AIR QUALITY CALCULATIONS AND RESULTS

EMPIRE MINE STATE HISTORIC PARK
NEVADA COUNTY, CALIFORNIA

APPENDIX D

PREPARED BY

Greg Griffith
Mining Engineer
Resource Design Technology
4990 Hillsdale Circle, Suite 400
El Dorado Hills, CA 95762

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1.0 INTRODUCTION

A Draft Program Environmental Impact Report (Draft PEIR) to evaluate the potential environmental impacts of a proposed Site Characterization and Remediation Project (Project) at the Empire Mine State Historic Park (Park) has been proposed. The Draft PEIR evaluates impacts associated with characterization and evaluation, interim actions, and remediation at the Park.

The Draft PEIR contains a detailed description of the Project and the required air quality impacts to be assessed. This document supports the required Draft PEIR and the reader is referred to the Draft PEIR for further information about the Project and summarizes the estimated air emissions from the proposed Project, the resulting ambient air exposure point concentrations that humans could be exposed to, and estimated worst-case human health effects.

Potential air quality impacts and environmental effects of the Project will likely be caused by Program Actions implemented at the site. Program Actions are described in Section 2.0 of the Draft PEIR and could be a combination of one or all the following activities described below:

- Operation of heavy construction equipment;
- Off-Area transportation of contaminated soils leaving the Park and importation of clean fill material entering the Area;
- Mobilization and demobilization of heavy construction equipment to the Park;
- Importation or delivery of supplies and materials that could be used for remediation activities;
- Grading activities;
- Boring activities;
- Excavation activities;
- Drilling and blasting activities;
- Scarifying activities;
- Removal of trees and other vegetation;
- Construction of ancillary structures to the water treatment facility;
- Construction and installation of permanent exclusion barriers; and
- Construction and maintenance of access roads.

This document examines air quality emissions of criteria pollutants associated with Program Actions and provide estimates of the maximum daily mass emissions. Criteria pollutants include carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM_{10}/$PM_{2.5}$), and reactive organic gases (ROG).

In addition, diesel engines in equipment associated with the Program Actions emit diesel particulate matter (DPM) which is considered a toxic air contaminant (TAC)

with associated human health effects. Emissions of DPM are estimated along with maximum potential exposure concentrations in air such that human cancer risk and chronic non-cancer health effects can be assessed.

Further, additional TACs (arsenic, cadmium and lead) referred to as constituents of concern (COC) were chosen for the air quality assessment where the average measured concentrations were above the CHHSL values or EPA Region 9 PRG for lead.

COC concentrations used for screening purposes were determined based on either the average concentration (calculated as the 95th percentile upper confidence level of the mean), when at least 15 sample values were available, or the maximum concentration, for each potential Remediation Area.

A review of much of the available data suggested that only arsenic, lead, and cadmium concentrations would be above the CHHSL evaluation thresholds for any potential Remediation Area. For purposes of this assessment, it was assumed that the actual concentrations of other metals in soil to be disturbed would be below these thresholds.

The remainder of this document discusses the potential sources of the air pollutants described above, provides maximum daily emissions estimates, and, in the case of those pollutants classified as TACs, provides estimates of human exposure point concentrations and resulting human health effects consistent with the methodologies specified by the California Office of Human Health Hazard Assessment (OEHHA).[1]

[1] Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, California Environmental Protection Agency, August 2003.

2.0 SOURCES OF AIR EMISSIONS

2.1 PROGRAM ACTIONS ACTIVITIES

2.1.1 DIESEL EXHAUST

Construction equipment associated with Program Actions will include equipment used for Project Actions as described in Table 4.0-1 of the Draft PEIR. Most of this equipment will be powered by diesel internal combustion engines. These engines emit criteria pollutants such as CO, NO_x, SO_2, PM_{10}, $PM_{2.5}$, and ROG. Because the particulate matter is emitted from diesel engines, it is also classified as DPM, which is identified as a TAC in California and is associated with human health effects.

2.1.2 FUGITIVE DUST

The use of construction equipment associated with Project Actions will also result in the generation of fugitive dust emissions. These emissions will be higher when the soil surface is dry and lower when the surface is wet (either due to the presence of surface water, precipitation, or manual application of water). These emissions can be classified as to particle size (e.g. PM_{10} consists of particles with mean diameters of 10 microns or less, $PM_{2.5}$ consists of particles with mean diameters of 2.5 microns or less, etc.).

These particulate emissions will contain any metals or chemical compounds that are constituents of the material that the particles are comprised of. Since the areas where Programs Actions may contain arsenic, lead, and cadmium at concentrations above the CHHSL level, there could be these particles in the fugitive dust as well.

3.0 AIR EMISSIONS CALCULATIONS

Air emissions were estimated for the sources of air emissions discussion in Section 2.0 above.

3.1 PROGRAM ACTIONS CONSTRUCTION ACTIVITIES

Construction activities comprise the majority of the Program Actions and are the largest source of Program Actions emissions. These activities are described in Table 4.0-1 of the Draft PEIR but typically would include ground preparation; excavation and hauling of soil; surface grading; ground watering; hauling of equipment, fuel, and workers onsite; and access road construction.

3.1.1 EQUIPMENT USAGE ESTIMATES

The Program Actions construction activities associated with the Project Actions for the purpose of simplicity were categorized to belong to one of four phases namely:

1) Grubbing and Land Clearing
2) Grading and Excavation
3) Drainage and Utilities Installation
4) Paving

3.1.1.1 Phase 1: Grubbing and Land Clearing

It was estimated that activities in this phase would occur over the period 07/01–08/01 assuming 8-hour workdays over the course of five days per week for two years. Estimated onsite construction equipment to be used was identified as follows.

Table 1. Estimated Grubbing and Land Clearing (Mass Grading) Onsite Program Actions Construction Equipment Activity and List

Onsite Equipment Description	No. of Pieces of Equipment
Excavator	1
Graders	1
Rubber Tire Dozer	1
Scraper	1

3.1.1.2 Phase 2: Grading and Excavation

It was estimated that activities in this phase would occur over the period of 08/02 – 09/30 assuming 8-hour workdays over the course of five days per week for two

years and beginning after the completion of the grubbing and land clearing phase. Estimated onsite construction equipment to be used was identified as follows.

Table 2. Estimated Grading and Excavation (Fine Grading) Onsite Program Actions Construction Equipment Activity and List

Onsite Equipment Description	No. of Pieces of Equipment
Scraper	1
Excavator	1
Grader	1
Rubber Tire Loader	1

3.1.1.3 Phase 3: Drainage and Utilities Installation

It was estimated that activities in this phase would occur the period of 10/01– 11/30 over the course of two years assuming 8 hour workdays over the course of five days per week for two years and beginning after completion of the grading and excavation phase. Estimated onsite construction equipment to be used was identified as follows.

Table 3. Estimated Drainage and Utilities Installation (Trenching) Onsite Program Actions Construction Equipment Activity List

Onsite Equipment Description	No. of Pieces of Equipment
Scraper	1
Grader	1
Plate Compactor	1
Trencher	1

3.1.1.4 Phase 4: Paving

It was estimated that activities in this phase would occur over the period 12/01 – 12/31 assuming 8 hour workdays beginning after completion of the drainage and utilities phase over the course of five days per week over two years. Estimated onsite construction equipment to be used was identified as follows.

Table 4. Estimated Paving (Paving) Onsite Program Actions Construction Equipment Activity and List

On-Site Equipment Description	No. of Pieces of Equipment
Pavers	1
Paving Equipment	1
Roller	1
Other Construction Equipment	1

3.1.2 EMISSION ESTIMATION METHODOLOGY

In most instances, area-specific information (referred to as a Remediation Area in Section 2.5.2 of the Draft PEIR) is not yet available on which to base assumptions for the quantification of air emissions. Hence, for the purposes of this air quality impact assessment, it is necessary to conduct an evaluation that is broader in nature to determine what level of activity related to Program Actions would result in emissions and ambient impacts that are less than significant when compared to the NSAQMD significance thresholds. This level of activity is termed the Maximum Daily Scenario (MDS) and it is an estimate of foreseeable Program Actions that could be occurring either concurrently or consecutively that are likely potential sources of emissions.

Emissions resulting from Program Actions construction activities were assessed for a maximum daily scenario (MDS) which equates to either of the scenarios as described below:

- Scenario 1 – the only Program Actions construction activity permitted is grading and excavation (includes soil hauling emissions); or
- Scenario 2 – the types of Program Actions construction activities that can occur concurrently are grubbing and land clearing, installation of drainage and utilities and paving.

The Program Actions construction activities and equipment list that are associated with the maximum daily scenario is presented in the table below.

Table 5. Maximum Daily Scenario, Construction Activities, And Equipment List

Max Equipment (Max Scenario) 8hr/day	Concurrent Program Actions (or construction activities)
Scenario 1: Scraper (1), Excavator (1), Grader (1), Rubber Tire Loader (1), (Other Construction Equipment, Haul Trucks)	Grading and Excavation
Scenario 2: Dozer (1), Scraper (2), Grader (1), Plate Compactor (1), Trencher (1), Paver (1), Paving Equipment (2), Roller (1)	Grubbing and Land Clearing, Drainage and Utilities, Paving

In addition to the equipment list, the MDS is correlated to the following hypothetical operating scenario:

- The maximum disturbed acreage should be 5 acres or less;
- The soil is assumed to be weathered rock and or soil;
- The amount of soil imported/exported should not exceed 10,000 cubic yards over the duration of the grading and excavation phase; and
- The truck capacity for on/off-site hauling is 20 cubic yards.

A detailed discussion of emission estimates follows in the sections below.

3.1.2.1 Onsite Emissions - URBEMIS

URBEMIS (Urban Emissions), Version 9.2.4 (June 2007) was used to model onsite emissions due to Program Actions construction activities for the maximum daily scenario.

A custom land use type was used and a total of 10 acres was assigned to the custom land use type. For purposes of estimating emissions related to on-site vehicle traffic generated due to the Program Actions, “trips per acre-day” was set to 10 trips per day total.

Project Actions were classified (for convenience purposes) to be one of four phases (as described in Section 3.1.1) and given the URBEMIS phase descriptions as listed in the Table 6. The maximum daily scenario is described below and can be either scenario 1 or scenario 2.

Under Scenario 1, the only construction activity permitted is grading and excavation (includes soil hauling emissions). The types of equipment would vary but could be one Scraper, one Grader, one Rubber Tire Loader, and Haul Trucks that would be utilized to transport material to and from the Remediation Area.

Under Scenario 2, the types of construction activities that could occur include grubbing and land clearing, installation of drainage and utilities and paving. The types of equipment could vary and could include one Dozer, two Scrapers, one grader, one Plate Compactor, one Trencher, on Paver, two pieces of Paving Equipment, and one Roller that would operate at the Remediation Area.

Table 6. Program Actions Construction Activities And Associated URBEMIS Phase Descriptions

Program Actions construction activities	URBEMIS Phase Descriptions
1. Grubbing and Land Clearing	Mass Grading
2. Grading and Excavation	Fine Grading
3. Drainage and Utilities	Trenching
4. Paving	Asphalt

For Program Actions construction activity Grading and Excavation (or Fine Grading per URBEMIS), the "total amount of material to export/import" was set to 10,000 cubic yards of material over the period this activity will occur.

For Grubbing and Land Clearing and Grading and Excavation, an average emission rate of 10 pounds per day of fugitive dust was used. This value was provided by URBEMIS.

The maximum disturbed area per day for any URBEMIS Phase was set equal to five acres. Construction data was input into URBEMIS using the lists of equipment as listed in Tables 1-4 above. For all activity years, default values provided by URBEMIS were used for horsepower and load factor.

Onsite DPM

Onsite DPM emissions were estimated for all Program Actions Construction activities using URBEMIS as described above. URBEMIS calculates PM_{10} values related to exhaust, differentiating it from PM_{10} emissions related to fugitive dust. It was assumed that 100% of the PM_{10} emissions related to exhaust were DPM. Onsite DPM emissions are presented in Appendix D.0. URBEMIS output summaries have been included in Appendix D.9.

Onsite COCs (Arsenic, Cadmium and Lead)

Onsite COC emissions were estimated based on the fugitive dust (PM_{10}) output from URBEMIS. URBEMIS calculates PM_{10} values associated with fugitive dust, differentiating it from PM_{10} emission related to exhaust. It was assumed that these particulate emission rates will contain any metals or chemical compounds that are constituents of the onsite soils where Program Actions Construction activities are being carried out. The three COCs, arsenic, cadmium and lead are present in on-site soils at the following average concentration 407, 9.9 and 904 mg/kg respectively. It therefore follows that the COC component of any dust generated on the site will be comprised of COC in the same concentration. Onsite arsenic emissions are presented in Appendix D.0. URBEMIS output summaries have been included in Appendix D.0.

Onsite Criteria Pollutants

Onsite criteria pollutants were estimated for all Program Actions Construction activities using URBEMIS as described above. Onsite criteria emissions are presented in Table 7. The emissions for the maximum daily scenario from Program Actions are presented in Table 8. URBEMIS output summaries have been included in Appendix D.9.

Table 7. Summary of Daily Emissions (Mitigated) from Program Actions by Phases

Program Actions Construction activities (URBEMIS Phase Description)	ROG (lbs/day)	CO (lbs/day)	NOx (lbs/day)	PM_{10} (lbs/day)	DPM (lbs/day)	$PM_{2.5}$ (lbs/day)	CO_2 (lbs/day)
Grubbing/Land Clearing (Mass Grading)	2.31	21.25	38.97	18.06	1.31	3.77	5,267
Grading/Excavation (Fine Grading)	2.75	23.56	46.19	18.05	1.58	5.26	6,182
Drainage/Utilities/Sub-Grade (Trenching)	1.71	14.39	28.88	0.0	0.99	0.93	3,929
Paving (Paving)	1.66	14.14	24.6 1	0.01	1.07	1.00	2,987

Table 8. Summary of Maximum Daily Scenario Emissions (Mitigated) **from Program Actions**

Scenarios	ROG[a] (lbs/day)	CO (lbs/day)	NOx[a] (lbs/day)	PM_{10}[a] (lbs/day)	DPM (lbs/day)	$PM_{2.5}$ (lbs/day)	CO_2 (lbs/day)
Scenario 1	2.31	21.25	38.97	18.06	1.31	3.77	5,267
Scenario 2	6.12	52.09	99.68	18.06	3.64	7.19	13,098
NSAQMD Level A Thresholds	<24	-	<24	<79		-	-
NSAQMD Level B Thresholds	24-136	-	24-136	79-136		-	-
NSAQMD Level C Thresholds	>136	-	>136	>136		-	-

[a] NASAQMD thresholds only exist for these pollutants;

4.0 ESTIMATING AIR EXPOSURE POINT CONCENTRATIONS

Maximum exposure concentrations in ambient air were estimated only for the following TACs (DPM, arsenic, cadmium and lead) so that maximum human health effects could be assessed.

Exposure point concentrations were assessed for Program Actions Construction activities for the maximum daily scenario which could be one of the two scenarios as described below.

- Scenario 1 – the only Program Actions construction activity permitted is grading and excavation (includes soil hauling emissions); and
- Scenario 2 – the types of Program Actions construction activities that can occur concurrently are grubbing and land clearing, installation of drainage and utilities and paving.

For the maximum daily scenario the exposure situation that was considered to occur is exposure to receptors due to emissions occurring onsite (within or near the Remediation Areas).

Approaches to assessing appropriate ambient concentrations from these scenarios are discussed below.

4.1 CONSTRUCTION ACTIVITIES

4.1.1 DIESEL PARTICULATE MATTER

4.1.1.1 Onsite Equipment

The U.S. EPA SCREEN3 dispersion model was used to estimate maximum ambient air concentrations of DPM due to onsite Program Actions construction activities for the maximum daily scenario.

During the maximum daily scenario, estimated emissions of DPM from Program Actions construction activities could occur from a subset of locations therefore, a square area source with a total area equal to 5 acres was assumed in the model. The assumed average release height for DPM emissions from engine exhaust pipes was six meters. Maximum hourly DPM emissions for the maximum daily scenario in units of grams per square meter per second were input to the model.

The model was run to predict the maximum one-hour ambient air concentration for DPM. The one-hour maximum concentration was converted to an annual average

exposure concentration by multiplying by 0.1.[2] The resulting maximum annual average DPM concentration for maximum daily scenario was estimated to be as follows:

- Maximum Daily Scenario :**1.64E-01 µg/m^3**

Emission rates modeled, scenario assumptions, and resulting maximum ambient concentrations are summarized in Appendix D.0. The SCREEN3 model printouts are provided in Appendix D-8.

4.1.2 METALS IN FUGITIVE DUST

The U.S. EPA SCREEN3 dispersion model was used to estimate maximum ambient air concentrations of COCs due to onsite Program Actions construction activities for the maximum daily scenario.

Estimated emissions of COCs from construction activities would occur from a subset of locations therefore, a square area source with a total area equal to 5 acres was assumed in the model. The assumed average release height for COC emissions from fugitive dust was two meters. Maximum hourly COC in units of grams per square meter per second were input to the model.

The model was run to predict the maximum one-hour ambient air concentration for COCs. Again, where annual average exposure concentrations were needed, the one-hour maximum concentration was converted to a maximum annual average concentration by multiplying by 0.1.

The resulting maximum annual average COC concentrations for the maximum daily scenario were estimated as follows:

- Maximum Daily Scenario – As described in Section 3.1.2: **1.47E-03 µg/m^3 for Arsenic, 3.57E-05 µg/m^3 for Cadmium and 3.27E-03 µg/m^3 for Lead.**

Emission rates modeled, scenario assumptions, and resulting maximum ambient concentrations are summarized in Appendix D.0. The SCREEN3 model printouts are provided in Appendix D.8.

[2] *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*, California Environmental Protection Agency, August 2003.

5.0 ESTIMATED HUMAN HEALTH RISK AND HAZARD

Lifetime excess cancer risk (LECR) and chronic non-cancer hazard were estimated based on annual average exposure point concentrations for the maximum daily scenario as discussed in Section 4.0 above using OEHHA-approved methodologies (OEHHA, 2003).

5.1 METHODOLOGY

The following general methodologies were used to estimate LECR and non-cancer hazard resulting from the maximum estimated exposure point concentrations for DPM and COCs (arsenic, cadmium and lead).

5.1.1 LIFETIME EXCESS CANCER RISK

Cancer risks from DPM and COCs concentrations in air would occur through the inhalation pathway. In addition, cancer risk from COCs was also assessed for the ingestion and dermal contact exposure pathways. The methodologies used to estimate LECR for each of these TACs for each exposure pathway considered is provided below. LECR values resulting from exposures to different TACs through the various exposure pathways are generally additive.

5.1.1.1 Inhalation Exposure Pathway

The LECR due to inhalation exposure to a single carcinogenic TAC is calculated as:

$$\text{LECR} = \text{Dose}_{inh} \times \text{CPF}_{inh} \qquad \text{(Eq 1)}$$

where,

LECR = Lifetime excess cancer risk; the increased probability of an individual developing cancer as a result of exposure to a carcinogenic chemical.

Dose_{inh} = Annual average dose of the carcinogenic chemical via the inhalation pathway (in mg/kg-day])

CPF_{inh} = Cancer potency factor for inhalation exposure (in $[\text{mg/kg-day}]^{-1}$)

Dose_{inh} is estimated as:

$$\text{Dose}_{inh} = \frac{\text{Conc} \times \text{DBR} \times \text{EF} \times \text{ED} \times 10^{-3}\ (\text{m}^3/\text{L}) \times 10^{-3}\ (\text{mg}/\mu\text{g})}{\text{AT}} \qquad \text{(Eq 2)}$$

where,

Conc = Average exposure point concentration in air during exposure periods ($\mu g/m^3$)
DBR = Daily breathing rate (L/kg – day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time (days)

5.1.1.2 Ingestion Exposure Pathway

The primary ingestion pathway resulting from air emissions of COCs would come from the ingestion of soil contaminated due to deposition of emitted COCs.

The LECR due to ingestion exposure to a single carcinogenic TAC is calculated as:

$$LECR = Dose_{ing} \times CPF_{ing} \qquad \text{(Eq 3)}$$

where,

LECR = Lifetime excess cancer risk; the increased probability of an individual developing cancer as a result of exposure to a carcinogenic chemical.
$Dose_{ing}$ = Average dose of the carcinogenic chemical via the ingestion pathway (in mg/kg-day])
CPF_{ing} = Cancer potency factor for ingestion exposure (in $[mg/kg\text{-}day]^{-1}$)

$Dose_{ing}$ is estimated as:

$$Dose_{ing} = \frac{C_{soil} \times GRAF \times SIR \times EF \times ED \times 10^{-6}}{AT} \qquad \text{(Eq 4)}$$

where:

10^{-6} = Conversion factor (kg/mg)
C_{soil} = Concentration of contaminant in soil (mg/kg)
GRAF = Gastrointestinal relative absorption fraction, unitless; chemical-specific
SIR = Soil ingestion rate (mg/kg BW * day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time, period of time over which exposure is averaged (days); AT = 70 yr x 365 d/yr = 25,550 days

5.1.1.3 Dermal Exposure Pathway

The primary dermal exposure pathway resulting from air emissions of COCs would come from physical contact with soil that was contaminated due to deposition of emitted COCs.

The LECR due to dermal exposure to a single carcinogenic TAC is calculated as:

$$LECR = Dose_{der} \times CPF_{der} \qquad \text{(Eq 5)}$$

where,

LECR = Lifetime excess cancer risk; the increased probability of an individual developing cancer as a result of exposure to a carcinogenic chemical.

$Dose_{der}$ = Average dose of the carcinogenic chemical via the dermal exposure pathway (in mg/kg-day])

CPF_{der} = Cancer potency factor for dermal exposure (in $[mg/kg\text{-}day]^{-1}$); assumed to be equal to the reference dose for the ingestion pathway for purposes of this study

$Dose_{der}$ is estimated as:

$$Dose_{der} = \frac{C_s \times SA \times SL \times EF \times ABS \times 10^{-9} \times ED}{BW \times AT} \qquad \text{(Eq 6)}$$

where,

$Dose_{der}$ = Exposure dose through dermal absorption (mg/kg/d)

Cs = Average soil concentration (µg/kg)

SA = Surface area of exposed skin (cm^2)

SL = Soil loading on skin (mg/cm^2-d)

ABS = Fraction absorbed across skin

BW = Body weight (kg)

10^{-9} = Micrograms to kilograms conversion factor (kg/µg)

EF = Exposure frequency (days/year)

AT = 25,550 days (70 years)

ED = Exposure Duration (years)

5.1.2 CHRONIC NONCANCER HAZARD

Chronic noncancer health effects from DPM and COCs concentrations in air would occur through the inhalation pathway. In addition, chronic noncancer health effects from COCS were also assessed for the ingestion and dermal contact exposure pathways. The methodologies used to estimate a hazard quotient for each of these TACs and exposure pathways is provided below.

5.1.2.1 Inhalation Exposure Pathway

The relationship for noncancer health effects for the inhalation exposure pathway is given by the following equation:

$$HQ = Conc/REL \qquad \text{(Eq 7)}$$

where,

HQ Hazard Quotient; an expression of the potential for non-cancer health effects.

Conc = Annual average (chronic) exposure point concentration in air during exposure periods ($\mu g/m^3$)

REL Chronic reference exposure level (REL); the concentration at which no adverse health effects are anticipated($\mu g/m^3$).

5.1.2.2 Ingestion Exposure Pathway

The relationship for non-cancer health effects for the ingestion exposure pathway is given by the following equation:

$$HQ = Dose_{ing} / RD_{ing} \qquad \text{(Eq 8)}$$

where,

HQ Hazard Quotient; an expression of the potential for non-cancer health effects.

$Dose_{ing}$ = Annual average dose of the non-cancer chemical via the ingestion pathway (in mg/kg-day])

RD_{ing} = Noncancer reference dose for ingestion exposure (in $[mg/kg\text{-}day]^{-1}$)

$Dose_{ing}$ is estimated as in Equation 4 above, except that AT = 365 for chronic noncancer exposure and ED is set equal to one.

5.1.2.3 Dermal Exposure Pathway

The relationship for noncancer health effects for the dermal exposure exposure pathway is given by the following equation:

$$HQ = Dose_{der} / RD_{der} \qquad \text{(Eq 9)}$$

where,

HQ Hazard Quotient; an expression of the potential for noncancer health effects.

$Dose_{der}$ = Annual average dose of the noncancer chemical via the dermal exposure pathway (in mg/kg-day])

RD_{der} = Noncancer reference dose for dermal exposure (in $[mg/kg\text{-}day]^{-1}$); assumed to be equal to the reference dose for the ingestion pathway for purposes of this study.

$Dose_{der}$ is estimated as in Equation 6 above, except that AT = 365 for chronic noncancer exposure and ED is set equal to one.

5.1.3 ACUTE NONCANCER HAZARD

Acute noncancer health effects from arsenic concentrations in air would occur primarily through the inhalation pathway (OEHHA does not provide an acute REL for DPM, cadmium and lead exposure). The methodology used to estimate a hazard quotient for acute exposure to arsenic is provided below.

5.1.3.1 Inhalation Exposure Pathway

The relationship for noncancer health effects for the inhalation exposure pathway is given by the following equation:

$$HQ = Conc/REL \qquad \text{(Eq 10)}$$

where,

HQ Hazard Quotient; an expression of the potential for noncancer health effects.

Conc = Hourly maximum (acute) exposure point concentration in air during exposure periods ($\mu g/m^3$)

REL Acute reference exposure level (REL); the concentration at which no adverse health effects are anticipated ($\mu g/m^3$).

5.2 ESTIMATED HUMAN HEALTH EFFECTS

Human health effects due to Program Actions emissions were estimated using the exposure point concentrations estimated in Section 4.0 and the methodologies described in Section 5.1.

5.2.1 DIESEL PARTICULATE MATTER EXPOSURE FROM ONSITE PROGRAM ACTIONS ACTIVITIES

Potential maximum human health effects were estimated based on exposure point concentrations calculated in Section 4.1 from DPM emissions from the use of diesel-powered equipment onsite due to the Program Actions activities.

5.2.1.1 Cancer Risk

The LECR resulting from inhalation exposure to DPM emissions associated with onsite Program Actions activities over the 2-year activity period, the worst-case distance from emissions, and high-end exposure assumptions for a receptor was estimated to be **1.56-in-a-million**. The calculation of this LECR and the numerical assumptions used in the calculation is provided in Appendix D.7.

5.2.1.2 Noncancer Hazard

The chronic noncancer hazard quotient resulting from inhalation exposure to DPM emissions associated with onsite Program Actions activities associated with maximum daily scenario over a one-year activity period, the worst-case distance from emissions, and high-end exposure assumptions for a receptor was estimated to be **3.28E-02**. The calculation of this HQ and the numerical assumptions used in the calculation is provided in Appendix D.3.

5.2.2 COCS (ARSENIC, CADMIUM AND LEAD) IN FUGITIVE DUST EXPOSURE FROM ONSITE PROGRAM ACTIONS ACTIVITIES

Potential maximum human health effects were estimated based on exposure point concentrations calculated in Section 4.1.2 resulting from arsenic, cadmium and lead emissions from fugitive dust associated with soil disturbance activities as a result of construction equipment usage onsite due to the Program Actions.

5.2.2.1 Cancer Risk

The LECR resulting from inhalation, ingestion, and dermal exposure to COC emissions associated with onsite Program Actions activities associated with maximum daily scenario over the 2-year activity period, the worst-case distance from emissions, and high-end exposure assumptions for a receptor was estimated to be **1.55E-01 chances in a million for arsenic, 5.54E-03 in a million for cadmium**

and 1.23E-03 in a million for lead. The calculation of this LECR and the numerical assumptions used in the calculation is provided in Appendices D.5 through D.7.

5.2.2.2 Noncancer Hazard

The chronic noncancer hazards resulting from inhalation, ingestion, and dermal exposure to COC emissions associated with onsite Program Actions equivalent to the maximum daily scenario over a one-year activity period, the worst-case distance from emissions, and high-end exposure assumptions for an occupational worker receptor were estimated to be 9.98E-02 for the Inhalation Pathway, 1.78E-02 for the Ingestion pathway, 6.69E-03 for the dermal pathway. The calculation of this HQ and the numerical assumptions used in the calculation is provided in Appendices D.1 through D.3.

The acute noncancer hazard resulting from inhalation exposure to COC emissions are discussed on a programmatic level for arsenic only. Remediation Areas where arsenic emissions would be a factor were classified into three levels of activity, viz., Level 1, Level 2 and Level 3 where the maximum hazard index (HI) is estimated to be less than 1.0, resulting in less than significant acute health impacts. These areas are described as:

1) Those Remediation Areas with maximum arsenic concentrations less than or equal to 363 mg/kg, within which only Standard and Specific Project Requirements would be necessary when Program Actions were taking place in accordance with the MDS.
2) Those Remediation Areas with maximum arsenic concentrations less than or equal to 3,500 mg/kg, but greater than 363 mg/kg, within which additional Mitigation Measures would be necessary when Program Actions were taking place, which include modifications to the MDS.

3) Those Remediation Areas with maximum arsenic concentrations greater than 3,500 mg/kg, within which a project-specific approach and MDS would need to be developed and assessed outside of this Program EIR. Project-specific requirements would then be developed to ensure that less than significant acute hazard impacts result.

The determination of the cutoff arsenic concentrations for the Level1 and Level 2 activities are shown in Appendix D. For Remediation Areas in classification Level 2, potential significant acute health impacts could result without implementation of additional mitigation. The acute noncancer hazard quotient for cadmium and lead were not determined since the exposure pathways did not have applicable toxicity data as provided by CARB.

Appendix D

Appendix D
Health Risk Data Summary

Table D.1
Cancer Risks

TAC	Inhalation	Ingestion	Dermal	Chances per Million
DPM	1.56E+00			1.56E+00
Arsenic	1.52E-01	2.67E-03	2.34E-09	1.55E-01
Cadmium	4.64E-03	6.51E-04	2.45E-04	5.54E-03
Lead	1.19E-03	3.37E-05	1.27E-05	1.23E-03
Totals	1.71E+00	3.35E-03	2.57E-04	**1.72E+00**
COC Total	1.58E-01	3.35E-03	2.57E-04	**1.62E-01**

Table D.2
Chronic Health Effects

TAC	Hazard Quotient			
	Inhalation	Ingestion	Dermal	
DPM	3.28E-02			
Arsenic	9.80E-02	1.78E-02	6.69E-03	
Cadmium	1.79E-03	3.04E-06	1.14E-06	Total HI
Hazard Index	**1.33E-01**	**1.78E-02**	**6.69E-03**	**1.57E-01**
HI for COC	**9.98E-02**	**1.78E-02**	**6.69E-03**	**1.24E-01**

Note: See Appendices D.0 to D.7 for reference to calculations in Appendix D

Appendix D.0

Appendix D.0
Screen 3 PM_{10} and DPM Input Emission Rates, Output Concentrations for Chronic Health Effects
and determination of Arsenic Concentration where Acute Non-Cancer Health Effects are below threshold standards

Particulate Matter 10 (PM10)	
Annual PM Emission (ton/yr)	6.50E-01
Annual PM Emission (g/s)	1.87E-02
Area Disturbed (Acres)	5.00E+00
Area Disturbed (m^2)	2.02E+04
Annual Emission Rate (g/s-m^2)	9.24E-07
Screen 3 Output: 1-hour PM10 concentration (µg/m^3)	3.61E+01
Adjusted 1-year PM10 concentration (µg/m^3)	3.61E+00

COC	Maximum 95 UCL [mg/kg]	Fraction of COC that is PM10 Concentration	1- hour COC Concentration (µg/m^3)	1 - Yr COC Concentration (µg/m^3)
Arsenic	407.10	4.07E-04	1.47E-02	1.47E-03
Cadmium	9.87	9.87E-06	3.57E-04	3.57E-05
Lead	904.00	9.04E-04	3.27E-02	3.27E-03

Note: Screen 3 Output: 1-hour PM10 concentration. See Screen 3 Output File
1 - year PM10 Concentration = (1-hr PM10 concentration) x (0.1)
Fraction of COC that is PM10 Concentration = (Max. 95 UCL) / (1,000,000)
1 hour COC Concentration = (1-hr PM10 concentration) x (Fraction of COC that is PM10)
1 year COC Concentration = (1-year PM10 concentration) x (Fraction of COC that is PM10)

Diesel Particulate Matter (DPM)	
Annual DPM Emission (ton/yr)	8.00E-02
Annual DPM Emission (g/s)	2.30E-03
Area Disturbed (Acres)	5.00E+00
Area Disturbed (m^2)	2.02E+04
Annual Emission Rate (g/s-m^2)	1.14E-07
Screen 3 Output: 1-hour PM10 concentration (µg/m^3)	1.64E+00
Adjusted 1-year PM10 concentration (µg/m^3)	1.64E-01

Determination of Level 1 and Level 2 Arsenic Soil Concentration Thresholds to keep Acute Arsenic Health Effects below threshold (HQ<1)

Maximum Daily Scenario (Level 1)

Emission Rate PM10 (lb/day)	18.06
Disturbed area (acres)	5.00
g/s	0.28
g/s-m^2	1.4E-05
Screen 3 Output (1-hr PM10 Emissions Concentration) ug/m^3	5.5E+02

Maximum Daily Scenario or Level 1 Threshold Concentration of Arsenic in soil in (mg/kg) required to keep Arsenic Acute Health Effects below 1*	3.6E+02

* Using a REL of 0.20 ($\mu g/m^3$)

Abated Scenario (Level 2)

95% Abatement	
Emission Rate PM10 (lb/day)	1.25
Disturbed area (acres)	2.50
PM10 Emission rate (g/s)	0.02
PM10 Area Emission rate (g/s-m^2)	1.9E-06
Screen 3 Output (1-hr PM10 Emissions Concentration) ug/m^3	5.7E+01
Level 2 (95% Abatement) Threshold Concentration of Arsenic in soil in (mg/kg) required to keep Arsenic Acute Health Effects below 1*	3.5E+03

Appendix D.1

Appendix D.1
Calculations for a Multi-Pathway Adult Chronic Hazard Assessment for Arsenic
For an Adult

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	CDI[A]	Chronic REL[B]	HQ[C]
Inhalation	C_A	Contaminanant concentration in air (during exposure days)	µg/m^3	1.47E-03	Screen 3 Model	1.47E-03 (µg/m^3)	1.50E-02 (µg/m^3)	9.80E-02
Ingestion	C_s (D)	concentration of contaminant in soil	mg/kg	4.36E-02	Site-specific	6.23E-08 (mg/kg/day)	3.50E-06 (mg/kg/day)	1.78E-02
	CF	conversion factor	10^{-6} kg/mg	1.00E-06				
	IR	ingestion rate - adult	mg/day	100	EPA 1989			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	365	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
Dermal	C_s (D)	concentration of contaminant in soil	µg/kg	4.36E+01	Site-specific	2.34E-08 (mg/kg/day)	3.50E-06 (mg/kg/day)	6.69E-03
	CF	conversion factor	10^{-9} kg/µg	1.00E-09				
	SA	Surface area of exposed skin	cm^2	4700	OEHHA HRA Guide			
	SL	Soil loading on skin	mg/cm^2/day	0.2	OEHHA HRA Guide			
	ABS	Fraction absorbed across skin	unitless	0.04	OEHHA HRA Guide			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	365	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
							Hazard Index	1.22E-01

Notes:

(A) - CDI Formula for Ingestion = $\frac{C \times CF \times IR \times EF}{BW \times 365 \text{ days/yr}}$

$CDI_{Dose\text{-}dermal} = (Cs * SA * SL * EF * ABS * 10^{-9}) / (BW * 365 \text{ days/yr})$

(B) - REL = Reference Exposure Levels - http://www.arb.ca.gov/toxics/healthval/contable.pdf

(C) - $HQ_{ingestion/dermal}$ = Hazard quotient = CDI / REL

(C) - $HQ_{inhalation}$ = CA x EF / (REL x 365 days/yr)

Calculations for Estimating Arsenic Concentration in Soil Due to Air Emissions

Equations:

(Note D) - $\mathbf{C_s = Dep * X / (K_s * SD * BD * T_t)}$ *Eq. 5.3.2 A from OEHHA, 2003)*

where:

C_s = Average soil concentration over evaluation period (µg/kg)

Dep = Deposition on the affected soil area per day (ug/m^2/day)

SD = Soil mixing depth (meters)

BD = Soil bulk density (kg/m^3)

Dep = GLC * Dep-rate * 86,400 (sec/day) *Eq. 5.3.2 B from OEHHA, 2003)*

where:

GLC = Ground-level concentration (ug/m^3)

Dep-rate = Vertical rate of dsposition (m/sec)

$\mathbf{X = [\{e^{(-K_s*T_f)} - e^{(-K_s*T_o)}\}/K_s] + T_t}$ *Equation 5.3.2 C from OEHHA, 2003)*

where:

K_s = Soil elimination constant

T_f = End of evaluation period (day)

T_o = Beginning of evaluation period (day)

T_t = Total days of exposure period (T_f - T_o) (days)

$\mathbf{K_s = 0.693 / t_{½}}$ *Equation 5.3.2 D from OEHHA, 2003)*

where:

$t_{½}$ = Half-life in soil

Constants:

GLC =	1.47E-03	Average concentration from SCREEN3 modeling
Dep-rate =	0.05	Default value for uncontrolled emissions from OEHHA, 2003
T_f =	183	End of 6 month period for construction activities
T_o =	0	Beginning of 6 month period of construction activities
T_t =	183	Total days in 6 month period for construction activities
$t_{½}$ =	1E+08	From Table 5.3 in OEHHA, 2003
SD =	0.01	From OEHHA, 2003 for non-agricultural setting
BD =	1,333	Default value from OEHHA, 2003

Results:

K_s =	7E-09	
X =	0.000116035	
Dep =	6.35E+00	
C_s =	4.36E+01	µg/kg
	4.36E-02	mg/kg

Reference: (OEHHA, 2003) -
The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments ,
California Environmental Protection Agency, August, 2003.

Appendix D.2

Appendix D.2
Calculations for a Multi-Pathway Adult Chronic Hazard Assessment for Cadmium
For an Adult

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	CDI[A]	Chronic REL[B]	HQ[C]
Inhalation	C_A	Contaminanant concentration in air (during exposure days)	$\mu g/m^3$	3.58E-05	Screen 3 Model	3.58E-05 ($\mu g/m^3$)	2.00E-02 ($\mu g/m^3$)	1.79E-03
Ingestion	C_s (D)	concentration of contaminant in soil	mg/kg	1.06E-03	Site-specific	1.52E-09 (mg/kg/day)	5.00E-04 (mg/kg/day)	3.04E-06
	CF	conversion factor	10^{-6} kg/mg	1.00E-06				
	IR	ingestion rate - adult	mg/day	100	EPA 1989			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	365	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
Dermal	C_s (D)	concentration of contaminant in soil	µg/kg	1.06E+00	Site-specific	5.71E-10 (mg/kg/day)	5.00E-04 (mg/kg/day)	1.14E-06
	CF	conversion factor	10^{-9} kg/µg	1.00E-09				
	SA	Surface area of exposed skin	cm^2	4700	OEHHA HRA Guide			
	SL	Soil loading on skin	$mg/cm^2/day$	0.2	OEHHA HRA Guide			
	ABS	Fraction absorbed across skin	unitless	0.04	OEHHA HRA Guide			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	365	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
							Hazard Index	1.80E-03

Notes:

(A) - CDI Formula for Ingestion = $\frac{C \times CF \times IR \times EF}{BW \times 365 \text{ days/yr}}$

$CDI_{Dose\text{-}dermal} = (Cs * SA * SL * EF * ABS * 10^{-9}) / (BW * 365 \text{ days/yr})$

(B) - REL = Reference Exposure Levels - http://www.arb.ca.gov/toxics/healthval/contable.pdf

(C) - $HQ_{ingestion/dermal}$ = Hazard quotient = CDI / REL

(C) - $HQ_{inhalation}$ = CA x EF / (REL x 365 days/yr)

Calculations for Estimating Cadmium Concentration in Soil Due to Air Emissions

Equations:

(Note D) - $\mathbf{C_s = Dep * X / (K_s * SD * BD * T_t)}$ *Eq. 5.3.2 A from OEHHA, 2003)*

where:

C_s = Average soil concentration over evaluation period (µg/kg)

Dep = Deposition on the affected soil area per day (ug/m ^{2}/day)

SD = Soil mixing depth (meters)

BD = Soil bulk density (kg/m ^{3})

Dep = GLC * Dep-rate * 86,400 (sec/day) *Eq. 5.3.2 B from OEHHA, 2003)*

where:

GLC = Ground-level concentration (ug/m ^{3})

Dep-rate = Vertical rate of dsposition (m/sec)

$\mathbf{X = [\{e^{(-K_s*T_f)} - e^{(-K_s*T_o)}\}/K_s] + T_t}$ *Equation 5.3.2 C from OEHHA, 2003)*

where:

K_s = Soil elimination constant

T_f = End of evaluation period (day)

T_o = Beginning of evaluation period (day)

T_t = Total days of exposure period (T_f - T_o) (days)

$\mathbf{K_s = 0.693 / t_{½}}$ *Equation 5.3.2 D from OEHHA, 2003)*

where:

$t_{½}$ = Half-life in soil

Constants:

GLC =	3.58E-05	Average concentration from SCREEN3 modeling
Dep-rate =	0.05	Default value for uncontrolled emissions from OEHHA, 2003
T_f =	183	End of 6 month period for construction activities
T_o =	0	Beginning of 6 month period of construction activities
T_t =	183	Total days in 6 month period for construction activities
$t_{½}$ =	1E+08	From Table 5.3 in OEHHA, 2003
SD =	0.01	From OEHHA, 2003 for non-agricultural setting
BD =	1,333	Default value from OEHHA, 2003

Results:

K_s =	7E-09	
X =	0.000116035	
Dep =	1.55E-01	
C_s =	1.06E+00	µg/kg
	1.06E-03	mg/kg

Reference: (OEHHA, 2003) -
The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments ,
California Environmental Protection Agency, August, 2003.

Appendix D.3

Appendix D.3
Calculations for an Inhalation Pathway Adult
Chronic Hazard Assessment for Diesel Particualte Matter

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	Dose[A] (mg/kg/day)	Chronic REL[B]	HQ_C
Inhalation	C_a	Contaminanant concentration in air	$\mu g/m^3$	1.64E-01	Screen 3 Model	7.08E-07	5.00E+00	3.28E-02
	DBR	Daily breathing rate	L/kg BW/day	302	OEHHA HRA Guide			
	A	Inhalation absorption factor	hr/day	1	OEHHA HRA Guide			
	EF	Exposure frequency	days/year	365	6 month, 5 days/week			
	ED	Exposure duration	years	1	EPA 1989			
	CF	conversion factor	10^{-6} L/m^3	1.00E-06				
	AT	Averaging time	days	25550	EPA 1989			
							Hazard Index	3.28E-02

Notes:

(A) - Dose-inh = $\frac{C_a * \{DBR\} * A * EF * ED * 10^{-6}}{AT}$

(B) - REL = Reference Exposure Levels per http://www.arb.ca.gov/toxics/healthval/contable.pdf

(C) $HQ_{inhalation}$ = CA x EF / (REL x 365 days/yr)

Appendix D.4

Appendix D.4
Calculations for a Multi-Pathway Adult Lifetime Excess Cancer Risk Assessment for Arsenic

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	CDI[A] (mg/kg day)	Cancer Potency Factor[B] $(mg/kg\text{-}day)^{-1}$	Cancer Risk[C] (chances per million)
Inhalation	C_a	Contaminanant concentration in air (during exposure days)	$\mu g/m^3$	1.47E-03	Screen 3 Model	1.27E-08	1.20E+01	1.52E-01
	DBR	Daily breathing rate	L/kg BW/day	302	OEHHA HRA Guide			
	A	Inhalation absorption factor	hr/day	1	OEHHA HRA Guide			
	EF	Exposure frequency	days/year	365	1 year			
	ED	Exposure duration	years	2	EPA 1989			
	CF	conversion factor	10^{-6} (m^3.mg/L.mg)	1.00E-06				
	AT	Averaging time	days	25550	EPA 1989			
Ingestion	C_s	concentration of contaminant in soil	mg/kg	4.36E-02	Site-specific	1.78E-09	1.50E+00	2.67E-03
	CF	conversion factor	10^{-6} kg/mg	1.00E-06	EPA 1989			
	IR	ingestion rate - adult	mg/day	100	EPA 1989			
	EF	exposure frequency	days/year	365	1 year			
	ED	exposure duration	years	2	OEHHA HRA Guide			
	AT	averaging time	days	25550	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
Dermal	C_s	concentration of contaminant in soil	µg/kg	4.36E+01	Site-specific	6.69E-10	3.50E-06	2.34E-09
	CF	conversion factor	10^{-9} kg/µg	1.00E-09				
	SA	Surface area of exposed skin	cm^2	4700	OEHHA HRA Guide			
	SL	Soil loading on skin	$mg/cm^2/day$	0.2	OEHHA HRA Guide			
	ABS	Fraction absorbed across skin	unitless	0.04	OEHHA HRA Guide			
	ED	exposure duration	years	2	OEHHA HRA Guide			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	25550	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
							Total	1.55E-01

Notes:

(A) - Dose-inh = $\frac{C_a * \{DBR\} * A * EF * ED * 10^{-6}}{AT}$

CDI Formula for Ingestion = $\frac{C_s \times CF \times IR \times EF \times ED}{AT \times BW}$

Dose-dermal = Cs * SA * SL * Ef * ABS * 10^{-9} * ED/ BW* AT

(B) - Cancer Potency Factor - reference Table 7.1 http://www.arb.ca.gov/toxics/healthval/contable.pdf

(C) - Cancer Risk = (Dose (mg/kg-day)) x (Cancer Potency (mg/kg-day)-1) x 10^6

Appendix D.5

Appendix D.5
Calculations for a Multi-Pathway Adult Lifetime Excess Cancer Risk Assessment for Lead

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	CDI[A] (mg/kg day)	Cancer Potency Factor[B] $(mg/kg\text{-}day)^{-1}$	Cancer Risk[C] (chances per million)
Inhalation	C_a	Contaminanant concentration in air (during exposure days)	$\mu g/m^3$	3.27E-03	Screen 3 Model	2.82E-08	4.20E-02	1.19E-03
	DBR	Daily breathing rate	L/kg BW/day	302	OEHHA HRA Guide			
	A	Inhalation absorption factor	hr/day	1	OEHHA HRA Guide			
	EF	Exposure frequency	days/year	365	1 year			
	ED	Exposure duration	years	2	EPA 1989			
	CF	conversion factor	10^{-6} (m^3.mg/L.mg)	1.00E-06				
	AT	Averaging time	days	25550	EPA 1989			
Ingestion	C_s	concentration of contaminant in soil	mg/kg	9.71E-02	Site-specific	3.96E-09	8.50E-03	3.37E-05
	CF	conversion factor	10^{-6} kg/mg	1.00E-06	EPA 1989			
	IR	ingestion rate - adult	mg/day	100	EPA 1989			
	EF	exposure frequency	days/year	365	1 year			
	ED	exposure duration	years	2	OEHHA HRA Guide			
	AT	averaging time	days	25550	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
Dermal	C_s	concentration of contaminant in soil	µg/kg	9.71E+01	Site-specific	1.49E-09	8.50E-03	1.27E-05
	CF	conversion factor	10^{-9} kg/µg	1.00E-09				
	SA	Surface area of exposed skin	cm^2	4700	OEHHA HRA Guide			
	SL	Soil loading on skin	$mg/cm^2/day$	0.2	OEHHA HRA Guide			
	ABS	Fraction absorbed across skin	unitless	0.04	OEHHA HRA Guide			
	ED	exposure duration	years	2	OEHHA HRA Guide			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	25550	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
							Total	1.23E-03

Notes:

(A) - Dose-inh = $\frac{C_a * \{DBR\} * A * EF * ED * 10^{-6}}{AT}$

CDI Formula for Ingestion = $\frac{C_s \times CF \times IR \times EF \times ED}{AT \times BW}$

Dose-dermal = Cs * SA * SL * Ef * ABS * 10^{-9} * ED/ BW* AT

(B) - Cancer Potency Factor - reference Table 7.1 http://www.arb.ca.gov/toxics/healthval/contable.pdf

(C) - Cancer Risk = (Dose (mg/kg-day)) x (Cancer Potency (mg/kg-day)-1) x 10^6

Calculations for Estimating Lead Concentration in Soil Due to Air Emissions

Equations:

(Note D) - $\mathbf{C_s = Dep * X / (K_s * SD * BD * T_t)}$ *Eq. 5.3.2 A from OEHHA, 2003)*

where:

C_s = Average soil concentration over evaluation period (µg/kg)

Dep = Deposition on the affected soil area per day (ug/m^2/day)

SD = Soil mixing depth (meters)

BD = Soil bulk density (kg/m^3)

Dep = GLC * Dep-rate * 86,400 (sec/day) *Eq. 5.3.2 B from OEHHA, 2003)*

where:

GLC = Ground-level concentration (ug/m^3)

Dep-rate = Vertical rate of dsposition (m/sec)

$\mathbf{X = [\{e^{(-K_s*T_f)} - e^{(-K_s*T_o)}\}/K_s] + T_t}$ *Equation 5.3.2 C from OEHHA, 2003)*

where:

K_s = Soil elimination constant

T_f = End of evaluation period (day)

T_o = Beginning of evaluation period (day)

T_t = Total days of exposure period (T_f - T_o) (days)

$\mathbf{K_s = 0.693 / t_{½}}$ *Equation 5.3.2 D from OEHHA, 2003)*

where:

$t_{½}$ = Half-life in soil

Constants:

GLC =	3.27E-03	Average Annual concentration adjusted by 0.1 from SCREEN3 1 hour concentration
Dep-rate =	0.05	Default value for uncontrolled emissions from OEHHA, 2003
T_f =	183	End of 6 month period for construction activities
T_o =	0	Beginning of 6 month period of construction activities
T_t =	183	Total days in 6 month period for construction activities
$t_{½}$ =	1E+08	From Table 5.3 in OEHHA, 2003
SD =	0.01	From OEHHA, 2003 for non-agricultural setting
BD =	1,333	Default value from OEHHA, 2003

Results:

K_s =	7E-09	
X =	0.000116035	
Dep =	1.41E+01	
C_s =	9.71E+01	µg/kg
	9.71E-02	mg/kg

Reference: (OEHHA, 2003) -
The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, California Environmental Protection Agency, August, 2003.

Appendix D.6

Appendix D.6
Calculations for a Multi-Pathway Adult Lifetime Excess Cancer Risk Assessment for Cadmium

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	CDI[A] (mg/kg day)	Cancer Potency Factor[B] $(mg/kg\text{-}day)^{-1}$	Cancer Risk[C] (chances per million)
Inhalation	C_a	Contaminanant concentration in air (during exposure days)	$\mu g/m^3$	3.58E-05	Screen 3 Model	3.09E-10	1.50E+01	4.64E-03
	DBR	Daily breathing rate	L/kg BW/day	302	OEHHA HRA Guide			
	A	Inhalation absorption factor	hr/day	1	OEHHA HRA Guide			
	EF	Exposure frequency	days/year	365	1 year			
	ED	Exposure duration	years	2	EPA 1989			
	CF	conversion factor	10^{-6} (m^3.mg/L.mg)	1.00E-06				
	AT	Averaging time	days	25550	EPA 1989			
Ingestion	C_s	concentration of contaminant in soil	mg/kg	1.06E-03	Site-specific	4.34E-11	1.50E+01	6.51E-04
	CF	conversion factor	10^{-6} kg/mg	1.00E-06	EPA 1989			
	IR	ingestion rate - adult	mg/day	100	EPA 1989			
	EF	exposure frequency	days/year	365	1 year			
	ED	exposure duration	years	2	OEHHA HRA Guide			
	AT	averaging time	days	25550	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
Dermal	C_s	concentration of contaminant in soil	µg/kg	1.06E+00	Site-specific	1.63E-11	1.50E+01	2.45E-04
	CF	conversion factor	10^{-9} kg/µg	1.00E-09				
	SA	Surface area of exposed skin	cm^2	4700	OEHHA HRA Guide			
	SL	Soil loading on skin	$mg/cm^2/day$	0.2	OEHHA HRA Guide			
	ABS	Fraction absorbed across skin	unitless	0.04	OEHHA HRA Guide			
	ED	exposure duration	years	2	OEHHA HRA Guide			
	EF	exposure frequency	days/year	365	1 year			
	AT	averaging time	days	25550	OEHHA HRA Guide			
	BW	Body Weight - adult	kg	70	OEHHA HRA Guide			
							Total	5.54E-03

Notes:

(A) - Dose-inh = $\frac{C_a * \{DBR\} * A * EF * ED * 10^{-6}}{AT}$

CDI Formula for Ingestion = $\frac{C_s \times CF \times IR \times EF \times ED}{AT \times BW}$

Dose-dermal = Cs * SA * SL * Ef * ABS * 10^{-9} * ED/ BW* AT

(B) - Cancer Potency Factor - reference Table 7.1 http://www.arb.ca.gov/toxics/healthval/contable.pdf

-Dermal and Oral Cancer Potency Factor derived by Inhalation Cancer Potency Factor x Dermal Absorbsion Factor(ABS) Per Table 5.3 of OEHHA. 2003

(C) - Cancer Risk = (Dose (mg/kg-day)) x (Cancer Potency (mg/kg-day)-1) x 10^6

Appendix D.7

Appendix D.7
Calculations for an Inhalation Pathway Adult
Lifetime Excess Cancer Risk Assessment for Diesel Particulate Matter

Exposure Route	Parameter Code	Parameter Definition	Units	Reasonable Maximum Exposure (RME) Value	RME Rationale/ Reference	CDI[A] (mg/kg day)	Cancer Potency Factor[B] $(mg/kg\text{-}day)^{-1}$	Cancer Risk[C] (chances per million)
Inhalation	C_a	Contaminanant concentration in air (during exposure days)	$\mu g/m^3$	1.64E-01	Screen 3 Model	1.42E-06	1.10E+00	1.56E+00
	DBR	Daily breathing rate	L/kg BW/day	302	OEHHA HRA Guide			
	A	Inhalation absorption factor		1	OEHHA HRA Guide			
	EF	Exposure frequency	days/year	365	1 year			
	ED	Exposure duration	years	2	EPA 1989			
	CF	conversion factor	10^{-6} (m3.mg/L.mg)	1.00E-06				
	AT	Averaging time	days	25550	EPA 1989			
							Total	1.56E+00

Notes:

(A) - Dose-inh = $\frac{C_a * \{DBR\} * A * EF * ED * 10^{-6}}{AT}$

(B) - Cancer Potency Factor - http://www.arb.ca.gov/toxics/healthval/contable.pdf

(C) - Cancer Risk = (Dose (mg/kg-day)) x (Cancer Potency (mg/kg-day)-1) x 10^6

Appendix D.8

```
Example #4 - Area Source Example
A
1.1374E-7
6
142
142
0
R
Y
1
Y
50 1000
Y
100
200
300
400
0.0
N
```

08/21/09

16:21:07
*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Example #4 - Area Source Example

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	AREA
EMISSION RATE (G/(S-M**2))	=	0.113740E-06
SOURCE HEIGHT (M)	=	6.0000
LENGTH OF LARGER SIDE (M)	=	142.0000
LENGTH OF SMALLER SIDE (M)	=	142.0000
RECEPTOR HEIGHT (M)	=	0.0000
URBAN/RURAL OPTION	=	RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION

BUOY. FLUX = 0.000 M**4/S**3; MOM. FLUX = 0.000 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
50.	0.8524	3	1.0	1.0	320.0	6.00	45.
100.	1.171	3	1.0	1.0	320.0	6.00	43.
200.	1.582	5	1.0	1.0	10000.0	6.00	45.
300.	1.628	6	1.0	1.0	10000.0	6.00	45.
400.	1.584	6	1.0	1.0	10000.0	6.00	45.
500.	1.444	6	1.0	1.0	10000.0	6.00	45.
600.	1.295	6	1.0	1.0	10000.0	6.00	45.
700.	1.161	6	1.0	1.0	10000.0	6.00	45.
800.	1.050	6	1.0	1.0	10000.0	6.00	45.
900.	0.9552	6	1.0	1.0	10000.0	6.00	45.
1000.	0.8728	6	1.0	1.0	10000.0	6.00	45.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 50. M:

325.	1.637	6	1.0	1.0	10000.0	6.00	45.

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST	CONC	U10M	USTK	MIX HT	PLUME	MAX DIR

(M)	(UG/M**3)	STAB	(M/S)	(M/S)	(M)	HT (M)	(DEG)
100.	1.171	3	1.0	1.0	320.0	6.00	43.
200.	1.582	5	1.0	1.0	10000.0	6.00	45.
300.	1.628	6	1.0	1.0	10000.0	6.00	45.
400.	1.584	6	1.0	1.0	10000.0	6.00	45.

```
***************************************
*** SUMMARY OF SCREEN MODEL RESULTS ***
***************************************
```

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	1.637	325.	0.

```
***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

```
Example #4 - Area Source Example
A
9.24E-7
2
142.24
142.24
0
R
Y
1
Y
50 1000
Y
100
200
300
400
0.0
N
```

08/21/09

14:21:27
*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Example #4 - Area Source Example

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	AREA
EMISSION RATE (G/(S-M**2))	=	0.924000E-06
SOURCE HEIGHT (M)	=	2.0000
LENGTH OF LARGER SIDE (M)	=	142.2400
LENGTH OF SMALLER SIDE (M)	=	142.2400
RECEPTOR HEIGHT (M)	=	0.0000
URBAN/RURAL OPTION	=	RURAL

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION

BUOY. FLUX = 0.000 M**4/S**3; MOM. FLUX = 0.000 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
50.	23.00	6	1.0	1.0	10000.0	2.00	45.
100.	31.61	6	1.0	1.0	10000.0	2.00	45.
200.	31.24	6	1.0	1.0	10000.0	2.00	45.
300.	23.06	6	1.0	1.0	10000.0	2.00	45.
400.	18.13	6	1.0	1.0	10000.0	2.00	45.
500.	14.87	6	1.0	1.0	10000.0	2.00	45.
600.	12.56	6	1.0	1.0	10000.0	2.00	45.
700.	10.84	6	1.0	1.0	10000.0	2.00	45.
800.	9.571	6	1.0	1.0	10000.0	2.00	45.
900.	8.559	6	1.0	1.0	10000.0	2.00	45.
1000.	7.721	6	1.0	1.0	10000.0	2.00	45.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 50. M:

140.	36.14	6	1.0	1.0	10000.0	2.00	45.

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST	CONC	U10M	USTK	MIX HT	PLUME	MAX DIR

(M)	(UG/M**3)	STAB	(M/S)	(M/S)	(M)	HT (M)	(DEG)
100.	31.61	6	1.0	1.0	10000.0	2.00	45.
200.	31.24	6	1.0	1.0	10000.0	2.00	45.
300.	23.06	6	1.0	1.0	10000.0	2.00	45.
400.	18.13	6	1.0	1.0	10000.0	2.00	45.

```
*************************************
*** SUMMARY OF SCREEN MODEL RESULTS ***
*************************************
```

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	36.14	140.	0.

```
***************************************************
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
***************************************************
```

Appendix D.9

8/24/2009 11:20:38 AM

Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Unmitigated Emissions (Pounds/Day)

File Name: C:\Documents and Settings\ggriffith.LAPTOP-RDT2\Application Data\Urbemis\Version9a\Projects\Empire_V7-1.urb924

Project Name: Empire

Project Location: Mountain Counties Air Basin

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

8/24/2009 11:20:38 AM

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Unmitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 7/1/2009-7/31/2009 Active Days: 23	2.31	38.97	21.25	0.00	50.00	1.31	51.31	10.44	1.23	11.68	5,267.20
Mass Grading 07/01/2009-08/01/2009	2.31	38.97	21.25	0.00	50.00	1.31	51.31	10.44	1.23	11.68	5,267.20
Mass Grading Dust	0.00	0.00	0.00	0.00	50.00	0.00	50.00	10.44	0.00	10.44	0.00
Mass Grading Off Road Diesel	2.23	38.85	19.37	0.00	0.00	1.30	1.30	0.00	1.23	1.23	5,165.47
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73
Time Slice 8/3/2009-9/30/2009 Active Days: 43	**2.75**	**46.19**	**23.59**	**0.01**	**50.04**	**1.58**	**51.61**	**10.45**	**1.48**	**11.94**	**6,182.20**
Fine Grading 08/02/2009-09/30/2009	2.75	46.19	23.59	0.01	50.04	1.58	51.61	10.45	1.48	11.94	6,182.20
Fine Grading Dust	0.00	0.00	0.00	0.00	50.00	0.00	50.00	10.44	0.00	10.44	0.00
Fine Grading Off Road Diesel	2.23	38.85	19.37	0.00	0.00	1.30	1.30	0.00	1.23	1.23	5,165.47
Fine Grading On Road Diesel	0.44	7.22	2.34	0.01	0.03	0.27	0.30	0.01	0.25	0.26	915.00
Fine Grading Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73
Time Slice 10/1/2009-11/30/2009 Active Days: 43	1.71	28.88	14.39	0.00	0.00	0.99	0.99	0.00	0.93	0.93	3,929.02
Trenching 10/01/2009-11/30/2009	1.71	28.88	14.39	0.00	0.00	0.99	0.99	0.00	0.93	0.93	3,929.02
Trenching Off Road Diesel	1.63	28.77	12.50	0.00	0.00	0.99	0.99	0.00	0.92	0.92	3,827.29
Trenching Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73
Time Slice 12/1/2009-12/31/2009 Active Days: 23	1.66	24.61	14.14	0.00	0.01	1.07	1.07	0.00	1.00	1.00	2,987.71
Asphalt 12/01/2009-12/31/2009	1.66	24.61	14.14	0.00	0.01	1.07	1.07	0.00	1.00	1.00	2,987.71
Paving Off-Gas	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.45	24.08	12.13	0.00	0.00	1.05	1.05	0.00	0.98	0.98	2,834.09
Paving On Road Diesel	0.03	0.41	0.13	0.00	0.00	0.02	0.02	0.00	0.01	0.01	51.89
Paving Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73

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Phase Assumptions

Phase: Fine Grading 8/2/2009 - 9/30/2009 - Grading and Excavation Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 227.27

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1396 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Mass Grading 7/1/2009 - 8/1/2009 - Grubbing and Land Clearing Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 0

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1396 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Trenching 10/1/2009 - 11/30/2009 - Dainage and Utilities Activities

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Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IIi Drainage Utilities.equip;Drainage Utilities
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Plate Compactors (8 hp) operating at a 0.43 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 600 hrs/year
1 Trenchers (63 hp) operating at a 0.75 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 618 hrs/year

Phase: Paving 12/1/2009 - 12/31/2009 - Paving Activities

Acres to be Paved: 1

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IV Paving.equip;Phase IV Paving
Off-Road Equipment:

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 821 hrs/year

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 829 hrs/year
1 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 695 hrs/year

1 Other Material Handling Equipment (191 hp) operating at a 0.59 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 500 hrs/year

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Urbemis 2007 Version 9.2.4

Detail Report for Summer Construction Mitigated Emissions (Pounds/Day)

File Name: C:\Documents and Settings\ggriffith.LAPTOP-RDT2\Application Data\Urbemis\Version9a\Projects\Empire_V7-1.urb924

Project Name: Empire

Project Location: Mountain Counties Air Basin

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

8/24/2009 11:23:34 AM

CONSTRUCTION EMISSION ESTIMATES (Summer Pounds Per Day, Mitigated)

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2
Time Slice 7/1/2009-7/31/2009 Active Days: 23	2.31	38.97	21.25	0.00	18.06	1.31	19.36	3.77	1.23	5.00	5,267.20
Mass Grading 07/01/2009-08/01/2009	2.31	38.97	21.25	0.00	18.06	1.31	19.36	3.77	1.23	5.00	5,267.20
Mass Grading Dust	0.00	0.00	0.00	0.00	18.05	0.00	18.05	3.77	0.00	3.77	0.00
Mass Grading Off Road Diesel	2.23	38.85	19.37	0.00	0.00	1.30	1.30	0.00	1.23	1.23	5,165.47
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73
Time Slice 8/3/2009-9/30/2009 Active Days: 43	**2.75**	**46.19**	**23.59**	**0.01**	18.09	**1.58**	19.67	3.78	**1.48**	5.26	**6,182.20**
Fine Grading 08/02/2009-09/30/2009	2.75	46.19	23.59	0.01	18.09	1.58	19.67	3.78	1.48	5.26	6,182.20
Fine Grading Dust	0.00	0.00	0.00	0.00	18.05	0.00	18.05	3.77	0.00	3.77	0.00
Fine Grading Off Road Diesel	2.23	38.85	19.37	0.00	0.00	1.30	1.30	0.00	1.23	1.23	5,165.47
Fine Grading On Road Diesel	0.44	7.22	2.34	0.01	0.03	0.27	0.30	0.01	0.25	0.26	915.00
Fine Grading Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73
Time Slice 10/1/2009-11/30/2009 Active Days: 43	1.71	28.88	14.39	0.00	0.00	0.99	0.99	0.00	0.93	0.93	3,929.02
Trenching 10/01/2009-11/30/2009	1.71	28.88	14.39	0.00	0.00	0.99	0.99	0.00	0.93	0.93	3,929.02
Trenching Off Road Diesel	1.63	28.77	12.50	0.00	0.00	0.99	0.99	0.00	0.92	0.92	3,827.29
Trenching Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73
Time Slice 12/1/2009-12/31/2009 Active Days: 23	1.66	24.61	14.14	0.00	0.01	1.07	1.07	0.00	1.00	1.00	2,987.71
Asphalt 12/01/2009-12/31/2009	1.66	24.61	14.14	0.00	0.01	1.07	1.07	0.00	1.00	1.00	2,987.71
Paving Off-Gas	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	1.45	24.08	12.13	0.00	0.00	1.05	1.05	0.00	0.98	0.98	2,834.09
Paving On Road Diesel	0.03	0.41	0.13	0.00	0.00	0.02	0.02	0.00	0.01	0.01	51.89
Paving Worker Trips	0.07	0.12	1.88	0.00	0.00	0.00	0.01	0.00	0.00	0.00	101.73

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 8/2/2009 - 9/30/2009 - Grading and Excavation Activities

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For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

The following mitigation measures apply to Phase: Mass Grading 7/1/2009 - 8/1/2009 - Grubbing and Land Clearing Activities

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

Phase Assumptions

Phase: Fine Grading 8/2/2009 - 9/30/2009 - Grading and Excavation Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 227.27

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1396 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Mass Grading 7/1/2009 - 8/1/2009 - Grubbing and Land Clearing Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

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10 lbs per acre-day

On Road Truck Travel (VMT): 0

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
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1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Trenching 10/1/2009 - 11/30/2009 - Dainage and Utilities Activities

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IIi Drainage Utilities.equip;Drainage Utilities
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Plate Compactors (8 hp) operating at a 0.43 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 600 hrs/year
1 Trenchers (63 hp) operating at a 0.75 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 618 hrs/year

Phase: Paving 12/1/2009 - 12/31/2009 - Paving Activities

Acres to be Paved: 1

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IV Paving.equip;Phase IV Paving
Off-Road Equipment:

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 821 hrs/year

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 829 hrs/year
1 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 695 hrs/year

1 Other Material Handling Equipment (191 hp) operating at a 0.59 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 500 hrs/year

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Urbemis 2007 Version 9.2.4

Detail Report for Annual Construction Unmitigated Emissions (Tons/Year)

File Name: C:\Documents and Settings\ggriffith.LAPTOP-RDT2\Application Data\Urbemis\Version9a\Projects\Empire_V7-1.urb924

Project Name: Empire

Project Location: Mountain Counties Air Basin

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Annual Tons Per Year, Unmitigated)

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

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2009	0.14	2.35	1.22	0.00	1.65	0.08	1.73	0.34	0.08	0.42	312.32
Mass Grading 07/01/2009-08/01/2009	0.03	0.45	0.24	0.00	0.58	0.02	0.59	0.12	0.01	0.13	60.57
Mass Grading Dust	0.00	0.00	0.00	0.00	0.58	0.00	0.58	0.12	0.00	0.12	0.00
Mass Grading Off Road Diesel	0.03	0.45	0.22	0.00	0.00	0.01	0.01	0.00	0.01	0.01	59.40
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17
Fine Grading 08/02/2009-09/30/2009	0.06	0.99	0.51	0.00	1.08	0.03	1.11	0.22	0.03	0.26	132.92
Fine Grading Dust	0.00	0.00	0.00	0.00	1.08	0.00	1.08	0.22	0.00	0.22	0.00
Fine Grading Off Road Diesel	0.05	0.84	0.42	0.00	0.00	0.03	0.03	0.00	0.03	0.03	111.06
Fine Grading On Road Diesel	0.01	0.16	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	19.67
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19
Trenching 10/01/2009-11/30/2009	0.04	0.62	0.31	0.00	0.00	0.02	0.02	0.00	0.02	0.02	84.47
Trenching Off Road Diesel	0.04	0.62	0.27	0.00	0.00	0.02	0.02	0.00	0.02	0.02	82.29
Trenching Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19
Asphalt 12/01/2009-12/31/2009	0.02	0.28	0.16	0.00	0.00	0.01	0.01	0.00	0.01	0.01	34.36
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.28	0.14	0.00	0.00	0.01	0.01	0.00	0.01	0.01	32.59
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Paving Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17

Phase Assumptions

Phase: Fine Grading 8/2/2009 - 9/30/2009 - Grading and Excavation Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 227.27

Off Road Diesel calculated using the Named Equipment EMS functions.

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The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1396 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Mass Grading 7/1/2009 - 8/1/2009 - Grubbing and Land Clearing Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 0

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1396 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Trenching 10/1/2009 - 11/30/2009 - Dainage and Utilities Activities

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IIi Drainage Utilities.equip;Drainage Utilities
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Plate Compactors (8 hp) operating at a 0.43 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 600 hrs/year

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1 Trenchers (63 hp) operating at a 0.75 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 618 hrs/year

Phase: Paving 12/1/2009 - 12/31/2009 - Paving Activities

Acres to be Paved: 1

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IV Paving.equip;Phase IV Paving
Off-Road Equipment:

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 821 hrs/year

1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 829 hrs/year
1 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 695 hrs/year

1 Other Material Handling Equipment (191 hp) operating at a 0.59 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 500 hrs/year

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Urbemis 2007 Version 9.2.4

Detail Report for Annual Construction Mitigated Emissions (Tons/Year)

File Name: C:\Documents and Settings\ggriffith.LAPTOP-RDT2\Application Data\Urbemis\Version9a\Projects\Empire_V7-1.urb924

Project Name: Empire

Project Location: Mountain Counties Air Basin

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

CONSTRUCTION EMISSION ESTIMATES (Annual Tons Per Year, Mitigated)

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10 Total	PM2.5 Dust	PM2.5 Exhaust	PM2.5 Total	CO2

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2009	0.14	2.35	1.22	0.00	0.60	0.08	0.68	0.12	0.08	0.20	312.32
Mass Grading 07/01/2009-08/01/2009	0.03	0.45	0.24	0.00	0.21	0.02	0.22	0.04	0.01	0.06	60.57
Mass Grading Dust	0.00	0.00	0.00	0.00	0.21	0.00	0.21	0.04	0.00	0.04	0.00
Mass Grading Off Road Diesel	0.03	0.45	0.22	0.00	0.00	0.01	0.01	0.00	0.01	0.01	59.40
Mass Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mass Grading Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17
Fine Grading 08/02/2009-09/30/2009	0.06	0.99	0.51	0.00	0.39	0.03	0.42	0.08	0.03	0.11	132.92
Fine Grading Dust	0.00	0.00	0.00	0.00	0.39	0.00	0.39	0.08	0.00	0.08	0.00
Fine Grading Off Road Diesel	0.05	0.84	0.42	0.00	0.00	0.03	0.03	0.00	0.03	0.03	111.06
Fine Grading On Road Diesel	0.01	0.16	0.05	0.00	0.00	0.01	0.01	0.00	0.01	0.01	19.67
Fine Grading Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19
Trenching 10/01/2009-11/30/2009	0.04	0.62	0.31	0.00	0.00	0.02	0.02	0.00	0.02	0.02	84.47
Trenching Off Road Diesel	0.04	0.62	0.27	0.00	0.00	0.02	0.02	0.00	0.02	0.02	82.29
Trenching Worker Trips	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19
Asphalt 12/01/2009-12/31/2009	0.02	0.28	0.16	0.00	0.00	0.01	0.01	0.00	0.01	0.01	34.36
Paving Off-Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.02	0.28	0.14	0.00	0.00	0.01	0.01	0.00	0.01	0.01	32.59
Paving On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60
Paving Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17

Construction Related Mitigation Measures

The following mitigation measures apply to Phase: Fine Grading 8/2/2009 - 9/30/2009 - Grading and Excavation Activities

For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

The following mitigation measures apply to Phase: Mass Grading 7/1/2009 - 8/1/2009 - Grubbing and Land Clearing Activities

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For Soil Stablizing Measures, the Water exposed surfaces 3x daily watering mitigation reduces emissions by:

PM10: 61% PM25: 61%

For Unpaved Roads Measures, the Reduce speed on unpaved roads to less than 15 mph mitigation reduces emissions by:

PM10: 44% PM25: 44%

For Unpaved Roads Measures, the Manage haul road dust 2x daily watering mitigation reduces emissions by:

PM10: 55% PM25: 55%

Phase Assumptions

Phase: Fine Grading 8/2/2009 - 9/30/2009 - Grading and Excavation Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 227.27

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
Off-Road Equipment:

1 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1092 hrs/year
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1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Rubber Tired Loaders (164 hp) operating at a 0.54 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 957 hrs/year

Phase: Mass Grading 7/1/2009 - 8/1/2009 - Grubbing and Land Clearing Activities

Total Acres Disturbed: 10

Maximum Daily Acreage Disturbed: 5

Fugitive Dust Level of Detail: Default

10 lbs per acre-day

On Road Truck Travel (VMT): 0

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase II Grading & Excavation.equip;Phase II Grading & Excavation
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1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 1396 hrs/year
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Phase: Trenching 10/1/2009 - 11/30/2009 - Dainage and Utilities Activities

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase Ili Drainage Utilities.equip;Drainage Utilities
Off-Road Equipment:

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1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 929 hrs/year
1 Plate Compactors (8 hp) operating at a 0.43 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 600 hrs/year
1 Trenchers (63 hp) operating at a 0.75 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 618 hrs/year

Phase: Paving 12/1/2009 - 12/31/2009 - Paving Activities

Acres to be Paved: 1

Off Road Diesel calculated using the Named Equipment EMS functions.

The Off Road Equipment was based on the Named Equipment List: C:\Documents and Settings\ggriffith\Application Data\Urbemis\Version9a\Data\Phase IV Paving.equip;Phase IV Paving
Off-Road Equipment:

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1 Paving Equipment (104 hp) operating at a 0.53 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 829 hrs/year
1 Rollers (95 hp) operating at a 0.56 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 695 hrs/year

1 Other Material Handling Equipment (191 hp) operating at a 0.59 load factor for 8 hours per day; Engine Built/Rebuilt in 2005 with average useage of 500 hrs/year