	<3.65E-02	<2.22	<3.35E-01	<3.85E-02	<2.22	<3.45E-01	<3.87E-02
62-50-0	Ethyl methanesulfonate	<2.27	--	--	<2.27	--	--	<2.27	--	--
118-74-1	Hexachlorobenzene	<2.06	--	--	<2.06	--	--	<2.06	--	--
87-68-3	Hexachlorobutadiene	<2.87	--	--	<2.87	--	--	<2.87	--	--
77-47-4	Hexachlorocyclopentadiene	<22.5	--	--	<22.5	--	--	<22.5	--	--
67-72-1	Hexachloroethane	<3.78	--	--	<3.78	--	--	<3.78	--	--
78-59-1	Isophorone	<1.84	--	--	<1.84	--	--	<1.84	--	--
66-27-3	Methyl methanesulfonate	<2.01	--	--	<2.01	--	--	<2.01	--	--

Table 4-8
Semivolatile Organics Emissions

CAS Registry Number	Analyte	Baseline Run 1			Baseline Run 2			Baseline Run 3		
		O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
		5.2	199.6	57,841	5.0	204.7	59,172	5.5	205.4	59,729
		Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
98-95-3	Nitrobenzene	<5.91	<9.26E-01	<1.03E-01	<11.36	<1.71E+00	<1.97E-01	<11.36	<1.76E+00	<1.98E-01
62-75-9	N-Nitrosodimethylamine	<5.22	<8.18E-01	<9.08E-02	<5.82	<8.78E-01	<1.01E-01	<5.82	<9.03E-01	<1.02E-01
924-16-3	N-Nitrosodi-n-butylamine	<2.36	--	--	<2.36	--	--	<2.36	--	--
621-64-7	N-Nitrosodi-n-propylamine	<2.11	--	--	<2.11	--	--	<2.11	--	--
86-30-6	N-Nitrosodiphenylamine	<1.99	--	--	<1.99	--	--	<1.99	--	--
100-75-4	N-Nitrosopiperidine	<1.85	--	--	<1.85	--	--	<1.85	--	--
95-53-4	o-Toluidine	<8	--	--	<8	--	--	<8	--	--
60-11-7	p-Dimethylaminoazobenzene	<1.97	--	--	<1.97	--	--	<1.97	--	--
608-93-5	Pentachlorobenzene	<1.89	--	--	<1.89	--	--	<1.89	--	--
82-68-8	Pentachloronitrobenzene	<2.26	--	--	<2.26	--	--	<2.26	--	--
87-86-5	Pentachlorophenol	<51.3	--	--	<51.3	--	--	<51.3	--	--
62-44-2	Phenacetin	<1.91	--	--	<1.91	--	--	<1.91	--	--
108-95-2	Phenol	<1891.1	<2.96E+02	<3.29E+01	<4001.1	<6.03E+02	<6.94E+01	<4001.1	<6.21E+02	<6.98E+01

Table 4-8
Semivolatile Organics Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	207.3	63,899	6.3	200.2	58,778	6.3	205.2	60,889
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
1,2,4,5-Tetrachlorobenzene	<2.19	--	--	<2.19	--	--	<2.19	--	--
1,2,4-Trichlorobenzene	<2.48	<3.76E-01	<4.59E-02	<2.48	<4.17E-01	<4.37E-02	<2.48	<4.06E-01	<4.41E-02
1,2-Dichlorobenzene	<3.7	<5.62E-01	<6.84E-02	<3.7	<6.21E-01	<6.52E-02	<3.7	<6.06E-01	<6.59E-02
1,2-Diphenylhydrazine	<1.69	--	--	<1.69	--	--	<1.69	--	--
1,3-Dichlorobenzene	<6.04	<9.17E-01	<1.12E-01	<6.04	<1.01E+00	<1.06E-01	<6.04	<9.89E-01	<1.08E-01
1,4-Dichlorobenzene	<4.87	<7.39E-01	<9.01E-02	<4.87	<8.18E-01	<8.58E-02	<4.87	<7.98E-01	<8.67E-02
1-Chloronaphthalene	<2.69	<4.08E-01	<4.97E-02	<2.69	<4.52E-01	<4.74E-02	<2.69	<4.41E-01	<4.79E-02
1-Naphthylamine	<12.23	--	--	<12.23	--	--	<12.23	--	--
2,3,4,6-Tetrachlorophenol	<3.05	--	--	<3.05	--	--	<3.05	--	--
2,4,5-Trichlorophenol	<4.41	--	--	<4.41	--	--	<4.41	--	--
2,4,6-Trichlorophenol	<3.11	--	--	<3.11	--	--	<3.11	--	--
2,4-Dichlorophenol	<2.89	--	--	<2.89	--	--	<2.89	--	--
2,4-Dimethylphenol	<9.79	--	--	<9.79	--	--	<9.79	--	--
2,4-Dinitrophenol	<29.4	--	--	<29.4	--	--	<29.4	--	--
2,4-Dinitrotoluene	<3.1	--	--	<3.1	--	--	<3.1	--	--
2,6-Dichlorophenol	<2.22	--	--	<2.22	--	--	<2.22	--	--
2,6-Dinitrotoluene	<10.49	<1.59E+00	<1.94E-01	<10.49	<1.76E+00	<1.85E-01	<10.49	<1.72E+00	<1.87E-01
2-Chloronaphthalene	<1.53	--	--	<1.53	--	--	<1.53	--	--
2-Chlorophenol	<34.61	<5.25E+00	<6.40E-01	<34.61	<5.81E+00	<6.10E-01	<34.61	<5.67E+00	<6.16E-01
2-Methylphenol	<15.3	<2.32E+00	<2.83E-01	<15.3	<2.57E+00	<2.70E-01	<15.3	<2.51E+00	<2.72E-01
2-Naphthylamine	<11.81	--	--	<11.81	--	--	<11.81	--	--
2-Nitroaniline	<2.16	--	--	<2.16	--	--	<2.16	--	--
2-Nitrophenol	<4.7	--	--	<4.7	--	--	<4.7	--	--
3,3'-Dichlorobenzidine	<13.1	--	--	<13.1	--	--	<13.1	--	--
3-Methylphenol & 4-Methylphenol	<56.3	<8.54E+00	<1.04E+00	<56.3	<9.46E+00	<9.92E-01	<56.3	<9.22E+00	<1.00E+00
3-Nitroaniline	<7.6	--	--	<7.6	--	--	<7.6	--	--
4,6-Dinitro-2-methylphenol	<14.26	--	--	<14.26	--	--	<14.26	--	--
4-Aminobiphenyl	<12.5	--	--	<12.5	--	--	<12.5	--	--

Table 4-8
Semivolatile Organics Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	207.3	63,899	6.3	200.2	58,778	6.3	205.2	60,889
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
4-Bromophenyl phenyl ether	<1.57	--	--	<1.57	--	--	<1.57	--	--
4-Chloro-3-methylphenol	<4.12	--	--	<4.12	--	--	<4.12	--	--
4-Chloroaniline	<10.2	--	--	<10.2	--	--	<10.2	--	--
4-Chlorophenyl phenyl ether	<2.21	--	--	<2.21	--	--	<2.21	--	--
4-Nitroaniline	<5.8	--	--	<5.8	--	--	<5.8	--	--
4-Nitrophenol	<8.1	--	--	<8.1	--	--	<8.1	--	--
Acetophenone	<71.97	<1.09E+01	<1.33E+00	<71.97	<1.21E+01	<1.27E+00	<71.97	<1.18E+01	<1.28E+00
Aniline	<15.25	--	--	<15.25	--	--	<15.25	--	--
Benzidine	<127	--	--	<127	--	--	<127	--	--
Benzoic acid	<209	<3.17E+01	<3.87E+00	<209	<3.51E+01	<3.68E+00	<209	<3.42E+01	<3.72E+00
Benzyl alcohol	<75.7	<1.15E+01	<1.40E+00	<75.7	<1.27E+01	<1.33E+00	<75.7	<1.24E+01	<1.35E+00
bis(2-Chloroethoxy)methane	<1.85	--	--	<1.85	--	--	<1.85	--	--
bis(2-Chloroethyl) ether	<1.96	--	--	<1.96	--	--	<1.96	--	--
bis(2-Chloroisopropyl) ether	<2.43	--	--	<2.43	--	--	<2.43	--	--
bis(2-Ethylhexyl) phthalate	<78.3	<1.19E+01	<1.45E+00	<78.3	<1.32E+01	<1.38E+00	<78.3	<1.28E+01	<1.39E+00
Butyl benzyl phthalate	<3.87	<5.87E-01	<7.16E-02	<3.87	<6.50E-01	<6.82E-02	<3.87	<6.34E-01	<6.89E-02
Dibenzofuran	<7.63	<1.16E+00	<1.41E-01	<7.63	<1.28E+00	<1.34E-01	<7.63	<1.25E+00	<1.36E-01
Diethyl phthalate	<19.1	<2.90E+00	<3.53E-01	<19.1	<3.21E+00	<3.37E-01	<19.1	<3.13E+00	<3.40E-01
Dimethyl phthalate	<1.81	<2.75E-01	<3.35E-02	<1.81	<3.04E-01	<3.19E-02	<1.81	<2.96E-01	<3.22E-02
Di-n-butyl phthalate	<12.11	--	--	<12.11	--	--	<12.11	--	--
Di-n-octyl phthalate	<4.76	<7.22E-01	<8.80E-02	<4.76	<8.00E-01	<8.39E-02	<4.76	<7.80E-01	<8.47E-02
Diphenylamine	<2.22	<3.37E-01	<4.11E-02	<2.22	<3.73E-01	<3.91E-02	<2.22	<3.64E-01	<3.95E-02
Ethyl methanesulfonate	<2.27	--	--	<2.27	--	--	<2.27	--	--
Hexachlorobenzene	<2.06	--	--	<2.06	--	--	<2.06	--	--
Hexachlorobutadiene	<2.87	--	--	<2.87	--	--	<2.87	--	--
Hexachlorocyclopentadiene	<22.5	--	--	<22.5	--	--	<22.5	--	--
Hexachloroethane	<3.78	--	--	<3.78	--	--	<3.78	--	--
Isophorone	<1.84	--	--	<1.84	--	--	<1.84	--	--
Methyl methanesulfonate	<2.01	--	--	<2.01	--	--	<2.01	--	--

Table 4-8
Semivolatile Organics Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	207.3	63,899	6.3	200.2	58,778	6.3	205.2	60,889
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
Nitrobenzene	<11.36	<1.72E+00	<2.10E-01	<11.36	<1.91E+00	<2.00E-01	<11.36	<1.86E+00	<2.02E-01
N-Nitrosodimethylamine	<5.82	<8.83E-01	<1.08E-01	<5.82	<9.78E-01	<1.03E-01	<5.82	<9.53E-01	<1.04E-01
N-Nitrosodi-n-butylamine	<2.36	--	--	<2.36	--	--	<2.36	--	--
N-Nitrosodi-n-propylamine	<2.11	--	--	<2.11	--	--	<2.11	--	--
N-Nitrosodiphenylamine	<1.99	<3.02E-01	<3.68E-02	<1.99	<3.34E-01	<3.51E-02	<1.99	<3.26E-01	<3.54E-02
N-Nitrosopiperidine	<1.85	--	--	<1.85	--	--	<1.85	--	--
o-Toluidine	<8	--	--	<8	--	--	<8	--	--
p-Dimethylaminoazobenzene	<1.97	--	--	<1.97	--	--	<1.97	--	--
Pentachlorobenzene	<1.89	--	--	<1.89	--	--	<1.89	--	--
Pentachloronitrobenzene	<2.26	--	--	<2.26	--	--	<2.26	--	--
Pentachlorophenol	<51.3	--	--	<51.3	--	--	<51.3	--	--
Phenacetin	<1.91	--	--	<1.91	--	--	<1.91	--	--
Phenol	<4001.1	<6.07E+02	<7.40E+01	<4001.1	<6.72E+02	<7.05E+01	<4001.1	<6.55E+02	<7.12E+01

Table 4-8
Semivolatile Organics Emissions

Analyte	Analyte Detected Baseline	Analyte Detected PDF	Detected Mass		Emission Concentration		Emission Rate	
			Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
1,2,4,5-Tetrachlorobenzene	--	--	<2.19E+00	<2.19E+00	--	--	--	--
1,2,4-Trichlorobenzene	yes	yes	<2.37E+00	<2.48E+00	<3.65E-01	<4.00E-01	<4.12E-02	<4.46E-02
1,2-Dichlorobenzene	yes	yes	<3.26E+00	<3.70E+00	<5.02E-01	<5.96E-01	<5.67E-02	<6.65E-02
1,2-Diphenylhydrazine	--	--	<1.69E+00	<1.69E+00	--	--	--	--
1,3-Dichlorobenzene	yes	yes	<5.14E+00	<6.04E+00	<7.90E-01	<9.72E-01	<8.94E-02	<1.09E-01
1,4-Dichlorobenzene	yes	yes	<4.27E+00	<4.87E+00	<6.57E-01	<7.85E-01	<7.43E-02	<8.75E-02
1-Chloronaphthalene	yes	yes	<2.42E+00	<2.69E+00	<3.73E-01	<4.34E-01	<4.22E-02	<4.83E-02
1-Naphthylamine	--	--	<1.22E+01	<1.22E+01	--	--	--	--
2,3,4,6-Tetrachlorophenol	--	--	<3.05E+00	<3.05E+00	--	--	--	--
2,4,5-Trichlorophenol	--	--	<4.41E+00	<4.41E+00	--	--	--	--
2,4,6-Trichlorophenol	--	--	<3.11E+00	<3.11E+00	--	--	--	--
2,4-Dichlorophenol	--	--	<2.89E+00	<2.89E+00	--	--	--	--
2,4-Dimethylphenol	--	--	<9.79E+00	<9.79E+00	--	--	--	--
2,4-Dinitrophenol	--	--	<2.94E+01	<2.94E+01	--	--	--	--
2,4-Dinitrotoluene	--	--	<3.10E+00	<3.10E+00	--	--	--	--
2,6-Dichlorophenol	--	--	<2.22E+00	<2.22E+00	--	--	--	--
2,6-Dinitrotoluene	yes	yes	<1.01E+01	<1.05E+01	<1.56E+00	<1.69E+00	<1.76E-01	<1.89E-01
2-Chloronaphthalene	yes	--	<1.53E+00	<1.53E+00	<2.36E-01	--	<2.66E-02	--
2-Chlorophenol	yes	yes	<2.83E+01	<3.46E+01	<4.34E+00	<5.58E+00	<4.92E-01	<6.22E-01
2-Methylphenol	yes	yes	<1.36E+01	<1.53E+01	<2.10E+00	<2.47E+00	<2.37E-01	<2.75E-01
2-Naphthylamine	--	--	<1.18E+01	<1.18E+01	--	--	--	--
2-Nitroaniline	--	--	<2.16E+00	<2.16E+00	--	--	--	--
2-Nitrophenol	--	--	<4.70E+00	<4.70E+00	--	--	--	--
3,3'-Dichlorobenzidine	--	--	<1.31E+01	<1.31E+01	--	--	--	--
3-Methylphenol & 4-Methylphenol	yes	yes	<5.11E+01	<5.63E+01	<7.87E+00	<9.07E+00	<8.89E-01	<1.01E+00
3-Nitroaniline	--	--	<7.60E+00	<7.60E+00	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	<1.43E+01	<1.43E+01	--	--	--	--
4-Aminobiphenyl	--	--	<1.25E+01	<1.25E+01	--	--	--	--

Table 4-8
Semivolatile Organics Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
4-Bromophenyl phenyl ether	--	--	<1.57E+00	<1.57E+00	--	--	--	--
4-Chloro-3-methylphenol	--	--	<4.12E+00	<4.12E+00	--	--	--	--
4-Chloroaniline	--	--	<1.02E+01	<1.02E+01	--	--	--	--
4-Chlorophenyl phenyl ether	--	--	<2.21E+00	<2.21E+00	--	--	--	--
4-Nitroaniline	--	--	<5.80E+00	<5.80E+00	--	--	--	--
4-Nitrophenol	--	--	<8.10E+00	<8.10E+00	--	--	--	--
Acetophenone	yes	yes	<6.06E+01	<7.20E+01	<9.34E+00	<1.16E+01	<1.06E+00	<1.29E+00
Aniline	--	--	<1.53E+01	<1.53E+01	--	--	--	--
Benzidine	--	--	<1.27E+02	<1.27E+02	--	--	--	--
Benzoic acid	yes	yes	<1.88E+02	<2.09E+02	<2.90E+01	<3.37E+01	<3.28E+00	<3.76E+00
Benzyl alcohol	yes	yes	<7.46E+01	<7.57E+01	<1.15E+01	<1.22E+01	<1.30E+00	<1.36E+00
bis(2-Chloroethoxy)methane	--	--	<1.85E+00	<1.85E+00	--	--	--	--
bis(2-Chloroethyl) ether	--	--	<1.96E+00	<1.96E+00	--	--	--	--
bis(2-Chloroisopropyl) ether	--	--	<2.43E+00	<2.43E+00	--	--	--	--
bis(2-Ethylhexyl) phthalate	yes	yes	<6.20E+01	<7.83E+01	<9.53E+00	<1.26E+01	<1.08E+00	<1.41E+00
Butyl benzyl phthalate	yes	yes	<3.44E+00	<3.87E+00	<5.30E-01	<6.24E-01	<5.98E-02	<6.96E-02
Dibenzofuran	yes	yes	<6.20E+00	<7.63E+00	<9.51E-01	<1.23E+00	<1.08E-01	<1.37E-01
Diethyl phthalate	yes	yes	<1.91E+01	<1.91E+01	<2.95E+00	<3.08E+00	<3.33E-01	<3.43E-01
Dimethyl phthalate	yes	yes	<1.75E+00	<1.81E+00	<2.70E-01	<2.92E-01	<3.04E-02	<3.25E-02
Di-n-butyl phthalate	yes	--	<1.21E+01	<1.21E+01	<1.87E+00	--	<2.10E-01	--
Di-n-octyl phthalate	yes	yes	<4.59E+00	<4.76E+00	<7.08E-01	<7.67E-01	<7.99E-02	<8.55E-02
Diphenylamine	yes	yes	<2.18E+00	<2.22E+00	<3.36E-01	<3.58E-01	<3.79E-02	<3.99E-02
Ethyl methanesulfonate	--	--	<2.27E+00	<2.27E+00	--	--	--	--
Hexachlorobenzene	--	--	<2.06E+00	<2.06E+00	--	--	--	--
Hexachlorobutadiene	--	--	<2.87E+00	<2.87E+00	--	--	--	--
Hexachlorocyclopentadiene	--	--	<2.25E+01	<2.25E+01	--	--	--	--
Hexachloroethane	--	--	<3.78E+00	<3.78E+00	--	--	--	--
Isophorone	--	--	<1.84E+00	<1.84E+00	--	--	--	--
Methyl methanesulfonate	--	--	<2.01E+00	<2.01E+00	--	--	--	--

Table 4-8
Semivolatile Organics Emissions

	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
Analyte	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
Nitrobenzene	yes	yes	<9.54E+00	<1.14E+01	<1.47E+00	<1.83E+00	<1.66E-01	<2.04E-01
N-Nitrosodimethylamine	yes	yes	<5.62E+00	<5.82E+00	<8.66E-01	<9.38E-01	<9.79E-02	<1.05E-01
N-Nitrosodi-n-butylamine	--	--	<2.36E+00	<2.36E+00	--	--	--	--
N-Nitrosodi-n-propylamine	--	--	<2.11E+00	<2.11E+00	--	--	--	--
N-Nitrosodiphenylamine	--	yes	<1.99E+00	<1.99E+00	--	<3.21E-01	--	<3.58E-02
N-Nitrosopiperidine	--	--	<1.85E+00	<1.85E+00	--	--	--	--
o-Toluidine	--	--	<8.00E+00	<8.00E+00	--	--	--	--
p-Dimethylaminoazobenzene	--	--	<1.97E+00	<1.97E+00	--	--	--	--
Pentachlorobenzene	--	--	<1.89E+00	<1.89E+00	--	--	--	--
Pentachloronitrobenzene	--	--	<2.26E+00	<2.26E+00	--	--	--	--
Pentachlorophenol	--	--	<5.13E+01	<5.13E+01	--	--	--	--
Phenacetin	--	--	<1.91E+00	<1.91E+00	--	--	--	--
Phenol	yes	yes	<3.30E+03	<4.00E+03	<5.07E+02	<6.45E+02	<5.74E+01	<7.19E+01

Table 4-8
Semivolatile Organics Emissions

	Emission Rate			PDF	Annualized Emissions		
Analyte	**Dec 2003 Baseline Average (lb/hr)**	**Dec 2003 PDF Average (lb/hr)**	**#39-00011 Permit Limit (lb/hr)**	**Emission Rate as % of Limit**	**Dec 2003 Baseline Average (tpy)**	**Dec 2003 PDF Average (tpy)**	**Change (tpy)**
1,2,4,5-Tetrachlorobenzene	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	0.00009	0.00010	--	--	0.00040	0.00043	0.00003
1,2-Dichlorobenzene	0.00013	0.00015	--	--	0.00055	0.00064	0.00009
1,2-Diphenylhydrazine	--	--	--	--	--	--	--
1,3-Dichlorobenzene	0.00020	0.00024	--	--	0.00086	0.00105	0.00019
1,4-Dichlorobenzene	0.00016	0.00019	--	--	0.00072	0.00084	0.00013
1-Chloronaphthalene	0.00009	0.00011	--	--	0.00041	0.00047	0.00006
1-Naphthylamine	--	--	--	--	--	--	--
2,3,4,6-Tetrachlorophenol	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--
2,4-Dichlorophenol	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--
2,4-Dinitrophenol	--	--	--	--	--	--	--
2,4-Dinitrotoluene	--	--	--	--	--	--	--
2,6-Dichlorophenol	--	--	--	--	--	--	--
2,6-Dinitrotoluene	0.00039	0.00042	--	--	0.00170	0.00183	0.00013
2-Chloronaphthalene	0.00006	--	--	--	0.00026	--	--
2-Chlorophenol	0.00108	0.00137	--	--	0.00475	0.00601	0.00126
2-Methylphenol	0.00052	0.00061	--	--	0.00229	0.00266	0.00037
2-Naphthylamine	--	--	--	--	--	--	--
2-Nitroaniline	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	--	--	--	--	--	--	--
3-Methylphenol & 4-Methylphenol	0.00196	0.00223	--	--	0.00858	0.00975	0.00117
3-Nitroaniline	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	--	--	--	--	--	--	--
4-Aminobiphenyl	--	--	--	--	--	--	--

Table 4-8
Semivolatile Organics Emissions

Analyte	Emission Rate			PDF	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
4-Bromophenyl phenyl ether	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	--	--	--	--	--	--
4-Chloroaniline	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	--	--	--	--	--	--	--
4-Nitroaniline	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--
Acetophenone	0.00234	0.00284	--	--	0.01024	0.01246	0.00222
Aniline	--	--	--	--	--	--	--
Benzidine	--	--	--	--	--	--	--
Benzoic acid	0.00723	0.00829	--	--	0.03167	0.03631	0.00463
Benzyl alcohol	0.00287	0.00300	--	--	0.01255	0.01313	0.00058
bis(2-Chloroethoxy)methane	--	--	--	--	--	--	--
bis(2-Chloroethyl) ether	--	--	--	--	--	--	--
bis(2-Chloroisopropyl) ether	--	--	--	--	--	--	--
bis(2-Ethylhexyl) phthalate	0.00238	0.00311	--	--	0.01043	0.01362	0.00319
Butyl benzyl phthalate	0.00013	0.00015	--	--	0.00058	0.00067	0.00009
Dibenzofuran	0.00024	0.00030	--	--	0.00104	0.00132	0.00028
Diethyl phthalate	0.00073	0.00076	--	--	0.00322	0.00331	0.00010
Dimethyl phthalate	0.00007	0.00007	--	--	0.00029	0.00031	0.00002
Di-n-butyl phthalate	0.00046	--	--	--	0.00203	--	--
Di-n-octyl phthalate	0.00018	0.00019	--	--	0.00077	0.00083	0.00005
Diphenylamine	0.00008	0.00009	--	--	0.00037	0.00039	0.00002
Ethyl methanesulfonate	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	--	--	--	--	--
Hexachlorobutadiene	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	--	--	--	--	--	--	--
Hexachloroethane	--	--	--	--	--	--	--
Isophorone	--	--	--	--	--	--	--
Methyl methanesulfonate	--	--	--	--	--	--	--

Table 4-8
Semivolatile Organics Emissions

Analyte	Emission Rate			PDF	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
Nitrobenzene	0.00037	0.00045	--	--	0.00160	0.00197	0.00037
N-Nitrosodimethylamine	0.00022	0.00023	--	--	0.00095	0.00101	0.00007
N-Nitrosodi-n-butylamine	--	--	--	--	--	--	--
N-Nitrosodi-n-propylamine	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	0.00008	--	--	--	0.00035	--
N-Nitrosopiperidine	--	--	--	--	--	--	--
o-Toluidine	--	--	--	--	--	--	--
p-Dimethylaminoazobenzene	--	--	--	--	--	--	--
Pentachlorobenzene	--	--	--	--	--	--	--
Pentachloronitrobenzene	--	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--	--
Phenacetin	--	--	--	--	--	--	--
Phenol	0.12654	0.15851	--	--	0.55426	0.69427	0.14001

Table 4-10
PCDD/PCDF Emissions

	Baseline Run 1			Baseline Run 2			Baseline Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.2	189.1	55,392	5.0	181.2	54,483	5.5	186.3	56,994
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
2,3,7,8-TCDD	1.09E-04	1.80E-05	1.92E-06	5.75E-06	9.80E-07	1.04E-07	4.63E-05	7.92E-06	8.50E-07
1,2,3,7,8-PeCDD	2.93E-04	4.84E-05	5.15E-06	1.69E-05	2.88E-06	3.05E-07	1.15E-04	1.97E-05	2.11E-06
1,2,3,4,7,8-HxCDD	1.77E-04	2.93E-05	3.11E-06	1.15E-05	1.96E-06	2.07E-07	6.03E-05	1.03E-05	1.11E-06
1,2,3,6,7,8-HxCDD	2.01E-04	3.32E-05	3.53E-06	1.12E-05	1.91E-06	2.02E-07	6.46E-05	1.11E-05	1.19E-06
1,2,3,7,8,9-HxCDD	2.08E-04	3.44E-05	3.66E-06	1.24E-05	2.11E-06	2.24E-07	6.61E-05	1.13E-05	1.21E-06
1,2,3,4,6,7,8-HpCDD	1.22E-03	2.02E-04	2.14E-05	6.35E-05	1.08E-05	1.15E-06	3.02E-04	5.17E-05	5.54E-06
OCDD	2.50E-03	4.13E-04	4.39E-05	1.24E-04	2.11E-05	2.24E-06	4.53E-04	7.75E-05	8.31E-06
2,3,7,8-TCDF	7.01E-06	1.16E-06	1.23E-07	2.08E-06	3.54E-07	3.75E-08	4.08E-06	6.98E-07	7.49E-08
1,2,3,7,8-PeCDF	2.35E-05	3.89E-06	4.13E-07	<5.00E-06	<8.52E-07	<9.02E-08	1.08E-05	1.85E-06	1.98E-07
2,3,4,7,8-PeCDF	1.82E-05	3.01E-06	3.20E-07	<5.00E-06	<8.52E-07	<9.02E-08	9.11E-06	1.56E-06	1.67E-07
1,2,3,4,7,8-HxCDF	1.78E-05	2.94E-06	3.13E-07	<5.00E-06	<8.52E-07	<9.02E-08	7.68E-06	1.31E-06	1.41E-07
1,2,3,6,7,8-HxCDF	1.63E-05	2.70E-06	2.86E-07	<5.00E-06	<8.52E-07	<9.02E-08	6.01E-06	1.03E-06	1.10E-07
2,3,4,6,7,8-HxCDF	1.20E-05	1.98E-06	2.11E-07	<5.00E-06	<8.52E-07	<9.02E-08	<5.00E-06	<8.55E-07	<9.18E-08
1,2,3,7,8,9-HxCDF	7.22E-06	1.19E-06	1.27E-07	6.49E-07	1.11E-07	1.17E-08	6.70E-07	1.15E-07	1.23E-08
1,2,3,4,6,7,8-HpCDF	4.17E-05	6.89E-06	7.33E-07	5.43E-06	9.25E-07	9.79E-08	1.42E-05	2.43E-06	2.61E-07
1,2,3,4,7,8,9-HpCDF	7.93E-06	1.31E-06	1.39E-07	1.36E-06	2.32E-07	2.45E-08	1.19E-06	2.04E-07	2.18E-08
OCDF	4.17E-05	6.89E-06	7.33E-07	1.33E-05	2.27E-06	2.40E-07	1.11E-05	1.90E-06	2.04E-07
ITEF TEQ (ND=0; EMPC=0)	3.46E-04	5.72E-05	6.08E-06	1.87E-05	3.19E-06	3.37E-07	1.34E-04	2.29E-05	2.46E-06
ITEF TEQ (ND=0; EMPC=EMPC)	3.46E-04	5.72E-05	6.08E-06	1.87E-05	3.19E-06	3.37E-07	1.34E-04	2.29E-05	2.46E-06
ITEF TEQ (ND=DL/2; EMPC=0)	3.46E-04	5.72E-05	6.08E-06	2.09E-05	3.56E-06	3.77E-07	1.34E-04	2.29E-05	2.46E-06
ITEF TEQ (ND=DL/2; EMPC=EMPC	3.46E-04	5.72E-05	6.08E-06	2.09E-05	3.56E-06	3.77E-07	1.34E-04	2.29E-05	2.46E-06
ITEF TEQ (ND=DL; EMPC=EMPC)	3.46E-04	5.72E-05	6.08E-06	2.31E-05	3.94E-06	4.17E-07	1.34E-04	2.29E-05	2.46E-06

Table 4-10
PCDD/PCDF Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	203.7	61,094	6.3	191.5	59,351	6.3	201.6	60,188
Analyte	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**
2,3,7,8-TCDD	4.35E-06	6.72E-07	7.83E-08	3.58E-05	6.29E-06	6.66E-07	4.12E-06	6.87E-07	7.38E-08
1,2,3,7,8-PeCDD	1.03E-05	1.59E-06	1.85E-07	1.47E-04	2.58E-05	2.73E-06	1.10E-05	1.83E-06	1.97E-07
1,2,3,4,7,8-HxCDD	8.00E-06	1.24E-06	1.44E-07	1.27E-04	2.23E-05	2.36E-06	7.59E-06	1.27E-06	1.36E-07
1,2,3,6,7,8-HxCDD	8.85E-06	1.37E-06	1.59E-07	1.44E-04	2.53E-05	2.68E-06	8.97E-06	1.50E-06	1.61E-07
1,2,3,7,8,9-HxCDD	9.23E-06	1.43E-06	1.66E-07	1.53E-04	2.69E-05	2.85E-06	9.29E-06	1.55E-06	1.66E-07
1,2,3,4,6,7,8-HpCDD	5.03E-05	7.77E-06	9.05E-07	1.19E-03	2.09E-04	2.21E-05	5.31E-05	8.86E-06	9.51E-07
OCDD	1.14E-04	1.76E-05	2.05E-06	3.05E-03	5.35E-04	5.67E-05	1.13E-04	1.88E-05	2.02E-06
2,3,7,8-TCDF	1.33E-06	2.05E-07	2.39E-08	3.17E-06	5.57E-07	5.89E-08	1.65E-06	2.75E-07	2.96E-08
1,2,3,7,8-PeCDF	<5.00E-06	<7.72E-07	<9.00E-08	1.04E-05	1.83E-06	1.93E-07	<5.00E-06	<8.34E-07	<8.96E-08
2,3,4,7,8-PeCDF	<5.00E-06	<7.72E-07	<9.00E-08	9.19E-06	1.61E-06	1.71E-07	<5.00E-06	<8.34E-07	<8.96E-08
1,2,3,4,7,8-HxCDF	<5.00E-06	<7.72E-07	<9.00E-08	1.14E-05	2.00E-06	2.12E-07	<5.00E-06	<8.34E-07	<8.96E-08
1,2,3,6,7,8-HxCDF	7.93E-07	1.22E-07	1.43E-08	1.05E-05	1.84E-06	1.95E-07	<5.00E-06	<8.34E-07	<8.96E-08
2,3,4,6,7,8-HxCDF	<5.00E-06	<7.72E-07	<9.00E-08	8.03E-06	1.41E-06	1.49E-07	<5.00E-06	<8.34E-07	<8.96E-08
1,2,3,7,8,9-HxCDF	9.79E-07	1.51E-07	1.76E-08	5.19E-06	9.11E-07	9.65E-08	3.63E-07	6.05E-08	6.50E-09
1,2,3,4,6,7,8-HpCDF	<5.00E-06	<7.72E-07	<9.00E-08	3.34E-05	5.86E-06	6.21E-07	<5.00E-06	<8.34E-07	<8.96E-08
1,2,3,4,7,8,9-HpCDF	1.41E-06	2.18E-07	2.54E-08	6.73E-06	1.18E-06	1.25E-07	7.19E-07	1.20E-07	1.29E-08
OCDF	1.11E-05	1.71E-06	2.00E-07	4.78E-05	8.39E-06	8.89E-07	<1.00E-05	<1.67E-06	<1.79E-07
ITEF TEQ (ND=0; EMPC=0)	1.28E-05	1.98E-06	2.30E-07	1.76E-04	3.09E-05	3.27E-06	1.30E-05	2.17E-06	2.33E-07
ITEF TEQ (ND=0; EMPC=EMPC)	1.28E-05	1.98E-06	2.30E-07	1.76E-04	3.09E-05	3.27E-06	1.30E-05	2.17E-06	2.33E-07
ITEF TEQ (ND=DL/2; EMPC=0)	1.48E-05	2.29E-06	2.66E-07	1.76E-04	3.09E-05	3.27E-06	1.52E-05	2.54E-06	2.72E-07
ITEF TEQ (ND=DL/2; EMPC=EMPC	1.48E-05	2.29E-06	2.66E-07	1.76E-04	3.09E-05	3.27E-06	1.52E-05	2.54E-06	2.72E-07
ITEF TEQ (ND=DL; EMPC=EMPC)	1.68E-05	2.60E-06	3.02E-07	1.76E-04	3.09E-05	3.27E-06	1.74E-05	2.90E-06	3.12E-07

Table 4-10
PCDD/PCDF Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
2,3,7,8-TCDD	yes	yes	5.37E-05	1.48E-05	8.97E-06	2.55E-06	9.58E-07	2.73E-07
1,2,3,7,8-PeCDD	yes	yes	1.42E-04	5.61E-05	2.37E-05	9.74E-06	2.52E-06	1.04E-06
1,2,3,4,7,8-HxCDD	yes	yes	8.29E-05	4.75E-05	1.39E-05	8.27E-06	1.48E-06	8.80E-07
1,2,3,6,7,8-HxCDD	yes	yes	9.23E-05	5.39E-05	1.54E-05	9.39E-06	1.64E-06	1.00E-06
1,2,3,7,8,9-HxCDD	yes	yes	9.55E-05	5.72E-05	1.59E-05	9.96E-06	1.70E-06	1.06E-06
1,2,3,4,6,7,8-HpCDD	yes	yes	5.29E-04	4.31E-04	8.82E-05	7.52E-05	9.36E-06	7.99E-06
OCDD	yes	yes	1.03E-03	1.09E-03	1.71E-04	1.90E-04	1.82E-05	2.03E-05
2,3,7,8-TCDF	yes	yes	4.39E-06	2.05E-06	7.37E-07	3.46E-07	7.85E-08	3.75E-08
1,2,3,7,8-PeCDF	yes	yes	<1.31E-05	<6.80E-06	<2.20E-06	<1.15E-06	<2.34E-07	<1.24E-07
2,3,4,7,8-PeCDF	yes	yes	<1.08E-05	<6.40E-06	<1.81E-06	<1.07E-06	<1.92E-07	<1.17E-07
1,2,3,4,7,8-HxCDF	yes	yes	<1.02E-05	<7.13E-06	<1.70E-06	<1.20E-06	<1.81E-07	<1.31E-07
1,2,3,6,7,8-HxCDF	yes	yes	<9.10E-06	<5.43E-06	<1.53E-06	<9.32E-07	<1.62E-07	<9.96E-08
2,3,4,6,7,8-HxCDF	yes	yes	<7.33E-06	<6.01E-06	<1.23E-06	<1.01E-06	<1.31E-07	<1.10E-07
1,2,3,7,8,9-HxCDF	yes	yes	2.85E-06	2.18E-06	4.72E-07	3.74E-07	5.03E-08	4.02E-08
1,2,3,4,6,7,8-HpCDF	yes	yes	2.04E-05	<1.45E-05	3.42E-06	<2.49E-06	3.64E-07	<2.67E-07
1,2,3,4,7,8,9-HpCDF	yes	yes	3.49E-06	2.95E-06	5.82E-07	5.06E-07	6.18E-08	5.44E-08
OCDF	yes	yes	2.20E-05	<2.30E-05	3.69E-06	<3.92E-06	3.92E-07	<4.23E-07
ITEF TEQ (ND=0; EMPC=0)	yes	yes	1.66E-04	6.73E-05	2.78E-05	1.17E-05	2.96E-06	1.24E-06
ITEF TEQ (ND=0; EMPC=EMPC)	yes	yes	1.66E-04	6.73E-05	2.78E-05	1.17E-05	2.96E-06	1.24E-06
ITEF TEQ (ND=DL/2; EMPC=0)	yes	yes	1.67E-04	6.87E-05	2.79E-05	1.19E-05	2.97E-06	1.27E-06
ITEF TEQ (ND=DL/2; EMPC=EMPC	yes	yes	1.67E-04	6.87E-05	2.79E-05	1.19E-05	2.97E-06	1.27E-06
ITEF TEQ (ND=DL; EMPC=EMPC)	yes	yes	1.68E-04	7.01E-05	2.80E-05	1.21E-05	2.99E-06	1.29E-06

Table 4-10
PCDD/PCDF Emissions

Analyte	Emission Rate Comparison						PDF Emission Rate as % of Standard
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	Dec 2003 Baseline Average (gr/dscf)	Dec 2003 PDF Average (gr/dscf)	July 2002 Average (gr TEQ/ dscf)	PC MACT Standard (gr TEQ/ dscf)	
2,3,7,8-TCDD	0.0000000021	0.0000000006	3.93E-12	1.09E-12			
1,2,3,7,8-PeCDD	0.0000000056	0.0000000023	1.03E-11	4.14E-12			
1,2,3,4,7,8-HxCDD	0.0000000033	0.0000000019	6.07E-12	3.50E-12			
1,2,3,6,7,8-HxCDD	0.0000000036	0.0000000022	6.73E-12	3.98E-12			
1,2,3,7,8,9-HxCDD	0.0000000037	0.0000000023	6.98E-12	4.22E-12			
1,2,3,4,6,7,8-HpCDD	0.0000000206	0.0000000176	3.84E-11	3.18E-11			
OCDD	0.0000000401	0.0000000448	7.47E-11	8.08E-11			
2,3,7,8-TCDF	0.0000000002	0.0000000001	3.22E-13	1.49E-13			
1,2,3,7,8-PeCDF	0.0000000005	0.0000000003	9.60E-13	4.94E-13			
2,3,4,7,8-PeCDF	0.0000000004	0.0000000003	7.88E-13	4.66E-13			
1,2,3,4,7,8-HxCDF	0.0000000004	0.0000000003	7.43E-13	5.21E-13			
1,2,3,6,7,8-HxCDF	0.0000000004	0.0000000002	6.65E-13	3.96E-13			
2,3,4,6,7,8-HxCDF	0.0000000003	0.0000000002	5.38E-13	4.38E-13			
1,2,3,7,8,9-HxCDF	0.0000000001	0.0000000001	2.06E-13	1.60E-13			
1,2,3,4,6,7,8-HpCDF	0.0000000008	0.0000000006	1.49E-12	1.06E-12			
1,2,3,4,7,8,9-HpCDF	0.0000000001	0.0000000001	2.54E-13	2.17E-13			
OCDF	0.0000000009	0.0000000009	1.61E-12	1.68E-12			
ITEF TEQ (ND=0; EMPC=0)	0.0000000065	0.0000000027	1.21E-11	4.94E-12	5.72E-12	8.7E-11	5.7%
ITEF TEQ (ND=0; EMPC=EMPC)	0.0000000065	0.0000000027	1.21E-11	4.94E-12	5.72E-12	8.7E-11	5.7%
ITEF TEQ (ND=DL/2; EMPC=0)	0.0000000065	0.0000000028	1.22E-11	5.05E-12	5.72E-12	8.7E-11	5.8%
ITEF TEQ (ND=DL/2; EMPC=EMPC	0.0000000065	0.0000000028	1.22E-11	5.05E-12	5.72E-12	8.7E-11	5.8%
ITEF TEQ (ND=DL; EMPC=EMPC)	0.0000000066	0.0000000028	1.23E-11	5.13E-12	5.72E-12	8.7E-11	5.9%

Table 4-10
PCDD/PCDF Emissions

			Annualized Emissions		
Analyte	#39-00011 Permit Limit (lb/hr)	PDF Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
2,3,7,8-TCDD	--	--	0.0000000093	0.0000000026	-0.0000000066
1,2,3,7,8-PeCDD	--	--	0.0000000243	0.0000000100	-0.0000000143
1,2,3,4,7,8-HxCDD	--	--	0.0000000143	0.0000000085	-0.0000000058
1,2,3,6,7,8-HxCDD	--	--	0.0000000158	0.0000000097	-0.0000000062
1,2,3,7,8,9-HxCDD	--	--	0.0000000164	0.0000000102	-0.0000000062
1,2,3,4,6,7,8-HpCDD	--	--	0.0000000904	0.0000000772	-0.0000000132
OCDD	--	--	0.0000001757	0.0000001960	0.0000000203
	--	--			
2,3,7,8-TCDF	--	--	0.0000000008	0.0000000004	-0.0000000004
1,2,3,7,8-PeCDF	--	--	0.0000000023	0.0000000012	-0.0000000011
2,3,4,7,8-PeCDF	--	--	0.0000000019	0.0000000011	-0.0000000007
1,2,3,4,7,8-HxCDF	--	--	0.0000000017	0.0000000013	-0.0000000005
1,2,3,6,7,8-HxCDF	--	--	0.0000000016	0.0000000010	-0.0000000006
2,3,4,6,7,8-HxCDF	--	--	0.0000000013	0.0000000011	-0.0000000002
1,2,3,7,8,9-HxCDF	--	--	0.0000000005	0.0000000004	-0.0000000001
1,2,3,4,6,7,8-HpCDF	--	--	0.0000000035	0.0000000026	-0.0000000009
1,2,3,4,7,8,9-HpCDF	--	--	0.0000000006	0.0000000005	-0.0000000001
OCDF	--	--	0.0000000038	0.0000000041	0.0000000003
ITEF TEQ (ND=0; EMPC=0)	--	--	0.0000000286	0.0000000120	-0.0000000166
ITEF TEQ (ND=0; EMPC=EMPC)	--	--	0.0000000286	0.0000000120	-0.0000000166
ITEF TEQ (ND=DL/2; EMPC=0)	--	--	0.0000000287	0.0000000123	-0.0000000164
ITEF TEQ (ND=DL/2; EMPC=EMPC	--	--	0.0000000287	0.0000000123	-0.0000000164
ITEF TEQ (ND=DL; EMPC=EMPC)	--	--	0.0000000289	0.0000000125	-0.0000000164

Table 4-11
PAH Emissions

	Baseline Run 1			Baseline Run 2			Baseline Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.2	189.1	55,392	5.0	181.2	54,483	5.5	186.3	56,994
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
Naphthalene	1.92E+02	3.17E+01	3.37E+00	2.30E+02	3.92E+01	4.15E+00	1.44E+02	2.46E+01	2.64E+00
2-Methylnaphthalene	2.82E+01	4.66E+00	4.96E-01	3.32E+01	5.66E+00	5.99E-01	2.65E+01	4.53E+00	4.86E-01
Acenaphthylene	1.54E+00	2.55E-01	2.71E-02	1.18E+00	2.01E-01	2.13E-02	5.08E-01	8.69E-02	9.32E-03
Acenaphthene	6.43E-01	1.06E-01	1.13E-02	5.64E-01	9.61E-02	1.02E-02	7.25E-02	1.24E-02	1.33E-03
Fluorene	3.00E+00	4.96E-01	5.27E-02	1.99E+00	3.39E-01	3.59E-02	4.00E-01	6.84E-02	7.34E-03
Phenanthrene	6.09E+01	1.01E+01	1.07E+00	3.54E+01	6.03E+00	6.39E-01	1.30E+01	2.22E+00	2.39E-01
Anthracene	4.34E+00	7.18E-01	7.63E-02	3.66E+00	6.23E-01	6.60E-02	1.20E+00	2.05E-01	2.20E-02
Fluoranthene	2.68E+01	4.43E+00	4.71E-01	1.26E+01	2.15E+00	2.27E-01	9.65E+00	1.65E+00	1.77E-01
Pyrene	1.60E+01	2.65E+00	2.81E-01	9.11E+00	1.55E+00	1.64E-01	7.12E+00	1.22E+00	1.31E-01
Benz(a)anthracene	7.88E-01	1.30E-01	1.39E-02	8.02E-01	1.37E-01	1.45E-02	2.56E-01	4.38E-02	4.70E-03
Chrysene	1.55E+00	2.56E-01	2.72E-02	1.43E+00	2.44E-01	2.58E-02	4.11E-01	7.03E-02	7.54E-03
Benzo(b)fluoranthene	1.34E+00	2.22E-01	2.36E-02	2.05E+00	3.49E-01	3.70E-02	2.25E-01	3.85E-02	4.13E-03
Benzo(k)fluoranthene	3.34E-01	5.52E-02	5.87E-03	5.99E-01	1.02E-01	1.08E-02	6.16E-02	1.05E-02	1.13E-03
Benzo(e)pyrene	1.07E+00	1.77E-01	1.88E-02	1.83E+00	3.12E-01	3.30E-02	1.71E-01	2.93E-02	3.14E-03
Benzo(a)pyrene	1.24E-01	2.05E-02	2.18E-03	3.35E-01	5.71E-02	6.04E-03	2.89E-02	4.94E-03	5.30E-04
Perylene	2.64E-02	4.37E-03	4.64E-04	8.53E-02	1.45E-02	1.54E-03	6.13E-03	1.05E-03	1.13E-04
Indeno(1,2,3-cd)pyrene	3.38E-01	5.59E-02	5.94E-03	1.15E+00	1.96E-01	2.07E-02	9.40E-02	1.61E-02	1.73E-03
Dibenz(a,h)anthracene	1.26E-01	2.08E-02	2.21E-03	4.53E-01	7.72E-02	8.17E-03	3.65E-02	6.24E-03	6.70E-04
Benzo(ghi)perylene	2.58E-01	4.27E-02	4.53E-03	1.03E+00	1.75E-01	1.86E-02	9.79E-02	1.67E-02	1.80E-03

Table 4-11
PAH Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	203.7	61,094	6.3	191.5	59,351	6.3	201.6	60,188
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
Naphthalene	1.86E+02	2.87E+01	3.35E+00	2.17E+02	3.81E+01	4.04E+00	2.14E+02	3.57E+01	3.83E+00
2-Methylnaphthalene	3.90E+01	6.02E+00	7.02E-01	4.80E+01	8.43E+00	8.93E-01	6.21E+01	1.04E+01	1.11E+00
Acenaphthylene	1.40E+00	2.16E-01	2.52E-02	2.17E+00	3.81E-01	4.04E-02	2.29E+00	3.82E-01	4.10E-02
Acenaphthene	8.83E-02	1.36E-02	1.59E-03	8.44E-02	1.48E-02	1.57E-03	1.99E-01	3.32E-02	3.57E-03
Fluorene	2.62E-01	4.05E-02	4.71E-03	2.30E-01	4.04E-02	4.28E-03	2.80E-01	4.67E-02	5.02E-03
Phenanthrene	6.53E+00	1.01E+00	1.18E-01	5.44E+00	9.55E-01	1.01E-01	1.58E+01	2.64E+00	2.83E-01
Anthracene	7.23E-01	1.12E-01	1.30E-02	9.31E-01	1.63E-01	1.73E-02	9.46E+00	1.58E+00	1.69E-01
Fluoranthene	2.84E+00	4.39E-01	5.11E-02	3.80E+00	6.67E-01	7.07E-02	1.40E+01	2.34E+00	2.51E-01
Pyrene	2.31E+00	3.57E-01	4.16E-02	3.30E+00	5.79E-01	6.14E-02	1.04E+01	1.73E+00	1.86E-01
Benz(a)anthracene	1.34E-01	2.07E-02	2.41E-03	3.54E-01	6.22E-02	6.58E-03	6.49E-01	1.08E-01	1.16E-02
Chrysene	2.47E-01	3.82E-02	4.44E-03	3.61E-01	6.34E-02	6.71E-03	9.93E-01	1.66E-01	1.78E-02
Benzo(b)fluoranthene	2.39E-01	3.69E-02	4.30E-03	2.65E-01	4.65E-02	4.93E-03	4.98E-01	8.31E-02	8.92E-03
Benzo(k)fluoranthene	7.39E-02	1.14E-02	1.33E-03	7.71E-02	1.35E-02	1.43E-03	1.50E-01	2.50E-02	2.69E-03
Benzo(e)pyrene	2.09E-01	3.23E-02	3.76E-03	2.24E-01	3.93E-02	4.17E-03	4.24E-01	7.07E-02	7.60E-03
Benzo(a)pyrene	6.84E-02	1.06E-02	1.23E-03	4.19E-02	7.36E-03	7.79E-04	1.57E-01	2.62E-02	2.81E-03
Perylene	1.40E-02	2.16E-03	2.52E-04	9.67E-03	1.70E-03	1.80E-04	4.78E-02	7.97E-03	8.56E-04
Indeno(1,2,3-cd)pyrene	1.27E-01	1.96E-02	2.29E-03	7.73E-02	1.36E-02	1.44E-03	1.39E-01	2.32E-02	2.49E-03
Dibenz(a,h)anthracene	4.13E-02	6.38E-03	7.43E-04	2.17E-02	3.81E-03	4.04E-04	5.07E-02	8.46E-03	9.08E-04
Benzo(ghi)perylene	1.75E-01	2.70E-02	3.15E-03	1.22E-01	2.14E-02	2.27E-03	1.82E-01	3.04E-02	3.26E-03

Table 4-11
PAH Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
Naphthalene	yes	yes	1.89E+02	2.06E+02	3.18E+01	3.42E+01	3.39E+00	3.74E+00
2-Methylnaphthalene	yes	yes	2.93E+01	4.97E+01	4.95E+00	8.28E+00	5.27E-01	9.02E-01
Acenaphthylene	yes	yes	1.08E+00	1.95E+00	1.81E-01	3.26E-01	1.92E-02	3.55E-02
Acenaphthene	yes	yes	4.27E-01	1.24E-01	7.15E-02	2.05E-02	7.61E-03	2.24E-03
Fluorene	yes	yes	1.80E+00	2.57E-01	3.01E-01	4.25E-02	3.20E-02	4.67E-03
Phenanthrene	yes	yes	3.64E+01	9.26E+00	6.12E+00	1.54E+00	6.49E-01	1.67E-01
Anthracene	yes	yes	3.07E+00	3.70E+00	5.15E-01	6.18E-01	5.48E-02	6.64E-02
Fluoranthene	yes	yes	1.64E+01	6.88E+00	2.74E+00	1.15E+00	2.92E-01	1.24E-01
Pyrene	yes	yes	1.07E+01	5.34E+00	1.81E+00	8.89E-01	1.92E-01	9.63E-02
Benz(a)anthracene	yes	yes	6.15E-01	3.79E-01	1.04E-01	6.36E-02	1.10E-02	6.86E-03
Chrysene	yes	yes	1.13E+00	5.34E-01	1.90E-01	8.92E-02	2.02E-02	9.65E-03
Benzo(b)fluoranthene	yes	yes	1.21E+00	3.34E-01	2.03E-01	5.55E-02	2.16E-02	6.05E-03
Benzo(k)fluoranthene	yes	yes	3.32E-01	1.00E-01	5.59E-02	1.66E-02	5.93E-03	1.82E-03
Benzo(e)pyrene	yes	yes	1.02E+00	2.86E-01	1.73E-01	4.74E-02	1.83E-02	5.18E-03
Benzo(a)pyrene	yes	yes	1.63E-01	8.91E-02	2.75E-02	1.47E-02	2.92E-03	1.61E-03
Perylene	yes	yes	3.93E-02	2.38E-02	6.64E-03	3.94E-03	7.06E-04	4.29E-04
Indeno(1,2,3-cd)pyrene	yes	yes	5.27E-01	1.14E-01	8.93E-02	1.88E-02	9.46E-03	2.07E-03
Dibenz(a,h)anthracene	yes	yes	2.05E-01	3.79E-02	3.47E-02	6.22E-03	3.68E-03	6.85E-04
Benzo(ghi)perylene	yes	yes	4.62E-01	1.60E-01	7.81E-02	2.63E-02	8.31E-03	2.89E-03

Table 4-11
PAH Emissions

Analyte	Emission Rate Comparison		#39-00011 Permit Limit (lb/hr)	PDF Emission Rate as % of Limit	Annualized Emissions		
	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)			Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
Naphthalene	0.0074735450	0.0082451499	--	--	0.0327341270	0.0361137566	0.0033796296
2-Methylnaphthalene	0.0011618166	0.0019885362	--	--	0.0050887566	0.0087097884	0.0036210317
Acenaphthylene	0.0000423280	0.0000782628	--	--	0.0001853968	0.0003427910	0.0001573942
Acenaphthene	0.0000167769	0.0000049383	--	--	0.0000734828	0.0000216296	-0.0000518532
Fluorene	0.0000705467	0.0000102954	--	--	0.0003089947	0.0000450939	-0.0002639008
Phenanthrene	0.0014307760	0.0003681658	--	--	0.0062667989	0.0016125661	-0.0046542328
Anthracene	0.0001208113	0.0001463845	--	--	0.0005291534	0.0006411640	0.0001120106
Fluoranthene	0.0006437390	0.0002733686	--	--	0.0028195767	0.0011973545	-0.0016222222
Pyrene	0.0004232804	0.0002123016	--	--	0.0018539683	0.0009298810	-0.0009240873
Benz(a)anthracene	0.0000242504	0.0000151235	--	--	0.0001062169	0.0000662407	-0.0000399762
Chrysene	0.0000445326	0.0000212743	--	--	0.0001950529	0.0000931812	-0.0001018717
Benzo(b)fluoranthene	0.0000476190	0.0000133377	--	--	0.0002085714	0.0000584193	-0.0001501521
Benzo(k)fluoranthene	0.0000130732	0.0000040123	--	--	0.0000572606	0.0000175741	-0.0000396865
Benzo(e)pyrene	0.0000403439	0.0000114198	--	--	0.0001767063	0.0000500185	-0.0001266878
Benzo(a)pyrene	0.0000064374	0.0000035494	--	--	0.0000281958	0.0000155463	-0.0000126495
Perylene	0.0000015564	0.0000009458	--	--	0.0000068172	0.0000041425	-0.0000026747
Indeno(1,2,3-cd)pyrene	0.0000208554	0.0000045635	--	--	0.0000913466	0.0000199881	-0.0000713585
Dibenz(a,h)anthracene	0.0000081129	0.0000015101	--	--	0.0000355344	0.0000066144	-0.0000289200
Benzo(ghi)perylene	0.0000183201	0.0000063713	--	--	0.0000802421	0.0000279061	-0.0000523360

Table 4-12
PCB Emissions

	Baseline Run 1			Baseline Run 2			Baseline Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.2	189.1	55,392	5.0	181.2	54,483	5.5	186.3	56,994
Analyte	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**
PCB-77	1.75E-02	2.89E-03	3.08E-04	1.91E-03	3.25E-04	3.45E-05	8.79E-03	1.50E-03	1.61E-04
PCB-81	1.12E-03	1.85E-04	1.97E-05	1.27E-04	2.16E-05	2.29E-06	6.01E-04	1.03E-04	1.10E-05
PCB-105	5.41E-03	8.95E-04	9.51E-05	6.03E-04	1.03E-04	1.09E-05	3.76E-03	6.43E-04	6.90E-05
PCB-114	6.03E-04	9.97E-05	1.06E-05	5.96E-05	1.02E-05	1.08E-06	3.88E-04	6.64E-05	7.12E-06
PCB-118	1.16E-02	1.92E-03	2.04E-04	1.30E-03	2.21E-04	2.34E-05	6.92E-03	1.18E-03	1.27E-04
PCB-123	<5.25E-05	--	--	<1.09E-05	--	--	<1.15E-05	--	--
PCB-126	<1.20E-04	--	--	<2.58E-05	--	--	<3.38E-05	--	--
PCB-156/157	<1.71E-04	<2.83E-05	<3.01E-06	1.69E-05	2.88E-06	3.05E-07	4.04E-05	6.91E-06	7.42E-07
PCB-167	<1.32E-04	--	--	<5.99E-06	--	--	<4.09E-06	--	--
PCB-169	<1.53E-04	--	--	<6.33E-06	--	--	<4.17E-06	--	--
PCB-189	<4.78E-05	--	--	<3.76E-06	--	--	<8.14E-06	--	--
Total Mono-PCBs	7.39E-02	1.22E-02	1.30E-03	1.04E-01	1.77E-02	1.88E-03	7.51E-02	1.28E-02	1.38E-03
Total Di-PCBs	2.40E-01	3.97E-02	4.22E-03	5.48E-02	9.34E-03	9.88E-04	3.21E-02	5.49E-03	5.89E-04
Total Tri-PCBs	9.77E+00	1.62E+00	1.72E-01	1.45E+00	2.47E-01	2.62E-02	1.51E+00	2.58E-01	2.77E-02
Total Tetra-PCBs	7.48E+00	1.24E+00	1.31E-01	7.14E-01	1.22E-01	1.29E-02	1.59E+00	2.72E-01	2.92E-02
Total Penta-PCBs	3.30E-01	5.46E-02	5.80E-03	3.96E-02	6.75E-03	7.14E-04	1.45E-01	2.48E-02	2.66E-03
Total Hexa-PCBs	9.63E-03	1.59E-03	1.69E-04	1.87E-03	3.19E-04	3.37E-05	6.80E-03	1.16E-03	1.25E-04
Total Hepta-PCBs	1.13E-03	1.87E-04	1.99E-05	4.80E-04	8.18E-05	8.66E-06	1.07E-03	1.83E-04	1.96E-05
Total Octa-PCBs	<3.52E-05	<5.82E-06	<6.19E-07	5.41E-05	9.22E-06	9.76E-07	8.20E-05	1.40E-05	1.51E-06
Total Nona-PCBs	<3.15E-05	--	--	<4.26E-06	--	--	<2.49E-05	--	--
PCB-209	<1.47E-05	<2.43E-06	<2.58E-07	8.46E-06	1.44E-06	1.53E-07	9.42E-06	1.61E-06	1.73E-07
PCB TEQs (WHO M/H)									
ND = 0	3.86E-06	6.38E-07	6.78E-08	4.32E-07	7.36E-08	7.79E-09	2.22E-06	3.80E-07	4.07E-08
ND = 0.5 x DL	1.07E-05	1.77E-06	1.88E-07	1.75E-06	2.98E-07	3.16E-08	3.93E-06	6.72E-07	7.21E-08

Table 4-12
PCB Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	203.7	61,094	6.3	191.5	59,351	6.3	201.6	60,188
Analyte	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**	**Detected Mass (ug)**	**Emission Conc. (ug/dscm @ 7% O_2)**	**Emission Rate (g/hr)**
PCB-77	1.42E-03	2.19E-04	2.56E-05	1.82E-03	3.20E-04	3.38E-05	1.28E-03	2.13E-04	2.29E-05
PCB-81	9.67E-05	1.49E-05	1.74E-06	1.23E-04	2.16E-05	2.29E-06	8.30E-05	1.38E-05	1.49E-06
PCB-105	4.78E-04	7.38E-05	8.60E-06	7.99E-04	1.40E-04	1.49E-05	7.46E-04	1.24E-04	1.34E-05
PCB-114	4.96E-05	7.66E-06	8.93E-07	7.83E-05	1.37E-05	1.46E-06	6.88E-05	1.15E-05	1.23E-06
PCB-118	1.04E-03	1.61E-04	1.87E-05	1.76E-03	3.09E-04	3.27E-05	1.39E-03	2.32E-04	2.49E-05
PCB-123	<9.52E-06	--	--	<1.12E-05	--	--	<1.71E-05	--	--
PCB-126	<1.70E-05	--	--	<2.90E-05	--	--	<2.14E-05	--	--
PCB-156/157	<1.27E-05	<1.96E-06	<2.29E-07	2.61E-05	4.58E-06	4.85E-07	2.16E-05	3.60E-06	3.87E-07
PCB-167	<9.38E-06	--	--	<6.93E-06	--	--	<5.08E-06	--	--
PCB-169	<1.07E-05	--	--	<7.22E-06	--	--	<5.66E-06	--	--
PCB-189	<1.48E-05	--	--	<1.65E-05	--	--	<4.61E-06	--	--
Total Mono-PCBs	1.33E-01	2.05E-02	2.39E-03	1.61E-01	2.83E-02	2.99E-03	2.22E-01	3.70E-02	3.98E-03
Total Di-PCBs	3.45E-02	5.33E-03	6.21E-04	2.36E-02	4.14E-03	4.39E-04	2.07E-02	3.45E-03	3.71E-04
Total Tri-PCBs	7.80E-01	1.20E-01	1.40E-02	5.24E-01	9.20E-02	9.74E-03	1.43E-01	2.39E-02	2.56E-03
Total Tetra-PCBs	4.86E-01	7.51E-02	8.75E-03	4.68E-01	8.22E-02	8.70E-03	1.75E-01	2.92E-02	3.14E-03
Total Penta-PCBs	3.70E-02	5.72E-03	6.66E-04	5.02E-02	8.81E-03	9.34E-04	2.89E-02	4.82E-03	5.18E-04
Total Hexa-PCBs	1.73E-03	2.67E-04	3.11E-05	3.24E-03	5.69E-04	6.02E-05	2.72E-03	4.54E-04	4.87E-05
Total Hepta-PCBs	3.97E-04	6.13E-05	7.14E-06	7.63E-04	1.34E-04	1.42E-05	6.58E-04	1.10E-04	1.18E-05
Total Octa-PCBs	1.73E-05	2.67E-06	3.11E-07	5.93E-05	1.04E-05	1.10E-06	5.49E-05	9.16E-06	9.84E-07
Total Nona-PCBs	<5.41E-06	--	--	<5.00E-06	--	--	<1.54E-05	--	--
PCB-209	6.92E-06	1.07E-06	1.25E-07	<4.08E-06	<7.16E-07	<7.59E-08	4.65E-06	7.76E-07	8.33E-08
PCB TEQs (WHO M/H)									
ND = 0	3.28E-07	5.07E-08	5.90E-09	5.02E-07	8.81E-08	9.34E-09	3.96E-07	6.60E-08	7.09E-09
ND = 0.5 x DL	1.24E-06	1.92E-07	2.23E-08	1.99E-06	3.49E-07	3.70E-08	1.50E-06	2.50E-07	2.69E-08

Table 4-12
PCB Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
PCB-77	yes	yes	9.40E-03	1.51E-03	1.57E-03	2.51E-04	1.68E-04	2.74E-05
PCB-81	yes	yes	6.16E-04	1.01E-04	1.03E-04	1.68E-05	1.10E-05	1.84E-06
PCB-105	yes	yes	3.26E-03	6.74E-04	5.47E-04	1.13E-04	5.83E-05	1.23E-05
PCB-114	yes	yes	3.50E-04	6.56E-05	5.88E-05	1.10E-05	6.27E-06	1.19E-06
PCB-118	yes	yes	6.61E-03	1.40E-03	1.11E-03	2.34E-04	1.18E-04	2.54E-05
PCB-123	--	--	<2.50E-05	<1.26E-05	--	--	--	--
PCB-126	--	--	<5.99E-05	<2.25E-05	--	--	--	--
PCB-156/157	yes	yes	<7.61E-05	<2.01E-05	<1.27E-05	<3.38E-06	<1.35E-06	<3.67E-07
PCB-167	--	--	<4.74E-05	<7.13E-06	--	--	--	--
PCB-169	--	--	<5.45E-05	<7.86E-06	--	--	--	--
PCB-189	--	--	<1.99E-05	<1.20E-05	--	--	--	--
Total Mono-PCBs	yes	yes	8.43E-02	1.72E-01	1.42E-02	2.86E-02	1.52E-03	3.12E-03
Total Di-PCBs	yes	yes	1.09E-01	2.63E-02	1.82E-02	4.31E-03	1.93E-03	4.77E-04
Total Tri-PCBs	yes	yes	4.24E+00	4.82E-01	7.08E-01	7.86E-02	7.53E-02	8.77E-03
Total Tetra-PCBs	yes	yes	3.26E+00	3.76E-01	5.45E-01	6.22E-02	5.77E-02	6.86E-03
Total Penta-PCBs	yes	yes	1.72E-01	3.87E-02	2.87E-02	6.45E-03	3.06E-03	7.06E-04
Total Hexa-PCBs	yes	yes	6.10E-03	2.56E-03	1.02E-03	4.30E-04	1.09E-04	4.67E-05
Total Hepta-PCBs	yes	yes	8.93E-04	6.06E-04	1.51E-04	1.02E-04	1.61E-05	1.10E-05
Total Octa-PCBs	yes	yes	<5.71E-05	4.38E-05	<9.68E-06	7.41E-06	<1.04E-06	7.98E-07
Total Nona-PCBs	--	--	<2.02E-05	<8.60E-06	--	--	--	--
PCB-209	yes	yes	<1.09E-05	<5.22E-06	<1.83E-06	<8.54E-07	<1.95E-07	<9.47E-08
PCB TEQs (WHO M/H)								
ND = 0	yes	yes	2.17E-06	4.09E-07	3.64E-07	6.83E-08	3.88E-08	7.44E-09
ND = 0.5 x DL	yes	yes	5.46E-06	1.58E-06	9.13E-07	2.64E-07	9.72E-08	2.87E-08

Table 4-12
PCB Emissions

Analyte	Percent Change from Baseline	Emission Rate Comparison		#39-00011 Permit Limit (lb/hr)	PDF Emission Rate as % of Limit	Annualized Emissions		
		Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)			Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
PCB-77	-84	0.0000003704	0.0000000604	--	--	0.0000016222	0.0000002646	-0.0000013576
PCB-81	-83	0.0000000243	0.0000000041	--	--	0.0000001062	0.0000000178	-0.0000000884
PCB-105	-79	0.0000001285	0.0000000271	--	--	0.0000005629	0.0000001188	-0.0000004442
PCB-114	-81	0.0000000138	0.0000000026	--	--	0.0000000605	0.0000000115	-0.0000000491
PCB-118	-78	0.0000002601	0.0000000560	--	--	0.0000011394	0.0000002453	-0.0000008942
PCB-123	#VALUE!	--	--	--	--	--	--	--
PCB-126	#VALUE!	--	--	--	--	--	--	--
PCB-156/157	-73	0.0000000030	0.0000000008	--	--	0.0000000130	0.0000000035	-0.0000000095
PCB-167	#VALUE!	--	--	--	--	--	--	--
PCB-169	#VALUE!	--	--	--	--	--	--	--
PCB-189	#VALUE!	--	--	--	--	--	--	--
				--	--			
Total Mono-PCBs	105	0.0000033510	0.0000068783	--	--	0.0000146772	0.0000301270	0.0000154497
Total Di-PCBs	-75	0.0000042549	0.0000010516	--	--	0.0000186362	0.0000046060	-0.0000140303
Total Tri-PCBs	-88	0.0001660053	0.0000193342	--	--	0.0007271032	0.0000846839	-0.0006424193
Total Tetra-PCBs	-88	0.0001272046	0.0000151235	--	--	0.0005571561	0.0000662407	-0.0004909153
Total Penta-PCBs	-77	0.0000067460	0.0000015564	--	--	0.0000295476	0.0000068172	-0.0000227304
Total Hexa-PCBs	-57	0.0000002403	0.0000001030	--	--	0.0000010525	0.0000004509	-0.0000006016
Total Hepta-PCBs	-32	0.0000000355	0.0000000243	--	--	0.0000001555	0.0000001062	-0.0000000492
Total Octa-PCBs	-23	0.0000000023	0.0000000018	--	--	0.0000000100	0.0000000077	-0.0000000023
Total Nona-PCBs	#VALUE!	--	--	--	--	--	--	--
PCB-209	-51	0.0000000004	0.0000000002	--	--	0.0000000019	0.0000000009	-0.0000000010
PCB TEQs (WHO M/H)				--	--			
ND = 0	-81	0.0000000001	0.00000000002	--	--	0.0000000004	0.0000000001	-0.0000000003
ND = 0.5 x DL	-70	0.0000000002	0.0000000001	--	--	0.0000000009	0.0000000003	-0.0000000007

Table 4-13
Hydrogen Halides/Halogens and Hydrogen Cyanide Emissions

	Baseline Run 2			Baseline Run 3			Baseline Run 4		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.3	73.6	60,225	5.5	73.3	61,942	5.1	72.5	61,427
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
Hydrogen Bromide	<105.434	--	--	<98.35	--	--	<96.95	--	--
Bromine	<61.082	--	--	<62.972	--	--	<68.6	--	--
Hydrogen Chloride	<26869.179	<1.18E+04	<1.36E+03	<24131.8	<1.08E+04	<1.26E+03	<7605.128	<3.35E+03	<3.97E+02
Chlorine	<61.082	--	--	<62.972	--	--	<68.6	--	--
Hydrogen Fluoride	<97.903	<4.41E+01	<5.06E+00	<609.5	<2.79E+02	<3.25E+01	<90.025	<4.06E+01	<4.81E+00
Nitrate	<97.903	--	--	<91.325	--	--	<90.025	--	--
Hydrogen Cyanide	<55.41306	<2.46E+01	<2.83E+00	161.82764	7.31E+01	8.52E+00	1232.26096	5.48E+02	6.50E+01

Table 4-13
Hydrogen Halides/Halogens and Hydrogen Cyanide Emissions

	PDF Run 1			PDF Run 2			PDF Run 3		
	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)	O2 Conc. (%)	Samp. Vol. (dscf)	Flow Rate (dscfm)
	5.7	71.3	61,449	6.0	73.2	60,381	6.6	68.8	59,241
Analyte	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)	Detected Mass (ug)	Emission Conc. (ug/dscm @ 7% O_2)	Emission Rate (g/hr)
Hydrogen Bromide	<107.016	--	--	<123.004	--	--	<112.168	--	--
Bromine	<62.482	--	--	<76.23	--	--	<67.494	--	--
Hydrogen Chloride	14418.348	6.71E+03	7.66E+02	<13018.016	<6.02E+03	<6.62E+02	<15268.5595	<7.84E+03	<8.11E+02
Chlorine	1889.802	8.55E+02	9.77E+01	<76.23	<3.43E+01	<3.77E+00	<67.494	<3.37E+01	<3.49E+00
Hydrogen Fluoride	<99.372	--	--	<114.218	--	--	<104.156	--	--
Nitrate	<99.372	--	--	<114.218	--	--	<104.156	--	--
Hydrogen Cyanide	416.51496	1.96E+02	2.24E+01	<730.30312	<3.41E+02	<3.75E+01	<381.02628	<1.97E+02	<2.04E+01

Table 4-13
Hydrogen Halides/Halogens and Hydrogen Cyanide Emissions

Analyte	Analyte Detected		Detected Mass		Emission Concentration		Emission Rate	
	Baseline	PDF	Baseline Average (ug)	PDF Average (ug)	Baseline Average (ug/dscm @ 7% O_2)	PDF Average (ug/dscm @ 7% O_2)	Baseline Average (g/hr)	PDF Average (g/hr)
Hydrogen Bromide	--	--	<1.00E+02	<1.14E+02	--	--	--	--
Bromine	--	--	<6.42E+01	<6.87E+01	--	--	--	--
Hydrogen Chloride	yes	yes	<1.95E+04	<1.42E+04	<8.65E+03	<6.86E+03	<1.01E+03	<7.46E+02
Chlorine	--	yes	<6.42E+01	<6.78E+02	--	<3.08E+02	--	<3.50E+01
Hydrogen Fluoride	yes	--	<2.66E+02	<1.06E+02	<1.21E+02	--	<1.41E+01	--
Nitrate	--	--	<9.31E+01	<1.06E+02	--	--	--	--
Hydrogen Cyanide	yes	yes	<4.83E+02	<5.09E+02	<2.15E+02	<2.45E+02	2.72E+02	<2.68E+01

Table 4-13

Hydrogen Halides/Halogens and Hydrogen Cyanide Emissions

	Emission Rate			PDF	Annualized Emissions		
Analyte	Dec 2003 Baseline Average (lb/hr)	Dec 2003 PDF Average (lb/hr)	#39-00011 Permit Limit (lb/hr)	Emission Rate as % of Limit	Dec 2003 Baseline Average (tpy)	Dec 2003 PDF Average (tpy)	Change (tpy)
Hydrogen Bromide	--	--	--	--	--	--	--
Bromine	--	--	--	--	--	--	--
Hydrogen Chloride	2.23	1.64	--	--	9.75	7.20	-2.55
Chlorine	--	0.08	--	--	--	0.34	--
Hydrogen Fluoride	0.03	--	--	--	0.14	--	--
Nitrate	--	--	--	--	--	--	--
Hydrogen Cyanide	0.60	0.06	--	--	2.63	0.26	-2.37

Table 4-14
VOC Results

Baseline Condition

Run No.	2	3	4	9	10	11	Dec 2003 Baseline Average
Date	12/02/03	12/02/03	12/02/03	12/03/03	12/03/03	12/03/03	
Test Time	15:20-16:20	16:40-17:40	18:00-19:00	9:55-10:55	11:10-12:10	12:25-13:25	
Emissions (ppmvw)							
THC	14.9	16.1	11.8	28.9	29.6	24.0	20.9
Methane (CH4)	11.9	27.3	26.3	51.9	48.1	30.0	32.6
Ethane (C2H6)	7.2	7.4	7.5	5.4	5.3	5.1	6.3
VOC (a)	6.1	2.1	0.0	8.0	10.1	10.6	6.2
Emissions (lb/hr)							
THC	6.31	6.84	4.99	12.44	12.50	9.56	8.8
VOC	2.6	0.9	0.0	3.5	4.3	4.2	2.6

PDF Condition

Run No.	5	6	7	Dec 2003 PDF Average	#39-00011 Permit Limit (lb/hr)	PDF Emission Rate as % of Limit
Date	12/05/03	12/05/03	12/05/03			
Test Time	13:45-14:45	15:02-16:02	16:20-17:25			
Emissions (ppmvw)						
THC	5.39	5.96	5.14	5.49	--	--
Methane (CH4)	0.55	0.00	0.00	0.18	--	--
Ethane (C2H6)	4.34	4.61	4.39	4.45	--	--
VOC (a)	2.30	2.90	2.20	2.47	--	--
Emissions (lb/hr)						
THC	2.14	2.37	2.06	2.19	--	--
VOC	0.9	1.2	0.9	0.98	5.4	18%

(a) VOC is calculated as the hydrocarbon result minus the sum of the methane result plus two times the ethane result. [VOC = THC - ((CH4/3)+(2*(C2H6)/3))]

5.0 OPERATING INFORMATION

5.1 Operating Data

Table 5-1 presents the averages of select operating parameters (baghouse inlet temperature, coal, coke, tire and PDF feedrates, raw mix feedrate and burning zone temperature collected during the baseline and PDF test conditions of Phase 2. Complete datasets are provided in Appendix F. Table 5-2 summarizes the Phase 2 PDF feedrate information, while Figure 5-1 shows the feedrate over time for PDF testing.

5.2 Plastic Data

The plastic utilized for the PDF Alternative Fuel Substitution Test consisted of Types 3—7 plastics that were shredded to less than ¾-inch. Polyvinyl chloride (PVC) plastics were segregated and removed from the PDF prior to shredding to the greatest extent possible through the use of manual sorting and x-ray separation technology. The plastic that was shredded to PDF was obtained from municipal recycling facilities, such as Todd Heller Recycling in Northampton, PA; Cougles Recycling in Hamburg, PA; or East Coast Recycling in Vineland, NJ. East Coast Recycling or Cougles Recycling performed the shredding of the plastic.

To characterize the PDF used in the test, representative samples were obtained and tested. The PDF was delivered to the feed system in Gaylord containers weighing approximately 1000 pounds each. A grab sample was taken from the feed hopper after each box was emptied into the delivery system. Each sample was placed into an individual container and labeled with the date, time and test run number. All samples were sent to Systech's Paulding Laboratory in Paulding, Ohio. Analytical reports from the composite samples collected are represented in Appendix I.

Figure 5-1

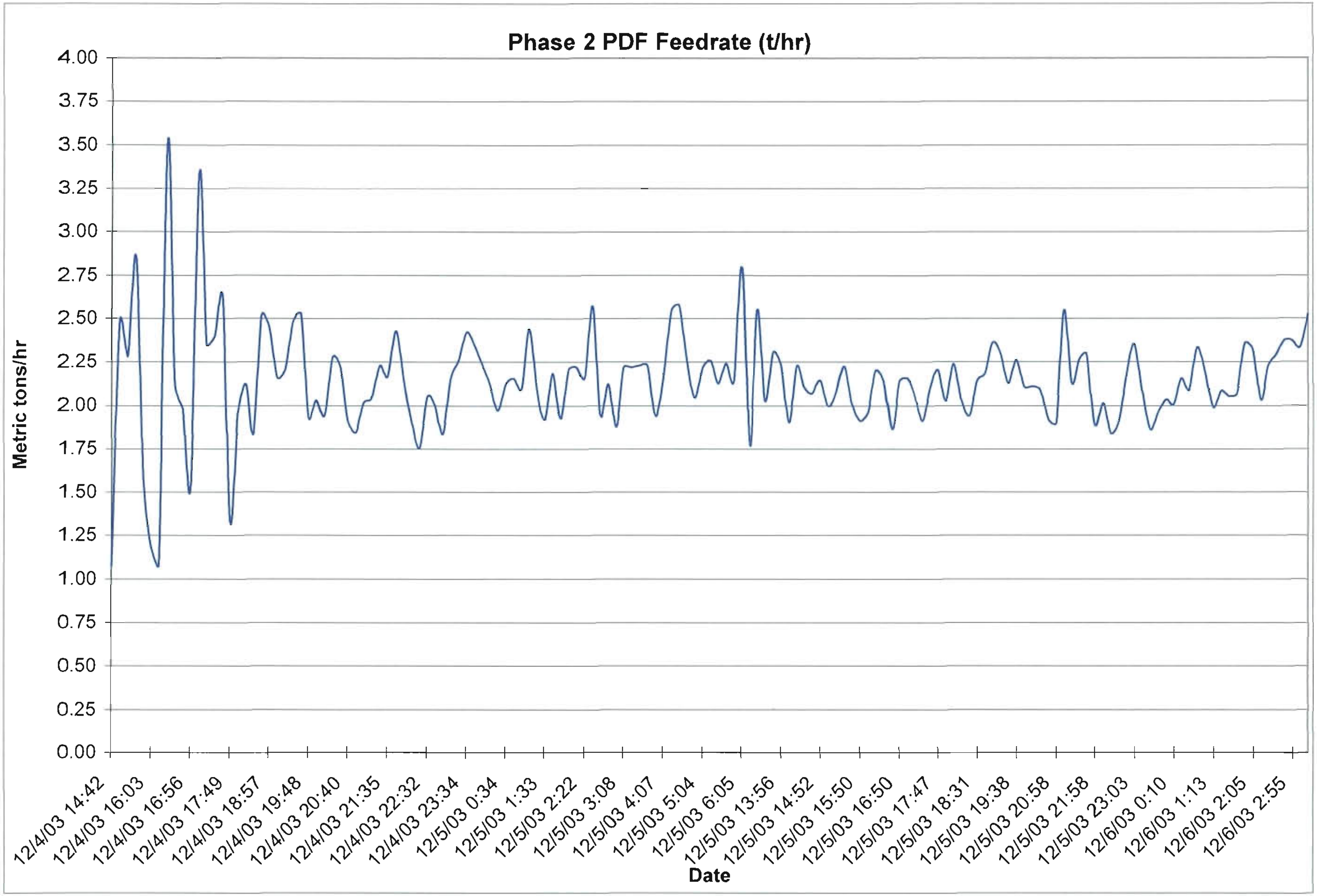

Phase 2 PDF Feedrate (t/hr)
Metric tons/hr
4.00
3.75
3.50
3.25
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
12/4/03 14:42
12/4/03 16:03
12/4/03 16:56
12/4/03 17:49
12/4/03 18:57
12/4/03 19:48
12/4/03 20:40
12/4/03 21:35
12/4/03 22:32
12/4/03 23:34
12/5/03 0:34
12/5/03 1:33
12/5/03 2:22
12/5/03 3:08
12/5/03 4:07
12/5/03 5:04
12/5/03 6:05
12/5/03 13:56
12/5/03 14:52
12/5/03 15:50
12/5/03 16:50
12/5/03 17:47
12/5/03 18:31
12/5/03 19:38
12/5/03 20:58
12/5/03 21:58
12/5/03 23:03
12/6/03 0:10
12/6/03 1:13
12/6/03 2:05
12/6/03 2:55
Date

Table 5-1
Summary of Operating Data

Sampling Parameter	Baseline Average							PDF Average							
	Baghouse Inlet Temp (deg C)	Baghouse DP (kPa)	Coal Feed (t/hr)	Coke Feed (t/hr)	Tire Feed (t/hr)	Raw Feed (t/hr)	BZ Temp (deg C)	Baghouse Inlet Temp (deg C)	Baghouse DP (kPa)	Coal Feed (t/hr)	Coke Feed (t/hr)	Tire Feed (t/hr)	PDF Feed (t/hr)	Raw Feed (t/hr)	BZ Temp (deg C)
PM & Anions (5&26)	247.7	1.3	3.59	1.54	1.15	81.60	1351	245.5	1.3	1.65	0.67	1.04	2.19	72.22	1263
PM10/CPM (201A/202)	247.8	1.2	3.52	1.51	1.21	83.15	1363	247.8	1.5	1.38	0.51	1.26	2.16	83.77	1258
Metals (29)	247.8	1.2	3.57	1.53	1.24	83.90	1348	248.1	1.3	1.43	0.61	1.20	2.18	81.95	1268
Hexavalent Chromium (0061)	247.7	1.3	3.57	1.53	1.21	82.85	1370	248.2	1.6	1.30	0.48	1.26	2.15	83.77	1263
D/F, PCBs, PAHs (Mod 23)	247.7	1.3	3.58	1.53	1.19	82.48	1349	248.2	1.3	1.49	0.61	1.22	2.13	83.14	1256
Semivolatile Organics (0010)	247.7	1.3	3.58	1.53	1.19	82.49	1349	248.2	1.3	1.49	0.61	1.22	2.13	83.14	1256
Volatile Organics (0030)	247.7	1.2	3.52	1.51	1.24	83.51	1345	248.1	1.3	1.57	0.67	1.20	2.13	82.78	1276

Table 5-2 PDF Feedrate Information (Phase 2)

Box Code K #1-9	Box #	Box Gross weight lbs	Box Tare weight lbs	Box Net weight lbs	Time mm/dd 00:00	Burn Time min	T/hr	Feeder speed %	Blower speed %	Blower P. psi	Line P. " WG	Comments
K4	-	1072	129	943	12/4/03 14:42	24	1.07	25-35-50	85 to 95	5.0 to 7.5	4.5	In Hopper + ABOUT 400 LBS BEFORE
K4	70	1406	127	1279	12/4/03 15:06	14	2.49	50-35	95	7.5	4.5	K9
K4	18	1041	118	923	12/4/03 15:20	11	2.28	50	95	7.5	4.5	STARTED TO CHOKE SCREW
K4	39	1823	146	1677	12/4/03 15:51	16	2.85	40-35	95	7.5	4.5	CO SPIKES FROM OVERFEED
K9	2	1050	135	915	12/4/03 15:47	16	1.56	40-36	95	7.8	4.5	
K4	68	608	220	388	12/4/03 16:03	9	1.17	36-38	95	7.8	4.5	BAD BOX, COTTON MATERIAL
K3	124	687	92	595	12/4/03 16:12	15	1.08	40-52	95	7.8	4.5	
K3	109	1270	105	1165	12/4/03 16:27	9	3.52	28-35-42	95	7.8	4.5	LOTS OF PELLETS IN BOX
K4	63	990	130	860	12/4/03 16:36	11	2.13	42-46-50	95	7.8	4.5	
K9	15	735	80	655	12/4/03 16:47	9	1.98	50-45-50	95	7.8	4.5	Spongy material, adj. Feed up
K4	46	869	76	793	12/4/03 16:56	14	1.54	50-70	95	7.8	4.5	
K4	58	1314	85	1229	12/4/03 17:10	10	3.34	50-35-40	95	7.8	4.5	
K4	60	1035	84	951	12/4/03 17:20	11	2.35	50-55	95	7.8	4.5	
K4	56	766	62	704	12/4/03 17:31	8	2.39	55-50	95	7.8	4.5	
K4	61	1065	100	965	12/4/03 17:39	10	2.63	50	95	7.8	4.5	
K9	24	670	85	585	12/4/03 17:49	12	1.33	50	95	7.8	4.5	
K4	71	910	118	792	12/4/03 18:01	11	1.96	50	95	7.8	4.5	
K3	115	1446	120	1326	12/4/03 18:12	17	2.12	50-25	95	7.8	4.5	very bad material in box, rate down to
K9	19	695	87	608	12/4/03 18:38	9	1.84	50	95	7.8	4.5	out the chunks.
K4	38	989	64	925	12/4/03 18:47	10	2.52	34	95	7.8	4.5	Fast feeding material
K4	65	1115	127	988	12/4/03 18:57	11	2.44	48	95	7.8	4.5	
K4	62	777	62	715	12/4/03 19:08	9	2.16	50	95	7.8	4.5	K4 box 64 rejected as bad material
K9	17	760	113	647	12/4/03 19:17	8	2.20	38-28	95	7.8	4.5	
K4	69	1270	86	1184	12/4/03 19:25	13	2.48	38	95	7.8	4.5	
K4	77	1045	118	927	12/4/03 19:38	10	2.52	40	95	7.8	4.5	
K4	40	938	87	851	12/4/03 19:48	12	1.93	44	95	7.8	4.5	
K9	-	1072	103	969	12/4/03 20:00	13	2.03	50-44-36	95	8	4.5	
7794	C51	775	61	714	12/4/03 20:13	10	1.94	40	95	8	4.5	
7794	C61	830	77	753	12/4/03 20:23	9	2.28	46	95	8	4.5	
7794	C57	741	88	653	12/4/03 20:32	8	2.22	42-45	95	8	4.5	
7794	C68	988	76	912	12/4/03 20:40	13	1.91	46	95	8	4.5	
7794	C47	739	62	677	12/4/03 20:53	10	1.84	48-50	95	8.1	4.5	
7994	C70	1028	65	963	12/4/03 21:03	13	2.02	47	95	8.1	4.5	
7794	C45	745	70	675	12/4/03 21:16	9	2.04	47	95	8.1	4.5	
7794	C65	912	94	818	12/4/03 21:25	10	2.23	48	95	8.1	4.5	
7994	C50	1201	86	1115	12/4/03 21:35	14	2.17	47	95	8.1	4.5	
7794	C58	870	67	803	12/4/03 21:49	9	2.43	47	95	8.1	4.5	
7794	C67	940	69	871	12/4/03 21:58	11	2.15	44	95	8.1	4.5	
7794	C18	847	77	770	12/4/03 22:09	11	1.91	46	95	8.1	4.5	
7794	C19	858	84	774	12/4/03 22:20	12	1.76	48	95	8.1	4.5	
7794	C17	1142	87	1055	12/4/03 22:32	14	2.05	50-52	95	8.1	4.5	

Table 5-2 PDF Feedrate Information (Phase 2)

Box Code	Box	Box Gross	Box Tare	Box Net	Time	Burn Time	T/hr	Feeder	Blower	Blower P.	Line P.	Comments
K #1-9	#	weight lbs	weight lbs	weight lbs	mm/dd 00:00	min		speed %	speed %	psi	" WG	
7794	C21	1300	123	1177	12/4/03 22:46	16	2.00	48-46	95	8.1	4.5	
7794	C22	824	82	742	12/4/03 23:02	11	1.84	48-50	95	8.1	4.5	
7801	C91	790	78	712	12/4/03 23:13	9	2.15	48	95	8.1	4.5	
7801	C92	1099	103	996	12/4/03 23:22	12	2.26	48	95	8.1	4.5	
7795	C7	1326	81	1245	12/4/03 23:34	14	2.42	46-42	95	8.1	4.5	
7801	C90	770	81	689	12/4/03 23:48	8	2.34	38	95	8.1	4.5	
7801	C87	1273	123	1150	12/4/03 23:56	14	2.24	42	95	8.2	4.5	
7801	C103	945	90	855	12/5/03 0:10	11	2.12	45	95	8.2	4.5	
7801	C104	1014	74	940	12/5/03 0:21	13	1.97	46	95	8.2	4.5	bad box, can't get it to load
7801	C96	1142	128	1014	12/5/03 0:34	13	2.12	48	95	8.2	4.5	small plastic starve before next box
7801	C111	716	83	633	12/5/03 0:47	8	2.15	50	95	8.2	4.5	dumped.
7801	C85	1261	107	1154	12/5/03 0:55	15	2.09	52	95	8.2	4.5	
7801	C107	818	77	1164	12/5/03 1:10	13	2.44	52	95	8.2	4.5	add495 to box from fixed broken box
7801	C106	848	79	769	12/5/03 1:23	10	2.09	45	95	8.2	4.5	above
7801	C104	725	91	634	12/5/03 1:33	9	1.92	47	95	8.2	4.5	
7801	C94	1329	125	1204	12/5/03 1:42	15	2.18	49	95	8.2	4.5	
7801	C86	876	98	778	12/5/03 1:57	11	1.92	44	95	8.2	4.5	
7801	C88	797	69	728	12/5/03 2:08	9	2.20	47	95	8.2	4.5	combined boxes 88 & 93 in hopper
7801	C93	506	98	408	12/5/03 2:17	5	2.22	46	95	8.2	4.5	
7801	C100	1083	131	952	12/5/03 2:22	12	2.16	46-48	95	8.2	4.5	
7794	C76B	654	88	566	12/5/03 2:34	6	2.57	45-42	95	8.2	4.5	combined boxes 76b & 83a in hopper
7801	C83A	371	85	286	12/5/03 2:40	4	1.95	42	95	8.2	4.5	
7801	C80	1350	103	1247	12/5/03 2:44	16	2.12	44	95	8.2	4.5	
7801	C82	698	78	620	12/5/03 2:59	9	1.87	48	95	8.2	4.5	
7801	C110	813	80	733	12/5/03 3:08	9	2.22	50	95	8.2	4.5	
7801	C81	1099	121	978	12/5/03 3:17	12	2.22	46	95	8.2	4.5	
7801	C108	1181	116	1065	12/5/03 3:30	13	2.23	50	95	8.2	4.5	hopper filled early rate not accurate
7801	C95	1364	137	1227	12/5/03 3:43	15	2.23	48	95	8.2	4.5	
7794	C53	761	120	641	12/5/03 3:58	9	1.94	48	95	8.2	4.5	
7794	C54	966	92	874	12/5/03 4:07	11	2.16	50	95	8.2	4.5	
7801	C79	834	87	747	12/5/03 4:18	8	2.54	50	95	8.2	4.5	
7794	C73	854	98	756	12/5/03 4:26	8	2.57	40	95	8.2	4.5	
7795	C35	1554	63	1491	12/5/03 4:34	18	2.25	42	95	8.2	4.5	
7795	C29	1007	106	901	12/5/03 4:52	12	2.04	42	95	8.2	4.5	
7795	C14	746	94	652	12/5/03 5:04	8	2.22	42	95	8.3	4.5	
7795	C36	1861	102	1409	12/5/03 5:12	17	2.26	39	95	8.3	4.5	Box broke upon loading lost app. 350 lb
7795	C15	891	109	782	12/5/03 5:29	10	2.13	39-40	95	8.3	4.5	
7801	C101	725	67	658	12/5/03 5:39	8	2.24	41	95	8.3	4.5	added spill of 350 to box 7801 C101
7795	C42	1485	72	1413	12/5/03 5:47	18	2.14	43	95	8.3	4.5	
7795	C37	1427	92	1335	12/5/03 6:05	13	2.79	40-35-28	95	8.3	4.5	kiln in the hole, plastic feed taken down
7795	C32	1550	55	1495	12/5/03 6:18	23	1.77	28-35-45	95	8.3 to 6.5	4.5	06:20 preheater choke- kiln down

Table 5-2 PDF Feedrate Information (Phase 2)

Box Code K #1-9	Box #	Box Gross weight lbs	Box Tare weight lbs	Box Net weight lbs	Time mm/dd 00:00	Burn Time min	T/hr	Feeder speed %	Blower speed %	Blower P. psi	Line P. " WG	Comments
7795	C33	1400	90	1310	12/5/03 13:21	14	2.55	46	95	7.5	4.5	Test restarted at 13:21
7795	C16	743	73	670	12/5/03 13:35	9	2.03	46-44	95	7.5	4.5	
7801	C4	1064	48	1016	12/5/03 13:44	12	2.30	42	95	7.5	4.5	
7799	C83B	530	120	410	12/5/03 13:56	5	2.23	40	95	7.5	4.5	
7799	C145	1286	100	1186	12/5/03 14:01	17	1.90	42	95	7.5	4.5	
7799	C142	1385	77	1308	12/5/03 14:18	16	2.22	45	95	7.5	4.5	
7794	C115	928	78	850	12/5/03 14:34	11	2.10	45	95	7.5	4.5	
7799	C49A	645	113	532	12/5/03 14:45	7	2.07	45	95	7.5	4.5	
7799	C118	1118	94	1024	12/5/03 14:52	13	2.14	45	95	7.5	4.5	
7799	C131	810	77	733	12/5/03 15:05	10	1.99	45	95	7.5	4.5	
7799	C120	1285	145	1140	12/5/03 15:15	15	2.07	45	95	7.5	4.5	
7799	C135	871	54	817	12/5/03 15:30	10	2.22	45	95	7.5	4.5	
7799	C134	820	83	737	12/5/03 15:40	10	2.01	45	95	7.5	4.5	
7799	C139	938	96	842	12/5/03 15:50	12	1.91	45	95	7.5	4.5	
MC MIX	MC MI	862	70	792	12/5/03 16:02	11	1.96	46	95	7.5	4.5	
7799	C132	983	95	888	12/5/03 16:13	11	2.20	46	95	7.5	4.5	
7799	C130	1188	85	1103	12/5/03 16:24	14	2.14	46	95	7.5	4.5	
7799	C136	901	80	821	12/5/03 16:38	12	1.86	46	95	7.5	4.5	
7799	C140	953	90	863	12/5/03 16:50	11	2.14	46	95	7.5	4.5	
7799	C124	799	87	712	12/5/03 17:01	9	2.15	46	95	7.5	4.5	
7799	C128	1153	100	1053	12/5/03 17:10	14	2.05	46	95	7.5	4.5	
7799	C113	993	80	913	12/5/03 17:24	13	1.91	46	95	7.5	4.5	
7799	C129	850	79	771	12/5/03 17:37	10	2.10	46	95	7.5	4.5	
7799	C127	1040	69	971	12/5/03 17:47	12	2.20	46	95	7.5	4.5	
7799	C126	820	76	744	12/5/03 17:59	10	2.02	47	95	7.5	4.5	
7799	C123	819	79	740	12/5/03 18:09	9	2.24	47	95	7.5	4.5	
7799	C133	756	86	670	12/5/03 18:18	9	2.03	47	95	7.5	4.5	
7794	C49B	357	72	285	12/5/03 18:27	4	1.94	47	95	7.5	4.5	
7795	C5	861	73	788	12/5/03 18:31	10	2.14	42	95	7.5	4.5	
7799	C143	1284	80	1204	12/5/03 18:41	15	2.18	46	95	7.5	4.5	
7794	C76A	1051	97	954	12/5/03 18:56	11	2.36	40-38	95	7.5	4.5	
7799	C119	1129	117	1012	12/5/03 19:07	12	2.30	42	95	7.5	4.5	box dumped early rate could be wrong
7799	C147	1561	76	1485	12/5/03 19:19	19	2.13	37	95	7.5	4.5	
7799	C117	1348	103	1245	12/5/03 19:38	15	2.26	39-40	95	7.5	4.5	fast material, feed rate adjusted down.
7795	C43	1714	88	1626	12/5/03 19:53	21	2.11	40-31	95	7.5	4.5	
7799	C144	1739	112	1627	12/5/03 20:14	21	2.11	31-35	95	7.5	4.5	
7799	C114	991	69	922	12/5/03 20:35	12	2.09	40	95	7.5	4.5	
7799	C116	856	81	775	12/5/03 20:47	11	1.92	43	95	7.5	4.5	
7799	C141	1462	69	1393	12/5/03 20:58	20	1.90	40	95	7.5	4.5	
7799	C146	1203	81	1122	12/5/03 21:18	12	2.54	42	95	7.5	4.5	
7795	C6	697	71	626	12/5/03 21:30	8	2.13	42	95	7.5	4.5	

Table 5-2 PDF Feedrate Information (Phase 2)

Box Code	Box	Box Gross	Box Tare	Box Net	Time	Burn Time	T/hr	Feeder	Blower	Blower P.	Line P.	Comments
K #1-9	#	weight lbs	weight lbs	weight lbs	mm/dd 00:00	min		speed %	speed %	psi	" WG	
7794	C72	831	82	749	12/5/03 21:38	9	2.26	45	95	7.5	4.5	
K4	35	1004	77	927	12/5/03 21:47	11	2.29	46	95	7.5	4.5	
K4	47	1235	125	1110	12/5/03 21:58	16	1.89	42	95	7.5	4.5	
7795	C121	816	77	739	12/5/03 22:14	10	2.01	48	95	7.5	4.5	small hole in eductor tube at shrink down
7795	C2	950	72	878	12/5/03 22:24	13	1.84	38	95	7.5	4.5	Maintence out to patch with rubber and
7794	C71	1180	130	1050	12/5/03 22:37	15	1.91	41	95	7.5	4.5	duct tape
7794	C74	973	96	877	12/5/03 22:52	11	2.17	44-42	95	7.5	4.5	Hole successfully patched
7794	C75	945	81	864	12/5/03 23:03	10	2.35	44	95	7.5	4.5	
7795	C24	1542	85	1457	12/5/03 23:13	19	2.09	40	95	7.5	4.5	
7799	C125	1154	59	1095	12/5/03 23:32	16	1.86	42	95	7.5	4.5	
7795	C12	718	70	648	12/5/03 23:48	9	1.96	44	95	7.6	4.5	
7795	C3	1109	138	971	12/5/03 23:57	13	2.03	47	95	7.7	4.5	
7795	C11	735	71	664	12/6/03 0:10	9	2.01	50-48	95	7.7	4.5	
7799	C137	934	63	871	12/6/03 0:19	11	2.15	48-50	95	7.7	4.5	
7795	C31	1219	67	1152	12/6/03 0:30	15	2.09	52	95	7.7	4.5	
7795	C39	1515	59	1456	12/6/03 0:45	17	2.33	40-44	95	7.7	4.5	fast material, feed rate adjusted down.
7795	C9	966	78	888	12/6/03 1:02	11	2.20	42	95	7.7	4.5	
7799	C122	839	109	730	12/6/03 1:13	10	1.99	42-44	95	7.7	4.5	
7799	C138	835	70	765	12/6/03 1:23	10	2.08	48	95	7.7	4.5	
7794	C77	855	101	754	12/6/03 1:33	10	2.05	52	95	7.6	4.5	
7794	C66	1073	84	989	12/6/03 1:43	13	2.07	42-45	95	7.6	4.5	fast material, feed rate adjusted down.
7794	C69	856	77	779	12/6/03 1:56	9	2.36	44	95	7.5	4.5	
7794	C56	1020	83	937	12/6/03 2:05	11	2.32	48	95	7.5	4.5	
7794	C70	798	126	672	12/6/03 2:16	9	2.03	45	95	7.5	4.5	
7794	C60	979	80	899	12/6/03 2:25	11	2.22	48	95	7.5	4.5	
7794	C64	863	106	757	12/6/03 2:36	9	2.29	44	95	7.5	4.5	
7794	C59	957	86	871	12/6/03 2:45	10	2.37	48	95	7.5	4.5	
7795	C10	786	89	697	12/6/03 2:55	8	2.37	50	95	7.5	4.5	
7795	C23	1515	55	1460	12/6/03 3:03	17	2.34	40	95	7.5	4.5	fast material, feed rate adjusted down.
7795	C27	1567	82	1485	12/6/03 3:20	16	2.53	36	95	7.5	4.5	fast material, feed rate adjusted down.
7795	C28	776	84	692	12/6/03 3:36			36	95	7.5	4.5	K2 Preheater choke, asked to shut off
					12/6/03 3:40							K2 Kiln down, Test suspended.
		Total # Boxes		Total Net weight lbs		Avg T/hr	2.14					
		153		140803	Total Burn Time (hr)							
			Total Net tons used				30.08					
				63.8672424								
				Avg T/hr weight								
				2.12								

6.0 QUALITY ASSURANCE/QUALITY CONTROL

6.1 Sample Collection

Stack sampling was conducted according to the methods and specifications presented in the test protocol, except as noted in Section 4.2. During sampling, adherence to the following activities ensured the collection of representative emissions samples:

- Collecting target minimum sample volumes;
- Collecting stack gas for target minimum duration;
- Collecting stack gas less than the target maximum sampling rate;
- Collecting stack gas isokinetically;
- Maintaining acceptable probe temperature;
- Maintaining acceptable filter temperature;
- Maintaining acceptable condenser exit temperatures;
- Maintaining acceptable impinger exit temperature;
- Performing train leak checks before, during and after port changes;
- Performing pitot tube leak checks;
- Completing sampling data sheets;
- Completing sampling recovery data sheets; and
- Using calibrated sampling equipment.

The sampling data were assessed against these activities and had the following findings:

- As discussed in Section 4.2 the collection of minimum sample volumes and durations were not achieved for PDF Runs 3 for the 0061 and 201A/202 trains, because of kiln instability. On-site PADEP personnel approved and validated these runs and the trains were recovered and the samples were submitted for analysis.

6.2 Sample Analysis

Sample analysis was conducted according to the methods and specifications presented in the test protocol, except as noted in Section 4.2. During analysis, adherence to the following activities, where applicable, ensured representative measurements of the samples:

- Sample shipment and preservation;

- Analysis within prescribed holding times;
- Analysis of field and laboratory blanks;
- Analysis of laboratory control samples (LCS) and LCS duplicate (LCSD) samples;
- Analysis of samples in duplicate;
- Analysis of matrix spike (MS) and MS duplicate samples;
- Analysis of a surrogate compound added to each sample for organics analyses; and
- Analysis of media spikes and media spike duplicates (SVOCs).

The analytical data were assessed against these activities and had the following findings:

- For the metals trains, antimony, arsenic, barium, copper, manganese, nickel, and selenium were detected in the front-half field blank sample; antimony and lead were detected in the back-half field sample. Antimony was also detected in the method blank. The detected masses found in the field samples were similar to the masses found in the associated field blank results. The field sample results have been impacted, and should be considered biased high.

- Due to the number of target analytes, especially benzene, found in the samples at high amounts, the laboratory performed bag dilutions in order to quantify the results within the linear range of the calibration curve, without diluting out other target analytes. Consequently, Table 6-1 presents the results that were still beyond the linear range of the curve and have been qualified with an “E” as estimated and potentially biased low.

- The LCS and/or LCSD recoveries of two analytes, 2-butanone and 2-hexanone, associated with VOST work orders were greater than their upper control limits. These analytes were detected in the associated samples and their results should be considered biased high.

- The LCS recoveries of two analytes, acrylonitrile and Freon 12, were less than their lower control limits; however, their corresponding LCSD exhibited a recovery within the control limits. These analytes were detected in the associated samples and their results are not impacted.

- The recovery for one analyte, 4-chloro-3-methylphenol, in one LCS was slightly greater than its upper control limit. This analyte was not detected in any associated samples so the data are not impacted.
- Diethyl phthalate (1.3 µg) and bis(2-ethylhexyl)phthalate (19 µg) were detected in the impinger/rinse field blank for the SVOST train. These two analytes were detected in the corresponding impinger/rinse samples in all three baselines and in all three PDF runs at similar results. Diethyl phthalate was also detected in the method blank. The diethyl phthalate and bis(2-ethylhexyl)phthalate results for the impinger/rinse samples from this test should be considered positively biased.
- The analyses for cyanide in the zinc acetate impingers from the Method 26A sampling train were performed on 39 to 40 days after collection. The holding time is 14 days, and the samples were not delivered to the laboratory until after the holding time had expired. These results should be considered bias low.
- For the cyanide analysis in the zinc acetate impingers, the MS recovery (71%) was less than the laboratory lower control limit of 75%. The amount spiked as approximately 25% the amount measured in the parent sample. The MSD recovery and the RPD met the laboratory specification. With regards to precision and accuracy, the data are not adversely impacted.

6.2.1 Collection Efficiency

VOST: Table 6-2 shows the collection efficiency of the Method 0030 sampling trains. Only those analytes that were detected in at least one front half or back half tube and having a collection efficiency less than the specification are presented. The detection limit was used in the calculation of collection efficiency for those results that were not detected in on the tubes. The specification for collection efficiency is 70%. For this test, 18 primary tube pairs were analyzed, 9 pairs per test condition. Table 6-3 presents the results of each tube and their collection efficiencies for those analytes that were detected in at least one sample. This table shows that of the 28 analytes detected there was at least one collection efficiency for 13 analytes that did not meet the specification. Based on discussions with the laboratory, 4 of these analytes (bromomethane, chloromethane, Freon 11 and Freon 12) typically breakthrough the Tenax tube because of their low molecular weights. Also, two analytes showed isolated detects leading to undesirable collection efficiencies.

Hydrogen Halides/Halogens and Cyanide: Table 6-4 shows the collection efficiency of the Method 26A sampling trains. Only those results that were detected in either the front half or back half samples are presented. The detection limit was used in the calculation of collection efficiency for those results that were not detected. The specification for collection efficiency is 90%. The chloride and fluoride results met this specification; however, the one instance when chlorine was detected in the test did not exhibit acceptable collection efficiency. In addition, none of the cyanide results, collected in either the sodium hydroxide or zinc acetate impingers, exhibited acceptable collection efficiencies. The chlorine and cyanide results should be considered biased low.

6.2.2 Audit Samples

At Lafarge's request, PADEP supplied audit samples for metals, PCDDs/PCDFs, and hydrogen halides/halogens. These audit samples were delivered to the testing contractor's office, transported to the plant, stored with the emissions samples, and shipped to the laboratories along with the field samples. The laboratory reports and correspondence for the audit samples are provided in Appendix A.5.

6.3 CEMs

6.3.1 Temporary Analyzers

Emission measurements using portable analyzers were conducted according to the methods and specifications presented in the test protocol, except as noted in Section 4.2. During analyzer use, adherence to the following activities ensured correct representative measurements of the stack gas:

- Zero drift;
- Calibration drift;
- Calibration error;
- System bias; and
- Leak checks.

6.3.2 Installed CEMs

Emission measurements using the plant installed CEMs were conducted according to the methods and specifications presented in the test protocol. Adherence to the following activities ensured correct, representative measurements of the stack gas:

- Performance Specification 2; and
- Performance Specification 3.

Table 6-1. VOST Results Exceeding Calibration Range

Analyte	Sample	Result (ng)	Analyte	Sample	Result (ng)
Baseline Condition			**PDF Condition**		
Benzene	11-01A	11000	Benzene	21-01A	16000
Benzene	11-02A	15000	Carbon disulfide	21-01B	1400
Acrolein	11-01A	2800	Benzene	21-02A	7700
Chloromethane	11-01B	1500	Benzene	21-03A	6900
Chloromethane	11-02B	4400	Carbon disulfide	21-03B	1600
Bromomethane	11-03A	1200	Benzene	22-01A	7100
Carbon disulfide	11-03A	1300	Carbon disulfide	22-01B	1700
Acrylonitrile	11-03A	2000	Benzene	22-02A	5700
Benzene	11-03A	>7000	Benzene	22-03A	7600
Toluene	11-03A	1600	Benzene	23-01A	9600
Iodomethane	11-03A	1600	Benzene	23-02A	9300
Chloromethane	11-03B	2400	Benzene	23-03A	9500
Benzene	12-01A	28000			
Chloromethane	12-01B	2900			
Benzene	12-02A	46000			
Chloromethane	12-02B	4400			
Benzene	12-04A	47000			
Chloromethane	12-04B	5000			
Benzene	13-01A	44000			
Chloromethane	13-01B	5100			
Bromomethane	13-01B	7800			
Benzene	13-02A	32000			
Chloromethane	13-02B	2700			
Bromomethane	13-02B	1100			
Bromomethane	13-03A	3400			
Carbon disulfide	13-03A	1800			
Acrylonitrile	13-03A	3900			
Benzene	13-03A	>11000			
Toluene	13-03A	2000			
Iodomethane	13-03A	2900			
Chloromethane	13-03B	5900			
Bromomethane	13-03B	2200			

Table 6-2. Collection Efficiency Summary of the Method 0030 Sampling Tubes

Analyte	Number of Tube Pairs Detected	Number of Tube Pairs not Meeting Specification	Average Collection Efficiency (a)
1,2-Dichloropropane	1	1	17%
2-Hexanone	10	10	41%
4-Methyl-2-pentanone	4	4	36%
Bromomethane	18	7	76%
Carbon disulfide	18	8	74%
Chloroethane	18	13	62%
Chloromethane	18	18	11%
Dibromomethane	18	4	84%
Freon 11	18	3	81%
Freon 12	18	9	70%
Methylene chloride	2	2	56%
Tetrachloroethene	1	1	28%
Vinyl chloride	18	18	43%

(a) Average Collection Efficiency was calculated for each analyte as the average of each tube pair collection efficiency when the analyte was detected in at least one tube per pair.

Table 6-3 Collection Efficiency of Method 0030 (Volatile Organics)

Analyte (results in ng)	0030-11-P1A03 12133 A-01A	0030-11-P1B03 12133 A-01B		0030-11-P2A03 12133 A-02A	0030-11-P2B03 12133 A-02B		0030-11-P3A03 12133 A-03A	0030-11-P3B03 12133 A-03B		0030-12-P1A03 12133 A-08A	0030-12-P1B03 12133 A-08B		0030-12-P2A03 12133 A-09A	0030-12-P2B03 12133 A-09B		0030-12-P4A03 12133 A-11A	0030-12-P4B03 12133 A-11B	
	Pair 1		CE	Pair 2		CE	Pair 3		CE	Pair 1		CE	Pair 2		CE	Pair 4		CE
1,2-Dichloropropane	16	80	17%	<30	<10	--	<10	<10	--	<70	<10	--	<120	<10	--	<120	<10	--
2-Butanone (Methyl Ethy	390	<50	89%	190	<50	79%	230	<50	82%	270	12	96%	140	<50	74%	200	<50	80%
2-Hexanone	50	<50	50%	29	<50	37%	36	<50	42%	<350	<50	--	<600	<50	--	<600	<50	--
3-Chloropropene	110	<10	92%	98	<10	91%	76	6.2	92%	99	23	81%	87	19	82%	120	29	81%
4-Methyl-2-pentanone	<150	<50	--	<150	<50	--	35	<50	41%	37	<50	43%	<600	<50	--	<600	<50	--
Acetone	1600	120	93%	540	87	86%	890	42	95%	650	150	81%	310	110	74%	560	180	76%
Acrolein	2800	<500	85%	<1500	<500	--	<500	<500	--	<3500	<500	--	<6000	<500	--	<6000	<500	--
Acrylonitrile	2700	63	98%	2200	63	97%	2000	72	97%	1100	450	71%	1300	440	75%	1300	360	78%
Benzene	11000	43	100%	15000	22	100%	7000	67	99%	28000	160	99%	46000	24	100%	47000	79	100%
Bromochloromethane	160	<10	94%	240	<10	96%	280	3.7	99%	250	17	94%	310	8.1	97%	350	14	96%
Bromomethane	1200	280	81%	2100	560	79%	1200	740	62%	2500	420	86%	4000	480	89%	5500	640	90%
Carbon Disulfide	1700	240	88%	1600	200	89%	1300	270	83%	1200	660	65%	1300	640	67%	1400	730	66%
Chlorobenzene	310	<10	97%	360	<10	97%	420	<10	98%	430	<10	98%	420	<10	98%	500	<10	98%
Chloroethane	35	27	56%	27	27	50%	22	22	50%	42	34	55%	<120	31	79%	<120	40	75%
Chloromethane	200	1500	12%	340	4400	7%	110	2400	4%	310	2900	10%	600	4400	12%	780	5000	13%
Dibromomethane	62	<10	86%	84	<10	89%	110	<10	92%	92	<10	90%	99	<10	91%	120	<10	92%
Freon 11	8.4	7.6	53%	<30	3.6	89%	4.3	3.7	54%	<70	5.7	92%	<120	4.2	97%	<120	6.2	95%
Freon 12	<30	20	60%	<30	16	65%	<10	11	48%	<70	22	76%	<120	14	90%	<120	15	89%
Iodomethane	1300	12	99%	1800	53	97%	1600	200	89%	1500	65	96%	2400	130	95%	2400	360	87%
Methyl Methacrylate	<150	<50	--	<150	<50	--	56	<50	53%	<350	<50	--	<600	<50	--	<600	<50	--
Methylene Chloride	74	110	40%	71	7.3	91%	49	10	83%	50	26	66%	62	23	73%	73	27	73%
Styrene	120	<10	92%	350	<10	97%	400	<10	98%	390	<10	98%	260	<10	96%	360	<10	97%
Tetrachloroethene	<30	<10	--	<30	<10	--	3.8	<10	28%	<70	<10	--	<120	<10	--	<120	<10	--
Toluene	2400	7.9	100%	1900	<10	99%	1600	<10	99%	2300	48	98%	1800	<10	99%	2300	110	95%
Vinyl Chloride	<30	52	37%	8.7	65	12%	5.5	41	12%	<70	67	51%	<120	75	62%	<120	81	60%

Table 6-3 Collection Efficiency of Method 0030 (Volatile Organics)

Analyte (results in ng)	0030-13-P1A03 12133 B-14A	0030-13-P1B03 12133 B-14B		0030-13-P2A03 12133 B-15A	0030-13-P2B03 12133 B-15B		0030-13-P3A03 12133 B-16A	0030-13-P3B03 12133 B-16B		0030-21-P1A03 12133 B-20A	0030-21-P1B03 12133 B-20B		0030-21-P2A03 12133 B-21A	0030-21-P2B03 12133 B-21B		0030-21-P3A03 12133 B-22A	0030-21-P3B03 12133 B-22B	
	Pair 1		CE	Pair 2		CE	Pair 3		CE	Pair 1		CE	Pair 2		CE	Pair 3		CE
1,2-Dichloropropane	<100	<10	--	<80	<10	--	<10	<10	--	<40	<10	--	<30	<10	--	<30	<10	--
2-Butanone (Methyl Ethy	260	<50	84%	170	<50	77%	280	<50	85%	210	<50	81%	200	<50	80%	120	14	90%
2-Hexanone	<500	<50	--	<400	<50	--	45	<50	47%	30	<50	38%	28	<50	36%	<150	<50	--
3-Chloropropene	180	<10	95%	140	<10	93%	120	<10	92%	62	22	74%	40	<10	80%	32	<10	76%
4-Methyl-2-pentanone	<500	<50	--	<400	<50	--	29	<50	37%	<200	<50	--	<150	<50	--	<150	<50	--
Acetone	680	180	79%	550	56	91%	920	31	97%	500	150	77%	560	120	82%	360	76	83%
Acrolein	<5000	<500	--	<4000	<500	--	<500	<500	--	<2000	<500	--	<1500	<500	--	<1500	<500	--
Acrylonitrile	3000	420	88%	900	45	95%	3900	42	99%	1500	340	82%	1400	160	90%	710	120	86%
Benzene	44000	69	100%	32000	42	100%	11000	8.5	100%	16000	46	100%	7700	10	100%	6900	35	99%
Bromochloromethane	520	<10	98%	320	<10	97%	360	<10	97%	150	6.6	96%	74	<10	88%	29	<10	74%
Bromomethane	4500	7800	37%	1800	1100	62%	3400	2200	61%	510	480	52%	280	70	80%	290	69	81%
Carbon Disulfide	2100	820	72%	2100	260	89%	1800	370	83%	2100	1400	60%	700	670	51%	1100	1600	41%
Chlorobenzene	620	<10	98%	360	<10	97%	590	<10	98%	280	<10	97%	190	<10	95%	110	<10	92%
Chloroethane	<100	64	61%	57	34	63%	30	32	48%	<40	33	55%	<30	20	60%	<30	16	65%
Chloromethane	1000	5100	16%	390	2700	13%	490	5900	8%	35	710	5%	29	480	6%	72	570	11%
Dibromomethane	200	<10	95%	110	<10	92%	130	<10	93%	80	<10	89%	38	<10	79%	11	<10	52%
Freon 11	<100	16	86%	<80	3.4	96%	3.3	3.4	49%	<40	6.6	86%	<30	5.6	84%	<30	7.8	79%
Freon 12	<100	34	75%	<80	15	84%	<10	15	40%	<40	18	69%	<30	15	67%	<30	14	68%
Iodomethane	2800	610	82%	2800	130	96%	2900	220	93%	740	500	60%	470	120	80%	540	57	90%
Methyl Methacrylate	<500	<50	--	<400	<50	--	70	<50	58%	<200	<50	--	<150	<50	--	<150	<50	--
Methylene Chloride	100	130	43%	88	12	88%	62	12	84%	45	130	26%	57	34	63%	110	64	63%
Styrene	620	<10	98%	250	<10	96%	700	<10	99%	430	<10	98%	290	<10	97%	240	<10	96%
Tetrachloroethene	<100	<10	--	<80	<10	--	<10	<10	--	<40	<10	--	<30	<10	--	<30	<10	--
Toluene	3000	180	94%	1900	<10	99%	2000	<10	100%	1700	46	97%	1200	<10	99%	1100	<10	99%
Vinyl Chloride	<100	130	43%	<80	80	50%	<10	82	11%	<40	60	40%	<30	35	46%	<30	29	51%

Table 6-3 Collection Efficiency of Method 0030 (Volatile Organics)

Analyte	0030-22-P1A03 12133 C-27A	0030-22-P1B03 12133 C-27B		0030-22-P2A03 12133 C-28A	0030-22-P2B03 12133 C-28B		0030-22-P3A03 12133 C-29A	0030-22-P3B03 12133 C-29B		0030-23-P1A03 12133 C-34A	0030-23-P1B03 12133 C-34B		0030-23-P2A03 12133 C-35A	0030-23-P2B03 12133 C-35B		0030-23-P3A03 12133 C-36A	0030-23-P3B03 12133 C-36B		Times Detected in a Tube Pair	Collection Efficiency Outside Specification	Average Collection Efficiency
(results in ng)	Pair 1		CE	Pair 2		CE	Pair 3		CE	Pair 1		CE	Pair 2		CE	Pair 3		CE			
1,2-Dichloropropane	<30	<10	--	<30	<10	--	<30	<10	--	<30	<10	--	<30	<10	--	<30	<10	--	1	1	17%
2-Butanone (Methyl Ethy	190	<50	79%	90	20	82%	140	<50	74%	260	<50	84%	240	<50	83%	250	19	93%	18	0	83%
2-Hexanone	<150	<50	--	<150	<50	--	21	<50	30%	38	<50	43%	34	<50	40%	37	<50	43%	10	10	41%
3-Chloropropene	<30	<10	--	<30	<10	--	42	<10	81%	65	<10	87%	59	<10	86%	68	<10	87%	16	0	86%
4-Methyl-2-pentanone	<150	<50	--	<150	<50	--	<150	<50	--	17	<50	25%	<150	<50	--	<150	<50	--	4	4	36%
Acetone	490	39	93%	330	65	84%	290	43	87%	680	74	90%	740	67	92%	670	32	95%	18	0	86%
Acrolein	<1500	<500	--	<1500	<500	--	<1500	<500	--	<1500	<500	--	<1500	<500	--	<1500	<500	--	1	0	85%
Acrylonitrile	1200	56	96%	390	66	86%	1400	35	98%	1900	90	95%	1600	59	96%	1700	35	98%	18	0	90%
Benzene	7100	8.1	100%	5700	14	100%	7600	<10	100%	9600	11	100%	9300	11	100%	9500	6.9	100%	18	0	100%
Bromochloromethane	39	<10	80%	38	<10	79%	42	<10	81%	100	<10	91%	110	<10	92%	120	<10	92%	18	0	92%
Bromomethane	410	550	43%	360	47	88%	440	250	64%	700	58	92%	900	29	97%	560	25	96%	18	7	76%
Carbon Disulfide	2700	1700	61%	520	160	76%	1900	320	86%	920	460	67%	1600	280	85%	890	92	91%	18	8	74%
Chlorobenzene	110	<10	92%	92	<10	90%	100	<10	91%	190	<10	95%	240	<10	96%	270	<10	96%	18	0	96%
Chloroethane	<30	16	65%	<30	9.7	76%	<30	11	73%	<30	14	68%	14	15	48%	<30	11	73%	18	13	62%
Chloromethane	66	850	7%	33	260	11%	48	610	7%	84	370	19%	130	480	21%	56	420	12%	18	18	11%
Dibromomethane	19	<10	66%	19	<10	66%	20	<10	67%	48	<10	83%	52	<10	84%	57	<10	85%	18	4	84%
Freon 11	<30	6.1	83%	<30	3.6	89%	<30	3.8	89%	<30	7.4	80%	<30	4.1	88%	7.4	2.6	74%	18	3	81%
Freon 12	<30	15	67%	<30	14	68%	<30	12	71%	<30	12	71%	<30	13	70%	<30	10	75%	18	9	70%
Iodomethane	570	170	77%	390	3.1	99%	550	120	82%	1200	8	99%	1300	50	96%	1000	6.4	99%	18	0	91%
Methyl Methacrylate	<150	<50	--	<150	<50	--	<150	<50	--	<150	<50	--	<150	<50	--	<150	<50	--	2	2	56%
Methylene Chloride	79	170	32%	39	19	67%	490	170	74%	130	190	41%	110	90	55%	95	26	79%	18	10	65%
Styrene	280	<10	97%	210	<10	95%	290	<10	97%	450	<10	98%	520	<10	98%	580	<10	98%	18	0	97%
Tetrachloroethene	<30	<10	--	<30	<10	--	<30	<10	--	<30	<10	--	<30	<10	--	<30	<10	--	1	1	28%
Toluene	1200	260	82%	870	<10	99%	1300	<10	99%	1500	130	92%	1600	<10	99%	1800	<10	99%	18	0	98%
Vinyl Chloride	<30	24	56%	<30	29	51%	<30	23	57%	<30	28	52%	<30	31	49%	<30	29	51%	18	18	43%

Table 6-4. Collection Efficiency Summary of the Method 26A Sampling Trains

Parameter	Run	Front Half Result (µg)	Back Half Result (µg)	Collection Efficiency (%)
Chloride	Baseline 2	26839	<29	> 99.9%
	Baseline 3	24102	<29	> 99.9%
	Baseline 4	7564	<40	> 99.5%
	PDF 1	14183	235	98.3%
	PDF 2	12975	<42	> 99.7%
	PDF 3	15235	<32	> 99.8%
Fluoride	Baseline 3	582	<27	> 95.5%
Chlorine	PDF 1	1271	618	67.3%
Cyanide	Baseline 2	15.5	<30.8	> 33.4%
	Baseline 3	100	61.7	61.9%
	Baseline 4 (NaOH)	67.4	68.9	80.4%
	Baseline 4 (ZnOAc)	854	242	
	PDF 1 (NaOH)	18.6	14.9	42.9%
	PDF 1 (ZnOAc)	145	238	
	PDF 2 (NaOH)	<36.6	79.6	59.9%
	PDF 2 (ZnOAc)	321	293	
	PDF 3 (NaOH)	<31.1	23.9	41.5%
	PDF 3 (ZnOAc)	103	223	

APPENDIX A

CORRESPONDENCE

Appendix A.1

Request for Source Testing Audit Samples

17 November 2003 **Transmitted by Electronic Mail**

Mr. Brian Richwine
PA Department of Environmental Protection
Bureau of Air Quality
Division of Source Testing and Monitoring
Quality Assurance Unit
400 Market Street, R.C.S.O. Bldg (12th Floor)
Harrisburg, Pennsylvania 17105-8468

Subject: Request for Source Testing Audit Samples

Dear Mr. Richwine:

Lafarge North America plans to conduct source emission testing at its cement manufacturing plant located in Whitehall, Pennsylvania. The test is currently scheduled to begin on December 2, 2003. Lafarge has submitted a test protocol to Mr. Tom DiLazaro of PADEP describing the test. URS Corporation (PADEP Registration Number: 68-2917) will be performing the stack sampling for the test. The attached tables provide contact information for the source and the testing contractor, and provide a summary of the sampling and analytical methods that will be used for the test.

This letter requests that PADEP provide appropriate audit samples for the test. We ask that the audit samples be delivered to the following address:

Robert F. Jongleux
URS Corporation
1600 Perimeter Park Drive
Morrisville, NC 27560
919 461-1242

URS Corporation will distribute the audit samples to the laboratories that are analyzing the collected emission samples. Based on previous emission testing of the cement kilns, URS anticipates the concentrations of all target analytes will be "non-detect" or detected at low levels.

Please call either Dan Packy at 410 785-7220 ext. 186 or Bob Jongleux at the telephone number listed above if you have any questions regarding this request.

Sincerely,

Stephen M. Falatko

Stephen M. Falatko
Project Chemist

Attachments

c: Vince Martin, Lafarge North America
Dan Packy / URS Corporation – Hunt Valley
Bob Jongleux / URS Corporation – Morrisville

Appendix A.2

Response to Comments
Emission Test Protocol for Alternative Fuel Substitution Test

November 21, 2003

Mr. Thomas DiLazaro
Air Quality Program
PA DEP – Bethlehem Office
4530 Bath Pike
Bethlehem, PA 18017

Subject: **Response to Comments**
Emission Test Protocol for Alternative Fuel Substitution Test
Lafarge NA – Whitehall Plant
Whitehall, PA
Title V Operating Permit #39-00011

Dear Mr. DiLazaro:

This letter responds to various technical comments posed by various Pa DEP staff during a telephone conference call held on Wednesday, 11/19/03 and included in an electronic mail message received on 11/21/03. The comments relate to the Emission Test Protocol for Alternative Fuel Substitution Test that Lafarge submitted to Pa DEP on 11/13/03. In this letter, we restate the comments that were raised and we provide technical responses. To summarize the changes to the planned testing, we also include revised Tables 2-1 and 3-1 from the test protocol.

Comment 1: Method 26A: Halide Sampling: Request to determine collection efficiency

We understand this comment to mean that each impinger of the Method 26A sampling train should be recovered and analyzed individually so that the mass of constituent recovered in each impinger can be reported.

Lafarge agrees to this request. We will recover and analyze the two (front) H_2SO_4 impingers individually so that HBr, HCl, and HF can be reported from each impinger. We will also will recover and analyze the two (back) NaOH impingers individually so that Br_2, Cl_2, and HCN can be reported from each impinger.

Please note that HCN will be analyzed by CTM 033 from the same (back) NaOH impingers as will be used to analyze for the Halogens by Method 26A.

Please also note that we intend to incorporate Method 5 with the Method 26A train to obtain a measurement of total particulate matter. In addition, as more fully described in Comment 11 below, we will also conduct sampling for PM_{10}.

Comment 2: Request for Audit Samples

URS Corporation submitted a written request to Mr. Bryon Richwine on 11/17/03 to obtain audit samples for the test program. The request included Tables 1-1, 2-1, and 3-1 of the test protocol to summarize the suite of sampling and analysis planned for the test.

Comment 3: Provide justification for not performing Method 0011 for aldehydes.

The Chemicals of Potential Concern (COPC) discussed at the 10/27/03 meeting included four aldehydes: propionaldehyde, crotonaldehyde, formaldehyde, and acetaldehyde by Method 0011A/8315. One chemical, crotonaldehyde is not a target analyte by this method, and is therefore not included.

Lafarge will perform the analysis of the three aldehydes as Tentatively Identified Compounds (TICs) as part of the VOST sampling train (Method 0030 followed by 5041A/8260B. Method 8260B uses a mass spectrometry detector and computer software to quantitate the spectra of target analytes based on characteristic ions and retention times. The software can also be used to search for, and compare the spectra of known non-target analytes in a sample. Once a match is made, the total ion current is used for quantitation and calculation of TIC results. The total ion current of the closest (by retention time) non-interfered with internal standard is used to calculate results. If all internal standards are interfered with, the method blank's internal standards are used to calculate results. A relative response factor of "1" is assumed.

Lafarge believes that sufficient quantitation of the three aldehydes can be accomplished from the Method 0030 train and subsequent analysis as TICs using Methods 5041A/ 8260B. The aldehydes in the COPC generally do not significantly impact direct inhalation risk assessments, therefore the quantitation of these compounds from the VOST train will not negatively impact use of the assessments.

Comment 4: Resolve discrepancy between analytical methods requested and proposed for metals, especially with respect to detection limits.

The COPC described sampling for metals by Method 29 and analysis by Method 6020A. The test protocol lists Method 29 for sampling but Method 6010B for analysis.

Both 6010B and 6020A are approved SW-846 methods for the analysis of metals from the Method 29 stack train. Method 6010B employs Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) while Method 6020A employs Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS).

The following table presents reporting limits for the two methods for various metals analyzed by the two methods. In some cases, the reporting limits are within a factor of three, in other cases the reporting limits vary by as much as a factor of 14.

Analyte	CAS Number	Method 6010B Target Reporting Limits (µg) Front Half	Method 6010B Target Reporting Limits (µg) Back Half	Method 6020A Reporting Limits (µg/sample)
Antimony	7440-36-0	6.0	6.2	0.30
Arsenic	7440-38-2	1.0	1.0	0.30
Barium	7440-39-3	20.0	20.5	0.15
Beryllium	7440-41-7	0.50	0.51	0.15
Cadmium	7440-39-3	0.50	0.51	0.15
Chromium	7440-47-3	1.0	1.0	0.30
Cobalt	7440-48-4	5.0	5.1	0.15
Copper	7440-50-8	2.5	2.6	0.30
Lead	7439-92-1	1.0	1.0	0.15
Manganese	7439-96-5	1.5	1.5	0.15
Nickel	7440-02-0	4.0	4.1	0.30
Selenium	7782-49-2	1.0	1.0	0.30
Silver	7440-22-4	2.0	2.1	0.15
Thallium	7440-28-0	2.0	2.1	0.15
Zinc	7440-66-6	2.0	2.1	0.30

While there are differences in the detection limits, Lafarge notes that the detection limit issue is largely inconsequential because essentially all of the 15 metals that were included in the COPC were actually detected in previous air-permit related sampling. Of the metals listed above, only cobalt was not detected in the Kiln 2 2003 sampling event at masses greater than detection limit values.

Comment 5: Explain the use of Method 5041A for the analysis of semi-volatile organic compounds.

SW-846 Method 5041A describes the desorption of volatile organic compounds from the sorbent cartridges used in the VOST. Method 5041A is a required intermediate step between sampling Method 0030 and analytical Method 8260B. Although Method 5041A was not explicitly included with the COPC, we assumed it was inferred and it needs to be performed. The following table presents the modifications to Method 5041A/8260B employed by our laboratory.

Requirement	**EPA Method 5041A/8260B**	**Modifications**
Batch Certification	Blanks from the same media as samples.	Analysis of set of cartridges prior to onset of any project; Sampling media provided by the client is batch certified ahead of time, only if client provides blank cartridges.
Method Blank	Cartridges from the same media batches as the samples.	Media batch is certified prior to use in the field. Method Blank is used to certify instrument is contaminant free.
Connection between cartridge thermal desorption apparatus & sample purge vessel.	PTFE 1/16" Teflon tubing.	Heated, 1/16" silica lined stainless steel tubing.
Calibration Criteria for non-CCCs.	RSD ≤15 % for all non-CCCs.	RSD ≤30 % for some compounds: Acetone, Bromoform, Vinyl Acetate, Bromomethane, Chloromethane, 1,1,2,2-Tetracholoroethane, & 1,2,3-Trichloropropane; for some non-5041A compounds (see attached Table)

Comment 6: Explain 8270C versus 8270D for analysis of semi-volatile organic compounds.

The COPC indicated Method 8270D for semi-volatile organic compound analysis. However, that method is only a proposed method EPA issued in 1998 that is being considered for inclusion in SW-846. 8270C is the currently approved SW-846 method for analysis.

Comment 7: Explain 1668A vs CARB 428 and 429 for the analysis of PCBs and PAHs.

The COPC indicated Methods 428 and 429 for the analysis of PCBs and PAHs, respectively. Both of these methods employ gas chromatography and either low or high resolution mass spectroscopy.

Lafarge intends to use Method 1668A for the PCB analyses and CARB Method 429 for the PAH analyses. Method 1668A employs gas chromatography with high resolution mass spectroscopy. Method 1668A is an approved EPA water method that has been successfully adapted for use to analyze stack emission samples.

Comment 8: Clarify HCN analysis: Will the results include all CN⁻ or only HCN?

As stated in response to Comment #1, HCN will be analyzed by CTM 0033 from the same (back) NaOH impingers as will be used to analyze for the Halogens by Method 26A. According to the method, HCN present in the stack gas stream reacts with NaOH to form a cyanide ion that is retained in the alkaline solution until analyzed by ion chromatography. The results are reported as "Total Cyanide as HCN". Particulate cyanide salts are retained on the filter, and are not analyzed during routine execution of the method.

Comment 9: Bis phenol A was added to the COPC but is not described in the test protocol.

Bis phenol A is not a target analyte in approved stack sampling trains. The U.S. National Toxicology Program does not consider bis phenol A as a carcinogen.

Comment 10: The COPC indicated that up to 25 of the largest TICs need to be identified and quantified in the semi-volatile train.

Lafarge will tentatively identify up to 25 of the largest TICs if they are present in each of the semivolatile samples. TICs will be identified by coupling Target™ software to the laboratory information management system (LIMS). Using a spectra library, the software checks the molecular ion and major ions in the tentative identification. TICs are searched using 20% of the height of the nearest unidentified internal standards. If the library search produces a match at or above 85%, that compound will be reported. Artifacts from the extraction and analysis process (e.g., siloxanes, CO_2, surrogates, and aldol condensation products) are removed from the TIC report. TIC concentrations are calculated using the height of the total ion chromatogram of the TIC, the height of the nearest internal standard, the amount of internal standard added. A response factor of 1 is assumed. Dilution and sample preparation factors are also incorporated into the calculation. The CAS number of the TIC will also be reported.

Comment 11: Additional sampling and analysis is required for PM10 during both baseline and plastic-derived fuel conditions to provide information that will be used to evaluate if the plant triggers Prevention of Significant Deterioration issues.

Lafarge will add a separate sampling train for Method 201A/202 to collect stack emission samples for the determination of PM_{10}. Lafarge will conduct this additional testing during baseline and PDF operating conditions.

Comment 12: Consider the use of an additional calibration gas that contains chlorine for the THC CEM to evaluate if chorine in the PDF fuel will decrease the monitor's sensitivity.

Lafarge acknowledges there is a potential for interference of a FID-based THC CEM from chlorine-containing hydrocarbons. However, the actual impact is not quantified and a calibration gas containing a suitable chlorine-containing hydrocarbon has not been identified. In addition, the preparation of such a calibration gas would require significant time to prepare and obtain.

The average chlorine concentration of the PDF is 1.0% and the proposed upper limit is 1.5%. However, there are other sources of chlorine in the kiln. Coal may contain chlorine at approximately 0.9%. The raw mix may contain approximately 0.01% chlorine. The larger feed rate of raw mix presents a similar mass of chlorine fed to the kiln even at the lower concentrations. Chlorine from these sources may also result in small emission quantities of chlorinated hydrocarbons. The presence of chlorine and chlorine-containing hydrocarbons therefore has the potential to induce an offset in the THC CEM in both the baseline and PDF testing conditions.

The purpose of the THC CEM is to generate relative data for some real-time comparison between baseline and PDF operations, and to establish a maximum PDF feed rate. Given that an offset may occur under both conditions, the utility of the THC CEM as an indicator of relative emissions is not diminished.

Based on previous THC CEM results to determine VOC emissions for the annual permit testing, the THC concentration is approximately 30- 50 ppm (total). Based on the Method 18 sampling and analysis conducted concurrently with the THC CEM, we have determined that methane and ethane comprise a significant fraction of the total THC content. We therefore expect that the potential level of individual chlorinated hydrocarbons to be in the low ppm range < 1 to < 10 ppm range. The exact level is not known, but we do not expect the concentration to cause a significant decrease in the FID response characteristics.

The response factor studies that have indicated potential problems with chlorinated hydrocarbons have historically been done with pure gases at significantly higher concentrations than we will experience in the kiln stack gas.

Comment 13: VOC emissions should be obtained to meet Plan Approval Condition 14. Use of a THC CEMs alone may overestimate VOC emissions.

Lafarge will add sampling and analysis by Method 18 to quantitate methane and ethane emissions. These emissions will be subtracted from the results obtained from the THC CEMs (Method 25A) to estimate VOC emissions. The Method 18 and 25A sampling will be performed as described in the January 2003 Test Protocol for the annual air permit testing for the kilns.

Comment 14: An example of all calculations for one test run per pollutant per source must be included in the final report. Sample equations are not considered actual calculations.

Lafarge will include a sample calculation in the final report.

Comment 15: Lafarge should conduct testing at both the baseline and PDF operating conditions at approximately the same time (i.e.: within a month).

Lafarge has reconsidered the existing testing schedule and agrees to perform the stack testing described in the test protocol, with the additions described in this letter, for both a baseline test condition and a test condition using the maximum expected PDF on Kiln 2 in during the first week of December 2003.

Lafarge plans to conduct the "feed rate optimization test" on Kiln 2 during the week of November 24, 2003 and to conduct the "feed rate optimization test" on Kiln 3 during the second week of December 2003. Lafarge intends to schedule the comprehensive emission testing for Kiln 3 for both the baseline and PDF test conditions in 2004. Lafarge will notify Pa DEP regarding a more specific schedule for the Kiln 3 testing when it is established.

Based on our understanding of the verbal and written comments received regarding the protocol, Lafarge assumes that the technical responses described in this letter resolve the technical issues. Lafarge therefore anticipates Pa DEP's approval for the test protocol so that we may perform the testing in the near future.

Sincerely,

Vince Martin
Environmental and Community Relations Manager
Whitehall Plant

c: Mr. Timothy Brooks, Pa DEP
Mr. Craig Evans, Pa DEP
Mr. Dave Baker, Pa DEP
Mr. Dan Packy, URS Corporation

Table 2-1. Sampling and Analytical Matrix

Parameter Measured	Sampling Method	Analytical Method	Laboratory Analysis
Flow	EPA Method 2	EPA Method 2	
Moisture	EPA Method 4	EPA Method 4	
PM	EPA Method 5 (combined with Method 26A)	EPA Method 5	Gravimetric
PM_{10} / CPM	EPA 201A/202	EPA 201A/202	Gravimetric
Metals	EPA Method 29	EPA Method 6010B/7470A	ICP and CVAAS
Hexavalent Chromium	SW-846 Method 0061	SW-846 Method 7199	IC/PCR
Volatile Organics	SW-846 Method 0030	SW-846 Method 5041/8260B	GC/MS
Semivolatile Organics	SW-846 Method 0010	SW-846 Method 8270C	GC/MS
Dioxins/Furans	EPA Method 23	SW-846 Method 8290	GC/MS
Polyaromatic Hydrocarbons (PAHs)	EPA Method 5 (mod) (combined with Method 23)	CARB Method 429	GC/MS
Polychlorinated Biphenyls (PCBs)	EPA Method 5 (mod) (combined with Method 23)	EPA Method 1668A	GC/MS
Hydrogen Halides / Halogens	EPA Method 26A	EPA Method 26A	IC
Hydrogen Cyanide	EPA Method 26A	CTM 033	IC

Notes:
1. SEM = scanning electron microscope
2. ICP = inductively coupled plasma emission spectroscopy
3. CVAAS = cold vapor atomic absorption spectroscopy
4. IC/PCR = Ion chromatography/post column-reactor
5. GC/MS = gas chromatography/mass spectrometry
6. IC= ion chromatography

Table 3-1. Instrument Sampling Matrix

Parameter Measured	Instrument	Test Method
THC	URS CEM	EPA Method 25A
Hydrocarbons	URS Gas Chromatograph	EPA Method 18
O_2/CO_2	URS CEM	EPA Method 3A
CO	URS CEM	EPA Method 10
NO_x	Plant installed CEM	EPA Method 7E
SO_2	Plant installed CEM	EPA Method 6C

Appendix A.3

PADEP Approval of Test Emission Protocol

Pennsylvania Department of Environmental Protection

Bethlehem District Office
4530 Bath Pike
Bethlehem, PA 18017

November 24, 2003

Bethlehem District Office

(610) 861-2070
FAX (610) 861-2072

Lafarge North America
5160 Main Street
Whitehall, PA 18052

Attention: Mr. Vince Martin
Environmental and Community Relations Manager

Gentlemen:

The Department of Environmental Protection, Air Quality Program, has completed its review of your November 13, 2003 request to conduct a test burn which would involve the substitution of a portion of the coal/coke fuel with plastic-derived fuel (PDF) for the Nos. 2 and 3 cement kilns at your Whitehall Plant located in Whitehall Township, Lehigh County. The test will consist of feeding the PDF into the front end of each kiln via a variable speed screw and educator at a rate between 1 ton per hour (20% coal/coke substitution) and 2.5 tons per hour (50% coal/coke substitution). The test burn for each kiln will occur for a 4-day test period. The test burn for the No 2 cement kiln is scheduled to begin on December 1, 2003. The test burn for the No. 3 cement kiln will be conducted at a date to be determined in early 2004.

The Department, hereby, grants its approval for the aforementioned test burn for each cement kiln. This approval is subject to the following conditions:

1. Source tests for particulate matter, SO_2, NO_X, CO, metals, hexavalent chromium, volatile organics (VOCs), semivolatile organics (SVOC's), dioxins/furans (PCDDs/PCDFs), polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), halides/halogens and hydrogen cyanide shall be conducted during the firing of the plastic-derived fuel. A baseline test for each kiln shall also be conducted for the above contaminants while firing coal, coke and tires as per normal operations. DEP-certified CEMS may be used in lieu of stack tests for SO_2 and NO_X. A temporary certified CEMS may be used in lieu of stack tests for CO. Specific test methodology approved in DEP's letter of November 24, 2003 shall be followed.

2. Source tests shall be conducted in accordance with Chapter 139 of the Rules and Regulations of the Department of Environmental Protection as per the Department's source testing procedures described in the latest Source Testing Manual and/or other source testing procedures.

3. The plastic-derived fuel can only be fired in each cement kiln during normal kiln operations.

4. This test burn is approved for <u>only</u> the plastic-derived fuel and <u>not</u> for any other fuel substitutions (i.e. waste oil, waste solvents, etc.).

5. Township and borough officials and/or representatives, including contractors, <u>must be</u> granted access to the plant site to observe the test burn.

Failure to comply with the above conditions will result in the termination of this test burn approval.

If you have any questions, please feel free to contact me.

Sincerely,

Thomas A. DiLazaro
Air Quality Program Manager
Air Quality Program

bas

CC: Whitehall Township
Borough of Northampton
Lehigh County
M. Carmon
T. DiLazaro
J. Epps

Pennsylvania Department of Environmental Protection

Rachel Carson State Office Building
P.O. Box 8468
Harrisburg, PA 17105-8468

November 24, 2003

717-783-9271

Bureau of Air Quality

Mr. Vince Martin
Lafarge North America-Whitehall Facility
5160 Main Street
Whitehall, PA 18052

Dear Mr. Martin:

The pre-test protocol submitted for the proposed baseline emission and trial burn for Kiln # 2 at Lafarge North America's Whitehall facility in Whitehall Township, Lehigh County has been referred to the Department for review and comment. Lafarge has contracted URS Corporation of Herndon, VA to conduct the test program while utilizing plastic derived fuel (PDF). URS has proposed conducting EPA Methods 1-4 (exhaust gas parameters), 5/26A (particulate/hydrogen halides/halogens/hydrogen cyanide), 10 (carbon monoxide), modified 5/23 (dioxins/furans/polyaromatic hydrocarbons/polychlorinated biphenyls), 29 (heavy metals), and 25A (total hydrocarbons) and Solid Waste Methods SW- 846 0010 (semi-volatile organics), 0030 (volatile organics), and 0061 (hexavalent chromium) in the stack breaching from Kiln #2 The protocol, as amended in the response letter dated November 21, 2003 from Vince Martin, Environmental and Community Relations Manager, Lafarge North America, to Thomas DiLazaro, Air Quality Program Manager, Northeast Regional Office is acceptable to the Department with the following understanding that:

- Comment 10 of the above referenced response letter is interpreted by the Department to state that up to 25 of the largest TICs will be identified for each test run.
- Lafarge's justification for exclusion of Solid Waste Method 0011 is acceptable to the Department.
- An amended protocol, complete with all agreed upon changes, shall be submitted to the Department prior to the actual commencement of the test program.

Final acceptance of the test report is contingent upon its meeting the above conditions and all the applicable requirements specified in 25 Pa. Code, Chapter 139; the Department's ***Source Testing Manual*** (Revision 3.3); and any stipulations specified in Permit No. TVOP-39-00011.

If you have any questions or require additional information, feel free to contact me at 717-783-9271.

Sincerely,

Timothy R. Brooks

Timothy R. Brooks, Chief
Source Testing Section
Division of Source Testing and Monitoring

Appendix A.4

PADEP Approval of ERG

"Richwine, Bryon"
<brichwine@state.pa.us>

12/19/2003 07:29 AM

To: <Steve_Falatko@urscorp.com>
cc:
Subject: RE: Lab for Lafarge Whitehall

Just for this test program. Candace Sorrell is currently discussing this situation with EPA personnel and as of yet has not come to a conclusion for future lab work at ERG were audits are involved.

Bryon M. Richwine
Quality Assurance Unit
Division of Source Testing and Monitoring
Phone No. 717-787-9483
Fax No. 717-772-2303

-----Original Message-----
From: Steve_Falatko@URSCorp.com [mailto:Steve_Falatko@URSCorp.com]
Sent: Thursday, December 18, 2003 4:20 PM
To: brichwine@state.pa.us
Cc: Dan_Packy@URSCorp.com
Subject: Lab for Lafarge Whitehall

Mr. Richwine:

This message serves to confirm your voice mail message to me on Wednesday, Dec 17 and it also establishes a record of the call. Please reply that you agree with the information.

PADEP is allowing Lafarge/URS to use the services of Eastern Research Group (ERG) of RTP, NC to analyze the Method 26A samples from the Dec 2003 testing as well as the audit sample supplied by PADEP. PADEP acknowledges that ERG prepared the audit samples and also realizes that ERG, under their EPA contract, is not permitted to analyze audit samples their company prepared. Based on telephone conversations and e-mail messages between PADEP and ERG personnel, the group at ERG that will analyze the samples is separate and distinct from the group at ERG that prepares audit samples. Furthermore, the information about audit samples is password protected, and only a couple of ERG personnel have access to this password, none of whom are members of the analysis group.

Please call or reply with any questions or comments.

Sincerely,

Steve Falatko

****
Stephen M. Falatko URS Corporation
Senior Chemist 13825 Sunrise Valley Drive #250
steve_falatko@urscorp.com Herndon, Virginia 20171-4672
703 / 713 - 6408 (direct) 703 / 713 - 1512 (fax)
****

Appendix A.5

Results of Source Testing Audit Samples

(Not included in this version)

Attachment C: Revised Electronic Copy of Initial Application

AttC 654-10-01 Applic FINALrev RAI#1.pdf

ATTACHMENT 1

TARMAC AMERICA, LLC

FACILITY ID: 0250020

APPLICATION FOR AIR CONSTRUCTION PERMIT AUTHORIZING ALTERNATIVE FUELS PROJECT

Regulatory Applicability Analysis

Background

The Florida Department of Environmental Protection (DEP) issued an air construction permit for the new Tarmac dry-process cement kiln in 2002 and it began operating in 2004. The Tarmac kiln is currently authorized through its air permits to use the following as fuels: bituminous coal, used oil, No. 6 oil, No. 2 oil, natural gas, and whole tires. To expand the types of fuels that may be used in the cement kiln, this air permit application requests the authority to add specific fuels listed in the Project Description, alone or in any combination.

The use of these fuels in the kiln has important co-benefits, including reduced greenhouse gas emissions through the use of biogenic materials in lieu of fossil fuels and by preventing the formation of methane in landfills; reduced environmental impacts associated with fossil fuel extraction, transportation, and usage (mining of coal, refining of petroleum, etc.); and reduced environmental impacts associated with landfill usage.

Federal

1. NSPS Subpart Eb (Large MWCs), 40 CFR 60.50b-60.59b – *Not Applicable*

Standards of Performance for Large Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996

NSPS Subpart Eb regulating large municipal waste combustors does not apply to cement kilns. The federal rules specifically provide as follows: "Cement kilns firing municipal solid waste are not subject to this subpart." 40 CFR 60.50b(p). Under this subpart, "municipal solid waste" is defined as:

> "... household, commercial/retail, and/or institutional waste. Household waste includes material discarded by single and multiple residential dwellings, hotels, motels, and other similar permanent or temporary housing establishments or facilities. Commercial/retail waste includes material discarded by stores, offices, restaurants, warehouses, non-manufacturing activities at industrial facilities, and other similar establishments or facilities. Institutional waste includes material discarded by schools, nonmedical waste discarded by hospitals, material discarded by nonmanufacturing activities at prisons and government facilities, and material discarded by other similar establishments or facilities. Household, commercial/retail, and institutional waste does not include used oil; sewage sludge; wood pallets; construction, renovation, and demolition wastes (which includes but is not limited to railroad ties and telephone poles); clean wood; industrial process or manufacturing wastes; medical waste; or motor vehicles (including motor vehicle parts or vehicle fluff). Household, commercial/retail, and institutional wastes include: (1) Yard waste; (2) Refuse-derived fuel; and (3) Motor vehicle maintenance materials limited to vehicle batteries and tires except as specified in s. 60.50b(g)."

The term "refuse-derived fuel" is in turn defined as "a type of municipal solid waste produced by processing municipal solid waste through shredding and size classification. This includes all classes of refuse-derived fuel including low-density fluff refuse-derived fuel through densified refuse-derived fuel and pelletized refuse-derived fuel." 40 CFR 60.51b.

The use of <u>any</u> materials considered to be municipal solid waste or refuse-derived fuel, consistent with the above definitions, may therefore be used in a cement kiln without subjecting the kiln to NSPS Subpart Eb. Because cement kilns using municipal solid waste and refuse-derived fuel are not subject to Subpart Eb, Tarmac's use of the proposed list of fuels in its kiln, even if the fuels would be considered municipal solid waste, would not trigger applicability of Subpart Eb.

2. <u>NSPS Subpart CCCC (2000 CISWI and 2011 New Unit CISWI)</u>, 40 CFR 60.2000-60.2265 – *Not Applicable*

Standards of Performance for Commercial and Industrial Solid Waste Incineration Units for Which Construction is Commenced After November 30, 1999 or for Which Modification or Reconstruction is Commenced on or After June 1, 2001

Cement kilns subject to the Cement MACT, like the Tarmac cement kiln, are exempt from the 2000 version of Subpart CCCC. The 2000 version of Subpart CCCC therefore does not apply. The 2011 version of Subpart CCCC applies only to <u>new</u> units (constructed after June 2010). Because the Tarmac cement kiln is considered an "existing" unit and is not considered a "new" unit for purposes of the 2011 version of Subpart CCCC, the 2011 version is not applicable even if solid waste were to be used as a fuel or an ingredient in the Tarmac cement kiln. The only exception would be if the kiln were to be "modified" or "reconstructed" after September 21, 2011.

EPA's rules for Commercial and Industrial Solid Waste Incineration (CISWI) Units were first promulgated on December 1, 2000 (60 Federal Register 75338), and in 2001 EPA granted a request for reconsideration and voluntarily remanded the rule, which the court granted without vacatur. This rule was never stayed and remains in effect. Subpart CCCC, as promulgated in 2000, specifically provides that <u>cement kilns</u> regulated under NESHAP 63 Subpart LLL, the Cement MACT, are *exempt* from compliance with the CISWI rules under Subpart CCCC. 40 CFR 60.2020(l). This exemption remains effective for compliance with the 2000 version of Subpart CCCC.

EPA subsequently revised the rules in 2005. Those revisions were then challenged, resulting in the D.C. Circuit Court of Appeals vacating and remanding the "CISWI definitions rule" in 2007. As a result of the 2007 remand, EPA revised Subpart CCCC this year (76 Federal Register 15704 (March 21, 2011)), and the new Subpart CCCC requirements become effective on May 20, 2011. EPA's preamble specifically provides that only "incinerators" and "small remote incinerators" remain subject to the standards in the 2000 Subpart CCCC rules. See 76 Federal Register 15711, col. 2. EPA states that CISWI units falling within other subcategories, including cement kilns, *"will not in any case"* be subject to the 2000 Subpart CCCC CISWI standards.

Under the new, 2011 version of Subpart CCCC, new, modified, reconstructed cement kilns will no longer be exempt from the CISWI rules. Paragraph (l) of 40 CFR 60.2020 that established the exemption from Subpart CCCC is now "reserved." Waste-burning cement kilns constructed prior to June 4, 2010, are not considered to be "new" units subject to the 2011 Subpart CCCC standards (unless they are subsequently modified or reconstructed). Waste-burning cement kilns constructed prior to June 4, 2010, are considered to be "existing" units subject to the 2011 version of NSPS Subpart DDDD (and not the 2000 or 2011 versions of Subpart CCCC). As explained in more detail below, if the Tarmac cement kiln were to use solid waste (not engineered or alternative fuels) in the future after Subpart DDDD becomes applicable and enforceable in Florida, then standards established pursuant to Subpart DDDD could apply (but not Subpart CCCC—unless the kiln is modified or reconstructed after September 21, 2011).

3. <u>NSPS Subpart DDDD (CISWI, Existing Units)</u>, 40 CFR 60.2500-60.2875 – *Not Applicable*

Emissions Guidelines (EG) and Compliance Times for Commercial and

Industrial Solid Waste Incineration Units

Under the 2000 version of Subpart DDDD, which is applicable in Florida, cement kilns are specifically exempt (along with 14 other source categories). The 2011 version of Subpart DDDD will not apply to waste-burning kilns in Florida until the Department of Environmental Protection undertakes a rulemaking to incorporate the provisions of Subpart DDDD into its rules, the Department submits a state plan to or seeks delegation from EPA, and EPA subsequently approves the plan or grants delegation. The new version of the rule, applicable to existing waste-burning kilns, does not apply directly to sources, and it is not anticipated that the requirements would be effective in Florida for at least two to five more years.

NSPS Subpart DDDD establishes "emission guidelines" and compliance schedules for the control of emissions from <u>existing</u> CISWI units. This NSPS does not establish standards that apply directly to emission units because "NSPS" standards are to be established for <u>new</u> units. Because Subpart DDDD is intended to apply to "existing" and not "new" units, the rules are considered "guidelines" for states. Unlike most NSPS standards, Subpart DDDD applies to state

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air quality programs instead of to emission units. A state may submit a request for delegation of Subpart DDDD or a state may develop its own "state plan" to implement Subpart DDDD. The rules require state plans to be submitted by March 21, 2012, for CISWI units other than incinerator units (e.g., waste-burning kilns) that commenced construction on or before June 4, 2010. 40 CFR 60.2524.

Regardless of whether a state develops its own plan or simply requests delegation by March 21, 2012, the deadline for compliance may not be later than March 21, 2016, or three years after the effective date of EPA's approval of the state plan, whichever occurs first. Because the 2011 version of Subpart DDDD was promulgated by EPA only within the last few weeks, the Florida Department of Environmental Protection (DEP) has not yet taken steps to develop a state plan or to seek delegation of Subpart DDDD, either of which would require notice and comment rulemaking under Chapter 120, Florida Statutes. The 2011 version of Subpart DDDD does not establish immediate and direct compliance requirements for non-incinerator CISWI units (like waste-burning kilns), so Subpart DDDD is not currently applicable to the Tarmac cement kiln, regardless of the fuels used. Further, units *not* using solid waste as a fuel will not be subject to Subpart DDDD now or in the future.

As stated above, the 2000 version of Subpart DDDD, which applies in Florida, exempts 15 different types of operations, including cement kilns. The Tarmac cement kiln is therefore not subject to this version of Subpart DDDD. Under the 2011 version of Subpart DDDD, waste-burning cement kilns that were constructed after November 30, 1999, and before June 4, 2010, will be required to comply with the standards and requirements for "existing units" established under Subpart DDDD – as implemented by the state. As long as the Tarmac cement kiln does not burn solid waste, it will not be subject to Subpart DDDD. If the Tarmac cement kiln were to begin using solid waste as a fuel, then Subpart DDDD (Table 8) could apply once Florida adopts the rules and its approved plan or delegation is in place. There is not currently a mechanism for applicability of the 2011 version of Subpart DDDD in Florida for waste-burning kilns, or a deadline for compliance with the applicable requirements under Subpart DDDD for waste-burning kilns. Until the Florida DEP completes a rulemaking to implement the 2011 version of Subpart DDDD through a state plan or delegation from EPA, and EPA has approved that plan or delegation, the provisions of the 2011 version of Subpart DDDD are not applicable to exiting CISWI waste-burning kilns in Florida regardless of the fuels being used. The Tarmac cement kiln is therefore not subject to Subpart DDDD at this time, regardless of the fuel it uses.

4. **Solid Waste Definition**: 40 CFR 241; Alternative Fuels Proposed for Tarmac's Cement Kiln are *not Solid Waste*

Non-Hazardous Discarded Materials That Are Solid Waste When Used as a Fuel or Ingredient

EPA recently promulgated new rules to be used when determining whether non-hazardous secondary materials are solid waste or not when used as fuels or ingredients in combustion units, including cement kilns. 40 CFR 241.3 (76 Federal Register 15456, March 21, 2011). The new rules provide that non-hazardous secondary material is *not* solid waste when combusted as a fuel or used as an ingredient if the material is sufficiently processed and it meets a "legitimacy" test. Under the legitimacy test, the processed material must be managed as a valuable commodity, storage of the material must not exceed reasonable time frames, and the material must be managed and adequately contained. In addition, the material must have a meaningful heating value if used as a fuel and must provide a useful contribution to the production or manufacturing process if used as an ingredient. Lastly, the material "must contain contaminants at levels comparable in concentrations to or lower than those in traditional fuels which the combustion unit is designed to burn." 40 CFR 241.3(d).

Under EPA's rules, a facility would either maintain records to demonstrate that any non-hazardous secondary materials used as a fuel or ingredient do not constitute solid waste, or a facility could seek a "non-waste determination" from the Regional EPA Administrator (e.g., Administrator of EPA Region IV) that a non-hazardous secondary material that is used as a fuel or ingredient is not a solid waste. Unless a facility seeks a formal determination, it would be required to maintain records to verify the sufficiency of the material processing and that the use of the material met the legitimacy test. Subpart CCCC (40 CFR 60.2740(v) provides that a facility burning materials other than traditional fuels "must keep records as to how the operations that produced the material satisfy the definitions of processing in s. 241.2." Alternatively, "[i]f the material received a non-waste determination pursuant to the petition process submitted under s. 241.3(c), you must keep a copy of the non-waste determination granted by EPA." EPA made it very clear in the preamble to the proposed definition of solid waste that facilities are to make self-determinations of whether a non-hazardous secondary material meets regulatory criteria *unless* a petition is submitted for an EPA determination. EPA believed that the self-implementing approach would "govern for the majority of situations." 75 Fed. Reg. 31860 (June 4, 2010). Facilities burning tires are likewise required to maintain records, including a certification that the tires are non-waste. This "certification" is to be signed by the owner or operator of the combustion unit, or by a responsible official of the established tire collection program." There is no requirement for EPA (or a state's) pre-approval or subsequent approval. 40 CFR 63.2175(w).

Similarly, at least for units subject to the Boiler MACT rules under 40 CFR 63 Subparts DDDDD or JJJJJJ, a facility's responsible official would need to certify that the units did not use any non-hazardous secondary materials as a fuel or ingredient that would constitute a solid waste. Even under the new Boiler MACT rules, there is no requirement for agency consent or authorization prior to using the materials as a fuels or ingredients, nor is there a requirement for submittal of all supporting documentation to the permitting agency for confirmation that the materials being used are not solid waste.

Florida has not yet incorporated by reference EPA's new rules establishing the test for determining whether non-hazardous secondary materials are solid waste for purposes of the air emission standards. Florida has also not revised its rules to establish any different requirements for submittal of information for determinations as to whether materials being used as a fuel or ingredient are solid waste or not. Additionally, EPA is retaining authority to make any *formal* non-waste determinations—this authority to make such determinations is not being delegated to the states.

On the same day that EPA published the new definition of solid waste, EPA also published a notice announcing its intention to reconsider portions of the new rules. The rules are therefore somewhat in a state of flux and could change prior to any applicable compliance deadlines. After the Florida DEP has completed a rulemaking to implement the 2011 version of NSPS Subpart DDDD, after EPA has either approved the state's plan or has delegated implementation of the 2011 version of Subpart DDDD to DEP, and after a compliance deadline has been formally established, it may be appropriate to confirm that the Tarmac cement kiln will not be using any non-hazardous secondary material as a fuel or ingredient that would be considered a solid waste. This could be done by a responsible official certification similar to that required under CISWI and the Boiler MACT. This certification would help ensure that all applicable requirements are appropriately identified in the Title V permit for the facility. Today, however, Subpart DDDD does not apply to the Tarmac cement kiln, and Tarmac would not be prohibited from using a material in its cement kiln that constitutes a non-hazardous solid waste.

5. **NESHAP 63 Subpart LLL (Cement MACT), 40 CFR 63.1340-63.1358 –** ***Applicable***

National Emission Standards for Hazardous Air Pollutants From the Portland Cement Manufacturing Industry

As set forth in Tarmac's Title V air operation permit, 40 CFR 63 Subpart LLL (commonly referred to as the Cement MACT) currently applies to the cement kiln, and new provisions based on revisions to the federal rule promulgated by EPA in 2010 will apply to the kiln beginning in 2013. (See 75 Federal Register 54970, September 9, 2010). The federal Cement MACT applies to all new and existing Portland cement plants at major and area sources, and the affected source includes the kiln. A "kiln" is defined under this rule to mean a device including the preheater and precalciner devices, and raw mills. The Cement MACT establishes emission limits that must be met, although it does not limit the types of materials that can be used in the kiln, other than clarification that if the kiln were to burn hazardous waste, it would be subject to and regulated under Subpart EEE instead of Subpart LLL.[1] The Tarmac cement kiln has not in the past and there is no intention in the future for the kiln to use "hazardous waste" as a fuel, so Subpart LLL and not Subpart EEE would apply. Again, Subpart LLL establishes emission limits and does not prohibit the use of non-hazardous discarded materials, municipal solid waste, refuse-derived waste, or any other form of solid waste as a fuel. As stated above, the use of solid waste does not at this time trigger any other NSPS or NESHAP standards. The Cement MACT controls. The Cement MACT requirements apply to the Tarmac kiln, and these requirements are already established in the current Title V permit.

State

Rule 62-296.407, F.A.C., applies to Portland cement plants. The emission limit established for "new" cement plant kilns is 0.3 pounds of particulate matter per ton of feed to the kiln. The limit established for clinker coolers within a new cement plant is 0.1 pounds of particulate matter per ton of feed to the kiln. The Tarmac kiln would be considered a new cement plant, so this standard would apply. The more stringent particulate matter emission standard of 0.063 pounds per ton of feed established under the Tarmac Title V permit, however, ensures that these emission limits set forth in Rule 62-296.407 are achieved.

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[1] Subpart LLL addresses the use of fly ash a fuel but does not prohibit its use. Under 40 CFR 63.1346(f), the mercury content of fly ash may be restricted to ensure that mercury levels do not increase above baseline levels. Subpart LLL does not restrict any other type of fuel.

Local

The Miami-Dade County Code does not specifically regulate Portland cement kilns.

DESCRIPTION OF PROPOSED PROJECT

DESCRIPTION OF PROPOSED PROJECT

INTRODUCTION

Tarmac America, LLC (Tarmac) owns and operates a cement plant located in Miami, Florida, designated as the Pennsuco Cement Plant. The cement plant consists of one dry-process kiln with preheater, precalciner, and clinker cooler capable of producing 2,190,000 tons per year (TPY) of clinker. The Department of Environmental Protection (DEP) issued an air construction permit for the new Tarmac dry-process cement kiln in 2002 and it began operating in 2004. The facility is currently permitted to utilize bituminous coal, used oil, No. 6 oil, No. 2 fuel oil, natural gas, and whole tires. The Tarmac kiln is currently authorized through Title V its current air permit to process and inject the following fuels: bituminous coal, used oil, No. 6 oil, No. 2 oil, natural gas, and whole tires. To expand the types of fuels that may be used in the cement kiln, this air permit application requests the authority to process and inject in the calciner and main burner of the kiln for the following fuels, alone or in any combination:

Deleted: back-end

- Coal, non-specific
- Engineered fuel
- Tire-derived fuel (including tire fluff)
- Agricultural film
- Agricultural Byproducts
- Carpet-derived fuel
- Clean cellulosic biomass
- Other cellulosic biomass
- Shingles, manufacturer rejects
- Pre-consumer paper

The equipment to process and inject these fuels is requested through this permit. In addition, PSD analysis of each fuel is provided as reasonable assurance that use of these fuels does not result in a significant net emissions increase. Subsequent to construction of the injection system and processing equipment, Tarmac will comply to annual review of emissions per, rule 62-212.300(1)(e), F.A.C. As discussed in the regulatory analysis, this permit will assure compliance to all federal, state, and local regulations.

This application does not request for an increase in either production or operation limits. During this construction permit, the Pennsuco Cement Plant shall operate under and at all times within the constraints specified by its existing operation permit (0250020-026-AV). If the co-firing of any material results in emissions exceeding current permit limits, co-firing shall cease immediately.

Tarmac believes this project is beneficial to the operation of the facility, as well as to the State of Florida for the following reasons:

1. Increase in the availability and stability of energy sources through the use of locally generated, processed, and transported energy sources in comparison to conventional fuels (i.e., coal which is transported from around the world).
2. Promotion of related recycling business activities (i.e., employment, taxable income) in the State.
3. Reduction of greenhouse gas emissions by re-using and reducing landfilled biogenic material, reducing source material transportation, and reducing methane emissions from landfilled materials.
4. Increase in the demand for recovered materials, which encourages an increase in processing versus landfilling. This matches the goals of the State efforts to increase waste diversion for re-use or recycling,[2]
5. Promotion of a more diverse energy supply.

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[2] http://www.dep.state.fl.us/waste/recyclinggoal75/default.htm (last visited April 18. 2011)

While these materials may be considered recovered or byproduct by some, they have the capacity to deliver significant heating value. Efficient thermal combustion in a cement kiln can provide an alternative use for the material heat content, as well as supplying a component to the cement making process when noncombustible material (e.g., sand/silica) is introduced into the kiln. The use of alternative materials in cement production will eliminate a substantial amount of landfilled waste, as well as reduce environmental taxes associated with the cement industry through mining, transport, and the use of fossil fuels. Similarly, when this waste is oxidized as fuel in a combustion environment, greenhouse gas emissions are effectively reduced when compared to the landfill process, which generates methane as a byproduct of anaerobic decomposition. The greenhouse gas potential of methane is 21 times greater than that of the carbon dioxide produced during combustion. A significant recent EPA-funded study indicates the environmental air emissions benefits of waste combustion compared to landfilling with gas reclamation[3].

Tarmac views its effort to promote the beneficial use of these recovered materials in cement production to be in concert with the guidance of the EPA[4] and European IPPC Bureau[5] The World Business Council for Sustainable Development lists the United States as 13 in the list of countries replacing conventional fuels with alternative fuels including countries such as Germany and Switzerland[6]. In 2009, German cement plants replaced conventional fuels with alternative fuels on the average by 58 percent[7]. The attached CD includes a number of studies and presentation information of activities around the world of the use of alternative fuels in cement kilns.

Each of these fuels are discussed below for comparative emissions for PSD analysis. Because the PSD analysis will be verified by an annual review per rule 62-212.300(1)(e), F.A.C., these fuels should not

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[3] Rosenthal, E. *Europe Finds Clean Energy in Trash, but U.S. Lags*. 2011 [cited 2011 3/10/2011]; Available from: http://www.nytimes.com/2010/04/13/science/earth/13trash.html?_r=1

[4] International, I. *Trends in Beneficial Use of Alternative Fuels and Raw Materials*. 2008; Available from: http://www.epa.gov/sectors/pdf/cement-sector-report.pdf.

[5] Cement, Lime and Magnesium Oxide Manufacturing Facilities, May 2010, Table 4.16, http://eippcb.jrc.ec.europa.eu

[6] Development, W.B.C.f.S., *Guidelines for the Selection and Use of Fuels and Raw Materials in the Cement Manufacturing Process*, 2005, http://www.wbcsd.org/DocRoot/Vjft3qGjo1v6HREH7jM6/tf2-guidelines.pdf (last visited April 2, 2011)

[7] Verein Deutsche Zementindustrie, Environmental Data of the German Cement Industry 2009, http://www.vdz-online.de/uploads/media/Environmental_data_2009.pdf (last visited April 2, 2011)

require for air permitting purposes a test burn. The permit application is based on an analysis that compares baseline actual emissions with projected actual emissions and avoids the requirements of subsection 62-212.400(4) through (12), F.A.C.. Tarmac will be subject to the following monitoring, reporting and recordkeeping provisions.

a. The permittee shall monitor the emissions of any PSD pollutant that the Department identifies could increase as a result of the construction or modification and that is emitted by any emissions unit that could be affected; and, using the most reliable information available, calculate and maintain a record of the annual emissions, in tons per year on a calendar year basis, for a period of 5 years following resumption of regular operations after the change. Emissions shall be computed in accordance with the provisions in Rule 62-210.370, F.A.C.

b. The permittee shall report to the Department within 60 days after the end of each calendar year during the trial period setting out the unit's annual emissions during the calendar year that preceded submission of the report. The report shall contain the following:
   1) The name, address and telephone number of the owner or operator of the major stationary source;
   2) The annual emissions calculations pursuant to the provisions of 62-210.370, F.A.C., which are provided in Appendix C of this permit;
   3) If the emissions differ from the preconstruction projection, an explanation as to why there is a difference; and
   4) Any other information that the owner or operator wishes to include in the report.

c. The information required to be documented and maintained pursuant to subparagraphs 62-212.300(1)(e)1 and 2, F.A.C., shall be submitted to the Department, which shall make it available for review to the general public.

For this project, Tarmac requests that the permit require the annual reporting of actual emissions from the cement kiln for the following pollutants: CO, NOx reported as NO_2, SO_2 based on data from the existing CEMS; VOC based on data from the existing THC monitor; mercury (Hg) based on material balance; and PM based on stack test data.

Tarmac proposes that the proposed fuels acceptance criteria not be based on a specific fuel vendor or geographic location but on the merits of the fuel to comply to air permitting regulations. These pollutants are addressed below in separate sections for each material.

It should be noted that regarding air pollutant emission of organic compounds the EPA has repeatedly determined that high temperature and long residence times of cement kilns provided an optimum method of organic chemical destruction into benign, primary combustion by-products (e.g., CO_2, H_2O).

The NESHAP addressed concerns of metal emissions from cement kilns by use of particulate matter as a surrogate for metals. Tarmac's current PM limit is equal to that of the recently revised NESHAP, subpart LLL which is not applicable until 2013.

QUALITY CEMENT PRODUCTION AND AIR EMISSIONS

Coal and pet coke comprise over 85 percent of the fuels used currently in the U.S. cement industry[8]. Coal and pet coke are historically the fuels of choice, not for cost, but primarily for predictable fuel combustion properties. Alternative fuels that are out of balance to the chemistry of the kiln system, can cause significant physical damage to the kiln. For example, highly variable heat content and fuel mass flow can cause local overheating and redox reactions. The potential for increased thermal stresses in the kiln can damage the anchor and furnace shell. Variable alkali, chlorine, or sulfur content of a fuel can cause kiln refractory damage and possibly alkali bursting. As well, the mechanical behavior of particle size of fuels plays an important role in thermal distribution that must be considered.

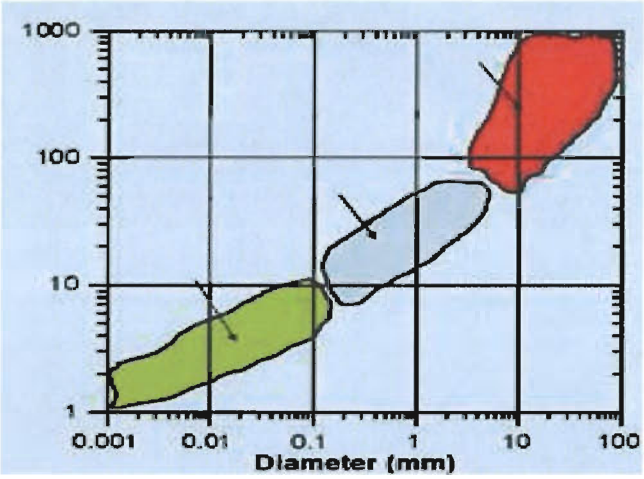

Figure 1. Burnout time (seconds) versus fuel particle size (mm)

Source: http://www.flsmidth.com/~/media/Brochures/Brochures%20for%20kilns%20and%20firing/AlternativeFuel.ashx

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[8] International, I. *Trends in Beneficial Use of Alternative Fuels and Raw Materials*. 2008; Available from: http://www.epa.gov/sectors/pdf/cement-sector-report.pdf.

Clearly, as the percent of fuel substitution increases, the specifications of the alternative fuel must be tighter. If the fuel has highly variably properties, the cement product can be ruined and the value of both cement and fuel is worthless.

In summary, a kiln functions to make cement, not to burn fuel.

The discussion above of the optimum burning regime and the effect of coal ash clearly shows the need to use a fuel that has constant and controllable composition and characteristics.

TRANSPORT, HANDLING, STORAGE, PROCESSING AND INJECTION

All materials will be transported to the facility by covered truck and stored in trailers or under cover on top of a paved or compacted clay surface. The materials will be supplied to the facility in a manner suitable for mechanical and/or pneumatic injection into the pyroprocessing system through a feeding system that includes both pneumatic and mechanical systems at the base of the precalciner tower. Mechanically transported materials will be moved by automated conveyance from storage to a hopper which feeds the injection system through an enclosed bucket elevator, crossing a weigh belt before being injected into the precalciner. Pneumatically transported materials will be fed from the dump hopper into a weigh Shenck feeder system, and then be pneumatically blown through an eight inch pipe into the calciner. The design capacity of both systems is expected to be 15 tons/hour.

Dust suppression, as needed, will consist of water sprays. Any stored material having nuisance odors will be removed from the site. Emissions from on-site material transport, storage, handling and processing are provided in Table 1.

A quantity of 200,000 tons of fuel is estimated to be conservative amount to be transported to the site annually. Grinding of any fuel materials is not expected to be needed as the fuel supplier will be required to deliver sized materials. However, Tarmac wants the option to grind, if needed, fuel materials on site. This option will allow fuels such as woody biomass to be further processed if a batch of material affects (e.g., clogging) the handling system. To remove the material and grind off-site wastes the time and effort to size on site. As well, the material will lose heat value through natural degradation as the material remains in storage and unburned. Tarmac sees the onsite processing as a logical option to deal with materials than need to be resized. As such, Tarmac limits the grinding to less than 75,000 tons per year. The resulting emissions from the grinding operations are below five tons for each pollutant allowing this operation to be an unregulated emissions unit.

TABLE [illegible]. FUGITIVE EMISSIONS ESTIMATE – TRANSPORT, STORAGE, HANDLING, AND PROCESSING

Step	Action/Task	Unit of Measurement	% of Total Throughput	PM Emission Factor	PM_{10} Emission Factor	PM Emissions	PM_{10} Emission Factor
1	Material Transport to Piles^{a,d}	9,333 miles	100%	0.524 lb/VMT	0.524 lb/VMT	2.45 tons	2.45 tons
2	Store in Covered Pile	200,000 tons	100%	*negligible, stored under cover*			
3	Material Loading to Grinding Hopper by Frontend Loader	200,000 tons	100%	8.74E-05 lb/ton	4.13E-05 lb/ton	8.74E-03 tons	4.13E-03 tons
4	Grinder^{b}	200,000 tons	100%	0.0012 lb/ton	0.00054 lb/ton	0.12 lb/ton	0.054 lb/ton
5	Screening^{b}	200,000 tons	100%	0.0001 lb/ton	0.000046 lb/ton	0.014 lb/ton	0.0046 lb/ton
6	Material Transport to Injection System^{a,d}	1,333 miles	100%	0.524 lb/VMT	0.524 lb/VMT	0.35 tons	0.35 tons
7	Material Loaded into Pneumatic Hopper^{b}	200,000 tons	100%	0.0001 lb/ton	0.0001 lb/ton	0.010 tons	0.010 tons
8	Pneumatic Transport to Calciner	200,000 tons	100%	*negligible, fully enclosed*			
					Total:	2.95 tons	2.87 tons

Source	Hours	SO_2 Emission Factor^{c}	NO_x and NMHC Emission Factor^{c}	CO Emission Factor^{c}	SO_2 Emissions	NO_x and NMHC Emissions	CO Emissions
Grinder Engine (630 HP Engine, 75,000 at 50 ton/hr)	1,500 hours	0.929 gr/bhp.hr	3.0 gr/bhp.hr	3.7 gr/bhp.hr	0.9228 lb/ton	3.0298 lb/ton	3.6755 lb/ton
Screen Engine (100 HP Engine, 75,000 at 50 ton/hr)	1,500 hours	0.929 gr/bhp.hr	3.0 gr/bhp.hr	2.6 gr/bhp.hr	0.1538 lb/ton	0.4967 lb/ton	0.4305 lb/ton

Sample Calculations:	
Step 1	$\frac{1.4\ miles}{trip^{d}} x \frac{trip^{d}}{15\ tons} x\ 200{,}000\ tons\ alt\ fuel = 9{,}333\ miles$
Step 6	$\frac{0.1\ miles}{trip} x \frac{trip}{15\ tons} x\ 200{,}000\ tons = 1{,}333 miles$
a.	$E = \left[k\left(\frac{sL}{2}\right)^{0.65}\left(\frac{W}{3}\right)^{1.5} - C\right] x\ (1 - \frac{P}{4N})$ where from AP-42 and references, k=0.082, sL=0.4, W=22, C=0.00047, p=120, N=1 $E = \left[k\left(\frac{0.4}{2}\right)^{0.65}\left(\frac{22}{3}\right)^{1.5} - 0.00047\right] x\ (1 - \frac{120}{4}) = 0.524$

a. Potential PM emissions from truck traffic from paved roads are calculated based on AP-42 factors in 13.2.1-1 and -2 and calculation a. above

b. Emission factors of screening, crushing, and conveying based on AP-42 Table 11.19.2-2. Alternate fuel PM factors assumed to have similar emissions to aggregate operation. Uncontrolled emission factors are used.

c. Schenk Shredder, shredding at minimum of 50 tn/hr of biomass having diesel engine maximum size 630 (grinder) and 100 (screen) horse power. Total shredding requires 1400 hours. 100 and 630 HP Tier 3 engine emission factors stated below. SO2 EF based on AP-42, 3.3-1 emission factor = 0.929gr/bhp*hr-SOx.

d. Trip: route from plant entrance to storage piles

Engine Power	Tier	Year	CO	HC	NMHC+NOx	NOx	PM
(100 ≤ hp < 175)	Tier 2	2003	3.70	-	4.90	-	0.22
	Tier 3	2007	3.70	-	3.00	-	†
(600 ≤ hp < 750)	Tier 2	2002	2.60	-	4.80	-	0.15
	Tier 3	2006	2.60	-	3.00	-	†

Tarmac is investing significant capital into this enclosed permanent mechanical feeder system. The system has an expected design capacity of 15 tons per hour dependent on factors such as material viscosity and density. The time frame for completing the capital budgeting process (following issuance of the air construction permit), engineering and design, equipment procurement process, obtaining the necessary building permits, and constructing the equipment will take approximately twelve to eighteen months to complete. Following completion of equipment installation, Tarmac will begin to introduce each of the various alternative fuels over the next twelve to eighteen months. Tarmac therefore requests a three-year construction permit for this project.

Figure 2 shows the proposed enclosed mechanical feeder system. Figure 3 shows the proposed pneumatic system. Figure 4 shows the location where storage will be located.

The primary burner modification is planned to occur in the next 12 months. The burner system will include not only a burner modification but the handling and injection system for the burner. The burner under consideration are similar to those seen in Figure 1b below . Given the design of the kiln system by FL Shmidth, the process to determine the handling, injection and burner design will include FLS. As the system is formalized, details of the system will be provided for review. As such, the design of the burner will not be such that increased production will be allowed. The kiln system production capacity is not limited by the burner such that construction of the burner will not de-bottleneck the system.

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Figure 1 b. Multi-fuel Primary burner.

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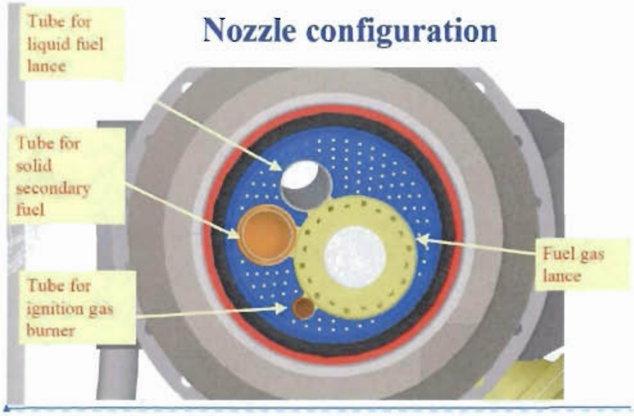

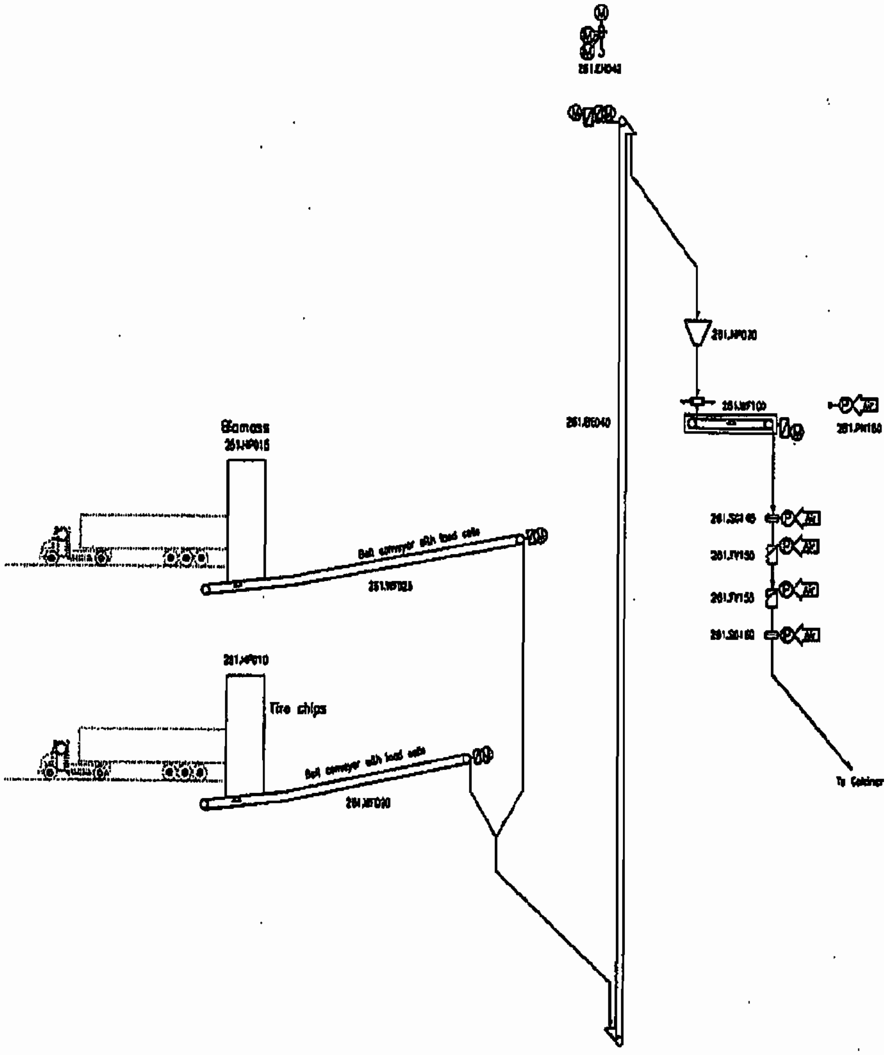

FIGURE 2. MECHANICAL FEEDER SYSTEM.

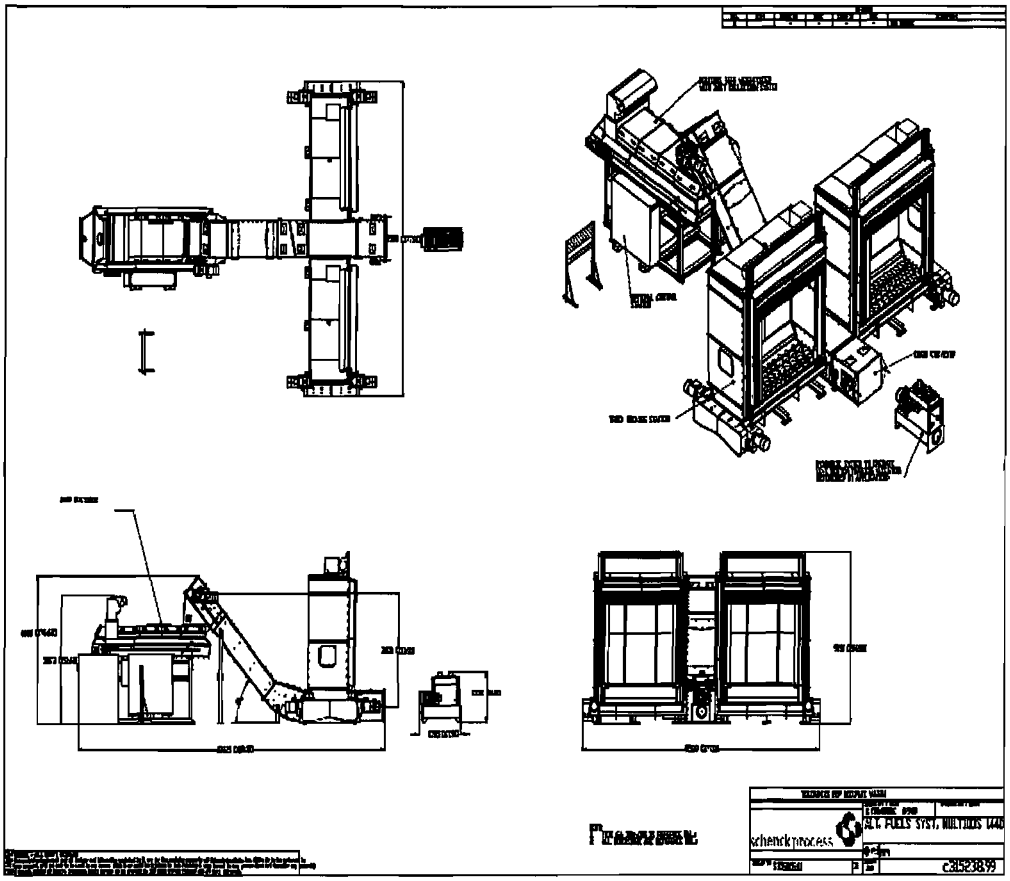

FIGURE 3. PNEUMATIC FEEDER SYSTEM.

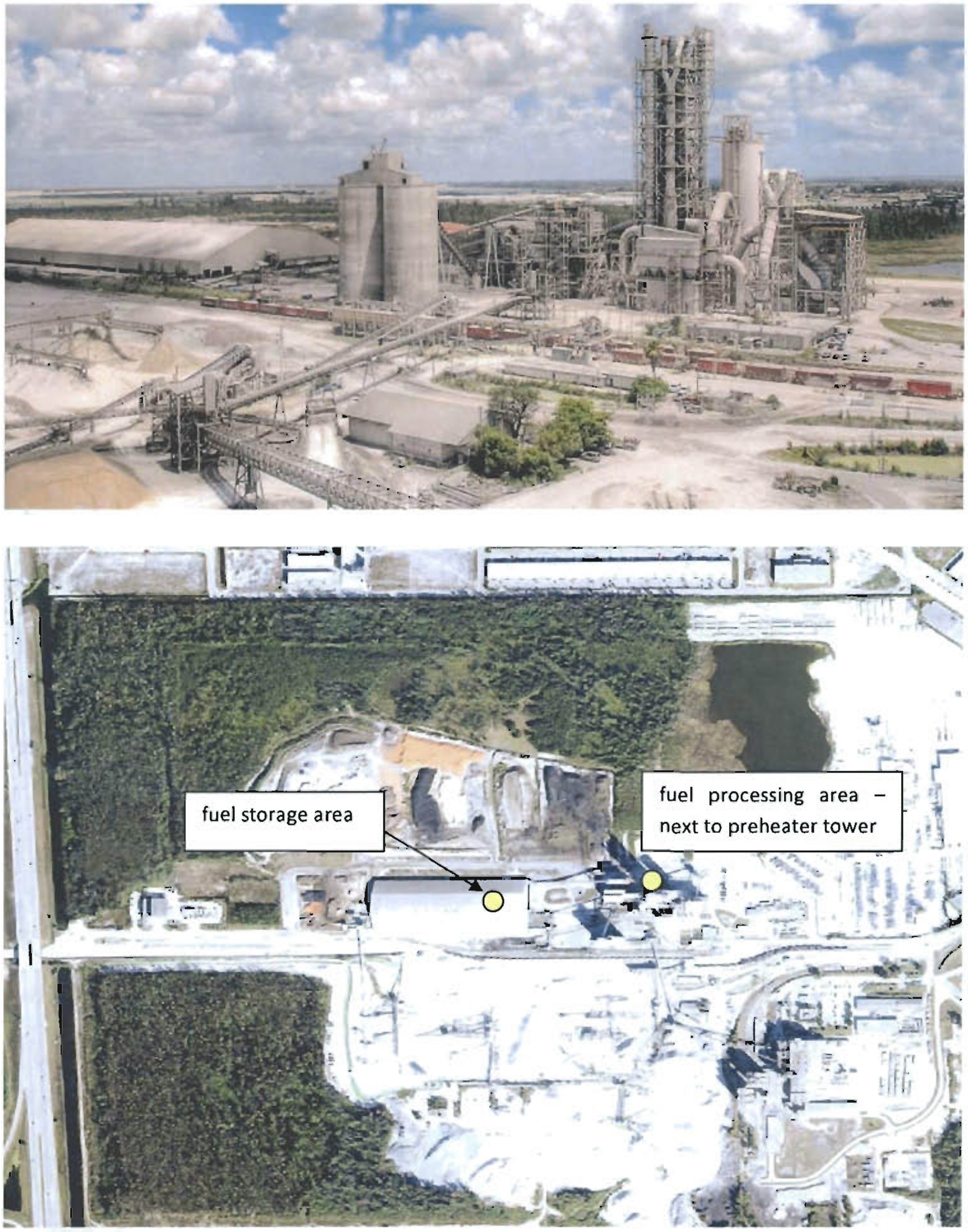

Figure 4. Location of the processing area next to the Kiln precalciner.

BEST MANAGEMENT PRACTICES

The following best management practices are proposed for the use the fuels at the Pennsuco Cement Plant.

BEST MANAGEMENT PRACTICES (BMP) PLAN FOR MINIMIZATION OF FUGITIVE DUST, PILE MANAGEMENT, AND FIRE PREVENTION

Practice	Description
Minimization of Fugitive Dust	1) Drop points to storage areas shall be designed to minimize the overall exposed (or exposed to the atmosphere) drop height 2) Periodic equipment maintenance shall be performed to maintain offloading locations and associated drop point integrity. Appropriate plant records shall be maintained on transportation equipment maintenance performed. 3) Daily observations of the off/up-loading and transportation and associated drop point integrity to identify any equipment abnormalities 4) Plant personnel shall be trained on identification of warning signs for potential equipment malfunction 5) Signs shall be posted identifying potential warning signs of equipment malfunction 6) Plant personnel shall visually observe truck offloading operations and if excessive fugitive dust is detected appropriate fugitive dust minimization techniques shall be implemented including water spray. Plant personnel shall be trained on procedures for defining and minimizing excessive dust from the truck unloading operations.
Storage Pile Management	1) Storage areas shall be managed to avoid excessive wind erosion. The material will be stored in the proposed storage area, only, which is covered and protected from wind 2) Mechanical moving by front end loaders and other supporting equipment shall be minimized on high wind event days. 3) Daily visual observations of the storage area shall be performed and if conditions are right for fugitive dust formation, procedures from the fugitive dust plan shall be implemented including water spray

Fire Prevention/ Spontaneous Combustion Minimization	1) The current Emergency Response Plan includes: a. Requirement to train onsite personnel to handle incipient fires and training on the identification of potential fire hazards; and b. Install and maintain equipment for plant personnel to handle incipient fires 2) Daily observations of the storage area shall be performed by plant personnel to identify potential fire hazards. Plant personnel shall be trained on identification of potential fire hazards. 3) Compaction of recovered materials in the storage areas shall be minimized
Quality Assurance	1) The materials will be delivered to the Plant in vehicles designed to prevent release 2) For each shipment of material, the permittee shall record the date, quantity and a description of the material received. 3) The permittee shall inspect each shipment of material. If the permittee identifies any such material that is not the expected material, the material shall be rejected and returned to the supplier. Rejected materials shall be moved off site in a logistically reasonable time period. 4) The permittee shall maintain records of rejected shipments and disposition thereof. Such records shall be made available to the Department upon request.

MONITORING AND TESTING

Emissions monitoring for each material tested shall consist of the following monitoring and stack testing:

- NO_x – CEM Data (PSD pollutant)
- SO_2 – CEM Data (PSD pollutant)
- VOC (as THC) – CEM Data (PSD pollutant)
- Opacity – COM Data (surrogate for HAP per NESHAP subpart LLL)
- PM – EPA Method 5 (PSD pollutant)
- CO – CEM Data(PSD pollutant)
- Hg – Materials Balance (HAP per NESHAP subpart LLL)

Submittal of all stack test reports will be provided in a timely manner as required by rule.

PSD ANALYSIS - ESTIMATED EMISSIONS

It should be stressed that while emission estimates are addressed, the Pennsuco Cement Plant will not exceed any current permit limit. Furthermore, in comparison to combustion for raw power production, Tarmac must create a salable product using the combustion process. As such, the combustion must be well controlled and predictable. Upsets or erratic behavior in combustion not only affect emissions, which is of concern to Tarmac, additionally the created product can easily be ruined. The air construction permit should include a note recognizing a shakedown period of 90/180 days (i.e., within 90 days of reaching maximum production or within 180 days after construction is completed) for each fuel. We believe that the shakedown period is for each fuel type because the handling and injection system operation depends on the type of fuel input. For example, the pneumatic injection system will vary depending on the type of fuel, its moisture, its viscosity, its "burnability". As well, each fuel may clog, corrode or affect the handling and injection system differently. So the shakedown period functions to allow the handling and injection system to be functional with each fuel type not just the system being able to be turned off and on.

Estimated emissions are addressed in the following sections for each material. Baseline emissions are calculated in detail for the baseline fuel, which is coal, using the hierarchy of data per 62-210.370, F.A.C. The coal emission factors for NO_x, SO_2, CO and THC (as VOC) are based on facility CEMs data. Emission factor of PM is based on the rolling average of stack tests performed for up to five year averages. Note that the facility commenced full operation of the new dry process kiln in 2004. Therefore, the emissions data for baseline is based on 2005 and forward years. The summary indicates that estimated emissions for any or all fuels should not exceed the values of PSD applicability thresholds.

Notwithstanding the calculation of estimated emissions, the following discussion is provided on current methods to control pollutant emissions applied at the Pennsuco Cement Plant.

In particular, mercury and lead emissions are discussed for a basis to not include these two compounds in the PSD analysis due to the limit (mercury limited to 229 lb/yr) and stack tested emissions of lead.

CARBON MONOXIDE EMISSIONS

Carbon Monoxide (CO) emissions are not expected to increase since they can be controlled through the process to complete combustion. Tarmac will closely monitor the combustion of all fuel materials to ensure there is no partial combustion which could create CO emissions, as well as other constituents. The Pennsuco Cement Plant is designed for the use of alternate fuels with reduced volatile content and a large partial sizing by having the addition of a separate calciner chamber. This separate calciner chamber is referred to as a Combustion Chamber. The Combustion Chamber allows for the introduction of alternative fuels along with kiln feed, tertiary air (ambient air/combustion air) and mixing with other fuels (fine coal) to insure proper ignition with retention in a high temperature atmosphere to initiate combustion of the alternate fuel.

In addition, the preheater is designed to extend retention time to provide long residence time at high temperatures to complete the combustion process. Tarmac will closely monitor the volatile content and particle sizing of the processed fuels along with the combustion characteristics of the preheater/calciner to insure proper combustion of all fuel. Currently, the Pennsuco Cement Plant operates with an oxygen rich combustion environment through the calciner and preheater assisting in the combustion process. Tarmac monitors CO with continuous emissions monitoring to insure compliance and proper combustion. Proper combustion will be maintained through process controls such as changes in the location of the introduction of tertiary air, increases in process draft and oxygen content through the process, changes in fine coal feed rates into the Combustion Chamber, and/or changes in the kiln feed rates.

Through testing and monitoring of the recovered materials prior to introduction and with combustion characteristics monitoring and process adjustments, Tarmac will be able to ensure proper and complete combustion of the alternate fuel with no generation of constituents of partial combustion, such as CO.

NITROGEN OXIDE EMISSIONS

Nitrogen Oxide (NO_x) emissions are not expected to change since they can be controlled by adjustments to the multistage combustion system timing, and fuel input rates.

DIOXIN/FURANS EMISSIONS

Emissions of dioxin/furans (D/F) are not expected to change when using these alternate fuels due to the formation of D/F as a function of exhaust gas residence time and particulate matter loading when at a temperature range of 700°F to 400°F, which is independent of the fuel type. FDEP states in the technical evaluation for draft permit 0530021-031-AC,

> "At high temperatures and sufficient residence times, dioxins/furans can be destroyed. Pre-heater/pre-calciner kilns like that at the Brooksville South Cement Plant have high temperatures and sufficient retention times to destroy these organic compounds. The preheater/calciner design rapidly cools the exhaust gases, which prevents dioxin/furans from reforming."

Tarmac operates a pre-heater/pre-calciner kiln. Through the Portland cement NESHAP (40 CFR 63 subpart LLL), EPA restricts the inlet temperature to the baghouse to a limit that is established during emissions testing for D/F. At Tarmac, based on the most recent emissions test for D/F the baghouse inlet temperature is now restricted to a temperature of 241.2 degree F when the raw mill is up and 421.1 degree F when the raw mill is down. Tarmac has shown compliance s to the D/F standard (described below) since it was established by EPA.

0.4 nanograms (toxic equivalent) per dry standard cubic meter (corrected to 7% O_2) – when the temperature at baghouse inlet 400 degree F or less

0.2 nanograms (toxic equivalent) per dry standard cubic meter (corrected to 7% O_2) – when the temperature at baghouse inlet greater than 400 degree F.

PARTICULATE MATTER EMISSIONS

The efficiency of a baghouse is related to the particulate loading. The impact of possible increased loading is to increase efficiency of particulate matter capture in the baghouse. The fuel type ash content impact on particulate matter loading is minimal (less than 10 percent of the total mass loading to the baghouse) given most of the particulate matter originates from the raw materials. As such the impact of PM emissions from fuel is expected to be limited. For example, the raw material particulate loading to the baghouse is about 8 percent of the raw material input (425 raw material input = 34 tons of dust per hour). Particulate matter from fuel ash is based on fuel. Coal input for maximum production is 23 tons per hour. The ash content of coal is typically 10 percent . So the fuel ash dust loading to the baghouse is 2.3 tons per hours. Therefore, the fraction of fuel ash to total dust is 6.3 percent of the total dust loading to the baghouse. Assuming a scenario of an alternative fuel replacing half the coal input, having half the heat content and twice the ash content, the portion of fuel ash from 6.3 percent to 14.4 percent.

Collaborative studies by EPA show that with competent test teams, the within-team Relative Standard Deviation (RSD) of a Method 5 test was 10.4 percent and the between-team RSD was 12.1 percent[9]. More recently, ASME reported that the RSD is from 5 to 11% and the accuracy of a Method 5 test (the departure of the average of three test runs from the true stack gas concentration) should be less than 14.7 percent[10].

Given that the precision and accuracy of one standard deviation of Method 5 test results are in the range of approximately 10-15 percent of the emission rate being measured, the impact of the fuel ash content should be within the measurement error of Method 5 and should not result in a measurable increase.

MERCURY EMISSIONS

The current permitted limit of 229 pounds per year. The PSD threshold is 200 pound per year. The current amount of mercury input for 2010 is 0.00132 lb Hg/ton clinker resulting in 94 pounds of mercury for production of 712,691 tons of clinker in 2010. Therefore, the PSD analysis for each material does not include mercury.

LEAD EMISSIONS

Stack testing in 2009 showed by EPA method 29 that lead emissions are (0.00207 lb/hr) 7 pounds per year for production of 3248 hours. The contribution of lead is from raw materials and fuels. The lead

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[9] Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III. Stationary sources Specific Methods. Section 3.16 EPA/600/4-77/027b.

[10] Lanier, S.; Hendricks, C. Reference Method Accuracy and Precision (ReMAP): Phase I. February 2001. ASME International.

content of limestone (85 percent or more of raw materials) is typically 3 ppm[11] and the typical content of coal is 10 ppm (Kentucky coal)[12]. Therefore the input from raw materials is predominantly from raw materials. Thus, any fuel contribution increase should be far below the PSD threshold of 1200 pounds per year. Therefore the PSD analysis for each material does not include lead.

FUEL ESTIMATED EMISSIONS

Each fuel type and the PSD analysis of each fuel is provided below. As noted above, the PSD analysis does not include mercury or lead. The analysis addresses NOx, SO2, CO, VOC and PM/PM10.

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[11] Hill, L; Stevenson, R., Mercury and lead Content in Raw Materials. Portland Cement Association, R&D serial No. 288.

[12] http://kgs.uky.edu/kgsweb/DataSearching/Coal/Quality/QualitySearch.asp (last visited April 18, 2011)

TABLE 2. SUMMARY OF ESTIMATED EMISSIONS FOR RECOVERED MATERIALS

	SO_2 Inc./Dec. (tons)	NO_x Inc./Dec. (tons)	CO Inc./Dec. (tons)	VOC Inc./Dec. (tons)	PM Inc./Dec. (tons)	PM10 Inc./Dec. (tons)
Trucking					4.89	4.89
Grinding, handling and storage	1.08	3.53	4.11	3.53	0.61	0.61
<u>Alternative fuels</u>						
Coal (non-specific ranking)	0.0	0.0	0.0	0.0	0.0	0.0
Engineered fuel	-5.0	-449.3	-20.4	-20.5	-9.7	-9.7
Tire Derived Fuel	-5.8	-476.8	42.0	-32.8	-8.3	-8.3
Agricultural Film	-5.8	-476.8	42.0	-32.8	-8.3	-8.3
Agricultural Byproduct	-5.0	-449.3	-20.4	-20.5	-9.7	-9.7
Carpet-Derived Fuel	-5.0	-449.3	-20.4	-20.5	-9.7	-9.7
Woody Biomass	-5.0	-449.3	-20.4	-20.5	-9.7	-9.7
Manufacturer Reject Roofing Shingles	-5.8	-476.8	42.0	-32.8	-8.3	-8.3
Preconsumer Paper	-5.0	-449.3	-20.4	-20.5	-9.7	-9.7
<u>Worst-case emissions from any fuel</u>	<u>0.0</u>	<u>0.0</u>	<u>42.0</u>	<u>0.0</u>	<u>0.0</u>	<u>0.0</u>
	↓	↓	↓	↓	↓	↓
Total	1.08	3.53	46.11	3.53	5.50	5.50
	↓	↓	↓	↓	↓	↓
PSD Threshold	40	40	100	40	25	15
PSD Threshold exceeded?	NO	NO	NO	NO	NO	NO

Deleted:

Trucking
Grinding, handlin
<u>Alternative fuels</u>
Coal (non-specific
Engineered fuel
Tire Derived Fuel
Agricultural Film
Agricultural Bypr
Carpet-Derived Fu
Woody Biomass
Manufacturer Rej
Preconsumer Pap
<u>Worst-case emissi</u>
Total
PSD Threshold
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COAL, NON-SPECIFIC

Tarmac requests to include all types of coal. As discussed below, the availability of all types of coal provides a option to Tarmac to maintain coal supplies from a broader range of sources. This coal can be processed in the existing coal mill and provide adequate heat input in the back end of the kiln as well as supplement front-end burning.

Coal is distributed around the world. It has been estimated that there are over 847 billion tonnes of proven coal reserves worldwide. This means that there is enough coal to last us around 119 years at current rates of production .[13]

USGS Information of coal[14]

Note please refer to the reference for linked figures and tables.

Coal is composed of complex mixtures of organic and inorganic compounds. The organic compounds, inherited from the plants that live and die in the swamps, number in the millions. The approximately more than 120 inorganic compounds in coal either were introduced into the swamp from waterborne or windborne sediment, or were derived from elements in the original vegetation; for instance, inorganic compounds containing such elements as iron and zinc are needed by plants for healthy growth. After the plants decompose, the inorganic compounds remain in the resulting peat. Some of those elements combine to form discrete minerals, such as pyrite. Other sources of inorganic compounds used by the plants may be either the mud that coats the bottom of the swamp, sediments introduced by drainage runoff, dissolved elements in the swamp water, windborne sand, ash, or dust.

Coals may contain as many as 76 of the 92 naturally occurring elements of the periodic table (fig. 9)[shown below]; however, most of those elements usually are present in only trace amounts on the order of parts per million. Occasionally, some trace elements may be concentrated in a specific coal bed, which may make that bed a valuable resource for those elements (such as silver, zinc, or germanium) (Finkelman and Brown, 1991). Some elements, however, have the potential to be hazardous (for example, cadmium or selenium), particularly if they are concentrated in more than trace amounts. Although as many as 120 different minerals have been identified in coal, only about 33 of them commonly are found in coal, and of these, only about 8 (quartz, kaolinite, illite, montmorillonite, chlorite, pyrite, calcite, and siderite) are abundant enough to be considered major constituents (table 1).

The organic compounds in coal are composed of the elements carbon, hydrogen, oxygen, nitrogen, sulfur, and trace amounts of a variety of other elements. Although only a few elements compose the organic compounds found in coal, these compounds are extremely complex and, as a result, they are not well understood; for example, an attempt to define the structure of just one organic compound in a brown coal (lignite) is shown in figure 10, but even this relatively simple structure is based on scientific conjecture. The organic compounds in coal produce heat when coal is burned; they also may be converted to synthetic fuels, or may be used to produce the organic chemicals shown in the centerfold illustration.

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[13] http://www.worldcoal.org/coal/where-is-coal-found/ (last visited April 18, 2011)

[14] http://pubs.usgs.gov/circ/c1143/html/text.html

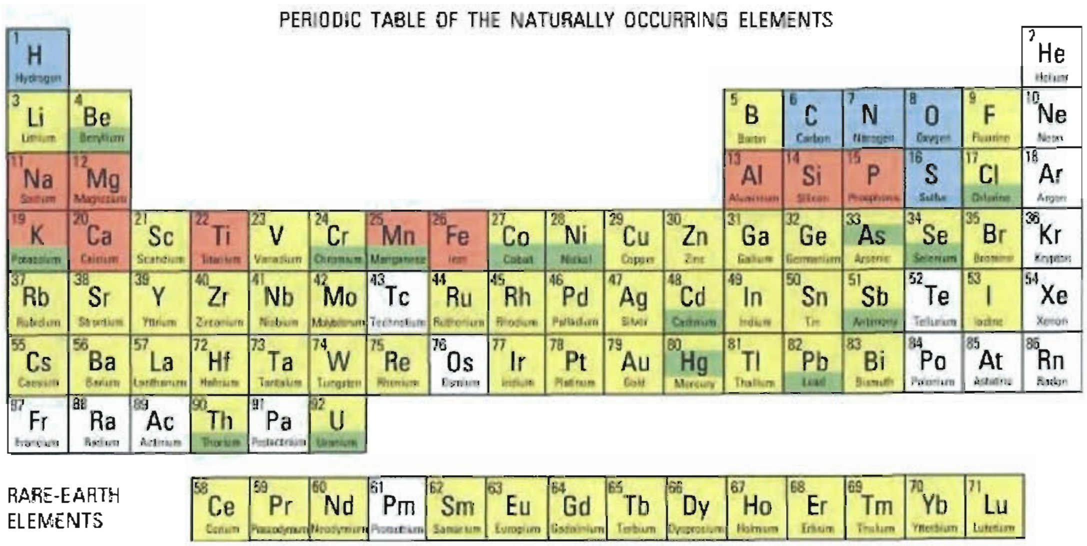
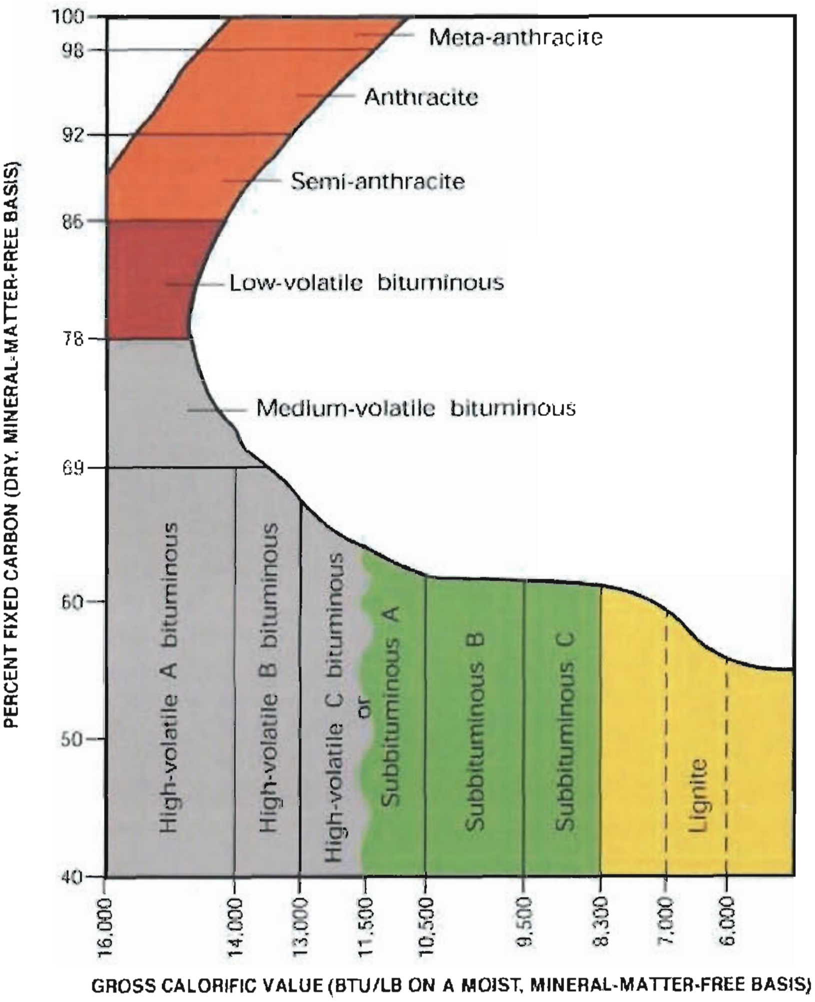


Figure 9. Periodic table of the elements. The 76 elements found in coal are highlighted by colors with regard to their general abundance in coal, as follows: blue, major elements (generally greater than 1.0 percent in abundance); red, minor elements (generally greater than or equal to 0.01 percent); and yellow, trace elements (generally less than 0.001 percent). Pursuant to the Clean Air Act Amendments of 1990 (Public Law 101-549), the U.S. Environmental Protection Agency (EPA) studied fifteen of these elements as potentially hazardous air pollutants (HAPs); green bars in their boxes indicate those fifteen elements. Thirteen of the original were cleared when the EPA found that there was no compelling evidence that they cause human health problems; a green bar across the bottom of the box indicates those elements. Two elements from the original fifteen, mercury (Hg) and arsenic (As), indicated by a green bar across the centers of their boxes, are still under study—mercury as a HAP and arsenic as a potential pollutant in ground water that flows through fly-ash and coal-mine spoil piles. Subsequently, in December 2000, EPA found that mercury emissions from coal-fired power plants require regulation; EPA will propose regulations in 2003 and issue final rules in 2004. Modified from Periodic Table of the Elements (Sargent-Welch Scientific Company, 1979), used with permission.

COAL RANK

A major factor in determining coal quality is coal rank. Rank refers to steps in a slow, natural process called "coalification," during which buried plant matter changes into an ever denser, drier, more carbon rich, and harder material. The major coal ranks, from lowest to highest, are lignite (also called "brown coal" in some parts of the world), subbituminous coal, bituminous coal, and anthracite. Each rank may be further subdivided, as shown in figure 17[shown below]. The rank of coal is determined by the percentage of fixed carbon, moisture (water), volatile matter, and calorific value in British thermal units (Btu) after the sulfur and mineral-matter content have been subtracted. Fixed carbon is solid, combustible matter left in coal after the lighter, volatile, hydrogen-rich compounds are driven off during coalification. Volatile matter is slowly removed from coal during coalification, but may be rapidly removed during destructive distillation. Volatile matter contains the raw materials from which the organic chemicals are obtained. In the U.S., the tests to determine the amounts of the above-mentioned substances and the rank of the coal are performed using standards published by ASTM International (2002).

In general, the higher the rank of a coal, the more deeply it was buried, and, therefore, the higher the temperature it was subjected to during and after burial. Older coals tend to be of higher rank because they are more likely to have been buried more deeply for longer periods of time than younger coals. To give a sense of the effects of increasing rank, the following comparison may be used: lignite is soft, dusty, and can ignite spontaneously under the appropriate conditions, whereas anthracite is quite hard, clean to the touch, and must reach a temperature of about 925°F before it will ignite. Furthermore, anthracite contains about twice the calorific value of lignite (about 15,000 Btu/lb and 7,000 Btu/lb, respectively) because lignite contains more moisture and oxygen and less fixed carbon than anthracite. Subbituminous and high-volatile bituminous C coals have oxygen and moisture content and calorific values that range between those of lignite and anthracite. Bituminous coals of higher rank have calorific values that may exceed those of anthracite (fig. 17)[shown below].



PSD Analysis – Comparison to other projects

Comprehensive data of European cement kilns show that firing of alternative fuels does not increase emissions of air pollutants.[5] Therefore, for PSD analysis in review of other projects is the general trend of similar or reduced emissions from comparable projects. The following example of emissions summary data shows these general trends. A CD is attached that provides substantial additional data showing similar results.

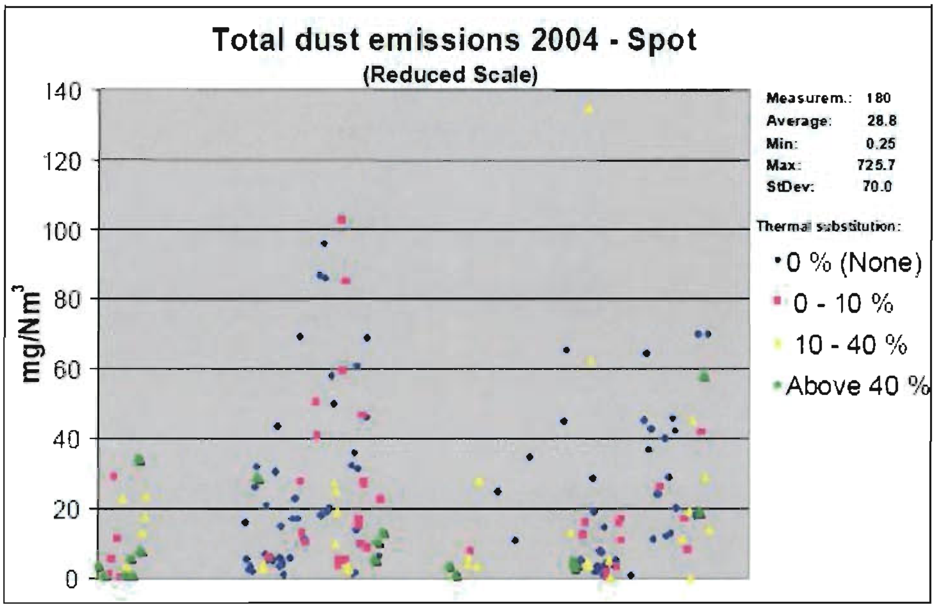


Figure 1.24: Dust emission values from 180 spot dust measurements in the clean gas of rotary kilns in the EU-27 and EU 23+ countries

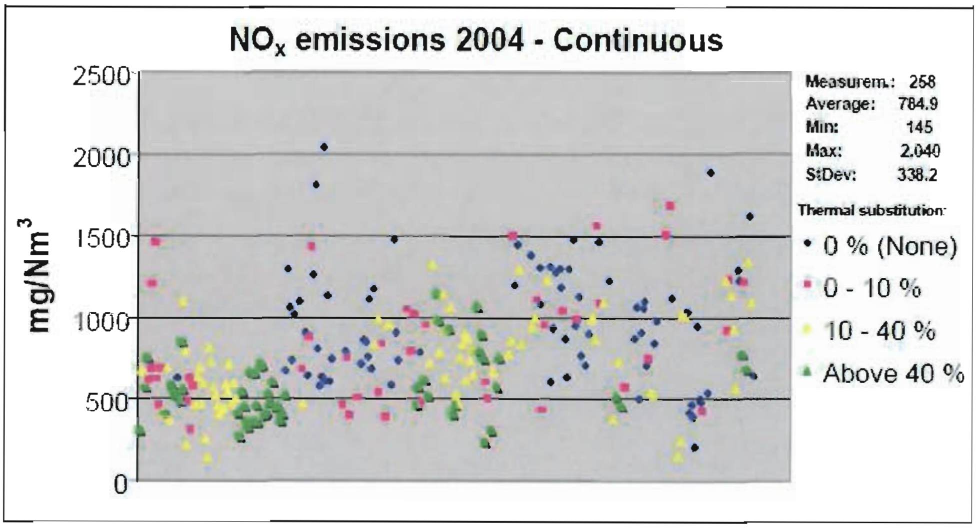


Figure 1.25: NO_x emissions (expressed as NO_2) from cement kilns in the EU-27 and EU-23+ countries in 2004 categorised by substitution rate

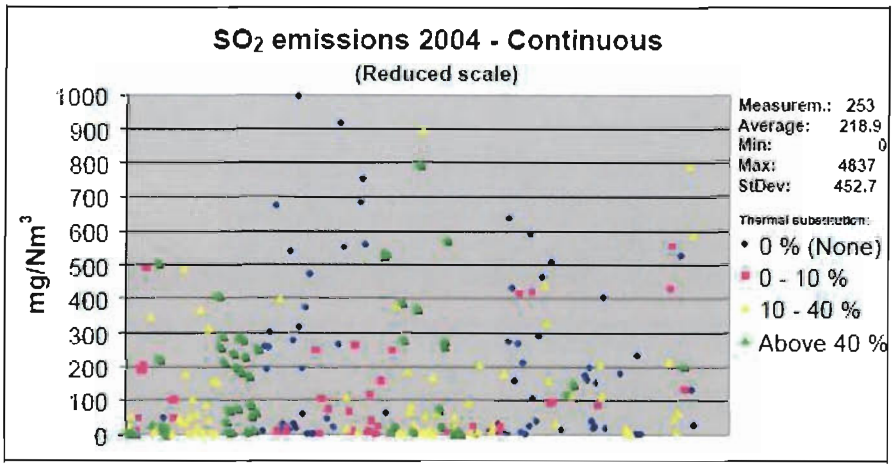


Figure 1.32: Values of SO_2 measurements in the clean gas from cement plants in the EU-27 and EU-23+ countries

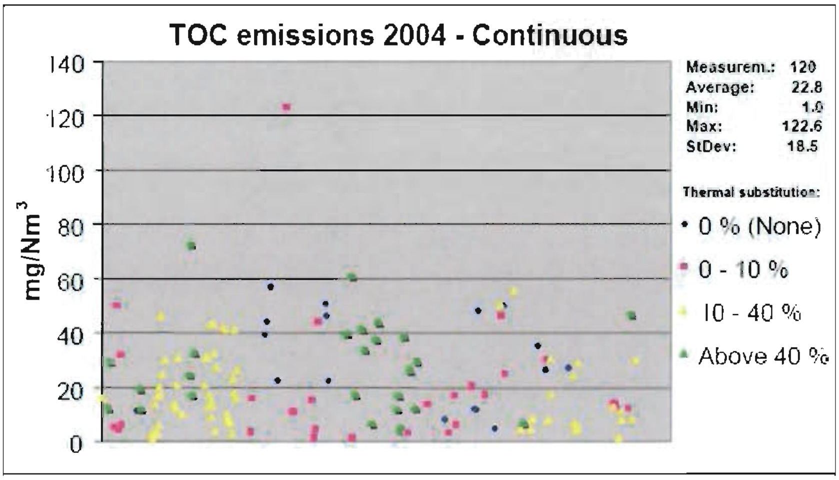


Figure 1.35: TOC emission values from continuous measurements in the clean gas of cement kilns in the EU-27 and EU-23+ countries

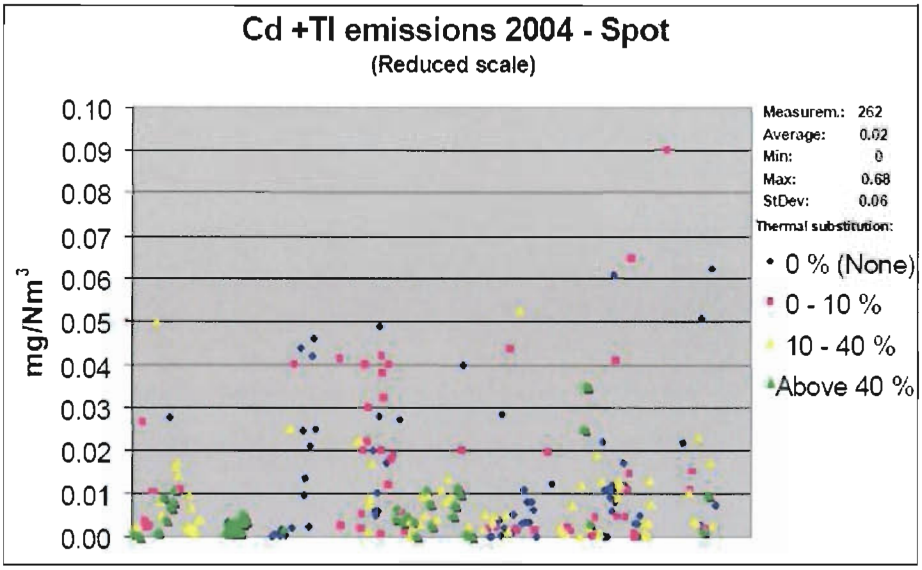


Figure 1.42: Cadmium and thallium emission values from 262 spot ∑ (Cd, Tl) measurements in the EU-27 and EU-23+ countries

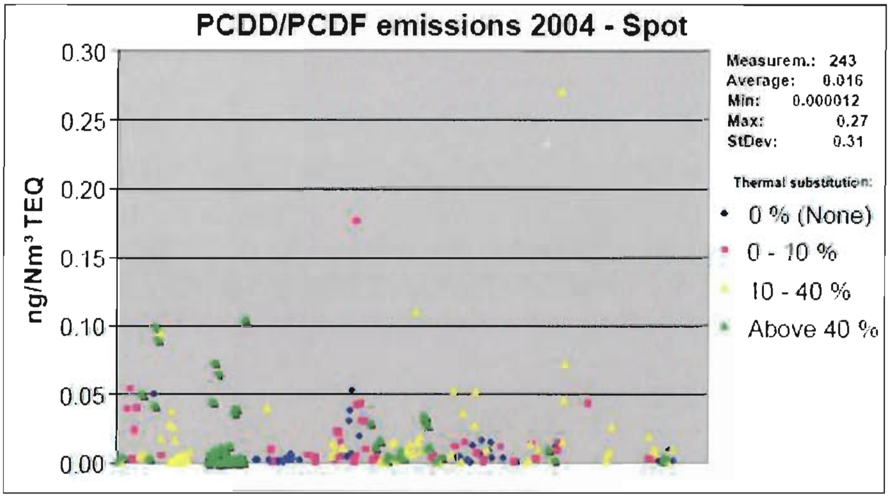


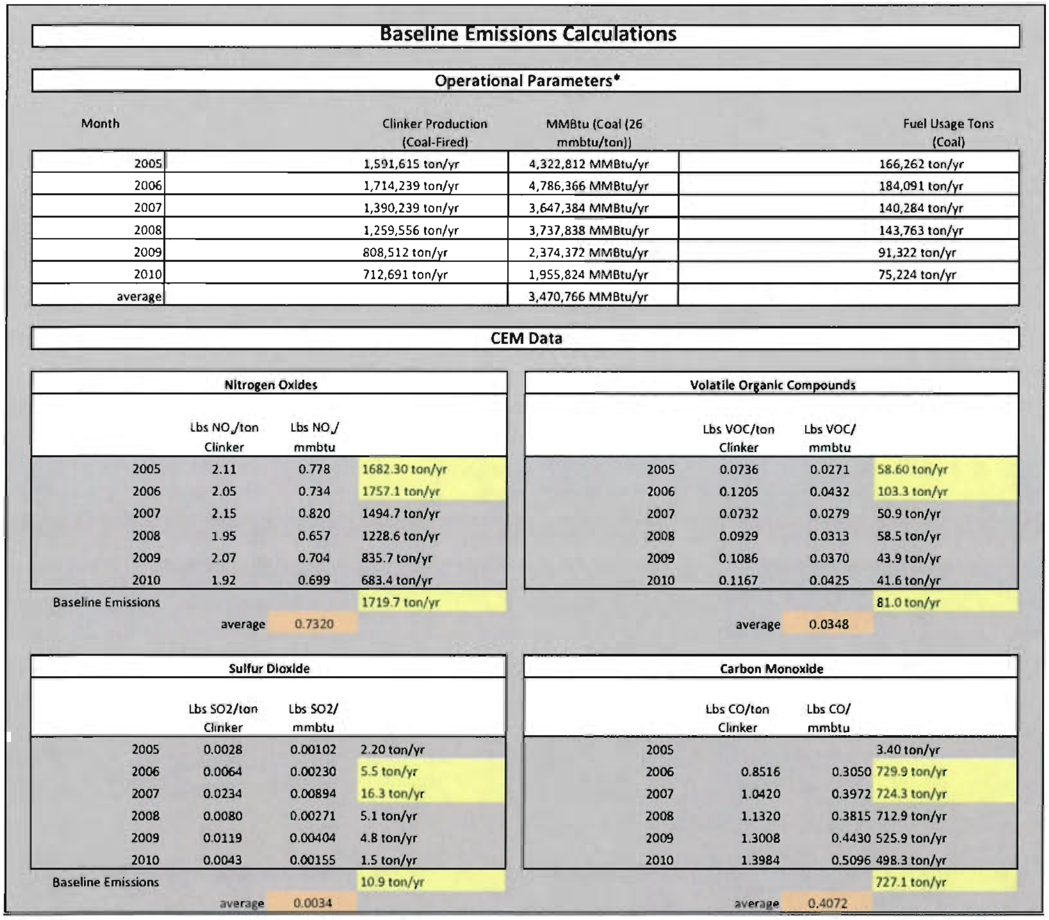
Figure 1.38: Emissions of PCDD/F in the EU-27 and EU-23+ countries in 2004 categorised by thermal substitution rate

PSD Analysis – Coal (non-specific)

Representative data of emissions from bituminous coal are applied for comparison to other forms of coal. The similarity of applicable coals that would be used in the kiln system are such the projected emissions would be the same.

The following table shows baseline emissions from bituminous coal. Note that the new kiln system was operational from 2005 onward.

Table 3. Summary of Baseline Emissions for coal.



Baseline Emissions Calculations

Operational Parameters*

Month	Clinker Production (Coal-Fired)	MMBtu (Coal (26 mmbtu/ton))	Fuel Usage Tons (Coal)
2005	1,591,615 ton/yr	4,322,812 MMBtu/yr	166,262 ton/yr
2006	1,714,239 ton/yr	4,786,366 MMBtu/yr	184,091 ton/yr
2007	1,390,239 ton/yr	3,647,384 MMBtu/yr	140,284 ton/yr
2008	1,259,556 ton/yr	3,737,838 MMBtu/yr	143,763 ton/yr
2009	808,512 ton/yr	2,374,372 MMBtu/yr	91,322 ton/yr
2010	712,691 ton/yr	1,955,824 MMBtu/yr	75,224 ton/yr
average		3,470,766 MMBtu/yr	

CEM Data

Nitrogen Oxides

	Lbs NO_x/ton Clinker	Lbs NO_x/ mmbtu	
2005	2.11	0.778	1682.30 ton/yr
2006	2.05	0.734	1757.1 ton/yr
2007	2.15	0.820	1494.7 ton/yr
2008	1.95	0.657	1228.6 ton/yr
2009	2.07	0.704	835.7 ton/yr
2010	1.92	0.699	683.4 ton/yr
Baseline Emissions			1719.7 ton/yr
	average	0.7320	

Volatile Organic Compounds

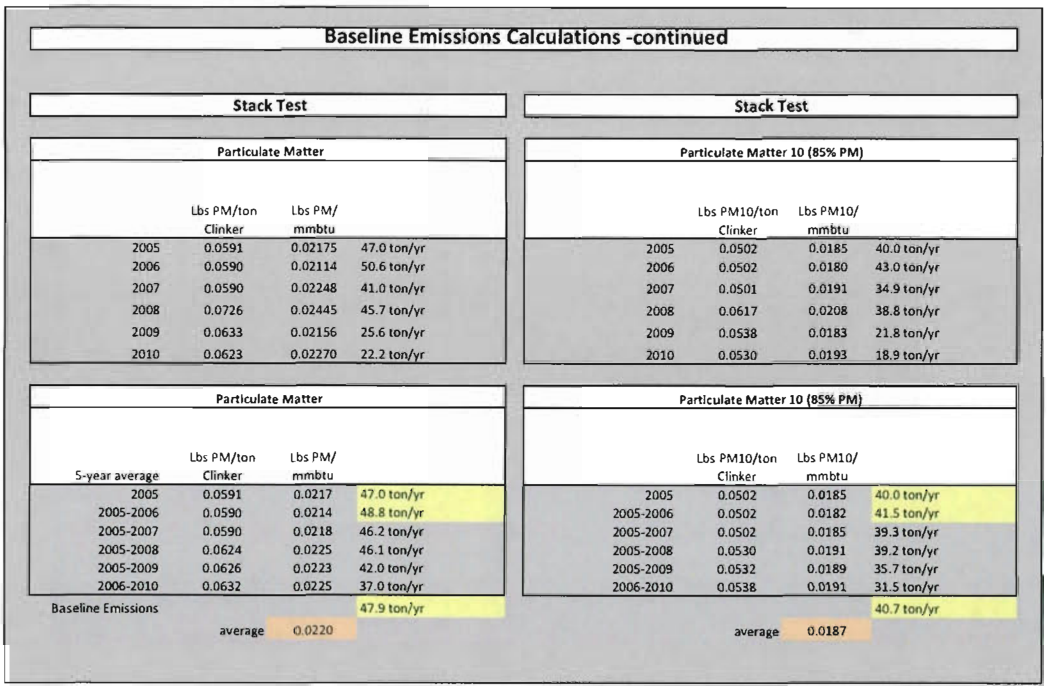
	Lbs VOC/ton Clinker	Lbs VOC/ mmbtu	
2005	0.0736	0.0271	58.60 ton/yr
2006	0.1205	0.0432	103.3 ton/yr
2007	0.0732	0.0279	50.9 ton/yr
2008	0.0929	0.0313	58.5 ton/yr
2009	0.1086	0.0370	43.9 ton/yr
2010	0.1167	0.0425	41.6 ton/yr
			81.0 ton/yr
	average	0.0348	

Sulfur Dioxide

	Lbs SO2/ton Clinker	Lbs SO2/ mmbtu	
2005	0.0028	0.00102	2.20 ton/yr
2006	0.0064	0.00230	5.5 ton/yr
2007	0.0234	0.00894	16.3 ton/yr
2008	0.0080	0.00271	5.1 ton/yr
2009	0.0119	0.00404	4.8 ton/yr
2010	0.0043	0.00155	1.5 ton/yr
Baseline Emissions			10.9 ton/yr
	average	0.0034	

Carbon Monoxide

	Lbs CO/ton Clinker	Lbs CO/ mmbtu	
2005			3.40 ton/yr
2006	0.8516	0.3050	729.9 ton/yr
2007	1.0420	0.3972	724.3 ton/yr
2008	1.1320	0.3815	712.9 ton/yr
2009	1.3008	0.4430	525.9 ton/yr
2010	1.3984	0.5096	498.3 ton/yr
			727.1 ton/yr
	average	0.4072	



Baseline Emissions Calculations -continued

Stack Test

Particulate Matter

	Lbs PM/ton Clinker	Lbs PM/ mmbtu	
2005	0.0591	0.02175	47.0 ton/yr
2006	0.0590	0.02114	50.6 ton/yr
2007	0.0590	0.02248	41.0 ton/yr
2008	0.0726	0.02445	45.7 ton/yr
2009	0.0633	0.02156	25.6 ton/yr
2010	0.0623	0.02270	22.2 ton/yr

Particulate Matter

5-year average	Lbs PM/ton Clinker	Lbs PM/ mmbtu	
2005	0.0591	0.0217	47.0 ton/yr
2005-2006	0.0590	0.0214	48.8 ton/yr
2005-2007	0.0590	0.0218	46.2 ton/yr
2005-2008	0.0624	0.0225	46.1 ton/yr
2005-2009	0.0626	0.0223	42.0 ton/yr
2006-2010	0.0632	0.0225	37.0 ton/yr
Baseline Emissions			47.9 ton/yr
	average	0.0220	

Stack Test

Particulate Matter 10 (85% PM)

	Lbs PM10/ton Clinker	Lbs PM10/ mmbtu	
2005	0.0502	0.0185	40.0 ton/yr
2006	0.0502	0.0180	43.0 ton/yr
2007	0.0501	0.0191	34.9 ton/yr
2008	0.0617	0.0208	38.8 ton/yr
2009	0.0538	0.0183	21.8 ton/yr
2010	0.0530	0.0193	18.9 ton/yr

Particulate Matter 10 (85% PM)

	Lbs PM10/ton Clinker	Lbs PM10/ mmbtu	
2005	0.0502	0.0185	40.0 ton/yr
2005-2006	0.0502	0.0182	41.5 ton/yr
2005-2007	0.0502	0.0185	39.3 ton/yr
2005-2008	0.0530	0.0191	39.2 ton/yr
2005-2009	0.0532	0.0189	35.7 ton/yr
2006-2010	0.0538	0.0191	31.5 ton/yr
			40.7 ton/yr
	average	0.0187	

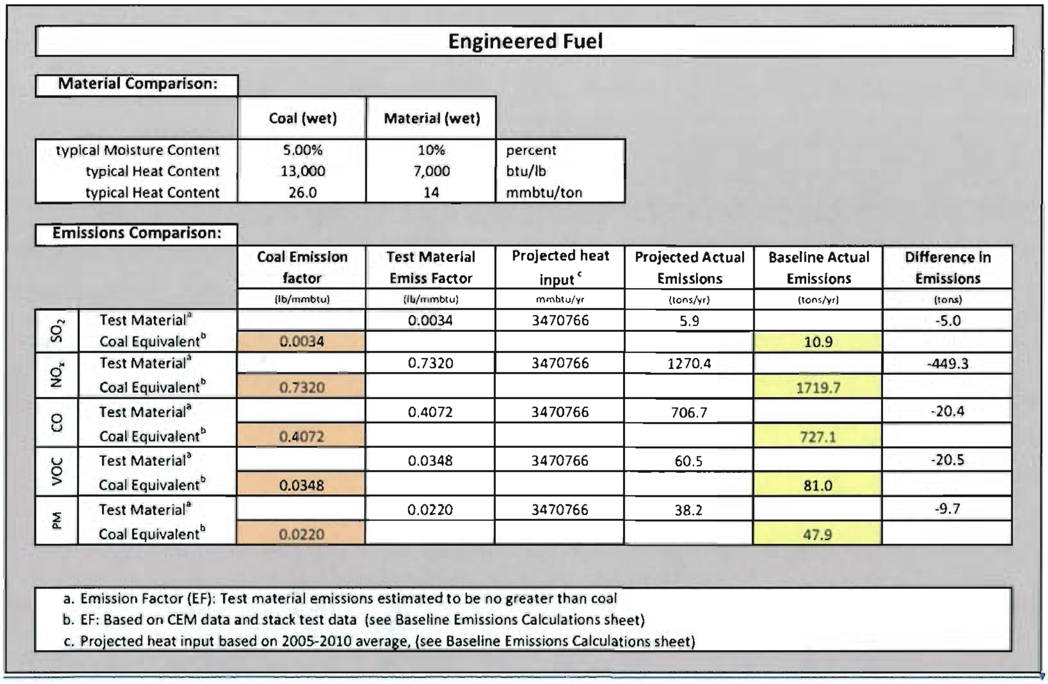
ENGINEERED FUEL

Engineered fuel is comprised of materials such as those included in the list of requested materials (e.g. clean woody biomass) and other non-hazardous materials to meet a fuel design specification that allows Tarmac to ensure it will meet regulatory limits as discussed in the Regulatory analysis section and quality control purposes. Tarmac will work with Engineered fuel supplier companies, such as PEER (in coordination with FLSmidth – see Appendix 2 for example engineered fuel creation) or VEXOR as a contracted provider to meet the specifications.

PSD Analysis – Engineered fuel

The PSD analysis for engineered fuel is based on the results of studies at the Cemex UK Rugby cement plant. Results of this study are attached (see appendix 2). The emission results from this study show that emissions are either the same or reduced when burning engineered fuel. For the PSD analysis, the emission factors for coal and engineered fuel are estimated to be the same.

Table 4. Summary of Emissions from Engineered fuel.



Engineered Fuel

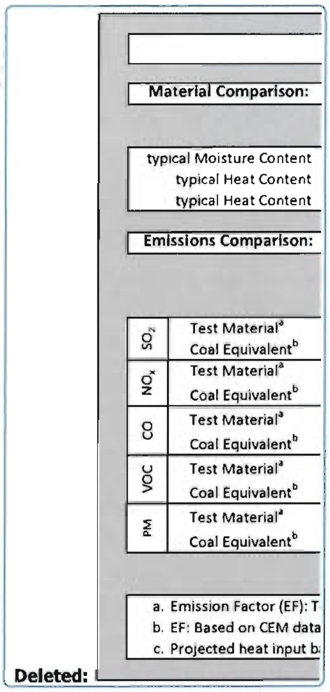
Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	10%	percent
typical Heat Content	13,000	7,000	btu/lb
typical Heat Content	26.0	14	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0034	3470766	5.9		-5.0
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7320	3470766	1270.4		-449.3
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4072	3470766	706.7		-20.4
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0348	3470766	60.5		-20.5
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0220	3470766	38.2		-9.7
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material emissions estimated to be no greater than coal
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)



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Material Comparison:
typical Moisture Content
typical Heat Content
typical Heat Content
Emissions Comparison:
SO_2 Test Material[a] Coal Equivalent[b]
NO_x Test Material[a] Coal Equivalent[b]
CO Test Material[a] Coal Equivalent[b]
VOC Test Material[a] Coal Equivalent[b]
PM Test Material[a] Coal Equivalent[b]
a. Emission Factor (EF): T
b. EF: Based on CEM data
c. Projected heat input b

TIRE-DERIVED FUEL (TDF) INCLUDING TIREFLUFF

This material must consist of shredded used tires and may have some steel belt material. The TDF may include tirefluff. Tires are readily available and have a higher heating value than coal. The high temperatures, long residence times, and inherent scrubbing that take place within a cement kiln provide an environment conducive to the efficient combustion of tires. For these reasons, firing tire-derived fuels (TDF) in cement kilns has become relatively common practice in Florida. Combustion of TDF alleviates problems associated with the stockpiling or landfilling of waste tires. Use of TDF at cement kilns in Florida is approved at the following cement production facilities: Florida Rock Industries - Newberry , Cemex - Miami, Cemex - Brooksville South and North, and American Cement Company - Sumter.

The following table is from the FDEP Technical Evaluation for the Kiln 2 project at Brooksville North, permit number 0530010-022-AC. This FDEP information indicates that tires and tire-derived fuel should either not change or reduce emissions except zinc.

Table 5. General Expected Effects of TDF On Emissions

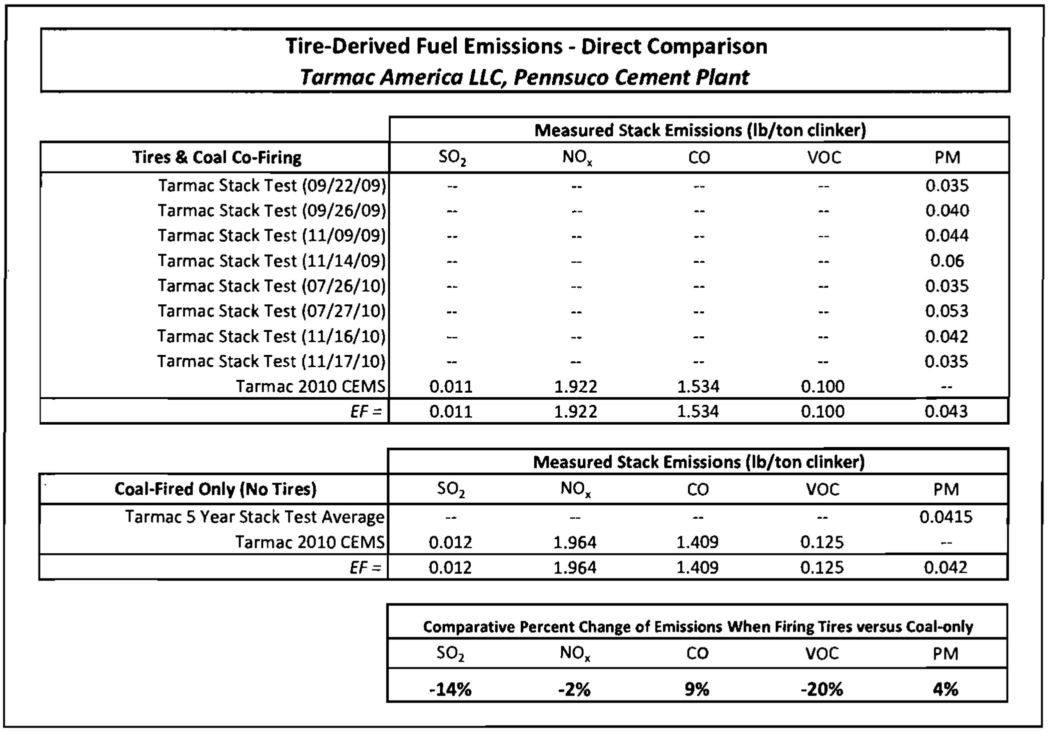
Pollutant	**Expected Effect of TDF/Scrap Tire**
CO	None
SO2	None
NOx	Decrease
PM	None
Total Hydrocarbons	None
Zinc	Increase
Other Metals	None or Decrease
Dioxins/Furans	None
Benzene	Decrease
Formaldehyde	Decrease
Semi-volatiles	Decrease

The above results are consistent with a USEPA report citing that "with the exception of zinc emissions, potential emissions from TDF are not *__expected__* *to be very much different from other conventional fossil fuels, as long as combustion occurs in a well-designed, well-operated, and well-maintained combustion device".[Emphasis added.] The data above is also consistent with claims of* NO_x *reductions as a result of firing TDF.* [0530010-022-AC]

PSD Analysis – TDF

Plant data are available for tires, which is the source material of tirefluff. Estimated emissions calculations are based on whole tire burning at the Pennsuco Cement Plant. The information found in Table 7, below, was extrapolated, applying the percent increase or decrease in emissions found to an equivalent baseline factor.

Table 6. Tire-Derived Fuel Emissions – Direct Comparison



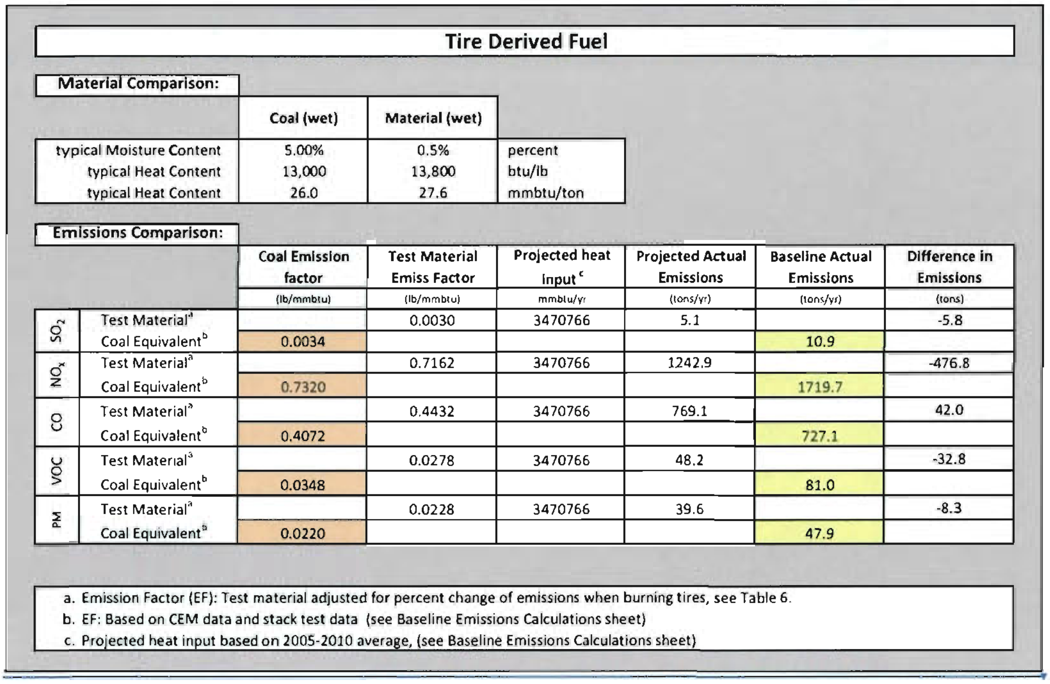
Tire-Derived Fuel Emissions - Direct Comparison
Tarmac America LLC, Pennsuco Cement Plant

	Measured Stack Emissions (lb/ton clinker)				
Tires & Coal Co-Firing	SO_2	NO_x	CO	VOC	PM
Tarmac Stack Test (09/22/09)	--	--	--	--	0.035
Tarmac Stack Test (09/26/09)	--	--	--	--	0.040
Tarmac Stack Test (11/09/09)	--	--	--	--	0.044
Tarmac Stack Test (11/14/09)	--	--	--	--	0.06
Tarmac Stack Test (07/26/10)	--	--	--	--	0.035
Tarmac Stack Test (07/27/10)	--	--	--	--	0.053
Tarmac Stack Test (11/16/10)	--	--	--	--	0.042
Tarmac Stack Test (11/17/10)	--	--	--	--	0.035
Tarmac 2010 CEMS	0.011	1.922	1.534	0.100	--
EF =	0.011	1.922	1.534	0.100	0.043

	Measured Stack Emissions (lb/ton clinker)				
Coal-Fired Only (No Tires)	SO_2	NO_x	CO	VOC	PM
Tarmac 5 Year Stack Test Average	--	--	--	--	0.0415
Tarmac 2010 CEMS	0.012	1.964	1.409	0.125	--
EF =	0.012	1.964	1.409	0.125	0.042

Comparative Percent Change of Emissions When Firing Tires versus Coal-only				
SO_2	NO_x	CO	VOC	PM
-14%	**-2%**	**9%**	**-20%**	**4%**

Table 7. Estimated Emissions for TDF



Tire Derived Fuel

Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	0.5%	percent
typical Heat Content	13,000	13,800	btu/lb
typical Heat Content	26.0	27.6	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0030	3470766	5.1		-5.8
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7162	3470766	1242.9		-476.8
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4432	3470766	769.1		42.0
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0278	3470766	48.2		-32.8
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0228	3470766	39.6		-8.3
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material adjusted for percent change of emissions when burning tires, see Table 6.
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)

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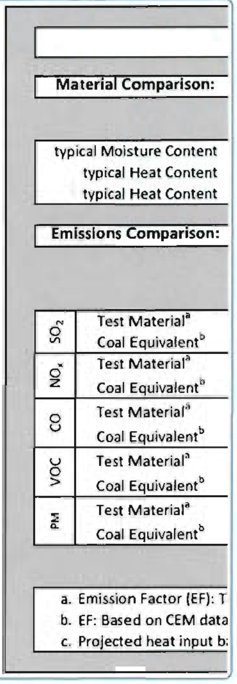


Material Comparison:

typical Moisture Content
typical Heat Content
typical Heat Content

Emissions Comparison:

SO_2 Test Material[a]
Coal Equivalent[b]
NO_x Test Material[a]
Coal Equivalent[b]
CO Test Material[a]
Coal Equivalent[b]
VOC Test Material[a]
Coal Equivalent[b]
PM Test Material[a]
Coal Equivalent[b]

a. Emission Factor (EF): T
b. EF: Based on CEM data
c. Projected heat input b

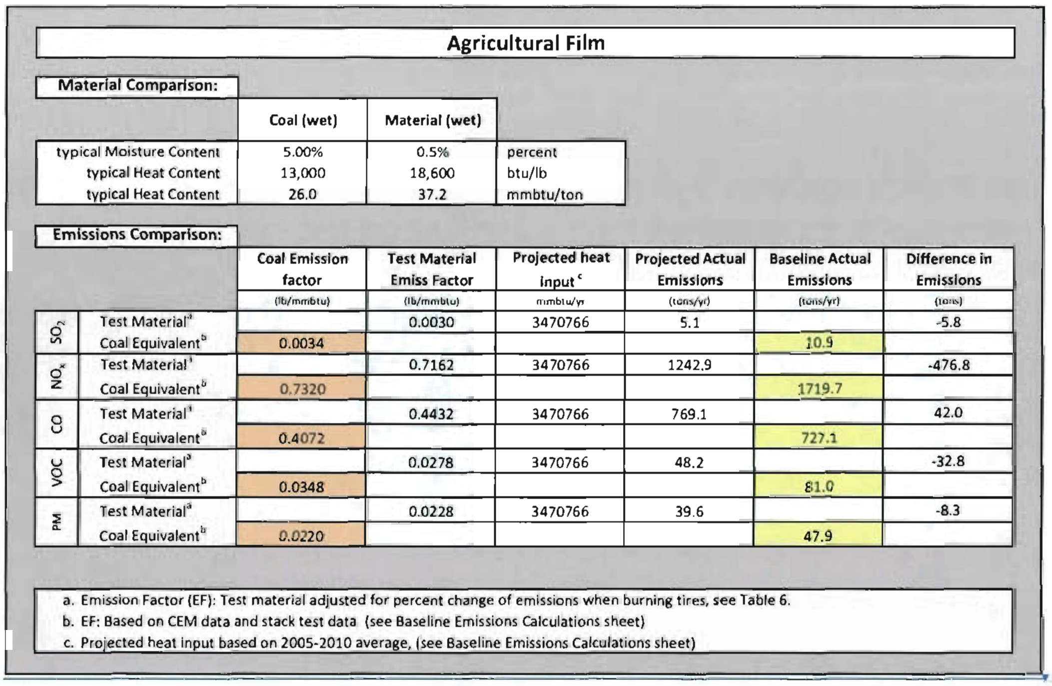
AGRICULTURAL FILM

Agricultural film is used in agriculture and silviculture to prevent weed growth, control soil erosion and moisture exposure. The film is a composed of polyethylene, non-chlorinated plastics. The energy content per ton for these films is near 50 percent higher than coal. The high temperatures, long residence times, and inherent scrubbing that take place within a cement kiln calciner provides an environment conducive to the efficient combustion of this film. Currently, agricultural film is disposed in landfills or open burned in fields.

PSD Analysis – Agricultural film

Data are not currently available for emissions from agricultural film burning in cement kilns; however the film is a petroleum-based polyethylene product manufactured to specification. Estimated emissions calculations are based on the whole tire burning at the Pennsuco Cement Plant. Tires are similarly manufactured from petroleum. Given the lack of testing data, these emissions are the best available comparison.

Table 8. Estimated Emissions for Agricultural Film.



Agricultural Film

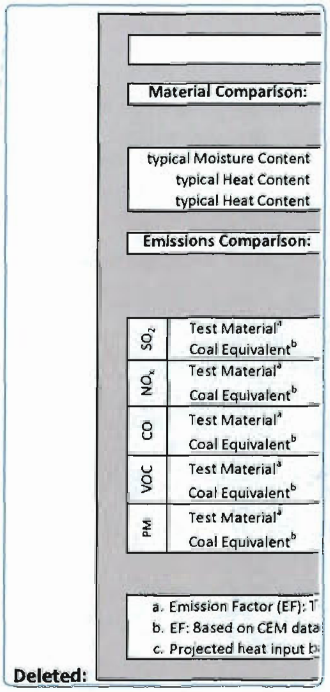
Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	0.5%	percent
typical Heat Content	13,000	18,600	btu/lb
typical Heat Content	26.0	37.2	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0030	3470766	5.1		-5.8
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7162	3470766	1242.9		-476.8
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4432	3470766	769.1		42.0
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0278	3470766	48.2		-32.8
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0228	3470766	39.6		-8.3
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material adjusted for percent change of emissions when burning tires, see Table 6.
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)



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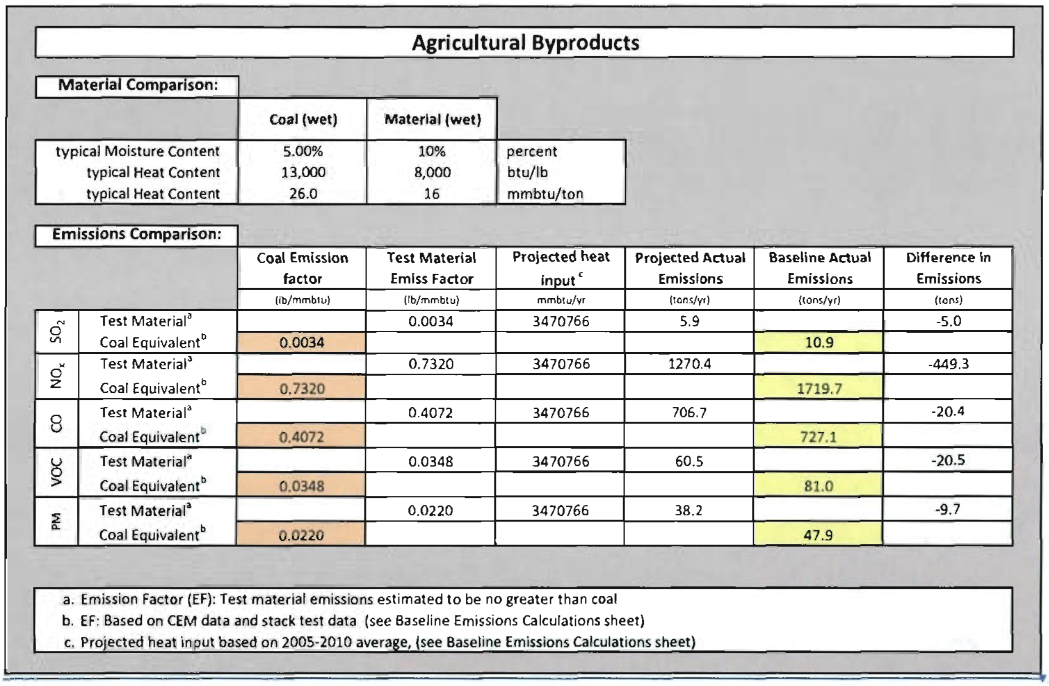
AGRICULTURAL BYPRODUCTS

This material include organic materials from agricultural operations such as peanut hulls, rice hulls, corn husks, citrus peels, cotton gin byproducts, animal bedding, etc. These materials are typically of little value to farmers. The materials can provide significant heat content and other parameters acceptable for kiln firing.

PSD Analysis – Agricultural byproducts

These materials have organic content and composition that is similar to cellulosic biomass. Therefore, the PSD analysis is based on the data applied for biomass.

Table 9. Estimated Emissions for Agricultural Byproducts.



Agricultural Byproducts

Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	10%	percent
typical Heat Content	13,000	8,000	btu/lb
typical Heat Content	26.0	16	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input [c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0034	3470766	5.9		-5.0
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7320	3470766	1270.4		-449.3
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4072	3470766	706.7		-20.4
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0348	3470766	60.5		-20.5
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0220	3470766	38.2		-9.7
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material emissions estimated to be no greater than coal
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)

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Material Comparison:

typical Moisture Content
typical Heat Content
typical Heat Content

Emissions Comparison:

SO_2 Test Material[a] Coal Equivalent[b]
NO_x Test Material[a] Coal Equivalent[b]
CO Test Material[a] Coal Equivalent[b]
VOC Test Material[a] Coal Equivalent[b]
PM Test Material[a] Coal Equivalent[b]

a. Emission Factor (EF): T
b. EF: Based on CEM data
c. Projected heat input b

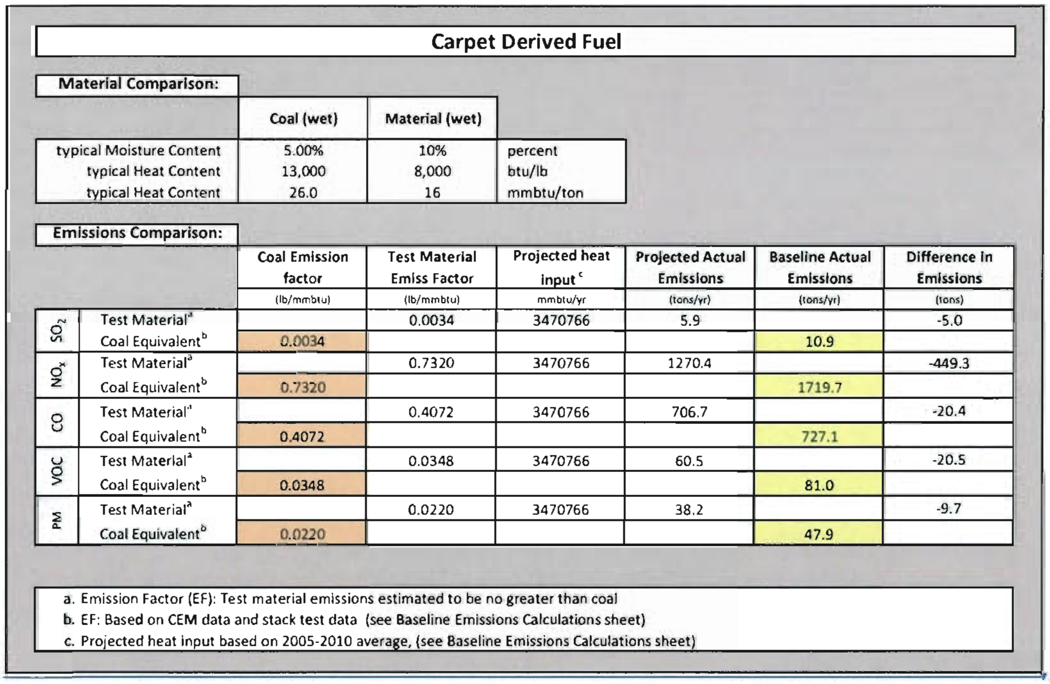
CARPET DERIVED FUEL

In the US, approximately 2 million tons of carpet is replaced annually. Most carpet is disposed of in landfills. Carpet is composed in part of non-chlorinated plastic and has an overall heating value similar to that of coal, and carpet contains a significant fraction (≈ 30 % by weight) of $CaCO_3$ in the backing material which is a beneficial component of cement production.[15]

PSD Analysis – CDF

Limited data are available for carpet derived fuel. The referenced emission data (14) provides reasonable assurance of emissions comparable to coal. Given the results of the testing show emissions are the same if not lower, the emissions estimates for carpet derived fuel are estimated to be the same as for coal.

Table 10. Estimated Emissions for CDF.



Carpet Derived Fuel

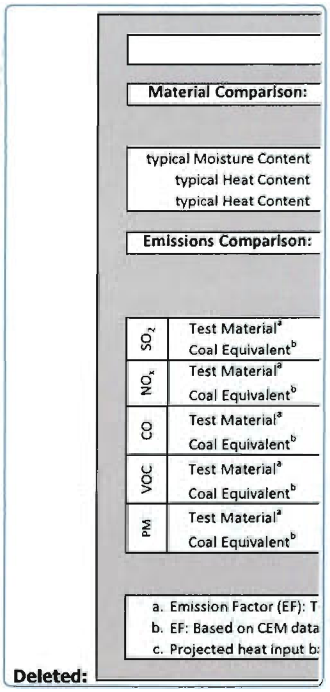
Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	10%	percent
typical Heat Content	13,000	8,000	btu/lb
typical Heat Content	26.0	16	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0034	3470766	5.9		-5.0
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7320	3470766	1270.4		-449.3
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4072	3470766	706.7		-20.4
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0348	3470766	60.5		-20.5
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0220	3470766	38.2		-9.7
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material emissions estimated to be no greater than coal
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)



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Material Comparison:

typical Moisture Content
typical Heat Content
typical Heat Content

Emissions Comparison:

SO_2 Test Material[a]
Coal Equivalent[b]
NO_x Test Material[a]
Coal Equivalent[b]
CO Test Material[a]
Coal Equivalent[b]
VOC Test Material[a]
Coal Equivalent[b]
PM Test Material[a]
Coal Equivalent[b]

a. Emission Factor (EF): T
b. EF: Based on CEM data
c. Projected heat input b

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[15] Carpet Derived Fuel - Emissions from Combustion of Post-consumer Carpet in a cement Kiln, P Lemieux, et al. , IT3 conference 2005. Paper for presentation at the 2005 Conference on Incineration and Thermal Treatment Technologies, Galveston, TX, May 9-13, 2005

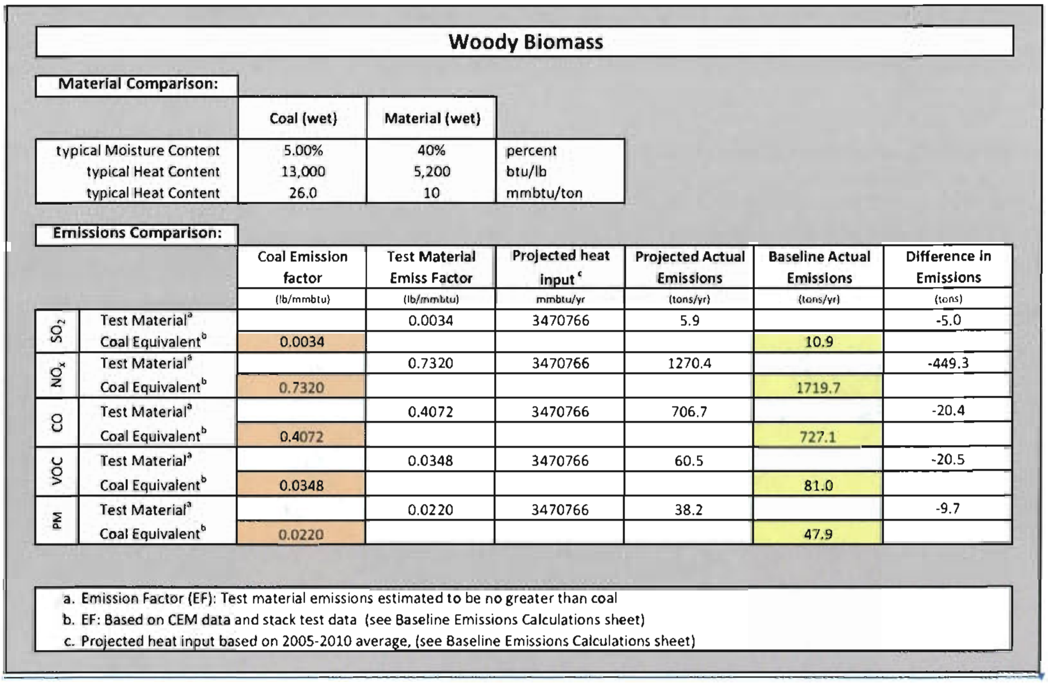
CELLULOSIC BIOMASS

Tarmac is proposing two categories of cellulosic biomass. The first category is clean cellulosic biomass as defined in 40 CFR 241.2. The second category is "other" cellulosic biomass which does not meet the definition of clean cellulosic biomass. For example other cellulosic biomass would include copper-chromium-arsenic (CCA)-treated wood, creosote-treated wood, construction and demolition (C&D) debris not meeting the definition of clean C&D wood per 40 CFR Part 241, plywood, particle board, medium density fiberboard, oriented strand board, laminated beams, finger-jointed trim and sheet goods. Other cellulosic biomass will be comparable to conventional fuels that the unit is designed to burn.

PSD Analysis – woody biomass

Data are available for woody biomass in cement kilns as discussed for agricultural byproducts.

Table 11. Estimated Emissions for Woody Biomass.



Woody Biomass

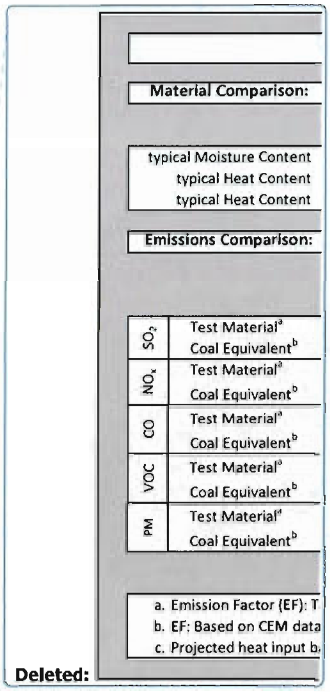
Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	40%	percent
typical Heat Content	13,000	5,200	btu/lb
typical Heat Content	26.0	10	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0034	3470766	5.9		-5.0
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7320	3470766	1270.4		-449.3
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4072	3470766	706.7		-20.4
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0348	3470766	60.5		-20.5
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0220	3470766	38.2		-9.7
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material emissions estimated to be no greater than coal
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)



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Material Comparison:
typical Moisture Content
typical Heat Content
typical Heat Content
Emissions Comparison:
SO_2 Test Material[a] Coal Equivalent[b]
NO_x Test Material[a] Coal Equivalent[b]
CO Test Material[a] Coal Equivalent[b]
VOC Test Material[a] Coal Equivalent[b]
PM Test Material[a] Coal Equivalent[b]
a. Emission Factor (EF):
b. EF: Based on CEM data
c. Projected heat input

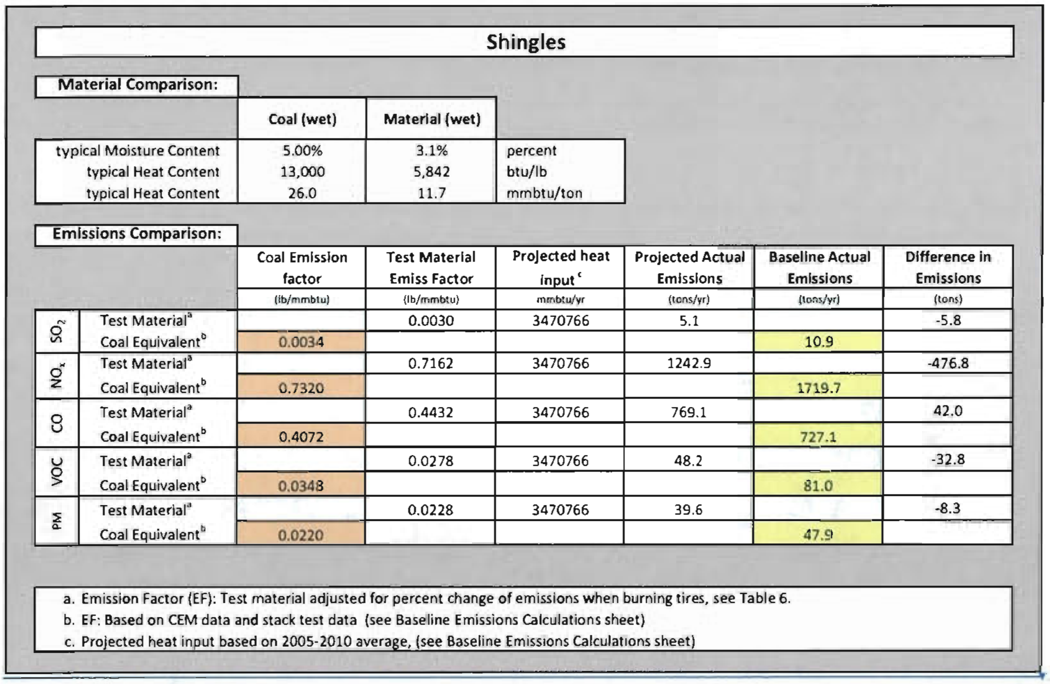
SHINGLES, MANUFACTURER REJECTS

Manufacturers of asphalt roofing shingles reject a certain fraction of roofing shingle product. This product contains valuable heat content and raw materials of a very consistent composition. This material is an excellent source of raw material and heat content for cement production. Shingles are no longer manufactured with asbestos and the manufacturer will provide written certification of this assertion.

PSD Analysis – Shingles

There are no data for emissions comparison of fuel from shingles. Shingles are a petroleum based product. The resulting emissions would be similar to an oil or other petroleum product. As such, similar to agricultural film, the same emissions from coal are used for shingles.

Table 12. Estimated Emissions for Shingles.



Shingles

Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	3.1%	percent
typical Heat Content	13,000	5,842	btu/lb
typical Heat Content	26.0	11.7	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0030	3470766	5.1		-5.8
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7162	3470766	1242.9		-476.8
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4432	3470766	769.1		42.0
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0278	3470766	48.2		-32.8
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0228	3470766	39.6		-8.3
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material adjusted for percent change of emissions when burning tires, see Table 6.
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)

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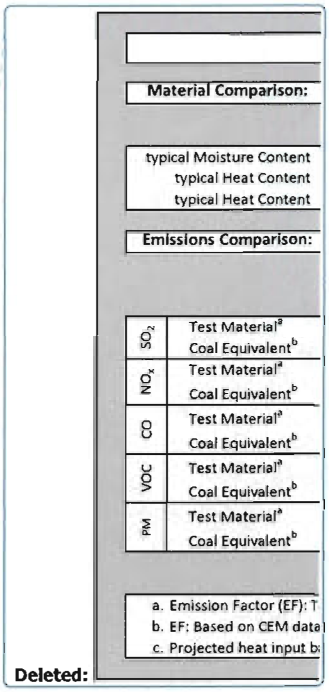


Material Comparison:

typical Moisture Content
typical Heat Content
typical Heat Content

Emissions Comparison:

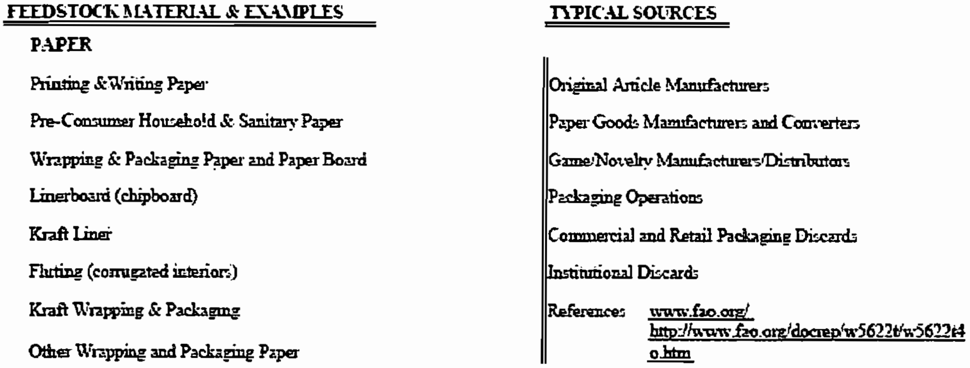
SO_2	Test Material[a]
	Coal Equivalent[b]
NO_x	Test Material[a]
	Coal Equivalent[b]
CO	Test Material[a]
	Coal Equivalent[b]
VOC	Test Material[a]
	Coal Equivalent[b]
PM	Test Material[a]
	Coal Equivalent[b]

a. Emission Factor (EF): T
b. EF: Based on CEM data
c. Projected heat input b

PRE-CONSUMER PAPER

Pre-consumer reject paper is produced by companies specifically marketing such a products (e.g., International Paper Products Corp (IPP), enviro-fuelcubes) or waste handlers that certify and manifest to only supply pre-consumer reject paper. Typical sources of such paper are manufacturers having a supply of outdated paper printings (e.g., calendars) that must dispose of the material in some manner. Example material sources are listed below. The obvious benefit of these materials is that consumers have not been able to potentially contaminate the paper. As such the quality of the product is much more reliable and the potential to contamination (e.g., mercury containing materials) is essentially negated.

These materials contain high amounts of energy, are relatively slow to biodegrade in landfills and have been successfully used at cement facilities in the US and around the world.

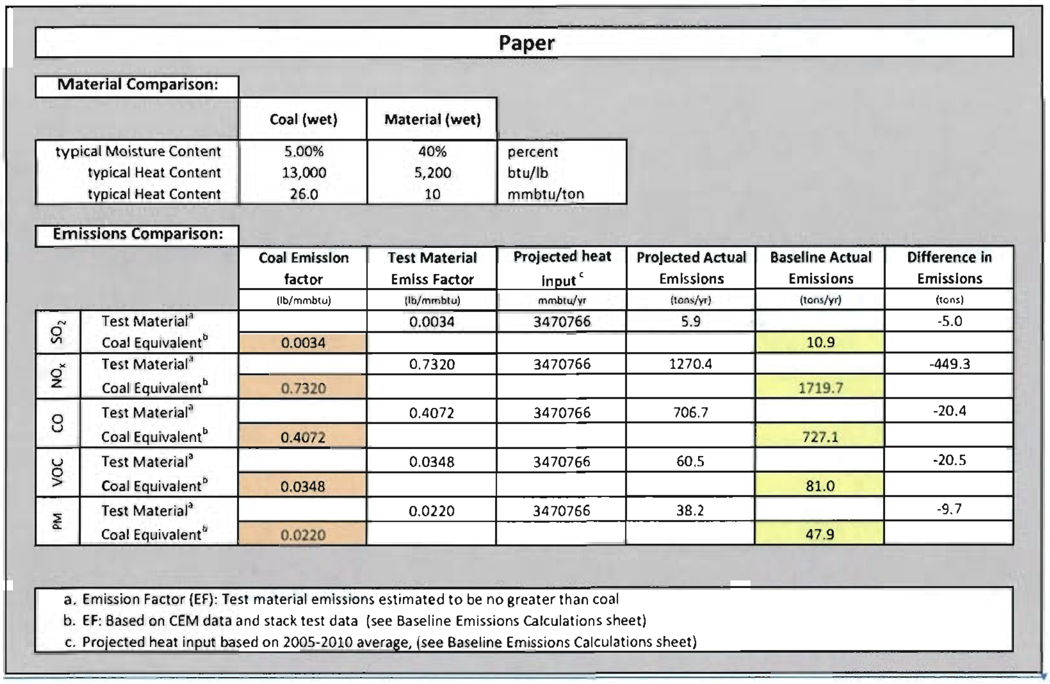


FEEDSTOCK MATERIAL & EXAMPLES	TYPICAL SOURCES
PAPER	
Printing & Writing Paper	Original Article Manufacturers
Pre-Consumer Household & Sanitary Paper	Paper Goods Manufacturers and Converters
Wrapping & Packaging Paper and Paper Board	Game/Novelty Manufacturers/Distributors
Linerboard (chipboard)	Packaging Operations
Kraft Liner	Commercial and Retail Packaging Discards
Fluting (corrugated interiors)	Institutional Discards
Kraft Wrapping & Packaging	References: www.fao.org/ http://www.fao.org/docrep/w5622t/w5622t4o.htm
Other Wrapping and Packaging Paper	

PSD Analysis – Paper

The organic content of paper is similar to a wood product. As such, the emissions of paper should be similar to that of biomass.

Table 13. Estimated Emissions for paper.



Paper

Material Comparison:

	Coal (wet)	Material (wet)	
typical Moisture Content	5.00%	40%	percent
typical Heat Content	13,000	5,200	btu/lb
typical Heat Content	26.0	10	mmbtu/ton

Emissions Comparison:

		Coal Emission factor (lb/mmbtu)	Test Material Emiss Factor (lb/mmbtu)	Projected heat input[c] mmbtu/yr	Projected Actual Emissions (tons/yr)	Baseline Actual Emissions (tons/yr)	Difference in Emissions (tons)
SO_2	Test Material[a]		0.0034	3470766	5.9		-5.0
	Coal Equivalent[b]	0.0034				10.9	
NO_x	Test Material[a]		0.7320	3470766	1270.4		-449.3
	Coal Equivalent[b]	0.7320				1719.7	
CO	Test Material[a]		0.4072	3470766	706.7		-20.4
	Coal Equivalent[b]	0.4072				727.1	
VOC	Test Material[a]		0.0348	3470766	60.5		-20.5
	Coal Equivalent[b]	0.0348				81.0	
PM	Test Material[a]		0.0220	3470766	38.2		-9.7
	Coal Equivalent[b]	0.0220				47.9	

a. Emission Factor (EF): Test material emissions estimated to be no greater than coal
b. EF: Based on CEM data and stack test data (see Baseline Emissions Calculations sheet)
c. Projected heat input based on 2005-2010 average, (see Baseline Emissions Calculations sheet)

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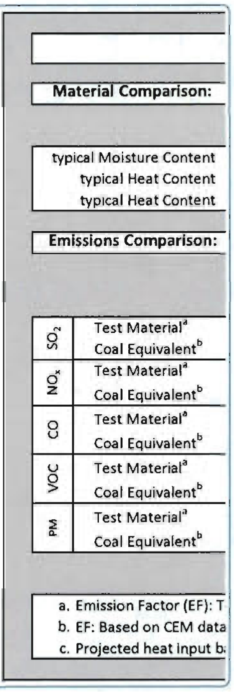


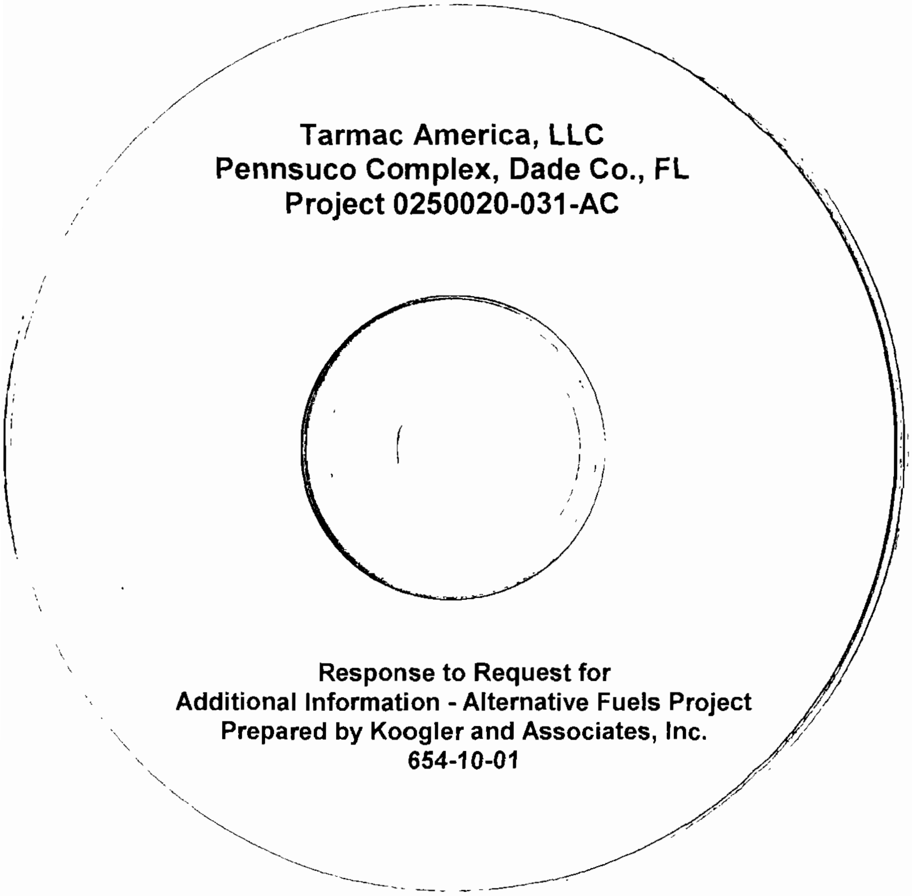
Material Comparison:

typical Moisture Content
typical Heat Content
typical Heat Content

Emissions Comparison:

SO_2	Test Material[a]
	Coal Equivalent[b]
NO_x	Test Material[a]
	Coal Equivalent[b]
CO	Test Material[a]
	Coal Equivalent[b]
VOC	Test Material[a]
	Coal Equivalent[b]
PM	Test Material[a]
	Coal Equivalent[b]

a. Emission Factor (EF): T
b. EF: Based on CEM data
c. Projected heat input b



Tarmac America, LLC
Pennsuco Complex, Dade Co., FL
Project 0250020-031-AC

Response to Request for
Additional Information - Alternative Fuels Project
Prepared by Koogler and Associates, Inc.
654-10-01