ENVIRONMENTAL FOOTPRINT ANALYSIS OF THREE POTENTIAL REMEDIES

BP WOOD RIVER
WOOD RIVER, ILLINOIS

Final Report
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NOTICE

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EXECUTIVE SUMMARY

This study quantifies the environmental footprints of three remedial options for managing leachate levels at a closed waste disposal unit at the former BP Products North America, Inc. oil refinery in Wood River, Illinois (BP Wood River) by estimating for each option the emissions of various environmental parameters, such as greenhouse gases, criteria pollutants, and air toxics, and the resources used, such as energy and water. The study considers contributions to the footprints from multiple components of the remedies, including construction, operations and maintenance, and long-term monitoring. Both on-site and off-site activities associated with each remedy component are included in the study.

This report documents the process used for estimating the footprints, provides the library of resources and reference values used in the study, documents findings specific to the evaluated remedies, and presents both site-specific and more generalized observations and lessons learned from conducting the study. Although the process, information, and lessons learned may apply to environmental footprint analysis efforts at other sites, the contents of this report are not intended as EPA policy statements regarding environmental footprint analyses.

One of the objectives of this analysis is to provide some of the information necessary to determine the level of detail that is merited for environmental footprint analysis of site remediation. It is therefore expected that the level of detail for this footprint analysis surpasses that which is needed to make informed decisions to reduce the environmental footprints of a typical remedy and that future footprint analyses at other sites will involve less detail. Other primary objectives of this study include, but are not limited to, the following:

- Identify or develop “footprint conversion factors” to calculate the footprints from various types of energy, materials, and services used in the remedy
- Estimate the footprints of up to 15 environmental parameters for three remedial alternatives
- Estimate the contribution to the various footprints from on-site activities, electricity generation, transportation, and non-transportation off-site activities
- Identify those components of the various remedial alternatives that have a significant effect on the environmental footprint and those components that have a negligible effect on the environmental footprint
- Conduct a sensitivity analysis for variations in the remedy design information, footprint conversion factors, or other input values

Footprint analyses may be conducted at clean-up sites beginning at the remedy selection stage. The results of a footprint analysis at this stage would provide useful background information for site managers, but generally are not expected to play a major role in the remedy selection. Once the remedy is selected, the results of the footprint analysis may be used during remedy design to identify areas where the environmental footprint of the remedy may be reduced. Results of a footprint analysis would also be valuable for reducing the environmental footprint of a remedy already in operation, for example during remedy optimization.

This study is not a formal life-cycle assessment following ISO Standards 14040 and 14044, but like a life-cycle assessment attempts to account for the total footprints from all energy, materials, and activities associated with the remedies, from resource extraction through use and "end-of-life" treatment.

This environmental footprint analysis has been conducted independently of site activities at BP Wood River. BP, its consultants, and the Illinois EPA site team have provided the footprint analysis study team information so that the study could be performed for illustrative purposes. BP, its consultants, and the Illinois EPA site team are acknowledged for this assistance.

Background and Methodology

The disposal unit at BP Wood River, referred to as the Closed Disposal Facility (CDF), is a 26-acre disposal site which received chemical and oil refinery wastes from an unknown starting date until 1980. The goal of remediation is to reduce or control the leachate levels in the CDF.

Footprints from on-site and off-site activities are calculated for the following three remedy alternatives:

- Phytoremediation using trees to reduce leachate levels
- Leachate extraction and disposal using extraction wells
- Landfill cover grading and repairs to reduce infiltration of precipitation

This study was conducted after the Phytoremediation alternative was selected as the remedy and after remedy implementation was initiated. Therefore, the final results of this study were not considered during the actual remedy selection or design. Some available information from the Phytoremediation implementation is used as input for this study. Conceptualized design information is used for the other two alternatives.

The results are organized into the following three analyses:

- Primary analysis – results are organized according to on-site activities, electricity generation, transportation, and non-transportation off-site activities.

- Secondary analysis – results are organized according to three main remedy components: remedy construction, operations and maintenance (O&M), and long-term monitoring (LTM).

- Sensitivity analysis – results are obtained for variations in remedy assumptions and other input information.

Many observations are made based on the findings from these analyses. Some of the observations are specific to the BP Wood River site and others are more general observations that might apply to footprint analyses conducted at other clean-up sites. The following is a limited sample of both types of observations. Many more observations are provided in the Observations section of this report.

Sample of Observations Specific to the BP Wood River Site

- When considering the total footprints (i.e., on-site plus off-site), the Phytoremediation alternative has smallest environmental footprint for most of the 15 environmental parameters by a relatively wide margin. The only parameter for which the Phytoremediation alternative has the highest total footprints is local water use (assumed to be potable water). Release of lead to the environment in the Phytoremediation alternative is statistically equal to that of the Leachate Extraction alternative. The local water use is for emergency irrigation of the trees and the lead release is associated with the production of steel for the deer fence. Lead would result in non-local environmental effects and may not be a high priority to local site stakeholders.

- The footprints for the various environmental parameters can be grouped according to the EPA five core elements for green remediation (energy, air, water, materials, and land/ecosystems) to reduce the likelihood that interpretation of the results of the footprint analysis would be dominated by several parameters that track together. Even with this grouping, the Phytoremediation alternative appears to have the most favorable environmental footprint.

- The footprint analysis results appear to indicate relatively low SOx emissions associated with diesel use (relative to NOx emissions), reflecting the use of low-sulfur fuel; however, there appears to be significant SOx emissions associated with the diesel refining process. As a result, the use of low-sulfur diesel does not appear to significantly improve total SOx footprints. Instead, according to the life-cycle inventory data, it may only shift the sulfur emissions from on-site and transport corridors to and from the site, to the area around the refineries where the diesel is produced.

- Each remedial alternative has only a few significant contributors, but the contributors differ for each alternative. For the Phytoremediation alternative, the important contributors include carbon storage in the growing biomass, laboratory analysis, fuel for transportation, and steel production for the deer fence. For the Leachate Extraction alternative, the important contributors include electricity production/transmission/use, laboratory analysis, and waste water treatment at the POTW. For the Cover Regrading alternative, the important contributors include on-site and off-site fuel use, production of the fuel, and laboratory analysis.

- Of the three remedy alternatives, the Phytoremediation alternative has the shortest estimated remedy duration, the fewest passenger trips, the fewest heavy duty truck trips, the fewest passenger miles, the fewest man-hours worked on-site, and the fewest hours of equipment operation. The one travel-related metric for which the Phytoremediation alternative does not have the most favorable value is heavy-duty truck miles. This is because this remedy alternative uses materials (specifically tree saplings or whips) that are not a local resource. By contrast, the Leachate Extraction alternative uses very few materials and all waste is disposed of at a local facility. The Cover Regrading alternative uses local soil and clay for remedy implementation.

Sample of General Observations that May Apply to Other Sites

- On-site activities, electricity generation, transportation, and off-site activities (e.g., manufacturing) all have the potential to contribute significantly to the footprints of clean-up remedies. For evaluating most remedy technologies at most sites, it appears that environmental footprint analysis should consider all four of these types of activities. Contributions from the above four categories of activities may differ from remedy to remedy. The large or significant contributors to a remedy footprint may not become apparent unless a wide range of contributors are included in the footprint analysis.

- Footprint analysis results derived during the remedy selection phase can be used to identify those components of a remedy that have the largest influence on environmental footprints, allowing these components to receive extra attention during design and implementation for potential ways of reducing the remedy footprint. For example, using partially loaded trucks to bring soil and clay to the site for routine, periodic, long-term cap repairs results in significant additional traffic and emissions footprints. Knowledge of this ahead of time may encourage site managers to arrange for full loads and to stockpile extra materials for future use.

- The use of electricity from renewable resources can significantly change footprint results and the comparison of alternative remedies. The availability of renewable electricity from the grid (whether provided by default by the electricity provider or purchased) provides an effective means of applying renewable energy to a remedy. Use of renewable energy from the grid requires no change to on-site equipment or work practices.

- Depending on the fuel mix for generating grid electricity, electricity generation may contribute significantly to air toxics emissions. Based on the life-cycle inventory data used, electricity generated from coal results in 3.5 times higher air toxics emissions than electricity generated from natural gas, assuming resource extraction is considered for both fuels. Air toxics emissions from the electricity intensive remedial alternative in this study are 8 times greater than the air toxics from the other remedial alternatives.

- Footprint intensity may be an important factor in interpreting the environmental footprint of a remedy. For example, for a construction-intensive or aggressive short-term remedy, emissions of NOx, SOx, PM, and air toxics may be intense over a relatively short-period of time and more likely to contribute to exceedances of National Ambient Air Quality Standards. By contrast, for the long-term component of a remedy (e.g., long-term monitoring), total long-term emissions of NOx, SOx, PM, and air toxics may be higher than those of the construction-intensive remedy but will occur over a 10, 20, or 30 year period and may have a negligible effect on local air quality.

- Footprint timing may be an important factor in interpreting the environmental footprint of a remedy. For example, for some environmental parameters, such as local water use or CO2e emissions, near-term footprints are more problematic than future footprints. Near term use of water resources can accelerate water shortage issues in areas with limited water resources, whereas future footprints allow for the option of planning for the greater water demand. Similarly, near-term CO2e emissions can contribute to global warming and climate change in the near term rather than 10, 20, or 30 years into the future. Moreover, actual future emissions may be lower than current estimates of future emissions due to improvements in energy efficiency, alternative energy, renewable energy, or other technologies that may be developed over these time frames and help reduce emissions.

Conclusion

The BP Wood River study has provided insight into key contributors to the environmental footprints associated with site remediation. It has also provided a preliminary framework for conducting an environmental footprint analysis. EPA has already completed a detailed footprint analysis at one remediation site prior to this analysis for BP Wood River, and plans to conduct a similar analysis at a third site, in order to explore other remediation technologies, increase the inventory of information needed for conducting footprint analyses, and further develop the framework for conducting footprint analyses. It is expected that this work will enhance the understanding of the environmental footprint process for site remediation.

PREFACE

This report was prepared as a collaborative pilot effort between U.S. EPA Region 9, the U.S. EPA Office of Superfund Remediation and Technology Innovation (OSRTI), and the U.S. EPA Office of Resource Conservation and Recovery (ORCR), in support of furthering the understanding of the process of estimating environmental footprints of various environmental remedies. This report is available for download from www.cluin.org/greenremediation.

Two additional pilot studies of similar scope are underway at two additional cleanup sites and will also be made available at www.cluin.org/greenremediation when completed. The authors of this report recognize that green remediation and the footprint analysis component of green remediation are developing practices, and comments and feedback are welcome on this report. Comments and feedback should be directed to Carlos Pachon and Karen Scheuermann (contact information below).

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LIST OF ACRONYMS

CO_2e – Carbon dioxide equivalents of global warming potential

EPA – U.S. Environmental Protection Agency

GHGs – Greenhouse gases

HAP – Hazardous air pollutant as defined by the Clean Air Act

HDPE – High density polyethylene

ISO – International Standards Organization

LTM – Long-term monitoring

NO_x – Nitrogen oxides (e.g., nitrogen dioxide)

O&M – Operations and maintenance

PM – Particulate matter (particles 10 microns or less in diameter)

POTW – Publicly owned treatment works

PVC – Polyvinyl chloride

SO_x – Sulfur oxides (e.g., sulfur dioxide)

VOCs – Volatile organic compounds

1.0 INTRODUCTION

1.1 ENVIRONMENTAL FOOTPRINT ANALYSIS

U.S. EPA defines green remediation as the practice of considering all environmental effects of remedy implementation and incorporating options to minimize the environmental footprints of a cleanup. To this end, green remediation involves quantifying the environmental effects of a remedy and then taking steps to reduce negative environmental effects and enhance positive environmental effects, while meeting the regulatory requirements governing the remedy.

Two concepts are central to quantifying the environmental effects of a remedy. The first is to establish those parameters that are to be quantified, and the second is to establish a straightforward methodology for quantifying those parameters. The term “footprint”, which is commonly applied to quantifying the emissions of carbon dioxide (i.e., “carbon footprint”), refers to the quantification or measure of a specific parameter that has been assigned some meaning. For example, the carbon footprint is the quantification or measure of carbon dioxide (and other greenhouse gases) emitted by a particular activity, facility, individual, or remedy. The carbon footprint is of interest because emissions of carbon dioxide (and other green house gases) have been linked to environmental effects such global warming and related climate change. The term “footprint” can be expanded to other environmental parameters such as energy use, water use, land use, and air pollutant emissions. In addition, an environmental footprint can be local, regional, or global. For example, the combustion of diesel fuel at a site will result in nitrogen oxide emissions (among other compounds) in the immediate vicinity of the site. The most significant environmental effects from this nitrogen oxide may be greatest near the site where it is most concentrated (i.e., a local effect). Contrastingly, diesel combustion at a site and diesel production at a refinery located far from the site will both emit carbon dioxide into the atmosphere. The environmental effects of carbon dioxide are of global not local concern, and a pound of carbon dioxide emitted at the site or far from the site will have equal environmental effect (i.e., a global effect).

Estimating the environmental footprint of remediation projects is becoming increasingly commonplace as are the development of tools to assist with the effort. However, as yet there is no standardized process, set of parameters, or accepted tool. Some projects focus on the carbon footprint and omit other parameters. Some projects limit the scope of the footprint analysis to fuel consumption and electricity use and omit contributions from manufacture of materials or off-site services that are required for a remedy. In general, however, the objective of the footprint analysis is to identify the most significant contributors to a remedy’s footprint so that efforts to reduce a remedy’s footprint can be targeted appropriately.

1.2 STUDY OBJECTIVES

This study involves the detailed environmental footprint analysis of three options for managing leachate levels at a closed waste disposal unit, referred to as at the Closed Disposal Facility (CDF), at the former BP Products North America, Inc. oil refinery in Wood River, Illinois (BP Wood River). For each of the three potential remedial options, the study estimates the footprint for a variety of parameters and attempts to consider all practical contributions to each footprint. This study is not a formal life-cycle assessment following ISO Standards 14040 and 14044. Rather, it is a footprint analysis that borrows from life-cycle assessment principles. Like a life-cycle assessment, this study uses data from life-cycle inventory databases to convert energy usage, materials usage, and various services associated with a particular activity (e.g., site remediation) into the environmental footprints of that activity. Like life-cycle assessment, the environmental footprints from resource extraction through use and "end-of-life" treatment are considered. Unlike a formal life-cycle assessment, this study estimates environmental footprints but does not convert them into actual human or ecological impacts or effects through a formal impact assessment.

One of the objectives of this detailed analysis is to provide some of the information necessary to determine the level of detail that is merited for environmental footprint analysis of site remediation. It is therefore expected that the level of detail for this footprint analysis surpasses that which is needed to make informed decisions regarding the remedy footprint and that future footprint analyses at other sites will involve less detail. The other primary objectives of this study are as follows:

- Identify or develop "footprint conversion factors" to calculate the footprints of each environmental parameter given a known usage of a specific type of energy, material, or service. Identify gaps in available information that, if filled, would improve the quantification of environmental footprints.

- Estimate the footprints of 15 environmental parameters for three remedial options and determine the remedial option that has the smallest estimated footprint for each parameter.

- For each environmental parameter, estimate the contribution to the footprint from on-site activities (e.g., on-site fuel combustion), electricity generation, transportation (e.g., personnel transportation, freight), and off-site activities (e.g., waste disposal, material manufacturing).

- Based on the estimated on-site and off-site footprints for the various parameters, consider which remedy a hypothetical group of site stakeholders might see as having the more favorable environmental footprint.

- Identify components of the various remedial alternatives that have a significant effect on the environmental footprint and those components that have a negligible effect on the environmental footprint.

- Conduct a sensitivity analysis for key components of remedies or key footprint conversion factors.

- Identify how the outcome of a footprint analysis conducted during the remedy selection phase might assist with optimizing the remedy during the remedy design and implementation phases.

Footprint analyses may be conducted at clean-up sites beginning at the remedy selection stage. The results of a footprint analysis at this stage would provide useful background information for site managers, but generally are not expected to play a major role in the remedy selection. Once the remedy is selected, the results of the footprint analysis may be used during remedy design to identify areas where the environmental footprint of the remedy may be reduced. Results of a footprint analysis would also be valuable for reducing the environmental footprint of a remedy already in operation, for example during remedy optimization.

BP, its consultants, and the Illinois EPA site team have provided site-specific information from BP Wood River so a footprint analysis study could be performed by U.S. EPA for illustrative purposes. However, this footprint analysis was conducted independent of site activities and decision-making at BP. That is, BP served as a test case of for the development of the methodology of the footprint analysis, and the conclusions and lessons discussed in this report pertain to the methodology for conducting such an analysis, rather than the application of the specific results to the BP Wood River site. Any decisions on how or whether the results of this study may be used by Illinois EPA or the site owner at BP will be an independent process within the site remediation program at Illinois EPA.

The findings from this analysis are specific to the CDF at the BP Wood River facility and to the remedies evaluated. The Observations section of this document provides, where applicable, general conclusions and lessons learned that may apply to other sites.

1.3 Brief Site Background

The BP Wood River Closed Disposal Facility (CDF) is a 26-acre disposal site located on riverfront property on the east bank of the Mississippi River that was used to manage various petroleum and additive wastes. A slurry wall surrounds the perimeter of the CDF, contains the CDF waste material and is keyed into underlying silty-clay deposits (flood plain deposits). The slurry wall separates the CDF horizontally from the shallow perched water bearing zone, which consists of unconsolidated deposits overlying the flood plain deposits. The flood plain deposits consist of low-hydraulic conductivity silty-clay that is present beneath the entire footprint of the CDF and separates the CDF vertically from the uppermost aquifer. A low-hydraulic conductivity 2-foot-thick clay cap typically covers the CDF. Until recently, BP operated a leachate extraction system that consisted of four extraction wells, piping, and an oil water separator. Product was discharged from the separator to a storage tank which was periodically emptied. Water was discharged from the separator to the riverfront sewer system. More recently, BP installed a phytoremediation remedy, planting trees on top of the CDF to control leachate levels.

Approximately 39 inches per year of precipitation falls on the CDF. Precipitation that does not run off either evaporates, evapotranspires, or infiltrates into the soil and/or CDF. The CDF containment system (clay cover, slurry wall, and underlying low-hydraulic conductivity flood plain deposits) is functioning to limit infiltration into the CDF and exfiltration of liquid from the CDF. Groundwater levels in shallow wells located outside of the CDF are lower than liquid levels within the CDF. The difference in liquid levels inside and outside of the slurry wall also demonstrates that the slurry wall provides containment of leachate. However, the resulting positive hydraulic gradient across the slurry wall indicates that the potential exists for contaminant migration through the slurry wall.

The primary objective of the corrective measure for the CDF is to further limit the potential for groundwater contamination by managing the leachate levels within the CDF. Potential alternatives considered for corrective measures include the following three alternatives:

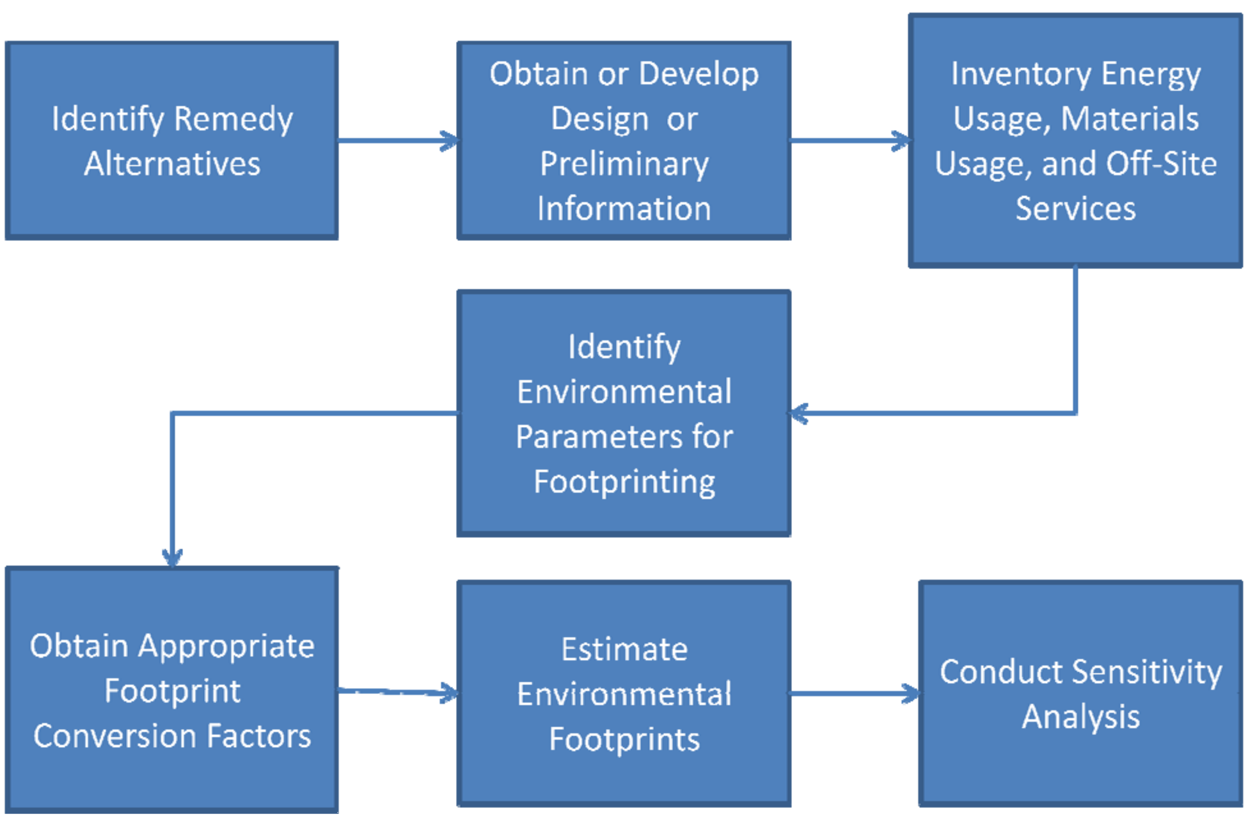
- Phytoremediation - planting trees to enhance evapotranspiration within the boundary of the CDF
- Leachate extraction - extracting leachate through additional extraction wells, processing the leachate through an oil/water separator, and discharging the leachate to the local sanitary sewer
- Cover regrading - restructuring approximately 5 acres of the CDF cap with fill and clay to reduce infiltration of precipitation.

In April 2006, BP submitted a report titled "Final Corrective Measures Plan" that recommended phytoremediation be selected as the final corrective measure for the CDF. The Illinois EPA approved the recommended final corrective measure in a letter dated August 1, 2007.

1.4 Scope and Methodology

For this study, footprints from on-site activities and off-site activities for three remedy alternatives are organized into two main analyses. The first or primary analysis organizes the footprint analysis results according to on-site activities, electricity generation, transportation, and non-transportation off-site activities. The second or secondary analysis organizes the footprint analysis results according to three major remedial components. For each analysis and for each analyzed remedy alternative, preliminary design information is developed from which an expected inventory of energy usage, materials usage, and off-site services can be quantified. Based on the items in the inventory, appropriate footprint conversion factors are obtained or developed that can be used to convert the items in the inventory into the environmental footprints. The footprints for the various environmental parameters are then estimated by applying the conversion factors to the items in the inventory. Once the process is conducted for one remedy alternative or sets of remedy alternatives, various components of the remedy designs are modified to conduct a sensitivity analysis. Figure 1 illustrates this process, and each step is described in more detail in the following sections.

Figure 1. Schematic of Footprinting Analysis Process



1.5 REMEDY ALTERNATIVES TO BE ANALYZED

This study evaluates the following three remedial alternatives:

- Alternative A (Phytoremediation) – This alternative involves planting over 3,000 trees on the surface of the CDF to use evapotranspiration to transfer water from the CDF into the atmosphere.

- Alternative B (Leachate Extraction) – This alternative involves extraction of the leachate with extraction wells, pre-treating the leachate with an oil/water separator, and discharging pretreated water to the sanitary sewer for treatment by the publicly-owned treatment works (POTW)

- Alternative C (Cover Regrading) – This alternative involves restructuring approximately 5 acres of the CDF with fill and clay to reduce infiltration of precipitation.

In addition, all three of the remedial alternatives include a long-term monitoring component.

All of the remedy alternatives evaluated are assumed to provide appropriate protection of human health and the environment. That is, each remedy alternative is assumed to provide equivalent control of leachate migration by effectively controlling leachate levels. As a result, the no-action alternative (institutional controls and long-term monitoring) originally considered by the site team during actual remedy selection was not evaluated in this study.

1.6 REMEDY DESIGN INFORMATION

Sufficient information for each remedial alternative is necessary to quantify or inventory the use of energy, materials, and off-site services for implementing the alternative. This information includes but is not limited to the number and types of trees to be planted, the number of extraction wells, and estimated volumes of low permeability soil to be placed on the cap. The level of detail of this information and the assumptions made has a direct effect on the calculated footprints. For this study, all aspects of the remedial design for the Phytoremediation alternative and most aspects of the other two alternatives have been provided by the site owner. For example, the site owner provided the number and types of trees to be planted for the Phytoremediation alternative based on bench scale tests of growing trees with leachate and pilot scale testing of planting various tree species at the site. As part of this study, the full size growth of the trees in the Phytoremediation alternative was scaled to 50% of the size documented in literature to account for potentially non-optimal growing conditions due to climate, air quality, and water quality. The sensitivity of the results to full tree size is evaluated. Some design information, particularly for the Leachate Extraction alternative, was developed as part of this study, including the type of extraction pumps and pipe diameter.

Appendix A provides for each remedial option a printout of a set of spreadsheet modules that is used to document the remedy information and inventory the level of effort, fuel, electricity, water, and materials usage. The printouts include a more detailed description of the remedies. The inventory files provided in Appendix A include the assumptions and information used to convert remedy activities (such as tree planting, well installation, or earth moving) into services, materials, or energy use (such as quantity of waste disposed, amount of PVC used for well casing, or diesel fuel used for equipment).

1.7 REMEDY INVENTORY

Footprint analysis for environmental remedies is relatively new, so footprint conversion factors are not readily available for common site remediation activities. For example, a conversion factor to estimate the carbon footprint for extraction well installation is not readily available. Rather, information from life-cycle databases for common, fundamental energy types, materials, and services are available. As a result, the remedy information is reduced to these fundamental components. An inventory is developed for electricity, diesel, gasoline, GAC, PVC, steel, concrete, waste disposal, and other energy, materials, or services directly involved in remedy implementation. For this study, the materials used on-site are included in the inventory, but materials used to manufacture equipment or materials not dedicated to the site are not included. For example, the energy used to transport a drill rig to the site and to operate it on-site is included, but the energy and resources used to manufacture the drill rig are not included.

For each remedial alternative, Appendix A includes design and inventory information for the following:

Three types of energy

• gasoline[1]	• grid electricity[2]
• diesel[1]	

15 common materials[3]

• PVC	• Borrow (clean soil)
• HDPE	• Concrete
• Steel	• Bentonite
• Stainless steel	• Nitrogen fertilizer
• Sand/gravel/clay	• Sodium hydroxide
• Cement grout	• Tree sapling (root ball)
• Hydroseed	• Tree sapling (whip)
• Phosphorus fertilizer	

Two types of water[4]

• Potable water	• Extracted groundwater

Four types of off-site services

• Solid waste disposal[5]	• Hazardous waste disposal[5]
• Laboratory analysis	• Off-site water treatment at a POTW

Notes

[1] *The inventory includes the use of these energy forms in on-site activities and for transportation of personnel and materials to and from the site.*

[2] *The inventory includes electricity used on-site, electricity lost due to transmission and distribution over the grid, and losses during the production of electricity by power plants (including an estimate of sacrificial loads by the power plants). Off-site electricity usage from materials manufacturing and other off-site activities is also estimated and included in the electricity footprint (see next section).*

[3] *The inventory includes materials used on-site*

[4] *The inventory includes potable water used on-site and groundwater extracted on-site. Other types of water (e.g., reclaimed water) were not considered for this project. Off-site water usage from materials manufacturing and other off-site activities is estimated as a footprint parameter (see next section).*

[5] *The inventory accounts for solid and hazardous waste that is generated on-site and requires off-site disposal.*

Each of the above items is expected to contribute to the footprint of one or more environmental parameters selected for use in the study. For example, the manufacturing of PVC for on-site use is expected to contribute to the footprints for carbon dioxide emissions, water use, waste generation, and many other environmental parameters. As another example, combustion of diesel fuel on-site and in transportation is expected to contribute to the footprints of carbon dioxide, NOx, SOx, and PM emissions.

1.8 ENVIRONMENTAL PARAMETERS

For this study, 15 environmental parameters that represent a cross-section of environmental effects were chosen for the footprint analysis. Footprints are estimated for the following environmental parameters, which are briefly described in Table 1. Other studies might choose a refined or expanded list of environmental parameters depending on the scope and objectives of the study.

Parameters for On-Site Activities	**Parameters for Electricity Generation, Transportation and Off-Site Activities**
Energy	Energy
Electricity	Electricity
All water	All water
Potable water	
Local groundwater extracted	
Carbon dioxide equivalents (CO2e) for greenhouse gas potential	Carbon dioxide equivalents (CO2e) for greenhouse gas potential
Nitrogen oxide (NOx) emissions	Nitrogen oxide (NOx) emissions
Sulfur oxide (SOx) emissions	Sulfur oxide (SOx) emissions
Particulate matter (PM) emissions	Particulate matter (PM) emissions
Solid (non-hazardous) waste generated	Solid (non-hazardous) waste generated
Hazardous waste generated	Hazardous waste generated
Air toxics (hazardous air pollutants emitted)	Air toxics (hazardous air pollutants emitted)
Mercury released to the environment	Mercury released to the environment
Lead released to the environment	Lead released to the environment
Dioxins released to the environment	Dioxins released to the environment

On-site parameters refer to parameters generated, emitted, or otherwise used on-site. The parameters in the right-hand column refer to parameters generated, emitted, or otherwise used from electricity generation, transportation, and other off-site activities (e.g., laboratory analysis). Potable water and groundwater are two parameters for which the on-site footprint is estimated but the off-site footprint is not estimated.

The report also briefly discusses the amount of fertilizer and pesticides applied to the site, recognizing that the most significant effects of using these materials may be in the application of them to the land surface rather than manufacturing them. The effects from application may include direct exposure to humans and the ecosystem, runoff into surface water, and formation of nitrous oxide from excessive nitrogen fertilizer. These effects are dependent on site-specific factors and are difficult to quantify; therefore, this analysis addresses the footprints due to fertilizers and pesticides qualitatively rather than quantitatively.

The remedy footprints for NOx, SOx, PM, air toxics, mercury, lead, and dioxins estimated in this study result from various contributing sources of these pollutants. These sources were included in the footprint estimate regardless of whether or not they are regulated or governed by a permit. The footprints of these parameters are quantified for the purpose of estimating the environmental footprints of the three remedial alternatives being evaluated, not for the purpose evaluating the compliance of off-site sources of these parameters or the regulations or permits governing them.

Each of the items in the remedy inventory (see Section 1.7) is expected to contribute to the footprints of one or more of these environmental parameters. The on-site, off-site, and total on-site/off-site footprints of these parameters are determined. The on-site footprint refers to the use, generation, or emission of a parameter within the boundaries of the site (e.g., the NOx emitted from combusting diesel on-site). Off-site would apply to the use, generation, or emission of a parameter during transportation, materials manufacturing, or some other off-site activity (e.g., the NOx emitted off-site during the production of diesel at the refinery or during combustion of diesel for off-site transportation). The reason for distinguishing between on-site and off-site is to quantify the portion of the footprint that may be of importance to the local community (such as PM emissions or local groundwater extraction) and at the same time quantify aspects of the footprint that have global effects (such as greenhouse gas emissions) or regional effects (e.g., ozone, aerosol, or acid rain formation).

The environmental parameters related to water merit additional discussion, because of the unique considerations involved. For this study, on-site “all water” use refers to on-site potable water use plus on-site groundwater extraction if the water resource is not returned to its original water quality. On-site “all water” use could also include on-site use of reclaimed water, storm water, or any other on-site use of a fresh water resource, but these other water resources are not used in the evaluated remedies at BP Wood River. On-site potable water use and on-site groundwater extracted are tracked separately from “all water” because they are of potential interest to the local community and because accurate information is available about on-site use of these water resources. On-site potable water use, in particular, is use of a refined resource that may be relatively scarce and of particular value to some local communities. The study team did not attempt to track potable water and groundwater sources used in association with off-site activities such as waste disposal and sand and gravel production. This is because it is not possible for the study team to determine, based on generalized available information, the quality of the groundwater used in off-site activities, or the source of the potable water used in these activities. Furthermore, the fate of the water after use in off-site processes is unclear. It may be returned to the same off-site aquifer, evaporated, or discharged to local fresh surface water.

Off-site “all-water” use refers to all fresh water resources that are used as part of the off-site activities associated with the remedy, such as the production of materials. In obtaining or developing conversion factors for off-site “all water”, the study team attempted to quantify water “consumed” by a process, rather than water “withdrawn”. However, the LCI data bases available to the study team did not always account for water in a consistent manner. In addition, for conversion factors developed by the study team, it was not always possible to make the distinction between water consumed and water withdrawn. In spite of these difficulties, the off-site “all water” footprints in this study should be seen as approximations for “all water” consumed. Total “all water” refers to the on-site “all water” (as defined above) plus off-site “all water”.

Additional comments are relevant to water required for production of hydroelectricity, which is part of the off-site “all water” parameter. The water use associated with hydroelectric plants is primarily due to evaporation from reservoirs used for the hydroelectric power. Based on the data sources used to develop the water footprint conversion factors for electricity production (see Appendix B), loss of water from hydroelectric reservoirs is apparently orders of magnitude higher than water use associated with fossil-fuel or nuclear power plants. Assuming that the reservoirs serve other purposes (such as flood control, urban and agricultural water supply, and recreation), it is recognized that water loss from the hydroelectric reservoirs would occur regardless of whether or not electricity for a site remediation is drawn from hydroelectric sources. In fact, electricity usage from a hydroelectric plant actually reduces the residence time of water in the reservoir and therefore would decrease the amount of evaporation, although this reduction may be negligible for the amount of electricity required by a site remediation of the scale at BP Wood River. Despite the above considerations, the factor used to convert grid electricity to water use includes the evaporative loss of water from hydroelectric facilities in order to be consistent with the literature cited.

The environmental parameters described in Table 1, along with the process of documenting the materials usage that contribute to the footprints of these parameters, address four of the core elements of green remediation (energy, air, water, and materials) outlined in *Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites* (April 2008, EPA 542-R-08-002). The fifth core element (ecosystem) is considered qualitatively in this report.

The following additional parameters relevant to transportation and labor are also tracked for each remedy alternative:

- miles traveled, by vehicle type
- trips to the site, by vehicle type
- man-days worked on site

1.9 FOOTPRINT CONVERSION FACTORS

A footprint conversion factor provides a means of converting the quantity of each energy type, material, or off-site service used in the remedy into the footprints of the environmental parameters (i.e., the emission, use, or generation of a particular environmental parameter). A footprint conversion factor for a particular environmental parameter, when multiplied by a quantity of energy, material, or service used, provides the footprint for the use of that quantity. For example, a carbon footprint conversion factor for PVC can be multiplied by the mass of PVC used in a well casing to estimate the carbon footprint associated with the production of that PVC pipe as follows:

Quantity of one item in inventory	×	*Footprint conversion factor for converting that item to footprint of one environmental parameter*	=	*Footprint for that environmental parameter from that inventory item*
Total PVC used on-site (in pounds)	×	*Footprint conversion factor for converting pounds of PVC to CO2e emitted for producing one pound of PVC*	=	*CO2e footprint from producing total amount of PVC used*

Similarly, the amount of nitrogen oxides emitted (or NOx footprint) for producing 100 gallons of diesel can be obtained by multiplying 100 gallons of diesel by a NOx footprint conversion factor for the production of diesel. This NOx conversion factor for producing diesel is different from the NOx conversion factor for using or combusting a gallon of diesel. In this study, where possible, a conversion factor is used for both the production and the use of items like diesel.

For this study, most conversion factors are obtained from life-cycle inventory databases. The study team expects that these are reasonable conversion factor values that would apply to most remedial sites because the conversion factors were developed from nationwide or industry-wide information rather than information from a specific manufacturer. This study refers to these generalized conversion factors as "default" conversion factors. In some cases, conversion factors are based on site-specific or local information. This study refers to these site-specific conversion factors as "actual" conversion factors. Examples of actual conversion factors used in this study are the conversion factors applied to electricity production because they are developed based on the documented local fuel blend rather than the average fuel blend used for electricity production in the United States. Other footprint analysis projects may choose to use the conversion factors developed as part of this study, but may identify more specific conversion factors for some of the more predominant materials used in the evaluated remedy. For example, a site team that uses a vendor that provides "carbon neutral" solid waste disposal (if properly documented and verified) would appropriately choose an "actual" carbon footprint conversion factor of zero for solid waste disposal, rather than the "default" generalized conversion factor used in this study.

Where possible, publicly-available databases are used to obtain the footprint conversion factors used in this study so that the information is readily available for confirmation and use by others. The following publicly-available databases are the primary sources of information for this study:

- The U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (NREL LCI) available at www.nrel.gov/lci and maintained by the Alliance for Sustainable Energy

- European Reference Life Cycle Database (EUROPA ECLD), version II compiled under contract on behalf of the European Commission - DG Joint Research Centre - Institute for Environment and Sustainability with technical and scientific support by JRC-IES from early 2008 to early 2009 available at http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm

- LCA Food Database (Nielsen PH, Nielsen AM, Weidema, BP, Dalgaard R and Halberg N, 2003), based on activities in Denmark and available at www.lcafood.dk (used primarily for food-based products, such as molasses, cheese whey, and vegetable oil in bioremediation remedies)

It is recognized that the life-cycle data developed for Europe may not translate directly to materials manufactured in the United States, but it is assumed that the manufacturing and food processing practices are similar and that the life-cycle inventory values reasonably represent those associated with activities in the United States, especially given that the life-cycle databases are based on average values from multiple manufacturing facilities. The information from these databases typically includes environmental footprints from resource extraction through the production of material. The information, however, is not specific to the form of the material. For example, the databases include the footprints for manufacturing of steel and PVC resin beginning at resource extraction, but do not include the specific footprints for manufacturing steel fencing, steel pipe, PVC pipe, or PVC liner.

Conversion factors for some items and services were not available from the life-cycle data resources used, such as those associated with growing tree sapling root balls, preparing hydroseed, and performing laboratory analyses. The study team used a combination of professional judgment and data from individual facilities to estimate these conversion factors.

For example, the conversion factors for laboratory analysis are based on assumptions made by the study team. The study team assumed that laboratory activity is comparable to the general activity of the United States economy such that the CO2e emissions associated with each dollar of laboratory revenue is comparable to each dollar of United States gross domestic product (GDP). It is further assumed that the CO2e emissions for the laboratory analysis can be equally distributed between electricity use and diesel combustion. This electricity use and diesel combustion can then be used to generate conversion factors for other parameters related to laboratory analysis. Refer to Appendix B for additional information.

The reference file that contains the footprint conversion factors that are used in this study is included in Appendix B, along with the reference information used to develop the conversion factors.

1.10 Calculation of Environmental Footprints

The calculation of environmental footprints is relatively straightforward once the remedy inventory is established, the environmental parameters for footprint analysis have been selected, and appropriate footprint conversion factors are identified. As stated in Section 1.9, the footprint for a specific environmental parameter from a particular energy type, material, or off-site service is obtained by multiplying the quantity of the relevant item by the footprint conversion factor for the specific environmental parameter. The footprints derived for a particular environmental parameter from all items in the remedy inventory are summed to obtain the total remedy footprint for a specific environmental parameter. For example, the on-site and off-site CO2e footprints for a remedial alternative are calculated as follows:

On-Site Remedy CO2e footprint	=	*CO2e footprint for on-site diesel combustion* + *CO2e footprint for on-site gasoline combustion* + *CO2e footprint from on-site process GHG emissions*

Off-Site Remedy CO2e footprint	=	*CO2e footprint for off-site diesel combustion* + *CO2e footprint for off-site gasoline combustion* + *CO2e footprint for electricity production* + *CO2e footprint for manufacturing of various products (e.g., PVC, HDPE, potable water, diesel, gasoline, etc.)* + *CO2e footprint for off-site wastewater treatment* + *CO2e footprint for solid waste disposal* + *CO2e footprint for hazardous waste disposal* + *CO2e footprint for laboratory analysis*

Note that the above example includes the footprint associated with producing the gasoline or diesel that is combusted.

1.11 Analyses

There are three sets of footprint analyses conducted for this study, each of which is described below.

1.11.1 Primary Analysis

In the primary analysis, the three remedy alternatives are analyzed to evaluate how on-site activities, transport to and from the site, and off-site activities (e.g., manufacturing) contribute to the on-site and total footprints for the remedies. The contribution to the footprint from generation of electricity used on-site is also accounted for separately. The footprint spreadsheet output files for this analysis are presented in Appendix C.

1.11.2 Secondary Analysis

In the secondary analysis, each of the three alternatives is divided into three components to determine which remedy components are negligible and which remedy components contribute significantly to the various footprints:

- Construction
- Operations and maintenance (O&M)
- Long-term monitoring (LTM)

The footprint spreadsheet output files for this analysis are presented in Appendix C.

1.11.3 Sensitivity Analysis

The estimated footprints are anticipated to be more sensitive to some input information than other input information. The output (estimated footprint) is considered sensitive to a parameter when a reasonable variation in input value results in a significant variation in the output. The output is not sensitive when large variations in input values do not substantially change the output. The sensitivity of the output to various input information can be determined by conducting sensitivity analyses, which involves varying the input and tracking the magnitude of the output. In general, footprint analysis output is sensitive to the input values associated with the largest contributors to the footprints. For example, electricity is a large component of the Leachate Extraction alternative. As a result, variations in electricity usage, or variations in the conversion factors used to convert electricity usage into footprints, would be expected to result in significant changes in the footprint estimate.

Determining the sensitivity of various parameters has the following two important functions for footprint analyses conducted during the remedy selection or remedy design phases.

- First, if the footprint is sensitive to a particular input parameter, then it suggests that modifications during design and implementation could help significantly reduce the footprint. For example, if the site team identifies that the Cover Regrading alternative is highly sensitive to the distances the soil and clay are transported to the site, then the site team may focus on limiting the amount of these materials used, identifying local sources of these materials, or finding energy efficient means of transporting them.

- Second, if the footprint is sensitive to a particular input parameter and the value of that input parameter is uncertain, then the quality and accuracy of the analysis is called into question because the value of the estimated footprint is similarly uncertain. For example, if the duration of the Leachate Extraction alternative is uncertain between 10 and 30 years, then the calculated footprints are also similarly uncertain, making it difficult to compare the footprint of this remedial option to another remedial option.

The following items are evaluated as part of the sensitivity analysis.

- Reduce groundwater quality sampling from semi-annual to annual
- Vary the growth rates of the trees and consequently the amount of carbon stored
- Vary the occurrence of cracks in the clay cap and related repairs
- Consider the need to replant up to 10% of the planted trees
- Consider the effects of applying various clean diesel technologies
- Vary the distances for transporting key materials to the site
- Consider potential variations in key footprint conversion factors

2.0 RESULTS

Some findings are presented below for each of the above-mentioned analyses as a sample of the types of findings that are available from a detailed footprint analysis. The Supplemental Charts section of this report provides a graphical representation for other footprints calculated but not discussed in the text. Appendices A through C provide detailed information regarding each of the remedies, the remedial parameters, and the environmental footprints. This supplemental information could be used to develop many other relevant findings.

2.1 PRIMARY ANALYSIS

2.1.1 TOTAL FOOTPRINTS FOR SELECTED GLOBAL/REGIONAL ENVIRONMENTAL PARAMETERS, BY REMEDY

Charts 1 through 3 present the total (i.e., the on-site plus off-site) footprints for CO2e, SOx, and mercury for each of the three remedy alternatives. These three environmental parameters are presented because they are representative of the global or regional environmental effects resulting from the remedies. CO2e is a measure of greenhouse gas potential, which can affect global climate change; SOx can lead to the formation of aerosols and acid rain, which are regional effects; and mercury is persistent in the environment and bioaccumulates. For all three parameters, the Leachate Extraction alternative has a larger footprint than either of the two other alternatives. The Phytoremediation alternative, which is anticipated to control leachate within 7 years, has a negative CO2e footprint because the carbon stored in the tree biomass more than offsets any other CO2e emissions associated with the remedy. Carbon storage in biomass is calculated for a 30-year period because this is the anticipated monitoring period for all three remedy alternatives. There is also a small but unnoticeable reduction in the SOx footprint due to deposition of ambient SOx on leaves of the trees. The Phytoremediation and Cover Regrading alternatives are similar for the SOx and mercury footprints.

The Phytoremediation alternative has the smallest environmental footprint for most of the 15 environmental parameters by a relatively wide margin. The only parameters for which the Phytoremediation alternative has the highest total footprint is local water use (assumed to be potable water). Release of lead to the environment in the Phytoremediation alternative is nearly equal to that of the Leachate Extraction alternative. For more information on how the total footprints for the other parameters compare among the three alternative remedies, refer to the charts labeled “Primary Analysis – Output by Parameter” in the Supplemental Charts section of this report and to the tables in Appendix C.

Chart 1

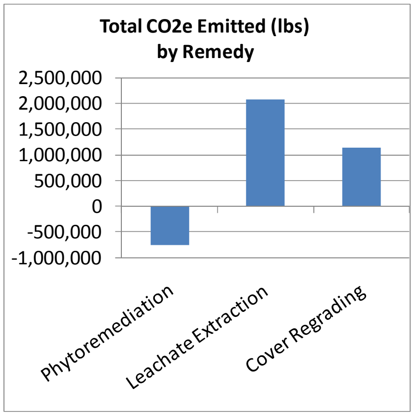


Chart 2

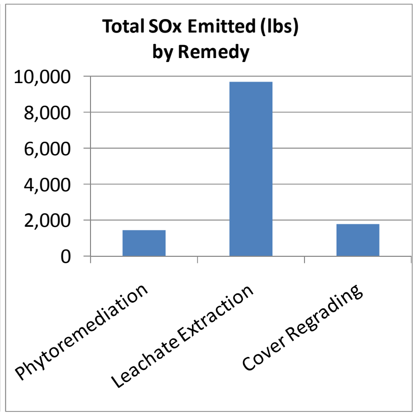
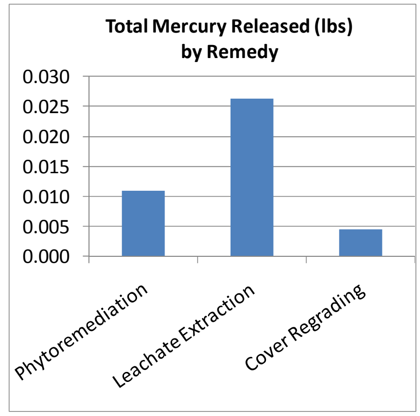


Chart 3



"Total" refers to on-site plus off-site footprint for the life-time of the remedies.

2.1.2 On-Site Footprints for Selected Local Environmental Parameters, by Remedy

Charts 4 through 6 present the on-site footprints for NOx, PM, and air toxics (i.e., the amount of NOx, PM, and air toxics emitted on-site) for each of the three remedy alternatives. These three environmental parameters are presented because they are representative of the local or regional environmental effects resulting from the remedies. NOx contributes to local or regional ground-level ozone formation, and PM and air toxics can lead to health problems when inhaled. For all three parameters, on-site emissions for the Phytoremediation and Leachate Extraction alternatives are significantly lower than the emissions for the Cover Regrading alternative. The on-site PM emissions for the Phytoremediation alternative are negative because of deposition of ambient particulates onto tree biomass. For more information on how the on-site footprints for the other parameters compare among the three alternative remedies, refer to the "Primary Analysis Charts – Output by Parameter" in the Supplemental Charts section of this report and to the tables in Appendix C.

Chart 4

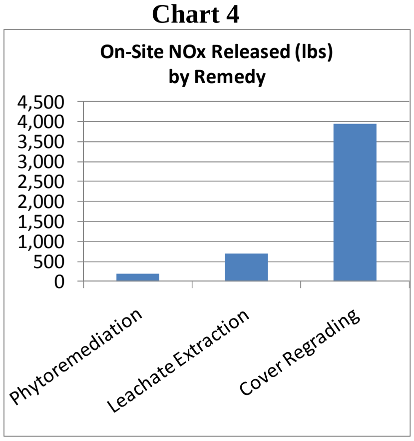


Chart 5

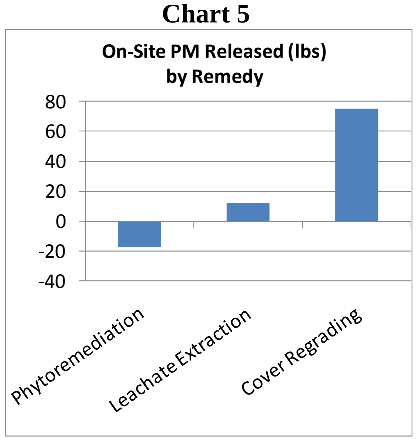
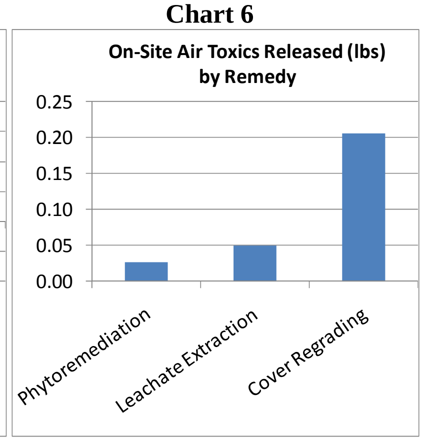


Chart 6



These charts show the on-site footprints over the life-time of the remedies.

2.1.3 On-Site, Electricity, Transportation, and Other Off-Site Distribution of Footprints

Charts 7 through 9 present, for each of the remedies, the distribution of CO_2e, NOx, and air toxics emissions from on-site, transportation, and non-transportation off-site activities, as well as generation of electricity used on-site. The following findings are noteworthy:

- CO_2e emissions from transportation and other off-site activities are generally similar (with some variation) among the three alternatives.

- The primary differences between the three alternatives for CO_2e emissions are from on-site activities and generation of electricity used on-site. The on-site CO_2e emissions are negative for the Phytoremediation alternative because of the carbon storage in tree biomass and are high for the Cover Regrading alternative because of the on-site equipment use. Electricity generation does not contribute to the Phytoremediation or Cover Regrading alternatives but is the most significant contributor for the Leachate Extraction alternative.

- For the Leachate Extraction alternative, the CO_2e emissions from on-site sources are too small relative to those from the off-site sources to be apparent on Chart 7 and are therefore negligible.

- Electricity generation and on-site activities contribute significantly to the NOx footprint of the Leachate Extraction alternative and the Cover Regrading alternative, respectively. In contrast, electricity generation and on-site activities contribute insignificantly to the NOx footprint of the Phytoremediation alternative.

- The air toxics footprints for the Phytoremediation and Cover Regrading alternatives are approximately equal and due to contributions from off-site activities. The “other off-site” air toxics footprint is almost double for the Leachate Extraction alternative as compared with the other two alternatives. Transportation further increases the air toxics footprint for the Leachate Extraction alternative, but the largest contributor to the air toxics footprint is electricity generation.

Chart 7

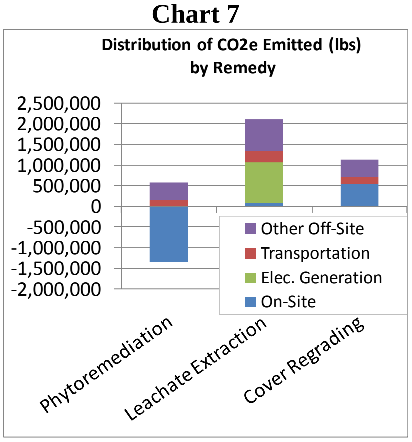


Chart 8

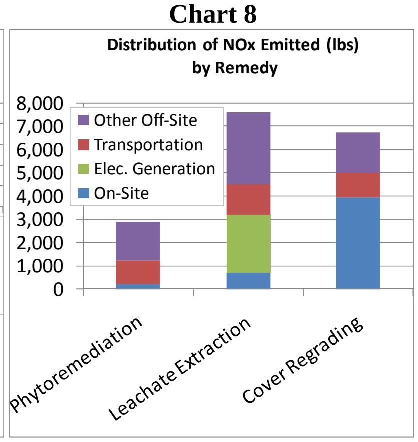
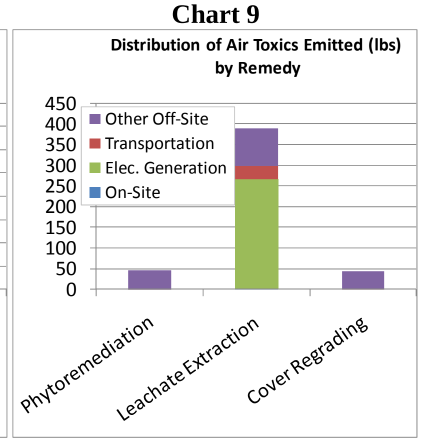


Chart 9



“Off-site” refers to non-transportation off-site sources (e.g, manufacturing) over the life-time of the remedies.

2.1.4 FINDINGS RELATED TO VARIOUS OTHER ENVIRONMENTAL PARAMETERS

A review of the spreadsheet output in Appendix C indicates the following additional findings related to solid waste generation, water use, effects to land and ecosystems, and chemical applications.

- Solid waste generation varies substantially by remedial alternative. The Phytoremediation alternative results in approximately 56 tons of solid waste generation and disposal. The primary sources of this solid waste (approximately 40 tons) are the drill cuttings from the tree planting and the stained soil from seep correction activities, both of which are on-site activities. Approximately 16 tons of solid waste results from production of steel used for the deer fence. The Leachate Extraction alternative results in approximately 930 tons of solid waste. All but two of these tons result from on-site activities. Approximately 30 tons is solid waste from well installation and seep correction. The remaining 900 tons is due to recovered sludge from the oil water separator. The Cover Regrading alternative involves no solid waste disposal.
- None of the remedy alternatives involve hazardous waste generation of more than 0.01 tons. The Leachate Extraction alternative involves generating approximately 0.005 tons (approximately 10 pounds) of hazardous waste associated with the production of the HDPE used for piping.
- All three alternatives have a small footprint for local water groundwater extracted because the remedies involve management of leachate rather than a valuable groundwater resource.
- All three alternatives use little potable water. The Phytoremediation alternative includes the use of approximately 26,000 gallons of local water for irrigation. The Leachate Extraction alternative does not include the use of any local potable water. The Cover Regrading alternative involves the estimated use 10,000 gallons of local water for dust control. The local water for irrigation and dust control could be but are not necessarily potable water.
- The water use from off-site activities greatly exceeds the local use of water. All three remedy alternatives include approximately 234,000 gallons of water use in association with laboratory activities. Aside from laboratory analyses, the biggest uses of off-site water for the three alternatives are summarized in the following table.

Phytoremediation	Steel production for deer fence (42,000 gallons)
Leachate Extraction	Electricity generation (535,000 gallons) Wastewater treatment at the POTW (276,000 gallons) Clay production (188,000 gallons) Solid waste disposal (139,000 gallons) Electricity transmission (64,000 gallons)
Cover Regrading	Clay production (237,000 gallons)

- The Phytoremediation alternative involves the direct application of pesticides and fertilizers to the site. For this study, it is assumed that fertilizers are applied in sufficient amounts to foster growth of the trees but avoid runoff of fertilizers into surface water. With respect to pesticide application, this study is not a toxicity evaluation of the pesticides used, and the assumption is made that pesticides are applied within regulatory guidelines and with appropriate controls to prevent exposure. This footprint analysis defers to the site stakeholders and remedy design for determining the appropriate usage of these chemicals, such that air-borne exposure to local wildlife, run-off into surface waters, and human exposure are avoided.

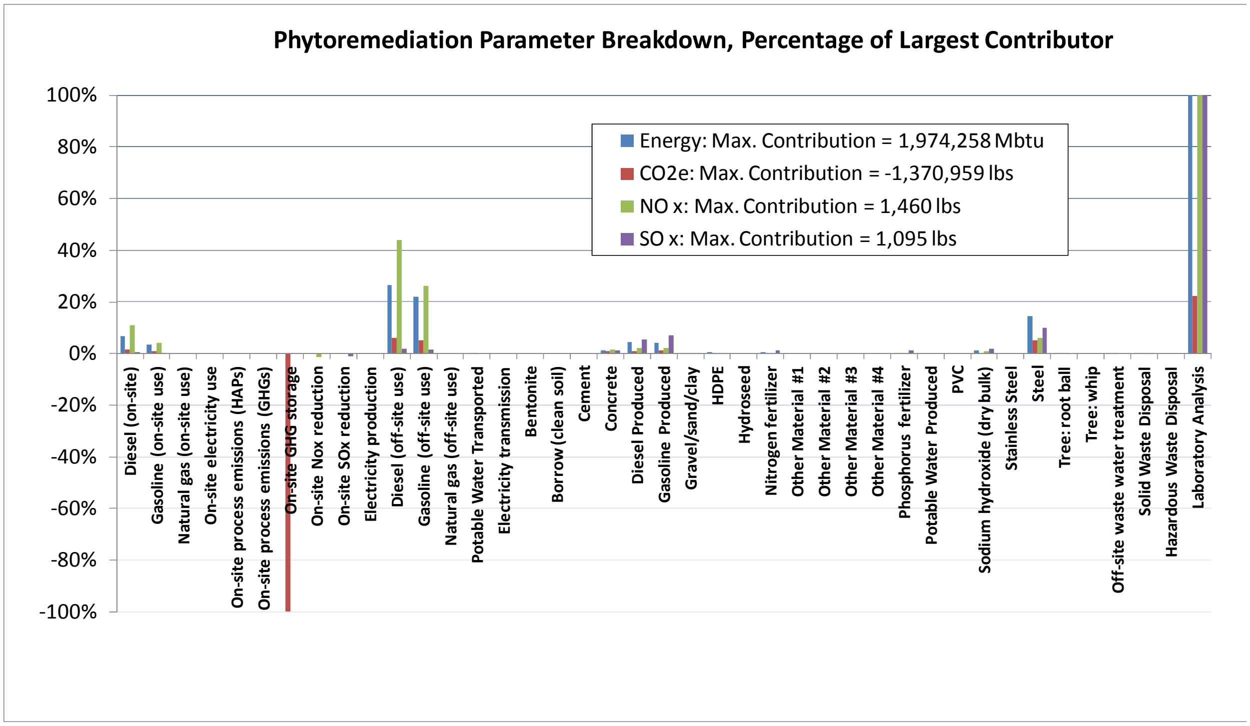
- Each of the three remedies maintains a natural habitat at the site. The Phytoremediation alternative results in 5 acres of newly established wooded habitat that is presumably appropriate for local wildlife. The Leachate Extraction alternative maintains a vegetated landfill cover with surrounding surface water impoundments that typically serve as suitable habitat for birds and other animals. The Cover Regrading alternative temporarily alters the existing vegetative cover but then establishes a new vegetative cover.

2.1.5 INDIVIDUAL CONTRIBUTORS TO FOOTPRINTS OF SELECTED PARAMETERS

Charts 10, 11, and 12 show the relative contributions of the full array of remedial activities (on-site and off-site) to the footprints of selected environmental parameters. These charts are designed to focus attention on the highest contributors to the environmental footprints.

Chart 10 presents the footprints for energy, CO2e, NOx, and SOx for the Phytoremediation alternative. The footprints for other parameters may be distributed differently. The chart is designed to indicate the contribution in terms of percentage of the maximum contributor such that the largest contributor for each parameter is depicted as 100%. The chart indicates that, with the exception of CO2e, the key contributors to these parameters are generally the same. Laboratory analysis is the single largest contributor for energy, NOx, and SOx. Laboratory analysis is also a large contributor for CO2e, but it appears to be relatively small because of the very large offset provided by the carbon stored in the biomass of the planted trees. Off-site diesel and gasoline usage in addition to steel production are the other considerable contributors to these four parameters.

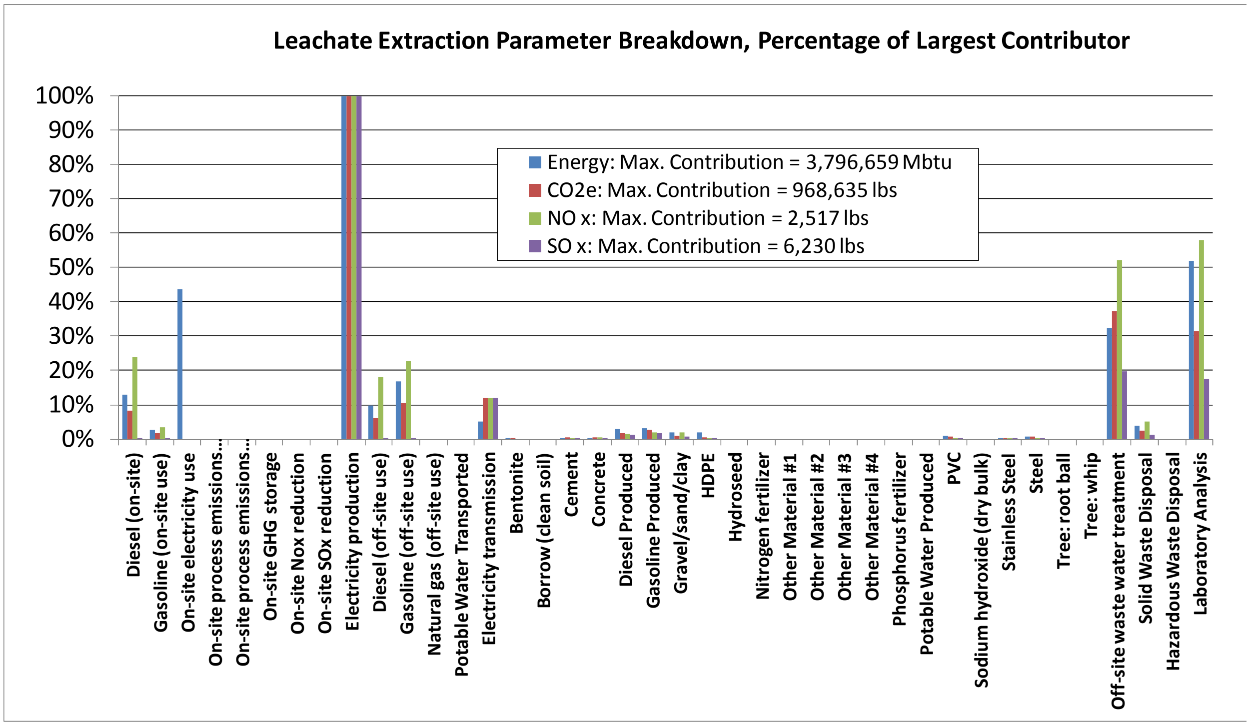
Chart 10



Notes: Electricity transmission refers to electricity lost due to transmission and distribution. Electricity production refers to the process of producing the electricity at the power plant and includes an estimate of sacrificial loads by the power plant. Electricity transmission and production are based on the amount of electricity used on-site.

Chart 11 presents the same information for the Leachate Extraction alternative. Once again, the key contributors to the four parameters are generally the same within the Leachate Extraction alternative, although the overall pattern of contributors differs from that of the Phytoremediation alternative. For the Leachate Extraction alternative, electricity production, off-site wastewater treatment, and laboratory analysis are the largest contributors. On-site electricity use is also a large contributor for the energy footprint. The contributions for off-site diesel and gasoline use (i.e., transportation) and electricity transmission to all four parameters are smaller but significant.

Chart 11



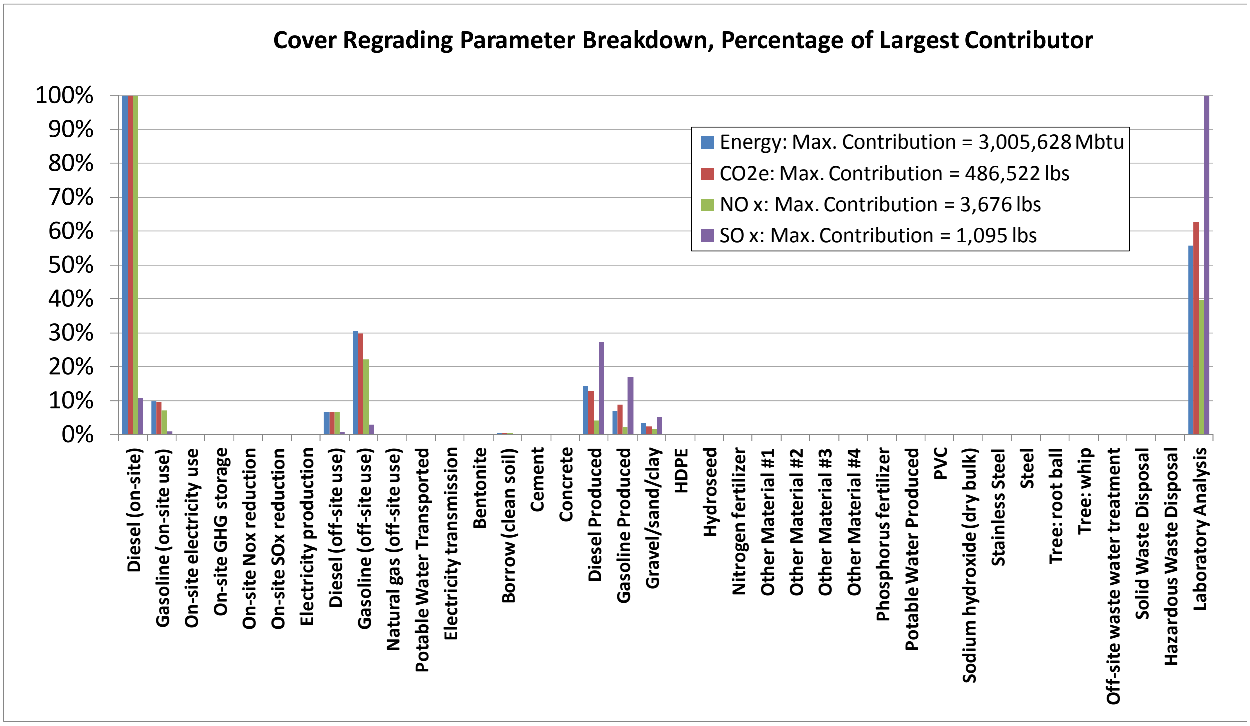
Notes: Electricity transmission refers to electricity lost due to transmission and distribution. Electricity production refers to the process of producing the electricity at the power plant and includes an estimate of sacrificial loads by the power plant. Electricity transmission and production" are based on the amount of electricity used on-site.

Chart 12 presents the same information for the Cover Regrading alternative. Once again, the key contributors to the four parameters are generally the same within the Cover Regrading alternative, although the overall pattern of contributors differs from that of the other two alternatives. For the Cover Regrading alternative, on-site diesel use (e.g., heavy equipment operation) is the largest contributor for energy, CO2e, and NOx. It is a smaller contributor for SOx emissions, but much of the SOx that is not released during on-site diesel usage is emitted during diesel production. The other major contributors to these four parameters are off-site diesel and gasoline use (i.e., transportation), laboratory analysis, and fuel production. The production of clay for the clay cap is a relatively minor contributor.

As noted in Section 1.9, the environmental conversion factors for laboratory analysis are based on assumptions made by the study team. The accuracy and appropriateness of these laboratory analysis conversion factors has a significant influence on the footprints for all three remedy alternatives, and the actual laboratory analysis footprints may be substantially higher or lower than presented in Charts 10,11, and 12.

The tables from which Charts 10, 11, and 12 were developed are provided in Appendix C and include the same information for other 11 environmental parameters for each remedy alternative. Similar charts that display the breakdown for other environmental footprints are provided in the Supplemental Charts section of this report.

Chart 12



Notes: Electricity transmission refers to electricity lost due to transmission and distribution. Electricity production refers to the process of producing the electricity at the power plant and includes an estimate of sacrificial loads by the power plant. Electricity transmission and production are based on the amount of electricity used on-site.

2.1.6 Findings Related to Remedy Duration, Labor, and Travel

The following table presents results for remedy duration, travel, and labor. The table is color-coded to indicate the lowest (green), middle (yellow), and highest (orange) values in each category. The Phytoremediation alternative has the lowest (most favorable) values for six of the seven categories and the highest (least favorable) value for one category (heavy-duty truck miles). The relatively high heavy-duty truck miles are due to transporting some of the trees long distances. The Leachate Extraction alternative has the middle values for six of the seven categories. The remaining category, heavy duty truck trips, is the highest (least favorable) value because of the truck trips required to pick up and dispose of the recovered oil and sludge from the oil/water separator. The Cover Regrading alternative has the highest (least favorable) values for five of the seven categories. It has the lowest (most favorable) value for heavy-duty truck miles because all of the resources used for the remedy are local.

	Remedy Duration	Trips to Site		Miles Driven		Man-Hours Worked On-Site	On-Site Heavy Equipment Operation
		Passenger Vehicle	Heavy-Duty Truck*	Passenger Vehicle	Heavy-Duty Truck*		
	Years	Trips	Trips	Miles	Miles	Man-hrs	Equip.-hrs
Phytoremediation	7	463	109.5	51,204	31,532	5,282	1,226
Leachate Extraction	10	1,147	304	70,932	20,812	12,712	2,482
Cover Regrading	30	1,571	269	89,202	10,010	17,544	8,292

**Materials, waste, or heavy equipment transportation*

2.1.7 INTERPRETING THE RESULTS

The footprints that are calculated as part of this study can be grouped into the following general categories that are consistent with the EPA core elements of green remediation:

- Energy usage and air quality
  - Energy usage
  - Air pollutant emissions associated with energy usage (e.g., CO2e, NOx, SOx, and PM)
  - Hazardous air pollutant and toxic pollutant emissions
- Water usage
  - On-site water usage
  - Off-site water usage
- Materials and waste
  - Unrefined materials usage - total tons of unrefined materials such as gravel/sand/clay borrow that are used directly in the remedy
  - Manufactured materials usage - total pounds of all manufactured materials such as steel, concrete, and chemicals (no overlap between unrefined and manufactured materials)
  - Waste generated
- Land and ecosystems
  - Direct physical, chemical, or biological impacts to local ecosystems
  - Remedy duration
  - Truck traffic (trips to site)
  - Hours of heavy equipment operation

This grouping eliminates some of the redundancy in parameters that typically track together. For example, with few exceptions, energy, CO2e, NOx, SOx, and PM track together such that an alternative that has a high footprint for one would likely have a high footprint for the others. Without grouping them together, analysis of the footprint study results may place more focus on energy use and related emissions than on the other core elements. The footprints associated with the above groupings for each remedy alternative are summarized in the following table and discussed below in an attempt to summarize the footprint analysis results. The table ranks the footprints for each parameter grouping as low, intermediate/neutral, or high footprints relative to the other alternatives.

	Phytoremediation	Leachate Extraction	Cover Regrading
Energy usage	Low	High	Intermediate
Energy related air emissions	Low	High	Intermediate
Toxic emissions	Low	High	Low
On-site water usage	Neutral	Neutral	Neutral
Off-site water usage	Low	Intermediate	Low
Manufactured materials usage	High	Intermediate	Low
Unrefined materials usage	Low	Low	High
Waste generated	Low	High	Low
Impact to ecosystems	Neutral	Neutral	Neutral
Remedy duration	Low	Intermediate	High
Truck traffic	Low	High	Intermediate
Hours of equipment operation	Low	Intermediate	High

The above table graphically illustrates that the Phytoremediation alternative has more "low" (favorable) results than the other two remedies. The Cover Regrading alternative ranks second in the number of "low" (favorable) results. A group of site stakeholders may assign more weight to some categories than others or assign more weight to on-site footprints than to off-site footprints, but given a review of this table plus the quantitative results that support it (Appendix C), it is likely that a group of stakeholders for this site would recognize the Phytoremediation alternative as the most favorable alternative from an environmental footprint perspective.

In general, the remedy alternative with the most "low" scores is not necessarily the most favorable alternative from an environmental footprint perspective. Some categories may be more important to site stakeholders than other categories. In addition, there are often trade-offs for various parameters between remedy alternatives. For example, the Phytoremediation option has low overall energy usage but has a high manufactured materials usage.

2.2 Secondary Analysis

2.2.1 Phytoremediation

Charts 13 through 15 present the total footprints for the Phytoremediation alternative for the same three global or regional environmental parameters (CO_2e, SO_x, and mercury) depicted in Charts 1 through 3, but organize the information according to remedy component. The charts indicate that O&M has the largest influence on the CO_2e footprint, which results from including carbon stored in the biomass of the growing trees in the O&M phase. The LTM component is the largest positive contributor to the CO_2e and SO_x footprints, with laboratory analysis as the greatest contributor within the LTM footprint. (See Section 1.9 for a discussion of the footprint conversion factors associated with laboratory analyses). The LTM component also contributes significantly to the mercury emissions but the contribution is smaller than the construction component of the remedy, with production of steel for the deer fence as the greatest contributor within the construction footprint.

Chart 13

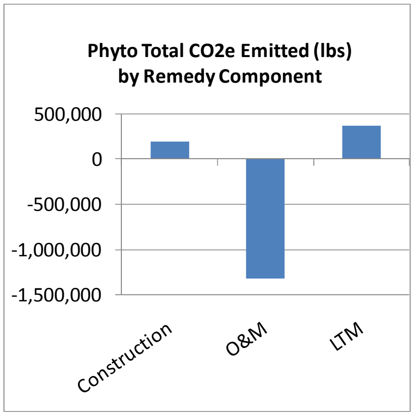


Chart 14

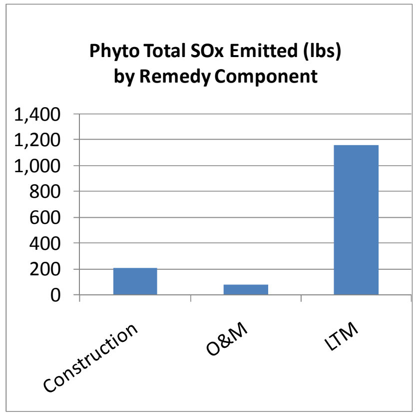
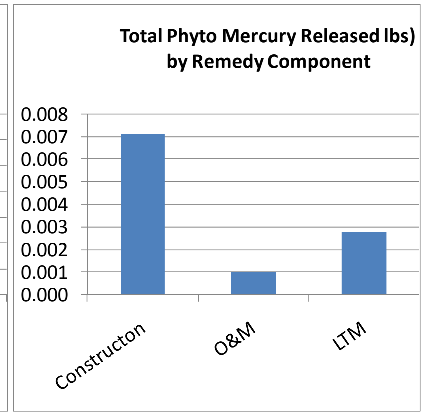


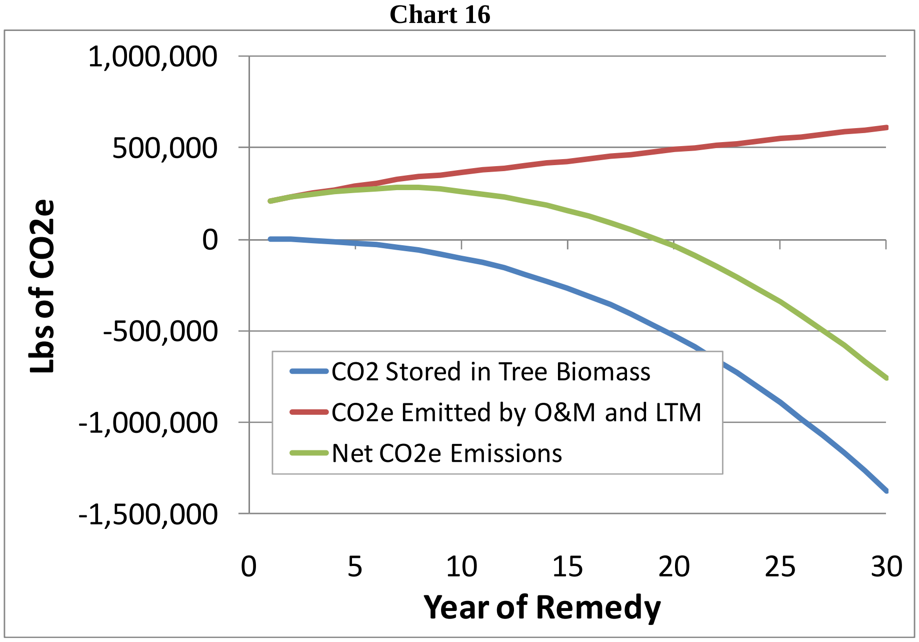
Chart 15



"Total" refers to on-site plus off-site footprint for the life-time of the remedy.

The carbon storage rate in the O&M phases increases exponentially with time as the trees grow. Chart 16 illustrates the CO2e footprint of the Phytoremediation alternative over time. The exponential rate would not continue indefinitely. Rather it would significantly slow after 30 or 40 years.

Chart 16



Notes: Carbon storage rates are calculated based on equations presented in Jenkins, Jennifer C.; Chojnacky, David C.; Heath, Linda S.; Birdsey, Richard A., National scale biomass estimators for United States tree species, Forest Science. 49: 12-35, 2003. See Appendix A for more information on biomass equations and assumed growth rates.

Charts 17 through 19 present the on-site footprints for the Phytoremediation alternative for the same three local or regional environmental parameters (NOx, PM, and air toxics) depicted in Charts 4 through 6, but organize the information according to remedy component. The LTM component does not contribute to the on-site footprints for these parameters because bailers, which are mechanical devices that do not require fuel or electricity, are used for collecting groundwater samples. Other forms of sample collection such as pumps powered by generators or compressors would contribute a relatively small amount to the on-site footprint. O&M is the component that appears to most influence the on-site footprints of the three parameters. The PM emissions are negative in the O&M component because of deposition of ambient particulates onto tree biomass. This PM deposition exceeds on-site PM emissions. Further review of the spreadsheet input and output in Appendices A and C indicates that on-site diesel and gasoline usage for fertilizer application, watering, and mowing during O&M contribute most significantly to the on-site emissions of all three parameters.

Chart 17

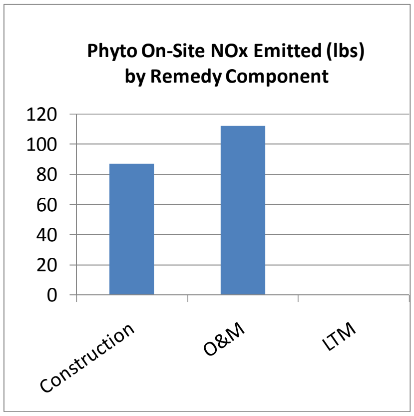


Chart 18

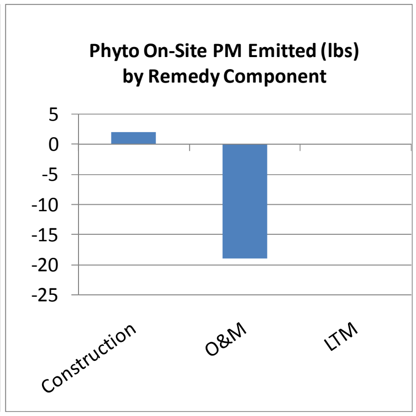
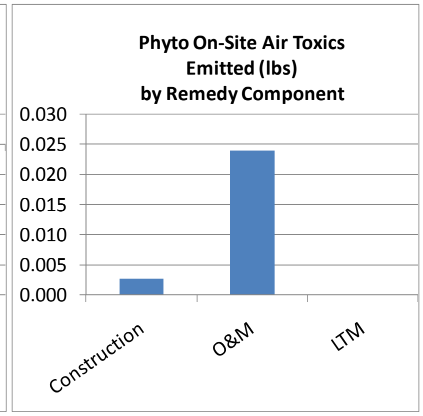


Chart 19



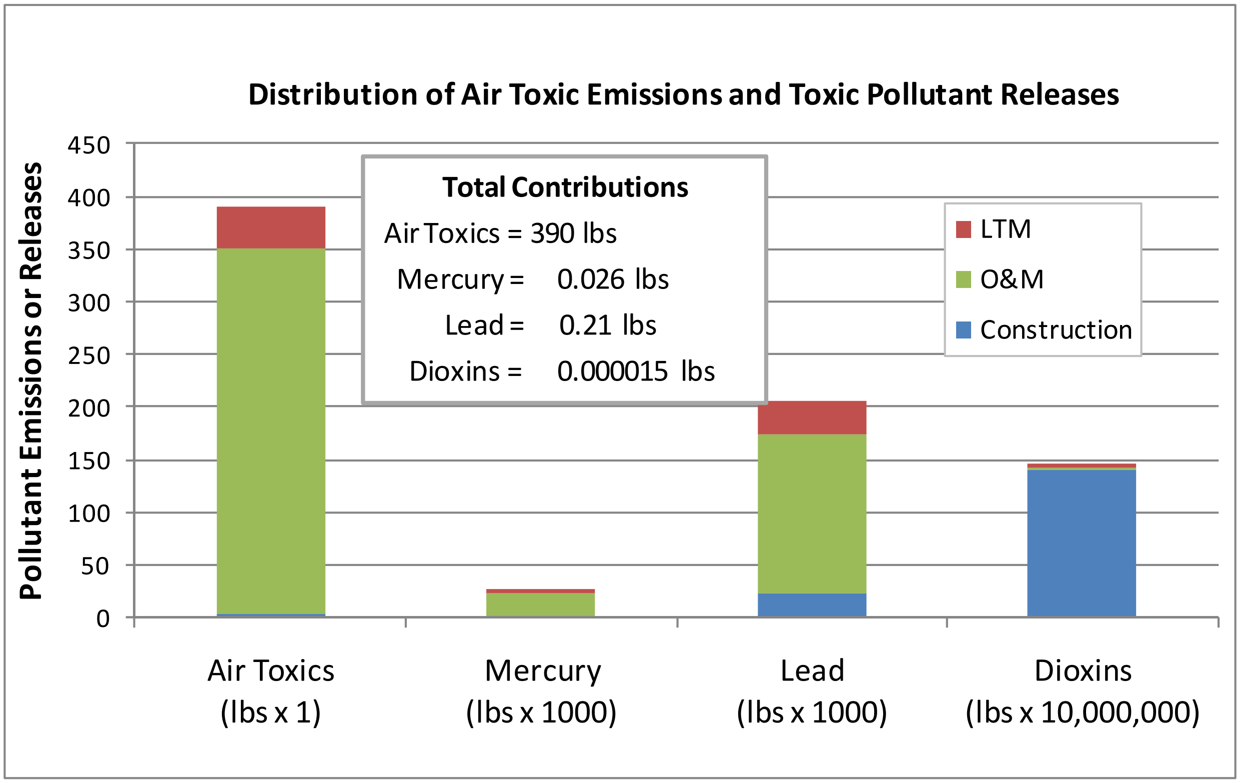
These charts show the on-site footprints over the life-time of the remedy.

More information regarding the distribution of total and on-site footprints for various parameters is included in the Supplemental Charts and in Appendix C.

2.2.2 Leachate Extraction

Chart 20 illustrates the contributions to the footprints of air toxics, mercury, lead, and dioxins from the three components of the Leachate Extraction alternative. The O&M component is the largest contributor for air toxics, mercury, and lead, primarily due to emissions and releases associated with electricity generation and off-site wastewater treatment. The construction component is the largest contributor to dioxin releases, primarily due to the production of PVC for the extraction well casings. Note that Chart 20 scales the values for mercury and lead by a factor of 1000 and for dioxins by a factor of 10,000,000 for display purposes. The magnitude of the mercury, lead, and dioxin releases in pounds are orders of magnitude lower than the magnitude of the air toxics emissions in pounds.

Chart 20



Note: Note that the magnitude of the mercury, lead, and dioxin releases in pounds are orders of magnitude lower than the magnitude of the air toxics emissions in pounds. The four parameters are placed on one chart for purposes of illustrating the differences in contributions from the phases of the remedy (LTM, O&M, and Construction).

The O&M component also dominates the footprints for energy, CO2e, NOx, and SOx. As illustrated in Chart 11, the energy, CO2e, NOx, and SOx footprints for the Leachate Extraction alternative are dominated by electricity production/transmission/usage, wastewater treatment at the POTW, and laboratory analysis. Electricity and wastewater discharge are both components of O&M, and the laboratory analysis is the primary component of LTM, but the two combined O&M components exceed the LTM component by approximately three to one.

Closer examination of Appendix C indicates that the O&M component is the largest source of solid waste generation, which is due to the disposal of sludge recovered from the oil/water separator. For this study, the recovered oil is not considered a waste because it is recycled. Furthermore, this study does not include the oil recycling process in the footprint for the Leachate Extraction alternative. Instead the study assigns the footprint associated with the oil recycling process to the user of the product derived from the recycled oil.

2.2.3 Cover Regrading

Charts 21 through 23 present the total footprints for the Cover Regrading alternative for the same three global or regional environmental parameters (CO2e, SOx, and mercury) depicted in Charts 1 through 3, but organize the information according to remedy component. The charts indicate that for SOx and mercury, the construction and O&M components have footprints of similar magnitude, while that for LTM is higher. Although the LTM component is the component that contributes the most to the footprints of these two parameters, the emissions associated with the LTM component are off-site and are spread across 30 years of activity. By contrast, the emissions associated with the construction component are emitted on-site over the course of several months at the beginning of remedy implementation. The different patterns of emissions might result in different potential impacts.

- Emission intensity - The short-term intensity of SOx emissions (and other emissions such as NOx, PM, and air toxics that affect human health and the environment) from construction activities may be more problematic for human health and the environment on a local or regional scale than low emissions over a 30-year period.

- Emission timing – Some of the emissions associated with O&M and LTM will not occur until 10, 20 or 30 years in the future. Therefore, the impacts of these emissions will also not occur until 10, 20, or 30 years in the future. Moreover, actual future emissions may be lower than current estimates of future emissions due to improvements in energy efficiency, alternative energy, renewable energy, or other technologies that may be developed over these time frames and help reduce emissions.

Chart 21

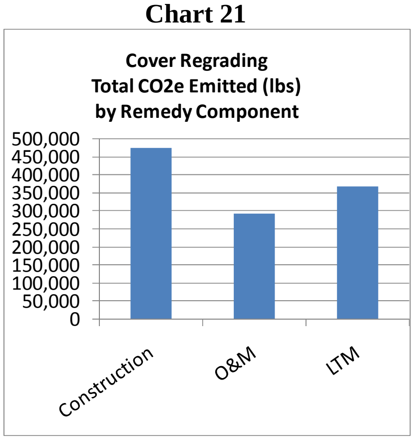


Chart 22

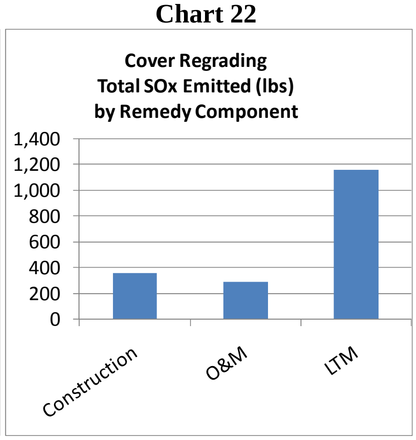
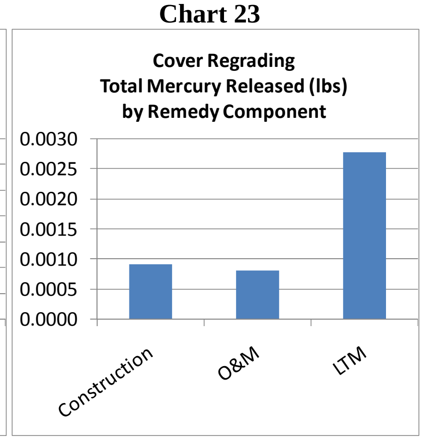


Chart 23



"Total" refers to on-site plus off-site footprint for the life-time of the remedy.

CO2e and SOx emissions are often both tied to combustion of fossil fuels, and so the distribution of their footprints might be expected to be similar. However, Charts 21 and 22 show that the SOx footprint for the construction component is small relative to the LTM component, while the CO2e footprint for the construction component is of similar magnitude to the LTM component. The difference between the CO2e and SOx footprint distributions in this case is due to the footprint conversion factors associated with diesel combustion (for heavy equipment) and for laboratory analysis. The laboratory analysis footprint conversion factor derived by the study team is based on energy usage coming from both diesel usage and electricity usage. The electricity produced from coal combustion has a higher ratio of SOx to CO2e emissions than combustion of diesel.

Charts 24 through 26 present the on-site footprints for the Cover Regrading alternative for the same three local or regional environmental parameters (NOx, PM, and air toxics) depicted in Charts 4 through 6, but organize the information according to remedy component. Similar to the Phytoremediation alternative (Charts 17, 18, and 19), these charts indicate that the LTM component does not contribute to on-site footprints. The construction component is a significant contributor to the footprints for all three of these parameters due to the use of on-site heavy equipment. Relative to the construction component, the O&M component is a significantly smaller contributor for NOx and PM footprints but is a slightly larger contributor to the air toxics footprint. This difference in footprint distribution is due to the type of fuel used. Construction activities all use diesel fuel. O&M activities use both diesel and gasoline, and based on the life-cycle inventory data, gasoline use has a higher rate of air toxics emissions relative to diesel use.

Chart 24

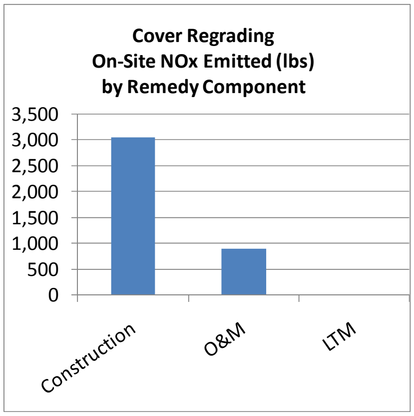


Chart 25

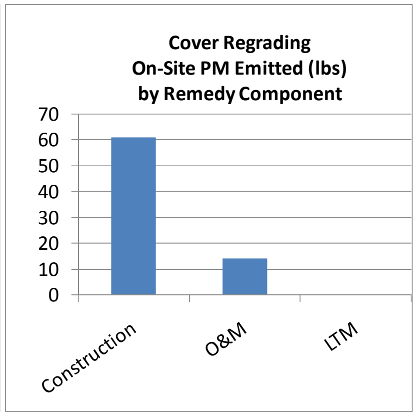
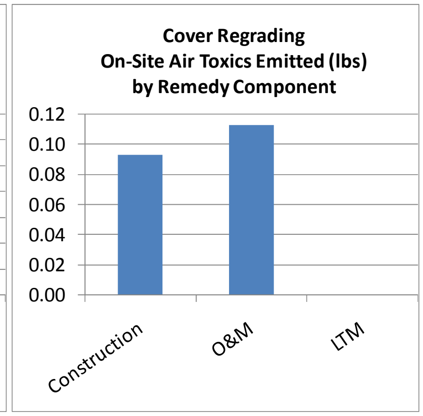


Chart 26



These charts show the on-site footprints over the life-time of the remedy.

2.3 Sensitivity Analysis

The scope of the sensitivity analysis is described in Section 1.11.3, and the findings are summarized below.

2.3.1 Reducing the Water Quality Sampling Frequency from Semi-Annual to Annual

The footprints associated with LTM are largely the result of the laboratory analysis and the off-site use of gasoline required for transportation of sampling technicians to the site. Therefore, the overall footprints may be sensitive to the frequency of the LTM sampling events. Reducing the water quality sampling frequency from semi-annual to annual would decrease the LTM activities by half, and therefore the LTM footprint, by approximately 50%. The following table presents the reductions in the total CO2e, SOx, and mercury footprints for all three remedies that would result from a 50% reduction in the LTM footprint.

Remedial Alternative	CO2e		SOx		Mercury	
	Reduction (lbs)	**% Change**	**Reduction (lbs)**	**% Change**	**Reduction (lbs)**	**% Change**
Phytoremediation	181,889	24% lower*	576	40% lower	0.00138	13% lower
Leachate Extraction	181,889	9% lower	576	6% lower	0.00138	5% lower
Cover Regrading	181,889	16% lower	576	32% lower	0.00138	31% lower

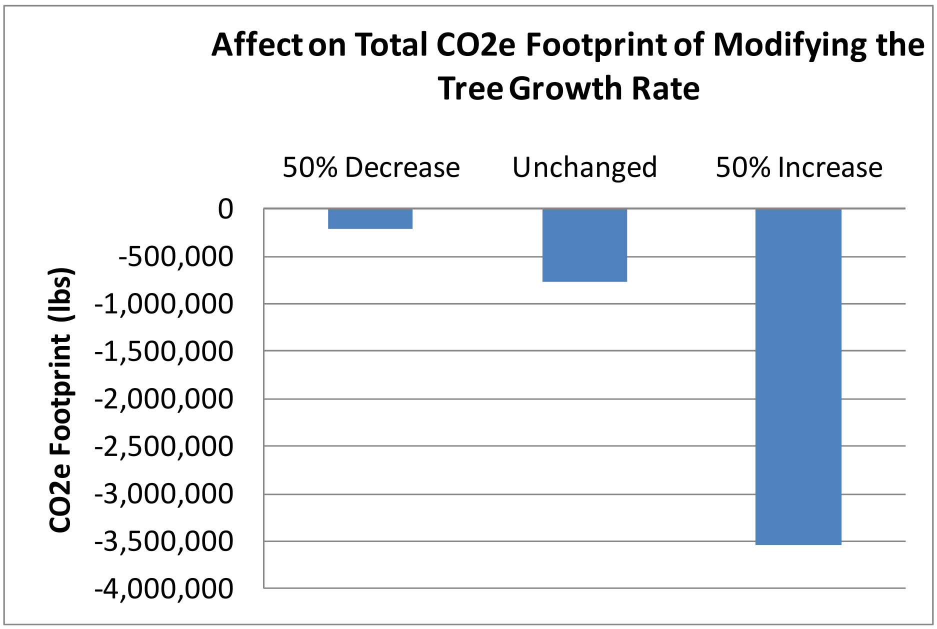
** CO2e footprint for Phytoremediation is already negative, and the 50% reduction in the water quality sampling further reduces the footprint by 24%*

As noted earlier (Section 2.2.1), there is no on-site contribution to the LTM footprints of most of the parameters because bailers are used for collecting the samples. Therefore, the reductions noted in the table above would not influence the on-site footprints but would significantly influence the off-site footprints.

2.3.2 Varying the Growth and Carbon Storage Rates for the Planted Trees

The growing biomass of the planted trees substantially influences the CO2e footprint for the Phytoremediation alternative, and this influence is subject to some variability and uncertainty. The model used in this study to estimate carbon storage by the trees is based on generalized models for estimating biomass from the "breast height diameter" of the trees, and estimated growth rates of the trees. The actual results may vary substantially from the modeled results, depending on the accuracy of the generalized model and the estimates of the tree growth rates. In addition, the model has an exponential relationship between "breast height diameter" and biomass. Therefore, small changes in the estimated growth rate of the trees can have a large impact on the estimated carbon storage. Chart 27 presents the results of leaving the original estimate of the tree growth rate unchanged, decreasing it by 50%, and increasing it by 50%. Obtaining more specific models and growth rates is not likely practical for environmental footprint analysis, and this underscores the importance of collecting measurements during remedy implementation to update carbon storage information as the remedy progresses.

Chart 27



2.3.3 Varying Frequency and Extent of Site Maintenance Activities

Since the selected remedy (Phytoremediation) is in its initial stages, and the other two alternative remedies (Leachate Extraction and Cover Regrading) are hypothetical and will not be implemented, it is not possible to predict the frequency of remedy maintenance that may be required. Therefore, this sensitivity analysis tests whether assumptions made regarding the frequency of site maintenance may be important to the overall footprint of the remedies. Site maintenance includes regular cap maintenance activities (such as mowing), major cap repairs, or maintaining the tree population. Each of these items is discussed separately.

It may be reasonable to assume that repairs of cracks in the cap could be reduced from an assumed three times per year to two times per year and that mowing could be reduced from eight times per year to two times per year. The following table summarizes the resulting changes the total CO2e, SOx, and mercury footprints for the three remedies.

Remedial Alternative	CO2e		SOx		Mercury	
	Reduction (lbs)	% Change	Reduction (lbs)	% Change	Reduction (lbs)	% Change
Phytoremediation	20,090	3% lower*	20	2%	0.00007	<1% lower
Leachate Extraction	47,784	2% lower	45	<1% lower	0.0007	3% lower
Cover Regrading	143,261	13% lower	142	8% lower	0.00044	10% lower

** CO2e footprint for Phytoremediation is already negative, and the reduction in cap maintenance further reduces the footprint by 3%. Unlike the Leachate Extraction and Cover Regrading alternatives, the Phytoremediation alternative does not include crack repair.*

The percent reduction is minor for the Phytoremediation and Leachate Extraction alternatives, but is significant (8 to 13%) for the Cover Regrading alternative.   This is due in large part to the longer time frame associated with the Cover Regrading alternative, which involves crack repair and mowing for 30 years, as compared with the shorter time frames for the Phytoremediation and Leachate Extraction alternatives (7 and 10 years, respectively).

If actual conditions require 10% of the trees to be replaced with new trees (for example, in response to a die-off of some of the trees originally planted), this would suggest a delay in 10% of the carbon storage. It would also require additional resources to plant the new trees. The resources required to replace 10% of the trees are relatively minor and results in an increase of approximately 10% in each of the parameter footprints during the construction component of the remedy (e.g., a CO2e increase of approximately 17,000 pounds and approximately 20 pounds of SOx). This 10% increase in the construction component translates to an increase in the total footprint of many of the environmental parameters of approximately 2% (e.g., an approximate 2% increase for both total CO2e and total SOx). Although the construction component is a relatively large source of mercury compared to the other components, much of the mercury results from the production of steel for the deer fence, and additional deer fence or steel would not be required for replanting 10% of the trees. Therefore, the increase in the total mercury footprint that results from replanting 10% of the trees is less than 1%.

2.3.4 APPLYING CLEAN DIESEL TECHNOLOGIES

One potential clean diesel technology that might be considered is a particulate filter that prevents particulate matter emissions by up to 90%. Applying this technology to on-site diesel equipment (e.g., excavators) and off-site diesel vehicles (e.g., heavy duty trucks used for transportation of materials) translates to the PM reductions in the following table:

	On-Site PM		Off-Site PM	
Remedial Alternative	Reduction (lbs)	% Change	Reduction (lbs)	% Change
Phytoremediation	2 to 3	2% to 3% lower*	11	13% lower
Leachate Extraction	10	1.5% lower	8	1% lower
Cover Regrading	62	51% lower	3 to 4	2% to 3% lower

** CO2e footprint for Phytoremediation is already negative, and the addition of particulate filters further reduces the footprint by 2 to 3%.*

The largest PM reductions are achieved for the on-site aspects the Cover Regrading alternative (51% reduction) and the off-site aspects of the Phytoremediation alternative (13% lower), which involve the most use of on-site equipment and off-site transport, respectively. The reductions from applying particulate filters appear relatively negligible for all other on-site and off-site aspects of the three remedy alternatives.

2.3.5 VARYING DISTANCES OF TRANSPORT FOR KEY MATERIALS

Transportation can account for a large portion of the environmental footprint of a remedy, and energy required for transportation may be used as a representative parameter to track the results of a sensitivity analysis in which transportation distances are increased or decreased. Using energy as an example parameter, "road transportation" (i.e., excluding electricity transmission) ranges from approximately 957,000 Mbtus for the Phytoremediation to approximately 1,010,000 Mbtus for Leachate Extraction. Although the magnitude of the "road transportation" energy usage is relatively similar among the three remedy alternatives, the percentage of "road transportation" in the total energy footprint differs significantly among the three remedy alternatives. "Road transportation" accounts for approximately 9% of the Leachate Extraction energy footprint, 16% of the Cover Regrading energy footprint, and 27% of the Phytoremediation energy footprint. Modifying distances of key materials or personnel from the site would therefore affect energy and other footprints for the Phytoremediation alternative more than those of the Cover Regrading and Leachate Extraction alternatives.

The transportation distances that would most significantly affect each of the remedy alternatives are as follows:

Phytoremediation	Distance of monitoring tech for water quality monitoring from site Distance of source for willow and poplar whips to site Distance of steel production (for deer fence) to site Distance of mowers/landscapers from site
Leachate Extraction	Distance of monitoring tech for water quality monitoring from site Distance of maintenance technician for extraction system from the site Distance of mowers/landscapers from site Distance of local contractors for routine crack repairs to the site Distance of HDPE manufacturing (used for piping) to the site
Cover Regrading	Distance of monitoring tech for water quality monitoring from site Distance of mowers/landscapers from site Distance of local contractors for routine crack repairs to the site Distance of clay for cap repair from the site

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2.3.6 VARYING FOOTPRINT CONVERSION FACTORS OF KEY CONTRIBUTORS

The following table presents the materials and services that account for the majority of the energy footprint for each of the remedy options. The table purposely excludes the energy associated with combustion of fuels and electricity production because there is generally more confidence in the factors for converting fuel combustion and electricity generation to energy content, than there is in the conversion factors for other off-site manufacturing and services. Any uncertainty associated with combustion of fuels and electricity production is more likely to result from uncertainty in the quantities of fuel or electricity required for the remedies.

Phytoremediation	Laboratory analysis (~51% of total energy footprint) Steel production (for deer fence) (~8% of total energy footprint)
Leachate Extraction	Laboratory analysis (~17% of total energy footprint) Wastewater treatment at the POTW (~12% of total energy footprint)
Cover Regrading	Laboratory analysis (~29% of total energy footprint) Diesel production (~7% of total energy footprint)

The Phytoremediation energy footprint would be more sensitive to variation in the laboratory analysis conversion factor than would be the energy footprints for Leachate Extraction or Cover Regrading, because laboratory analysis accounts for over 50% of the energy footprint for the Phytoremediation remedy, and only 17 to 29% of the energy footprints for the other two remedy alternatives. On the other hand, large variations in conversion factors for steel production, waste water treatment, and diesel production would have relatively small influences on the energy footprints for the three remedy alternatives because of relatively small contributions (7 to 12%) of these items to the total energy footprints. For example a 50% increase in the wastewater treatment footprint conversion factor would only result in a 6% increase in the Leachate Extraction energy footprint. By contrast, steel production is a key contributor to the air toxics footprint in the Phytoremediation alternative, and variations in the footprint conversion factors for air toxics from steel manufacturing would be expected to have a noticeable effect on the total air toxics footprint for the Phytoremediation alternative.

3.0 OBSERVATIONS

The observations discussed here are divided into two categories: those specifically relevant to the conditions and assumptions at the BP Wood River facility and lessons learned that might apply to footprint analysis of remediation in general.

3.1 OBSERVATIONS RELEVANT TO REMEDIATION AT BP WOOD RIVER

The following observations are based on the results for the remedy alternatives considered for the BP Wood River site. The footprint analysis results are highly dependent on the site-specific assumptions, and these observations do not necessarily apply to environmental footprint in general or other sites, even if the remedial technologies are the same as considered here.

3.1.1 A COMPARISON OF FOOTPRINTS FOR DIFFERENT REMEDIES

- When considering the total footprints (i.e., on-site plus off-site), the Phytoremediation alternative has smallest environmental footprint for most of the 15 environmental parameters by a relatively wide margin. The only parameter for which the Phytoremediation alternative has the highest total footprint is local water use (assumed to be potable water). Release of lead to the environment in the Phytoremediation alternative is nearly equal to that of the Leachate Extraction alternative. The local water use is for emergency irrigation of the trees and the lead release is associated with the production of steel for the deer fence. The lead release would result in non-local environmental effects and may not be a priority for local site stakeholders.

- The footprints for the various environmental parameters can be grouped according to the EPA five core elements for green remediation (energy, air, water, materials, and land/ecosystems) to reduce the likelihood that interpretation of the results of the footprint analysis would be dominated by several parameters that track together. Even with this grouping, the Phytoremediation alternative appears to have the most favorable environmental footprint.

3.1.2 CONTRIBUTING FACTORS TO FOOTPRINTS OF THE THREE ALTERNATIVES

- Based on energy as a representative parameter, the largest contributors to the Phytoremediation footprint are laboratory analysis, off-site fuel use and production (for transportation), and steel production for the deer fence. Changes in each of these activities may cause significant changes to the remedy footprint. For example, information about the specific laboratory used by BP Wood River may result in a larger or smaller footprint than that estimated by the study team. Substantial reduction in the footprint of the laboratory, and corresponding reduction of the footprints of the remedy alternatives, would occur if the laboratory utilized “green” practices, including renewable energy to power the facility. Regarding off-site fuel use and production, utilizing low emission vehicles and identifying vendors closer to the facility may reduce the footprints associated with transportation, with a corresponding reduction of the footprints of the remedy alternatives. Regarding steel production, constructing the deer fence out of an alternative material may help reduce the footprint associated with the fencing.

- The carbon storage offered by the biomass of the growing trees has a substantial influence on the CO2e footprint for the Phytoremediation alternative, resulting in a negative CO2e footprint for that alternative.

- Using energy as a representative parameter, the largest contributors to the Leachate Extraction and Cover Regrading alternatives are electricity production/transmission/use and on-site/off-site diesel use, respectively. Laboratory analysis is also a large contributor for both of these remedy alternatives, and the off-site water treatment at the POTW is a large contributor for the Leachate Extraction alternative. The footprint associated with materials production is relatively small compared to the other footprint contributors for the Leachate Extraction and Cover Regrading alternatives.

3.1.3 The Role of Transportation in the Overall Remedy Footprint

- Using energy as a representative parameter, the energy footprint from "road transportation" (i.e., personnel, equipment, materials, and waste transportation) is similar in magnitude for all three remedy alternatives, but the percentage contribution varies depending on the magnitude of the total energy footprints for each of the alternatives. Because the Phytoremediation alternative has a lower total energy footprint than the other two remedy alternatives, the footprint due to transportation is relatively high (approximately 27% of the total footprint). The footprint due to transportation for the Leachate Extraction alternative, however, is lower (approximately 10%) because of the significantly higher energy footprint from electricity use.

3.1.4 Relative Contributions from Each Remedy Component

- There is substantial variation in the remedy component that contributed most to the remedy footprints. This is because of the underlying nature of each of the remedy alternatives:
    - The Phytoremediation alternative is relatively passive and relies on natural processes to achieve remedial objectives.
    - The Leachate Extraction alternative reduces initial outlay of resources in exchange for greater resources required for long-term operations and maintenance.
    - The Cover Regrading alternative has a large initial outlay of resources in exchange for lesser resources required for long-term operations and maintenance.

  Using energy as a representative parameter, following results are apparent:
    - The LTM component dominates the footprint for the Phytoremediation alternative.
    - The O&M component dominates the footprint for the Leachate Extraction alternative.
    - The LTM, O&M, and construction components each contribute relatively equally to the Cover Regrading alternative.

- For all three alternatives, the LTM component is a significant contributor to the footprints of many parameters, primarily due to the laboratory analysis associated with the LTM component. The conversion factors used for laboratory analysis have been developed by the footprint analysis study team based on general information and may not be accurate for the specific laboratory used by BP Wood River. Nevertheless, laboratory analysis would still be a large contributor even if the conversion factors were 50% lower than the values used.

- The footprint analysis results appear to indicate relatively low SOx emissions associated with diesel use (relative to NOx emissions), reflecting the use of low-sulfur fuel; however, there appears to be significant SOx emissions associated with the diesel refining process. As a result, the use of low-sulfur diesel does not appear to significantly improve total SOx footprints. Instead, according to the life-cycle inventory data, it may only shift the sulfur emissions from on-site and transport corridors to and from the site, to the area around the refineries where the diesel is produced.

- Each remedial alternative has only a few significant contributors, but the contributors differ for each alternative. For the Phytoremediation alternative, the important contributors include carbon storage in the growing biomass, laboratory analysis, fuel for transportation, and steel production for the deer fence. For the Leachate Extraction alternative, the important contributors include electricity production/transmission/use, laboratory analysis, and waste water treatment at the POTW. For the Cover Regrading alternative, the important contributors include on-site and off-site fuel use, production of the fuel, and laboratory analysis.

- On-site or local potable water use is relatively small for all three remedies. The primary off-site water uses include electricity production, laboratory analysis, wastewater treatment at the POTW, and production /extraction of clay for capping.

3.1.5 SENSITIVITY TO INPUT

- Because laboratory analysis is a large contributor to many of the footprints for all three remedies, changes in the LTM program or assumptions regarding the LTM program can have a significant effect on the footprint results.

- Because of the exponential nature of the biomass growth associated with the growing trees, assumptions regarding tree growth rate have a significant effect on the estimated amount of carbon stored and the CO2e footprint of the Phytoremediation alternative.

- Site conditions that require less cap maintenance (i.e., reduced mowing and reduced crack repair) have a relatively negligible effect on the footprints for the Leachate Extraction alternative because the alternative has a very high footprint as a result of electricity usage to operate the extraction well pumps. By contrast, the reduced cap maintenance has a relatively significant affect on the footprints for the Cover Regrading alternative, partially because the Cover Regrading alternative has a longer duration than the Leachate Extraction alternative and partially because the footprints for the Cover Regrading alternative are lower than the footprints for the Leachate Extraction alternative.

- The use of clean diesel technologies for PM removal has a relatively small effect on the footprints for the Phytoremediation and Leachate Extraction alternatives. This is because the PM emissions from diesel usage associated with these two remedies are small relative to the PM emissions from electricity generation and laboratory analysis associated with the remedies. (Recall that PM emissions related to laboratory analysis are due in large part to the electricity demand from the laboratory.) By contrast, the clean diesel technologies have a significant effect on the PM emissions for the Cover Regrading alternative because of the intensive on-site diesel use.

- Road transportation contributes to approximately 9% of the Leachate Extraction energy footprint, 16% of the Cover Regrading energy footprint, and 27% of the Phytoremediation energy footprint. Therefore, significant changes in total distance traveled can result in noticeable changes to the energy footprints (and footprints of other parameters) for these alternatives. For example, significant reductions in total distance traveled for supplies and personnel could come from reducing long distances traveled (even if these trips are infrequent), or in reducing the frequency of trips (even if the trip distance is short). The biggest contributor to distances traveled and fuel used for all three alternatives is the monitoring technicians' travel from Chicago to the site, which is a long but relatively infrequent trip. Another big contributor is the mowing and cap maintenance crews. Although these crews do not travel great distances to the site, they travel to the site many times over the course of a remedy.

- Variations in the footprint conversion factors also can affect footprint results, particularly the conversion factors for those items that are large contributors the footprints, such as laboratory analysis (all three remedy alternatives), wastewater treatment at the POTW (Leachate Extraction), steel production (Phytoremediation), and diesel production (Cover Regrading). It is therefore worthwhile to confirm the accuracy of the existing conversion factors for these activities or obtain or develop accurate conversion factors if the existing conversion factors lack sufficient accuracy.

3.1.6 OBSERVATIONS REGARDING TRAVEL AND LABOR

Of the three remedy alternatives, the Phytoremediation alternative has the shortest estimated remedy duration, the fewest passenger trips, the fewest heavy duty truck trips, the fewest passenger miles, the fewest man-hours worked on-site, and the fewest hours of equipment operation. The one travel-related metric for which the Phytoremediation alternative does not have the most favorable value is heavy-duty truck miles. This is because this remedy alternative uses materials (specifically tree saplings or whips) that are not a local resource. By contrast, the Leachate Extraction alternative uses very few materials and all waste is disposed of at a local facility. The Cover Regrading alternative uses local soil and clay for remedy implementation.

3.1.7 ON-SITE APPLICATION OF CHEMICALS

The Phytoremediation alternative involves the direct application of pesticides and fertilizers to the site. Misapplication of these chemicals could lead to adverse environmental impacts (e.g., eutrophication of surface water) and/or direct human or wildlife exposure. For this study, it is assumed that fertilizers are applied in sufficient amounts to foster growth of the trees but to avoid runoff of fertilizers into surface water. With respect to pesticide application, this study is not a toxicity evaluation of the pesticides used, and the assumption is made that pesticides are applied within regulatory guidelines and with appropriate controls to prevent exposure.

3.2 OBSERVATIONS RELEVANT TO ENVIRONMENTAL FOOTPRINT ANALYSIS OF REMEDIES IN GENERAL

The following observations are based on generalizations that may apply to environmental footprint analysis in general. Although these observations are made on the basis of the BP Wood River analysis, some general principles from that analysis may extend to environmental footprint analysis at other sites. However, specific observations from the BP Wood River analysis should not be applied to another site, without first taking into account the unique aspects of the new site, and the specific design of the remedial technology used. In addition, the general observations resulting from this study may change or be refined as more experience is gained by conducting similar analyses at other sites and for different remedial technologies.

- **It can be difficult to interpret the significance of environmental footprints and to determine which remedial alternative has the preferable footprint, without clear programmatic and site-specific green remediation objectives.** For this study, the determination of the remedial alternative with the preferable environmental footprint is relatively straightforward because the Phytoremediation alternative has substantially lower footprints for most of the environmental parameters compared to the other alternatives. At another site, the differences between remedy alternatives may be less dramatic. For example, the footprints for the environmental parameters with greatest stakeholder interest may be similar among remedy alternatives, resulting in no clear preference. Or, there may be large differences, but the differences may strongly favor one remedy alternative for some of the parameters (e.g., water use, CO2e, and PM), and strongly favor another remedy alternative for other parameters (e.g., air toxics and waste generated).

- **On-site activities, electricity generation, transportation, and off-site activities (e.g., manufacturing) all have the potential to contribute significantly to the footprints of clean-up remedies.** For evaluating most remedy technologies at most sites, it appears that environmental footprint analysis should consider all four of these types of activities. However, contributions from these four categories of activities may differ from remedy to remedy. The large or significant contributors to a remedy footprint may not become apparent unless a wide range of contributors are included in the footprint analysis.

- The environmental footprint process and the results are useful for the remedy selection phase, remedy design, and remedy implementation phase. **During remedy selection, the footprint analysis process and the interpretation of results can help involve local stakeholders in the remedy selection process and help the site team better understand the effects of the remedy on the local community.** Input from local community stakeholders may be needed to help interpret the results of a footprint study and identify the environmental parameters and footprints that are of greatest interest or concern to the community. For example, some communities may be most concerned with water use, others may be concerned with waste generation and associated landfill space, others may be concerned about traffic and air emissions from fuel combustion, and others may be concerned with chemical (e.g., pesticide) application.

- **Footprint analysis results derived during the remedy selection phase can be used to identify those components of a remedy that have the largest influence on environmental footprints, allowing these components to receive extra attention during design and implementation for potential ways of reducing the remedy footprint.** For example, using partially loaded trucks to bring soil and clay to the site for routine, periodic, long-term cap repairs results in significant additional traffic and emissions footprints. Knowledge of this ahead of time may encourage site managers to arrange for full loads and to stockpile extra materials for future use.

- **Environmental footprint analysis and the use of best management practices are complimentary tools in applying green remediation and reducing the environmental footprint of a remedy.** Due to the quantitative nature of environmental footprint analysis, the results of environmental footprint analysis will generally draw the user's attention to the aspects of a remedy with the higher percent contributions to the environmental footprints. As a result, an activity that contributes a small percentage to the total footprint may not receive attention, although it may still be large in magnitude and may offer opportunities for significant reductions. Appropriate best management practices, when applied, can reduce the environmental footprints of both big and small contributors to the environmental footprints.

- **Planting native trees or other native biomass (even if not explicitly required for site remediation) can have a significant, positive influence on the CO2e footprint of a remedy.** The associated carbon storage from planting native species may be relatively small for some remedies, but applying this best management practice across a portfolio of relevant sites could lead to significant carbon storage.

- **The outcome of an environmental footprint analysis may be dependent on the quality of remedy design information input into the analysis.** While some remedy design information may be straightforward to determine and predict during the remedy selection phase, other information can be difficult to estimate or predict. For example, the Leachate Extraction remedy is highly sensitive to the extraction rate of the leachate and the duration of the remedy, and both of these parameters are highly sensitive to the amount of precipitation, which could vary significantly over the estimated 10-year period of the remedy.

- **The outcome of an environmental footprint analysis may be dependent on the quality, accuracy, and appropriateness of the fuel usage estimates.** Accurate and appropriate inputs may not always be available for a footprint analysis. For example, the primary contributor to site construction activities (such as found in Cover Regrading) may be the diesel use for on-site heavy equipment. In the absence of actual fuel usage data, approximate fuel usage rates will be used in a footprint analysis. Many items influence fuel usage including efficiency of the strategy to move soil from one place to another, work conditions, equipment idling practices, operator experience, and equipment condition. Some of these factors will be accounted for in approximate fuel usage rates and the other factors will be accounted for in engineering estimates as to how long the work will take, the equipment needed to conduct the work, and the hours of equipment operation. Another major contributor to site construction activities may be diesel used for transportation, and the amount of diesel used is dependent on distance travelled and fuel economy. Fuel economy in turn depends on many factors including mode of transportation, equipment make and model, equipment condition, changes in elevation, gross vehicle weight, amount of highway or city driving, and whether or not a delivery truck must make an empty return trip. However, in a footprint analysis, average fuel economies will typically be used and assumptions will be made regarding distances and modes of transport.

- Given the above-mentioned uncertainties, **environmental footprint analyses should be applied with caution if used during remedy selection.** The primary factors for remedy selection should be those established by the remedial program, such as protectiveness of human health and the environment. The results of an environmental footprint analysis, however, can help further inform remedy selection as part of the other balancing criteria associated with remedy selection.

- **Laboratory analysis can contribute significantly to a remedy's environmental footprint.** The study team estimated the conversion factors for laboratory analyses using best engineering judgment. Additional research on footprint conversion factors associated with laboratory analysis is merited to improve the accuracy of footprint analyses in the future.

- **Footprint intensity may be an important factor in interpreting the environmental footprint of a remedy.** For example, for a construction-intensive or aggressive short-term remedy, emissions of NOx, SOx, PM, and air toxics may be intense over a relatively short-period of time and more likely to contribute to exceedances of National Ambient Air Quality Standards. By contrast, for long-term component of a remedy (e.g., long-term monitoring), total long-term emissions of NOx, SOx, PM, and air toxics may be higher than those of the construction-intensive remedy but will occur over a 10, 20, or 30 year period and may have a negligible effect on local air quality.

- **Footprint timing may be an important factor in interpreting the environmental footprint of a remedy.** For example, for some environmental parameters, such as local water use or CO2e emissions, near-term footprints are more problematic than future footprints. Near term use of water resources can accelerate water shortage issues in areas with limited water resources, whereas future footprints allow for the option of planning for the greater water demand. Similarly, near-term CO2e emissions can contribute to global warming and climate change in the near term rather than 10, 20, or 30 years into the future. Moreover, actual future emissions may be lower than current estimates of future emissions due to improvements in energy efficiency, alternative energy, renewable energy, or other technologies that may be developed over these time frames and help reduce emissions.

- **The use of electricity from renewable resources can significantly change footprint results and the comparison of alternative remedies.** For example, negating or offsetting the footprints of electricity usage for the Leachate Extraction alternative at BP Wood River by using renewable electricity would reduce the CO2e footprint of this alternative by over 45% (approximately 970,000 pounds of CO2e), making the CO2e footprint for the Leachate Extraction alternative approximately equal to the CO2e footprint of the Cover Regrading alternative. The availability of renewable electricity from the grid (whether provided by default by the electricity provider or purchased) provides an effective means of applying renewable energy to a remedy. Use of renewable energy from the grid requires no change to on-site equipment or work practices. In addition, offsetting footprints from electricity use would increase the relative contributions from other activities in a remedy, causing them to become “key contributors” to the footprint and perhaps be targets for further footprint reductions.

- **Use of renewable energy by outside providers (e.g., laboratories and off-site waste water treatment plants) can substantially reduce a remedy footprint.** For example, at BP Wood River, if half of the footprint from laboratory analysis and wastewater treatment is due to the electricity use (rather than production of materials and supplies) and this electricity were renewable electricity, the CO2e footprints for the three remedy alternatives discussed in this study would be reduced from 13% to 20%. Reducing contributions to the remedy footprint from laboratories and wastewater treatment facilities would make contributions from other sources more apparent.

- Given the complexity and difficulty of conducting detailed environmental footprint analyses, **it would be valuable to use the information from detailed studies such as this one to derive generic footprint conversion factors for broader activities.** For example, the CO2e footprint for drilling 6-inch extraction wells in difficult drilling conditions (e.g., with a bucket auger through a landfill), is between 150 and 200 pounds of carbon dioxide per foot drilled, including all aspects of field work (e.g., drilling, oversight, materials, waste disposal, transportation). This CO2e conversion factor could be used in footprint analyses at sites with similar construction conditions and site characteristics, resulting in a reduction in the time and effort required to conduct the footprint analysis.

- **Depending on the fuel mix for generating grid electricity, electricity generation may contribute significantly to air toxics emissions.** Based on the life-cycle inventory data used, electricity generated from coal results in 3.5 times higher air toxics emissions than electricity generated from natural gas, assuming resource extraction is considered for both fuels. Air toxics emissions from the electricity intensive remedial alternative in this study (Leachate Extraction) are 8 times greater than the air toxics emissions of the other remedial alternatives (Phytoremediation and Cover Regrading).

- **The amount of solid waste, hazardous waste, air toxics, mercury, lead, and dioxin generated in association with off-site materials manufacturing may be very small and may seem insignificant when compared with on-site parameters of a remedy that will potentially affect the local community.** Given all of the other information that is considered by site stakeholders over the course of a remedy, tracking parameters associated with manufacturing processes far from the site may not be merited in environmental footprint studies, especially considering the potential variation in footprint conversion factors depending on the manufacturing source. It may be more appropriate to recognize that, with respect to off-site footprints for these parameters, the release or generation of certain parameters is regulated under various environmental programs, and may best be addressed in the remedial process by best management practices of minimizing materials use, maximizing reuse/recycling, and identifying manufacturers/suppliers that have strong, positive environmental records. This approach does not necessarily apply to on-site generation of hazardous waste or on-site emissions of air toxics, lead, mercury, dioxins, and other pollutants. The approach also does not apply to off-site footprints of certain other parameters, such as greenhouse gases, water, and energy, which may be large in comparison with on-site footprints.

- NOx, SOx, and PM all have adverse effects on human health and the environment, and are regulated under the same federal regulations as "criteria pollutants". In addition, fossil fuel combustion is a major source of these pollutants. Considering energy, CO2e, NOx, SOx, and PM separately leads to five categories that are all closely linked to the combustion of fossil fuels. This large number of closely-related categories may result in biased focus on fossil fuel use rather than other important environmental parameters, such as toxic pollutants, materials and waste, and water. **In order to more clearly interpret the information obtained from a footprint analysis, it may be appropriate to combine these "criteria pollutants" into one category.**

- When estimating the magnitudes of footprints of site remedies, it may be unclear what is considered a "large" footprint for a particular parameter and what is considered a "small" footprint for a particular parameter. The footprint for a particular parameter may be a small percentage of the overall remedy at one site, but may be a sufficiently large footprint relative to those from other sites to merit further attention. **In general, for specific parameters it may be valuable from a programmatic perspective to identify what is considered to be a significant footprint, what is considered to be a significant footprint reduction, and what the programmatic objectives are with respect to managing environmental footprints of remedies.**

- **Choice of environmental parameters for a footprint study can influence the apparent outcome.** For example, if the footprint analysis for BP Wood River had focused on local water use and ecosystems, all three remedy alternatives would have similar environmental footprints.

However, if air emissions or materials use are considered, then the footprints of the three alternatives are substantially different.

- **Conducting a detailed footprint analysis for an environmental cleanup can require a substantial level of effort. The process can be significantly streamlined** by using an existing framework that organizes the information and provides the necessary footprint conversion factors. The process can be further streamlined if the footprint analysis is done in conjunction with other site activities that provide relevant remedy information, such as the feasibility studies, remedial designs, and remedy optimization evaluations.

4.0 SUMMARY

This study quantifies the environmental footprints of three remedial options for corrective action at a closed waste disposal unit at the former BP Products North America, Inc. refinery in Wood River, Illinois by estimating for each option the emissions of various environmental parameters, such as greenhouse gases, criteria pollutants, and air toxics, and the resources used, such as energy and water. A total of 15 environmental parameters plus four other parameters related to remedy duration, labor, and traffic are considered. The study accounts for footprints from production and use of three forms of energy, production of over 10 materials, and use of four off-site services. The following three analyses are conducted.

- Primary analysis - For each parameter, footprints from on-site activities, electricity generation, transportation, and off-site activities are estimated separately and then summed together to estimate the total remedy footprint for each parameter.

- Secondary analysis - Footprints are estimated for three main remedy components: construction, operations and maintenance, and long-term monitoring.

- Sensitivity analysis – Footprints are estimated for different configurations of the remedies to assess the sensitivity of the outcome to variations in design, various remedial parameters, and the footprint conversion factors.

This report documents the process used for estimating the footprints, provides the library of resources and reference values used in the study, documents findings specific to the evaluated remedies, and presents both site-specific and more generalized observations and lessons learned from conducting the study. Although the selected parameters, process, reference information, and lessons learned may apply to environmental footprint analysis efforts at other sites, the contents of this report are not to be seen as EPA policy statements regarding environmental footprint analyses.

It is expected that the level of detail for this footprint analysis surpasses that which is needed to make informed decisions to reduce the environmental footprints of a typical remedy and that future footprint analyses at other sites will involve less detail. Other footprint analysis efforts at other sites might also consider additional, fewer, or different environmental parameters than those considered for this study. EPA has already completed a detailed footprint analysis at one remediation site prior to this analysis for BP Wood River, and plans to conduct a similar analysis at a third site, in order to enhance the understanding of the environmental footprint analysis process for cleanup activities and expand the inventory of information needed for conducting footprint analyses.

This environmental footprint analysis has been conducted independently of site activities at BP Wood River. The BP Wood River site owners and Illinois EPA site team have provided the study team information so a footprint study could be performed for illustrative purposes. The BP Wood River owners and Illinois EPA site team are acknowledged for this assistance.

TABLES

Table 1. Summary of Environmental Parameters for which Footprints are Estimated

Parameter	Unit of Measure	Brief Description	Reason for Inclusion in the Study
Energy	Mbtu	Total energy used, including coal, natural gas, oil, hydroelectric, and renewable energy	• Fossil fuel-based energy (e.g., coal, oil, natural gas, etc.) is generally considered to be a limited resource • Energy use has a large environmental footprint and energy may be an appropriate proxy for other environmental parameters
Electricity	MWh	Amount of grid electricity used	• Grid Electricity and the means to provide it is generally considered to be a limited resource • Grid Electricity usage puts strain on existing infrastructure
All Water	gal x 1000	Total amount of water used, including potable water (see below), extracted water (see below), reclaimed water, and water from various other fresh water resources.	Water in some locations is a limited resource.
Potable Water (on-site)	gal x 1000	Amount of potable water (or drinking water quality groundwater) used on-site.	• Potable water in some locations is a limited resource. • Furnishing potable water requires energy for production and transmission • Potable water use can be reduced by (among other methods) using alternative water resources.
Ground Water (on-site)	gal x 1000	Total amount of groundwater extracted on-site that is not returned to the same aquifer as part of the remedy.	• Groundwater in some locations is a limited resource. • Groundwater extraction can have a detrimental effect on yield of nearby wells • Groundwater extraction rates are closely linked to energy and materials usage of a pump and treat remedy
CO2e	Lbs	Global warming potential measured in carbon dioxide equivalents considering carbon dioxide, methane, nitrous oxide, and CFCs (where significant quantities of CFCs are emitted)	• Global warming can have global detrimental effects on the climate and can lead to an increase in sea levels. • Carbon footprints are commonly determined for other aspects of the economy and the means/information for determining carbon footprints is rapidly growing, facilitating the footprint analysis of this parameter relative to some other parameters.
NO x	Lbs	Total amount of nitrogen oxides emitted.	Nitrogen oxides lead to the formation of ground-level ozone, particulate matter, and acid rain and can cause respiratory irritation and illness.
SO x	Lbs	Total amount of sulfur dioxide emitted.	Like nitrogen oxides, sulfur dioxide leads to the formation of particulate matter and acid rain and can cause respiratory irritation and illness.

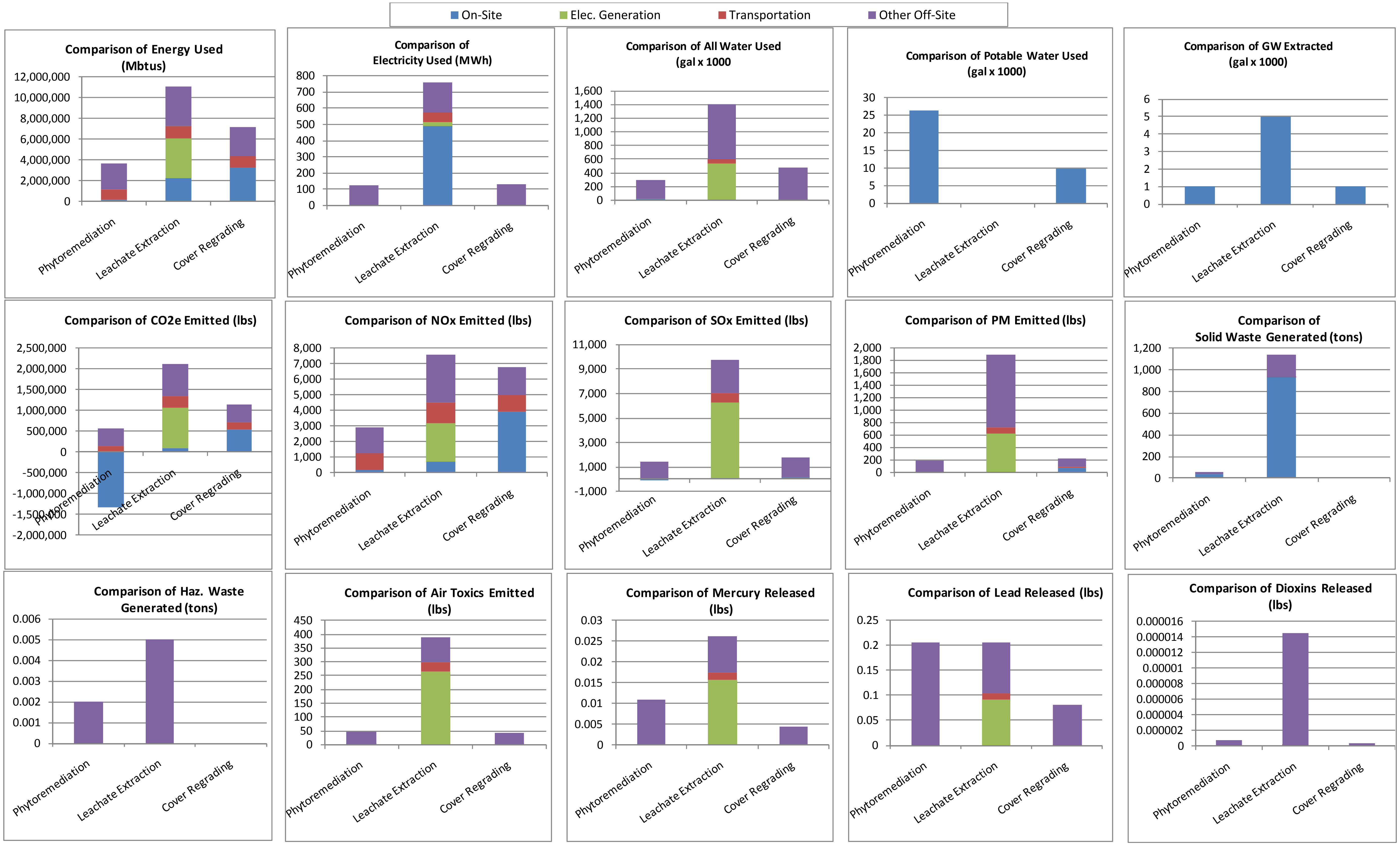
Table 1. Summary of Environmental Parameters for which Footprints are Estimated (continued)

Parameter	Unit of Measure	Brief Description	Reason for Inclusion in the Study
PM	Lbs	Total particulate matter 10 microns or less in diameter that is emitted.	Particulate matter has been linked to a number of health problems including respiratory illness and heart attacks. Particulate matter also contributes to haze, visibility reduction, and acid rain.
Solid Waste	Tons	Solid waste generated and disposed of at a permitted RCRA Subtitle D facility.	Solid waste transportation increases heavy truck traffic, landfilling solid waste requires space that is relatively close to communities, involves activities with a substantial environmental footprint, and residents are often averse to the development of additional landfills in their local community.
Haz. Waste	Tons	Hazardous waste generated and disposed of at a permitted RCRA Subtitle C facility.	Hazardous waste transportation increases heavy truck traffic, landfilling hazardous waste requires space, and handling of hazardous waste involves activities with a substantial environmental footprint, and residents are often averse to the development of additional landfills in their local community.
Air Toxics	Lbs	Total hazardous air pollutants (HAPs), as defined by EPA, that are emitted to the atmosphere.	Each HAP or degradation byproduct in the atmosphere has a toxic effect.
Lead	Lbs	Total amount of lead released to air, water, or soil.	Particularly toxic effect of lead and its ability to persist in the environment.
Mercury	Lbs	Total amount of mercury released to air, water, or soil.	Particularly toxic effect of mercury and its ability to persist in the environment.
Dioxins	Lbs	Total amount of dioxins released to air, water, or soil.	Particularly toxic effect of dioxins and their ability to persist in the environment.

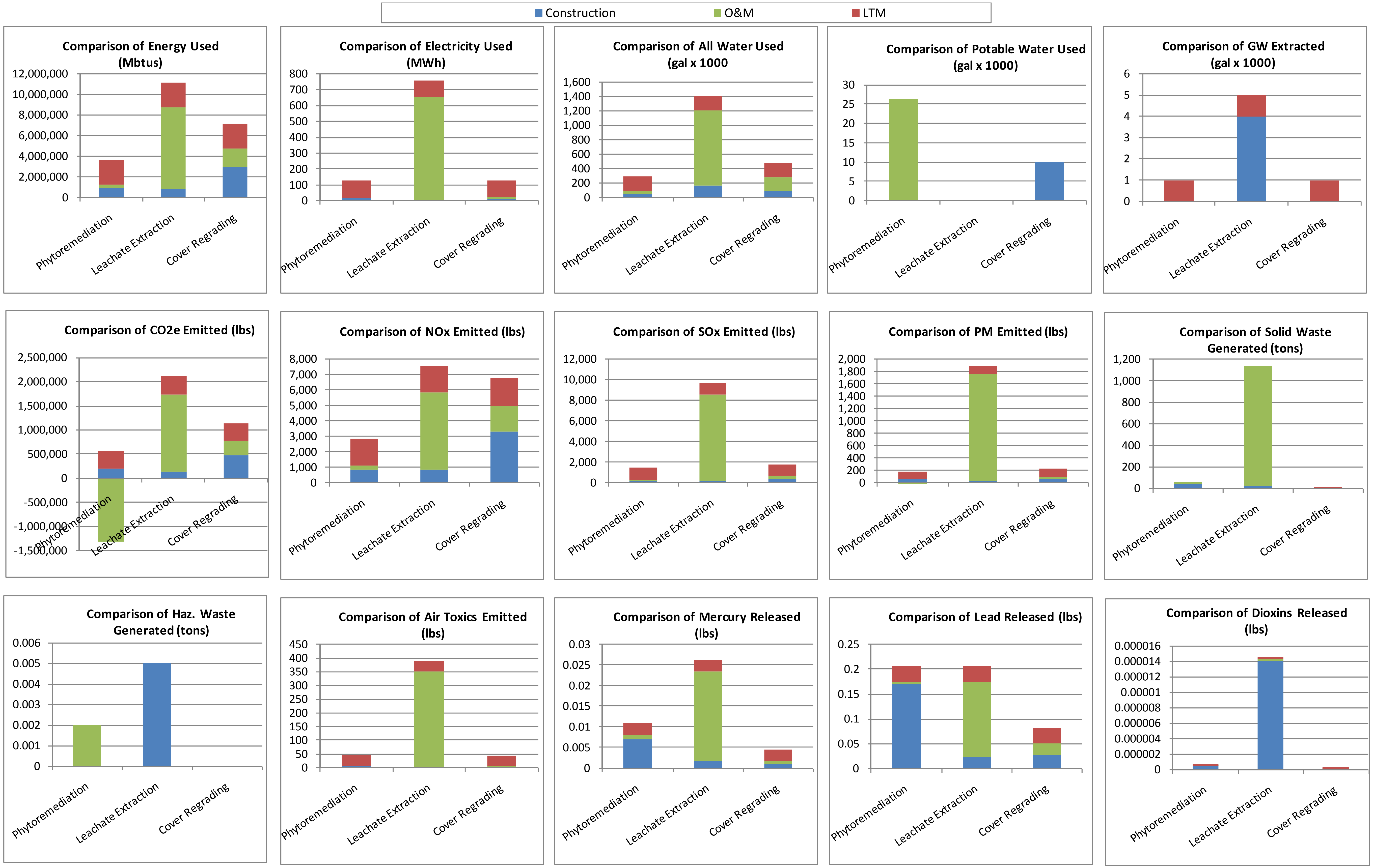
Groundwater extraction and potable water use are only estimated as on-site parameters. All other parameters are estimated as both on-site and off-site parameters

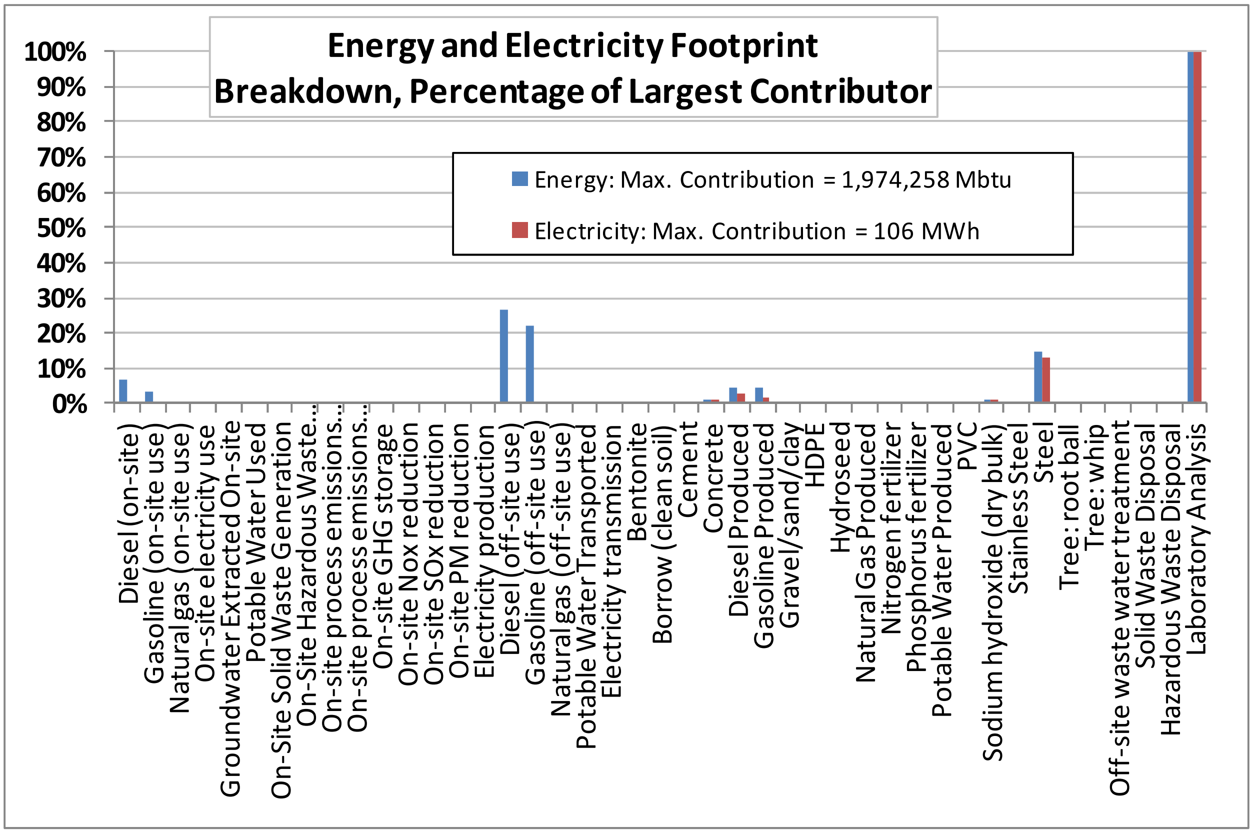
SUPPLEMENTAL CHARTS

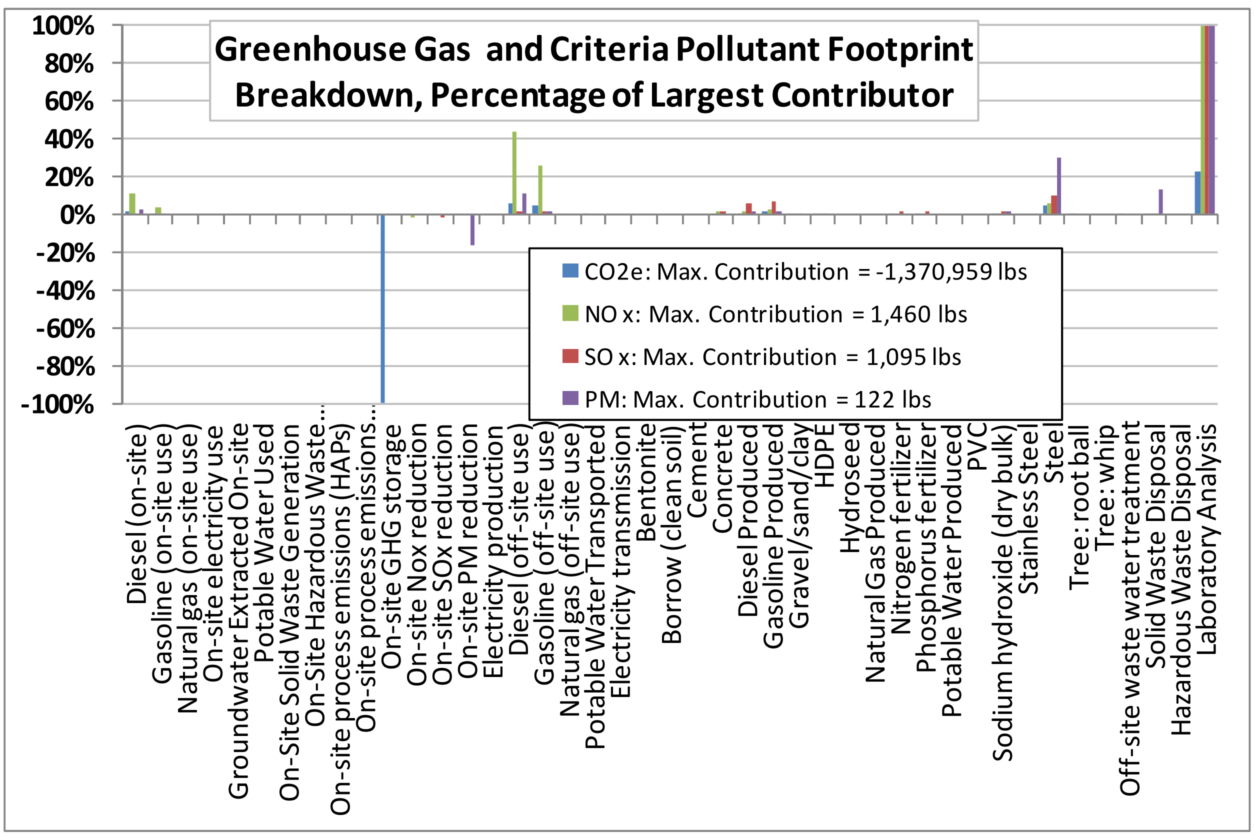
BP Wood River, IL - Primary Analysis - Output by Parameter

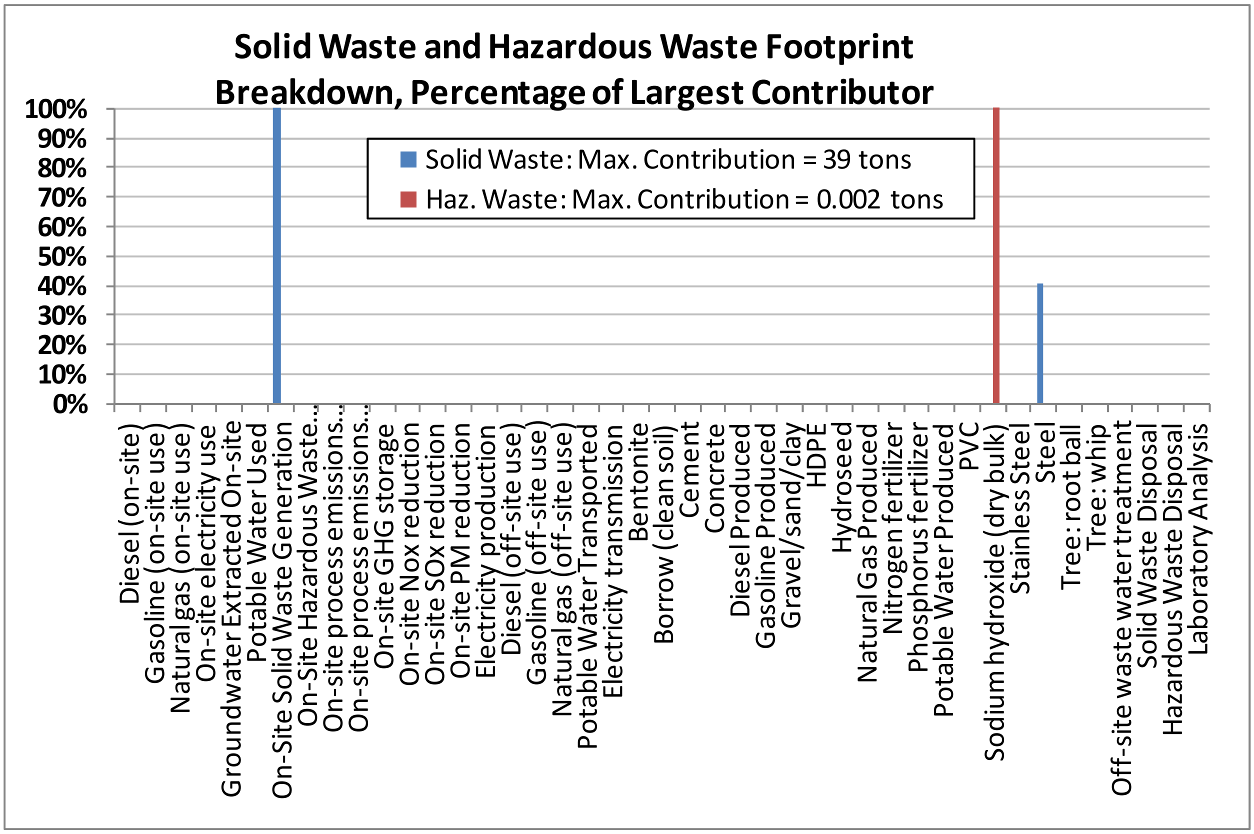


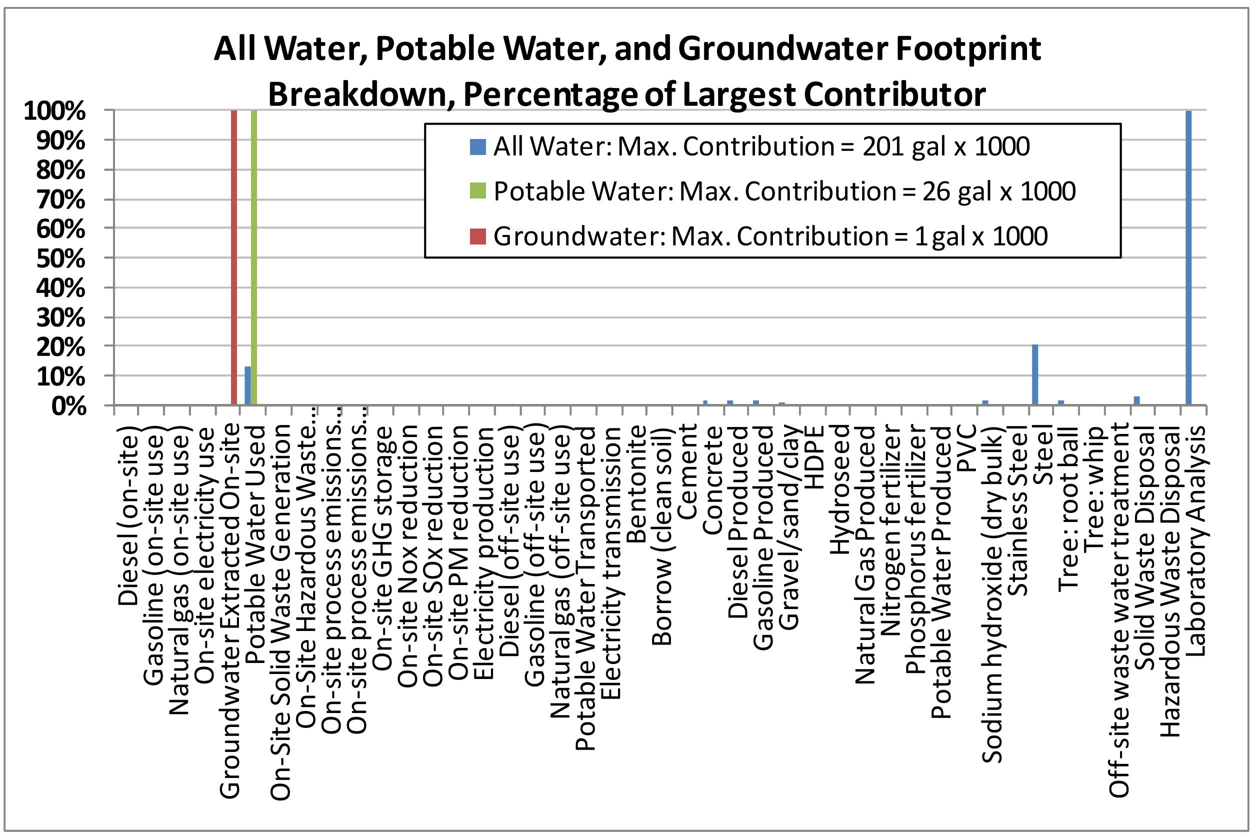
BP Wood River, IL - Secondary Analysis - Output by Parameter

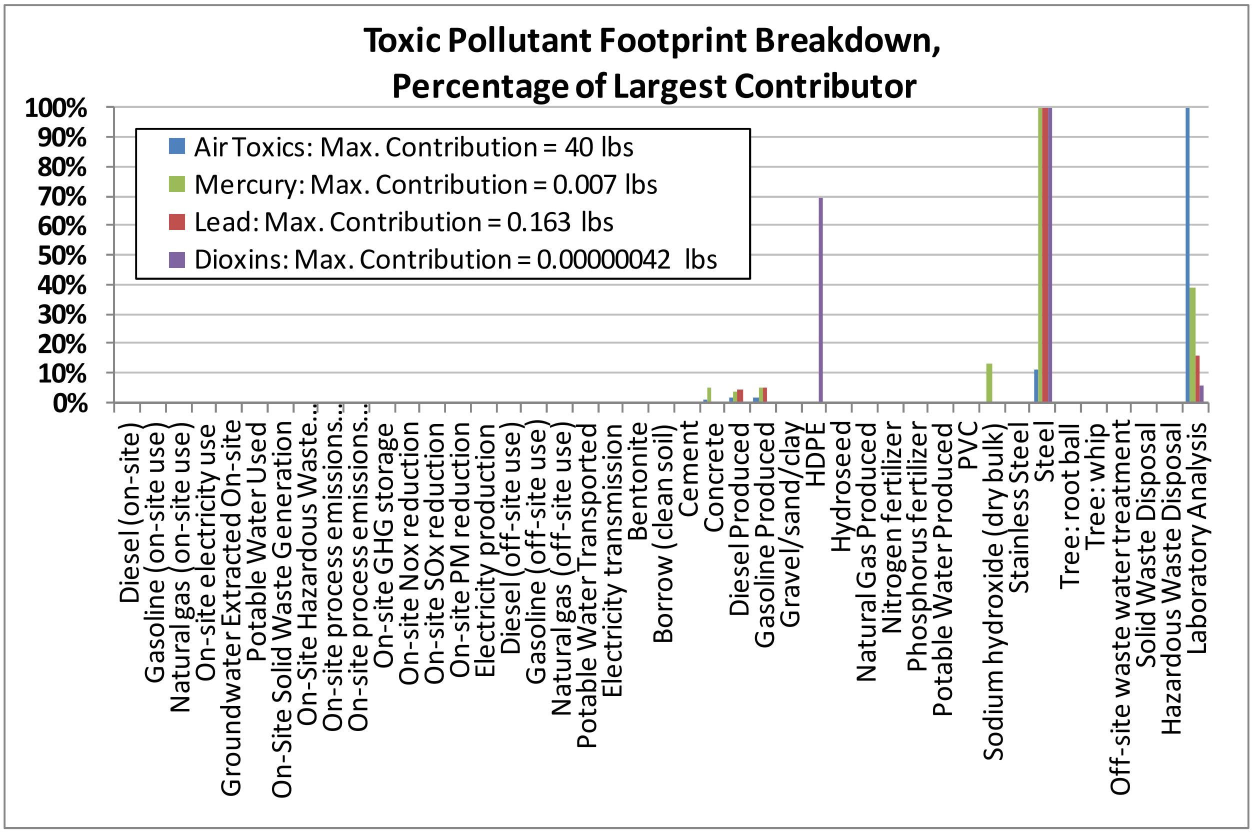



Energy and Electricity Footprint Breakdown, Percentage of Largest Contributor
Energy: Max. Contribution = 1,974,258 Mbtu
Electricity: Max. Contribution = 106 MWh
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

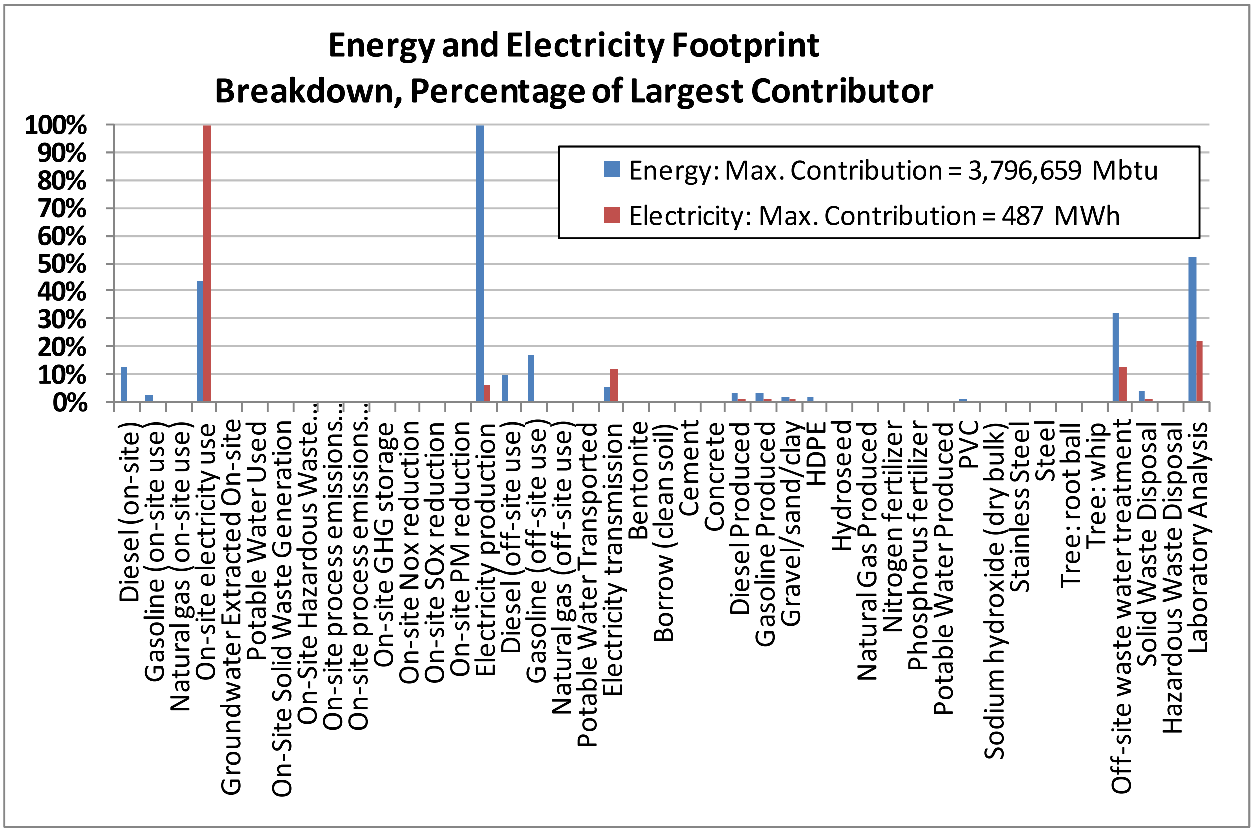

Greenhouse Gas and Criteria Pollutant Footprint Breakdown, Percentage of Largest Contributor
CO2e: Max. Contribution = -1,370,959 lbs
NO x: Max. Contribution = 1,460 lbs
SO x: Max. Contribution = 1,095 lbs
PM: Max. Contribution = 122 lbs
100%
80%
60%
40%
20%
0%
-20%
-40%
-60%
-80%
-100%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions (HAPs)
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

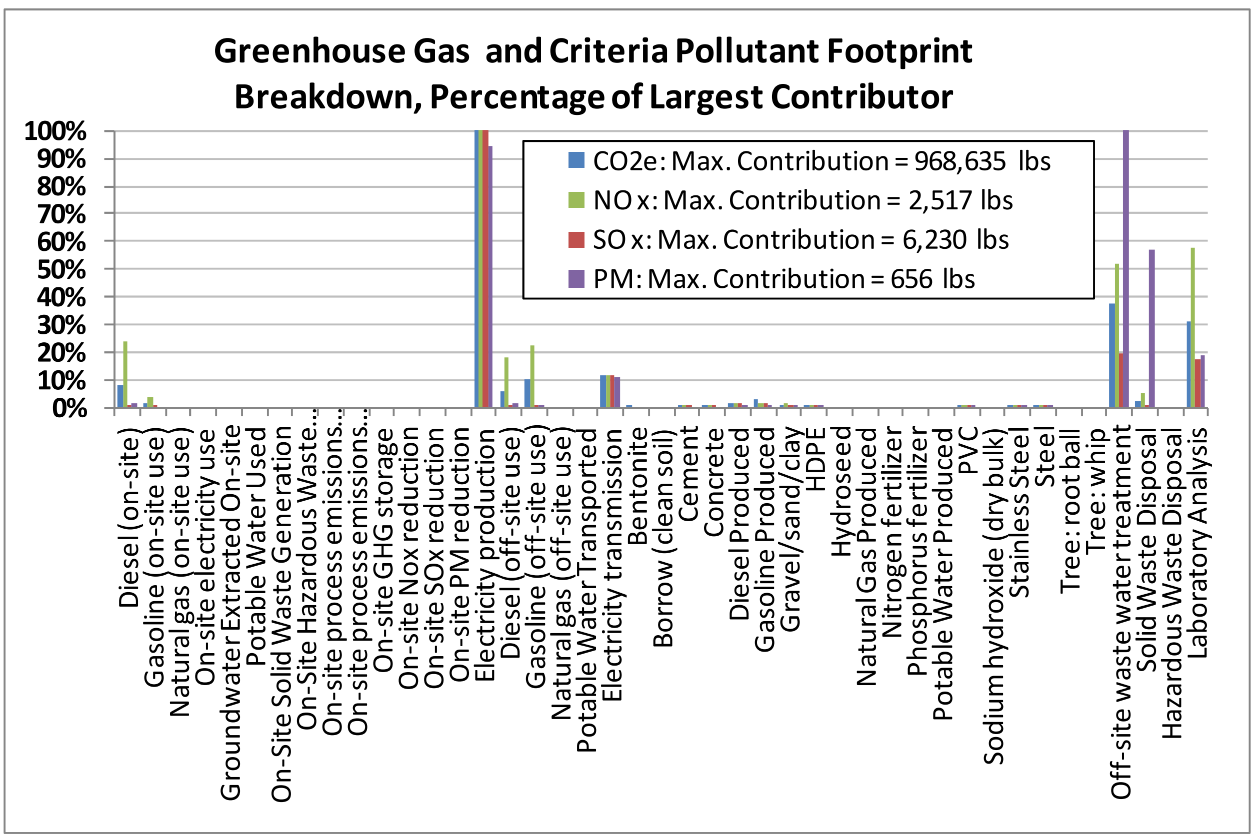

Solid Waste and Hazardous Waste Footprint Breakdown, Percentage of Largest Contributor
Solid Waste: Max. Contribution = 39 tons
Haz. Waste: Max. Contribution = 0.002 tons
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

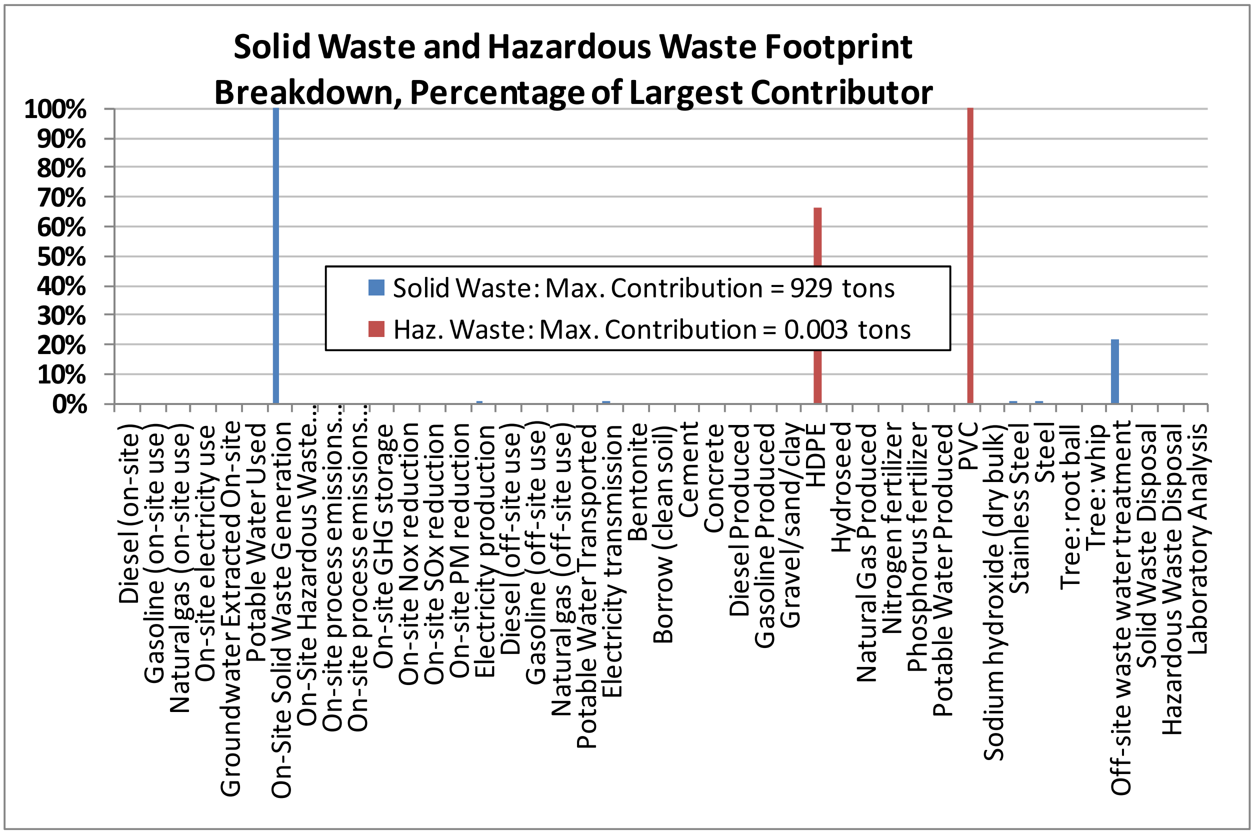

All Water, Potable Water, and Groundwater Footprint Breakdown, Percentage of Largest Contributor
All Water: Max. Contribution = 201 gal x 1000
Potable Water: Max. Contribution = 26 gal x 1000
Groundwater: Max. Contribution = 1 gal x 1000
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

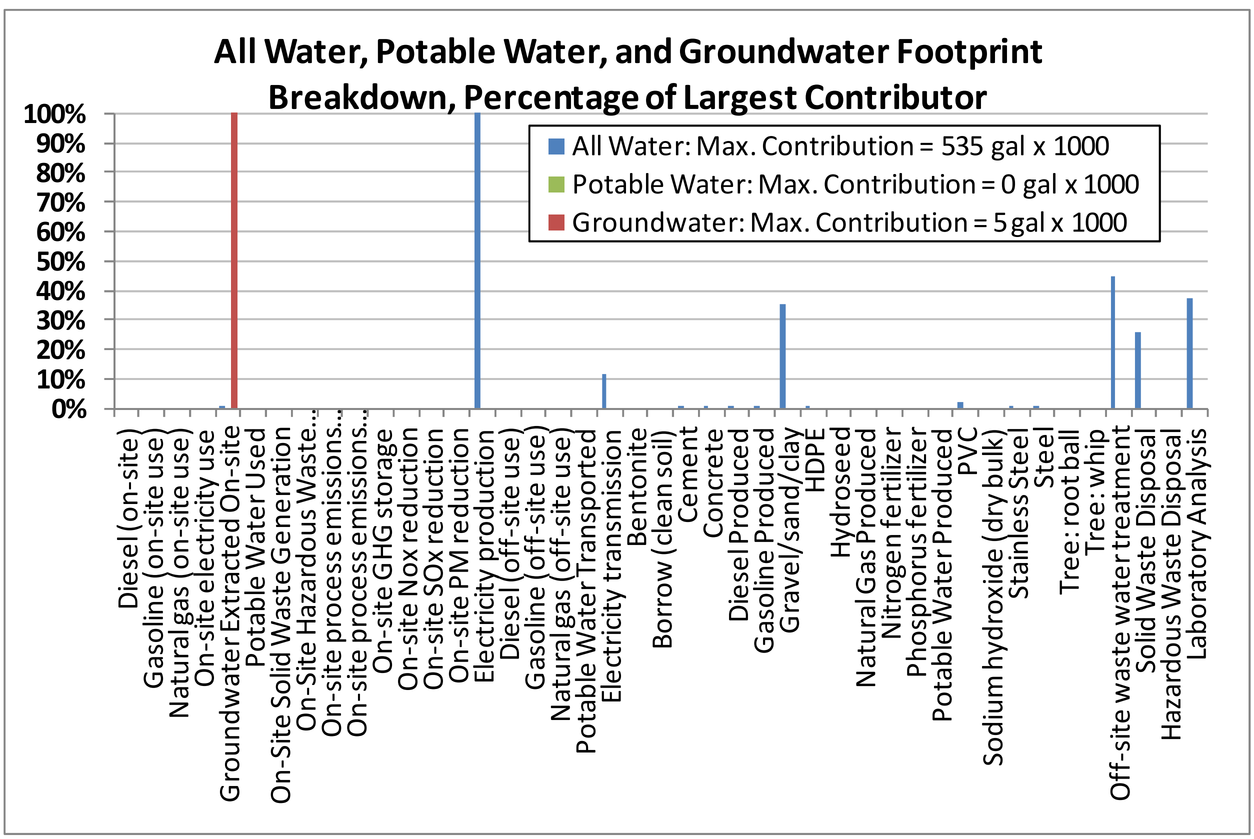

Toxic Pollutant Footprint Breakdown,
Percentage of Largest Contributor
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Air Toxics: Max. Contribution = 40 lbs
Mercury: Max. Contribution = 0.007 lbs
Lead: Max. Contribution = 0.163 lbs
Dioxins: Max. Contribution = 0.00000042 lbs
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

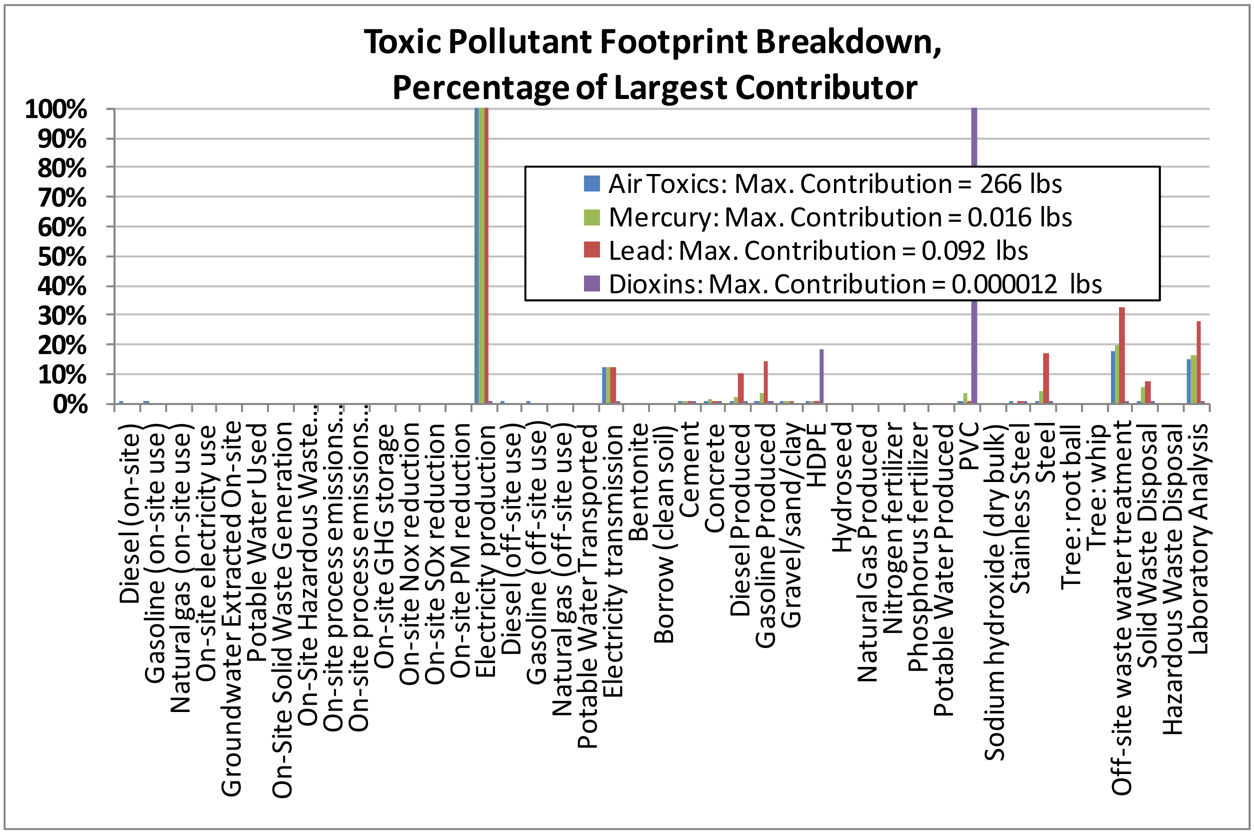
Leachate Extraction Breakdown of Energy/Air, Water, Waste, and Toxic Pollutant Footprints

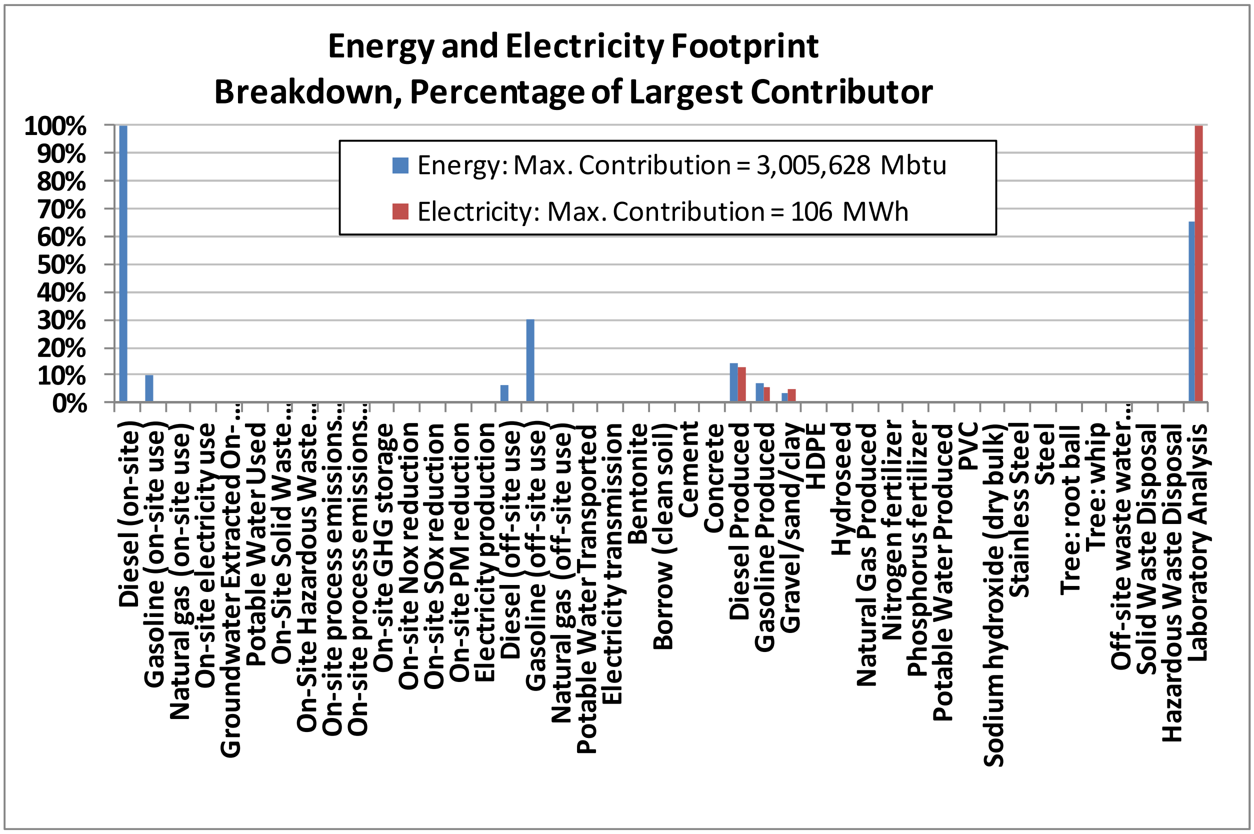


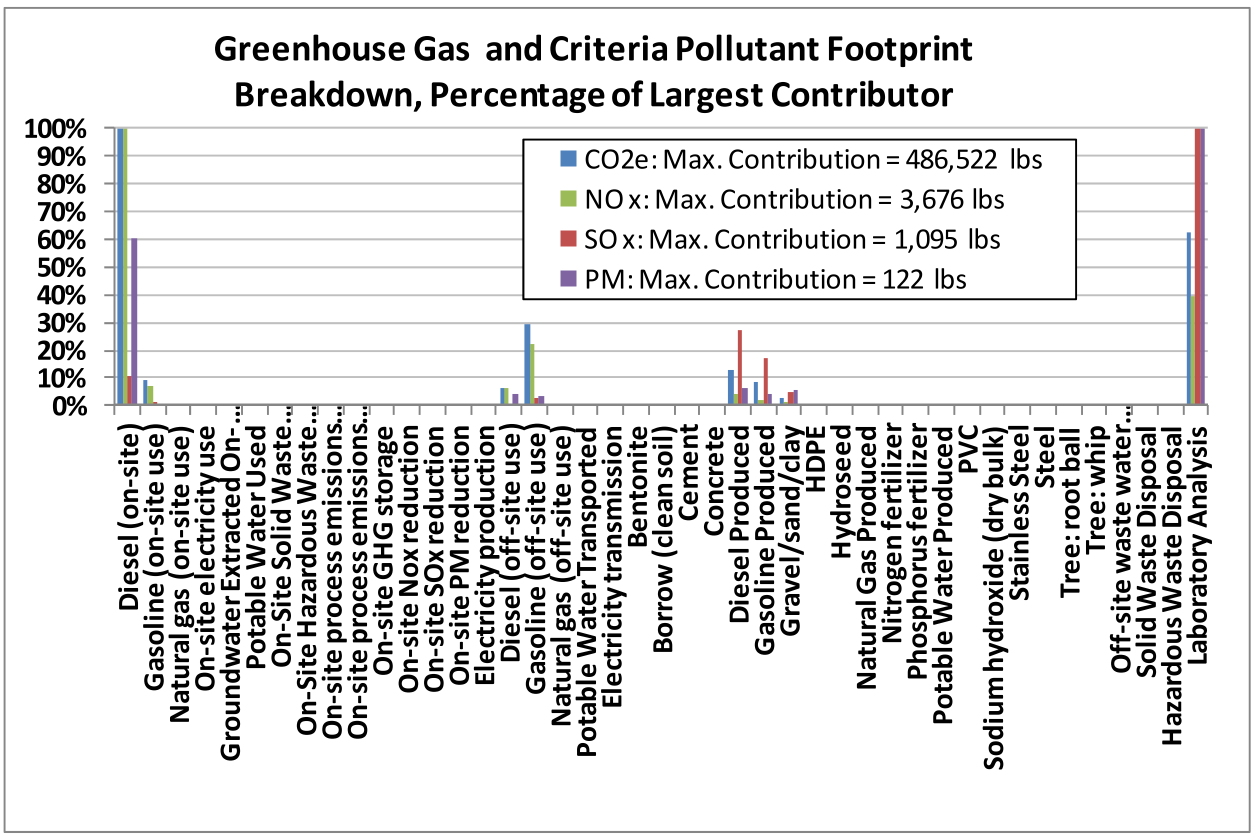


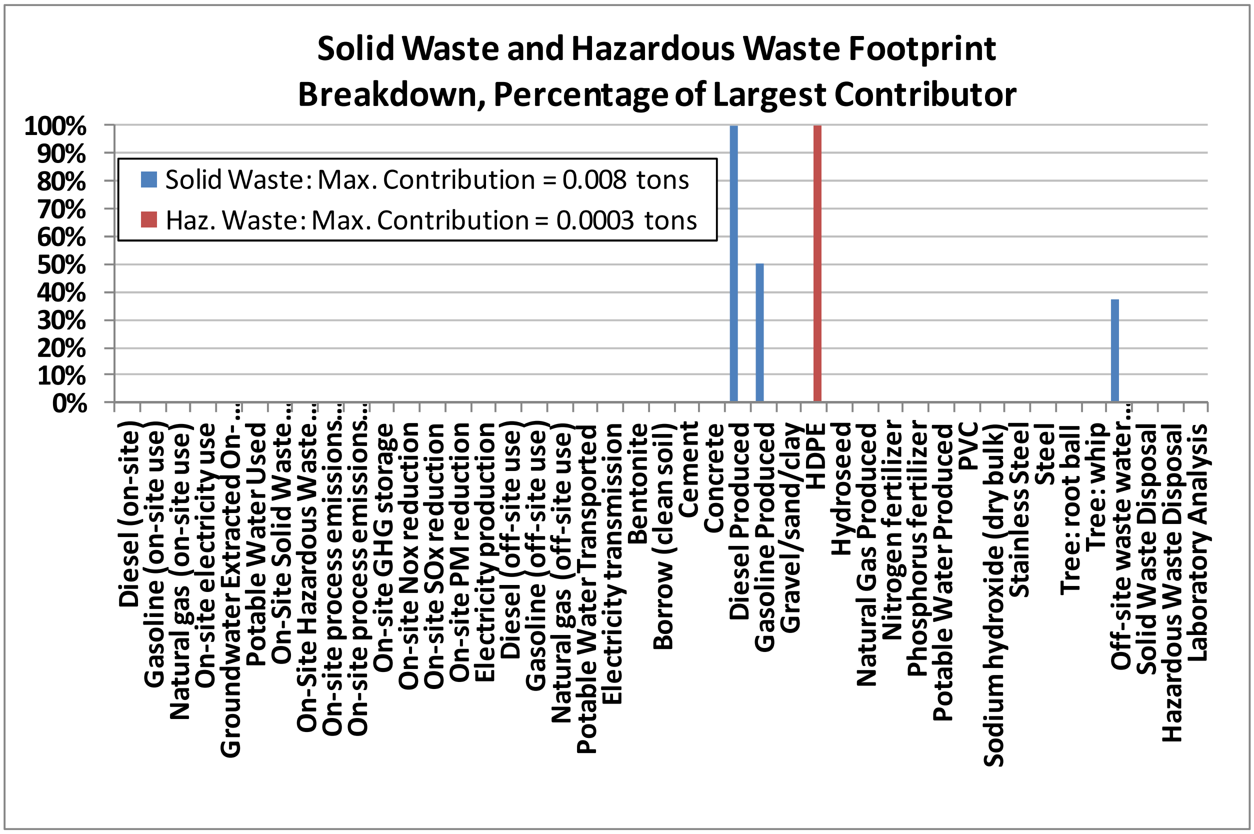

Solid Waste and Hazardous Waste Footprint Breakdown, Percentage of Largest Contributor
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Solid Waste: Max. Contribution = 929 tons
Haz. Waste: Max. Contribution = 0.003 tons
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

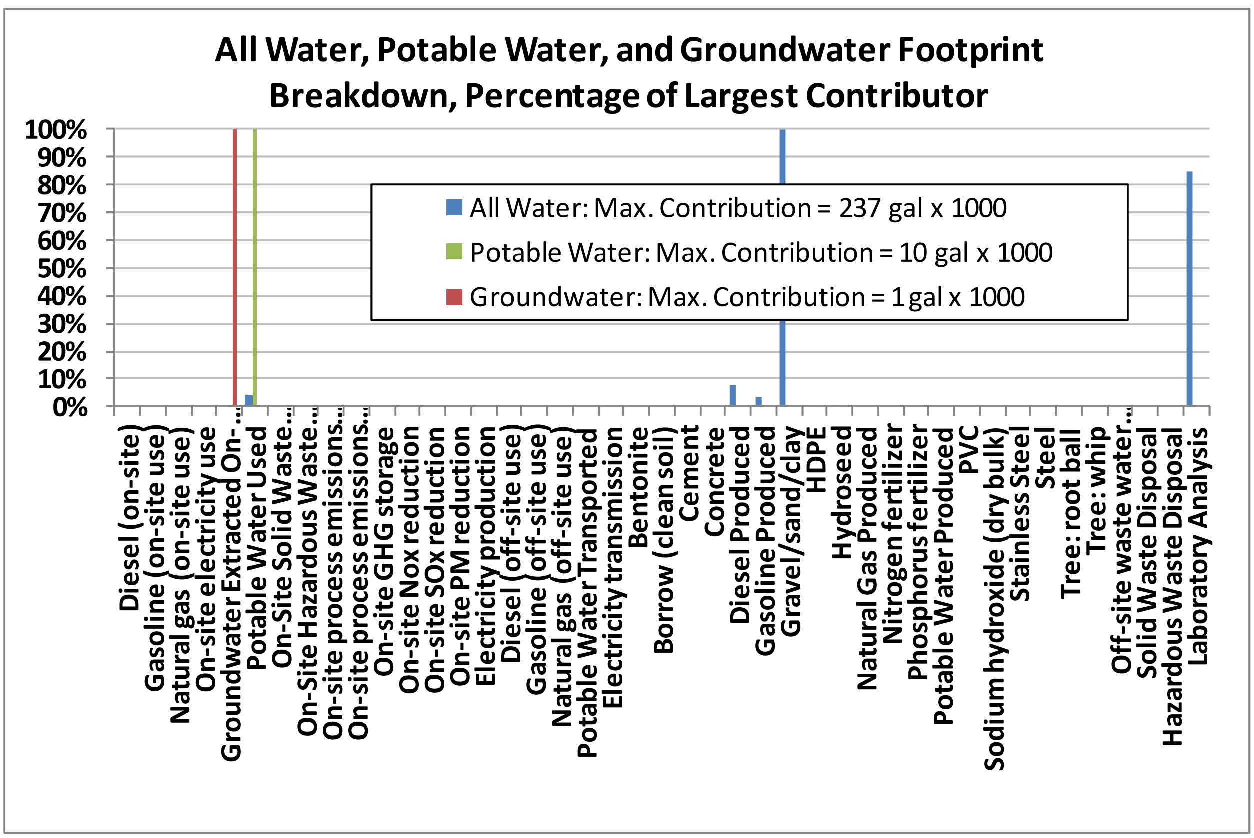

All Water, Potable Water, and Groundwater Footprint Breakdown, Percentage of Largest Contributor
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
All Water: Max. Contribution = 535 gal x 1000
Potable Water: Max. Contribution = 0 gal x 1000
Groundwater: Max. Contribution = 5 gal x 1000
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

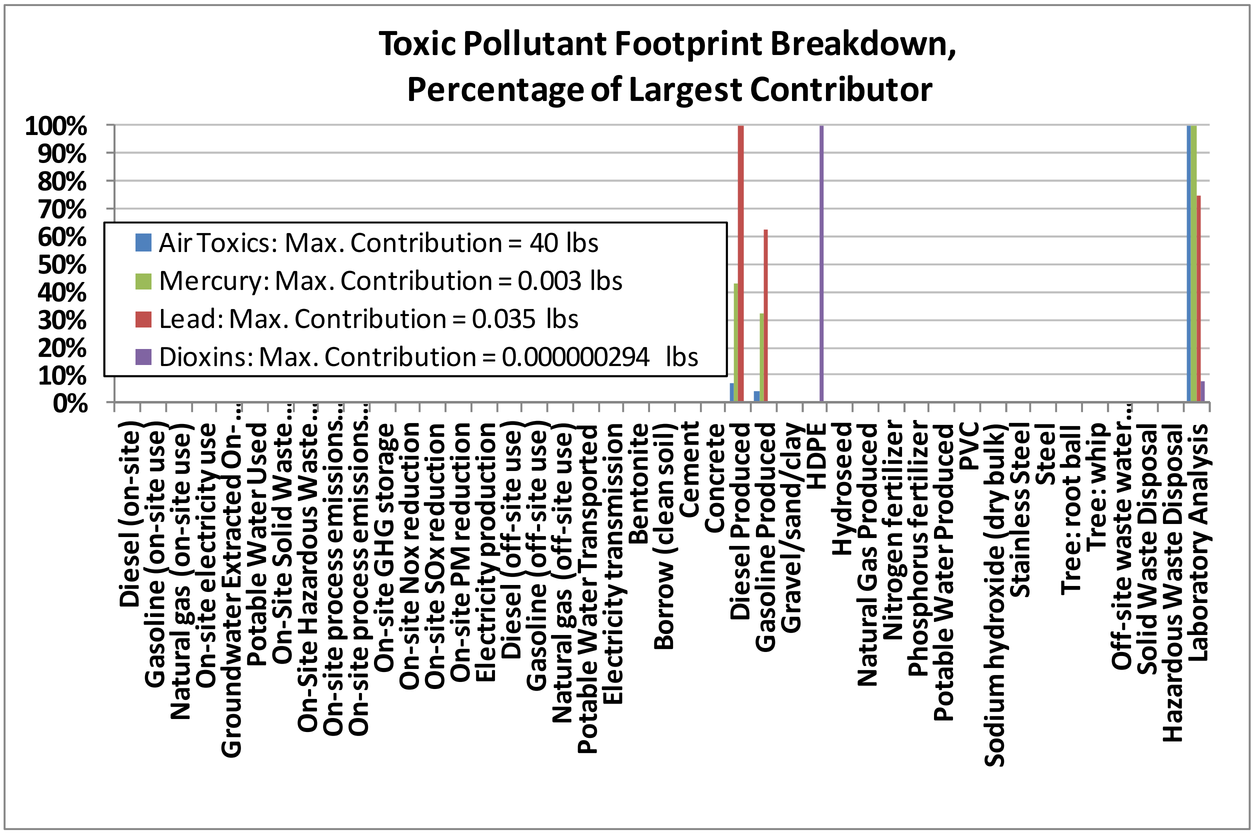

Toxic Pollutant Footprint Breakdown,
Percentage of Largest Contributor
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Air Toxics: Max. Contribution = 266 lbs
Mercury: Max. Contribution = 0.016 lbs
Lead: Max. Contribution = 0.092 lbs
Dioxins: Max. Contribution = 0.000012 lbs
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-site
Potable Water Used
On-Site Solid Waste Generation
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water treatment
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis


Energy and Electricity Footprint
Breakdown, Percentage of Largest Contributor
Energy: Max. Contribution = 3,005,628 Mbtu
Electricity: Max. Contribution = 106 MWh
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-...
Potable Water Used
On-Site Solid Waste...
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water...
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis


Greenhouse Gas and Criteria Pollutant Footprint
Breakdown, Percentage of Largest Contributor
CO2e: Max. Contribution = 486,522 lbs
NO x: Max. Contribution = 3,676 lbs
SO x: Max. Contribution = 1,095 lbs
PM: Max. Contribution = 122 lbs
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-...
Potable Water Used
On-Site Solid Waste...
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water...
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis


Solid Waste and Hazardous Waste Footprint Breakdown, Percentage of Largest Contributor
Solid Waste: Max. Contribution = 0.008 tons
Haz. Waste: Max. Contribution = 0.0003 tons
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-...
Potable Water Used
On-Site Solid Waste...
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water...
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis


All Water, Potable Water, and Groundwater Footprint Breakdown, Percentage of Largest Contributor
All Water: Max. Contribution = 237 gal x 1000
Potable Water: Max. Contribution = 10 gal x 1000
Groundwater: Max. Contribution = 1 gal x 1000
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-...
Potable Water Used
On-Site Solid Waste...
On-Site Hazardous Waste...
On-site process emissions...
On-site process emissions...
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water...
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis


Toxic Pollutant Footprint Breakdown,
Percentage of Largest Contributor
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Air Toxics: Max. Contribution = 40 lbs
Mercury: Max. Contribution = 0.003 lbs
Lead: Max. Contribution = 0.035 lbs
Dioxins: Max. Contribution = 0.000000294 lbs
Diesel (on-site)
Gasoline (on-site use)
Natural gas (on-site use)
On-site electricity use
Groundwater Extracted On-…
Potable Water Used
On-Site Solid Waste…
On-Site Hazardous Waste…
On-site process emissions…
On-site process emissions…
On-site GHG storage
On-site Nox reduction
On-site SOx reduction
On-site PM reduction
Electricity production
Diesel (off-site use)
Gasoline (off-site use)
Natural gas (off-site use)
Potable Water Transported
Electricity transmission
Bentonite
Borrow (clean soil)
Cement
Concrete
Diesel Produced
Gasoline Produced
Gravel/sand/clay
HDPE
Hydroseed
Natural Gas Produced
Nitrogen fertilizer
Phosphorus fertilizer
Potable Water Produced
PVC
Sodium hydroxide (dry bulk)
Stainless Steel
Steel
Tree: root ball
Tree: whip
Off-site waste water…
Solid Waste Disposal
Hazardous Waste Disposal
Laboratory Analysis

APPENDIX A

REMEDY INVENTORY SHEETS

REMEDY INVENTORY SHEETS

The remedy information for each remedy alternative is entered into a set of spreadsheet modules that documents these remedy parameters and calculates the level of effort, fuel, electricity, water, and materials usage to implement the remedy. The set of spreadsheet modules is sufficiently flexible to use for other remedial alternatives or for other sites. Modules can be added for various remedy components, and more modules can be added to the spreadsheet file as long as the summary tables at the end of the spreadsheet are linked to the new modules. Figure A-1 illustrates the organization of the typical spreadsheet file used for this study.

BP Wood River Footprinting Analysis
Green Remediation - Inventory of Energy, Material, Waste, and Other Remedy Aspects
Remedy Conceptual Design and Assumptions:
Alternative A - Phytoremediation

Overview

The purpose of the phytoremediation alternative is to lower the leachate level in the Closed Disposal Facility (CDF) via evapotranspiration of trees. This alternative entails planting a mix of 5 species of trees in each of 5 circular plots on the CDF, for a total of 5 acres of plantings. The trees were planted in spring 2009, and were not supplied with an irrigation system. Monitoring and maintenance of the trees will be conducted as needed to ensure vigorous growth. The intention is to leave the trees in place after the leachate level has been satisfactorily lowered in the CDF. The remedy is expected to take 7 years.

General Assumptions Regarding Site Characteristics

Material Shipping Distances (One-Way)

Materials	Units	Miles from Site	Conv. To Tons
Asphalt	tons		
Bentonite	tons		
Borrow	tons		
Cement	tons		
Cheese whey	lbs		
Concrete	tons		
Emulsified vegetable oil	lbs		
GAC: regenerated	lbs		
GAC: virgin coal-based	lbs		
GAC: virgin coconut-based	lbs		
Gravel/sand/clay	tons		
HDPE	lbs		
Hydrochloric acid (30%, SG = 1.18)	lbs		
Hydrogen peroxide (50%, SG=1.19)	lbs		
Hydroseed	lbs		
Lime	lbs		
Molasses	lbs		
Nitrogen fertilizer	lbs		
Other 1 - Compost	lbs	15	0.0005
Other 2 - Mulch	cy	15	0.405
Other 3 - Pesticide 1	lbs	500	0.0005
Other 4 - Pesticide 2	lbs	500	0.0005
Other 5			
Phosphorus fertilizer	lbs		
Polymer	lbs		
Potable water	gals		
Potassium permanganate	lbs		
PVC	lbs		
Sequestering agent	lbs		
Sodium hydroxide (20%, SG=1.22)	lbs		
Stainless steel	lbs		
Steel	lbs		
Trees: root balls	each	70	
Trees: whips	each	1500	

Waste Shipping Distances (Round Trip)

Waste Disposal Facility	Miles
Non-hazardous	14
Hazardous	
Recyclable Oil	30
Hauled to POTW	
For incineration	

Gasoline Fuel Economies for Special Vehicles

	Type	mpg
Other #1	Vehicle type	0
Other #2	Vehicle type	0
Other #3	Vehicle type	0

Key for Cell Shading

Blue	Automatically calculated
Yellow	Information input from a drop-down list
White	Manual input

Input for Meetings

General Scope	***Typical Scope Items***	***Useful Information***
Initial planning meeting		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Site Planning meeting (travel)	3	2	10	60	1	2,028	Car	Gasoline	2028	20	101.4	Roundtrip from Chicago and Indianapolis to site. One way from Houston to site.
Site Planning meeting (daily)	3	1	10	30	3	54	Car	Gasoline	162	20	8.1	Roundtrip from local hotel.

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Distance to Site	Total Miles Traveled	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Activity or Notes
			Totals				

Input for Meetings

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
	Totals	0	0

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Cap Maintenance

General Scope	***Typical Scope Items***	***Useful Information***
- Mowing 8 times per year for 10 years. - Two events of seep correction		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Local contractor	2	2	8	32	2	56	Heavy-Duty Truck	Gasoline	112	10	11.2	seep correction, two events, one day each
On-site monitoring tech	1	2	8	16	2	1	Light-Duty Truck	Gasoline	2	15	0.133333333	oversight for seep repair
Landscaper (mowing)	4	56	8	1792	112	50	Heavy-Duty Truck	Gasoline	5600	10	560	mow 8 times/year for 7 years, tow equip. behind two trucks

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Excavator/hoe (small)	41	0.57	Diesel	1.19187	6	7.15122							towed by truck, operates 3 hrs/day, 1 day/event, 2 events (seep correction)
Skid-steer (small)	81	0.55	Diesel	2.27205	6	13.6323							towed by truck, operates 3 hrs/day, 1 day/event, 2 events (seep correction)
Mowers	21	0.55	Gasoline	0.65835	504	331.8084							towed by trucks, 2 mowers, 4.5 hrs/day, 8 days/year, 7 years (mowing)
Tractor mower	75	0.6	Gasoline	2.565	84	215.46							towed by trucks, 1 mower, 1.5 hrs/day, 8 days/year, 7years (mowing)
Other	1	0.5	Gasoline	0.0285	336	9.576							weed wackers, two operating for 3 hours per day, 8 days per year, 7 years (mowing)

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Cap Maintenance

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Gravel/sand/clay	tons	16.6666667	2	60	Truck B (5-15 tons)	Diesel	7.2	8.3	150 ft3 for each of 2 seep correction events
Gravel/sand/clay	tons	0	2	60	Truck A (< 5 tons)	Diesel	8.5	7.1	empty return trips

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons	16.6666667	2	28	Truck C (15+ tons)	Diesel	5.92	4.7	stained soil removed from seep correction
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Phytoremediation Construction

General Scope	***Typical Scope Items***	***Useful Information***
Installation of phytoremediation system consisting of: removal of existing trees, removal of standing water, flagging tree locations, planting of trees, construction of deer fence		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
local contractor	2	1	5	10	1	56	Light-Duty Truck	Gasoline	56	15	3.733333333	Existing tree removal
local contractor	1	2	8	16								removal of standing water
RMT mobe from Chicago	1				4	590	Car	Gasoline	2360	20	118	planting of trees
local contractor from hotel	3	12	9	324	36	7.2	Light-Duty Truck	Gasoline	259.2	15	17.28	Local contractor commute to site from hotel for planting of trees
RMK from hotel	1	12	9	108	12	7.2	Car	Gasoline	86.4	20	4.32	RMT commute to site from hotel for planting of trees
Sonic drill contractor	1	10	9	90	10	7.2	Car	Gasoline	72	20	3.6	Sonic driller commute to site from hotel for planting of trees
local contractor	2	1	5	10	1	56	Light-Duty Truck	Gasoline	56	15	3.733333333	Mobe to site for flagging of trees
local contractor	5	9	8	360	9	56	Light-Duty Truck	Gasoline	504	15	33.6	Mobe to site for construction of deer fence

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Skid-steer (small)	81	0.55	Diesel	2.27205	60.5	137.45903	1	56	56	Diesel	7.2	7.8	Used for existing tree removal, removal of standing water, and planting of trees
Drilling - direct push	81	0.75	Diesel	3.09825	9	27.88425							Used for construction of deer fence
Drilling - direct push	68	0.75	Diesel	2.601	57	148.257	1.5	1912	2868	Diesel	7.2	398.3	Sonic drill rig used for planing trees
Tractor mower	22	0.6	Diesel	0.6732	75	50.49							Small John Deere tractor used for planting trees
Other	3	0.5	Gasoline	0.0855	2	0.171							Chainsaw used for existing tree removal
Other	86	0.5	Diesel	2.193	2	4.386							Wood chipper used for existing tree removal
Other	4	0.5	Gasoline	0.114	8	0.912							Tresh pump used during removal of standing water
Other	170	0.5	Diesel	4.335	1	4.335							Vacuum excavator used during construction of deer fence
Other	80	0.5	Diesel	2.04	1	2.04							Air compressor used during constrction of deer fence
Other	300	0.5	Diesel	7.65	18	137.7							Ford F-250 used during construction of deer fence

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Phytoremediation Construction

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Trees: root balls	each	250	10	700	Truck B (5-15 tons)	Diesel	7.2	97.2	Bald Cypress from Elsberry, MO (roundtrip)
Trees: root balls	each	250	10	700	Truck B (5-15 tons)	Diesel	7.2	97.2	Water Oak *from Elsberry, MO (roundtrip)*
Trees: root balls	each	250	10	700	Truck B (5-15 tons)	Diesel	7.2	97.2	River Birch from Elsberry, MO (roundtrip)
Trees: whips	each	1,573	2	3000	Truck B (5-15 tons)	Diesel	7.2	416.7	Willows from Oregon or New York, one-way
Trees: whips	each	1,423	2	3000	Truck B (5-15 tons)	Diesel	7.2	416.7	Poplar from Oregon or New York, one-way
Concrete	tons	8	1	30	Truck B (5-15 tons)	Diesel	7.2	4.2	4 cubic yards of concrete estimated at 2 tons/
Steel	lbs	55,197	4	2000	Truck B (5-15 tons)	Diesel	7.2	277.8	cubic yard for construction of deer fence
Steel	lbs	10,116	4	2000	Truck B (5-15 tons)	Diesel	7.2	277.8	Steel used for fence posts (estimated 13.9 lbs/8
Other 1 - Compost	lbs	880	1	15	Truck A (< 5 tons)	Diesel	8.5	1.8	foot fence post)
									Steel used in Chain link fencing (estimated that
									9 guage, 2 inch mesh fencing weighs 281 lbs/50
									Compost used during planting of trees
Trees: whips	each	0	4	6000	Truck A (< 5 tons)	Diesel	8.5	705.9	empty return trips
Trees: root balls	each	0	30	2100	Truck A (< 5 tons)	Diesel	8.5	247.1	empty return trips
Concrete	tons	0	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	empty return trips
Steel	lbs	0	8	4000	Truck A (< 5 tons)	Diesel	8.5	470.6	empty return trips
Other 1 - Compost	lbs	0	1	15	Truck A (< 5 tons)	Diesel	8.5	1.8	empty return trips

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons	22.5	1	14	Truck C (15+ tons)	Diesel	5.92	2.4	Dill cutting from installation of deer fence were
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Phytoremediation O&M

General Scope

Operation and maintenance of phytoremediation system. Including: Inspections, watering, fertilizer application, pesticide application, and mulching

Typical Scope Items

Useful Information

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Tree Inspector	1	18	2	36	18	20	Car	Gasoline	360	20	18	Arborist tree inspections and sampling
RMT Tree Inspection oversight	1	2	2	4	4	590	Car	Gasoline	2360	20	118	Mobe for RMT oversight for tree inspections and sampling
RMT Inspections	1	12	2	24								General inspections conducted concurent with other site activites
local contractor	2	6	8	96								local contractor mobe for watering trees
local contractor	2	9	8	144	9	26	Light-Duty Truck	Gasoline	234	15	15.6	local contractor mobe for fertilizing trees
local contractor	2	3	8	48	3	26	Light-Duty Truck	Gasoline	78	15	5.2	local contractor mobe for pesticide application
local contractor	2	9	9	162	9	26	Light-Duty Truck	Gasoline	234	15	15.6	local contractor mobe for mulching and installing tree guards

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Water truck	230	0.57	Diesel	6.6861	24	160.4664	6	26	156	Diesel	7.2	21.7	Water truck used for watering trees
Other	300	0.5	Diesel	7.65	24	183.6							Ford F-250 used during fertilizer application
Other	300	0.5	Diesel	7.65	8	61.2							Ford F-250 used during pesticide application

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Phytoremediation O&M

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Nitrogen fertilizer	lbs	739.2	1	500	Train (gptm)	Diesel	0.0024	0.4	1980 lbs of Doggett XL 32-7-7 fertilizer
Phosphorus fertilizer	lbs	772.2	1	500	Train (gptm)	Diesel	0.0024	0.5	2112 lbs of Doggett XL 5-30-30 fertilizer
Sodium hydroxide (20%, SG=1.22)	lbs	3861	1	500	Train (gptm)	Diesel	0.0024	2.3	NaOH as proxy for potassium hydroxide
Other 2 - Mulch	cubic yard	120		0					Mulch
Other 3 - Pesticide 1	lbs	0.21875	1	500	Train (gptm)	Diesel	0.0024	0	Agristrep pesticide (3.5 oz, 100% product)
Other 4 - Pesticide 2	lbs	2.559375	1	500	Train (gptm)	Diesel	0.0024	0	Syngenta Banner Maxx pesticide
									72 oz per application, 1.3 lbs active
									ingredient per gallon
									materials carried by contractor to site
									chemicals transported by train in bulk to
									batching facilities

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)	26	**Water used to water trees**
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere	81993.6	Transpiration to atmosphere
Public Use		
Irrigation	26	
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions	1,370,959	Carbon dioxide stored by growing trees over 30 year period
On-site Nox reductions	21	Dry deposition of Nox by growing trees over 30 year period
On-site SOx reductions	10	Dry deposition of SOx by growing trees over 30 year period
On-site PM reductions	20	Dry deposition of particulate matter by growing trees over 30 year period

Input for Long-Term Monitoring

General Scope	Typical Scope Items	Useful Information
Groundwater monitoring, 10 wells monitored semi-annually for 30 years. Well maintenance considered to be negligible Leachate monitoring quarterly for 10 years.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT monitoring tech	1	60	10	600	60	590	Light-Duty Truck	Gasoline	35400	15	2360	initial travel for monitoring (2 times per year, 30 years)
RMT monitoring tech	1	120	10	1200	120	10	Light-Duty Truck	Gasoline	1200	15	80	travel for other days (2 days/event, 2 events/year, 30 years)
On-site monitoring tech	1	40	3	120	40	1	Light-Duty Truck	Gasoline	40	15	2.666666667	quarterly leach level monitoring for 10 years

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Long-Term Monitoring

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
HDPE	lbs	300	1	1500	Truck B (5-15 tons)	Diesel	7.2	208.3	0.5 pounds/bailer, 600 bailers
									over 9,000 feet of nylon rope not considered
									assume bottle ware is covered by lab
									transported by contractor to site
									transported by truck in bulk to general area
									by common freight (no return trip)

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs	$90	780	$70,200
SVOCs	$150	780	$117,000
PCBs/Pesticides			$0
Metals	$100	780	$78,000
Chloride and sulfate	$50	780	$39,000
Other			$0
Other			$0
Other			$0
Other			$0
Other			$0
			$0
			$0
			$0
	Totals	**3120**	**$304,200**

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)	1.2	purge water, 6 gal/well, 600 wells total
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW	1.2	discharge to catch basin on main property for treatment
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Summary

Level	1	2	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	
Item	**meetings**	**cap maint.**	**Phyto Const**	**Phyto O&M**	**LTM**													**Total**
Labor and Travel																		
Hours worked	90	1840	918	514	1920													**5282**
Heavy equip. operating hours	0	936	233.5	56	0													**1225.5**
Passenger trips to site	4	116	73	43	220													**456**
Passenger vehicle miles	2190	5714	3393.6	3266	36640													**51203.6**
Heavy equip. trips to site	0	0	2.5	6	0													**8.5**
Heavy equip. transport miles	0	0	2924	156	0													**3080**
Materials transport trips	0	4	88	5	1													**98**
Materials transport miles	0	120	24290	2500	1500													**28410**
Waste transport trips	0	2	1	0	0													**3**
Waste transport miles	0	28	14	0	0													**42**
Energy																		
On-site																		
Gasoline (gallons)	0	556.8444	1.083	0	0													**557.9274**
E85 (gallons)	0	0	0	0	0													**0**
Diesel (gallons)	0	20.78352	512.551275	405.2664	0													**938.601195**
B20 (gallons)	0	0	0	0	0													**0**
Off-site																		
Gasoline (gallons)	109.5	571.3333333	184.2666667	172.4	2442.666667													**3480.166667**
E85 (gallons)	0	0	0	0	0													**0**
Diesel (gallons)	0	20.1	3524	24.9	208.3													**3777.3**
B20 (gallons)	0	0	0	0	0													**0**
Total Fuel																		
Gasoline (gallons)	109.5	1128.177733	185.3496667	172.4	2442.666667													**4038.094067**
E85 (gallons)	0	0	0	0	0													**0**
Diesel (gallons)	0	40.88352	4036.551275	430.1664	208.3													**4715.901195**
B20 (gallons)	0	0	0	0	0													**0**
Electricity Demand (kW)	0	0	0	0	0													**0**
Electricity Usage (MWh)	0	0	0	0	0													**0**
Natural gas usage (therms)	0	0	0	0	0													**0**

Summary

Level		**1**	**2**	**1**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Item		**meetings**	**cap maint.**	**Phyto Const**	**Phyto O&M**	**LTM**													**Total**
Materials																			
Asphalt	(tons)	0	0	0	0	0													**0**
Bentonite	(tons)	0	0	0	0	0													**0**
Borrow	(tons)	0	0	0	0	0													**0**
Cement	(tons)	0	0	0	0	0													**0**
Cheese whey	(lbs)	0	0	0	0	0													**0**
Concrete	(tons)	0	0	8	0	0													**8**
Emulsified vegetable oil	(lbs)	0	0	0	0	0													**0**
GAC: regenerated	(lbs)	0	0	0	0	0													**0**
GAC: virgin coal-based	(lbs)	0	0	0	0	0													**0**
GAC: virgin coconut-based	(lbs)	0	0	0	0	0													**0**
Gravel/sand/clay	(tons)	0	16.66666667	0	0	0													**16.66666667**
HDPE	(lbs)	0	0	0	0	300													**300**
Hydrochloric acid (30%, SG = 1.18)	(lbs)	0	0	0	0	0													**0**
Hydrogen peroxide (50%, SG=1.19)	(lbs)	0	0	0	0	0													**0**
Hydroseed	(lbs)	0	0	0	0	0													**0**
Lime	(lbs)	0	0	0	0	0													**0**
Molasses	(lbs)	0	0	0	0	0													**0**
Nitrogen fertilizer	(lbs)	0	0	0	739.2	0													**739.2**
Other 1 - Compost	(lbs)	0	0	880	0	0													**880**
Other 2 - Mulch	(cy)	0	0	0	120	0													**120**
Other 3 - Pesticide 1	(lbs)	0	0	0	0.21875	0													**0.21875**
Other 4 - Pesticide 2	(lbs)	0	0	0	2.559375	0													**2.559375**
Other 5	(0)	0	0	0	0	0													**0**
Phosphorus fertilizer	(lbs)	0	0	0	772.2	0													**772.2**
Polymer	(lbs)	0	0	0	0	0													**0**
Potable water	(gals)	0	0	0	0	0													**0**
Potassium permanganate	(lbs)	0	0	0	0	0													**0**
PVC	(lbs)	0	0	0	0	0													**0**
Sequestering agent	(lbs)	0	0	0	0	0													**0**
Sodium hydroxide (20%, SG=1.22)	(lbs)	0	0	0	3861	0													**3861**
Stainless steel	(lbs)	0	0	0	0	0													**0**
Steel	(lbs)	0	0	65313	0	0													**65313**
Trees: root balls	(each)	0	0	750	0	0													**750**
Trees: whips	(each)	0	0	2996	0	0													**2996**
Waste																			
Non-hazardous		0	16.66666667	22.5	0	0													**39.16666667**
Hazardous		0	0	0	0	0													**0**
Recyclable oil		0	0	0	0	0													**0**
Hauled to POTW		0	0	0	0	0													**0**
For incineration		0	0	0	0	0													**0**
Water Use																			
Public water (1000 x gal.)		0	0	0	26.4	0													**26.4**
Extracted GW #1 (1000 x gals)		0	0	0	0	1.2													**1.2**
Extracted GW #2 (1000 x gals)		0	0	0	0	0													**0**
Surface water (1000 x gals)		0	0	0	0	0													**0**
Reclaimed water (1000 x gals)		0	0	0	0	0													**0**
Stormwater (1000 x gals)		0	0	0	0	0													**0**

Summary

Level	1	2	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	
Item	**meetings**	**cap maint.**	**Phyto Const**	**Phyto O&M**	**LTM**													**Total**
Water Discharge																		
Discharge to surface water	0	0	0	0	0													**0**
Reinjected to aquifer	0	0	0	0	0													**0**
Discharge to POTW	0	0	0	0	1.2													**1.2**
Discharge to atmosphere	0	0	0	81993.6	0													**81993.6**
Public Use	0	0	0	0	0													**0**
Irrigation	0	0	0	26.4	0													**26.4**
Industrial process water	0	0	0	0	0													**0**
Other beneficial use	0	0	0	0	0													**0**
Laboratory Analysis																		
Total samples	0	0	0	0	3120													**3120**
Total cost	0	0	0	0	304200													**304200**
Other																		
On-site HAP emissions	0	0	0	0	0													**0**
On-site GHG emissions	0	0	0	0	0													**0**
On-site GHG storage	0	0	0	1370959	0													**1370959**
On-site Nox reductions	0	0	0	21	0													**21**
On-site SOx reductions	0	0	0	10	0													**10**
On-site PM reductions	0	0	0	20	0													**20**

Phytoremediation Worksheet

Tree Type	Willow	Poplar	River Birch	Water Oak	Bald Cypress	Total					
Growth Rate (cm bhd/yr*)	0.6125	0.4625	0.353448	0.37	0.625						
# of Trees	1573	1423	250	250	250	3746					
							Carbon Content	CO2 Stored (lbs)	Nox Removed (lbs)	SOx Removed (lbs)	PM10 Removed (lbs)
Project Year	Cumulative Biomass (lbs Dry Weight)						46%				
1	200	113	20	17	40	390	179	656	0	0	0
2	838	412	57	55	162	1,524	701	2,570	0	0	0
3	2,089	1,000	130	131	387	3,737	1,719	6,303	0	0	0
4	4,054	1,919	245	252	726	7,196	3,310	12,137	0	0	0
5	6,813	3,208	404	423	1,189	12,037	5,537	20,302	0	0	0
6	10,439	4,898	611	648	1,782	18,378	8,454	30,998	0	0	0
7	14,994	7,018	870	934	2,512	26,328	12,111	44,407	1	0	1
8	20,533	9,595	1,183	1,282	3,385	35,978	16,550	60,683	1	0	1
9	27,109	12,652	1,553	1,698	4,404	47,416	21,811	79,974	1	1	1
10	34,770	16,212	1,983	2,184	5,575	60,724	27,933	102,421	2	1	1
11	43,560	20,295	2,475	2,744	6,902	75,976	34,949	128,146	2	1	2
12	53,521	24,920	3,031	3,381	8,389	93,242	42,891	157,267	2	1	2
13	64,693	30,106	3,653	4,098	10,039	112,589	51,791	189,900	3	1	3
14	77,114	35,870	4,342	4,897	11,856	134,079	61,676	226,145	4	2	3
15	90,821	42,230	5,102	5,782	13,843	157,778	72,578	266,119	4	2	4
16	105,847	49,200	5,933	6,754	16,003	183,737	84,519	309,903	5	2	4
17	122,226	56,798	6,838	7,817	18,339	212,018	97,528	357,603	6	3	5
18	139,990	65,036	7,818	8,973	20,853	242,670	111,628	409,303	6	3	6
19	159,169	73,929	8,874	10,224	23,549	275,745	126,843	465,091	7	3	7
20	179,794	83,492	10,008	11,572	26,429	311,295	143,196	525,052	8	4	8
21	201,893	93,737	11,221	13,020	29,496	349,367	160,709	589,266	9	4	8
22	225,494	104,678	12,516	14,569	32,751	390,008	179,404	657,815	10	5	9
23	250,624	116,327	13,892	16,222	36,197	433,262	199,301	730,770	11	5	11
24	277,310	128,695	15,353	17,981	39,836	479,175	220,421	808,210	13	6	12
25	305,578	141,796	16,898	19,847	43,671	527,790	242,783	890,204	14	6	13
26	335,453	155,641	18,529	21,823	47,703	579,149	266,409	976,833	15	7	14
27	366,958	170,241	20,248	23,910	51,935	633,292	291,314	1,068,151	17	8	15
28	400,118	185,607	22,056	26,111	56,368	690,260	317,520	1,164,240	18	8	17
29	434,957	201,749	23,953	28,426	61,005	750,090	345,041	1,265,150	20	9	18
30	471,497	218,679	25,941	30,859	65,846	812,822	373,898	1,370,959	21	10	20
31	509,760	236,407	28,021	33,410	70,895	878,493	404,107	1,481,726	23	11	21
32	549,769	254,943	30,195	36,081	76,152	947,140	435,684	1,597,508	25	11	23
33	591,545	274,297	32,463	38,874	81,620	1,018,799	468,648	1,718,376	27	12	25
34	635,109	294,478	34,826	41,790	87,300	1,093,503	503,011	1,844,374	29	13	27
35	680,482	315,497	37,285	44,832	93,194	1,171,290	538,793	1,975,574	31	14	28
36	727,684	337,362	39,842	48,000	99,303	1,252,191	576,008	2,112,029	33	15	30
37	776,736	360,083	42,497	51,297	105,629	1,336,242	614,671	2,253,794	35	16	32
38	827,656	383,669	45,252	54,723	112,174	1,423,474	654,798	2,400,926	37	17	35
39	880,464	408,129	48,107	58,281	118,939	1,513,920	696,403	2,553,478	40	18	37
40	935,179	433,472	51,063	61,971	125,925	1,607,610	739,501	2,711,504	42	20	39

** bhd = breast height diameter*

Biomass calculated based on equations from Jenkins, Jennifer C.; Chojnacky, David C.; Heath, Linda S.; Birdsey, Richard A., *National scale biomass estimators for United States tree species* , Forest Science. 49: 12-35, 2003

Growth rates based on data provided in the following resources and reduced by 50% to account for non-optimal growing conditions:

- Willow - http://na.fs.fed.us/pubs/silvics_manual/volume_2/salix/nigra.htm species group (aa) according to Jenkins 2003
- Bald Cypress - http://na.fs.fed.us/pubs/silvics_manual/Volume_1/taxodium/distichu species group (cl) according to Jenkins 2003
- Poplar - http://na.fs.fed.us/pubs/silvics_manual/volume_2/liriodendron/tulipifera.ht species group (aa) according to Jenkins 2003
- River Birch - http://na.fs.fed.us/pubs/silvics_manual/volume_2/betula/nigra.htm species group (mb) according to Jenkins 2003
- Water Oak - http://na.fs.fed.us/pubs/silvics_manual/volume_2/quercus/nigra.htm species group (mo) according to Jenkins 2003

Reductions of NOx, SOx, and PM based on Nowak, 1994 dry deposition of up to 1.4 kg/year of contaminants by healthy 77 cm diameter trees. Nowak, D.J. 1994. Air pollution removal by Chicago's urban forest. In: McPherson, E.G., D.J. Nowak, and R.A. Rowntree. Chicago's Urban Forest Ecosystem: Results of the Chicago Urban Forest Climate Project. USDA Forest Service General Technical Report NE-186. pp. 63-81.

Removal of individual contaminants based on:
Nowak and Crane, The Urban Forest Effects (UFORE) Model: Quantifying Urban Forest Structure and Functions
Biomass equation scaled so that a 77 cm tree would remove 1.4 kg/yr of pollutants

Lookup Table

Fuel Type for Personnel	Modifying Factor to mpg
E85	0.73
Gasoline	1

Based on higher heating values (mmBtu per barrel) of 5.218 mmBtu (gasoline) and 3.539 for (ethanol), Climate Leaders Direct Emissions from Mobile Sources

Fuel Type for Equipment Transport	mpg
B20	7.09
Diesel	7.2

B20 efficiency based on higher heating value of 127,960 btu per gallon for biodiesel (Alternative Fuels & Advanced Vehicles Data Center, www.afdc.energy.gov.

Fuel Type for Equip. Use	Gals. per HP-hr
B20	0.052
Diesel	0.051
E85	0.078
Gasoline	0.057

Fuel consumption based on thermal efficiency of 36% for diesel and 38% for gasoline.

Mode of Transport. For Personnel	Gasoline mpg
Car	20
Heavy-Duty Truck	10
Light-Duty Truck	15
Vehicle type	0
Vehicle type	0
Vehicle type	0

Typical fuel efficiencies from from www.fueleconomy.gov

Mode of Transport. For Materials	rate
Train (gptm)	0.0024
Truck A (< 5 tons)	8.5
Truck B (5-15 tons)	7.2
Truck C (15+ tons)	5.92

gptm = gallons per ton-mile

Rail fuel usage from Climate Leaders, Direct Emissions from Mobile Sources

Truck usages from Climate Leaders, Direct Emissions from Mobil Sources and Effects of Payload on the Fuel Consumption of Trucks, Dept. for Transportation (Great Britain), December 2007

Equipment Type	Default Load Factor	
Asphalt paver	0.62	
Backhoe	0.57	
Concrete paving machine	0.53	
Dozer (large)	0.55	
Dozer (small)	0.55	
Drilling - direct push	0.75	
Drilling - large rig (e.g., CME-75)	0.75	
Drilling - medium rig (e.g., CME-55)	0.75	
Dump truck	0.57	
Excavator (large)	0.57	
Excavator (medium)	0.57	
Excavator/hoe (small)	0.57	
Grader	0.61	
Grout pump	0.5	
Hydroseeder	0.62	
Integrated tool carrier	0.43	
Loader	0.55	
Loader (small)	0.55	
Mobile laboratory	0.5	
Mowers	0.55	
Other	0.5	
Riding trencher	0.75	
Roller	0.56	
Rotary-screw air compressor (250 cfm)	0.48	
Skid-steer (small)	0.55	
Telescopic handler	0.43	
Tractor mower	0.6	
Water truck	0.57	

Materials	Units	Conv. to tons	Default Distance from Source to Site	Site-Specific Distance Used
Asphalt	tons	1	30	
Bentonite	tons	1	1000	
Borrow	tons	1	30	
Cement	tons	1	30	
Cheese whey	lbs	0.0005	1000	
Concrete	tons	1	30	
Emulsified vegetable oil	lbs	0.0005	1000	
GAC: regenerated	lbs	0.0005	1000	
GAC: virgin coal-based	lbs	0.0005	1000	
GAC: virgin coconut-based	lbs	0.0005	1000	
Gravel/sand/clay	tons	1	30	
HDPE	lbs	0.0005	1,500	
Hydrochloric acid (30%, SG = 1.18)	lbs	0.0005	500	
Hydrogen peroxide (50%, SG=1.19)	lbs	0.0005	500	
Hydroseed	lbs	0.0005	500	
Lime	lbs	0.0005	500	
Molasses	lbs	0.0005	500	
Nitrogen fertilizer	lbs	0.0005	500	
Other 1 - Compost	lbs	0.0005	0	X
Other 2 - Mulch	cy	0.405	0	X
Other 3 - Pesticide 1	lbs	0.0005	0	X
Other 4 - Pesticide 2	lbs	0.0005	0	X
Other 5	0	0	0	
Phosphorus fertilizer	lbs	0.0005	500	
Polymer	lbs	0.0005	1000	
Potable water	gals	0.00417	30	
Potassium permanganate	lbs	0.0005	1400	
PVC	lbs	0.0005	500	
Sequestering agent	lbs	0.0005	1000	
Sodium hydroxide (20%, SG=1.22)	lbs	0.0005	500	
Stainless steel	lbs	0.0005	500	
Steel	lbs	0.0005	500	
Trees: root balls	each	NA	500	X
Trees: whips	each	NA	1000	X

Waste Hauling	Distance from Site
Non-hazardous	14
Hazardous	0
Recyclable Oil	30
Hauled to POTW	0
For incineration	0

BP Wood River Footprinting Analysis
Green Remediation - Inventory of Energy, Material, Waste, and Other Remedy Aspects
Remedy Conceptual Design and Assumptions:
Alternative B - Extraction Wells

Overview

The purpose of the extraction well alternative is to lower the leachate level in the Closed Disposal Facility (CDF) via pumping at extraction wells. This alternative entails the installation of 20 new extraction wells, and the use of 4 existing extraction wells. The extracted leachate would be treated in an oil/water separator at the CDF and discharged off-site. The intention is to leave the wells in place after the leachate level has been satisfactorily lowered, to be used in the event that the leachate level rises again. The remedy is expected to take 10 years.

General Assumptions Regarding Site Characteristics

Material Shipping Distances (One-Way)

Materials	Units	Miles from Site	Conv. To Tons
Asphalt	tons		
Bentonite	tons		
Borrow	tons		
Cement	tons		
Cheese whey	lbs		
Concrete	tons		
Emulsified vegetable oil	lbs		
GAC: regenerated	lbs		
GAC: virgin coal-based	lbs		
GAC: virgin coconut-based	lbs		
Gravel/sand/clay	tons		
HDPE	lbs		
Hydrochloric acid (30%, SG = 1.18	lbs		
Hydrogen peroxide (50%, SG=1.1	lbs		
Hydroseed	lbs		
Lime	lbs		
Molasses	lbs		
Nitrogen fertilizer	lbs		
Other 1 - Compost	lbs	15	0.0005
Other 2 - Mulch	cy	15	0.405
Other 3 - Pesticide 1	lbs	500	0.0005
Other 4 - Pesticide 2	lbs	500	0.0005
Other 5			
Phosphorus fertilizer	lbs		
Polymer	lbs		
Potable water	gals		
Potassium permanganate	lbs		
PVC	lbs		
Sequestering agent	lbs		
Sodium hydroxide (20%, SG=1.22	lbs		
Stainless steel	lbs		
Steel	lbs		
Trees: root balls	each		
Trees: whips	each		

Waste Shipping Distances (Round Trip)

Waste Disposal Facility	Miles
Non-hazardous	14
Hazardous	
Recyclable Oil	30
Hauled to POTW	
For incineration	

Gasoline Fuel Economies for Special Vehicles

	Type	mpg
Other #1	Vehicle type	0
Other #2	Vehicle type	0
Other #3	Vehicle type	0

Key for Cell Shading

Blue	Automatically calculated
Yellow	Information is input from a drop-down list
White	Manual input

Input for Meetings

General Scope	***Typical Scope Items***	***Useful Information***
Initial planning meeting		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT from Chicago	1	1	8	8	1	590	Car	Gasoline	590	20	29.5	
RMT from Hotel	1	1	8	8	1	10	Car	Gasoline	10	20	0.5	
Local contractor	4	2	8	64	4	30	Light-Duty Truck	Gasoline	120	15	8	carpooling - two people per car

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Distance to Site	Total Miles Traveled	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Activity or Notes
			Totals				

Input for Meetings

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals		**0**	**0**

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Site Investigation

General Scope	***Typical Scope Items***	***Useful Information***
Site preparation. Locate and survey utilities. Mark utilities with reusable stakes		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT from Chicago	1	1	8	8	1	590	Car	Gasoline	590	20	29.5	
RMT from Hotel	1	1	8	8	1	10	Car	Gasoline	10	20	0.5	
Utility locator - Indianapolis	1	1	8	8	1	482	Light-Duty Truck	Gasoline	482	15	32.13333333	carpooling - two people per car
Utility locator - hotel	1	1	8	8	1	36	Light-Duty Truck	Gasoline	36	15	2.4	
Local surveyor	2	2	8	32	2	30	Light-Duty Truck	Gasoline	60	15	4	carpooling - two people per car

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Distance to Site	Total Miles Traveled	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Activity or Notes
			Totals				

Input for Site Investigation

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
	Totals		

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Cap Maintenance

General Scope	***Typical Scope Items***	***Useful Information***
Initial seep correction (2 events) Quarterly cover inspections for 10 years. Cover repairs 3 times per year for 10 years Mowing 8 times per year for 10 years.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Local contractor	2	2	8	32	2	56	Heavy-Duty Truck	Gasoline	112	10	11.2	seep correction, two events, one day each
On-site monitoring tech	1	2	8	16	2	1	Light-Duty Truck	Gasoline	2	15	0.133333333	oversight for seep repair
Landscaper (mowing)	4	80	8	2560	160	50	Heavy-Duty Truck	Gasoline	8000	10	800	mow 8 times/year for 7 years, tow equip. behind two trucks
Local contractor	2	60	8	960	120	56	Heavy-Duty Truck	Gasoline	6720	10	672	crack repair
On-site oversight	1	60	8	480	120	1	Light-Duty Truck	Gasoline	120	15	8	crack repair oversight

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Excavator/hoe	41	0.57	Diesel	1.19187	6	7.15122							seep correction: towed by truck, operates 3 hrs/day, 1 day/event, 2 events
Skid-steer (small)	81	0.55	Diesel	2.27205	6	13.6323							seep correction: towed by truck, operates 3 hrs/day, 1 day/event, 2 events
Excavator/hoe	41	0.57	Diesel	1.19187	360	429.0732							crack repair: towed by truck, operates 6 hrs/day, 2 days/event, 3 times/yr, 10 yrs
Skid-steer (small)	81	0.55	Diesel	2.27205	360	817.938							crack repair: towed by truck, operates 6 hrs/day, 2 days/event, 3 times/yr, 10 yrs
Mowers	21	0.55	Gasoline	0.65835	720	474.012							mowing: towed by trucks, 2 mowers, 4.5 hrs/day, 8 days/year, 10 years
Tractor mower	75	0.6	Gasoline	2.565	120	307.8							mowing: towed by trucks, 1 mower, 1.5 hrs/day, 8 days/year, 10 years
Other	1	0.5	Gasoline	0.0285	480	13.68							mowing: weed wackers 2 units, 3 hours/day, 8 days/year, 10 years

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Cap Maintenance

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
									seep correction
Gravel/sand/clay	tons	16.6666667	2	60	Truck B (5-15 tons)	Diesel	7.2	8.3	150 ft3 for each of two events
Gravel/sand/clay	tons	0	2	60	Truck A (< 5 tons)	Diesel	8.5	7.1	empty return trips
									crack repair
Gravel/sand/clay	tons	450	30	900	Truck C (15+ tons)	Diesel	5.92	152	10 cy, 1.5 tons/cy, 3 times/yr, 10 yrs.
									minimal seeds and mulch for cover repair
Gravel/sand/clay	tons	0	30	900	Truck A (< 5 tons)	Diesel	8.5	105.9	empty return trips

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons	16.6666667	2	28	Truck B (5-15 tons)	Diesel	7.2	3.9	stained soil removed
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Well Installation

General Scope	***Typical Scope Items***	***Useful Information***
Install 20 6-inch PVC extraction wells Drill cuttings are non-hazardous Outfit 20 new wells and 4 existing wells with pneumatic pumps		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT oversight from Chicago	1	1	10	10	1	590	Car	Gasoline	590	20	29.5	
RMT oversight from hotel	1	29	10	290	29	10	Car	Gasoline	290	20	14.5	
Driller	3	30	10	900	30	70	Light-Duty Truck	Gasoline	2100	15	140	
Driller support truck	0	0	0		1	70	Heavy-Duty Truck	Gasoline	70	10	7	

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Drilling - large rig (e.g., CME-75)	200	0.75	diesel	7.65	240	1836	1	70	70	diesel	7.2	9.7	30 8-hour days of drilling for 20 wells
Skid-steer (small)	81	0.55	diesel	2.27205	120	272.646	1						handle drill cuttings… towed behind passenger truck

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Well Installation

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
PVC	lbs	1750	1	500	Truck A (< 5 tons)	Diesel	8.5	58.8	well casing
Gravel/sand/clay	tons	5.4	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	gravel pack
Bentonite	tons	0.1	0	0	Truck A (< 5 tons)				carried with driller
Cement	tons	2.3	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	cement grout
Steel	lbs	4360	2	1000	Truck A (< 5 tons)	Diesel	8.5	117.6	steel for bollards and well caps
concrete	tons	4.42	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	concrete for bollards and surface finish
stainless steel	lbs	312	1	500	Truck A (< 5 tons)	Diesel	8.5	58.8	well pumps (pneumatic submersible)
Gravel/sand	tons	0	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	empty return trip
concrete	tons	0	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	empty return trip
PVC		0	1	500	Truck A (< 5 tons)	Diesel	8.5	58.8	empty return trip
Cement	tons	0	1	30	Truck A (< 5 tons)	Diesel	8.5	3.5	empty return trip
steel	lbs	0	2	1000	Truck A (< 5 tons)	Diesel	8.5	117.6	empty return trip

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons	15.2	1	14	Truck B (5-15 tons)	Diesel	7.2	1.9	disposal of cuttings
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)	3.6	from well development
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW	3.6	water disposed of in catch basin of main property
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Piping

General Scope	***Typical Scope Items***	***Useful Information***
Install 5,000 feet of 1-inch discharge pipe and 5,000 feet of plastic hose to distribute air to pneumatic pumps. Pipe and tube laid in common trench, 3-feet wide, 3.5 feet deep, 14-inches of bedding and pipe cover		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Local contractor	4	5	10	200	10	60	Light-Duty Truck	Gasoline	600	15	40	
RMT oversight from Chicago	1	1	10	10	1	590	Car	Gasoline	590	20	29.5	
RMT ovesight from hotel	1	4	10	40	4	10	Car	Gasoline	40	20	2	

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Excavator/hoe (small)	54	0.57	diesel	1.56978	30	47.0934	1	60	60	diesel	7.2	8.3	equipment transported together
Loader (small)	100	0.55	diesel	2.805	20	56.1							

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Piping

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Gravel/sand/clay	tons	972	35	1050	Truck C (15+ tons)	diesel	5.92	177.4	sand/gravel for bedding
HDPE	lbs	2000	2	3000	Truck A (< 5 tons)	diesel	8.5	352.9	1-inch piping for conveying water
									1-inch tubing for air for pneum. pumps
Gravel/sand/clay	tons	0	35	1050	Truck A (< 5 tons)	diesel	8.5	123.5	empty return trips
hdpe	lbs	0	2	3000	Truck A (< 5 tons)	diesel	8.5	352.9	empty return trips

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Construction

General Scope	*Typical Scope Items*	*Useful Information*
Install oil/water separator, piping, etc. in existing building Commission system		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
local contractor	3	5	10	150	15	20	Light-Duty Truck	gasoline	300	15	20	installation
RMT oversight from Chicago	1	1	10	10	1	590	Car	Gasoline	590	20	29.5	
RMT oversight from hotel	1	9	10	90	9	10	Car	gasoline	90	20	4.5	
local contractor	2	5	10	100	10	10	Light-Duty Truck	gasoline	100	15	6.666666667	system commissioning

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Integrated tool carrier	170	0.43	diesel	3.7281	10	37.281	1	20	20	diesel	7.2	2.8	
telescopic handler	85	0.43	diesel	1.86405	10	18.6405	1	20	20	diesel	7.2	2.8	

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Construction

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
steel	lbs	1350	1	500	Truck A (< 5 tons)	diesel	8.5	58.8	steel representing oil/water separator
Steel	lbs	600	1	500	Truck A (< 5 tons)	diesel	8.5	58.8	steel for air compressor
steel	lbs	0	2	1000	Truck A (< 5 tons)	diesel	8.5	117.6	empty return trips

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for System O&M

General Scope	***Typical Scope Items***	***Useful Information***
Operate and maintain (O&M) the leachate collection system including 24 extraction wells, conveyance piping, and oil water sepertor. O&M activities include removal of oil and sludge from the oil water sepeartor, repair/replacement of extraction well and conveyance pumps. O&M is anticipated to occur for 10 years at an average extraction rate of ???.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Maintenance Crew #1	2	80	10	1600	80	31	Light-Duty Truck	Gasoline	2480	15	165.3333333	Maintenance of Leachate Extraction Wells
Maintenance Crew #2	2	160	10	3200	320	30	Light-Duty Truck	Gasoline	9600	15	640	Maintenance of oil/water seperator

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
Conveyance Pump	2	80%	0.75	1.59146667	78840	125471.23	- 1 pump operatring for 10 yr operating
7.5 HP compressor	7.5	80%	0.75	5.968	56940	339817.92	- Compressor for extraction well pumps
Process Controls and computer				0.2	87600	17520	- Process controls electrical demand is an approximation
Building Lighting				0.9	4380	3942	- Building lighting is based on 75 foot-
	N/A						
	N/A						
	N/A						
			Totals	8.65946667		486751.15	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for System O&M

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes

gptm = gallons per ton-mile

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons	897.522444	50	700	Truck B (5-15 tons)	Diesel	7.2	97.2	
Hazardous	tons								
Recyclable oil	tons	1282.17492	90	2700	Truck B (5-15 tons)	Diesel	7.2	375	
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW	81993.6	leachate discharged to POTW (1000 x gal)
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Long-Term Monitoring

General Scope	***Typical Scope Items***	***Useful Information***
Groundwater monitoring, 10 wells monitored semi-annually for 30 years. Well maintenance considered to be negligible Leachate monitoring quarterly for 10 years.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT monitoring tech	1	60	10	600	60	590	Light-Duty Truck	Gasoline	35400	15	2360	initial travel for monitoring (2 times per year, 30 years)
RMT monitoring tech	1	120	10	1200	120	10	Light-Duty Truck	Gasoline	1200	15	80	travel for other days (2 days/event, 2 events/year, 30 years)
On-site monitoring tech	1	40	3	120	40	1	Light-Duty Truck	Gasoline	40	15	2.666666667	quarterly leach level monitoring for 10 years

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Long-Term Monitoring

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
HDPE	lbs	300	1	1500	Truck B (5-15 tons)	Diesel	7.2	208.3	0.5 pounds/bailer, 600 bailers
									over 9,000 feet of nylon rope not considered
									assume bottle ware is covered by lab
									transported by contractor to site
									transported by truck in bulk to general area

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs	$90	780	$70,200
SVOCs	$150	780	$117,000
PCBs/Pesticides			$0
Metals	$100	780	$78,000
Chloride and sulfate	$50	780	$39,000
Other			$0
Other			$0
Other			$0
Other			$0
Other			$0
			$0
			$0
			$0
	Totals	3120	$304,200

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)	1.2	purge water, 6 gal/well, 600 wells total
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW	1.2	discharge to catch basin on main property for treatment
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Summary

Level	1	1	2	1	1	1	2	3	0	0	0	0	0	0	0	0	0	
Item	**meetings**	**site preparation**	**cap maint.**	**well installation**	**piping**	**construction**	**system O&M**	**LTM**										**Total**
Labor and Travel																		
Hours worked	80	64	4048	1200	250	350	4800	1920										**12712**
Heavy equip. operating hours	0	0	2052	360	50	20	0	0										**2482**
Passenger trips to site	6	6	404	61	15	35	400	220										**1147**
Passenger vehicle miles	720	1178	14954	3050	1230	1080	12080	36640										**70932**
Heavy equip. trips to site	0	0	0	2	1	2	0	0										**5**
Heavy equip. transport miles	0	0	0	70	60	40	0	0										**170**
Materials transport trips	0	0	64	13	74	4	0	1										**156**
Materials transnport miles	0	0	1920	3680	8100	2000	0	1500										**17200**
Waste transport trips	0	0	2	1	0	0	140	0										**143**
Waste transport miles	0	0	28	14	0	0	3400	0										**3442**
Energy																		
On-site																		
Gasoline (gallons)	0	0	795.492	0	0	0	0	0										**795.492**
E85 (gallons)	0	0	0	0	0	0	0	0										**0**
Diesel (gallons)	0	0	1267.79472	2108.646	103.1934	55.9215	0	0										**3535.55562**
B20 (gallons)	0	0	0	0	0	0	0	0										**0**
Off-site																		
Gasoline (gallons)	38	68.53333333	1491.333333	191	71.5	60.66666667	805.3333333	2442.666667										**5169.033333**
E85 (gallons)	0	0	0	0	0	0	0	0										**0**
Diesel (gallons)	0	0	277.2	444.2	1015	240.8	472.2	208.3										**2657.7**
B20 (gallons)	0	0	0	0	0	0	0	0										**0**
Total Fuel																		
Gasoline (gallons)	38	68.53333333	2286.825333	191	71.5	60.66666667	805.3333333	2442.666667										**5964.525333**
E85 (gallons)	0	0	0	0	0	0	0	0										**0**
Diesel (gallons)	0	0	1544.99472	2552.846	1118.1934	296.7215	472.2	208.3										**6193.25562**
B20 (gallons)	0	0	0	0	0	0	0	0										**0**
Electricity Demand (kW)	0	0	0	0	0	0	8.659466667	0										**8.659466667**
Electricity Usage (MWh)	0	0	0	0	0	0	486.751152	0										**486.751152**
Natural gas usage (therms)	0	0	0	0	0	0	0	0										**0**

Summary

Level		1	1	2	1	1	1	2	3	0	0	0	0	0	0	0	0	0	
Item		**meetings**	**site preparation**	**cap maint.**	**well installation**	**piping**	**construction**	**system O&M**	**LTM**										**Total**
Materials																			
Asphalt	(tons)	0	0	0	0	0	0	0	0										**0**
Bentonite	(tons)	0	0	0	0.1	0	0	0	0										**0.1**
Borrow	(tons)	0	0	0	0	0	0	0	0										**0**
Cement	(tons)	0	0	0	2.3	0	0	0	0										**2.3**
Cheese whey	(lbs)	0	0	0	0	0	0	0	0										**0**
Concrete	(tons)	0	0	0	4.42	0	0	0	0										**4.42**
Emulsified vegetable oil	(lbs)	0	0	0	0	0	0	0	0										**0**
GAC: regenerated	(lbs)	0	0	0	0	0	0	0	0										**0**
GAC: virgin coal-based	(lbs)	0	0	0	0	0	0	0	0										**0**
GAC: virgin coconut-based	(lbs)	0	0	0	0	0	0	0	0										**0**
Gravel/sand/clay	(tons)	0	0	466.6666667	5.4	972	0	0	0										**1444.066667**
HDPE	(lbs)	0	0	0	0	2000	0	0	300										**2300**
Hydrochloric acid (30%, SG = 1.18)	(lbs)	0	0	0	0	0	0	0	0										**0**
Hydrogen peroxide (50%, SG=1.19)	(lbs)	0	0	0	0	0	0	0	0										**0**
Hydroseed	(lbs)	0	0	0	0	0	0	0	0										**0**
Lime	(lbs)	0	0	0	0	0	0	0	0										**0**
Molasses	(lbs)	0	0	0	0	0	0	0	0										**0**
Nitrogen fertilizer	(lbs)	0	0	0	0	0	0	0	0										**0**
Other 1 - Compost	(lbs)	0	0	0	0	0	0	0	0										**0**
Other 2 - Mulch	(cy)	0	0	0	0	0	0	0	0										**0**
Other 3 - Pesticide 1	(lbs)	0	0	0	0	0	0	0	0										**0**
Other 4 - Pesticide 2	(lbs)	0	0	0	0	0	0	0	0										**0**
Other 5	(0)	0	0	0	0	0	0	0	0										**0**
Phosphorus fertilizer	(lbs)	0	0	0	0	0	0	0	0										**0**
Polymer	(lbs)	0	0	0	0	0	0	0	0										**0**
Potable water	(gals)	0	0	0	0	0	0	0	0										**0**
Potassium permanganate	(lbs)	0	0	0	0	0	0	0	0										**0**
PVC	(lbs)	0	0	0	1750	0	0	0	0										**1750**
Sequestering agent	(lbs)	0	0	0	0	0	0	0	0										**0**
Sodium hydroxide (20%, SG=1.22)	(lbs)	0	0	0	0	0	0	0	0										**0**
Stainless steel	(lbs)	0	0	0	312	0	0	0	0										**312**
Steel	(lbs)	0	0	0	4360	0	1950	0	0										**6310**
Trees: root balls	(each)	0	0	0	0	0	0	0	0										**0**
Trees: whips	(each)	0	0	0	0	0	0	0	0										**0**
Waste																			
Non-hazardous		0	0	16.66666667	15.2	0	0	897.522444	0										**929.3891107**
Hazardous		0	0	0	0	0	0	0	0										**0**
Recyclable oil		0	0	0	0	0	0	1282.17492	0										**1282.17492**
Hauled to POTW		0	0	0	0	0	0	0	0										**0**
For incineration		0	0	0	0	0	0	0	0										**0**
Water Use																			
Public water (1000 x gal.)		0	0	0	0	0	0	0	0										**0**
Extracted GW #1 (1000 x gals)		0	0	0	3.6	0	0	0	1.2										**4.8**
Extracted GW #2 (1000 x gals)		0	0	0	0	0	0	0	0										**0**
Surface water (1000 x gals)		0	0	0	0	0	0	0	0										**0**
Reclaimed water (1000 x gals)		0	0	0	0	0	0	0	0										**0**
Stormwater (1000 x gals)		0	0	0	0	0	0	0	0										**0**

Summary

Level	1	1	2	1	1	1	2	3	0	0	0	0	0	0	0	0	0	
Item	**meetings**	**site preparation**	**cap maint.**	**well installation**	**piping**	**construction**	**system O&M**	**LTM**										**Total**
Water Discharge																		
Discharge to surface water	0	0	0	0	0	0	0	0										**0**
Reinjected to aquifer	0	0	0	0	0	0	0	0										**0**
Discharge to POTW	0	0	0	3.6	0	0	81993.6	1.2										**81998.4**
Discharge to atmosphere	0	0	0	0	0	0	0	0										**0**
Public Use	0	0	0	0	0	0	0	0										**0**
Irrigation	0	0	0	0	0	0	0	0										**0**
Industrial process water	0	0	0	0	0	0	0	0										**0**
Other beneficial use	0	0	0	0	0	0	0	0										**0**
Laboratory Analysis																		
Total samples	0	0	0	0	0	0	0	3120										**3120**
Total cost	0	0	0	0	0	0	0	304200										**304200**
Other																		
On-site HAP emissions	0	0	0	0	0	0	0	0										**0**
On-site GHG emissions	0	0	0	0	0	0	0	0										**0**
On-site GHG reductions	0	0	0	0	0	0	0	0										**0**
On-site NOx reductions	0	0	0	0	0	0	0	0										**0**
On-site SOx reductions	0	0	0	0	0	0	0	0										**0**
On-site PM reductions	0	0	0	0	0	0	0	0										**0**

Conveyance Piping Worksheet

Piping Features			**Units**	**Quantity of 1-inch Pipe**	**Quantity of 2-inch Pipe**	**Quantity of 3-inch Pipe**	**Quantity of 4-inch Pipe**	**Quantity of 6-inch Pipe**	**Total**
Mass of HDPE pipe per linear foot			lbs/ft	**0.2**	**0.64**	**1.4**	**2.3**	**5.0**	
Length of HDPE pipe			feet	10000	0	0	0	0	
Average distance between wells in same zone			feet	0	0	0	0	0	
Trench depth			feet	3.5	0	0	0	0	
Trench width			feet	3	0	0	0	0	
Total length of piping/trench (including drop tubes)			feet	5000	0	0	0	0	
Materials									
Bedding (sand/gravel) depth	14	inches	cy	648.1481	0	0	0	0	648.1481
Total mass of bedding material (sand/gravel)	1.5	tons/cy	tons	972.2222	0	0	0	0	972.2222
Total mass of HDPE			lbs	2000	0	0	0	0	2000
Waste									
Off-site soil disposal (non-hazardous)			cy	0	0	0	0	0	0
Off-site soil disposal (hazardous)			cy	0	0	0	0	0	0
Off-site soil disposal (non-hazardous)	1.5	tons/cy	tons	0	0	0	0	0	0
Off-site soil disposal (hazardous)	1.5	tons/cy	tons	0	0	0	0	0	0

Notes:

- 1-inch piping for discharge of water, equivalent of 1-inch piping to supply air for pneumatic pumps

- no waste, materials regraded on site

Lookup Table

Fuel Type for Personnel	Modifying Factor to mpg
E85	0.73
Gasoline	1

Based on higher heating values (mmBtu per barrel) of 5.218 mmBtu (gasoline) and 3.539 for (ethanol), Climate Leaders Direct Emissions from Mobile Sources

Fuel Type for Equipment Transport	mpg
B20	7.09
Diesel	7.2

B20 efficiency based on higher heating value of 127,960 btu per gallon for biodiesel (Alternative Fuels & Advanced Vehicles Data Center, www.afdc.energy.gov.

Fuel Type for Equip. Use	Gals. per HP-hr
B20	0.052
Diesel	0.051
E85	0.078
Gasoline	0.057

Fuel consumption based on thermal efficiency of 36% for diesel and 38% for gasoline.

Mode of Transport. For Personnel	Gasoline mpg
Car	20
Heavy-Duty Truck	10
Light-Duty Truck	15
Vehicle type	0
Vehicle type	0
Vehicle type	0

Typical fuel efficiencies from from www.fueleconomy.gov

Mode of Transport. For Materials	rate
Train (gptm)	0.0024
Truck A (< 5 tons)	8.5
Truck B (5-15 tons)	7.2
Truck C (15+ tons)	5.92

gptm = gallons per ton-mile

Rail fuel usage from Climate Leaders, Direct Emissions from Mobile Sources

Truck usages from Climate Leaders, Direct Emissions from Mobil Sources and Effects of Payload on the Fuel Consumption of Trucks, Dept. for Transportation (Great Britain), December 2007

Equipment Type	Default Load Factor	
Asphalt paver	0.62	
Backhoe	0.57	
Concrete paving machine	0.53	
Dozer (large)	0.55	
Dozer (small)	0.55	
Drilling - direct push	0.75	
Drilling - large rig (e.g., CME-75)	0.75	
Drilling - medium rig (e.g., CME-55)	0.75	
Dump truck	0.57	
Excavator (large)	0.57	
Excavator (medium)	0.57	
Excavator/hoe (small)	0.57	
Grader	0.61	
Grout pump	0.5	
Hydroseeder	0.62	
Integrated tool carrier	0.43	
Loader	0.55	
Loader (small)	0.55	
Mobile laboratory	0.5	
Mowers	0.55	
Other	0.5	
Riding trencher	0.75	
Roller	0.56	
Rotary-screw air compressor (250 cfm)	0.48	
Skid-steer (small)	0.55	
Telescopic handler	0.43	
Tractor mower	0.6	
Water truck	0.57	

Materials	Units	Conv. to tons	Default Distance from Source to Site	Site-Specific Distance Used
Asphalt	tons	1	30	
Bentonite	tons	1	1000	
Borrow	tons	1	30	
Cement	tons	1	30	
Cheese whey	lbs	0.0005	1000	
Concrete	tons	1	30	
Emulsified vegetable oil	lbs	0.0005	1000	
GAC: regenerated	lbs	0.0005	1000	
GAC: virgin coal-based	lbs	0.0005	1000	
GAC: virgin coconut-based	lbs	0.0005	1000	
Gravel/sand/clay	tons	1	30	
HDPE	lbs	0.0005	1,500	
Hydrochloric acid (30%, SG = 1.18)	lbs	0.0005	500	
Hydrogen peroxide (50%, SG=1.19)	lbs	0.0005	500	
Hydroseed	lbs	0.0005	500	
Lime	lbs	0.0005	500	
Molasses	lbs	0.0005	500	
Nitrogen fertilizer	lbs	0.0005	500	
Other 1 - Compost	lbs	0.0005	0	X
Other 2 - Mulch	cy	0.405	0	X
Other 3 - Pesticide 1	lbs	0.0005	0	X
Other 4 - Pesticide 2	lbs	0.0005	0	X
Other 5	0	0	0	
Phosphorus fertilizer	lbs	0.0005	500	
Polymer	lbs	0.0005	1000	
Potable water	gals	0.00417	30	
Potassium permanganate	lbs	0.0005	1400	
PVC	lbs	0.0005	500	
Sequestering agent	lbs	0.0005	1000	
Sodium hydroxide (20%, SG=1.22)	lbs	0.0005	500	
Stainless steel	lbs	0.0005	500	
Steel	lbs	0.0005	500	
Trees: root balls	each	NA	500	X
Trees: whips	each	NA	1000	X

Waste Hauling	Distance from Site
Non-hazardous	14
Hazardous	0
Recyclable Oil	30
Hauled to POTW	0
For incineration	0

BP Wood River Footprinting Analysis
Green Remediation - Inventory of Energy, Material, Waste, and Other Remedy Aspects
Remedy Conceptual Design and Assumptions:
Alternative C - Cover Regrading

Overview

The purpose of the regrading alternative is to restructure the existing cover at the Closed Disposal Facility (CDF) in order to create positive drainage, which would eliminate the potential for ponding of precipitation and greatly reduce the amount of infiltration. This alternative entails regrading approximately 5 acres of the cover, and would require the addition of fill and clay cover in certain areas. It is expected that differential settlement would require cover repairs after the initial regrading. Leachate extraction would not be included in this alternative. However, a gradual decrease in the leachate level would be expected. It is assumed that the regraded cover would be left in place indefinitely, and therefore there would be no decommissioning activities. The length of this remedy is set at 30 years.

General Assumptions Regarding Site Characteristics

Material Shipping Distances (One-Way)

Materials	Units	Miles from Site	Conv. To Tons
Asphalt	tons		
Bentonite (or clay)	tons		
Borrow	tons		
Cement	tons		
Cheese whey	lbs		
Concrete	tons		
Emulsified vegetable oil	lbs		
GAC: regenerated	lbs		
GAC: virgin coal-based	lbs		
GAC: virgin coconut-based	lbs		
Gravel/sand/clay	tons		
HDPE	lbs		
Hydrochloric acid (30%, SG = 1.18	lbs		
Hydrogen peroxide (50%, SG=1.19	lbs		
Hydroseed	lbs		
Lime	lbs		
Molasses	lbs		
Nitrogen fertilizer	lbs		
Other 1 - Compost	lbs	15	0.0005
Other 2 - Mulch	cy	15	0.405
Other 3 - Pesticide 1	lbs	500	0.0005
Other 4 - Pesticide 2	lbs	500	0.0005
Other 5			
Phosphorus fertilizer	lbs		
Polymer	lbs		
Potable water	gals		
Potassium permanganate	lbs		
PVC	lbs		
Sequestering agent	lbs		
Sodium hydroxide (20%, SG=1.22	lbs		
Stainless steel	lbs		
Steel	lbs		
Trees: root balls	each		
Trees: whips	each		

Waste Shipping Distances (Round Trip)

Waste Disposal Facility	Miles
Non-hazardous	14
Hazardous	
Recyclable Oil	30
Hauled to POTW	
For incineration	

Gasoline Fuel Economies for Special Vehicles

	Type	mpg
Other #1	Vehicle type	0
Other #2	Vehicle type	0
Other #3	Vehicle type	0

Key for Cell Shading

Blue	Automatically calculated
Yellow	Information is input from a drop-down list
White	Manual input

Input for Meetings

General Scope	*Typical Scope Items*	*Useful Information*
Initial planning meeting		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT from Chicago	1	1	10	10	1	590	Car	Gasoline	590	20	29.5	
RMT from Hotel	1	1	10	10	1	10	Car	Gasoline	10	20	0.5	
Local contractor	4	2	10	80	4	30	Light-Duty Truck	Gasoline	120	15	8	carpooling - two people per car

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Distance to Site	Total Miles Traveled	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Activity or Notes
			Totals				

Input for Meetings

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
	Totals		

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Site Investigation

General Scope	***Typical Scope Items***	***Useful Information***
Site preparation. Locate and survey utilities. Mark utilities with reusable stakes		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT from Chicago	1	1	8	8	1	590	Car	Gasoline	590	20	29.5	
RMT from Hotel	1	1	8	8	1	10	Car	Gasoline	10	20	0.5	
Utility locator - Indianapolis	1	1	8	8	1	482	Light-Duty Truck	Gasoline	482	15	32.13333333	carpooling - two people per car

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Distance to Site	Total Miles Traveled	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Activity or Notes
			Totals				

Input for Site Investigation

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
	Totals		

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Cap Construction

General Scope	*Typical Scope Items*	*Useful Information*
Add 12,023 ft3 fill (borrow) to 4.5 acres to ensure 2% slope for drainage in north central part of site. Add 8,519 ft3 clay to 5.3 acres to ensure 2.5 ft thickness in southern areas.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT from Chicago	1	1	10	10	1	590	Car	Gasoline	590	20	29.5	
RMT from Hotel	1	29	10	290	29	10	Car	Gasoline	290	20	14.5	
Local contractor	9	30	10	2700	90	20	Light-Duty Truck	Gasoline	1800	15	120	carpooling - 3 people per truck
landscaping contractor	2	1	10	20	2	30	Heavy-Duty Truck	Gasoline	60	10	6	for reseeding - tow hydroseeder and hydroseed behind trucks

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Loader	100	0.55	Diesel	2.805	270	757.35	1	30	30	Diesel	7.2	4.2	one mobilization for project
Dump truck	400	0.57	Diesel	11.628	1080	12558.24	4	30	120	Diesel	7.2	16.7	4 dump trucks, one mobilization each for project
Dozer (large)	200	0.55	Diesel	5.61	810	4544.1	3	30	90	Diesel	7.2	12.5	3 dozers, one mobilization each for project
water truck	230	0.57	Diesel	6.6861	1	6.6861	1	30	30	Diesel	7.2	4.2	dust control
hydroseeder	50	0.62	Diesel	1.581	10	15.81							towed by passenger truck

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Cap Construction

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Borrow	tons	667.944444	23	690	Truck C (15+ tons)	Diesel	5.92	116.6	12,023 ft3, 1.5 tons/cy, 20 cy per trip
Gravel/sand/clay	tons	473.277778	16	480	Truck C (15+ tons)	Diesel	5.92	81.1	8519 ft3, 1.5 tons/cy, 20 cy per trip
Hydroseed	lbs	15680	1	500	Truck B (5-15 tons)	Diesel	7.2	69.4	transport of hydroseed to landscape supply
									weight of seed plus mulch
Borrow	tons		23	690	Truck A (< 5 tons)	Diesel	8.5	81.2	empty return trips for turcks
Gravel/sand/clay	tons		16	480	Truck A (< 5 tons)	Diesel	8.5	56.5	empty return trips for trucks

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)	10	for dust control, obtained from public supply on site
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water	81993.6	Diverted to surface water
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere	10	evaporated from dust control application
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Cap Maintenance

General Scope	***Typical Scope Items***	***Useful Information***
Quarterly cover inspections for 30 years. Cover repairs 3 times per year for Mowing 8 times per year for 30 years.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
Local contractor	1	120	2	240	120	30	Light-Duty Truck	Gasoline	3600	15	240	quarterly cover inspection for 30 years
Local contractor	2	180	8	2880	360	56	Heavy-Duty Truck	Gasoline	20160	10	2016	cover repair, 3 times/year, 2 days/event, 30 years, tow equipment behind trucks
On-site monitoring tech	1	180	8	1440	180	1	Light-Duty Truck	Gasoline	180	15	12	oversight for cover repair
Landscaper (mowing)	4	240	8	7680	480	50	Heavy-Duty Truck	Gasoline	24000	10	2400	two trucks

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes
Excavator/hoe (small)	41	0.57	Diesel	1.19187	1080	1287.2196							crack repair: towed by truck, operates 6 hrs/day, 2 days/event, 3 times/yr, 30 yrs
Skid-steer (small)	81	0.55	Diesel	2.27205	1080	2453.814							crack repair: towed by truck, operates 6 hrs/day, 2 days/event, 3 times/yr, 30 yrs
Mowers	21	0.55	Gasoline	0.65835	2160	1422.036							towed by trucks, 2 mowers, 4.5 hrs/day, 8 days/year, 30 years
Tractor mower	75	0.6	Gasoline	2.565	360	923.4							towed by trucks, 1 mower, 1.5 hrs/day, 8 days/year, 30 years
Other	1	0.5	Gasoline	0.0285	1440	41.04							weed wackers

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Cap Maintenance

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Gravel/sand/clay	tons	1350	90	2700	Truck C (15+ tons)	Diesel	5.92	456.1	10 cy, 1.5 tons/cy, 3 times/yr, 30 yrs.
									minimal seeds and mulch for cover repair
Gravel/sand/clay	tons	0	90	2700	Truck A (< 5 tons)	Diesel	8.5	317.6	empty return trips

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs			
SVOCs			
PCBs/Pesticides			
Metals			
Other			
Other			
Other			
Other			
Other			
Other			
Totals			

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)		
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW		
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Input for Long-Term Monitoring

General Scope	*Typical Scope Items*	*Useful Information*
Groundwater monitoring, 10 wells monitored semi-annually for 30 years. Well maintenance considered to be negligible Leachate monitoring quarterly for 30 years.		

Labor, Mobilizations, Mileage, and Fuel

Participant	Crew Size	Number of Days	Hours Worked Per Day	Total Hours Worked	Trips to Site	Roundtrip Miles to Site	Mode of Transport.	Fuel Type	Total Miles Traveled	Miles Per Gallon	Total Fuel Used	Activity or Notes
RMT monitoring tech	1	60	10	600	60	590	Light-Duty Truck	Gasoline	35400	15	2360	initial travel for monitoring (2 times per year, 30 years)
RMT monitoring tech	1	120	10	1200	120	10	Light-Duty Truck	Gasoline	1200	15	80	travel for other days (2 days/event, 2 events/year, 30 years) from hotel
On-site monitoring tech	1	120	3	360	120	1	Light-Duty Truck	Gasoline	120	15	8	

Equipment Use, Mobilization, and Fuel Usage

Equipment Type	HP	Load Factor	Equip. Fuel Type	Gallons Fuel Used per Hour	Total Hours Operated	Gallons Fuel Used On-Site	Trips to Site	Roundtrip Miles to Site	Total Miles Transported	Transport Fuel Type	Miles per Gallon	Gallons Fuel Used for Transport.	Activity or Notes

Electricity Usage

Equipment Type	HP	% Full Load	Efficiency	Electrical Rating (kW)	Hours Used	Energy Used (kWh)	Notes
	N/A						
	N/A						
	N/A						
			Totals	0		0	

Natural Gas Usage

Equipment Type	Heat Load (btu/hr)	Power Rating (btu/hr)	Effiency	Total Hours Used	Btus Required	Total Therms Used	Notes
			Totals				

Input for Long-Term Monitoring

Materials Usage

Material Type	Unit	Quantity	Trips	Total Miles Transported	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
HDPE	lbs	300	1	1500	Truck B (5-15 tons)	Diesel	7.2	208.3	0.5 pounds/bailer, 600 bailers
									over 9,000 feet of nylon rope not considered
									assume bottle ware is covered by lab
									transported by contractor to site
									transported by truck in bulk to general area

gptm = gallons per ton-mile

Laboratory Analysis

Parameter and Notes	Unit Cost	Number of Samples	Total Cost
VOCs	$90	780	$70,200
SVOCs	$150	780	$117,000
PCBs/Pesticides			$0
Metals	$100	780	$78,000
Chloride and sulfate	$50	780	$39,000
Other			$0
Other			$0
Other			$0
Other			$0
Other			$0
			$0
			$0
			$0
	Totals	3120	$304,200

Waste Generation

Waste Type	Unit	Quantity	Trips	Total Miles Transport.	Mode of Transport.	Fuel Type	Fuel Use Rate	Total Fuel Use	Notes
Non-hazardous	tons								
Hazardous	tons								
Recyclable oil	tons								
Hauled to POTW	tons								
For incineration	tons								

gptm = gallons per ton-mile

On-Site Water Usage

Resource Type	Quantity	Use of Resource
Public water (1000 x gal.)		
Extracted GW #1 (1000 x gals)	1.2	purge water, 6 gal/well, 600 wells total
Extracted GW #2 (1000 x gals)		
Surface water (1000 x gals)		
Reclaimed water (1000 x gals)		
Stormwater (1000 x gals)		
Water table drawdown (ft)		

Fate of On-Site Water Usage

Discharge Location	Quantity	Activity or Notes
Discharge to surface water		
Reinjected to aquifer		
Discharge to POTW	1.2	discharge to catch basin on main property for treatment
Discharge to atmosphere		
Public Use		
Irrigation		
Industrial process water		
Other beneficial use		

Other

Item	Quantity	Activity or Notes
On-site HAP emissions		
On-site GHG emissions		
On-site GHG reductions		
On-site NOx reductions		
On-site SOx reductions		
On-site PM reductions		

Summary

Level	1	1	1	2	3	0	0	0	0	0	0	0	0	0	0	0	0	
Item	**meetings**	**site preparation**	**capping**	**cap maint.**	**LTM**													**Total**
Labor and Travel																		
Hours worked	100	24	3020	12240	2160													**17544**
Heavy equip. operating hours	0	0	2171	6120	0													**8291**
Passenger trips to site	6	3	122	1140	300													**1571**
Passenger vehicle miles	720	1082	2740	47940	36720													**89202**
Heavy equip. trips to site	0	0	9	0	0													**9**
Heavy equip. transport miles	0	0	270	0	0													**270**
Materials transport trips	0	0	79	180	1													**260**
Materials transnport miles	0	0	2840	5400	1500													**9740**
Waste transport trips	0	0	0	0	0													**0**
Waste transport miles	0	0	0	0	0													**0**
Energy																		
On-site																		
Gasoline (gallons)	0	0	0	2386.476	0													**2386.476**
E85 (gallons)	0	0	0	0	0													**0**
Diesel (gallons)	0	0	17882.1861	3741.0336	0													**21623.2197**
B20 (gallons)	0	0	0	0	0													**0**
Off-site																		
Gasoline (gallons)	38	62.13333333	170	4668	2448													**7386.133333**
E85 (gallons)	0	0	0	0	0													**0**
Diesel (gallons)	0	0	442.4	773.7	208.3													**1424.4**
B20 (gallons)	0	0	0	0	0													**0**
Total Fuel																		
Gasoline (gallons)	38	62.13333333	170	7054.476	2448													**9772.609333**
E85 (gallons)	0	0	0	0	0													**0**
Diesel (gallons)	0	0	18324.5861	4514.7336	208.3													**23047.6197**
B20 (gallons)	0	0	0	0	0													**0**
Electricity Demand (kW)	0	0	0	0	0													**0**
Electricity Usage (MWh)	0	0	0	0	0													**0**
Natural gas usage (therms)	0	0	0	0	0													**0**

Summary

Level		**1**	**1**	**1**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Item		**meetings**	**site preparation**	**capping**	**cap maint.**	**LTM**													**Total**
Materials																			
Asphalt	(tons)	0	0	0	0	0													**0**
Bentonite (or clay)	(tons)	0	0	0	0	0													**0**
Borrow	(tons)	0	0	667.9444444	0	0													**667.9444444**
Cement	(tons)	0	0	0	0	0													**0**
Cheese whey	(lbs)	0	0	0	0	0													**0**
Concrete	(tons)	0	0	0	0	0													**0**
Emulsified vegetable oil	(lbs)	0	0	0	0	0													**0**
GAC: regenerated	(lbs)	0	0	0	0	0													**0**
GAC: virgin coal-based	(lbs)	0	0	0	0	0													**0**
GAC: virgin coconut-based	(lbs)	0	0	0	0	0													**0**
Gravel/sand/clay	(tons)	0	0	473.2777778	1350	0													**1823.277778**
HDPE	(lbs)	0	0	0	0	300													**300**
Hydrochloric acid (30%, SG = 1.18)	(lbs)	0	0	0	0	0													**0**
Hydrogen peroxide (50%, SG=1.19)	(lbs)	0	0	0	0	0													**0**
Hydroseed	(lbs)	0	0	15680	0	0													**15680**
Lime	(lbs)	0	0	0	0	0													**0**
Molasses	(lbs)	0	0	0	0	0													**0**
Nitrogen fertilizer	(lbs)	0	0	0	0	0													**0**
Other 1 - Compost	(lbs)	0	0	0	0	0													**0**
Other 2 - Mulch	(cy)	0	0	0	0	0													**0**
Other 3 - Pesticide 1	(lbs)	0	0	0	0	0													**0**
Other 4 - Pesticide 2	(lbs)	0	0	0	0	0													**0**
Other 5	(0)	0	0	0	0	0													**0**
Phosphorus fertilizer	(lbs)	0	0	0	0	0													**0**
Polymer	(lbs)	0	0	0	0	0													**0**
Potable water	(gals)	0	0	0	0	0													**0**
Potassium permanganate	(lbs)	0	0	0	0	0													**0**
PVC	(lbs)	0	0	0	0	0													**0**
Sequestering agent	(lbs)	0	0	0	0	0													**0**
Sodium hydroxide (20%, SG=1.22)	(lbs)	0	0	0	0	0													**0**
Stainless steel	(lbs)	0	0	0	0	0													**0**
Steel	(lbs)	0	0	0	0	0													**0**
Trees: root balls	(each)	0	0	0	0	0													**0**
Trees: whips	(each)	0	0	0	0	0													**0**
Waste																			
Non-hazardous		0	0	0	0	0													**0**
Hazardous		0	0	0	0	0													**0**
Recyclable oil		0	0	0	0	0													**0**
Hauled to POTW		0	0	0	0	0													**0**
For incineration		0	0	0	0	0													**0**
Water Use																			
Public water (1000 x gal.)		0	0	10	0	0													**10**
Extracted GW #1 (1000 x gals)		0	0	0	0	1.2													**1.2**
Extracted GW #2 (1000 x gals)		0	0	0	0	0													**0**
Surface water (1000 x gals)		0	0	0	0	0													**0**
Reclaimed water (1000 x gals)		0	0	0	0	0													**0**
Stormwater (1000 x gals)		0	0	0	0	0													**0**

Summary

Level	**1**	**1**	**1**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	
Item	**meetings**	**site preparation**	**capping**	**cap maint.**	**LTM**													**Total**
Water Discharge																		
Discharge to surface water	0	0	81993.6	0	0													**81993.6**
Reinjected to aquifer	0	0	0	0	0													**0**
Discharge to POTW	0	0	0	0	1.2													**1.2**
Discharge to atmosphere	0	0	10	0	0													**10**
Public Use	0	0	0	0	0													**0**
Irrigation	0	0	0	0	0													**0**
Industrial process water	0	0	0	0	0													**0**
Other beneficial use	0	0	0	0	0													**0**
Laboratory Analysis																		
Total samples	0	0	0	0	3120													**3120**
Total cost	0	0	0	0	304200													**304200**
Other																		
On-site HAP emissions	0	0	0	0	0													**0**
On-site GHG emissions	0	0	0	0	0													**0**
On-site GHG reductions	0	0	0	0	0													**0**
On-site NOx reductions	0	0	0	0	0													**0**
On-site SOx reductions	0	0	0	0	0													**0**
On-site PM reductions	0	0	0	0	0													**0**

Lookup Table

Fuel Type for Personnel	Modifying Factor to mpg
E85	0.73
Gasoline	1

Based on higher heating values (mmBtu per barrel) of 5.218 mmBtu (gasoline) and 3.539 for (ethanol), Climate Leaders Direct Emissions from Mobile Sources

Fuel Type for Equipment Transport	mpg
B20	7.09
Diesel	7.2

B20 efficiency based on higher heating value of 127,960 btu per gallon for biodiesel (Alternative Fuels & Advanced Vehicles Data Center, www.afdc.energy.gov.

Fuel Type for Equip. Use	Gals. per HP-hr
B20	0.052
Diesel	0.051
E85	0.078
Gasoline	0.057

Fuel consumption based on thermal efficiency of 36% for diesel and 38% for gasoline.

Mode of Transport. For Personnel	Gasoline mpg
Car	20
Heavy-Duty Truck	10
Light-Duty Truck	15
Vehicle type	0
Vehicle type	0
Vehicle type	0

Typical fuel efficiencies from from www.fueleconomy.gov

Mode of Transport. For Materials	rate
Train (gptm)	0.0024
Truck A (< 5 tons)	8.5
Truck B (5-15 tons)	7.2
Truck C (15+ tons)	5.92

gptm = gallons per ton-mile

Rail fuel usage from Climate Leaders, Direct Emissions from Mobile Sources

Truck usages from Climate Leaders, Direct Emissions from Mobil Sources and Effects of Payload on the Fuel Consumption of Trucks, Dept. for Transportation (Great Britain), December 2007

Equipment Type	Default Load Factor	
Asphalt paver	0.62	
Backhoe	0.57	
Concrete paving machine	0.53	
Dozer (large)	0.55	
Dozer (small)	0.55	
Drilling - direct push	0.75	
Drilling - large rig (e.g., CME-75)	0.75	
Drilling - medium rig (e.g., CME-55)	0.75	
Dump truck	0.57	
Excavator (large)	0.57	
Excavator (medium)	0.57	
Excavator/hoe (small)	0.57	
Grader	0.61	
Grout pump	0.5	
Hydroseeder	0.62	
Integrated tool carrier	0.43	
Loader	0.55	
Loader (small)	0.55	
Mobile laboratory	0.5	
Mowers	0.55	
Other	0.5	
Riding trencher	0.75	
Roller	0.56	
Rotary-screw air compressor (250 cfm)	0.48	
Skid-steer (small)	0.55	
Telescopic handler	0.43	
Tractor mower	0.6	
Water truck	0.57	

Materials	Units	Conv. to tons	Default Distance from Source to Site	Site-Specific Distance Used
Asphalt	tons	1	30	
Bentonite	tons	1	1000	
Borrow	tons	1	30	
Cement	tons	1	30	
Cheese whey	lbs	0.0005	1000	
Concrete	tons	1	30	
Emulsified vegetable oil	lbs	0.0005	1000	
GAC: regenerated	lbs	0.0005	1000	
GAC: virgin coal-based	lbs	0.0005	1000	
GAC: virgin coconut-based	lbs	0.0005	1000	
Gravel/sand/clay	tons	1	30	
HDPE	lbs	0.0005	1,500	
Hydrochloric acid (30%, SG = 1.18)	lbs	0.0005	500	
Hydrogen peroxide (50%, SG=1.19)	lbs	0.0005	500	
Hydroseed	lbs	0.0005	500	
Lime	lbs	0.0005	500	
Molasses	lbs	0.0005	500	
Nitrogen fertilizer	lbs	0.0005	500	
Other 1 - Compost	lbs	0.0005	0	X
Other 2 - Mulch	cy	0.405	0	X
Other 3 - Pesticide 1	lbs	0.0005	0	X
Other 4 - Pesticide 2	lbs	0.0005	0	X
Other 5	0	0	0	
Phosphorus fertilizer	lbs	0.0005	500	
Polymer	lbs	0.0005	1000	
Potable water	gals	0.00417	30	
Potassium permanganate	lbs	0.0005	1400	
PVC	lbs	0.0005	500	
Sequestering agent	lbs	0.0005	1000	
Sodium hydroxide (20%, SG=1.22)	lbs	0.0005	500	
Stainless steel	lbs	0.0005	500	
Steel	lbs	0.0005	500	
Trees: root balls	each	NA	500	X
Trees: whips	each	NA	1000	X

Waste Hauling	Distance from Site
Non-hazardous	14
Hazardous	0
Recyclable Oil	30
Hauled to POTW	0
For incineration	0

APPENDIX B

FOOTPRINT CONVERSION FACTORS

Default Conversion and Emission Factors

		Parameters Used, Extracted, Emitted, or Generated															
		Energy **Used**	Electricity **Used**	All Water **Used**	Potable Water **Used**	Groundwater **Extracted**	CO2e **Emitted**	NO x **Emitted**	SO x **Emitted**	PM **Emitted**	Solid Waste **Generated**	Haz. Waste **Generated**	Air Toxics **Emitted**	Mercury **Released**	Lead **Released**	Dioxins **Released**
		Mbtu	MWh	gal x 1000	gal x 1000	gal x 1000	lbs	lbs	lbs	lbs	tons	tons	lbs	lbs	lbs	lbs
ON-SITE																
Energy																
Diesel (on-site)	gal	139					22.5	0.17	0.0054	0.0034			0.0000052	0	0	0
Gasoline (on-site use)	gal	124					19.6	0.11	0.0045	0.00054			0.000039	0	0	0
Natural gas (on-site use)	ccf	103					12.2	0.01	0.0000063	0.00076			0.0000084	0.000000026	0.00000005	0
On-site electricity use	MWh	3413	1													
Other Energy 1	TBD															
Other Energy 2	TBD															
Other Energy 3	TBD															
Water																
Groundwater Extracted On-site	gal x 1000			1		1										
Potable Water Used	gal x 1000			1	1											
Other On-Site Water 1	gal x 1000			1												
Other On-Site Water 2	gal x 1000			1												
Other On-Site Water 3	gal x 1000			1												
Waste Generation																
On-Site Solid Waste Generation	ton										1					
On-Site Solid Waste Disposal	ton															
On-Site Hazardous Waste Generation	ton											1				
On-Site Hazardous Waste Disposal	ton															
Other																
On-site process emissions (HAPs)	lbs												1			
On-site process emissions (GHGs)	lbs CO2e						1									
On-site GHG storage	lbs CO2e						-1									
On-site Nox reduction	lbs							-1								
On-site SOx reduction	lbs								-1							
On-site PM reduction	lbs									-1						
Other 4	TBD															
Other 5	TBD															
ELECTRICITY GENERATION																
Electricity production	MWh	7800	0.06	2 X			1540 X	3.9 X	10 X	0.94 X	0.0009	0	0.4 X	0.000023 X	0.00017 X	2.40E-10
TRANSPORTATION																
Diesel (off-site use)	gal	139					22.5	0.17	0.0054	0.0034			0.0000052	0	0	0
Gasoline (off-site use)	gal	124					19.6	0.11	0.0045	0.00054			0.000039	0	0	0
Natural gas (off-site use)	ccf	103					12.2	0.01	0.0000063	0.00076			0.0000084	0.000000026	0.00000005	0
Potable Water Transported	gal x 1000	7.4	0.000645995	0.00129199			0.994832041	0.00251938	0.006459948	0.000607235	5.81395E-07	0	0.000258398	1.48579E-08	1.09819E-07	1.55039E-13
Electricity transmission	MWh	410	0.12	0.24 X			184.8 X	0.468 X	1.2 X	0.1128 X	0.000108	0	0.048 X	0.00000276 X	0.0000204 X	2.88E-11
Other Transportation 1	TBD															
Other Transportation 2	TBD															
Other Transportation 3	TBD															
OFF-SITE OTHER																
Materials																
Asphalt	tons															
Bentonite	tons	55	0.0027	0.13			6.7	0.033	0.03	0.004	0	0	0.00000041	6.4E-11	1.2E-09	1.5E-16
Borrow (clean soil)	tons	15.75	0.000059	0.000077			2.52	0.01764	0.00184	0.000374	0.000000036	0	0.00001252	4.8E-09	0.00000015	3E-15
Cement	dry-ton	4100	0.13	0.41			1800	3.6	2.1	0.0063	0	0	0.058	0.000057	0.00013	8.50E-11
Cheese Whey	lbs	1.87	0	0			1.1	0.0083	0.0099	0.000166	0	0	0	0	0	0
Concrete	tons	3020	0.096	0.33			1322	2.6	1.5	0.0057	0.000000028	0	0.043	0.000042	0.000095	6.2E-11
Diesel Produced	gal	18.5	0.00059	0.00077			2.7	0.0064	0.013	0.00034	0.00000036	0	0.00012	0.000000048	0.0000015	3E-14
Emulsified vegetable oil	lbs	3.6	0.000055	0.000024			3.51	0.0265	0.031	0.0017	0	0	0	0	0	0
GAC: regenerated	lbs	9.6	0.00044	0.0064			2	0.025	0.015	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs															
GAC: virgin coconut-based	lbs															
Gasoline Produced	gal	21	0.00059	0.00079			4.4	0.008	0.019	0.00052	0.00000042	0	0.00016	0.000000085	0.0000022	3.1E-14
Gravel/sand/clay	ton	55	0.0027	0.13			6.7	0.033	0.03	0.004	0	0	0.00000041	6.4E-11	1.2E-09	1.5E-16
HDPE	lb	31	0.00025	0.0023			1.9	0.0032	0.0041	0.00064	0.00000043	0.000001	0.0000034	2.6E-09	2.4E-09	9.8E-10

Default Conversion and Emission Factors

		Parameters Used, Extracted, Emitted, or Generated														
		Energy	Electricity	All Water	Potable Water	Groundwater	CO2e	NO x	SO x	PM	Solid Waste	Haz. Waste	Air Toxics	Mercury	Lead	Dioxins
		Used	**Used**	**Used**	**Used**	**Extracted**	**Emitted**	**Emitted**	**Emitted**	**Emitted**	**Generated**	**Generated**	**Emitted**	**Released**	**Released**	**Released**
		Mbtu	MWh	gal x 1000	gal x 1000	gal x 1000	lbs	lbs	lbs	lbs	tons	tons	lbs	lbs	lbs	lbs
Hydrochloric acid (30%, SG = 1.18)	lbs															
Hydrogen peroxide (50%, SG=1.19)	lbs															
Hydroseed	lbs	0.049	1.46044E-07	0.00012			0.0046	0.0000027	0.000053	0.00000028	0	0	0.00000081	2E-11	1.29E-10	0
Lime	lbs															
Molasses	lbs	1.31	0.000005	0.000091			0.4	0.003	0.0026	0.00006	0	0	0	0	0	0
Natural Gas Produced	ccf	5.2	0.00025	0.000077			2.2	0.0037	0.0046	0.000072	0	0	0.0000061	2.1E-08	0.0000009	5.1E-14
Nitrogen fertilizer	lbs	16.2	0.000023				1.5	0.00078	0.0174	0.000067			0.00026	6.1E-09	0.000000038	
Other Material #1	TBD															
Other Material #2	TBD															
Other Material #3	TBD															
Other Material #4	TBD															
Other Material #5	TBD															
Phosphorus fertilizer	lbs	3.39	0.000073				0.35	0.0017	0.017	0.00011			0.000052	2.1E-09	0.000000048	
Polymer	lbs															
Potable Water Produced	gal x 1000	9.2	0.00044	0.021			5	0.0097	0.0059	0.016	8.34E-07	0	0.000015	8.2E-09	0.000000067	1E-13
Potassium permanganate	lbs															
PVC	lbs	22	0.00056	0.0069			2.6	0.0048	0.0076	0.0012	0.0000022	0.0000016	0.00047	0.00000034	0.0000013	6.9E-09
Sequestering agent	lbs															
Sodium hydroxide (dry bulk)	lbs	6.6	0.00032	0.00115			1.37	0.003	0.0048	0.00054	0.000019	4.70E-07	0.000062	2.20E-07	2.50E-08	2.40E-14
Stainless Steel	lb	11.6	0.00056	0.0023			3.4	0.0075	0.012	0.0044	0.00062	0	0.000144	0	0.00000052	2.2E-12
Steel	lb	4.4	0.00021	0.00064			1.1	0.0014	0.0017	0.00056	0.00025	0	0.000067	0.0000001	0.0000025	6.5E-12
Tree: root ball	trees	3.7	0.0000019	0.004			0.6	0.003	0.00061	0.000029	0.00000001		0.000006	2.2E-09	0.00000006	
Tree: whip	trees			0												
Off-Site Services																
Off-site waste water treatment	gal x 1000	15	0.00073	0.00292			4.4	0.016	0.015	0.0017	0.0024	0	0.00058	3.70E-08	3.70E-07	3.45E-13
Solid Waste Disposal	ton	160	0.0077	0.15			25	0.14	0.075	0.4	0.000008	0	0.0014	9.70E-07	0.0000076	1.20E-11
Hazardous Waste Disposal	ton	176	0.0085	0.165			27.5	0.154	0.0825	0.44	0.0000088	0	0.00154	0.000001067	0.00000836	1.32E-11
Laboratory Analysis	$	6.49	0.00035	0.00066			1	0.0048	0.0036	0.0004	0	0	0.00013	8.4E-09	0.000000085	7.9E-14
Other 1	TBD															
Other 2	TBD															
Other 3	TBD															
Other 4	TBD															
Other 5	TBD															
Other																
Other 1	TBD															
Other 2	TBD															
Other 3	TBD															
Other 4	TBD															
Other 5	TBD															

Notes: An "X" n Notes: An "X" next to a conversion rate indicates that a "actual" value has been assigned and is overriding the "default" value.

Actual Conversion and Emission Factors

		Parameters Used, Extracted, Emitted, or Generated														
		Energy	Electricity	All Water	Potable Water	Groundwater	CO2e	NO x	SO x	PM	Solid Waste	Haz. Waste	Air Toxics	Mercury	Lead	Dioxins
		Used	**Used**	**Used**	**Used**	**Extracted**	**Emitted**	**Emitted**	**Emitted**	**Emitted**	**Generated**	**Generated**	**Emitted**	**Released**	**Released**	**Released**
		Mbtu	MWh	gal x 1000	gal x 1000	gal x 1000	lbs	lbs	lbs	lbs	tons	tons	lbs	lbs	lbs	lbs
ON-SITE																
Energy																
Diesel (on-site)	gal															
Gasoline (on-site use)	gal															
Natural gas (on-site use)	ccf															
On-site electricity use	MWh															
Other Energy 1	TBD															
Other Energy 2	TBD															
Other Energy 3	TBD															
Water																
Groundwater Extracted On-site	gal x 1000															
Potable Water Used	gal x 1000															
Other On-Site Water 1	gal x 1000															
Other On-Site Water 2	gal x 1000															
Other On-Site Water 3	gal x 1000															
Waste Generation																
Solid Waste Generation	ton															
On-Site Solid Waste Disposal	ton															
Hazardous Waste Generation	ton															
On-Site Hazardous Waste Disposal	ton															
Other																
On-site process emissions (HAPs)	lbs															
On-site process emissions (GHGs)	lbs CO2e															
On-site GHG storage	lbs CO2e															
Other 1	TBD															
Other 2	TBD															
Other 3	TBD															
Other 4	TBD															
Other 5	TBD															
ELECTRICITY GENERATION																
Electricity production	MWh			1.1			1990	5.17	12.8	1.274			0.5462	0.000032	0.00019	
TRANSPORTATION																
Diesel (off-site use)	gal															
Gasoline (off-site use)	gal															
Natural gas (off-site use)	ccf															
Potable Water Transported	gal x 1000															
Electricity transmission	MWh			0.132			238.8	0.6204	1.536	0.15288			0.065544	0.00000384	0.0000228	
Other Transportation 1	TBD															
Other Transportation 2	TBD															
Other Transportation 3	TBD															

Actual Conversion and Emission Factors

		Parameters Used, Extracted, Emitted, or Generated														
		Energy	Electricity	All Water	Potable Water	Groundwater	CO2e	NO x	SO x	PM	Solid Waste	Haz. Waste	Air Toxics	Mercury	Lead	Dioxins
		Used	**Used**	**Used**	**Used**	**Extracted**	**Emitted**	**Emitted**	**Emitted**	**Emitted**	**Generated**	**Generated**	**Emitted**	**Released**	**Released**	**Released**
		Mbtu	MWh	gal x 1000	gal x 1000	gal x 1000	lbs	lbs	lbs	lbs	tons	tons	lbs	lbs	lbs	lbs
OFF-SITE OTHER																
Materials																
Asphalt	tons															
Bentonite	tons															
Borrow (clean soil)	tons															
Cement	dry-ton															
Cheese Whey	lbs															
Concrete	tons															
Diesel Produced	gal															
Emulsified vegetable oil	lbs															
GAC: regenerated	lbs															
GAC: virgin coal-based	lbs															
GAC: virgin coconut-based	lbs															
Gasoline Produced	gal															
Gravel/sand	ton															
HDPE	lb															
Hydrochloric acid (30%, SG = 1.18)	lbs															
Hydrogen peroxide (50%, SG=1.19)	lbs															
Hydroseed	lbs															
Lime	lbs															
Molasses	lbs															
Natural Gas Produced	ccf															
Nitrogen fertilizer	lbs															
Other Material #1	TBD															
Other Material #2	TBD															
Other Material #3	TBD															
Other Material #4	TBD															
Other Material #5	TBD															
Phosphorus fertilizer	lbs															
Polymer	lbs															
Potable Water Produced	gal x 1000															
Potassium permanganate	lbs															
PVC	lbs															
Sequestering agent	lbs															
Sodium hydroxide (dry bulk)	lbs															
Stainless Steel	lb															
Steel	lb															
Tree: root ball	trees															
Tree: whip	trees															
Off-Site Services																
Off-site waste water treatment	gal x 1000															
Solid Waste Disposal	ton															
Hazardous Waste Disposal	ton															
Laboratory Analysis	$															
Other 1	TBD															
Other 2	TBD															
Other 3	TBD															
Other 4	TBD															
Other 5	TBD															
Other																
Other 1	TBD															
Other 2	TBD															
Other 3	TBD															
Other 4	TBD															
Other 5	TBD															

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Diesel (on-site)	Energy Used	139	Mbtu/gal	The reference provides the higher heating value of diesel as 5.825 MMBTU per barrel and defines a barrel as 42 gallons. This converts to approximately 139 Mbtu/gallon.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	Electricity Used		MWh/gal		
	All Water Used		gal x 1000/gal		
	Potable Water Used		gal x 1000/gal		
	Groundwater Extracted		gal x 1000/gal		
	CO2e Emitted	22.5	lbs/gal	The reference provides CO2e emitted as 10.15 kg of CO2 per gallon. This converts to 22.3 pounds per gallon. Additionally, N2O and CH4 emissions are provided as g/gal. Values are converted to lbs/gal using a global warming potential (GWP) of 1 for carbon dioxide, 21 for methane, and 310 for nitrous oxide.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	NO x Emitted	0.17	lbs/gal	NREL LCI reported the amount of diesel in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (nitrogen oxides) generated from transporting 1 tkm was divided by the amount of diesel required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, diesel powered.xls
	SO x Emitted	0.0054	lbs/gal	NREL LCI reported the amount of diesel in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (sulfur oxides) generated from transporting 1 tkm was divided by the amount of diesel required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, diesel powered.xls
	PM Emitted	0.0034	lbs/gal	NREL LCI reported the amount of diesel in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (Particulates, > 2.5 um, and < 10um) generated from transporting 1 tkm was divided by the amount of diesel required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, diesel powered.xls
	Solid Waste Generated		tons/gal	not applicable -- no waste generated when diesel is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Haz. Waste Generated		tons/gal	not applicable -- no waste generated when diesel is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Air Toxics Emitted	0.0000052	lbs/gal	Not available in NREL LCI transport files. Summed hazardous air pollutants emitted from combusting diesel in industrial equipment. NREL LCI provides results in kg per L combusted. Converted this to pounds per gallon by multiplying by 3.785 and multiplying by .2.2	NREL LCI File: SS_diesel combusted in industrial equipment.xls
	Mercury Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of mercury.	EUROPA file location: Lorry transport; Euro 0, 1, 2, 3, 4 mix; 22 t total weight, 17,3 t max payload (excluding fuel supply): http://lca.jrc.ec.europa.eu/lcainfohub/datasets/elcd/processes/b444f4d2-3393-11dd-bd11-0800200c9a66_02.00.000.xml
	Lead Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of lead	
	Dioxins Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of dioxins.	

"NREL LCI" refers to the U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (www.nrel.gov/lci) maintained by the Alliance for Sustainable Energy, LLC.
EUROPA ECLD refers to the European Reference Life Cycle Database (ELCD core database), version II compiled under contract on behalf of the European Commission - DG Joint Research Centre - Institute for Environment and Sustainability with technical and scientific support by JRC-IES from early 2008 to early 2009. (http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm)

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Gasoline (on-site use)	Energy Used	124	Mbtu/gal	The reference provides the higher heating value of gasoline as 5.218 MMBTU per barrel and defines a barrel as 42 gallons. This converts to approximately 124 Mbtu/gallon.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	Electricity Used		MWh/gal	not applicable -- no electricity used when gasoline is combusted on-site or in transportation	
	All Water Used		gal x 1000/gal	not applicable -- no water used when gasoline is combusted on-site or in transportation	
	Potable Water Used		gal x 1000/gal	not applicable -- no water used when gasoline is combusted on-site or in transportation	
	Groundwater Extracted		gal x 1000/gal	not applicable -- no water used when gasoline is combusted on-site or in transportation	
	CO2e Emitted	19.6	lbs/gal	The reference provides CO2e emitted as 8.81 kg of CO2 per gallon. This converts to 19.4 pounds per gallon. Additionally, N2O and CH4 emissions are provided as g/gal. Values are converted to lbs/gal using a global warming potential (GWP) of 1 for carbon dioxide, 21 for methane, and 310 for nitrous oxide.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	NO x Emitted	0.11	lbs/gal	NREL LCI reported the amount of gasoline in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (nitrogen oxides) generated from transporting 1 tkm was divided by the amount of gasoline required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, gasoline powered.xls
	SO x Emitted	0.0045	lbs/gal	NREL LCI reported the amount of gasoline in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (sulfur oxides) generated from transporting 1 tkm was divided by the amount of gasoline required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, gasoline powered.xls
	PM Emitted	0.00054	lbs/gal	NREL LCI reported the amount of gasoline in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (Particulates, > 2.5 um, and < 10um) generated from transporting 1 tkm was divided by the amount of gasoline required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, gasoline powered.xls
	Solid Waste Generated		tons/gal	not applicable -- no waste generated when gasoline is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Haz. Waste Generated		tons/gal	not applicable -- no waste generated when gasoline is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Air Toxics Emitted	0.000039	lbs/gal	Not available in NREL LCI transport files. Summed hazardous air pollutants emitted from combusting gasoline in industrial equipment. NREL LCI provides results in kg per L combusted. Converted this to pounds per gallon by multiplying by 3.785 and multiplying by .2.2	NREL LCI File: SS_gasoline combusted in industrial equipment.xls
	Mercury Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of mercury.	EUROPA file location: Lorry transport; Euro 0, 1, 2, 3, 4 mix; 22 t total weight, 17,3 t max payload (excluding fuel supply): http://lca.jrc.ec.europa.eu/lcainfohub/datasets/elcd/processes/b444f4d2-3393-11dd-bd11-0800200c9a66_02.00.000.xml
	Lead Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of lead	
	Dioxins Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of dioxins.	

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Natural gas (on-site use)	Energy Used	103	Mbtu/ccf	The reference provides the higher heating value of natural gas as 1,027 BTU per scf. This converts to approximately 103 Mbtu/ccf.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	Electricity Used		MWh/ccf	not applicable -- no electricity used when nat gas is combusted on-site or in transportation	
	All Water Used		gal x 1000/ccf	not applicable -- no water used when nat gas is combusted on-site or in transportation	
	Potable Water Used		gal x 1000/ccf	not applicable -- no water used when nat gas is combusted on-site or in transportation	
	Groundwater Extracted		gal x 1000/ccf	not applicable -- no water used when nat gas is combusted on-site or in transportation	
	CO2e Emitted	12.2	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits. Outputs for carbon dioxide and fossil methane were used to calculated CO2e. Nitrous oxide was not included as an output. Methane was assigned a global warming potential equal to 21 times that of CO2.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	NO x Emitted	0.01	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	SO x Emitted	0.0000063	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	PM Emitted	0.00076	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Solid Waste Generated		tons/ccf	not applicable -- no solid waste generated when natural gas is combusted on-site or in transportation	
	Haz. Waste Generated		tons/ccf	not applicable -- no haz waste generated when natural gas is combusted on-site or in transportation	
	Air Toxics Emitted	0.0000084	lbs/ccf	NREL - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere converted from kg/m3 to lb/ccf. Note that the value for combustion in equipment is significantly lower than the value reported here for use in an industrial boiler.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Mercury Released	0.000000026	lbs/ccf	NREL - Mercury released converted from kg/m3 to lb/ccf. Note that according to NREL there is no mercury released for natural gas combusted in industrial equipment.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Lead Released	0.00000005	lbs/ccf	NREL - Lead released converted from kg/m3 to lb/ccf. Note that according to NREL there is no lead released for natural gas combusted in industrial equipment.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Dioxins Released	0	lbs/ccf	NREL does not indicate the formation of dioxins during natural gas combustion	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site electricity use	Energy Used	3413	Mbtu/MWh	Actual conversion factor	
	Electricity Used	1	MWh/MWh	One to one conversion.	
	All Water Used		gal x 1000/MWh		
	Potable Water Used		gal x 1000/MWh		
	Groundwater Extracted		gal x 1000/MWh		
	CO2e Emitted		lbs/MWh		
	NO x Emitted		lbs/MWh		
	SO x Emitted		lbs/MWh		
	PM Emitted		lbs/MWh		
	Solid Waste Generated		tons/MWh		
	Haz. Waste Generated		tons/MWh		
	Air Toxics Emitted		lbs/MWh		
	Mercury Released		lbs/MWh		
	Lead Released		lbs/MWh		
	Dioxins Released		lbs/MWh		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Groundwater Extracted On-site	Energy Used		Mbtu/gal x 1000		
	Electricity Used		MWh/gal x 1000		
	All Water Used	1	gal x 1000/gal x 1000	One to one conversion.	
	Potable Water Used		gal x 1000/gal x 1000		
	Groundwater Extracted	1	gal x 1000/gal x 1000	One to one conversion.	
	CO2e Emitted		lbs/gal x 1000		
	NO x Emitted		lbs/gal x 1000		
	SO x Emitted		lbs/gal x 1000		
	PM Emitted		lbs/gal x 1000		
	Solid Waste Generated		tons/gal x 1000		
	Haz. Waste Generated		tons/gal x 1000		
	Air Toxics Emitted		lbs/gal x 1000		
	Mercury Released		lbs/gal x 1000		
	Lead Released		lbs/gal x 1000		
	Dioxins Released		lbs/gal x 1000		

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Potable Water Used	Energy Used		Mbtu/gal x 1000		
	Electricity Used		MWh/gal x 1000		
	All Water Used	1	gal x 1000/gal x 1000	One to one conversion.	
	Potable Water Used	1	gal x 1000/gal x 1000	One to one conversion.	
	Groundwater Extracted		gal x 1000/gal x 1000		
	CO2e Emitted		lbs/gal x 1000		
	NO x Emitted		lbs/gal x 1000		
	SO x Emitted		lbs/gal x 1000		
	PM Emitted		lbs/gal x 1000		
	Solid Waste Generated		tons/gal x 1000		
	Haz. Waste Generated		tons/gal x 1000		
	Air Toxics Emitted		lbs/gal x 1000		
	Mercury Released		lbs/gal x 1000		
	Lead Released		lbs/gal x 1000		
	Dioxins Released		lbs/gal x 1000		

EUROPA ECLD refers to the European Reference Life Cycle Database (ELCD core database), version II compiled under contract on behalf of the European Commission - DG Joint Research Centre - Institute for Environment and Sustainability with technical and scientific support by JRC-IES from early 2008 to early 2009. (http://lca.jrc.ec.europa.eu/lcainfohub/datasetArea.vm)

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-Site Solid Waste Generation	Energy Used		Mbtu/ton		
	Electricity Used		MWh/ton		
	All Water Used		gal x 1000/ton		
	Potable Water Used		gal x 1000/ton		
	Groundwater Extracted		gal x 1000/ton		
	CO2e Emitted		lbs/ton		
	NO x Emitted		lbs/ton		
	SO x Emitted		lbs/ton		
	PM Emitted		lbs/ton		
	Solid Waste Generated	1	tons/ton	One to one conversion.	
	Haz. Waste Generated		tons/ton		
	Air Toxics Emitted		lbs/ton		
	Mercury Released		lbs/ton		
	Lead Released		lbs/ton		
	Dioxins Released		lbs/ton		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-Site Hazardous Waste Generation	Energy Used		Mbtu/ton		
	Electricity Used		MWh/ton		
	All Water Used		gal x 1000/ton		
	Potable Water Used		gal x 1000/ton		
	Groundwater Extracted		gal x 1000/ton		
	CO2e Emitted		lbs/ton		
	NO x Emitted		lbs/ton		
	SO x Emitted		lbs/ton		
	PM Emitted		lbs/ton		
	Solid Waste Generated		tons/ton		
	Haz. Waste Generated	1	tons/ton	One to one conversion.	
	Air Toxics Emitted		lbs/ton		
	Mercury Released		lbs/ton		
	Lead Released		lbs/ton		
	Dioxins Released		lbs/ton		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site process emissions (HAPs)	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted	1	lbs/lbs	One to one conversion.	
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site process emissions (GHGs)	Energy Used		Mbtu/lbs CO2e		
	Electricity Used		MWh/lbs CO2e		
	All Water Used		gal x 1000/lbs CO2e		
	Potable Water Used		gal x 1000/lbs CO2e		
	Groundwater Extracted		gal x 1000/lbs CO2e		
	CO2e Emitted	1	lbs/lbs CO2e	One to one conversion.	
	NO x Emitted		lbs/lbs CO2e		
	SO x Emitted		lbs/lbs CO2e		
	PM Emitted		lbs/lbs CO2e		
	Solid Waste Generated		tons/lbs CO2e		
	Haz. Waste Generated		tons/lbs CO2e		
	Air Toxics Emitted		lbs/lbs CO2e		
	Mercury Released		lbs/lbs CO2e		
	Lead Released		lbs/lbs CO2e		
	Dioxins Released		lbs/lbs CO2e		

"NREL LCI" refers to the U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (www.nrel.gov/lci) maintained by the Alliance for Sustainable Energy, LLC.

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site GHG storage	Energy Used		Mbtu/lbs CO2e		
	Electricity Used		MWh/lbs CO2e		
	All Water Used		gal x 1000/lbs CO2e		
	Potable Water Used		gal x 1000/lbs CO2e		
	Groundwater Extracted		gal x 1000/lbs CO2e		
	CO2e Emitted	-1	lbs/lbs CO2e	One to one conversion.	
	NO x Emitted		lbs/lbs CO2e		
	SO x Emitted		lbs/lbs CO2e		
	PM Emitted		lbs/lbs CO2e		
	Solid Waste Generated		tons/lbs CO2e		
	Haz. Waste Generated		tons/lbs CO2e		
	Air Toxics Emitted		lbs/lbs CO2e		
	Mercury Released		lbs/lbs CO2e		
	Lead Released		lbs/lbs CO2e		
	Dioxins Released		lbs/lbs CO2e		

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site Nox reduction	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted	-1	lbs/lbs	One to one conversion.	
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site SOx reduction	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted	-1	lbs/lbs	One to one conversion.	
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
On-site PM reduction	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted	-1	lbs/lbs	One to one conversion.	
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Diesel (off-site use)	Energy Used	139	Mbtu/gal	The reference provides the higher heating value of diesel as 5.825 MMBTU per barrel and defines a barrel as 42 gallons. This converts to approximately 139 Mbtu/gallon.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	Electricity Used		MWh/gal		
	All Water Used		gal x 1000/gal		
	Potable Water Used		gal x 1000/gal		
	Groundwater Extracted		gal x 1000/gal		
	CO2e Emitted	22.5	lbs/gal	The reference provides CO2e emitted as 10.15 kg of CO2 per gallon. This converts to 22.3 pounds per gallon. Additionally, N2O and CH4 emissions are provided as g/gal. Values are converted to lbs/gal using a global warming potential (GWP) of 1 for carbon dioxide, 21 for methane, and 310 for nitrous oxide.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	NO x Emitted	0.17	lbs/gal	NREL LCI reported the amount of diesel in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (nitrogen oxides) generated from transporting 1 tkm was divided by the amount of diesel required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, diesel powered.xls
	SO x Emitted	0.0054	lbs/gal	NREL LCI reported the amount of diesel in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (sulfur oxides) generated from transporting 1 tkm was divided by the amount of diesel required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, diesel powered.xls
	PM Emitted	0.0034	lbs/gal	NREL LCI reported the amount of diesel in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (Particulates, > 2.5 um, and < 10um) generated from transporting 1 tkm was divided by the amount of diesel required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, diesel powered.xls
	Solid Waste Generated		tons/gal	not applicable -- no waste generated when diesel is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Haz. Waste Generated		tons/gal	not applicable -- no waste generated when diesel is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Air Toxics Emitted	0.0000052	lbs/gal	Not available in NREL LCI transport files. Summed hazardous air pollutants emitted from combusting diesel in industrial equipment. NREL LCI provides results in kg per L combusted. Converted this to pounds per gallon by multiplying by 3.785 and multiplying by .2.2	NREL LCI File: SS_diesel combusted in industrial equipment.xls
	Mercury Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of mercury.	EUROPA file location: Lorry transport; Euro 0, 1, 2, 3, 4 mix; 22 t total weight, 17,3 t max payload (excluding fuel supply): http://lca.jrc.ec.europa.eu/lcainfohub/datasets/elcd/processes/b444f4d2-3393-11dd-bd11-0800200c9a66_02.00.000.xml
	Lead Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of lead	
	Dioxins Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of dioxins.	

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Gasoline (off-site use)	Energy Used	124	Mbtu/gal	The reference provides the higher heating value of gasoline as 5.218 MMBTU per barrel and defines a barrel as 42 gallons. This converts to approximately 124 Mbtu/gallon.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	Electricity Used		MWh/gal	not applicable -- no electricity used when gasoline is combusted on-site or in transportation	
	All Water Used		gal x 1000/gal	not applicable -- no water used when gasoline is combusted on-site or in transportation	
	Potable Water Used		gal x 1000/gal	not applicable -- no water used when gasoline is combusted on-site or in transportation	
	Groundwater Extracted		gal x 1000/gal	not applicable -- no water used when gasoline is combusted on-site or in transportation	
	CO2e Emitted	19.6	lbs/gal	The reference provides CO2e emitted as 8.81 kg of CO2 per gallon. This converts to 19.4 pounds per gallon. Additionally, N2O and CH4 emissions are provided as g/gal. Values are converted to lbs/gal using a global warming potential (GWP) of 1 for carbon dioxide, 21 for methane, and 310 for nitrous oxide.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	NO x Emitted	0.11	lbs/gal	NREL LCI reported the amount of gasoline in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (nitrogen oxides) generated from transporting 1 tkm was divided by the amount of gasoline required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, gasoline powered.xls
	SO x Emitted	0.0045	lbs/gal	NREL LCI reported the amount of gasoline in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (sulfur oxides) generated from transporting 1 tkm was divided by the amount of gasoline required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, gasoline powered.xls
	PM Emitted	0.00054	lbs/gal	NREL LCI reported the amount of gasoline in liters required to transport one ton-kilometer (tkm) and provided outputs to nature in kg. The output (Particulates, > 2.5 um, and < 10um) generated from transporting 1 tkm was divided by the amount of gasoline required to transport 1 tkm, and the units of the result were converted from kg/L to lbs/gallon.	NREL LCI File: SS_Transport, single unit truck, gasoline powered.xls
	Solid Waste Generated		tons/gal	not applicable -- no waste generated when gasoline is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Haz. Waste Generated		tons/gal	not applicable -- no waste generated when gasoline is combusted on-site or in transportation (solid waste and waste oil from maintenance would be tracked separately)	
	Air Toxics Emitted	0.000039	lbs/gal	Not available in NREL LCI transport files. Summed hazardous air pollutants emitted from combusting gasoline in industrial equipment. NREL LCI provides results in kg per L combusted. Converted this to pounds per gallon by multiplying by 3.785 and multiplying by .2.2	NREL LCI File: SS_gasoline combusted in industrial equipment.xls
	Mercury Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of mercury.	EUROPA file location: Lorry transport; Euro 0, 1, 2, 3, 4 mix; 22 t total weight, 17,3 t max payload (excluding fuel supply): http://lca.jrc.ec.europa.eu/lcainfohub/datasets/elcd/processes/b444f4d2-3393-11dd-bd11-0800200c9a66_02.00.000.xml
	Lead Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of lead	
	Dioxins Released	0	lbs/gal	EUROPA ELCD - Reference does not indicate a release of dioxins.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Natural gas (off-site use)	Energy Used	103	Mbtu/ccf	The reference provides the higher heating value of natural gas as 1,027 BTU per scf. This converts to approximately 103 Mbtu/ccf.	Climate Leader GHG Inventory EPA-430--K-08-004, May 2008
	Electricity Used		MWh/ccf	not applicable -- no electricity used when nat gas is combusted on-site or in transportation	
	All Water Used		gal x 1000/ccf	not applicable -- no water used when nat gas is combusted on-site or in transportation	
	Potable Water Used		gal x 1000/ccf	not applicable -- no water used when nat gas is combusted on-site or in transportation	
	Groundwater Extracted		gal x 1000/ccf	not applicable -- no water used when nat gas is combusted on-site or in transportation	
	CO2e Emitted	12.2	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits. Outputs for carbon dioxide and fossil methane were used to calculated CO2e. Nitrous oxide was not included as an output. Methane was assigned a global warming potential equal to 21 times that of CO2.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	NO x Emitted	0.01	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	SO x Emitted	0.0000063	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	PM Emitted	0.00076	lbs/ccf	NREL LCI reported output in kg and input in m3. The units were converted from kg/m3 to lbs per 100 cubic feet (ccf) and rounded to two significant digits.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Solid Waste Generated		tons/ccf	not applicable -- no solid waste generated when natural gas is combusted on-site or in transportation	
	Haz. Waste Generated		tons/ccf	not applicable -- no haz waste generated when natural gas is combusted on-site or in transportation	
	Air Toxics Emitted	0.0000084	lbs/ccf	NREL - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere converted from kg/m3 to lb/ccf. Note that the value for combustion in equipment is significantly lower than the value reported here for use in an industrial boiler.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Mercury Released	0.000000026	lbs/ccf	NREL - Mercury released converted from kg/m3 to lb/ccf. Note that according to NREL there is no mercury released for natural gas combusted in industrial equipment.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Lead Released	0.00000005	lbs/ccf	NREL - Lead released converted from kg/m3 to lb/ccf. Note that according to NREL there is no lead released for natural gas combusted in industrial equipment.	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls
	Dioxins Released	0	lbs/ccf	NREL does not indicate the formation of dioxins during natural gas combustion	NREL LCI File: SS_Natural gas, combusted in industrial boiler.xls

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Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Potable Water Transported	Energy Used	7.4	Mbtu/gal x 1000	Calculated based on electricity used. Accounts for 10% energy loss through electricity transmission losses and a thermal efficiency of 33%.	
	Electricity Used	0.000645995	MWh/gal x 1000	Electricity usage calculated assuming water is distributed from the source at 50 psi by a 75% efficient pump with a 75% efficient motor. Some head loss will be realized during pipe flow such that the site will receive water at a lower pressure, but the 50 psi represents the energy that is needed at the treatment plant to distribute the water through the distribution network. All other environmental parameters are calculated from this calculated electricity usage using site-specific conversion factors for electricity.	
	All Water Used	0.00129199	gal x 1000/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Potable Water Used		gal x 1000/gal x 1000	not applicable -- no potable water used when potable water is being transported (assumes no leakage water distribution system).	
	Groundwater Extracted		gal x 1000/gal x 1000	not applicable -- no on-site ground water used when potable water is being transported.	
	CO2e Emitted	0.994832041	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	NO x Emitted	0.00251938	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	SO x Emitted	0.006459948	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	PM Emitted	0.000607235	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Solid Waste Generated	5.81395E-07	tons/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Haz. Waste Generated	0	tons/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Air Toxics Emitted	0.000258398	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Mercury Released	1.48579E-08	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Lead Released	1.09819E-07	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	
	Dioxins Released	1.55039E-13	lbs/gal x 1000	Calculated based on calculated "electricity used". Default value uses default electricity parameters and actual value uses actual electricity parameters.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Asphalt	Energy Used		Mbtu/tons		
	Electricity Used		MWh/tons		
	All Water Used		gal x 1000/tons		
	Potable Water Used		gal x 1000/tons		
	Groundwater Extracted		gal x 1000/tons		
	CO2e Emitted		lbs/tons		
	NO x Emitted		lbs/tons		
	SO x Emitted		lbs/tons		
	PM Emitted		lbs/tons		
	Solid Waste Generated		tons/tons		
	Haz. Waste Generated		tons/tons		
	Air Toxics Emitted		lbs/tons		
	Mercury Released		lbs/tons		
	Lead Released		lbs/tons		
	Dioxins Released		lbs/tons		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Bentonite	Energy Used	55	Mbtu/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Electricity Used	0.0027	MWh/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	All Water Used	0.13	gal x 1000/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Potable Water Used		gal x 1000/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Groundwater Extracted		gal x 1000/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	CO2e Emitted	6.7	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	NO x Emitted	0.033	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	SO x Emitted	0.03	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	PM Emitted	0.004	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Solid Waste Generated	0	tons/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Haz. Waste Generated	0	tons/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Air Toxics Emitted	0.00000041	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Mercury Released	6.4E-11	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Lead Released	1.2E-09	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	
	Dioxins Released	1.5E-16	lbs/tons	Absent other information, gravel and sand used as a surrogate material. See notes for "gravel and sand".	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Borrow (clean soil)	Energy Used	15.75	Mbtu/tons	All parameters based on the use of 0.1 gallons of diesel per ton of soil provided, which is represenative of excavating bulk soil with a hydraulic excavator and hauling bulk soil a short distance in a dump truck.	
	Electricity Used	0.000059	MWh/tons		
	All Water Used	0.000077	gal x 1000/tons		
	Potable Water Used		gal x 1000/tons		
	Groundwater Extracted		gal x 1000/tons		
	CO2e Emitted	2.52	lbs/tons		
	NO x Emitted	0.01764	lbs/tons		
	SO x Emitted	0.00184	lbs/tons		
	PM Emitted	0.000374	lbs/tons		
	Solid Waste Generated	0.000000036	tons/tons		
	Haz. Waste Generated	0	tons/tons		
	Air Toxics Emitted	0.00001252	lbs/tons		
	Mercury Released	4.8E-09	lbs/tons		
	Lead Released	0.00000015	lbs/tons		
	Dioxins Released	3E-15	lbs/tons		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Cement	Energy Used	4100	Mbtu/dry-ton	EUROPA ELCD - All forms of energy summed and converted to Mbtus per short ton of product.	Primary NREL LCI Files: -SS_portland cement, at plant.xls EUROPA file location: Portland Cement: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/600573dd-dfa5-44e5-b458-8727e793ffd7_02.00.000.html
	Electricity Used	0.13	MWh/dry-ton	Not provided by EUROPA ELCD. NREL LCI includes electricity usage for portland cement. Electricity from portland cement, at plant (but none of the subcomponent files as they are assumed to be negligible) is included in this estimate.	
	All Water Used	0.41	gal x 1000/dry-ton	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per short ton of product.	
	Potable Water Used		gal x 1000/dry-ton	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/dry-ton	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	1800	lbs/dry-ton	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per short ton of product.	
	NO x Emitted	3.6	lbs/dry-ton	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per short ton of product.	
	SO x Emitted	2.1	lbs/dry-ton	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per short ton of product.	
	PM Emitted	0.0063	lbs/dry-ton	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per short ton of product.	
	Solid Waste Generated	0	tons/dry-ton	EUROPA ELCD - There is no indication of generated solid waste that would be disposed ofat a landfill. Typical wastes indicated include radioactive wastes, mining wastes, and slag (expected to be used in some form elsewhere in industry).	
	Haz. Waste Generated	0	tons/dry-ton	EUROPA ELCD - "Chemical waste, toxic" converted into tons per pound of product. No hazardous waste is listed in EUROPA for gravel/sand, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.058	lbs/dry-ton	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported in pounds per short ton of product.	
	Mercury Released	0.000057	lbs/dry-ton	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water. Reported in pounds per short ton of product.	
	Lead Released	0.00013	lbs/dry-ton	EUROPA ELCD - Sum of all lead and lead compounds released to air or water. Reported in pounds per short ton of product.	
	Dioxins Released	8.5E-11	lbs/dry-ton	EUROPA ELCD - Sum of all dioxins released to air or water. Reported in pounds per short ton of product.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Cheese Whey	Energy Used	1.87	Mbtu/lbs	See attached support file titled "Derivation of Cheese Whey Values from LCA Food"	- Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk Andersen M and Jensen JD (2003). Marginale producenter af udvalgte basislevnedsmidler (in Danish) Udkast d. 5. februar 2003
	Electricity Used	0	MWh/lbs	None indicated.	
	All Water Used	0	gal x 1000/lbs	None indicated.	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	1.1	lbs/lbs	See attached support file titled "Derivation of Cheese Whey Values from LCA Food"	
	NO x Emitted	0.0083	lbs/lbs	See attached support file titled "Derivation of Cheese Whey Values from LCA Food"	
	SO x Emitted	0.0099	lbs/lbs	See attached support file titled "Derivation of Cheese Whey Values from LCA Food"	
	PM Emitted	0.000166	lbs/lbs	See attached support file titled "Derivation of Cheese Whey Values from LCA Food"	
	Solid Waste Generated	0	tons/lbs	Not available	
	Haz. Waste Generated	0	tons/lbs	Not available	
	Air Toxics Emitted	0	lbs/lbs	Not available	
	Mercury Released	0	lbs/lbs	Not available	
	Lead Released	0	lbs/lbs	Not available	
	Dioxins Released	0	lbs/lbs	Not available	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Concrete	Energy Used	3020	Mbtu/tons	Energy and all parameters calculated using values for potable water, sand/gravel, and cement grout assuming a 0.45:1:4 ratio by weight (typical). A quantity of 0.02 gals x 1000 is also added to "all water" to account for the 8.25% of the concrete mass that is water.	
	Electricity Used	0.096	MWh/tons		
	All Water Used	0.33	gal x 1000/tons		
	Potable Water Used		gal x 1000/tons		
	Groundwater Extracted		gal x 1000/tons		
	CO2e Emitted	1322	lbs/tons		
	NO x Emitted	2.6	lbs/tons		
	SO x Emitted	1.5	lbs/tons		
	PM Emitted	0.0057	lbs/tons		
	Solid Waste Generated	0.000000028	tons/tons		
	Haz. Waste Generated	0	tons/tons		
	Air Toxics Emitted	0.043	lbs/tons		
	Mercury Released	0.000042	lbs/tons		
	Lead Released	0.000095	lbs/tons		
	Dioxins Released	6.2E-11	lbs/tons		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Diesel Produced	Energy Used	18.5	Mbtu/gal	EUROPA ELCD - All forms of energy summed and converted to Mbtus per gallon of product.	Primary NREL LCI File: -SS_crude oil, in refinery.xls Secondary NREL LCI File: -SS_crude oil, at production.xls EUROPA file location: Diesel at refinery: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/244524ed-7b85-4548-b345-f58dc5cf9dac_02.00.000.html
	Electricity Used	0.00059	MWh/gal	Not provided by EUROPA ELCD. NREL LCI includes electricity usage for crude oil, in refinery with an allocation to diesel. Electricity from crude oil, in refinery (allocated to diesel) and crude oil, at production are included.	
	All Water Used	0.00077	gal x 1000/gal	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per gallon of product	
	Potable Water Used		gal x 1000/gal	Not applicable -- no local potable water used during diesel production.	
	Groundwater Extracted		gal x 1000/gal	Not applicable -- no local or on-site ground water extracted during diesel production.	
	CO2e Emitted	2.7	lbs/gal	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per gallon of product.	
	NO x Emitted	0.0064	lbs/gal	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per gallon of product.	
	SO x Emitted	0.013	lbs/gal	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per gallon of product.	
	PM Emitted	0.00034	lbs/gal	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per gallon of product.	
	Solid Waste Generated	0.00000036	tons/gal	EUROPA ELCD - Sum of all listed wastes (demolition debris) except for radioactive wastes, slag, and mining wastes, which would likely not be disposed of in a landfill.	
	Haz. Waste Generated	0	tons/gal	EUROPA ELCD - "Chemical waste, toxic" converted into tons per pound of product. No hazardous waste is listed in EUROPA for diesel production, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.00012	lbs/gal	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported as pounds per gallon of product.	
	Mercury Released	0.000000048	lbs/gal	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water. Reported as pounds per gallon of product.	
	Lead Released	0.0000015	lbs/gal	EUROPA ELCD - Sum of all lead and lead compounds released to air or water. Reported as pounds per gallon of product.	
	Dioxins Released	3E-14	lbs/gal	EUROPA ELCD - Sum of all dioxins released to air or water. Reported as pounds per gallon of product.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Emulsified vegetable oil	Energy Used	3.6	Mbtu/lbs	See attached support file titled "Derivation of Vegetable Oil Values from LCA Food"	Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk Landbrugets rådgivningscenter (2000). Tal fra Fodermiddeltabellen, Raport nr. 91. In Danish. Weidema BP (1999). System expansions to handle co-products of renewable materials. Presentation Summaries of the 7th LCA Case Studies Symposium SETAC-Europe, 1999. Pp. 45-48. pdf. Weidema B (2003). Market information in life cycle assessments. Technical report, Danish Environmental Protection Agency (Environmental Project no. 863).
	Electricity Used	0.000055	MWh/lbs	See attached support file titled "Derivation of Vegetable Oil Values from LCA Food"	
	All Water Used	0.000024	gal x 1000/lbs	See attached support file titled "Derivation of Vegetable Oil Values from LCA Food"	
	Potable Water Used		gal x 1000/lbs	Not used. -- no local potable water used during soybean oil production.	
	Groundwater Extracted		gal x 1000/lbs	Not used. -- no local or on-site ground water extracted during soybean oil production.	
	CO2e Emitted	3.51	lbs/lbs	See attached support file titled "Derivation of Vegetable Oil Values from LCA Food"	
	NO x Emitted	0.0265	lbs/lbs		
	SO x Emitted	0.031	lbs/lbs		
	PM Emitted	0.0017	lbs/lbs		
	Solid Waste Generated	0	tons/lbs	Not available	
	Haz. Waste Generated	0	tons/lbs	Not available	
	Air Toxics Emitted	0	lbs/lbs	Not available	
	Mercury Released	0	lbs/lbs	Not available	
	Lead Released	0	lbs/lbs	Not available	
	Dioxins Released	0	lbs/lbs	Not available	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
GAC: regenerated	Energy Used	9.6	Mbtu/lbs	Calculated using information from the cited reference. See support file for calculations.	Use of Adsorbents for the Removal of Pollutants from Wastewaters, by Gordon McKay, published by CRC Press, 1995, ISBN 0849369207
	Electricity Used	0.00044	MWh/lbs	Calculated using information from the cited reference. See support file for calculations.	
	All Water Used	0.0064	gal x 1000/lbs	Calculated using information from the cited reference. See support file for calculations.	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	2	lbs/lbs	Calculated using information from the cited reference. See support file for calculations.	
	NO x Emitted	0.025	lbs/lbs		
	SO x Emitted	0.015	lbs/lbs		
	PM Emitted	0	lbs/lbs	Not calculated	
	Solid Waste Generated	0	tons/lbs	Information not available. To be added when additional information becomes available.	
	Haz. Waste Generated	0	tons/lbs	Information not available. To be added when additional information becomes available.	
	Air Toxics Emitted	0	lbs/lbs	Information not available. To be added when additional information becomes available.	
	Mercury Released	0	lbs/lbs	Information not available. To be added when additional information becomes available.	
	Lead Released	0	lbs/lbs	Information not available. To be added when additional information becomes available.	
	Dioxins Released	0	lbs/lbs	Information not available. To be added when additional information becomes available.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
GAC: virgin coal-based	Energy Used		Mbtu/lbs	Calculated using information from the cited reference. See support file for calculations.	Use of Adsorbents for the Removal of Pollutants from Wastewaters, by Gordon McKay, published by CRC Press, 1995, ISBN 0849369207
	Electricity Used		MWh/lbs	Calculated using information from the cited reference. See support file for calculations.	
	All Water Used		gal x 1000/lbs	Calculated using information from the cited reference. See support file for calculations.	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted		lbs/lbs	Calculated using information from the cited reference. See support file for calculations.	
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs	Not calculated	
	Solid Waste Generated		tons/lbs	Information not available. To be added when additional information becomes available.	
	Haz. Waste Generated		tons/lbs	Information not available. To be added when additional information becomes available.	
	Air Toxics Emitted		lbs/lbs	Information not available. To be added when additional information becomes available.	
	Mercury Released		lbs/lbs	Information not available. To be added when additional information becomes available.	
	Lead Released		lbs/lbs	Information not available. To be added when additional information becomes available.	
	Dioxins Released		lbs/lbs	Information not available. To be added when additional information becomes available.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
GAC: virgin coconut-based	Energy Used		Mbtu/lbs	Calculated using information from the cited reference. See support file for calculations.	Use of Adsorbents for the Removal of Pollutants from Wastewaters, by Gordon McKay, published by CRC Press, 1995, ISBN 0849369207
	Electricity Used		MWh/lbs	Calculated using information from the cited reference. See support file for calculations.	
	All Water Used		gal x 1000/lbs	Calculated using information from the cited reference. See support file for calculations.	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted		lbs/lbs	Calculated using information from the cited reference. See support file for calculations.	
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs	Not calculated	
	Solid Waste Generated		tons/lbs	Information not available. To be added when additional information becomes available.	
	Haz. Waste Generated		tons/lbs	Information not available. To be added when additional information becomes available.	
	Air Toxics Emitted		lbs/lbs	Information not available. To be added when additional information becomes available.	
	Mercury Released		lbs/lbs	Information not available. To be added when additional information becomes available.	
	Lead Released		lbs/lbs	Information not available. To be added when additional information becomes available.	
	Dioxins Released		lbs/lbs	Information not available. To be added when additional information becomes available.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Gasoline Produced	Energy Used	21	Mbtu/gal	EUROPA ELCD - All forms of energy summed and converted to Mbtus per gallon of product.	Primary NREL LCI File: -SS_crude oil, in refinery.xls Secondary NREL LCI File: -SS_crude oil, at production.xls EUROPA file location: Gasoline at refinery: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/5f62ed77-85d0-4c99-8d2c-be56951d8fb3_02.00.000.html
	Electricity Used	0.00059	MWh/gal	Not provided by EUROPA ELCD. NREL LCI includes electricity usage for crude oil, in refinery with an allocation to diesel. Electricity from crude oil, in refinery (allocated to diesel) and crude oil, at production are included.	
	All Water Used	0.00079	gal x 1000/gal	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per gallon of product	
	Potable Water Used		gal x 1000/gal	Not applicable -- no local potable water used during gasoline production.	
	Groundwater Extracted		gal x 1000/gal	Not applicable -- no local or on-site ground water extracted during gasoline production.	
	CO2e Emitted	4.4	lbs/gal	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per gallon of product.	
	NO x Emitted	0.008	lbs/gal	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per gallon of product.	
	SO x Emitted	0.019	lbs/gal	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per gallon of product.	
	PM Emitted	0.00052	lbs/gal	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per gallon of product.	
	Solid Waste Generated	0.00000042	tons/gal	EUROPA ELCD - Sum of all listed wastes (demolition debris) except for radioactive wastes, slag, and mining wastes, which would likely not be disposed of in a landfill.	
	Haz. Waste Generated	0	tons/gal	EUROPA ELCD - "Chemical waste, toxic" converted into tons per pound of product. No hazardous waste is listed in EUROPA for diesel production, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.00016	lbs/gal	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported as pounds per gallon of product.	
	Mercury Released	0.000000085	lbs/gal	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water. Reported as pounds per gallon of product.	
	Lead Released	0.0000022	lbs/gal	EUROPA ELCD - Sum of all lead and lead compounds released to air or water. Reported as pounds per gallon of product.	
	Dioxins Released	3.1E-14	lbs/gal	EUROPA ELCD - Sum of all dioxins released to air or water. Reported as pounds per gallon of product.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Gravel/sand/clay	Energy Used	55	Mbtu/ton	EUROPA ELCD - All forms of energy summed and converted to Mbtus per short ton of product.	EUROPA file Location: Gravel 2/32: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/898618b2-3306-11dd-bd11-0800200c9a66_02.00.000.html
	Electricity Used	0.0027	MWh/ton	Not provided by EUROPA ELCD. Arbitrarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33%)	
	All Water Used	0.13	gal x 1000/ton	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per short ton of product.	
	Potable Water Used		gal x 1000/ton	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/ton	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	6.7	lbs/ton	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per short ton of product.	
	NO x Emitted	0.033	lbs/ton	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per short ton of product.	
	SO x Emitted	0.03	lbs/ton	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per short ton of product.	
	PM Emitted	0.004	lbs/ton	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per short ton of product.	
	Solid Waste Generated	0	tons/ton	EUROPA ELCD - There is no indication of generated solid waste that would be disposed ofat a landfill. Typical wastes indicated include radioactive wastes, mining wastes, and slag (expected to be used in some form elsewhere in industry).	
	Haz. Waste Generated	0	tons/ton	EUROPA ELCD - "Chemical waste, toxic" converted into tons per pound of product. No hazardous waste is listed in EUROPA for gravel/sand, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.00000041	lbs/ton	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported in pounds per short ton of product.	
	Mercury Released	6.4E-11	lbs/ton	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water. Reported in pounds per short ton of product.	
	Lead Released	1.2E-09	lbs/ton	EUROPA ELCD - Sum of all lead and lead compounds released to air or water. Reported in pounds per short ton of product.	
	Dioxins Released	1.5E-16	lbs/ton	EUROPA ELCD - Sum of all dioxins released to air or water. Reported in pounds per short ton of product.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
HDPE	Energy Used	31	Mbtu/lb	EUROPA ELCD - All forms of energy summed and converted to Mbtus per pound of product.	EUROPA file location: Polyethylene high density granulate (PE-HD) ; production mix, at plant: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/0704c700-2fb0-43c5-8803-bed8a6f1b968_02.00.000.html
	Electricity Used	0.00025	MWh/lb	Not provided by EUROPA ELCD. NREL LCI includes electricity usage for HDPE manufacturing. Electricity from polyvinyl chloride resin, at plant file and the following major subcomponent files is included in this estimate: Ethylene dichloride-vinyl chloride monomer, at plant; Ethylene, at plant; Chlorine, PVC producer average, at plant; Oxygen, liquid, at plant.	
	All Water Used	0.0023	gal x 1000/lb	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per pound.	
	Potable Water Used		gal x 1000/lb	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lb	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	1.9	lbs/lb	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per pound of product.	
	NO x Emitted	0.0032	lbs/lb	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.0041	lbs/lb	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.00064	lbs/lb	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated	0.00000043	tons/lb	EUROPA ELCD - Sum of all wastes except for mine wastes and toxic chemical wastes.	
	Haz. Waste Generated	0.000001	tons/lb	EUROPA ELCD - "Chemical waste, toxic" converted into tons per pound of product.	
	Air Toxics Emitted	0.0000034	lbs/lb	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	2.6E-09	lbs/lb	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	2.4E-09	lbs/lb	EUROPA ELCD - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released	9.8E-10	lbs/lb	EUROPA ELCD - Sum of all dioxins released to air or water.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Hydrochloric acid (30%, SG = 1.18)	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Hydrogen peroxide (50%, SG=1.19)	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Hydroseed	Energy Used	0.049	Mbtu/lbs	Assume content by weight as follows: - 90% water - 10% mulch - 0.3% nitrogen fertilizer - 0.5% seed Assume mulch is readily available wood waste product that is being recycled and has a negligible footprint. Assume water is obtained by pumping against a head of 50 psi with a 75% efficient pump and 75% efficient motor Assume seeds have a negligible footprint.	
	Electricity Used	1.46044E-07	MWh/lbs		
	All Water Used	0.00012	gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted	0.0046	lbs/lbs		
	NO x Emitted	0.0000027	lbs/lbs		
	SO x Emitted	0.000053	lbs/lbs		
	PM Emitted	0.00000028	lbs/lbs		
	Solid Waste Generated	0	tons/lbs		
	Haz. Waste Generated	0	tons/lbs		
	Air Toxics Emitted	0.00000081	lbs/lbs		
	Mercury Released	2E-11	lbs/lbs		
	Lead Released	1.29E-10	lbs/lbs		
	Dioxins Released	0	lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Lime	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Molasses	Energy Used	1.31	Mbtu/lbs	See attached support file titled "Derivation of Molasses Values from LCA Food"	Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk Sugar Production based on Danisco Sugar Author: Per H. Nielsen July 2003
	Electricity Used	0.000005	MWh/lbs	See attached support file titled "Derivation of Molasses Values from LCA Food"	
	All Water Used	0.000091	gal x 1000/lbs	See attached support file titled "Derivation of Molasses Values from LCA Food"	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	0.4	lbs/lbs	See attached support file titled "Derivation of Molasses Values from LCA Food"	
	NO x Emitted	0.003	lbs/lbs		
	SO x Emitted	0.0026	lbs/lbs		
	PM Emitted	0.00006	lbs/lbs		
	Solid Waste Generated	0	tons/lbs	Not available	
	Haz. Waste Generated	0	tons/lbs	Not available	
	Air Toxics Emitted	0	lbs/lbs	Not available	
	Mercury Released	0	lbs/lbs	Not available	
	Lead Released	0	lbs/lbs	Not available	
	Dioxins Released	0	lbs/lbs	Not available	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Natural Gas Produced	Energy Used	5.2	Mbtu/ccf	EUROPA ELCD - All forms of energy summed and converted to Mbtus per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot (approximately 20 liters per mole of methane).	EUROPA file location: Natural Gas at consumer: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/3d602e55-aaa2-44e3-adb9-40f49eb1a915_02.00.000.html
	Electricity Used	0.00025	MWh/ccf	Not provided by EUROPA ELCD. Arbritrarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33%)	
	All Water Used	0.000077	gal x 1000/ccf	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	Potable Water Used		gal x 1000/ccf	Not applicable -- no local potable water used during natural gas production.	
	Groundwater Extracted		gal x 1000/ccf	Not applicable -- no local or on-site ground water extracted during natural gas production.	
	CO2e Emitted	2.2	lbs/ccf	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	NO x Emitted	0.0037	lbs/ccf	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	SO x Emitted	0.0046	lbs/ccf	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	PM Emitted	0.000072	lbs/ccf	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	Solid Waste Generated	0	tons/ccf	EUROPA ELCD - There is no indication of generated solid waste that would be disposed ofat a landfill. Typical wastes indicated include radioactive wastes, mining wastes, and slag (expected to be used in some form elsewhere in industry).	
	Haz. Waste Generated	0	tons/ccf	EUROPA ELCD - No hazardous waste is listed in EUROPA for natural gas production, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.0000061	lbs/ccf	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported as pounds per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	Mercury Released	0.000000021	lbs/ccf	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water. Reported as pounds per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	Lead Released	0.0000009	lbs/ccf	EUROPA ELCD - Sum of all lead and lead compounds released to air or water. Reported as pounds per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	
	Dioxins Released	5.1E-14	lbs/ccf	EUROPA ELCD - Sum of all dioxins released to air or water. Reported as pounds per hundred cubic feet (ccf) of product, assuming 0.05 pounds per cubic foot.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Nitrogen fertilizer	Energy Used	16.6	Mbtu/lbs	NREL - Consistent with www.eia.gov calculators, coal assumed to have an energy content of 10,000 btu per pound, and natural gas is assumed to have an energy content of 1,000 btus. Electricity at the grid is assumed to be generated with 33% thermal efficiency and 10% loss from transmission.	Primary NREL LCI File: -SS_Nitrogen fertilizer, production mix, at plant.xls All supporting files.
	Electricity Used	0.000023	MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted	1.5	lbs/lbs	NREL - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide.	
	NO x Emitted	0.00078	lbs/lbs	NREL - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.0174	lbs/lbs	NREL - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.000067	lbs/lbs	NREL - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted	0.00026	lbs/lbs	NREL - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	6.1E-09	lbs/lbs	NREL - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	0.000000038	lbs/lbs	NREL - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Phosphorus fertilizer	Energy Used	3.39	Mbtu/lbs	NREL - Consistent with www.eia.gov calculators natural gas is assumed to have an energy content of 1,000 btus. Electricity at the grid is assumed to be generated with 33% thermal efficiency and 10% loss from transmission.	
	Electricity Used	0.000073	MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted	0.35	lbs/lbs	NREL - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide.	
	NO x Emitted	0.0017	lbs/lbs	NREL - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.017	lbs/lbs	NREL - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.00011	lbs/lbs	NREL - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted	0.000052	lbs/lbs	NREL - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	2.1E-09	lbs/lbs	NREL - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	0.000000048	lbs/lbs	NREL - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Polymer	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Potable Water Produced	Energy Used	9.2	Mbtu/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. All forms of energy summed and converted to Mbtus per thousand gallons of product.	EUROPA file location: Drinking water from surface water and drinking water from groundwater: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/db009014-338f-11dd-bd11-0800200c9a66_02.00.000.html http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/db009013-338f-11dd-bd11-0800200c9a66_02.00.000.html
	Electricity Used	0.00044	MWh/gal x 1000	Not provided by EUROPA ELCD. Arbitrarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33% and divided by 3,413 Mbtu/MWh to convert to MWh).	
	All Water Used	0.021	gal x 1000/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per thousand gallons of product. The EUROPA file provides all of the water required to produce on gallon of water leavingt the treatment plant. In this analysis, the 1 gallon that is used is tracked separately ("potable water used"). Therefore, for this analysis, the water required to produce one gallon of water is the EUROPA value (1.21 gallons per gallon) minus the 1 gallon that is used.	
	Potable Water Used		gal x 1000/gal x 1000	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/gal x 1000	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	5	lbs/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per thousand gallons of product.	
	NO x Emitted	0.0097	lbs/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per thousand gallons of product.	
	SO x Emitted	0.0059	lbs/gal x 1000	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per gallon of product.	
	PM Emitted	0.016	lbs/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per thousand gallons of product.	
	Solid Waste Generated	0.000000834	tons/gal x 1000	EUROPA ELCD - Sum of all listed wastes (demolition debris) except for radioactive wastes, slag, and mining wastes, which would likely not be disposed of in a landfill.	
	Haz. Waste Generated	0	tons/gal x 1000	EUROPA ELCD - No hazardous waste is listed in EUROPA for water production, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.000015	lbs/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported as pounds per thousand gallons of product.	
	Mercury Released	8.2E-09	lbs/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of all mercury and mercury compounds released to air or water. Reported as pounds per thousand gallons of product.	
	Lead Released	0.000000067	lbs/gal x 1000	EUROPA ELCD -Average of values from drinking water derived from surface water and from groundwater. Sum of all lead and lead compounds released to air or water. Reported as pounds per thousand gallons of product.	
	Dioxins Released	1E-13	lbs/gal x 1000	EUROPA ELCD - Average of values from drinking water derived from surface water and drinking water derived from groundwater. Sum of all dioxins released to air or water. Reported as pounds per thousand gallons of product.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Potassium permanganate	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
PVC	Energy Used	22	Mbtu/lbs	EUROPA ELCD - All forms of energy summed and converted to Mbtus per pound of product.	Primary NREL file for electricity: polyvinyl chloride resin, at plant file Secondary NREL files for electricity: Ethylene dichloride-vinyl chloride monomer, at plant; Ethylene, at plant; Chlorine, PVC producer average, at plant; Oxygen, liquid, at plant. EUROPA file location: Suspension Polymerisation PVC: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/129b8f8d-7667-41bc-91f4-421bfcdfc8c3_02.00.000.html
	Electricity Used	0.00056	MWh/lbs	Not provided by EUROPA ELCD. NREL LCI includes electricity usage for PVC manufacturing. Electricity from polyvinyl chloride resin, at plant file and the following major subcomponent files is included in this estimate: Ethylene dichloride-vinyl chloride monomer, at plant; Ethylene, at plant; Chlorine, PVC producer average, at plant; Oxygen, liquid, at plant.	
	All Water Used	0.0069	gal x 1000/lbs	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to gallons per pound.	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	2.6	lbs/lbs	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per pound of product.	
	NO x Emitted	0.0048	lbs/lbs	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.0076	lbs/lbs	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.0012	lbs/lbs	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated	0.0000022	tons/lbs	EUROPA ELCD - Sum of all wastes except for mine wastes and toxic chemical wastes.	
	Haz. Waste Generated	0.0000016	tons/lbs	EUROPA ELCD - "Chemical waste, toxic" converted into tons per pound of product.	
	Air Toxics Emitted	0.00047	lbs/lbs	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	0.00000034	lbs/lbs	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	0.00000013	lbs/lbs	EUROPA ELCD - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released	6.9E-09	lbs/lbs	EUROPA ELCD - Sum of all dioxins released to air or water.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Sequestering agent	Energy Used		Mbtu/lbs		
	Electricity Used		MWh/lbs		
	All Water Used		gal x 1000/lbs		
	Potable Water Used		gal x 1000/lbs		
	Groundwater Extracted		gal x 1000/lbs		
	CO2e Emitted		lbs/lbs		
	NO x Emitted		lbs/lbs		
	SO x Emitted		lbs/lbs		
	PM Emitted		lbs/lbs		
	Solid Waste Generated		tons/lbs		
	Haz. Waste Generated		tons/lbs		
	Air Toxics Emitted		lbs/lbs		
	Mercury Released		lbs/lbs		
	Lead Released		lbs/lbs		
	Dioxins Released		lbs/lbs		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Sodium hydroxide (dry bulk)	Energy Used	6.6	Mbtu/lbs	EUROPA ELCD - All forms of energy summed and converted to Mbtus per pound of product.	EUROPA file location: Sodium Hydroxide, at plant 100%
	Electricity Used	0.00032	MWh/lbs	Not provided by EUROPA ELCD. Arbritrarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33%)	
	All Water Used	0.00115	gal x 1000/lbs	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per pound.	
	Potable Water Used		gal x 1000/lbs	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lbs	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	1.37	lbs/lbs	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per pound of product.	
	NO x Emitted	0.003	lbs/lbs	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.0048	lbs/lbs	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.00054	lbs/lbs	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated	0.000019	tons/lbs	EUROPA ELCD - All waste for steel production is listed as "unspecified". Until additional information is available, all "unspecified" waste has been included in the "solid waste generated" category, and no value is provided for hazardous waste.	
	Haz. Waste Generated	0.00000047	tons/lbs	EUROPA ELCD - All waste for steel production is listed as "unspecified". Until additional information is available, all "unspecified" waste has been included in the "solid waste generated" category, and no value is provided for hazardous waste.	
	Air Toxics Emitted	0.000062	lbs/lbs	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	0.00000022	lbs/lbs	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	0.000000025	lbs/lbs	EUROPA ELCD - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released	2.4E-14	lbs/lbs	EUROPA ELCD - Sum of all dioxins released to air or water.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Stainless Steel	Energy Used	11.6	Mbtu/lb	EUROPA ELCD - All forms of energy summed and converted to Mbtus per pound of product.	EUROPA file location: Stainless Steel: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/119e8cc1-0859-45ca-8f63-93a8a518ffd2_02.00.000.html
	Electricity Used	0.00056	MWh/lb	Not provided by EUROPA ELCD. Arbitrarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33%)	
	All Water Used	0.0023	gal x 1000/lb	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per pound.	
	Potable Water Used		gal x 1000/lb	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lb	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	3.4	lbs/lb	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per pound of product.	
	NO x Emitted	0.0075	lbs/lb	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.012	lbs/lb	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.0044	lbs/lb	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated	0.00062	tons/lb	EUROPA ELCD - All waste for steel production is listed as "unspecified". Until additional information is available, all "unspecified" waste has been included in the "solid waste generated" category, and no value is provided for hazardous waste.	
	Haz. Waste Generated	0	tons/lb	EUROPA ELCD - All waste for steel production is listed as "unspecified". Until additional information is available, all "unspecified" waste has been included in the "solid waste generated" category, and no value is provided for hazardous waste.	
	Air Toxics Emitted	0.000144	lbs/lb	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	0	lbs/lb	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	0.00000052	lbs/lb	EUROPA ELCD - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released	2.2E-12	lbs/lb	EUROPA ELCD - Sum of all dioxins released to air or water.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Steel	Energy Used	4.4	Mbtu/lb	EUROPA ELCD - All forms of energy summed and converted to Mbtus per pound of product.	Conversion numbers were based upon an avearage of the following three files, EUROPA file locations: Steel hot rolled section:http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/f9d4581e-14de-417e-8f9f-6c74e6f14051_02.00.000.html Steel hot rolled coil: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/119e8cc1-0859-45ca-8f63-93a8a518ffd2_02.00.000.html Steel rebar: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/268a11fb-baf2-4b9e-8867-38bea0e76ef6_02.00.000.html
	Electricity Used	0.00021	MWh/lb	Not provided by EUROPA ELCD or NREL. Arbitritarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33%)	
	All Water Used	0.00064	gal x 1000/lb	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per pound.	
	Potable Water Used		gal x 1000/lb	Not applicable -- no local potable water used.	
	Groundwater Extracted		gal x 1000/lb	Not applicable -- no local or on-site ground water extracted.	
	CO2e Emitted	1.1	lbs/lb	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per pound of product.	
	NO x Emitted	0.0014	lbs/lb	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per pound of product.	
	SO x Emitted	0.0017	lbs/lb	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per pound of product.	
	PM Emitted	0.00056	lbs/lb	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per pound of product.	
	Solid Waste Generated	0.00025	tons/lb	EUROPA ELCD - All waste for steel production is listed as "unspecified". Until additional information is available, all "unspecified" waste has been included in the "solid waste generated" category, and no value is provided for hazardous waste.	
	Haz. Waste Generated	0	tons/lb	EUROPA ELCD - EUROPA indicates all waste for steel production as "unspecified". Until additional information is available, all "unspecified" waste has been included in the "solid waste generated" category, and no value is provided for hazardous waste.	
	Air Toxics Emitted	0.000067	lbs/lb	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere.	
	Mercury Released	0.0000001	lbs/lb	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water.	
	Lead Released	0.0000025	lbs/lb	EUROPA ELCD - Sum of all lead and lead compounds released to air or water.	
	Dioxins Released	6.5E-12	lbs/lb	EUROPA ELCD - Sum of all dioxins released to air or water.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Tree: root ball	Energy Used	3.7	Mbtu/trees	Energy based on electricity required to pump water to water trees and gasoline for commute. For electricity assume 4 gallons of water (Keeling Nursery) at a total head of 50 psi,, 75% pump efficiency, 0.746 kW per horsepower, energy for electricity and electricity production. For gasoline, assume 0.025 gallons of gasoline based on a tree requiring 0.2 man hours over lifetime at nursery (Keeling Nursery), a 8-hour day, and a gallon of gasoline to commute to and from the nursery.	
	Electricity Used	0.0000019	MWh/trees		
	All Water Used	0.004	gal x 1000/trees	4 gallons of water over life-time in nursery based on verbal discussions with Keeling Nursery	
	Potable Water Used		gal x 1000/trees		
	Groundwater Extracted		gal x 1000/trees		
	CO2e Emitted	0.6	lbs/trees	All paramete values based on the energy consumption outlined above.	
	NO x Emitted	0.003	lbs/trees		
	SO x Emitted	0.00061	lbs/trees		
	PM Emitted	0.000029	lbs/trees		
	Solid Waste Generated	0.00000001	tons/trees		
	Haz. Waste Generated		tons/trees		
	Air Toxics Emitted	0.000006	lbs/trees	All paramete values based on the energy consumption outlined above.	
	Mercury Released	2.2E-09	lbs/trees		
	Lead Released	0.00000006	lbs/trees		
	Dioxins Released		lbs/trees		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Tree: whip	Energy Used		Mbtu/trees		
	Electricity Used		MWh/trees		
	All Water Used	0	gal x 1000/trees		
	Potable Water Used		gal x 1000/trees		
	Groundwater Extracted		gal x 1000/trees		
	CO2e Emitted		lbs/trees		
	NO x Emitted		lbs/trees		
	SO x Emitted		lbs/trees		
	PM Emitted		lbs/trees		
	Solid Waste Generated		tons/trees		
	Haz. Waste Generated		tons/trees		
	Air Toxics Emitted		lbs/trees		
	Mercury Released		lbs/trees		
	Lead Released		lbs/trees		
	Dioxins Released		lbs/trees		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Off-site waste water treatment	Energy Used	15	Mbtu/gal x 1000	Consistent with life-cycle total energy requirements for the Ann Abor waste water treatment plant and the average of all three waste water treatment plants in the study. See Table 5-2 of the referenced report.	Life-Cycle Energy and Emissions for Municipal Water and Wastewater Services: Case-Studies of Treatment Plants in US Malavika Tripathi, Center for Sustainable Systems, University of Michigan Report No. CSS07-06, April 17, 2007
	Electricity Used	0.00073	MWh/gal x 1000	Consistent with total energy for electricity for the Ann Abor waste water treatment plant and the average of all three waste water treatment plants in the study. See Figure 5-3 of the referenced report. Total energy converted to electricity usage assuming a 33% thermal efficiency.	
	All Water Used	0.00292	gal x 1000/gal x 1000	Assume that 50% of the CO2e results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. The conversion factor results from this electricity and diesel usage.	
	Potable Water Used		gal x 1000/gal x 1000		
	Groundwater Extracted		gal x 1000/gal x 1000		
	CO2e Emitted	4.4	lbs/gal x 1000	Consistent with life-cycle total energy requirements for the Ann Abor waste water treatment plant and the average of all three waste water treatment plants in the study. See Table 5-2 of the referenced report.	
	NO x Emitted	0.016	lbs/gal x 1000	Calculated from acidification potential from NOx (Table 3-5 of the reference document) by dividing by an impact factor of 40.04 (Table 1-2 of the referenced document).	
	SO x Emitted	0.015	lbs/gal x 1000	Calculated from acidification potential from SOx (Table 3-5 of the reference document) by dividing by an impact factor of 50.79 (Table 1-2 of the referenced document).	
	PM Emitted	0.0017	lbs/gal x 1000	Assume that 50% of the CO2e results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. The conversion factor results from this electricity and diesel usage.	
	Solid Waste Generated	0.0024	tons/gal x 1000	Calcualted from approximate average of 15,000 metric tons of sludge taken to landfill (see Table 3-1 of referenced report), converted to short tons, and assuming sludge generation from 19 million gallons of wastewater per day (see page 53 of referenced report).	
	Haz. Waste Generated	0	tons/gal x 1000		
	Air Toxics Emitted	0.00058	lbs/gal x 1000	Assume that 50% of the CO2e results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. The conversion factor results from this electricity and diesel usage.	
	Mercury Released	0.000000037	lbs/gal x 1000	Assume that 50% of the CO2e results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. The conversion factor results from this electricity and diesel usage.	
	Lead Released	0.00000037	lbs/gal x 1000	Assume that 50% of the CO2e results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. The conversion factor results from this electricity and diesel usage.	
	Dioxins Released	3.45E-13	lbs/gal x 1000	Assume that 50% of the CO2e results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. The conversion factor results from this electricity and diesel usage.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Solid Waste Disposal	Energy Used	160	Mbtu/ton	EUROPA ELCD - All forms of energy summed and converted to Mbtus per short ton disposed of.	EUPOA ECLD file location: Inert waste disposal: http://lca.jrc.ec.europa.eu/lcainfohub/datasets/html/processes/64197304-3307-11dd-bd11-0800200c9a66_02.00.000.html Inert waste used so that methane and carbon dioxide from decomposing waste is not included.
	Electricity Used	0.0077	MWh/ton	Not provided by EUROPA ELCD. Arbitrarily taken as 50% of all energy consumed assuming a 33% thermal efficiency. (i.e., MWh 50% of Mbtus of energy multiplied by 33%)	
	All Water Used	0.15	gal x 1000/ton	EUROPA ELCD - Sum of "water", "surface water", "groundwater", and "river water". Negative values (indicating return of water to the hydrosphere) were not included. Sea water was also not included. Result converted to thousands of gallons per short ton disposed of.	
	Potable Water Used		gal x 1000/ton	Not applicable -- no local potable water used during waste disposal.	
	Groundwater Extracted		gal x 1000/ton	Not applicable -- no local or on-site ground water extracted during waste disposal.	
	CO2e Emitted	25	lbs/ton	EUROPA ELCD - Sum of total global warming potential for carbon dioxide, methane, and nitrous oxide released to atmosphere. A global warming potential of 21 is used for methane and a global warming potential of 310 is used for nitrous oxide. Results converted to pounds of carbon dioxide equivalents per short ton disposed of.	
	NO x Emitted	0.14	lbs/ton	EUROPA ELCD - Sum of nitrogen oxides emitted to atmosphere. Results converted to pounds of NO x per short ton disposed of.	
	SO x Emitted	0.075	lbs/ton	EUROPA ELCD - Sum of sulfur oxides emitted to atmosphere. Results converted to pounds of SO x per short ton disposed of.	
	PM Emitted	0.4	lbs/ton	EUROPA ELCD - Sum of particulate matter (PM 10 and smaller) emitted to atmosphere. Results converted to pounds of PM per short ton disposed of.	
	Solid Waste Generated	0.000008	tons/ton	EUROPA ELCD - Sum of all listed wastes (demolition debris) except for radioactive wastes, slag, and mining wastes, which would likely not be disposed of in a landfill.	
	Haz. Waste Generated	0	tons/ton	EUROPA ELCD - No hazardous waste is listed in EUROPA for water production, suggesting that little or no hazardous waste is produced as a result of these activities.	
	Air Toxics Emitted	0.0014	lbs/ton	EUROPA ELCD - Sum of all hazardous air pollutants and groups of contaminants as defined by EPA (HAPs) emitted to atmosphere. Reported as pounds per short ton disposed of.	
	Mercury Released	0.00000097	lbs/ton	EUROPA ELCD - Sum of all mercury and mercury compounds released to air or water. Reported as pounds per short ton disposed of.	
	Lead Released	0.0000076	lbs/ton	EUROPA ELCD - Sum of all lead and lead compounds released to air or water. Reported as pounds per short ton disposed of.	
	Dioxins Released	1.2E-11	lbs/ton	EUROPA ELCD - Sum of all dioxins released to air or water. Reported as pounds per short ton disposed of.	

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Hazardous Waste Disposal	Energy Used	176	Mbtu/ton	For energy and all other parameters, values are calculated by assuming a 10% premium on values for solid waste disposal.	
	Electricity Used	0.0085	MWh/ton		
	All Water Used	0.165	gal x 1000/ton		
	Potable Water Used		gal x 1000/ton		
	Groundwater Extracted		gal x 1000/ton		
	CO2e Emitted	27.5	lbs/ton		
	NO x Emitted	0.154	lbs/ton		
	SO x Emitted	0.0825	lbs/ton		
	PM Emitted	0.44	lbs/ton		
	Solid Waste Generated	0.0000088	tons/ton		
	Haz. Waste Generated	0	tons/ton		
	Air Toxics Emitted	0.00154	lbs/ton		
	Mercury Released	0.000001067	lbs/ton		
	Lead Released	0.00000836	lbs/ton		
	Dioxins Released	1.32E-11	lbs/ton		

Default Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Laboratory Analysis	Energy Used	6.49	Mbtu/$	Based on the cited reference, approximatley 1 lb of CO2 is emitted per dollar of GDP. In the absence of other information, it is assumed that the laboratory also has an emission profile of approximately 1 lb of CO2 emitted per dollar of sample cost. Conversion factor estimates assume that 50% of this 1 lb of CO2 per dollar of sample cost results from electricity use (U.S. average fuel blend) and 50% is due to diesel use. A dollar of sample cost can then be converted into electricity and diesel usage. The conversion factors result from this electricity and diesel usage. Additionally, one gallon of potable water is added per $100 of analytical cost to account for water usage associated with lab activities.	U.S. CARBON DIOXIDE EMISSIONS AND INTENSITIES OVER TIME: A DETAILED ACCOUNTING OF INDUSTRIES, GOVERNMENT AND HOUSEHOLDS, APRIL 2010
	Electricity Used	0.00035	MWh/$		
	All Water Used	0.00066	gal x 1000/$		
	Potable Water Used		gal x 1000/$		
	Groundwater Extracted		gal x 1000/$		
	CO2e Emitted	1	lbs/$		
	NO x Emitted	0.0048	lbs/$		
	SO x Emitted	0.0036	lbs/$		
	PM Emitted	0.0004	lbs/$		
	Solid Waste Generated	0	tons/$		
	Haz. Waste Generated	0	tons/$		
	Air Toxics Emitted	0.00013	lbs/$		
	Mercury Released	8.4E-09	lbs/$		
	Lead Released	0.000000085	lbs/$		
	Dioxins Released	7.9E-14	lbs/$		

Actual Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Electricity production	Energy Used		Mbtu/MWh		
	Electricity Used		MWh/MWh		
	All Water Used	1.1	gal x 1000/MWh	Actual water usage based on the specific fuel blend (see attached support file titled "Power Sources and Global Emissions Factors for Electricity Provided by AmerenCIPS" for calculations).	Gleick PH. Water and energy. Annu. Rev. Energy Environ. Vol 19, 1994. p 267-99. Consumptive Water Use for U.S. Power Production
	Potable Water Used		gal x 1000/MWh		
	Groundwater Extracted		gal x 1000/MWh		
	CO2e Emitted	1990	lbs/MWh	Actual values for emissions for electricity production calculated based upon the fuel blend for the local electricity provider (AmerenCIPS). Emissions of CO2e, NOx, SOx, and PM for all fuel blends calculated using NREL LCI and includes resource extraction, transportation, and power generation. Actual values DO include resource extraction and transportation.	Primary NREL LCI Files: - SS_Electricity, natural gas, at power plant.xls - SS_Electricity, nuclear, at power plant.xls - SS_Electricity, bituminous coal, at power plant.xls Secondary NREL LCI files: - SS_Natural gas, processed, at plant.xls - SS_Fuel grade uranium, at regional storage.xls All Supporting NREL LCI files to the above files except for SS_Electricity, at grid, US.xls. CO2, NOx, SOx, and PM emissions provided by EGRID were used in place of this file to avoid circular references. No value used for "dummy" inputs.
	NO x Emitted	5.17	lbs/MWh		
	SO x Emitted	12.8	lbs/MWh		
	PM Emitted	1.274	lbs/MWh		
	Solid Waste Generated		tons/MWh		
	Haz. Waste Generated		tons/MWh		
	Air Toxics Emitted	0.5462	lbs/MWh	For all parameters, used output values from NREL for electricity production from natural gas, bituminous coal, and nuclear. For natural gas and bituminous coal, accounted only for direct combustion for energy production and did not account for resource extraction as it is anticipated to be negligible. For nuclear, accounted for major components of processing uranium (electricity, coal in industrial boiler, natural gas in industrial boiler, and diesel in industrial boiler). For electricity in uranium processing, assumed a 50/50 blend of bituminous coal and natural gas (excluded resource extraction). For actual values, applied output 74% bitum. coal, 3% hydro, 14% natural gas, 6% nuclear, 1% oil and 1% wind , which approximates the Ameren CIPS blend. Assumed no emissions/releases associated with hydro power. NREL output is for electricity at the power plant. All results are multiplied by 1.12 to account for additional electricity generated to offset transmission losses (1.12 = 1 MWh + 0.12 MWh for transmission losses, see above).	Primary NREL LCI Files: - SS_Electricity, natural gas, at power plant.xls - SS_Electricity, nuclear, at power plant.xls - SS_Electricity, bituminous coal, at power plant.xls Secondary NREL LCI files: - SS_Fuel grade uranium, at regional storage.xls - SS_Bituminous coal, combusted in industrial boiler.xls - SS_Natural gas, combusted in industrial boiler.xls - SS_Diesel, combusted in industrial boiler.xls
	Mercury Released	0.000032	lbs/MWh		
	Lead Released	0.00019	lbs/MWh		
	Dioxins Released		lbs/MWh		

Actual Environmental Footprint Conversion Factor References

Material/Fuel/Service	Green Indicator	Value	Units	Assumptions	Information Source
Electricity transmission	Energy Used		Mbtu/MWh		
	Electricity Used		MWh/MWh		
	All Water Used	0.132	gal x 1000/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	U.S. Dept. of Energy GridWorks: Overview of the Electric Grid http://sites.energetics.com/gridworks/grid.html Consumptive Water Use for U.S. Power Production December 2003 • NREL/TP-550-33905 Note relevant to all the entries for "electricity transmitted": "electricity transmitted" refers to the flow of electricity through the lines, which would have 0 emissions and resource use. Another aspect of electrical transmissions would be installation and maintenance of electrical transmission lines. This would result in emissions and resource use, but they would be very small when allocated per kWh transmitted. It would also be similar in concept to installation and maintenance of roadways for truck transportation, which we also do not account for in this analysis.
	Potable Water Used		gal x 1000/MWh		
	Groundwater Extracted		gal x 1000/MWh		
	CO2e Emitted	238.8	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	NO x Emitted	0.6204	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	SO x Emitted	1.536	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	PM Emitted	0.15288	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	Solid Waste Generated		tons/MWh		
	Haz. Waste Generated		tons/MWh		
	Air Toxics Emitted	0.065544	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	Mercury Released	0.00000384	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	Lead Released	0.0000228	lbs/MWh	Footprint associated with electricity that is generated but lost to transmission, using local fuel blend for electricity production	
	Dioxins Released		lbs/MWh		

Power Sources and Global Emissions Factors for Electricity Provided by AmerenCIPS

Type	% Used*	Water (gal/kWh)		CO2e (lbs/kWh)		NOx (lbs/kWh)		SOx (lbs/kWh)		PM (lbs/kWh)		HAPs (lbs/kWh)		Lead (lbs/kWh)		Mercury (lbs/kWh)		Dioxins (lbs/kWh)	
		Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted	Full Load	Adjusted
Biomass	0%	55	0	0	0	0.0015	0	0.00060	0	0.000084	0	0	0	0	0	0	0	0	0
Coal	74%	1.21	0.8954	2.4	1.776	0.0067	0.004958	0.015	0.0111	0.0017	0.001258	0.0007	0.000518	0.00000024	1.776E-07	0.000000042	3.108E-08	3.8E-13	3.40252E-13
Geothermal	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydro	3%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas	14%	1.15	0.161	1.4	0.196	0.0012	0.000168	0.012	0.00168	0.000088	0.00001232	0.000193	0.00002702	1.31E-08	1.834E-09	2.9E-09	4.06E-10	0	0
Nuclear	6%	1.13	0.0678	0.024	0.00144	0.000056	0.0000034	0.000131	0.00000786	0.0000126	0.000000756	0.0000053	0.000000318	5.2E-09	3.12E-10	4.6E-10	2.76E-11	2.9E-15	1.9662E-16
Oil	1%	1.13	0.0113	1.9	0.019	0.0036	0.0000360	0.0041	0.000041	0.00029	0.0000029	0.0000902	0.000000902	0.00000129	1.29E-08	1.01E-08	1.01E-10	1.04E-12	1.1752E-14
Solar	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wind	1%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other	0%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total based on kWh at plant	**99%**		**1.1**		**1.99**		**0.00517**		**0.0128**		**0.001274**		**0.0005462**		**0.00000019**		**0.000000032**		**3.5E-13**
Total based on kWh at point of use (0.12 kWh/kWh lost in transmission)			**1.2**		**2.23**		**0.00579**		**0.0143**		**0.001427**		**0.000612**		**0.00000021**		**0.000000036**		**3.9E-13**

** Provided by AmerenCIPs by phone on April 15, 2010*

Notes:

*- Water consumption for thermoelectric power plants in Illinois - 1.05 gallons per kWh**

- Water consumption for hydroelectric power assumed to be 0 gallons per kWh (i.e., considers evaporation from reservoir as non-additive)

*- Water consumption for coal resource extraction and fuel processing - 0.16 gallons per kWh***

*- Water consumption for uranium resource extraction and fuel processing - 0.082 gallons per kWh***

*- Water consumption for natural gas resource extraction and fuel processing - 0.10 gallons per kWh***

*- Water consumption for biomass based on 55 gallons per kWh****

*- CO2e, Nox, SOx, and PM emissions from NREL LCI for each fuel type *****

** Consumptive Water Use for U.S. Power Production, December 2003 • NREL/TP-550-33905*

*** Gleick PH. Water and energy. Annu. Rev. Energy Environ. Vol 19, 1994. p 267-99.*

**** The Water Footprint of Energy Consumption : an Assessment of Water Requirements of Primary Energy Carriers, Winnie Gerbens-Leenes, Arjen Hoekstra, Theo an der Meer, ISESCO Science and Technology Vision, Volume 4 - Number 5, May 2008*

***** "NREL LCI" refers to the U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (www.nrel.gov/lci) maintained by the Alliance for Sustainable Energy, LLC.*

Electricity and Energy Used for the Production, Transmission, and On-Site Use of Electricity

For the purpose of this study, the sum of the "energy used" for "electricity production", "electricity transmission", and "on-site electricity use" equals the total amount of energy used to generate the 1 MWh used by the consumer. According to the U.S. Dept. of Energy (GridWorks: Overview of the Electric Grid http://sites.energetics.com/gridworks/grid.html) approximately power plants have a thermal efficiency of approximately 33% and the transmission of electricity results in a loss of approximately 10% of the electricity produced. In addition, the National Renewable Energy Laboratory (Consumptive Water Use for U.S. Power Production December 2003 • NREL/TP-550-33905) states that thermoelectric plants use approximately 5% of the gross electricity produced for on-site demand (i.e., parasitic loads).

This study assumes that the 33% thermal efficiency includes the 5% parasitic load.

For use of 1 MWh of electricity on-site, the following calculations illustrate the electricity and energy used.

$$G = P + T + U$$
$$G = 5\%G + 10\%G + 1$$
$$G(1 - 15\%) = 1$$
$$G = 1.18$$

where

G = *electricity generated* (MWh)
P = *parasitic load* (MWh): 5% *of* G
T = *transmission loss* (MWh): 10% *of* G
U = *energy used onsite* (MWh)

$$P = 5\% \times 1.18 = 0.06\ MWh$$
$$T = 10\% \times 1.18 = 0.12\ MWh$$

$$E_I = E_P + E_T + E_U$$
$$E_U + E_T = \eta \times E_I$$

$$E_U = 1\ MWh \times \frac{3{,}413\,btu}{MWh} = 3{,}413\,btu$$
$$E_T = 0.12\ MWh \times \frac{3{,}413\,btu}{MWh} = 410\,btu$$

$$E_I = \frac{(3{,}413 + 410)}{33\%} = 11{,}584\,btu$$

$$E_P = 11{,}584 - 3{,}413 - 410 = 7{,}761\,btu$$

where

E_I = *energy input* (btu)
E_P = *energy lost electricity production (thermal loss and parasitic load)* (btu)
E_T = *energy lost electricity transmission* (btu)
E_U = *energy used onsite in the form of electricity* (btu)
η = *thermal efficiency* (33%)

Virgin and Regenerated GAC Footprints

Information from Literature

Use of Adsorbents for the Removal of Pollutants from Wastewaters, by Gordon McKay, published by CRC Press, 1995, ISBN 0849369207

Table 8.1

Granular Carbon Regeneration Process Energy Requirements (15,000 kg/day Regeneration Rate)			
System	**Fuel, kJ/kg**	**Electricity, kWh/kg**	**Steam, kg/kg**
Electric infrared furnace	0	0.36	0
Multiple-hearth furnace	18,600	0.10	1.0
Rotary Kiln	23,300	0.07	1.0
Fluid bed furnace	11,700	0.11	0.8

1.2		Specific gravity of coal (www.engineeringtoolbox.com)
0.5		Specific gravity of GAC (Westates/Siemens)
0.7		Fraction of coal that is carbon (http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html)
0.015		Fraction of coal that is sulfur (http://www.eia.doe.gov/cneaf/coal/quarterly/co2_article/co2.html)
0.015		Fraction of coal that is nitrogen (assumed to be similar to that of sulfur)
0.27	lb CO2e/lb	Carbon footprint of extracting and delivering 1 lb of coal to a plant (EUROPA ELCD - Hard Coal)
0.0007	lb SO2/lb	Sulfur dioxide (SOx) footprint of extracting and delivering 1 lb of coal (EUROPA ELCD - Hard Coal)
0.001	lb NO2/lb	Nitrogen dioxide (NOx) footprint of extracting and delivering 1 lb of coal (EUROPA ELCD - Hard Coal)
600	btu/lb	Energy requirement of extracting and delivering 1 lb of coal to plant (EUROPA ELCD)
0.38	gal/lb	Water requirement of extracting and delivering 1 lb of coal to plant (EUROPA ELCD)
14	lb CO2e	Carbon footprint of natural gas, including natural gas production (per therm) (NREL, industrial boiler)
0.0046	lb SO2	SOx footprint of natural gas combustion per therm (NREL), including natural gas production (EUROPA ELCD)
0.0138	lb NO2	NOx footprint of natural gas combustion per therm (NREL), including natural gas production (EUROPA ELCD)
1.34	lb CO2e	Carbon footprint of electricity (per kWh) (EGRID, US Average)
0.0053	lb SO2	SOx footprint of electricity (per kWh) (EGRID, US Average)
0.00088	lb NO2	NOx footprint of electricity (per kWh) (EGRID, US Average)

Assumptions:

- Use fuel and electricity requirements for multiple hearth furnace to estimate energy required for regeneration
- Assume energy and water requirements for regeneration is the same as they are for initial activation

Calculations for Virgin Coal:

Carbon Footprint

2.4		Pounds of coal required to produce one pound of GAC
1.68		Pounds of that coal that is carbon
1		Pounds of carbon in one pound of GAC
0.68		Pounds of carbon from coal emitted to atmosphere
2.5	lb CO2e	Pounds of carbon dioxide emitted for burning off coal (measured as pounds of CO2)
0.65	lb CO2e	Pounds of CO2e emitted during coal extraction
8,920	btus	Fuel required to activate one pound of GAC (2.2 pounds per kg and 1.055 kJ/btu)
1.2	lb CO2e	Pounds of CO2e emitted for combustion of natural gas during activation (100,000 btus per therm)
0.045	kWh	Electricity required to activate one pound of GAC
0.061	lb CO2e	Pounds of CO2e emitted for electricity generation
4.5	lb CO2e	Total CO2e emitted for carbon activation

Energy Footprint

2.4		Pounds of coal required to produce one pound of GAC
1440	btus	Energy required during coal extraction
8,920	btus	Fuel required to activate one pound of GAC (2.2 pounds per kg and 1.055 kJ/btu)
0.045	kWh	Electricity required to activate one pound of GAC
470	btus	Energy required to generate that electricity (3,413 btus/kWh and 33% thermal efficiency)
10,800	btus	Total energy required for virgin carbon activation

SOx Footprint

2.4		Pounds of coal required to produce one pound of GAC
0.036		Pounds of that coal that is sulfur
0		Pounds of sulfur in one pound of GAC
0.036		Pounds of sulfur from coal emitted to atmosphere
0.072	lb SO2	Pounds of sulfur dioxide emitted for burning off coal (measured as pounds of SO2)
0.00168	lb SO2	Pounds of SO2 emitted during coal extraction
8,920	btus	Fuel required to activate one pound of GAC (2.2 pounds per kg and 1.055 kJ/btu)
0.00041	lb SO2	Pounds of SO2 emitted for combustion of natural gas during activation (100,000 btus per therm)
0.045	kWh	Electricity required to activate one pound of GAC
0.00024	lb SO2	Pounds of SO2 emitted for electricity generation
0.074	lb SO2	Total SO2 emitted for carbon activation

NOx Footprint

2.4		Pounds of coal required to produce one pound of GAC
0.036		Pounds of that coal that is nitrogen
0		Pounds of nitrogen in one pound of GAC
0.036		Pounds of nitrogen from coal emitted to atmosphere
0.12	lb NO2	Pounds of nitrogen dioxide emitted for burning off coal (measured as pounds of NO2)
0.0024	lb NO2	Pounds of NO2 emitted during coal extraction
8,920	btus	Fuel required to activate one pound of GAC (2.2 pounds per kg and 1.055 kJ/btu)
0.00123	lb NO2	Pounds of NO2 emitted for combustion of natural gas during activation (100,000 btus per therm)
0.045	kWh	Electricity required to activate one pound of GAC
0.00004	lb NO2	Pounds of NO2 emitted for electricity generation
0.12	lb NO2	Total NO2 emitted for carbon activation

Calculations for Regenerated Coal

Footprint per Regeneration Cycle (including 10% virgin GAC to make-up for loss)

Energy	CO2e	NOx	SOx
9500	1.6	0.014	0.008

Footprints over 10 Regeneration Cycles

Cycle	Energy	CO2e	NOx	SOx
1	10,800	4.50	0.12	0.074
2	10,200	3.1	0.069	0.041
3	9,900	2.6	0.051	0.03
4	9,800	2.3	0.041	0.025
5	9,800	2.2	0.036	0.021
6	9,700	2.1	0.032	0.019
7	9,700	2	0.03	0.017
8	9,700	2	0.028	0.016
9	9,600	1.9	0.026	0.015
10	9,600	1.9	0.025	0.015

Calculations for Water Footprint

Use Siemens Water Technologies (formerly Westates Carbon) in Parker, AZ as a basis

4,000 tons/yr hazardous spent carbon treated at Siemens

Each year, Siemens receives about 4,000 tons of spent carbon from 30 - 35 states across the United States. About half of this is considered hazardous waste by EPA.

source: http://www.epa.gov/region09/waste/siemens/

EPA Web Page on Siemens Carbon Regeneration Facility (last updated Dec 2007), see third paragraph on first page

conversion: 2,000 lb/ton

8,000,000 lbs/yr spent carbon treated

138,000 gallons/day wastewater discharged by Siemens to POTW

source: Fact Sheet for NPDES Permit for Colorado River Sewage System Joint Venture (EPA June 2001) -- hard copy in EPA files

page 1, General Information: Westates Carbon discharges about 138,000 gallons per day of process waste water used in the air pollution control unit, equipment/facility washdown, and slurry spent carbon.

conversion: 365 days/yr

50,370,000 gal/yr wastewater discharged

as an estimate, assume this is equal to the amount of fresh water withdrawn for processing spent carbon

this assumption will lead to an underestimate of the water withdrawn because water is "lost" as steam in the stack gases (note also that some of the steam exiting in the stack gases is due to products of combustion, rather than volatilization of water introduced into the system as liquid)

50,370,000 gal/yr fresh water withdrawn

6.3 gallons H2O / lb carbon regenerated

Water Footprint for Coal Extraction

2.4		Pounds of coal required to produce one pound of GAC
0.91	gallons	Gallons of water consumed during extraction of the coal

7.2 Total gallons of water for generating one pound of virgin GAC

6.3 Gallons of water per pound of regenerated GAC (includes makeup GAC if the original GAC is produced at the same plant)

Footprints over 10 Regeneration Cycles

Cycle	Water
1	7.2
2	6.8
3	6.6
4	6.5
5	6.5
6	6.5
7	6.4
8	6.4
9	6.4
10	6.4

Derivation of Molasses Values from LCA Food

The LCA Food database (process and product files) indicates the following allocation of products from sugar production by weight
- Sugar - 1 ton
- Molasses - 0.24 tons
- Feed pills - 0.33
- Grass, cut off etc. - 0.53 tons

This is a total of 2.1 tons, of which molasses is 0.24 tons or 11.4%. For the purposes of this study the allocation of input and output data is based on weight (molasses is 11.4% of the products/byproducts by weight). This essentially equally distributes the inputs/outputs by weight evenly accross the various products and byproducts (e.g., the footprint of 1 lb of sugar would be the same as a footprint of one lb of molasses). Because molasses is a byproduct of sugar production, a more appropriate footprint for molasses might be to assign to molasses the footprint of the materials that it displaces in other applications, but insufficient information is known about the footprints of the various materials that molasses displaces to to assign an appropriate footprint values. However, LCA Food also accounts for some assumed offset to the footprint by assuming production byproducts displace some animal feed. Overall, this described approach for determining the molasses footprint, results in a lower footprint than what is reported for sugar because the footprint is distributed amongst various products/byproducts by weight and constructive use of some byproducts is assumed.

All relevant inputs and outputs are multiplied by 11.4% to allocate the input/output to molasses and multiplied by 4.17 (i.e., 1/0.24) to obtain one unit of molasses (rather than 0.24 units). Combined, this is a factor of 0.475.

General Conversion Factors Used in Calculations

3.29	kg/gal	density of diesel (NREL - Crude Oil)
139	Mbtu/gal	heat content of diesel (Climate Leaders)
0.027224	L/tkm	diesel usage per ton-kilometer of transport (NREL
3.785	L/gal	standard conversion
3.413	Mbtu/kWh	standard conversion
10%		energy loss due to electricity transmission (Gridworks)
33%		thermal efficiency of power plant (Gridworks)
947.8	Mbtu/GJ	standard conversion
263.95	gal/m^3	standard conversion
2.2	lb/kg	standard conversion
2200	lb/ton	standard conversion of pounds to metric tons
0.00755556	lb/lb	ratio of Nox emission to CO2e emission for combustion of diesel in truck (NREL)
0.00015111	lb/lb	ratio of PM emission to CO2e emission for combustion of diesel in truck (NREL)

Energy Footprint

0.0112	kg diesel	diesel for farm machinery for crop harvesting for one metric ton of sugar
0.00340426	gal diesel	diesel for farm machinery for crop harvesting for one metric ton of sugar
0.47319149	Mbtu diesel	energy from diesel for farm machinery for crop harvesting for one metric ton of sugar
0.511	tkm	transportation of crops to factory for one metric ton of sugar
0.01391146	L	diesel for transportation (NREL) associated with production of one metric ton of sugar
0.00367542	gal	diesle for transportation (NREL) asspciated with production of one metric ton of sugar
0.511	Mbtu	energy from diesel for transportation for production of one metric ton of sugar
23	kWh	electricity for producing one metric ton of sugar
78.499	Mbtu	energy contained in electricity for producing one metric ton of sugar
86.3	Mbtu	energy in electricity from power plant (prior to transmission) for producing one metric ton of sugar
261.7	Mbtu	energy needed to produce electricity (including transmission losses) for one metric ton of sugar
6.1	GJ	energy for heat for industrial processsing of one metric ton of sugar
5,782	Mbtu	energy for heat for industrial processing of one metric ton of sugar
6,044.2	Mbtu/ton	total energy for producing 1 metric ton of sugar
2,871.01	Mbtu/ton	total energy for producing 1 metric ton of molasses (apply allocation conversion factor of 0.475)
1.31	Mbtu/lb	total energy for producing 1 lb of molasses (apply allocation conversion factor of 0.475)

Electricity Footprint

23	kWh/ton	electricity per metric ton of sugar
10.9	KWh/ton	electricity for producing 1 metric ton of molasses (apply allocation conversion factor of 0.475)
0.0050	KWh/lb	electricity for producing 1 pound of molasses (divide by 2200)

Water Footprint

1.6	m^3	water for industrial processing of one metric ton of sugar (i.e., no water for irrigation)
422.3	gal	water for industrial processing of one metric ton of sugar (i.e., no water for irrigation)
0.422	1000 gals.	water for industrial processing of one metric ton of sugar (i.e., no water for irrigation)
0.200603	1000 gals.	water for producing one metric ton of molasses (does not include any water for irrigation) (apply 0.475 factor)
0.000091	1000 gals./lb	water for producing one pound of molasses (does not include any water for irrigation) (divide by 2200)

Carbon Footprint

840.0	g/kg	carbon dioxide equivalents emitted per production of one kg of sugar
0.84	lb/lb	carbon dioxide equivalents emitted per production of one pound of sugar
0.40	lb/lb	carbon dioxide equivalents emitted per production of one pound of molasses (apply factor of 0.475)

NOx Footprint

840.0	g/kg	carbon dioxide equivalents emitted per production of one kg of sugar
6.3467	g/kg	approximated NOx equivalents emitted per production of one kg of sugar based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions
0.0063	lb/lb	approximated NOx equivalents emitted per production of one pound of sugar based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions
0.0030	lb/lb	approximated NOx equivalents emitted per production of one pound of molasses based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions (apply factor of 0.475)

SOx Footprint

5.5	g/kg	SOx equivalents emitted per production of one kg of sugar
0.0055	lb/lb	SOx equivalents emitted per production of one pound of sugar
0.0026	lb/lb	SOx equivalents emitted per production of one pound of molasses (apply factor of 0.475)

PM Footprint

840.0	g/kg	carbon dioxide equivalents emitted per production of one kg of sugar
0.1269	g/kg	approximated PM equivalents emitted per production of one kg of sugar based on scaling the carbon equilavent by the ratio of PM:CO2e emissions
0.000127	lb/lb	approximated PM equivalents emitted per production of one pound of sugar based on scaling the carbon equilavent by the ratio of PM:CO2e emissions
0.000060	lb/lb	approximated PM equivalents emitted per production of one pound of molasses based on scaling the carbon equilavent by the ratio of PM:CO2e emissions (apply factor of 0.475)

Insufficient information to estimate other footprints.

References

- Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk, Sugar Production based on Danisco Sugar, Author: Per H. Nielsen July 2003
- NREL - Transport - transport, combination truck, diesel powered
- NREL - Crude oil - crude oil, at refinery

"NREL" refers to the U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (www.nrel.gov/lci) maintained by the Alliance for Sustainable Energy, LLC.

Derivation of Cheese Whey Values from LCA Food

The LCA Food database (product and process files) indicates the following allocation of products from cheese production by weight under natural market conditions
- Cheese - 1 ton
- Whey - 8.5 tons (94% of which is water, only approximately 0.5 tons is solids)
- Cream - 0.68 tons

This is a total of 10.18 tons, of which whey is approximatley 83.5%. For the purposes of this study, the allocation of input and output data is based on weight (whey is 83.5% of the products/byproducts by weight). Because 8.5 times more whey is made for each pound of cheese, less cheese needs to be made to make one pound of whey. This essentially equally distributes the inputs/outputs by weight evenly accross the various products and byproducts (e.g., the footprint of 1 lb of cheese would be the same as a footprint of one lb of whey). Because whey is a byproduct of cheese production, a more appropriate footprint for whey might be to assign to whey the footprint of the materials that it displaces in other applications, but insufficient information is known about the footprints of the various materials that whey displaces to to assign an appropriate footprint values. However, LCA Food also accounts for some assumed offset to the footprint by assuming production byproducts displace some animal feed. Overall, this described approach for determining the whey footprint, results in a lower footprint than what is reported for cheese because the footprint is distributed amongst various products/byproducts by weight and constructive use of some byproducts is assumed.

All relevant inputs and outputs are multiplied by 83.5% to allocate the inputs/outputs to whey and multiplied by 0.118 (i.e., 1/8.5) to obtain one unit of whey (rather than 8.5 units). Combined, this is a factor of 0.098.

General Conversion Factors Used in Calculations

3.29	kg/gal	density of diesel (NREL - Crude Oil)
139	Mbtu/gal	heat content of diesel (Climate Leaders)
0.027224	L/tkm	diesel usage per ton-kilometer of transport (NREL
3.785	L/gal	standard conversion
3.413	Mbtu/kWh	standard conversion
10%		energy loss due to electricity transmission (Gridworks)
33%		thermal efficiency of power plant (Gridworks)
947.8	Mbtu/GJ	standard conversion
263.95	gal/m^3	standard conversion
2.2	lb/kg	standard conversion
2200	lb/ton	standard conversion of pounds to metric tons
0.00755556	lb/lb	ratio of Nox emission to CO2e emission for combustion of diesel in truck (NREL)
0.00015111	lb/lb	ratio of PM emission to CO2e emission for combustion of diesel in truck (NREL)

Energy Footprint

0.157	kg diesel	diesel for farm machinery for crop harvesting associated with one kg of cheese production
0.04772036	gal diesel	diesel for farm machinery for crop harvesting for one kg of cheese
6.6331307	Mbtu diesel	energy from diesel for farm machinery for crop harvesting for one kg of cheese
0	tkm	assume crops are co-located with cows and dairy such that transportation between feed and dairy is 0.
0	L	diesel for transportation (NREL) associated with production of one kg of cheese
0	gal	diesle for transportation (NREL) asspciated with production of one kg of cheese
0.000	Mbtu	energy from diesel for transportation for production of one kg of cheese
0	kWh	no electricity usage indicated for cheese production without quotas
0.000	Mbtu	no electricity usage indicated for cheese production without quotas
0.0	Mbtu	no electricity usage indicated for cheese production without quotas
0.0	Mbtu	no electricity usage indicated for cheese production without quotas
0.013	GJ	energy for heat for industrial processing of one kg of cheese
12.4	Mbtu	energy for heat for producing one kg of cheese
19.0	Mbtu/kg	total energy for producing 1 kg of cheese
1.87	Mbtu/lb	total energy for producing 1 lb of cheese whey solids (apply allocation conversion factor of 0.098)

Electricity Footprint

N/A	kWh	no electricity usage indicated for cheese production without quotas
N/A	kWh	no electricity usage indicated for cheese production without quotas
N/A	kWh	no electricity usage indicated for cheese production without quotas

Water Footprint

N/A	m^3	information not available for cheese processing without quotas
N/A	gal	information not available for cheese processing without quotas
N/A	1000 gals.	information not available for cheese processing without quotas
N/A	1000 gals.	information not available for cheese processing without quotas
N/A	1000 gals.	information not available for cheese processing without quotas

Carbon Footprint

11,200.0	g/kg	carbon dioxide equivalents emitted per production of one kg of cheese (ex dairy)
11.20	lb/lb	carbon dioxide equivalents emitted per production of one pound of cheese
1.10	lb/lb	carbon dioxide equivalents emitted per pound of cheese whey solids (apply factor of 0.098)

NOx Footprint

11,200.0	g/kg	carbon dioxide equivalents emitted per production of one kg of cheese
84.6222	g/kg	approximated NOx equivalents emitted per production of one kg of cheese based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions
0.0846	lb/lb	approximated NOx equivalents emitted per production of one pound of cheese based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions
0.0083	lb/lb	approximated NOx equivalents emitted per production of one pound of cheese whey solids based on scaling the carbon equilavent by the ratio of Nox:CO2e (apply factor of 0.098) emissions

SOx Footprint

101.0	g/kg	SOx equivalents emitted per production of one kg of cheese
0.1010	lb/lb	SOx equivalents emitted per production of one pound of cheese
0.0099	lb/lb	SOx equivalents emitted per production of one pound of cheese whey solids (apply factor of 0.098)

PM Footprint

11,200.0	g/kg	carbon dioxide equivalents emitted per production of one kg of cheese
1.6924	g/kg	approximated PM equivalents emitted per production of one kg of cheese based on scaling the carbon equilavent by the ratio of PM:CO2e emissions
0.001692	lb/lb	approximated PM equivalents emitted per production of one pound of cheese based on scaling the carbon equilavent by the ratio of PM:CO2e emissions
0.000166	lb/lb	approximated PM equivalents emitted per production of one pound of cheese whey solids based on scaling the carbon equilavent by the ratio of PM:CO2e emissions (apply factor of 0.098)

Insufficient information to estimate other footprints.

References

- Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk, Andersen M and Jensen JD (2003). Marginale producenter af udvalgte
- NREL - Transport - transport, combination truck, diesel powered
- NREL - Crude oil - crude oil, at refinery

"NREL" refers to the U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (www.nrel.gov/lci) maintained by the Alliance for Sustainable Energy, LLC.

Derivation of Vegetable Oil Values from LCA Food

The LCA Food database (vegetable oil product and rapeseed crushing process files) provides information for producing vegetable oil, with some of the byproducts used as animal feed. The LCA Food database assumes that that some of the offset animal feed is shipped from oversees, which is not likely applicable for farming and vegetable oil production in the U.S.

General Conversion Factors Used in Calculations

3.29	kg/gal	density of diesel (NREL - Crude Oil)
139	Mbtu/gal	heat content of diesel (Climate Leaders)
0.027224	L/tkm	diesel usage per ton-kilometer of transport (NREL
3.785	L/gal	standard conversion
3.413	Mbtu/kWh	standard conversion
10%		energy loss due to electricity transmission (Gridworks)
33%		thermal efficiency of power plant (Gridworks)
947.8	Mbtu/GJ	standard conversion
263.95	gal/m^3	standard conversion
2.2	lb/kg	standard conversion
2200	lb/ton	standard conversion of pounds to metric tons
0.00755556	lb/lb	ratio of Nox emission to CO2e emission for combustion of diesel in truck (NREL)
0.00015111	lb/lb	ratio of PM emission to CO2e emission for combustion of diesel in truck (NREL)

Energy Footprint

0.102	kg diesel	diesel for farm machinery for crop harvesting associated with one kg of vegetable oil
0.03100304	gal diesel	diesel for farm machinery for crop harvesting for one kg of vegetable oil
4.30942249	Mbtu diesel	energy from diesel for farm machinery for crop harvesting for one kg of vegetable oil
0.22	tkm	transportation of crops to factory for one kg of vegetable oil (assumes no oversees shipment of crops)
0.00598928	L	diesel for transportation (NREL) associated with production of one metric ton of cheese
0.00158237	gal	diesle for transportation (NREL) asspciated with production of one metric ton of cheese
0.220	Mbtu	energy from diesel for transportation for production of one metric ton of cheese
120	kWh/ton	electricity for crushing rapeseed for production of 1 metric ton of vegetable oil
0.12	kWh/kg	electricity for crushing rapeseed for production of 1 kg of vegetable oil
0.410	Mbtu	energy contained in electricity for producing one kg ton of processed oil
0.5	Mbtu	energy in electricity from power plant (prior to transmission) for producing one kg of processed oil
1.4	Mbtu	energy needed to produce electricity (including transmission losses) for one kg of processed oil
0.0021	GJ	energy for heat for industrial processing of one kg of vegetable oil
1.99	Mbtu	energy for heat for industrial processing of one kg of vegetable oil
7.9	Mbtu/kg	total energy for producing 1 kg of vegetable oil
3.6	Mbtu/lb	total energy for producing 1 lb of vegetable oil

Electricity Footprint

120	kWh/ton	electricity for crushing rapeseed for production of 1 metric ton of vegetable oil
0.12	kWh/kg	electricity for crushing rapeseed for production of 1 kg of vegetable oil
0.055	kWh/lb	electricity for producing 1 lb of vegetable oil
0.000055	MWh/lb	electricity for producing 1 lb of vegetable oil

Water Footprint

200.0	L	water required for processing 1 metric ton of oil (does not include water potentially used for crop irrigation)
52.8	gal	water required for processing 1 metric ton of oil
0.053	1000 gals.	water required for processing 1 metric ton of oil
0.000053	1000 gals.	water required for processing 1 kg of oil
0.000024	1000 gals./lb	water required for processing 1 lb of oil

Carbon Footprint

3,510.0	g/kg	carbon dioxide equivalents emitted per production of one kg of vegetable oil (ex factory)
3.51	lb/lb	carbon dioxide equivalents emitted per production of one pound of oil

NOx Footprint

3,510.0	g/kg	carbon dioxide equivalents emitted per production of one kg of vegetable oi;
26.5200	g/kg	approximated NOx equivalents emitted per production of one kg of vegetable oil based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions
0.0265	lb/lb	approximated NOx equivalents emitted per production of one pound of vegetable oil based on scaling the carbon equilavent by the ratio of Nox:CO2e emissions

SOx Footprint

31.0	g/kg	SOx equivalents emitted per production of one kg of vegetable oil
0.0310	lb/lb	SOx equivalents emitted per production of one pound of vegetable oil

PM Footprint

11,200.0	g/kg	carbon dioxide equivalents emitted per production of one kg of vegetable oil
1.6924	g/kg	approximated PM equivalents emitted per production of one kg of vegetable oil based on scaling the carbon equilavent by the ratio of PM:CO2e emissions
0.001692	lb/lb	approximated PM equivalents emitted per production of one pound of vegetable oil based on scaling the carbon equilavent by the ratio of PM:CO2e emissions

Insufficient information to estimate other footprints.

References

Nielsen PH, Nielsen AM, Weidema BP, Dalgaard R and Halberg N (2003). LCA food data base. www.lcafood.dk

Landbrugets rådgivningscenter (2000). Tal fra Fodermiddeltabellen, Raport nr. 91. In Danish.

Weidema BP (1999). System expansions to handle co-products of renewable materials. Presentation Summaries of the 7th LCA Case Studies Symposium SETAC-Europe, 1999. Pp. 45-48. pdf.

Weidema B (2003). Market information in life cycle assessments. Technical report, Danish Environmental Protection Agency (Environmental Project no. 863).

- NREL - Transport - transport, combination truck, diesel powered
- NREL - Crude oil - crude oil, at refinery

"NREL" refers to the U.S. Dept. of Energy, National Renewable Energy Laboratory (NREL), Life-Cycle Inventory Database (www.nrel.gov/lci) maintained by the Alliance for Sustainable Energy, LLC.

APPENDIX C

FOOTPRINT ANALYSIS SPREADSHEET OUTPUT

SPREADSHEET OUTPUT FILES

Figures C-1and C-2 illustrate the organization of the footprint analysis spreadsheets. Each remedy has a footprint analysis spreadsheet that receives the information from the remedy inventory sheets. The information and calculations from all of the footprint analysis spreadsheets are then compiled in a general or main spreadsheet. Each remedy footprint analysis spreadsheet refers to its own footprint conversion spreadsheet so that the footprint conversion factors can be changed by alternative if preferred. For each alternative, a total footprint is calculated and subtotals for on-site, electricity generation, transportation, and "other off-site" footprints are calculated.

This appendix provides all of the spreadsheet output for the BP analysis. The output from the main sheet is provided first, followed by the detailed spreadsheet output for each of the remedy alternatives. The charts illustrating the output are provided in the "Supplemental Charts" section of the report and are not reproduced here.

For this analysis the following assignments apply:

- Alternative A – Phytoremediation
- Alternative B – Leachate Extraction
- Alternative C – Cover Regrading

- Level 1 – Construction
- Level 2 – O&M
- Level 3 – Long-term Monitoring

Figure C-1. Organization of Files for Analysis

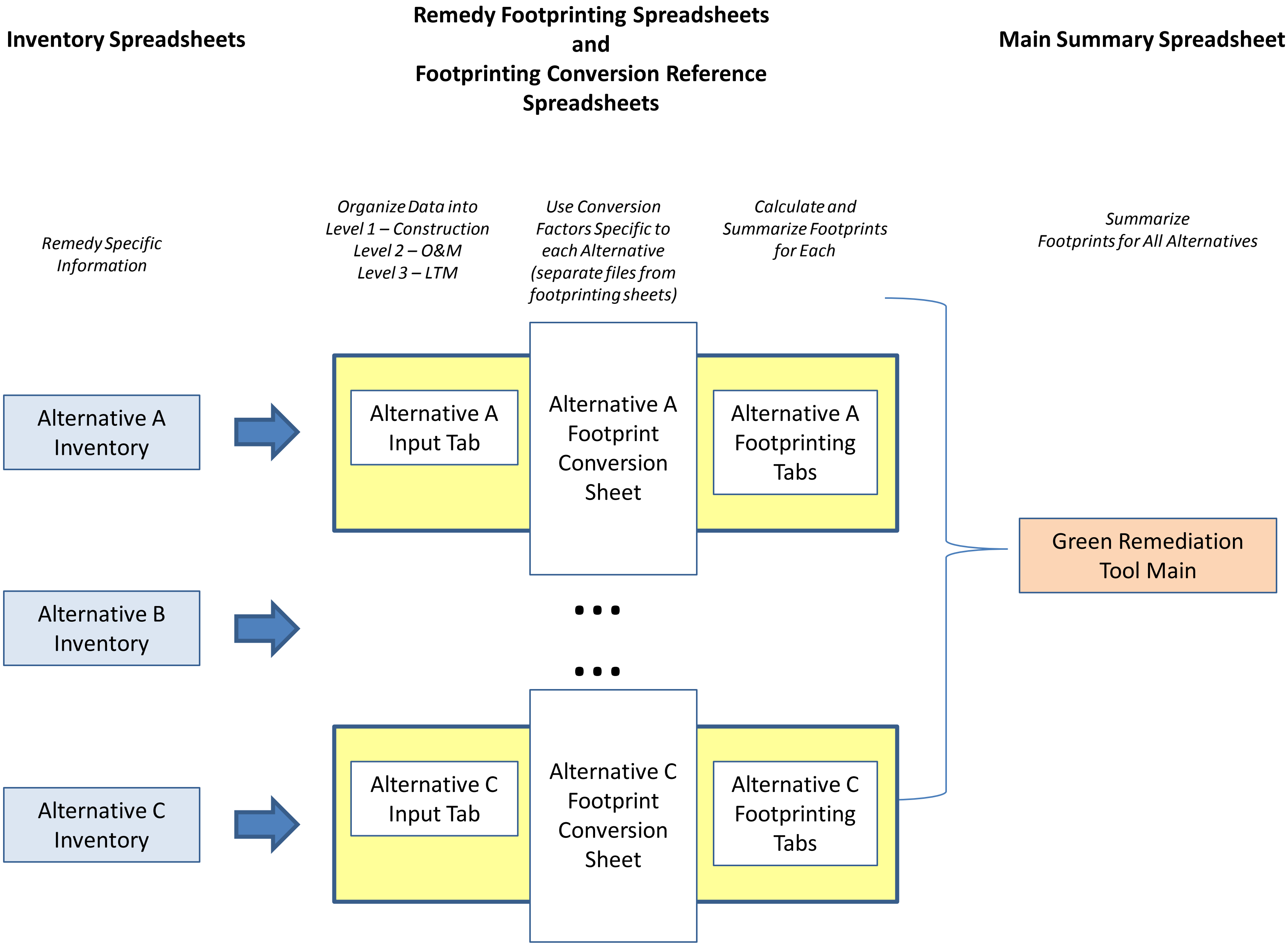
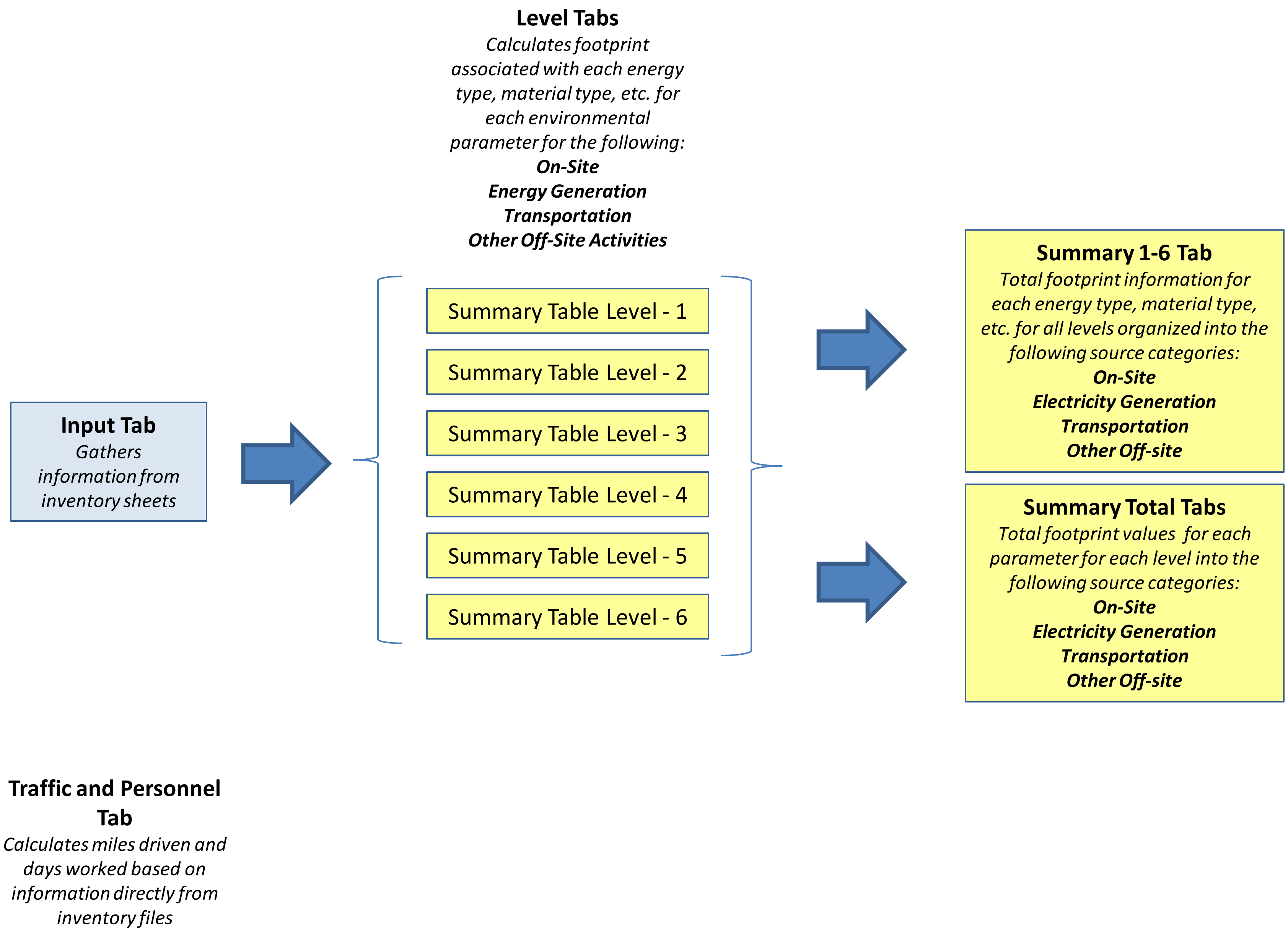


Figure C-2. Organization of Footprint Analysis Spreadsheets



Footprint Analysis Spreadsheets - General Output
BP, Wood River, IL - Primary Analysis

Variables In Alternative:

Level 1	Construction
Level 2	O&M
Level 3	LTM
Level 4	Not Used
Level 5	Not Used
Level 6	Not Used

File Path :

File Name	Baseline	Alternative Name
Green Remediation Tool Alternative A.xlsx	X	Phytoremediation
Green Remediation Tool Alternative B.xlsx		Leachate Extraction
Green Remediation Tool Alternative C.xlsx		Cover Regrading
Green Remediation Tool Alternative 10.xlsx		
Green Remediation Tool Alternative 10.xlsx		
Green Remediation Tool Alternative 10.xlsx		
Green Remediation Tool Alternative 10.xlsx		
Green Remediation Tool Alternative 10.xlsx		
Green Remediation Tool Alternative 10.xlsx		
Green Remediation Tool Alternative 10.xlsx		

Put an "X" in the "Baseline" column next to the alternative that should be considered the baseline when doing a scaled comparions of the various alternatives

Sheet Name:

	Comparison for Parameters Used, Extracted, Emitted, or Generated On-Site														
	Energy Used Mbtu	**Electricity Used MWh**	**All Water Used gal x 1000**	**Potable Water Used gal x 1000**	**Groundwater Extracted gal x 1000**	**CO2e Emitted lbs**	**NO x Emitted lbs**	**SO x Emitted lbs**	**PM Emitted lbs**	**Solid Waste Generated tons**	**Haz. Waste Generated tons**	**Air Toxics Emitted lbs**	**Mercury Released lbs**	**Lead Released lbs**	**Dioxins Released lbs**
Level 1 - Construction															
Phytoremediation	71,379.	0	0	0	0	11,553.	87.	3.	2.	22.5	0	0.0027	0	0	0
Leachate Extraction	315,219.	0	4.	0	4.	51,025.	386.	12.	8.	15.2	0	0.0118	0	0	0
Cover Regrading	2,485,624.	0	10.	10.	0	402,349.	3,040.	97.	61.	0	0	0.093	0	0	0
Level 2 - O&M															
Phytoremediation	128,270.	0	26.	26.4	0		112.			16.7	0	0.0239	0	0	0
Leachate Extraction	1,936,146.	487.	0	0	0	44,117.	304.	11.	4.	914.2	0	0.0376	0	0	0
Cover Regrading	815,927.	0	0	0	0	130,948.	899.	31.	14.	0	0	0.1126	0	0	0
Level 3 - LTM															
Phytoremediation	0	0	1.	0	1.	0	0	0	0	0	0	0	0	0	0
Leachate Extraction	0	0	1.	0	1.	0	0	0	0	0	0	0	0	0	0
Cover Regrading	0	0	1.	0	1.	0	0	0	0	0	0	0	0	0	0
Total (All Levels)															
Phytoremediation	199,649.	0	27.	26.4	1.		199.		-17.	39.2	0	0.0266	0	0	0
Leachate Extraction	2,251,365.	487.	5.	0	5.	95,142.	690.	23.	12.	929.4	0	0.0494	0	0	0
Cover Regrading	3,301,551.	0	11.	10.	1.	533,297.	3,939.	128.	75.	0	0	0.2056	0	0	0

	Comparison for Parameters Used, Extracted, Emitted, or Generated from Electricity Generation														
	Energy	**Electricity**	**All Water**	**Potable Water**	**Groundwater**	**CO2e**	**NO x**	**SO x**	**PM**	**Solid Waste**	**Haz. Waste**	**Air Toxics**	**Mercury**	**Lead**	**Dioxins**
	Used	**Used**	**Used**	**Used**	**Extracted**	**Emitted**	**Emitted**	**Emitted**	**Emitted**	**Generated**	**Generated**	**Emitted**	**Released**	**Released**	**Released**
	Mbtu	**MWh**	**gal x 1000**	**gal x 1000**	**gal x 1000**	**lbs**	**lbs**	**lbs**	**lbs**	**tons**	**tons**	**lbs**	**lbs**	**lbs**	**lbs**
Level 1 - Construction															
Phytoremediation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leachate Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cover Regrading	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 2 - O&M															
Phytoremediation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leachate Extraction	3,796,659.	29.	535.	0	0	968,635.	2,517.	6,230.	620.	0.4	0	265.8635	0.015576037	0.092482719	0.00000011682
Cover Regrading	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Level 3 - LTM															
Phytoremediation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leachate Extraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cover Regrading	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (All Levels)															
Phytoremediation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leachate Extraction	3,796,659.	29.	535.	0	0	968,635.	2,517.	6,230.	620.	0.4	0	265.8635	0.015576037	0.092482719	0.00000011682
Cover Regrading	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comparison for Total Parameters Used, Extracted, Emitted, or Generated from Transportation

	Energy Used Mbtu	Electricity Used MWh	All Water Used gal x 1000	Potable Water Used gal x 1000	Groundwater Extracted gal x 1000	CO2e Emitted lbs	NO x Emitted lbs	SO x Emitted lbs	PM Emitted lbs	Solid Waste Generated tons	Haz. Waste Generated tons	Air Toxics Emitted lbs	Mercury Released lbs	Lead Released lbs	Dioxins Released lbs
Level 1 - Construction															
Phytoremediation	526,263.	0	0	0	0	85,048.	631.	20.	12.	0	0	0.0298	0	0	0
Leachate Extraction	289,583.	0	0	0	0	46,672.	336.	11.	6.	0	0	0.0256	0	0	0
Cover Regrading	95,065.	0	0	0	0	15,259.	105.	3.	2.	0	0	0.0154	0.000000149	0.000001098	0.000000000002
Level 2 - O&M															
Phytoremediation	98,673.	0	0	0	0	15,616.	90.	3.	0	0	0	0.036	0.000000392	0.000002899	0.000000000004
Leachate Extraction	588,522.	58.	64.	0	0	178,113.	682.	762.	78.	0.1	0	31.9971	0.001869124	0.011097926	0.000000014018
Cover Regrading	686,376.	0	0	0	0	108,901.	645.	25.	6.	0	0	0.1861	0	0	0
Level 3 - LTM															
Phytoremediation	331,845.	0	0	0	0	52,563.	304.	12.	2.	0	0	0.0964	0	0	0
Leachate Extraction	331,845.	0	0	0	0	52,563.	304.	12.	2.	0	0	0.0964	0	0	0
Cover Regrading	332,506.	0	0	0	0	52,668.	304.	12.	2.	0	0	0.0966	0	0	0
Total (All Levels)															
Phytoremediation	956,781.	0	0	0	0	153,227.	1,025.	35.	14.	0	0	0.1622	0.000000392	0.000002899	0.000000000004
Leachate Extraction	1,209,950.	58.	64.	0	0	277,348.	1,322.	785.	86.	0.1	0	32.1191	0.001869124	0.011097926	0.000000014018
Cover Regrading	1,113,947.	0	0	0	0	176,828.	1,054.	40.	10.	0	0	0.2981	0.000000149	0.000001098	0.000000000002

	Comparison for Parameters Used, Extracted, Emitted, or Generated from Other Off-Site Activities														
	Energy Used Mbtu	**Electricity Used MWh**	**All Water Used gal x 1000**	**Potable Water Used gal x 1000**	**Groundwater Extracted gal x 1000**	**CO2e Emitted lbs**	**NO x Emitted lbs**	**SO x Emitted lbs**	**PM Emitted lbs**	**Solid Waste Generated tons**	**Haz. Waste Generated tons**	**Air Toxics Emitted lbs**	**Mercury Released lbs**	**Lead Released lbs**	**Dioxins Released lbs**
Level 1 - Construction															
Phytoremediation	398,780.	17.	54.	0	0	95,629.	145.	183.	47.	16.3	0	5.2876	0.007109591	0.170961996	0.000000425431
Leachate Extraction	293,338.	8.	156.	0	0	48,510.	106.	138.	19.	1.8	0.005	2.1892	0.001789858	0.023903446	0.000014077486
Cover Regrading	381,996.	12.	78.	0	0	55,591.	147.	259.	8.	0.007	0	2.2635	0.000906091	0.028183955	0.00000000056
Level 2 - O&M															
Phytoremediation	79,686.	2.	10.	0	0	14,193.	30.	78.	10.	0.1	0.002	0.7597	0.001004878	0.003856214	0.000000000347
Leachate Extraction	1,504,094.	71.	441.	0	0	405,805.	1,493.	1,398.	510.	196.8	0	49.5732	0.004280214	0.04711457	0.000000039415
Cover Regrading	305,917.	11.	185.	0	0	52,275.	130.	234.	11.	0.005	0	1.6711	0.000816423	0.022293567	0.000000000354
Level 3 - LTM															
Phytoremediation	2,038,726.	107.	204.	0	0	316,085.	1,482.	1,145.	123.	0	0	39.9635	0.002773729	0.031544481	0.000000318114
Leachate Extraction	2,038,726.	107.	204.	0	0	316,085.	1,482.	1,145.	123.	0	0	39.9635	0.002773729	0.031544481	0.000000318114
Cover Regrading	2,038,838.	107.	204.	0	0	316,108.	1,482.	1,146.	123.	0.004	0	39.9644	0.002774182	0.031556214	0.000000318114
Total (All Levels)															
Phytoremediation	2,517,192.	126.	268.	0	0	425,907.	1,657.	1,406.	180.	16.4	0.002	46.0108	0.010888198	0.206362691	0.000000743892
Leachate Extraction	3,836,158.	186.	801.	0	0	770,400.	3,081.	2,681.	652.	198.6	0.005	91.7259	0.008843801	0.102562497	0.000014435015
Cover Regrading	2,726,751.	130.	467.	0	0	423,974.	1,759.	1,639.	142.	0.016	0	43.899	0.004496696	0.082033736	0.000000319028

Comparison for TOTAL Parameters Used, Extracted, Emitted, or Generated

	Energy Used Mbtu	Electricity Used MWh	All Water Used gal x 1000	Potable Water Used gal x 1000	Groundwater Extracted gal x 1000	CO2e Emitted lbs	NO x Emitted lbs	SO x Emitted lbs	PM Emitted lbs	Solid Waste Generated tons	Haz. Waste Generated tons	Air Toxics Emitted lbs	Mercury Released lbs	Lead Released lbs	Dioxins Released lbs
Level 1 - Construction															
Phytoremediation	996,422.	17.	54.	0	0	192,230.	863.	206.	61.	38.8	0	5.3201	0.007109591	0.170961996	0.000000425431
Leachate Extraction	898,140.	8.	160.	0	4.	146,207.	828.	161.	33.	17.	0.005	2.2266	0.001789858	0.023903446	0.000014077486
Cover Regrading	2,962,685.	12.	88.	10.	0	473,199.	3,292.	359.	71.	0.007	0	2.3719	0.00090624	0.028185053	0.000000000562
Level 2 - O&M															
Phytoremediation	306,629.	2.	36.	26.4	0	-1,320,650.	232.	76.		16.8	0.002	0.8196	0.00100527	0.003859113	0.000000000351
Leachate Extraction	7,825,421.	645.	1,040.	0	0	1,596,670.	4,996.	8,401.	1,212.	1,111.5	0	347.4714	0.021725375	0.150695215	0.000000170253
Cover Regrading	1,808,220.	11.	185.	0	0	292,124.	1,674.	290.	31.	0.005	0	1.9698	0.000816423	0.022293567	0.000000000354
Level 3 - LTM															
Phytoremediation	2,370,571.	107.	205.	0	1.	368,648.	1,786.	1,157.	125.	0	0	40.0599	0.002773729	0.031544481	0.000000318114
Leachate Extraction	2,370,571.	107.	205.	0	1.	368,648.	1,786.	1,157.	125.	0	0	40.0599	0.002773729	0.031544481	0.000000318114
Cover Regrading	2,371,344.	107.	205.	0	1.	368,776.	1,786.	1,158.	125.	0.004	0	40.061	0.002774182	0.031556214	0.000000318114
Total (All Levels)															
Phytoremediation	3,673,622.	126.	295.	26.4	1.	-759,772.	2,881.	1,439.	177.	55.6	0.002	46.1996	0.01088859	0.20636559	0.000000743896
Leachate Extraction	11,094,132.	760.	1,405.	0	5.	2,111,525.	7,610.	9,719.	1,370.	1,128.5	0.005	389.7579	0.026288962	0.206143142	0.000014565853
Cover Regrading	7,142,249.	130.	478.	10.	1.	1,134,099.	6,752.	1,807.	227.	0.016	0	44.4027	0.004496845	0.082034834	0.00000031903

Alternative:	**Alternative A**
Alternative Name:	**Phytoremediation**
Path Name:	
Main File Name:	Green Remediation Tool Main.xlsx
Reference File Name:	Green Remediation Tool Reference 100110.xlsx
Module File Name:	Alt A - Phytoremediation inventory module.xlsx

Variables In Alternative:

Level 1	Construction
Level 2	O&M
Level 3	Monitoring
Level 4	Not Used
Level 5	Not Used
Level 6	Not Used

Usage Input - Alternative A

	Abbrev.	Units	Level 1 Construction	Level 2 O&M	Level 3 Monitoring	Level 4 Not Used	Level 5 Not Used	Level 6 Not Used	Total
ON-SITE									
Energy									
Diesel (on-site)		gal	512.5513	426.0499	0	0	0	0	938.6012
Gasoline (on-site use)		gal	1.083	556.8444	0	0	0	0	557.9274
Natural gas (on-site use)		ccf	0	0	0	0	0	0	0
On-site electricity use		MWh	0	0	0	0	0	0	0
Other Energy 1		TBD							0
Other Energy 2		TBD							0
Other Energy 3		TBD							0
Water									
Groundwater Extracted On-site		gal x 1000	0	0	1.2	0	0	0	1.2
Potable Water Used		gal x 1000	0	26.4	0	0	0	0	26.4
Other On-Site Water 1		gal x 1000							0
Other On-Site Water 2		gal x 1000							0
Other On-Site Water 3		gal x 1000							0
Waste Generation									
On-Site Solid Waste Generation		ton	22.5	16.66667	0	0	0	0	39.16667
On-Site Solid Waste Disposal		ton							0
On-Site Hazardous Waste Generation		ton	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		ton							0
Other									
On-site process emissions (HAPs)		lbs	0	0	0	0	0	0	0
On-site process emissions (GHGs)		lbs CO2e	0	0	0	0	0	0	0
On-site GHG storage		lbs CO2e	0	1370959	0	0	0	0	1370959
On-site Nox reduction		lbs		21					21
On-site SOx reduction		lbs		10					10
On-site PM reduction		lbs		20					20
Other 4		TBD							0
Other 5		TBD							0
ELECTRICITY GENERATION									
Electricity production		MWh	0	0	0	0	0	0	0
TRANSPORTATION									
Diesel (off-site use)		gal	3524	45	208.3	0	0	0	3777.3
Gasoline (off-site use)		gal	293.7667	743.7333	2442.667	0	0	0	3480.167
Natural gas (off-site use)		ccf							0
Potable Water Transported		gal x 1000	0	26.4	0	0	0	0	26.4
Electricity transmission		MWh	0	0	0	0	0	0	0
Other Transportation 1		TBD							0
Other Transportation 2									
Other Transportation 3									

Usage Input - Alternative A

	Abbrev.	Units	Level 1 Construction	Level 2 O&M	Level 3 Monitoring	Level 4 Not Used	Level 5 Not Used	Level 6 Not Used	Total
OFF-SITE OTHER									
Materials									
Asphalt		tons	0	0	0	0	0	0	0
Bentonite		tons	0	0	0	0	0	0	0
Borrow (clean soil)		tons	0	0	0	0	0	0	0
Cement		dry-ton	0	0	0	0	0	0	0
Cheese Whey		lbs	0	0	0	0	0	0	0
Concrete		tons	8	0	0	0	0	0	8
Diesel Produced		gal	4036.551	471.0499	208.3	0	0	0	4715.901
Emulsified vegetable oil		lbs	0	0	0	0	0	0	0
GAC: regenerated		lbs	0	0	0	0	0	0	0
GAC: virgin coal-based		lbs	0	0	0	0	0	0	0
GAC: virgin coconut-based		lbs	0	0	0	0	0	0	0
Gasoline Produced		gal	294.8497	1300.578	2442.667	0	0	0	4038.094
Gravel/sand/clay		ton	0	16.66667	0	0	0	0	16.66667
HDPE		lb	0	0	300	0	0	0	300
Hydrochloric acid (30%, SG = 1.18)		lbs	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)		lbs	0	0	0	0	0	0	0
Hydroseed		lbs	0	0	0	0	0	0	0
Lime		lbs	0	0	0	0	0	0	0
Molasses		lbs	0	0	0	0	0	0	0
Natural Gas Produced		ccf	0	0	0	0	0	0	0
Nitrogen fertilizer		lbs	0	739.2	0	0	0	0	739.2
Other Material #1		TBD	880	0	0	0	0	0	880
Other Material #2		TBD	0	120	0	0	0	0	120
Other Material #3		TBD	0	0.21875	0	0	0	0	0.21875
Other Material #4		TBD	0	2.559375	0	0	0	0	2.559375
Other Material #5		TBD	0	0	0	0	0	0	0
Phosphorus fertilizer		lbs	0	772.2	0	0	0	0	772.2
Polymer		lbs	0	0	0	0	0	0	0
Potable Water Produced		gal x 1000	0	0	0	0	0	0	0
Potassium permanganate		lbs	0	0	0	0	0	0	0
PVC		lbs	0	0	0	0	0	0	0
Sequestering agent		lbs	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)		lbs	0	3861	0	0	0	0	3861
Stainless Steel		lb	0	0	0	0	0	0	0
Steel		lb	65313	0	0	0	0	0	65313
Tree: root ball		trees	750	0	0	0	0	0	750
Tree: whip		trees	2996	0	0	0	0	0	2996
Off-Site Services									
Off-site waste water treatment		gal x 1000	0	0	1.2	0	0	0	1.2
Solid Waste Disposal		ton	22.5	16.66667	0	0	0	0	39.16667
Hazardous Waste Disposal		ton	0	0	0	0	0	0	0
Laboratory Analysis		$	0	0	304200	0	0	0	304200
Other 1		TBD							0
Other 2		TBD							0
Other 3		TBD							0
Other 4		TBD							0
Other 5		TBD							0
Other									
Other 1		TBD							0

Usage Input - Alternative A

			Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	
		Units	Construction	O&M	Monitoring	Not Used	Not Used	Not Used	Total
	Abbrev.								
Other 2		TBD							0
Other 3		TBD							0
Other 4		TBD							0
Other 5		TBD							0

	Totals For Parameters Used, Extracted, Emitted, or Generated - Alternative A														
	Energy Used Mbtu	**Electricity Used MWh**	**All Water Used gal x 1000**	**Potable Water Used gal x 1000**	**Groundwater Extracted gal x 1000**	**CO2e Emitted lbs**	**NO x Emitted lbs**	**SO x Emitted lbs**	**PM Emitted lbs**	**Solid Waste Generated tons**	**Haz. Waste Generated tons**	**Air Toxics Emitted lbs**	**Mercury Released lbs**	**Lead Released lbs**	**Dioxins Released lbs**
Level 1 - Construction															
On-Site	71,379.	0	0	0	0	11,553.	87.	3.	2.	22.5	0	0.0027	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	526,263.	0	0	0	0	85,048.	631.	20.	12.	0	0	0.0298	0	0	0
Other Off-Site	398,780.	17.	54.	0	0	95,629.	145.	183.	47.	16.3	0	5.2876	0.007109591	0.170961996	0.000000425431
Construction Total	***996,422.***	***17.***	***54.***	***0***	***0***	***192,230.***	***863.***	***206.***	***61.***	***38.8***	***0***	***5.3201***	***0.007109591***	***0.170961996***	***0.000000425431***
Level 2 - O&M															
On-Site	128,270.	0	26.	26.4	0	-1,350,459.	112.	-5.	-19.	16.7	0	0.0239	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	98,673.	0	0	0	0	15,616.	90.	3.	0	0	0	0.036	0.000000392	0.000002899	0.000000000004
Other Off-Site	79,686.	2.	10.	0	0	14,193.	30.	78.	10.	0.1	0.002	0.7597	0.001004878	0.003856214	0.000000000347
O&M Total	***306,629.***	***2.***	***36.***	***26.4***	***0***	***-1,320,650.***	***232.***	***76.***	***-9.***	***16.8***	***0.002***	***0.8196***	***0.00100527***	***0.003859113***	***0.000000000351***
Level 3 - Monitoring															
On-Site	0	0	1.	0	1.	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	331,845.	0	0	0	0	52,563.	304.	12.	2.	0	0	0.0964	0	0	0
Other Off-Site	2,038,726.	107.	204.	0	0	316,085.	1,482.	1,145.	123.	0	0	39.9635	0.002773729	0.031544481	0.000000318114
Monitoring Total	***2,370,571.***	***107.***	***205.***	***0***	***1.***	***368,648.***	***1,786.***	***1,157.***	***125.***	***0***	***0***	***40.0599***	***0.002773729***	***0.031544481***	***0.000000318114***
Level 4 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Level 5 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Level 6 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Total	***3,673,622.***	***126.***	***295.***	***26.4***	***1.***	***-759,772.***	***2,881.***	***1,439.***	***177.***	***55.6***	***0.002***	***46.1996***	***0.01088859***	***0.20636559***	***0.000000743896***

All Levels - Parameters Used, Extracted, Emitted, or Generated On-Site - Alternative A

		Quantity Used	Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
			Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***3,673,622.***		***127.***		***296.***		***26.4***		***1.***		***-759,773.***		***2,882.***		***1,440.***		***179.***		***55.***		***0.002***		***46.1996***		***0.010888591***		***0.20636559***		***0.000000743896***
ON-SITE																																		
Energy																																		
Diesel (on-site)	gal	938.6012	139	130,466.	0	0	0	0	0	0	0	0	22.5	21,119.	0.17	160.	0.005	5.	0.003	3.	0	0	0	0	5E-06	0.0049	0	0	0	0	0	0
Gasoline (on-site use)	gal	557.9274	124	69,183.	0	0	0	0	0	0	0	0	19.6	10,935.	0.11	61.	0.005	3.	5E-04	0	0	0	0	0	4E-05	0.0218	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																		
Groundwater Extracted On-site	gal x 1000	1.2	0	0	0	0	1	1.	0	0	1	1.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	26.4	0	0	0	0	1	26.	1	26.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																		
On-Site Solid Waste Generation	ton	39.166667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	39.	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																		
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	1370959	0	0	0	0	0	0	0	0	0	0	-1	-1,370,959.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	21	0	0	0	0	0	0	0	0	0	0	0	0	-1	-21.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-10.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-20.	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**199,649.**		**0**		**27.**		**26.4**		**1.**		**-1,338,905.**		**200.**		**-2.**		**-17.**		**39.**		**0**		**0.0267**		**0**		**0**		**0**
ELECTRICITY GENERATION																																		
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																		
Diesel (off-site use)	gal	3777.3	139	525,045.	0	0	0	0	0	0	0	0	22.5	84,989.	0.17	642.	0.005	20.	0.003	13.	0	0	0	0	5E-06	0.0196	0	0	0	0	0	0
Gasoline (off-site use)	gal	3480.1667	124	431,541.	0	0	0	0	0	0	0	0	19.6	68,211.	0.11	383.	0.005	16.	5E-04	2.	0	0	0	0	4E-05	0.1357	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	26.4	7.4	195.	6E-04	0	0.001	0	0	0	0	0	0.995	26.	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0.0068	1E-08	0.000000392	1E-07	0.000002899	2E-13	0.000000000004
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**956,781.**		**0**		**0**		**0**		**0**		**153,226.**		**1,025.**		**36.**		**15.**		**0**		**0**		**0.1621**		**0.000000392**		**0.000002899**		**0.000000000004**

			All Levels - Parameters Used, Extracted, Emitted, or Generated On-Site - Alternative A																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	8	3020	24,160.	0.096	1.	0.33	3.	0	0	0	0	1322	10,576.	2.6	21.	1.5	12.	0.006	0	3E-08	0	0	0	0.043	0.344	4E-05	0.000336	1E-04	0.00076	6E-11	0.000000000496
Diesel Produced	gal	4715.9012	18.5	87,244.	6E-04	3.	8E-04	4.	0	0	0	0	2.7	12,733.	0.006	30.	0.013	61.	3E-04	2.	4E-07	0	0	0	1E-04	0.5659	5E-08	0.000226363	2E-06	0.007073852	3E-14	0.000000000141
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	4038.0941	21	84,800.	6E-04	2.	8E-04	3.	0	0	0	0	4.4	17,768.	0.008	32.	0.019	77.	5E-04	2.	4E-07	0	0	0	2E-04	0.6461	9E-08	0.000343238	2E-06	0.008883807	3E-14	0.000000000125
Gravel/sand/clay	ton	16.666667	55	917.	0.003	0	0.13	2.	0	0	0	0	6.7	112.	0.033	1.	0.03	1.	0.004	0	0	0	0	0	4E-07	0	6E-11	0.000000001	1E-09	0.00000002	2E-16	0
HDPE	lb	300	31	9,300.	3E-04	0	0.002	1.	0	0	0	0	1.9	570.	0.003	1.	0.004	1.	6E-04	0	4E-07	0	1E-06	0	3E-06	0.001	3E-09	0.00000078	2E-09	0.00000072	1E-09	0.000000294
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	739.2	16.2	11,975.	2E-05	0	0	0	0	0	0	0	1.5	1,109.	8E-04	1.	0.017	13.	7E-05	0	0	0	0	0	3E-04	0.1922	6E-09	0.000004509	4E-08	0.00002809	0	0
Other Material #1	TBD	880	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0.21875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	2.559375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	772.2	3.39	2,618.	7E-05	0	0	0	0	0	0	0	0.35	270.	0.002	1.	0.017	13.	1E-04	0	0	0	0	0	5E-05	0.0402	2E-09	0.000001622	5E-08	0.000037066	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	3861	6.6	25,483.	3E-04	1.	0.001	4.	0	0	0	0	1.37	5,290.	0.003	12.	0.005	19.	5E-04	2.	2E-05	0	5E-07	0.002	6E-05	0.2394	2E-07	0.00084942	3E-08	0.000096525	2E-14	0.000000000093
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	65313	4.4	287,377.	2E-04	14.	6E-04	42.	0	0	0	0	1.1	71,844.	0.001	91.	0.002	111.	6E-04	37.	3E-04	16.	0	0	7E-05	4.376	1E-07	0.0065313	3E-06	0.1632825	7E-12	0.000000424535
Tree: root ball	trees	750	3.7	2,775.	2E-06	0	0.004	3.	0	0	0	0	0.6	450.	0.003	2.	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0.0045	2E-09	0.00000165	6E-08	0.000045	0	0
Tree: whip	trees	2996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	1.2	15	18.	7E-04	0	0.003	0	0	0	0	0	4.4	5.	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0.0007	4E-08	0.000000044	4E-07	0.000000444	3E-13	0
Solid Waste Disposal	ton	39.166667	160	6,267.	0.008	0	0.15	6.	0	0	0	0	25	979.	0.14	5.	0.075	3.	0.4	16.	8E-06	0	0	0	0.001	0.0548	1E-06	0.000037992	8E-06	0.000297667	1E-11	0.00000000047
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	304200	6.49	1,974,258.	4E-04	106.	7E-04	201.	0	0	0	0	1	304,200.	0.005	1,460.	0.004	1,095.	4E-04	122.	0	0	0	0	1E-04	39.546	8E-09	0.00255528	9E-08	0.025857	8E-14	0.000000024032
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				2,517,192.		127.		269.		0		0		425,906.		1,657.		1,406.		181.		16.		0.002		46.0108		0.010888199		0.206362691		0.000000743892

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 1 (Construction) Parameters Used, Extracted, Emitted, or Generated - Alternative A																													
			Energy		**Electricity**		**All Water**		**Potable Water**		**Groundwater**		**CO2e**		**NO x**		**SO x**		**PM**		**Solid Waste**		**Haz. Waste**		**Air Toxics**		**Mercury**		**Lead**		**Dioxins**	
		Quantity Used	**Conv. Factor**	**Used**	**Conv. Factor**	**Used**	**Conv. Factor**	**Used**	**Conv. Factor**	**Used**	**Conv. Factor**	**Extracted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Generated**	**Conv. Factor**	**Generated**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Released**	**Conv. Factor**	**Released**	**Conv. Factor**	**Released**
				Mbtu		**MWh**		**gal x 1000**		**gal x 1000**		**gal x 1000**		**lbs**		**lbs**		**lbs**		**lbs**		**tons**		**tons**		**lbs**		**lbs**		**lbs**		**lbs**
Totals				***996,422.***		***17.***		***54.***		***0***		***0***		***192,230.***		***863.***		***206.***		***61.***		***38.8***		***0***		***5.3201***		***0.007109591***		***0.170961996***		***0.000000425431***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	512.55128	139	71,245.	0	0	0	0	0	0	0	0	22.5	11,532.	0.17	87.	0.005	3.	0.003	2.	0	0	0	0	5E-06	0.0027	0	0	0	0	0	0
Gasoline (on-site use)	gal	1.083	124	134.	0	0	0	0	0	0	0	0	19.6	21.	0.11	0	0.005	0	5E-04	0	0	0	0	0	4E-05	0	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	22.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	22.5	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**71,379.**		**0**		**0**		**0**		**0**		**11,553.**		**87.**		**3.**		**2.**		**22.5**		**0**		**0.0027**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	3524	139	489,836.	0	0	0	0	0	0	0	0	22.5	79,290.	0.17	599.	0.005	19.	0.003	12.	0	0	0	0	5E-06	0.0183	0	0	0	0	0	0
Gasoline (off-site use)	gal	293.76667	124	36,427.	0	0	0	0	0	0	0	0	19.6	5,758.	0.11	32.	0.005	1.	5E-04	0	0	0	0	0	4E-05	0.0115	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**526,263.**		**0**		**0**		**0**		**0**		**85,048.**		**631.**		**20.**		**12.**		**0**		**0**		**0.0298**		**0**		**0**		**0**

			Level 1 (Construction) Parameters Used, Extracted, Emitted, or Generated - Alternative A																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	8	3020	24,160.	0.096	1.	0.33	3.	0	0	0	0	1322	10,576.	2.6	21.	1.5	12.	0.006	0	3E-08	0	0	0	0.043	0.344	4E-05	0.000336	1E-04	0.00076	6E-11	0.000000000496
Diesel Produced	gal	4036.5513	18.5	74,676.	6E-04	2.	8E-04	3.	0	0	0	0	2.7	10,899.	0.006	26.	0.013	52.	3E-04	1.	4E-07	0	0	0	1E-04	0.4844	5E-08	0.000193754	2E-06	0.006054827	3E-14	0.000000000121
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	294.84967	21	6,192.	6E-04	0	8E-04	0	0	0	0	0	4.4	1,297.	0.008	2.	0.019	6.	5E-04	0	4E-07	0	0	0	2E-04	0.0472	9E-08	0.000025062	2E-06	0.000648669	3E-14	0.000000000009
Gravel/sand/clay	ton	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
HDPE	lb	0	31	0	3E-04	0	0.002	0	0	0	0	0	1.9	0	0.003	0	0.004	0	6E-04	0	4E-07	0	1E-06	0	3E-06	0	3E-09	0	2E-09	0	1E-09	0
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	880	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	65313	4.4	287,377.	2E-04	14.	6E-04	42.	0	0	0	0	1.1	71,844.	0.001	91.	0.002	111.	6E-04	37.	3E-04	16.3	0	0	7E-05	4.376	1E-07	0.0065313	3E-06	0.1632825	7E-12	0.000000424535
Tree: root ball	trees	750	3.7	2,775.	2E-06	0	0.004	3.	0	0	0	0	0.6	450.	0.003	2.	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0.0045	2E-09	0.00000165	6E-08	0.000045	0	0
Tree: whip	trees	2996	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	0	15	0	7E-04	0	0.003	0	0	0	0	0	4.4	0	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0	4E-08	0	4E-07	0	3E-13	0
Solid Waste Disposal	ton	22.5	160	3,600.	0.008	0	0.15	3.	0	0	0	0	25	563.	0.14	3.	0.075	2.	0.4	9.	8E-06	0	0	0	0.001	0.0315	1E-06	0.000021825	8E-06	0.000171	1E-11	0.00000000027
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	0	6.49	0	4E-04	0	7E-04	0	0	0	0	0	1	0	0.005	0	0.004	0	4E-04	0	0	0	0	0	1E-04	0	8E-09	0	9E-08	0	8E-14	0
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				398,780.		17.		54.		0		0		95,629.		145.		183.		47.		16.3		0		5.2876		0.007109591		0.170961996		0.000000425431

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 2 (O&M) Parameters Used, Extracted, Emitted, or Generated - Alternative A																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***306,629.***		***2.***		***36.***		***26.4***		***0***		***-1,320,650.***		***232.***		***76.***		***-9.***		***16.8***		***0.002***		***0.8196***		***0.00100527***		***0.003859113***		***0.000000000351***
ON-SITE																																		
Energy																																		
Diesel (on-site)	gal	426.04992	139	59,221.	0	0	0	0	0	0	0	0	22.5	9,586.	0.17	72.	0.005	2.	0.003	1.	0	0	0	0	5E-06	0.0022	0	0	0	0	0	0
Gasoline (on-site use)	gal	556.8444	124	69,049.	0	0	0	0	0	0	0	0	19.6	10,914.	0.11	61.	0.005	3.	5E-04	0	0	0	0	0	4E-05	0.0217	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																		
Groundwater Extracted On-site	gal x 1000	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	26.4	0	0	0	0	1	26.	1	26.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																		
On-Site Solid Waste Generation	ton	16.666667	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	16.7	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																		
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	1370959	0	0	0	0	0	0	0	0	0	0	-1	-1,370,959.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	21	0	0	0	0	0	0	0	0	0	0	0	0	-1	-21.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-10.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-20.	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**128,270.**		**0**		**26.**		**26.4**		**0**		**-1,350,459.**		**112.**		**-5.**		**-19.**		**16.7**		**0**		**0.0239**		**0**		**0**		**0**
ELECTRICITY GENERATION																																		
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																		
Diesel (off-site use)	gal	45	139	6,255.	0	0	0	0	0	0	0	0	22.5	1,013.	0.17	8.	0.005	0	0.003	0	0	0	0	0	5E-06	0.0002	0	0	0	0	0	0
Gasoline (off-site use)	gal	743.73333	124	92,223.	0	0	0	0	0	0	0	0	19.6	14,577.	0.11	82.	0.005	3.	5E-04	0	0	0	0	0	4E-05	0.029	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	26.4	7.4	195.	6E-04	0	0.001	0	0	0	0	0	0.995	26.	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0.0068	1E-08	0.000000392	1E-07	0.000002899	2E-13	0.000000000004
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**98,673.**		**0**		**0**		**0**		**0**		**15,616.**		**90.**		**3.**		**0**		**0**		**0**		**0.036**		**0.000000392**		**0.000002899**		**0.000000000004**

Level 2 (O&M) Parameters Used, Extracted, Emitted, or Generated - Alternative A

		Quantity Used	Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
			Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	471.04992	18.5	8,714.	6E-04	0	8E-04	0	0	0	0	0	2.7	1,272.	0.006	3.	0.013	6.	3E-04	0	4E-07	0	0	0	1E-04	0.0565	5E-08	0.00002261	2E-06	0.000706575	3E-14	0.00000000014
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	1300.5777	21	27,312.	6E-04	1.	8E-04	1.	0	0	0	0	4.4	5,723.	0.008	10.	0.019	25.	5E-04	1.	4E-07	0	0	0	2E-04	0.2081	9E-08	0.000110549	2E-06	0.002861271	3E-14	0.0000000004
Gravel/sand/clay	ton	16.666667	55	917.	0.003	0	0.13	2.	0	0	0	0	6.7	112.	0.033	1.	0.03	1.	0.004	0	0	0	0	0	4E-07	0	6E-11	0.000000001	1E-09	0.00000002	2E-16	0
HDPE	lb	0	31	0	3E-04	0	0.002	0	0	0	0	0	1.9	0	0.003	0	0.004	0	6E-04	0	4E-07	0	1E-06	0	3E-06	0	3E-09	0	2E-09	0	1E-09	0
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	739.2	16.2	11,975.	2E-05	0	0	0	0	0	0	0	1.5	1,109.	8E-04	1.	0.017	13.	7E-05	0	0	0	0	0	3E-04	0.1922	6E-09	0.000004509	4E-08	0.00002809	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0.21875	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	2.559375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	772.2	3.39	2,618.	7E-05	0	0	0	0	0	0	0	0.35	270.	0.002	1.	0.017	13.	1E-04	0	0	0	0	0	5E-05	0.0402	2E-09	0.000001622	5E-08	0.000037066	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	3861	6.6	25,483.	3E-04	1.	0.001	4.	0	0	0	0	1.37	5,290.	0.003	12.	0.005	19.	5E-04	2.	2E-05	0.1	5E-07	0.002	6E-05	0.2394	2E-07	0.00084942	3E-08	0.000096525	2E-14	0.00000000093
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	0	15	0	7E-04	0	0.003	0	0	0	0	0	4.4	0	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0	4E-08	0	4E-07	0	3E-13	0
Solid Waste Disposal	ton	16.666667	160	2,667.	0.008	0	0.15	3.	0	0	0	0	25	417.	0.14	2.	0.075	1.	0.4	7.	8E-06	0	0	0	0.001	0.0233	1E-06	0.000016167	8E-06	0.000126667	1E-11	0.000000002
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	0	6.49	0	4E-04	0	7E-04	0	0	0	0	0	1	0	0.005	0	0.004	0	4E-04	0	0	0	0	0	1E-04	0	8E-09	0	9E-08	0	8E-14	0
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				79,686.		2.		10.		0		0		14,193.		30.		78.		10.		0.1		0.002		0.7597		0.001004878		0.003856214		0.00000000347

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 3 (Monitoring) Parameters Used, Extracted, Emitted, or Generated - Alternative A																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***2,370,571.***		***107.***		***205.***		***0***		***1.***		***368,648.***		***1,786.***		***1,157.***		***125.***		***0***		***0***		***40.0599***		***0.002773729***		***0.031544481***		***0.000000318114***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	0	139	0	0	0	0	0	0	0	0	0	22.5	0	0.17	0	0.005	0	0.003	0	0	0	0	0	5E-06	0	0	0	0	0	0	0
Gasoline (on-site use)	gal	0	124	0	0	0	0	0	0	0	0	0	19.6	0	0.11	0	0.005	0	5E-04	0	0	0	0	0	4E-05	0	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	1.2	0	0	0	0	1	1.	0	0	1	1.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**0**		**0**		**1.**		**0**		**1.**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	208.3	139	28,954.	0	0	0	0	0	0	0	0	22.5	4,687.	0.17	35.	0.005	1.	0.003	1.	0	0	0	0	5E-06	0.0011	0	0	0	0	0	0
Gasoline (off-site use)	gal	2442.6667	124	302,891.	0	0	0	0	0	0	0	0	19.6	47,876.	0.11	269.	0.005	11.	5E-04	1.	0	0	0	0	4E-05	0.0953	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**331,845.**		**0**		**0**		**0**		**0**		**52,563.**		**304.**		**12.**		**2.**		**0**		**0**		**0.0964**		**0**		**0**		**0**

			Level 3 (Monitoring) Parameters Used, Extracted, Emitted, or Generated - Alternative A																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	208.3	18.5	3,854.	6E-04	0	8E-04	0	0	0	0	0	2.7	562.	0.006	1.	0.013	3.	3E-04	0	4E-07	0	0	0	1E-04	0.025	5E-08	0.000009998	2E-06	0.00031245	3E-14	0.000000000006
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	2442.6667	21	51,296.	6E-04	1.	8E-04	2.	0	0	0	0	4.4	10,748.	0.008	20.	0.019	46.	5E-04	1.	4E-07	0	0	0	2E-04	0.3908	9E-08	0.000207627	2E-06	0.005373867	3E-14	0.000000000076
Gravel/sand/clay	ton	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
HDPE	lb	300	31	9,300.	3E-04	0	0.002	1.	0	0	0	0	1.9	570.	0.003	1.	0.004	1.	6E-04	0	4E-07	0	1E-06	0	3E-06	0.001	3E-09	0.00000078	2E-09	0.00000072	1E-09	0.000000294
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	1.2	15	18.	7E-04	0	0.003	0	0	0	0	0	4.4	5.	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0.0007	4E-08	0.000000044	4E-07	0.000000444	3E-13	0
Solid Waste Disposal	ton	0	160	0	0.008	0	0.15	0	0	0	0	0	25	0	0.14	0	0.075	0	0.4	0	8E-06	0	0	0	0.001	0	1E-06	0	8E-06	0	1E-11	0
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	304200	6.49	1,974,258.	4E-04	106.	7E-04	201.	0	0	0	0	1	304,200.	0.005	1,460.	0.004	1,095.	4E-04	122.	0	0	0	0	1E-04	39.546	8E-09	0.00255528	9E-08	0.025857	8E-14	0.000000024032
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				2,038,726.		107.		204.		0		0		316,085.		1,482.		1,145.		123.		0		0		39.9635		0.002773729		0.031544481		0.000000318114

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

Traffic and Personnel - Alternative A

Item	Units	Level 1 - Construction	Level 2 - O&M	Level 3 - Monitoring	Level 4 - Not Used	Level 5 -Not Used	Level 6 -Not Used	Total
Traffic								
Number of passenger car or truck trips to the site	trips	77	159	220				**456**
Number of freight or other heavy duty truck trips to the site	trips	92	17	1				**110**
Total passenger car miles driven	miles	5,584	8,980	36,640				**51,204**
Total freight or other heavey duty truck miles driven	miles	27,228	2,804	1,500				**31,532**
Personnel								
Total on-site hours worked	man-hours	1,008	2,354	1,920				**5,282**
Heavy equipment hours operated	hours	234	992	0				**1,226**

Alternative:	**Alternative B**
Alternative Name:	**Leachate Extraction**
Path Name:	
Main File Name:	Green Remediation Tool Main.xlsx
Reference File Name:	Green Remediation Tool Reference 100110.xlsx
Module File Name:	Alt B - leachate extraction inventory module.xlsx

Variables In Alternative:

Level 1	Construction
Level 2	O&M
Level 3	Monitoring
Level 4	Not Used
Level 5	Not Used
Level 6	Not Used

Usage Input - Alternative B

	Abbrev.	Units	Level 1 Construction	Level 2 O&M	Level 3 Monitoring	Level 4 Not Used	Level 5 Not Used	Level 6 Not Used	Total
ON-SITE									
Energy									
Diesel (on-site)		gal	2267.761	1267.795	0	0	0	0	3535.556
Gasoline (on-site use)		gal	0	795.492	0	0	0	0	795.492
Natural gas (on-site use)		ccf	0	0	0	0	0	0	0
On-site electricity use		MWh	0	486.7512	0	0	0	0	486.7512
Other Energy 1		TBD							0
Other Energy 2		TBD							0
Other Energy 3		TBD							0
Water									
Groundwater Extracted On-site		gal x 1000	3.6	0	1.2	0	0	0	4.8
Potable Water Used		gal x 1000	0	0	0	0	0	0	0
Other On-Site Water 1		gal x 1000							0
Other On-Site Water 2		gal x 1000							0
Other On-Site Water 3		gal x 1000							0
Waste Generation									
On-Site Solid Waste Generation		ton	15.2	914.1891	0	0	0	0	929.3891
On-Site Solid Waste Disposal		ton							0
On-Site Hazardous Waste Generation		ton	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		ton							0
Other									
On-site process emissions (HAPs)		lbs	0	0	0	0	0	0	0
On-site process emissions (GHGs)		lbs CO2e	0	0	0	0	0	0	0
On-site GHG storage		lbs CO2e	0	0	0	0	0	0	0
On-site Nox reduction		lbs							0
On-site SOx reduction		lbs							0
On-site PM reduction		lbs							0
Other 4		TBD							0
Other 5		TBD							0
ELECTRICITY GENERATION									
Electricity production		MWh	0	486.7512	0	0	0	0	486.7512
TRANSPORTATION									
Diesel (off-site use)		gal	1700	749.4	208.3	0	0	0	2657.7
Gasoline (off-site use)		gal	429.7	2296.667	2442.667	0	0	0	5169.033
Natural gas (off-site use)		ccf							0
Potable Water Transported		gal x 1000	0	0	0	0	0	0	0
Electricity transmission		MWh	0	486.7512	0	0	0	0	486.7512
Other Transportation 1		TBD							0
Other Transportation 2									
Other Transportation 3									

Usage Input - Alternative B

	Abbrev.	Units	Level 1 Construction	Level 2 O&M	Level 3 Monitoring	Level 4 Not Used	Level 5 Not Used	Level 6 Not Used	Total
OFF-SITE OTHER									
Materials									
Asphalt		tons	0	0	0	0	0	0	0
Bentonite		tons	0.1	0	0	0	0	0	0.1
Borrow (clean soil)		tons	0	0	0	0	0	0	0
Cement		dry-ton	2.3	0	0	0	0	0	2.3
Cheese Whey		lbs	0	0	0	0	0	0	0
Concrete		tons	4.42	0	0	0	0	0	4.42
Diesel Produced		gal	3967.761	2017.195	208.3	0	0	0	6193.256
Emulsified vegetable oil		lbs	0	0	0	0	0	0	0
GAC: regenerated		lbs	0	0	0	0	0	0	0
GAC: virgin coal-based		lbs	0	0	0	0	0	0	0
GAC: virgin coconut-based		lbs	0	0	0	0	0	0	0
Gasoline Produced		gal	429.7	3092.159	2442.667	0	0	0	5964.525
Gravel/sand/clay		ton	977.4	466.6667	0	0	0	0	1444.067
HDPE		lb	2000	0	300	0	0	0	2300
Hydrochloric acid (30%, SG = 1.18)		lbs	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)		lbs	0	0	0	0	0	0	0
Hydroseed		lbs	0	0	0	0	0	0	0
Lime		lbs	0	0	0	0	0	0	0
Molasses		lbs	0	0	0	0	0	0	0
Natural Gas Produced		ccf	0	0	0	0	0	0	0
Nitrogen fertilizer		lbs	0	0	0	0	0	0	0
Other Material #1		TBD	0	0	0	0	0	0	0
Other Material #2		TBD	0	0	0	0	0	0	0
Other Material #3		TBD	0	0	0	0	0	0	0
Other Material #4		TBD	0	0	0	0	0	0	0
Other Material #5		TBD	0	0	0	0	0	0	0
Phosphorus fertilizer		lbs	0	0	0	0	0	0	0
Polymer		lbs	0	0	0	0	0	0	0
Potable Water Produced		gal x 1000	0	0	0	0	0	0	0
Potassium permanganate		lbs	0	0	0	0	0	0	0
PVC		lbs	1750	0	0	0	0	0	1750
Sequestering agent		lbs	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)		lbs	0	0	0	0	0	0	0
Stainless Steel		lb	312	0	0	0	0	0	312
Steel		lb	6310	0	0	0	0	0	6310
Tree: root ball		trees	0	0	0	0	0	0	0
Tree: whip		trees	0	0	0	0	0	0	0
Off-Site Services									
Off-site waste water treatment		gal x 1000	3.6	81993.6	1.2	0	0	0	81998.4
Solid Waste Disposal		ton	15.2	914.1891	0	0	0	0	929.3891
Hazardous Waste Disposal		ton	0	0	0	0	0	0	0
Laboratory Analysis		$	0	0	304200	0	0	0	304200
Other 1		TBD							0
Other 2		TBD							0
Other 3		TBD							0
Other 4		TBD							0
Other 5		TBD							0
Other									
Other 1		TBD							0

Usage Input - Alternative B

			Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	
		Units	Construction	O&M	Monitoring	Not Used	Not Used	Not Used	Total
	Abbrev.								
Other 2		TBD							0
Other 3		TBD							0
Other 4		TBD							0
Other 5		TBD							0

	Totals For Parameters Used, Extracted, Emitted, or Generated - Alternative B														
	Energy Used Mbtu	**Electricity Used MWh**	**All Water Used gal x 1000**	**Potable Water Used gal x 1000**	**Groundwater Extracted gal x 1000**	**CO2e Emitted lbs**	**NO x Emitted lbs**	**SO x Emitted lbs**	**PM Emitted lbs**	**Solid Waste Generated tons**	**Haz. Waste Generated tons**	**Air Toxics Emitted lbs**	**Mercury Released lbs**	**Lead Released lbs**	**Dioxins Released lbs**
Level 1 - Construction															
On-Site	315,219.	0	4.	0	4.	51,025.	386.	12.	8.	15.2	0	0.0118	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	289,583.	0	0	0	0	46,672.	336.	11.	6.	0	0	0.0256	0	0	0
Other Off-Site	293,338.	8.	156.	0	0	48,510.	106.	138.	19.	1.8	0.005	2.1892	0.001789858	0.023903446	0.000014077486
Construction Total	***898,140.***	***8.***	***160.***	***0***	***4.***	***146,207.***	***828.***	***161.***	***33.***	***17.***	***0.005***	***2.2266***	***0.001789858***	***0.023903446***	***0.000014077486***
Level 2 - O&M															
On-Site	1,936,146.	487.	0	0	0	44,117.	304.	11.	4.	914.2	0	0.0376	0	0	0
Electricity Generation	3,796,659.	29.	535.	0	0	968,635.	2,517.	6,230.	620.	0.4	0	265.8635	0.015576037	0.092482719	0.00000011682
Transportation	588,522.	58.	64.	0	0	178,113.	682.	762.	78.	0.1	0	31.9971	0.001869124	0.011097926	0.000000014018
Other Off-Site	1,504,094.	71.	441.	0	0	405,805.	1,493.	1,398.	510.	196.8	0	49.5732	0.004280214	0.04711457	0.000000039415
O&M Total	***7,825,421.***	***645.***	***1,040.***	***0***	***0***	***1,596,670.***	***4,996.***	***8,401.***	***1,212.***	***1,111.5***	***0***	***347.4714***	***0.021725375***	***0.150695215***	***0.000000170253***
Level 3 - Monitoring															
On-Site	0	0	1.	0	1.	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	331,845.	0	0	0	0	52,563.	304.	12.	2.	0	0	0.0964	0	0	0
Other Off-Site	2,038,726.	107.	204.	0	0	316,085.	1,482.	1,145.	123.	0	0	39.9635	0.002773729	0.031544481	0.000000318114
Monitoring Total	***2,370,571.***	***107.***	***205.***	***0***	***1.***	***368,648.***	***1,786.***	***1,157.***	***125.***	***0***	***0***	***40.0599***	***0.002773729***	***0.031544481***	***0.000000318114***
Level 4 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Level 5 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Level 6 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Total	***11,094,132.***	***760.***	***1,405.***	***0***	***5.***	***2,111,525.***	***7,610.***	***9,719.***	***1,370.***	***1,128.5***	***0.005***	***389.7579***	***0.026288962***	***0.206143142***	***0.000014565853***

All Levels - Parameters Used, Extracted, Emitted, or Generated On-Site - Alternative B

		Quantity Used	Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
			Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***11,094,129.***		***762.***		***1,405.***		***0***		***5.***		***2,111,524.***		***7,612.***		***9,719.***		***1,370.***		***1,128.5***		***0.005***		***389.7577***		***0.026288962***		***0.206143142***		***0.000014565854***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	3535.5556	139	491,442.	0	0	0	0	0	0	0	0	22.5	79,550.	0.17	601.	0.005	19.	0.003	12.	0	0	0	0	5E-06	0.0184	0	0	0	0	0	0
Gasoline (on-site use)	gal	795.492	124	98,641.	0	0	0	0	0	0	0	0	19.6	15,592.	0.11	88.	0.005	4.	5E-04	0	0	0	0	0	4E-05	0.031	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	486.75115	3413	1,661,282.	1	487.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	4.8	0	0	0	0	1	5.	0	0	1	5.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	929.38911	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	929.4	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**2,251,365.**		**487.**		**5.**		**0**		**5.**		**95,142.**		**689.**		**23.**		**12.**		**929.4**		**0**		**0.0494**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	486.75115	7800	3,796,659.	0.06	29.	1.1	535.	0	0	0	0	1990	968,635.	5.17	2,517.	12.8	6,230.	1.274	620.	9E-04	0.4	0	0	0.546	265.8635	3E-05	0.015576037	2E-04	0.092482719	2E-10	0.00000011682
TRANSPORTATION																																
Diesel (off-site use)	gal	2657.7	139	369,420.	0	0	0	0	0	0	0	0	22.5	59,798.	0.17	452.	0.005	14.	0.003	9.	0	0	0	0	5E-06	0.0138	0	0	0	0	0	0
Gasoline (off-site use)	gal	5169.0333	124	640,960.	0	0	0	0	0	0	0	0	19.6	101,313.	0.11	569.	0.005	23.	5E-04	3.	0	0	0	0	4E-05	0.2016	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	486.75115	410	199,568.	0.12	58.	0.132	64.	0	0	0	0	238.8	116,236.	0.62	302.	1.536	748.	0.153	74.	1E-04	0.1	0	0	0.066	31.9036	4E-06	0.001869124	2E-05	0.011097926	3E-11	0.000000014018
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**1,209,948.**		**58.**		**64.**		**0**		**0**		**277,347.**		**1,323.**		**785.**		**86.**		**0.1**		**0**		**32.119**		**0.001869124**		**0.011097926**		**0.000000014018**

			All Levels - Parameters Used, Extracted, Emitted, or Generated On-Site - Alternative B																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0.1	55	6.	0.003	0	0.13	0	0	0	0	0	6.7	1.	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	2.3	4100	9,430.	0.13	0	0.41	1.	0	0	0	0	1800	4,140.	3.6	8.	2.1	5.	0.006	0	0	0	0	0	0.058	0.1334	6E-05	0.0001311	1E-04	0.000299	9E-11	0.000000000196
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	4.42	3020	13,348.	0.096	0	0.33	1.	0	0	0	0	1322	5,843.	2.6	11.	1.5	7.	0.006	0	3E-08	0	0	0	0.043	0.1901	4E-05	0.00018564	1E-04	0.0004199	6E-11	0.000000000274
Diesel Produced	gal	6193.2556	18.5	114,575.	6E-04	4.	8E-04	5.	0	0	0	0	2.7	16,722.	0.006	40.	0.013	81.	3E-04	2.	4E-07	0	0	0	1E-04	0.7432	5E-08	0.000297276	2E-06	0.009289883	3E-14	0.000000000186
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	5964.5253	21	125,255.	6E-04	4.	8E-04	5.	0	0	0	0	4.4	26,244.	0.008	48.	0.019	113.	5E-04	3.	4E-07	0	0	0	2E-04	0.9543	9E-08	0.000506985	2E-06	0.013121956	3E-14	0.000000000185
Gravel/sand/clay	ton	1444.0667	55	79,424.	0.003	4.	0.13	188.	0	0	0	0	6.7	9,675.	0.033	48.	0.03	43.	0.004	6.	0	0	0	0	4E-07	0.0006	6E-11	0.000000092	1E-09	0.000001733	2E-16	0
HDPE	lb	2300	31	71,300.	3E-04	1.	0.002	5.	0	0	0	0	1.9	4,370.	0.003	7.	0.004	9.	6E-04	1.	4E-07	0	1E-06	0.002	3E-06	0.0078	3E-09	0.00000598	2E-09	0.00000552	1E-09	0.000002254
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	1750	22	38,500.	6E-04	1.	0.007	12.	0	0	0	0	4.1	7,175.	0.005	8.	0.008	13.	0.001	2.	2E-06	0	2E-06	0.003	5E-04	0.8225	3E-07	0.000595	1E-07	0.0002275	7E-09	0.000012075
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	312	11.6	3,619.	6E-04	0	0.002	1.	0	0	0	0	3.4	1,061.	0.008	2.	0.012	4.	0.004	1.	6E-04	0.2	0	0	1E-04	0.0449	0	0	5E-07	0.00016224	2E-12	0.000000000686
Steel	lb	6310	4.4	27,764.	2E-04	1.	6E-04	4.	0	0	0	0	1.1	6,941.	0.001	9.	0.002	11.	6E-04	4.	3E-04	1.6	0	0	7E-05	0.4228	1E-07	0.000631	3E-06	0.015775	7E-12	0.000000041015
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	81998.4	15	1,229,976.	7E-04	60.	0.003	239.	0	0	0	0	4.4	360,793.	0.016	1,312.	0.015	1,230.	0.002	139.	0.002	196.8	0	0	6E-04	47.5591	4E-08	0.003033941	4E-07	0.030339408	3E-13	0.000000028289
Solid Waste Disposal	ton	929.38911	160	148,702.	0.008	7.	0.15	139.	0	0	0	0	25	23,235.	0.14	130.	0.075	70.	0.4	372.	8E-06	0	0	0	0.001	1.3011	1E-06	0.000901507	8E-06	0.007063357	1E-11	0.000000011153
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	304200	6.49	1,974,258.	4E-04	106.	7E-04	201.	0	0	0	0	1	304,200.	0.005	1,460.	0.004	1,095.	4E-04	122.	0	0	0	0	1E-04	39.546	8E-09	0.00255528	9E-08	0.025857	8E-14	0.000000024032
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				3,836,157.		188.		801.		0		0		770,400.		3,083.		2,681.		652.		198.6		0.005		91.7258		0.008843801		0.102562497		0.000014435016

Notes:
- ***All subtotals are rounded to two significant digits***
- ***Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality***
- ***All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.***
- ***Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA***

Level 1 (Construction) Parameters Used, Extracted, Emitted, or Generated - Alternative B

			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used Mbtu	Conv. Factor	Used MWh	Conv. Factor	Used gal x 1000	Conv. Factor	Used gal x 1000	Conv. Factor	Extracted gal x 1000	Conv. Factor	Emitted lbs	Conv. Factor	Emitted lbs	Conv. Factor	Emitted lbs	Conv. Factor	Emitted lbs	Conv. Factor	Generated tons	Conv. Factor	Generated tons	Conv. Factor	Emitted lbs	Conv. Factor	Released lbs	Conv. Factor	Released lbs	Conv. Factor	Released lbs
Totals				***898,140.***		***8.***		***160.***		***0***		***4.***		***146,207.***		***828.***		***161.***		***33.***		***17.***		***0.005***		***2.2266***		***0.001789858***		***0.023903446***		***0.000014077486***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	2267.7609	139	315,219.	0	0	0	0	0	0	0	0	22.5	51,025.	0.17	386.	0.005	12.	0.003	8.	0	0	0	0	5E-06	0.0118	0	0	0	0	0	0
Gasoline (on-site use)	gal	0	124	0	0	0	0	0	0	0	0	0	19.6	0	0.11	0	0.005	0	5E-04	0	0	0	0	0	4E-05	0	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	3.6	0	0	0	0	1	4.	0	0	1	4.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	15.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15.2	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**315,219.**		**0**		**4.**		**0**		**4.**		**51,025.**		**386.**		**12.**		**8.**		**15.2**		**0**		**0.0118**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	1700	139	236,300.	0	0	0	0	0	0	0	0	22.5	38,250.	0.17	289.	0.005	9.	0.003	6.	0	0	0	0	5E-06	0.0088	0	0	0	0	0	0
Gasoline (off-site use)	gal	429.7	124	53,283.	0	0	0	0	0	0	0	0	19.6	8,422.	0.11	47.	0.005	2.	5E-04	0	0	0	0	0	4E-05	0.0168	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**289,583.**		**0**		**0**		**0**		**0**		**46,672.**		**336.**		**11.**		**6.**		**0**		**0**		**0.0256**		**0**		**0**		**0**

			Level 1 (Construction) Parameters Used, Extracted, Emitted, or Generated - Alternative B																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0.1	55	6.	0.003	0	0.13	0	0	0	0	0	6.7	1.	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	2.3	4100	9,430.	0.13	0	0.41	1.	0	0	0	0	1800	4,140.	3.6	8.	2.1	5.	0.006	0	0	0	0	0	0.058	0.1334	6E-05	0.0001311	1E-04	0.000299	9E-11	0.000000000196
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	4.42	3020	13,348.	0.096	0	0.33	1.	0	0	0	0	1322	5,843.	2.6	11.	1.5	7.	0.006	0	3E-08	0	0	0	0.043	0.1901	4E-05	0.00018564	1E-04	0.0004199	6E-11	0.000000000274
Diesel Produced	gal	3967.7609	18.5	73,404.	6E-04	2.	8E-04	3.	0	0	0	0	2.7	10,713.	0.006	25.	0.013	52.	3E-04	1.	4E-07	0	0	0	1E-04	0.4761	5E-08	0.000190453	2E-06	0.005951641	3E-14	0.000000000119
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	429.7	21	9,024.	6E-04	0	8E-04	0	0	0	0	0	4.4	1,891.	0.008	3.	0.019	8.	5E-04	0	4E-07	0	0	0	2E-04	0.0688	9E-08	0.000036525	2E-06	0.00094534	3E-14	0.000000000013
Gravel/sand/clay	ton	977.4	55	53,757.	0.003	3.	0.13	127.	0	0	0	0	6.7	6,549.	0.033	32.	0.03	29.	0.004	4.	0	0	0	0	4E-07	0.0004	6E-11	0.000000063	1E-09	0.000001173	2E-16	0
HDPE	lb	2000	31	62,000.	3E-04	1.	0.002	5.	0	0	0	0	1.9	3,800.	0.003	6.	0.004	8.	6E-04	1.	4E-07	0	1E-06	0.002	3E-06	0.0068	3E-09	0.0000052	2E-09	0.0000048	1E-09	0.00000196
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	1750	22	38,500.	6E-04	1.	0.007	12.	0	0	0	0	4.1	7,175.	0.005	8.	0.008	13.	0.001	2.	2E-06	0	2E-06	0.003	5E-04	0.8225	3E-07	0.000595	1E-07	0.0002275	7E-09	0.000012075
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	312	11.6	3,619.	6E-04	1.	0.002	1.	0	0	0	0	3.4	1,061.	0.008	2.	0.012	4.	0.004	1.	6E-04	0.2	0	0	1E-04	0.0449	0	0	5E-07	0.00016224	2E-12	0.000000000686
Steel	lb	6310	4.4	27,764.	2E-04	1.	6E-04	4.	0	0	0	0	1.1	6,941.	0.001	9.	0.002	11.	6E-04	4.	3E-04	1.6	0	0	7E-05	0.4228	1E-07	0.000631	3E-06	0.015775	7E-12	0.000000041015
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	3.6	15	54.	7E-04	0	0.003	0	0	0	0	0	4.4	16.	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0.0021	4E-08	0.000000133	4E-07	0.000001332	3E-13	0.000000000001
Solid Waste Disposal	ton	15.2	160	2,432.	0.008	0	0.15	2.	0	0	0	0	25	380.	0.14	2.	0.075	1.	0.4	6.	8E-06	0	0	0	0.001	0.0213	1E-06	0.000014744	8E-06	0.00011552	1E-11	0.00000000182
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	0	6.49	0	4E-04	0	7E-04	0	0	0	0	0	1	0	0.005	0	0.004	0	4E-04	0	0	0	0	0	1E-04	0	8E-09	0	9E-08	0	8E-14	0
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				293,338.		8.		156.		0		0		48,510.		106.		138.		19.		1.8		0.005		2.1892		0.001789858		0.023903446		0.000014077486

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 2 (O&M) Parameters Used, Extracted, Emitted, or Generated - Alternative B																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***7,825,421.***		***645.***		***1,040.***		***0***		***0***		***1,596,670.***		***4,996.***		***8,401.***		***1,212.***		***1,111.5***		***0***		***347.4714***		***0.021725375***		***0.150695215***		***0.000000170253***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	1267.7947	139	176,223.	0	0	0	0	0	0	0	0	22.5	28,525.	0.17	216.	0.005	7.	0.003	4.	0	0	0	0	5E-06	0.0066	0	0	0	0	0	0
Gasoline (on-site use)	gal	795.492	124	98,641.	0	0	0	0	0	0	0	0	19.6	15,592.	0.11	88.	0.005	4.	5E-04	0	0	0	0	0	4E-05	0.031	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	486.75115	3413	1,661,282.	1	487.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	914.18911	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	914.2	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**1,936,146.**		**487.**		**0**		**0**		**0**		**44,117.**		**304.**		**11.**		**4.**		**914.2**		**0**		**0.0376**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	486.75115	7800	3,796,659.	0.06	29.	1.1	535.	0	0	0	0	1990	968,635.	5.17	2,517.	12.8	6,230.	1.274	620.	9E-04	0.4	0	0	0.546	265.8635	3E-05	0.015576037	2E-04	0.092482719	2E-10	0.00000011682
TRANSPORTATION																																
Diesel (off-site use)	gal	749.4	139	104,167.	0	0	0	0	0	0	0	0	22.5	16,862.	0.17	127.	0.005	4.	0.003	3.	0	0	0	0	5E-06	0.0039	0	0	0	0	0	0
Gasoline (off-site use)	gal	2296.6667	124	284,787.	0	0	0	0	0	0	0	0	19.6	45,015.	0.11	253.	0.005	10.	5E-04	1.	0	0	0	0	4E-05	0.0896	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	486.75115	410	199,568.	0.12	58.	0.132	64.	0	0	0	0	238.8	116,236.	0.62	302.	1.536	748.	0.153	74.	1E-04	0.1	0	0	0.066	31.9036	4E-06	0.001869124	2E-05	0.011097926	3E-11	0.000000014018
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**588,522.**		**58.**		**64.**		**0**		**0**		**178,113.**		**682.**		**762.**		**78.**		**0.1**		**0**		**31.9971**		**0.001869124**		**0.011097926**		**0.000000014018**

Level 2 (O&M) Parameters Used, Extracted, Emitted, or Generated - Alternative B

		Quantity Used	Energy		Electricity		All Water		Potable Water		Groundwater		CO2e	
			Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs
OFF-SITE OTHER														
Materials														
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0
Diesel Produced	gal	2017.1947	18.5	37,318.	6E-04	1.	8E-04	2.	0	0	0	0	2.7	5,446.
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	3092.1587	21	64,935.	6E-04	2.	8E-04	2.	0	0	0	0	4.4	13,605.
Gravel/sand/clay	ton	466.66667	55	25,667.	0.003	1.	0.13	61.	0	0	0	0	6.7	3,127.
HDPE	lb	0	31	0	3E-04	0	0.002	0	0	0	0	0	1.9	0
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services														
Off-site waste water treatment	gal x 1000	81993.6	15	1,229,904.	7E-04	60.	0.003	239.	0	0	0	0	4.4	360,772.
Solid Waste Disposal	ton	914.18911	160	146,270.	0.008	7.	0.15	137.	0	0	0	0	25	22,855.
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0
Laboratory Analysis	$	0	6.49	0	4E-04	0	7E-04	0	0	0	0	0	1	0
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other														
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				1,504,094.		71.		441.		0		0		405,805.

	NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																		
Materials																		
Asphalt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	0.006	13.	0.013	26.	3E-04	1.	4E-07	0	0	0	1E-04	0.2421	5E-08	0.000096825	2E-06	0.003025792	3E-14	0.000000000061
Emulsified vegetable oil	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	0.008	25.	0.019	59.	5E-04	2.	4E-07	0	0	0	2E-04	0.4947	9E-08	0.000262833	2E-06	0.006802749	3E-14	0.000000000096
Gravel/sand/clay	0.033	15.	0.03	14.	0.004	2.	0	0	0	0	4E-07	0.0002	6E-11	0.00000003	1E-09	0.00000056	2E-16	0
HDPE	0.003	0	0.004	0	6E-04	0	4E-07	0	1E-06	0	3E-06	0	3E-09	0	2E-09	0	1E-09	0
Hydrochloric acid (30%, SG = 1.18)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																		
Off-site waste water treatment	0.016	1,312.	0.015	1,230.	0.002	139.	0.002	196.8	0	0	6E-04	47.5563	4E-08	0.003033763	4E-07	0.030337632	3E-13	0.000000028288
Solid Waste Disposal	0.14	128.	0.075	69.	0.4	366.	8E-06	0	0	0	0.001	1.2799	1E-06	0.000886763	8E-06	0.006947837	1E-11	0.00000001097
Hazardous Waste Disposal	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	0.005	0	0.004	0	4E-04	0	0	0	0	0	1E-04	0	8E-09	0	9E-08	0	8E-14	0
Other 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																		
Other 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL		1,493.		1,398.		510.		196.8		0		49.5732		0.004280214		0.04711457		0.000000039415

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

		Quantity Used	Level 3 (Monitoring) Parameters Used, Extracted, Emitted, or Generated - Alternative B																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
			Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***2,370,571.***		***107.***		***205.***		***0***		***1.***		***368,648.***		***1,786.***		***1,157.***		***125.***		***0***		***0***		***40.0599***		***0.002773729***		***0.031544481***		***0.000000318114***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	0	139	0	0	0	0	0	0	0	0	0	22.5	0	0.17	0	0.005	0	0.003	0	0	0	0	0	5E-06	0	0	0	0	0	0	0
Gasoline (on-site use)	gal	0	124	0	0	0	0	0	0	0	0	0	19.6	0	0.11	0	0.005	0	5E-04	0	0	0	0	0	4E-05	0	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	1.2	0	0	0	0	1	1.	0	0	1	1.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**0**		**0**		**1.**		**0**		**1.**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	208.3	139	28,954.	0	0	0	0	0	0	0	0	22.5	4,687.	0.17	35.	0.005	1.	0.003	1.	0	0	0	0	5E-06	0.0011	0	0	0	0	0	0
Gasoline (off-site use)	gal	2442.6667	124	302,891.	0	0	0	0	0	0	0	0	19.6	47,876.	0.11	269.	0.005	11.	5E-04	1.	0	0	0	0	4E-05	0.0953	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**331,845.**		**0**		**0**		**0**		**0**		**52,563.**		**304.**		**12.**		**2.**		**0**		**0**		**0.0964**		**0**		**0**		**0**

			Level 3 (Monitoring) Parameters Used, Extracted, Emitted, or Generated - Alternative B																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	208.3	18.5	3,854.	6E-04	0	8E-04	0	0	0	0	0	2.7	562.	0.006	1.	0.013	3.	3E-04	0	4E-07	0	0	0	1E-04	0.025	5E-08	0.000009998	2E-06	0.00031245	3E-14	0.00000000006
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	2442.6667	21	51,296.	6E-04	1.	8E-04	2.	0	0	0	0	4.4	10,748.	0.008	20.	0.019	46.	5E-04	1.	4E-07	0	0	0	2E-04	0.3908	9E-08	0.000207627	2E-06	0.005373867	3E-14	0.00000000076
Gravel/sand/clay	ton	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
HDPE	lb	300	31	9,300.	3E-04	0	0.002	1.	0	0	0	0	1.9	570.	0.003	1.	0.004	1.	6E-04	0	4E-07	0	1E-06	0	3E-06	0.001	3E-09	0.00000078	2E-09	0.00000072	1E-09	0.000000294
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	1.2	15	18.	7E-04	0	0.003	0	0	0	0	0	4.4	5.	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0.0007	4E-08	0.000000044	4E-07	0.000000444	3E-13	0
Solid Waste Disposal	ton	0	160	0	0.008	0	0.15	0	0	0	0	0	25	0	0.14	0	0.075	0	0.4	0	8E-06	0	0	0	0.001	0	1E-06	0	8E-06	0	1E-11	0
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	304200	6.49	1,974,258.	4E-04	106.	7E-04	201.	0	0	0	0	1	304,200.	0.005	1,460.	0.004	1,095.	4E-04	122.	0	0	0	0	1E-04	39.546	8E-09	0.00255528	9E-08	0.025857	8E-14	0.000000024032
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				2,038,726.		107.		204.		0		0		316,085.		1,482.		1,145.		123.		0		0		39.9635		0.002773729		0.031544481		0.000000318114

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

Traffic and Personnel - Alternative B

Item	Units	Level 1 - Construction	Level 2 - O&M	Level 3 - Monitoring	Level 4 - Not Used	Level 5 -Not Used	Level 6 -Not Used	Total
Traffic								
Number of passenger car or truck trips to the site	trips	123	804	220				**1,147**
Number of freight or other heavy duty truck trips to the site	trips	97	206	1				**304**
Total passenger car miles driven	miles	7,258	27,034	36,640				**70,932**
Total freight or other heavey duty truck miles driven	miles	13,964	5,348	1,500				**20,812**
Personnel								
Total on-site hours worked	man-hours	1,944	8,848	1,920				**12,712**
Heavy equipment hours operated	hours	430	2,052	0				**2,482**

Alternative:	**Alternative C**
Alternative Name:	**Cover Regrading**
Path Name:	
Main File Name:	Green Remediation Tool Main.xlsx
Reference File Name:	Green Remediation Tool Reference 100110.xlsx
Module File Name:	Alt C - cover regrading inventory module.xlsx

Variables In Alternative:

Level 1	Construction
Level 2	O&M
Level 3	Monitoring
Level 4	Not Used
Level 5	Not Used
Level 6	Not Used

Usage Input - Alternative C

	Abbrev.	Units	Level 1 Construction	Level 2 O&M	Level 3 Monitoring	Level 4 Not Used	Level 5 Not Used	Level 6 Not Used	Total
ON-SITE									
Energy									
Diesel (on-site)		gal	17882.19	3741.034	0	0	0	0	21623.22
Gasoline (on-site use)		gal	0	2386.476	0	0	0	0	2386.476
Natural gas (on-site use)		ccf	0	0	0	0	0	0	0
On-site electricity use		MWh	0	0	0	0	0	0	0
Other Energy 1		TBD							0
Other Energy 2		TBD							0
Other Energy 3		TBD							0
Water									
Groundwater Extracted On-site		gal x 1000	0	0	1.2	0	0	0	1.2
Potable Water Used		gal x 1000	10	0	0	0	0	0	10
Other On-Site Water 1		gal x 1000	0	0	0	0	0	0	0
Other On-Site Water 2		gal x 1000							0
Other On-Site Water 3		gal x 1000							0
Waste Generation									
On-Site Solid Waste Generation		ton	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		ton							0
On-Site Hazardous Waste Generation		ton	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		ton							0
Other									
On-site process emissions (HAPs)		lbs	0	0	0	0	0	0	0
On-site process emissions (GHGs)		lbs CO2e	0	0	0	0	0	0	0
On-site GHG storage		lbs CO2e	0	0	0	0	0	0	0
On-site Nox reduction		lbs							0
On-site SOx reduction		lbs							0
On-site PM reduction		lbs							0
Other 4		TBD							0
Other 5		TBD							0
ELECTRICITY GENERATION									
Electricity production		MWh	0	0	0	0	0	0	0
TRANSPORTATION									
Diesel (off-site use)		gal	442.4	773.7	208.3	0	0	0	1424.4
Gasoline (off-site use)		gal	270.1333	4668	2448	0	0	0	7386.133
Natural gas (off-site use)		ccf							0
Potable Water Transported		gal x 1000	10	0	0	0	0	0	10
Electricity transmission		MWh	0	0	0	0	0	0	0
Other Transportation 1		TBD							0
Other Transportation 2									
Other Transportation 3									

Usage Input - Alternative C

	Abbrev.	Units	Level 1 Construction	Level 2 O&M	Level 3 Monitoring	Level 4 Not Used	Level 5 Not Used	Level 6 Not Used	Total
OFF-SITE OTHER									
Materials									
Asphalt		tons	0	0	0	0	0	0	0
Bentonite		tons	0	0	0	0	0	0	0
Borrow (clean soil)		tons	667.9444	0	0	0	0	0	667.9444
Cement		dry-ton	0	0	0	0	0	0	0
Cheese Whey		lbs	0	0	0	0	0	0	0
Concrete		tons	0	0	0	0	0	0	0
Diesel Produced		gal	18324.59	4514.734	208.3	0	0	0	23047.62
Emulsified vegetable oil		lbs	0	0	0	0	0	0	0
GAC: regenerated		lbs	0	0	0	0	0	0	0
GAC: virgin coal-based		lbs	0	0	0	0	0	0	0
GAC: virgin coconut-based		lbs	0	0	0	0	0	0	0
Gasoline Produced		gal	270.1333	7054.476	2448	0	0	0	9772.609
Gravel/sand/clay		ton	473.2778	1350	0	0	0	0	1823.278
HDPE		lb	0	0	300	0	0	0	300
Hydrochloric acid (30%, SG = 1.18)		lbs	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)		lbs	0	0	0	0	0	0	0
Hydroseed		lbs	15680	0	0	0	0	0	15680
Lime		lbs	0	0	0	0	0	0	0
Molasses		lbs	0	0	0	0	0	0	0
Natural Gas Produced		ccf	0	0	0	0	0	0	0
Nitrogen fertilizer		lbs	0	0	0	0	0	0	0
Other Material #1		TBD	0	0	0	0	0	0	0
Other Material #2		TBD	0	0	0	0	0	0	0
Other Material #3		TBD	0	0	0	0	0	0	0
Other Material #4		TBD	0	0	0	0	0	0	0
Other Material #5		TBD	0	0	0	0	0	0	0
Phosphorus fertilizer		lbs	0	0	0	0	0	0	0
Polymer		lbs	0	0	0	0	0	0	0
Potable Water Produced		gal x 1000	0	0	0	0	0	0	0
Potassium permanganate		lbs	0	0	0	0	0	0	0
PVC		lbs	0	0	0	0	0	0	0
Sequestering agent		lbs	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)		lbs	0	0	0	0	0	0	0
Stainless Steel		lb	0	0	0	0	0	0	0
Steel		lb	0	0	0	0	0	0	0
Tree: root ball		trees	0	0	0	0	0	0	0
Tree: whip		trees	0	0	0	0	0	0	0
Off-Site Services									
Off-site waste water treatment		gal x 1000	0	0	1.2	0	0	0	1.2
Solid Waste Disposal		ton	0	0	0	0	0	0	0
Hazardous Waste Disposal		ton	0	0	0	0	0	0	0
Laboratory Analysis		$	0	0	304200	0	0	0	304200
Other 1		TBD							0
Other 2		TBD							0
Other 3		TBD							0
Other 4		TBD							0
Other 5		TBD							0
Other									
Other 1		TBD							0

Usage Input - Alternative C

			Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	
		Units	Construction	O&M	Monitoring	Not Used	Not Used	Not Used	Total
	Abbrev.								
Other 2		TBD							0
Other 3		TBD							0
Other 4		TBD							0
Other 5		TBD							0

	Totals For Parameters Used, Extracted, Emitted, or Generated - Alternative C														
	Energy Used Mbtu	Electricity Used MWh	All Water Used gal x 1000	Potable Water Used gal x 1000	Groundwater Extracted gal x 1000	CO2e Emitted lbs	NO x Emitted lbs	SO x Emitted lbs	PM Emitted lbs	Solid Waste Generated tons	Haz. Waste Generated tons	Air Toxics Emitted lbs	Mercury Released lbs	Lead Released lbs	Dioxins Released lbs
Level 1 - Construction															
On-Site	2,485,624.	0	10.	10.	0	402,349.	3,040.	97.	61.	0	0	0.093	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	95,065.	0	0	0	0	15,259.	105.	3.	2.	0	0	0.0154	0.000000149	0.000001098	0.000000000002
Other Off-Site	381,996.	12.	78.	0	0	55,591.	147.	259.	8.	0.007	0	2.2635	0.000906091	0.028183955	0.00000000056
Construction Total	***2,962,685.***	***12.***	***88.***	***10.***	***0***	***473,199.***	***3,292.***	***359.***	***71.***	***0.007***	***0***	***2.3719***	***0.00090624***	***0.028185053***	***0.000000000562***
Level 2 - O&M															
On-Site	815,927.	0	0	0	0	130,948.	899.	31.	14.	0	0	0.1126	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	686,376.	0	0	0	0	108,901.	645.	25.	6.	0	0	0.1861	0	0	0
Other Off-Site	305,917.	11.	185.	0	0	52,275.	130.	234.	11.	0.005	0	1.6711	0.000816423	0.022293567	0.000000000354
O&M Total	***1,808,220.***	***11.***	***185.***	***0***	***0***	***292,124.***	***1,674.***	***290.***	***31.***	***0.005***	***0***	***1.9698***	***0.000816423***	***0.022293567***	***0.000000000354***
Level 3 - Monitoring															
On-Site	0	0	1.	0	1.	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	332,506.	0	0	0	0	52,668.	304.	12.	2.	0	0	0.0966	0	0	0
Other Off-Site	2,038,838.	107.	204.	0	0	316,108.	1,482.	1,146.	123.	0.004	0	39.9644	0.002774182	0.031556214	0.000000318114
Monitoring Total	***2,371,344.***	***107.***	***205.***	***0***	***1.***	***368,776.***	***1,786.***	***1,158.***	***125.***	***0.004***	***0***	***40.061***	***0.002774182***	***0.031556214***	***0.000000318114***
Level 4 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Level 5 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Level 6 - Not Used															
On-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Electricity Generation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Transportation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Off-Site	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Not Used Total	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***	***0***
Total	***7,142,249.***	***130.***	***478.***	***10.***	***1.***	***1,134,099.***	***6,752.***	***1,807.***	***227.***	***0.016***	***0***	***44.4027***	***0.004496845***	***0.082034834***	***0.00000031903***

			All Levels - Parameters Used, Extracted, Emitted, or Generated On-Site - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***7,142,248.***		***131.***		***478.***		***10.***		***1.***		***1,134,098.***		***6,752.***		***1,808.***		***226.***		***0***		***0***		***44.4024***		***0.004496848***		***0.082034836***		***0.00000031903***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	21623.22	139	3,005,628.	0	0	0	0	0	0	0	0	22.5	486,522.	0.17	3,676.	0.005	117.	0.003	74.	0	0	0	0	5E-06	0.1124	0	0	0	0	0	0
Gasoline (on-site use)	gal	2386.476	124	295,923.	0	0	0	0	0	0	0	0	19.6	46,775.	0.11	263.	0.005	11.	5E-04	1.	0	0	0	0	4E-05	0.0931	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	1.2	0	0	0	0	1	1.	0	0	1	1.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	10	0	0	0	0	1	10.	1	10.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**3,301,551.**		**0**		**11.**		**10.**		**1.**		**533,297.**		**3,939.**		**128.**		**75.**		**0**		**0**		**0.2055**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	1424.4	139	197,992.	0	0	0	0	0	0	0	0	22.5	32,049.	0.17	242.	0.005	8.	0.003	5.	0	0	0	0	5E-06	0.0074	0	0	0	0	0	0
Gasoline (off-site use)	gal	7386.1333	124	915,881.	0	0	0	0	0	0	0	0	19.6	144,768.	0.11	812.	0.005	33.	5E-04	4.	0	0	0	0	4E-05	0.2881	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	10	7.4	74.	6E-04	0	0.001	0	0	0	0	0	0.995	10.	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0.0026	1E-08	0.000000149	1E-07	0.000001098	2E-13	0.000000000002
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**1,113,947.**		**0**		**0**		**0**		**0**		**176,827.**		**1,054.**		**41.**		**9.**		**0**		**0**		**0.2981**		**0.000000149**		**0.000001098**		**0.000000000002**

			All Levels - Parameters Used, Extracted, Emitted, or Generated On-Site - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	667.94444	15.75	10,520.	6E-05	0	8E-05	0	0	0	0	0	2.52	1,683.	0.018	12.	0.002	1.	4E-04	0	4E-08	0	0	0	1E-05	0.0084	5E-09	0.000003206	2E-07	0.000100192	3E-15	0.000000000002
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	23047.62	18.5	426,381.	6E-04	14.	8E-04	18.	0	0	0	0	2.7	62,229.	0.006	148.	0.013	300.	3E-04	8.	4E-07	0.008	0	0	1E-04	2.7657	5E-08	0.001106286	2E-06	0.03457143	3E-14	0.000000000691
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	9772.6093	21	205,225.	6E-04	6.	8E-04	8.	0	0	0	0	4.4	42,999.	0.008	78.	0.019	186.	5E-04	5.	4E-07	0.004	0	0	2E-04	1.5636	9E-08	0.000830672	2E-06	0.021499741	3E-14	0.000000000303
Gravel/sand/clay	ton	1823.2778	55	100,280.	0.003	5.	0.13	237.	0	0	0	0	6.7	12,216.	0.033	60.	0.03	55.	0.004	7.	0	0	0	0	4E-07	0.0007	6E-11	0.000000117	1E-09	0.000002188	2E-16	0
HDPE	lb	300	31	9,300.	3E-04	0	0.002	1.	0	0	0	0	1.9	570.	0.003	1.	0.004	1.	6E-04	0	4E-07	0	1E-06	0.0003	3E-06	0.001	3E-09	0.00000078	2E-09	0.00000072	1E-09	0.000000294
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	15680	0.049	768.	1E-07	0	1E-04	2.	0	0	0	0	0.005	72.	3E-06	0	5E-05	1.	3E-07	0	0	0	0	0	8E-07	0.0127	2E-11	0.000000314	1E-10	0.000002023	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	1.2	15	18.	7E-04	0	0.003	0	0	0	0	0	4.4	5.	0.016	0	0.015	0	0.002	0	0.002	0.003	0	0	6E-04	0.0007	4E-08	0.000000044	4E-07	0.000000444	3E-13	0
Solid Waste Disposal	ton	0	160	0	0.008	0	0.15	0	0	0	0	0	25	0	0.14	0	0.075	0	0.4	0	8E-06	0	0	0	0.001	0	1E-06	0	8E-06	0	1E-11	0
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	304200	6.49	1,974,258.	4E-04	106.	7E-04	201.	0	0	0	0	1	304,200.	0.005	1,460.	0.004	1,095.	4E-04	122.	0	0	0	0	1E-04	39.546	8E-09	0.00255528	9E-08	0.025857	8E-14	0.000000024032
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				2,726,750.		131.		467.		0		0		423,974.		1,759.		1,639.		142.		0.015		0.0003		43.8988		0.004496699		0.082033738		0.000000319028

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 1 (Construction) Parameters Used, Extracted, Emitted, or Generated - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***2,962,685.***		***12.***		***88.***		***10.***		***0***		***473,199.***		***3,292.***		***359.***		***71.***		***0.007***		***0***		***2.3719***		***0.00090624***		***0.028185053***		***0.000000000562***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	17882.186	139	2,485,624.	0	0	0	0	0	0	0	0	22.5	402,349.	0.17	3,040.	0.005	97.	0.003	61.	0	0	0	0	5E-06	0.093	0	0	0	0	0	0
Gasoline (on-site use)	gal	0	124	0	0	0	0	0	0	0	0	0	19.6	0	0.11	0	0.005	0	5E-04	0	0	0	0	0	4E-05	0	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	10	0	0	0	0	1	10.	1	10.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**2,485,624.**		**0**		**10.**		**10.**		**0**		**402,349.**		**3,040.**		**97.**		**61.**		**0**		**0**		**0.093**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	442.4	139	61,494.	0	0	0	0	0	0	0	0	22.5	9,954.	0.17	75.	0.005	2.	0.003	2.	0	0	0	0	5E-06	0.0023	0	0	0	0	0	0
Gasoline (off-site use)	gal	270.13333	124	33,497.	0	0	0	0	0	0	0	0	19.6	5,295.	0.11	30.	0.005	1.	5E-04	0	0	0	0	0	4E-05	0.0105	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	10	7.4	74.	6E-04	0	0.001	0	0	0	0	0	0.995	10.	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0.0026	1E-08	0.000000149	1E-07	0.000001098	2E-13	0.000000000002
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**95,065.**		**0**		**0**		**0**		**0**		**15,259.**		**105.**		**3.**		**2.**		**0**		**0**		**0.0154**		**0.000000149**		**0.000001098**		**0.000000000002**

			Level 1 (Construction) Parameters Used, Extracted, Emitted, or Generated - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	667.94444	15.75	10,520.	6E-05	0	8E-05	0	0	0	0	0	2.52	1,683.	0.018	12.	0.002	1.	4E-04	0	4E-08	0	0	0	1E-05	0.0084	5E-09	0.000003206	2E-07	0.000100192	3E-15	0.000000000002
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	18324.586	18.5	339,005.	6E-04	11.	8E-04	14.	0	0	0	0	2.7	49,476.	0.006	117.	0.013	238.	3E-04	6.	4E-07	0.007	0	0	1E-04	2.199	5E-08	0.00087958	2E-06	0.027486879	3E-14	0.00000000055
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	270.13333	21	5,673.	6E-04	0	8E-04	0	0	0	0	0	4.4	1,189.	0.008	2.	0.019	5.	5E-04	0	4E-07	0	0	0	2E-04	0.0432	9E-08	0.000022961	2E-06	0.000594293	3E-14	0.000000000008
Gravel/sand/clay	ton	473.27778	55	26,030.	0.003	1.	0.13	62.	0	0	0	0	6.7	3,171.	0.033	16.	0.03	14.	0.004	2.	0	0	0	0	4E-07	0.0002	6E-11	0.00000003	1E-09	0.000000568	2E-16	0
HDPE	lb	0	31	0	3E-04	0	0.002	0	0	0	0	0	1.9	0	0.003	0	0.004	0	6E-04	0	4E-07	0	1E-06	0	3E-06	0	3E-09	0	2E-09	0	1E-09	0
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	15680	0.049	768.	1E-07	0	1E-04	2.	0	0	0	0	0.005	72.	3E-06	0	5E-05	1.	3E-07	0	0	0	0	0	8E-07	0.0127	2E-11	0.000000314	1E-10	0.000002023	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	0	15	0	7E-04	0	0.003	0	0	0	0	0	4.4	0	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0	4E-08	0	4E-07	0	3E-13	0
Solid Waste Disposal	ton	0	160	0	0.008	0	0.15	0	0	0	0	0	25	0	0.14	0	0.075	0	0.4	0	8E-06	0	0	0	0.001	0	1E-06	0	8E-06	0	1E-11	0
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	0	6.49	0	4E-04	0	7E-04	0	0	0	0	0	1	0	0.005	0	0.004	0	4E-04	0	0	0	0	0	1E-04	0	8E-09	0	9E-08	0	8E-14	0
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				381,996.		12.		78.		0		0		55,591.		147.		259.		8.		0.007		0		2.2635		0.000906091		0.028183955		0.00000000056

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 2 (O&M) Parameters Used, Extracted, Emitted, or Generated - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***1,808,220.***		***11.***		***185.***		***0***		***0***		***292,124.***		***1,674.***		***290.***		***31.***		***0.005***		***0***		***1.9698***		***0.000816423***		***0.022293567***		***0.000000000354***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	3741.0336	139	520,004.	0	0	0	0	0	0	0	0	22.5	84,173.	0.17	636.	0.005	20.	0.003	13.	0	0	0	0	5E-06	0.0195	0	0	0	0	0	0
Gasoline (on-site use)	gal	2386.476	124	295,923.	0	0	0	0	0	0	0	0	19.6	46,775.	0.11	263.	0.005	11.	5E-04	1.	0	0	0	0	4E-05	0.0931	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**815,927.**		**0**		**0**		**0**		**0**		**130,948.**		**899.**		**31.**		**14.**		**0**		**0**		**0.1126**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	773.7	139	107,544.	0	0	0	0	0	0	0	0	22.5	17,408.	0.17	132.	0.005	4.	0.003	3.	0	0	0	0	5E-06	0.004	0	0	0	0	0	0
Gasoline (off-site use)	gal	4668	124	578,832.	0	0	0	0	0	0	0	0	19.6	91,493.	0.11	513.	0.005	21.	5E-04	3.	0	0	0	0	4E-05	0.1821	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**686,376.**		**0**		**0**		**0**		**0**		**108,901.**		**645.**		**25.**		**6.**		**0**		**0**		**0.1861**		**0**		**0**		**0**

			Level 2 (O&M) Parameters Used, Extracted, Emitted, or Generated - Alternative C																													
			Energy		**Electricity**		**All Water**		**Potable Water**		**Groundwater**		**CO2e**		**NO x**		**SO x**		**PM**		**Solid Waste**		**Haz. Waste**		**Air Toxics**		**Mercury**		**Lead**		**Dioxins**	
		Quantity Used	**Conv. Factor**	**Used**	**Conv. Factor**	**Used**	**Conv. Factor**	**Used**	**Conv. Factor**	**Used**	**Conv. Factor**	**Extracted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Generated**	**Conv. Factor**	**Generated**	**Conv. Factor**	**Emitted**	**Conv. Factor**	**Released**	**Conv. Factor**	**Released**	**Conv. Factor**	**Released**
				Mbtu		**MWh**		**gal x 1000**		**gal x 1000**		**gal x 1000**		**lbs**		**lbs**		**lbs**		**lbs**		**tons**		**tons**		**lbs**		**lbs**		**lbs**		**lbs**
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	4514.7336	18.5	83,523.	6E-04	3.	8E-04	3.	0	0	0	0	2.7	12,190.	0.006	29.	0.013	59.	3E-04	2.	4E-07	0.002	0	0	1E-04	0.5418	5E-08	0.000216707	2E-06	0.0067721	3E-14	0.000000000135
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	7054.476	21	148,144.	6E-04	4.	8E-04	6.	0	0	0	0	4.4	31,040.	0.008	56.	0.019	134.	5E-04	4.	4E-07	0.003	0	0	2E-04	1.1287	9E-08	0.00059963	2E-06	0.015519847	3E-14	0.000000000219
Gravel/sand/clay	ton	1350	55	74,250.	0.003	4.	0.13	176.	0	0	0	0	6.7	9,045.	0.033	45.	0.03	41.	0.004	5.	0	0	0	0	4E-07	0.0006	6E-11	0.000000086	1E-09	0.00000162	2E-16	0
HDPE	lb	0	31	0	3E-04	0	0.002	0	0	0	0	0	1.9	0	0.003	0	0.004	0	6E-04	0	4E-07	0	1E-06	0	3E-06	0	3E-09	0	2E-09	0	1E-09	0
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	0	15	0	7E-04	0	0.003	0	0	0	0	0	4.4	0	0.016	0	0.015	0	0.002	0	0.002	0	0	0	6E-04	0	4E-08	0	4E-07	0	3E-13	0
Solid Waste Disposal	ton	0	160	0	0.008	0	0.15	0	0	0	0	0	25	0	0.14	0	0.075	0	0.4	0	8E-06	0	0	0	0.001	0	1E-06	0	8E-06	0	1E-11	0
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	0	6.49	0	4E-04	0	7E-04	0	0	0	0	0	1	0	0.005	0	0.004	0	4E-04	0	0	0	0	0	1E-04	0	8E-09	0	9E-08	0	8E-14	0
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				305,917.		11.		185.		0		0		52,275.		130.		234.		11.		0.005		0		1.6711		0.000816423		0.022293567		0.000000000354

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

			Level 3 (Monitoring) Parameters Used, Extracted, Emitted, or Generated - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
Totals				***2,371,344.***		***107.***		***205.***		***0***		***1.***		***368,776.***		***1,786.***		***1,158.***		***125.***		***0.004***		***0***		***40.061***		***0.002774182***		***0.031556214***		***0.000000318114***
ON-SITE																																
Energy																																
Diesel (on-site)	gal	0	139	0	0	0	0	0	0	0	0	0	22.5	0	0.17	0	0.005	0	0.003	0	0	0	0	0	5E-06	0	0	0	0	0	0	0
Gasoline (on-site use)	gal	0	124	0	0	0	0	0	0	0	0	0	19.6	0	0.11	0	0.005	0	5E-04	0	0	0	0	0	4E-05	0	0	0	0	0	0	0
Natural gas (on-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
On-site electricity use	MWh	0	3413	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Energy 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water																																
Groundwater Extracted On-site	gal x 1000	1.2	0	0	0	0	1	1.	0	0	1	1.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Used	gal x 1000	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 1	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 2	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other On-Site Water 3	gal x 1000	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waste Generation																																
On-Site Solid Waste Generation	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
On-Site Solid Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste	ton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
On-Site Hazardous Waste Disposal		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
On-site process emissions (HAPs)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
On-site process emissions (GHGs)	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site GHG storage	lbs CO2e	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site Nox reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site SOx reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
On-site PM reduction	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ON-SITE TOTAL				**0**		**0**		**1.**		**0**		**1.**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**		**0**
ELECTRICITY GENERATION																																
Electricity production	MWh	0	7800	0	0.06	0	1.1	0	0	0	0	0	1990	0	5.17	0	12.8	0	1.274	0	9E-04	0	0	0	0.546	0	3E-05	0	2E-04	0	2E-10	0
TRANSPORTATION																																
Diesel (off-site use)	gal	208.3	139	28,954.	0	0	0	0	0	0	0	0	22.5	4,687.	0.17	35.	0.005	1.	0.003	1.	0	0	0	0	5E-06	0.0011	0	0	0	0	0	0
Gasoline (off-site use)	gal	2448	124	303,552.	0	0	0	0	0	0	0	0	19.6	47,981.	0.11	269.	0.005	11.	5E-04	1.	0	0	0	0	4E-05	0.0955	0	0	0	0	0	0
Natural gas (off-site use)	ccf	0	103	0	0	0	0	0	0	0	0	0	12.2	0	0.01	0	6E-06	0	8E-04	0	0	0	0	0	8E-06	0	3E-08	0	5E-08	0	0	0
Potable Water Transported	gal x 1000	0	7.4	0	6E-04	0	0.001	0	0	0	0	0	0.995	0	0.003	0	0.006	0	6E-04	0	6E-07	0	0	0	3E-04	0	1E-08	0	1E-07	0	2E-13	0
Electricity transmission	MWh	0	410	0	0.12	0	0.132	0	0	0	0	0	238.8	0	0.62	0	1.536	0	0.153	0	1E-04	0	0	0	0.066	0	4E-06	0	2E-05	0	3E-11	0
Other Transportation 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Transportation 3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TRANSPORTATION TOTAL				**332,506.**		**0**		**0**		**0**		**0**		**52,668.**		**304.**		**12.**		**2.**		**0**		**0**		**0.0966**		**0**		**0**		**0**

			Level 3 (Monitoring) Parameters Used, Extracted, Emitted, or Generated - Alternative C																													
			Energy		Electricity		All Water		Potable Water		Groundwater		CO2e		NO x		SO x		PM		Solid Waste		Haz. Waste		Air Toxics		Mercury		Lead		Dioxins	
		Quantity Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Used	Conv. Factor	Extracted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Emitted	Conv. Factor	Generated	Conv. Factor	Generated	Conv. Factor	Emitted	Conv. Factor	Released	Conv. Factor	Released	Conv. Factor	Released
				Mbtu		MWh		gal x 1000		gal x 1000		gal x 1000		lbs		lbs		lbs		lbs		tons		tons		lbs		lbs		lbs		lbs
OFF-SITE OTHER																																
Materials																																
Asphalt	tons	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bentonite	tons	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
Borrow (clean soil)	tons	0	15.75	0	6E-05	0	8E-05	0	0	0	0	0	2.52	0	0.018	0	0.002	0	4E-04	0	4E-08	0	0	0	1E-05	0	5E-09	0	2E-07	0	3E-15	0
Cement	dry-ton	0	4100	0	0.13	0	0.41	0	0	0	0	0	1800	0	3.6	0	2.1	0	0.006	0	0	0	0	0	0.058	0	6E-05	0	1E-04	0	9E-11	0
Cheese Whey	lbs	0	1.87	0	0	0	0	0	0	0	0	0	1.1	0	0.008	0	0.01	0	2E-04	0	0	0	0	0	0	0	0	0	0	0	0	0
Concrete	tons	0	3020	0	0.096	0	0.33	0	0	0	0	0	1322	0	2.6	0	1.5	0	0.006	0	3E-08	0	0	0	0.043	0	4E-05	0	1E-04	0	6E-11	0
Diesel Produced	gal	208.3	18.5	3,854.	6E-04	0	8E-04	0	0	0	0	0	2.7	562.	0.006	1.	0.013	3.	3E-04	0	4E-07	0	0	0	1E-04	0.025	5E-08	0.000009998	2E-06	0.00031245	3E-14	0.000000000006
Emulsified vegetable oil	lbs	0	3.6	0	6E-05	0	2E-05	0	0	0	0	0	3.51	0	0.027	0	0.031	0	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: regenerated	lbs	0	9.6	0	4E-04	0	0.006	0	0	0	0	0	2	0	0.025	0	0.015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coal-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GAC: virgin coconut-based	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gasoline Produced	gal	2448	21	51,408.	6E-04	1.	8E-04	2.	0	0	0	0	4.4	10,771.	0.008	20.	0.019	47.	5E-04	1.	4E-07	0.001	0	0	2E-04	0.3917	9E-08	0.00020808	2E-06	0.0053856	3E-14	0.000000000076
Gravel/sand/clay	ton	0	55	0	0.003	0	0.13	0	0	0	0	0	6.7	0	0.033	0	0.03	0	0.004	0	0	0	0	0	4E-07	0	6E-11	0	1E-09	0	2E-16	0
HDPE	lb	300	31	9,300.	3E-04	0	0.002	1.	0	0	0	0	1.9	570.	0.003	1.	0.004	1.	6E-04	0	4E-07	0	1E-06	0	3E-06	0.001	3E-09	0.00000078	2E-09	0.00000072	1E-09	0.000000294
Hydrochloric acid (30%, SG = 1.18)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydrogen peroxide (50%, SG=1.19)	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroseed	lbs	0	0.049	0	1E-07	0	1E-04	0	0	0	0	0	0.005	0	3E-06	0	5E-05	0	3E-07	0	0	0	0	0	8E-07	0	2E-11	0	1E-10	0	0	0
Lime	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molasses	lbs	0	1.31	0	5E-06	0	9E-05	0	0	0	0	0	0.4	0	0.003	0	0.003	0	6E-05	0	0	0	0	0	0	0	0	0	0	0	0	0
Natural Gas Produced	ccf	0	5.2	0	3E-04	0	8E-05	0	0	0	0	0	2.2	0	0.004	0	0.005	0	7E-05	0	0	0	0	0	6E-06	0	2E-08	0	9E-07	0	5E-14	0
Nitrogen fertilizer	lbs	0	16.2	0	2E-05	0	0	0	0	0	0	0	1.5	0	8E-04	0	0.017	0	7E-05	0	0	0	0	0	3E-04	0	6E-09	0	4E-08	0	0	0
Other Material #1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Material #5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Phosphorus fertilizer	lbs	0	3.39	0	7E-05	0	0	0	0	0	0	0	0.35	0	0.002	0	0.017	0	1E-04	0	0	0	0	0	5E-05	0	2E-09	0	5E-08	0	0	0
Polymer	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Potable Water Produced	gal x 1000	0	9.2	0	4E-04	0	0.021	0	0	0	0	0	5	0	0.01	0	0.006	0	0.016	0	8E-07	0	0	0	2E-05	0	8E-09	0	7E-08	0	1E-13	0
Potassium permanganate	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PVC	lbs	0	22	0	6E-04	0	0.007	0	0	0	0	0	4.1	0	0.005	0	0.008	0	0.001	0	2E-06	0	2E-06	0	5E-04	0	3E-07	0	1E-07	0	7E-09	0
Sequestering agent	lbs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sodium hydroxide (dry bulk)	lbs	0	6.6	0	3E-04	0	0.001	0	0	0	0	0	1.37	0	0.003	0	0.005	0	5E-04	0	2E-05	0	5E-07	0	6E-05	0	2E-07	0	3E-08	0	2E-14	0
Stainless Steel	lb	0	11.6	0	6E-04	0	0.002	0	0	0	0	0	3.4	0	0.008	0	0.012	0	0.004	0	6E-04	0	0	0	1E-04	0	0	0	5E-07	0	2E-12	0
Steel	lb	0	4.4	0	2E-04	0	6E-04	0	0	0	0	0	1.1	0	0.001	0	0.002	0	6E-04	0	3E-04	0	0	0	7E-05	0	1E-07	0	3E-06	0	7E-12	0
Tree: root ball	trees	0	3.7	0	2E-06	0	0.004	0	0	0	0	0	0.6	0	0.003	0	6E-04	0	3E-05	0	1E-08	0	0	0	6E-06	0	2E-09	0	6E-08	0	0	0
Tree: whip	trees	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-Site Services																																
Off-site waste water treatment	gal x 1000	1.2	15	18.	7E-04	0	0.003	0	0	0	0	0	4.4	5.	0.016	0	0.015	0	0.002	0	0.002	0.003	0	0	6E-04	0.0007	4E-08	0.000000044	4E-07	0.000000444	3E-13	0
Solid Waste Disposal	ton	0	160	0	0.008	0	0.15	0	0	0	0	0	25	0	0.14	0	0.075	0	0.4	0	8E-06	0	0	0	0.001	0	1E-06	0	8E-06	0	1E-11	0
Hazardous Waste Disposal	ton	0	176	0	0.009	0	0.165	0	0	0	0	0	27.5	0	0.154	0	0.083	0	0.44	0	9E-06	0	0	0	0.002	0	1E-06	0	8E-06	0	1E-11	0
Laboratory Analysis	$	304200	6.49	1,974,258.	4E-04	106.	7E-04	201.	0	0	0	0	1	304,200.	0.005	1,460.	0.004	1,095.	4E-04	122.	0	0	0	0	1E-04	39.546	8E-09	0.00255528	9E-08	0.025857	8E-14	0.000000024032
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other																																
Other 1	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 2	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 3	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 4	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other 5	TBD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OFF-SITE OTHER TOTAL				2,038,838.		107.		204.		0		0		316,108.		1,482.		1,146.		123.		0.004		0		39.9644		0.002774182		0.031556214		0.000000318114

Notes:
- All subtotals are rounded to two significant digits
- Groundwater extracted refers to Groundwater extracted on-site that is not reinjected to an aquifer of similar quality
- All water refers to all water of any variety used on-site that is not returned to its original source. This can include potable water, groundwater, surface water, reclaimed water, etc.
- Air toxics refers to Hazardous Air Pollutant (HAPs) as defined by EPA

Traffic and Personnel - Alternative C

Item	Units	Level 1 - Construction	Level 2 - O&M	Level 3 - Monitoring	Level 4 - Not Used	Level 5 -Not Used	Level 6 -Not Used	Total
Traffic								
Number of passenger car or truck trips to the site	trips	131	1,140	300				**1,571**
Number of freight or other heavy duty truck trips to the site	trips	88	180	1				**269**
Total passenger car miles driven	miles	4,542	47,940	36,720				**89,202**
Total freight or other heavey duty truck miles driven	miles	3,110	5,400	1,500				**10,010**
Personnel								
Total on-site hours worked	man-hours	3,144	12,240	2,160				**17,544**
Heavy equipment hours operated	hours	2,171	6,120	0				**8,291**