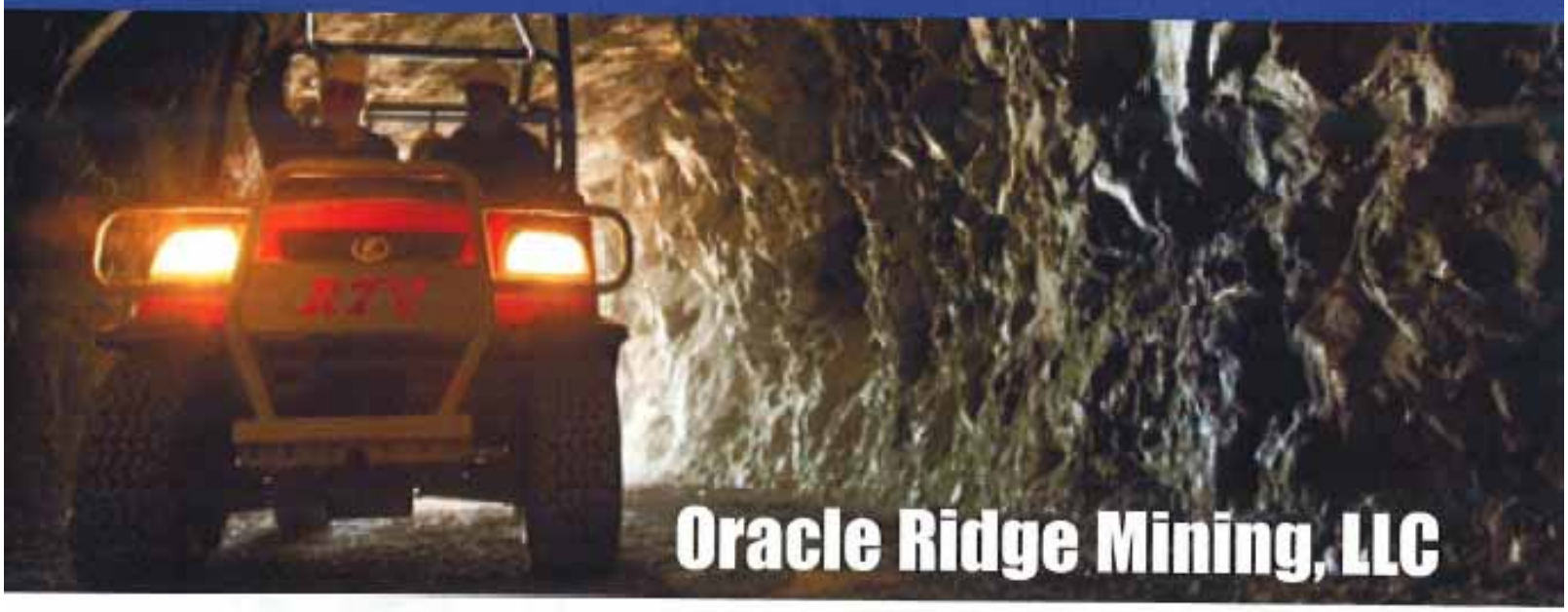

Oracle Ridge Mining, LLC

Class II Air Quality Permit Application

October 14, 2011

Submitted To:

Pima County Department of Environmental Quality
33 North Stone Avenue, Suite 700
Tucson, Arizona 85701-1429

Submitted By:

Oracle Ridge Mining, LLC
10445 N. Oracle Road, Suite 101
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Prepared By:

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Oracle Ridge Copper

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Oracle Ridge Copper

PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY
CLASS II AIR QUALITY PERMIT APPLICATION

TABLE OF CONTENTS

SECTION TAB	CONTENTS DESCRIPTION
PERMIT SUMMARY	Permit summary with source description and proposed permit limits, table listing description of equipment locations within the mine site facility, and a Mine Site General layout with Property Boundary distances
PDEQ CHECKLIST	Completed PDEQ Permit Checklist demonstrating compliance that includes Pima County Code references.
STANDARD APPLICATION FORMS	Completed PDEQ Standard Permit Application Forms for Oracle Ridge Mine, Class II Air Quality Permit.
POTENTIAL-TO-EMIT CALCULATIONS	PTE Calculations Task Description References Used Facility Emissions Summary Criteria, Codes, and Standards Assumptions Source Data

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SECTION TAB	CONTENTS DESCRIPTION
POTENTIAL-TO-EMIT CALCULATIONS (cont'd)	PTE Calculations: ✓ Conveyor Transfer Points ✓ Crushed Ore Bunker Drop Points ✓ Milk-of-Lime Storage & Distribution System ✓ Emergency Fire Pump Engine ✓ Emergency Generator ✓ Diesel Fuel Tank ✓ Gasoline Fuel Tank ✓ Tailings Facility Fugitive Dust Emissions ✓ Reagent VOC Emissions ✓ Reagent H_2S Emissions ✓ Reagent Bag Breaker Particulate Emissions ✓ Tailings Dam Xanthate HAP Emissions ✓ Unpaved Roadway Particulate Emissions ✓ Construction Activity Particulate Emissions
	PTE Appendices: ✓ Appendix A – Bulk Bag Unloader System ✓ Appendix B – Emergency Fire Pump Data ✓ Appendix C – Emergency Generator Data ✓ Appendix D – EPA Tanks 4.0.9d Emission Reports ✓ Appendix E – Tailings Facility Stockpile Plan Sheets ✓ Appendix F – Reagent Chemical Usage Detail ✓ Appendix G – Material Safety Data Sheets (MSDS) ✓ Appendix I – Vehicle Miles Traveled (VMT) Data ✓ Appendix J - NCDC) Precipitation Data for Tucson, AZ ✓
PROCESS DESCRIPTIONS	Oracle Ridge Mine Process Descriptions: ✓ Introduction and General Process Philosophy ✓ Ore Crushing & Storage ✓ Ore Communication System ✓ Flotation ✓ General Flotation Process Description ✓ Flash Flotation ✓ Rougher Flotation ✓ Scavenger Flotation ✓ Re-Grind Ball Mill

Oracle Ridge Copper

TABLE OF CONTENTS – CON'T

SECTION TAB	CONTENTS DESCRIPTION
PROCESS DESCRIPTIONS (cont'd)	✓ Cleaner Flotation ✓ Copper Concentrate Thickening and Filtration ✓ Tailings Thickening and Filtration ✓ Reagent Make-up and Distribution ✓ Milk-of-Lime Distribution System ✓ Utilities ✓ Fugitive Dust Particles and Gases
PROCESS FLOW DIAGRAMS ----------	Oracle Ridge Mine Process Flow Diagrams including mass balance data: ✓ Crushing Flowsheet ✓ Grinding Flowsheet ✓ Rougher & Scavenger Flotation Flowsheet ✓ Regrind Mill & Copper Cleaner Flotation Flowsheet ✓ Copper Thickener & Filer Press Flowsheet ✓ Tailings Thickener & Filter Press Flowsheet ✓ Water Storage & Distribution Flowsheet ✓ Plant Air & Flotation Distribution Flowsheet ✓ Reagent Mixing & Distribution Flowsheet ✓ Milk-of-Lime Storage & Distribution Flowsheet ✓ Fuel Storage & Distribution Flowsheet
EQUIPMENT LIST ----------	Detail listing of Oracle Ridge Mine equipment including assigned equipment numbers (Equipment ID#s), equipment name and description.
INSIGNIFICANT ACTIVITIES ----------	Listing of Oracle Ridge Mine insignificant activities including regulatory references for justification.

END - TABLE OF CONTENTS

ORACLE RIDGE MINING, LLC

PERMIT SUMMARY

- Background Information
- Mine Location
- Proposed Operations
- Proposed Permit Limits
- Alternate Operating Scenarios (2)
- Emissions Summary
- Applicable Test Methods
- Description of Equipment Locations
- Site Layout and Property Boundary Distances

BACKGROUND

This is an existing copper mine where an estimated one (1) million tons in tailings had been produced by others in previous mining operations. Gold Hawk Resources, Inc. (Gold Hawk) purchased the mine late in the spring of 2010 and is doing business as (DBA) Oracle Ridge Mining, LLC. (ORM). The parent company is now Oracle Mining Corporation. The ORM is comprised of two facilities: (1) the Mine Facility and (2) the Tailings Facility. The two facilities are separated by a distance of approximately two (2) miles. Pima County acquired the land or property between the two facilities for unpaid property taxes. An estimated eight (8) to ten (10) million tons of ore remain to be mined.

ORM's proposed unit operations include various environmental mitigation measures and control technologies for recovery of the copper and minor amounts of gold and silver in order to minimize environmental impacts. Magnetite mineralization is also anticipated; however, the proposed facility does not include magnetite processing at this time. That is, metallurgical testing is required in order to determine if the magnetite is economically feasible for recovery. Therefore ORM's magnetite processes remain a consideration for future ORM operations.

ORACLE RIDGE MINE LOCATION

The ORM project site, approximately elevation = 9,157 feet (ft) above mean sea level (AMSL), is located approximately six (6) to seven (7) miles from the Summerhaven community in the Old Hat Mining District on Marble Peak on the north side of the Santa Catalina Mountains in Pima Count, Arizona. More specifically, ORM is located inside of Township 11 South, Range 16 East. The latitude and longitude of the mine entrance gate are approximately 32.47566°N and 110.70509°W, respectively (NAD 83). The tailings facility entrance gate is located at approximately 32.48278°N and 110.69083°W (NAD 83), approximately 4 miles (6.4 kilometers) east of the mine on Black Hills Mine Road (NFSR 4450). The project location is illustrated in Figure 1 on the following page.

Figure 1: Oracle Ridge Mine Project Location

PROPOSED OPERATIONS

ORM's proposed operations would be two (2) ten (10) hour shifts per day or twenty (20) operating hours per day for 365 days per year. Operations include an annual "average" ore crushing rate of 2,000 short tons per day (STPD); however, a proposed permit limit of 3,000 STPD (150 STPH) through the Concentrator Plant. The 3,000 STPD permit limit is used for PTE calculations from the Crushed Ore Bins through the Concentrator Plant.

All crushing operations occur underground inside of the mine and; therefore, emissions from these operations are not included in this air quality permit application. The hourly maximum ore flow from the mine up to the Crushed Ore Bunkers used in calculating the potential to emit (PTE) is 500 STPH and reflects the maximum design capacity of the Radial Stacking Conveyor (Equipment ID# 100-CV-04).

Crushed ore storage and ore processing occur above ground at the site and *does not include smelting* operations. Proposed ORM mine facility operations include assigned functional areas listed below:

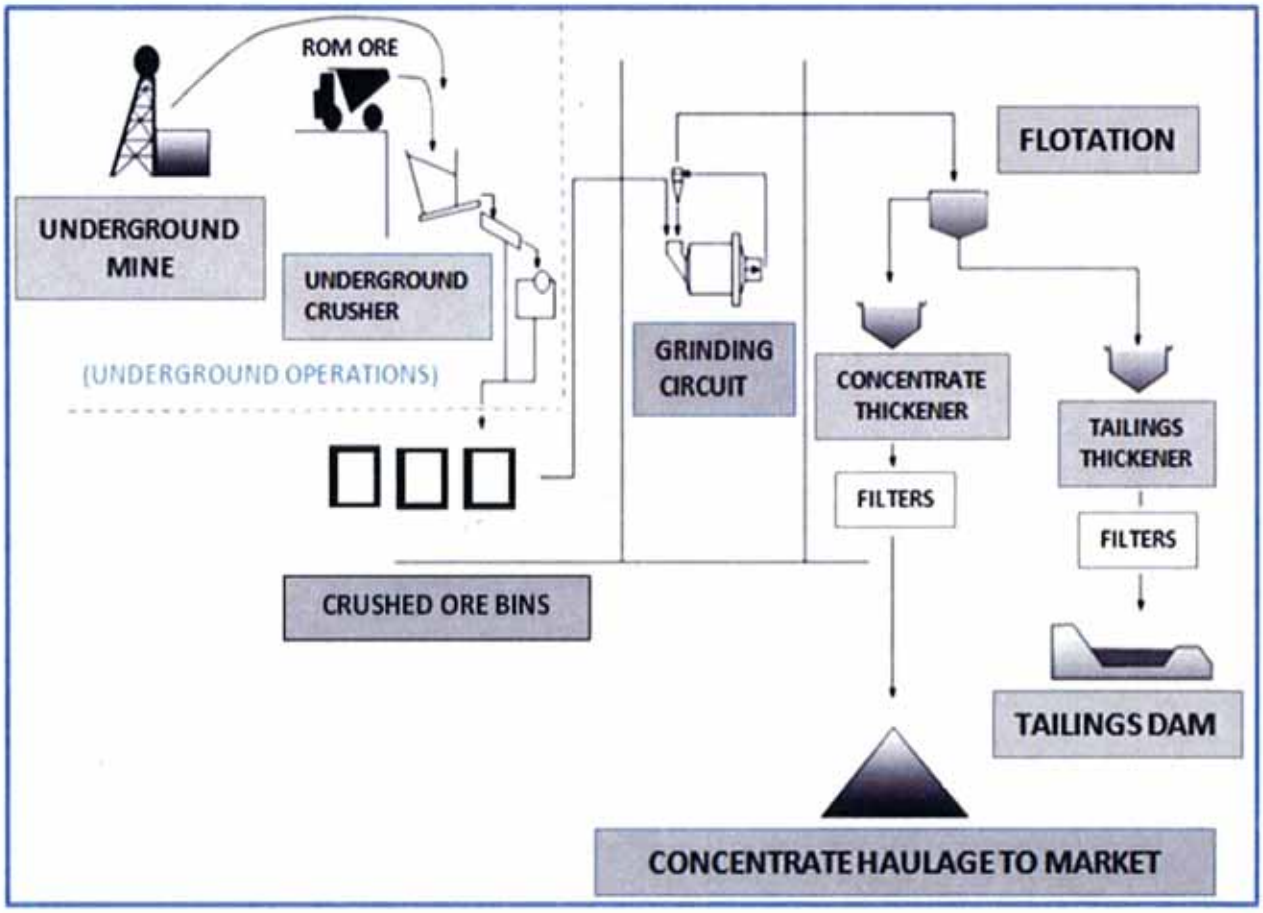
AREA PREFIX	MINE FACILITY PROCESS – FUNCTIONAL AREA DESIGNATION
100	Crushing and Material Handling
200	Grinding Circuit
300	Flash Flotation Circuit
400	Cu Rougher/Scavenger Flotation Circuit
410	Cu 1st Cleaner Flotation Circuit
420	Cu 1st Cleaner/Scavenger Flotation Circuit
430	Cu 2nd Cleaner Flotation Circuit
440	Cu Thickener/Filtration Circuit
500	Re-grind Ball Mill Grinding Circuit
700	Tailings Thickener/Filtration Circuit
800	Water Systems: Fresh Water, Reclaim, Firewater, Potable Water, Air Systems
900	Flotation Reagents & Milk-of-Lime Circuits

EMERGENCY POWER AND FIRE PUMP ENGINE

The ORM Class II Air Quality Permit Application includes an Emergency Generator System (Genset) and Fire Pump Diesel Engine. The Genset is a skid mounted diesel generator set rated at 1500 kW (standby), 415/3/50 complete with a 10,000 gallon diesel fuel tank, instrumentation, and an electrical control system. The Fire Pump System includes a diesel-powered back-up pump and is connected to the Fire Water reserve Tank piping system for use in emergency situations in a power outage whereby fire water is required at the mine site.

Both the Genset and the Fire Water Back-up System are each limited to 100 hours per year for maintenance checks and readiness testing as provided for in 40 CFR 60.4211 (f).

The following diagram is a general representation of overall ORM Facility operations.



PROPOSED PERMIT LIMITS

The ORM Class II Air Quality Permit Application includes the following proposed *process operation* permit limits:

Proposed Permit Limit	Affected Emission Source(s)	Emissions Limit Target Pollutant(s)	PTE (tpy)	Proposed Compliance Method
3,000 STPD	Concentrator Plant Process Equipment	Volatile Organic Compounds (VOCs)	31.76	Belt Scale Ore Throughput Records
219,000 lbs/yr Sodium Hydrosulfide (NaHS)	Concentrator Plant, Scavenger Flotation Cells	Hydrogen Sulfide (H_2S)	9.6	Concentrator Plant Sodium Hydrosulfide Material Usage Records
146,730 lbs/yr Aerofroth 70 and 343 Xanthate	Concentrator Plant Process Units	Volatile Organic Compounds (VOCs)	31.76	Concentrator Plant Reagent Material Usage Records
100 hrs/yr	Fire Pump Engine	All Criteria Pollutants plus HAP emissions	See Permit Application, PTE tab, Page 20 of 37.	Fire Pump Engine Run Hour Meter Readings/Records
100 hrs/yr	Emergency Generator	All Criteria Pollutants plus HAP emissions	See Permit Application, PTE tab, Page 22 of 37.	Emergency generator Run Hour Meter Readings/Records

The ORM Class II Air Quality Permit Application includes the following proposed permit *emission* limits:

REQUESTED PERMIT ANNUAL EMISSION LIMITS								
EMISSION SOURCE	PM (tpy)	PM10 (tpy)	CO (tpy)	NOX (tpy)	SO2 (tpy)	VOC (tpy)	H2S (tpy)	HAP (tpy)
Lime System	6.92	6.92						
Fire Pump	0.02	0.02	0.06	0.27	0.02	0.02		2.36E-04
Genset	0.05	0.04	0.56	2.46	0.04	0.06		3.12E-03
Fuel Tanks						2.18		
Concentrator Plant						31.76	9.6	
Xanthate Bag Breaker	0.42	0.42						
Facility Totals =	**7.4**	**7.4**	**0.6**	**2.7**	**0.1**	**34.0**	**9.6**	**3.36E-03**
Class II Permit Thresholds[1] =	25	15	100	40	40	40	10	25

(1) Thresholds per Pima County Code (PCC), Title 17 whereas 100 tpy for each pollutant is the threshold per the Pima County State Implementation Plan (SIP) 171 (C)(2)(a) - See PTE Summary on page 7 of 13.

ALTERNATE OPERATING SCENARIOS

The ORM Class II Air Quality Permit Application includes two (2) alternate operating scenarios as described below:

1. Use of Potassium Amyl Xanthate (PAX) as a conditioning reagent in place of Sodium Isopropyl Xanthate (NAX31).

2. Use of Milk-of-Lime throughout the Communication Circuitry and the Cu Flotation Circuitry in order to adjust the pH of the slurry to enable flotation of the Cu, Ag, and Au particles. Note: If the pH of the slurry does not require adjustment, milk-of-lime will not be required in processing the ore. The vendor-supplied High Density Lime (Milk-of-Lime) Distribution System includes a particulate emissions control system that is used for the basis of PTE calculations.

CONCENTRATOR PLANT CIRCULATING LOAD

This process description is provided to explain Concentrator Building ore flowrates (i.e., solids, tph) that appear to be in excess of the 150 STPH (i.e. 3,000 STPD permit limit) - See Drawing No. 11005-F-02 (Rev G) in the "Process Flow Diagrams" tab of this Class II Air Quality Permit Application. The following description serves to illustrate how these ore process flow rates shown in the mass balance details on Drawing No. 11005-F-02 (Rev G) do not impact the reagent demand rate that is based on the accepted ore processing limit of 3,000 STPD.

The circulating load of the ore is in the Ball Mill Circuit (i.e. Ball Mill, Pumps, and Cyclone Circuit) and is calculated at approximately 250% of the new ore feed (i.e. 150 STPH) that enters the Ball Mill Circuit. This circulating load occurs because the Ball Mill cannot grind the incoming ore (Particle size of P80 = ½") to the necessary design particle size of P80 = 100 mesh in a single pass thru the Ball Mill; therefore a circulating load of ore is required to achieve the design particle size. The calculations that support this circulating load and provide documentation for the mass balance illustrated on Drawing No. 11005-F-02 (Rev G) are included on page 13 of 37 under the "PTE Calculations" tab of this Class II Air Quality Permit Application.

POTENTIAL-TO-EMIT (PTE) DISCUSSION AND SUMMARY

PTE calculations based on the maximum ore process design rate of 3,000 STPD through the Concentrator Building process units as reflected in the table below.

PROPOSED OPERATING PARAMETERS			
EMISSION SOURCE	**CAPACITY**	**PROPOSED LIMIT (YES / NO)**	**ANNUAL OPERATION**
Concentrator Plant Operating Hours	8,760 hours/Year	No	8,760 hours/year[1]
Concentrator Plant Process Rate	3,000 STPD	Yes	365 days/year
Conveyor Transfer & Drop Points[2]	500 STPH	No	365 days/year
Milk-of-Lime System[3]	274 tpy	No	365 days/year
Emergency Diesel Generator	1500 Kw	Yes	100 hours/year
Fire Pump Diesel Engine	86 Kw	Yes	100 hours/year
Fuel Tanks (Combined)	20,000 gallons	No	8,760 hours/year
VOC-emitting Concentrator Reagents[3]	146,730 lbs/yr	Yes	365 days/year
Fire Pump Engine	8,760 hours/year	Yes	100 hours/year
Emergency Generator	8,760 hours/year	Yes	100 hours/year
Sodium Hydrosulfide Reagent	219,000 lbs/yr	Yes	365 days/year
Tailings Facility Production Rate	2,000 STPD	No	365 days/year
Unpaved Roads, Heavy Duty Vehicles	-------	No	788,022 VMT/yr
Unpaved Roads, Light Duty Vehicles	-------	No	186,150 VMT/yr

Notes:

1. Two (2) ten (10) hours shifts per day; however, PTE based on 8,760 hours per year.
2. Based on Maximum Design Capacity of the Crushed Ore Bin Feed/Tripper Conveyor (Equipment ID# 100-CV-03).
3. Compliance demonstrated through facility material usage records.

ORM will average 2,000 STPD for ore crushing and processing; however, PTE calculations are based on two (2) ore process rates:

1. The maximum ore process design rate of 3,000 STPD through the Concentrator Plant, and
2. An ore flow rate of 500 STPH up to the Crushed Ore Bins. Potential-to-Emit (PTE) calculations are included in the same named tab herein.

The ORM Facility includes ore material belt scale (Equipment ID #200-SC-01) to measure the amount of ore material processed per day (i.e., tpd). The scale records provide means to gauge actual emissions to potential emissions (PTE) calculated in this application. Methods used to calculate PTE from sources at ORM operations are, for the most part, based on emission factors provided in AP-42. The results of PTE calculations are maximum potential emissions based on daily and annual ore material process rates. Detailed PTE calculations are provided under the PTE Calculations tab, included herein.

POTENTIAL-TO-EMIT SUMMARY (tpy) *[Note: Includes both fugitive and non-fugitive emissions]*[1]

EMISSION SOURCE	PM	PM_{10}	CO	NOx	SO_2	VOC	HAP	H_2S
Ore Transfer/Drop Points	12.91	12.91						
Lime Storage System	6.92	6.92						
Fire Pump Engine	0.02	0.02	0.06	0.27	0.02	0.02	2.36E-04	
Emergency Generator	0.05	0.04	0.56	2.46	0.04	0.06	3.12E-03	
Fuel Tanks (combined)						2.18		
Tailings Fugitive Dust	2.29	1.47						
Concentrator Reagents						31.76		9.6
Reagent Bag Breaker	0.42	0.42						
Tailings Dam Emissions							2.11E-02	
Unpaved Roads	36	11						
Facility Totals =	**59**	**33**	**0.62**	**2.74**	**0.06**	**34.0**	**2.44E-02**	**9.6**
Pima County SIP Major Source Threshold =	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

(1) **Note:** Potential-to-emit (PTE) totals in this permit application are summarized both with and without fugitive emissions in order to demonstrate Class II Source applicability with both Pima County Code and Pima County State Implementation Plan (SIP) 171 (C)(2)(a).

A major stationary source of air pollutants - as defined in Section 302 of the U.S. Clean Air Act (the Act) - that directly emits or has the potential to emit, 100 tons per year (tpy) or more of any pollutant; 10 tpy or more of any hazardous air pollutant (HAP) - in the aggregate - that has been listed pursuant to Section 112(b) of the Act; or 25 tpy or more of any combination of HAP. Fugitive emissions of a stationary source shall not be considered in determining whether it is a major stationary source for the purposes of, unless the source belongs to one of the 27 categories of stationary source as listed in Section 302(j) of the Act. The ORM Facility does not include any of the 27 listed category stationary sources, so, only non-fugitive emissions are used for source classification

The proposed facility's underground operations include Vent Raise features per MSHA regulations. Vent Raise emissions are not included in the Class II Permit Application as these underground emissions are regulated through MSHA and the Arizona State Mine Inspector.

The applicability of Clean Air Act (CAA) Title V provisions is triggered for a facility that has the "potential to emit" (PTE) 100 tons per year (tpy) of any criteria air pollutant or 10 tpy of any single HAP, or 25 tpy of any combination of HAPs. The calculated emissions for the proposed ORM facilities result in PTE below Title V (Class I) operating permit thresholds.

REAGENT VOLATILE ORGANIC COMPOUNDS (VOCs)

Hydrated lime is used to produce Milk-of-Lime that is then used throughout the Communication Circuitry and the Cu Flotation Circuitry in order to adjust the pH of the slurry to enable flotation of the Cu, Ag, and Au particles. Sodium isopropyl Xanthate is used as a conditioning reagent in order to coat the Cu, Au, and Ag particles to make the particles hydrophobic (water repellent) prior to subjecting the Cu, Au, and Ag particles to the flotation process. Methyl isobutyl carbinol (MIBC) is used as a frothing reagent that will produce air bubbles in the slurry. These air bubbles make contact with the Cu, Au, and Ag particles and the particles attached to the bubbles and thereby float to the surface of the slurry in the flotation cells. A flocculant reagent is used in the Cu Concentrate and Tailings Thickeners to cause individual particles within the concentrate and tailings slurries to coalesce and settle to the bottom of

the Concentrate and Tailings Thickeners.

A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. However, for air permitting purposes, and, as defined in 40 CFR 51.100(s), the term VOC includes any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) which participates in atmospheric photochemical reactions. These photochemical reactions contribute to ozone and are therefore considered to be ozone precursors. Troposphere or ground-level ozone (i.e., smog) is formed by a combination of sun, nitrogen oxides (NOx), carbon monoxide (CO), and VOCs, such as xylene. Examples of ozone precursor VOCs include trichloroethane; trichloroethylene; and benzene, toluene, ethylbenzene, and xylene (BTEX).

Evaluation of Material Safety Data Sheets (MSDS) for proposed ORM Facility reagents with regulatory information regarding if reagent chemical constituents participate in atmospheric photochemical reactions or not. Only those VOCs that were verified as photochemical by reactive were included in the VOC emission estimate.

These reagent VOCs are regulated pollutants assigned to the Concentrator Building and the Reagent Building. There are no VOC pollution controls are identified for the Concentrator Building, so, VOC emissions are exhausted via the building ventilation system. The proposed ventilation rate is four (4) to six (6) air changes per hour or approximately 80,000 scfm to 120,000 scfm of total building ventilation.

NEW SOURCE PERFORMANCE STANDARDS (NSPS) REQUIREMENTS

A.A.C. R18-2-901.1	Standards of Performance for New Stationary Sources Subpart A - General Provisions
A.A.C. R18-2-901.16	Standards of Performance for New Stationary Sources: Subpart Kb - Volatile Liquid Storage Vessels for Which Construction, Reconstruction, or Modification Commenced after July 23, 1984.
A.A.C. R18-2-901.41	Standards of Performance for New Stationary Sources: Subpart LL - Metallic Mineral Processing Plants

Relative to State and Federal regulations and permit conditions, some of the ore crushing and handling emission unit sources are subject to new source performance standards (NSPS) for metallic material processing plants (40 CFR, Part 60, Subpart LL). This NSPS applies to new, modified and reconstructed facilities and apply to each crusher, screen, bucket elevator, conveyor belt transfer point, product packaging station, storage bin, enclosed storage area, truck loading station at the mill or concentrator. NSPS, Subpart LL identifies a stack emission limitation for particulate matter (PM). It also provides emission limits for fugitive dust emissions by adopting a capacity or visibility of fugitive dust emissions and compares it with established limits. The rule also requires periodic monitoring of baghouses that are PM emissions control devices. Testing is required once every five years for these control devices to assure that fugitive emissions that are not controlled by water sprays are minimized. NSPS, Subpart LL limits PM emissions from each affected emission unit to 0.22 grains per dry standard cubic foot (gr/dscf) of exhaust.

NATIONAL EMISSIONS STANDARDS FOR HAZARDOUS AIR POLLUTANTS (NESHAPS)

National Emission Standards for Hazardous Air Pollutants (NESHAPS) are stationary source standards for hazardous air pollutants. NESHAPs are found in 40 CFR Part 61 and 40 CFR Part 63. Part 61 NESHAPs regulate the following seven (7) hazardous air pollutants:

- Asbestos
- Beryllium
- Mercury
- Vinyl chloride
- Benzene
- Arsenic
- Radon/radionuclides

NESHAP under 40 CFR Part 61, Subpart EEEEEEE, Gold Mine Ore Processing and Production (area sources) includes mercury emission standards for non-carbon concentrate processes for new sources of 0.2 lb/ton of concentrate. However, the ORM Facility primarily produces copper from ore processing and is not anticipated to have mercury emissions from these ore processes. Other copper NESHAPS (i.e.,

Subpart QQQ) pertain specifically to copper smelting, and, therefore are found to be not applicable to the ORM Facility.

OTHER APPLICABLE REQUIRMENTS

New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart LL, Standards of Performance for Metallic Mineral Processing Plants.
New Source Performance Standards for Hazardous Air Pollutants (NESHAPS), 40 CFR Part 63, Subpart RRRRR (Ore Processing MACT).
40 CFR Part 60, Subpart IIII, Compression Ignition Internal Combustion Engines.
40 CFR Part 63, Subpart ZZZZ, Compression Ignition Internal Combustion Engines
40 CFR Part 63, Subpart CCCCCC, Gasoline Storage and Dispensing.
Pima County State Implementation Plan (SIP), Rule 171 (C)(2)(a), source definition.
Pima County SIP, Rule 202, Installation Permits.
Pima County SIP, Rule 211, Permit Applications.
Pima County SIP, Rule 224, Fugitive Dust Producing Activities.
Pima County SIP, Rule 316, Particulate Materials.
Pima County SIP, Rule 332, Compilation of Mass Rates and Concentrations.
Pima County SIP, Rule 334, Petroleum Liquids.
Pima County SIP, Rule 341, Applicability of Ambient Air Quality Standards (NAAQS).
Pima County SIP, Rule 342, Mass-Concentration Ceilings, Table 341.
Pima County SIP, Rule 601, Classification of Pollutants.
PCC Title 17, Chapter 17.04.340(212)(a) - Significant Emissions
PCC Title 17, Chapter 17.04.340(A)(114), Insignificant Activities.
PCC Title 17, Chapter 17.12.140 (Note: Class II permit applies if subject to a federal new source standard).
PCC Title 17, Chapter 17.12.160/165/180/185 (PDEQ Permit application requirements).
PCC Title 17, Chapter 17.12.190, Permits containing synthetic emission limitations and standards.
PCC Title 17, Chapter 17.12.195 (conditions for acceptance of an emission cap to be classified as Class II).
PCC Title 17, Chapter 17.12.310, Permit Shields.
PCC Title 17, Chapter 17.12.470, Fugitive Dust Activity Permits.
PCC Title 17, Chapter 17.16.060, Fugitive Dust Producing Activities.
PCC Title 17, Chapter 17.16.100, Particulate Materials.
PCC Title 17, Chapter 17.16.120, Mineral Tailings.
PCC Title 17, Chapter 17.16.130, NSPS Applicability.
PCC Title 17, Chapter 17.16.140, Compilation of Mass Rates and Concentrations.
PCC Title 17, Chapter 17.16.230, Standards of Performance for Storage Vessels for Petroleum Liquids.
PCC Title 17, Chapter 17.16.360, Standards of Performance for Nonferrous Metals Industry Sources.
PCC Title 17, Chapter 17.16.430, Standards of Performance for unclassified sources.

AIR POLLUTION CONTROL EQUIPMENT AND TECHNIQUES

The Lime Storage Silo includes a Bin Vent Filter that captures lime particulate dust created during the pebble lime off-loading process. Conveyor transfer points and drops include the use of a water spray system for dust suppression.

APPLICABLE TEST OR MONITORING METHODS

Compliance with applicable requirements is determined by Method-9 for opacity standards and Methods 1 through 5 for particulate emission standards. Other compliance methods for proposed permit limits are listed in the table on page 5 of 13 herein.

ORACLE RIDGE MINING, LLC

Description of Equipment Locations

EQUIPMENT LOCATIONS

All equipment identified by serial number and included in the PDEQ Class II Air Quality Permit Application requires it's location be delineated in the permit document. At this time equipment location is not detailed. So, please fill in the **Specific Building and Building Location** that houses each piece of equipment listed below. If the

Type of Equipment	Manufacturer	Serial Number/Unique Equipment ID	Mine Site Location or specific Building where equipment is located[1]
Dust Spray/Collection System	Local Supply	100-DS-01	Underground in the mine at all ore transfer points in the crusher system, conveyor ore transfer points, and on the surface at all conveyor ore transfer points and apron feeders
Feed Hopper	Local Supply	100-HP-01	Underground in the mine at Crusher System Area
Vibrating Grizzly Feeder	Simplex	100-FE-01	Underground in the mine at Crusher System Area
Rock Breaker	Simplex	100-RB-01	Underground in the mine at Crusher System Area
Primary Jaw Crusher	Metso	100-CR-01	Underground in the mine at Crusher System Area
Under-crusher Conveyor	Simplex	100-CV-01	Underground in the mine at Crusher System Area
Conveyor to Surface	Simplex	100-CV-02	Underground in the mine leading to the Surface
Crushed Ore Bin Feed/Tripper Conveyor	Superior Conveyor	100-CV-03	Surface Area near Concentrator Building
Crushed Ore Bin No. 1	Local Supply	100-BK-01	Surface Area near Concentrator Building
Crushed Ore Bin No. 2	Local Supply	100-BK-02	Surface Area near Concentrator Building
Crushed Ore Bin No. 3	Local Supply	100-BK-3	Surface Area near Concentrator Building
Apron Feeder No. 1	Simplex	100-FE-01	Surface Area under Storage Bunker No. 1
Apron Feeder No. 2	Simplex	100-FE-02	Surface Area under Storage Bunker No. 2
Apron Feeder No.3	Simplex	100-FE-03	Surface Area under Storage Bunker No. 3
Reclaim Tunnel Conveyor	Simplex	100-CV-05	Surface Area under Storage Bunkers
SAG Mill Feed Conveyor	Simplex	200-CV-01	Surface Area from Storage Bunkers and into the Concentrator Building
SAG Mill Feed Chute	Local Supply	200-HP-01	Within the Concentrator Building

[1]Proposed location for all listed ORM equipment.

EQUIPMENT LOCATIONS

All equipment identified by serial number and included in the PDEQ Class II Air Quality Permit Application requires it's location be delineated in the permit document. At this time equipment location is not detailed. So, please fill in the **Specific Building and Building Location** that houses each piece of equipment listed below. If the

Type of Equipment	Manufacturer	Serial Number/Unique Equipment ID	Mine Site Location or specific Building where equipment is located[1]
SAG Mill	Metso	200-SG-01	Within the Concentrator Building
SAG Mill Trash Bin	Local Supply	200-BN-01	Within the Concentrator Building
Ball Mill Cyclone Feed Sump	Local Supply	200-SU-01	Within the Concentrator Building
Primary Ball Mill Feed Chute	Local Supply	200-HP-02	Within the Concentrator Building
Primary Ball Mill	Metso	200-BM-01	Within the Concentrator Building
Primary Ball Mill Trash Bin	Local Supply	200-BN-02	Within the Concentrator Building
Primary Ball Mill Hydrocyclones	Krebs	200-CY-01	Within the Concentrator Building
Particle Size Sampler	Heath & Sherwood	200-SA-01	Within the Concentrator Building
Flash Flotation Feed Sump	Local Supply	200-SU-02	Within the Concentrator Building
Flash Flotation Cell	Metso	300-FL-01	Within the Concentrator Building
Flash Flotation Tailings Sump	Local Supply	300-SU-02	Within the Concentrator Building
Flash Flotation Concentrate Sampler	Heath & Sherwood	300-SA-01	Within the Concentrator Building
Rougher Flotation Conditioning Tank	Local Supply	400-TK-01	Within the Concentrator Building
Rougher Flotation Cells	Metso	400-FL-01/06	Within the Concentrator Building
Flotation Concentrate Sampler	Heath & Sherwood	400-SA-02	Within the Concentrator Building
Scavenger Flotation Cells	Outotec	400-FL-07/10	Within the Concentrator Building
Scavenger Flotation Tailings Sump	Local Supply	400-SU-01	Within the Concentrator Building

[1]Proposed location for all listed ORM equipment.

EQUIPMENT LOCATIONS

All equipment identified by serial number and included in the PDEQ Class II Air Quality Permit Application requires it's location be delineated in the permit document. At this time equipment location is not detailed. So, please fill in the **Specific Building and Building Location** that houses each piece of equipment listed below. If the

Type of Equipment	Manufacturer	Serial Number/Unique Equipment ID	Mine Site Location or specific Building where equipment is located[1]
Scavenger Flotation Tailings Sampler	Heath & Sherwood	400-SA-01	Within the Concentrator Building
Re-Grind Ball Mill Feed Chute	Local Supply	500-HP-01	Within the Concentrator Building
Re-Grind Ball Mill	Metso	500-RM-01	Within the Concentrator Building
Re-Grind Ball Mill Discharge Sump	Local Supply	500-SU-01	Within the Concentrator Building
Re-Grind Ball Mill Cyclones	Krebs	500-CY-01	Within the Concentrator Building
Particle Size Sampler	Heath & Sherwood	500-SA-01	Within the Concentrator Building
Re-Grind Ball Mill Trash Bin	Local Supply	500-BN-01	Within the Concentrator Building
Cleaner Flotation Conditioning Tank	Local Supply	500-TK-01	Within the Concentrator Building
1st Cleaner Flotation Cells	Metso	410-FL-01/06	Within the Concentrator Building
Cleaner/Scavenger Flotation Cells	Metso	420-FL-01/03	Within the Concentrator Building
Cleaner/Scavenger Tailings Sump	Local Supply	420-SU-01	Within the Concentrator Building
Cleaner/Scavenger Tailings Sampler	Heath & Sherwood	420-SA-01	Within the Concentrator Building
2nd Cleaner Flotation Cells	Metso	430-FL-01/05	Within the Concentrator Building
2nd Cleaner Flotation Tailings Sump	Local Supply	430-SU-01	Within the Concentrator Building
Copper Concentrate Thickener Tank	Delkor	440-TH-01	Adjacent to the Concentrator Building
Copper Thickener O-flow Sump	Local Supply	440-SU-01	Adjacent to the Concentrator Building
Copper Concentrate Sampler	Heath & Sherwood	440-SA-01	Adjacent to the Concentrator Building

[1]Proposed location for all listed ORM equipment.

EQUIPMENT LOCATIONS

All equipment identified by serial number and included in the PDEQ Class II Air Quality Permit Application requires it's location be delineated in the permit document. At this time equipment location is not detailed. So, please fill in the **Specific Building and Building Location** that houses each piece of equipment listed below. If the

Type of Equipment	Manufacturer	Serial Number/Unique Equipment ID	Mine Site Location or specific Building where equipment is located[1]
Copper Thickener Underflow Tank	Local Supply	440-TK-01	Adjacent to the Concentrator Building
Copper Filter Surge Tank	Local Supply	440-TK-02	Surface at the Existing Tailings Area
Copper Dewatering Filter Press	Micronics	440-FL-01	Surface Area at the Existing Tailings Area
Copper Filtrate Return Tank	Local Supply	440-TK-03	Surface Area at the Existing Tailings Area
Copper Concentrate Storage Bunker	Local Supply	440-BK-01	Surface Area at the Existing Tailings Area
Tailings Thickener Tank	Delkor	700-TH-01	Adjacent to the Concentrator Building
Tailings Thickener Underflow Tank	Local Supply	700-TK-01	Adjacent to the Concentrator Building
Tailings Filter Surge Tank	Local Supply	700-TK-02	Surface Area at the Existing Tailings Area
Tailings Dewatering Filter Press	Micronics	700-FL-01	Surface Area at the Existing Tailings Area
Tailings Filtrate Return Tank	Local Supply	700-TK-03	Surface Area at the Existing Tailings Area
Dewatered Tailings Storage Bunker	Local Supply	700-BK-01	Surface Area at the Existing Tailings Area
Complete Hydrated Lime System	Merrick	900-MS-01	Within the Concentrator Building
Bulk Bag Unloader	Merrick	900-BU-01	Within the Concentrator Building
Hydrated Lime Screw Conveyor	Merrick	900-CV-01	Within the Concentrator Building
Milk-of-Lime Mix Tank	Merrick	900-TK-01	Within the Concentrator Building
Xanthate Mix Tank	Local Supply	920-TK-03	Within the Concentrator Building
Xanthate Day Tank	Local Supply	920-TK-04	Within the Concentrator Building

[1]Proposed location for all listed ORM equipment.

EQUIPMENT LOCATIONS

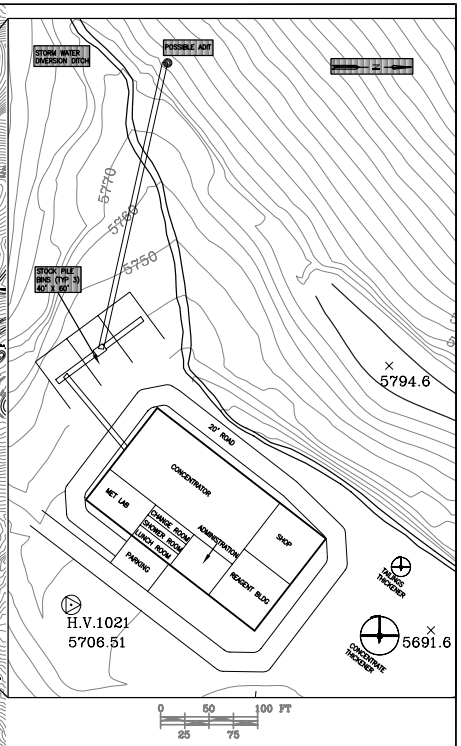
All equipment identified by serial number and included in the PDEQ Class II Air Quality Permit Application requires it's location be delineated in the permit document. At this time equipment location is not detailed. So, please fill in the **Specific Building and Building Location** that houses each piece of equipment listed below. If the

Type of Equipment	Manufacturer	Serial Number/Unique Equipment ID	Mine Site Location or specific Building where equipment is located[1]
Screw Feeder	Simplex	910-FE-01	Within the Concentrator Building
Flocculant Mix Tank	Velodyne	910-TK-01	Within the Concentrator Building
Flocculant Day Tank	Velodyne	910-TK-02	Within the Concentrator Building
Gasoline Storage Tank	Highland Tank	800-TK-01	Mine Site Area
Diesel Fuel Storage Tank	Highland Tank	800-TK-02	Mine Site Area
Emergency Standby Generator	Wagner Power Systems	170-GE-01	Adjacent to the Concentrator Building

[1]Proposed location for all listed ORM equipment.

ORACLE RIDGE MINING, LLC

Mine General layout and Property Boundary Distances



DISTANCES TO PROPERTY BOUNDARY			
LOCATION	SOUTH	EAST	NORTH
CONCENTRATOR	1,573 FT	435 FT	936 FT
REAGENT	1,559 FT	324 FT	815 FT
METLAB	1,002 FT	411 FT	1484 FT
STOCK PILES	1,121 FT	567 FT	1,565 FT
DIESEL/STORAGE TANKS	NW 312 FT	NE 576 FT	

LEGEND
PROPERTY BOUNDARY
PLANT ROAD
PLANT BUILDING
UNPAVED ROAD
EQUIPMENT

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE	NO	REVISIONS	BY	APP	DATE
							A	ISSUED FOR REVIEW	OC	ND	07/26/11

THIS DRAWING WAS PREPARED BY LYNTEK, ALL OF THE INFORMATION CONTAINED THEREIN IS THE PROPERTY OF LYNTEK AND NO REPRODUCTION CAN BE MADE WITHOUT THE PROPER WRITTEN AUTHORIZATION OF LYNTEK.

ENGINEER	E. HUNTER	21/07/11
DRAWN BY	O. CHAVEZ	21/07/11
P.M. CHECK	N. DE MEL	21/07/11
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

MINESITE GENERAL LAYOUT

DATE.TIME LAST MODIFIED	DRAWING NO.	REV.
21 JULY 2011 – 1439	11005-C-08	A
SCALE: (D) NTS		

ORACLE RIDGE MINING, LLC

PDEQ Checklist

ORACLE RIDGE MINE - AIR QUALITY PERMIT APPLICATION CHECKLIST (Rev-01)

	Pima County Air Quality Permit Application Checklist	*PCC Reference*	*Yes*	*No*	*NA*	*COMMENTS*
1	Has the Standard Appliocation Form been completed?	§ 17.12.165.B	√			Included herein under "Standard Application Forms" tab
2	Has the Responsible Official signed the application form?	App Form	√			Included herein under "Standard Application Forms" tab
3	Has a Certification of Truth, Accuracy and Completeness been included?	§ 17.12.165.H	√			Included herein under "Standard Application Forms" tab
4	Have potential to emit calculations been provided and do they include potential emissions of all regulated air pollutants (including fugitives)?	Filing 7.	√			Included herein under "PTE Calculations" tab
5	Have the Operating Schedules (hours/day, days/year, days/week) been included?	Filing 10.g	√			Included herein under "Permit Summary" tab (Page 7 of 13) and "PTE Calculations" tab (Pages 6 of 37 and Page 9 of 37)
6	Have all applicable NSPS requirements been identified?	§ 17.12.165.B.1	√			Included herein under "Permit Summary" tab (Page 10 of 13) - includes 40 CFR, Part 60, Subpart LL (Standards of Performance for Metallic Mineral Processing plants).
7	Have all applicable NESHAP requirements been identified?	§ 17.12.165.B.1	√			Based on review of MSDS provided for the project - AEROFROTH 70, DAF-30, Limate Dolomitic Hydrated Lime, and Sodium Isopropyl Xanthate (NAX 31).
8	Does the application include an equipment list with the type, name make, model, serial number or equipment number, and date of manufacturer?	Filing 11.	√			Included herein under "Equipment List" tab
9	Has a Statement of Compliance with all applicable conditions by a responsible official been included and does the application include an identification of the applicable requirements which are the basis of the statement?	Filing 17.a, 7.a.i	√			Included herein under "Standard Application Forms" tab (Page 3 of 4)
10	Does the application include a list of applicable requirements to which the applicant has stated compliance with above?	§ 17.12.165.B.1	√			Included herein under "PTE Calculations" tab (Page 8 of 37)
11	Have the calculations on which all information is based been included in the application?	Filing 19.	√			Included herein under "PTE Calculations" tab (PTE Calculations Appendices A thru I)
12	Has a description of each process or emission unit been included?	Filing 1.	√			Included herein under "PTE Calculations" tab (Page 11 of 37 thru Page 37 of 37)
13	Has a product and raw material description been included?	Filing 2.	√			Included herein under "PTE Calculations" tab (Page 3 of 37 and Page 4 of 37) and under "Permit Summary" tab (Page 3 of 13)
14	Has a complete description of Alternate Operating Scenarios been included?	Filing 3.	√			Included herein under "PTE Calculations" tab (Page 28 of 37) and under "Permit Summary" tab (Page 6 of 13)
15	Has a Flow Diagram for all processes been included?	Filing 6.	√			Included herein under "Process Flow Diagrams" tab
16	Have any proposed exemptions and insignificant activities been included? If so, has the applicant provided sufficient evidence?	Filing 9.	√			Included herein under "Insignificant Activities" tab
17	Has information on the fuel type and calculations for the maximum usage (hourly and annual) been included (if applicable)?	Filing 10.e	√			Included herein under "PTE Calculations" tab (Page 19 of 37 thru Page 24 of 37)
18	Has the information and calculations on maximum raw material hourly and annual usage been included?	Filing 10.f	√			Included herein under "PTE Calculations" tab (Page 6 of 37 and throughout PTE calculations from Page 11 of 37 thru Page 37 of 37) and under "Permit Summary" tab (Page 5 of 13)
19	Have any limitations on operations and work practice standards affecting emissions been included?	Filing 10.h	√			Included herein under "PTE Calculations" tab (throughout PTE calculations from Page 11 of 37 thru Page 37 of 37) and under "Permit Summary" tab (Page 5 of 13 and Page 7 of 13)

ORACLE RIDGE MINE - AIR QUALITY PERMIT APPLICATION CHECKLIST (Rev-01)

	Pima County Air Quality Permit Application Checklist	*PCC Reference*	*Yes*	*No*	*NA*	*COMMENTS*
20	Does the application include a site diagram which includes: property boundaries, adjacent streets/roads, directional arrow, elevation, equipment layout, location of emission points, emission areas and air pollution control equipment and the closest distance between emissions and property boundary?	Filing 13.	√			Included herein under "Permit Summary" tab (last page - 11" x 17") and under "PTE Calculations" tab (Appendix E)
21	Have the applicable test or monitoring methods for determining compliance been included?	Filing 14.a	√			Included herein under "Permit Summary" tab (Page 5 of 13 and Page 13 of 13)
22	Does the application contain an identification, location and description of pollution controls, including data establishing their rated and operating efficiency?	Filing 14.b, 14.c, 14.d	√			Included in PTE Calculations Tab and associated PTE Calculations Appendices - i.e., Reagent Bag Dump Station Particulate Control System and Lime Bag Breaker Particulate Control System.
23	Does the application/ source state compliance with all applicable requirements identified in the application? If not does:	§ 17.12.165.B.1	√			Included herein under "Standard Application Forms" tab (Page 3 of 4)
24	the application include a compliance schedule that contains remedial measures, including an enforceable sequence of actions with milestones leading to compliance with the noncompliant requirements?	§ 17..12.110.E			√	NA

ORACLE RIDGE MINING, LLC

PDEQ Standard Application Forms

#6154

PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY
Air Program
33 N. Stone Avenue • Suite 700 • Tucson, AZ 85701 • Phone: (520) 243-7400

RECEIVED
PIMA COUNTY
OCT 14 2011
ENVIRONMENTAL QUALITY
AIR PROGRAM

STANDARD PERMIT APPLICATION FORM
FOR CLASS II/III SOURCES

(As required by A.R.S. § 49-480, and Title 17 of the Pima County Code)

1. **Permit to be issued to (Arizona Corporate Commission Registered Name):** Oracle Ridge Mining, LLC

2. **Mailing Address:** 10445 N. Oracle Rd., Ste. 101
   City: Oro Valley **State:** Arizona **ZIP:** 85737

3. **Name (or names) of Owner or Operator:** Oracle Ridge Mining, LLC
   FAX #: (520) 329-8296 **Phone:** (520) 329-8293
   Email: info@oracleminingcorp.com

4. **Name of Owner's Agent:** Tetra Tech, Inc
   FAX #: (602) 267-0446 **Phone:** (602) 267-0336
   Email: Tom.Sheber@tetratech.com

5. **Plant Name (if different than item #1):** (Same as item #1)

6. **Proposed Equipment/Plant Location Address:** Pima County, Arizona, Township 11 South, Range 16, on two (2) non-contiguous properties four (4) miles from the town of San Manuel, Arizona
   City: San Manuel **State:** Arizona **ZIP:** 85631

7. **Plant/Site Manager/Contact Person:** Victor Rozon
   FAX #: (520) 329-8296 **Phone:** (520) 329-8293
   Email: vrozon@oracleminingcorp.com

8. **General Nature of Business:** Copper Ore Mining and Processing
   Standard Industrial Classification Code(s): 1021 **Permit Class:** Class II

9. **Type of Organization:** √ Corporation ☐ Individual Owner ☐ Partnership ☐ Government Entity ☐ Other

10. **Permit Application Basis** ***(Check all that apply):*** √ New Source ☐ General Permit ☐ Portable Source
    ☐ Renewal ***Revision:*** ☐ Administrative ☐ Minor ☐ Significant **Existing Permit #**
    Date of Commencement of Construction or Modification:
    Is any of the equipment to be leased to another individual or entity? ☐ Yes √ No

11. **Typed or Printed Name of Responsible Official (RO):** Victor Rozon
    Official Title of RO: Vice President of Operations
    RO Fax #: (520) 329-8296 **RO Phone #:** (520) 329-8293
    RO Email: vrozon@oracleminingcorp.com **Date:** Oct 14, 2011

12. **Signature of Responsible Official of Organization:**

EQUIPMENT LIST

The following table should include all equipment utilized at the facility and be complete with all data requested. The date of manufacture must be included in order to determine if portions of the facility are subject to NSPS. Make additional copies of this form if necessary.

Type of Equipment	Manufacturer	Model	Serial Number/Unique Equipment ID	Maximum Rated Capacity	Fuel(s) Used (If Applicable)	Date of Manufacture	Date of Installation[1]
Dust Spray/Collection System	Local Supply	TBD	100-DS-01	10 to 20 GPM at 200 psi pressure	n/a	New Equipment	Est. 2012-13
Feed Hopper for Vibrating Grizzly Feeder	Local Supply	TBD	100-HP-01	50 ST Capacity	n/a	New Equipment	Est. 2012-13
Vibrating Grizzly Feeder	Simplex	TBD	100-FE-01	500 STPH	n/a	New Equipment	Est. 2012-13
Rock Breaker	Simplex	TBD	100-RB-01	3,500 ft./lbs. of force	n/a	New Equipment	Est. 2012-13
Primary Jaw Crusher	Metso	TBD	100-CR-01	345 STPH	n/a	New Equipment	Est. 2012-13
Under-crusher Conveyor	Simplex	TBD	100-CV-01	1150 STPH	n/a	New Equipment	Est. 2012-13
Conveyor to Surface	Simplex	TBD	100-CV-02	666 STPH	n/a	New Equipment	Est. 2012-13
Crushed Ore Bin Feed/Tripper Conveyor	Superior Conveyor	TBD	100-CV-03	500 STPH	n/a	New Equipment	Est. 2012-13
Crushed Ore Storage Bunker No. 1	Local Supply	TBD	100-BK-01	10000 Total Tons 2000 Live Tons	n/a	New Equipment	Est. 2012-13
Crushed Ore Storage Bunker No. 2	Local Supply	TBD	100-BK-02	10000 Total Tons 2000 Live Tons	n/a	New Equipment	Est. 2012-13
Crushed Ore Storage Bunker No. 3	Local Supply	TBD	100-BK-3	10000 Total Tons 2000 Live Tons	n/a	New Equipment	Est. 2012-13
Apron Feeder No. 1	Simplex	TBD	100-FE-01	200 STPH	n/a	New Equipment	Est. 2012-13
Apron Feeder No. 2	Simplex	TBD	100-FE-02	200 STPH	n/a	New Equipment	Est. 2012-13
Apron Feeder No.3	Simplex	TBD	100-FE-03	200 STPH	n/a	New Equipment	Est. 2012-13
Reclaim Tunnel Conveyor	Simplex	TBD	100-CV-05	405 STPH	n/a	New Equipment	Est. 2012-13
SAG Mill Feed Conveyor	Simplex	TBD	200-CV-01	405 STPH	n/a	New Equipment	Est. 2012-13
SAG Mill Feed Chute	Local Supply	TBD	200-HP-01	136 STPH	n/a	New Equipment	Est. 2012-13

[1]Provide the date of installation or the most recent date of reconstruction/modification of your equipment.

EQUIPMENT LIST

The following table should include all equipment utilized at the facility and be complete with all data requested. The date of manufacture must be included in order to determine if portions of the facility are subject to NSPS. Make additional copies of this form if necessary.

Type of Equipment	Manufacturer	Model	Serial Number/Unique Equipment ID	Maximum Rated Capacity	Fuel(s) Used (If Applicable)	Date of Manufacture	Date of Installation[1]
SAG Mill	Metso	TBD	200-SG-01	136 STPH	n/a	New Equipment	Est. 2012-13
SAG Mill Trash Bin	Local Supply	TBD	200-BN-01	71 ft3	n/a	New Equipment	Est. 2012-13
Ball Mill Cyclone Feed Sump	Local Supply	TBD	200-SU-01	755 ft3	n/a	New Equipment	Est. 2012-13
Primary Ball Mill Feed Chute	Local Supply	TBD	200-HP-02	136 STPH	n/a	New Equipment	Est. 2012-13
Primary Ball Mill	Metso	TBD	200-BM-01	136 STPH	n/a	New Equipment	Est. 2012-13
Primary Ball Mill Trash Bin	Local Supply	TBD	200-BN-02	71 ft3	n/a	New Equipment	Est. 2012-13
Primary Ball Mill Hydrocyclones	Krebs	TBD	200-CY-01	1,482 GPM	n/a	New Equipment	Est. 2012-13
Particle Size Sampler	Heath & Sherwood	TBD	200-SA-01	1,482 GPM	n/a	New Equipment	Est. 2012-13
Flash Flotation Feed Sump	Local Supply	TBD	200-SU-02	755 ft3	n/a	New Equipment	Est. 2012-13
Flash Flotation Cell	Metso	TBD	300-FL-01	706 ft3	n/a	New Equipment	Est. 2012-13
Flash Flotation Tailings Sump	Local Supply	TBD	300-SU-02	755 ft3	n/a	New Equipment	Est. 2012-13
Flash Flotation Concentrate Sampler	Heath & Sherwood	TBD	300-SA-01	20 GPM	n/a	New Equipment	Est. 2012-13
Rougher Flotation Conditioning Tank	Local Supply	TBD	400-TK-01	402 ft3	n/a	New Equipment	Est. 2012-13
Rougher Flotation Cells	Metso	TBD	400-FL-01/06	901 ft3	n/a	New Equipment	Est. 2012-13
Flotation Concentrate Sampler	Heath & Sherwood	TBD	400-SA-02	143 GPM	n/a	New Equipment	Est. 2012-13
Scavenger Flotation Cells	Outotec	TBD	400-FL-07/10	600 ft3	n/a	New Equipment	Est. 2012-13
Scavenger Flotation Tailings Sump	Local Supply	TBD	400-SU-01	437 ft3	n/a	New Equipment	Est. 2012-13

[1]Provide the date of installation or the most recent date of reconstruction/modification of your equipment.

EQUIPMENT LIST

The following table should include all equipment utilized at the facility and be complete with all data requested. The date of manufacture must be included in order to determine if portions of the facility are subject to NSPS. Make additional copies of this form if necessary.

Type of Equipment	Manufacturer	Model	Serial Number/Unique Equipment ID	Maximum Rated Capacity	Fuel(s) Used (If Applicable)	Date of Manufacture	Date of Installation[1]
Scavenger Flotation Tailings Sampler	Heath & Sherwood	TBD	400-SA-01	150 GPM	n/a	New Equipment	Est. 2012-13
Re-Grind Ball Mill Feed Chute	Local Supply	TBD	500-HP-01	12 STPH	n/a	New Equipment	Est. 2012-13
Re-Grind Ball Mill	Metso	TBD	500-RM-01	12 STPH	n/a	New Equipment	Est. 2012-13
Re-Grind Ball Mill Discharge Sump	Local Supply	TBD	500-SU-01	219 ft3	n/a	New Equipment	Est. 2012-13
Re-Grind Ball Mill Cyclones	Krebs	TBD	500-CY-01	104 GPM	n/a	New Equipment	Est. 2012-13
Particle Size Sampler	Heath & Sherwood	TBD	500-SA-01	104 GPM	n/a	New Equipment	Est. 2012-13
Re-Grind Ball Mill Trash Bin	Local Supply	TBD	500-BN-01	71 ft^3	n/a	New Equipment	Est. 2012-13
Cleaner Flotation Conditioning Tank	Local Supply	TBD	500-TK-01	98 ft3	n/a	New Equipment	Est. 2012-13
1st Cleaner Flotation Cells	Metso	TBD	410-FL-01/06	270 ft3	n/a	New Equipment	Est. 2012-13
Cleaner/Scavenger Flotation Cells	Metso	TBD	420-FL-01/03	135 ft3	n/a	New Equipment	Est. 2012-13
Cleaner/Scavenger Tailings Sump	Local Supply	TBD	420-SU-01	110 ft3	n/a	New Equipment	Est. 2012-13
Cleaner/Scavenger Tailings Sampler	Heath & Sherwood	TBD	420-SA-01	148 GPM	n/a	New Equipment	Est. 2012-13
2nd Cleaner Flotation Cells	Metso	TBD	430-FL-01/05	225 ft3	n/a	New Equipment	Est. 2012-13
2nd Cleaner Flotation Tailings Sump	Local Supply	TBD	430-SU-01	110 ft3	n/a	New Equipment	Est. 2012-13
Copper Concentrate Thickener Tank	Delkor	TBD	440-TH-01	7 STPH	n/a	New Equipment	Est. 2012-13
Copper Thickener O-flow Sump	Local Supply	TBD	440-SU-01	110 ft3	n/a	New Equipment	Est. 2012-13
Copper Concentrate Sampler	Heath & Sherwood	TBD	440-SA-01	91 GPM	n/a	New Equipment	Est. 2012-13

[1]Provide the date of installation or the most recent date of reconstruction/modification of your equipment.

EQUIPMENT LIST

The following table should include all equipment utilized at the facility and be complete with all data requested. The date of manufacture must be included in order to determine if portions of the facility are subject to NSPS. Make additional copies of this form if necessary.

Type of Equipment	Manufacturer	Model	Serial Number/Unique Equipment ID	Maximum Rated Capacity	Fuel(s) Used (If Applicable)	Date of Manufacture	Date of Installation[1]
Copper Thickener Underflow Tank	Local Supply	TBD	440-TK-01	402 ft3	n/a	New Equipment	Est. 2012-13
Copper Filter Surge Tank	Local Supply	TBD	440-TK-02	402 ft3	n/a	New Equipment	Est. 2012-13
Copper Dewatering Filter Press	Micronics	TBD	440-FL-01	20 ft3	n/a	New Equipment	Est. 2012-13
Copper Filtrate Return Tank	Local Supply	TBD	440-TK-03	269 ft3	n/a	New Equipment	Est. 2012-13
Copper Concentrate Storage Bunker	Local Supply	TBD	440-BK-01	5,200 ft3	n/a	New Equipment	Est. 2012-13
Tailings Thickener Tank	Delkor	TBD	700-TH-01	84.4 STPH	n/a	New Equipment	Est. 2012-13
Tailings Thickener Underflow Tank	Local Supply	TBD	700-TK-01	2,651 ft3	n/a	New Equipment	Est. 2012-13
Tailings Filter Surge Tank	Local Supply	TBD	700-TK-02	2,651 ft3	n/a	New Equipment	Est. 2012-13
Tailings Dewatering Filter Press	Micronics	TBD	700-FL-01	401 ft3	n/a	New Equipment	Est. 2012-13
Tailings Filtrate Return Tank	Local Supply	TBD	700-TK-03	2,651 ft3	n/a	New Equipment	Est. 2012-13
Dewatered Tailings Storage Bunker	Local Supply	TBD	700-BK-01	7,800 ft3	n/a	New Equipment	Est. 2012-13
Complete Hydrated Lime System	Merrick	TBD	900-MS-01	1,800 lbs/day	n/a	New Equipment	Est. 2012-13
Bulk Bag Unloader	Merrick	TBD	900-BU-01	1,800 lbs/day	n/a	New Equipment	Est. 2012-13
Hydrated Lime Screw Conveyor	Merrick	TBD	900-CV-01	1,800 lbs/day	n/a	New Equipment	Est. 2012-13
Milk-of-Lime Mix Tank	Merrick	TBD	900-TK-01	1,800 lbs/day	n/a	New Equipment	Est. 2012-13
Xanthate Mix Tank	Local Supply	TBD	920-TK-03	346 ft3	n/a	New Equipment	Est. 2012-13
Xanthate Day Tank	Local Supply	TBD	920-TK-04	346 ft3	n/a	New Equipment	Est. 2012-13

[1]Provide the date of installation or the most recent date of reconstruction/modification of your equipment.

EQUIPMENT LIST

The following table should include all equipment utilized at the facility and be complete with all data requested. The date of manufacture must be included in order to determine if portions of the facility are subject to NSPS. Make additional copies of this form if necessary.

Type of Equipment	Manufacturer	Model	Serial Number/Unique Equipment ID	Maximum Rated Capacity	Fuel(s) Used (If Applicable)	Date of Manufacture	Date of Installation[1]
Screw Feeder	Velodyne	TBD	910-FE-01	4 lbs/min	n/a	New Equipment	Est. 2012-13
Flocculant Mix Tank	Velodyne	TBD	910-TK-01	100 Gallon	n/a	New Equipment	Est. 2012-13
Flocculant Day Tank	Velodyne	TBD	910-TK-02	130 Gallon	n/a	New Equipment	Est. 2012-13
Gasoline Storage Tank	Highland Tank	TBD	800-TK-01	10,000 Gallon	Gasoline	New Equipment	Est. 2012-13
Diesel Fuel Storage Tank	Highland Tank	TBD	800-TK-02	10,000 Gallon	Diesel	New Equipment	Est. 2012-13
Emergency Fire Pump	Clarke	Model JU4H-UF34	800-PP-07	86 kW	Diesel	New Equipment	Est. 2012-13
Emergency Standby Generator	Wagner Power Systems	Caterpillar Model #3512C	170-GE-01	1500 Kw	Diesel	New Equipment	Est. 2012-13

[1]Provide the date of installation or the most recent date of reconstruction/modification of your equipment.

Statement of Compliance with all Applicable Requirements

Permit Number (If existing source) ____N/A_____

Any applicant who fails to submit any relevant facts or who has submitted incorrect information in a permit application shall, upon becoming aware of such failure or incorrect submittal, promptly submit such supplementary facts or corrected information. In addition, an applicant shall provide additional information as necessary to address any requirements that become applicable to the source after the date it files a complete application, but prior to release of a proposed permit. Should there be any discrepancies between this application package and Title 17 of the Pima County Code (PCC), the PCC shall be preferred.

This statement must be signed by a Responsible Official. Applications without a signed statement will be deemed incomplete.

> *The responsible official is defined as a person who is in charge of principal business functions or who performs policy or decision making functions for the business. This may also include an authorized representative for such persons. For a complete definition, see Pima County Air Quality Control, Title 17, Section 17.04.340(A)(199).*

I certify that I have knowledge of the facts herein set forth, that the same are true, accurate and complete to the best of my knowledge and belief, and that all information not identified by me as confidential in nature shall be treated by the Pima County Department of Environmental Quality (PDEQ) as public record. I also attest that I am in compliance with the applicable requirements and will continue to comply with such requirements and any future requirements that become effective during the life of my permit. I further state that I will assume responsibility for the construction, modification, or operation of the source in accordance with the requirements of Title 17 of the Pima County Code and any permit issued thereof.

Name (Print/Type): ____Victor Rozon_____ Title: __Vice President of Operations_____

(Signature): _____ Date: Oct 14, 2011

Certification of Truth, Accuracy, and Completeness

17.12.165(H) - Certification of Truth, Accuracy, and Completeness. Any application form, report, or compliance certification submitted pursuant to this Chapter shall contain certification by a responsible official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the documents are true, accurate, and complete.

By my signature I, (Name) ____Victor Rozon_____, hereby certify that based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete.

(Signature): _____

Official Title: __Vice President of Operations____ Date: Oct 14, 2011

Fee Summary for Class II Sources - Revised January 07, 2009	
Individual	
Processing Fee $110.40 per hour (Minimum One Hour - Maximum $25,000)	
Accelerated Permit Application Fee $15,000	
Source Category	Annual Fee
Area Sources	$540
NSPS/NESHAP Boilers & Generators	$2500
NSPS/NESHAP True Minor Sources	$6040
NSPS/NESHAP Synthetic Minor Sources	$11,040
General Permit	
Application Fee $540	
Source Category	Annual Fee
Area Sources	$540
Other Sources	$3250

Fee Summary for Class III Sources - Revised January 07, 2009	
Individual	
Processing Fee $110.40 per hour (Minimum One Hour - Maximum $25,000)	
Accelerated Permit Application Fee $15,000	
Source Category	Annual Fee
Non-NSPS/NESHAP Boilers & Generators	$1960
True Minor Sources	$1960
Synthetic Minor Sources	$3920
General Permit	
Application Fee $540	
Source Category	Annual Fee
Gasoline Service Stations	$540
Crematories	$1085
Other Sources	$1085

Notes:

The fee rates for individual permits are adjusted each year based on the CPI index.

Annual fees are due February 1 or 60 days after the control officer mails the invoice.

Information is taken from Pima County Code Title 17 Sections 17.12.400 and 17.12.520.

ORACLE RIDGE MINING, LLC

POTENTIAL-TO-EMIT (PTE) CALCULATIONS

TETRA TECH

TETRA TECH CALCULATION COVER SHEET

PROJECT: ORACLE RIDGE MINE CLASS II AIR QUALITY PERMIT | JOB NO.: 197-2010-0134 | CALC NO. 197-2010-0134-05

SUBJECT: DETERMINATION OF POTENTIAL-TO-EMIT (PTE) | FILE NO. 197-2010-0134

ORIGINATOR / DATE: THOMAS J. SHEBER, P.E. / 10-12-11 | CHECKER / DATE: KEITH A. JOHNSON, P.E. / 10-13-11 | REV NO. 5

REV NO.	DESCRIPTION	TOTAL NO. OF SHEETS	LAST SHEET NO.	ORIG	DATE	CKR	DATE	APR	DATE
1	Preliminary determination of air emission rates in support of Pima County Department of Environmental Quality (PDEQ) Class II air permit - original issue.	81	H-7	TJS	8/19/2011	KAJ	8/31/2011	NOT USED	NA
2	Revised determination of air emission rates in support of PDEQ Class II air quality permit application via review comments and new client data.	81	H-7	TJS	8/31/2011	KAJ	9/7/2011	NOT USED	NA
3	Submittal copy determination of air emission rates in support of PDEQ Class II air permit application via review comments and new client data.	172	I-1	TJS	9/22/2011	KAJ	9/23/2011	NOT USED	NA
4	Revised Preliminary Submittal copy determination of air emission rates for PDEQ Class II air permit application.	173	I-1	TJS	9/23/2011	KAJ	9/26/2011	NOT USED	NA
5	Final Submittal based on design changes and for improved consistency with Pima County State Implementation Plan (SIP) requirements.	208	J-27	TJS	10/12/2011	KAJ	10/13/2011	NOT USED	NA

INFORMATION ENTERED IN THIS SPACE:
(1) SHOW PROFESSIONAL ENGINEER SEAL, IF APPROPRIATE OR REQUIRED.
(2) ENETR REFERENCE TO CHECKER'S ALTERNATE CALCULATIONS, IF USED.
(3) PROVIDE ANY NOTES TO ASSIST CHECKING AND APPROVAL.

PARAMETERS USED FOR PTE BASIS

1 Maximum 3,000 short tons per day (STPD) thru Concentrator Plant processes (permit limit).
2 Maximum 500 STPH through Crushing Circuit up to Crushed Ore Bins (maximum equipment design capacity).
3 Limit 100 hours per year for Emergency Fire Pump Engine, Diesel, for readiness testing and maintenance (permit limit).
4 Limit 100 hours per year for Emergency Generator, Diesel, for readyness testing and maintenance (permit limit).
5 Maximum 219,000 pounds per year (lbs/yr) sodium hydrosulfide (permit limit).
6 Maximum 146,730 pounds per year (lbs/yr) Aerofroth 70 and 343 Xanthate (permit limit).

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	Appendix A -	11
	Appendix B -	10
	Appendix C -	3
	Appendix D -	10
	Appendix E -	17
	Appendix F -	4
	Appendix G -	80
	Appendix H -	7
	Appendix I -	1
	Appendix J -	28
	Total =	208

Registered Professional Engineer (Mechanical)
CERTIFICATE NO.
36137
THOMAS J.
SHEBER
Date Signed 10-12-11
ARIZONA, U.S.A.

EXPIRES 3/31/2013

TETRA TECH

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APPENDIX C	Caterpillar Diesel-Fueled Emergency Generator Data Sheets
APPENDIX D	Diesel and Gasoline Storage - EPA Tanks 4.0.9d Emission Reports
APPENDIX E	Tailings Facility General Arrangement Drawing and Stockpile Plan Sheets
APPENDIX F	Concentrator Plant Reagent Usage Detail
APPENDIX G	Reagent and Fuel Material Safety Data Sheets (MSDS)
APPENDIX H	Cyclonaire Xanthate Bag Dump Station Equipment Detail
APPENDIX I	Vehicle Miles Traveled (VMT) Data, Transportation and Fuel Consumption Data
APPENDIX J	National Climatic Data Center (NCDC) 10-Year Precipitation Data for Tucson, AZ

TETRA TECH

I. TASK DESCRIPTION

The purpose of these calculations is to determine Potential-to-Emit (PTE) emission levels for all regulated air pollutants, including fugitive emissions, for the proposed Oracle Ridge Mine (ORM) in support of an air quality permit submittal to the Pima County Department of Environmental Quality (PDEQ). ORM is comprised of two (2) separate facilities - the ORM Mine Facility and the ORM Tailings Facility. Although separated by approximately two (2) miles, the two facilities are included in a single PDEQ air permit per discussions with PDEQ personnel (ref. 1).

The mine is located in the Old Hat Mining District at Marble Mountain in northern Pima County, Arizona. Emission calculations, included herein, pertain to ORM proposed unit operations for recovery of the copper along with gold and silver. Magnetite mineralization is also anticipated; however, the proposed facility does not include magnetite processing at this time. That is, metallurgical testing is required in order to determine if the magnetite is economically feasible for recovery. Therefore ORM magnetite processes remain a consideration for future ORM operations.

ORM facility will average 2,000 tons per day (tpd) ore production and processing annually; however, equipment design capacity provides for an occasional peak ore production rate of 4,000 tpd. Operations include an underground Raw Ore Feed System for transport of mined ore from various underground locations to a Feed Hopper that is located underground. Ore material is then fed to an underground Grizzly Feeder to facilitate movement of ore material to a Rock Breaker and Primary Jaw Crusher that are both located underground. Crushed ore material is then conveyed to the surface for storage and further processing, above ground, including additional ore size reductions by use of a Semi-Autogenous (SAG) Mill and a Ball Mill. The finely divided ore particels of interest are separated from the waste rock and concentrated in a liquid medium by active flotation, then cleaned, thickened, filtered and dried prior to shipment as product concentrate to a refinery.

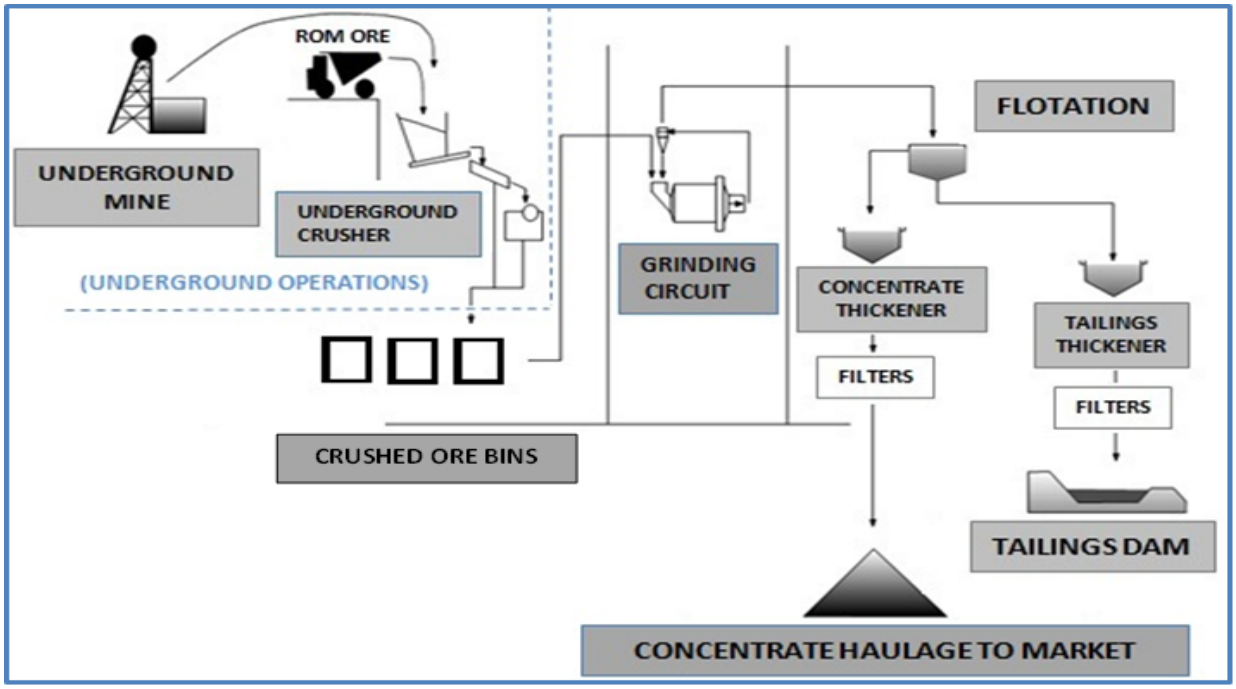
Although ORM will annually average 2,000 STPD for ore crushing and processing, PTE calculations are based on the maximum crushing and concentrator plant process design capacity of 3,000 STPD and 8,760 operating hours per year.

Power for the proposed ORM facilites is provided by off-site utility source from nearby San Manuel or Summerhaven. However, the proposed ORM facility includes a 1500 KW emergency generator. The on-site generators include annual operating hour limitation of 100 hrs/yr to accomodate maintenance checks and readiness testing.

The proposed ORM mine facility includes assigned functional areas (ref. 2), listed below. The functional area prefix is used in this document as the prefix for emission point labeling in the emission calculations in this Determination of Emissions document.

Area Prefix	*ORM Mine Facility Process - Functional Area Designation*
100	Crushing and Material Handling
200	Grinding Circuit
300	Flash Flotation Circuit
400	Cu Rougher/Scavenger Flotation Circuit
410	Cu 1st Cleaner Flotation Circuit
420	Cu 1st Cleaner/Scavenger Flotation Circuit
430	Cu 2nd Cleaner Flotation Circuit
440	Cu Thickener/Filtration Circuit
500	Re-grind Ball Mill Grinding Circuit
700	Tailings Thickener/Filtration Circuit
800	Water Systems: Fresh Water, Reclaim, Firewater, Potable Water, Air Systems
900	Flotation Reagents & Milk-of-Lime Circuits

The following diagram represents an overview of the proposed mine operations:



TETRA TECH

II. REFERENCES

1 Oracle Ridge Mine, Process Description - Revision 8, dated 10/6/11.

2 Oracle Ridge Mine / Air Quality Permit Pre-Application Meeting Minutes, 5/3/11, PDEQ offices, Tucson, Arizona and Project Email Correspondence, PDEQ, 5/5/11.

3 National Climatic Data Center (NCDC) - U.S. Department of Commerce.

4 USEPA, 1986. *Generalized Particle Size Distributions for Use in Preparing Size-Specific Particulate Emissions Inventories* , EPA-450/4-86-013, July.

5 MRI, 2006. *Background Document for Revisions to Fine Ratios Used for AP-42 Fugitive Emission Factors* , prepared for the WRAP by Midwest Research Institute, Feb. 1.

6 Email Correspondence, Gold Hawlk Resources, 5/27/11, 8/30/11, 8/31/11, and 9/1/11.

7 Feasibility Design Report, Dry Filter Tailings Stack Facility - Oracle Ridge Copper Project, prepared by AB Engineering, Inc., July 2011.

8 Oracle Ridge Mine, Material Safety Data Sheets (MSDS) - Aerofroth 70 Frother, Sodium Isopropyl Xanthate (NAX 31), DAF-30, Limate, and Sodium Hydrosulfide - PTE Calculations - Appendix G.

9 Commonwealth of Australia, National Pollutant Inventory (NPI), Emission Estimation Technique Manual For Mining, Version 3.0, Section 5.7 - Carbon Disulfide, June 2011.

10 U.S. EPA White Paper, dated 7/10/95.

11 Oracle Ridge Mining, LLC, Grinding Flowsheet, Mass Balance Table, Drawing No. 11005-F-02 (Rev G), September 13, 2011.

12 Pima County State Implementation Plan (SIP) 171 (C)(2)(a).

TETRA TECH CALCULATION SHEET

		CALC NO.	197-2010-0134-05	REV NO.	5
ORIGINATOR / DATE:	THOMAS J. SHEBER, P.E. / 10-12-11	CHECKER / DATE:	KEITH A. JOHNSON, P.E. / 10-13-11		
PROJECT:	ORACLE RIDGE MINE CLASS II AIR QUALITY PERMIT	JOB NO.	197-2010-0134	SHEET NO.	6 of 37
SUBJECT:	DETERMINATION OF POTENTIAL-TO-EMIT (PTE)				

III. FACILITY EMISSIONS SUMMARY

OPERATING PARAMETERS

EMISSION SOURCE	MAXIMUM CAPACITY			ANNUAL OPERATION	
Concentrator Plant Ore Process Rate	3,000	STPD	*<Proposed Permit Limit*	365	days/yr
Conveyor Transfer Points and Drop Points	500	STPH (Conveyor maximum design capaity)			
Mik-of-Lime Storage System	274	tpy (hydrated lime)		365	days/yr
Emergency Diesel Powered Generator	1500	kW	*Proposed Permit Limit>*	100	hrs/yr
Emergency Fire Pump Engine	86	kW	*Proposed Permit Limit>*	100	hrs/yr
Fuel Tanks (combined)	20,000	gallons (combined)		8,760	hrs/yr
Tailings Facility Production Rate	2,000	tpd		365	days/yr
Concentrator Plant Hours of Operation	-----			8,760	hrs/yr
Sodium Hydrosulfide Reagent Usage	219,000	lbs/year	*<Proposed Permit Limit*	365	days/yr
Concentrator Reagents (MIBC & AERO 343 Xanthate)	146,730	lbs/year	<Proposed Permit Limit	365	days/yr
Unpaved Roads - Heavy Duty Vehicles	-----			788,022	VMT/yr
Unpaved Roads - Light Duty Vehicles	-----			186,150	VMT/yr

FACILITY ANNUAL PTE - EMISSIONS (Fugitive and Non-Fugitive Emission Sources)[1]

EMISSION SOURCE	TSP (tpy)	PM_{10} (tpy)	CO (tpy)	NO_X (tpy)	SO_2 (tpy)	VOC (tpy)	H_2S (tpy)	HAP (tpy)
Conveyor Transfer Points and Drop Points	12.91	12.91						
Milk-of-Lime Silo Filter Vent	6.92	6.92						
Emergency Fire Pump Engine	0.02	0.02	0.06	0.27	0.02	0.02		2.36E-04
Emergency Generator	0.05	0.04	0.56	2.46	0.04	0.06		3.12E-03
Fuel Tanks (combined)						2.18		
Tailings Facility Fugitive Dust	2.29	1.47						
Concentrator Plant (Reagents)						31.76	9.6	
Xanthate Bag Breaker Vent Emissions	0.42	0.42						
Xanthate Tailings Dam HAP Emissions								2.11E-02
Unpaved Roads - Heavy Duty Vehicles	32	10						
Unpaved Roads - Light Duty Vehicles	4	1						
FACILITY TOTALS[(1)] =	**59**	**33**	**0.62**	**2.74**	**0.06**	**34.0**		**2.44E-02**

(1) Construction fugitive dust emissions are included; however, annualized emissions are not shown above due to limited activity durations.

FACILITY ANNUAL PTE - EMISSIONS *(for Source Classification Determinations)*

EMISSION SOURCE	TSP (tpy)	PM_{10} (tpy)	CO (tpy)	NO_x (tpy)	SO_2 (tpy)	VOC (tpy)	H_2S (tpy)	HAP (tpy)
Milk-of-Lime Silo Filter Vent	6.92	6.92						
Conveyor Transfer Points and Drop Points	12.91	12.91						
Tailings Facility Fugitive Dust	2.29	1.47						
Emergency Fire Pump Engine	0.02	0.02	0.06	0.27	0.02	0.02		2.36E-04
Emergency Generator	0.05	0.04	0.56	2.46	0.04	0.06		3.12E-03
Fuel Tanks (combined)						2.18		
Concentrator Plant (Reagents)						31.76	9.6	
Xanthate Bag Breaker Vent Emissions	0.42	0.42						
Unpaved Roadway Fugitive Emissions	36.20	11.08						
Facility PTE Totals per Pima County SIP =	**58.8**	**32.9**	**0.6**	**2.7**	**0.1**	**34.0**	**9.6**	**3.36E-03**
Pima County SIP Major Source Thresholds =	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*
Facility PTE Totals per Pima County Code =	**7.4**	**7.4**	**0.6**	**2.7**	**0.1**	**34.0**	**9.6**	**3.36E-03**
Pima County Class II Permit Thresholds =	*25*	*15*	*100*	*40*	*40*	*40*	*10*	*25*

TETRA TECH

TETRA TECH CALCULATION SHEET

		CALC NO.	197-2010-0134-05	REV NO.	5
ORIGINATOR / DATE:	THOMAS J. SHEBER, P.E. / 10-12-11	CHECKER / DATE:	KEITH A. JOHNSON, P.E. / 10-13-11		
PROJECT:	ORACLE RIDGE MINE CLASS II AIR QUALITY PERMIT	JOB NO.	197-2010-0134	SHEET NO.	7 of 37
SUBJECT:	DETERMINATION OF POTENTIAL-TO-EMIT (PTE)				

DAILY PTE - EMISSIONS (Fugitive and Non-Fugitive Emission Sources)

EMISSION SOURCE	TSP (lbs/day)	PM_{10} (lbs/day)	CO (lbs/day)	NO_x (lbs/day)	SO_2 (lbs/day)	VOC (lbs/day)	H_2S (lbs/day)	HAP (lbs/day)
Conveyor Transfer Points and Drop Points	71	71						
Milk-of-Lime Silo Filter Vent	5.42	5.42						
Emergency Fire Pump Engine	9.3	9.3	28.4	132	8.7	9.8		1.13E-01
Emergency Generator	24.0	19.6	270.7	1,181	19.9	30.5		1.5E+00
Fuel Tanks (combined)						11.96		
Tailings Facility Fugitive Dust	12.57	8.06						
Concentrator Plant (Reagents)						174	52.56	
Xanthate Bag Breaker Vent Emissions	0.3	0.3						
Xanthate Tailings Dam HAP Emissions								1.15E-01
Unpaved Roads - Heavy Duty Vehicles	175	53						
Unpaved Roads - Light Duty Vehicles	24	7						
FACILITY TOTALS =	**321**	**174**	**299**	**1,313**	**29**	**226**	**53**	**1.73**

TETRA TECH

IV. CRITERIA, CODES AND STANDARDS

1. New Source Performance Standards (NSPS), 40 CFR Part 60, Subpart LL, Standards of Performance for Metallic Mineral Processing Plants.
2. New Source Performance Standards for Hazardous Air Pollutants (NESHAPS), 40 CFR Part 63, Subpart RRRRR (Ore Processing MACT).
3. 40 CFR Part 60, Subpart IIII, Compression Ignition Internal Combustion Engines.
4. 40 CFR Part 63, Subpart ZZZZ, Compression Ignition Internal Combustion Engines; however, the engines meet the requirements of Subpart ZZZZ through 40 CFR 60, Subpart IIII.
5. 40 CFR Part 63, Subpart CCCCCC, Gasoline Storage and Dispensing.
6. Pima County State Implementation Plan (SIP), Rule 171 (C)(2)(a), source definition.
7. Pima County SIP, Rule 202, Installation Permits.
8. Pima County SIP, Rule 211, Permit Applications.
9. Pima County SIP, Rule 224, Fugitive Dust Producing Activities.
10. Pima County SIP, Rule 316, Particulate Materials.
11. Pima County SIP, Rule 332, Compilation of Mass Rates and Concentrations.
12. Pima County SIP, Rule 334, Petroleum Liquids.
13. Pima County SIP, Rule 341, Applicability of Ambient Air Quality Standards (NAAQS).
14. Pima County SIP, Rule 342, Mass-Concentration Ceilings, Table 341.
15. Pima County SIP, Rule 601, Classification of Pollutants.
16. PCC Title 17, Chapter 17.04.340(212)(a) - Significant" means: In reference to a net emissions increase or the potential of a source to emit any of the following pollutants, a rate of emissions that would equal or exceed any of the following rates:

Pollutant	Threshold Emissions Rate (tons per year)
Carbon Monoxide	100 tpy
Nitrogen Oxides	40 tpy
Sulfur Dioxide	40 tpy
Particulate matter	25 tpy
PM_{10}	15 tpy
VOC	40 tpy
Lead	0.6 tpy
Fluorides	3 tpy
Sulfuric acid mist	7 tpy
Hydrogen sulfide (H_2S)	10 tpy
Total reduced sulfur (including H_2S)	10 tpy
Reduced sulfur compounds (including H_2S)	10 tpy

TETRA TECH

IV. CRITERIA, CODES AND STANDARDS - cont'd

17 PCC Title 17, Chapter 17.04.340(A)(114), Insignificant Activities.
18 PCC Title 17, Chapter 17.12.140 (Note: Class II permit applies if subject to a federal new source standard).
19 PCC Title 17, Chapter 17.12.160/165/180/185 (PDEQ Permit application requirements).
20 PCC Title 17, Chapter 17.12.190, Permits containing synthetic emission limitations and standards.
21 PCC Title 17, Chapter 17.12.195 (conditions for acceptance of an emission cap to be classified as Class II).
22 PCC Title 17, Chapter 17.12.310, Permit Shields.
23 PCC Title 17, Chapter 17.12.470, Fugitive Dust Activity Permits.
24 PCC Title 17, Chapter 17.16.060, Fugitive Dust Producing Activities.
25 PCC Title 17, Chapter 17.16.100, Particulate Materials.
26 PCC Title 17, Chapter 17.16.120, Mineral Tailings.
27 PCC Title 17, Chapter 17.16.130, NSPS Applicability.
28 PCC Title 17, Chapter 17.16.140, Compilation of Mass Rates and Concentrations.
29 PCC Title 17, Chapter 17.16.230, Standards of Performance for Storage Vessels for Petroleum Liquids.
30 PCC Title 17, Chapter 17.16.360, Standards of Performance for Nonferrous Metals Industry Sources.
31 PCC Title 17, Chapter 17.16.430, Standards of Performance for unclassified sources.

V. ASSUMPTIONS

1 Maximum ore Crushing Circuit flowrate is 500 short tons per hour (STPH) and is based on the maximum design capacity of the Radial Stacking Conveyor (Equipment ID# 100-CV-04) that feeds ore to the Crushed Ore Bunkers (Equipment ID#'s 100-BK-01, 100-BK-02, and 100-BK-03).

3 Mining operating days per year = 365.

4 Mining operating hours per year = 8,760 hrs/yr.

5 Mining operating days per week = 7 and mining operating weeks per year = 52.

6 Maximum ore flowrate from the Crushed Ore Bins through ore processing in the Concentrator Plant is 3,000 STPD (Proposed Permit Limit) with compliance demonstration by use of Belt Scale records (Equipment ID# 200-SC-01).

7 Maximum ore flowrate from the Crushed Ore Bins through ore processing in the Concentrator Plant is 150 standard short tons per hour (STPH) and 3000 standard short tons per day (STPD).

8 Dry stack tonnage = 700,000 tons per year (tpy).

9 Tailings production = 2,000 tpd.

10 Maximum non-emergengy hours of operation for Fire Pump Engine and Emergency Generator = 100 hours per year for each engine (Proposed Permit Limits).

TETRA TECH

VI. APPLICABLE SOURCE DATA

Data Description	Data Value	Units	Ref. No.
Mine Facility maximum ore processing design capacity (tons per day)	3,000	tpd	6
Annual average ore processing design rate (tpd)	2,000	tpd	2
Annual hours of operation for calculating potential to emit (PTE)	8,760	hrs/yr	12
Ore material percent moisture prior to SAG Mill	4.1 - 5.5	%	11
Average wind speed (miles per hour)	8.3	mph	3
Ore crushing operating schedule, number of shifts (Mine Facility)	2	shifts/day	6
Hours of crushing operations per shift	10	hours/shift	6
Mining operations, Concentrator Plant number of days per year	365	days/year	6
Tailings Facility Annual Operating Days	365	days/year	7
Tailings production rate	2,000	tpd	7
Tailings Facility Dry Stack Tonnage	700,000	tpy	7
Dry Filter Tailings Material Moisture Content	10 to 20	%	7
Amount of *"Existing"* on-site Tailing Materials	950,000	tons	7
Tailings Facility Perimeter Access Road, minimum width	15	ft	7
Percent coverage of the "Active Tailings Surfaces" for mitigation of fugitive	80	%	7
Number of Days with at least 0.01" precipitation (Tucson, AZ)	44	days/year	3

TETRA TECH

VII. PTE CALCULATIONS

The following sections provide the ORM Facility estimated potential-to-emit (PTE) for both stationary and fugitive emission sources. Federal regulations define "potential to emit" as: "the maximum capacity of a stationary source to emit a pollutant under its physical and operational design. Any physical or operational limitation on the capacity of the source to emit a pollutant, including air pollution control equipment and restrictions on hours of operation or on the type or amount of fuel combusted, stored or processed, shall be treated as part of its design if the limitation or the effect it would have on emissions is federally enforceable."

A major stationary source of air pollutants - as defined in Section 302 of the U.S. Claen Air Act (the Act) - that directly emits or has the potential to emit, 100 tons per year (tpy) or more of any pollutant; 10 tpy or more of any hazardous air pollutant (HAP) - in the aggregate - that has been listed pursuant to Section 112(b) of the Act; or 25 tpy or more of any combination of HAP. Section 302 of the Act indicated that fugitive emissions of a stationary source shall not be considered in determining whether it is a major stationary source for the purposes of Section 302(j) of the Act, unless the source belongs to one of the following categories of stationary source (i.e., Categorical Source):

1 Coal cleaning plants (with thermal dryers);
2 Kraft pulp mills;
3 Portland cement plants;
4 Primary zinc smelters;
5 Iron and steel mills;
6 Primary aluminum ore reduction plants;
7 Primary copper smelters;
8 Municipal incinerators capable of charging more than 250 tons of refuse per day;
9 Hydrofluoric, sulfuric, or nitric acid plants;
10 Petroleum refineries;
11 Lime plants;
12 Phosphate rock processing plants;
13 Coke oven batteries;
14 Sulfur recovery plants;
15 Carbon black plants (furnace process);
16 Primary lead smelters;
17 Fuel conversion plants;
18 Sintering plants;
19 Secondary metal production plants;
20 Chemical process plants;
21 Fossil-fuel boilers (or combination thereof) totaling more than 250 million British thermal units per
22 Petroleum storage and transfer units with a total storage capacity exceeding 3 million barrels;
23 Taconite ore processing plants;
24 Glass fiber processing plants;
25 Charcol production plants;
26 Fossil-fuel-fired steam electric plants of more than 250 MMBtu/hr heat input; or
27 All other stationary source categories regulated by a standard promulgated under Section 111 or 112 of the Act, but only with respect to those air pollutants that have been regulated for that category.

The ORM Facility does not include smelting operations and **is not a Category Source**; therefore, only non-fugitive emissions are used for souce determination in accordance with Pima County Code (PCC), Title 17. However, potential-to-emit (PTE) totals in this permit application are summarized both with and without fugitive emissions in order to demonstrate Class II Source applicability with both Pima County Code and Pima County State Implementation Plan (SIP) 171 (C)(2)(a).

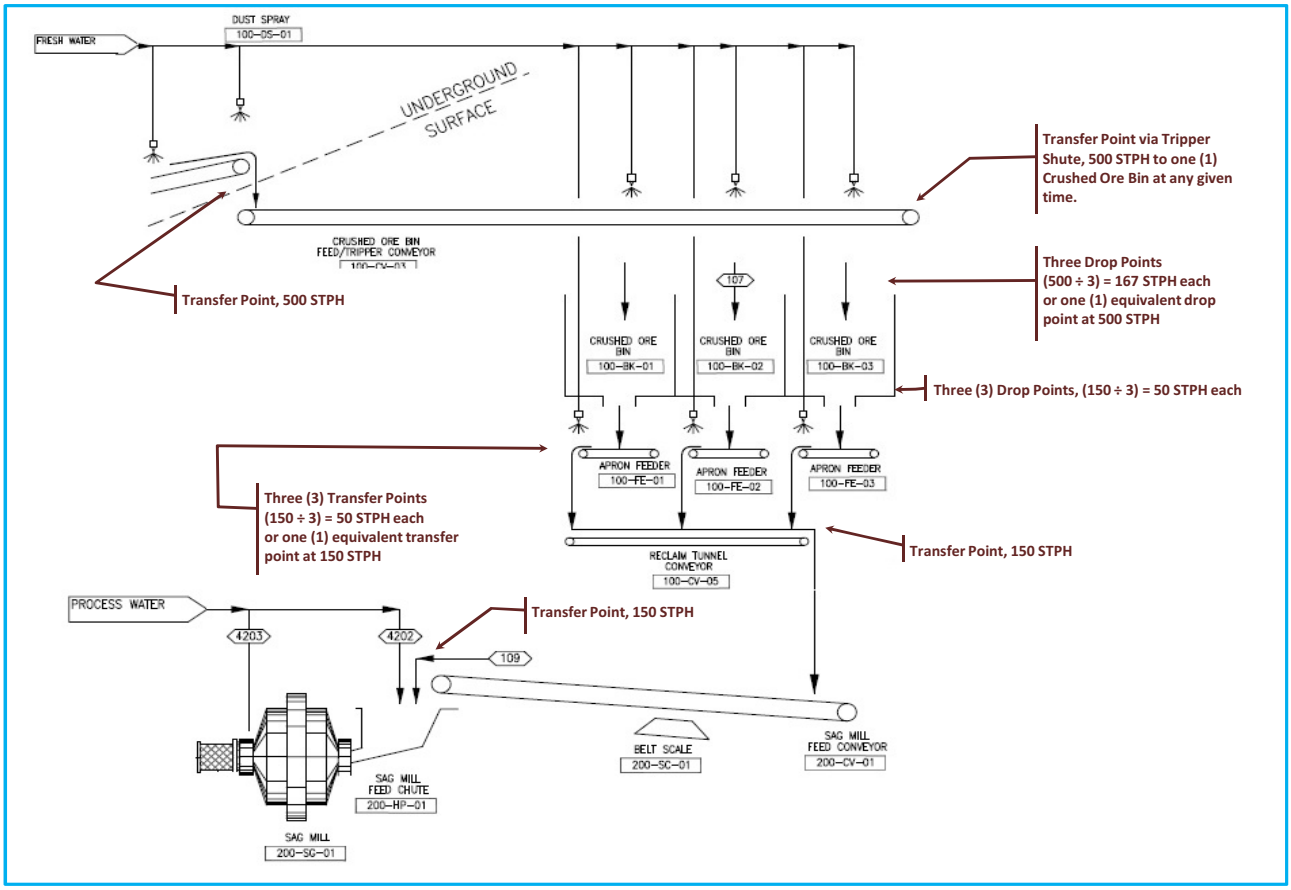
A. Conveyor Transfer Points (PTE)

Process Description (Transfer Points and Drop Points)

The Oracle Ridge Crushing Circuit will consist of a single-stage Primary Jaw Crushing System located underground. Ore from the underground Jaw Crushing System is conveyed to the surface and transferred to the Crushed Ore Bin Feed/Tripper Conveyor (Equipment ID# 100-CV-03). Ore is then transfered to Crushed Ore Bins, one bin at any given a time, through a tripper mechanism built into the Crushed Ore Bin Feed/Tripper Conveyor. The Crushed Ore Bins each have a 10,000 ton holding capacity (See Figure 1). The Crushed Ore Bins provide storage capacity should underground crushing operations be down for routine maintenance as the downstream operations could continue at the ore processing design rate is 150 STPH.

The Crushed Ore Bins dispense ore (i.e. Drop Points) to Aprin Feeders (Equipment ID #s 100-BK-01, 100-BK-02, and 100-BK-03) which then transfer ore to the Reclaim Tunnel Conveyor (Equipment ID# 100-CV-05). The Reclaim Tunnel Conveyor transfers ore to the SAG Mill Feed Conveyor (Equipment ID# 200-CV-01) which then transfers ore to the SAG Mill Feed Chute (Equipment ID# 200-HP-01).

Figure 1: Ore Crushing Circuit Transfer and Drop Points



Conveyor Transfer Points (PTE) - Cont'd

Process Description (Ore Circulating Load)

This process description is provided to explain Concentrator Building ore flowrates (i.e., solids, tph) that appear to be in excess of the accepted limit of 150 tph (See Figure 2). The following description serves to illustrate how these ore process flow rates shown in the mass balance details on Drawing No. 11005-F-02 (Rev G) and in **Figure 2** are consistent with the proposed ore processing limitation and **do not** impact the reagent demand rate that is based on the accepted ore processing limit of 150 tph.

The circulating load of the ore is in the Ball Mill Circuit (i.e. Ball Mill, Pumps, Cyclone Circuit) and is calculated as 250.17% of the new ore feed (i.e. 150 STPH) that enters the Ball Mill Circuit. This circulating load occurs because the Ball Mill can not grind the incoming ore (Particle size of P80 = ½") to the necessary design particle size of P80 = 100 mesh in a single pass thru the Ball Mill; therefore a circulating load of ore is required to achieve the design particle size. The calculations that support this circulating load and provide documentation for the mass balance illustrated on Drawing No. 11005-F-02 (Rev G) and highlighted in yellow shown in Figure 2 are as follows:

Circulating Load Calculations

New Ore Feed = 150 STPH (Streem 111)

Percent Circulating Load = 250.17%

Feed to Ball Mill Circuit = (150 STPH) + (250% x 150 STPH) = 525.3 STPH

Note: This is under standard operating conditions; however, there is a Flash Flotation Cell in the circuit that removes 2.3 STPH (Stream 217). Therefore, the revised flow to the Ball Mill Circuit becomes:

(150 - 2.3) + (2.5017) x (150-2.3) = 517.2 STPH (Stream 216)

so, Feed to the Cyclone Circuit = 517.2 STPH; Cyclone Overflow from Cyclone Circuit = 147.8 STPH (Stream 218)

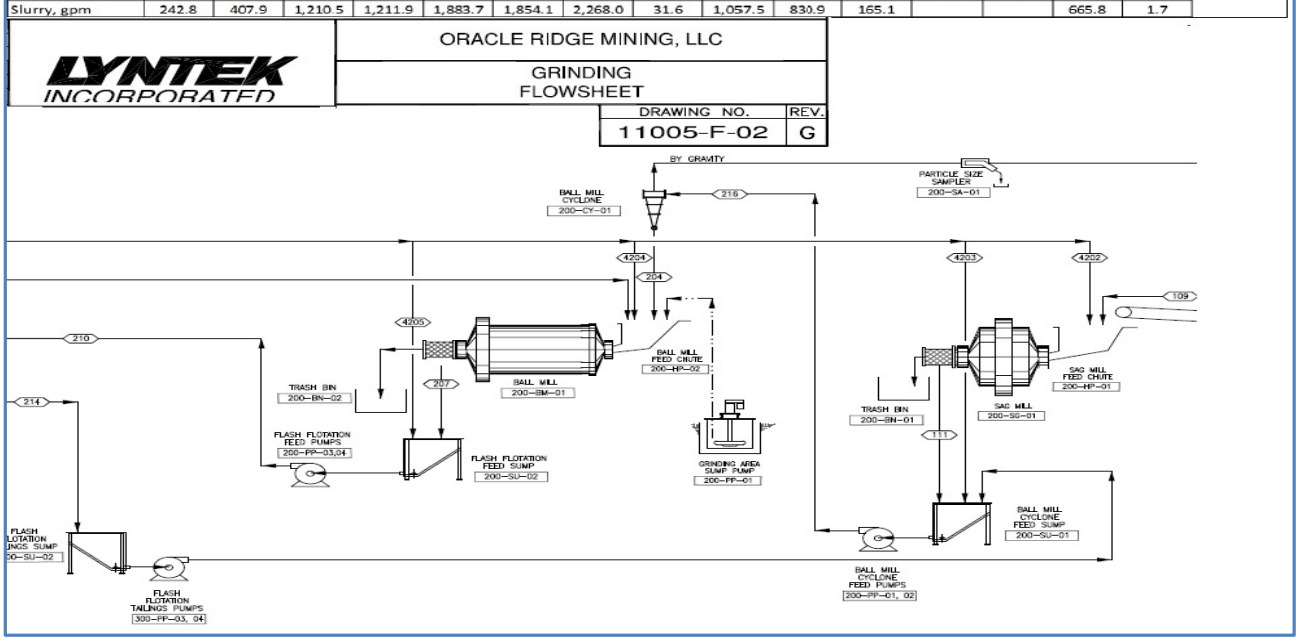
Cyclone Underflow to the Ball Mill = 517.2 - 147.8 = 369.4 STPH (Stream 204); therefore,

Ball Mill Discharge = 369.4 STPH (Stream 207) and Flash Flotation Feed = 369.4 STPH (Stream 210)

ESSENTIALLY, 150 STPH OF ORE GOES INTO THE BALL MILL CIRCUIT AND 147.7 STPH + 2.3 STPH = 150 STPH LEAVES THE BALL MILL CIRCUIT.

Figure 2: Ore Circulating Load

10/06/2011 Description	SAG Mill Feed	SAG Mill Discharge	Cyclone U/F	Ball Mill Discharge	Flash Flot. Feed	Flash Flot. Tails	Cyclone Feed	Flash Flot. Conc.	Cyclone O/F	Process Water Grinding	SAG Dilution Water	SAG Discharge Dilution	Ball Dilution Water	Ball Discharge Dilution	Admin & Mine Dry Water
Stream Number	109	111	204	207	210	214	216	217	218	4201	4202	4203	4204	4205	4811
Total Mass, tph	158.7	200.0	543.7	544.0	711.9	702.9	904.4	9.5	360.7	207.7	41.3			166.4	0.4
Solids, tph	150.0	150.0	369.4	369.4	369.4	367.2	517.2	2.3	147.8	0.0	0.0			0.0	
Liquids, tph	8.7	50.0	174.3	174.6	342.5	335.7	387.2	7.3	213.0	207.7	41.3			166.4	0.4
% Solids	94.5	75.0	67.9	67.9	51.9	52.2	57.2	23.7	41.0	0.0	0.0	0.0	0.0	0.0	
Slurry SG	2.6	2.0	1.8	1.8	1.5	1.5	1.6	1.2	1.4	1.0	1.0	1.0	1.0	1.0	1.0
Slurry, gpm	242.8	407.9	1,210.5	1,211.9	1,883.7	1,854.1	2,268.0	31.6	1,057.5	830.9	165.1			665.8	1.7



Conveyor Transfer Points (PTE) - Cont'd

Transfer Point Emission Calculation Methodology:

The emission factor for TSP is taken from AP42, Table 11.24-2. Emission factors for PM_{10} and $PM_{2.5}$ derived from AP42, Appendix B.2, Category 3 (i.e., material handling of unprocessed ores) and applivcation of Natural Mitigation based on days with precipitation greater than 0.01 inches as noted below.

NOTE: Reference for the following natural mitigation emission factor adjustment is Western Governors' Association (WRAP) Fugitive Dust Handbook, September 7, 2006, page 6-5.

Emission Factor adjustment for Natural Mitigation (E_{ext}) = E [(365 - P) ÷ 365] , Equation (2) from WRAP Fugitive Dust Handbook

where,

E_{ext} = Annual size-specific emission factor extrapolated for natural mitigation.

E = EF = Emission factors used from AP42

P = Number of days is a year with at least 0.01 inches of precipitation.

P = 44 days/year Tucson, AZ [reference: National Climatic Data Center (NCDC) - See Appendix J].

so, the AP42 emission factor correction for natural mitigation = (365 - 44) ÷ 365 = 0.88 (dimensionless)

Transfer Points Emission Calculation Parameters:

Planned Conveyor operating hours = (2 shifts/day) x (10 hours/shift) x (365 days/year) = 7300 hrs/yr; however, no limt requested. So,

PTE Conveyor operating hours = 8760 hrs/yr

Design Capacity Limit Prior to Bins = 500 STPH

No. of Transfer Points at 500 STPH = 2 — Transfer Points prior to the Crushed Ore Bins - (See Figure 1 above and Oracle Ridge Mining, LLC Crushing Flowsheet, Drawing No. 11005-F-01 (Rev I), dated 10/7/11 included under the "Process Flow Diagrams" tab of the Class II Air Quality permit Application.

Design Limit After Crushed Ore Bins = 150 STPH

No. of Transfer Points at 150 STPH = 2 — Transfer Points after the Crushed Ore Bunkers - (See Figure 1 above and Oracle Ridge Mining, LLC Crushing Flowsheet, Drawing No. 11005-F-01 (Rev I), dated 10/7/11 included under the "Process Flow Diagrams" tab of the Class II Air Quality permit Application.

No. of Transfer Points at 50 STPH = 3 — Transfer Points after the Crushed Ore Bunkers - (See Figure 1 above and Oracle Ridge Mining, LLC Crushing Flowsheet, Drawing No. 11005-F-01 (Rev I), dated 10/7/11 included under the "Process Flow Diagrams" tab of the Class II Air Quality permit Application.

Material Flowrates Prior to Crushed Ore Bins

PTE Material Process Rate (tpy) = (500 tons/hour) x (8,760 hours/year)

PTE Material Process Rate (tpy) = 4,380,000 tpy

Material Flowrates After to Crushed Ore Bins

PTE Material Process Rate (tpy) = (150 tons/hour) x (8,760 hours/year)

PTE Material Process Rate (tpy) = 1,314,000 tpy

Material Flowrate per Crushed Ore Bin

PTE Material Process Rate (tpy) = (50 tons/hour) x (8,760 hours/year)

PTE Material Process Rate (tpy) = 438,000 tpy

Conveyor Transfer Points (PTE) - Cont'd

UNCONTROLLED TSP EMISSIONS AT 500 STPD

TSP Emission Factor (lbs/ton) = 0.01

[AP42, Table 11.24-2 for uncontrolled conveyor transfer points, lbs TSP per ton of material handled for high moisture ore with a percent moisture of 4 weight % or greater as stipulated in AP42 Sectiuon 11.24 (Metallic Minerals Processing, page 11.24-5]

TSP Emission Factor corrected w/natural mitigation (lbs/ton) = (0.01 x 0.88) = 0.009 lbs/ton

TSP Emissions (lbs/yr) = 0.009 lbs/ton x 4,380,000 tons/yr x No. of conveyor transfer points (2)
TSP Emissions (lbs/yr) = 77,040 lbs/yr
TSP Emissions (tons/yr) = 39 tons/yr

500 STPD Transfer Point Uncontrolled Size Emissions

	Particle size (µm)		
	≤ 2.5	≤ 6	≤ 10
Distribution, Cumulative percent (%) equal to or less than size =	15	34	51
Cumulative mass ≤ particle size emissions (tons/yr) =	5.8	13.1	19.6

* *500 STPD Transfer Point Controlled Size Emissions*

Type of control device: Dust suppression by water sprays.

	Particle size (µm)		
	0 - 2.5	2.5 - 6	6 - 10
% Collection efficiency (AP42, Table B.2-3) =	40	65	90
**Mass is size range before control (tons/yr) =	5.8	7.3	6.5
Mass is size range after control (tons/yr) =	3.5	2.6	0.7
Cumulative mass (tons/yr) =	3.5	6.0	6.7

CONTROLLED PARTICULATE EMISSIONS AT 500 STPD - PTE

$PM_{2.5}$ = 3.5 tpy = 19.0 lbs/day

PM_{10} = 6.7 tpy = 36.6 lbs/day

* *These data do not include results for the greater than 10 µ m particle size range.*

** *Uncontrolled size data are cumulative percent equal to or less than the size. Control efficiency data apply only to size range and are not cumulative.*

UNCONTROLLED TSP EMISSIONS AT 150 STPD

TSP Emission Factor (lbs/ton) = 0.01

[AP42, Table 11.24-2 for uncontrolled conveyor transfer points, lbs TSP per ton of material handled for high moisture ore with a percent moisture of 4 weight % or greater as stipulated in AP42 Sectiuon 11.24 (Metallic Minerals Processing, page 11.24-5]

Corrected TSP Emission Factor for Natural Mitigation (lbs/ton) = (0.01 x 0.88) = 0.009 lbs/ton

TSP Emissions (lbs/yr) = 0.009 lbs/ton x 1,314,000 tons/yr x No. of conveyor transfer points (2)
TSP Emissions (lbs/yr) = 23,112 lbs/yr
TSP Emissions (tons/yr) = 12 tons/yr

Conveyor Transfer Points (PTE) - Cont'd

150 STPD Transfer Point Uncontrolled Size Emissions

	Particle size (µm)		
	≤ 2.5	≤ 6	≤ 10
Distribution, Cumulative percent (%) equal to or less than size =	15	34	51
Cumulative mass ≤ particle size emissions (tons/yr) =	1.7	3.9	5.9

* *150 STPD Transfer Point Controlled Size Emissions*

Type of control device: Dust suppression by water sprays.

	Particle size (µm)		
	0 - 2.5	2.5 - 6	6 - 10
% Collection efficiency (AP42, Table B.2-3) =	40	65	90
**Mass is size range before control (tons/yr) =	1.7	2.2	2.0
Mass is size range after control (tons/yr) =	1.0	0.8	0.2
Cumulative mass (tons/yr) =	1.0	1.8	2.0

CONTROLLED PARTICULATE EMISSIONS AT 150 STPD - PTE

$PM_{2.5}$ = 1.0 tpy = 5.7 lbs/day

PM_{10} = 2.0 tpy = 11.0 lbs/day

* *These data do not include results for the greater than 10 µm particle size range.*

** *Uncontrolled size data are cumulative percent equal to or less than the size. Control efficiency data apply only to size range and are not cumulative.*

UNCONTROLLED TSP EMISSIONS AT 50 STPD

TSP Emission Factor (lbs/ton) = 0.01

[AP42, Table 11.24-2 for uncontrolled conveyor transfer points, lbs TSP per ton of material handled for high moisture ore with a percent moisture of 4 weight % or greater as stipulated in AP42 Sectiuon 11.24 (Metallic Minerals Processing, page 11.24-5]

Corrected TSP Emission Factor for Natural Mitigation (lbs/ton) = (0.01 x 0.88) = 0.009 lbs/ton

TSP Emissions (lbs/yr) = 0.009 lbs/ton x 438,000 tons/yr x No. of conveyor transfer points (2)
TSP Emissions (lbs/yr) = 11,556 lbs/yr
TSP Emissions (tons/yr) = 6 tons/yr

50 STPD Transfer Point Uncontrolled Size Emissions

	Particle size (µm)		
	≤ 2.5	≤ 6	≤ 10
Distribution, Cumulative percent (%) equal to or less than size =	15	34	51
Cumulative mass ≤ particle size emissions (tons/yr) =	0.9	2.0	2.9

* *50 STPD Transfer Point Controlled Size Emissions*

Type of control device: Dust suppression by water sprays.

	Particle size (µm)		
	0 - 2.5	2.5 - 6	6 - 10
% Collection efficiency (AP42, Table B.2-3) =	40	65	90
**Mass is size range before control (tons/yr) =	0.9	1.1	1.0
Mass is size range after control (tons/yr) =	0.5	0.4	0.1
Cumulative mass (tons/yr) =	0.5	0.9	1.0

CONTROLLED PARTICULATE EMISSIONS AT 50 STPD - PTE

$PM_{2.5}$ = 0.5 tpy = 2.8 lbs/day

PM_{10} = 1.0 tpy = 5.5 lbs/day

* *These data do not include results for the greater than 10 µm particle size range.*

** *Uncontrolled size data are cumulative percent equal to or less than the size. Control efficiency data apply only to size range and are not cumulative.*

Transfer Point Particulate Emissions Totals PTE

TSP = PM_{10} = 9.69 tpy = 53.10 lbs/day

TETRA TECH

B. Crushed Ore Bin Drop Points (PTE)

Process Description

The Crushed Ore Bin Feeder/Tripper Conveyor drops ore into the Crushed Ore Bins. The ore feed rate into the Crushed Ore Bins is limited by the 500 STPH design capacity of the Crushed Ore Bin Feeder/Tripper Conveyor. The Crushed Ore Bins drop ore onto the Aprin Feeders (Equipment ID#s 100-FE-01, 100-FE-02, and 100-FE-03) at a total maximum controlled feed rate of 150 STPD or 50 STPH per Crushed Ore Bin.

Emission Calculation Methodology:

Particulate size-specific emission factors are estimated using methodology in AP42, Section 13.2.4, Equation (1) for drop operations and emission factors are corrected for Natural Mitigation to account for precipitation as follows:

$$E = k \times (0.0032) \times \frac{(U/5)^{1.3}}{(M/2)^{1.4}} \quad \text{(pound [lb]/ton)}$$

Equation (1)

Where:

E = emission factor (pound [lb]/ton)

k_{PM10} = particulate size multiplier (dimensionless) = 0.35 (for PM_{10})

$k_{PM2.5}$ = particulate size multiplier (dimensionless) = 0.053 (for $PM_{2.5}$)

U = mean wind speed, miles per hour [mph] = 8.3 mph (National Climatic Data Center, NOAA - 2001)

M = material moisture content (%) = 2.9% (Ref. mass balance data provided on Process Flow Diagrams/Flowsheets, i.e. 1 - % solids)

The particle size multiplier in the equation, k, varies with aerodynamic particle size range, as follows:

$$E_{PM10} = (0.35) \times (0.0032) \times [(8.3/5)^{1.3} / (2.9/2)^{1.4}]$$

$$E_{PM10} = 1.29E\text{-}03 \quad \text{(pound [lb]/ton)}$$

$$E_{PM2.5} = (0.053) \times (0.0032) \times [(8.3/5)^{1.3} / (2.9/2)^{1.4}]$$

$$E_{PM2.5} = 1.95E\text{-}04 \quad \text{(pound [lb]/ton)}$$

NOTE: Reference for the following natural mitigation emission factor adjustment is Western Governors' Association (WRAP) Fugitive Dust Handbook, September 7, 2006, page 6-5.

Emission Factor adjustment for Natural Mitigation (E_{ext}) = E [(365 - P) ÷ 365] , Equation (2) from WRAP Fugitive Dust Handbook

where,

E_{ext} = Annual size-specific emission factor extrapolated for natural mitigation.

E = EF = Emission factors used from AP42

P = Number of days is a year with at least 0.01 inches of precipitation.

P = 44 days/year for Tucson, Arizona [reference: The National Climatic Data Center (NCDC)].

so, the AP42 emission factor correction for natural mitigation = (365 - 44) ÷ 365 = 0.88 (dimensionless)

E_{PM10} Corrected for Natural Mitigation =	1.29E-03	x	0.88	=	1.13E-03	lb/ton
$E_{PM2.5}$ Corrected for Natural Mitigation =	1.95E-04	x	0.88	=	1.71E-04	lb/ton

Crushed Ore Bin Drop Points Emission Calculation Parameters:

Crushed Ore Bin operating hours = (2 shifts/day) x (10 hours/shift) x (365 days/year); however, PTE calculated with 8760 hours.

Crushed Ore Bins operating hours (PTE) =	8,760	hrs/yr	*[Note: No operating hour permit limitations requested]*
Design Capacity Limit Prior to Bins =	500	STPH	
Ore Flowrate after Bins =	150	STPH	

Crushed Ore Bin Drop Points (PTE) - cont'd

Drop Point Ore Flowrate Into Bins

Crushed Ore Flowrate to Bins (tph) = 500 ÷ 3 = 166.7 tph (per bin)

Crushed Ore Flowrate to Bins (tpy) = (166.7 tph) x (8,760 hrs/yr)

Crushed Ore Flowrate to Bins (tpy) = 1.46E+06 tpy (per bin)

Drop Point Ore Flowrate From Bins

Crushed Ore Flowrate from Bins (tph) = 150 ÷ 3 = 50 STPH

Crushed Ore Flowrate to Bins (tpy) = (50 tph) x (8,760 hrs/yr)

Crushed Ore Flowrate to Bins (tpy) = 4.38E+05 tpy (per bin)

No. of Drop Points **into** Crushed Ore Bins = 3

No. of Drop Points **from** Crushed Ore Bunkers = 3

See Figure 1 in previous section and Oracle Ridge Mining, LLC Crushing Flowsheet, Drawing No. 11005-F-01 (Rev I), dated 10/7/11 included under the "Process Flow Diagrams" tab of the Class II Air Quality permit Application.

Crushed Ore Bin Drop Points (PTE) - Con't

*Drop Points **into** Crushed Ore Bins PTE:*

PM_{10} Drop Point Emissions = (1.46E+06 tpy) x (1.13E-03 lbs/ton) x (3 Drop Points)

PM_{10} Drop Point Emissions = 4,956 lbs/yr

PM_{10} = 2.48 tpy = 13.58 lbs/day

$PM_{2.5}$ Drop Point Emissions = (1.46E+06 tpy) x (1.71E-04 lbs/ton) x (3 Drop Points)

$PM_{2.5}$ Drop Point Emissions = 750 lbs/yr

$PM_{2.5}$ = 0.38 tpy = 2.06 lbs/day

*Drop Points **from** Crushed Ore Bins PTE:*

PM_{10} Drop Point Emissions = (4.38E+05 tpy) x (1.06E-03 lbs/ton) x (3 Drop Points)

PM_{10} Drop Point Emissions = 1,487 lbs/yr

PM_{10} = 0.74 tpy = 4.07 lbs/day

$PM_{2.5}$ Drop Point Emissions = (4.38E+05 tpy) x (1.61E-04 lbs/ton) x (3 Drop Points)

$PM_{2.5}$ Drop Point Emissions = 225 lbs/yr

$PM_{2.5}$ = 0.11 tpy = 0.62 lbs/day

Drop Point Particulate Emissions Totals PTE

TSP = PM_{10} = 3.22 tpy = 17.65 lbs/day

TETRA TECH

D. Milk-of-Lime Storage & Distribution System (PTE)

Process Description

Bulk hydrated lime is delivered via truck in 1,500 or 2,000 lb super-sacks and off-loaded from the truck to be stored in the warehouse located near the High Density Lime (Milk-of-Lime) Distribution System. The Milk-of-Lime System includes a vendor supplied (Conseco, Model DLBBMFD) Bulk Bag Unloader, Screw Feeder, Mix Tank, Metering Pump, System Control Panel with Griffin Fabric Filter Dust Control equipment (See **Appendix A**). Metering pumps will pump the Milk-of-Lime to the required equipment locations in the Concentrator Plant. A System Control Panel that contains a Mass Flow Density Meter will control the operation of the Bulk Bag Unloader, Screw Feeder, Mix Tank, Valves, and Metering Pump.

Hydrated Lime Usage & Lime System Operating Schedule:

HYDRATED LIME USAGE[1]			
lbs/day =	1500	tons/day =	0.75
lbs/week =	10,500	tons/week =	5.25
lbs/year =	547,500	tons/year =	274

(1) The maximum rated capacity of the vendor-supplied Mik-of-Lime System (Equipment ID #900-MS-01) is 1800 lbs/day; however, the system includes a particulate emissions control device with a manufacturer guaranteed exhaust grain outlet loading of 0.02 gr/acf (See emission calculations below).

OPERATING SCHEDULE	
hours/day =	24
days/week =	7
days/year =	365

Emissions Control Device

The Milk-of-Lime System includes Silo Filter Vent equipment for dust control (Merrick Bulk Bag Unloader, Model DLBBMFD, that includes a Griffin Blower Filter Vent, Model No. 54-LS - See **Appendix A**). This system includes 375 ft^2 of filter cloth area and blower capacity of 1280 cfm at 6" w.c. to 1580 cfm at 4" w.c.; manufacturer guarantee of 99.9% collection efficiency down to one (1) micron; and a guarantee of 0.02 grains per acf outlet loading.

Emission Calculation Methodology:

Manufacturer guaranteed controlled emissions of 0.02 grain per actual cubic foot are used for PM and PM_{10}.

Emission Calculation Parameters:

PM = PM_{10} Emission Factor (grains/acf) =	0.02	Manufacturer guaranteed grain loading (See **Appendix A**)
Maximum exhaust flow rate (cfm) =	1,580	Griffin Silo Vent Filter System, Model No. 54-LS (See **Appendix A**)

Emission Calculations (PTE):

Silo Vent PM (lbs/day) = [(0.02 gr/scf)x(1,580 scfm)x(60 min/hr)x(20 hr/dayx(2.29E-03 oz/gr)]÷[16 oz/lb] =	**5.42**	**lbs/day**
PM Lime Silo Filter Vent Emissions (lbs/week) = [PM (lbs/day)] x [days/week] =	38	lbs/wk
PM Lime Silo Filter Vent Emissions (lbs/year) = [PM (lbs/week)] x [weeks/year] =	13,841	lbs/yr
PM =	**6.92**	**tons/year**

Silo PM_{10} Emissions (lbs/day) = [(0.02 gr/scf) x (1,580 scfm) x (60 min/hr)x(20 hr/day)] ÷ [2.29E-03 oz/gr] ÷ [16 oz/lb] =	**5.42**	**lbs/day**
PM_{10} Lime Silo Filter Vent Emissions (lbs/week) = [PM_{10} (lbs/day)] x [days/week] =	38	lbs/wk
PM_{10} Lime Silo Filter Vent Emissions (lbs/year) = [PM_{10} (lbs/week)] x [weeks/year] =	13,841	lbs/yr
PM_{10} =	**6.92**	**tons/year**

Conversion Factors

1 grain =	2.29E-03	ounce
1 lb =	16	ounces
1 ton =	2,000	lbs

E. Emergency Fire Pump Engine (PTE)

Process Description

A diesel-powered back-up pump is connected to the Fire Water reserve Tank piping system for use in emergency situations in a power outage whereby fire water is required at the mine site. The Fire Water Back-up System (Equipment ID# 800-PP-07) is skid-mounted, complete with pump, diesel engine, fuel tank, and controls. Hours of operation are limited to 100 hours per year (hrs/yr) for maintenance checks and readiness testing as provided for in 40 CFR 60.4211 (f). The fire pump engine system is provided by Clarke Fire Protection Products, Inc. (Model #JU4H-UF-34, See **Appendix B**).

Emergency Generator Emissions Calculation Methodology

Emission factors for PM_{10}, $PM_{2.5}$, NO_x, SO_2, CO, and organic compounds are obtained from AP42, Chapter 3 - Table 3.3-1 and Table 3.3-2 (Diesel Industrial Engines).

Emission Calculation Input Parameters

Maximum Rated Capacity =	86	kW	*(See Appendix B)*
Maximum Rated Capacity =	115	HP	*(See Appendix B)*
Max Fuel Consumption =	9.1	gallons/hour	*(See Appendix B)*
Average BSFC(1) (efficiency) =	7,000	Btu/hp-hr	*(reference, AP42 Table 3.3-1, footnote "a")*
Hours per Year =	100	hrs/yr	*(Hourly limit per 40 CFR Part 60.4211)*
Heat Value =	137,000	Btu/gallon	*(reference, AP42, Appendix A, page A-5)*
Sulfur Content of Diesel =	0.05	%	*(reference, 40 CFR Part 80.29)*

(1) Brake Specific Fuel Consumption (BSFC) is a measure of fuel efficiency within a shaft reciprocating engine.

Fuel Heat Input Calculation

Fuel Heat Input = (9.1 gallons/hr) x (100 hrs/yr) x (137,000 Btu/gallon)

Fuel Heat Input =	1.25E+08	Btu/yr	=	125	MMBtu/yr
Fuel Heat Input =	1.25E+06	Btu/hr		1.25	MMBtu/hr

Power Output Calculation

Power Output = (Fuel Consumption, gallons/hour) x (Hours/Year) x (Heat Value, Btu/gallon) ÷ (BSFC, Btu/hp-hr)

Power Output = (9.1 gallons/hr) x (100 hrs/yr) x (137,000 Btu/gallon) ÷ (7,000 Btu/hp-hr)

Annual Power Output	1.78E+04	hp-hr
Hourly Power Output	1.78E+02	hp-hr

Non-HAP Pollutant Emission Factors :

POLLUTANT	EMISSION FACTORS lb/MMBtu (fuel input)	lb/hp-hr (power output)	REFERENCE
PM	0.31	2.20E-03	*AP42 Table 3.3-1 (10/96) Stationary Diesel Industrial Engines*
PM_{10}	0.31	2.20E-03	*AP42 Table 3.3-1 (10/96) Stationary Diesel Industrial Engines*
CO	0.95	6.68E-03	*AP42 Table 3.3-1 (10/96) Stationary Diesel Industrial Engines*
NO_X	4.41	3.10E-02	*AP42 Table 3.3-1 (10/96) Stationary Diesel Industrial Engines (uncntl'd)*
SO_2(1)	0.29	2.05E-03	*AP42 Table 3.3-1 (10/96) Stationary Diesel Industrial Engines*
VOC(2)	0.33	2.29E-03	*AP42 Table 3.3-1 (10/96) Stationary Diesel Industrial Engines*

(1) Assumes that all sulfur in the fuel is converted to SO_2.

(2) Includes exhaust and crankcase total organic compounds (TOC) and VOC = TOC x 0.91, TOC is by weight 9% methane and 91% nonmethane. (AP42 Table 3.4-1 (10/96) footnote f).

Emergency Fire Pump Engine (PTE) - Con't

Emergency Fire Pump HAP Emission Factors :

POLLUTANT	EMISSION FACTORS lb/MMBtu (fuel input)	REFERENCE
Benzene	9.33E-04	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
Toluene	4.09E-04	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
Xylenes	2.85E-04	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
1,3 Butadiene	3.91E-05	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
Formaldehyde	1.18E-03	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
Acetaldehyde	7.67E-04	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
Acrolein	9.25E-05	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*
Naphthalene	8.48E-05	*AP42 Table 3.3-2 (10/96) Uncontrolled Stationary Diesel Engines*

Emergency Fire Pump HAP and Non-HAP Emissions:

POLLUTANT	EMISSIONS (lbs/hr)	(lbs/day)	(tons/yr)
PM	3.86E-01	9.28E+00	1.93E-02
PM_{10}	3.86E-01	9.28E+00	1.93E-02
CO	1.18E+00	2.84E+01	5.92E-02
NO_X	5.50E+00	1.32E+02	2.75E-01
SO_2	3.62E-01	8.68E+00	1.81E-02
VOC	4.08E-01	9.80E+00	2.04E-02
Benzene	1.16E-03	2.79E-02	5.82E-05
Toluene	5.10E-04	1.22E-02	2.55E-05
Xylenes	3.55E-04	8.53E-03	1.78E-05
1,3 Butadiene	4.87E-05	1.17E-03	2.44E-06
Formaldehyde	1.47E-03	3.53E-02	7.36E-05
Acetaldehyde	9.56E-04	2.29E-02	4.78E-05
Acrolein	1.15E-04	2.77E-03	5.77E-06
Naphthalene	1.06E-04	2.54E-03	5.29E-06
Total HAPs =	**4.73E-03**	**1.13E-01**	**2.36E-04**

F. Emergency Generator (PTE)

Process Description

The proposed Emergency Generator System includes a skid mounted diesel generator set rated at 1500 kw (standby), 415/3/50 complete with a 10,000 gallon diesel fuel tank, instrumentation, and an electrical control system. Fuel Oil is delivered by truck and transferred into a Fuel Oil Storage Tank. Fuel oil from the Fuel Oil Storage Tank flows by gravity to a Fuel Oil Day Tank that provides fuel to the Diesel Generator. A Local Control Panel will monitor the fuel within the Fuel Day Tank, operate the fuel transfer pumps, and monitor the proper operation of the Diesel Generators. The Control Room PLC will also monitor the proper operation of the Diesel Generators as well as the operating status of the Fuel Oil Return Pump and the fuel oil level within the Fuel Oil Storage Tank. Details regarding the proposed emergency generator, Caterpillar Genset Model No. 3512C, is provided in **Appendix C**.

EPA allows up to 100 hours for the emergency generator beyond which the generator is no longer considered an "emergency" generator. These hours are provided in order to exercise and test the generator. Please note that in the event of an emergency ORM Facility is not restricted to 100 hours under federal regulations.

Emergency Generator Emissions Calculation Methodology

Emission factors for PM_{10}, $PM_{2.5}$, NO_x, SO_2, CO, and organic compounds are obtained from AP42, Chapter 3 - Table 3.4-1, Table 3.4-2, and Table 3.4-3 (Large Stationary Diesel Engines).

Emission Calculation Input Parameters

Generator Capacity =	1500	kW	*(See Appendix C)*
Fuel Consumption =	104.8	gallons/hour	*(See Appendix C)*
Average BSFC[(1)] (efficiency) =	7,000	Btu/hp-hr	*(reference, AP42 Table 3.4-1, footnote "e")*
Hours per Year =	100	hrs/yr	*(Hourly limit per 40 CFR Part 60.4211)*
Heat Value =	137,000	Btu/gallon	*(reference, AP42, Appendix A, page A-5)*
Sulfur Content of Diesel =	0.05	%	*(reference, 40 CFR Part 80.29)*

(1) Brake Specific Fuel Consumption (BSFC) is a measure of fuel efficiency within a shaft reciprocating engine.

Fuel Heat Input Calculation

Fuel Heat Input = (104.8 gallons/hr) x (100 hrs/yr) x (137,000 Btu/gallon)

Fuel Heat Input =	1.44E+09	Btu/yr	=	1,436	MMBtu/yr
Fuel Heat Input =	1.44E+07	Btu/hr		14	MMBtu/hr

Emergency Generator (PTE) - Con't

Power Output Calculation

Power Output = (Fuel Consumption, gallons/hour) x (Hours/Year) x (Heat Value, Btu/gallon) ÷ (BSFC, Btu/hp-hr)
Power Output = (104.8 gallons/hr) x (100 hrs/yr) x (137,000 Btu/gallon) ÷ (7,000 Btu/hp-hr)

Annual Power Output 2.05E+05 hp-hr
Hourly Power Output 2.05E+03 hp-hr

Emergency Generator Non-HAP Pollutant Emission Factors :

POLLUTANT	EMISSION FACTORS lb/MMBtu (fuel input)	lb/hp-hr (power output)	REFERENCE
PM	6.97E-02	--	*AP42 Table 3.4-2 (10/96) Large Stationary Diesel Engines*
PM_{10}	5.70E-02	--	*AP42 Table 3.4-2 (10/96) Large Stationary Diesel Engines*
CO	--	5.50E-03	*AP42 Table 3.4-1 (10/96) Large Stationary Diesel Engines*
NO_X	--	2.40E-02	*AP42 Table 3.4-1 (10/96) Large Stationary Diesel Engines (uncontrolled)*
SO_2*	--	8.09E-03 x (S_1)	*AP42 Table 3.4-1 (10/96) Large Stationary Diesel Engines*
VOC**	--	6.20E-04	*AP42 Table 3.4-1 (10/96) Large Stationary Diesel Engines*

** Assumes that all sulfur in the fuel is converted to SO_2 and where S_1 = % sulfur in fuel oil. (AP42 Table 3.4-1 (10/96) footnote d)*
*** VOC = TOC x 0.91, TOC is by weight 9% methane and 91% nonmethane. (AP42 Table 3.4-1 (10/96) footnote f)*

Emergency Generator HAP Emission Factors :

POLLUTANT	EMISSION FACTORS lb/MMBtu (fuel input)	REFERENCE
Benzene	7.76E-04	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Toluene	2.81E-04	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Xylenes	1.93E-04	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Propylene	2.79E-03	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Formaldehyde	7.89E-05	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Acetaldehyde	2.52E-05	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Acrolein	7.88E-05	*AP42 Table 3.4-3 (10/96) Large Stationary Diesel Engines*
Naphthalene	1.30E-04	*AP42 Table 3.4-4 (10/96) Large Stationary Diesel Engines*

Emergency Generator HAP and Non-HAP Emissions:

POLLUTANT	EMISSIONS (lbs/hr)	(lbs/day)	(tons/yr)
PM	1.00E+00	2.40E+01	5.00E-02
PM_{10}	8.18E-01	1.96E+01	4.09E-02
CO	1.13E+01	2.71E+02	5.64E-01
NO_X	4.92E+01	1.18E+03	2.46E+00
SO_2	8.30E-01	1.99E+01	4.15E-02
VOC	1.27E+00	3.05E+01	6.36E-02
Benzene	1.11E-02	2.67E-01	5.57E-04
Toluene	4.03E-03	9.68E-02	2.02E-04
Xylenes	2.77E-03	6.65E-02	1.39E-04
Propylene	4.01E-02	9.61E-01	2.00E-03
Formaldehyde	1.13E-03	2.72E-02	5.66E-05
Acetaldehyde	3.62E-04	8.68E-03	1.81E-05
Acrolein	1.13E-03	2.72E-02	5.66E-05
Naphthalene	1.87E-03	4.48E-02	9.33E-05
Total HAPs =	**6.25E-02**	**1.50E+00**	**3.12E-03**

G. Diesel Fuel Tank (PTE)

Process Description

Diesel Fuel is delivered by truck and transferred into a 10,000 gallon capacity Fuel Oil Storage Tank (Equipment ID# 800-TK-01). Diesel fuel from the Fuel Oil Storage Tank flows by gravity to a Fuel Oil Day Tank that provides fuel to the Diesel Generator and is pumped to the various OPRM Facility vehicles, as required.

Tank Emission Calculation Methodology

Tank emissions estimating tool, TANKS 4.0.9d, from the U.S. EPA's Office of Air Quality Planning and Standards (OAQPS) is used to estimate working and breathing loss emissions from the Oracle Ridge Mine Diesel Fuel Storage Tank (Equipment ID 800-TK-01). TANKS is a Windows-based computer software program that estimates volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from fixed- and floating-roof storage tanks. The TANKS program employs a chemical database of over 100 organic liquids, and a meteorological database of over 240 cities in the United States. Metorological data for Tucson, Arizona was used for the ORM Facility fuel storage tank emissions calculations. EPA Tanks 4.0.9d Emissions Reports are provided in **Appendix D**.

Tanks 4.0.9d Input Parameters

Tank Dimensions:	Diameter	10	ft	Shell Color/Shade:	Gray/Light	
	Height	18	ft	Shell Condition:	Good	(Default)
	Working Volume	10,000	gallons	Roof Color/Shade:	Gray/Light	
				Roof Paint Condition:	Good	(Default)
	[1,2,3]Tank Throughput:	55,511	gallons/year	Type:	Cone	
	Turnovers:	5.55		Roof Height (ft):	1.08	(roof slope x shell radius)
	Tank Contents:	Distillate Fuel Oil #2		Location:	Tucson, AZ	
	Tank Type:	Vertical Fixed Roof Tank				

Notes:

(1)	Generator fuel rate (104.8 gph) x hrs/yr (100) = Tank Throughput =	10,480	gallons/year	
(2)	Fire Pump Engine fuel rate (9.1 gph) x hrs/yr (100) = Tank Throughput =	910	gallons/year	
(3)	ORM Facility diesel fuel rate = (120.88 gallons/day) x (365 days/year) =	44,121	gallons/year	(See Appendix D)
	Total Diesel Usage =	55,511	gallons/year	

Emissions (Tanks 4.0.9d Output) : **VOC Emissions = 7.29 lbs/yr** (See **Appendix D** for Detailed Report)

VOC Emissions = 3.65E-03 tpy

TETRA TECH

H. Gasoline Fuel Tank (PTE)

Process Description

Gasoline fuel is delivered by truck and transferred into a 10,000 gallon capacity Gasoline Storage Tank (Equipment ID# 800-TK-02). Gasoline fuel is dispensed from the tank to fuel ORM Facility vehicles, as required.

Tank Emission Calculation Methodology

Tank emissions estimating tool, Tanks 4.0.9d, from the U.S. EPA's Office of Air Quality Planning and Standards (OAQPS) is used to estimate working and breathing loss emissions from the Oracle Ridge Mine Gasoline Fuel Storage Tank (Equipment ID 800-TK-02). TANKS is a Windows-based computer software program that estimates volatile organic compound (VOC) and hazardous air pollutant (HAP) emissions from fixed- and floating-roof storage tanks. The TANKS program employs a chemical database of over 100 organic liquids, and a meteorological database of over 240 cities in the United States. Metorological data for Tucson, Arizona was used for the ORM Facility fuel storage tank emissions calculations.

Tanks 4.0.9d Input Parameters

Tank Dimensions:	Diameter	10	ft	Shell Color/Shade:	Gray/Light	
	Height	18	ft	Condition:	Good	(Default)
	Working Volume	10,000	gallons	Roof Color/Shade:	Gray/Light	
				Roof Paint Condition:	Good	(Default)
	[1]Tank Throughput:	30,000	gallons/year	Type:	Cone	
	Turnovers:	3.00		Roof Height (ft):	1.08	(roof slope x shell radius)
	Tank Contents:	Gasoline, RVP 11.5		Location:	Tucson, AZ	
	Tank Type:	Vertical Fixed Roof Tank				

Note:

(1) Estimated gasoline fuel usage rate (2,500 gallons/month) x 12 months/yr = Annual Tank Throughput = 30,000 gallons.

Emissions (Tanks 4.0.9d Output) : **VOC Emissions = 4,359 lbs/yr** (See **Appendix D** for Detailed Report)

VOC Emissions = 2.18 tpy

TETRA TECH

I. Tailings Facility Fugitive Dust Emissions (PTE)

Process Description

The ultimate Tailings Storage Facility (TSF) refers to the volume of tailings envisioned to contain an additional 8.4 million tons of new tailings from the new plant plus an additional 1.0 million tons of existing tailings. It is planned that the existing tailings will be removed and placed over a liner system as the new tailings facility is constructed. Panels are used on disturbed areas to mitigate dust generation.

The design of the TSF is centered around 8 technical design stages referred to as Stages 1 through 8. These stages have been generated as the basis for the annual period of TSF progression through the construction process. The mine development plan extends out 12 years, so, the development of more than one year can be included in an individual stage. The table below includes the proposed Tailings Facility Layout data over 12 years. See **Appendix E** for the Tailings Facility General Arrangement Drawing and Stockpile Plan Sheets.

Tailings Facility Surface Area Activity Data (ref. 9):

YEAR	STAGE	Geo-Membrane Liner Area (ft^2)	Reclaimed Area (ft^2)	Dry Stack Tailings Area (ft^2)	Total Area (ft^2)	[a] Total Disturbed Area (ft^2)	[b] Panel Area Coverage (ft^2)	[c] Unprotected / Unreclaimed Area (ft^2)	[c] Unprotected / Unreclaimed Area (Acres)	[c] Unprotected / Unreclaimed Area (m^2)
0	1	803,000	21,000	136,000	960,000	939,000	751,200	187,800	4.31	17,447
1	1	414,000	86,000	596,000	1,096,000	1,010,000	808,000	202,000	4.64	18,766
2	1	266,000	144,000	685,000	1,095,000	951,000	760,800	190,200	4.37	17,670
3	1	136,000	231,000	715,000	1,082,000	851,000	680,800	170,200	3.91	15,812
4	2	473,000	386,000	1,022,000	1,881,000	1,495,000	1,196,000	299,000	6.86	27,778
5	2	250,000	914,000	844,000	2,008,000	1,094,000	875,200	218,800	5.02	20,327
6	2	34,000	1,019,000	1,124,000	2,177,000	1,158,000	926,400	231,600	5.32	21,516
7	3	573,000	1,147,000	464,000	2,184,000	1,037,000	829,600	207,400	4.76	19,268
8	4	123,000	1,417,000	1,062,000	2,602,000	1,185,000	948,000	237,000	5.44	22,018
9	5	434,000	1,417,000	743,000	2,594,000	1,177,000	941,600	235,400	5.40	21,869
10	6	360,000	2,053,000	545,000	2,958,000	905,000	724,000	181,000	4.16	16,815
11	7	343,000	2,523,000	416,000	3,282,000	759,000	607,200	151,800	3.48	14,103
12	8	0	2,950,000	333,000	3,283,000	333,000	266,400	66,600	1.53	6,187

(a) Total disturbed area is the "Dry Stack Area" for each Tailings Facility Stage added to the "Geo-Membrane Liner Area" for that same Tailings Facility Stage.
(b) Panels are used on disturbed areas to mitigate dust generation for those areas. The table above assumes that the dust mitigated area is equal to 80% of the "Panel Area Coverage" (ref. 9).
(c) The table above assumes that 20% of the disturbed area is being used for tailings cell development and will contribute to fugitive dust.

NOTE: Reference for the following natural mitigation emission factor adjustment is Western Governors' Association (WRAP) Fugitive Dust Handbook, September 7, 2006, page 6-5.

Emission Factor adjustment for Natural Mitigation (E_{ext}) = E [(365 - P) ÷ 365] , Equation (2) from WRAP Fugitive Dust Handbook

where,

E_{ext} = Annual size-specific emission factor extrapolated for natural mitigation.
E = EF = Emission factors used from AP42
P = Number of days is a year with at least 0.01 inches of precipitation.
P = 44 days/year for Tucson, Arizona [reference: The National Climatic Data Center (NCDC)].

so, the AP42 emission factor correction for natural mitigation = (365 - 44) ÷ 365 = 0.88 (dimensionless)

Emission Factors:

EF TSP = 0.38 (tons/acre-yr) *[Ref.: AP-42, Table 11.9-4, Wind erosion of exposed areas]*
EF TSP, corrected for natural mitigation = 0.38 x 0.88 = 0.33 (tons/acre-yr)
PM_{10} Emission Factor Equation, E = k x Sum (P) *[Ref.: AP-42, Table 13.2.5, Equation 2]*
PM_{10} Emission Factor, corrected for Natural Mitigation = E = k x Sum (P) x 0.88
k = Particle Size Multiplier for PM_{10} = 0.5 (Dimensionless) *[Ref.: AP-42, Page 13.2.5-3, k= 0.5 for PM_{10}]*
$PM_{2.5}/PM_{10}$ Ratio = 0.15 *[Ref.: U.S. EPA CHIEF, $PM_{2.5}/PM_{10}$ ratio for windblown fugitive dust]*

Tailings Facility Fugitive Dust Emissions (PTE) - cont'd

Emission Factor Parameters:

Disturbance frequency per day = 1

Duration of exposure (months) = 12

Roughness height (cm) = 0.5

Threshold peak wind speed at height of 10 m (m/s) = 10

P = erosion potential (g/m^2)

$P = \sum^{N}_{i=1} [58 \times (u^* - u_t^*)^2 + 12 \times (u^* - u_t^*)]$ *[Ref.: AP-42, Table 13.2.5, Equation 3]*

$P = 0$ for $u^* \leq u_t^*$

where, N = Number of Disturbances Per Year = 350 (Note: N = 365 for a surface disturbed everyday in the year - i.e., daily)

u_t = Threshold Friction Velocity (m/s) = 1.02 *[Ref.: AP-42, Table 13.2.5-2, Threshold Friction Velocity for Overburden Material]*

Threshold friction velocity u^*_t (m/s) = 0.053 x u^+_{10} = 0.53

Monthly Erosion Potential (P) [a]				
	Peak Wind (u^+_{10})		u*	P
Day of Month	mph	m/s	m/s	g/m^2
8	26	11.6	0.62	2.58
10	28	12.5	0.66	4.37
15	23	10.3	0.54	0.39
29	25	11.2	0.59	1.78
			Sum of P	**9.11**

[a]Assumed to apply to 12 months for each Tailings Facility year of operation.

Tailings Facility Emissions

PM_{10} Fugitive Dust Emissions

YEAR	Unprotected Unreclaimed Area (m^2)	PM_{10} (lbs)	[a]PM_{10} lbs/mo	Unprotected Area (Acres)	TSP (tons/yr)
0	17,447	1,848	154	4.31	1.441
1	18,766	1,988	166	4.64	1.550
2	17,670	1,872	156	4.37	1.459
3	15,812	1,675	140	3.91	1.306
4	27,778	2,943	**245**	6.86	**2.294**
5	20,327	2,153	179	5.02	1.679
6	21,516	2,279	190	5.32	1.777
7	19,268	2,041	170	4.76	1.591
8	22,018	2,333	194	5.44	1.818
9	21,869	2,317	193	5.40	1.806
10	16,815	1,781	148	4.16	1.389
11	14,103	1,494	125	3.48	1.165
12	6,187	655	55	1.53	0.511
Maximum lbs/mo PM_{10} emissions =			**245**	**Max TSP (tons/yr) =**	**2.294**

[a]Estimated PM_{10} emissions per month equal Total PM_{10} emissions for the year of operation divided by 12 months.

Tailings Facility Fugitive Dust Emissions Summary

$PM_{2.5}$ =	441	lbs/yr	0.050	lbs/hr	0.221	Tons/yr		
PM_{10} =	**2,943**	**lbs/yr**	**0.336**	**lbs/hr**	**1.47**	**Tons/yr =**	**8.06**	**lbs/day**
TSP =	**4,588**	**lbs/yr**	**0.524**	**lbs/hr**	**2.29**	**Tons/yr =**	**12.57**	**lbs/day**

TETRA TECH

J. Reagent Volatile Organic Compound (VOC) Emissions (PTE)

Process Description

Sodium isopropyl xanthate is used as a conditioning reagent in order coat the Cu, Au, and Ag particles to make the particles hydrophobic (water repellent) prior to subjecting the Cu, Au, and Ag particles to the flotation process. A mixture of MIBC (90% of total frother used) and Aero Froth 65 - polypropylene glycol ethylene glycol ether - (10% of total frother used) will be added to the flotation process. Methyl isobutyl carbinol (MIBC) and Aero Froth 65 (AF 65) will be used as frothing agents that will produce air bubbles in the slurry in the flotation cells. These air bubbles make contact with the Cu, Au, and Ag particles and the particles attached to the bubbles and thereby float to the surface of the slurry in the flotation cells. A flocculant reagent is used in the Cu Concentrate and Tailings Thickeners to cause individual particles within the concentrate and tailings slurries to coalesce and settle to the bottom of the Concentrate and Tailings Thickeners. The following table lists proposed Oracle Ridge Mine reagents, proposed usage rates, and evaluations for volatile organic compounds (VOC) and hazardous air pollutants (HAP). See **Appendix F** for reagent usage details and photochemical reactivity information. See **Appendix G** for reagent material safety data sheets (MSDS).

Sodium Hydrosulfide (NaHS) as a conditioning reagent may be used to activate the oxide copper minerals in the ore in order for these copper oxide particles to float in the Flotation Circuit. Sodium Hydrosulfide (NaHS) will be transferred by hand from bags (NaHS is in a crystalline, flake, or powder form) to a Bag Breaker System that will automatically open the bag and transfer the NaHS to a vendor-supplied Reagent Mixing/Dilution System. The Bag Breaker System will have a totally-enclosed compartment with a filtration/vent system that captures dust particles from the bag breaking process. The Reagent Mixing/Dilution System will meter the NaHS in the correct amount into an agitated NaHS Mix Tank along with fresh water. The mixed NaHS solution will then be transferred to the NaHS Day Tank as a diluted, prepared solution ready for use in the flotation process. The diluted NaHS solution will be in the amount of about 0.2 to 0.35 lbs./ST in the flotation process. NaHS Metering Pumps will be monitored by the PLC in order to pump the NaHS solution from the Day Tank to the Cu Flotation Circuit.

Alternate Operating Scenarios (2) - Process Descriptios

Alternate Operating Scenario 1: Potassium Amyl Xanthate (PAX) will be used as a conditioning reagent in place of the Sodium Isopropyl Xanthate (NAX31).

Alternate Operating Scenario 2:

Milk-of-Lime may be used throughout the Comminution Circuitry and the Cu Flotation Circuitry in order to adjust the pH of the slurry to enable flotation of the Cu, Ag, and Au particles.
Note: If the pH of the slurry does not require adjustment, milk-of-lime will not be required.
Bulk hydrated lime (CaOH2) will arrive by truck in 1,500 or 2,000 lb. super-sacks and off-loaded from the truck to be stored in the warehouse and near the High Density Lime (Milk-of-Lime) Distribution System. The High Density Lime (Milk-of-Lime) Distribution System will consist of a Bulk Bag Un-loader, Screw Feeder, Mix Tank, Metering Pump, and System Control Panel. Metering pumps will pump the high density lime (milk-of-lime) to the required equipment locations in the concentrator. A System Control Panel that contains a Mass Flow Density Meter will control the operation of the Bulk Bag Un-loader, Screw Feeder, Mix Tank, Valves, and Metering Pump. The High Density Lime (Milk-of-Lime) Distribution System is a complete vendor package with particulate emissions control.

Reagent VOC Emissions - Con't

Emission Factor Parameters:

ORACLE RIDGE MINE (ORM) - REAGENT SUMMARY (Ref. #s 2, 11, and 12)						MAXIMUM		
REAGENT TYPE	CHEMICAL NAME	COMPOSITION		LISTED HAP[1]	VOC[2]	DAILY USAGE[3]	% VOC	
Product Name	Composition	% (by weight)	CAS #	Yes / No	Yes / No	lbs/day	(by volume)	MIR[4]
FROTHER								
Aerofroth 70® Frother ---------- (Liquid form, usage rate = 0.054 lbs/ton of plant feed) ---------->						162 lbs/day	100%	2.89
$(CH_3)_2CHCH_2CH(OH)CH_3$	*Methyl Isobutyl Carbinol (MIBC)*							
	Methyl Isobutyl Carbinol	60% to 100%	000108-11-2	No	Yes			
Aerofroth 65® Frother ---------- (Liquid form, usage rate = 0.006 lbs/ton of plant feed) ---------->						18 lbs/day	NA	NA
LIME								
Limate, Dolomitic Hydrated Lime ---------- (Granular form, usage rate = 0.5 lbs/ton of plant feed) ---------->						1,500 lbs/day	NA	NA
	Calcium Magnesium Hydroxide							
$Ca(OH)_2$	Calcium Hydroxide	LT 58%	001305-62-0	No	No		NA	NA
$Mg(OH)_2$	Magnesium Hydroxide	LT 38%	001309-42-8	No	No		NA	NA
$CaMgC_2O_6$	Dolomite	LT 1%	016389-88-1	No	No		NA	NA
MgO	Magnesium Oxide	LT 1%	001309-48-4	No	No		NA	NA
SiO_2	Crystalline Silica	NA	014808-60-7	No	No		NA	NA
FLOCCULANT								
DAF-30 ---------- (Powder form, usage rate = 0.01 lbs/ton of concentrate) ---------->						30 lbs/day	* NA	* NA
" " ---------- (Powder form, usage rate = 0.02 lbs/ton of tailings) ---------->						60 lbs/day	* NA	* NA
		* None Listed	* None Listed	* NA	* NA			
	***Note: No chemical compounds or composition on MSDS**							
	(Polymer Ventures, Inc. - Product Code: PVDAF30)							
CONDITIONING REAGENT								
AERO 343 Xanthate ---------- (Delivered in Pellet form then hydrated into slurry, usage rate = 0.08 lbs/ton of plant feed) ------>						240 lbs/day	20%	(see note 4)
	Sodium Isopropyl Xanthate (NAX31)							
$NaC_4H_7OS_2$	Sodium Isopropyl Xanthate	60% to 100%	000140-93-2	No	No		NA	NA
NaOH	Sodium Hydroxide	1% to 5%	001310-73-2	No	No		NA	NA
$(CH_3)_2CHCH_2OH$	Isopropanol	1% to 5%	000067-63-0	No	Yes		100%	0.71
Sodium Hydrosulfide--(Delivered in crystalline, flake, or powder form then hydrated into slurry, usage rate = 0.2 lb/ton)->						600 lbs/day	NA	NA
NaHS	Sodium Hydrosulfide							
$NaHS \bullet H_2O$	Sodium Hydrosulfide	66%	016721-80-5	No	No		NA	NA
H_2O	Water	27%	007732-18-5	No	No		NA	NA
$Na_2S \bullet 3H_2O$	Sodium Sulfide	< 6%	001313-82-2	No	No		NA	NA
Na_2CO_3	Sodium Carbonate	1%	000497-19-8	No	No		NA	NA
ALTERNATE OPERATING SCENARIO *(Use of Potassium Amyl Xanthate, PAX, in place of AERO 343 Xanthate)*								
Potassium Amyl Xanthate (PAX)-(Delivered in Pellet form then hydrated into slurry, usage rate = 0.12 lbs/ton of plant feed) -->						360 lbs/day		
	Potassium Sulfide	~ 1%		No	No		NA	NA
	Carbonodithioic Acid,						NA	NA
	(3-methylbutyl) ester,	> 90%		No	No		NA	NA
	potassium salt						NA	NA
	Potassium Hydroxide	0% to 1%		No	No		NA	NA

NOTES:

1 Listing per United States Federal Clean Air Act, Title I, Section 112(b) - Hazardous Air Pollutants (HAP).

2 Per EPA 40 CFR 51.100 definition of VOCs that includes list of VOCs specifically excluded from the definition (i.e. non-precursors to ozone, not photoreactive).

3 Maximum daily reagent usage rate based on maximum daily ore crusshing rate of 3000 STPD.

4 Maximum Incremental Reactivity, MIR (see definitions). MIR listed values per SAPRC-07 Chemical Mechanism software developed by the College of Engineering Center for Environmental Research and Technology (CE-CERT) at the University of California at Riverside (UCR) with funding by the California Air Resources Board (CARB).

Reagent Volatile Organic Compound (VOC) Emissions (PTE) - Con't

DEFINITIONS:

Volatilization - The conversion of a chemical substance from a liquid or solid state to a gaseous vapor state.

Volatile Organic Compound (VOC) - A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. However, for air permitting purposes, and, as defined in 40 CFR 51.100(s), the term VOC includes any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) which participates in atmospheric photochemical reactions. These photochemical reactions contribute to ozone and are therefore considered to be ozone precursors. Troposphere or ground-level ozone (i.e., smog) is formed by a combination of sun, nitrogen oxides (NOx), carbon monoxide (CO), and VOCs, such as xylene. Examples of ozone precursor VOCs include trichloroethane; trichloroethylene; and benzene, toluene, ethylbenzene, and xylene (BTEX). These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

Maximum Incremental Reactivity (MIR) - An incremental reactivity (IR) calculated for a volatile organic mixture where the emissions of NOx ($NO + NO_2$) have been adjusted to maximize the calculated MIR.
IR = $\Delta[O_3]/\Delta[VOC]$. For a specified set of meteorological conditions, emissions, and initial concentrations, the incremental reactivity of an organic compound is the change in the peak ozone concentration, in grams, divided by an incremental change in the initial concentration and emissions of the organic compound.

Annual Reagent Amounts:

Reagent	Usage (lbs/yr)
Aerofroth 70® Frother (MICB)	59,130
Aerofroth 65® Frother	6,570
Limate, Dolomitic Hydrated Lime	547,500
DAF-30	32,850
AERO 343 Xanthate	87,600
Sodium Hydrosulfide	219,000
Potassium Amyl Xanthate (PAX)	131,400
Total =	**1,084,050 lbs/yr**

AERO 343 Xanthate VOC Emissions (PTE)

NOTE: No volatile ingredients are presented in the MSDS for Potassium Amyl Xanthate (PAX) that is proposed as an alternate operating scenario, so, the following calculations for use of Sodium Isopropyl Xanthate present the highest emissions of the two scenarios.

Emission Calculation Parameters:

Concentrator Plant Operating Hours =	7300	hrs/yr
Xanthate usage =	[0.08 lbs/ton], of ore processed x [3000 STPD], maximum ore process design rate (tons per day - tpd)	
Xanthate usage =	240	lbs/day
Xanthate % Volatility (by volume) =	20	%
% Isopropanol (by weight), VOC =	5	%
Xanthate Density =	1.263	g/cm^3
Xanthate Density =	(1.263 g/cm^3) x (2.20E-03 lbs/g) x (2.64E-04 $gallons/cm^3$)	
Xanthate Density =	10.54	lbs/gallon

Reagent Volatile Organic Compound (VOC) Emissions (PTE) - Con't

Xanthate Volumetric Usage Rate:

Volume Usage = (240 lbs/day) x (1 gallon/10.54 lbs)
Volume Usage = 22.77 gallons/day
Annual Xanthate Mass Usage = (22.77 gal/day) x (365 days/yr)
Annual Xanthate Mass Usage = 8,311 lbs/yr

Volume of Volatile Xanthate:
Volatile Xanthate = (10.54 lbs/gallon) x (22.77 gallons/day) x (20% Volatility)
Volatile Xanthate = **48** **lbs/day**

Xanthate VOC Emissions (isopropanol):
Isopropanol VOC Emissions = (30.36 gallons/day) x (10.54 lbs/gallon) x (5% isopropanol)
Isopropanol VOC Emissions = **12** **lbs/day**

Isopropanol VOC Emissions = (16 lbs/day) x (365 days/yr)
Isopropanol VOC Emissions = 4380 lbs/yr
Isopropanol VOC Emissions = **2.19** **tpy**

MICB VOC Emissions (PTE)
MIBC Usage = [0.054 lbs/ton], of ore processed x [3000 STPD], maximum ore process design rate (tpd)
MIBC Usage = 162 lbs/day
MIBC % Volatility = 100% (by weight, See MSDS in **Appendix G** - Used for PTE)
so, MIBC VOC Emissions = **162** **lbs/day**
MIBC VOC Emissions = (162 lbs/day) x (365 days/yr)
MIBC VOC Emissions = 59,130 lbs/yr
MIBC VOC Emissions = **29.57** **tpy**

Conversion Factors
1 g = 2.20E-03 lbs
1 cm^3 = 2.64E-04 gallons
1 ton = 2,000 lbs

K. Reagent Hydrogen Sulfide Emissions (PTE)

Process Description

Hydrogen sulfide is formed as a result of a byproduct reaction between the sodium hydrosulfide reagent, used to modify the surface chemistry of copper minerals, and other agents in the concentrate slurry added during flotation. Also, sulfides react with disolved metals in the concentrate, forming metal sulfides that percipitate out. The Maximun Theoretical Emissions (MTE) of hydrogen sulfide (H2S) are calculated based on the maximum usage rate of sodium hydrosulfide per hour and on assumptions regarding the quantity of H_2S emissions.

Sodium Hydrosulfide Reagent Usage:

Maximum sodium hydrosulfide dosage rate = 0.2 lb/ton of ore
Maximum ore throughput rate = 3,000 STPH [Proposed Process Limit - *belt scale records for compliance*)
Maximum sodium hydrosulfide usage rate = (0.20 lb/ton) x (3,000 ton/day)
Maximum sodium hydrosulfide usage rate = 600 lbs/day
Maximum sodium hydrosulfide usage rate = (600 lbs/day ÷ 24 hrs/day)
Maximum sodium hydrosulfide usage rate = 25 lbs/hr

Composition of Sodium Hydrosulfide Reagent (See MSDS, Appendix G)

MSDS Reagent Ingredient	Chemical Formula	Molecular Weight	Weight Percent (%)	Hourly Rate (lbs/hr)[1]
Sodium Hydrosulfide	$NaHS \bullet H_2O$	74.07	66%	16.50
Water	H_2O	18.02	27%	6.75
Sodium Sulfide	$Na_2S \bullet 3H_2O$	132.09	6%	1.50
Sodium Carbonate	Na_2CO_3	105.99	1%	0.25

(1) Usage Rate = [Maximum Hydrosulfide Usage Rate, lbs/hr] x [Weight % of Ingredient]

Molecular Weight (H_2S): 34.08 lb_m/lb_{mol} where, lb_m = pound-mass

Emission Calculations - Emission calculations are based on the following equation:

Emissions = (Total H_2S Equivalent) - (Sulfide Precipitated H_2S Equivalent) - (Sulfide Oxidized H_2S Equivalent)

TOTAL H_2S EQUIVALENT

Total H_2S Equivalent$_1$ = [16.50 lbs NaHS/hr] x [(34.08 lbs H_2S) ÷ (74.07 lbs NaHS)]
Total H_2S Equivalent$_1$ = 7.59 lbs/hr
Total H_2S Equivalent$_2$ = [1.50 lbs Na_2S/hr] x [(34.08 lbs H_2S) ÷ (132.09 lbs Na_2HS)]
Total H_2S Equivalent$_2$ = 0.39 lbs/hr
Total H_2S Equivalent = (Total H_2S Equivalent$_1$) + (Total H_2S Equivalent$_2$)
Total H_2S Equivalent = **7.98 lbs/hr**

SULFIDE PRECIPITATED

It is conservatively assumed that 0.5 milligram per liter (mg/L) of sulfide (as S^{-2}) precipitates out as metal sulfides.
Flotation Slurry Flowrate[1] = 814.20 gallons per minute (gpm)
[1] See Flotation Flowsheet, average of Steam #305 and #312.

Sulfide Precipitated = [814.20 gpm] x [60 min/hr] x [0.5 mg S^{-2}/L] x [8.33 x 10-6 liter•lb/mg•gallon]
Sulfide Precipitated = 0.20 lb/hr as H_2S

TETRA TECH

Reagent Hydrogen Sulfide Emissions (PTE) - Cont'd

SULFIDE OXIDIZED

Oxidation of S^{-2} in the flotation slurry to sulfite or sulfate is expected to be 70 % of sulfide in the concentrate slurry.

Sulfur Oxidized H_2S Equivalent = [7.98 lbs H_2S/hr] x [0.70]

Sulfur Oxidized H_2S Equivalent = 5.59 lbs/hr as H_2S

Therefore:

MTE = [7.98 lbs H_2S/hr] - [0.20 lbs H_2S/hr] - [5.59 lbs (as H_2S)/hr]

MTE = **2.19 lbs/hr H_2S**

MTE = [2.19 lbs/hr] x [8,760 hrs/yr] ÷ 2000 lbs/ton

H_2S PTE = MTE[1] = 9.6 tpy

[1]Emissions are unrestricted and uncontrolled; therefore, potential emissions (PTE) are equivalent to MTE.

TETRA TECH

L. Xanthate Bag Breaker System Vent Emissions (PTE)

Process Description

Bags of Xanthate material will be transfered by hand to a Bag Breaker System. The Bag Breaker is used to break 100 pound bags of xanthate reagent and transfer the xanthate pellets to a vendor-supplied Reagent Mixing/Dilution System. Because the bags are assumed to weigh 100 pounds each and the amount of xanthate required at the peak Concentrator Plant process rate is 240 lbs/day, it is assumed that the process will use 2.4 bags per day or about 3 bags per day. *Although bag breaking does not occur all day, hourly emissions are averaged over the 24-hour period.*

Emissions Control Device

The Reagent Distribution System includes a Cyclonaire Bag Dump Station (See Appendix I) that uses plant compressed air at 3 scfm to 5 scfm compressed air at 90 psig to 110 psig for reverse pulse cleaning of Bag Dump Station filter elements . The Cyclonaire Bag Dump Station includes a 634 cfm exhaust fan, 1.5 hp, and three (3) filter cartridges with a manufacturer-supplied filter efficiency, inlet grain loading, guaranteed outlet grain loading, and exhaust blower outlet flow rate shown below.

Emission Calculation Methodology:

Manufacturer guaranteed controlled emissions in grains per actual cubic foot are used for PM and PM_{10}.

Emission Calculation Parameters and Vendor Provided Data:

Filter Efficiency =	99.99%	
Inlet Grain Loading =	30	grains/acf
Guaranteed Outlet Grain Loading =	0.0025	grains/acf
Operating Exhaust Flow Rate =	634	acfm

Emission Calculations (PTE):

PM (lbs/day) = [(0.0025 gr/cf) x (634 cfm) x (60 min/hr) x (24 hr/day x (2.29E-03 oz/gr)] ÷ [16 oz/lb] =	**0.33**	**lbs/day**
PM Xanthate Bag Breaker Emissions (lbs/week) = [PM (lbs/day)] x [7 days/week] =	2	lbs/wk
PM Xanthate Bag Breaker Emissions (lbs/year) = [PM (lbs/week)] x [52 weeks/year] =	833	lbs/yr
PM =	**0.42**	**tons/year**

PM_{10} (lbs/day) = [(0.0025 gr/scf) x (634 scfm) x (60 min/hr) x (24 hr/day)] ÷ [2.29E-03 oz/gr] ÷ [16 oz/lb] =	**0.33**	**lbs/day**
PM_{10} Xanthate Bag Breaker Emissions (lbs/week) = [PM_{10} (lbs/day)] x [7 days/week] =	2	lbs/wk
PM_{10} Xanthate Bag Breaker Emissions (lbs/year) = [PM_{10} (lbs/week)] x [52 weeks/year] =	833	lbs/yr
PM_{10} =	**0.42**	**tons/year**

Conversion Factors

1 grain =	2.29E-03	ounce
1 lb =	16	ounces
1 ton =	2,000	lbs

M. Xanthate HAP Emissions (PTE) - Tailings Dam

Process Description

Xanthates are widely used in flotation processes and have the propensity to decompose in the presence of moisture and/or heat to produce carbon disulfide (CAS #75150), a listed HAP under the U.S. Federal Clean Air Act (CAA), Title I, Section 112(b). When xanthates are used as a flotation agent they are usually pre-mixed with water at concentrations of about 10 per cent. Typical xanthates include sodium ethyl xanthate (SEX) and sodium isobutyl xanthate (SIBX), etc. - the ORM Facility will use sodium isopropyl xanthate (SIPX). Most of the xanthates are retained in the froth that contains the ore concentrate collected during the flotation process. Some (approximately 1 per cent) will be discharged to the tailings dam.

In the mining industry, xanthate solutions are usually used in a pH range of between 7 and 11. The decomposition stoichiometry will vary with the form of xanthate used at particular facilities. The stoichiometry of xanthate composition, and hence carbon disulfide formation, will also vary according to the pH. Assumed that 0.2 per cent will decompose hydrolytically to release carbon disulfide whereas heat and low pH will accelerate this process (Ref #9).

Emission Calculation Parameters and Data:

Xanthate Molecular Weight, SIPX (MW) =	158	(dimensionless)
Carbon Disulfide Molecular Weight, CS_2 (MW) =	76	(dimensionless)
Maximum SIPX Daily Usage =	240	lbs/day
% Hydrolytic decomposition to CS_2 at Tailings Dam =	0.2	%

Xanthate Decomposition Rates (Typical)

Conditions	Decomposition Coeficient "D" (Stoichiometry of hydrlytic decomposition of Xanthate to CS_2)
Alkaline	1.0:0.5
Acidic	1:1

Emission Calculations (PTE):

The emissions of CS_2 resulting from use of xanthates can be calculated using the following equation:

$$E_{CS_2} = D \times 0.2\% \times M_{xanthate} \times \frac{MW_{CS_2}}{MW_{xanthate}}$$

(Ref #9, Page 22, Equation 3)

Where,

E_{CS_2} = Emission of CS_2 (kg/yr)

D = Decomposition Coefficient = 0.5 (Assumes ORM Tailings Facility personnel maintain the tailings dam under alkaline conditions.)

$M_{xanthate}$ = Mass of xanthate consumed (kg/yr) = (240 lbs/day) x (365 days/year) x (4.54E-01 kg/lb) = 3.97E+04 kg/yr

MW_{CS2} = Molecular weight of CS_2 (= 76)

$MW_{xanthate}$ = Molecular weight of xanthate (= 158)

E_{CS_2} = 0.5 x 0.2% x 3.97E+04 kg/yr x (76 ÷ 158)

E_{CS_2} = 1.91E+01 kg/yr

E_{CS_2} = **4.21E+01 lbs/yr = 1.15E-01 lbs/day**

E_{CS_2} = 2.11E-02 tons/yr

E_{CS_2} = **2.11E-02 tpy**

Ref 9 : Commonwealth of Australia, National Pollutant Inventory (NPI), Emission Estimation Technique Manual For Mining, Version 3.0, Section 5.7 - Carbon Disulfide, June 2011.

Conversion Factors

1 lb = 4.54E-01 kilogram (kg)

1 ton = 2,000 lbs

TETRA TECH

N. Unpaved Roadway Emissions (PTE)

TSP, PM_{10}, and $PM_{2.5}$ Particulate Fugitive Emission Calculations for Vehicles on Unpaved Roads:

TSP, PM_{10}, and $PM_{2.5}$ = VMT x EF ,(lbs/year)

VMT = Vehicle Miles Traveled

Control Eff. = 70% (Use of water truck for dust suppression on unpaved roadways)

EF (lb/VMT) = k x (% silt content/12)^a x (vehicle weight/3)^b *[Ref.: AP42, Equation (1a), page 13.2.2-4]*

VMT Heavy = 788,022 VMT (Heavy) from Section 7

VMT Light = 186,150 VMT (Light) from Section 7

% silt content = 5.8% (Per AP42, Table 13.2.2-1, Taconite mining and processing used for Light Duty and Heavy Duty Vehicles - most representative entry)

NOTE: Reference for the following natural mitigation emission factor adjustment > Western Governors' Association (WRAP) Fugitive Dust Handbook, September 7, 2006, page 6-5.

Adjustment to EF for Natural Mitigation (E_{ext}) = E [(365 - P) / 365] , Equation (2) from WRAP Fugitive Dust Handbook (2006)

where, E_{ext} = Annual size-specific emission factor extrapolated for natural mitigation.

E = EF = Emission factor from AP42, Equation (1a), page 13.2.2-4.

P = Number of days is a year with at least 0.01 inches of precipitation.

P = 44 days/year for Tucson, Arizona [reference: The National Climatic Data Center (NCDC)].

EF Heavy TSP (lb/VMT) =	$4.9 \times (17/12)^{0.7} \times (25.4/3)^{0.45}$ =	0.307 lb/VMT	*[Ref.: AP42, Table 13.2.2-2, k=4.9, a=0.7, b=0.45]*
EF Heavy PM_{10} (lb/VMT) =	$1.5 \times (17/12)^{0.9} \times (25.4/3)^{0.45}$ =	0.094 lb/VMT	*[Ref.: AP42, Table 13.2.2-2, k=1.5, a=0.9, b=0.45]*
EF Heavy $PM_{2.5}$ (lb/VMT) =	$0.15 \times (17/12)^{0.9} \times (25.4/3)^{0.45}$ =	0.003 lb/VMT	*[Ref.: AP42, Table 13.2.2-2, k=0.15, a=0.9, b=0.45]*

Adjustments to EF for Natural Mitigation (E_{ext}):

EF Heavy TSP (lb/VMT) =	0.307 x [(365 - 44) / 365] =	0.270 lb/VMT
EF Heavy PM_{10} (lb/VMT) =	0.094 x [(365 - 44) / 365] =	0.083 lb/VMT
EF Heavy $PM_{2.5}$ (lb/VMT) =	0.003 x [(365 - 44) / 365] =	0.003 lb/VMT

UNCONTROLLED EMISSIONS - HEAVY DUTY VEHICLES

EF Heavy TSP =	2.13E+05	lb/yr	=	106	tpy	=	5.82E+02 lbs/day
EF Heavy PM_{10} =	6.51E+04	lb/yr	=	33	tpy	=	1.78E+02 lbs/day
EF Heavy $PM_{2.5}$ =	2.24E+03	lb/yr	=	1	tpy	=	6.14E+00 lbs/day

Controlled Emissions = Uncontrolledd Emissions x (1 - 0.70)

Note: Daily emissions based on 365 days per year to adhere to Pima County SIP definition for PTE.

CONTROLLED EMISSIONS - HEAVY DUTY VEHICLES

EF Heavy TSP =	6.38E+04	lb/yr	=	**31.88**	**tpy**	**=**	**174.67 lbs/day**
EF Heavy PM_{10} =	1.95E+04	lb/yr	=	**9.76**	**tpy**	**=**	**53.47 lbs/day**
EF Heavy $PM_{2.5}$ =	6.72E+02	lb/yr	=	0.34	tpy	=	1.92 lbs/day

EF Light TSP (lb/VMT) =	$4.9 \times (17/12)^{0.7} \times (7.4/3)^{0.45}$ =	0.176 lb/VMT	*[Ref.: AP42, Table 13.2.2-2, k=4.9, a=0.7, b=0.45]*
EF Light PM_{10} (lb/VMT) =	$1.5 \times (17/12)^{0.9} \times (7.4/3)^{0.45}$ =	0.054 lb/VMT	*[Ref.: AP42, Table 13.2.2-2, k=1.5, a=0.9, b=0.45]*
EF Light $PM_{2.5}$ (lb/VMT) =	$0.15 \times (17/12)^{0.9} \times (7.4/3)^{0.45}$ =	0.002 lb/VMT	*[Ref.: AP42, Table 13.2.2-2, k=0.15, a=0.9, b=0.45]*

Adjustments to EF for Natural Mitigation (E_{ext}):

EF Light TSP (lb/VMT) =	0.176 x [(365 - 63) / 365] =	0.155 lb/VMT
EF Light PM_{10} (lb/VMT) =	0.054 x [(365 - 63) / 365] =	0.047 lb/VMT
EF Light $PM_{2.5}$ (lb/VMT) =	0.002 x [(365 - 63) / 365] =	0.002 lb/VMT

UNCONTROLLED EMISSIONS - LIGHT DUTY VEHICLES

EF Light TSP =	2.88E+04	lb/yr	=	14.4	tpy	=	8.23E+01 lbs/day
EF Light PM_{10} =	8.82E+03	lb/yr	=	4.4	tpy	=	2.52E+01 lbs/day
EF Light $PM_{2.5}$ =	3.04E+02	lb/yr	=	1.52E-01	tpy	=	8.68E-01 lbs/day

Controlled Emissions = Uncontrolledd Emissions x (1 - 0.70)

Note: Daily emissions based on 365 days per year to adhere to Pima County SIP definition for PTE.

CONTROLLED EMISSIONS - LIGHT DUTY VEHICLES

EF Light TSP =	8.65E+03	lb/yr	=	**4.32**	**tpy**	**=**	**23.69 lbs/day**
EF Light PM_{10} =	2.65E+03	lb/yr	=	**1.32**	**tpy**	**=**	**7.25 lbs/day**
EF Light $PM_{2.5}$ =	9.11E+01	lb/yr	=	4.56E-02	tpy	=	2.50E-01 lbs/day

TETRA TECH

O. Construction Emissions (PTE)

ORM Facility construction emissions pertain to two (2) key above-ground construction activities, (1) Concentrator Building and Tailings Facility Building Construction, and (2) Tailings Pipeline Construction.

Construction Particulate Emission Calculation Methodology

Particulate emission factor used is AP-42, Section 13.2.3.3 (Heavy Construction Operations).

BUILDING STRUCTURE	AREA OF CONSTRUCTION (acres)	
Concentrator Plant Bldg	1.30	
Tailings Facility Bldg	0.25	
Total Construction Area =	**1.55**	**acres**

Construction Particulate Emission Calculations:

(1) *Building Construction (Concentrator and Tailings Facility Buildings)*

Total Area(s) of Construction = 1.55 acres

Duration of Construction = 12 months

Dust Control Permits in place - watering used to control particulate emissions

Control Efficiency = 70%

PM_{10} emission factor, E, per AP42, Section 13.2.3.3

E = 1.2 tons/acre/month of activity

Building Construction Emissions:

PM_{10} (uncontrolled) = (1.2 tons/acre/mo) X (1.55 acres) X (12 months)

PM_{10} (uncontrolled) = 22.32 tons

PM_{10} (uncontrolled) = 44,640 lbs

PM_{10} (controlled) = 44,640 lbs X (1 - 70%)

PM_{10} (controlled) = 13,392 lbs

PM_{10} (controlled) = **6.70** **tons**

(2) *Concentrate Pipeline Construction*

Estimated Construction Area = Estimated twenty (20) feet construction alignment width x two (2) miles

Estimated Construction Area = (20 ft) x (2 miles x 5,280 ft/mile)

Estimated Construction Area = 2.11E+05 ft^2

Estimated Construction Area = 4.85 acres

Duration of Construction = 3 months

Conversion Factors

1 acre = 43,560 ft^2

1 mile = 5,280 ft

Concentrate Pipeline Construction Emissions:

PM_{10} (uncontrolled) = (1.2 tons/acre/mo) X (4.85 acres) X (3 months)

PM_{10} (uncontrolled) = 17.45 tons

PM_{10} (uncontrolled) = 34,909 lbs

PM_{10} (controlled) = 34,909 lbs X (1 - 70%)

PM_{10} (controlled) = 10,473 lbs

PM_{10} (controlled) = **5.24** **tons**

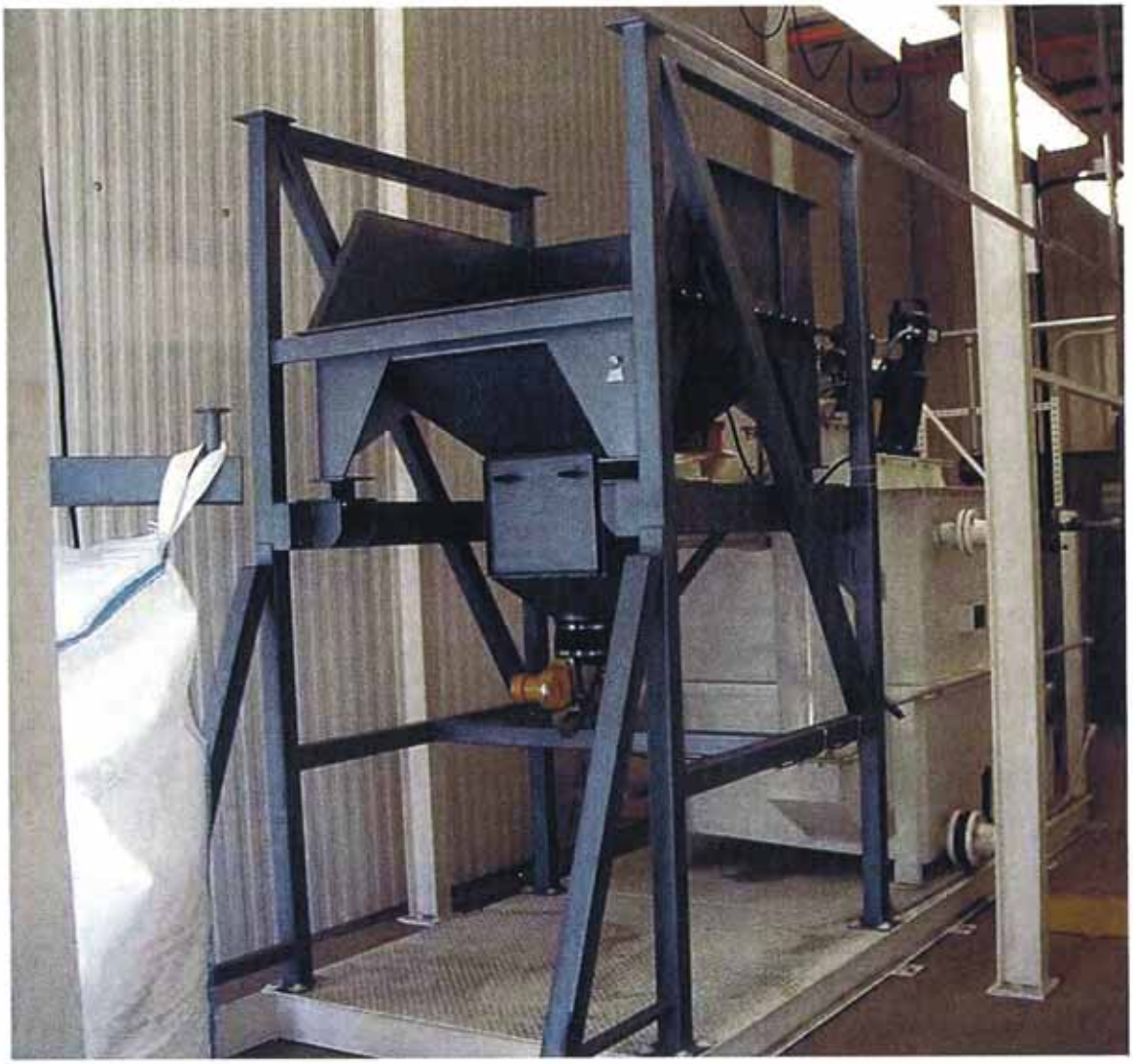
APPENDIX A

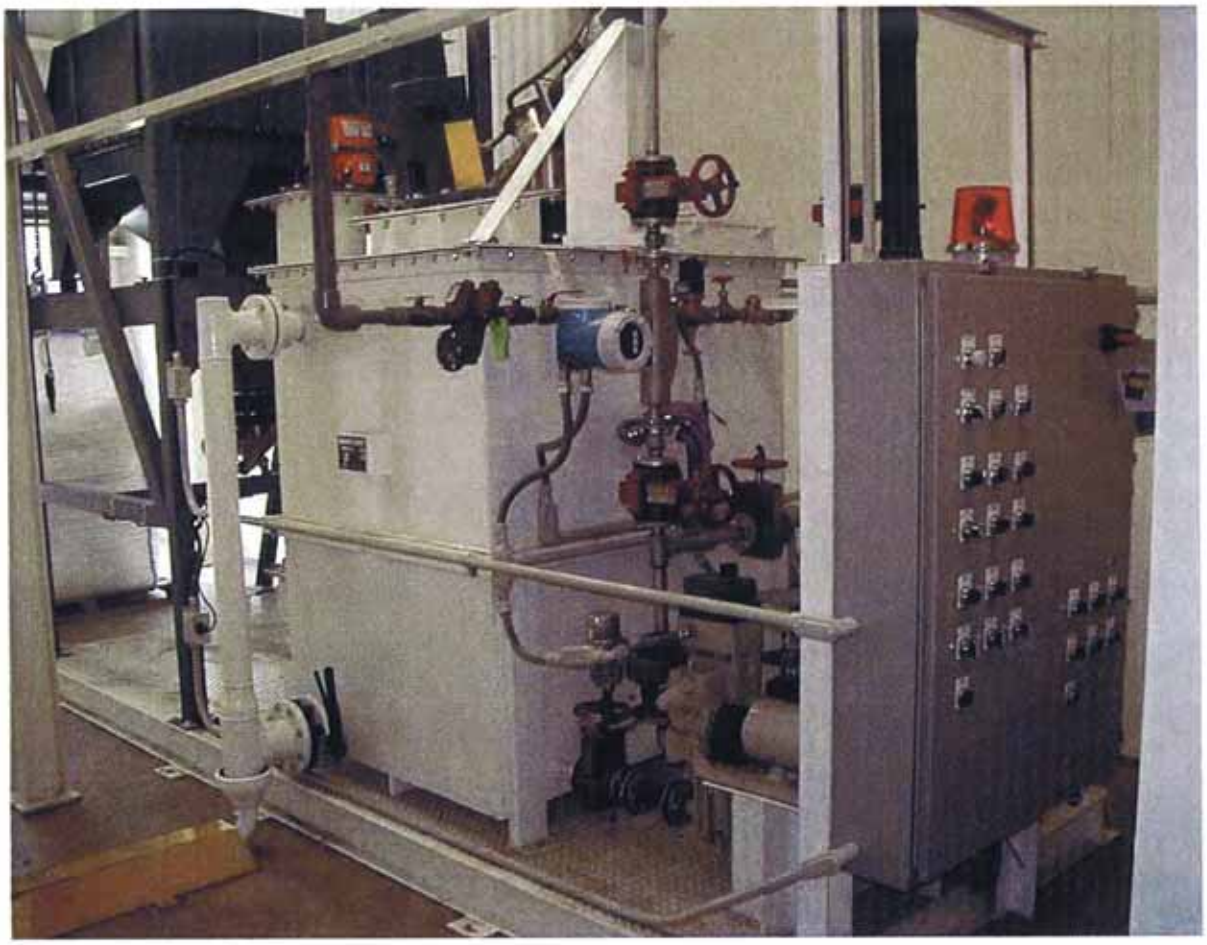
Oracle Ridge Mine, Merrick Bulk Bag Lime Unloader System and Griffin Fabric Filter Dust Controls

MERRICK

Dry Lime, Bulk Bag Unloader, High Density Slurry Production and Metering System

ConSeCo Model DLBBMFD



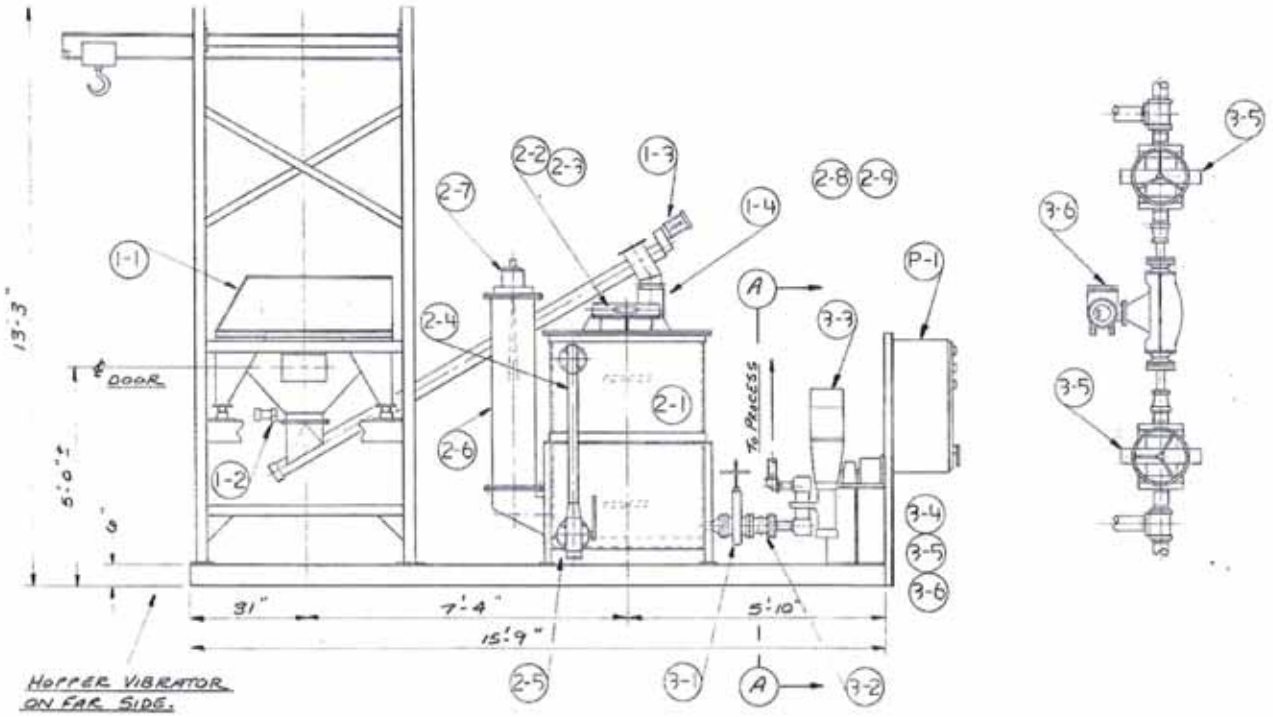


BRIEF DESCRIPTION OF SYSTEM OPERATIONS

1. System designed for bulk bag unloading.
2. Inclined feeder to meter lime.
3. High density slurry batching system
4. Metering pumps and mass flow-density meter to maintain and control density
5. System is designed to batch-in and pump-out at the same time and is PLC based.
6. System is skid mounted for ease of installation and factory assembly.

OPTIONS

A. Dust Collector & Fan
B. All contact parts are stainless steel
C. NEMA 4X stainless steel control panels



BILL OF MATERIALS

Mk.No.	Quan	Description
1-1	1	Bulk Bag Unloader w/Extended Leg Supports, Beam Hoist, 1-1/2Hp Vibrator
1-2	1	Electric Vibrator & Mounting Plate
1-3	1	AFC Screw Feeder
1-4	1	16" Lg. Flex Connector
2-1	1	3'6" x 4'0" x 5'0" High Stl. Mix Tank
2-2	1	10 Deg. Angled Mixer Mount
2-3	1	XJC117 Electric Mixer (Not Shown)
2-4	1	3" Overflow / 4" Drain Assembly
2-5	1	4" Butterfly Valve
2-6	1	Std. Still Well Assembly
2-7	1	Ultrasonic Level Control
2-8	1	14" x 20" Inspection Door
2-9	1	Std. 6" Breather Bag Assembly
3-1	2	2" Manual Pinch Valves
3-2	2	2" (1) Arch Expansion Joint
3-3	2	JESCO 1740 Series Metering Pump
3-4	2	2" In-line Pressure Sensor w/Gauge & Pressure Switch (Ga. & Sw, Not Shown)
3-5	6	2" Manual Pinch Valves (Suction / Bypass)
3-6	1	Mass Flow Density Meter
P-1	1	System Control Panel

System Weight With Full Bulk Bag & Slurry Tank
Approximately 14,000 lbs.

Required Services:
Electrical – 60Amp 460V/3ph/60Hz
Water – 1" Line @ 50 PSIG

MERRICK

Dry Lime, Bulk Bag Unloader, High Density Slurry Production and Metering System
ConSeCo Model DLBBMFD

Why High Density Lime Slurry?

1. *Lime slurries made from dry/hydrate lime will not, for all practical purposes, scale. This greatly reduces maintenance cost due to scaling of pumps, mixers, tanks, piping and valves.*
2. *High density lime slurries will not, for all practical purposes, settle and plug pipe lines, pumps, etc.*

System Design Standards

1. *All control panels are U.L. labels*
2. *Tank structures built to the United States Uniform Building Code*
3. *All wiring to the latest edition of the National Electrical Code*
4. *All structures have engineering calculations and P.E. stamp for the state installed*
5. *All ladders, cages, handrails, shaft guards, etc. OSHA design*
6. *Conseco Warranty; covers the equipment and the process*
7. *Dust collector written warranty to meet or exceed all requirements as imposed by the Clean Air Act of 1994*

For more information about liquid lime handling systems contact

MERRICK
MERRICK INDUSTRIES, INC

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Fax: (850) 265-1824
e-mail: info@merrick-inc.com
www.merrick-inc.com

Merrick de Mexico
Parral 78, BIS sexton piso
Delef. Cuauhtemoc
Col. Condesa 06140 MEXICO, D.F.
Phone: (011)(52)(555) 286-3544
Fax: (011)(52)(555) 553-4063

GRIFFIN FILTERS
Merrick Industries, Inc.

GRIFFIN FILTERS – NFPA/OSHA Compliant for your safety!

COLLECTION EFFICIENCY

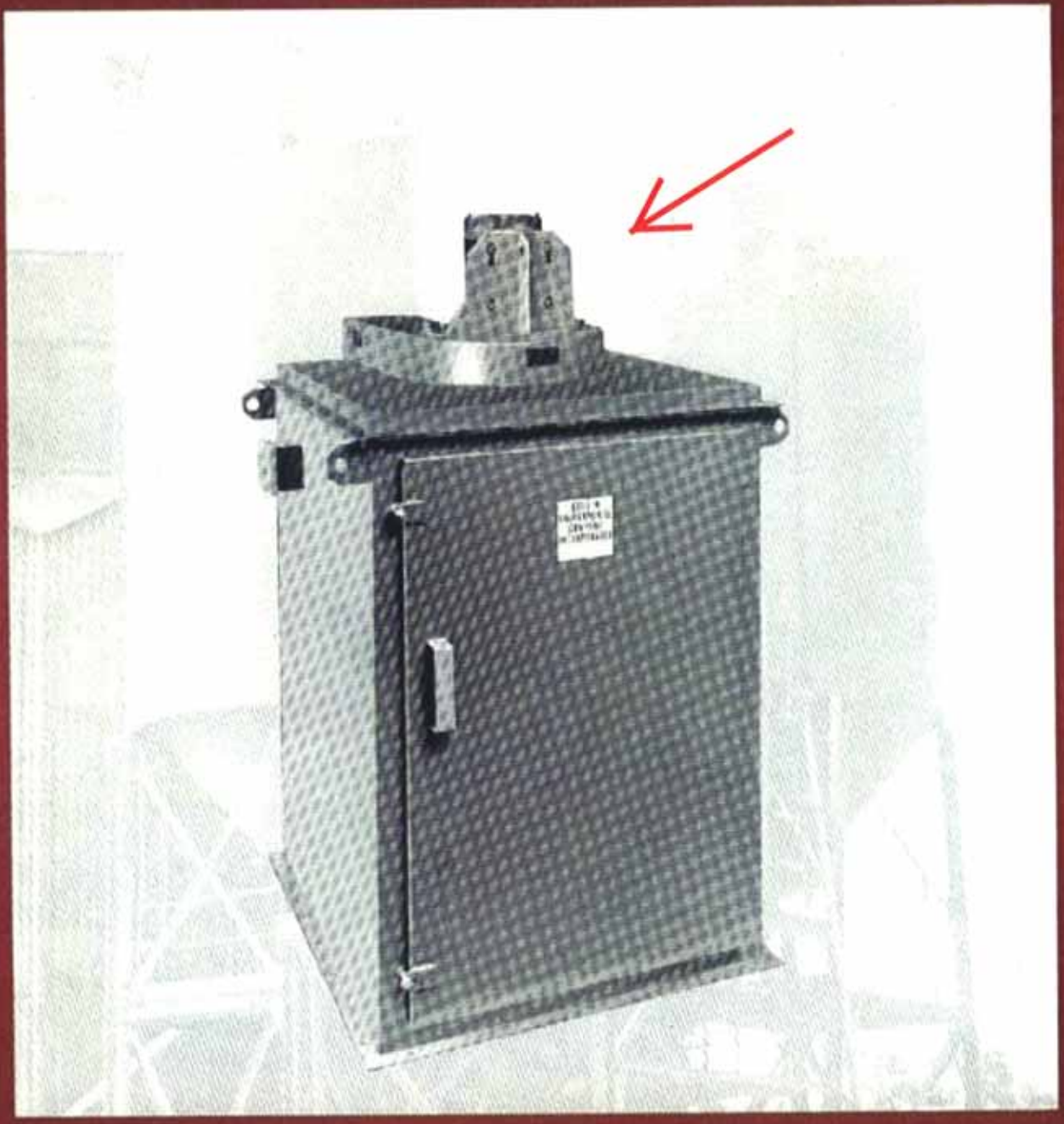
Merrick Industries & Griffin Filters guarantees that the fabric filter dust collectors, as quoted in Griffin Filters' proposals, will collect, at minimum, 99.9%+ down to 1 micron based on the weight of the suspended solids contained in the gas entering the dust collector. An outlet loading of .02 grains per actual cubic foot or less shall constitute fulfillment of the guarantee and current requirements. This guarantee is based on the parameters as outlined in the proposal. The guarantee is invalid if the equipment is not installed, properly precoated, operated, or maintained within the guidelines of Griffin's installation, operation and maintenance manual. Testing shall be done using EPA test method 5. If test results indicate the dust collectors are out of compliance, Griffin personnel shall address the problem in the following manner:

1) If bag material or workmanship is found to be the cause of the non-compliance, Griffin will replace the bags in question at no charge, or make compensation to the end user in the amount of our cost of the bags to be replaced on a one-for-one basis.

2) If the failure is a result of faulty installation, faulty operation, or incorrect maintenance, or the system failure is a result of continuous operation in an upset condition, or the operating conditions have been altered from those defined in the initial specification, then all guaranties and warranties are void.

Silo Filter Vents

Weigh Batcher Filter Vents
Overfill Control Systems



Pollution Control Systems
Designed, Engineered and Manufactured by

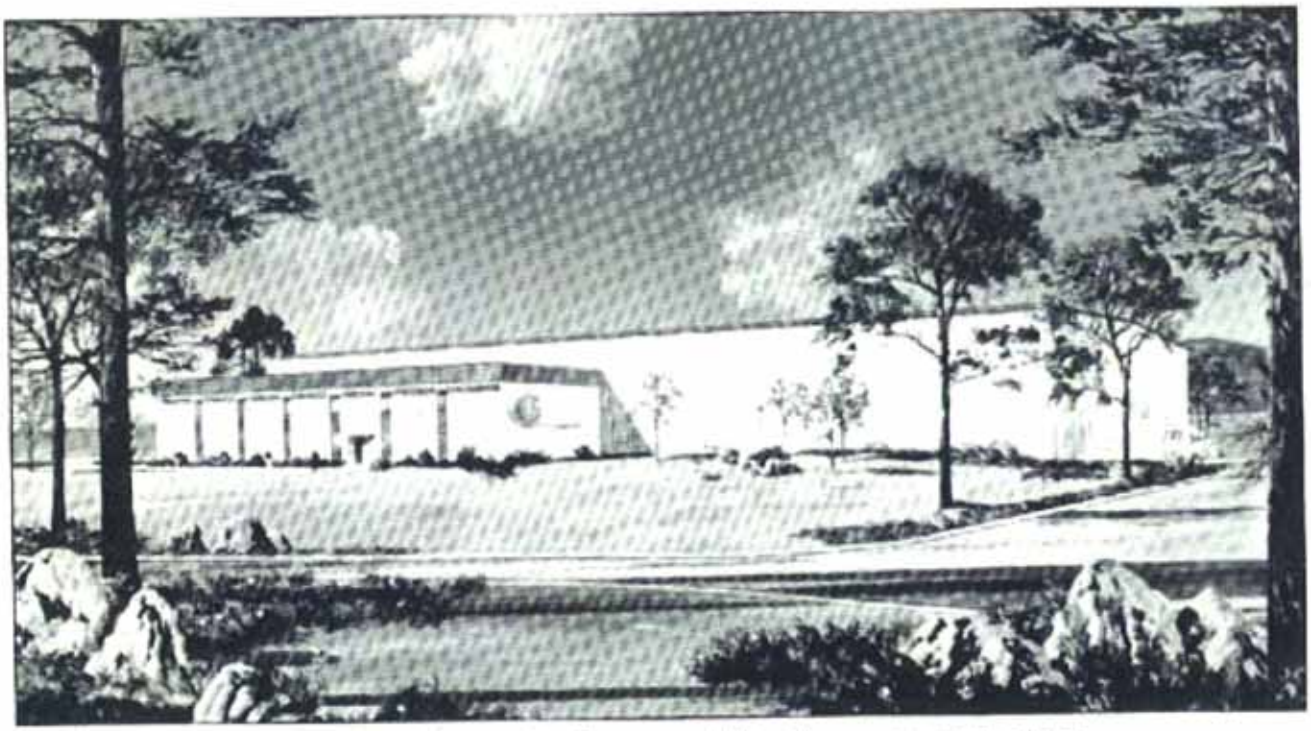
Griffin Environmental Company, Inc.

Discover Why Griffin is Unique in the Dust Collection Industry

If all dust problems were easily solved our ruggedly built standard collectors would be our only business.

In fact, most dust collection problems present opportunities for individual attention and specifications. It is here that Griffin can best serve its customer's needs.

Griffin dust collectors are designed, engineered and manufactured in our own plant under rigid quality standards. Communication between our engineers and the factory is a convenient, ongoing process. At Griffin, custom engineering and individual attention are not just promises. They are built into every unit.



Our new manufacturing plant is located in Syracuse, NY at the cross roads of the New York State Thruway and Interstate 690.

DUSTY DUSTLESS has been clearing the air for over 30 years. Let him handle your dust problems.

Filter Vent Products

Silo Filter Vents

These units are small, compact collectors used in all phases of pneumatic venting of tanks and silos, or other applications where usage or filtering is not continuous. Filter Bags are cleaned by motorized shaking. These filter vents can quickly pay for themselves by returning valuable materials to the silo.

The shaking mechanism is of rugged design, providing years of dependable service with minimum maintenance. The collector housing is manufactured from heavy gauge steel all-welded construction. The unit is shipped factory assembled, bagged and fully tested.

Weigh Batcher Filter Vents

This batcher filter vent not only catches the dust escaping from a weigh batcher, but returns it to the same batcher for product recovery. The Griffin Weigh Batcher Filter Vent is easy to install and requires a minimum of maintenance. Housing is of welded construction.

Overfill Control System

Silo overfilling is a common problem which results in not only a large waste of material but sometimes can do costly damage to a silo filter vent. The Overfill Control System completely automates silo filling and venting, and extends the life of the silo filter vent.

Silo Filter Vents With Blower

Model 36-JS Filter Vent

Griffin Blower Filter Vents are used on many types of silo applications. This unit is provided with a blower which creates a slight negative pressure (vacuum) inside the silo, allowing the air mass to escape more rapidly and resulting in faster pneumatic unloading.

This unit is also recommended for silos which do not have a positive seal (i.e. cracks, split seams, loose hatches, etc.), as the blower will prevent material from escaping due to a defective closure. This also applies to silos that are filled by belt conveyors or bucket elevators. With the Blower Filter Vent unit, the problem of back pressure forcing dust from the storage silo can be eliminated.

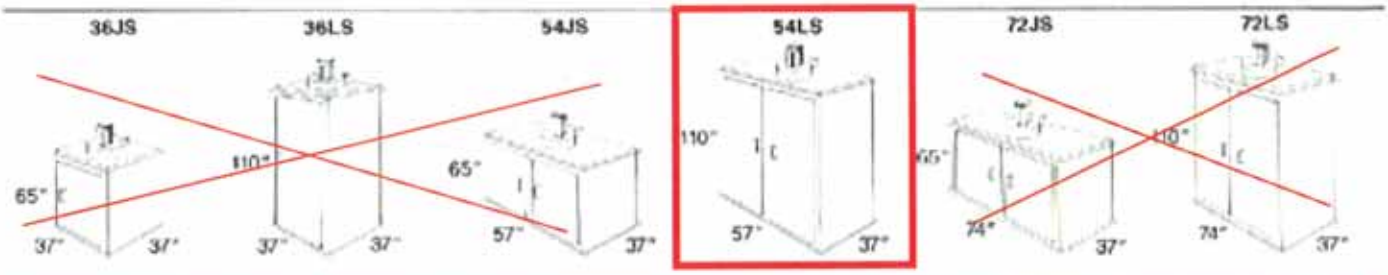
Standard bags for this unit are snap-in woven polyester.

Optional Solid State Electrical Control

The C-8 Control is used with Blower Filter Vent models 36-JS, 36-LS, 54-JS, 54-LS, 72-JS and 72-LS. Operation is very similar to the C-10 control described on the facing page. However, additional circuits are provided for the manual operation of the blower. When the operator shuts off the blower, he automatically starts the shaking cycle described for the C-10 control.

The control is provided in a NEMA 4 enclosure, 115V 1φ 60Hz operation.

NOTE: Motor starters are not included but may be required by local codes. They are offered as optional equipment.



Model No.	Cloth Area	Number of Bags	Length of 4" Diameter Bags	Shaker Motor HP/Volts/Phase	Blower CFM at 4" W.C.	Blower CFM at 6" W.C.	Blower HP*	Weight (lbs.)
36-JS	125 sq. ft.	36	38-1/2"	1/6-115-1	1120	920	2	585
36-LS	250 sq. ft.	36	79"	1/6-115-1	1560	1280	5	845
54-JS	188 sq. ft.	54	38-1/2"	1/4-230/460-3	1560	1280	5	665
54-LS	375 sq. ft.	54	79"	1/4-230/460-3	1560	1280	5	1160
72-JS	250 sq. ft.	72	38-1/2"	1/4-230/460-3	1560	1280	5	1000
72-LS	500 sq. ft.	72	79"	1/4-230/460-3	2000	1720	5	1600

* Blower Motor Voltage: 230/460V 3PH 60Hz

Continuous Duty Shaker Filter Vents

Mechanical Shaker with Blower

This Filter Vent is widely used in pneumatic venting and other operations requiring continuous filtration. It is designed for moderate usage, where compressed air for cleaning may not be available.

Housing is manufactured from heavy-gauge steel, all-welded construction, and is divided into two individual compartments.

The unit achieves continuous operation by being able to collect dust in one compartment while the other is cleaning. Airflow is regulated from one compartment to the other by a pneumatically or electrically operated "Y" valve. Filter bags are cleaned mechanically by two independent shaker systems, one in each compartment.

This model includes a blower with outlet weather hood and control panel as standard equipment, as well as the manifold ductwork with swing valve and actuator. As with all Griffin units, it is shipped assembled, bagged and factory tested.

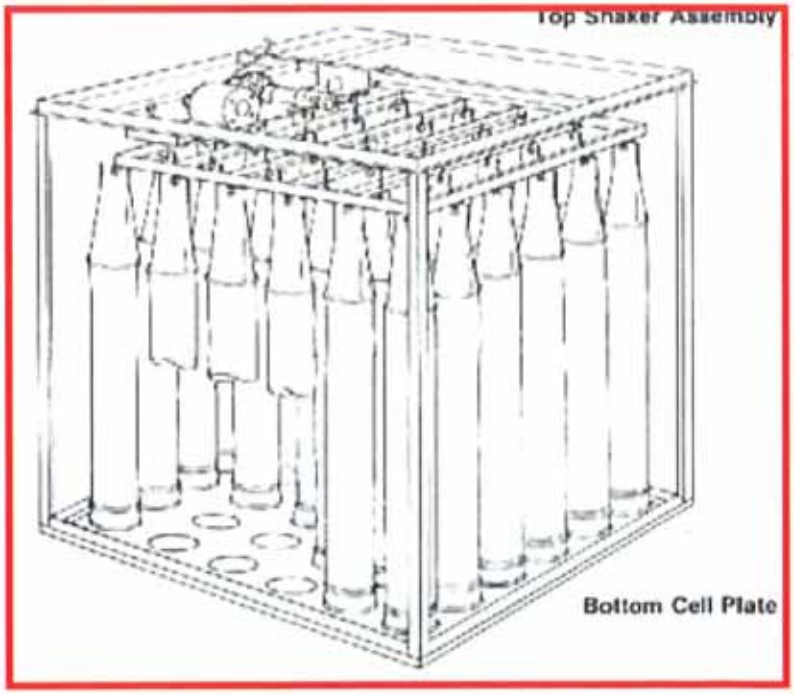
72CS

Model No.	Cloth Area	Number of Bags	Length of 4" Diameter Bags	Shaker Motor HP/Volts/Phase	Blower CFM at 4" WC	Blower Motor HP/Volts/Phase	Weight (lbs.)
72-CS	500 sq. ft.	72	79"	(2)1/6 HP-115-1	1560	5-230/460/3	1410

How Filter Bags Are Attached and Shaken

Shaker mechanism consists of motor, drive, saw mandrel, eccentric and relay arm. Motor drives saw mandrel and eccentric, which moves relay arm. Shaker arm is attached to bag rack. Rack is shaken horizontally causing the dust from the bags to drop, by gravity, into the silo or hopper.

Bags have grommet top for attaching to screw hook on bag rack and garter spring bottom for snapping into tube sheet.



Over 30 Years of Know-How Are Built Into Griffin Dust Collectors

FOR INDUSTRY...FOR CONSTRUCTION

Experience A leader in the design and manufacture of pollution control equipment for over three decades...with over 25,000 installations, world-wide.

Quality Ruggedly built for top efficiency plus years of reliable service and trouble-free operation. Griffin units are easy to install, easy to operate and easy to maintain.

Versatility Our business is innovative design and application know-how. We offer systems for every need, both standard units and custom designed.

Engineering All units are designed and engineered by our own experienced staff, with capabilities extending from the manufacture of individual components through the fabrication of complete systems.

Fabrication All Griffin equipment is built in our Syracuse, N.Y., plant under rigid quality and manufacturing standards. Our employees are experienced and dedicated.

Service Our network of sales representatives is qualified to understand the needs of our customers. They will provide expert advice as to the specifications that will meet your requirements fully and economically.

Griffin Environmental, Inc. is dedicated to ongoing research and development and therefore reserves the right to change design and specifications without notice.

GRIFFIN ENVIRONMENTAL CO., INC.
7066 Interstate Island Road
Syracuse, NY 13209
Phone: 315/451 5300
Telex No. 937415

APPENDIX B

Clarke Emergency Fire Pump Engine Data Sheets

CLARKE®

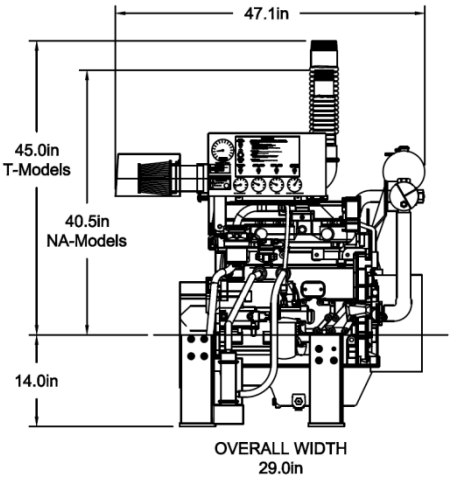
FIRE PUMP ENGINES

MODELS

JU4H-UF10 JU4H-UF12 JU4H-UF14 JU4H-UF20 JU4H-UF22 JU4H-UFAB26 JU4H-UF24 JU4H-UF30 JU4H-UF32 JU4H-UF34 JU4H-UFH8 JU4H-UFH0 JU4H-UFH2 JU4H-UF40 JU4H-UF42 JU4H-UF58 JU4H-UF50 JU4H-UF52 JU4H-UF54

FM-UL-cUL APPROVED RATINGS BHP/*KW*

JU4H MODEL ♦	RATED SPEED 1470		1760		2100		2350		2600		2800		3000		US-EPA (NSPS) Available Until ●
UF10			41	*31*	51	*38*	55	*41*							*12/31/10*
UF12							55	*41*	59	*44*					*12/31/10*
UF14											70	*52*	71	*53*	*12/31/13 +*
UF20			60	*45*	67	*50*	72	*54*							*12/31/10*
UF22							72	*54*	75	*56*					*12/31/10*
UFAB26											80	*60*			*12/31/13 +*
UF24											80	*60*	83	*62*	*12/31/13 +*
UF30			64	*48*	79	*59*	85	*63*							*12/31/10*
UF32							85	*63*	85	*63*					*12/31/10*
UF34											104	*78*	115	*86*	*12/31/10 +*
UFH8	63	*47*	73	*54*											*12/31/13*
UFH0			73	*54*	88	*66*	98	*73*							*12/31/10*
UFH2							98	*73*	99	*74*					*12/31/10*
UF40			94	*70*	105	*78*	106	*79*							*12/31/10 ▼* *12/31/09 ▲*
UF42							106	*79*	106	*79*					*12/31/09*
UF58	79	*59*	110	*82*											*12/31/09*
UF50			110	*82*	130	*97*	127	*95*							*12/31/09*
UF52							127	*95*	127	*95*					*12/31/09*
UF54											145	*108*	145	*108*	*12/31/12 +*



● USA EPA (NSPS) Emissions Compliant. Applies to John Deere model year per Table 4 of 40 CFR Part 60 Sub Part IIII.

♦ All Models are available for Export

\+ Not Available in California

▼ Less than 100HP

▲ Greater than 99HP

SPECIFICATIONS

ITEM	JU4H MODELS UF10/12/14	UF20/22/AB26/24	UF30/32/34	UFH8/H0/H2	UF40/42	UF58/50/52/54
Number of Cylinders	4					
Aspiration	NA		T			
Rotation*	CW					
Weight – lb (kg)	910 (413)		935 (424)			
Compression Ratio	17.6:1		17.0:1			
Displacement – cu. in. (L)	275 (4.5)					
Engine Type	4 Stroke Cycle – Inline Construction					
Bore & Stroke – in. (mm)	4.19 x 5.00 (106 x 127)					
Installation Drawing	D534					
Wiring Diagram AC	C07591					
Wiring Diagram DC	C071590					
Engine Series	John Deere 4045 Series					
Speed Interpolation	OPT.					

Abbreviations: CW – Clockwise NA – Naturally Aspirated T – Turbocharged
*Rotation viewed from Heat Exchanger / Front of engine

CERTIFIED POWER RATING

- Each engine is factory tested to verify power and performance.
- Although FM-UL ratings are shown at specific speeds, Clarke engines with optional speed interpolation can be applied at any intermediate speed. To determine the intermediate speed power; make a linear interpolation from the Clarke FM-UL power curve. Contact Clarke or your Pump OEM Representative to obtain details.

ENGINE RATINGS BASELINES

- Engines are to be used for stationary emergency standby fire pump service only. Engines are to be tested in accordance with NFPA 25.
- Engines are rated at standard SAE conditions of 29.61 in. (752.1 mm) Hg barometer and 77°F (25°C) inlet air temperature [approximates 300 ft. (91.4 m) above sea level] by the testing laboratory (see SAE Standard J 1349).
- A deduction of 3 percent from engine horsepower rating at standard SAE conditions shall be made for diesel engines for each 1000 ft. (305 m) altitude above 300 ft. (91.4 m)
- A deduction of 1 percent from engine horsepower rating as corrected to standard SAE conditions shall be made for diesel engines for every 10°F (5.6°C) above 77°F (25°C) ambient temperature.

ENGINE EQUIPMENT

EQUIPMENT	STANDARD	OPTIONAL
Air Cleaner	Direct Mounted, Washable, Indoor Service with Drip Shield	Disposable, Drip Proof, Indoor Service Outdoor Type
Alternator	12V-DC, 42 Amps with Poly-Vee Belt and Guard	24V-DC, 40 Amps with Poly-Vee Belt and Guard
Exhaust Protection	Blankets on UF10/12/14/20/22/AB26/24; Metal Guards on Manifolds and Turbocharger on UF30/32/34/H8/H0/H2/40/42/58/50/52/54	
Coupling	Bare Flywheel	Listed Driveshaft and Guard, UF10/12/14, UF20/22/AB26/24 – CDS10-SC; UF30/32/34, UFH8/H0/H2, UF40/42 – CDS20-SC; UF58/50/52/54 – CDS30-S1
Exhaust Flex Connection	For NA Engines - Stainless Steel Flex, NPT(M) Connection, 3” For T Engines – Stainless Steel Flex, NPT(M) Connection, 4”	For NA Engines – Stainless Steel Flex, NPT(M) Connection, 4” For T Engines - Stainless Steel Flex, 150# ANSI Flanged Connection, 5”
Flywheel Housing	SAE #3	
Flywheel Power Take Off	11.5” SAE Industrial Flywheel Connection	
Fuel Connections	Fire Resistant, Flexible, USA Coast Guard Approved, Supply and Return Lines	Stainless Steel, Braided, cUL Listed, Supply and Return Lines
Fuel Filter	Primary Filter with Priming Pump	
Fuel Injection System	Stanadyne Direct Injection	
Engine Heater	120V-AC, 1500 Watt	240V-AC, 1500 Watt
Governor, Speed	Constant Speed, Mechanical	
Heat Exchanger	Tube and Shell Type, 60 PSI (4 BAR), NPT(F) Connections	
Instrument Panel	English and Metric, Tachometer, Hourmeter, Water Temperature, Oil Pressure and Two (2) Voltmeters	
Junction Box	Integral with Instrument Panel; For DC Wiring Interconnection to Engine Controller	
Lube Oil Cooler	Engine Water Cooled, Plate Type	
Lube Oil Filter	Full Flow with By-Pass Valve	
Lube Oil Pump	Gear Driven, Gear Type	
Manual Start Control	On Instrument Panel with Control Position Warning Light	
Overspeed Control	Electronic with Reset and Test on Instrument Panel	
Raw Water Solenoid Operation	Automatic from Fire Pump Controller and from Engine Instrument Panel	
Run – Stop Control	On Instrument Panel with Control Position Warning Light	
Run Solenoid	12V-DC Energized to Run	12V-DC Energized to Stop; 24V-DC Energized to Run; 24V-DC Energized to Stop
Starters	Two (2) 12V-DC	Two (2) 24V-DC
Throttle Control	Adjustable Speed Control, Tamper Proof	
Water Pump	Centrifugal Type, Poly-Vee Belt Drive with Guard	

Abbreviations: DC –Direct Current, AC – Alternating Current, SAE – Society of Automotive Engineers, NPT(F) – National Pipe Tapered Thread (Female), NPT(M) – National Pipe Tapered Thread (Male), NA – Naturally Aspirated, T- Turbocharged, ANSI – American National Standards Institute

MODEL NOMENCLATURE (10 Digit Models)

J U 4 H - UF A B 26

- John Deere Base Engine
- 350 Series
- 4 Cylinder
- Heat Exchanger Cooled
- UL Listed and FM Approved
- Built in USA
- EPA NSPS Compliant
- Power Curve Number

MODEL NOMENCLATURE (8 Digit Models)

J U 4 H - UF 34

- John Deere Base Engine
- 350 Series
- 4 Cylinder
- Heat Exchanger Cooled
- UL Listed and FM Approved
- Power Curve Number

CLARKE®

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United States of America
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www.clarkefire.com

CLARKE UK, Ltd.
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United Kingdom
Tel +44-1236-429946 Fax +44-1236-427274
www.clarkefire.com

C13600 revJ
28JULY11

Specifications and information contained in this brochure subject to change without notice.

CLARKE

Fire Protection Products, Inc.

JU4H-UF34

INSTALLATION & OPERATION DATA (I&O Data)

USA Produced

Basic Engine Description

Engine Manufacturer	John Deere Co.
Ignition Type	Compression (Diesel)
Number of Cylinders	4
Bore and Stroke - in (mm)	4.19 (106) X 5 (127)
Displacement - in³ (L)	275 (4.5)
Compression Ratio	17.0:1
Valves per cylinder	
Intake	1
Exhaust	1
Combustion System	Direct Injection
Engine Type	In-Line, 4 Stroke Cycle
Fuel Management Control	Mechanical, Rotary Pump
Firing Order (CW Rotation)	1-3-4-2
Aspiration	Turbocharged
Rotation, viewed from front of engine, Clockwise (CW)	Standard
Engine Crankcase Vent System	Open
Installation Drawing	D534
Weight - lb (kg)	935 (424)

Power Rating	**2350**	**2600**	**2800**	**3000**
Nameplate Power - HP (kW)	85 (63)	85 (63)	104 (78)	115 (86)

Cooling System - [C051128]	**2350**	**2600**	**2800**	**3000**
Engine Coolant Heat - Btu/sec (kW)	40 (42.2)	42 (44.3)	51 (53.8)	58 (61.2)
Engine Radiated Heat - Btu/sec (kW)	19.2 (20.3)	19.2 (20.3)	23.7 (25)	26.1 (27.5)
Heat Exchanger Minimum Flow				
60°F (15°C) Raw H_20 - gal/min (L/min)	7 (26.5)	7 (26.5)	9 (34.1)	9 (34.1)
95°F (35°C) Raw H_20 - gal/min (L/min)	10 (37.9)	10 (37.9)	12 (45.4)	14 (53)
Heat Exchanger Maximum Cooling Raw Water				
Inlet Pressure - psi (bar)	60 (4.1)			
Flow - gal/min (L/min)	40 (151)			
Typical Engine H_20 Operating Temp - °F (°C)[1]	170 (76.7) - 190 (87.8)			
Thermostat				
Start to Open - °F (°C)	187 (86.1)			
Fully Opened - °F (°C)	196 (91.1)			
Engine Coolant Capacity - qt (L)	14.8 (14)			
Coolant Pressure Cap - lb/in² (kPa)	10 (68.9)			
Maximum Engine Coolant Temperature - °F (°C)	200 (93.3)			
Minimum Engine Coolant Temperature - °F (°C)	160 (71.1)			
High Coolant Temp Alarm Switch - °F (°C)	205 (96.1)			

Electric System - DC	**Standard**		**Optional**	
System Voltage (Nominal)	12		24	
Battery Capacity for Ambients Above 32°F (0°C)				
Voltage (Nominal)	12	[C07633]	24	[C07633]
Qty. Per Battery Bank	1		2	
SAE size per J537	8D		8D	
CCA @ 0°F (-18°C)	1375		1375	
Reserve Capacity - Minutes	430		430	
Battery Cable Circuit, Max Resistance - ohm	0.0012		0.0012	
Battery Cable Minimum Size				
0-120 in. Circuit Length[2]	00		00	
121-160 in. Circuit Length[2]	000		000	
161-200 in. Circuit Length[2]	0000		0000	
Charging Alternator Maximum Output - Amp,	40	[C07639]	40	[C071048]
Starter Cranking Amps, Rolling - @60°F (15°C)	345	[RE59595/RE59589]	250	[C07819/C07820]

NOTE: This engine is intended for indoor installation or in a weatherproof enclosure. [1]Engine H_2O temperature is dependent on raw water temperature and flow. [2]Positive and Negative Cables Combined Length.

CLARKE

Fire Protection Products, Inc.

JU4H-UF34

INSTALLATION & OPERATION DATA (I&O Data)

USA Produced

Exhaust System	**2350**	**2600**	**2800**	**3000**
Exhaust Flow - ft.³/min (m³/min)	602 (17)	631 (17.9)	788 (22.3)	910 (25.8)
Exhaust Temperature - °F (°C)	966 (519)	901 (483)	952 (511)	949 (509)
Maximum Allowable Back Pressure - in H_20 (kPa)	30 (7.5)	30 (7.5)	30 (7.5)	30 (7.5)
Minimum Exhaust Pipe Dia. - in (mm)[3]	4 (102)	4 (102)	4 (102)	4 (102)

Fuel System	**2350**	**2600**	**2800**	**3000**
Fuel Consumption - gal/hr (L/hr)	4.5 (17)	7.8 (29.5)	9.1 (34.4)	8.6 (32.6)
Fuel Return - gal/hr (L/hr)	9 (34.1)	9.5 (36)	9.9 (37.5)	10.3 (39)
Fuel Supply - gal/hr (L/hr)	13.5 (51.1)	17.3 (65.5)	19 (71.9)	18.9 (71.5)
Fuel Pressure - lb/in² (kPa)	3 (20.7) - 6 (41.4)			
Minimum Line Size - Supply - in.	.50 Schedule 40 Steel Pipe			
Pipe Outer Diameter - in (mm)	0.848 (21.5)			
Minimum Line Size - Return - in.	.375 Schedule 40 Steel Pipe			
Pipe Outer Diameter - in (mm)	0.675 (17.1)			
Maximum Allowable Fuel Pump Suction Lift with clean Filter - in H_20 (mH_20)	31 (0.8)			
Maximum Allowable Fuel Head above Fuel pump, Supply or Return - ft (m)	4.5 (1.4)			
Fuel Filter Micron Size	2			

Heater System	**Standard**	**Optional**
Engine Coolant Heater		
Wattage (Nominal)	1500	1500
Voltage - AC, 1 Phase	115 (+5%, -10%)	230 (+5%, -10%)
Part Number	[C124948]	[C124949]

Air System	**2350**	**2600**	**2800**	**3000**
Combustion Air Flow - ft.³/min (m³/min)	231.6 (6.6)	255 (7.2)	305.2 (8.6)	352.9 (10)
Air Cleaner	**Standard**		**Optional**	
Part Number	[C03249]		[C03327]	
Type	Indoor Service Only, with Shield		Canister, Single-Stage	
Cleaning method	Washable		Disposable	
Air Intake Restriction Maximum Limit				
Dirty Air Cleaner - in H_20 (kPa)	10 (2.5)		10 (2.5)	
Clean Air Cleaner - in H_20 (kPa)	5 (1.2)		5 (1.2)	
Maximum Allowable Temperature (Air To Engine Inlet) - °F (°C)[4]	130 (54.4)			

Lubrication System	
Oil Pressure - normal - lb/in² (kPa)	35 (241) - 50 (345)
Low Oil Pressure Alarm Switch - lb/in² (kPa)	20 (138)
In Pan Oil Temperature - °F (°C)	220 (104) - 245 (118)
Total Oil Capacity with Filter - qt (L)	15.5 (14.7)

Lube Oil Heater	**Optional**	**Optional**
Wattage (Nominal)	150	150
Voltage	120V (+5%, -10%)	240V (+5%, -10%)
Part Number	C04430	C04431

Performance	**2350**	**2600**	**2800**	**3000**
BMEP - lb/in² (kPa)	104 (717)	94 (648)	107 (738)	110 (758)
Piston Speed - ft/min (m/min)	1958 (597)	2167 (661)	2333 (711)	2500 (762)
Mechanical Noise - dB(A) @ 1m	C131534			
Power Curve	C131090			

[3]Based on Nominal System. Back pressure flow analysis must be done to assure maximum allowable back pressure is not exceeded. (Note: minimum exhaust Pipe diameter is based on: 15 feet of pipe, on 90° elbow, and a silencer pressure drop no greater than one half of the maximum allowable back pressure.) [4]Review for horsepower derate if ambient air entering engine exceeds 77°F (25°C). [ ] indicates component reference part number.

JU4H-UF34
Stationary Fire Pump Engine Driver
EMISSION DATA
EPA 40 CFR Part 60

4 *Cylinders*
Four *Cycle*
Lean *Burn*
Turbocharged

500 PPM SULFUR #2 DIESEL FUEL								
RPM	BHP [3]	FUEL GAL/HR (L/HR)	GRAMS / HP- HR				EXHAUST	
			NMHC	NOx	CO	PM [4]	°F (°C)	CFM (m^3/min)
2800	104	9.1 (34.4)	0.36	3.15	0.75	0.12	952 (511)	788 (22.3)
3000	115	8.6 (32.6)	0.33	3.23	0.90	0.13	949 (509)	910 (25.8)

Notes:

1) *4045TF252 Base Engine Model manufactured by John Deere Corporation. For John Deere Emissions Conformance to EPA 40 CFR Part 60 see Page 2 of 2.*
2) *The Emission Warranty for this engine is provided directly to the owner by John Deere Corporation. A copy of the John Deere Emission Warranty can be found in the Clarke Operation and Maintenance Manual.*
3) *Engines are rated at standard conditions of 29.61in. (7521 mm) Hg barometer and 77°F (25° C) inlet air temperature. (SAE J1349)*
4) *PM is a measure of total particulate matter, including PM_{10}.*

CLARKE
FIRE PROTECTION PRODUCTS
3133 EAST KEMPER ROAD
CINCINNATI, OH 45241

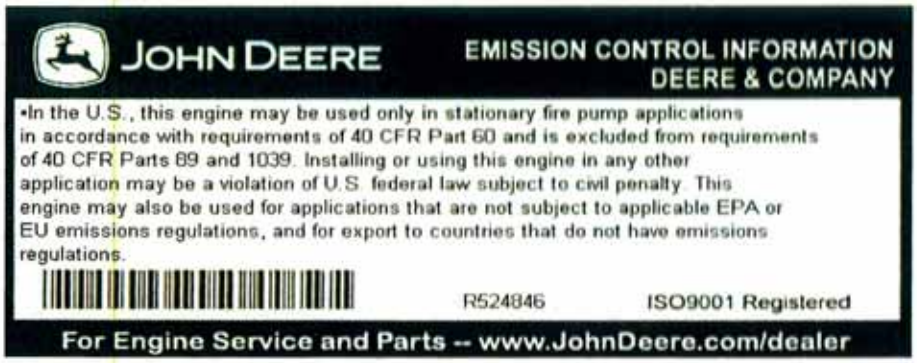
JOHN DEERE

John Deere Power Systems
3801 W. Ridgeway Ave., PO Box 5100
Waterloo, Iowa USA 50704-5100

31 October 2007

Subject: **Fire Pump Ratings – Conformance to EPA 40 CFR Part 60 (NSPS requirements)**

All John Deere stationary fire pump engines conform to the requirements of 40 CFR Part 60. All such engines include an emission label, stating the engine conforms to the requirements of 40 CFR Part 60. An example of the emission label is show below:



This label applies to all of the following engine models, sold to Clarke Fire Protection, for use in stationary fire pump applications:

John Deere Engine Model
4045DF120
4045DF159
4045TF252
4045TF254
4045TF220
6068TF252
6068TF254
6068HF252
6068HF254
6068HF120
6068TF220
6081AF001
6081HF001
6125AF001
6125HF070

All engines conforming to 40 CFR Part 60 (identified by emission label, as shown above) are covered under the emissions warranty of 40 CFR Part 89.

Sincerely,

Kyle J. Tingle
Regional Sales Manager, JDPS

CLARKE

Fire Protection Products, Inc.

Clarke EPA NSPS Stationary
Fire Pump Engine Driver Emissions Summary
(Per 40 CFR 60 Subpart IIII)
for 2010 USA Installations

Heat Exchanger Cooled

ENGINE INFORMATION				EMISSION OUTPUTS g / HP-hr				EMISSION LIMITS g / HP-hr		
CLARKE MODEL NUMBER	RPM	NAMEPLATE BHP	NSPS EMMISIONS TIER	NHMC	NOx	CO	PM	NOx + NMHC	CO	PM
JU4H-UF10	1760	41	1 Compliant	0.91	5.78	1.70	0.46	7.1	4.1	0.60
JU4H-UF10	2100	51	1 Compliant	0.86	5.46	1.67	0.40	7.8	3.7	0.60
JU4H-UF10	2350	55	1 Compliant	0.78	4.80	1.85	0.40	7.8	3.7	0.60
JU4H-UF12	2350	55	1 Compliant	0.78	4.80	1.85	0.40	7.8	3.7	0.60
JU4H-UF12	2600	59	1 Compliant	0.95	4.30	2.30	0.40	7.8	3.7	0.60
JU4H-UF14	2800	70	1 Compliant	0.77	3.79	2.38	0.16	7.8	3.7	0.60
JU4H-UF14	3000	71	1 Compliant	0.83	3.64	2.80	0.18	7.8	3.7	0.60
JU4H-UF20	1760	60	1 Compliant	0.39	5.41	0.87	0.24	7.8	3.7	0.60
JU4H-UF20	2100	67	1 Compliant	0.53	5.05	1.07	0.24	7.8	3.7	0.60
JU4H-UF20	2350	72	1 Compliant	0.58	4.49	1.24	0.25	7.8	3.7	0.60
JU4H-UF22	2350	72	1 Compliant	0.58	4.49	1.24	0.25	7.8	3.7	0.60
JU4H-UF22	2600	75	1 Compliant	0.60	4.06	1.59	0.28	7.8	3.7	0.60
JU4H-UFAB26	2800	80	1 Compliant	CONSULT CLARKE				7.8	3.7	0.60
JU4H-UF24	2800	80	1 Compliant	0.37	4.16	1.71	0.15	7.8	3.7	0.60
JU4H-UF24	3000	83	1 Compliant	0.41	4.29	2.36	0.18	7.8	3.7	0.60
JU4H-UF30	1760	64	1 Compliant	0.40	5.41	0.50	0.17	7.8	3.7	0.60
JU4H-UF30	2100	79	1 Compliant	0.37	4.66	0.46	0.16	7.8	3.7	0.60
JU4H-UF30	2350	85	1 Compliant	0.45	4.33	0.51	0.20	7.8	3.7	0.60
JU4H-UF32	2350	85	1 Compliant	0.45	4.33	0.51	0.20	7.8	3.7	0.60
JU4H-UF32	2600	85	1 Compliant	0.53	4.06	0.60	0.28	7.8	3.7	0.60
JU4H-UF34	2800	104	1 Compliant	0.36	3.15	0.75	0.12	7.8	3.7	0.60
JU4H-UF34	3000	115	1 Compliant	0.33	3.23	0.90	0.13	7.8	3.7	0.60
JU4H-UFH8	1760	73	1 Compliant	0.33	5.47	0.34	0.17	7.8	3.7	0.60
JU4H-UFH0	1760	73	1 Compliant	0.33	5.47	0.34	0.17	7.8	3.7	0.60
JU4H-UFH0	2100	88	1 Compliant	0.34	4.75	0.38	0.16	7.8	3.7	0.60
JU4H-UFH0	2350	98	1 Compliant	0.31	4.42	0.40	0.18	7.8	3.7	0.60
JU4H-UFH2	2350	98	1 Compliant	0.31	4.42	0.40	0.18	7.8	3.7	0.60
JU4H-UFH2	2600	99	1 Compliant	0.39	4.05	0.49	0.22	7.8	3.7	0.60
JU4H-UF40	1760	94	1 Compliant	0.25	5.68	0.36	0.21	7.8	3.7	0.60
JU4H-UFAD4G	1760	100	3 Certified	CONSULT CLARKE				3.0	3.7	0.22
JU4H-UFAD4G	2100	101	3 Certified					3.0	3.7	0.22
JU4H-UFAD4G	2350	105	3 Certified					3.0	3.7	0.22
JU4H-UFAD5G	1760	110	3 Certified					3.0	3.7	0.22
JU4H-UFAD5G	2100	113	3 Certified					3.0	3.7	0.22
JU4H-UFAD5G	2350	118	3 Certified					3.0	3.7	0.22
JU4H-UFADJG	1760	109	3 Certified					3.0	3.7	0.22
JU4H-UFADJG	2100	120	3 Certified					3.0	3.7	0.22
JU4H-UFADJG	2350	123	3 Certified					3.0	3.7	0.22
JU4H-UFADP0	1760	121	3 Certified					3.0	3.7	0.22
JU4H-UFADP0	2100	125	3 Certified					3.0	3.7	0.22
JU4H-UFADP0	2350	130	3 Certified					3.0	3.7	0.22
JU4H-UFADR0	1760	113	3 Certified					3.0	3.7	0.22
JU4H-UFADR0	2100	136	3 Certified					3.0	3.7	0.22
JU4H-UFADR0	2350	140	3 Certified					3.0	3.7	0.22
JU4H-UFADW8	1760	144	3 Certified					3.0	3.7	0.22
JU4H-UF54	2800	145	1 Compliant	0.20	3.48	0.70	0.11	7.8	3.7	0.60
JU4H-UF54	3000	145	1 Compliant	0.21	3.57	0.85	0.13	7.8	3.7	0.60
JU6H-UF34	2800	160	1 Compliant	0.33	3.67	0.95	0.26	7.8	3.7	0.60
JU6H-UF34	3000	175	1 Compliant	0.29	4.13	1.17	0.30	7.8	2.6	0.40
JU4H-UFAD98	1760	173	3 Certified	CONSULT CLARKE				3.0	3.7	0.22
JU6H-UFAD58	1760	183	3 Certified	0.119	2.70	0.89	0.10	3.0	2.6	0.22
JU6H-UFADNG	1760	190	3 Certified	0.119	2.70	0.89	0.10	3.0	2.6	0.15
JU6H-UFADNG	2100	181	3 Certified	0.209	2.49	0.98	0.087	3.0	2.6	0.15
JU6H-UFADNG	2350	183	3 Certified	0.239	2.49	1.09	0.088	3.0	2.6	0.15
JU6H-UFADN0	1760	197	3 Certified	0.119	2.70	0.89	0.10	3.0	2.6	0.15
JU6H-UFADN0	2100	197	3 Certified	0.209	2.49	0.98	0.087	3.0	2.6	0.15
JU6H-UFADN0	2350	200	3 Certified	0.239	2.49	1.09	0.088	3.0	2.6	0.15
JU6H-UF54	2800	216	1 Compliant	0.17	4.36	0.98	0.24	7.8	2.6	0.40
JU6H-UF54	3000	216	1 Compliant	0.19	4.67	1.13	0.25	7.8	2.6	0.40
JU6H-UFADP8	1760	220	3 Certified	0.119	2.70	0.89	0.1	3.0	2.6	0.15
JU6H-UFADP0	1760	220	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15

ENGINE INFORMATION				EMISSION OUTPUTS g / HP-hr				EMISSION LIMITS g / HP-hr		
CLARKE MODEL NUMBER	RPM	NAMEPLATE BHP	NSPS EMMISIONS TIER	NHMC	NOx	CO	PM	NOx + NMHC	CO	PM
JU6H-UFADP0	2100	209	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADP0	2350	211	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADQ0	2100	224	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADQ0	2350	226	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFAB76	2800	225	1 Compliant	CONSULT CLARKE				7.8	2.6	0.4
JU6H-UFAD88	1760	237	3 Certified	0.119	2.70	0.89	0.10	3.0	2.6	0.15
JU6H-UFADR0	2100	238	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADR0	2350	240	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADR8	1760	250	3 Certified	0.060	2.69	0.45	0.055	3.0	2.6	0.15
JU6H-UF84	2800	259	1 Compliant	0.16	2.75	0.60	0.28	7.8	2.6	0.40
JU6H-UF84	3000	275	1 Compliant	0.13	2.83	0.75	0.34	7.8	2.6	0.40
JU6H-UFADS8	1760	260	3 Certified	0.060	2.69	0.45	0.055	3.0	2.6	0.15
JU6H-UFADS0	2100	260	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADS0	2350	268	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADT0	1760	229	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADT0	2100	274	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADT0	2350	275	3 Certified	0.067	2.56	0.597	0.079	3.0	2.6	0.15
JU6H-UFADW8	1760	282	3 Certified	0.060	2.69	0.45	0.055	3.0	2.6	0.15
JU6H-UFADX8	1760	305	3 Certified	0.060	2.69	0.45	0.055	3.0	2.6	0.15
JU6H-UFAD98	1760	315	3 Certified	0.060	2.69	0.45	0.055	3.0	2.6	0.15
JW6H-UFADD0	1760	324	3 Certified					3.0	2.6	0.15
JW6H-UFADD0	2100	351	3 Certified					3.0	2.6	0.15
JW6H-UFADF0	1760	327	3 Certified	0.089	2.64	0.68	0.107	3.0	2.6	0.15
JW6H-UFADF0	2100	311	3 Certified	0.104	2.61	0.84	0.103	3.0	2.6	0.15
JW6H-UFADJ0	1760	350	3 Certified	0.089	2.64	0.68	0.107	3.0	2.6	0.15
JW6H-UFADJ0	2100	332	3 Certified	0.104	2.61	0.84	0.103	3.0	2.6	0.15
JW6H-UFAD70	1760	376	3 Certified	0.089	2.64	0.68	0.107	3.0	2.6	0.15
JW6H-UFAD70	2100	399	3 Certified	0.104	2.61	0.84	0.103	3.0	2.6	0.15
JW6H-UFAD80	1760	422	3 Certified	0.089	2.64	0.68	0.107	3.0	2.6	0.15
JW6H-UFAD80	2100	400	3 Certified	0.104	2.61	0.84	0.103	3.0	2.6	0.15
JX6H-UFADF0	1760	460	3 Certified	0.097	2.60	0.53	0.087	3.0	2.6	0.15
JX6H-UFADF0	2100	488	3 Certified	0.172	2.47	0.63	0.085	3.0	2.6	0.15
JX6H-UFAD60	1760	510	3 Certified	0.097	2.60	0.53	0.087	3.0	2.6	0.15
JX6H-UFAD60	2100	525	3 Certified	0.172	2.47	0.63	0.085	3.0	2.6	0.15
JX6H-UFADK0	1760	517	3 Certified	0.104	2.63	0.38	0.043	3.0	2.6	0.15
JX6H-UFADK0	2100	526	3 Certified	0.104	2.63	0.38	0.043	3.0	2.6	0.15
JX6H-UFADN0	1760	542	3 Certified	0.097	2.60	0.53	0.087	3.0	2.6	0.15
JX6H-UFADN0	2100	575	3 Certified	0.172	2.47	0.63	0.085	3.0	2.6	0.15
JX6H-UFADP0	1760	575	3 Certified	0.097	2.60	0.53	0.087	3.0	2.6	0.15
JX6H-UFADP0	2100	600	3 Certified	0.172	2.47	0.63	0.085	3.0	2.6	0.15
JX6H-UFAD88	1760	617	3 Certified	0.097	2.60	0.53	0.087	3.0	2.6	0.15

Radiator Cooled

ENGINE INFORMATION				EMISSION OUTPUTS g / HP-hr				EMISSION LIMITS g / HP-hr		
CLARKE MODEL NUMBER	RPM	NAMEPLATE BHP	NSPS EMMISIONS TIER	NHMC	Nox	CO	PM	NOx + NMHC	CO	PM
JU4R-UF09	1760	39	1 Compliant	0.91	5.78	1.70	0.46	7.1	4.1	0.60
JU4R-UF09	2100	48	1 Compliant	0.86	5.46	1.67	0.40	7.1	4.1	0.60
JU4R-UF09	2350	52	1 Compliant	0.78	4.80	1.85	0.40	7.8	3.7	0.60
JU4R-UF11	2350	52	1 Compliant	0.78	4.80	1.85	0.40	7.8	3.7	0.60
JU4R-UF11	2600	55.5	1 Compliant	0.95	4.30	2.30	0.40	7.8	3.7	0.60
JU4R-UF13	2800	66.5	1 Compliant	0.77	3.79	2.38	0.18	7.8	3.7	0.60
JU4R-UF13	3000	66.5	1 Compliant	0.83	3.64	2.80	0.18	7.8	3.7	0.60
JU4R-UF19	1760	58.5	1 Compliant	0.39	5.41	0.87	0.24	7.8	3.7	0.60
JU4R-UF19	2100	64.5	1 Compliant	0.53	5.05	1.07	0.24	7.8	3.7	0.60
JU4R-UF19	2350	68	1 Compliant	0.58	4.49	1.24	0.25	7.8	3.7	0.60
JU4R-UF21	2350	68	1 Compliant	0.58	4.49	1.24	0.25	7.8	3.7	0.60
JU4R-UF21	2600	70.5	1 Compliant	0.60	4.06	1.59	0.28	7.8	3.7	0.60
JU4R-UF23	2800	76.5	1 Compliant	0.37	4.16	1.71	0.15	7.8	3.7	0.60
JU4R-UF23	3000	78	1 Compliant	0.41	4.29	2.36	0.18	7.8	3.7	0.60
JU4R-UF40	1760	94	1 Compliant	0.25	5.68	0.36	0.21	7.8	3.7	0.60
JU4R-UF53	2800	135	1 Compliant	0.20	3.48	0.70	0.11	7.8	3.7	0.60
JU4R-UF53	3000	133	1 Compliant	0.21	3.57	0.85	0.13	7.8	3.7	0.60

CLARKE

Fire Protection Products, Inc.

CLARKE UK, LTD.

Fire Protection Products

Diesel Fuel for Clarke Fire Pump Drivers

All Diesel Fire Pump Drivers manufactured by Clarke are designed and tested for use with only No. 2-D Diesel Fuel conforming to ASTM D-975. Additionally, in European Countries an acceptable alternative fuel is "Red" Diesel Fuel conforming to BS2869 Class A2. Both of these fuel specifications must contain **NO** (0%) Bio-fuel.

Clarke Fire Protection Products, Inc.	Clarke UK, Ltd.
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C13902 – 23 Oct 2010

TABLE 2 TO SUBPART IIII OF PART 60.—EMISSION STANDARDS FOR 2008 MODEL YEAR AND LATER EMERGENCY STATIONARY CI ICE <37 KW (50 HP) WITH A DISPLACEMENT OF <10 LITERS PER CYLINDER

[As stated in § 60.4202(a)(1), you must comply with the following emission standards]

Engine power	Emission standards for 2008 model year and later emergency stationary CI ICE <37 KW (50 HP) with a displacement of <10 liters per cylinder in g/KW-hr (g/HP-hr)			
	Model year(s)	NO_X + NMHC	CO	PM
KW<8 (HP<11)	2008+	7.5 (5.6)	8.0 (6.0)	0.40 (0.30)
8≤KW<19 (11≤HP<25)	2008+	7.5 (5.6)	6.6 (4.9)	0.40 (0.30)
19≤KW<37 (25≤HP<50)	2008+	7.5 (5.6)	5.5 (4.1)	0.30 (0.22)

TABLE 3 TO SUBPART IIII OF PART 60.—CERTIFICATION REQUIREMENTS FOR STATIONARY FIRE PUMP ENGINES

[As stated in § 60.4202(d), you must certify new stationary fire pump engines beginning with the following model years:]

Engine power	Starting model year engine manufacturers must certify new stationary fire pump engines according to § 60.4202(d)
KW<75 (HP<100)	2011
75≤KW<130 (100≤HP<175)	2010
130≤KW≤560 (175≤HP≤750)	2009
KW>560 (HP>750)	2008

TABLE 4 TO SUBPART IIII OF PART 60.—EMISSION STANDARDS FOR STATIONARY FIRE PUMP ENGINES

[As stated in §§ 60.4202(d) and 60.4205(c), you must comply with the following emission standards for stationary fire pump engines]

Maximum engine power	Model year(s)	NMHC + NO_X	CO	PM
KW<8 (HP<11)	2010 and earlier	10.5 (7.8)	8.0 (6.0)	1.0 (0.75)
	2011+	7.5 (5.6)		0.40 (0.30)
8≤KW<19 (11≤HP<25)	2010 and earlier	9.5 (7.1)	6.6 (4.9)	0.80 (0.60)
	2011+	7.5 (5.6)		0.40 (0.30)
19≤KW<37 (25≤HP<50)	2010 and earlier	9.5 (7.1)	5.5 (4.1)	0.80 (0.60)
	2011+	7.5 (5.6)		0.30 (0.22)
37≤KW<56 (50≤HP<75)	2010 and earlier	10.5 (7.8)	5.0 (3.7)	0.80 (0.60)
	2011+ [1]	4.7 (3.5)		0.40 (0.30)
56≤KW<75 (75≤HP<100)	2010 and earlier	10.5 (7.8)	5.0 (3.7)	0.80 (0.60)
	2011+ [1]	4.7 (3.5)		0.40 (0.30)
75≤KW<130 (100≤HP<175)	2009 and earlier	10.5 (7.8)	5.0 (3.7)	0.80 (0.60)
	2010+ [2]	4.0 (3.0)		0.30 (0.22)
130≤KW<225 (175≤HP<300)	2008 and earlier	10.5 (7.8)	3.5 (2.6)	0.54 (0.40)
	2009+ [3]	4.0 (3.0)		0.20 (0.15)
225≤KW<450 (300≤HP<600)	2008 and earlier	10.5 (7.8)	3.5 (2.6)	0.54 (0.40)
	2009+ [3]	4.0 (3.0)		0.20 (0.15)
450≤KW≤560 (600≤HP≤750)	2008 and earlier	10.5 (7.8)	3.5 (2.6)	0.54 (0.40)
	2009+	4.0 (3.0)		0.20 (0.15)
KW>560 (HP>750)	2007 and earlier	10.5 (7.8)	3.5 (2.6)	0.54 (0.40)
	2008+	6.4 (4.8)		0.20 (0.15)

[1] For model years 2011–2013, manufacturers, owners and operators of fire pump stationary CI ICE in this engine power category with a rated speed of greater than 2,650 revolutions per minute (rpm) may comply with the emission limitations for 2010 model year engines.

[2] For model years 2010–2012, manufacturers, owners and operators of fire pump stationary CI ICE in this engine power category with a rated speed of greater than 2,650 rpm may comply with the emission limitations for 2009 model year engines.

[3] In model years 2009–2011, manufacturers of fire pump stationary CI ICE in this engine power category with a rated speed of greater than 2,650 rpm may comply with the emission limitations for 2008 model year engines.

TABLE 5 TO SUBPART IIII OF PART 60.—LABELING AND RECORDKEEPING REQUIREMENTS FOR NEW STATIONARY EMERGENCY ENGINES

[You must comply with the labeling requirements in § 60.4210(f) and the recordkeeping requirements in § 60.4214(b) for new emergency stationary CI ICE beginning in the following model years:]

Engine power	Starting model year
19≤KW<56 (25≤HP<75)	2013
56≤KW<130 (75≤HP<175)	2012
KW≥130 (HP≥175)	2011

Oracle Ridge Copper

APPENDIX C

Caterpillar Diesel-Fueled Emergency Generator Data Sheets

CATERPILLAR

Project Sizing Report

Price List: U.S.

Version: 2.5
Data Date: 1/14/2010

Modified Date	5/10/2011	**Electricity Supply**	60 Hz 480/277 V
Customer Name	Lyntek - Oracle Ridge - 1250kw Stand	**Connection**	STAR
Project Name/Ref #	11RMK00	**Max Ambient Temperature**	104.0F
Prepared By	Bob Keller	**Altitude**	5,800.0 Ft. A.S.L

Load Analysis Summary

Max Transient Load Step	1,250.0 SkVA	1,250.0 SkW	
Peak Transient Load	1,250.0 SkVA	1,250.0 SkW	
Final Running Load	1,250.0 kVA	1,250.0 kW	1.00 PF
Max Running Non Linear Load	0.0 RkVA		
Maximum Running Load	1,250.0 kVA	1,250.0 kW	

Generator Set

Genset Model	(1) of 3512 C	**Nameplate Rating**	1,500.0 kW / 1,875.0 kVA
Voltage Regulator and Slope	CDVR, 2:1 slope		0.8 PF
Feature Code	512DE6C	**Site Output**	1,330.3 kW / 1,662.9 kVA
Fuel	Diesel	**Rating Type**	Standby
Dry Weight	30,941.9 lbs		
Length / Width / Height	232.1in / 99.9in / 108.2in		

Alternator Motor Starting Capability		Block Load (only) Transient Response			
Instantaneous Voltage Dip **	skVA Capability	Load Change %	FDip %	VDip %	Recovery Time (sec)
10%	694	0 - 25	< 5.0	5.5	< 3
20%	1,563	0 - 50	< 5.0	10.3	< 3
30%	2,679	0 - 75	7.1	14.7	< 3
35%	3,365	0 - 100	12.0	23.8	3.5

Engine Technical Data at 100% Load

Make/Model	3512 C	**Emissions/Certifications**	EPA T2
Aspiration	TA	**Governor**	ADEM3
Cylinder Configuration	60V - 12	**Aftercooler Type**	ATAAC
Displacement	3,161 Cubic Inch / 52 Liter	**Rejection To Jacket Water**	35,031 BTU/min
Speed	1800 RPM	**Rejection To Aftercooler**	27,411 BTU/min
Fuel Rate	104.8 gph	**Rejection To Oil Cooler**	11,260 BTU/min
Exhaust Sound Level	103 dBA at 23 ft/7 m	**Rejection To Atmosphere**	7,052 BTU/min
Mechanical Sound Level	101 dBA at 23 ft/7 m	**Rejection To Exhaust**	75,465 BTU/min
Max Combustion Inlet Air Temp	121.6 F	**Exhaust Recoverable**	35,316 BTU/min
Combustion Airflow	4,573.2 cfm	**Exhaust Stack Temperature**	764 F
Cooling System Ambient Capability	114.8 F	**Exhaust Flow Rate**	11,061 cfm
Cooling System Airflow *	73,277.9 cfm	**Exhaust Flange Size**	8in
Engine Performance Number	DM8260		

Alternator Technical Data

Alternator Arrangement Number	2628100	**Insulation**	CLASS H
Alternator Type / Frame Size	SR4B / 697	**Temperature Rise**	130 C
Alternator Winding Pitch	0.7333	**Rejection To Atmosphere**	3,645.3 BTU/min
Number Of Poles	4	**Peak Amps / Rated Amps**	*** / 2,255.3
Excitation / Winding Type	PM / RANDOM	**Short Circuit Ratio**	0.2600

Reactances		per unit	ohms	Generator Time Constants		sec
Subtransient - Direct Axis	X"d	0.2165	0.0266	**Open Circuit Transient - Direct Axis**	T'd0	3.9660
Subtransient - Quadrature Axis	X"q	0.4753	0.0584	**Short Circuit Transient - Quadrature Axis**	T'd	0.2874
Transient - Saturated	X'd	0.3133	0.0385	**Open Circuit Subtransient - Direct Axis**	T"d0	0.0064
Synchronous - Direct Axis	Xd	4.3254	0.5315	**Short Circuit Subtransient - Direct Axis**	T"d	0.0056
Synchronous - Quadrature Axis	Xq	2.1493	0.2641	**Open Circuit Subtransient - Quadrature Axis**	T"q0	0.0127
Negative Sequence	X2	0.3459	0.0425	**Short Circuit Subtransient - Quadtrature Axis**	T"q	0.0113
Zero Sequence	X0	0.1229	0.0151	**Armature Short Circuit**	TA	0.0722

Notes:

* Based on 1/2 inch water (0.12 kPa) external restriction and 1000 ft (300m) altitude.

** Based on instantaneous voltage dip as defined per NEMA MG-1.

*** See your Caterpillar dealer and/or Spec Sheet for technical information.

Maximum voltage distortion due to non-linear load calculated to be within specified limits.

Overall dimensions and weight not to be used for installation. Contact your Caterpillar dealer for specific dimension drawings.

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CATERPILLAR

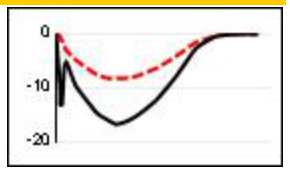
Project Load Report

Version: 2.5

Data Date: 1/14/2010

Modified Date	5/10/2011	**Rating Type**	Standby	**Max Ambient Temperature**	104 Deg. F
Customer Name:	Lyntek - Oracle Ridge - 1	**Fuel**	Diesel	**Altitude**	5,800.0 Ft. A.S.L
Project Name/Ref #	11RMK00	**Electricity Supply**	60 Hz 480/277 V		
Prepared By	Bob Keller				

Load Details			Permitted Dip		Predicted Dip		Load Analysis										
Load Step		Load Description	Frequency	Voltage	Frequency	Voltage	Transient Inrush		Running		Resultant Peak		Cumulative Running		Fdip	Vdip 1	Vdip 2
							SkVA	SkW	kVA	kW	SkVA	SkW	kVA	kW			
Step 1			**Selection Criteria: Step Passed**														
1.1	1	1,250.00 kW - Miscellaneous Loads Resistive, 3-Phase	30%	30%			1,250.0	1,250.0	1,250.0	1,250.0							
		Step 1 Total	**30%**	**30%**	**8.5%**	**16.7%**	**1,250.0**	**1,250.0**	**1,250.0**	**1,250.0**							
		Total Through Step 1									**1,250.0**	**1,250.0**	**1,250.0**	**1,250.0**			



8.5% 13.3% 16.7%

Load Analysis Summary

Maximum Step		Maximum Peak		Final Running	
SkVA	SkW	SkVA	SkW	kVA	kW
1,250.0	1,250.0	1,250.0	1,250.0	1,250.0	1,250.0

Transient Performance Report

Price List: U.S.
Version: 2.5
Data Date: 1/14/2010

Load Scenario

Step 1

Frequency Dip

Permitted - 30.0%

Predicted - 8.5%

Voltage Dip

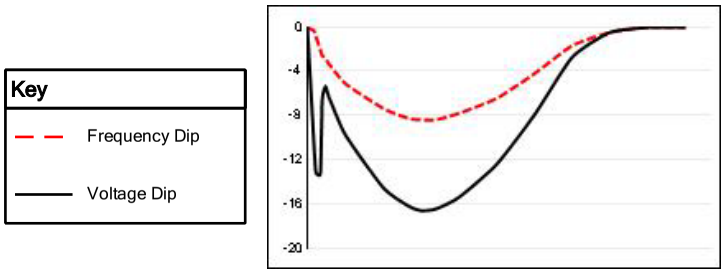
Permitted - 30.0%

Predicted - 16.7%

Synchronous (Vdip 1) - 13.3%

Frequency-induced (Vdip 2) - 16.7%

Selection Criteria:



Fdip:	Vdip 1:	Vdip 2:
8.5%	13.3%	16.7%

Selected Generator Set

1,500.0 EkW / 1,875.0 kVA 60 Hz Standby, 480/277V, 3512 ATAAC EPA T2, 697 PM SR4B RANDOM, CDVR 2:1 slope

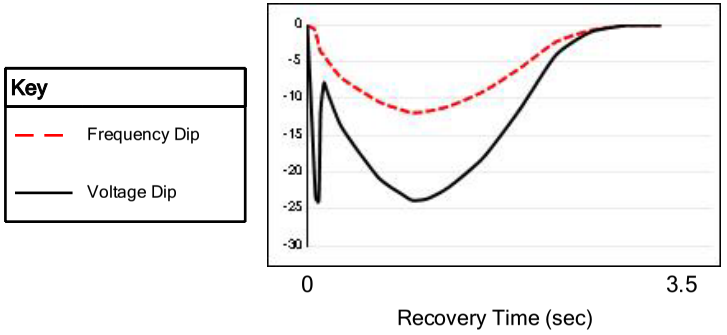
Block Load (only) Transient Response

Load Change %	FDip %	VDip %	Recovery Time (sec)
0 - 25	< 5.0	5.5	< 3
0 - 50	< 5.0	10.3	< 3
0 - 75	7.1	14.7	< 3
0 - 100	12.0	23.8	3.5

Transient Performance

The selected representative generator set was factory tested in accordance to NFPA 110 block load step capability and acceptable frequency and voltage response on load addition and rejection.

0 - 100 Load Change %



Oracle Ridge Copper

APPENDIX D

Diesel and Gasoline Storage - EPA Tanks 4.0.9d Emission Reports

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	800-TK-01
City:	Tucson
State:	Arizona
Company:	Oracle Ridge Mining, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	Diesel Fuel Storage Tank

Tank Dimensions

Shell Height (ft):		18.00
Diameter (ft):		10.00
Liquid Height (ft) :		16.00
Avg. Liquid Height (ft):		10.00
Volume (gallons):		10,000.00
Turnovers:		5.55
Net Throughput(gal/yr):		55,500.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		1.08
Slope (ft/ft) (Cone Roof)		0.22

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Tucson, Arizona (Avg Atmospheric Pressure = 13.41 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

800-TK-01 - Vertical Fixed Roof Tank
Tucson, Arizona

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	Jan	66.77	58.09	75.46	70.64	0.0082	0.0061	0.0106	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Feb	69.48	59.35	79.61	70.64	0.0089	0.0064	0.0119	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009
Distillate fuel oil no. 2	Mar	73.03	61.18	84.88	70.64	0.0099	0.0068	0.0140	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Apr	78.08	64.06	92.11	70.64	0.0114	0.0075	0.0173	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	May	82.81	67.58	98.04	70.64	0.0131	0.0084	0.0208	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Jun	87.42	71.96	102.88	70.64	0.0150	0.0096	0.0220	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Jul	87.19	74.07	100.31	70.64	0.0149	0.0102	0.0220	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Aug	85.77	73.30	98.23	70.64	0.0143	0.0100	0.0209	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Sep	83.07	71.22	94.92	70.64	0.0132	0.0094	0.0190	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Oct	77.32	66.34	88.31	70.64	0.0112	0.0081	0.0153	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Nov	70.74	61.30	80.19	70.64	0.0092	0.0068	0.0121	130.0000			188.00	Option 1: VP70 = .009 VP80 = .012
Distillate fuel oil no. 2	Dec	66.73	58.54	74.92	70.64	0.0082	0.0062	0.0105	130.0000			188.00	Option 1: VP60 = .0065 VP70 = .009

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

800-TK-01 - Vertical Fixed Roof Tank
Tucson, Arizona

Month:	January	February	March	April	May	June	July	August	September	October	November	December
Standing Losses (lb):	0.2365	0.2696	0.3883	0.5073	0.6451	0.7102	0.6156	0.5638	0.4832	0.3984	0.2775	0.2218
Vapor Space Volume (cu ft):	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929
Vapor Density (lb/cu ft):	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002
Vapor Space Expansion Factor:	0.0618	0.0725	0.0850	0.1006	0.1088	0.1095	0.0924	0.0877	0.0836	0.0779	0.0672	0.0581
Vented Vapor Saturation Factor:	0.9964	0.9961	0.9956	0.9950	0.9942	0.9934	0.9935	0.9937	0.9942	0.9951	0.9959	0.9964
Tank Vapor Space Volume:												
Vapor Space Volume (cu ft):	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929	656.5929
Tank Diameter (ft):	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000
Vapor Space Outage (ft):	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600
Tank Shell Height (ft):	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000
Average Liquid Height (ft):	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000
Roof Outage (ft):	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600
Roof Outage (Cone Roof)												
Roof Outage (ft):	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600
Roof Height (ft):	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800
Roof Slope (ft/ft):	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200
Shell Radius (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Vapor Density												
Vapor Density (lb/cu ft):	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002
Vapor Molecular Weight (lb/lb-mole):	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0082	0.0089	0.0099	0.0114	0.0131	0.0150	0.0149	0.0143	0.0132	0.0112	0.0092	0.0082
Daily Avg. Liquid Surface Temp. (deg. R):	526.4421	529.1531	532.7004	537.7531	542.4801	547.0912	546.8598	545.4354	542.7384	536.9947	530.4135	526.4002
Daily Average Ambient Temp. (deg. F):	51.2500	54.4000	58.7000	65.8000	73.9500	83.7500	86.5000	84.4500	80.4000	70.4500	59.1500	52.0500
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731
Liquid Bulk Temperature (deg. R):	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142
Tank Paint Solar Absorptance (Shell):	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,092.6779	1,403.2852	1,791.3064	2,243.4162	2,510.8748	2,580.9915	2,243.0989	2,120.6327	1,906.1582	1,586.0327	1,208.7987	1,000.3523
Vapor Space Expansion Factor												
Vapor Space Expansion Factor:	0.0618	0.0725	0.0850	0.1006	0.1088	0.1095	0.0924	0.0877	0.0836	0.0779	0.0672	0.0581
Daily Vapor Temperature Range (deg. R):	34.7373	40.5137	47.3886	56.0965	60.9324	61.8486	52.4917	49.8480	47.3971	43.9248	37.7890	32.7653
Daily Vapor Pressure Range (psia):	0.0045	0.0055	0.0072	0.0097	0.0124	0.0124	0.0118	0.0109	0.0096	0.0072	0.0053	0.0043
Breather Vent Press. Setting Range(psia):	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0082	0.0089	0.0099	0.0114	0.0131	0.0150	0.0149	0.0143	0.0132	0.0112	0.0092	0.0082
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0061	0.0064	0.0068	0.0075	0.0084	0.0096	0.0102	0.0100	0.0094	0.0081	0.0068	0.0062
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0106	0.0119	0.0140	0.0173	0.0208	0.0220	0.0220	0.0209	0.0190	0.0153	0.0121	0.0105
Daily Avg. Liquid Surface Temp. (deg R):	526.4421	529.1531	532.7004	537.7531	542.4801	547.0912	546.8598	545.4354	542.7384	536.9947	530.4135	526.4002
Daily Min. Liquid Surface Temp. (deg R):	517.7578	519.0247	520.8533	523.7290	527.2470	531.6291	533.7369	532.9734	530.8891	526.0135	520.9662	518.2089
Daily Max. Liquid Surface Temp. (deg R):	535.1264	539.2816	544.5476	551.7773	557.7132	562.5534	559.9827	557.8973	554.5877	547.9760	539.8607	534.5916
Daily Ambient Temp. Range (deg. R):	25.3000	26.8000	28.2000	30.8000	31.9000	31.7000	25.8000	24.7000	25.8000	27.7000	27.1000	24.5000
Vented Vapor Saturation Factor												
Vented Vapor Saturation Factor:	0.9964	0.9961	0.9956	0.9950	0.9942	0.9934	0.9935	0.9937	0.9942	0.9951	0.9959	0.9964
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0082	0.0089	0.0099	0.0114	0.0131	0.0150	0.0149	0.0143	0.0132	0.0112	0.0092	0.0082
Vapor Space Outage (ft):	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600	8.3600
Working Losses (lb):	0.1173	0.1270	0.1419	0.1636	0.1879	0.2143	0.2130	0.2048	0.1894	0.1603	0.1320	0.1171
Vapor Molecular Weight (lb/lb-mole):	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000	130.0000
Vapor Pressure at Daily Average Liquid												

Surface Temperature (psia):	0.0082	0.0089	0.0099	0.0114	0.0131	0.0150	0.0149	0.0143	0.0132	0.0112	0.0092	0.0082
Net Throughput (gal/mo.):	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000	4,625.0000
Annual Turnovers:	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500	5.5500
Turnover Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Maximum Liquid Volume (gal):	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000
Maximum Liquid Height (ft):	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000
Tank Diameter (ft):	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000
Working Loss Product Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total Losses (lb):	0.3538	0.3966	0.5301	0.6708	0.8330	0.9245	0.8286	0.7686	0.6725	0.5587	0.4096	0.3390

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: January, February, March, April, May, June, July, August, September, October, November, December

800-TK-01 - Vertical Fixed Roof Tank
Tucson, Arizona

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	1.97	5.32	7.29

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	800-TK-02
City:	Tucson
State:	Arizona
Company:	Oracle Ridge Mining, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	Gasoline Fuel Storage Tank

Tank Dimensions

Shell Height (ft):		18.00
Diameter (ft):		10.00
Liquid Height (ft) :		16.00
Avg. Liquid Height (ft):		12.00
Volume (gallons):		10,000.00
Turnovers:		3.00
Net Throughput(gal/yr):		30,000.00
Is Tank Heated (y/n):	N	

Paint Characteristics

Shell Color/Shade:	Gray/Light
Shell Condition	Good
Roof Color/Shade:	Gray/Light
Roof Condition:	Good

Roof Characteristics

Type:	Cone	
Height (ft)		1.08
Slope (ft/ft) (Cone Roof)		0.22

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Tucson, Arizona (Avg Atmospheric Pressure = 13.41 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

800-TK-02 - Vertical Fixed Roof Tank
Tucson, Arizona

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Gasoline (RVP 11.5)	Jan	66.77	58.09	75.46	70.64	6.8811	5.8427	8.0610	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Feb	69.48	59.35	79.61	70.64	7.2336	5.9859	8.6795	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Mar	73.03	61.18	84.88	70.64	7.7164	6.1974	9.5165	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Apr	78.08	64.06	92.11	70.64	8.4478	6.5421	10.7678	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	May	82.81	67.58	98.04	70.64	9.1806	6.9843	11.8888	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Jun	87.42	71.96	102.88	70.64	9.9430	7.5680	12.8687	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Jul	87.19	74.07	100.31	70.64	9.9035	7.8622	12.3407	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Aug	85.77	73.30	98.23	70.64	9.6637	7.7546	11.9249	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Sep	83.07	71.22	94.92	70.64	9.2221	7.4668	11.2877	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Oct	77.32	66.34	88.31	70.64	8.3346	6.8266	10.0947	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Nov	70.74	61.30	80.19	70.64	7.4023	6.2106	8.7686	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3
Gasoline (RVP 11.5)	Dec	66.73	58.54	74.92	70.64	6.8757	5.8934	7.9840	65.0000			92.00	Option 4: RVP=11.5, ASTM Slope=3

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

800-TK-02 - Vertical Fixed Roof Tank
Tucson, Arizona

Month:	January	February	March	April	May	June	July	August	September	October	November	December
Standing Losses (lb):	146.4163	169.3547	249.4420	349.6267	487.3317	615.4829	530.6181	463.6490	369.7007	272.7003	176.4549	137.7009
Vapor Space Volume (cu ft):	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132
Vapor Density (lb/cu ft):	0.0792	0.0828	0.0877	0.0952	0.1025	0.1101	0.1097	0.1073	0.1029	0.0940	0.0845	0.0791
Vapor Space Expansion Factor:	0.3964	0.5028	0.6611	0.9434	1.2571	1.6235	1.3552	1.1878	0.9848	0.7136	0.4869	0.3729
Vented Vapor Saturation Factor:	0.3013	0.2908	0.2777	0.2599	0.2442	0.2298	0.2305	0.2349	0.2434	0.2625	0.2861	0.3014
Tank Vapor Space Volume:												
Vapor Space Volume (cu ft):	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132	499.5132
Tank Diameter (ft):	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000
Vapor Space Outage (ft):	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600
Tank Shell Height (ft):	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000	18.0000
Average Liquid Height (ft):	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000	12.0000
Roof Outage (ft):	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600
Roof Outage (Cone Roof)												
Roof Outage (ft):	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600	0.3600
Roof Height (ft):	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800	1.0800
Roof Slope (ft/ft):	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200	0.2200
Shell Radius (ft):	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Vapor Density												
Vapor Density (lb/cu ft):	0.0792	0.0828	0.0877	0.0952	0.1025	0.1101	0.1097	0.1073	0.1029	0.0940	0.0845	0.0791
Vapor Molecular Weight (lb/lb-mole):	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	6.8811	7.2336	7.7164	8.4478	9.1806	9.9430	9.9035	9.6637	9.2221	8.3346	7.4023	6.8757
Daily Avg. Liquid Surface Temp. (deg. R):	526.4421	529.1531	532.7004	537.7531	542.4801	547.0912	546.8598	545.4354	542.7384	536.9947	530.4135	526.4002
Daily Average Ambient Temp. (deg. F):	51.2500	54.4000	58.7000	65.8000	73.9500	83.7500	86.5000	84.4500	80.4000	70.4500	59.1500	52.0500
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731	10.731
Liquid Bulk Temperature (deg. R):	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142	530.3142
Tank Paint Solar Absorptance (Shell):	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Tank Paint Solar Absorptance (Roof):	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400	0.5400
Daily Total Solar Insulation Factor (Btu/sqft day):	1,092.6779	1,403.2852	1,791.3064	2,243.4162	2,510.8748	2,580.9915	2,243.0989	2,120.6327	1,906.1582	1,586.0327	1,208.7987	1,000.3523
Vapor Space Expansion Factor												
Vapor Space Expansion Factor:	0.3964	0.5028	0.6611	0.9434	1.2571	1.6235	1.3552	1.1878	0.9848	0.7136	0.4869	0.3729
Daily Vapor Temperature Range (deg. R):	34.7373	40.5137	47.3886	56.0965	60.9324	61.8486	52.4917	49.8480	47.3971	43.9248	37.7890	32.7653
Daily Vapor Pressure Range (psia):	2.2183	2.6936	3.3191	4.2258	4.9045	5.3007	4.4785	4.1704	3.8209	3.2681	2.5580	2.0906
Breather Vent Press. Setting Range(psia):	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	6.8811	7.2336	7.7164	8.4478	9.1806	9.9430	9.9035	9.6637	9.2221	8.3346	7.4023	6.8757
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	5.8427	5.9859	6.1974	6.5421	6.9843	7.5680	7.8622	7.7546	7.4668	6.8266	6.2106	5.8934
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	8.0610	8.6795	9.5165	10.7678	11.8888	12.8687	12.3407	11.9249	11.2877	10.0947	8.7686	7.9840
Daily Avg. Liquid Surface Temp. (deg R):	526.4421	529.1531	532.7004	537.7531	542.4801	547.0912	546.8598	545.4354	542.7384	536.9947	530.4135	526.4002
Daily Min. Liquid Surface Temp. (deg R):	517.7578	519.0247	520.8533	523.7290	527.2470	531.6291	533.7369	532.9734	530.8891	526.0135	520.9662	518.2089
Daily Max. Liquid Surface Temp. (deg R):	535.1264	539.2816	544.5476	551.7773	557.7132	562.5534	559.9827	557.8973	554.5877	547.9760	539.8607	534.5916
Daily Ambient Temp. Range (deg. R):	25.3000	26.8000	28.2000	30.8000	31.9000	31.7000	25.8000	24.7000	25.8000	27.7000	27.1000	24.5000
Vented Vapor Saturation Factor												
Vented Vapor Saturation Factor:	0.3013	0.2908	0.2777	0.2599	0.2442	0.2298	0.2305	0.2349	0.2434	0.2625	0.2861	0.3014
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	6.8811	7.2336	7.7164	8.4478	9.1806	9.9430	9.9035	9.6637	9.2221	8.3346	7.4023	6.8757
Vapor Space Outage (ft):	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600	6.3600
Working Losses (lb):	26.6232	27.9872	29.8551	32.6849	35.5203	38.4698	38.3173	37.3892	35.6807	32.2472	28.6399	26.6025
Vapor Molecular Weight (lb/lb-mole):	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000	65.0000
Vapor Pressure at Daily Average Liquid												

Surface Temperature (psia):	6.8811	7.2336	7.7164	8.4478	9.1806	9.9430	9.9035	9.6637	9.2221	8.3346	7.4023	6.8757
Net Throughput (gal/mo.):	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000	2,500.0000
Annual Turnovers:	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000
Turnover Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Maximum Liquid Volume (gal):	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000	10,000.0000
Maximum Liquid Height (ft):	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000	16.0000
Tank Diameter (ft):	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000	10.0000
Working Loss Product Factor:	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
Total Losses (lb):	173.0395	197.3419	279.2971	382.3116	522.8520	653.9526	568.9353	501.0382	405.3814	304.9474	205.0948	164.3034

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: January, February, March, April, May, June, July, August, September, October, November, December

800-TK-02 - Vertical Fixed Roof Tank
Tucson, Arizona

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Gasoline (RVP 11.5)	390.02	3,968.48	4,358.50

Oracle Ridge Copper

APPENDIX E

Tailings Facility General Arrangement Drawings and Stockpile Plan Sheets

FEASIBILITY STUDY DRAWINGS

ORACLE RIDGE COPPER PROJECT

SECTION 17, T 11S, R 16E, ARIZONA

GENERAL LEGEND

℄ – CENTERLINE
DIA. – DIAMETER
EL. – ELEVATION
MAX. – MAXIMUM
MIN. – MINIMUM
NOM. – NOMINAL
TYP. – TYPICAL
50ft – DIMENSION IN FEET
2:1 – 2 HORIZONTAL TO 1 VERTICAL SLOPE
~ – APPROXIMATE

EXISTING CONTOUR (ft)
EXISTING ROAD
EXISTING DRAINAGE

AREA OF DETAIL
DETAIL NUMBER
SHEET NUMBER WHERE DETAIL IS CALLED OUT
SHEET NUMBER WHERE DETAIL IS SHOWN
DETAIL CALL-OUT

SECTION LETTER
SHEET NUMBER WHERE SECTION IS SHOWN
SHEET NUMBER WHERE SECTION IS CALLED OUT
LINE WHERE SECTION IS CUT
CROSS SECTION LOCATION

LIST OF DRAWINGS:

01 - TITLE SHEET AND PROJECT LOCATION MAP
02 - GENERAL FACILITIES ARRANGEMENT
03 - STARTUP TSF AND TOPSOIL STOCKPILE PLAN
04A - STAGE 1 (YEAR 1) DRY STACK DEVELOPMENT PLAN
04B - STAGE 1 (YEAR 2) DRY STACK DEVELOPMENT PLAN
04C - STAGE 1 (YEAR 3) DRY STACK DEVELOPMENT PLAN
05A - STAGE 2 (YEAR 4) DRY STACK DEVELOPMENT PLAN
05B - STAGE 2 (YEAR 5) DRY STACK DEVELOPMENT PLAN
05C - STAGE 2 (YEAR 6) DRY STACK DEVELOPMENT PLAN
06 - STAGE 3 (YEAR 7) DRY STACK DEVELOPMENT PLAN
07 - STAGE 4 (YEAR 8) DRY STACK DEVELOPMENT PLAN
08 - STAGE 5 (YEAR 9) DRY STACK DEVELOPMENT PLAN
09 - STAGE 6 (YEAR 10) DRY STACK DEVELOPMENT PLAN
10 - STAGE 7 (YEAR 11) DRY STACK DEVELOPMENT PLAN
11 - STAGE 8 (YEAR 12) DRY STACK DEVELOPMENT PLAN
11B - STAGE 8 (YEAR 12) FINAL SPILL WAY
12 - STARTUP DRY FILTER TSF - PLAN
13 - STARTUP DRY FILTER TSF - SECTIONS
14A - STARTUP TOE BERM - PLAN & SECTION
14B - STARTUP TOE BERM PLAN & DETAILS
15 - STARTUP DRY FILTER TSF - DETAILS
16 - ULTIMATE DRY FILTER TSF - PLAN
17 - ULTIMATE DRY FILTER TSF - SECTIONS
18 - UNDERDRAIN SYSTEM - PLAN & DETAILS
19 - OVERDRAIN SYSTEM - PLAN & DETAILS
20 - LEAK DETECTION - PLAN, SECTION & DETAILS
21 - COLLECTION SUMP - PLAN, SECTION & DETAILS
22 - SURFACE WATER MANAGEMENT - PLANS
23 - SURFACE WATER MANAGEMENT - SECTIONS

ALAN J. WHEELBARGER, P.E.

Rev	Description	By	Date
C	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
A	ISSUED FOR REVIEW	AJB	6/11

REVISIONS

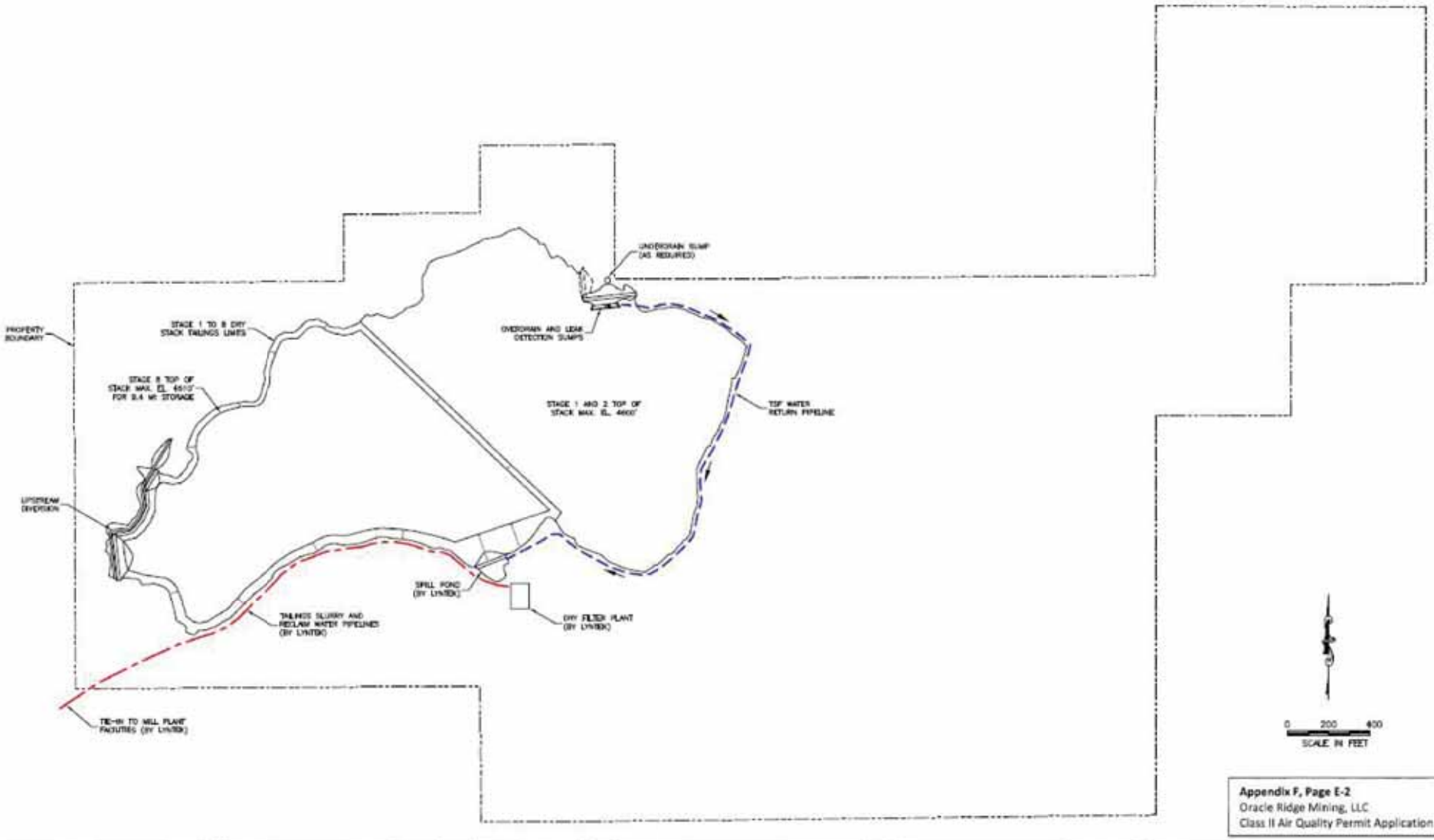
Scale: As Shown
Designed by: GME
Drawn by: DKS
Checked by: AJB
Approved by: AJB

Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
TITLE SHEET AND PROJECT LOCATION MAP

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 01
REVISION C



Appendix F, Page E-2
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVISION	AJB	8/11

REVISIONS

Scale: As Shown
Designed by: GRE
Drawn by: DKS
Checked by: AJB
Approved by: AJB

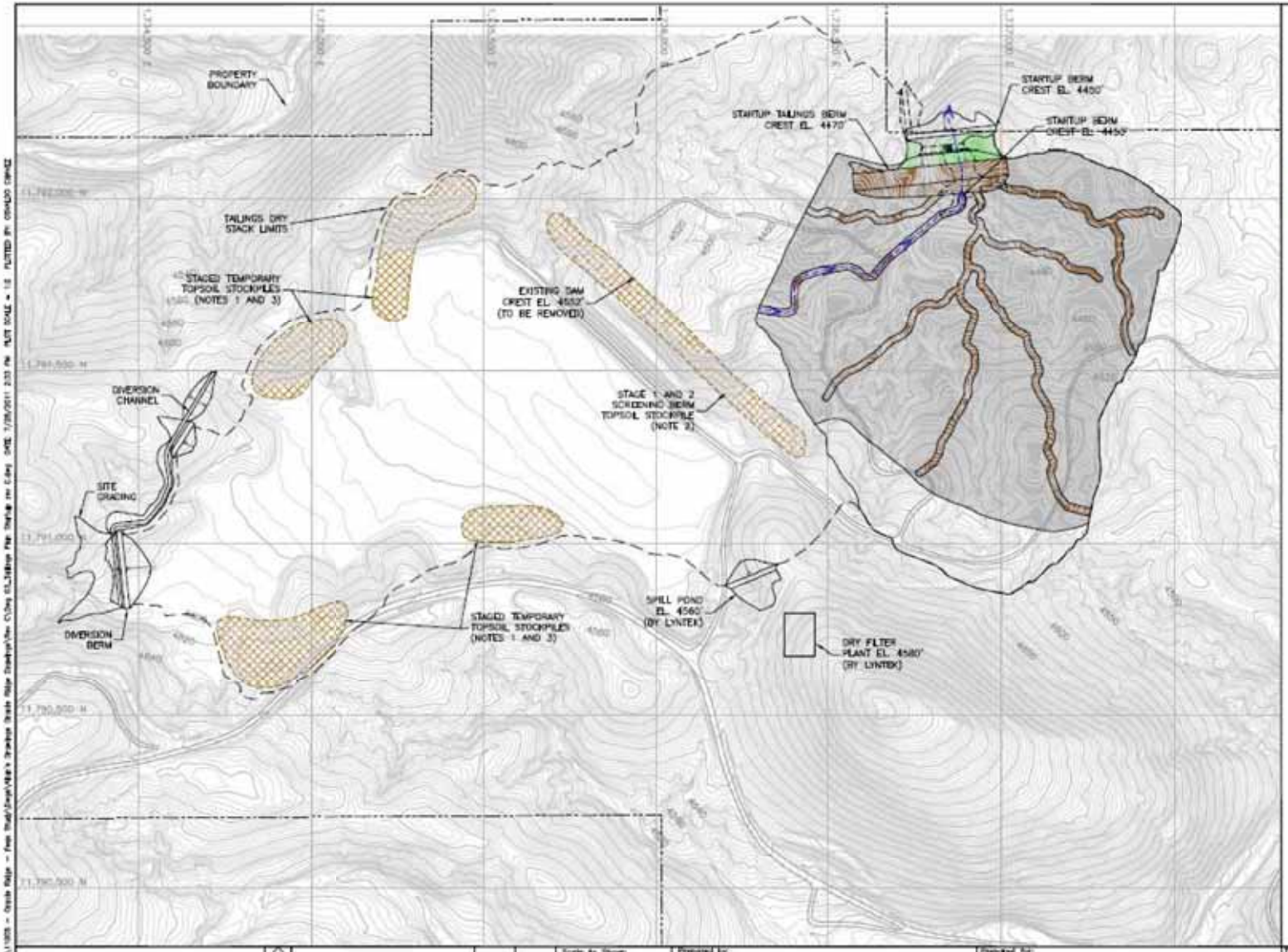
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
GENERAL FACILITIES ARRANGEMENT

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 02
REVISION C

ALLAN J. BREITENBACH, P.E.



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.803M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.136M ft²
- RECLAIMED FLAT AREA = 0.021M ft²
- TEMPORARY TOPSOIL STOCKPILE AREA

NOTES:

1) TOPSOIL STOCKPILES TO COVER RECLAIMED FINAL TSF SLOPES AND TOP SURFACES AS DRY STACK LIFT CONSTRUCTION PROGRESSES.

2) STAGE 1 AND 2 SCREENING BERM TOPSOIL STOCKPILE TO MINIMIZE VISUAL IMPACT DURING TSF CONSTRUCTION TO 30 FEET MAX. HEIGHT AT 2H:1V SLOPES AND CREST WIDTH VARIES AS NEEDED.

3) STAGED TEMPORARY TOPSOIL STOCKPILES LOCATED ON NATURAL GROUND WITHIN ULTIMATE TSF LIMITS INCLUDE SALVAGED EXISTING TAILINGS EARTH FILL COVER AND REMOVED EARTH AND ROCK FILL FROM EXISTING DAM.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-3
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALLAN J. GREENBACK, P.E.

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

REVISIONS

Scale: As Shown
Designed by: GRE
Drawn by: DKS
Checked by: AJB
Approved by: AJB

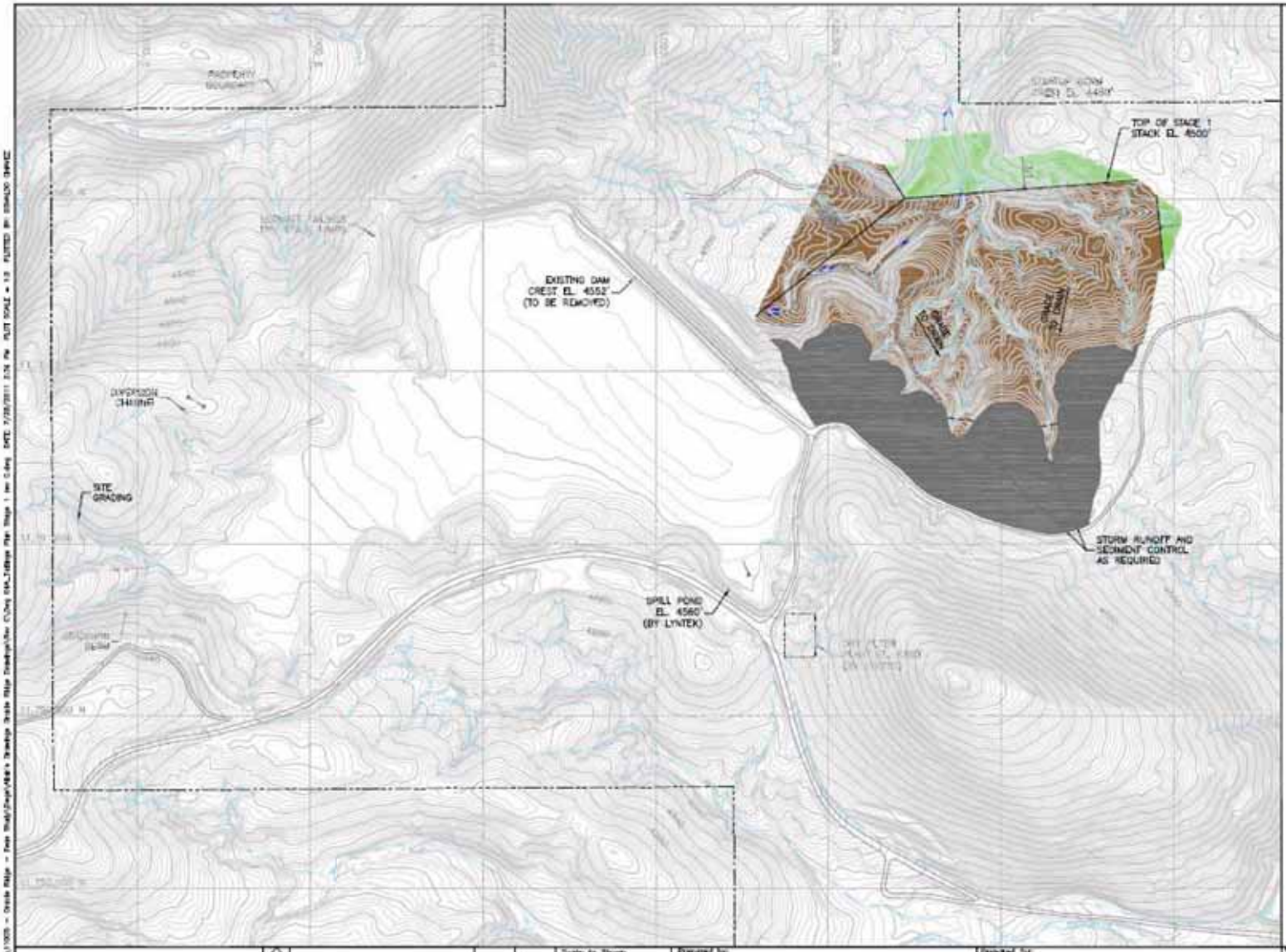
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 1 YEAR 0
STARTUP TSF AND TOPSOIL
STOCKPILE PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 03



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.414M ft^2
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.598M ft^2 (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 0.086M ft^2

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-4
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
C	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
A	ISSUED FOR REVIEW	AJB	6/11

REVISIONS

ALLAN J. BREEDWACH, P.E.

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Checked by: AJB
Approved by: AJB

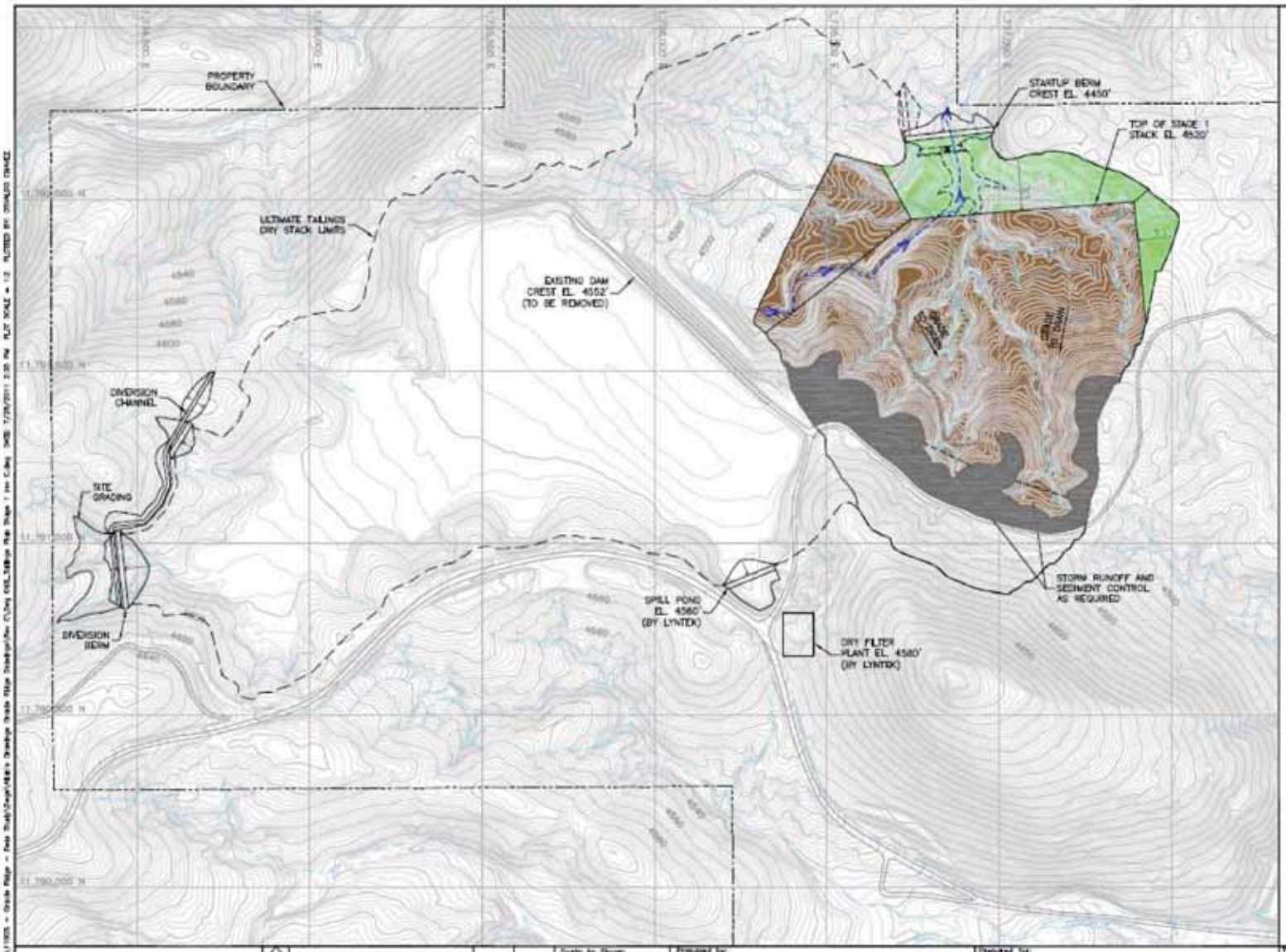
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 1 (YEAR 1)
DRY STACK DEVELOPMENT PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION 17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 04A



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.266M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.685M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 0.144M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-5
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

REVISIONS

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Approved by: AJB

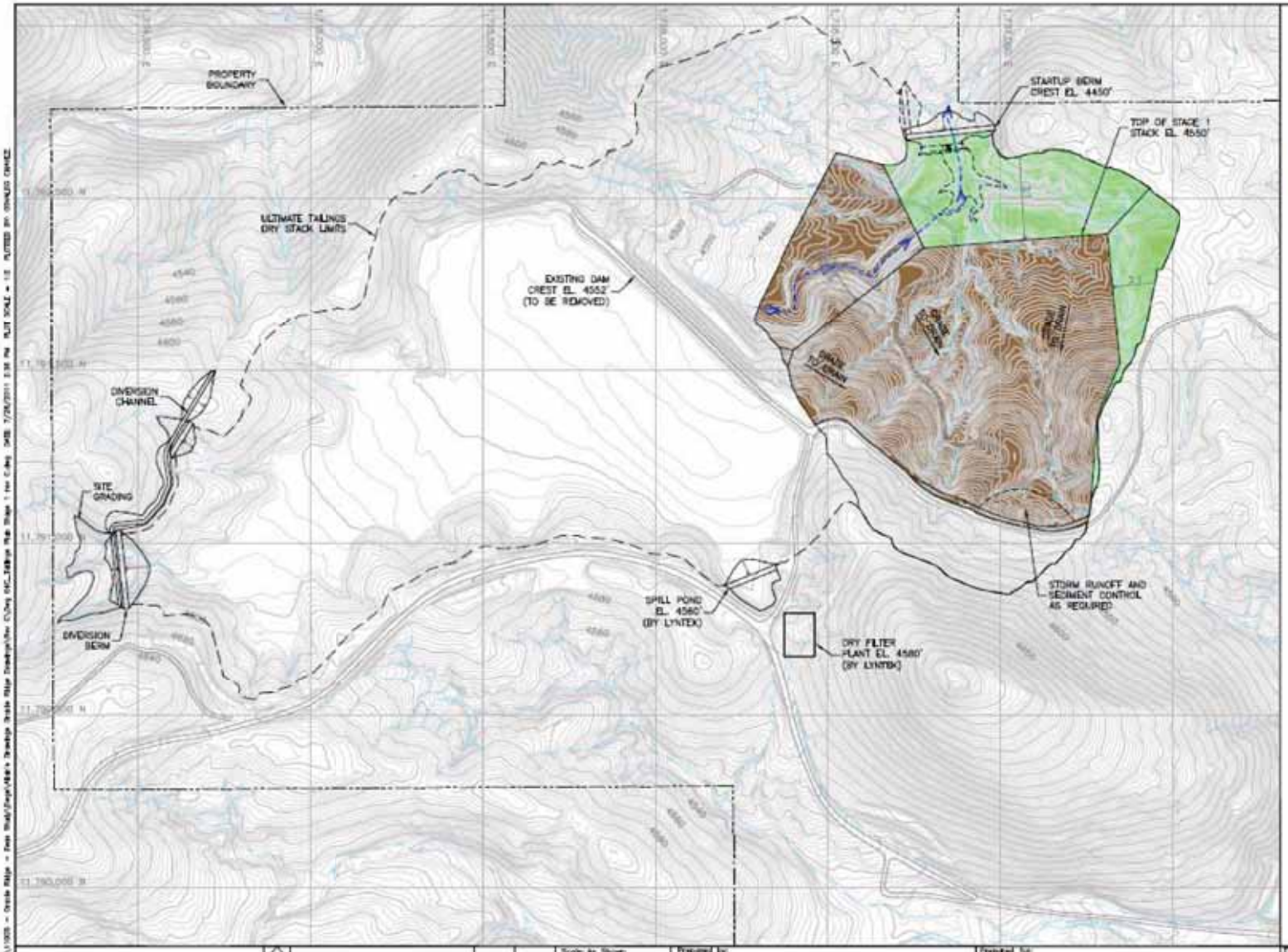
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 1 (YEAR 2)
DRY STACK DEVELOPMENT PLAN

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING: 04B
REVISION: C

ALAN J. BREDENBACH, P.E.



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.136M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.715M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 0.231M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

Appendix F, Page E-6
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALLAN J. BREITENBACH, P.E.

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

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Designed by: GHE
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Approved by: AJB

Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

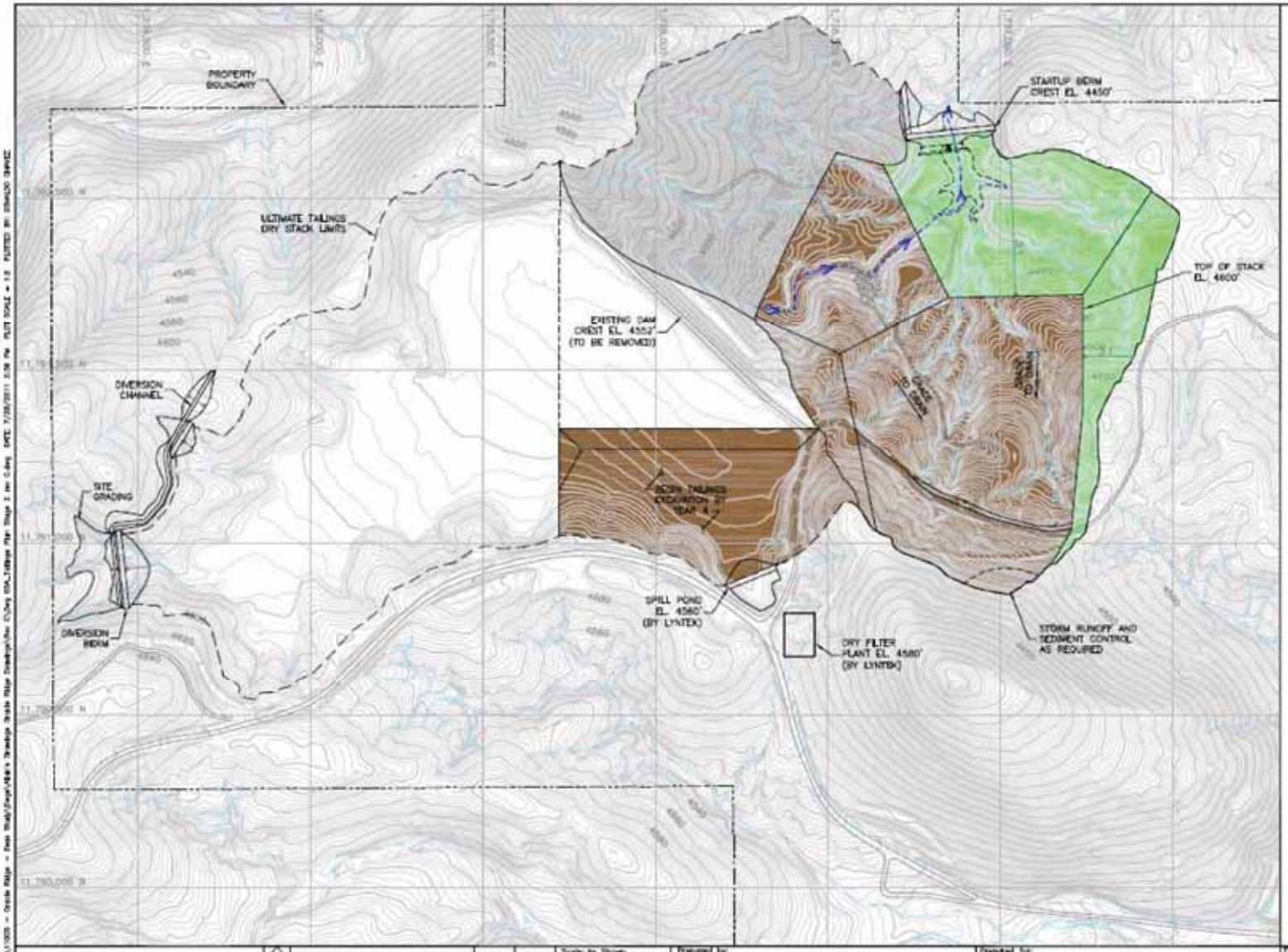
Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 1 (YEAR 3)
DRY STACK DEVELOPMENT PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011

DRAWING 04C



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.473M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 1.022M ft² (MINIMUM ROX WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 0.386M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-7
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALLAN J. BREITENBACH, P.E.

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

REVISIONS

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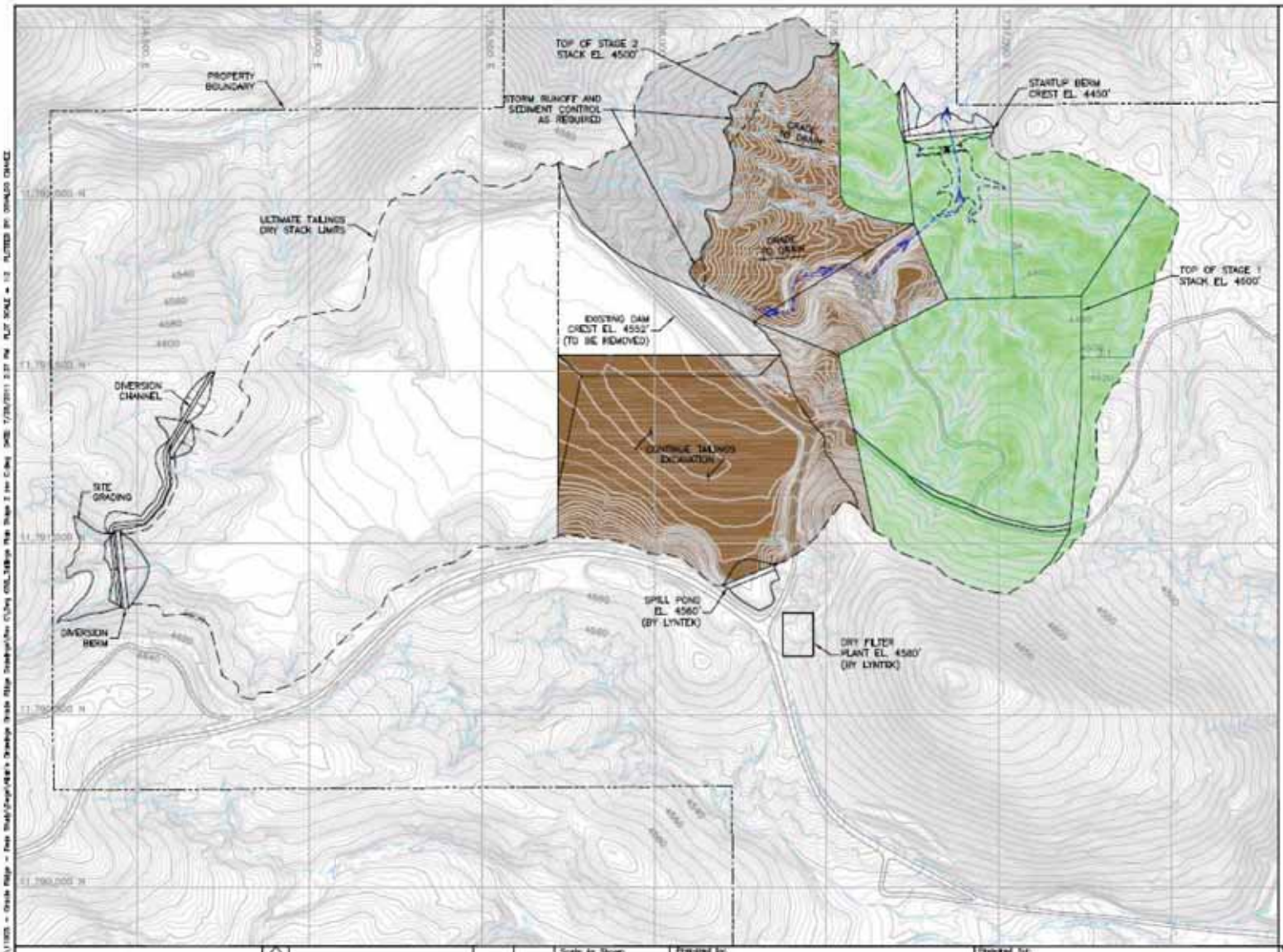
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 2 (YEAR 4)
DRY STACK DEVELOPMENT PLAN

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING: 05A
REVISION: C



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.250M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.844M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 0.914M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

Appendix F, Page E-8
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALAN J. BREIDENBACH, P.E.

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
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REVISIONS

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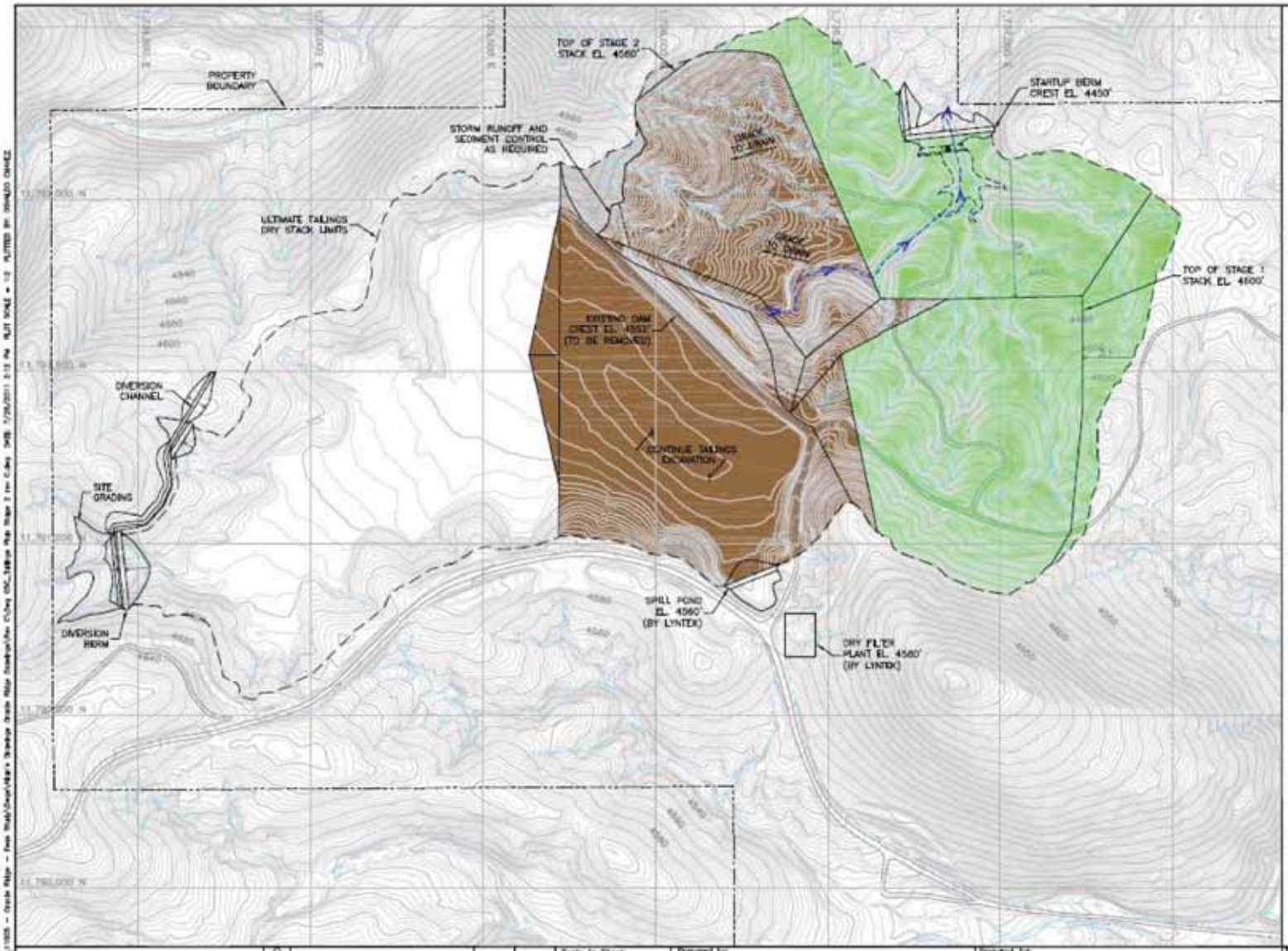
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 2 (YEAR 5)
DRY STACK DEVELOPMENT PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 05B



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.034M ft^2
- EXPOSED DRY STACK TAILINGS FLAT AREA = 1.124M ft^2 (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 1.019M ft^2

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

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Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALAN J. BREDENKAMP, P.E.

Rev	Description	By	Date
C	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
A	ISSUED FOR REVIEW	AJB	6/11

REVISIONS

Scale As Shown
Designed by: GME
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Checked by: AJB
Approved by: AJB

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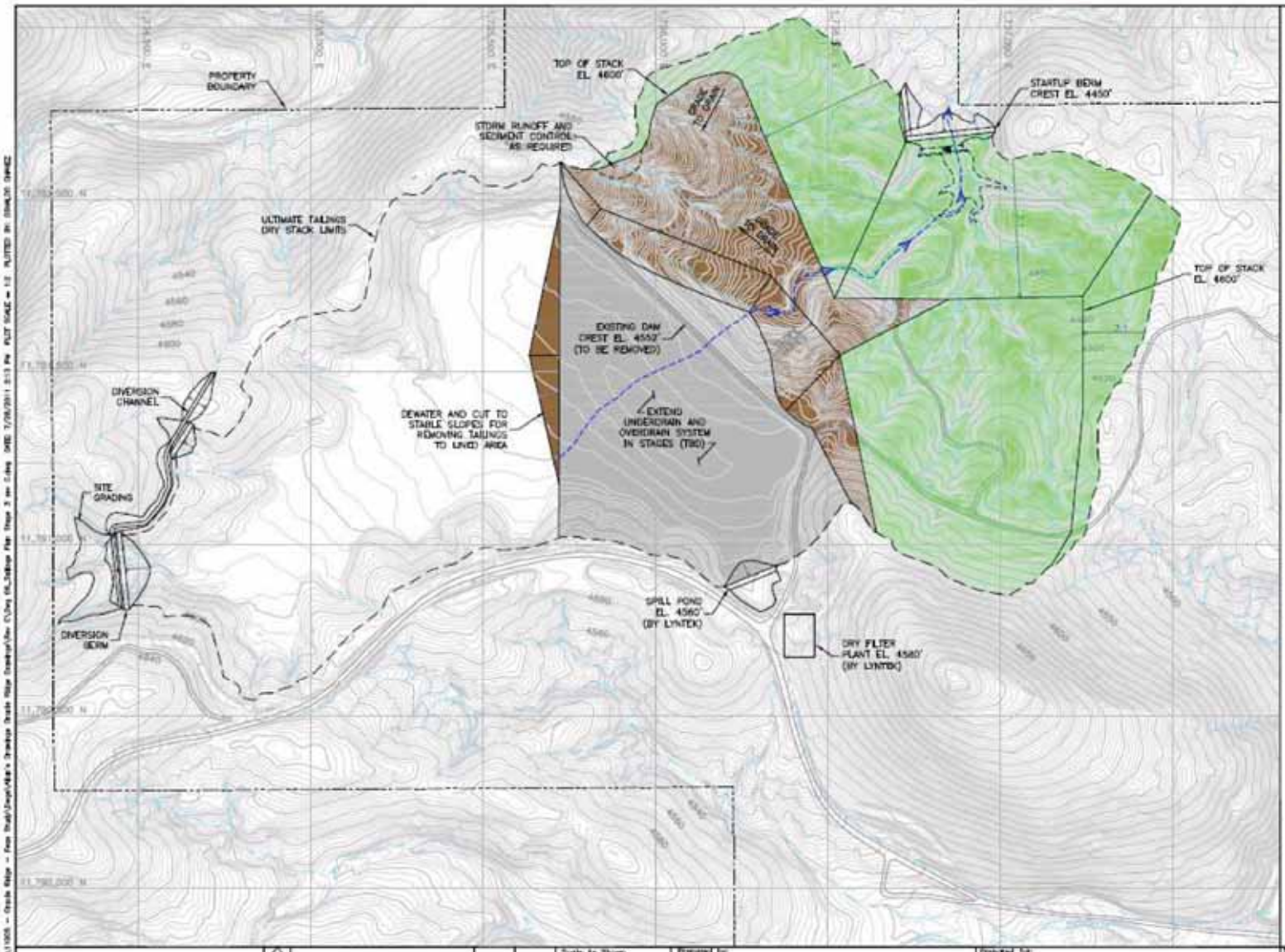
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 2 (YEAR 6)
DRY STACK DEVELOPMENT PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 89037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 05C



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.573M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.464M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 1.147M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

3) STAGED UNDERDRAIN AND OVERDRAIN SYSTEMS TO BE EXTENDED INTO EACH COMPLETED EXCAVATION UNIT, AS DETERMINED BY ENGINEER DURING CONSTRUCTION.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-10
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

REVISIONS

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Designed by: GHE
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Approved by: AJB

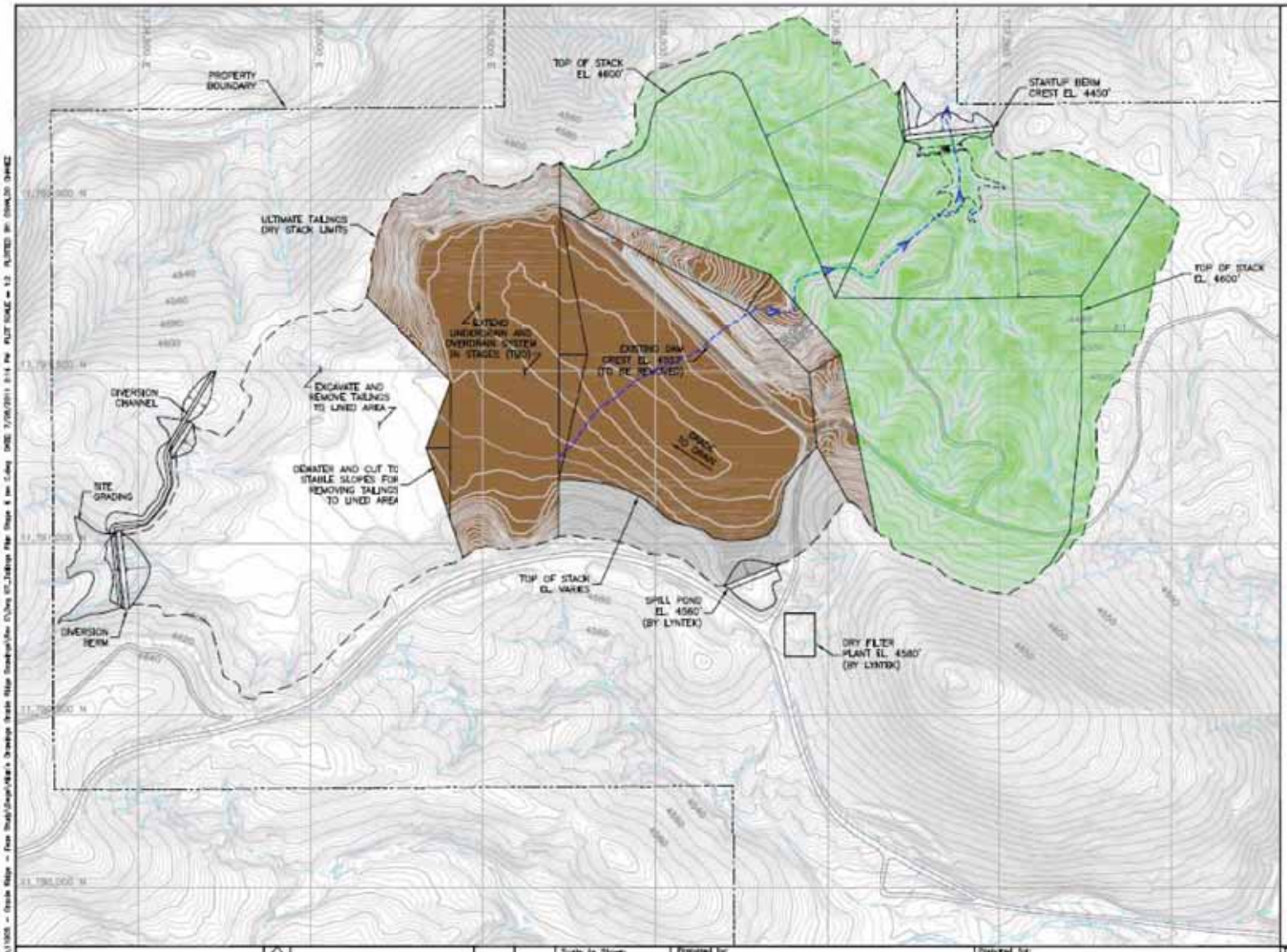
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

ALAN J. BRESENHAN, P.E.

Title:
STAGE 3 (YEAR 7)
DRY STACK DEVELOPMENT PLAN

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION 17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 06



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.123M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 1.062M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 1.417M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

3) STAGED UNDERDRAIN AND OVERDRAIN SYSTEMS TO BE EXTENDED INTO EACH COMPLETED EXCAVATION UNIT, AS DETERMINED BY ENGINEER DURING CONSTRUCTION.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-11
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
C	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
A	ISSUED FOR REVIEW	AJB	6/11

REVISIONS

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Drawn by: DKS
Checked by: AJB
Approved by: AJB

Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

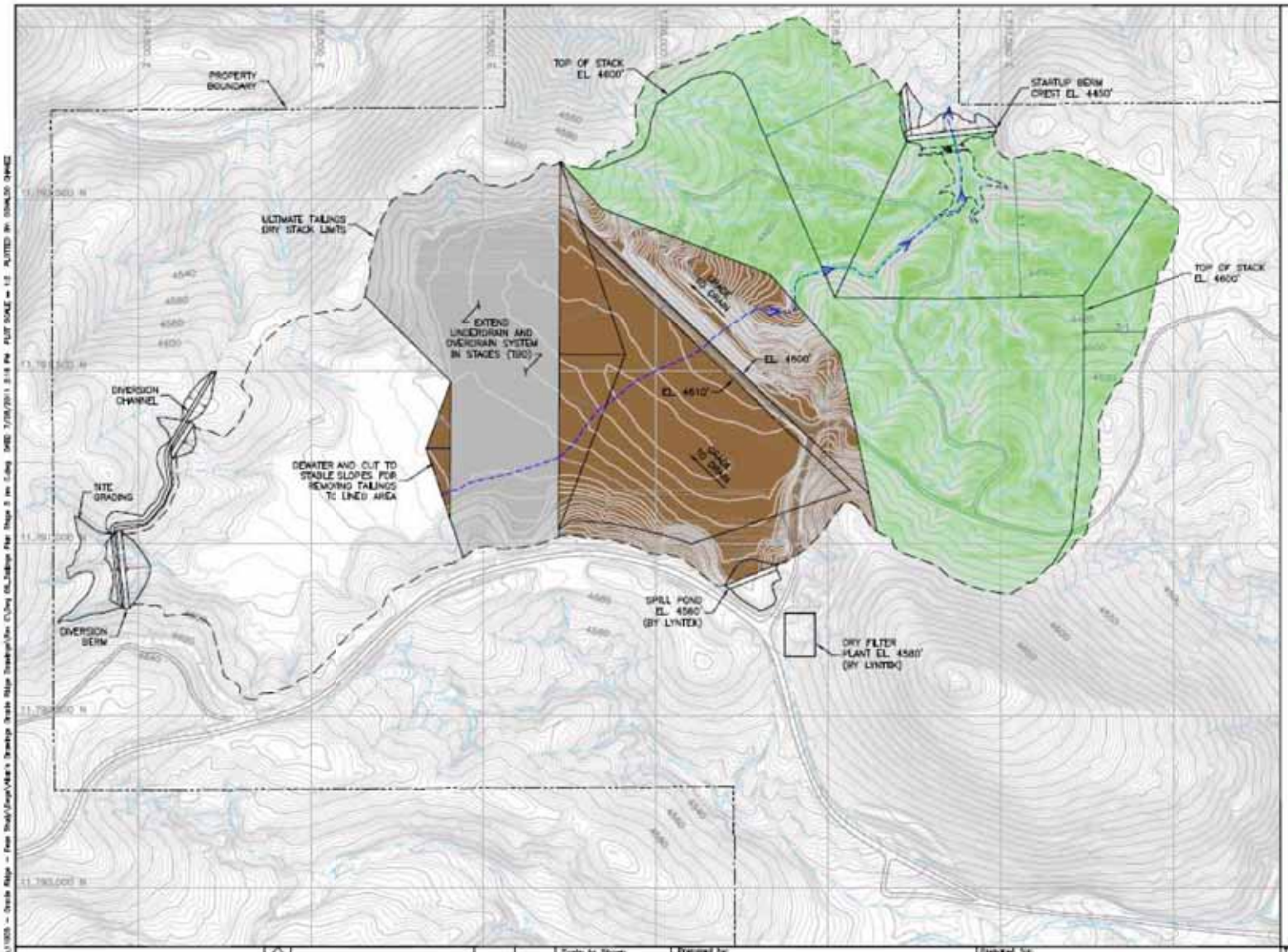
Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 4 (YEAR 8)
DRY STACK DEVELOPMENT PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 07

ALAN J. BRESENHAN, P.E.



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.434M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.743M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 1.417M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

3) STAGED UNDERDRAIN AND OVERDRAIN SYSTEMS TO BE EXTENDED INTO EACH COMPLETED EXCAVATION LIMIT, AS DETERMINED BY ENGINEER DURING CONSTRUCTION.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-12
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
C	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
A	ISSUED FOR REVIEW	AJB	6/11

REVISIONS

Scale: As Shown
Designed by: GHE
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Checked by: AJB
Approved by: AJB

Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

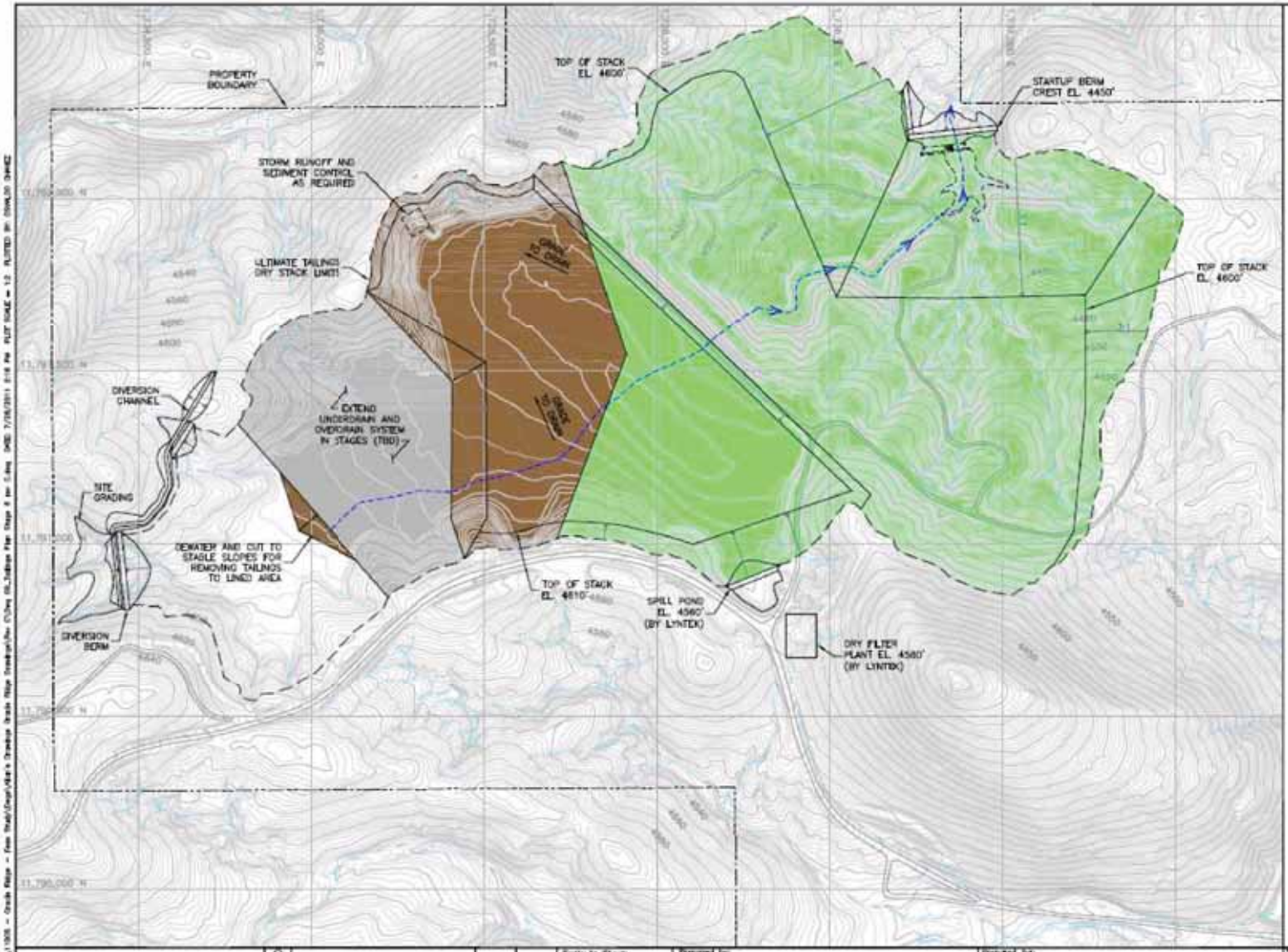
Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 5 (YEAR 9)
DRY STACK DEVELOPMENT PLAN

C REVISION

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION 17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 08

ALLAN J. BREDENKAMP, P.E.



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.360M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.543M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 2.053M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

3) STAGED UNDERDRAIN AND OVERDRAIN SYSTEMS TO BE EXTENDED INTO EACH COMPLETED EXCAVATION UNIT, AS DETERMINED BY ENGINEER DURING CONSTRUCTION.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-13
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALAN J. SWEDENBACH, P.E.

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

REVISIONS

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Checked by: AJB
Approved by: AJB

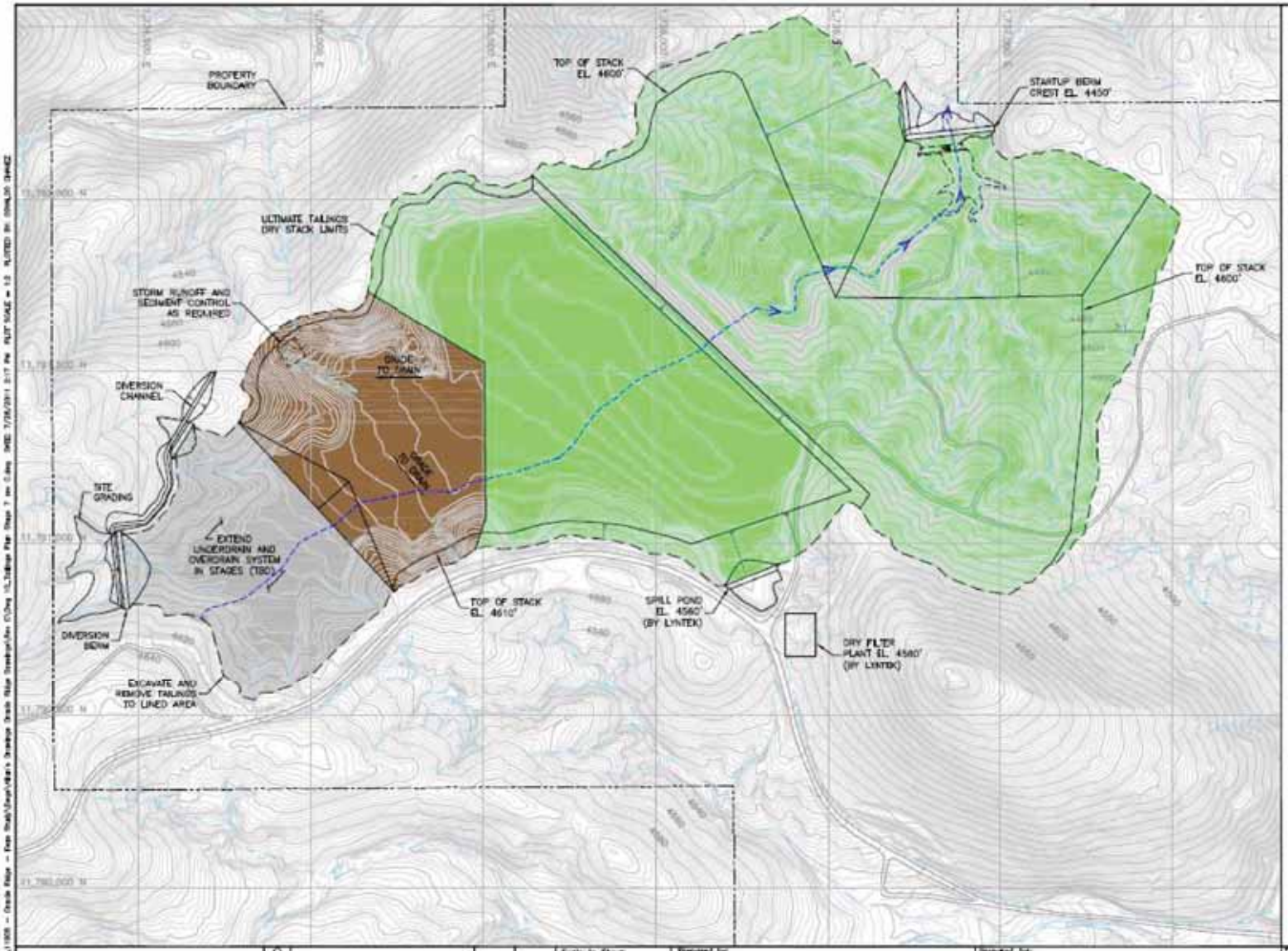
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 6 (YEAR 10)
DRY STACK DEVELOPMENT PLAN

REVISION C

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 09



LEGEND

- GEOMEMBRANE LINER FLAT AREA = 0.343M ft²
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.416M ft² (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 2.523M ft²

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

3) STAGED UNDERDRAIN AND OVERDRAIN SYSTEMS TO BE EXTENDED INTO EACH COMPLETED EXCAVATION LIMIT, AS DETERMINED BY ENGINEER DURING CONSTRUCTION.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-14
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
C	ISSUED FOR REVIEW	AJB	7/28
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A	ISSUED FOR REVIEW	AJB	6/11

REVISIONS

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Drawn by: DKS
Checked by: AJB
Approved by: AJB

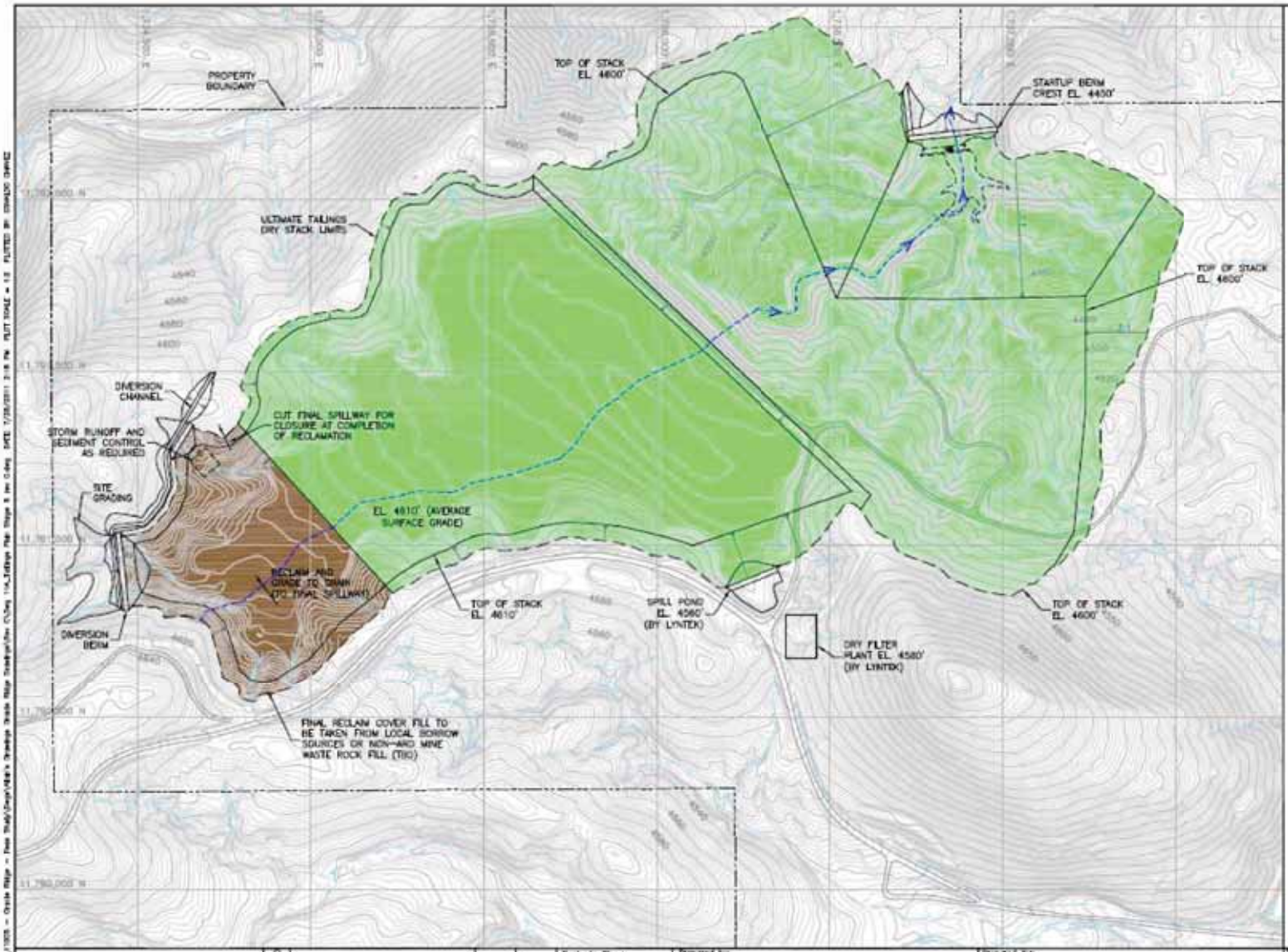
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STAGE 7 (YEAR 11)
DRY STACK DEVELOPMENT PLAN

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 10

ALAN J. BRESDINCH, P.E.



LEGEND

- GEOMEMBRANE LINER FLAT AREA
- EXPOSED DRY STACK TAILINGS FLAT AREA = 0.333M ft^2 (MINIMUM 80% WITH TEMPORARY COVER TBD)
- RECLAIMED FLAT AREA = 2.950M ft^2

NOTES:

1) SEE DRAWING 03 FOR TEMPORARY TOPSOIL STOCKPILE LOCATIONS (VARY TO SUIT STAGED CONSTRUCTION).

2) LEGEND LIMITS ARE APPROXIMATE AND MAY VARY TO SUIT EXISTING TAILINGS STAGED EXCAVATIONS.

3) STAGED UNDERDRAIN AND OVERDRAIN SYSTEMS TO BE EXTENDED INTO EACH COMPLETED EXCAVATION LIMIT, AS DETERMINED BY ENGINEER DURING CONSTRUCTION.

0 150 300
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-15
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
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REVISIONS

ALLAN J. BREITENBACH, P.E.

Scale: As Shown
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Checked by: AJB
Approved by: AJB

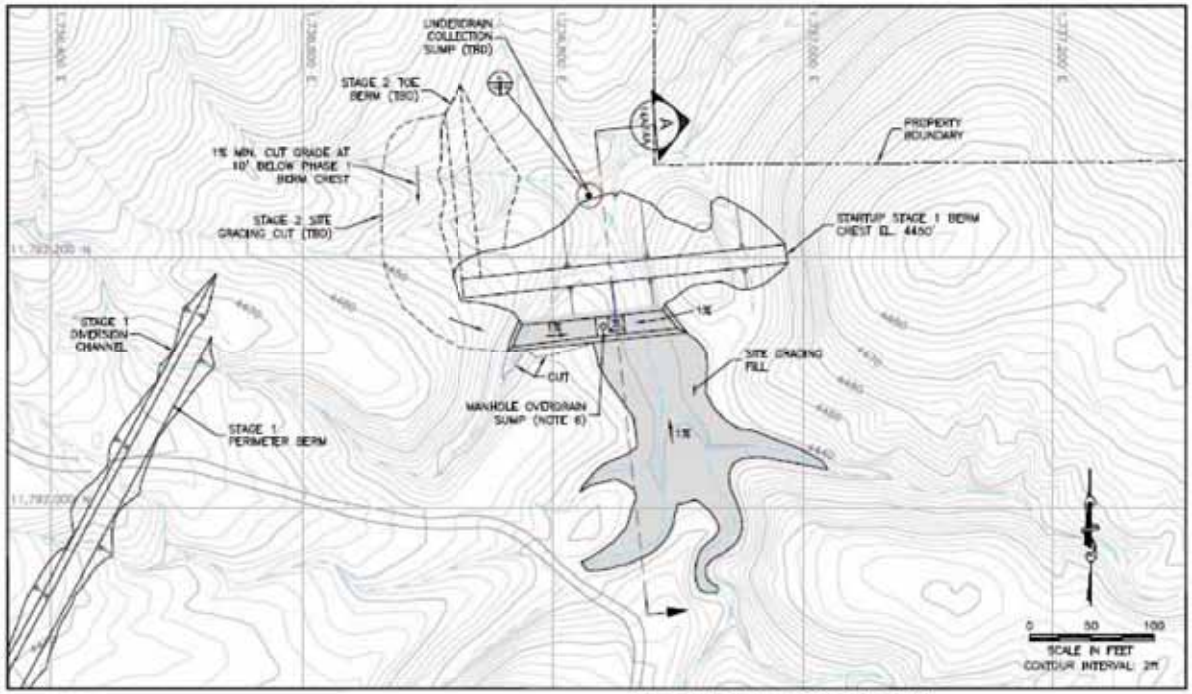
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

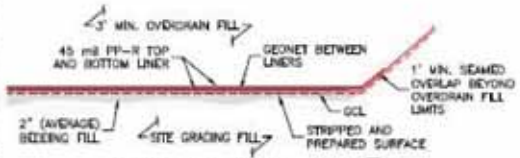
Title:
STAGE 8 (YEAR 12)
DRY STACK DEVELOPMENT PLAN

REVISION C

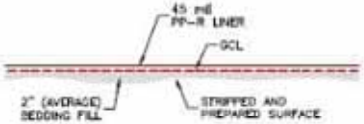
Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 11



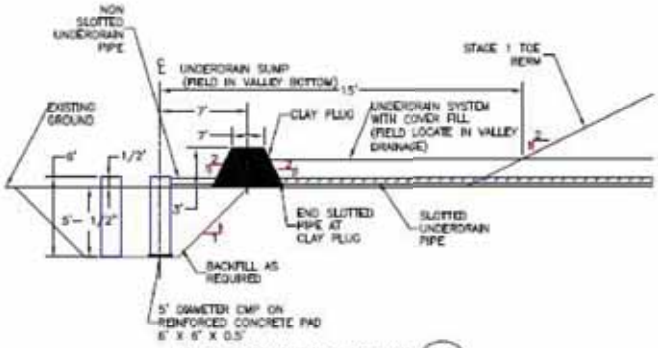
STARTUP STAGE 1 TOE BERM PLAN



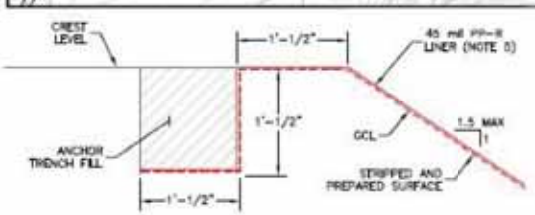
DRY STACK LINER DETAIL 3
NOT TO SCALE



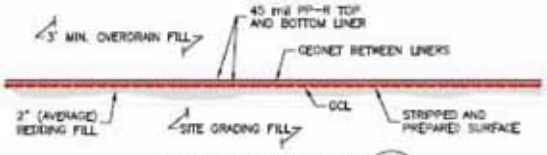
DRY STACK LINER DETAIL 4
NOT TO SCALE



UNDERDRAIN SUMP DETAIL 5
NOT TO SCALE



ANCHOR TRENCH DETAIL 1
NOT TO SCALE



DRY STACK LINER DETAIL 2
NOT TO SCALE

NOTES:

1) ENTIRE SURFACE OF SITE GRADING FILL TO BE COVERED WITH 3M. OF OVERDRAIN FILL AND 5' MIN. TAILINGS FILL.
2) ALL PP-R LINER SHALL BE 45 mil SCRIM REINFORCED POLYPROPOLENE LINER.
3) GCL SHALL BE CETCO STM GRADE GEOSYNTHETIC CLAY LINER OR EQUIVALENT APPROVED BY THE ENGINEER.
4) ALL GEOGRID TO BE COVERED TOP AND BOTTOM WITH 8 oz/yd² NON-WOVEN GEOTEXTILE.
5) DOUBLE LINER AND LEAK DETECTION TO EXTEND UP TO ANCHOR TRENCH AT 5' EACH SIDE OF LEAK DETECTION WELL PIPE.
6) OVERDRAIN SUMP TO BE FIELD LOCATED ON COMPETENT BEDROCK SURFACE.
7 LOCKED GRATE COVER FOR ACCESS BY AUTHORIZED PERSONEL

Appendix F, Page E-16
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

ALLAN J. GREENWACH, P.E.

Rev	Description	By	Date
	ISSUED FOR REVIEW	AJG	7/28
	ISSUED FINAL	AJG	7/11
	ISSUED FOR REVIEW	AJG	5/11

REVISIONS

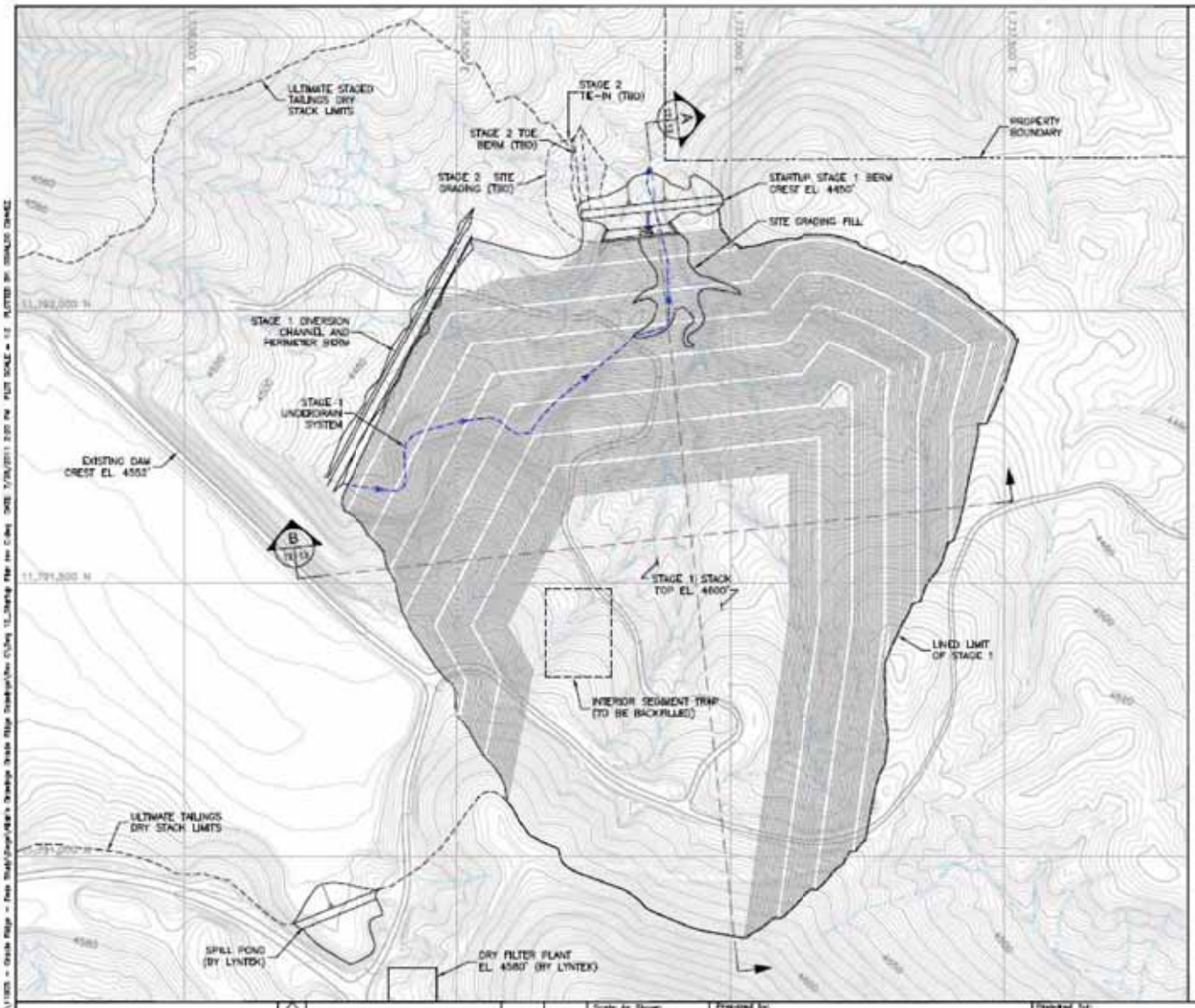
Scale: As Shown
Designed by: GHE
Drawn by: DKS
Checked by: AJG
Approved by: AJG

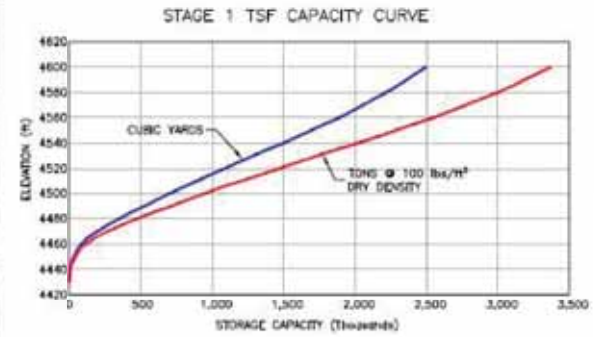
Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STARTUP TOE BERM PLAN & DETAILS

Project: ORACLE RIDGE COPPER
Project No.: 89037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING: 14B
REVISION: C





NOTES:

1) TOPOGRAPHY PROVIDED BY DAVIDI.

2) SIMPLIFIED TSF STACK BENCHES SHOWN FOR FEASIBILITY DESIGN. ACTUAL BENCHES TO BE GRADED FOR RECLAMATION DRAINAGE.

0 100 200
SCALE IN FEET
CONTOUR INTERVAL: 2ft

Appendix F, Page E-17
Oracle Ridge Mining, LLC
Class II Air Quality Permit Application

Rev	Description	By	Date
A	ISSUED FOR REVIEW	AJB	7/28
B	ISSUED FINAL	AJB	7/11
C	ISSUED FOR REVIEW	AJB	8/11

REVISIONS

Scale: As Shown
Designed by: GRE
Drawn by: DKS
Checked by: AJB
Approved by: AJB

Prepared by:
AB ENGINEERING INC.
LITTLETON, COLORADO USA

Prepared for:
ORACLE RIDGE MINING, LLC
10445 N. ORACLE RD, STE 101
ORO VALLEY, AZ 85737

Title:
STARTUP DRY FILTER
TSF - PLAN

Project: ORACLE RIDGE COPPER
Project No.: 99037
Location: SECTION17, T11S, R16E, ARIZONA
Date: 7/2011
DRAWING 12
REVISION C

ALLAN J. BREITENBACH, P.E.

APPENDIX F

Concentrator Plant Reagent Usage Detail

ORACLE RIDGE MINE (ORM) - REAGENT SUMMARY									
REAGENT TYPE	CHEMICAL NAME	COMPOSITION		LISTED HAP[1]	VOC[2]	DAILY USAGE[3]	% VOC		
Product Name	Composition	% (by weight)	CAS #	Yes / No	Yes / No	lbs/day	(by volume)	MIR[4]	ORM FACILITY LOCATION OF USAGE
FROTHER									
Aerofroth 70® Frother --------- (Liquid form, usage rate = 0.05 lbs/ton of plant feed) ---------->						162 lbs/day	100%	2.89	MINE FACILITY CONCENTRATOR BUILDING
$(CH_3)_2CHCH_2CH(OH)CH_3$	*Methyl Isobutyl Carbinol (MIBC)*								
	Methyl Isobutyl Carbinol	60% to 100%	000108-11-2	No	Yes				
Aerofroth 65® Frother --------- (Liquid form, usage rate = 0.006 lbs/ton of plant feed) ---------->						18 lbs/day	100%	2.89	MINE FACILITY CONCENTRATOR BUILDING
LIME									
Limate, Dolomitic Hydrated Lime --------- (Granualr form, usage rate = 0.5 lbs/ton of plant feed) ---------->						1500 lbs/day	NA	NA	MINE FACILITY CONCENTRATOR BUILDING
	Calcium Magnesium Hydroxide								
$Ca(OH)_2$	Calcium Hydroxide	LT 58%	001305-62-0	No	No		NA	NA	
$Mg(OH)_2$	Magnesium Hydroxide	LT 38%	001309-42-8	No	No		NA	NA	
$CaMgC_2O_6$	Dolomite	LT 1%	016389-88-1	No	No		NA	NA	
MgO	Magnesium Oxide	LT 1%	001309-48-4	No	No		NA	NA	
SiO_2	Crystalline Silica	NA	014808-60-7	No	No		NA	NA	
FLOCCULANT									
DAF-30 --------- (Powder form, usage rate = 0.01 lbs/ton of concentrate) ---------->						30 lbs/day	* NA	* NA	MINE FACILITY CONCENTRATOR BUILDING
" " --------- (Powder form, usage rate = 0.02 lbs/ton of tailings) ---------->						60 lbs/day	* NA	* NA	TAILINGS FACILITY DRY FILTER PLANT
	***Note: No chemical compounds or composition on MSDS**	* None Listed	* None Listed	* NA	* NA				
	(Polymer Ventures, Inc. - Product Code: PVDAF30)								
CONDITIONING REAGENT									
AERO 343 Xanthate --------- (Delivered in Pellet form then hydrated into slury, usage rate = 0.08 lbs/ton of plant feed) ---------->						240 lbs/day	20%	(see below)	MINE FACILITY CONCENTRATOR BUILDING
	Sodium Isopropyl Xanthate (NAX31)								
$C_4H_7OS_2Na$	Sodium Isopropyl Xanthate	60% to 100%	000140-93-2	No	No		NA	NA	
NaOH	Sodium Hydroxide	1% to 5%	001310-73-2	No	No		NA	NA	
$(CH_3)_2CHCH_2OH$	Isopropanol	1% to 5%	000067-63-0	No	Yes		100%	0.71	
Sodium Hydrosulfide -------(Delivered in crystalline, flake, or powder form then hydrated into slurry, usage rate = 0.2 lb/ton) ---------->						600 lb/day	NA	NA	MINE FACILITY CONCENTRATOR BUILDING
NaHS	*Sodium Hydrosulfide*								
$NaHS \bullet H_2O$	Sodium Hydrosulfide	66%	016721-80-5						
H_2O	Water	27%	007732-18-5						
$Na_2S \bullet 3H_2O$	Sodium Sulfide	< 6%	001313-82-2						
Na_2CO_3	Sodium Carbonate	1%	000497-19-8						
ALTERNATE OPERATING SCENARIO ***(Use of Potassium Amyl Xanthate, PAX, in place of AERO 343 Xanthate)***						**OR**			
Potassium Amyl Xanthate (PAX)-------(Delivered in Pellet form then hydrated into slurry, usage rate = 0.12 lbs/ton of plant feed) ---------->						360 lbs/day	NA	NA	MINE FACILITY CONCENTRATOR BUILDING
	Potassium Sulfide	~ 1%	001312-73-8	No	No		NA	NA	
	Carbonodithioic Acid, (3-methylbutyl) ester, potassium salt	> 90%	001928-70-1	No	No		NA	NA	
	Potassium Hydroxide	0% to 1%	001310-58-3	No	No		NA	NA	

NOTES:

1 Listing per United States Federal Clean Air Act, Title I, Section 112(b) - Hazardous Air Pollutants (HAP).
2 Per EPA 40 CFR 51.100 definition of VOCs that includes list of VOCs specfically excluded from the definition (i.e. non-precursors to ozone, not photoreactive).
3 See Permit Section ... for Process Description for details regardings usage rates.
4 Maximum Incremental Reactivity, MIR (see definition below). MIR listed values per SAPRC-07 Chemical Mechanism software developed by the College of Engineering Center for Environmental Research and Technology (CE-CERT) at the University of California at Riverside (UCR) with funding by the California Air Resources Board (CARB).

DEFINITIONS:

Volatilization - The conversion of a chemical substance from a liquid or solid state to a gaseous vapor state.

Volatile Organic Compound (VOC) - A VOC is one of a group of carbon-containing compounds that evaporate readily at room temperature. However, for air permitting purposes, and, as defined in 40 CFR 51.100(s), the term VOC includes any compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) which participates in atmospheric photochemical reactions. These photochemical reactions contribute to ozone and are therefore considered to be ozone precursers. Trpospheric or ground-level ozone (i.e., smog) is formed by a combination of sun, nitrogen oxides (NOx), carbon monoxide (CO), and VOCs, such as xylene. Examples of ozone precurser VOCs include trichloroethane; trichloroethylene; and benzene, toluene, ethylbenzene, and xylene (BTEX). These contaminants typically are generated from metal degreasing, printed circuit board cleaning, gasoline, and wood preserving processes.

Maximum Incremental Reactivity (MIR) - An incremental reactivity (IR) calculated for a volatile organic mixture where the emissions of NOx (NO + NO2) have been adjusted to maximize the calculated MIR. IR = Δ[O3]/Δ[VOC]. For a specified set of meteorological conditions, emissions, and initial concentrations, the incremental reactivity of an organic compound is the change in the peak ozone concentration, in grams, divided by an incremental change in the initial concentration and emissions of the organic compound.

Table C-1 Listing of detailed model species, their representation in the model, atmospheric reactivity estimates, and uncertainty assignments. (Updated 2/5/03

Name	Description	CAS Number	MWt	Unc [a]	Exp [b]	Notes [c]	MIR [d]	UL MIR [e]		Representation in Model [f]	Lump Gp. [g]	Adj Prod [h]	Seq	MIR [d]	UL MIR [e]	Rep'd
MIBUCBN	4-methyl-2-pentanol (methyl isobutyl carbinol)	108-11-2	102.18	3			2.89	(16.29)	Gen'd	CH3-CH(OH)-CH2-CH(CH3)-CH3	ALK5	yes	387	2.885	16.29	TRUE
I-C3-OH	Isopropyl Alcohol	67-63-0	60.10	1	1	2,3	0.71	(7.21)	Gen'd	CH3-CH(OH)-CH3	ALK4	-	372	0.710	7.21	TRUE

NOTES:

[a] Uncertainty codes are given in Table C-2.

[b] Experimental data availability codes are given in Table C-3.

[c] Notes on representation of the detailed model species are given in Table C-4.

[d] Maximum incremental reactivity in units of grams O_3 per gram VOC.

[e] Upper limit maximum incremental reactivity in units of grams O_3 per gram VOC. Parentheses indicate that the MIR is not considered to be suficiently uncertain that use of upper limit values are appropriate.

[f] Representation in the mechanism: "Expl" = explicit in the base mechanism; "Asn'd" = mechanistic parameters assigned; "Gen'd" = mechanistic parameters generated using the mechanism generation system, using the structure shown; "L.Mol" = represented on a mole for mole basis by the model species or mixture shown; "-" = not represented in current version of the mechanism; "Mix" = mixture.

[g] Lumped group used when represnting this compound in ambient simulations using the recommended condensed mechanism. Note that ETHE, ISOP, IPRD, MACR are short for ETHYLENE, ISOPRENE, ISOPROD, AND METHACRO, respectively.

[h] A "yes" indicates that the mechanisms for the model species for the more reactive products were adjusted based on the estimated mechanisms for the predicted products as described in Section III.M of the SAPRC-99 documentation report.

Table C-2. Uncertainty codes used in the listing of the detailed model species

Code	Description
-	No representation of this compound has been developed for this version of the mechanism
0	Compound believed to be unreactive.
1	Considered to be relatively uncertain, or some uncertainties but reactivity is not expected to change significantly
2	Uncertain mechanism may change somewhat if refined, but change is expected to be less than a factor of two. If the compound is predicted to inhibit O3, changes are not expected to affect predicted inhibition, but may affect magnitude of inhibition. This code is also used for compounds whose reactivities are expected to be highly sensitive to ambient conditions or to changes in the base mechanism.
3	Uncertain and may change if compound is studied (or studied further) or estimation methods are updated. Change in MIR could be as much as a factor of two. This code is also used for (1) compounds whose reactivities are expected to be sensitive to the representation of the reactive products, whose accuracy is difficult to test experimentally and (2) compounds whose reactivities are expected to be highly sensitive to ambient conditions or to changes in the base mechanism.
4	Uncertain and is expected to change if compound is studied or estimation methods are updated. It is recommended that uncertainty adjustments be employed in regulatory applications
5	Non-negligible chance of the estimate being incorrect in significant respects. It is recommended that uncertainty adjustments be employed in regulatory applications
6	Current mechanism is probably incorrect, but biases in atmospheric reactivity predictions are uncertain. It is recommended that uncertainty adjustments be employed in regulatory applications
a	The reactivity of this compound is expected to be sensitive to ambient conditions and/or changes in the base mechanism
b	Some uncertainty due to differences in reactivities of compounds represented by this class. Look at differences among compounds in this class for the magnitude of this uncertainty
c	Parameterized mechanism used, with uncertain portions adjusted to fit chamber data for representative compounds
d	Highly simplified "Placeholder" mechanism used to represent the approximate range of reactivity of this compound. Mechanism does not represent an estimate of the actual mechanism of the compound
e	The current version of this mechanism does not represent these compounds, but based on previous studies they are expected to be O3 inhibitors under all conditions

Table C-3. Notes on availability of experimental data for evaluating mechanisms

Code	Description
-	No data available to test ozone predictions for this compound.
1	Tested under MIR and other conditions; well tested.
2	Tested under MIR conditions. There may be limited data for other conditions in some cases
3	Tested under some conditions, but not MIR reactivity.
4	Tested under some conditions, but data are limited, or are of low quality or precision
5	This compound has not been studied by itself, but its mechanism has been evaluated using experiments where it is formed as the major reactive product, for which model simulations are highly sensitive to assumed mechanisms for this compound.
6	Experimental data are available for some members of this class or for complex mixtures containing significant amounts of compounds of this class
7	Chamber data may be available to test mechanisms for this compound, but were not used in this evaluation. Data are believed to be limited, of low precision, not well characterized or difficult to characterize, or highly sensitive to chamber effects.
8	There may be chamber data available to test mechanisms for this compound, but their availability and utility for mechanism evaluation have not been assessed
9	Attempts to conduct chamber experiments with this compound have been unsuccessful because of experimental difficulties. Probably not possible to study this compound using current methods
a	Model does not successfully simulate results of all chamber experiments. This may be due to experimental difficulties, though mechanism problems cannot be completely ruled out
b	Reactivity of this compound may be sensitive to the nature of the light source, but data are available only from blacklight chambers. Effect of changing light source is uncertain and needs to be evaluated
c.	The current version of the mechanism does not represent this compound or the available data were not used to evaluate how it is currently represented
d	Although there are chamber data available for this compound and the model performance has been evaluated using them, the current mechanism does not represent halogen chemistry and the predictions of the mechanism may be inaccurate in ambient simulations.
e	Chamber data are available that will be used to develop a mechanism for this compound, which is not represented in the current version of the mechanism

Table C-4. Notes and comments for the listed detailed model species. Updated 1/22/03

Note.	Notes or Comments
1	Mechanism believed to be fairly well established. See Atkinson (1990, 1994, 1997a) reviews
2	Evaluation of the mechanism for this compound against chamber data is discussed in this report. See Section V and Appendix B
3	Mechanism was derived using the mechanism generation system discussed in Section III. Lumped product version of the mechanism used for all simulations
4	Mechanism was derived using the mechanism generation system discussed in Section III. Adjusted product version of the mechanism used when representing this compound in reactivity or mechanism evaluation simulations, and the lumped product version of the mechanism is used when representing this compound in mixtures. See documentation of product lumping approaches.
5	Adjustments were made to mechanism to improve fits to chamber data.
6	It is uncertain whether the compound(s) used to represent this class is most appropriate for all complex mixtures containing this class.
7	The current mechanism gives reasonably good simulations of incremental reactivity experiments of mineral spirits samples believed to contain significant amounts of these compounds (Carter et al, 1997f). See Section V and Appendix B.
8	The appropriateness of the lumped molecule representation for this class is uncertain.
9	Parameterized mechanism used, with uncertain portions adjusted to fit chamber data for representative compounds. See Section IV.
10	Mixture based roughly on terpenes in estimated North American annual biogenic rates given by Guenther et al (2000).
11	An estimated mechanism was derived as discussed in Section IV.B.2.
12	These are present in relatively large amounts in emissions inventories. The specific compound(s) referred to in these classes are unknown. They are assumed to be similar to the Texanol isomers, though the molecular weights are slightly different.
13	Mixture composition for commercial Texanol samples based on information provided by David Morgott of Eastman Kodak Company (private communication, 1999).
14	The reactions of this compound is represented explicitly in the base mechanism. See Section II.C.
15	Mechanism for this compound estimated by analogy from para toluene isocyanate.
16	Mechanisms for amines have not been developed. A placeholder mechanism used to represent their approximate range of reactivity, given the OH rate constant. See Section IV.B.6
17	The reactions for this compound can be added to the mechanism if needed, but this has not been done for the current version of the mechanism.
18	An estimated mechanism was derived as discussed in Section IV.B.3.
19	The current version of the mechanism does not provide for representing reactions of ClOx or BrOx species. However, earlier versions of the mechanism that did represent these reactions did not perform well simulating chamber data for most of the halogenated compounds that were studied (Carter et al, 1996d, 1997d). A placeholder mechanism is used to estimate the approximate MIR given the compound's OH rate constant. This mechanism probably overestimates the reactivity of these compounds under low NOx conditions.
20	The current version of the mechanism does not provide for representing reactions of ClOx species, and this compound is not currently represented. However, an earlier version of the mechanism that did represent these reactions gave reasonably good fits to the chamber data for this compound (Carter et al, 1997h).
21	An experimental and modeling study of the reactivity of this compound is underway at our laboratories
22	Volatile silicone compounds are not represented in the current version of the mechanism. They have previously been shown to be ozone inhibitors under all conditions likely to occur in the atmosphere (Carter et al, 1992
23	The Base ROG mixture is used to represent reactive VOCs from all sources in the atmospheric reactivity calculations, as discussed in Section VII.A.1. It is derived from the "all city average" mixture derived by Jeffries et al (1989) from analysis of air quality data, with minor modifications as discussed by Carter (1994a,b). The compositions of this mixture is given on Table C-5a.
24	These are the "Transitional Low Emissions Vehicle" exhaust mixtures used by the California ARB to calculate reactivity adjustment factors for its Clean Fuels, Low-Emissions Vehicle regulations. Composition obtained from the CARB. The compositions of these mixtures are given on Table C-5a.
25	These are "Low Emissions Vehicle" exhaust mixtures provided by the California ARB. The compositions of these mixtures are given on Table C-5a.
26	These are the mineral spirits samples provided by Safety-Kleen Corporation for environmental chamber reactivity studies (Carter et al, 1997f). Contrary to the earlier version of the mechanism discussed by in that report, the current mechanism performs reasonably well in simulating the chamber results for these samples (see Section V and Appendix B). The assumed compositions of these mixtures are given on Table C-5b.
27	These are commercial solvents produced by Exxon Chemical company. The assumed compositions of these solvents were derived as discussed by Carter et al (2000g), and are given in Table C-5b.
28	These represent commercial solvents produced by Exxon Chemical company, and also similar mixtures consisting of esters of C6+ branched alcohols. Their assumed compositions were derived as discussed by Carter et al (2000g), and are given in Table C-5e.
29	This was used in part to derive the mechanism for the ISO-PROD model species, as discussed in the documentation of the base mechanism.
30	This was used in part to derive the mechanism for the PROD2 model species, as discussed in the documentation of the base mechanism.
31	This was used in part to derive the mechanism for the RNO3 model species, as discussed in the documentation of the base mechanism.
	Following footnote added for new model species created after SAPRC-99 documentation completed (1/22/03)
101	Mechanism estimated by considering the reactions at the phenyl and the ethanol portions of the molecule separately, and adding up the contributions. The rate constant and products for reactions of OH at the -CH-CH_2-OH group estimated using the SAPRC-99 mechanism generation system. The rate constant for addition to the phenoxy group estimated using the OH + methoxybenzene rate constant of 1.73×10^{-11} cm^3 $molec^{-1}$ s^{-1} as recommended by Atkinson (1989), and subtracting off the estimated rate constant at the methoxy group (1.15×10^{-12} cm^3 $molec^{-1}$ s^{-1}), as estimated by the SAPRC-99 mechanism generation system for alkyl methoxy compounds. The products of the reactions following OH addition at the phenoxy group are estimated to be the same as the products used in the SAPRC-99 mechanism for OH addition to the aromatic ring in ethyl benzene, i.e., the products derived for the OH + ethylbenzene mechanism subtracting off those associated with abstraction from the ethyl group.

Table C-6. Summary of calculated incremental and relative reactivities in various scales. Calculated using the SAPRC-99 mechansim Updated 2/5/03

Name	Compound or Mixture	MIR (gm O3 / gm VOC)					MOIR (gm/gm)			EBIR (gm/gm)			Base Case Relative Reactivities [a]									
		39 Scenarios			Avg. Conds		39 Scenarios			39 Scenarios			Ozone Yield (gm basis)					Max 8-Hour Avg (gm basis)				
		Avg.	Sdev			Δ%	Avg.	Sdev		Avg.	Sdev		Avg.	Max	Min	Sdev		Avg.	Max	Min	Sdev	
MIBUCBN	4-methyl-2-pentanol (methyl isobutyl carbinol)	2.89	0.64	22%	2.93	2%	1.48	0.33	22%	1.00	0.29	29%	1.15	1.88	0.58	0.22	19%	0.80	1.05	0.52	0.11	14%
I-C3-OH	Isopropyl Alcohol	0.71	0.14	20%	0.73	2%	0.39	0.07	18%	0.28	0.07	23%	0.33	0.62	0.15	0.09	27%	0.26	0.40	0.14	0.06	22%

[a] Maximum, minimum, and standard deviations for base ROG mixture are incremental reactivities relative to the average.

Table C-7. Ozone Yield Incremental Reactivities in the Individual Base Case and Adjusted NOx Scenarios. Calculated using the SAPRC-99 Mechanism. Updated 2/5/03

Name	Compound or Mixture	Base Case (gm O3 / gm VOC)					MIR (gm O3 / gm VOC)						MOIR (gm O3 / gm VOC)						EBIR (gm O3 / gm VOC)					
		Avg	Std. Dev	Max	Min	Phoenix, AZ	Avg	Std. Dev	Max	Min	Avg. Cond.	Phoenix, AZ	Avg	Std. Dev	Max	Min	Avg. Cond.	Phoenix, AZ	Avg	Std. Dev	Max	Min	Avg. Cond.	Phoenix, AZ
ARBROG	Base ROG Mixture	1.03	0.42	2.14	0.26	1.46	3.71	0.63	5.32	2.16	3.79	3.76	1.46	0.28	2.04	0.80	1.46	1.57	0.85	0.21	1.28	0.41	0.83	0.79
MIBUCBN	4-methyl-2-pentanol (methyl isobutyl carbinol)	1.11	0.32	1.88	0.50	1.51	2.89	0.64	4.48	1.33	2.93	2.76	1.48	0.33	2.08	0.70	1.49	1.58	1.01	0.25	1.48	0.48	1.00	1.04
I-C3-OH	Isopropyl Alcohol	0.31	0.07	0.48	0.16	0.36	0.71	0.14	1.06	0.35	0.73	0.63	0.39	0.07	0.54	0.22	0.40	0.37	0.29	0.05	0.39	0.17	0.28	0.26

Table C-8. Maximum 8-Hour Average Incremental Reactivities in the Individual Base Case and NOx Adjusted Scenarios. Calculated using the SAPRC-99 Mechanism. Updated 2/5/03

Name	Compound or Mixture	Base Case (Proportional to ppm O3 per gram VOC)					MIR (Proportional to ppm O3 per gram VOC)						MOIR (Proportional to ppm O3 per gram VOC)						EBIR (Proportional to ppm O3 per gram VOC)					
		Avg	Std. Dev	Max	Min	Phoenix, AZ	Avg	Std. Dev	Max	Min	Avg. Cond.	Phoenix, AZ	Avg	Std. Dev	Max	Min	Avg. Cond.	Phoenix, AZ	Avg	Std. Dev	Max	Min	Avg. Cond.	Phoenix, AZ
ARBROG	Base ROG Mixture	1.04	0.32	1.68	0.41	1.52	2.03	0.34	3.21	1.17	2.07	2.13	1.43	0.25	2.08	0.86	1.45	1.59	0.94	0.17	1.31	0.60	0.93	0.99
MIBUCBN	4-methyl-2-pentanol (methyl isobutyl carbinol)	0.81	0.21	1.21	0.40	1.09	1.39	0.31	2.43	0.63	1.41	1.35	1.08	0.24	1.70	0.51	1.09	1.13	0.77	0.18	1.17	0.39	0.76	0.78
I-C3-OH	Isopropyl Alcohol	0.26	0.05	0.35	0.13	0.30	0.37	0.07	0.61	0.18	0.38	0.34	0.32	0.05	0.47	0.18	0.32	0.31	0.25	0.04	0.35	0.15	0.25	0.24

Oracle Ridge Copper

APPENDIX G

Reagent and Fuel Material Safety Data Sheets (MSDS)

SDS: 0000628
Print Date: 08/09/2011
Revision Date: 08/09/2011

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	**AEROFROTH® 70 Frother**
Synonyms:	Methyl isobutyl carbinol; Methyl amyl alcohol; 4-methyl-2-pentanol
Chemical Family:	Alcohol
Molecular Formula:	CH3CHOHCH2CH(CH3)2
Molecular Weight:	102

CYTEC INDUSTRIES INC., FIVE GARRET MOUNTAIN PLAZA, WOODLAND PARK, NEW JERSEY 07424, USA
For Product Information call 1-800/652-6013. Outside the USA and Canada call 1-973/357-3193.

EMERGENCY PHONE (24 hours/day) - For emergency involving spill, leak, fire, exposure or accident call:
Asia Pacific:
Australia - +61-3-9663-2130 or 1800-033-111
China (PRC) - +86 10 5100 3039 (Carechem24 China)
New Guinea - +61-3-9663-2130
New Zealand - +61-3-9663-2130 or 0800-734-607
All Others - +65 3158 1074 (Carechem24 Singapore)
Canada: +1-905-356-8310 (Cytec Welland, Canada plant)
Europe/Africa/Middle East (Carechem24 UK):
Europe, Middle East, Africa, Israel - +44 (0) 1235 239 670
Middle East, Africa (Arabic speaking countries) - +44 (0) 1235 239 671
Latin America:
Brazil - 0800 0111 767 (SOS Cotec)
Chile - +56-2-247-3600 (CITUC QUIMICO)
All Others - +52-376-73 74122 (Cytec Atequiza, Mexico plant)
USA: +1-703-527-3887 or 1-800-424-9300 (CHEMTREC #CCN6083)

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2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

APPEARANCE AND ODOR:

Color:	colorless to white
Appearance:	liquid
Odor:	mild

STATEMENTS OF HAZARD:

DANGER! CAUSES EYE BURNS
MAY CAUSE SKIN IRRITATION
COMBUSTIBLE LIQUID AND VAPOR

POTENTIAL HEALTH EFFECTS

EFFECTS OF EXPOSURE:
Direct contact with this material may cause severe eye and mild skin irritation. Inhalation overexposure may cause irritation of the respiratory tract and eyes. Refer to Section 11 for toxicology information on the regulated components of this product.

3. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA REGULATED COMPONENTS

Component / CAS No.	%	Carcinogen
Methyl isobutyl carbinol 108-11-2	98 - 100	-
Diisobutyl ketone 108-83-8	1 - 2	-

4. FIRST AID MEASURES

Eye Contact:
Rinse immediately with plenty of water for at least 15 minutes. Obtain medical attention immediately.

Skin Contact:
Wash immediately with plenty of water and soap.

Ingestion:
If swallowed, call a physician immediately. Only induce vomiting at the instruction of a physician. Never give anything by mouth to an unconscious person.

Inhalation:
Remove to fresh air. If breathing is difficult, give oxygen. Obtain medical advice if there are persistent symptoms.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:
Use water spray, alcohol foam, carbon dioxide or dry chemical to extinguish fires. Water stream may be ineffective.

Protective Equipment:
Firefighters, and others exposed, wear self-contained breathing apparatus. Wear full firefighting protective clothing. See MSDS Section 8 (Exposure Controls/Personal Protection).

Special Hazards:
Keep containers cool by spraying with water if exposed to fire.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:
Where exposure level is known, wear approved respirator suitable for level of exposure. Where exposure level is not known, wear approved, positive pressure, self-contained respirator. In addition to the protective clothing/equipment in Section 8 (Exposure Controls/Personal Protection), wear impermeable boots.

Methods For Cleaning Up:
Remove sources of ignition. Cover spills with some inert absorbent material; sweep up and place in a waste disposal container. Flush spill area with water.

Environmental Precautions:
None known

7. HANDLING AND STORAGE

HANDLING

Precautionary Measures: Do not get in eyes, on skin or on clothing. Keep away from heat and flame. Wash thoroughly after handling.

Special Handling Statements: None

STORAGE

Areas containing this material should have fire safe practices and electrical equipment in accordance with applicable regulations and/or guidelines. Standards are primarily based on the material`s flashpoint, but may also take into account properties such as miscibility with water or toxicity. All local and national regulations should be followed.
In the Americas, National Fire Protection Association (NFPA) 30: Flammable and Combustible Liquids Code, is a widely used standard. NFPA 30 establishes storage conditions for the following classes of materials: Class I Flammable Liquids, Flashpoint <37.8 °C. Class II Combustible Liquids, 37.8 °C < Flashpoint <60 °C. Class IIIa Combustible Liquids, 60 °C < Flashpoint < 93 °C. Class IIIb Combustible Liquids, Flashpoint > 93 °C.

Storage Temperature: Room temperature
Reason: Safety.

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Measures:
Utilize a closed system process where feasible. Where this material is not used in a closed system, good enclosure and local exhaust ventilation should be provided to control exposure.

Respiratory Protection:
Where exposures are below the established exposure limit, no respiratory protection is required. Where exposures exceed the established exposure limit, use respiratory protection recommended for the material and level of exposure.

Eye Protection:
Prevent eye and skin contact. Provide eye wash fountain and safety shower in close proximity to points of potential exposure. Wear eye/face protection such as chemical splash proof goggles or face shield.

Skin Protection:
Prevent contamination of skin or clothing when removing protective equipment. Wear impermeable gloves and suitable protective clothing.

Additional Advice:
Food, beverages, and tobacco products should not be carried, stored, or consumed where this material is in use. Before eating, drinking, or smoking, wash face and hands thoroughly with soap and water.

Exposure Limit(s)

108-11-2 Methyl isobutyl carbinol

OSHA (PEL):	25 ppm (TWA) 100 mg/m^3 (TWA) (skin)
ACGIH (TLV):	40 ppm (STEL) (skin) 25 ppm (TWA)
Other Value:	Not established

108-83-8 Diisobutyl ketone

OSHA (PEL):	50 ppm (TWA) 290 mg/m^3 (TWA)

108-11-2 Methyl isobutyl carbinol

ACGIH (TLV):	25 ppm (TWA)
Other Value:	Not established

9. PHYSICAL AND CHEMICAL PROPERTIES

Color:	colorless to white
Appearance:	liquid
Odor:	mild
Boiling Point:	132 °C 270 °F
Melting Point:	-126 °C -194 °F
Vapor Pressure:	3.7 - 4.7mm Hg @ 20 °C
Specific Gravity/Density:	0.81@ 20°C @ 20 °C
Vapor Density:	3.5(air = 1)
Percent Volatile (% by wt.):	100
pH:	Not available
Saturation In Air (% By Vol.):	0.66
Evaporation Rate:	0.26 - 0.43(Butyl acetate = 1)
Solubility In Water:	1.7 - 1.82% @ 20 °C
Volatile Organic Content:	Not available
Flash Point:	39 °C 102 °F Tag Closed Cup
Flammable Limits (% By Vol):	Lower: 1.0 Upper: 5.5
Autoignition Temperature:	360.3 °C 680.5 °F
Decomposition Temperature:	Not available
Partition coefficient (n-octanol/water):	Not applicable
Odor Threshold:	Not available

10. STABILITY AND REACTIVITY

Stability:	Stable
Conditions To Avoid:	None known
Polymerization:	Will not occur
Conditions To Avoid:	None known
Materials To Avoid:	Strong oxidizing agents, strong acids, and alkalies.
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide (CO)

11. TOXICOLOGICAL INFORMATION

Toxicological information for the product is found under Section 2. HAZARDS IDENTIFICATION.
Toxicological information on the regulated components of this product is as follows:

Methyl isobutyl carbinol has acute oral (rat) and dermal (rabbit) LD50 values of 2.6 g/kg and 3.6 g/kg, respectively. This material has an acute 4-hour inhalation LC50 (rat) >2000 ppm (8.34 mg/L). Acute overexposure to methyl isobutyl carbinol vapor causes mucous membrane irritation and moderate to severe eye irritation. Direct contact with this material causes mild skin irritation.

Diisobutyl ketone has acute oral (rat) and dermal (rabbit) LD50 values of 5750 mg/kg and 16.1 g/kg, respectively. Acute overexposure to diisobutyl ketone vapor causes respiratory tract and eye irritation. Direct contact with this material causes mild skin and eye irritation.

11. TOXICOLOGICAL INFORMATION

12. ECOLOGICAL INFORMATION

This material is not classified as dangerous for the environment. This material is readily biodegradable.

FISH TEST RESULTS

Test: Acute toxicity, freshwater (OECD 203)
Duration: 96 hr. **Procedure:** Static.
Species: Rainbow Trout (Oncorhyncus mykiss)
>100 mg/l LC50

INVERTEBRATE TEST RESULTS

Test: Acute Immobilization (OECD 202)
Duration: 48 hr **Procedure:** Static
Species: Water Flea (Daphnia magna)
710 mg/l EC50

DEGRADATION

Test: Biodegradability
Duration: 28 day **Procedure:** Ready biodegradability
>70 %

13. DISPOSAL CONSIDERATIONS

The information on RCRA waste classification and disposal methodology provided below applies only to the product, as supplied. If the material has been altered or contaminated, or it has exceeded its recommended shelf life, the guidance may be inapplicable. Hazardous waste classification under federal regulations (40 CFR Part 261 et seq) is dependent upon whether a material is a RCRA `listed hazardous waste`or has any of the four RCRA `hazardous waste characteristics.`Refer to 40 CFR Part 261.33 to determine if a given material to be disposed of is a RCRA `listed hazardous waste`; information contained in Section 15 of this MSDS is not intended to indicate if the product is a `listed hazardous waste.`RCRA Hazardous Waste Characteristics: There are four characteristics defined in 40 CFR Section 261.21-61.24: Ignitability, Corrosivity, Reactivity, and Toxicity. To determine Ignitability, see Section 9 of this MSDS (flash point). For Corrosivity, see Sections 9 and 14 (pH and DOT corrosivity). For Reactivity, see Section 10 (incompatible materials). For Toxicity, see Section 3 (composition). Federal regulations are subject to change. State and local requirements, which may differ from or be more stringent than the federal regulations, may also apply to the classification of the material if it is to be disposed. The Company encourages the recycle, recovery and reuse of materials, where permitted, as an alternate to disposal as a waste. The Company recommends that organic materials classified as RCRA hazardous wastes be disposed of by thermal treatment or incineration at EPA approved facilities. The Company has provided the foregoing for information only; the person generating the waste is responsible for determining the waste classification and disposal method.

14. TRANSPORT INFORMATION

This section provides basic shipping classification information. Refer to appropriate transportation regulations for specific requirements.

US DOT

Dangerous Goods? X
Proper Shipping Name: Methyl isobutyl carbinol
Hazard Class: 3
Packing Group: III
UN/ID Number: UN2053
Transport Label Required: Flammable Liquid

Comments: Flammable liquids with a flash point at or above 38° C (100° F) and not meeting the definition of any other hazard class may be reclassed as a Combustible liquid except for transport by vessel or aircraft. If reclassed, these Combustible liquids are not regulated in non-bulk packagings.

TRANSPORT CANADA

Dangerous Goods? X
Proper Shipping Name: Methyl isobutyl carbinol
Hazard Class: 3
Packing Group: III
UN Number: UN2053
Transport Label Required: Flammable Liquid

ICAO / IATA

Dangerous Goods? X
Proper Shipping Name: Methyl isobutyl carbinol
Hazard Class: 3
Packing Group: III
UN Number: UN2053
Transport Label Required: Flammable Liquid

IMO

Dangerous Goods? X
Proper Shipping Name: Methyl isobutyl carbinol
Hazard Class: 3
UN Number: UN2053
Packing Group: III
Transport Label Required: Flammable Liquid

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15. REGULATORY INFORMATION

Inventory Information

United States (USA): All components of this product are included on the TSCA Chemical Inventory or are not required to be listed on the TSCA Chemical Inventory.

Canada: All components of this product are included on the Domestic Substances List (DSL) or are not required to be listed on the DSL.

Australia: All components of this product are included in the Australian Inventory of Chemical Substances (AICS) or are not required to be listed on AICS.

China: All components of this product are included on the Chinese inventory or are not required to be listed on the Chinese inventory.

Japan: All components of this product are included on the Japanese (ENCS) inventory or are not required to be listed on the Japanese inventory.

Korea: All components of this product are included on the Korean (ECL) inventory or are not required to be listed on the Korean inventory.

Philippines: All components of this product are included on the Philippine (PICCS) inventory or are not required to be listed on the Philippine inventory.

OTHER ENVIRONMENTAL INFORMATION
The following components of this product may be subject to reporting requirements pursuant to Section 313 of CERCLA (40 CFR 372), Section 12(b) of TSCA, or may be subject to release reporting requirements (40 CFR 307, 40 CFR 311, etc.) See Section 13 for information on waste classification and waste disposal of this product.

This product does not contain any components regulated under these sections of the EPA

PRODUCT HAZARD CLASSIFICATION UNDER SECTION 311 OF SARA

- Acute
- Fire

---

16. OTHER INFORMATION

NFPA Hazard Rating (National Fire Protection Association)

Health: 3 - Materials that, under emergency conditions, can cause serious or permanent injury.

Fire: 2 - Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur.

Instability: 0 - Materials that in themselves are normally stable, even under fire exposure conditions.

Reasons For Issue: Revised Section 3
Revised Section 8
Revised Section 11

Randy Deskin, Ph.D., DABT +1-973-357-3100

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CYTEC

Technology ahead of its time™

MSDS: 0000304
Date: 07/01/2005
Supersedes: 12/18/2003

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	**AEROFROTH® 65 Frother**
Synonyms:	None
Chemical Family:	Polyglycols
Molecular Formula:	Mixture
Molecular Weight:	Mixture

CYTEC INDUSTRIES INC., FIVE GARRET MOUNTAIN PLAZA, WEST PATERSON, NEW JERSEY 07424, USA
For Product Information call 1-800/652-6013. Outside the USA and Canada call 1-973/357-3193.
EMERGENCY PHONE: For emergency involving spill, leak, fire, exposure or accident call CHEMTREC: 1-800/424-9300. Outside the USA and Canada call 1-703/527-3887.

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2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA REGULATED COMPONENTS

No Permissible Exposure Limits (PEL/TLV) have been established by OSHA or ACGIH.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

APPEARANCE AND ODOR:

Color:	reddish-brown
Appearance:	liquid
Odor:	polyglycol

STATEMENTS OF HAZARD:
CAUTION! MAY CAUSE EYE AND SKIN IRRITATION

POTENTIAL HEALTH EFFECTS

EFFECTS OF EXPOSURE:
The acute oral (rat) LD50 and dermal (rabbit) LD50 values are estimated to be >3000 mg/kg and >2000 mg/kg, respectively. Direct contact with this material may cause mild eye and skin irritation.

4. FIRST AID MEASURES

Ingestion:
Material is not expected to be harmful by ingestion. No specific first aid measures are required.

Skin Contact:
Wash immediately with plenty of water and soap.

Eye Contact:
Rinse immediately with plenty of water for at least 15 minutes.

Inhalation:
Material is not expected to be harmful if inhaled. Remove to fresh air.

---

5. FIRE-FIGHTING MEASURES

Extinguishing Media:
Use water spray, carbon dioxide or dry chemical.

Protective Equipment:
Firefighters, and others exposed, wear self-contained breathing apparatus.

Special Hazards:
Keep containers cool by spraying with water if exposed to fire.

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6. ACCIDENTAL RELEASE MEASURES

Personal precautions:
Where exposure level is known, wear approved respirator suitable for level of exposure. Where exposure level is not known, wear approved, positive pressure, self-contained respirator. In addition to the protective clothing/equipment in Section 8 (Exposure Controls/Personal Protection), wear impermeable boots.

Methods For Cleaning Up:
Cover spills with some inert absorbent material; sweep up and place in a waste disposal container. Flush spill area with water.

---

7. HANDLING AND STORAGE

HANDLING
Precautionary Measures: Avoid contact with eyes, skin and clothing. Wash thoroughly after handling.

Special Handling Statements: None

STORAGE
None

Storage Temperature: Room temperature
Reason: Integrity.

---

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering Measures:
Engineering controls are not usually necessary if good hygiene practices are followed.

Respiratory Protection:
For operations where inhalation exposure can occur, use an approved respirator recommended by an industrial hygienist after an evaluation of the operation. Where inhalation exposure can not occur, no respiratory protection is required.

Eye Protection:
Wear eye/face protection such as chemical splash proof goggles or face shield.

Skin Protection:
Avoid skin contact. Wear impermeable gloves.

Additional Advice:
Before eating, drinking, or smoking, wash face and hands thoroughly with soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Color:	reddish-brown
Appearance:	liquid
Odor:	polyglycol
Boiling Point:	Not available
Melting Point:	-37 °C -35 °F
Vapor Pressure:	19.86mm Hg
Specific Gravity:	1.01
Vapor Density:	>1(air = 1)
Percent Volatile (% by wt.):	Not available
pH:	7.0 - 10.0(5% aqueous solution)
Saturation In Air (% By Vol.):	Not applicable
Evaporation Rate:	Not applicable
Solubility In Water:	Complete
Volatile Organic Content:	Not available
Flash Point:	>93 °C 200 °F Pensky-Martens Closed Cup
Flammable Limits (% By Vol):	Not available
Autoignition Temperature:	Not available
Decomposition Temperature:	Not available
Partition coefficient (n-octanol/water):	Not available
Odor Threshold:	Not available

10. STABILITY AND REACTIVITY

Stability:	Stable
Conditions To Avoid:	None known
Polymerization:	Will not occur
Conditions To Avoid:	None known
Materials To Avoid:	No specific incompatibility
Hazardous Decomposition Products:	None known

11. TOXICOLOGICAL INFORMATION

Toxicological information for the product is found under Section 3. HAZARDS IDENTIFICATION.
Toxicological information on the regulated components of this product is as follows:

This product contains no OSHA regulated (hazardous) components.

12. ECOLOGICAL INFORMATION

This material is not classified as dangerous for the environment.
This material is readily biodegradable.

FISH TEST RESULTS

Test: Acute toxicity, freshwater (OECD 203)
Duration: 96 hr. **Procedure:** Static.
Species: Rainbow Trout (Oncorhyncus mykiss)
>100 mg/l LC50

INVERTEBRATE TEST RESULTS

Test: Acute Immobilization (OECD 202)
Duration: 48 hr **Procedure:** Static
Species: Water Flea (Daphnia magna)
>100 mg/l EC50

DEGRADATION

Test: Closed Bottle (OECD 301D)
Duration: 28 day **Procedure:** Ready biodegradability
86.6 %

13. DISPOSAL CONSIDERATIONS

The information on RCRA waste classification and disposal methodology provided below applies only to the Cytec product, as supplied. If the material has been altered or contaminated, or it has exceeded its recommended shelf life, the guidance may be inapplicable. Hazardous waste classification under federal regulations (40 CFR Part 261 et seq) is dependent upon whether a material is a RCRA `listed hazardous waste`or has any of the four RCRA `hazardous waste characteristics.`Refer to 40 CFR Part 261.33 to determine if a given material to be disposed of is a RCRA `listed hazardous waste`; information contained in Section 15 of this MSDS is not intended to indicate if the product is a `listed hazardous waste.`RCRA Hazardous Waste Characteristics: There are four characteristics defined in 40 CFR Section 261.21-61.24: Ignitability, Corrosivity, Reactivity, and Toxicity. To determine Ignitability, see Section 9 of this MSDS (flash point). For Corrosivity, see Sections 9 and 14 (pH and DOT corrosivity). For Reactivity, see Section 10 (incompatible materials). For Toxicity, see Section 2 (composition). Federal regulations are subject to change. State and local requirements, which may differ from or be more stringent than the federal regulations, may also apply to the classification of the material if it is to be disposed. Cytec encourages the recycle, recovery and reuse of materials, where permitted, as an alternate to disposal as a waste. Cytec recommends that organic materials classified as RCRA hazardous wastes be disposed of by thermal treatment or incineration at EPA approved facilities. Cytec has provided the foregoing for information only; the person generating the waste is responsible for determining the waste classification and disposal method.

---

14. TRANSPORT INFORMATION

This section provides basic shipping classification information. Refer to appropriate transportation regulations for specific requirements.

US DOT

Proper Shipping Name: Not applicable/Not regulated
Hazardous Substances:
Not applicable

TRANSPORT CANADA

Proper Shipping Name: Not applicable/Not regulated

ICAO / IATA

Proper Shipping Name: Not applicable/Not regulated
Packing Instructions/Maximum Net Quantity Per Package:
Passenger Aircraft: -
Cargo Aircraft: -

IMO

Proper Shipping Name: Not applicable/Not regulated

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15. REGULATORY INFORMATION

INVENTORY INFORMATION

United States (USA): All components of this product are included on the TSCA Chemical Inventory or are not required to be listed on the TSCA Chemical Inventory.

Canada: All components of this product are included on the Domestic Substances List (DSL) or are not required to be listed on the DSL.

European Union (EU): All components of this product are included on the European Inventory of Existing Chemical Substances (EINECS) or are not required to be listed on EINECS.

Australia: All components of this product are included in the Australian Inventory of Chemical Substances (AICS) or are not required to be listed on AICS.

China: All components of this product are included on the Chinese inventory or are not required to be listed on the Chinese inventory.

Japan: All components of this product are included on the Japanese (ENCS) inventory or are not required to be listed on the Japanese inventory.

Korea: All components of this product are included on the Korean (ECL) inventory or are not required to be listed on the Korean inventory.

Philippines: All components of this product are included on the Philippine (PICCS) inventory or are not required to be listed on the Philippine inventory.

OTHER ENVIRONMENTAL INFORMATION
The following components of this product may be subject to reporting requirements pursuant to Section 313 of CERCLA (40 CFR 372), Section 12(b) of TSCA, or may be subject to release reporting requirements (40 CFR 307, 40 CFR 311, etc.) See Section 13 for information on waste classification and waste disposal of this product.

This product does not contain any components regulated under these sections of the EPA

PRODUCT HAZARD CLASSIFICATION UNDER SECTION 311 OF SARA

- Not applicable

---

16. OTHER INFORMATION

NFPA Hazard Rating (National Fire Protection Association)

Health: 1 - Materials that, under emergency conditions, can cause significant irritation.

Fire: 1 - Materials that must be preheated before ignition can occur.

Reactivity: 0 - Materials that in themselves are normally stable, even under fire exposure conditions.

Reasons For Issue: Revised Section 15

Randy Deskin, Ph.D., DABT +1-973-357-3100

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Maximizing the Value of Flotation Chemicals Technology

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME:	**Flottec F150 Frother**
SYNONYMS:	None
CHEMICAL FAMILY:	Mixed polyglycols
MOLECULAR FORMULA:	Mixture
MOLECULAR WEIGHT	Mixture
MANUFACTURER:	Flottec, LLC • 338 West Main Street • Boonton, New Jersey 07005 • USA
PRODUCT INFORMATION:	Tel: +1.973.588.4717 • Fax: +1.973.588.4719 • Web Site: www.flottec.com
EMERGENCY PHONE:	CHEMTREC • North America: +1.800.424.9300 • International: +1.703.527.3887
ISSUE DATE:	November 1, 2009

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA REGULATED COMPONENTS

COMPONENT	CAS No.	% (w/w)	OSHA (PEL)	ACGIH (TLV)	Carcinogen
No Permissible Exposure Limits (PEL/TLV) have been established by OSHA or ACGIH					

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

APPEARANCE AND ODOR

Color:	Light to dark straw
Appearance:	Heavy liquid
Odor:	Typical polyglycol odor

STATEMENT OF HAZARD

WARNING! CAUSES EYE BURNS AND SKIN IRRITATION

POTENTIAL HEALTH EFFECTS

EFFECTS / ROUTES OF EXPOSURE

The acute oral (rat) LD50 and acute dermal (rabbit) LD50 values for this material are estimated to be >2000 mg/kg and >2000 mg/kg, respectively. Direct contact with this material may cause mild eye and skin irritation. Refer to Section 11 for toxicology information on the regulated components of this product.

4. FIRST AID MEASURES

INGESTION:	If swallowed, call a physician immediately. ONLY induce vomiting at the instructions of a physician. Never give anything by mouth to an unconscious person.
SKIN CONTACT:	Remove contaminated clothing without delay. Flush skin thoroughly with water. Do not reuse clothing without laundering.
EYE CONTACT:	Rinse immediately with plenty of water for at least 15 minutes. Obtain medical advice if there are persistent symptoms
INHALATION:	Material is not expected to be harmful if inhaled. If inhaled, remove to fresh air.

5. FIREFIGHTING MEASURES.

EXTINGUISHING MEDIA AND FIRE FIGHTING INSTRUCTIONS

Extinguishing Media:	Use water spray, alcohol foam, carbon dioxide or dry chemical to extinguish fires. Water stream may be ineffective.
Protective Equipment:	Firefighters, and others exposed, wear self-contained breathing apparatus. Wear full firefighting protective clothing. See MSDS Section 8 (Exposure Controls/Personal Protection).
Special Hazards:	Keep containers cool by spraying with water if exposed to fire.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:	Where exposure level is known, wear approved respirator suitable for level of exposure. Where exposure level is not known, wear approved, positive pressure, self-contained respirator. In addition to the protective clothing/equipment in Section 8 (Exposure Controls/Personal Protection), wear a two piece PVC suit with hood or PVC overalls with hood.
METHODS FOR CLEAN UP:	Remove sources of ignition. Cover spills with some inert absorbent material; sweep up and place in a waste disposal container. Flush spill area with water.
ENVIRONMENTAL PRECAUTIONS:	Dispose of in accordance with EPA rules and regulations.

7. HANDLING AND STORAGE

HANDLING

Precautionary Measures :	Avoid contact with eyes, skin and clothing. Keep away from heat and flame. Wash thoroughly after handling.
Special Handling Statements :	None
STORAGE	None, although areas containing this material should have fire safe practices and electrical equipment in accordance with applicable regulations and/or guidelines.
Storage Temperature:	Room Temperature **Reason:** Integrity

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING MEASURES	Where this material is not used in a closed system, good enclosure and local exhaust ventilation should be provided to control exposure.

PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION:	Where exposures are below the established exposure limit, no respiratory protection is required. Where exposures exceed the established exposure limit, use respiratory protection recommended for the material and level of exposure.
EYE PROTECTION:	Wear eye/face protection such as chemical splash proof goggles or face shield. Eyewash equipment and safety shower should be provided in areas of potential exposure.
SKIN PROTECTION:	Avoid skin contact. Wear impermeable gloves and suitable protective clothing. Since this product is absorbed through the skin, care must be taken to prevent skin contact and contamination of clothing.
ADDITIONAL ADVICE:	Food, beverage and tobacco products should not be carried, stored or consumed where this material is used. Before eating, drinking, or smoking, wash face and hands with soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

COLOR:	Light to dark straw
APPEARANCE:	Heavy liquid
ODOR:	Typical polyglycol odor
BOILING POINT:	Not available
MELTING POINT:	-35ºF; (-37ºC)
VAPOR PRESSURE:	0.38 psia
SPECIFIC GRAVITY:	1.01 @ 25ºC
VAPOR DENSITY:	>1 (air = 1)
% VOLATILE (BY WT.):	Not available
pH:	7.0-10.0; (5% aqueous solution)
SATURATION IN AIR (% by Vol):	Not applicable
EVAPORATION RATE:	Not applicable
SOLUBILITY IN WATER:	Complete
VOLATILE ORGANIC CONTENT:	Not available
FLASH POINT:	>200ºF (93ºC) MPCC
FLAMMABLE LIMITS (% BY VOL.):	Not available
AUTO IGNITION TEMPERATURE:	Not available
DECOMPOSITION TEMPERATURE:	Not available
PARTIAL COEFFICIENT (n-octanol/water):	Not available
ODOR THRESHOLD:	See Section 2 for exposure limits

10. STABILITY AND REACTIVITY

STABILITY:	Stable
CONDITIONS TO AVOID:	None known
POLYMERIZATION:	Will not occur
CONDITIONS TO AVOID:	None known
MATERIALS TO AVOID:	Avoid contact with oxidizers, unintended contact with isocyanates due to heat liberation, and strong acids.
HAZARDOUS DECOMPOSITION PRODUCTS:	Carbon dioxide; carbon monoxide; aldehydes; ketones; organic acids

11. TOXICOLOGICAL INFORMATION

Toxicological information for the product is found under SECTION 3: HAZARDS IDENTIFICATION
Toxicological information on the regulated components of this product is as follows:

This product contains no OSHA regulated (hazardous) components

12. ECOLOGICAL INFORMATION

This product is not classified as dangerous for the environment and is readily biodegradable.

ALGAE TEST RESULTS

Test	Duration	Procedure	Species	Results	

FISH TEST RESULTS

Test	Duration	Procedure	Species	Results	

INVERTEBRATE TEST RESULTS

Test	Duration	Procedure	Species	Results	

ACCUMULATION TEST RESULTS

Test	Duration	Procedure	Species	Results	

DEGRADATION

Test	Duration	Procedure	Results
COMMENTS:			

13. DISPOSAL CONSIDERATIONS

RECOMMENDATIONS FOR THE PRODUCT:	Dispose of product in accordance with local, state, and federal laws and regulations. Do not contaminate any lakes, streams, ponds, ground water or soil.
RECOMMENDATIONS FOR PACKAGING:	DO NOT PRESSURIZE, CUT, WELD, BRAZE, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SURCES OF IGNINITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Empty drums should be completely drained, properly bunged and promptly returned to a drum re-conditioner, or properly disposed of.
RECOMMENDED CLEANSING AGENT:	Water

14. Transportation Information

This section provides basic shipping classification information.
Refer to appropriate transportation regulations for specific requirements.

U.S. DOT				
PROPER SHIPPING NAME:	NOT APPLICABLE / NOT REGULATED			
HAZARD CLASS	Not Applicable			
PACKING GROUP:	Not applicable			
UN/ID NUMBER:	Not applicable			
TRANSPORT LABEL REQUIRED:	NONE REQUIRED			
TECHNICAL NAME (N.O.S.):	Not applicable			
HAZARDOUS SUBSTANCE:	Not applicable			
COMMENTS:	-			
TRANSPORT CANADA				
PROPER SHIPPING NAME:	NOT APPLICABLE / NOT REGULATED			
HAZARD CLASS	Not Applicable			
PACKING GROUP:	Not applicable			
UN/ID NUMBER:	Not applicable			
TRANSPORT LABEL REQUIRED:	NONE REQUIRED			
TECHNICAL NAME (N.O.S.):	Not applicable			
ICAO/IATA				
PROPER SHIPPING NAME:	NOT APPLICABLE/NOT REGULATED			
HAZARD CLASS:	Not applicable			
PACKING GROUP:	Not applicable			
UN NUMBER:	Not applicable			
TRANSPORT LABEL REQUIRED:	NONE REQUIRED			
PACKING INSTRUCTIONS/ MAXIMUM NET QUANTITY:	PASSENGER AIRCRAFT	-	-	
	CARGO AIRCRAFT	-	-	
TECHNICAL NAME (N.O.S.):	Not applicable			
IMO				
PROPER SHIPPING NAME:	NOT APPLICABLE/NOT REGULATED			
HAZARD CLASS:	Not applicable			
UN NUMBER:	Not applicable			
PACKING GROUP:	Not applicable			
TRANSPORT LABEL REQUIRED:	NONE REQUIRED			
TECHNICAL NAME (N.O.S.):	Not applicable			

15. REGULATORY INFORMATION

INVENTORY INFORMATION

United States (USA)	All components of this product are included on the TSCA Inventory in compliance with the Toxic Substances Control Act, 15 U. S. C. 2601 et. seq.
Canada	Components of this product have been reported to Environment Canada in accordance with subsection 25 of the Canadian Environmental Protection Act and are included on the Domestic Substances List.
European Union (EU)	All components of this product are included in the European Inventory of Existing Chemical Substances (EINECS) or the "No Longer Polymer" list in compliance with Council Directive 67/548/EEC and its amendments.

OTHER ENVIRONMENTAL INFORMATION

The following components of this product may be subject to reporting requirements pursuant to Section 313 of CERCLA (40 CFR 372), Section 12(b) of TSCA, or may be subject to release reporting requirements (40 CFR 307, 40 CFR 311, etc.) See Section 13 for information on waste classification and waste disposal of this product.

Component	CAS NO.	% (w/w)	TPQ (lbs)	RQ (lbs)	S313	TSCA 12B
This product does not contain any components regulated under these sections of the EPA						

PRODUCT CLASSIFICATION UNDER SECTION 311 OF SARA

Not applicable under SARA TITLE III

16. OTHER INFORMATION

NFPA HAZARD RATING
(National Fire Protection Association)

HEALTH - 1 -	Materials that must be preheated before ignition can occur.
FIRE - 1 -	Materials that, under emergency conditions, can cause significant irritation.
REACTIVITY - 0 -	Materials that in themselves are normally stable, even under fire exposure conditions.

REASON FOR REVISION: New format; Revised all sections

Prepared By: F. Cappuccitti **Revised By:** R. Nix

IMPORTANT: The above information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warrant, expressed or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular uses.

Maximizing the Value of Flotation Chemicals Technology

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME:	**Flottec F160 Frother**
CHEMICAL FAMILY:	Mixed polyglycol ethers
SYNONYMS:	None
MOLECULAR FORMULA:	Mixture
MOLECULAR WEIGHT:	Mixture
MANUFACTURER:	Flottec, LLC • 338 West Main Street • Boonton, New Jersey 07005 • USA
PRODUCT INFORMATION:	Tel: +1.973.588.4717 • Fax: +1.973.588.4719 • Web Site: www.flottec.com
EMERGENCY PHONE:	CHEMTREC • North America: +1.800.424.9300 • International: +1.703.527.3887
ISSUE DATE:	November 1, 2009

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA REGULATED COMPONENTS

COMPONENT	CAS No.	% (w/w)	OSHA (PEL)	ACGIH (TLV)	Carcinogen
No Permissible Exposure Limits (PEL/TLV) have been established by OSHA or ACGIH					

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

APPEARANCE AND ODOR

Color:	Brown
Appearance:	Heavy liquid
Odor:	slight polyglycol ether odor

STATEMENT OF HAZARD

CAUTION! MAY CAUSE EYE AND SKIN IRRITATION

POTENTIAL HEALTH EFFECTS

EFFECTS / ROUTES OF EXPOSURE

The acute oral (rat) LD50 and acute dermal (rabbit) LD50 values for this material are estimated to be >2000 mg/kg and >2000 mg/kg, respectively.
Direct contact with this material may cause mild eye and skin irritation.
Refer to Section 11 for toxicology information on the regulated components of this product.

4. FIRST AID MEASURES

INGESTION:	If swallowed, call a physician immediately. ONLY induce vomiting at the instructions of a physician. Never give anything by mouth to an unconscious person.
SKIN CONTACT:	Remove contaminated clothing without delay. Flush skin thoroughly with water. Do not reuse clothing without laundering.
EYES CONTACT:	Rinse immediately with plenty of water for at least 15 minutes. Obtain medical advice if there are persistent symptoms
INHALATON:	Material is not expected to be harmful if inhaled. If inhaled, remove to fresh air.

5. FIREFIGHTING MEASURES

EXTINGUISHING MEDIA AND FIRE FIGHTING INSTRUCTIONS

Extinguishing Media

Use water spray, alcohol foam, carbon dioxide or dry chemical to extinguish fires.

Protective Equipment

Firefighters, and others exposed, wear self-contained breathing apparatus. Wear full firefighting protective clothing. See MSDS Section 8 (Exposure Controls/personal Protection).

Special Hazards

Keep containers cool by spraying with water if exposed to fire.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS

Where exposure level is known, wear approved respirator suitable for level of exposure. Where exposure level is not known, wear approved, positive pressure, self-contained respirator. In addition to the protective clothing/equipment in Section 8 (Exposure Controls/personal Protection). Wear impervious boots.

METHODS FOR CLEAN UP

Remove source of ignition. Cover spills with some inert absorbent material; sweep up and place in a waste disposal container. Flush spill area with water.

ENVIRONMENTAL PRECAUTIONS

Not available

7. HANDLING AND STORAGE

HANDLING

Precautionary Measures

Do not get in eyes, on skin, on clothing. Keep away from heat and flame. Wash thoroughly after handling.

Special Handling Statements

None Known

STORAGE

None although areas containing this material should have fire safe practices and electrical equipment in accordance with applicable regulations and/or guidelines.

Storage Temperature:	Room Temperature
Reason:	Integrity

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING CONTROLS

Where this material is not used in a closed system, good enclosure and local exhaust ventilation should be provided to control exposure.

PERSONAL PROTECTIVE EQUIPMENT

EYES:	Wear eye/face protection such as chemical splash proof goggles or face shield. Eyewash equipment and safety shower should be provided in areas of potential exposure.
SKIN:	Avoid skin contact. Wear impermeable gloves and suitable protective clothing.
RESPIRATORY PROTECTION:	Where exposures are below the established exposure limit, no respiratory protection is required. Where exposures exceed the established exposure limit, use respiratory protection recommended for the material and level of exposure.

ADDITIONAL ADVICE

Food, beverage and tobacco products should not be carried, stored or consumed where this material is used. Before eating, drinking, or smoking, wash face and hands with soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARNCE AND ODOR:	Brown, typical polyglycol odor
BOILING POINT:	522 F (272 C)
MELTING POINT:	Not available
VAPOR PRESSURE:	0.03 mmHG@20C
SPECIFIC GRAVITY:	0.95 @ 25ºC
VAPOR DENSITY:	>6 (air = 1)
% VOLATILE (BY WT.):	Not available
pH:	7.0-10.0; (5% aqueous solution)
SATURATION IN AIR (% by Vol):	Not applicable
EVAPORATION RATE:	Not applicable
SOLUBILITY IN WATER:	<5%
VOLATILE ORGANIC CONTENT:	Not available
FLASH POINT:	>285ºF (140ºC) MPCC
FLAMMABLE LIMITS (% BY VOL.):	Not available
AUTOIGNITION TEMPERATURE:	Not available
DECOMPOSITION TEMPERATURE:	Not available
PARTIAL COEFFICIENT (n-octanol/water):	Not available
ODOR TRESHOLD:	See Section 2 for exposure limits

10. STABILITY AND REACTIVITY

STABILITY:	Stable
CONDITIONS TO AVOID:	None known
POLYMERIZATION:	Will not occur
CONDITIONS TO AVOID:	None known
INCOMPATABILE MATERIALS:	Avoid contact with oxidizers, unintended contact with isocyanates due to heat liberation, and strong acids.
HAZARDOUS DECOMPOSITION PRODUCTS:	Carbon dioxide; carbon monoxide; aldehydes; ketones; organic acids

11. TOXICOLOGICAL INFORMATION

Toxicological information for the product is found under SECTION 3: HAZARDS IDENTIFICATION
Toxicological information on the regulated components of this product is as follows:

This product contains no OSHA regulated (hazardous) components

12. ECOLOGICAL INFORMATION

This product is not classified as dangerous for the environment and is readily biodegradeable.

13. DISPOSAL CONSIDERATIONS

RECOMMENDATIONS FOR THE PRODUCT:	Dispose of product in accordance with local, state, and federal laws and regulations. Do not contaminate any lakes, streams, ponds, ground water or soil.
RECOMMENDATIONS FOR PACKAGING:	DO NOT PRESSURIZE, CUT, WELD, BRAZE, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SURCES OF IGNINITION. THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Empty drums should be completely drained, properly bunged and promptly returned to a drum re-conditioner, or properly disposed of.
RECOMMENDED CLEANSING AGENT:	Water

14. Transportation Information

	D.O.T. Shipping Information			IMO Shipping Information
SHIPPING NAME:	Not applicable/Not regulated			Not applicable/Not regulated
HAZARD CLASS	Not applicable			Not applicable
PACKING GROUP:	Not applicable			Not applicable
UN/ID NUMBER:	Not applicable			Not applicable
IMDG PAGE:	Not applicable			Not applicable
DOT HAZARDOUS SUBSTANCE:	Not applicable			Not applicable
TRANSPORT LABEL REQUIRED:	None required			None required
	ICAO/IATA			**Transport Canada**
SHIPPING NAME:	Not applicable			Not applicable/Not regulated
HAZARD CLASS:	Not applicable			Not applicable
SUBSIDIARY CLASS:	Not applicable			Not applicable
UN/ID NUMBER:	Not applicable			Not applicable
PACKING GROUP:	Not applicable			Not applicable
TRANSPORT LABEL REQUIRED:	Not applicable			Not applicable
PACKING INSTRUCTIONS/ MAXIMIMUM NET QUANTITY:	PASSENGER	Not app.	Not app.	Not applicable
	CARGO	Not app.	Not app.	

ADDITIONAL TRANSPORTATION INFORMATION

Technical Name (N.O.S.): Not applicable/not regulated

15. REGULATORY INFORMATION

INVENTORY INFORMATION

United States (USA):	All components of this product are included on the TSCA Inventory in compliance with the Toxic Substances Control Act, 15 U. S. C. 2601 et. seq.
Canada:	Components of this product have been reported to Environment Canada in accordance with subsection 25 of the Canadian Environmental Protection Act and are included on the Domestic Substances List.
European Union (EU):	All components of this product are included in the European Inventory of Existing Chemical Substances (EINECS) or the "No Longer Polymer" list in compliance with Council Directive 67/548/EEC and its amendments.

OTHER ENVIRONMENTAL INFORMATION

The following components of this product may be subject to reporting requirements pursuant to Section 313 of CERCLA (40 CFR 372), Section 12(b) of TSCA, or may be subject to release reporting requirements (40 CFR 307, 40 CFR 311, etc.) See Section 13 for information on waste classification and waste disposal of this product.

Component	CAS NO.	% (w/w)	TPQ (lbs)	RQ (lbs)	S313	TSCA 12B
This product does not contain any components regulated under these sections of the EPA						

PRODUCT CLASSIFICATION UNDER SECTION 311 OF SARA

Not applicable under SARA TITLE III

16. OTHER INFORMATION

NFPA HAZARD RATING
(National Fire Protection Association)

FIRE:	Materials that must be preheated before ignition can occur.
HEALTH:	Materials that, under emergency conditions, can cause significant irritation.
REACTIVITY:	Materials that in themselves are normally stable, even under fire exposure conditions.

REASON FOR REVISION: Update Section 1 with new address and contact information

Prepared By: F. Cappuccitti **Revised By:** C. Yuen

IMPORTANT: The above information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warrant, expressed or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular uses.

Sodium Hydrosulfide

Sodium Hydrosulfide

Material Safety Data Sheet

Chemical: Sodium Hydrosulfide

NFPA: H=2 F=1 I= 2 S=None
HMIS: H=2 F=1 R=2 PPE= Supplied by user; dependent on conditions

MSDS Number: Sodhydrosulfide -1003
Effective Date: 31 October 2003
Issued by: Solvay Chemicals, Inc. Regulatory Affairs Department

Not valid three years after effective date or after issuance of superseding MSDS, whichever is earlier. French or Spanish translations of this MSDS may be available. Check www.solvaychemicals.us or call Solvay Chemicals, Inc. to verify the latest version or translation availability.

Material Safety Data Sheets contain country specific regulatory information. Therefore, the MSDS's provided are for use only by customers of Solvay Chemicals, Inc. in North America. If you are located in a country other than Canada, Mexico or the United States, please contact the Solvay Group company in your country for MSDS information applicable to your location.

1. Company and Product Identification

1.1 Product Name: Sodium Hydrosulfide (solid 70-72%)
Chemical Name: Sodium hydrogen sulfide
Synonyms: Sodium sulfhydrate
Chemical Formula: $NaHS \cdot H_2O$
Molecular Weight: 74
CAS Number: 16721-80-5
EINECS Number: 240-778-0
Grade/Trade Names: Sodium hydrosulfide

1.2 Recommended Uses: Leather treatment, dye and lubricant manufacture, flotation agents, dyes, wastewater treatment, metals finishing, ore beneficiation, pharmaceuticals.

1.3 Supplier: Solvay Chemicals, Inc.
PO BOX 27328 Houston, TX 77227-7328
3333 Richmond Ave. Houston, Texas 77098

1.4 Emergency Telephone Numbers
Emergencies (USA): 1-800-424-9300 (CHEMTREC®)
Transportation Emergencies (INTERNATIONAL/MARITIME): 1-703-527-3887 (CHEMTREC®)
Transportation Emergencies (CANADA): 1-613-996-6666 (CANUTEC)
Transportation Emergencies (MEXICO-SETIQ): 01-800-00-214-00 (MEX. REPUBLIC)
525-559-1588 (Mexico City and metro area)

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Sodium Hydrosulfide

Material Safety Data Sheet

2. Composition/Information on Ingredients

INGREDIENTS	FORMULA	WT. PERCENT	CAS #
Sodium Hydrosulfide	$NaHS \bullet H_2O$	66	16721-80-5
Water	H_2O	27	7732-18-5
Sodium Sulfide	$Na_2S \bullet 3H_2O$	≤ 6	1313-82-2
Sodium Carbonate	Na_2CO_3	1	0497-19-8

3. Hazards Identification

Emergency Overview:

- Corrosive product.
- Hazardous to human health and the aquatic environment.
- Contact causes burns to skin and eyes.
- If inhaled, may be harmful.
- Fire may produce irritating or poisonous gases.
- Dust may form explosive mixture with air. Keep away from heat, sparks and flame.

3.1 Route of Entry: Inhalation: Yes Skin: Yes Ingestion: Yes

3.2 Potential Effects of exposure:

- May be fatal if inhaled or swallowed.
- In humid or damp conditions, product will react with moisture in air to produce toxic hydrogen sulfide gas.
- Overexposure to hydrogen sulfide gas may cause memory loss, paralysis, nerve damage or death.

Inhalation:

- Causes respiratory tract irritation.
- Sodium sulfide and hydrogen sulfide paralyses the sense of smell.

Eyes:

- Product can cause severe eye damage-CORROSIVE.
- Prolonged contact may cause permanent damage or blindness.

Skin contact: Product can cause severe skin damage-CORROSIVE.

Ingestion:

- May be fatal if swallowed-CORROSIVE.
- May cause burns to the mouth and throat. Symptoms may include vomiting, nausea, diarrhea, and abdominal pain.

Carcinogenicity: See section 11.3.

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4. First-Aid Measures

General Recommendations:

4.1 Inhalation:
- Remove the patient to fresh air.
- If breathing has stopped or patient experiences difficulty in breathing, administer artificial respiration and seek immediate medical attention.

Eyes:
- Immediately flush the contaminated eye with plenty of water for at least 15 minutes.
- Consult an ophthalmologist in all cases.

Skin:
- Remove contaminated clothing.
- Wipe material from the skin.
- Rinse the affected area with large amounts of water for at least 15 minutes.
- If irritation persists, seek medical attention.

Ingestion: DO NOT INDUCE VOMITING. Obtain medical advice immediately.

If the subject is completely conscious: Rinse mouth with fresh water.

If the subject is unconscious:
- NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.
- Remove any residue of the substance from the patient's mouth.

4.2 Medical Treatment/Notes to Physician:
- In case of intense pain, inject an I.M. morphominetic analgesic drug before taking patient to hospital.
- See medical references for applicable antidotes.

5. Fire-Fighting Measures

5.1 Flash point: Not applicable.

5.2 Auto-ignition Temperature: >90°C (194°F). Pyrophoric product if water crystallization is <25%.

5.3 Flammability Limits: Not applicable.

5.4 Unusual Fire and Explosion Hazards: CAUTION - Product may ignite spontaneously if water crystallization is < 25 %. Product forms dangerous gas/vapors during decomposition (920°C - (1688°F)). Product forms flammable gas on contact with water or humid air.

5.5 Common Extinguishing Methods: Flood with powder or foam. Do not use carbon dioxide or water because it may promote generation of flammable, toxic hydrogen sulfide gas.

5.6 Fire Fighting Procedures:
- Wear full protective clothing including NIOSH/MSHA-approved self-contained breathing apparatus and chemically-resistant suits.
- Water sprayed on fire may dissolve sodium hydrosulfide and become highly corrosive and toxic.
- Finely divided sodium hydrosulfide dust forms explosive/combustible mixtures in air.

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Sodium Hydrosulfide

Material Safety Data Sheet

6. Accidental Release Measures

6.1 Precautions:

- Evacuate non-essential personnel.
- Eliminate all sources of ignition and do not generate flames or sparks.
- Wear suitable protective clothing including a self-contained breathing apparatus or a supplied-air respirator.

6.2 Cleanup methods:

- Collect the product with suitable means avoiding dust formation.
- Contain the spill and deposit in a closed, labeled, DOT-approved waste container.

6.3 Precautions for protection of the environment:

- Dispose of spilled material in an EPA-approved waste facility.
- Empty containers can have residues, gases and mists that are hazardous.

7. Handling and Storage

7.1 Handling: Carry out all operations in closed piping circuits and equipment.

7.2 Storage:

- Store in a cool, dry, well-ventilated area.
- Store away from other chemicals including acids, oxidizers, zinc, aluminum or copper.
- Product will corrode containers not made of iron or steel.
- Store away from all ignition sources and out of direct sunlight.
- Keep product in closed, dustproof containers.

7.3 Specific Uses: See Section 1.2.

7.4 Packaging:

- Iron or steel drums.
- PE.

8. Exposure Controls/Personal Protection

8.1 Exposure Limit Values:

Exposure Limit Values	TLV® ACGIH®-USA (2002)
Hydrogen sulfide	TLV-10 ppm, STEL-15 ppm, and IDLH-100 ppm
Sulfur dioxide	TLV-2 ppm, STEL-5 ppm and IDLH-100 ppm

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8.2 Exposure Controls:

8.2.1 Ventilation: Material must be handled or transferred with adequate ventilation.

8.2.2 Respiratory protection:

- Use a NIOSH-approved dust/mist or positive-pressure respirator, depending on dust concentration and presence of hydrogen sulfide gas.
- An air-supplied respirator is recommended for unknown concentrations of hydrogen sulfide gas.

8.2.3 Hand protection: Impervious protective chemical gloves (PVC, neoprene or rubber).

8.2.4 Eye protection:

- Chemical goggles unless a full face-piece respirator is also worn.
- Contact lenses are not recommended when handling this product.

8.2.5 Skin protection: Wear boots, apron, long sleeves and other protective clothing suitable for use conditions to prevent contact with the skin.

8.3 Other precautions:

- Wear chemical protective clothing in dusty areas.
- An eyewash and safety shower should be nearby and ready for use.
- Use good hygiene practices when handling this product including changing work clothes after use.
- Do not eat, drink or smoke in areas where this material is handled.

9. Physical and Chemical Properties

9.1 Appearance: Hygroscopic solid scales.
Color: Yellow.
Odor: Sulfurous.

9.2 Important Health, Safety and Environmental information:
pH: 11.9 @ 10 g/l @ 20°C (68°F).

Change of state:
Melting point: 35-55°C (95-131°F).
Boiling point: 115°C (239°F).
Decomposition Temperature: >90°C (194°F). Pyrophoric product if water crystallization is <25%.

Flash Point: Not applicable.

Oxidizing Properties: Product will corrode containers not made of iron or steel.

Vapor Pressure: Not applicable.

Relative Density:
Specific gravity: 1.5 @ 16°C (60.8°F).
(H_2O=1).

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Solubility:
Water: 500-600 g/l @ 20°C (68°F) (slow hydrolysis).

Partition coefficient: Not listed.
P (n-octanol/water).

Viscosity: Not applicable.

Vapor Density (air=1): Not applicable.

Evaporation Rate (water=1): Not applicable.

9.3 **Other Information:** Bulk Density: 750 kg/m^3 (46 lbs./ft.^{3}).

10. Stability and Reactivity

Stability:
- Although stable at room temperatures, sodium hydrosulfide is unstable and can explode with rapid heating or percussion.
- This material is hygroscopic.

10.1 **Conditions to avoid:**
- Avoid contact with heat, moisture and ignition sources.
- Product corrodes containers not made of iron or steel.

10.2 **Materials and substances to avoid:** Avoid contact with water, acids, carbon dioxide, oxidizing materials and non-ferrous metals (aluminum-copper-zinc).

10.3 **Hazardous decomposition products:** Hydrogen sulfide gas (with acids) & sulfur dioxide gas (with oxidizers).

10.4 **Hazardous Polymerization:** Will not occur.

11. Toxicological Information

11.1 **Acute toxicity:**

Inhalation(Hydrogen sulfide gas): Mouse LC_{50} = 1,500 mg/m^3 (18-minute duration).

Oral: Rat LD_{50} = 96-208 mg/kg.

Irritation: Rabbit, corrosive (eyes & skin).

Comments:
- Direct contact with sodium sulfide irritates the skin and other tissue.
- Eye contact may cause painful conjunctivitis, colored halo effects on vision, and eyelid spasm.

11.2 **Chronic toxicity:** In vitro, mutagenic effect.

11.3 **Carcinogenic Designation:** None.

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12. Ecological Information

12.1 Acute ecotoxicity:
- Fishes, Semolitus atromaculatus, LC_{50}, 24 h, from 4 - 10 mg/l.
- Fishes, Gambusia affinis, LOEC, 96 h, 206 mg/l.

12.2 Chronic ecotoxicity: Fishes, Salmon, LOEC, mortality, 2.5 mg/l.

12.3 Mobility:
- Air: Mobility as solid aerosols.
- Water/soil: Considerable solubility and mobility.

12.4 Degradation:

Abiotic:
- Air: Indirect photo-oxidation, degradation from 0.62%, 1 hour. Conditions: sensitizer: OH/O_3 radicals. Degradation products: sulfur dioxide/sulfates/sulfites (hydrogen sulfide gas).
- Water/soil: Complexation/precipitation of inorganic and organic materials.
- Water/soil-oxidation: Degradation products: sulfates.

Biotic:
- Not Applicable (inorganic compound).
- Anaerobic-test biodegradation by sulforeduction. Degradation products: hydrogen sulfide (Sulfates).
- Anaerobic-test methanogenesis: inhibitory action (Sulfates).

12.5 Potential for bioaccumulation: Bio-concentration: log Po/w. Not Applicable (inorganic compound).

12.6 Other adverse effects /Comments: Very toxic for aquatic organisms. Product fate highly dependent on environmental conditions: pH, temperature, oxidoreductive potential, and mineral and organic content of the medium.

13. Disposal Considerations

13.1 Waste treatment:
- Sodium hydrosulfide is considered hazardous to the environment.
- Spilled product should be disposed of in an EPA-approved disposal facility in accordance with applicable national, state and local environmental laws and regulations.

13.2 Packaging treatment:
- To avoid treatment, use dedicated containers where possible.
- Rinse the empty containers and treat the effluent in the same way as waste.

13.3 RCRA Hazardous Waste: Listed as a hazardous waste (D003 per 40 CFR 261.22).

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Sodium Hydrosulfide

Material Safety Data Sheet

14. Transport Information

Mode	DOT	IMDG	IATA
UN Number	2949	2949	2949
Class (Subsidiary)	8	8	8
Proper Shipping Name	Sodium hydrosulfide	Sodium hydrosulfide	Sodium hydrosulfide
Hazard label (Subsidiary)	Corrosive	Corrosive	Corrosive
Marine Pollutant	No	No	No
Placard (Subsidiary)	2949	2949	2949
Packing Group	II	II	II
Reportable Quantity	5,000	5,000	5,000
Emergency Info	ERG # 154:	EmS: 8-05	ERG Code: 8L
STCC #	4935669		

15. Regulatory Information

National Regulations (US)

TSCA Inventory 8(b): Yes.

SARA Title III Sec. 302/303 Extremely Hazardous Substances (40 CFR 355): No.

SARA Title III Sec. 311/312 (40 CFR 370):
Hazard Category: Acute health hazard. Reactive hazard.
Threshold planning quantity: 10,000 lbs.

SARA Title III Sec. 313 Toxic Chemical Emissions Reporting (40 CFR 372): No.

CERCLA Hazardous Substance (40 CFR Part 302)
Listed: Yes.
Reportable Quantity: 5,000 lbs.

State Component Listing:

State	Comment
CA	Hazardous substance list
CT	Hazardous materials summary
IL	Toxic substance disclosure
IL	Chemical safety act
LA	Spill reporting
MA	Right to Know & Oil and hazardous material list
NJ	Right to Know
NJ	Spill Tax List
NY	Release Reporting List of Hazardous Substance
PA	Right to Know
RI	Right to Know

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National Regulations (Canada)

Canadian NDSL/DSL Registration: DSL.

WHMIS Classification: E Corrosive.
D1A-Very toxic materials.

This product has been classified in accordance with the hazard criteria of the ***Controlled Products Regulations,*** and the MSDS contains all the information required by the ***Controlled Products Regulations.***

Sodium Sulfite Labeling according to Directive 1999/45/EC.

Symbols	T	Toxic.
Phrases R	25	Toxic if swallowed.
	31	Contact with acids liberates toxic gas.
	36/38	Irritating to eyes and skin.
Phrases S	20	When using, do not eat or drink.
	24/25	Avoid contact with skin and eyes.
	45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
	50.1	Do not mix with acids.

16. Other Information

16.1 Ratings:

NFPA (NATIONAL FIRE PROTECTION ASSOCIATION)
Health = 2 Flammability = 1 Instability = 2 Special = None

HMIS (HAZARDOUS MATERIAL INFORMATION SYSTEM)
Health = 2 Fire = 1 Reactivity = 2 PPE = Supplied by User; dependent on local conditions

16.2 Other Information:

The previous information is based upon our current knowledge and experience of our product and is not exhaustive. It applies to the product as defined by the specifications. In case of combinations or mixtures, one must confirm that no new hazards are likely to exist. In any case, the user is not exempt from observing all legal, administrative and regulatory procedures relating to the product, personal hygiene, and integrity of the work environment. (Unless noted to the contrary, the technical information applies only to pure product).

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16.3 Reason for revision:

Supersedes edition: Solvay Minerals, Inc. MSDS # 47 dated 06/26/03
Purpose of revision: Change Company name and MSDS format

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DAF-30	MATERIAL SAFETY DATA SHEET	PAGE 1 / 2

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

Product Name	DAF-30		
Product Code	PVDAF30		
Company Name	Polymer Ventures, Inc.	HMIS Codes*	
Company Address	1612 Harbor View Road, Charleston, SC 29412	Health	1
Company Website	www.polymerventures.com	Flammability	0
Emergency Phone (24 Hrs)	800-424-9300	Reactivity	0
Information Phone	843-853-8817	Protection	B
Sheet Revised	1/1/2006		

PolymerVentures

SECTION 2 - HAZARDOUS INGREDIENTS / SARA TITLE III INFORMATION

COMPONENTS	CAS #	% BY WT	OSHA PEL	ACGIH TWA	SARA TITLE III	RPT QTY
None						

SECTION 3 - HAZARDS IDENTIFICATION

Inhalation	Inhalation may cause inflammation of mucous membranes and irritation.					
Eyes	Causes pain, reddening, and swelling of the conjunctiva.					
Skin	May cause irritation similar to a rash with localized edema, reddening, and raised lesions.					
Ingestion	There is no direct data available pertaining to the hazards associated with ingestion of this product. As with most chemicals, ingestion may cause gastrointestinal irritation accompanied by nausea, vomiting, and diarrhea.					
Carcinogenicity	NTP?	No	IARC MONOGRAPHS?	No	OSHA REGULATED?	No

SECTION 4 - FIRST AID MEASURES

Inhalation	Immediately remove individual to fresh air. If individual has stopped breathing, give artificial respiration. Get immediate medical attention.
Eyes	Immediately flush eyes with plenty of cool, clean water for at least 15 minutes. Keep eyelids apart to maintain maximum contact with water. Do not allow the individual to rub their eyes. Get immediate medical attention.
Skin	Remove contaminated clothing and footwear. Wash thoroughly with water, and do not reuse clothing until properly cleaned. Discard footwear. If a rash should develop, get medical attention.
Ingestion	If victim is conscious and able to swallow, quickly have them drink water or milk to dilute. Do not give anything by mouth if victim is unconscious or having convulsions. Induce vomiting only if advised by a physician or poison control center. Contact a physician or Poison Control Center immediately.

SECTION 5 - FIRE AND EXPLOSION HAZARD DATA

Flash Point	>212 Degrees F	Flammable Limits	LOWER	N/A		
Method Used	Tag Closed Cup		UPPER	N/A		

Extinguishing Media	Use water spray, dry chemicals, foam, or carbon dioxide. Use water spray to keep fire exposed containers cool. If a spill has ignited, use water spray to disperse the vapors. Water spray may be used to flush spills away from a fire and to dilute spills to non-flammable mixtures. Do not flush into a storm drain or public sewer.
Special Firefighting Procedures	Do not direct a solid stream of water or foam into hot, burning pools; this may cause frothing and increase fire intensity. Use self-contained breathing apparatus (SCBA) and proper personal protection clothing.
Unusual Fire and Explosion Hazards	There are no known unusual fire and explosion hazards associated with this material in its virgin form. However, in a fire-fighting scenario involving multiple chemicals, fire fighters should be aware of possible synergistic effects and attack the fire accordingly.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Land Release	This material may cause groundwater contamination. Contain as much material as possible. Begin a containerization process as soon as practical. Rinse spill area with water after cleanup is complete and containerize all rinse water.
Water Release	This material is soluble/dispersible in water. Stop source of spill if safe to do so. Divert all flow and contain. Remove and containerize or neutralize in place, then remove for proper disposal.
Air Release	Vapors may be suppressed by the use of a water fog. Contain all run-off water for proper disposal.

SECTION 7 - HANDLING AND STORAGE

Storage	This material is safe to store in well ventilated areas at ambient temperatures. Keep containers closed when not in use to prevent evaporative losses and possible contamination. Protect product from freezing.
Other Precautions	Eyewash and safety showers are recommended in the immediate work area. Check with you state OSHA to determine the need and maximum distance for stations to be placed in regards to possible chemical exposure.

SECTION 8 - CONTROL MEASURES

Respiratory Protection	If air contaminants exceed a TLV, PEL, or STEL, use a NIOSH-MSHA approved full-face , air purifying respirator with appropriate cartridge or SCBA. Respirators and cartridges should be selected based upon the form and concentration of the contaminants in accordance with applicable regulations.
Ventilation	Normal ventilation has been found to be generally adequate. The end-user must determine if the process or methods involved with the use of this material requires any additional or special ventilation.
Protective Gloves	Rubber, butyl, neoprene, or plastic gloves should be worn when using this material to avoid skin contact.
Eye Protection	Safety glasses with side shields are recommended.
Other Protective Equipment	Not generally required under normal working conditions. The end user must determine if the process or methods involved require other personal protection clothing or equipment.
Hygienic Practices	Do not eat, drink, or smoke in areas where chemicals are being stored or handled. Wash thoroughly before handling food or drink.

SECTION 9 - PHYSICAL/CHEMICAL CHARACTERISTICS

Appearance and Odor	White granular powder	pH	4.0 - 9.0 typical
Boiling Point	N/D	Specific Gravity	N/D
Vapor Density	N/D	Evaporation Rate	N/D
Solubility in Water	Completely soluble	Percent Volatiles	N/D

MATERIAL SAFETY DATA SHEET

SECTION 10 - REACTIVITY DATA

Stability	Stable
Conditions to Avoid	None known or noted
Materials to Avoid	Strong oxidizing agents
Hazardous Byproducts	Oxides of carbon and nitrogen
Hazardous Polymerization	Will not occur

SECTION 11 - TOXICOLOGICAL INFORMATION

Toxicity Test Results	No information is available.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Impact	No information is available.

SECTION 13 - DISPOSAL CONSIDERATIONS

Waste disposal methods	Dispose of material in an approved chemical waste landfill or incinerate in accordance with applicable federal, state, and local regulations.
	Since empty containers retain material residues, all labeled hazard precautions must be observed.

SECTION 14 - TRANSPORTATION INFORMATION

This material is regulated by the DOT?	No
DOT Description from Hazardous Materials Table 49 CFR 172.101	Not regulated
Reportable Quantity if Applicable	No reportable materials

SECTION 15 -REGULATORY INFORMATION

REGULATION	REPORTABLE COMPONENTS
CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act)	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 302 and 304	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 311 and 312	None
SARA TITLE III (Superfund Amendments and Reauthorization Act) Sections 313	Refer to Section 2 of the MSDS.
Clean Air Act, Section 111, Volatile Organic Compounds (VOC)	None
Clean Air Act, Section 112, Hazardous Air Pollutants	None
Clean Water Act, Section 307, Priority Pollutants List	None

SECTION 16 -ADDITIONAL INFORMATION

ABBREVIATION	DEFINITION	ABBREVIATION	DEFINITION
N/A	Not Applicable	TLV	Threshold Limit Value
N/E	Not Established	PEL	Personal Exposure Limit
N/D	Not Determined	STEL	Short Term Exposure Limit
UNK	Unknown	<	Less Than
EHS	Environmental, Health, and Safety Department	>	Greater Than
OSHA	Occupational Safety and Health Administration	PNOR	Particulates Not Otherwise Regulated
ACGIH	American Conference of Governmental Industrial Hygienists	PNOC	Particulates Not Otherwise Classified

*Please Note: The Hazardous Material Information System (HMIS) is a voluntary, subjective alpha-numeric symbolic system for recommending hazard risk and personal protection equipment information. It is a subjective rating system based on the evaluator's understanding of the chemical associated risks. The end-user must determine if the code is appropriate for their use.

The regulatory listings provided herein are not all inclusive of possible regulations affecting this material. It is the end-user's responsibility to determine all local, state, federal, or international regulations/restrictions that may apply.

SECTION 17 - DISCLAIMER

This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Such information is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty, or guarantee is made as to its accuracy, reliability, or completeness. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use. We do not accept liability for any loss or damage that may occur from the use of this information nor do we offer warranty against patent infringement.

END MSDS

I. Product and Company Information — Reviewed on 08/07/09

Manufacturer: Western Lime Corporation
206 N. 6th Avenue
West Bend, WI 53095
Information: 800-433-0036

Chemical Name	Chemical Family	Chemical Formula
Calcium Magnesium Hydroxide	Alkaline earth hydroxide	$Ca(OH)_2 + Mg(OH)_2$
Molecular weight $Ca(OH)_2$= 74.10 $Mg(OH)_2$ = 58.34	Trade Names/Synonyms Dolomitic Hydrated Lime, Limate	Material Use Whitewash, pH adjustment, soil/water treatment

II. Composition and Information on Ingredients

Component	CAS#	Exposure Limits	% by weight
Calcium Hydroxide	1305-62-0	OSHA PEL: 5mg/m3 ACGIH TLV: 5 mg/m3	>58%
Magnesium Hydroxide	1309-42-8	OSHA PEL: n/a ACGIH TLV: n/a	>38%
Dolomite	16389-88-1	OSHA PEL: 15 mg/m3 ACGIH TLV: 10 mg/m3	<1.0%
Magnesium Oxide	1309-48-4	OSHA PEL: 10 mg/m3 ACGIH TLV: 10 mg/m3	<1.0%
Crystalline Silica	14808-60-7	OSHA PEL: 10 mg/m3 (% SiO2 resp +2) ACGIH TLV: 0.025 mg/m3	N/A

III. Hazards Identification

Emergency Overview: Hydrated Lime is an odorless white or greyish-white granular powder. Contact can cause irritation to eyes, skin, respiratory system, and gastrointestinal tract.

Eyes:	Contact can cause severe irritation or burning of eyes, including permanent damage.
Skin:	Contact can cause severe irritation or burning of skin, especially in the presence of moisture.
Ingestion:	This product can cause severe irritation or burning of gastro-intestinal tract if swallowed
Inhalation:	This product can cause severe irritation of the respiratory system. Long-term exposure may cause permanent damage. Hydrated Lime is not listed by MSHA, OSHA, or IARC as a carcinogen, but this product may contain crystalline silica, which has been classified by IARC as (Group I) carcinogenic to humans when inhaled in the form of quartz or crystobalite. Inhalation of silica can cause a chronic lung disorder, silicosis.

Medical Conditions Aggravated by Exposure: Contact may aggravate disorders of eyes, skin, gastrointestinal tract, and respiratory system.

Potential Environmental Effects: This material is alkaline and if released into water or soil will cause and increase in its pH.

IV. First Aid Measures

Eyes:	Immediately flush eyes with large amounts of water for at least 15 minutes. Pull back the eyelid to make sure all the lime dust has been washed out.
Skin:	Flush exposed area with large amounts of water. Seek medical attention immediately.
Inhalation:	Remove to fresh air. Seek medical attention if necessary. If breathing has stopped, give artificial respiration.

Ingestion:	Give large quantities of water or fruit juice. Do not induct vomiting. Seek medical attention immediately. Never give anything by mouth if victim is rapidly losing consciousness or is unconscious or convulsing.
Note to Physicians: Provide general supportive measures and treat symptomatically.	

V. Fire Fighting Measures	
Fire Hazards:	Hydrated Lime is not combustible or flammable. Hydrated Lime is not an explosion hazard.
Hazardous Combustion Products:	None Identified.
Extinguishing Media:	Use dry chemical fire extinguisher or water
Fire Fighting Instructions:	Keep personnel removed from and upwind of fire. Wear full fire-fighting turn-out gear(full Bunker gear), and respiratory protection (SCBA)

VI. Accidental Release Measures	
Spill/Leak Procedures:	Use proper protective equipment. Hydrated Lime is a fine powder which can easily be entrained into the air.
Small Spills:	Wash area with water. Neutralize with dilute vinegar solution.
Large Spills:	Use dry methods to collect spilled materials. Evacuate area down wind of clean-up operations to avoid dust exposure. Store spilled materials in dry, sealed plastic or metal containers.
Containment:	For large spills, as much as possible avoid the generation of dusts. Do not release into sewers or waterways.
Cleanup:	Residual amounts can be flushed with large amounts of water. Equipment can be decontaminated by washing with either a mild vinegar and water solution, or detergent and water solution.

VII. Handling and Storage	
Handling:	Keep in tightly closed containers. Protect from physical damage. Avoid direct contact with material.
Storage:	Store in a cool, dry and well ventilated location. Do not store near incompatible materials. Keep away from moisture. Do not store or ship in aluminum containers.

VIII. Exposure controls/Personal Protection Equipment	
Personal Protective Equipment (PPE)	Wear clean, dry gloves, full length pants over boots, long sleeved shirt buttoned at the neck, head protection and approved eye protection selected for the working conditions.
Gloves	Gauntlets cuff style
Respiratory	NIOSH approved filtering anti-dust mask
Eyes	Tight fitting goggles/glasses with side shield
Footwear	Resistant to caustics
Clothing	Fully covering skin

IX. Physical and chemical properties			
Physical State: Solid	Appearance: White powder substance	Odor: No Odor	Specific Gravity: 2.4 – 2.46g/cc
Boiling Point:	Vapor Pressure:	pH (25° C):	Density (kg/m3):

5162 F, 2850 C	N/A	Sat Soln CaO: 12.45	450 - 750
Melting Point: 4658 F, 2570 C	Vapor Density: N/A	Solubility in Water: 0.125/100 g Sat.soln	Freezing Point: 2580 C

X. Stability and Reactivity	
Stability:	Chemically stable, but reacts slowly with carbon dioxide to form calcium carbonate.
Incompatibility/ Conditions to avoid:	Hydrated Lime should not be mixed or stored with the following materials, due to the potential for violent reaction and release of heat. Acids, Reactive Fluorinated Compounds, Reactive Brominated Compounds, Reactive Powdered Metals, Organic Acid Anhydrides, Nitro-Organic Compounds, Reactive Phosphorous Compounds.
Hazardous Decomposition Products:	Dolomitic hydrated lime will decompose at 540 C to produce calcium oxide, magnesium oxide, and water
Hazardous Polymerization:	None

XI. Toxicological Information
No LD50/LC50 have been identified for this products components. Hydrated Lime is not listed by MSHA, OSHA, or IARC as a carcinogen, but this product may contain crystalline silica, which has been classified by IARC as (Group I) carcinogenic to humans when inhaled in the form of quartz or crystobalite.

XII. Ecological Information	
Ecotoxicity:	Because of the high pH of this product, it would be expected to produce significant ecotoxicity upon exposure to aquatic organisms and aquatic systems.
Environmental Fate:	This material shows no bioaccumulation or food chain toxicity potential.

XIII. Disposal Considerations:
Dispose of in accordance with all applicable federal, state, and local environmental regulations. If this product as supplied becomes a waste, it does not meet the criteria of a hazardous waste as defined under the Resource Conservation Act

XIV. Transportation Information
Hydrated Lime is not classified as a hazardous material by DOT when transported.

XV. Regulatory Information

EPA Regulations	
RCRA Hazardous Waste Number (40 CFR 261.33)	Not Listed
RCRA Hazardous Waste Classification (40 CFR 261)	Not Listed
CERCLA Hazardous Substance (40 CFR 261)	Not Listed
CERLA Reportable Quantity (RQ)	Not Listed
SARA 311/312 codes	Not Listed
Sara Toxic Chemical (40 CFR 372.65)	Not Listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355)	Not Listed
Threshold Planning Quantity (TPQ)	Not Listed
All components are listed on the USEPA TSCA Inventory List	
OSHA/MSHA Regulations	
Air Contaminant (29 CFR 1910.1000, Table Z-1)	Not Listed
MSHA	Not Listed
OSHA Specifically Regulated Substance (29CFR 1910)	Not Listed
State Regulations: Consult state and local authorities for guidance	
Canadian Environmental Protection Act (CEPA)	
Domestic Substances List	Listed

XVI. Other Information

HMIS	Health Risks Flammability Reactivity Personal Protection	1 0 0 E
NFPA	Health Hazard Fire Hazard Reactivity	1 0 0
WHIMS Classification	“E” Corrosive Materials	
WHIMS Classification	“D2A” Materials Causing Other toxic effects	

Western Lime Corporation presents this information in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling. Individuals receiving this material must consult their own legal or technical advisors and/or exercise their own judgment in determining this materials appropriateness for a particular application. Western Lime Corporation makes no representations or warranties, either expressed or implied, and will not assume responsibility or liability for any claims losses or damages resulting from the use or reliance upon or failure to use this information.

Brenntag Canada Inc.

BRENNTAG

SODIUM ISOPROPYL XANTHATE (NAX 31)

PRODUCT DISTRIBUTED BY / PRODUIT DISTRIBUÉ PAR

Brenntag Canada Inc.
43 Jutland Road.
Toronto, Ontario
M8Z 2G6
(416) 259-8231

WHMIS Number: 00060710
Index: GCD0058/07B
Effective Date: 2007 May 08
Date of Revision: 2007 May 08
Website: http://www.brenntag.ca

EMERGENCY TELEPHONE NUMBERS / EN CAS D'URGENCE

Toronto, ON (416) 226-6117	Montréal, QC (514) 861-1211	Winnipeg, MB (204) 943-8827
Edmonton, AB (780) 424-1754	Calgary, AB (403) 263-8660	Vancouver, BC (604) 685-5036

This document consists of an English and French MSDS.

Le présent document comprend une fiche signalétique en anglais et en français.

READ THE ENTIRE MSDS FOR THE COMPLETE HAZARD EVALUATION OF THIS PRODUCT.

LIRE LA FICHE SIGNALÉTIQUE EN ENTIER POUR UNE ÉVALUATION COMPLÈTE DES DANGERS QUE REPRÉSENTE CE PRODUIT

PROSPEC CHEMICALS
P.O. BOX 3478
176 STURGEON DRIVE
STURGEON COUNTY; ALBERTA; T8L 2T4
CANADA

PRODUCT: NAX 31

Section 01: CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MANUFACTURERS..... PROSPEC CHEMICALS
P.O. BOX 3478
176 STURGEON DRIVE
STURGEON COUNTY, ALBERTA
T8L 2T4
(780) 992-1522
PRODUCT NAME ..... NAX 31
CHEMICAL NAME:..... SODIUM ISOPROPYL XANTHATE.
MATERIAL USE:..... ORE PROCESSING.
CHEMICAL FAMILY:..... SALTS OF CARBONIC ACID DITHIO ESTERS.
CHEMICAL FORMULA:..... NOT APPLICABLE.
MOLECULAR WEIGHT:..... NOT APPLICABLE.

Section 02: COMPOSITION/INFORMATION ON INGREDIENTS

Hazardous Ingredients	%	Exposure Limit	C.A.S.#	LD/50, Route,Species	LC/50 Route,Species
SODIUM ISOPROPYL XANTHATE	60-100	NOT AVAILABLE	140-93-2	ORAL RAT 250-2000mg/ Kg	NOT AVAILABLE
SODIUM HYDROXIDE	1-5	2 mg/m3 (CEILING) ACGIH	1310-73-2	140 - 340 MG/KG RAT ORAL	NOT AVAILABLE
ISOPROPANOL	1-5	400 ppm	67-63-0	ORAL RAT 5045 mg/kg DERMAL RABBIT 12800 mg/kg	RAT 12000 ppm/8h

Section 03: HAZARDS IDENTIFICATION

ROUTE OF ENTRY:
SKIN CONTACT:..... DUST OR VAPORS MAY BE IRRITATING. XANTHATE SOLUTIONS WILL CAUSE SEVERE SKIN IRRITATION.
SKIN ABSORPTION:..... NOT AVAILABLE.
EYE CONTACT:..... DUST OR VAPORS MAY IRRITATE. XANTHATE SOLUTIONS WILL CAUSE SEVERE EYE IRRITATION.
INHALATION ACUTE:..... AIRBORNE DUST MAY CAUSE IRRITATION OF RESPIRATORY AIRWAYS. VAPOURS FROM DECOMPOSITION (CARBON DISULPHIDE) CAN CAUSE SEVERE DISTURBANCES OF MOOD AND BEHAVIOR, INCLUDING EXCITATION, ANGER AND VIOLENT DREAMS.
INHALATION CHRONIC:..... HIGH CONCENTRATIONS OF DECOMPOSITION PRODUCT (CARBON DISULPHIDE) CAN CAUSE DEATH.
INGESTION:..... CAN CAUSE GASTRO-INTESTINAL IRRITATION, NAUSEA, VOMITING AND DIARRHEA.
EFFECTS OF ACUTE EXPOSURE:..... REFER TO ROUTE OF ENTRY.
EFFECTS OF CHRONIC EXPOSURE:..... REFER TO ROUTE OF ENTRY.

Section 04: FIRST AID MEASURES

SKIN:..... REMOVE ALL CONTAMINATED CLOTHING. WASH SKIN AREAS FOR 20 MINUTES OR UNTIL CHEMICAL IS REMOVED WITH SOAP AND WATER. DO NOT USE SOLVENTS. LAUNDER CLOTHES BEFORE RE-USE.
EYE:..... CHECK FOR AND REMOVE ANY CONTACT LENSES. FLUSH CONTINUOUSLY WITH WATER FOR 15 MINUTES. FORCIBLY HOLD EYELIDS APART TO ENSURE IRRIGATION OF ALL EYE TISSUE. IF IRRITATION PERSISTS GET MEDICAL ATTENTION.
INHALATION:..... REMOVE TO FRESH AIR. GIVE ARTIFICIAL RESPIRATION, OR CARDIOPULMONARY RESUSCITATION (CPR) IF REQUIRED. IF BREATHING IS DIFFICULT, GIVE OXYGEN. KEEP WARM AND QUIET, AND OBTAIN MEDICAL ATTENTION.
INGESTION:..... IF CONSCIOUS:. DO NOT INDUCE VOMITING. HAVE VICTIM RINSE MOUTH THOROUGHLY WITH WATER. GIVE A MINIMUM OF 500 ml WATER. IF INGESTION OF

PRODUCT: NAX 31

Section 04: FIRST AID MEASURES

INGESTION:.....	A LARGE AMOUNT DOES OCCUR SEEK MEDICAL ATTENTION. IF VOMITING OCCURS NATURALLY, HAVE VICTIM LEAN FORWARD TO REDUCE RISK OF ASPIRATION. IF UNCONSCIOUS:. IF INGESTION OF A LARGE AMOUNT DOES OCCUR SEEK MEDICAL ATTENTION.
NOTES TO PHYSICIAN:.....	THERE IS NO SPECIFIC ANTIDOTE. TREATMENT OF EXPOSURE SHOULD BE DIRECTED AT THE CONTROL OF SYMPTOMS AND THE CLINICAL CONDITION OF THE PATIENT.
GENERAL ADVICE:.....	CONSULT A PHYSICIAN AND/OR THE NEAREST POISON CONTROL CENTRE FOR ALL BUT MINOR INSTANCES OF INHALATION OR SKIN CONTACT. AVOID HIGH LEVELS OF DUST, USE DUST MASK OR RESPIRATOR WHEN NECESSARY. PRECAUTIONS SHOULD ALWAYS BE TAKEN TO AVOID SKIN/EYE CONTACT WITH ANY CHEMICAL SUBSTANCE.

Section 05: FIRE FIGHTING MEASURES

FLAMMABLE LIMITS:.....	VAPOURS FROM DECOMPOSITION (CARBON DISULPHIDE) ARE EXTREMELY FLAMMABLE.
IF YES, UNDER WHICH CONDITIONS?.....	SOLID XANTHATES WHEN EXPOSED TO HEAT AND/OR MOISTURE CAUSES DECOMPOSITION, AND VAPOURS ARE VERY FLAMMABLE AND SPONTANEOUS COMBUSTION CAN RESULT.
MEANS OF EXTINCTION:.....	CARBON DIOXIDE. DRY CHEMICAL. WATER.
SPECIAL PROCEDURES:.....	SELF-CONTAINED, POSITIVE PRESSURE BREATHING APPARATUS AND PROPER PROTECTIVE CLOTHING SHOULD BE WORN IN FIGHTING FIRES INVOLVING ANY CHEMICAL SUBSTANCE. HEAT WILL DECOMPOSE BOTH SOLID AND LIQUID XANTHATES YIELDING CARBON DISULPHIDE WHICH IS EXTREMELY FLAMMABLE AND TOXIC.
FLASH POINT (°C), METHOD:.....	NOT APPLICABLE. -30 oC FOR CARBON DISULPHIDE VAPOURS.
AUTO IGNITION TEMPERATURE °C:.....	90 (CARBON DISULPHIDE VAPOURS).
T.D.G. FLAMMABLE CLASS:.....	CLASS 4.2, SELF-HEATING SUBSTANCES.
UPPER EXPLOSION LIMIT:.....	50% (RESIDUAL CARBON DISULPHIDE).
LOWER EXPLOSION LIMIT:.....	1.25% (RESIDUAL CARBON DISULPHIDE).
HAZARDOUS COMBUSTION PRODUCTS..	CARBON DISULPHIDE. CARBONYL SULPHIDE. SODIUM SULPHIDE. ISOPROPYL ALCOHOL.
EXPLOSION DATA:	
SENSITIVITY TO STATIC DISCHARGE:.....	CARBON DISULPHIDE VAPOURS WHICH MAY EVOLVE DUE TO DECOMPOSITION CAN BE READILY IGNITED BY STATIC DISCHARGE.
SENSITIVITY TO IMPACT:.....	NOT AVAILABLE.
RATE OF BURNING:.....	NOT AVAILABLE.
EXPLOSIVE POWER:.....	NOT AVAILABLE.

Section 06: ACCIDENTAL RELEASE MEASURES

CLEAN-UP PROCEDURES, LEAK/SPILL:...	IF IN THE LIQUID STATE:. STOP SPILL AT SOURCE. CONTAIN ANY SPILLED MATERIAL TO PREVENT DISCHARGE INTO THE ENVIRONMENT. ELIMINATE ALL SOURCES OF IGNITION. PERSONS NOT WEARING PROTECTIVE EQUIPMENT SHOULD BE EXCLUDED FROM THE AREA. ABSORB WITH INERT DRY MATERIAL. PUT INTO AN APPROVED METAL SALVAGE DRUM FOR DISPOSAL. IF IN THE SOLID STATE:. ELIMINATE ALL SOURCES OF IGNITION. RESTRICT ACCESS TO AREA UNTIL COMPLETION OF CLEAN-UP. ENSURE CLEAN-UP IS CONDUCTED BY TRAINED PERSONNEL ONLY. DO NOT TOUCH SPILLED MATERIAL. DO NOT USE WATER ON SPILLED MATERIAL AS HEAT WILL BE GENERATED. PUT SPILLED MATERIAL INTO APPROVED SALVAGE DRUMS FOR DISPOSAL. FLUSH CLEANED AREA WITH WATER, MAKING SURE NO WATER ENTERS XANTHATE CONTAINERS.

Section 07: HANDLING AND STORAGE

STORAGE NEEDS:.....	STORE SOLID XANTHATES UNDER COOL, DARK, DRY CONDITIONS. LIQUID PRODUCTS MUST BE KEPT COOL AND USED AS QUICKLY AS POSSIBLE.
HANDLING PROCEDURES AND EQUIPMENT:	AVOID ALL SKIN CONTACT. AVOID CONTACT WITH EYES. AVOID BREATHING VAPOURS. EQUIPMENT SHOULD BE GROUNDED TO AVOID STATIC DISCHARGE. KEEP AWAY FROM HEAT, SPARKS, AND OPEN FLAME. USE NON-SPARKING TOOLS AND DO NOT SMOKE.
SPECIAL SHIPPING INSTRUCTIONS.....	USE PRECAUTION WHEN HANDLING OR SHIPPING ANY CHEMICAL SUBSTANCE. PROTECT AGAINST PHYSICAL DAMAGE.

Section 08: EXPOSURE CONTROLS/PERSONAL PROTECTION

PROTECTIVE EQUIPMENT:	
GLOVES/TYPE:.....	WEAR IMPERVIOUS GLOVES (E.G. NEOPRENE, RUBBER).

PRODUCT: NAX 31

Section 08: EXPOSURE CONTROLS/PERSONAL PROTECTION

RESPIRATOR/TYPE:.....	IF RESPIRATORY PROTECTION IS REQUIRED, INSTITUTE A COMPLETE RESPIRATORY PROTECTION PROGRAM INCLUDING SELECTION, FIT TESTING, TRAINING, MAINTENANCE AND INSPECTION. REFER TO THE CAS STANDARD Z94.4-M1982 "SELECTION, CARE, AND USE OF RESPIRATORS" WHICH IS AVAILABLE FROM CANADIAN STANDARDS ASSOCIATION, REXDALE ONTARIO, M9W 1R3. IF VAPOURS ARE PRESENT, USE A NIOSH OR MSHA APPROVED RESPIRATOR FOR ACIDIC VAPOURS OR A SELF CONTAINED BREATHING APPARATUS. SEE M.S.D.S FOR MORE DETAIL ON THIS SECTION.
EYE/TYPE:.....	FACE SHIELD. CHEMICAL SAFETY GOGGLES.
FOOTWEAR/TYPE:.....	RUBBER SAFETY BOOTS.
CLOTHING/TYPE:.....	WEAR ADEQUATE PROTECTIVE CLOTHES.
OTHER/TYPE:.....	AN EYE WASH STATION AND SAFETY SHOWER SHOULD BE NEAR THE WORK AREA.
ENGINEERING CONTROLS:.....	EXPLOSION PROOF MECHANICAL VENTILATION TO LIMIT VAPOUR CONCENTRATION BELOW T.L.V.

Section 09: PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE:.....	SOLID.
ODOUR/APPEARANCE:.....	YELLOW TO YELLOW-GREEN.
ODOUR THRESHOLD:.....	NOT AVAILABLE.
VAPOUR PRESSURE:.....	NOT APPLICABLE.
VAPOUR DENSITY (AIR=1):.....	NOT APPLICABLE.
% VOLATILE: BY VOLUME.....	< 20.
BY WEIGHT	
EVAPORATION RATE:.....	NOT APPLICABLE.
BOILING POINT °C:.....	NOT APPLICABLE. M.P. 150 - 250 (decomposes).
FREEZING POINT °C:.....	NOT APPLICABLE.
pH:.....	10% H2O 13 +/- 1.
SPECIFIC GRAVITY:.....	NOT APPLICABLE.
SOLUBILITY IN WATER (20 °C):.....	SOLUBLE.
COEFFICIENT WATER/OIL DIST.:.....	NOT AVAILABLE.

Section 10: STABILITY AND REACTIVITY

CHEMICAL STABILITY:	
YES.	
NO, WHICH CONDITIONS?.....	SOLID XANTHATES ARE STABLE WHEN KEPT COOL AND DRY, EXPOSURE TO HEAT CAUSES DECOMPOSITION. ACIDS AND OXIDIZING AGENTS ACCELERATE AGING. IN SOLUTION, XANTHATES WILL DECOMPOSE SLOWLY EVEN AT ROOM TEMPERATURE.
COMPATIBILITY WITH OTHER SUBSTANCES:	
YES.	
NO, WHICH ONES?.....	STRONG ACIDS. OXIDIZING AGENTS.
REACTIVITY, UNDER WHAT CONDITIONS?	VAPORS OR DUSTS MAY EXPLODE.
DECOMPOSITION:.....	CARBON DISULPHIDE. TRITHIOCARBONATE. ISOPROPYL ALCOHOL.

Section 11: TOXICOLOGICAL INFORMATION

LD 50 OF MATERIAL, SPECIES & ROUTE:..	NOT AVAILABLE. SEE SECTION 2, HAZARDOUS INGREDIENTS.
LC 50 OF MATERIAL, SPECIES & ROUTE:.	NOT AVAILABLE. SEE SECTION 2, HAZARDOUS INGREDIENTS.
EXPOSURE LIMIT OF MATERIAL:.....	TLV FOR DUST: 2 mg/m3; TLV FOR VAPOURS FROM DECOMP.: 31 mg/m3 (see ACGIH).
IRRITANCY OF MATERIAL:.....	IRRITANT. REFER TO ROUTE OF ENTRY, SECTION 3.
SENSITIZING CAPABILITY OF MATERIAL:	NOT AVAILABLE.
CARCINOGENICITY OF MATERIAL:.....	NOT AVAILABLE.
REPRODUCTIVE EFFECTS:	
REPRODUCTIVE TOXICITY:.....	NOT AVAILABLE.
MUTAGENICITY:.....	NOT AVAILABLE.
TERATOGENICITY & EMBRYOTOXICITY:..	NOT AVAILABLE.
SYNERGISTIC MATERIALS:.....	NOT AVAILABLE.
MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:	MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE TO THIS PRODUCT HAVE NOT BEEN ESTABLISHED. UNNECESSARY EXPOSURE TO THIS PRODUCT OR ANY OTHER CHEMICAL SHOULD BE AVOIDED.

PRODUCT: NAX 31

Section 12: ECOLOGICAL INFORMATION

BIODEGRADABILITY..... NOT AVAILABLE.
ENVIRONMENTAL..... NOT AVAILABLE.

Section 13: DISPOSAL CONSIDERATIONS

WASTE DISPOSAL, METHOD AND EQUIPMENT: ..... ALL WASTE FROM THIS PRODUCT INCLUDING ALL EMPTY CONTAINERS MUST BE DISPOSED OF IN ACCORDANCE WITH MUNICIPAL, PROVINCIAL AND FEDERAL REGULATIONS.

Section 14: TRANSPORT INFORMATION

T.D.G. CLASSIFICATION:..... CLASS 4.2 UN 3342 P.G. II.
T.D.G. SHIPPING NAME:..... XANTHATES.
T.D.G. SHIPPING INFORMATION:..... THE DANGEROUS GOODS ARE DESCRIBED IN ACCORDANCE WITH THE UN RECOMMENDATIONS.

Section 15: REGULATORY INFORMATION

WHMIS CLASSIFICATION:..... CLASS B DIV. 6. CLASS D DIV. 1 SUB. B.
CPR COMPLIANCE..... THIS PRODUCT HAS BEEN CLASSIFIED IN ACCORDANCE WITH THE HAZARD CRITERIA OF THE CPR AND THE MSDS CONTAINS ALL OF THE INFORMATION REQUIRED BY THE CPR.

Section 16: OTHER INFORMATION

MANUFACTURERS MSDS DATE:..... JUNE 21, 2004.
MSDS REVISION DATE:..... MAY 8, 2007.
NOTES:..... We urge each customer or recipient of this MSDS to study it carefully to become aware of and understand the hazards associated with the product. The reader should consider consulting reference works or individuals who are experts in ventilation, toxicology, and fire prevention, as necessary or to use and understand the data contained in this MSDS. To promote safe handling, each customer or recipient should: (1) notify its employees, agents, contractors and others whom it knows or believes will use this material of the information in this MSDS and any other information regarding hazards or safety, (2) furnish this same information to each of its customers for the product; and (3) requests its customers to notify their employees, customers, and other users of the product of this information.

NOTE (EMPTY):
PREPARED BY ..... Regulatory Affairs
PREPARATION DATE May08/07

PROSPEC CHEMICALS
PROSPEC CHEMICALS
P.O. BOX 3478
176 STURGEON DRIVE
STURGEON COUNTY; ALBERTA; T8L 2T4
CANADA

PRODUIT: NAX 31

Section 01: IDENTIFICATION DU PRODUIT CHIMIQUE ET DE LA SOCIETE

FABRICANTS..... PROSPEC CHEMICALS
P.O. BOX 3478
176 STURGEON DRIVE
STURGEON COUNTY, ALBERTA
T8L 2T4
(780) 992-1522
PRODUCT NAME ..... NAX 31
NOM CHIMIQUE:..... XANTHATE DU SODIUM ISOPROPYL.
UTILISATION DU PRODUIT:..... TRAITEMENT DE MINERAI.
FAMILLE CHIMIQUE:..... SELS de DITHIOESTERS D'ACIDE CARBONIQUE.
FORMULE CHIMIQUE:..... SANS OBJET.
POIDS MOLECULAIRE:..... SANS OBJET.

Section 02: COMPOSITION/INGREDIENTS SUR LES COMPOSANTS

INGREDIENTS DANGEREUX	%	LIMITES D'EXP	#C.A.S.	DL/50, VOIE, ESPECE	CL/50 VOIE, ESPECE
XANTHATE ISOPROPYL DE SODIUM	60-100	NOT AVAILABLE	140-93-2	ORALE RAT 250-2000 mg/Kg	NON DISPONIBLE
HYDROXYDE DE SODIUM	1-5	2 mg/m3 (CEILING)	1310-73-2	DERM.LAP.500 mg/24HR	NON DISPONIBLE
ISOPROPANOL	1-5	STEL 500 ppm	67-63-0	ORALE RAT 5045 mg/kg DERMIQUE LAPIN 12800 mg/kg	RAT 12000 ppm/8h

Section 03: IDENTIFICATION DES DANGERS

VOIES D'ADMINISTRATIONS
CONTACT AVEC LA PEAU:..... LES POUSSIERES OU LES VAPEURS PEUVENT ETRE IRRITANTES. LES SOLUTIONS DE XANTHATES PEUVENT PROVOQUER UNE IRRITATION LEGERE A GRAVE DE LA PEAU.
ABSORPTION PAR LA PEAU:..... NON DISPONIBLE.
CONTACT AVEC L'OEIL:..... LES POUSSIERES OU LES VAPEURS PEUVENT IRRITER. LES SOLUTIONS DE XANTHATES PEUVENT CAUSER UNE IRRITATION LEGERE A GRAVE DE L'OEIL.
INHALATION AIGUE:..... LA POUSSIERE DANS L'AIR AMBIANT PEUT PROVOQUER L'IRRITATION DES VOIES RESPIRATOIRES. LES VAPEURS DE LA DECOMPOSITION (BISULFURE DE CARBONE) PEUVENT CAUSER DES TROUBLES GRAVES DE L'HUMEUR ET DU COMPORTEMENT, Y COMPRIS L'EXCITATION, LA COLERE ET DES CAUCHEMARS.
INHALATION CHRONIQUE:..... DES CONCENTRATIONS ELEVEES DU PRODUIT DE DECOMPOSITION (BISULFURE DE CARBONE) PEUVENT ENTRAINER LA MORT.
INGESTION:..... PEUT CAUSER DE L'IRRITATION GASTRO-INTESTINALE, LA NAUSEE, LE VOMISSEMENT ET LA DIARRHEE.
EFFETS D'EXPOSITION AIGUE:..... VOIR LES VOIES D'ADMINISTRATION.
EFFETS D'EXPOSITION CHRONIQUE..... VOIR LES EFFETS D'EXPOSITION AIGUE.

Section 04: PREMIERS SOINS

PEAU:..... ENLEVER TOUT VETEMENT SOUILLE OU CONTAMINE. LAVAGE A L'EAU SAVONNEUSE. NE JAMAIS UTILISER DE SOLVANTS. LAVER TOUT VETEMENT SOUILLE AVANT REUTILISATION.
YEUX:..... CHERCHER ET ENLEVER DES VERS DE CONTACT. RINCER SANS ARRET A L'EAU PENDANT 15 MINUTES. TENIR DE FORCE LES PAUPIERES OUVERTES AFIN D'ASSURER L'IRRIGATION DE TOUT LE TISSU OCULAIRE. CONSULTER UN MEDECIN SANS TARDER.
INHALATION:..... ELOIGNER LE SUJET A L'AIR FRAIS. PRATIQUER LA RESPIRATION ARTIFICIELLE, OU LA RESSUSCITATION CARDIOPULMONAIRE SI NECESSAIRE. EN CAS DE DIFFICULTE RESPIRATOIRE DONNER DE L'OXYGENE. MAINTENIR LE PATIENT AU CHAUD ET AU REPOS, FAIRE APPEL AU MEDECIN.

PRODUIT: NAX 31

Section 04: PREMIERS SOINS

INGESTION:.....	SI CONSCIENT(E):. NE PAS FAIRE VOMIR. RINCER LA BOUCHE DE LA VICTIME LONGUEMENT A L'EAU. DONNER 500 ml D'EAU AU MINIMUM. CONSULTER VOTRE MEDECIN IMMEDIATEMENT. SI LA VICTIME VOMIT NATURELLEMENT, LA PENCHER EN AVANT POUR EVITER LES RISQUES D'ASPIRATION. SI INCONSCIENT(E);. CONSULTER VOTRE MEDECIN IMMEDIATEMENT.
AVIS AU MEDECIN:.....	IL N'EXISTE PAS D'ANTIDOTE SPECIFIQUE. LE TRAITEMENT RELATIF A UNE EXPOSITION DEVRA DEPENDRE DES SYMPTOMES ET DE LA CONDITION CLINIQUE DU PATIENT.
AVIS GENERAL:.....	CONSULTER UN MEDECIN OU LE CENTRE ANTIPOISON LE PLUS PROCHE, SAUF POUR LES CAS BENINS D'INHALATION OU DE CONTACT AVEC LA PEAU. EVITER LES FORTES CONCENTRATIONS DE POUSSIERES; EMPLOYER, AU BESOIN, UN MASQUE ANTIPOUSSIERES OU UN MASQUE FILTRANT. TOUJOURS PRENDRE LES PRECAUTIONS D'USAGE AFIN D'EVITER UN CONTACT DE LA PEAU OU DES YEUX AVEC TOUTE SUBSTANCE CHIMIQUE.

Section 05: LUTTE CONTRE L'INCENDIE

INFLAMMABILITE:.....	LES VAPEURS PROVENANT DE LA DECOMPOSITION (BISULFURE DE CARBONE) SONT EXTREMEMENT INFLAMMABLES.
SI OUI, SOUS QUELLES CONDITIONS?.....	LES XANTHATES SOLIDES, S'ILS SONT EXPOSES A LA CHALEUR OU A L'HUMIDITE. CREENT UNE DECOMPOSITION ET LES VAPEURS SONT TRES INFLAMMABLES; UNE COMBUSTION SPONTANEE PEUT SE PRODUIRE.
MOYENS D'EXTINCTION:.....	DIOXYDE DE CARBONE. POUDRE CHIMIQUE. EAU.
PROCEDURES SPECIALES:.....	TOUJOURS PORTER UN EQUIPEMENT DE RESPIRATION AUTONOME A PRESSION POSITIVE ET LES VETEMENTS DE PROTECTION APPROPRIES DANS LE COMBAT D'INCENDIES IMPLIQUANT UNE SUBSTANCE CHIMIQUE. LA CHALEUR DECOMPOSE LES XANTHATES SOLIDES ET LIQUIDES EMETTANT DU DISULFIDE DE CARBONE, PRODUIT EXTREMEMENT INFLAMMABLE ET TOXIQUE.
POINT D'ECLAIR (°C), METHODE:.....	SANS OBJET. -30 oC POUR LES VAPEURS DE DISULPHIDE DE CARBONE.
TEMPERATURE D'AUTO IMFLAMMATION °C:	90 (VAPEURS DE DISULPHIDE DE CARBONE).
CLASSE D'INFLAMMABILITE DU T.M.D.:....	CLASSE 4.2, MATIERES AUTO-ECHAUFFANTES.
SEUIL MAXIMAL D'INFLAMMABILITE:.....	50% (BISULFURE DE CARBONE RESIDUEL).
SEUIL MINIMAL D'INFLAMMABILITE:.....	1.25% (BISULFURE DE CARBONE RESIDUEL).
PRODUITS DE COMBUSTION DANGEREUX:	DISULFURE DE CARBONE. SULFURE DE CARBONYLE. SULFURE DE SODIUM. ALCOOL ISOPROPYLIQUE.
DONNEES D'EXPLOSION:	
SENSIBILITE AUX DECHARGES STATIQUES:	LES VAPEURS DE BISULFURE DE CARBONE SUSCEPTIBLES DE SE DEGAGER A CAUSE DE LA DECOMPOSITION, PEUVENT FACILEMENT S'ENFLAMER PAR DECHARGE STATIQUE.
SENSIBILITE AUX CHOCS:.....	NON DISPONIBLE.
VITESSE DE COMBUSTION:.....	NON DISPONIBLE.
POUVOIR EXPLOSIF:.....	NON DISPONIBLE.

Section 06: LUTTE CONTRE LES DEVERSEMENTS

PROCEDURES DE NETTOYAGE, FUITE/DEVERSEMENT:	SI A L'ETAT LIQUIDE:. ARRETER LE DEVERSEMENT A LA SOURCE. CONFINER TOUT DEVERSEMENT POUR EMPECHER SA DECHARGE DANS LE MILIEU ENVIRONNANT. ELIMINER TOUTES LES SOURCES D'IGNITION. LES PERSONNES NE PORTANT PAS UN EQUIPEMENT DE PROTECTION NE SONT PAS ADMISES DANS LA SECTEUR. ABSORBER AVEC UNE MATIERE INERTE. METTRE DANS UN TONNELET DE RECUPERATION METALLIQUE APPROUVE AVANT DE METTRE AU REBUT. SI A L'ETAT SOLIDE:. ELIMINER TOUTES LES SOURCES D'IGNITION. LIMITER L'ACCES A LA ZONE JUSQU'AU NETTOYAGE COMPLET. S'ASSURER QUE LE NETTOYAGE EST PRATIQUE PAR UN PERSONNEL SPECIALISE UNIQUEMENT NE PAS TOUCHER LA SUBSTANCE REPANDUE. NE PAS UTILISER DE L'EAU SUR LA SUBSTANCE REPANDUE, CAR CELA ENTRAINERAIT UNE PRODUCTION DE CHALEUR. PLACER LA SUBSTANCE REPANDUE DANS DES FUTS APPROUVES POUR LA RECUPERATION DESTINES AU REBUT. ARROSER L'ENDROIT NETTOYE A L'EAU, EN S'ASSURANT QUE DE L'EAU NE PENETRE PAS DANS LES RECIPIENTS DE XANTHATE.

Section 07: MANUTENTION ET ENTREPOSAGE

CONDITIONS D'ENTREPOSAGE:.....	RANGER LES XANTHATES SOLIDES EN MILIEU FRAIS, SOMBRE ET SEC. LES PRODUITS LIQUIDES DOIVANT ETRE TENUS AU FRAIS ET UTILISES AUSSI VITE QUE POSSIBLE.
PROCEDURES DE MANUTENTION ET EQUIPEMENT:	EVITER TOUT CONTACT AVEC LA PEAU. EVITER TOUT CONTACT AVEC LES YEUX. EVITER DE RESPIRER LES VAPEURS. L'EQUIPEMENT DEVRAIT ETRE MIS A LA TERRE POUR EVITER LA DECHARGE STATIQUE. GARDER A L'ECART DE LA CHALEUR, DES ETINCELLES ET DES FLAMMES. EMPLOYER DES OUTILS NON ETINCELEURS ET NE PAS FUMER.

PRODUIT: NAX 31

Section 07: MANUTENTION ET ENTREPOSAGE

INSTRUCTIONS SPECIALES POUR EXPEDITIONS:	PRENDRE LES PRECAUTIONS D'USAGE LORS DE LA MANIPULATION OU DE L'EXPEDITION DE TOUTE SUBSTANCE CHIMIQUE. PROTEGER CONTRE LES DOMMAGES PHYSIQUES.

Section 08: MECANISMES TECHNIQUES DE CONTROLE/PROTECTION PERSONNELLE

EQUIPEMENTS PROTECTEURS:	
GANTS/TYPE:	PORTER DES GANTS IMPERMEABLES (E.G. NEOPRENE, CAOUTCHOUC).
APPAREIL RESPIRATOIRE/TYPE:	SI LA PROTECTION RESPIRATOIRE EST NECESSAIRE, ETABLIR UN PROGRAMME COMPLET DE PROTECTION RESPIRATOIRE COMPRENANT CHOIX, ESSAI D'ADJUSTEMENT, FORMATION, ENTRETIEN ET INSPECTION. SE REFERER A LA NORME ACNOR Z94.4-M1982 "CHOIX, SOINS ET UTILISATION DES MASQUES" DISPONIBLE AUPRES DE L'ASSOCIATION CANADIENNE DE NORMALISATION, REXDALE ONTARIO M9W 1R3. DANS LE CAS DE VAPEURS, EMPLOYER UN MASQUE ANTIPOUSSIERES APPROUVE PAR NIOSH OU MSHA POUR VAPEURS ACIDES OU UN EQUIPEMENT DE RESPIRATION AUTONOME. VOIR M.S.D.S. POUR PLUS DE DETAILS SUR CE CHAPITRE.
OEIL/TYPE:	MASQUE DE PROTECTION. LUNETTES DE SECURITE.
CHAUSSURES/TYPE:	BOTTES DE PROTECTION EN CAOUTCHOUC.
VETEMENT/TYPE:	PORTER DES VETEMENTS PROTECTEURS APPROPRIES.
AUTRE/TYPE:	UNE DOUCHE OCULAIRE AUTOMATIQUE ET UNE DOUCHE DE SECURITE DOIVENT SE TROUVER A PROXIMITE DE LA ZONE DE TRAVAIL.
CONTROLES D'INGENIERIE:	VENTILATION MECANIQUE ANTIDEFLAGRANTE POUR LIMITER LES CONCENTRATIONS DE VAPEURS AU-DESSOUS DE LA CMA.

Section 09: PROPRIETES PHYSIQUES ET CHIMIQUES

ETAT PHYSIQUE:	SOLIDE.
ODEUR ET APPARENCE:	ODEUR DE SOUFRE DESAGREABLE, GRAINS JAUNES-VERTS.
SEUIL DE L'ODEUR:	NON DISPONIBLE.
PRESSION DE VAPEUR:	SANS OBJET.
DENSITE DE VAPEUR (AIR=1):	SANS OBJET.
% DE VOLATILITE:	
PAR VOLUME	< 20.
PAR POIDS	
TAUX D'EVAPORATION:	SANS OBJET.
POINT D'EBULLITION °C:	SANS OBJET. M.P. 150 - 250 (se decompose).
POINT DE CONGELATION °C:	SANS OBJET.
pH:	10% H2O 13 +/- 1.
MASSE VOLUMIQUE:	SANS OBJET.
SOLUBILITE DANS L'EAU (20°C):	SOLUBLE.
COEFFICIENT DE REPARTITION EAU/HUILE:	NON DISPONIBLE.

Section 10: STABILITE ET REACTIVITE

STABILITE CHIMIQUE:	
OUI.	
NON, QUELLES CONDITIONS?	LES XANTHATES SOLIDES SONT STABLES LORSQU'ILS SONT GARDES DANS UN ENDROIT FRAIS ET SEC; L'EXPOSITION A LA CHALEUR ENTRAINE LA DECOMPOSITION. LES ACIDES ET LES OXYDANTS ACCELERENT LE VIELLISSEMENT. EN SOLUTION, LES XANTHATES SE DECOMPOSENT LENTEMENT MEME A LA TEMPERATURE AMBIANTE.
COMPATABILITE AVEC D'AUTRES SUBSTANCES:	
OUI.	
NO, LESQUELLES?	DES ACIDES FORTS. OXYDANTS.
REACTIVITE, SOUS QUELLES CONDITIONS?	LES VAPEURS OU POUSSIERES PEUVENT S'ENFLAMMER.
PRODUITS DANGEREUX DE DECOMPOSITION:	DISULFURE DE CARBONE. TRITHIOCARBONATE. ALCOOL ISOPROPYLIQUE.

Section 11: RENSEIGNEMENTS SUR LA TOXICITE

DL 50 DU PRODUIT, ESPECES ET VOIE D'ADMINISTRATION:	NON DISPONIBLE. CONSULTER LE CHAPITRE 2, SUR LES INGREDIENTS DANGEREUX.
CL 50 DU PRODUIT, ESPECES ET VOIE D'ADMINISTRATION:	NON DISPONIBLE. VOIRE LE CHAPITRE 2 SUR LES INGREDIENTS DANGEREUX.
LIMITE D'EXPOSITION DU PRODUIT:	TLV: 2 mg/m3 DE POUSSIERE ou 31 mg/m3 de VAPEUR provenant de la decomposition (VOIR ACGIH).
IRRITATION DU PRODUIT:	IRRITANT. VOIR LES VOIES D'ACCES.
CAPACITE DE SENSIBILISATION DU PRODUIT:	NON DISPONIBLE.

PRODUIT: NAX 31

Section 11: RENSEIGNEMENTS SUR LA TOXICITE

CANCEROGENICITE DU PRODUIT:.....	NON DISPONIBLE.
EFFETS DE REPRODUCTION:	
REPRODUCTION TOXICITE:.....	NON DISPONIBLE.
MUTAGENICITE:.....	NON DISPONIBLE.
TERATOGENICITE & EMBRYOTOXICITE:..	NON DISPONIBLE.
PRODUITS SYNERGIQUES:.....	NON DISPONIBLE.
ETAT DE SANTE AGGRAVE PAR UNE ..... SUREXPOSITION:	AUCUNE AGGRAVATION DE L'ETAT MEDICAL PAR UNE SUREXPOSITION A CE PRODUIT N'A ETE PROUVEE. IL FAUT EVITER TOUTE EXPOSITION INUTILE A CE PRODUIT OU A TOUT AUTRE PRODUIT CHIMIQUE.

Section 12: RENSEIGNEMENTS ECOLOGIQUES

BIODEGRADABILITE.....	NON DISPONIBLE.
ENVIRONNEMENT.....	NON DISPONIBLE.

Section 13: DECHETS

EVACUATIONS DES DECHETS, ... METHODES ET EQUIPEMENTS:	TOUS DECHETS DU PRODUIT Y COMPRIS LES CONTENANTS VIDES DOIVENT ETRES ELIMINES SELON LES REGLEMENTS MUNICIPAUX, PROVINCIAUX ET FEDERAUX.

Section 14: TRANSPORT

CLASSIFICATION DU T.M.D.:.....	CLASSE 4.2 UN 3342 G.E. II.
NOM POUR LIVRAISON TMD:.....	XANTHATES.
INFORMATION SUR LA LIVRAISON TMD:..	LES MATIERES DANGEREUSES SONT DECRITES CONFORMEMENT AUX RECOMMENDATIONS DU NIP.

Section 15: LEGISLATION

CLASSIFICATION SIMDUT:.....	CLASSE B DIV. 6. CLASSE D DIV. 1 SUB. B.
CONFORMITE AU REGLEMENT SUR LES PRODUITS CONTROLES	CE PRODUIT A ETE CLASSIFIE CONFORMEMENT AUX CRITERES DU REGLEMENT SUR LES PRODUITS CONTROLES, ET LA FICHE SIGNALETIQUE CONTIENT TOUTES LES INFORMATIONS EXIGEES PAR LEDIT REGLEMENT.

Section 16: AUTRES RENSEIGNEMENTS

DATE DE FABRICATION FOURNISSEUR:..	21 JUIN 2004 .
DATE DE REVISION DE LA FS:.....	MAI 8, 2007.
REMARQUE:.....	Nous recommandons que chaque client ou receveur de cette fiche technique l'etudie soigneusement pour etre bien informe et pour bien comprendre les dangers associes a ce produit. Le lectuer doit par ailleurs envisager de consulter, le cas echeant, des travaux de reference ou des specialistes dans les domaines de la ventilation, de la toxicologie, et de la prevention des incendies. Le lecteur doit bien assimiler les donnees contenues dans cette fiche technique avant d'utiliser le produit. Afin d'assurer une manipulation sans danger, chaque client ou personne ayant recu ce produit doit: (1) avertir ses employes, entrepreneurs et autres dont il sait qu'ils vont employer cette substance, de l'information contenue dans cette fiche technique, et de toute autre information concernant les risques ou la securite; (2) fournir cette meme information a chacun des utilisateurs de ce produit; et (3) demander aux utilisateurs du produit d'avertir leurs employes, clients et autres sur les dites informations.
REMARQUE;	
REDIGE PAR.....	Regulatory Affairs
DATE DU PREPARATION:.....	MAI08/07

Maximizing the Value of Flotation Chemicals Technology

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME:	**Flottec PAX Collector**
SYNONYMS:	Potassium Amyl Xanthate, Potassium Isoamyl Xanthate
CHEMICAL FAMILY:	Alkyl xanthate salt
MOLECULAR FORMULA:	C6H12OS2K
MOLECULAR WEIGHT	203.4
MANUFACTURER:	Flottec, LLC • 338 West Main Street • Boonton, New Jersey 07005 • USA
PRODUCT INFORMATION:	Tel: +1.973.588.4717 • Fax: +1.973.588.4719 • Web Site: www.flottec.com
EMERGENCY PHONE:	CHEMTREC • North America: +1.800.424.9300 • International: +1.703.527.3887
ISSUE DATE:	November 1, 2009

2. COMPOSITION/INFORMATION ON INGREDIENTS

OSHA REGULATED COMPONENTS

COMPONENT	CAS No.	% (w/w)	OSHA (PEL)	ACGIH (TLV)	Carcinogen
Potassium sulfide	1312-73-8	~ 1	Not established	Not established	-
Carbonodithioic acid, O-(3-methylbutyl) ester, potassium salt	1928-70-1	> 90	Not established	Not established	-
Potassium hydroxide	1310-58-3	0 - 1	2 mg/m^3 (Ceiling)	2 mg/m^3 (Ceiling)	-

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

APPEARANCE AND ODOR

Color: Yellow-green
Appearance: Pellets, flakes, or powder
Odor: Disagreeable

STATEMENT OF HAZARD

DANGER! **SELF-HEATING MATERIAL**
MAY BE SPONTANEOUSLY COMBUSTIBLE
MAY FORM EXPLOSIVE DUST-AIR MIXTURES
HARMFUL IF ABSORBED THROUGH SKIN
DUST IRRITATING
CAUSES EYE AND SKIN IRRITATION

POTENTIAL HEALTH EFFECTS

EFFECTS / ROUTES OF EXPOSURE

The acute oral (rat) LD50 and dermal (rabbit) LD50 values are estimated to be >1,000 mg/kg and >500 mg/kg, respectively. Skin or eye contact with solutions of this product may cause moderate skin and eye irritation. Airborne dust may cause significant eye, skin or respiratory tract irritation. Refer to Section 11 for toxicology information on the regulated components of this product.

4. FIRST AID MEASURES

INGESTION:	If swallowed, call a physician immediately. Only induce vomiting at the instruction of a physician. Never give anything by mouth to an unconscious person.
SKIN CONTACT:	Remove contaminated clothing and shoes without delay. Wash immediately with plenty of water. Do not reuse contaminated clothing without laundering. Get medical attention if pain or irritation persists after washing or if signs and symptoms of overexposure appear.
EYE CONTACT:	Rinse immediately with plenty of water for at least 15 minutes. Obtain medical attention immediately.
INHALATION:	Remove to fresh air. If breathing is difficult, give oxygen. Obtain medical advice if there are persistent symptoms.

5. FIREFIGHTING MEASURES.

EXTINGUISHING MEDIA AND FIRE FIGHTING INSTRUCTIONS

Extinguishing Media:	Use carbon dioxide, dry chemical or large quantities of water.
Protective Equipment:	Firefighters, and others exposed, wear self-contained breathing apparatus. Wear full firefighting protective clothing. See MSDS Section 8 (Exposure Controls/Personal Protection).
Special Hazards:	Solid xanthates are stable when kept cool and dry. Exposure to heat and moisture can cause decomposition to flammable and explosive vapor of carbon disulfide. Since xanthates decompose in solution, even at room temperature, fire and explosion hazards can develop with aging.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS:	Where exposure level is not known, wear approved, positive pressure, self-contained respirator. Where exposure level is known, wear approved respirator suitable for level of exposure. Refer to Section 8 (Exposure Controls/Personal Protection) for appropriate personal protective equipment.
METHODS FOR CLEAN UP:	Sweep up into containers for disposal. Flush spill area with water.
ENVIRONMENTAL PRECAUTIONS:	Dispose of in accordance with EPA rules and regulations.

7. HANDLING AND STORAGE

HANDLING

Precautionary Measures :	Avoid excessive heat or moisture. Avoid contact with eyes, skin and clothing. Avoid breathing dust. Keep container closed. Wash thoroughly after handling. Use non-sparking tools and do not smoke when opening drum. Use with adequate ventilation. Contains finely divided material. Dust suspended in air may ignite with static discharge, sparks or flame. Equipment, including venting systems, should be grounded. Provide adequate ventilation in areas of use to remove dust. Wash contaminated clothing before reuse.
Special Handling Statements :	Minimize dust. Special precautions against fire and explosion must be observed in (1) pumping xanthate solutions, (2) draining mobile tanks, (3) cleaning mobile tanks, and (4) performing maintenance work on storage tanks and pipelines leading to and from tanks. Use non-sparking tools and do not smoke when opening drums of xanthate. DUST EXPLOSION HAZARD CLASS - 2 Handling of material should be in accordance with standards for venting of deflagrations (e.g. NFPA-68). If handled with flammable or combustible materials the explosion hazard may increase
STORAGE	Heating or overexposure to moisture of solid xanthates or heating or aging of xanthate solutions causes some decomposition to poisonous and flammable carbon disulfide. Storage tanks should have certain design features for maximum safety, and the vapor space should be free of sources of ignition.
Storage Temperature:	Store at <32.2 - 10 °C 90 - 50 °F **Reason:** Safety

8. EXPOSURE CONTROLS AND PERSONAL PROTECTION

ENGINEERING MEASURES	Where this material is not used in a closed system, good enclosure and local exhaust ventilation should be provided to control exposure.

PERSONAL PROTECTIVE EQUIPMENT

RESPIRATORY PROTECTION:	Where exposures are below the established exposure limit, no respiratory protection is required. Where exposures exceed the established exposure limit, use respiratory protection recommended for the material and level of exposure.
EYE PROTECTION:	Wear eye/face protection such as chemical splash proof goggles or face shield. Eyewash equipment and safety shower should be provided in areas of potential exposure.
SKIN PROTECTION:	Avoid skin contact. Wear impermeable gloves and suitable protective clothing.
ADDITIONAL ADVICE:	Food, beverage and tobacco products should not be carried, stored or consumed where this material is used. Before eating, drinking, or smoking, wash face and hands with soap and water.

9. PHYSICAL AND CHEMICAL PROPERTIES

COLOR:	Yellow-green
APPEARANCE:	Pellets, flakes, or powder
ODOR:	Disagreeable
BOILING POINT:	Not applicable
MELTING POINT:	491 - 536°F; 255 - 280°C
VAPOR PRESSURE:	Not applicable
SPECIFIC GRAVITY:	Not available
VAPOR DENSITY:	Not applicable
% VOLATILE (BY WT.):	~ 1.5
pH:	Not applicable
SATURATION IN AIR (% by Vol):	Not applicable
EVAPORATION RATE:	Not applicable
SOLUBILITY IN WATER:	35 g/100 g at 20°C
VOLATILE ORGANIC CONTENT:	Not available
FLASH POINT:	Not applicable
FLAMMABLE LIMITS (% BY VOL.):	Not applicable
AUTO IGNITION TEMPERATURE:	>248°F; 120°C (value for carbon disulfide)
DECOMPOSITION TEMPERATURE:	>267.8 - 536°F; 131 - 280°C
PARTIAL COEFFICIENT (n-octanol/water):	Not available
ODOR THRESHOLD:	See Section 2 for exposure limits

10. STABILITY AND REACTIVITY

STABILITY:	Stable
CONDITIONS TO AVOID:	Containers filled with this product should be kept closed when not in use. Keep container in a cool, well-ventilated area. Exposure of the solid xanthate to heat or moisture and heating or aging of xanthate solutions. Avoid prolonged exposure to heat; avoid strong acids, alkalies and oxidizing agents. Keep water and moist air out of container.
POLYMERIZATION:	Will not occur
CONDITIONS TO AVOID:	None known
MATERIALS TO AVOID:	Strong oxidizing agents, acidic material. High temperatures
HAZARDOUS DECOMPOSITION PRODUCTS:	Carbon disulfide, carbon monoxide, carbon dioxide, oxides of sulfur (includes sulfur di and tri oxides), hydrogen sulfide

11. TOXICOLOGICAL INFORMATION

Toxicological information for the product is found under SECTION 3: HAZARDS IDENTIFICATION
Toxicological information on the regulated components of this product is as follows:

Potassium hydroxide has an acute oral (rat) LD50 value of 273 mg/kg. Acute overexposure to potassium hydroxide or dusts causes severe respiratory irritation. Potassium hydroxide is severely irritating to the eyes and skin.

Potassium sulfide may cause eye and skin irritation. Under acidic conditions, potassium sulfide can decompose to produce flammable poisonous hydrogen sulfide gas.

Potassium 3 methyl butyl xanthate has an estimated acute oral (rat) LD50 and acute dermal (rabbit) LD50 values of > 1,000 mg/kg and > 500 mg/kg, respectively, based on similar materials. Direct contact with this material may cause moderate eye and skin irritation. Airborne dust may cause significant eye, skin or respiratory tract irritation.

California Proposition 65 Warning (applicable in California only) - This product contains (a) chemical(s) known to the State of California to cause birth defects or other reproductive harm.

12. ECOLOGICAL INFORMATION

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
This material is not readily biodegradable.
All ecological information provided was conducted on a structurally similar product.

ALGAE TEST RESULTS

Test	Duration	Procedure	Species	Results	

FISH TEST RESULTS

Test	Duration	Procedure	Species	Results	
Acute toxicity, freshwater (OECD 203)	96 hr.	-	Rainbow Trout (Oncorhyncus mykiss)	> 10 – 100 mg/l	LC50

INVERTEBRATE TEST RESULTS

Test	Duration	Procedure	Species	Results	
Acute Immobilization (OECD 202)	48 hr.	-	Water Flea (Daphnia magna)	>1 - 10 mg/l	EC50

ACCUMULATION TEST RESULTS

Test	Duration	Procedure	Species	Results	

DEGRADATION

Test	Duration	Procedure	Results
Biodegradability	-	-	< 70 %
COMMENTS:	Information based on structurally similar material		

13. DISPOSAL CONSIDERATIONS

RECOMMENDATIONS FOR THE PRODUCT:	In accordance with regulations for special waste, product must be taken, after pretreatment, to an authorized special waste incineration plant.
RECOMMENDATIONS FOR PACKAGING:	Packaging that cannot be cleaned should be disposed of like the product.
RECOMMENDED CLEANSING AGENT:	Water

14. Transportation Information

This section provides basic shipping classification information.
Refer to appropriate transportation regulations for specific requirements.

U.S. DOT				
PROPER SHIPPING NAME:	XANTHATES			
HAZARD CLASS	4.2			
PACKING GROUP:	II			
UN/ID NUMBER:	UN3342			
TRANSPORT LABEL REQUIRED:	Spontaneously Combustible Marine Pollutant			
TECHNICAL NAME (N.O.S.):	Contains potassium amyl xanthate			
HAZARDOUS SUBSTANCE:	Not applicable			
COMMENTS:	Marine Pollutants - DOT requirements specific to Marine Pollutants do not apply to non-bulk packagings transported by motor vehicles, rail cars or aircraft.			
TRANSPORT CANADA				
PROPER SHIPPING NAME:	XANTHATES			
HAZARD CLASS	4.2			
PACKING GROUP:	II			
UN/ID NUMBER:	3342			
TRANSPORT LABEL REQUIRED:	Spontaneously Combustible Marine Pollutant			
TECHNICAL NAME (N.O.S.):	Contains potassium amyl xanthate			
ICAO/IATA				
PROPER SHIPPING NAME:	XANTHATES			
HAZARD CLASS:	4.2			
PACKING GROUP:	II			
UN NUMBER:	3342			
TRANSPORT LABEL REQUIRED:	Spontaneously Combustible			
PACKING INSTRUCTIONS/ MAXIMUM NET QUANTITY:	PASSENGER AIRCRAFT	415	15 kg	
	CARGO AIRCRAFT	417	50 kg	
TECHNICAL NAME (N.O.S.):	Contains potassium amyl xanthate			
IMO				
PROPER SHIPPING NAME:	XANTHATES			
HAZARD CLASS:	4.2			
UN NUMBER:	3342			
PACKING GROUP:	II			
TRANSPORT LABEL REQUIRED:	Spontaneously Combustible Marine Pollutant			
TECHNICAL NAME (N.O.S.):	Contains potassium amyl xanthate			

15. REGULATORY INFORMATION

INVENTORY INFORMATION

United States (USA)	All components of this product are included on the TSCA Chemical Inventory or are not required to be listed on the TSCA Chemical Inventory.
Canada	This product contains components not on the Domestic Substances List. These components are on the Non-Domestic Substances List.
European Union (EU)	All components of this product are included in the European Inventory of Existing Chemical Substances (EINECS) in compliance with Council Directive 67/548/EEC and its amendments.
Australia	All components of this product are included in the Australian Inventory of Chemical Substances (AICS) or are not required to be listed on AICS.
China	All components of this product are included on the Chinese inventory or are not required to be listed on the Chinese inventory.
Japan	All components of this product are included on the Japanese (ENCS) inventory or are not required to be listed on the Japanese inventory.
Korea	All components of this product are NOT included on the Korean (ECL) inventory.
Philippines	All components of this product are NOT included on the Philippine (PICCS) inventory.

OTHER ENVIRONMENTAL INFORMATION

The following components of this product may be subject to reporting requirements pursuant to Section 313 of CERCLA (40 CFR 372), Section 12(b) of TSCA, or may be subject to release reporting requirements (40 CFR 307, 40 CFR 311, etc.) See Section 13 for information on waste classification and waste disposal of this product.

Component	CAS NO.	% (w/w)	TPQ (lbs)	RQ (lbs)	S313	TSCA 12B
Carbon disulfide	75-15-0	~ 0.001	10,000	100	YES	YES

PRODUCT CLASSIFICATION UNDER SECTION 311 OF SARA

ACUTE (Y)	CHRONIC (N)	FIRE (Y)	REACTIVE (Y)	PRESSURE (N)

16. OTHER INFORMATION

NFPA HAZARD RATING
(National Fire Protection Association)

HEALTH - 2 -	Materials that, under emergency conditions, can cause temporary incapacitation or residual injury.
FIRE - 1 -	Materials that must be preheated before ignition can occur.
REACTIVITY - 1 -	Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures.

REASON FOR REVISION: New format; Revised all sections

Prepared By: F. Cappuccitti **Revised By:** R. Nix

IMPORTANT: The above information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warrant, expressed or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular uses.

MATERIAL SAFETY DATA SHEET

Diesel Fuels

VALERO MARKETING & SUPPLY COMPANY
and Affiliates
P.O. Box 696000
San Antonio, TX 78269-6000

Emergency Phone Numbers
24 Hour Emergency: 866-565-5220
Chemtrec Emergency: 800-424-9300

General Assistance
General Assistance: 210-345-4593

BRAND NAMES: Valero, Diamond Shamrock, Shamrock, Ultramar, Beacon, Total

Section 1. Chemical Product and Company Identification

Common / Trade name : Diesel Fuels

Synonym : Diesel Fuels All Grades, Diesel Fuel No.2, Fuel Oil No.2, High Sulfur Diesel Fuel, Low Sulfur Diesel Fuel, Ultra Low Sulfur Diesel Fuel, Off-Road Diesel fuel, Dyed Diesel Fuel, X Grade Diesel Fuel, X-1 Diesel Fuel

SYNONYMS/COMMON NAMES: This Material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical specifications vary greatly depending on the product and are not reflected in this document. Consult specification sheets for technical information. This product contains ingredients that are considered to be hazardous as defined by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Material uses : Motor fuels. Heating fuels.

MSDS # : 102

CAS # : 68476-34-6

Section 2. Composition, information on ingredients

Name	CAS number	Concentration (%)
Diesel fuel	68476-34-6	85 - 95
Naphthalene	91-20-3	1 - 3
n-Nonane	111-84-2	1 - 3
Hexane (Other Isomers)	mixture	1 - 3
n-Heptane	142-82-5	1 - 2
n-Hexane	110-54-3	1 - 2
Octane (All Isomers)	111-65-9	1 - 2

Section 3. Hazards Identification

Danger! Diesel Exhaust has been Reported to be an Occupational hazard due to NIOSH-reported potential carcinogenic properties.

Danger! Product May Contain or Release Hydrogen Sulfide. H2S is a highly toxic, highly flammable gas which can be fatal if inhaled at certain concentrations.

May cause irritation to eyes, skin and respiratory system. Avoid liquid, mist and vapor contact. Harmful or fatal if swallowed. Aspiration hazard, can enter lungs and cause damage. May cause irritation or be harmful if inhaled or absorbed through the skin. Avoid prolonged or repeated skin contact. Combustible Liquid. Vapors may explode.

Physical state : Liquid. (May be dyed red.)

Continued on next page

Emergency overview : Danger!

CAUSES EYE BURNS.
HARMFUL IF SWALLOWED.
CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: BLOOD, KIDNEYS, LIVER, PERIPHERAL NERVOUS SYSTEM, RESPIRATORY TRACT, SKIN, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.
SUSPECT CANCER HAZARD.
CONTAINS MATERIAL WHICH MAY CAUSE CANCER.
COMBUSTIBLE LIQUID AND VAPOR.
VAPOR MAY CAUSE FIRE.

Do not ingest. Do not get in eyes or on skin or clothing. Avoid breathing vapor or mist. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Risk of cancer depends on duration and level of exposure.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Eyes : Corrosive to eyes. May cause severe irritation, redness, tearing, blurred vision and conjunctivitis.

Skin : Prolonged or repeated contact may cause moderate irritation, defatting (cracking), redness, itching, inflammation, dermatitis and possible secondary infection. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Injury may not appear serious at first. Within a few hours, tissues will become swollen, discolored and extremely painful.

Inhalation : Nasal and respiratory tract irritation, central nervous system effects including excitation, euphoria, contracted eye pupils, dizziness, drowsiness, blurred vision, fatigue, nausea, headache, loss of reflexes, tremors, convulsions, seizures, loss of consciousness, coma, respiratory arrest and sudden death could occur as a result of long term and/or high concentration exposure to vapors. May also cause anemia and irregular heart rhythm. Repeated or prolonged exposure may cause behavioral changes. NIOSH Current Intelligence Bulletin 50 reports a potential occupational carcinogenic hazard exists due to human exposure to diesel exhaust.

Ingestion : Toxic if swallowed. May cause burns to mouth, throat and stomach. This product may be harmful or fatal if swallowed. This product may cause nausea, vomiting, diarrhea and restlessness. DO NOT INDUCE VOMITING. Aspiration into the lungs can cause severe chemical pneumonitis or pulmonary edema/hemorrhage, which can be fatal. May cause gastrointestinal disturbances. Symptoms may include irritation, depression, vomiting and diarrhea. May cause harmful central nervous system effects, similar to those listed under "inhalation".

Medical conditions aggravated by over-exposure : Repeated or prolonged contact with spray or mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray or mist may produce respiratory tract irritation, leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Over-exposure signs/symptoms : Nasal and respiratory tract irritation, central nervous system effects including excitation, euphoria, contracted eye pupils, dizziness, drowsiness, blurred vision, fatigue, nausea, headache, loss of reflexes, tremors, convulsions, seizures, loss of consciousness, coma, respiratory arrest or sudden death could occur as a result of long term and/or high concentration exposure to vapors. May also cause anemia and irregular heart rhythm.

See toxicological information (section 11)

Continued on next page

Section 4. First Aid Measures

Eye contact : Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Seek medical advice if pain or redness continues.

Skin contact : In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention. Wash exposed area thoroughly with soap and water. Remove contaminated clothing promptly and launder before reuse. Contaminated leather goods should be discarded. If irritation persists or symptoms described in the MSDS develop, seek medical attention. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Get immediate medical attention.

Inhalation : If inhaled, remove to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.

Ingestion : This product may be harmful or fatal if swallowed. This product may cause nausea, vomiting, diarrhea and restlessness. DO NOT INDUCE VOMITING. Aspiration into the lungs can cause severe chemical pneumonitis or pulmonary edema/hemorrhage, which can be fatal. May cause gastrointestinal disturbances. Symptoms may include irritation, depression, vomiting and diarrhea. May cause harmful central nervous system effects, similar to those listed under "inhalation".

Notes to physician : In case of ingestion, gastric lavage with activated charcoal can be used promptly to prevent absorption. Consideration should be given to the use of an intratracheal tube, to prevent aspiration. Irregular heart beat may occur, use of adrenalin is not advisable. Individuals intoxicated by the product should be hospitalized immediately, with acute and continuing attention to neurological and cardiopulmonary function. Positive pressure ventilation may be necessary. After the initial episode, individuals should be monitored for changes in blood variables and the delayed appearance of pulmonary edema and chemical pneumonitis. Such patients should be monitored for several days or weeks for delayed effects, including bone marrow toxicity, hepatic and renal impairment. Individuals with chronic pulmonary disease will be more seriously impaired, and recovery from inhalation exposure may be complicated. In case of skin injection, prompt debridement of the wound is necessary to minimize necrosis and tissue loss.

Section 5. Fire Fighting Measures

Flammability of the product : Combustible.

Auto-ignition temperature : 257.2°C (495°F)

Flash point : Closed cup: 51.67 to 87.78°C (125 to 190°F).

Flammable limits : Lower: 0.4% Upper: 8%

Products of combustion : These products are carbon oxides (CO, CO_2), nitrogen and sulfur oxides (NO_X, SO_X), particulate matter, VOC's.

Fire hazards in the presence of various substances : Flammable in the presence of open flames, sparks and static discharge.

Explosion hazards in the presence of various substances : Explosive in the presence of open flames, sparks and static discharge.

Fire-fighting media and instructions : Combustible Liquid. Use dry chemical, foam or carbon dioxide to extinguish the fire. Consult foam manufacturer for appropriate media, application rates and water/foam ratio. Water can be used to cool fire- exposed containers, structures and to protect personnel. If a leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor and to protect personnel attempting to stop a leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers.

Collect contaminated fire-fighting water separately. It must not enter the sewage system. Dike area of fire to prevent runoff. Decontaminate emergency personnel and equipment with soap and water.

Continued on next page

Combustible liquid and vapor. Vapor may cause flash fire. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Special remarks on fire hazards : No additional remark.

Special remarks on explosion hazards : No additional remark.

Section 6. Accidental Release Measures

Personal precautions : Immediately contact emergency personnel. Eliminate all ignition sources. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Do not touch or walk through spilled material. Tanks, vessels or other confined spaces which have contained product should be freed of vapors before entering. The container should be checked to ensure a safe atmosphere before entry. Empty containers may contain toxic,flammable/combustible or explosive residues or vapors. Do not cut, grind, drill, weld or reuse empty containers that contained this product. Do not transfer this product to another container unless the container receiving the product is labeled with proper DOT shipping name, hazard class and other information that describes the product and its hazards.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. If facility or operation has an "oil or hazardous substance contingency plan", activate its procedures. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Extremely flammable. Review Fire and Explosion Hazard Data before proceeding with clean up. Keep all sources of ignition (flames, smoking, flares, etc.) and hot surfaces away from release. Contain spill in smallest possible area. Recover as much product as possible (e.g., by vacuuming). Stop leak if it can be done without risk. Use water spray to disperse vapors. Spilled material may be absorbed by an appropriate absorbent, and then handled in accordance with environmental regulations. Prevent spilled material from entering sewers, storm drains, other unauthorized treatment or drainage systems and natural waterways. Contact fire authorities and appropriate federal, state and local agencies. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, contact the National Response Center at 800-424- 8802. For highway or railway spills, contact Chemtrec at 800-424-9300.

Methods for cleaning up : If emergency personnel are unavailable, contain spilled material. For small spills, add absorbent (soil may be used in the absence of other suitable materials) and use a non-sparking or explosion-proof means to transfer material to a sealable, appropriate container for disposal. For large spills, dike spilled material or otherwise contain it to ensure runoff does not reach a waterway. Place spilled material in an appropriate container for disposal.

Section 7. Handling and Storage

Handling : Do not ingest. Do not get in eyes, on skin or on clothing. Keep container closed. Use only with adequate ventilation. Avoid breathing vapor or mist. Keep away from heat, sparks and flame. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. Use only in well ventilated locations. Keep away from heat, spark and flames. In case of fire, use water spray, foam, dry chemical or carbon dioxide as described in the Fire and Explosion Hazard Data section of the MSDS. Do not pressurize, cut, weld, braze, solder, drill on or near this container. "Empty" container contains residue (liquid and/or vapor) and may explode in heat of a fire.

Continued on next page

Keep out of reach of children. Failure to use caution may cause serious injury or illness. Never siphon by mouth. For use as a motor fuel only. Do not use as a cleaning solvent or for other non-motor fuel uses. Wash thoroughly after handling. To prevent ingestion and exposure - Do not siphon by mouth to transfer product between containers. Use good personal hygiene practices. After handling this product, wash hands before eating, drinking, or using toilet facilities.

Storage : Store in tightly closed containers in cool, dry, isolated and well ventilated area away from heat, sources of ignition and incompatible materials. Use non-sparking tools and explosion proof equipment. Ground lines, containers, and other equipment used during product transfer to reduce the possibility of a static induced spark. Do not "switch load" because of possible accumulation of a static charge resulting in a source of ignition. Use good personal hygiene practices.

Section 8. Exposure controls, personal protection

Engineering controls : Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Flame Retardant Clothing is recommended.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary.Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protective equipment (Pictograms) : Consult your supervisor or S.O.P. for special handling direction.

Personal protection in case of a large spill : Splash goggles. Full suit. Vapor respirator. Boots. Gloves. Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product. Suggested protective clothing might not be adequate. Consult a specialist before handling this product.

Component	Exposure limits
Diesel fuel	**ACGIH TLV (United States, 1/2004). Skin Notes: 2002 Adoption.** TWA: 100 mg/m^3 8 hour/hours. Form: Total hydrocarbons
Naphthalene	**NIOSH REL (United States, 6/2001).** STEL: 15 ppm 15 minute/minutes. Form: All forms TWA: 10 ppm 10 hour/hours. Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 10 ppm 8 hour/hours. Form: All forms **ACGIH TLV (United States, 5/2004). Notes: 1996 Adoption Refers to Appendix A -- Carcinogens.** STEL: 15 ppm 15 minute/minutes. Form: All forms TWA: 10 ppm 8 hour/hours. Form: All forms
n-Nonane	**NIOSH REL (United States, 6/2001).** TWA: 200 ppm 10 hour/hours. Form: All forms

Continued on next page

	ACGIH TLV (United States, 9/2004). TWA: 200 ppm 8 hour/hours. Form: All forms
Hexane (Other Isomers)	**ACGIH TLV (United States, 9/2004).** STEL: 1000 ppm 15 minute/minutes. Form: All forms TWA: 500 ppm 8 hour/hours. Form: All forms **NIOSH REL (United States, 6/2001).** CEIL: 510 ppm 15 minute/minutes. Form: All forms
n-Heptane	**ACGIH TLV (United States, 9/2004).** STEL: 500 ppm 15 minute/minutes. Form: All forms TWA: 400 ppm 8 hour/hours. Form: All forms **NIOSH REL (United States, 6/2001).** TWA: 350 mg/m^3 10 hour/hours. Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 500 ppm 8 hour/hours. Form: All forms
n-Hexane	**OSHA PEL (United States, 6/1993).** TWA: 500 ppm 8 hour/hours. Form: All forms **ACGIH TLV (United States, 9/2004). Skin** TWA: 50 ppm 8 hour/hours. Form: All forms **NIOSH REL (United States, 6/2001).** TWA: 50 ppm 10 hour/hours. Form: All forms
Octane (All Isomers)	**NIOSH REL (United States, 6/2001).** CEIL: 385 ppm 15 minute/minutes. Form: All forms TWA: 75 ppm 10 hour/hours. Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 500 ppm 8 hour/hours. Form: All forms **ACGIH TLV (United States, 3/2004). Notes: 1999 Adoption.** TWA: 300 ppm 8 hour/hours. Form: All forms

Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties

Physical state	: Liquid. (May be dyed red.)
Color	: Clear. Straw.
Odor	: Kerosene (Strong.)
Boiling point	: 162.78 to 371.11°C (325 to 700°F)
Melting/freezing point	: May start to solidify at -51.15°C (-60.1°F) based on data for: n-Nonane. Weighted average: -92.6°C (-134.7°F)
Specific gravity	: 0.84 to 0.93 (Water = 1) (@ 60 °F)
Vapor pressure	: <0.7 kPa (<5.2 mm Hg) (at 20°C)
Vapor density	: 3 (Air = 1)
Volatility	: Negligilble
Evaporation rate	: 0.02

Section 10. Stability and reactivity data

Stability and reactivity	: The product is stable.
Incompatibility with various substances	: Reactive with oxidizing agents, acids, alkalis.
Hazardous decomposition products	: These products are carbon oxides (CO, CO_2), nitrogen and sulfur oxides (NO_X, SO_X), particulate matter, VOC's.
Hazardous polymerization	: Will not occur.

Continued on next page

Section 11. Toxicological Information

Toxicity data

DIESEL EXHAUST FUMES have been reported to be a potential occupational carcinogen in humans by NIOSH Current Intelligence Bulletin 50.

HEPTANE can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. Heptane vapor is a narcotic. Concentrations of 10,000 to 15,000 ppm produced narcosis in mice within 30 to 60 minutes, while 15,000 to 20,000 ppm caused convulsions and death. At 48,000 ppm, respiratory arrest was produced in mice in 3 to 4 minutes from the start of exposure. Human subjects exposed to 1,000 ppm for 6 minutes, or to 2,000 ppm for 4 minutes, reported slight vertigo. At 5,000 ppm for 4 minutes, there was marked vertigo, inability to walk a straight line, hilarity, and incoordination, but no complaints of eye and upper respiratory tract or mucous membrane irritation. A 15-minute exposure at 5,000 ppm produced in some subjects a state of stupor lasting for 30 minutes after exposure. These subjects also reported loss of appetite, slight nausea, and a taste resembling gasoline for several hours after exposure. Although chronic nervous system affects have not been attributed to heptane, polyneuritis has been reported following prolonged exposure to a petroleum fraction with boiling range between 70C and 100C, and this fraction would normally contain various isomers of heptane as major ingredients.

n-HEXANE can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. Hexane vapor is a narcotic and a mild upper respiratory irritant. Polyneuropathy (peripheral nerve damage) has been reported to occur in workers exposed to hexane vapors, characterized by progressive weakness and numbness in the extremities, loss of deep tendon reflexes and reduction of motor nerve conduction velocity. Recovery ranges from no recovery to complete recovery depending upon the duration of exposure and severity of nerve damage. Concentrations of 30,000 ppm produced narcosis in mice within 30 to 60 minutes, convulsions and death occurred at 35,000 to 40,000 ppm, and at 64,000 ppm respiratory arrest was produced in 2.5 to 4.5 minutes from the start of exposure. Concentrations up to 8000 ppm produced no anesthesia. In human subjects, 2000 ppm for 10 minutes produced no effects, but 5000 ppm resulted in dizziness and a sensation of giddiness. Other investigators reported slight nausea, headache and irritation of the eyes and throat at 1400 to 1500 ppm. In industrial practice, mild narcotic symptoms such as dizziness have been observed when concentrations exceeded 1000 ppm, but not below 500 ppm.

NONANE causes a four hour LC50 in rats at concentrations of 3200 ppm, or at about the same level as VM&P Naphtha. This level is markedly lower than the lethal concentrations reported in earlier mice studies involving octane (13,500 ppm) and heptane (16,000 ppm), supporting the lower limit for nonane.

OCTANE can affect the body if it is inhaled, comes in contact with the skin or eyes or is swallowed. Octane vapor is a mild narcotic and mucous membrane irritant. Concentrations of 6600 to 13,700 ppm produced narcosis in mice in 30 to 90 minutes, the fatal concentration for animals is near 13,500 ppm. No chronic systemic effects have been reported in humans.

NAPHTHALENE can affect the body if it is inhaled, comes into contact with the eyes or the skin or if it is swallowed. Naphthalene vapor causes hemolysis and eye irritation, and may cause cataracts. Severe intoxication from ingestion of the solid results in characteristic manifestations of marked intravascular hemolysis and its consequences, including potentially fatal hyperkalemia. Initial symptoms include eye irritation, headache, confusion, excitement, malaise, profuse sweating, nausea, vomiting, abdominal pain, and irritation of the bladder. There may be progression to jaundice, hematuria, hemoglobinuria, renal tubular blockage, and acute renal shutdown. Hematologic features include red cell fragmentation, icterus, severe anemia with nucleated red cells, leukocytosis, and dramatic decreases in hemoglobin, hematocrit and red cell count; sometimes there is formation of Heinz bodies and methemoglobin. Individuals with a deficiency of glucose-6-phosphate dehydrogenase in erythrocytes may be more susceptible to hemolysis by naphthalene. Cataracts and ocular irritation have been produced experimentally in animals and have been described in humans. Of 21 workers exposed to high concentrations of fume or vapor for 5 years, 8 had peripheral lens opacities; in other studies, no abnormalities of the eyes have been detected in workers exposed to naphthalene for several years. The vapor causes eye irritation at 15 ppm. Eye contact with the solid may result in conjunctivitis, superficial injury to the cornea, chorioretinitis, scotoma, and diminished visual acuity. Naphthalene on the skin may cause hypersensitivity dermatitis, chronic dermatitis is rare.

HEXANE ISOMERS are three times as toxic to mice as is pentane. Narcosis was produced in mice within 30-60 minutes at concentrations of 30,000 ppm. In man, concentrations for 10 minutes at 2000 ppm produced no effects, but 5000 ppm caused dizziness and a sense of giddiness. Concentrations of 1400-1500 ppm produced slight nausea, headache, eye, and throat irritation.

Ingredient name	Test	Result	Route	Species
Naphthalene	LD50	490 mg/kg	Oral	Rat
	LD50	316 mg/kg	Oral	Mouse
	LD50	1200 mg/kg	Oral	Guinea pig
	LD50	>2500 mg/kg	Dermal	Rat
	LDLo	100 mg/kg	Oral	child
	LDLo	400 mg/kg	Oral	Dog

Chronic effects on humans : **CARCINOGENIC EFFECTS**: Classified A3 (Proven for animals.) by ACGIH, 3 (Possible for humans.) by European Union [Diesel fuel]. Classified 3 (Not classifiable for humans.) by IARC [Diesel fuel]. Classified 2B (Possible for humans.) by IARC [Naphthalene]. Classified A4 (Not classifiable for humans or animals.) by ACGIH [Naphthalene].
Contains material which causes damage to the following organs: blood, kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Other toxic effects on humans : Very hazardous in case of eye contact (corrosive).
Hazardous in case of skin contact (irritant), of ingestion, of inhalation (lung irritant).

Continued on next page

Special remarks on toxicity to animals : No additional remark.

Special remarks on chronic effects on humans : No additional remark.

Special remarks on other toxic effects on humans : No additional remark.

Specific effects

Carcinogenic effects : Contains material which may cause cancer. Risk of cancer depends on duration and level of exposure.

Target organs : Contains material which causes damage to the following organs: blood, kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS), eye, lens or cornea.

Section 12. Ecological Information

Ecotoxicity data

Ingredient name	Species	Period	Result
Naphthalene	Daphnia magna (EC50)	48 hour/hours	1.6 mg/l
	Daphnia magna (EC50)	48 hour/hours	2.194 mg/l
	Daphnia magna (EC50)	48 hour/hours	2.55 mg/l
	Daphnia pulex (LC50)	96 hour/hours	1 mg/l
	Oncorhynchus mykiss (LC50)	96 hour/hours	1.6 mg/l
	Oncorhynchus mykiss (LC50)	96 hour/hours	1.8 mg/l
n-Hexane	Pimephales promelas (LC50)	96 hour/hours	2.5 mg/l

Products of degradation : These products are carbon oxides (CO, CO_2) and water.

Toxicity of the products of biodegradation : The products of degradation are less toxic than the product itself.

Section 13. Disposal Considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.

Consult your local or regional authorities.

Section 14. Transport Information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1993	Diesel fuel	3 Combustible liquid.	III		Not available.
TDG Classification	UN1993	Diesel fuel Mixture	3	III		Not available.

Continued on next page

Section 15. Regulatory Information

United States

U.S. Federal regulations : TSCA 4(a) final test rules: Hexane (Other Isomers); n-Hexane
TSCA 8(a) PAIR: Naphthalene; n-Heptane; n-Nonane
TSCA 8(b) inventory: Hexane (Other Isomers); Naphthalene; n-Heptane; n-Hexane; n-Nonane; Diesel fuel; Octane (All Isomers); Toluene; Benzene

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Hexane (Other Isomers); Naphthalene; n-Heptane; n-Hexane; n-Nonane; Octane (All Isomers)
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Hexane (Other Isomers): Fire hazard, Immediate (acute) health hazard; Naphthalene: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard; n-Heptane: Fire hazard; n-Hexane: Fire hazard, Immediate (acute) health hazard, Delayed (chronic) health hazard; n-Nonane: Fire hazard, Immediate (acute) health hazard; Octane (All Isomers): Fire hazard

Clean Water Act (CWA) 307: Naphthalene; Toluene; Benzene

Clean Water Act (CWA) 311: Naphthalene; Toluene; Benzene

Clean Air Act (CAA) 112 accidental release prevention: No products were found.

Clean Air Act (CAA) 112 regulated flammable substances: No products were found.

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

	Product name	CAS number	Concentration
Form R - Reporting requirements :	Naphthalene	91-20-3	1 - 3
	n-Hexane	110-54-3	1 - 2
Supplier notification :	Naphthalene	91-20-3	1 - 3
	n-Hexane	110-54-3	1 - 2

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations : Connecticut carcinogen reporting list.: Benzene
Connecticut hazardous material survey.: Naphthalene; n-Hexane; Toluene; Benzene
Illinois toxic substances disclosure to employee act: Naphthalene; n-Hexane; Toluene; Benzene
Rhode Island RTK hazardous substances: Naphthalene; n-Hexane; Toluene; Benzene
Pennsylvania RTK: Hexane (Other Isomers): (generic environmental hazard); Naphthalene: (environmental hazard, generic environmental hazard); n-Heptane: (generic environmental hazard); n-Hexane: (generic environmental hazard); n-Nonane: (generic environmental hazard); Octane (All Isomers): (generic environmental hazard); Toluene: (environmental hazard, generic environmental hazard); Benzene: (special hazard, environmental hazard, generic environmental hazard)
Florida: Naphthalene; n-Hexane; Toluene; Benzene
Michigan critical material: Toluene; Benzene
Massachusetts RTK: Hexane (Other Isomers); Naphthalene; n-Heptane; n-Hexane; n-Nonane; Octane (All Isomers); Toluene; Benzene
New Jersey: Naphthalene; n-Heptane; n-Hexane; n-Nonane; Diesel fuel; Octane (All Isomers); Toluene; Benzene

WARNING: This product contains chemical/chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.: Naphthalene; Toluene; Benzene
WARNING: This product contains chemical/chemicals known to the state of California to cause reproductive harm (male).: Benzene
California prop. 65 (no significant risk level): Benzene
California prop. 65 (Maximum Acceptable Dosage Level): Toluene; Benzene
WARNING: This product contains chemical/chemicals known to the state of California to cause birth defects or other reproductive harm.: Toluene; Benzene
WARNING: This product contains chemical/chemicals known to the state of California to

Continued on next page

cause cancer.: Naphthalene; Benzene

Canada

WHMIS (Canada) : Class B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).
Class D-1B: Material causing immediate and serious toxic effects (Toxic).
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class E: Corrosive liquid.

CEPA DSL: Hexane (Other Isomers); Naphthalene; n-Heptane; n-Hexane; n-Nonane; Diesel fuel; Octane (All Isomers); Toluene; Benzene

Section 16. Other Information

Label requirements : CAUSES EYE BURNS.
HARMFUL IF SWALLOWED.
CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: BLOOD, KIDNEYS, LIVER, PERIPHERAL NERVOUS SYSTEM, RESPIRATORY TRACT, SKIN, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.
SUSPECT CANCER HAZARD.
CONTAINS MATERIAL WHICH MAY CAUSE CANCER.
COMBUSTIBLE LIQUID AND VAPOR.
VAPOR MAY CAUSE FIRE.

Hazardous Material Information System (U.S.A.) :

Health	0
Fire hazard	2
Physical Hazard	0
Personal protection	

National Fire Protection Association (U.S.A.) :

Date of printing : **1/30/2006.**

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Version : **1.01**

Disclaimer

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Definitions of Material Safety Data Sheet Terminology

GOVERNMENT AGENCIES AND PRIVATE ASSOCIATIONS

ACGIH - American Conference of Governmental Industrial Hygienists, (private association)
DOT - United States Department of Transportation
EPA - United States Environmental Protection Agency
IARC - International Agency for Research on Cancer, (private association)
NFPA - National Fire Protection Association, (private association)
MSHA - Mine Safety and Health Administration, U.S. Department of Labor
NIOSH - National Institute of Occupational Safety and Health, U.S. Department of Health and Human Services
NTP - National Toxicology Program, (private association)
OSHA - Occupational Safety and Health Administration, U.S. Department of Labor
WHMIS- Workplace Hazardous Material Information System
CSA- Canadian Standards Association

HAZARD AND EXPOSURE INFORMATION

Acute Hazard - An adverse health effect which occurs rapidly as a result of short term exposure.
CAS # - American Chemical Society's Chemical Abstract service registry number which identifies the product and/or ingredients.
Ceiling - The concentration that should not be exceeded during any part of the working exposure
Chronic Hazard - An adverse health effect which generally occurs as a result of long term exposure or short term exposure with delayed health effects and is of long duration
Fire Hazard - A material that poses a physical hazard by being flammable, combustible, phyrophoric or an oxidizer as defined by 29 CFR 1910.1200
Hazard Class - DOT hazard classification
Hazardous Ingredients - Names of ingredients which have been identified as health hazards
IDLH- Immediately Dangerous to Life and Health, the airborne concentration below which a person can escape without respiratory protection and exposure up to 30 minutes, and not suffer debilitating or irreversible health effects. Established by NIOSH.
mg/m3 - Milligrams of contaminant per cubic meter of air, a mass to volume ratio
N/A - Not available or no relevant information found
NA - Not applicable
PEL - OSHA permissible exposure limit; an action level of one half this value may be applicable
ppm - Part per million (one volume of vapor or gas in one million volumes of air)
Pressure Hazard - A material that poses a physical hazard due to the potential of a sudden release of pressure such as explosive or a compressed gas as defined by 29 CFR 1910.1200
Reactive Hazard - A material that poses a physical hazard due to the potential to become unstable reactive, water reactive or that is an organic peroxide as defined by 29 CFR 1910.1200.
STEL - The ACGIH Short-Term Exposure Limit, a 15-minute Time-Weighted Average exposure which should not be exceeded at any time during a workday, even if the 8-hour TWA is less than the TLV.
TLV - ACGIH Threshold Limit Value, represented herein as an 8-hour TWA concentration.
8-hour TWA - The time weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
LD50 – Single dose of a substance that, when administered by a defined route in an animal assay, is expected to the cause the death of 50% of the defined animal population.
LC50 - The concentration of a substance in air that, when administered by means of inhalation over a specified length of time in an animal assay, is expected to cause the death of 50% of a defined animal population.

MATERIAL SAFETY DATA SHEET

Unleaded Gasoline

VALERO MARKETING & SUPPLY COMPANY
and Affiliates
P.O. Box 696000
San Antonio, TX 78269-6000

Emergency Phone Numbers
24 Hour Emergency: 866-565-5220
Chemtrec Emergency: 800-424-9300

General Assistance
General Assistance: 210-345-4593

BRAND NAMES: Valero, Diamond Shamrock, Shamrock, Ultramar, Beacon, Total

Section 1. Chemical Product and Company Identification

Common / Trade name : Unleaded Gasoline

Synonym : Regular/Premium/Midgrade - Unleaded Gasoline, Petrol, Motor Fuel, Reformulated Gasoline, RFG, Conventional, Oxygenated, Non-Oxygenated, CARB Gasoline

SYNONYMS/COMMON NAMES: This Material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical specifications vary greatly depending on the product and are not reflected in this document. Consult specification sheets for technical information. This product contains ingredients that are considered to be hazardous as defined by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Material uses : Motor fuels.

MSDS# : 002

CAS # : 86290-81-5

Section 2. Composition, Information on Ingredients

Name	CAS number	Concentration (%)
Gasoline	86290-81-5	0 - 100
Hexane (Other Isomers)	mixture	5 - 25
Toluene	108-88-3	0 - 30
Xylene (o,m,p isomers)	1330-20-7	0 - 25
Octane (All Isomers)	111-65-9	0 - 18.5
Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	0 - 16
Ethanol	64-17-5	0 - 10
1,2,4-Trimethylbenzene	95-63-6	0 - 6
n-Heptane	142-82-5	1 - 5
Pentane	109-66-0	1 - 5
Tertiary Amyl Methyl Ether (TAME)	994-05-8	0 - 6
Ethylbenzene	100-41-4	0 - 5
Cumene	98-82-8	0 - 5
Benzene	71-43-2	0 - 4.9
Cyclohexane	110-82-7	0 - 3
n-Hexane	110-54-3	0 - 3

Continued on next page

Section 3. Hazards Identification

Danger! Contains Benzene. Cancer Hazard. Can cause kidney, liver and blood disorders. May cause irritation to eyes, skin and respiratory system. Avoid liquid, mist and vapor contact. Harmful or fatal if swallowed. Aspiration hazard; can enter lungs and cause damage. May cause irritation or be harmful if inhaled or absorbed through the skin. Extremely flammable liquid. Vapors may explode.

Physical state : Liquid.

Emergency overview : Warning!

CANCER HAZARD
CONTAINS MATERIAL WHICH CAN CAUSE CANCER
HIGHLY FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF SWALLOWED.
CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: BLOOD, KIDNEYS, LUNGS, REPRODUCTIVE SYSTEM, LIVER, PERIPHERAL NERVOUS SYSTEM, GASTROINTESTINAL TRACT, RESPIRATORY TRACT, SKIN, BONE MARROW, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.
VAPOR MAY CAUSE FLASH FIRE.
MAY BE HARMFUL IF ABSORBED THROUGH SKIN.

Do not ingest. Avoid prolonged contact with eyes, skin, and clothing. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Wash thoroughly after handling. Risk of cancer depends on duration and level of exposure.

Routes of entry : Dermal contact. Eye contact. Inhalation. Ingestion.

Potential acute health effects

Eyes : May cause severe irritation, redness, tearing, blurred vision and conjunctivitis.

Skin : Prolonged or repeated contact may cause moderate irritation, defatting (cracking), redness, itching, inflammation, dermatitis and possible secondary infection. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Injury may not appear serious at first. Within a few hours, tissues will become swollen, discolored and extremely painful.

Inhalation : Nasal and respiratory tract irritation, central nervous system effects including excitation, euphoria, contracted eye pupils, dizziness, drowsiness, blurred vision, fatigue, nausea, headache, loss of reflexes, tremors, convulsions, seizures, loss of consciousness, coma, respiratory arrest and sudden death could occur as a result of long term and/or high concentration exposure to vapors. May also cause anemia and irregular heart rhythm. Repeated or prolonged exposure may cause behavioral changes.

Ingestion : Toxic if swallowed. This product may be harmful or fatal if swallowed. This product may cause nausea, vomiting, diarrhea and restlessness. DO NOT INDUCE VOMITING. Aspiration into the lungs can cause severe chemical pneumonitis or pulmonary edema/hemorrhage, which can be fatal. May cause gastrointestinal disturbances. Symptoms may include irritation, depression, vomiting and diarrhea. May cause harmful central nervous system effects, similar to those listed under "inhalation".

Medical conditions aggravated by overexposure: : Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs. Preexisting eye, skin, heart, central nervous system and respiratory disorders may be aggravated by exposure to this product. Impaired kidney, liver and blood disorders may be aggravated by exposure to this product.

Over-exposure signs/symptoms : Nasal and respiratory tract irritation, central nervous system effects including excitation, euphoria, contracted eye pupils, dizziness, drowsiness, blurred vision, fatigue, nausea, headache, loss of reflexes, tremors, convulsions, seizures, loss of consciousness, coma, respiratory arrest or sudden death could occur as a result of long term and/or high concentration exposure to vapors. May also cause anemia and irregular heart rhythm.

See toxicological Information (section 11)

Continued on next page

Section 4. First Aid Measures

Eye contact : Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Seek medical advice if pain or redness continues.

Skin contact : Remove contaminated clothing and shoes. Wash exposed area thoroughly with soap and water. Remove contaminated clothing promptly and launder before reuse. Contaminated leather goods should be discarded. If irritation persists or symptoms described in the MSDS develop, seek medical attention. High pressure skin injections are SERIOUS MEDICAL EMERGENCIES. Get immediate medical attention.

Inhalation : If inhaled, remove to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.

Ingestion : This product may be harmful or fatal if swallowed. This product may cause nausea, vomiting, diarrhea and restlessness. DO NOT INDUCE VOMITING. Aspiration into the lungs can cause severe chemical pneumonitis or pulmonary edema/hemorrhage, which can be fatal. May cause gastrointestinal disturbances. Symptoms may include irritation, depression, vomiting and diarrhea. May cause harmful central nervous system effects, similar to those listed under "inhalation".

Notes to physician : In case of ingestion, gastric lavage with activated charcoal can be used promptly to prevent absorption. Consideration should be given to the use of an intratracheal tube, to prevent aspiration. Irregular heart beat may occur, use of adrenalin is not advisable. Individuals intoxicated by the product should be hospitalized immediately, with acute and continuing attention to neurological and cardiopulmonary function. Positive pressure ventilation may be necessary. After the initial episode, individuals should be monitored for changes in blood variables and the delayed appearance of pulmonary edema and chemical pneumonitis. Such patients should be monitored for several days or weeks for delayed effects, including bone marrow toxicity, hepatic and renal impairment. Individuals with chronic pulmonary disease will be more seriously impaired, and recovery from inhalation exposure may be complicated. In case of skin injection, prompt debridement of the wound is necessary to minimize necrosis and tissue loss.

Section 5. Fire Fighting Measures

Flammability of the product : Flammable.

Auto-ignition temperature : >260°C (500°F)

Flash point : Closed cup: -40°C (-40°F).

Flammable limits : Lower: 1.3% Upper: 7.1%

Products of combustion : These products are carbon oxides (CO, CO_2), nitrogen and sulfur oxides (NO_x, SO_x), particulate matter, VOC's.

Fire hazards in presence of various substances : Extremely flammable in presence of open flames, sparks and static discharge.

Explosion hazards in presence of various substances : Explosive in presence of open flames, sparks and static discharge.

Fire fighting media and instructions : Flammable Liquid. Use dry chemical, foam or carbon dioxide to extinguish the fire. Consult foam manufacturer for appropriate media, application rates and water/foam ratio. Subsurface application is only recommended where it is known that the fuel contains less than 3% oxygenated blending components. Water can be used to cool fire- exposed containers, structures and to protect personnel. If a leak or spill has not ignited, ventilate area and use water spray to disperse gas or vapor and to protect personnel attempting to stop a leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers.

Collect contaminated fire fighting water separately. It must not enter the sewage system. Dike area of fire to prevent product run-off. Decontaminate emergency personnel and equipment with soap and water.

Continued on next page

Highly flammable liquid and vapor. Vapor may cause flash fire. Vapors may accumulate in low or confined areas, travel considerable distance to source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.

Special protective equipment for fire-fighters : Fire fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full facepiece operated in positive pressure mode.

Special remarks on fire hazards : Dangerous when exposed to heat or flame. Vapors form flammable or explosive mixtures with air at room temperature. Vapor or gas may spread to distant ignition sources (pilot lights, welding equipment, electrical equipment, etc.) and flash back. Vapors may accumulate in low areas. Vapors may concentrate in confined areas. Flowing product can be ignited by self generated static electricity. Use adequate bonding and grounding to prevent static buildup. Runoff to sewer may cause fire or explosion hazard. Containers may explode in heat of fire. Irritating or toxic substances may be emitted upon thermal decomposition. For fires involving this material, do not enter any enclosed or confined space without proper protective equipment, which may include NIOSH approved self-contained breathing apparatus with full face mask. Clothing, rags or similar organic material contaminated with this product and stored in a closed space may undergo spontaneous combustion. Transfer to and from commonly bonded and grounded containers.

Special remarks on explosion hazards : No additional remark.

Section 6. Accidental Release Measures

Personal precautions : Immediately contact emergency personnel. Eliminate all ignition sources. Keep unnecessary personnel away. Use suitable protective equipment (Section 8). Do not touch or walk through spilled material. Tanks, vessels or other confined spaces which have contained product should be freed of vapors before entering. The container should be checked to ensure a safe atmosphere before entry. Empty containers may contain toxic,flammable/combustible or explosive residues or vapors. Do not cut, grind, drill, weld or reuse empty containers that contained this product. Do not transfer this product to another container unless the container receiving the product is labeled with proper DOT shipping name, hazard class and other information that describes the product and its hazards.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Gasoline may contain oxygenated blend products (Ethanol, MTBE, etc.) that are soluble in water and therefore precautions should be taken to protect surface and groundwater sources from contamination. If facility or operation has an "oil or hazardous substance contingency plan", activate its procedures. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Extremely flammable. Review Fire and Explosion Hazard Data before proceeding with clean up. Keep all sources of ignition (flames, smoking, flares, etc.) and hot surfaces away from release. Contain spill in smallest possible area. Recover as much product as possible (e.g., by vacuuming). Stop leak if it can be done without risk. Use water spray to disperse vapors. Spilled material may be absorbed by an appropriate absorbent, and then handled in accordance with environmental regulations. Prevent spilled material from entering sewers, storm drains, other unauthorized treatment or drainage systems and natural waterways. Contact fire authorities and appropriate federal, state and local agencies. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, contact the National Response Center at 800-424- 8802. For highway or railway spills, contact Chemtrec at 800-424-9300.

Methods for cleaning up : If emergency personnel are unavailable, contain spilled material. For small spills add absorbent (soil may be used in the absence of other suitable materials) and use a non-sparking or explosion proof means to transfer material to a sealed, appropriate container for disposal. For large spills dike spilled material or otherwise contain material to ensure runoff does not reach a waterway. Place spilled material in an appropriate container for disposal.

Continued on next page

Section 7. Handling and Storage

Handling : Do not ingest. Avoid prolonged contact with eyes, skin, and clothing. Keep container closed. Use only with adequate ventilation. Keep away from heat, sparks and flame. To avoid fire or explosion, dissipate static electricity during transfer by grounding and bonding containers and equipment before transferring material. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Wash thoroughly after handling. Use only in well ventilated locations. Keep away from heat, spark and flames. In case of fire, use water spray, foam, dry chemical or carbon dioxide as described in the Fire and Explosion Hazard Data section of the MSDS. Do not pressurize, cut, weld, braze, solder, drill on or near this container. "Empty" container contains residue (liquid and/or vapor) and may explode in heat of a fire.

Keep out of reach of children. Failure to use caution may cause serious injury or illness. Never siphon by mouth. For use as a motor fuel only. Do not use as a cleaning solvent or for other non-motor fuel uses. To prevent ingestion and exposure - Do not siphon by mouth to transfer product between containers. Use good personal hygiene practices. After handling this product, wash hands before eating, drinking, or using toilet facilities.

Storage : Store in tightly closed containers in cool, dry, isolated and well ventilated area away from heat, sources of ignition and incompatible materials. Use non-sparking tools and explosion proof equipment. Ground lines, containers, and other equipment used during product transfer to reduce the possibility of a static induced spark. Do not "switch load" because of possible accumulation of a static charge resulting in a source of ignition. Use good personal hygiene practices. After handling this product, wash hands before eating, drinking, smoking or using toilet facilities.

Section 8. Exposure Controls, Personal Protection

Engineering controls : Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective occupational exposure limits. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts. Keep away from eyes. Eye contact can be avoided by wearing safety glasses or chemical splash goggles.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. Keep away from skin. Skin contact can be minimized by wearing protective gloves such as neoprene, nitrile-butadiene rubber, etc. and, where necessary, impervious clothing and boots. Leather goods contaminated with this product should be discarded. A source of clean water should be available in the work area for flushing eyes and skin. Flame Retardant Clothing is recommended.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary.Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. If workplace exposure limits for product or components are exceeded, NIOSH approved equipment should be worn. Proper respirator selection should be determined by adequately trained personnel, based on the contaminants, the degree of potential exposure and published respiratory protection factors. This equipment should be available for nonroutine and emergency use.

Hands : Chemical-resistant, impervious gloves or gauntlets complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protective equipment (Pictograms) : Consult your Supervisor or S.O.P. for special handling directions.

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Personal protection in case of a large spill : Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Component	Exposure limits
Gasoline	**ACGIH TLV (United States, 5/2004).** STEL: 500 ppm 15 minute(s). Form: All forms TWA: 300 ppm 8 hour(s). Form: All forms
Hexane (Other Isomers)	**ACGIH TLV (United States, 9/2004).** STEL: 1000 ppm 15 minute(s). Form: All forms TWA: 500 ppm 8 hour(s). Form: All forms **NIOSH REL (United States, 6/2001).** CEIL: 510 ppm 15 minute(s). Form: All forms
Toluene	**ACGIH TLV (United States, 5/2004). Skin Notes: 1996 Adoption Refers to Appendix A -- Carcinogens.** TWA: 50 ppm 8 hour(s). Form: All forms **NIOSH REL (United States, 6/2001).** STEL: 150 ppm 15 minute(s). Form: All forms TWA: 100 ppm 10 hour(s). Form: All forms **OSHA PEL Z2 (United States, 6/2002).** AMP: 500 ppm 10 minute(s). Form: All forms CEIL: 300 ppm Form: All forms TWA: 200 ppm 8 hour(s). Form: All forms
Xylene (o,m,p isomers)	**ACGIH TLV (United States, 5/2004).** STEL: 150 ppm 15 minute(s). Form: All forms TWA: 100 ppm 8 hour(s). Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 100 ppm 8 hour(s). Form: All forms
Octane (All Isomers)	**NIOSH REL (United States, 6/2001).** CEIL: 385 ppm 15 minute(s). Form: All forms TWA: 75 ppm 10 hour(s). Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 500 ppm 8 hour(s). Form: All forms **ACGIH TLV (United States, 3/2004). Notes: 1999 Adoption.** TWA: 300 ppm 8 hour(s). Form: All forms
Methyl Tertiary Butyl Ether (MTBE)	**ACGIH TLV (United States, 1/2004). Notes: 2002 Adoption.** TWA: 50 ppm 8 hour(s). Form: All forms
Ethanol	**ACGIH TLV (United States, 5/2004). Notes: 1996 Adoption Refers to Appendix A -- Carcinogens.** TWA: 1000 ppm 8 hour(s). Form: All forms **NIOSH REL (United States, 6/2001).** TWA: 1000 ppm 10 hour(s). Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 1000 ppm 8 hour(s). Form: All forms
1,2,4-Trimethylbenzene	**NIOSH REL (United States, 6/2001).** TWA: 25 ppm 10 hour(s). Form: All forms
n-Heptane	**ACGIH TLV (United States, 9/2004).** STEL: 500 ppm 15 minute(s). Form: All forms TWA: 400 ppm 8 hour(s). Form: All forms **NIOSH REL (United States, 6/2001).** TWA: 350 mg/m^3 10 hour(s). Form: All forms **OSHA PEL (United States, 6/1993).** TWA: 500 ppm 8 hour(s). Form: All forms
Pentane	**ACGIH TLV (United States, 9/2004). Notes: 1998 Adoption.** TWA: 600 ppm 8 hour(s). Form: All forms

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	TWA: 600 ppm 8 hour(s). Form: All forms
	NIOSH REL (United States, 6/2001).
	CEIL: 610 ppm 15 minute(s). Form: All forms
	TWA: 120 ppm 10 hour(s). Form: All forms
	OSHA PEL (United States, 6/1993).
	TWA: 1000 ppm 8 hour(s). Form: All forms
Tertiary Amyl Methyl Ether (TAME)	**ACGIH TLV (United States, 1/2004). Notes: 2002 Adoption.**
	TWA: 20 ppm 8 hour(s). Form: All forms
Ethylbenzene	**ACGIH TLV (United States, 1/2004).**
	STEL: 125 ppm 15 minute(s). Form: All forms
	TWA: 100 ppm 8 hour(s). Form: All forms
	NIOSH REL (United States, 6/2001).
	STEL: 125 ppm 15 minute(s). Form: All forms
	TWA: 100 ppm 10 hour(s). Form: All forms
	OSHA PEL (United States, 6/1993).
	TWA: 100 ppm 8 hour(s). Form: All forms
Cumene	**ACGIH TLV (United States, 3/2004). Notes: 1999 Adoption.**
	TWA: 50 ppm 8 hour(s). Form: All forms
	NIOSH REL (United States, 6/2001). Skin
	TWA: 50 ppm 10 hour(s). Form: All forms
	OSHA PEL (United States, 6/1993). Skin
	TWA: 50 ppm 8 hour(s). Form: All forms
Benzene	**NIOSH REL (United States, 6/2001). Notes: See Appendix A - NIOSH Potential Occupational Carcinogen**
	STEL: 1 ppm 15 minute(s). Form: All forms
	TWA: 0.1 ppm 10 hour(s). Form: All forms
	ACGIH TLV (United States, 5/2004). Skin
	STEL: 2.5 ppm 15 minute(s). Form: All forms
	TWA: 0.5 ppm 8 hour(s). Form: All forms
	OSHA PEL (United States, 6/1993).
	STEL: 5 ppm 15 minute(s). Form: All forms
	TWA: 1 ppm 8 hour(s). Form: All forms
Cyclohexane	**ACGIH TLV (United States, 1/2004).**
	TWA: 100 ppm 8 hour(s). Form: All forms
	NIOSH REL (United States, 6/2001).
	TWA: 300 ppm 10 hour(s). Form: All forms
	OSHA PEL (United States, 6/1993).
	TWA: 300 ppm 8 hour(s). Form: All forms
n-Hexane	**OSHA PEL (United States, 6/1993).**
	TWA: 500 ppm 8 hour(s). Form: All forms
	ACGIH TLV (United States, 9/2004). Skin
	TWA: 50 ppm 8 hour(s). Form: All forms
	NIOSH REL (United States, 6/2001).
	TWA: 50 ppm 10 hour(s). Form: All forms

Consult local authorities for acceptable exposure limits.

Section 9. Physical and Chemical Properties

Physical state	: Liquid.
Color	: Light Straw to Red Clear Liquid
Odor	: Characteristic Gasloine Odor (Strong.)
Boiling point	: 26.7 to 226.7°C (80.1 to 440.1°F)
Melting/freezing point	: May start to solidify at 6.67°C (44°F) based on data for: Cyclohexane. Weighted average: -91.9°C (-133.4°F)
Specific gravity	: 0.66 to 0.75 (Water = 1) (@ 60 °F)
Vapor pressure	: 60.8 to 101.3 kPa (456 to 760 mm Hg) (at 20°C)
Vapor density	: 3 to 4 (Air = 1)
Volatility	: Essentially 100%

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Evaporation rate : 10 to 11 compared to Butyl acetate.

Solubility : Very slightly soluble in cold water, hot water.

Section 10. Stability and Reactivity Data

Stability and reactivity : The product is stable.

Incompatibility with various substances : Reactive with oxidizing agents, reducing agents, acids, alkalis.

Hazardous decomposition products : These products are carbon oxides (CO, CO_2), nitrogen and sulfur oxides (NO_x, SO_x), particulate matter, VOC's.

Hazardous polymerization : Will not occur.

Section 11. Toxicological Information

Toxicity data

BENZENE is considered to be a carcinogen to humans, and may cause adverse health effects following exposure via inhalation, ingestion or dermal or eye contact. Acute inhalation of benzene by rats, mice or rabbits caused narcosis, spontaneous heart contractions (ventricular fibrillation) and death due to respiratory paralysis. Subchronic inhalation of benzene by rats produced decreased white blood cell counts, decreased bone marrow cell activity, increased red blood cell activity and cataracts. In rats, chronic inhalation or oral administration of benzene produced cancers of the liver, mouth and Zymbal gland. Acute inhalation exposure of benzene in humans has caused nerve inflammation (polyneuritis), central nervous system depression and cardiac sensitization. Chronic exposure to benzene has produced anorexia and irreversible injury to the blood forming organs. Potential effects include aplastic anemia and leukemia. It has a caused fetal defects in tests on laboratory animals.

CUMENE can affect the body if it is it inhaled, swallowed or comes in contact with the eyes or skin. The main toxic effect is irritation of the eyes, skin and upper respiratory tract. Narcosis has been reported to occur in animals on high exposure. There are no reports of systemic effects in man as a result of industrial exposure. Chronic exposure of rats above 500 ppm causes congestion of lungs, liver and kidneys, but no bone marrow changes.

CYCLOHEXANE can affect the body if it is inhaled, swallowed, or comes in contact with the eyes or skin. It is primarily a local irritant and central nervous system depressant. The depressant effect is from exposure to concentrations above 12,000 ppm, while prolonged or repeated exposure to concentrations above 300 ppm produces a mild irritation of the eyes and upper respiratory tract.

ETHANOL is rapidly absorbed through the gastrointestinal tract and normally metabolized and excreted in a relatively few hours. Only in very unusual work situations could the inhalation of ethanol vapors result in symptoms of alcohol intoxication. Can be fatal or cause blindness if swallowed in extreme quantities. Inhalation or ingestion can cause headache, nausea, dizziness or narcosis. Chronic overexposure (inhalation or ingestion) can cause damage to the gastrointestinal tract, liver, kidneys and cardiovascular system. Prolonged contact causes irritation to skin and eyes. Medical conditions aggravated by exposure include kidney, liver, heart and GI conditions. This material is not listed as a cancer causing agent but is suspected of being a promoter.

ETHYLBENZENE can affect the body if it is inhaled, swallowed or comes in contact with the eyes or skin. It is primarily an irritant of skin, and to some degree, of eyes and upper respiratory tract. Systemic absorption causes depression of the central nervous system with narcosis at very high concentrations. On the eyes and nose, the vapor at 5000 ppm causes intolerable irritation, eye irritation and lacrimation are immediate and severe at 2000 ppm, irritation and tearing occur at 1000 ppm although tolerance develops rapidly, and the vapor is a transient irritant on human eyes at 200 ppm. Aspiration of small amounts causes extensive edema and hemorrhage of lung tissue. A draft report on a study conducted by the National Toxicology program states that lifetime inhalation exposure of rats and mice to concentrations of ethylbenzene(750 ppm) resulted in increases in certain types of cancer, including kidney tumors in rats and lung and liver tumors in mice. These effects were not observed in animals exposed to lower concentrations of ethlybenzene (75 ppm or 250 ppm). The draft report does not address the relevance of these results to humans.

GASOLINE contains benzene, as well as n-hexane, other aromatics and certain olefins. Gasoline generally acts as an anesthetic and mucous membrane irritant. Inhalation is the most important route of occupational entry. Eye and throat irritation occur in several hours at exposures of 160 to 270 ppm, eye, nose and throat irritation and dizziness occurs at exposures of 500 to 900 ppm in one hour, mild anesthesia occurs in 30 minutes at exposures of 2000 ppm. The threshold for immediate mild toxic effect if 900 to 1000 ppm. There are reports of toxic neuritis after exposure to gasoline. Repeated exposure of laboratory animals to high concentrations of gasoline vapors has caused kidney damage and cancer in rats and cancer in mice. Gasoline was evaluated for genetic activity in assays using microbial cells, cultured mammalian cells and rat bone marrow cells. The results were all negative so gasoline was considered nonmutagenic under these conditions. Overexposure to this product or its components has been suggested as a cause of liver abnormalities in laboratory animals and humans. Lifetime studies by the American Petroleum Institute have shown that kidney damage and kidney cancer can occur in male rats after prolonged inhalation exposures at elevated concentrations of total gasoline. Kidneys of mice and female rats were unaffected. The U.S. EPA Risk Assessment Forum has concluded that the male rat kidney tumor results are not relevant for humans. Total gasoline exposure also produced liver tumors in female mice only. The implication of these data for humans has not neen determined.

HEPTANE can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. Heptane vapor is a narcotic. Concentrations of 10,000 to 15,000 ppm produced narcosis in mice within 30 to 60 minutes, while 15,000 to 20,000 ppm caused convulsions and death. At 48,000 ppm, respiratory arrest was produced in mice in 3 to 4 minutes from the start of exposure. Human subjects exposed to 1,000 ppm for 6 minutes, or to 2,000 ppm for 4 minutes, reported slight vertigo. At 5,000 ppm for 4 minutes, there was marked vertigo, inability to walk a straight line, hilarity, and incoordination, but no complaints of eye and upper respiratory tract or mucous membrane irritation. A 15-minute exposure at 5,000 ppm produced in some subjects a state of stupor lasting for 30 minutes after exposure. These subjects also reported loss of appetite, slight nausea, and a taste resembling gasoline for several hours after exposure. Although chronic nervous system affects have not been attributed to heptane, polyneuritis has been reported following prolonged exposure to a petroleum fraction with boiling range between 70°C and 100° C, and this fraction would normally contain various isomers of heptane as major ingredients.

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n-HEXANE can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. Hexane vapor is a narcotic and a mild upper respiratory irritant. Polyneuropathy (peripheral nerve damage) has been reported to occur in workers exposed to hexane vapors, characterized by progressive weakness and numbness in the extremities, loss of deep tendon reflexes and reduction of motor nerve conduction velocity. Recovery ranges from no recovery to complete recovery depending upon the duration of exposure and severity of nerve damage. Concentrations of 30,000 ppm produced narcosis in mice within 30 to 60 minutes, convulsions and death occurred at 35,000 to 40,000 ppm, and at 64,000 ppm respiratory arrest was produced in 2.5 to 4.5 minutes from the start of exposure. Concentrations up to 8000 ppm produced no anesthesia. In human subjects, 2000 ppm for 10 minutes produced no effects, but 5000 ppm resulted in dizziness and a sensation of giddiness. Other investigators reported slight nausea, headache and irritation of the eyes and throat at 1400 to 1500 ppm. In industrial practice, mild narcotic symptoms such as dizziness have been observed when concentrations exceeded 1000 ppm, but not below 500 ppm.

MTBE is a mild irritant to the eye. An increase in anesthesia with increasing concentrations was observed during a rat exposure study. Controlled human exposure to MTBE in air under relatively temperate conditions does not cause increased symptoms or measurable responses (irritation, behavioral changes) in healthy adult subjects. Although MTBE and TBA were detectable in the blood of subjects in clinical studies, no increase in symptoms occurred. A tentative review of the carcinogenicity (i.e., a tentative C classification). A sensitivity analysis of cancer risk indices also suggests that, if MTBE is carcinogenic, its potency is not likely to be greater than that already assigned to gasoline itself, which currently has a hazard classification of "probable" human carcinogen.

OCTANE can affect the body if it is inhaled, comes in contact with the skin or eyes or is swallowed. Octane vapor is a mild narcotic and mucous membrane irritant. Concentrations of 6600 to 13,700 ppm produced narcosis in mice in 30 to 90 minutes, the fatal concentration for animals is near 13,500 ppm. No chronic systemic effects have been reported in humans.

PENTANE can affect the body if it is inhaled, comes in contact with the eyes or skin, or is swallowed. The chief effects of inhalation are narcosis and irritation of the respiratory passages. Exposures of 90,000 to 120,000 ppm resulted in narcosis in animals in 5 to 6 minutes, 130,000 ppm was fatal with respiratory arrest occurring within 5 minutes of exposure. Pentane injected subcutaneously in rats produced temporary impairment of liver function and moderate neutropenia. While other aliphatic hydrocarbons produce drowsiness and mild irritation of the eyes and nose in human subjects, no symptoms resulted from exposure to pentane vapor for 10 minutes at 5000 ppm. Chronic exposure to high concentrations may lead to polyneuropathy (peripheral nerve damage), characterized by progressive weakness and numbness in the extremities, loss of deep tendon reflexes and reduction of motor nerve conduction velocity.

TOLUENE can affect the body if it is inhaled, comes in contact with the eyes or skin or it is swallowed. It may also enter the body through the skin. Toluene vapors cause narcosis. Controlled exposures of human subjects to 200 ppm for 8 hours produced mild fatigue, weakness, confusion, lacrimation and paresthesia. At 600 ppm for 8 hours, there was euphoria, headache, dizziness, dilated pupils and nausea. At 800 ppm for 8 hours, symptoms were more pronounced, and after effects included nervousness, muscular fatigue and insomnia persisting for several days. In workers exposed for many years to concentrations in the range of 80 to 300 ppm, there was no clinical or laboratory evidence of altered liver function. Toluene exposure does not result in the same chronic injury to bone marrow caused by benzene. Liquid splashed in the eyes of workers has caused transient corneal damage and conjunctival irritation, complete recovery occurred within 48 hours. Animal studies have shown that inhalation of high levels of toluene produced cardiac sensitization. Such sensitization may cause fatal changes in heart rhythms. This later effect was shown to be enhanced by hypoxia or the injection of adrenalin-like agents. Workers exposed at less than 200 ppm have complained of headache, lassitude and nausea, but physical findings were essentially negative. At concentrations between 200 and 500 ppm, impairment of coordination, momentary loss of memory and anorexia were present. Between 500 and 1500 ppm, palpitation, extreme weakness, pronounced loss of coordination and impairment of reaction time were noted. The red cell count fell in many instances and there were cases of aplastic anemia in which recovery followed intensive hospital treatment (although some of the effects may have been due to benzene impurity). Toluene has been reported to decrease immunological responses and cause recordable hearing loss in test animals. Damages genetic material in mammalian test systems. May cause adverse reproductive effects based on animal testing.

TRIMETHYL BENZENE (PSEUDOCUMENE) can affect the body if it is inhaled, comes in contact with the eyes or skin or it is swallowed. It may also enter the body through the skin. The liquid is a primary skin irritant, but system intoxication due to absorption through the skin is not probable. High concentrations of vapors (5000 to 9000 ppm) caused central nervous system depression. Pseudocumene may cause nervousness, tension, anxiety, and asthmatic bronchitis. In addition, the peripheral blood showed a tendency to hypochromic anemia and a deviation from the normal in the coagulability of the blood.

XYLENE can affect the body if it is inhaled, comes in contact with the eyes or skin or it is swallowed. It may also enter the body through the skin. Xylene vapor irritates the eyes, mucous membranes and skin. At high concentrations it causes narcosis. In animals, xylene causes blood changes reflecting mild toxicity to the hematopoietic system. Laboratory animals exposed by various routes to high does of xylene showed evidence of effects in the liver, kidneys, lungs, spleen, heart and adrenals. Rats exposed to xylene vapor during pregnancy showed embryo/fetotoxic effects. Mice exposed orally to doses producing maternal toxicity also showed embryo or fetotoxic effects. Laboratory rats exposed to high concentrations of toluene experienced recordable hearing loss. In humans, exposure to high concentrations can cause dizziness, excitement, drowsiness, incoordination and a staggering gait. Workers exposed to concentrations above 200 ppm complain of anorexia, nausea, vomiting and abdominal pain. Brief exposures of humans to 200 ppm caused irritation of the eyes, nose and throat. There are reports of reversible corneal vacuolation in workers exposed to xylene, or to xylene plus other volatile solvents.

HEXANE ISOMERS are three times as toxic to mice as is pentane. Narcosis was produced in mice within 30-60 minutes at concentrations of 30,000 ppm. In man, concentrations for 10 minutes at 2000 ppm produced no effects, but 5000 ppm caused dizziness and a sense of giddiness. Concentrations of 1400-1500 ppm produced slight nausea, headache, eye, and throat irritation.

Ingredient name	Test	Result	Route	Species
Toluene	LD50	636 mg/kg	Oral	Rat
	LDLo	50 mg/kg	Oral	human
Xylene (o,m,p isomers)	LD50	4300 mg/kg	Oral	Rat
	LD50	2119 mg/kg	Oral	Mouse
	LD50	4300 mg/kg	Oral	Mammal
	LD50	>1700 mg/kg	Dermal	Rabbit
	LDLo	50 mg/kg	Oral	human

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Ethanol	LD50	7060 mg/kg	Oral	Rat
	LD50	6300 mg/kg	Oral	Rabbit
	LD50	3450 mg/kg	Oral	Mouse
	LDLo	1400 mg/kg	Oral	human
	LDLo	5500 mg/kg	Oral	Dog
Tertiary Amyl Methyl Ether (TAME)	LD50	1602 mg/kg	Oral	Rat
Pentane	LD50	400 mg/kg	Oral	Rat
Cumene	LD50	1400 mg/kg	Oral	Rat
	LD50	12750 mg/kg	Oral	Mouse
Ethylbenzene	LD50	3500 mg/kg	Oral	Rat
Benzene	LD50	930 mg/kg	Oral	Rat
	LD50	4700 mg/kg	Oral	Mouse
	LD50	5700 mg/kg	Oral	Mammal
	LD50	48 mg/kg	Dermal	Mouse
	LDLo	50 mg/kg	Oral	man
Cyclohexane	LD50	12705 mg/kg	Oral	Rat
	LD50	813 mg/kg	Oral	Mouse
	LDLo	5500 mg/kg	Oral	Rabbit

Chronic effects on humans : **CARCINOGENIC EFFECTS**: Classified A3 (Proven for animal.) by ACGIH [Gasoline]. Classified A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC [Toluene]. Classified A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC [Xylene (o,m,p isomers)]. Classified A3 (Proven for animal.) by ACGIH [Methyl Tertiary Butyl Ether (MTBE)]. Classified 3 (Not classifiable for human.) by IARC [Methyl Tertiary Butyl Ether (MTBE)]. Classified A4 (Not classifiable for human or animal.) by ACGIH [Ethanol]. Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC [Ethylbenzene]. Classified A1 (Confirmed for human.) by ACGIH, 1 (Proven for human.) by IARC, 1 (Known To Be Human Carcinogens.) by NTP, + (Proven.) by OSHA, + (Proven.) by NIOSH [Benzene]. Contains material which causes damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, peripheral nervous system, gastrointestinal tract, upper respiratory tract, skin, bone marrow, central nervous system (CNS), eye, lens or cornea.

Other toxic effects on humans : Extremely hazardous in case of ingestion.
Very hazardous in case of eye contact (irritant), .
Hazardous in case of skin contact (irritant).
Slightly hazardous in case of inhalation (lung irritant).

Special remarks on toxicity to animals : No additional remark.

Special remarks on chronic effects on humans : No additional remark.

Special remarks on other toxic effects on humans : No additional remark.

Specific effects

Carcinogenic effects : Contains material which can cause cancer. Risk of cancer depends on duration and level of exposure.

Target organs : Contains material which causes damage to the following organs: blood, kidneys, lungs, the reproductive system, liver, peripheral nervous system, gastrointestinal tract, upper respiratory tract, skin, bone marrow, central nervous system (CNS), eye, lens or cornea.

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Section 12. Ecological Information

Ecotoxicity data

Ingredient name	Species	Period	Result
Toluene	Daphnia magna (EC50)	48 hour(s)	6 mg/l
	Daphnia magna (EC50)	48 hour(s)	6.56 mg/l
	Oncorhynchus mykiss (EC50)	48 hour(s)	6.78 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	5.8 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	6.78 mg/l
	Pimephales promelas (LC50)	96 hour(s)	12.6 mg/l
Xylene (o,m,p isomers)	Oncorhynchus mykiss (LC50)	96 hour(s)	3.3 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	8.2 mg/l
	Lepomis macrochirus (LC50)	96 hour(s)	8.6 mg/l
	Lepomis macrochirus (LC50)	96 hour(s)	12 mg/l
	Lepomis macrochirus (LC50)	96 hour(s)	13.3 mg/l
	Pimephales promelas (LC50)	96 hour(s)	13.4 mg/l
Methyl Tertiary Butyl Ether (MTBE)	Pimephales promelas (LC50)	96 hour(s)	672 mg/l
Ethanol	Daphnia magna (EC50)	48 hour(s)	2 mg/l
	Daphnia magna (EC50)	48 hour(s)	9.3 mg/l
	Daphnia magna (EC50)	48 hour(s)	>100 mg/l
	Pimephales promelas (LC50)	96 hour(s)	>100 mg/l
	Daphnia magna (LC50)	96 hour(s)	>100 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	13000 mg/l
1,2,4-Trimethylbenzene	Pimephales promelas (LC50)	96 hour(s)	7.72 mg/l
Cumene	Daphnia magna (EC50)	48 hour(s)	10.6 mg/l
	Daphnia magna (EC50)	48 hour(s)	11.2 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	2.7 mg/l
	Poecilia reticulata (LC50)	96 hour(s)	5.1 mg/l
	Pimephales promelas (LC50)	96 hour(s)	6.32 mg/l
Ethylbenzene	Daphnia magna (EC50)	48 hour(s)	2.93 mg/l
	Daphnia magna (EC50)	48 hour(s)	2.97 mg/l
	Selenastrum capricornutum (EC50)	48 hour(s)	7.2 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	4.2 mg/l
	Pimephales promelas (LC50)	96 hour(s)	9.09 mg/l
	Poecilia reticulata (LC50)	96 hour(s)	9.6 mg/l
Benzene	Daphnia magna (EC50)	48 hour(s)	9.23 mg/l
	Daphnia magna (EC50)	48 hour(s)	10 mg/l
	Daphnia magna (EC50)	48 hour(s)	11.73 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	5.3 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	5.9 mg/l
	Oncorhynchus mykiss (LC50)	96 hour(s)	9.2 mg/l
n-Hexane	Pimephales promelas (LC50)	96 hour(s)	2.5 mg/l
Cyclohexane	Pimephales promelas (LC50)	96 hour(s)	4.53 mg/l
	Pimephales promelas (LC50)	96 hour(s)	32.71 mg/l
	Lepomis macrochirus (LC50)	96 hour(s)	34.72 mg/l
	Pimephales promelas (LC50)	96 hour(s)	42.33 mg/l
	Poecilia reticulata (LC50)	96 hour(s)	57.68 mg/l
	Pimephales promelas (LC50)	96 hour(s)	93 mg/l

Products of degradation : These products are carbon oxides (CO, CO_2) and water.

Toxicity of the products of biodegradation : The products of biodegradation are as toxic as the original product.

Special remarks on the products of biodegradation : No additional remark.

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Section 13. Disposal Considerations

Waste disposal : The generation of waste should be avoided or minimized wherever possible. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements.

Consult your local or regional authorities.

Section 14. Transport Information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	1203	Gasoline	3	II		Not available.
TDG Classification	1203	Gasoline (Hexane (Other Isomers), Toluene)	3	II		Not available.

Section 15. Regulatory Information

United States

U.S. Federal regulations : TSCA 4(a) final test rules: Hexane (Other Isomers); n-Hexane
TSCA 8(a) PAIR: Tertiary Amyl Methyl Ether (TAME); n-Heptane; Pentane
TSCA 8(b) inventory: Toluene; Hexane (Other Isomers); Xylene (o,m,p isomers); Octane (All Isomers); Methyl Tertiary Butyl Ether (MTBE); Ethanol; Tertiary Amyl Methyl Ether (TAME); 1,2,4-Trimethylbenzene; n-Heptane; Pentane; Cumene; Ethylbenzene; Benzene; n-Hexane; Cyclohexane; Trimethyl Benzene (Pseudocumene); Gasoline

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: Toluene; Hexane (Other Isomers); Xylene (o,m,p isomers); Octane (All Isomers); Methyl Tertiary Butyl Ether (MTBE); Ethanol; 1,2,4-Trimethylbenzene; n-Heptane; Pentane; Cumene; Ethylbenzene; Benzene; n-Hexane; Cyclohexane
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: Toluene: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; Hexane (Other Isomers): Fire hazard, Immediate (Acute) Health Hazard; Xylene (o,m,p isomers): Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; Octane (All Isomers): Fire hazard; Methyl Tertiary Butyl Ether (MTBE): Fire hazard, Immediate (Acute) Health Hazard; Ethanol: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; 1,2,4-Trimethylbenzene: Fire hazard, Delayed (Chronic) Health Hazard; n-Heptane: Fire hazard; Pentane: Fire hazard, Immediate (Acute) Health Hazard; Cumene: Fire hazard, Immediate (Acute) Health Hazard; Ethylbenzene: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; Benzene: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; n-Hexane: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; Cyclohexane: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard; Gasoline: Fire hazard, Immediate (Acute) Health Hazard, Delayed (Chronic) Health Hazard

Clean Water Act (CWA) 307: Toluene; Ethylbenzene; Benzene

Clean Water Act (CWA) 311: Toluene; Xylene (o,m,p isomers); Ethylbenzene; Benzene; Cyclohexane

Clean air act (CAA) 112 accidental release prevention: Pentane

Clean air act (CAA) 112 regulated flammable substances: Pentane

Continued on next page

Clean air act (CAA) 112 regulated toxic substances: No products were found.

SARA 313

		Product name	CAS number	Concentration
Form R - Reporting requirements	:	Toluene	108-88-3	0 - 30
		Xylene (o,m,p isomers)	1330-20-7	0 - 25
		Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	0 - 16
		1,2,4-Trimethylbenzene	95-63-6	0 - 6
		Cumene	98-82-8	0 - 5
		Ethylbenzene	100-41-4	0 - 5
		Benzene	71-43-2	0 - 4.9
		n-Hexane	110-54-3	0 - 3
		Cyclohexane	110-82-7	0 - 3
Supplier notification	:	Toluene	108-88-3	0 - 30
		Xylene (o,m,p isomers)	1330-20-7	0 - 25
		Methyl Tertiary Butyl Ether (MTBE)	1634-04-4	0 - 16
		1,2,4-Trimethylbenzene	95-63-6	0 - 6
		Cumene	98-82-8	0 - 5
		Ethylbenzene	100-41-4	0 - 5
		Benzene	71-43-2	0 - 4.9
		n-Hexane	110-54-3	0 - 3
		Cyclohexane	110-82-7	0 - 3

SARA 313 notifications must not be detached from the MSDS and any copying and redistribution of the MSDS shall include copying and redistribution of the notice attached to copies of the MSDS subsequently redistributed.

State regulations : Connecticut carcinogen reporting list.: Benzene
Connecticut hazardous material survey.: Toluene; Xylene (o,m,p isomers); Ethanol; Cumene; Ethylbenzene; Benzene; n-Hexane; Gasoline
Illinois toxic substances disclosure to employee act: Toluene; Xylene (o,m,p isomers); Ethanol; Cumene; Ethylbenzene; Benzene; n-Hexane; Gasoline
Rhode Island RTK hazardous substances: Toluene; Xylene (o,m,p isomers); Ethanol; Cumene; Ethylbenzene; Benzene; n-Hexane; Gasoline
Pennsylvania RTK: Toluene: (environmental hazard, generic environmental hazard); Hexane (Other Isomers): (generic environmental hazard); Xylene (o,m,p isomers): (environmental hazard, generic environmental hazard); Octane (All Isomers): (generic environmental hazard); Methyl Tertiary Butyl Ether (MTBE): (environmental hazard, generic environmental hazard); Ethanol: (generic environmental hazard); 1,2,4-Trimethylbenzene: (environmental hazard, generic environmental hazard); n-Heptane: (generic environmental hazard); Pentane: (generic environmental hazard); Cumene: (environmental hazard, generic environmental hazard); Ethylbenzene: (environmental hazard, generic environmental hazard); Benzene: (special hazard, environmental hazard, generic environmental hazard); n-Hexane: (generic environmental hazard); Cyclohexane: (environmental hazard, generic environmental hazard); Trimethyl Benzene (Pseudocumene): (generic environmental hazard); Gasoline: (generic environmental hazard)
Florida: Toluene; Xylene (o,m,p isomers); Ethanol; Cumene; Ethylbenzene; Benzene; n-Hexane; Gasoline
Michigan critical material: Toluene; Xylene (o,m,p isomers); Cumene; Benzene
Massachusetts RTK: Toluene; Hexane (Other Isomers); Xylene (o,m,p isomers); Octane (All Isomers); Methyl Tertiary Butyl Ether (MTBE); Ethanol; 1,2,4-Trimethylbenzene; n-Heptane; Pentane; Cumene; Ethylbenzene; Benzene; n-Hexane; Cyclohexane; Trimethyl Benzene (Pseudocumene); Gasoline
New Jersey: Toluene; Xylene (o,m,p isomers); Octane (All Isomers); Methyl Tertiary Butyl Ether (MTBE); Ethanol; 1,2,4-Trimethylbenzene; n-Heptane; Pentane; Cumene; Ethylbenzene; Benzene; n-Hexane; Cyclohexane; Trimethyl Benzene (Pseudocumene); Gasoline
Louisiana RTK reporting list: Gasoline

Continued on next page

WARNING: This product contains chemical(s) known to the state of California to cause cancer, birth defects or other reproductive harm: Toluene; Benzene
WARNING: This product contains chemical(s) known to the state of California to cause reproductive harm (male): Benzene
California prop. 65 (no significant risk level): Benzene
California prop. 65 (acceptable daily intake level): Toluene; Benzene
WARNING: This product contains chemical(s) known to the state of California to cause birth defects or other reproductive harm.: Toluene; Benzene
WARNING: This product contains chemical(s) known to the state of California to cause cancer.: Benzene

Canada

WHMIS (Canada) : Class B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
Class D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
Class D-2A: Material causing other toxic effects (VERY TOXIC).
Class D-2B: Material causing other toxic effects (TOXIC).

CEPA DSL: Toluene; Hexane (Other Isomers); Xylene (o,m,p isomers); Octane (All Isomers); Methyl Tertiary Butyl Ether (MTBE); Ethanol; Tertiary Amyl Methyl Ether (TAME); 1,2,4-Trimethylbenzene; n-Heptane; Pentane; Cumene; Ethylbenzene; Benzene; n-Hexane; Cyclohexane; Trimethyl Benzene (Pseudocumene); Gasoline

Section 16. Other Information

Label Requirements : CANCER HAZARD
CONTAINS MATERIAL WHICH CAN CAUSE CANCER
HIGHLY FLAMMABLE LIQUID AND VAPOR.
HARMFUL IF SWALLOWED.
CONTAINS MATERIAL WHICH CAUSES DAMAGE TO THE FOLLOWING ORGANS: BLOOD, KIDNEYS, LUNGS, REPRODUCTIVE SYSTEM, LIVER, PERIPHERAL NERVOUS SYSTEM, GASTROINTESTINAL TRACT, RESPIRATORY TRACT, SKIN, BONE MARROW, CENTRAL NERVOUS SYSTEM, EYE, LENS OR CORNEA.
VAPOR MAY CAUSE FLASH FIRE.
MAY BE HARMFUL IF ABSORBED THROUGH SKIN.

Hazardous Material Information System (U.S.A.) :

Health	1
Fire hazard	3
Physical Hazard	0
Personal protection	

National Fire Protection Association (U.S.A.) :

Date of printing : **11/28/2005.**
Date of issue : **11/28/2005.**
Date of previous issue : **No Previous Validation.**
Version : **1**

Disclaimer

THIS MATERIAL SAFETY DATA SHEET ("MSDS") WAS PREPARED IN ACCORDANCE WITH 29 CFR 1910.1200 BY VALERO MARKETING & SUPPLY CO., ("VALERO"). VALERO DOES NOT ASSUME ANY LIABILITY ARISING OUT OF PRODUCT USE BY OTHERS. THE INFORMATION, RECOMMENDATIONS, AND SUGGESTIONS PRESENTED IN THIS MSDS ARE BASED UPON TEST RESULTS AND DATA BELIEVED TO BE RELIABLE. THE END USER OF THE PRODUCT HAS THE RESPONSIBILITY FOR EVALUATING THE ADEQUACY OF THE DATA UNDER THE CONDITIONS OF USE, DETERMINING THE SAFETY, TOXICITY, AND SUITABILITY OF THE PRODUCT UNDER THESE CONDITIONS, AND OBTAINING ADDITIONAL OR CLARIFYING INFORMATION WHERE UNCERTAINTY EXISTS. NO GUARANTEE EXPRESSED OR IMPLIED IS MADE AS TO THE EFFECTS OF SUCH USE, THE RESULTS TO BE

Continued on next page

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Definitions of Material Safety Data Sheet Terminology

GOVERNMENT AGENCIES AND PRIVATE ASSOCIATIONS

ACGIH - American Conference of Governmental Industrial Hygienists, (private association)
DOT - United States Department of Transportation
EPA - United States Environmental Protection Agency
IARC - International Agency for Research on Cancer, (private association)
NFPA - National Fire Protection Association, (private association)
MSHA - Mine Safety and Health Administration, U.S. Department of Labor
NIOSH - National Institute of Occupational Safety and Health, U.S. Department of Health and Human Services
NTP - National Toxicology Program, (private association)
OSHA - Occupational Safety and Health Administration, U.S. Department of Labor
WHMIS- Workplace Hazardous Material Information System
CSA- Canadian Standards Association

HAZARD AND EXPOSURE INFORMATION

Acute Hazard - An adverse health effect which occurs rapidly as a result of short term exposure.
CAS # - American Chemical Society's Chemical Abstract service registry number which identifies the product and/or ingredients.
Ceiling - The concentration that should not be exceeded during any part of the working exposure
Chronic Hazard - An adverse health effect which generally occurs as a result of long term exposure or short term exposure with delayed health effects and is of long duration
Fire Hazard - A material that poses a physical hazard by being flammable, combustible, phyrophoric or an oxidizer as defined by 29 CFR 1910.1200
Hazard Class - DOT hazard classification
Hazardous Ingredients - Names of ingredients which have been identified as health hazards
IDLH- Immediately Dangerous to Life and Health, the airborne concentration below which a person can escape without respiratory protection and exposure up to 30 minutes, and not suffer debilitating or irreversible health effects. Established by NIOSH.
mg/m3 - Milligrams of contaminant per cubic meter of air, a mass to volume ratio
N/A - Not available or no relevant information found
NA - Not applicable
PEL - OSHA permissible exposure limit; an action level of one half this value may be applicable
ppm - Part per million (one volume of vapor or gas in one million volumes of air)
Pressure Hazard - A material that poses a physical hazard due to the potential of a sudden release of pressure such as explosive or a compressed gas as defined by 29 CFR 1910.1200
Reactive Hazard - A material that poses a physical hazard due to the potential to become unstable reactive, water reactive or that is an organic peroxide as defined by 29 CFR 1910.1200.
STEL - The ACGIH Short-Term Exposure Limit, a 15-minute Time-Weighted Average exposure which should not be exceeded at any time during a workday, even if the 8-hour TWA is less than the TLV.
TLV - ACGIH Threshold Limit Value, represented herein as an 8-hour TWA concentration.
8-hour TWA - The time weighted average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.
LD50 – Single dose of a substance that, when administered by a defined route in an animal assay, is expected to the cause the death of 50% of the defined animal population.
LC50 - The concentration of a substance in air that, when administered by means of inhalation over a specified length of time in an animal assay, is expected to cause the death of 50% of a defined animal population.

APPENDIX H

Cyclonaire Xanthate Bag Dump Station Equipment Detail

2922 North Division Avenue ▪ PO Box 366 ▪ York, NE 68467 ▪ 402-362-2000 ▪ 800-445-0730 ▪ Fax 402-362-2001 ▪ sales@cyclonaire.com ▪ www.cyclonaire.com

cyclonaire

PNEUMATIC CONVEYING SYSTEMS

BAG DUMP STATION

OVERVIEW

Cyclonaire's Bag Dump Station offers safe and simple handling of bagged materials in a dust free environment.

Operator friendly design includes bi-fold hinged door, heavy duty bag support grate and easy bag piercing.

Self-contained fan and self-cleaning pulse jet style filter elements trap fugitive dusting for recycling.

The unit has a large work platform, easy controls and a working hopper that integrates easily into your material handling system.

Quality, custom built at competitive prices.

APPLICATIONS

- Clean and safe unloading of bagged materials

MATERIALS / CHARACTERISTICS

- Powdered, granular or pelletized bagged materials

CAPACITY

- 6.3 ft^3 of standard hopper design

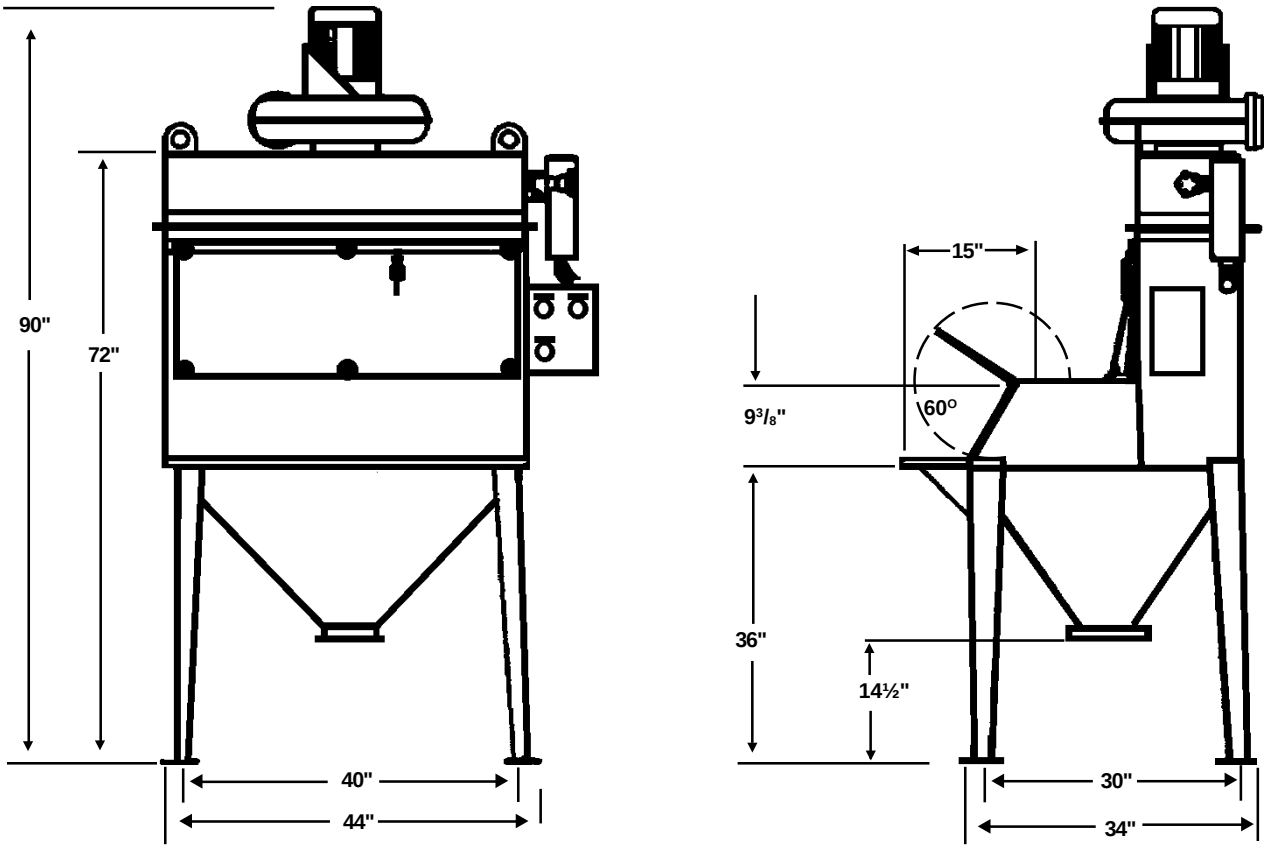
BENEFITS AND FEATURES

- Compact, self contained unit consisting of fan, filter elements, start/stop controls and holding hopper
- Dusting from bag dumping is contained, drawn through filtration and recycled to reduce waste and fugitive dust
- Integrates easily into conveying systems
- Pulse jet filter cleaning to maintain media effectiveness
- Front access to filter elements for easy changing
- Standard
  - Carbon steel - 10 gauge
  - Hinged cover
  - 18"x40" work platform with safety grid
  - Integral dust suppression/collection,
  - TEFC exhaust fan
  - Solid state timer board with NEMA 4 control box
- Specify
  - 304 or 316 Stainless Steel
  - NEMA 4x, 7/9 hopper aeration kit
  - bag breaker
  - bag compactor

REQUIREMENTS

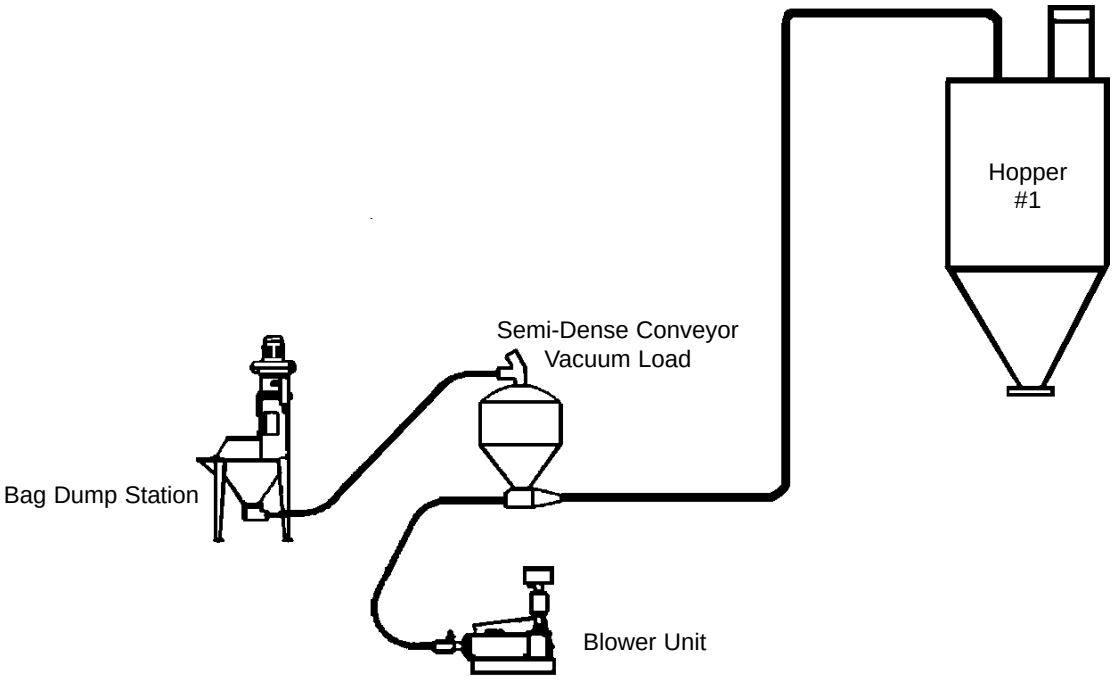
- 90-110 PSIG @ 3-5 SCFM air for reverse pulse filter cleaning
- 110 VAC, 50-60 Hz

BAG DUMP STATION



NOTE: Dimensional data for reference only. Subject to change without notice.
All weights are in pounds, all dimensional units are in inches, unless noted.

BAG DUMP STATION SYSTEM



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Sheber, Tom

From: Scott Berner <sberner@cyclonaire.com>
Sent: Friday, September 02, 2011 1:31 PM
To: Sheber, Tom
Subject: FW: filtration information
Attachments: BHA Efficiency Statement.pdf; BHA-TEX SPEC SHEET.pdf

Tom,

Thanks for the phone call, here is all of the information that I have, hopefully this will answer all of your questions, if not please feel free to give me a call and I will be more than happy to answer them. Have a great weekend.

1. Bin Vent Efficiency = 99.9916%
2. Inlet Material Loading = 30 grains/ACF
3. Outlet Loading = .0025 grains/ ACF

Scott Berner / Cyclonaire Corporation / Regional Sales Manager
Phone: 402-362-2000 ext 51 / Cell Phone: 402-710-3049 / Fax: 402-362-2001
sberner@cyclonaire.com / www.cyclonaire.com

FAN SELECTION And PERFORMANCE

Your Cincinnati Fan Representative:
David Sprung
Brookside and Lane

Phone
Fax

Friday, September 02, 2011

Job Name:
Reference:

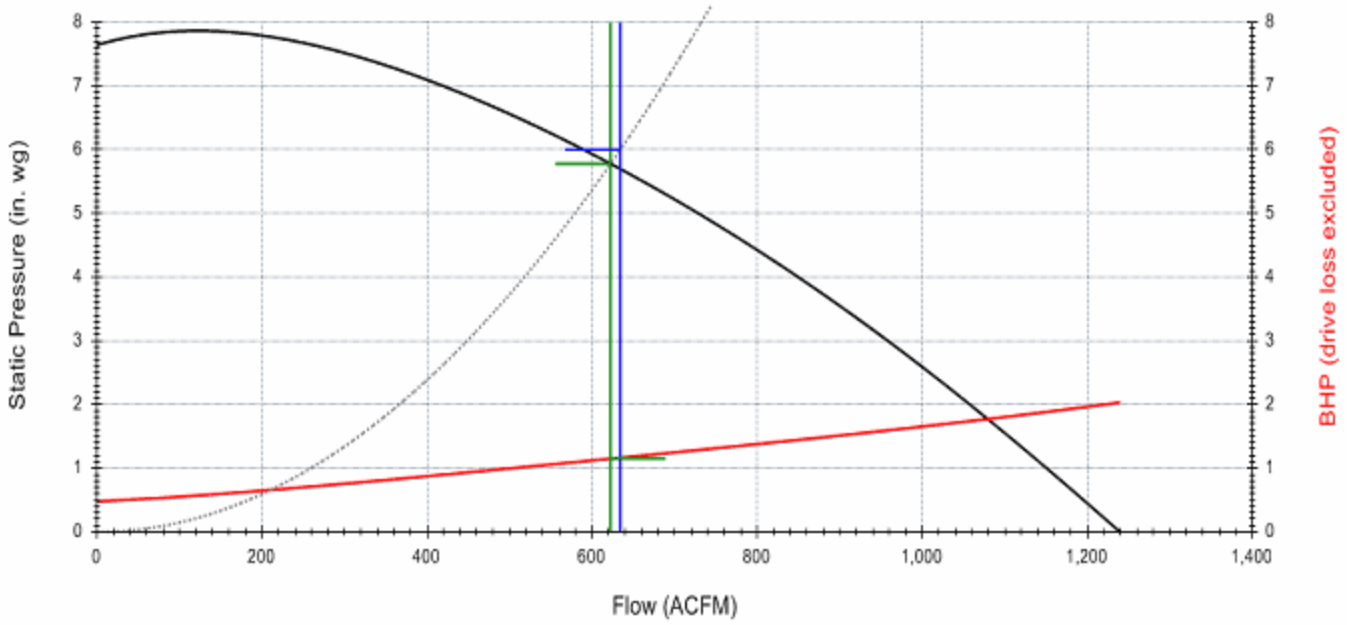
Operating Requirements

Volume, ACFM	634
Static Pressure, in. wg	6.0
Density, lb./ft.³	0.0711
Operating Temperature, °F	70
Site Altitude, Feet ASL	1,000
Relative Humidity, %	0
Specific Gravity	1.0
Inlet Pressure, ± in. wg	-6.0
AMCA Arrangement No.	#4 (Direct)
Motor Frequency, Hz	60
Start-Up Temperature, °F	70

Fan Selection and Specifications

Model	PB-12A
Fan RPM	3,450
Wheel Description	11 X 2-3/4 Radial
Wheel Width, %	100%
Wheel Diameter, in.	11.00
Inlet Diameter, in.	7.00
Outlet Velocity, ft./min.	3,169
Fan BHP	1.15
Static Efficiency, %	49.1%
Cold Start BHP	1.15
Construction Class	

Cincinnati Fan PB-12A 11 X 2-3/4 Radial Wheel (Full Width) @ 3,450 RPM
Rating Point: 634 ACFM @ 6.0 in. wg SP, 0.0711 lb./ft.³ Density, 1.15 BHP, 7.0 in. Inlet



Cincinnati Fan Selector - Copyright © 2004 by Cincinnati Fan and Ventilator Co. All Rights Reserved

GE Energy

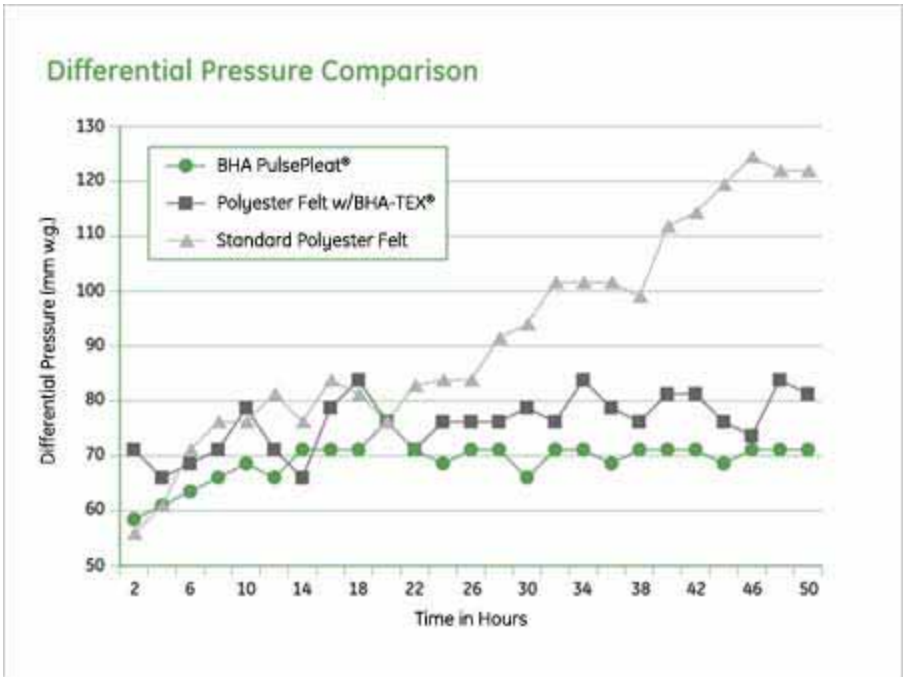
WORLDWIDE PARTNER

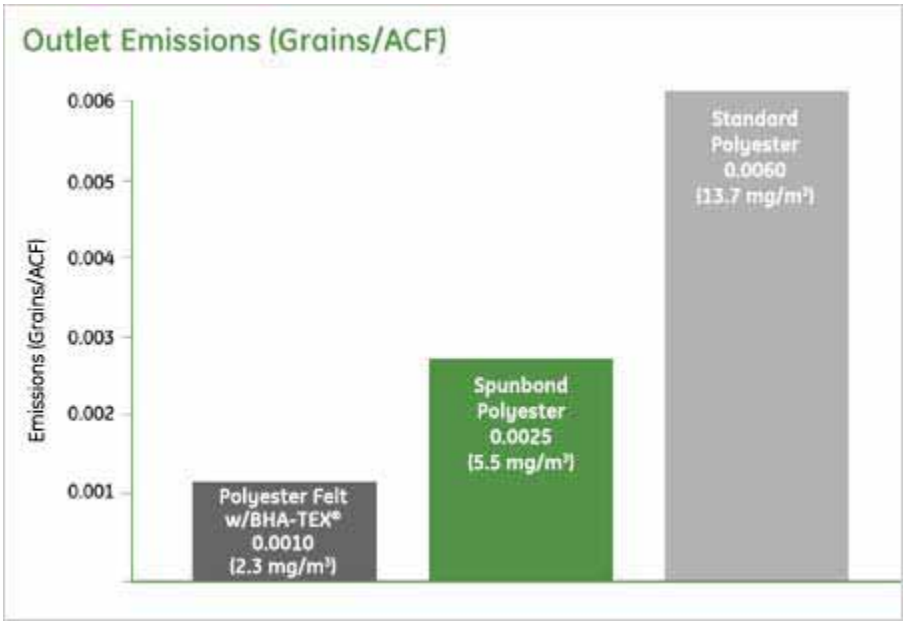
Tested Performance

In a controlled Variable Environmental Simulation Analysis (VESA) test, the spunbond media was tested against traditional 16 oz/yd^2 (542 g/m^2) polyester felt media and 16 oz/yd^2 polyester media laminated with BHA-TEX® expanded PTFE membrane.

Criteria:

- Air-to-cloth ratio: 5:1 ft/min (1.5 m/min)
- Mean particle size: 0.5 micron
- Inlet dust loading: 30 grains/ACF (69 g/m^2)
- Pulse cleaning: 80 PSI (5.5. bar)
- Frequency and duration: 15-minute intervals for 50 hours





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ROYAL UNITED

Products & Services for Manufacturers of Environmental Equipment

Filtration Fabric Spec Sheet

Style:	**QP842**	
Fiber:	**100% Spunbond Polyester**	
Construction:	**Non-Woven, Spunbond**	
Finish:	**Expanded Microporous PTFE Membrane**	
Weight:	**7.4 oz/yd^2** **(251 g/m^2)**	
Air Permeability:	**5-12 ft^3/min/ft^2 (cfm) @ .5" H_2O** **30-57.6 1/dm^2/min @ 200 Pa** **2.5-6 cm^3/cm^2/s @ 125 Pa**	**-ASTM D 737 (U.S.)** **-DIN 53887 (Germany)** **-JIS L 1096-A (Japan)**
Minimum Mullen Burst Strength:	**300 psi (21 kg/cm^2)**	
Maximum Operating Temperature:	**275° F (135° C)**	
Thermal Stability:	**2% max. @ 266° F For 1 hour**	**2% max. @131° C For 1 hour**

The above data is nominal and provided for information only. This data is not to be construed as manufacturing specifications and is subject to change. All metric conversions are approximate.

The OEM Filter Connection
Filter Bags, Cartridges and Pleated Bags

1826 Roberts Street • Winchester, VA 22601 USA • Phone: 540.662.9119 • Fax: 540.662.4747

SF AIR FILTRATION

Oracle Ridge Copper

APPENDIX I

Vehicle Miles Traveled (VMT) Data, Transportation and Fuel Consumption Data

Lyntek, Inc.
Oracle Ridge Mine
Headcount and Transportation Evaluation

		Headcount			
		Day Shift	2nd Shift	3rd Shift	Total
Traffic Control/Security		1	1	1	3
Admin Staff	Office	21			21
Mine Labor	Mine	38	38	38	114
Mine Staff	Mine	23	3	3	29
Plant Labor	Plant	22	14	14	50
Plant Staff	Plant	9			9
Tailings Labor	Tails Fac.	5	2	2	9
Totals =		**119**	**58**	**58**	**235**
Staff Requiring Transport		118	57	57	

	Transportation						
Vehicle[1, 2]	Haul Road Trips Required per Day	Vehicle Weight (Empty) (lbs)	Vehicle Weight (Full) (lbs)	Hours of Operation per Day	Hours of Operation per Year	VMT/day[3]	VMT/yr[3]
Bluebird Bus (36 pax)	16.00		36,000	11.73	4,283	352	128,480
Water Truck	4.00	22,000	56,000	2.00	730	60	21,900
Pickup Trucks	30.00		10,000	15.00	5,475	450	164,250
Maintenance Truck	4.00		19,500	2.00	730	60	21,900
Fuel/Lube Truck	0.14		37,000	0.07	26	2	782
20-ton Dump Truck	100.29		75,000	50.14	18,302	1,504	549,064
Fuel Truck w/ 3350 gal tank	0.04		56,000	0.02	7	1	196
Grader- Cat 120M	16.00		44,690	8.00	2,920	240	87,600
					Total VMTs =	**2,669**	**974,172**
	Average Heavy Duty Vehicle Weight (tons) =			25.4	Heavy Duty Vehicle VMT/yr =	2,159	788,022
	Average Light Duty Vehicle Weight (tons) =			7.4	Light Duty Vehicle VMT/yr =	510	186,150

Assumptions:

1 7 day per week schedule
2 Minimize trips for environmental concerns
3 Multiple vehicles to allow for flexibility
4 Daily maintenance traffic moving from plant/mine site to Tailings site
5 Staff Transportation is provided with Bluebird All-American Forward Engine Activity Bus w/ 141" wheelbase and 36 passenger capacity
6 Pickup Trucks are assumed to be Ford F250 Crewcabs
7 Plant and Mine foreman will require individual vehicles to travel from mine site to admin offices and tailings sites
8 Speed Limit on Hual Road is assumed to be 30mph based on Arizona Revised Statuates 28-701.
9 Distance from Gravel Pit to Mine Site is calculated to be approximately 15 miles based on Lyntek internal estimates gathered via Google Earth.
10 Distance from Suan Miguel Substation to Mine Site is calculated to be approximately 22 miles based on Lyntek internal estimates gathered via Google Earth.
11 Fuel consumption at mine site is based on 15 20-ton underground haul trucks each operating at 85% availability w/ 3 work shifts with fuel consumption of 4.11 gal/hr based on InfoMine's *Mine and Mill Equipment Costs 2009.*
12 Grader fuel consumption is 4.63 gal/hr based on *Mine and Mill Equipment Costs 2009.*
13 One Fuel Truck load will sustain operations for 4 weeks based on a weekly consumption of 846.16 gal/week.
14 Tailings Site will rely on a conveyor system for tailings distribution.
15 Daily production is estimated at 3000 tons/day.

Assumed Site Vehicles:	Quantity	GVWR (lbs)	Vehicle Information	
Skid Steer Loader	1	5,690	Equipment Information	
Pickup Trucks	9	10,000	Vehicle Information	
D4C Series III Bulldozer	1	16,019	Equipment Information	
Maintenance Truck	1	19,500	Chasis Information	Body Information
Bluebird Bus (36 pax)	3	36,000	Vehicle Information	
Fuel/Lube Truck	1	37,000	Chasis Information	Body Information
Grader- Cat 120M	1	44,690	Equipment Information	
Water Truck	1	56,000		
Fuel Truck w/ 3350 gal tank	1	56,000	Vehicle Information	
20-ton Dump Truck	1	75,000		

Calculations		
Haul Road Trip Time	30.00	Minutes
Trip Time from San Miguel Substation	44.00	Minutes
Mine Site Surface Vehicle Daily Fuel Consumption		
Grader Daily Fuel Consumption	37.04	Gallons
Underground Haul Truck Daily Fuel Consumption	83.84	Gallons
Total Daily Diesel Fuel Consumption	**120.88**	**Gallons**

Notes:

1 Water Truck GVWR 5600, Empty WR 22000.
2 20-ton Dump Truck is intended for hauling of reagents and steel balls for ball mill.
3 VMT based on 30 mph and Hours of Operation data.

Oracle Ridge Copper

APPENDIX J

National Climatic Data Center (NCDC) 10-Year Precipitation Data for Tucson, AZ

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2001	January	6	0.10	
028820	Tucson International Airport	07	2001	January	8	0.09	
028820	Tucson International Airport	07	2001	January	9	0.34	
028820	Tucson International Airport	07	2001	January	12	0.51	
028820	Tucson International Airport	07	2001	January	16	0.13	
028820	Tucson International Airport	07	2001	January	22	0.01	
028820	Tucson International Airport	07	2001	January	27	0.02	
028820	Tucson International Airport	07	2001	January	28	0.04	
					January 2001 Total Days =		8
028820	Tucson International Airport	07	2001	February	8	0.27	
028820	Tucson International Airport	07	2001	February	14	0.01	
028820	Tucson International Airport	07	2001	February	15	0.08	
028820	Tucson International Airport	07	2001	February	23	0.01	
028820	Tucson International Airport	07	2001	February	26	0.01	
028820	Tucson International Airport	07	2001	February	27	0.08	
					February 2001 Total Days =		6
028820	Tucson International Airport	07	2001	March	7	0.70	
028820	Tucson International Airport	07	2001	March	10	0.02	
028820	Tucson International Airport	07	2001	March	11	0.03	
028820	Tucson International Airport	07	2001	March	13	0.13	
					March 2001 Total Days =		4
028820	Tucson International Airport	07	2001	April	5	0.30	
028820	Tucson International Airport	07	2001	April	6	0.42	
028820	Tucson International Airport	07	2001	April	10	0.03	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2001	April	21	0.06	
028820	Tucson International Airport	07	2001	April	26	0.03	
						April 2001 Total Days =	5
028820	Tucson International Airport	07	2001	May	12	0.13	
028820	Tucson International Airport	07	2001	May	13	0.01	
028820	Tucson International Airport	07	2001	May	19	0.10	
						May 2001 Total Days =	3
028820	Tucson International Airport	07	2001	June	20	0.33	
028820	Tucson International Airport	07	2001	June	21	0.07	
028820	Tucson International Airport	07	2001	June	22	0.01	
028820	Tucson International Airport	07	2001	June	25	0.13	
						June 2001 Total Days =	4
028820	Tucson International Airport	07	2001	July	5	0.27	
028820	Tucson International Airport	07	2001	July	6	0.10	
028820	Tucson International Airport	07	2001	July	14	0.01	
028820	Tucson International Airport	07	2001	July	16	0.04	
028820	Tucson International Airport	07	2001	July	18	0.48	
028820	Tucson International Airport	07	2001	July	19	0.02	
028820	Tucson International Airport	07	2001	July	25	0.01	
028820	Tucson International Airport	07	2001	July	31	0.06	
						July 2001 Total Days =	8
028820	Tucson International Airport	07	2001	August	4	0.10	
028820	Tucson International Airport	07	2001	August	9	0.05	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2001	August	12	0.14	
028820	Tucson International Airport	07	2001	August	13	0.01	
028820	Tucson International Airport	07	2001	August	16	0.26	
028820	Tucson International Airport	07	2001	August	17	0.28	
						August 2001 Total Days =	6
028820	Tucson International Airport	07	2001	September	14	0.26	
028820	Tucson International Airport	07	2001	September	30	0.07	
						September 2001 Total Days =	2
028820	Tucson International Airport	07	2001	October	1	0.01	
028820	Tucson International Airport	07	2001	October	6	0.03	
028820	Tucson International Airport	07	2001	October	8	0.65	
						October 2001 Total Days =	3
028820	Tucson International Airport	07	2001	November	5	0.05	1
						November 2001 Total Days =	1
028820	Tucson International Airport	07	2001	December	4	0.08	
028820	Tucson International Airport	07	2001	December	11	0.35	
028820	Tucson International Airport	07	2001	December	12	0.03	
028820	Tucson International Airport	07	2001	December	15	0.14	
						December 2001 Total Days =	4
						NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2001 =	54

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2002	January	23	0.07	
028820	Tucson International Airport	07	2002	January	30	0.27	
						January 2002 Total Days =	2
028820	Tucson International Airport	07	2002	February	4	0.27	1
						February 2002 Total Days =	1
028820	Tucson International Airport	07	2002	March	8	0.06	
028820	Tucson International Airport	07	2002	March	18	0.01	
						March 2002 Total Days =	2
028820	Tucson International Airport	07	2002	April		---	0
						April 2002 Total Days =	0
028820	Tucson International Airport	07	2002	May		---	0
						May 2002 Total Days =	0
028820	Tucson International Airport	07	2002	June		---	0
						June 2002 Total Days =	0
028820	Tucson International Airport	07	2002	July	8	0.01	
028820	Tucson International Airport	07	2002	July	9	0.05	
028820	Tucson International Airport	07	2002	July	11	0.05	
028820	Tucson International Airport	07	2002	July	14	0.96	
028820	Tucson International Airport	07	2002	July	18	0.24	
028820	Tucson International Airport	07	2002	July	22	0.45	
028820	Tucson International Airport	07	2002	July	23	0.01	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2002	July	27	0.70	
						July 2002 Total Days =	8
028820	Tucson International Airport	07	2002	August	2	0.06	
028820	Tucson International Airport	07	2002	August	3	0.06	
028820	Tucson International Airport	07	2002	August	5	0.80	
028820	Tucson International Airport	07	2002	August	9	0.04	
028820	Tucson International Airport	07	2002	August	18	0.03	
028820	Tucson International Airport	07	2002	August	28	0.43	
028820	Tucson International Airport	07	2002	August	29	0.21	
						August 2002 Total Days =	7
028820	Tucson International Airport	07	2002	September	6	0.66	
028820	Tucson International Airport	07	2002	September	8	0.24	
028820	Tucson International Airport	07	2002	September	9	0.01	
028820	Tucson International Airport	07	2002	September	10	0.77	
						September 2002 Total Days =	4
028820	Tucson International Airport	07	2002	October	18	0.07	
028820	Tucson International Airport	07	2002	October	27	0.43	
						October 2002 Total Days =	2
028820	Tucson International Airport	07	2002	November	29	0.23	1
						November 2002 Total Days =	1
028820	Tucson International Airport	07	2002	December	2	0.13	
028820	Tucson International Airport	07	2002	December	17	0.23	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2002	December	18	0.10	
028820	Tucson International Airport	07	2002	December	22	0.06	
028820	Tucson International Airport	07	2002	December	23	0.09	
028820	Tucson International Airport	07	2002	December	29	0.03	
					December 2002 Total Days =		6
			NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2002 =				33
028820	Tucson International Airport	07	2003	January	8	0.03	
028820	Tucson International Airport	07	2003	January	20	0.05	
					January 2003 Total Days =		2
028820	Tucson International Airport	07	2003	February	12	0.01	
028820	Tucson International Airport	07	2003	February	13	0.53	
028820	Tucson International Airport	07	2003	February	14	0.19	
028820	Tucson International Airport	07	2003	February	15	0.01	
028820	Tucson International Airport	07	2003	February	20	0.04	
028820	Tucson International Airport	07	2003	February	25	0.09	
028820	Tucson International Airport	07	2003	February	28	0.15	
					February 2003 Total Days =		7
028820	Tucson International Airport	07	2003	March	2	0.22	
028820	Tucson International Airport	07	2003	March	16	0.01	
028820	Tucson International Airport	07	2003	March	17	0.28	
					March 2003 Total Days =		3

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2003	April	15	0.04	1
						April 2003 Total Days =	1
028820	Tucson International Airport	07	2003	May	29	0.02	
028820	Tucson International Airport	07	2003	May	30	0.11	
						May 2003 Total Days =	2
028820	Tucson International Airport	07	2003	June		---	0
						June 2003 Total Days =	0
028820	Tucson International Airport	07	2003	July	12	0.50	
028820	Tucson International Airport	07	2003	July	13	0.04	
028820	Tucson International Airport	07	2003	July	17	0.04	
028820	Tucson International Airport	07	2003	July	18	0.12	
028820	Tucson International Airport	07	2003	July	20	0.01	
028820	Tucson International Airport	07	2003	July	22	0.02	
028820	Tucson International Airport	07	2003	July	24	0.02	
028820	Tucson International Airport	07	2003	July	25	0.32	
028820	Tucson International Airport	07	2003	July	28	0.08	
028820	Tucson International Airport	07	2003	July	29	1.31	
028820	Tucson International Airport	07	2003	July	31	0.04	
						July 2003 Total Days =	11
028820	Tucson International Airport	07	2003	August	1	0.18	
028820	Tucson International Airport	07	2003	August	13	0.05	
028820	Tucson International Airport	07	2003	August	14	0.02	
028820	Tucson International Airport	07	2003	August	15	0.17	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2003	August	18	0.01	
028820	Tucson International Airport	07	2003	August	22	0.09	
028820	Tucson International Airport	07	2003	August	23	0.31	
028820	Tucson International Airport	07	2003	August	24	0.06	
028820	Tucson International Airport	07	2003	August	25	0.58	
028820	Tucson International Airport	07	2003	August	26	0.54	
028820	Tucson International Airport	07	2003	August	27	0.02	
					August 2003 Total Days =		11
028820	Tucson International Airport	07	2003	September	8	0.13	
028820	Tucson International Airport	07	2003	September	9	0.33	
028820	Tucson International Airport	07	2003	September	23	0.36	
028820	Tucson International Airport	07	2003	September	24	1.33	
028820	Tucson International Airport	07	2003	September	25	0.01	
					September 2003 Total Days =		5
028820	Tucson International Airport	07	2003	October	7	0.24	
028820	Tucson International Airport	07	2003	October	8	0.01	
028820	Tucson International Airport	07	2003	October	9	0.11	
028820	Tucson International Airport	07	2003	October	10	0.02	
					October 2003 Total Days =		4
028820	Tucson International Airport	07	2003	November	11	0.03	
028820	Tucson International Airport	07	2003	November	12	1.00	
					November 2003 Total Days =		2
028820	Tucson International Airport	07	2003	December	8	0.01	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2003	December	12	0.04	
028820	Tucson International Airport	07	2003	December	26	0.05	
028820	Tucson International Airport	07	2003	December	31	0.06	
					December 2003 Total Days =		4
				NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2003 =			47
028820	Tucson International Airport	07	2004	January	14	0.07	
028820	Tucson International Airport	07	2004	January	21	0.04	
028820	Tucson International Airport	07	2004	January	22	0.60	
028820	Tucson International Airport	07	2004	January	23	0.02	
028820	Tucson International Airport	07	2004	January	24	0.02	
028820	Tucson International Airport	07	2004	January	25	0.04	
					January 2004 Total Days =		6
028820	Tucson International Airport	07	2004	February	4	0.13	
028820	Tucson International Airport	07	2004	February	23	0.17	
028820	Tucson International Airport	07	2004	February	27	0.15	
					February 2004 Total Days =		3
028820	Tucson International Airport	07	2004	March	3	0.09	
028820	Tucson International Airport	07	2004	March	4	0.51	
028820	Tucson International Airport	07	2004	March	13	0.13	
028820	Tucson International Airport	07	2004	March	31	0.39	
					March 2004 Total Days =		4

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2004	April	1	0.11	
028820	Tucson International Airport	07	2004	April	2	0.71	
028820	Tucson International Airport	07	2004	April	3	0.05	
028820	Tucson International Airport	07	2004	April	4	0.09	
028820	Tucson International Airport	07	2004	April	10	0.07	
028820	Tucson International Airport	07	2004	April	27	0.02	
						April 2004 Total Days =	6
028820	Tucson International Airport	07	2004	May		---	0
						May 2004 Total Days =	0
028820	Tucson International Airport	07	2004	June		---	0
						June 2004 Total Days =	0
028820	Tucson International Airport	07	2004	July	13	0.03	
028820	Tucson International Airport	07	2004	July	17	0.15	
028820	Tucson International Airport	07	2004	July	26	0.63	
028820	Tucson International Airport	07	2004	July	28	0.05	
						July 2004 Total Days =	4
028820	Tucson International Airport	07	2004	August	3	0.04	
028820	Tucson International Airport	07	2004	August	11	0.03	
028820	Tucson International Airport	07	2004	August	13	0.48	
028820	Tucson International Airport	07	2004	August	18	0.40	
						August 2004 Total Days =	4
028820	Tucson International Airport	07	2004	September	4	0.20	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2004	September	18	0.37	
028820	Tucson International Airport	07	2004	September	19	0.04	
					September 2004 Total Days =		3
028820	Tucson International Airport	07	2004	October	21	0.43	
028820	Tucson International Airport	07	2004	October	22	0.04	
028820	Tucson International Airport	07	2004	October	28	0.15	
					October 2004 Total Days =		3
028820	Tucson International Airport	07	2004	November	8	0.02	
028820	Tucson International Airport	07	2004	November	15	0.03	
028820	Tucson International Airport	07	2004	November	22	0.28	
028820	Tucson International Airport	07	2004	November	23	0.11	
					November 2004 Total Days =		4
028820	Tucson International Airport	07	2004	December	4	0.54	
028820	Tucson International Airport	07	2004	December	5	0.01	
028820	Tucson International Airport	07	2004	December	6	0.08	
028820	Tucson International Airport	07	2004	December	28	0.01	
028820	Tucson International Airport	07	2004	December	29	0.07	
					December 2004 Total Days =		5
				NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2004 =			42
028820	Tucson International Airport	07	2005	January	2	0.13	
028820	Tucson International Airport	07	2005	January	3	0.23	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2005	January	4	0.07	
028820	Tucson International Airport	07	2005	January	20	0.06	
028820	Tucson International Airport	07	2005	January	21	0.39	
028820	Tucson International Airport	07	2005	January	24	0.07	
028820	Tucson International Airport	07	2005	January	26	0.15	
028820	Tucson International Airport	07	2005	January	27	0.25	
					January 2005 Total Days =		8
028820	Tucson International Airport	07	2005	February	6	0.01	
028820	Tucson International Airport	07	2005	February	10	0.06	
028820	Tucson International Airport	07	2005	February	11	0.37	
028820	Tucson International Airport	07	2005	February	12	0.42	
028820	Tucson International Airport	07	2005	February	17	0.11	
028820	Tucson International Airport	07	2005	February	18	0.02	
028820	Tucson International Airport	07	2005	February	19	0.26	
028820	Tucson International Airport	07	2005	February	21	0.01	
028820	Tucson International Airport	07	2005	February	24	0.01	
					February 2005 Total Days =		9
028820	Tucson International Airport	07	2005	March	5	0.13	
028820	Tucson International Airport	07	2005	March	6	0.04	
028820	Tucson International Airport	07	2005	March	19	0.11	
028820	Tucson International Airport	07	2005	March	23	0.09	
					March 2005 Total Days =		4
028820	Tucson International Airport	07	2005	April	23	0.11	
028820	Tucson International Airport	07	2005	April	24	0.22	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
					April 2005 Total Days =		2
028820	Tucson International Airport	07	2005	May	27	0.44	
028820	Tucson International Airport	07	2005	May	28	0.19	
					May 2005 Total Days =		2
028820	Tucson International Airport	07	2005	June	23	0.01	1
					June 2005 Total Days =		
028820	Tucson International Airport	07	2005	July	18	0.12	
028820	Tucson International Airport	07	2005	July	21	0.15	
028820	Tucson International Airport	07	2005	July	22	0.05	
028820	Tucson International Airport	07	2005	July	23	0.04	
028820	Tucson International Airport	07	2005	July	27	0.02	
028820	Tucson International Airport	07	2005	July	30	0.13	
028820	Tucson International Airport	07	2005	July	31	0.21	
					July 2005 Total Days =		7
028820	Tucson International Airport	07	2005	August	1	0.03	
028820	Tucson International Airport	07	2005	August	4	0.15	
028820	Tucson International Airport	07	2005	August	5	0.15	
028820	Tucson International Airport	07	2005	August	7	0.11	
028820	Tucson International Airport	07	2005	August	8	0.51	
028820	Tucson International Airport	07	2005	August	13	0.51	
028820	Tucson International Airport	07	2005	August	14	0.26	
028820	Tucson International Airport	07	2005	August	15	0.36	
028820	Tucson International Airport	07	2005	August	22	0.15	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2005	August	23	2.29	
					August 2005 Total Days =		10
028820	Tucson International Airport	07	2005	September	8	0.05	1
					September 2005 Total Days =		1
028820	Tucson International Airport	07	2005	October	6	0.15	
028820	Tucson International Airport	07	2005	October	14	0.06	
028820	Tucson International Airport	07	2005	October	17	0.10	
					October 2005 Total Days =		3
028820	Tucson International Airport	07	2005	November		---	0
					November 2005 Total Days =		0
028820	Tucson International Airport	07	2005	December	12	0.01	1
					December 2005 Total Days =		1
				NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2005 =			48
028820	Tucson International Airport	07	2006	January		---	0
					January 2006 Total Days =		0
028820	Tucson International Airport	07	2006	February		---	0
					February 2006 Total Days =		0
028820	Tucson International Airport	07	2006	March	11	0.05	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2006	March	12	0.17	
028820	Tucson International Airport	07	2006	March	19	0.18	
028820	Tucson International Airport	07	2006	March	28	0.01	
						March 2006 Total Days =	4
028820	Tucson International Airport	07	2006	April		---	0
						April 2006 Total Days =	0
028820	Tucson International Airport	07	2006	May		---	0
						May 2006 Total Days =	0
028820	Tucson International Airport	07	2006	June	6	0.31	
028820	Tucson International Airport	07	2006	June	27	0.08	
028820	Tucson International Airport	07	2006	June	29	0.11	
						June 2006 Total Days =	3
028820	Tucson International Airport	07	2006	July	3	0.01	
028820	Tucson International Airport	07	2006	July	4	0.42	
028820	Tucson International Airport	07	2006	July	5	0.74	
028820	Tucson International Airport	07	2006	July	7	0.03	
028820	Tucson International Airport	07	2006	July	14	0.30	
028820	Tucson International Airport	07	2006	July	18	0.05	
028820	Tucson International Airport	07	2006	July	23	0.02	
028820	Tucson International Airport	07	2006	July	27	0.24	
028820	Tucson International Airport	07	2006	July	28	0.15	
028820	Tucson International Airport	07	2006	July	29	1.53	
028820	Tucson International Airport	07	2006	July	30	0.01	

(1) NCDC Cooperative Station Number.
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NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2006	July	31	1.90	
						July 2006 Total Days =	12
028820	Tucson International Airport	07	2006	August	4	0.02	
028820	Tucson International Airport	07	2006	August	8	1.06	
028820	Tucson International Airport	07	2006	August	14	0.31	
028820	Tucson International Airport	07	2006	August	16	0.86	
028820	Tucson International Airport	07	2006	August	20	0.33	
028820	Tucson International Airport	07	2006	August	22	0.02	
028820	Tucson International Airport	07	2006	August	23	0.02	
028820	Tucson International Airport	07	2006	August	25	0.19	
028820	Tucson International Airport	07	2006	August	26	0.20	
						August 2006 Total Days =	9
028820	Tucson International Airport	07	2006	September	4	0.09	
028820	Tucson International Airport	07	2006	September	7	1.15	
028820	Tucson International Airport	07	2006	September	8	0.02	
028820	Tucson International Airport	07	2006	September	9	0.29	
028820	Tucson International Airport	07	2006	September	12	0.05	
						September 2006 Total Days =	5
028820	Tucson International Airport	07	2006	October	4	0.03	
028820	Tucson International Airport	07	2006	October	6	0.06	
028820	Tucson International Airport	07	2006	October	8	0.09	
028820	Tucson International Airport	07	2006	October	9	0.01	
028820	Tucson International Airport	07	2006	October	24	0.06	
028820	Tucson International Airport	07	2006	October	29	0.02	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
					October 2006 Total Days =		6
028820	Tucson International Airport	07	2006	November		---	0
					November 2006 Total Days =		0
028820	Tucson International Airport	07	2006	December	18	0.01	
028820	Tucson International Airport	07	2006	December	19	0.01	
028820	Tucson International Airport	07	2006	December	22	0.06	
028820	Tucson International Airport	07	2006	December	27	0.09	
028820	Tucson International Airport	07	2006	December	28	0.40	
028820	Tucson International Airport	07	2006	December	29	0.05	
					December 2006 Total Days =		6
				NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2006 =			45
028820	Tucson International Airport	07	2007	January	5	0.03	
028820	Tucson International Airport	07	2007	January	10	0.02	
028820	Tucson International Airport	07	2007	January	19	0.24	
028820	Tucson International Airport	07	2007	January	21	0.37	
028820	Tucson International Airport	07	2007	January	30	0.05	
					January 2007 Total Days =		5
028820	Tucson International Airport	07	2007	February	13	0.01	
028820	Tucson International Airport	07	2007	February	14	0.03	
					February 2007 Total Days =		2

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2007	March	22	0.25	
028820	Tucson International Airport	07	2007	March	23	0.34	
						March 2007 Total Days =	2
028820	Tucson International Airport	07	2007	April	12	0.07	
028820	Tucson International Airport	07	2007	April	21	0.08	
						April 2007 Total Days =	2
028820	Tucson International Airport	07	2007	May	16	0.14	1
						May 2007 Total Days =	1
028820	Tucson International Airport	07	2007	June		---	0
						June 2007 Total Days =	0
028820	Tucson International Airport	07	2007	July	16	0.09	
028820	Tucson International Airport	07	2007	July	19	0.14	
028820	Tucson International Airport	07	2007	July	21	1.04	
028820	Tucson International Airport	07	2007	July	22	0.28	
028820	Tucson International Airport	07	2007	July	23	0.42	
028820	Tucson International Airport	07	2007	July	24	0.07	
028820	Tucson International Airport	07	2007	July	25	0.10	
028820	Tucson International Airport	07	2007	July	27	0.29	
028820	Tucson International Airport	07	2007	July	28	1.26	
028820	Tucson International Airport	07	2007	July	30	0.04	
028820	Tucson International Airport	07	2007	July	31	1.49	
						July 2007 Total Days =	11

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2007	August	5	0.02	
028820	Tucson International Airport	07	2007	August	6	0.34	
028820	Tucson International Airport	07	2007	August	15	0.25	
028820	Tucson International Airport	07	2007	August	16	0.24	
028820	Tucson International Airport	07	2007	August	18	0.01	
028820	Tucson International Airport	07	2007	August	25	0.03	
028820	Tucson International Airport	07	2007	August	29	0.01	
					August 2007 Total Days =		7
028820	Tucson International Airport	07	2007	September	1	0.06	
028820	Tucson International Airport	07	2007	September	6	0.05	
028820	Tucson International Airport	07	2007	September	7	0.01	
028820	Tucson International Airport	07	2007	September	16	0.33	
					September 2007 Total Days =		4
028820	Tucson International Airport	07	2007	October	1	0.02	1
					October 2007 Total Days =		
028820	Tucson International Airport	07	2007	November	29	0.13	
028820	Tucson International Airport	07	2007	November	30	0.67	
							2
028820	Tucson International Airport	07	2007	December	1	0.03	
028820	Tucson International Airport	07	2007	December	8	0.33	
028820	Tucson International Airport	07	2007	December	9	0.02	
028820	Tucson International Airport	07	2007	December	11	0.37	
028820	Tucson International Airport	07	2007	December	12	0.01	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
					December 2007 Total Days =		5
			NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2007 =				42
028820	Tucson International Airport	07	2008	January	3	0.02	
028820	Tucson International Airport	07	2008	January	7	0.10	
028820	Tucson International Airport	07	2008	January	8	0.01	
028820	Tucson International Airport	07	2008	January	27	0.03	
028820	Tucson International Airport	07	2008	January	28	0.01	
					January 2008 Total Days =		5
028820	Tucson International Airport	07	2008	February	4	0.18	
028820	Tucson International Airport	07	2008	February	15	0.94	
028820	Tucson International Airport	07	2008	February	16	0.10	
					February 2008 Total Days =		3
028820	Tucson International Airport	07	2008	March	16	0.15	
028820	Tucson International Airport	07	2008	March	17	0.22	
					March 2008 Total Days =		2
028820	Tucson International Airport	07	2008	April	9	0.05	1
					April 2008 Total Days =		1
028820	Tucson International Airport	07	2008	May	22	0.02	1
					May 2008 Total Days =		1

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2008	June	25	0.02	
028820	Tucson International Airport	07	2008	June	26	0.14	
					June 2008 Total Days =		2
028820	Tucson International Airport	07	2008	July	3	0.01	
028820	Tucson International Airport	07	2008	July	4	0.01	
028820	Tucson International Airport	07	2008	July	5	0.14	
028820	Tucson International Airport	07	2008	July	6	0.10	
028820	Tucson International Airport	07	2008	July	7	0.19	
028820	Tucson International Airport	07	2008	July	8	0.01	
028820	Tucson International Airport	07	2008	July	10	0.02	
028820	Tucson International Airport	07	2008	July	11	1.73	
028820	Tucson International Airport	07	2008	July	14	0.22	
028820	Tucson International Airport	07	2008	July	19	0.64	
028820	Tucson International Airport	07	2008	July	20	0.31	
028820	Tucson International Airport	07	2008	July	23	0.02	
028820	Tucson International Airport	07	2008	July	26	0.01	
028820	Tucson International Airport	07	2008	July	27	0.01	
					July 2008 Total Days =		14
028820	Tucson International Airport	07	2008	August	3	0.05	
028820	Tucson International Airport	07	2008	August	4	0.01	
028820	Tucson International Airport	07	2008	August	5	0.59	
028820	Tucson International Airport	07	2008	August	7	0.32	
028820	Tucson International Airport	07	2008	August	14	0.07	
028820	Tucson International Airport	07	2008	August	25	0.06	
028820	Tucson International Airport	07	2008	August	28	0.03	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2008	August	30	0.05	
028820	Tucson International Airport	07	2008	August	31	0.52	
						August 2008 Total Days =	9
028820	Tucson International Airport	07	2008	September	10	0.09	
028820	Tucson International Airport	07	2008	September	11	0.15	
						September 2008 Total Days =	2
028820	Tucson International Airport	07	2008	October		---	0
						October 2008 Total Days =	0
028820	Tucson International Airport	07	2008	November	9	0.01	
028820	Tucson International Airport	07	2008	November	27	0.26	
						November 2008 Total Days =	2
028820	Tucson International Airport	07	2008	December	14	0.04	
028820	Tucson International Airport	07	2008	December	18	0.03	
028820	Tucson International Airport	07	2008	December	23	0.63	
028820	Tucson International Airport	07	2008	December	26	0.30	
						December 2008 Total Days =	4
						NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2008 =	45
028820	Tucson International Airport	07	2009	January	4	0.32	
028820	Tucson International Airport	07	2009	January	5	0.06	
028820	Tucson International Airport	07	2009	January	21	0.06	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2009	January	22	0.16	
028820	Tucson International Airport	07	2009	January	23	0.03	
					January 2009 Total Days =		5
028820	Tucson International Airport	07	2009	February	8	0.39	
028820	Tucson International Airport	07	2009	February	10	0.17	
					February 2009 Total Days =		2
028820	Tucson International Airport	07	2009	March	8	0.01	
028820	Tucson International Airport	07	2009	March	9	0.17	
					March 2009 Total Days =		2
028820	Tucson International Airport	07	2009	April	11	0.29	1
					April 2009 Total Days =		1
028820	Tucson International Airport	07	2009	May	21	0.53	
028820	Tucson International Airport	07	2009	May	22	0.14	
					May 2009 Total Days =		2
028820	Tucson International Airport	07	2009	June	25	0.01	1
					June 2009 Total Days =		1
028820	Tucson International Airport	07	2009	July	3	0.43	
028820	Tucson International Airport	07	2009	July	4	0.31	
028820	Tucson International Airport	07	2009	July	8	0.78	
028820	Tucson International Airport	07	2009	July	16	0.02	
028820	Tucson International Airport	07	2009	July	19	0.02	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2009	July	23	0.22	
						July 2009 Total Days =	6
028820	Tucson International Airport	07	2009	August	12	0.08	
028820	Tucson International Airport	07	2009	August	13	0.06	
028820	Tucson International Airport	07	2009	August	21	0.15	
028820	Tucson International Airport	07	2009	August	22	0.04	
						August 2009 Total Days =	4
028820	Tucson International Airport	07	2009	September	3	0.04	
028820	Tucson International Airport	07	2009	September	6	0.64	
028820	Tucson International Airport	07	2009	September	12	0.06	
						September 2009 Total Days =	3
028820	Tucson International Airport	07	2009	October	3	0.05	1
						October 2009 Total Days =	1
028820	Tucson International Airport	07	2009	November	29	0.10	
028820	Tucson International Airport	07	2009	November	30	0.03	
						November 2009 Total Days =	2
028820	Tucson International Airport	07	2009	December	8	0.15	
028820	Tucson International Airport	07	2009	December	14	0.01	
028820	Tucson International Airport	07	2009	December	22	0.14	
						December 2009 Total Days =	3
						NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2009 =	32

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2010	January	20	0.40	
028820	Tucson International Airport	07	2010	January	21	0.12	
028820	Tucson International Airport	07	2010	January	22	1.11	
028820	Tucson International Airport	07	2010	January	23	0.14	
028820	Tucson International Airport	07	2010	January	27	0.14	
028820	Tucson International Airport	07	2010	January	28	0.19	
					January 2010 Total Days =		6
028820	Tucson International Airport	07	2010	February	3	0.06	
028820	Tucson International Airport	07	2010	February	7	0.26	
028820	Tucson International Airport	07	2010	February	10	0.31	
028820	Tucson International Airport	07	2010	February	20	0.20	
028820	Tucson International Airport	07	2010	February	22	0.09	
028820	Tucson International Airport	07	2010	February	28	0.97	
					February 2010 Total Days =		6
028820	Tucson International Airport	07	2010	March	7	0.01	
028820	Tucson International Airport	07	2010	March	15	0.01	
028820	Tucson International Airport	07	2010	March	16	0.03	
028820	Tucson International Airport	07	2010	March	23	0.10	
028820	Tucson International Airport	07	2010	March	24	0.02	
					March 2010 Total Days =		5
028820	Tucson International Airport	07	2010	April	22	0.10	
028820	Tucson International Airport	07	2010	April	23	0.13	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
						April 2010 Total Days =	2
028820	Tucson International Airport	07	2010	May	2	0.02	1
						May 2010 Total Days =	1
028820	Tucson International Airport	07	2010	June		---	0
						June 2010 Total Days =	0
028820	Tucson International Airport	07	2010	July	15	0.01	
028820	Tucson International Airport	07	2010	July	17	0.10	
028820	Tucson International Airport	07	2010	July	19	0.15	
028820	Tucson International Airport	07	2010	July	20	0.46	
028820	Tucson International Airport	07	2010	July	21	0.12	
028820	Tucson International Airport	07	2010	July	22	0.51	
028820	Tucson International Airport	07	2010	July	26	0.01	
028820	Tucson International Airport	07	2010	July	27	0.01	
028820	Tucson International Airport	07	2010	July	29	0.40	
028820	Tucson International Airport	07	2010	July	30	0.90	
028820	Tucson International Airport	07	2010	July	31	0.04	
						July 2010 Total Days =	11
028820	Tucson International Airport	07	2010	August	5	0.04	
028820	Tucson International Airport	07	2010	August	7	0.06	
028820	Tucson International Airport	07	2010	August	14	0.02	
028820	Tucson International Airport	07	2010	August	15	0.03	
028820	Tucson International Airport	07	2010	August	16	0.05	
028820	Tucson International Airport	07	2010	August	21	0.08	

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

NATIONAL CLIMATIC DATA CENTER (NCDC) PRECIPITATION DATA - TUCSON, ARIZONA							
COOPID[1]	STATION NAME	CD[2]	YEAR	MONTH	DAY	PRECIPITATION (INCHES)	NUMBER OF DAYS PRECIPITATION AT OR ABOVE 0.01"
028820	Tucson International Airport	07	2010	August	24	1.21	
028820	Tucson International Airport	07	2010	August	26	0.32	
028820	Tucson International Airport	07	2010	August	28	0.23	
						August 2010 Total Days =	9
028820	Tucson International Airport	07	2010	September	3	0.61	
028820	Tucson International Airport	07	2010	September	7	0.08	
028820	Tucson International Airport	07	2010	September	21	0.01	
						September 2010 Total Days =	3
028820	Tucson International Airport	07	2010	October	5	0.23	
028820	Tucson International Airport	07	2010	October	15	0.16	
028820	Tucson International Airport	07	2010	October	21	0.07	
						October 2010 Total Days =	3
028820	Tucson International Airport	07	2010	November		---	0
						November 2010 Total Days =	0
028820	Tucson International Airport	07	2010	December	16	0.08	
028820	Tucson International Airport	07	2010	December	23	0.16	
028820	Tucson International Airport	07	2010	December	29	0.07	
028820	Tucson International Airport	07	2010	December	30	0.15	
						December 2010 Total Days =	4
						NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2010 =	50
						10-YEAR AVERAGE NUMBER OF DAYS WITH AT LEAST 0.01" PRECIPITATION, 2001 - 2010 =	44

(1) NCDC Cooperative Station Number.
(2) NCDC Cooperative Division Number.

ORACLE RIDGE MINING, LLC

PROCESS DESCRIPTIONS

Lyntek INCORPORATED
1550 DOVER ST.
DENVER, CO 80215
PHONE (303) 623.8365
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Oracle Ridge
Lyntek Feasibility Study
Project No. 11005
10/06/11

JOB NO: 11005 SPEC. NO.:

FOR: PROCESS DESCRIPTION – DRAFT – Revision 8

Gold Hawk Resources

Oracle Ridge Mining, LLC

Tucson, Arizona

PREPARED BY: Leslie E. Apodaca	DISCIPLINE: Senior Process Engineer	DATE: 06/29/11
PRIME REVIEW BY:	DISCIPLINE: Engineering Manager	DATE:
TECH.REVIEW BY:	DISCIPLINE: Project Engineer	DATE:
TECH.REVIEW BY: Ed Bentzen	DISCIPLINE: Lead Metallurgical Engineer	DATE: 07/18/11
TECH.REVIEW BY:	DISCIPLINE:	DATE:
PROJ. ENGR APPROV.	TITLE:	DATE:
PROJ MGM. APPROV. BY: Nihal de Mel	TITLE: Project Manager	DATE: 07/15/11
APPROVAL BY: Oracle Ridge Mining, LLC		DATE:

Original document prepared by Les Apodaca was technically reviewed by Ed Bentzen and re-written by N de Mel.					

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INTRODUCTION

AND GENERAL PROCESS DESCRIPTION

1.0 Introduction

This document provides a functional process description for Unit Operations for recovery of the copper, silver, and minor gold values that are present in the Oracle Ridge Mine ore. Oracle Ridge Mine is located in the Old Hat Mining District at Marble Mountain in northern Pima County, Arizona.

Copper is present in the ore as chalcopyrite, bornite, and chalcocite and occurs as finely disseminated grains to massive blobs within fractures, veins or as disseminations in the ore body. Skarn mineralization that occurs at the Oracle Ridge Mining property consists of copper along with gold and silver mineralization as well as the occurrence of magnetite. The copper grade of the ore, on average, will be 2.34% and magnetite, when present, is reported to be in the range of 10% to 20%. The magnetite mineralization will undergo metallurgical testing in order to determine if the magnetite will be economically feasible for recovery and this process will be considered for the future. The silver and gold values, on average, are reported to be 0.82 oz./ton of Ag and 0.010 oz./ton of Au. It is expected that the silver and gold values in the ore will report to the copper concentrate.

The Unit Operations are schematically shown in the Process Flow Diagrams (PFDs) and the preliminary Process Flow Diagrams (PFD's) for this project are listed below:

Drawing No.	Drawing Title
11005-F-01	Oracle Ridge Mining, LLC – CRUSHING FLOWSHEET
11005-F-02	Oracle Ridge Mining, LLC – GRINDING FLOWSHEET
11005-F-03	Oracle Ridge Mining, LLC – ROUGHER & SCAVENGER FLOTATION FLOWSHEET
11005-F-04	Oracle Ridge Mining, LLC – REGRIND MILL & COPPER CLEANER FLOTATION FLOWSHEET
11005-F-05	Oracle Ridge Mining, LLC – COPPER THICKENER & FILTER PRESS FLOWSHEET
11005-F-06	Oracle Ridge Mining, LLC – TAILINGS THICKENER & FILTER PRESS FLOWSHEET
11005-F-09	Oracle Ridge Mining, LLC – WATER STORAGE AND DISTRIBUTION FLOWSHEET
11005-F-10	Oracle Ridge Mining, LLC – PLANT AIR AND FLOTATION AIR DISTRIBUTION FLOWSHEET
11005-F-11	Oracle Ridge Mining, LLC – REAGENT MIXING AND DISTRIBUTION FLOWSHEET
11005-F-12	Oracle Ridge Mining, LLC – MILK-OF-LIME STORAGE & DISTRIBUTION FLOWSHEET
11005-F-13	Oracle Ridge Mining, LLC – OVERALL PLANT WATER BALANCE

The basic premises that will be used during the PFD development include the following:

1.1 Equipment Labeling

The equipment number prefixes will be assigned by functional areas as follows:

100	Crushing and Material Handling
200	Grinding Circuit
300	Flash Flotation Circuit
400	Cu Rougher/Scavenger Flotation Circuit
410	Cu 1st Cleaner Flotation Circuit
420	Cu 1st Cleaner/Scavenger Flotation Circuit
430	Cu 2nd Cleaner Flotation Circuit
440	Cu Thickener/Filtration Circuit
500	Re-grind Ball Mill Grinding Circuit
700	Tailings Thickener/Filtration Circuit
800	Water Systems: Fresh Water, Reclaim, Firewater, Potable Water, Plant Air & Flotation Air Systems
900	Flotation Reagents & Milk-of-Lime Circuits

2.0 ORE CRUSHING & STORAGE

2.1 Crushing

The Oracle Ridge Crushing Circuit will consist of a single-stage Primary Jaw Crushing System that will be located underground in the mine. Feed to the underground Jaw Crushing system will be provided by a Raw Ore Feed System that will transport ROM ore from the various underground mine locations to a Feed Hopper which has a feed grate to capture +18 inches oversize ore. Any oversize ore will be broken down with a hydraulic rock breaker positioned near the Feed Hopper and the vibrating Grizzly Feeder. The Feed Hopper feeds ore to a vibrating Grizzly Feeder with a discharge grate spacing of 8 inches allowing -8 inch ore to by-pass the Primary Jaw Crusher and fall directly onto an Under-crusher Conveyor which in turn will discharge the -8 inch ore onto a Conveyor to convey material to surface. Oversize material (typically -18 inch +8 inch) from the Vibrating Grizzly Feeder will report to the Primary Jaw Crusher for size reduction (jaw setting 5"). Crushed ore is

discharged on to the Under-crusher Conveyor which in turn will discharge material on to the conveyor to the surface. A Stationary Magnet as well as a Metal Detector will be suspended above the crushed ore being conveyed on the Conveyor to Surface for removal of any tramp iron debris as well as any other metallic debris so this material can be removed and not allowed to be discharged onto the Crushed Ore Bin Feed/Tripper Conveyor.

The Oracle Ridge Crushing Circuit is designed to operate for 10 hours per 24 hour day while the Concentrator is designed to operate for a full 24 hour day.

2.2 Ore Storage

The Conveyor to Surface will transport the crushed ore from underground Primary Jaw Crushing System to the Crushed Ore Bin Feed/Tripper Conveyor. The crushed ore from the Crushed Ore Bin Feed/Tripper Conveyor will discharge the crushed ore into each of the three Crushed Ore Storage Bins. Each Crushed Ore Bin will store a different ore that will be processed in the concentrator.

Each Crushed Ore Storage Bin will be equipped with a discharge Apron Feeder equipped with a variable speed drive that will allow the crushed ore to be discharged onto a single Reclaim Tunnel Conveyor that will discharge ore onto the SAG Mill Feed Conveyor to feed the Semi-Autogenous (SAG) Mill. Depending upon the process requirements of the concentrator, it is possible to feed crushed ore from a single Crushed Ore Storage Bin, two Crushed Ore Storage Bins or all three Crushed Ore Storage Bins. Variable speed drives provided in each Apron Feeder will also enable ore from each of the different Crushed Ore Storage Bins to be fed, at different discharge rates to the Reclaim Tunnel Conveyor which feeds a blended ore to the SAG Mill Feed Conveyor.

2.3 Dust Suppression System

The Dust Suppression System will consist of a Fresh Water Tank, Fresh Water Supply Pump, and Spray Water System that will provide fresh water sprays and mists for the ore on the underground Primary Jaw Crusher System and Conveyor to Surface in order to prevent dust particles reporting to the atmosphere. Fresh water sprays and mists will also be provided for the ore carried on the Crushed Ore Bin Feed/Tripper Conveyor to the Crushed Ore Storage Bins that will be located above ground and also the three Apron Feeders and the Reclaim Tunnel Conveyor located inside the Reclaim Tunnel located underneath the Crushed Ore Storage Bins. These water sprays on the ore will be designed to mitigate dust particle generation in the crushing and conveying system as well as at the conveyor transfer points.

3.0 ORE COMMINUTION

3.1 SAG Mill

The SAG Mill Crushing System will be a continuous operation in order to provide ground ore to the Primary Ball Mill and thus to the flotation circuitry. The SAG Mill operates at an initial feed rate of 90.6 STPH (2,000 STPD) of crushed ore.

The SAG Mill Feed Conveyor feeds crushed ore to the SAG Mill. This conveyor will be equipped with a belt scale in order to monitor the weight of ore that will be fed in to the feed chute of the SAG Mill.

The SAG Mill motor will be equipped with a Variable Frequency Drive (VFD) for ease of initially starting of the SAG Mill as well as for allowing the SAG Mill to operate at a reduced tonnage throughput, when required.

The SAG Mill will discharge the minus ½ inch ground ore into the Ball Mill Cyclone Feed Sump where the slurry will be pumped to the Primary Ball Mill Cyclone Circuit in order to remove fine particles from the SAG Mill discharge so these particles do not report as feed to the Primary Ball Mill. The removal of the fines generated by the SAG Mill will prevent over grinding of the minerals in the Ball Mill.

Overflow material (+½" material) from SAG Mill discharge trommel will be discharged into a Trash Bin either for disposal purposes or for return to the SAG Mill feed.

3.2 Primary Ball Mill Cyclones

The Primary Ball Mill Cyclone Circuit will be designed to produce a cyclone overflow particle size of 80% finer than 100 mesh (P_{80} = 100 mesh). The Primary Ball Mill Cyclone Circuit underflow product will flow back to the Primary Ball Mill Feed Chute as re-circulating feed to the Primary Ball Mill. Cyclone overflow will flow by gravity to the Rougher Conditioner Tank. The slurry stream from the cyclone overflow will be sampled with an in-line Flotation Feed Metallurgical Sampler.

3.3 Primary Ball Mill

The Primary Ball Mill with an accompanying Cyclone Circuit is designed to produce ground ore to the downstream Flash Flotation Cell and Rougher/Scavenger Flotation circuit.

The Primary Ball Mill motor will be equipped with a Variable Frequency Drive (VFD) for ease of initially starting of the Primary Ball Mill as well as for allowing the Primary Ball Mill to operate at a reduced tonnage throughput, when required.

The Primary Ball Mill will be equipped with a discharge trommel that will have screen apertures of ½" to separate any trash and oversize particles from the ground ore. The Primary Ball Mill will operate at an initial feed rate of 90.6 STPH (2,000 STPD) in addition to an estimated 250% re-circulating load from the Primary Ball Mill Cyclone Circuit. A Re-Grind Ball Mill with an accompanying Re-Grind Ball Mill Cyclone Circuit will be designed to produce re-ground concentrate from the Flash Flotation Cell and the Rougher/Scavenger Flotation Circuit.

The feed to the Primary Ball Mill will be provided by the underflow of the Primary Ball Mill Cyclone Circuit and will consist of SAG Mill discharge and Flash Flotation discharge. It is estimated that this cyclone underflow product will be at an estimated 250% of the initial nominal feed rate of 90.6 STPH. The slurry discharging from the Primary Ball Mill will flow into the discharge trommel and the ground particles will flow through the trommel apertures to the Flash Flotation Feed Sump while any oversize particles or trash will discharge into the Trash Bin for disposal purposes or for return to the Ball Mill feed. The slurry in the Flash Flotation Feed Sump will be pumped to the Flash Flotation Cell by Flash Flotation Feed Pumps with only one pump operating at any given time.

Water from the Process Water System will be added to the Primary Ball Mill Feed Chute in order to provide the correct % solids by weight in the feed to the Primary Ball Mill.

The Primary Ball Mill Circuit area will be provided with a Grinding Area Sump Pump. Slurry level switches will control the operation of the pump and any slurry spilled from the Primary Ball Mill process will be pumped back into the feed to the Primary Ball Mill.

4.0 FLOTATION

4.1 General Flotation Process Description

Froth flotation is a mineral separation process that will take place in conditioned slurry that is composed of the ground ore that has been mixed with water, reagents and air. Reagents are added to the slurry to make the desired mineral particles hydrophobic (water repellent) that attach to air bubbles. The separation occurs in flotation cells in which the slurry is vigorously stirred and air is dispersed into the flotation cell to mix with the slurry. The hydrophobic (water-repellant) particles will attach themselves to the air bubbles and will float to the surface of the slurry within

the cell where they will form a layer of froth. The froth, now designated as the "concentrate", is collected from the surface of the slurry and will overflow into the adjoining froth concentrate launder. The remaining slurry will flow out of the first cell and into the next cell in the flotation bank for continued froth flotation and froth removal until the remaining slurry exits the flotation bank as "tailings" to be subjected to further treatment or for disposal.

Each of the flotation banks in the Flotation Circuit will have an independent level control system within each given set of cells in the flotation bank as well as at the end of each flotation bank. The slurry levels in each flotation bank must be controlled properly in order to achieve optimum control of the slurry and of the froth within each given set of cells. These level controls can be monitored and adjusted manually at each individual level control system or by monitoring in the Control Room and adjusted via the PLC.

Forced, low pressure air from a blower system will be directed to each flotation bank air header via an air piping system. The forced air is directed from the air header into each individual cell in the flotation bank via flexible piping and is controlled by a manual valve.

The Flotation Circuit area will be provided with a Flotation Area sump pump. Slurry level switches will control the operation of the pump and any fluids or slurries spilled from the Flotation process will be pumped into the Rougher Conditioner.

4.2 Flash Flotation

The Oracle Ridge Flash Flotation System will consist of a single Flash Flotation Cell that will perform an initial flotation process on the discharge from the Primary Ball Mill. The purpose of the Flash Flotation Cell will be to remove relatively coarse Cu particles from the Primary Ball Mill's discharge in order to prevent the over-grinding of these Cu particles.

Initial Primary Ball Mill discharge will be pumped to the Flash Flotation Cell for particle activation and recovery of the coarse Cu particles. Conditioning reagents (collectors such as potassium amyl xanthate or sodium isopropyl xanthate) for the Cu particles will be added to the Flash Flotation Feed Sump or Ball Mill feed in order to condition and activate the Cu particles for flotation. A frothing agent (frothers such as methyl isobutyl carbinol or a glycol frother) will be added to the Flash Flotation Feed Box in order to create stable air bubbles that will attach to the Cu particles so these particles will float to the surface of the Flash Flotation Cell. Water from the Process Water System will be added to the Flash Flotation Feed Sump in order to provide the correct % solids by weight in the feed to the Flash Flotation Cell.

The froth flotation concentrate from the Flash Flotation Cell will discharge into the Flash Flotation Froth Pump to be pumped either to the Cu Concentrate Thickener, if the froth concentrate has a high enough Cu grade, or to the Regrind Ball Mill for further particle size reduction in order to release the Cu particles.

Tailings from the Flash flotation Cell will discharge into the Flash Flotation Tailings sump to be pumped to the Ball Mill Cyclone Feed Sump to join the SAG Mill discharge to be pumped to the Primary Ball Mill Cyclone Circuit that will be designed to produce a cyclone overflow particle size of 80% finer than 100 mesh (P_{80} = 100 mesh). The cyclone circuit underflow will flow back to the Primary Ball Mill Feed Chute

The Flash Flotation Tailings slurry will be pumped to the Ball Mill Cyclone Feed Sump by Flash Flotation Tailings Pumps, with only one pump operating at any given time.

4.3 Rougher Conditioner

The overflow from the Ball Mill Cyclone Circuit will flow by gravity into an agitated Rougher Conditioner Tank. Potassium Amyl Xanthate (PAX) or Sodium Isopropyl Xanthate (SIPX) will be used as a collector that will coat the Cu, Ag, and Au particles to make the particles hydrophobic prior to subjecting the Cu, Ag, and Au particles to the flotation process. The flotation reagents will be added to the conditioner tank via reagent metering pumps and the addition of these reagents will be controlled by manual adjustment of the metering pumps or by adjustment of the metering pumps via the PLC. After a certain mixing time period, as determined by the volume of the conditioning tank and the influent slurry flow, the conditioned slurry will flow by gravity into the Cu Rougher Flotation Cells. The Rougher/Scavenger Flotation System will be used to maximize the recovery of the desired Cu, Ag, and Au minerals.

4.4 Rougher Flotation

The conditioned Cu particles in the slurry from the Rougher Conditioning Tank will flow into the Rougher Flotation Cells in order to be subjected to the flotation process. A frothing reagent will be added to the feedbox of the Rougher Flotation Cells in order to produce stable air bubbles in the slurry. The conditioned hydrophobic (water-repellant) particles will attach themselves to the air bubbles and float to the surface of the cells where they will form a layer of froth. The froth, now designated as the "concentrate", will be skimmed and collected from the surface of the slurry to overflow into the adjoining froth concentrate launders. Water can be added to the froth collection launders to assist with froth flowing within the cell launders. This water flow will be controlled with manually-operated valves.

The Rougher Flotation Cells will be used to recover the major portion of the Cu and precious metals in the Rougher Flotation froth concentrate. The Rougher Flotation froth concentrate will overflow into the Rougher Flotation Froth Pump and will be pumped to the Regrind Mill.

The tailings from Rougher Flotation Cells will flow by gravity into the Scavenger Flotation Cells where additional mineral flotation will occur.

4.5 Scavenger Flotation

The tailings from the Rougher Flotation Cells will flow into the Scavenger Flotation Cells in order to recover any remaining, slow-floating, Cu and precious metals via the flotation process. Additional copper collecting reagent and frothing reagent, if required, will be added to the feedbox of the Scavenger Flotation Cells in order to produce air bubbles in the slurry. As in the Rougher Flotation Cells, any remaining, conditioned hydrophobic (water-repellant) particles will attach themselves to the air bubbles and float to the surface of the Scavenger cells where they will form a layer of froth. The Scavenger Flotation Cells froth will be skimmed and collected from the surface of the slurry to overflow into the adjoining concentrate launders. Water can be added to the froth collection launders to assist with froth flow within the cell launders. This water flow will be controlled with manually-operated valves.

The Scavenger Flotation Cells will be used to recover the remaining, slow-floating Cu and precious metal particles into the Scavenger froth concentrate. The Scavenger Flotation concentrate will overflow into the Scavenger Flotation Froth Pump and will be pumped to the Regrind Mill.

Scavenger flotation tailings slurry will flow through the Metallurgical Sampler prior to reporting to the Scavenger Tailings Sump to be pumped to the Tailings Thickener.

The Scavenger Tailings slurry will be pumped to the Tailings Thickener by Tailings Thickener Feed Pumps, with only one pump operating at any given time.

5.0 RE-GRIND BALL MILL

5.1 Re-Grind Ball Mill System

The Re-Grind Ball Mill System will consist of a Re-Grind Ball Mill with an accompanying Re-Grind Ball Mill Cyclone Circuit that will be designed to produce re-ground flotation concentrate for the downstream Cleaner Flotation Circuit and Cleaner/Scavenger Flotation circuit. The Re-Grind Ball Mill will be sized to re-grind the Flash Flotation concentrate (if required), Rougher Flotation concentrate, and Scavenger Flotation concentrate in addition to an estimated 100% re-circulating load from the Re-Grind Ball Mill Cyclone Circuit. The importance of the Re-Grind Ball

Mill will be to grind the flotation concentrate particles until all gangue material has been released from the desired Cu particles. The Re-Grind Ball Mill will be equipped with a discharge trommel for removal of any trash particles that may occur with the re-ground ore.

The slurry discharging from the Re-Grind Ball Mill will flow into the discharge trommel and the ground particles will discharge thru the trommel openings into the Re-Grind Ball Mill Sump to be pumped to the Re-Grind Ball Mill Cyclone Circuit that will be designed to produce a cyclone overflow particle size of 80% finer than 200 mesh (P_{80} = 200 mesh). Any oversize trash particles in the material flowing to the discharge trommel will discharge into the Re-Grind Ball Mill Trash Bin.

The slurry in the Re-Grind Ball Mill Sump will be pumped to the Re-Grind Ball Mill Cyclone Circuit by Re-Grind Cyclone Feed Pumps, with only one pump operating at any given time.

The Re-Grind Ball Mill Cyclone Circuit will be designed to selectively produce a cyclone overflow particle size of 80% finer than 200 mesh (P_{80} = 200 mesh) as well as recycling the cyclone underflow oversize particles back to the Re-Grind Ball Mill. The cyclone overflow will flow by gravity to the 1st Cleaner Conditioner Tank. The slurry stream from the cyclone overflow will be sampled with the inline 1st Cleaner Flotation Feed Metallurgical Sampler.

Water from the Process Water System will be added to the Re-Grind Ball Mill Sump to dilute the ball mill discharge, as required, as feed to the Re-Grind Ball Mill Cyclone Circuit.

The Re-Grind Ball Mill area will be provided with a Re-Grind Ball Mill area sump pump. Slurry level switches will control the operation of the pump and any fluids or slurries spilled from the Re-Grind Ball Mill process will be pumped into the Re-Grind Ball Mill Sump.

6.0 CLEANER FLOTATION

6.1 1st Cleaner Conditioner

The overflow from the Re-Grind Ball Mill Cyclone Circuit will flow by gravity into the agitated 1st Cleaner Conditioner Tank. Flotation reagents (promoters such as potassium amyl xanthate or sodium isopropyl xanthate) will be added to the 1st Cleaner Conditioner Tank via chemical metering pumps and the addition of these reagents will be controlled by manual adjustments to the dispensing pumps or by adjustments via the PLC. After a certain mixing time period, as determined by the volume of the conditioning tank and the influent slurry flow, the conditioned slurry will then flow by gravity into the 1st Cleaner Flotation Cells and subsequently into the

1st Cleaner/Scavenger Flotation Cells with the froth concentrate from the 1st Cleaner Cells pumped to the 2nd Cleaner Flotation Cells. The Cleaner Flotation System will be used to maximize the recovery of the desired Cu, Ag, and minor Au minerals from the Flash Flotation concentrate, Rougher Flotation concentrate, and Scavenger Flotation concentrate while removing as much of the gangue material as possible.

6.2 1st Cleaner Flotation

The conditioned particles in the slurry from the 1st Cleaner Conditioning Tank will flow into the 1st Cleaner Flotation Cells in order to be subjected to the flotation process. A frothing reagent will be added to the feedbox of the 1st Cleaner Flotation Cells in order to produce air bubbles in the slurry. The conditioned hydrophobic (water-repellant) particles in the slurry will attach themselves to the air bubbles and float to the surface of the cells where they will form a layer of froth. The 1st Cleaner froth, designated as the "concentrate", will be skimmed and collected from the surface of the slurry to overflow into the concentrate launders. Water can be added to the froth collection launders to assist with froth flowing within the cell launders. The 1st Cleaner Flotation concentrate will overflow into the 1st Cleaner Flotation Froth Pump and will be pumped to the 2nd Cleaner Flotation Cells.

The 1st Cleaner Flotation Cells will be used to recover the maximum amount of the Cu and precious metals from the conditioned slurry while removing as much gangue as possible. This froth concentrate will flow into the 1st Cleaner Froth Pump to be pumped to the 2nd Cleaner Flotation Bank.

The tailings from 1st Cleaner Flotation Cells will flow by gravity into the 1st Cleaner/ Scavenger Flotation Cells where additional mineral flotation will occur.

6.3 1st Cleaner/Scavenger Flotation

The tailings from the 1st Cleaner Flotation Cells will flow into the 1st Cleaner/Scavenger Flotation Cells in order to recover any remaining, slow-floating, desired minerals via the flotation process. A frothing reagent, if required, will be added to the feedbox of the 1st Cleaner/Scavenger Flotation Cells in order to produce air bubbles in the slurry. As in the 1st Cleaner Flotation Cells, any remaining, conditioned hydrophobic (water-repellant) particles will attach themselves to the air bubbles and float to the surface of the cells where they will form a layer of froth. The 1st Cleaner/Scavenger Flotation Cells froth will be skimmed and collected from the surface of the slurry to overflow into the concentrate launders. Water can be added to the froth collection launders to assist with froth flowing within the cell launders.

The 1st Cleaner/Scavenger Flotation Cells will be used to recover the remaining, slow-floating Cu and precious metals into the froth concentrate. The 1st Cleaner/Scavenger Flotation concentrate will overflow into the 1st Cleaner/Scavenger

Flotation Froth Pump and will be pumped back to the feedbox of the 1st Cleaner Flotation Cells.

1st Cleaner/Scavenger flotation tailings slurry will flow through the Metallurgical Sampler prior to reporting to the 1st Cleaner/Scavenger Tailings Sump to be pumped either to the Rougher Flotation Conditioner or to the Scavenger Tailings Sump.

The slurry in the 1st Cleaner/Scavenger Tailings Sump will be pumped either to the Rougher Flotation Conditioner or to the Scavenger Tailings Sump by 1st Cleaner/Scavenger Tailings Pumps, with only one pump operating at any given time.

6.4 2nd Cleaner Flotation

The 1st Cleaner Flotation concentrate will be pumped to the 2nd Cleaner Flotation Cells in order to recover the maximum amount of the Cu and precious metals from the 1st Cleaner Flotation concentrate and remove as much of the gangue particles as possible.. A frothing reagent, if required, will be added to the feedbox of the 2nd Cleaner Flotation Cells in order to produce air bubbles in the slurry. The conditioned hydrophobic (water-repellant) particles will attach themselves to the air bubbles and float to the surface of the cells where they will form a layer of froth. The 2nd Cleaner froth will be skimmed and collected from the surface of the slurry to overflow into the concentrate launders. Water can be added to the froth collection launders to assist with froth flowing within the cell launders. The 2nd Cleaner Flotation concentrate will overflow into the 2nd Cleaner Flotation Froth Pump and will be pumped to the Cu Concentrate Thickener.

The tailings from 2nd Cleaner Flotation Cells will be pumped back to the 1st Cleaner Conditioner Tank in order to enhance the recovery of any desired mineral particles that have not been activated to float to the surface of the slurry.

7.0 COPPER CONCENTRATE THICKENING & FILTRATION

7.1 Copper Concentrate Thickener

Copper Concentrate Thickener will be located outside Concentrator building and feed to the Copper Concentrate Thickener will be provided by the 2nd Cleaner Flotation concentrate and also from the Flash Flotation concentrate. The copper concentrate slurry containing silver and gold values will flow through the Cu Metallurgical Sampler and into the Mix Box of the Cu Concentrate Thickener. After the addition of flocculants to the copper concentrate slurry in the Mix Box, the Cu Thickener will operate to allow the flocculated solids to settle to the bottom of the Cu Concentrate Thickener. The thickened slurry, at about 55% to 60% solids by weight, will be pumped to the Underflow Tank, located next to the Thickener, by VFD controlled pumps. The slurry in the Underflow Tank will flow by gravity into Copper Filtration

Surge Tank located near dry Tailings Dam Facility, approximately 1200 feet down hill below the Thickener and Underflow Tank.

Clarified water from the Cu Concentrate Thickener will overflow into the Overflow Sump and pumped uphill to the Reclaim Process Water Tank.

7.2 Copper Concentrate Filter Press

The Cu Concentrate Filter Press is located downhill from Copper Concentrate Thickener at the dry Tailings Dam Facility and receives feed from Copper Filter Surge Tank via Filter Feed Pumps to produce a filter cake that contains 10% to 15% moisture by weight. The filtrate from the Cu filter press operation will flow by gravity to the Cu Filtrate Return Tank and then pumped back to the Reclaim Process Water Tank. The filter cake from each cycle will be discharged into the Cu Concentrate Storage Bin that will be located directly beneath the Cu Concentrate Filter Press.

The Cu Filter Press will be of semi-automatic design which will allow the filter press operator to monitor the proper operation of the filter press. The filter press operator will program the Cu Filter Press PLC to fill the Cu Filter Press which will set in motion the operation of the Cu Filter Feed Pump as well as the operation of the valves that are in the piping of the fill system.

8.0 TAILINGS THICKENING & FILTRATION

8.1 Tailings Thickener

The Tailings Thickener will be located outside Concentrator building and receives Tailings slurry in the Mix Box from Flotation Banks. After the addition of flocculants to the tailings slurry in the Mix Box, the Tailings Thickener will operate to settle the flocculated solids to the bottom of the Tailings Thickener. The thickened Tailings underflow slurry, at about 60% solids by weight, will be pumped to the Tailings Filter Underflow Tank by VFD controlled thickener underflow Pumps. The slurry in the Underflow Tank will flow by gravity into Tailings Filter Surge Tank located near dry Tailings Dam Facility, approximately 1200 feet down hill below the Tailings Thickener and Underflow Tank.

Clarified water from the Tailings Thickener will overflow into the Tailings Thickener Overflow Sump and pumped uphill to the Reclaim Process Water Tank.

8.2 Tailings Filter Press

The Tailings Filter Press is located downhill from Tailings Thickener at the dry Tailings Dam Facility. The Tailings Filter Press receives feed from Tailings Filter

Surge Tank via Tailings Filter Feed Pumps and de-water the tailings slurry to produce a filter cake that contains 10% to 15% moisture by weight and discharge the dry tailings into the Tailings Storage Bin.

The filtrate from the Tailings Filter Press will flow by gravity to the Tailings Filtrate Return Tank and pumped uphill to the Reclaim Process Water Tank.

The Tailings Filter Press will be of semi-automatic design which will allow the filter press operator to monitor the proper operation of the filter press. The filter press operator will program the Tailings Filter Press PLC to fill the Tailings Filter Press which will set in motion the operation of the Tailings Filter Feed Pump as well as the operation of the valves that are in the piping of the fill system.

9.0 REAGENT MAKE-UP AND DISTRIBUTION

9.1 Reagent System

9.1.1 Collector Distribution System

Potassium Amyl Xanthate (PAX) or Sodium Isopropyl Xanthate (SIPX) as a conditioning reagent will be used to condition the sulfide copper minerals in the ore in order for these copper sulfide particles to float in the Flotation Circuit. Potassium Amyl Xanthate (PAX) or Sodium Isopropyl Xanthate (SIPX) will be transferred by hand from bags (xanthate is in a pellet form) to a Bag Breaker System that will automatically open the bag and transfer the xanthate pellets to a vendor-supplied Reagent Mixing/Dilution System. The Bag Breaker System will have a totally-enclosed compartment with a filtration/vent system that will capture any xanthate dust particles. The Reagent Mixing/Dilution System will meter the xanthate in the correct amount into an agitated Xanthate Mix Tank along with fresh water. The mixed Xanthate solution will then be transferred to the Xanthate Day Tank as a diluted, prepared solution ready for use in the flotation process. Xanthate Metering Pumps will be monitored by the PLC in order to pump the xanthate solution from the Day Tank to the Cu Flotation Circuit.

Sodium Hydrosulfide (NaHS) as a conditioning reagent may be used to activate the oxide copper minerals in the ore in order for these copper oxide particles to float in the Flotation Circuit. Sodium Hydrosulfide (NaHS) will be transferred by hand from bags (NaHS is in a crystalline, flake, or powder form) to a Bag Breaker System that will automatically open the bag and transfer the NaHS to a vendor-supplied Reagent Mixing/Dilution System. The Bag Breaker System will have a totally-enclosed compartment with a filtration/vent system that will capture any xanthate dust particles. The Reagent Mixing/Dilution System will meter the NaHS in the correct amount into an agitated NaHS Mix Tank along with fresh

water. The mixed NaHS solution will then be transferred to the NaHS Day Tank as a diluted, prepared solution ready for use in the flotation process. The diluted NaHS solution will be in the amount of about 0.2 to 0.35 lbs./ST in the flotation process. NaHS Metering Pumps will be monitored by the PLC in order to pump the NaHS solution from the Day Tank to the Cu Flotation Circuit.

9.1.2 Frother Distribution System

A mixture of MIBC (90% of total frother used) and Aero Froth 65 (10% of total frother used) will be added to the flotation process. Methyl isobutyl carbinol (MIBC) and Aero Froth 65 (AF 65) will be used as frothing agents that will produce air bubbles in the slurry in the flotation cells. These air bubbles will make contact with the conditioned, hydrophobic Cu, Ag, and Au particles and the particles will attach themselves to the bubbles that will cause the particles to float to the surface of the slurry. MIBC and AF 65 will be supplied in drums that will be located in the Reagent Room or placed near the flotation banks within the concentrator. The MIBC and AF 65 will not be diluted and will be pumped via metering pumps directly to the flotation banks.

9.1.3 Flocculant Distribution System

A flocculant reagent will be used in the Cu Concentrate Thickener and Tailings Thickener to cause individual particles within the concentrate and tailings slurries to coalesce and settle to the bottom of the Concentrate and Tailings Thickeners. The DAF-30 flocculant, in powder form, will be transferred by hand from bags to a vendor supplied Reagent Mixing/Dilution System. The flocculant bags will be placed in a Bag Breaker System that will automatically open the bags and transfer the dry flocculant to a vendor supplied Reagent Mixing/Dilution System. The Bag Breaker System will have a totally-enclosed compartment with a filtration/vent system that will capture any flocculant dust particles.

The Reagent Mixing/Dilution System will meter the flocculant in the correct amount into the agitated Flocculant Mix Tank along with fresh water. The Reagent Mixing/Dilution System will monitor the mixing of the flocculant in the Flocculant Mix Tank until the flocculant has been properly mixed, diluted, and aged. The mixed and diluted flocculant solution will then be transferred to the Flocculant Day Tank as a diluted, prepared solution ready for use in the settling process in the Thickeners.

9.2 Milk-of-Lime Distribution System

Milk-of-Lime may be used throughout the Comminution Circuitry and the Cu Flotation Circuitry in order to adjust the pH of the slurry to enable flotation of the Cu, Ag, and Au particles.

Note: If the pH of the slurry does not require adjustment, milk-of-lime will not be required.

Bulk hydrated lime (CaOH2) will arrive by truck in 1,500 or 2,000 lb. super-sacks and off-loaded from the truck to be stored in the warehouse and near the High Density Lime (Milk-of-Lime) Distribution System.

The High Density Lime (Milk-of-Lime) Distribution System will consist of a Bulk Bag Un-loader, Screw Feeder, Mix Tank, Metering Pump, and System Control Panel.

Metering pumps will pump the high density lime (milk-of-lime) to the required equipment locations in the concentrator.

A System Control Panel that contains a Mass Flow Density Meter will control the operation of the Bulk Bag Un-loader, Screw Feeder, Mix Tank, Valves, and Metering Pump. The High Density Lime (Milk-of-Lime) Distribution System is a complete vendor package that is guaranteed to produce zero emissions into the surrounding atmosphere.

10.0 UTILITIES

10.1 Water Supply

10.1.1 Fresh Water Supply System

The Fresh Water Tank will be filled from fresh water wells at the mine site. Fresh water from the Fresh Water Tank will be pumped and distributed to the following areas of the concentrator and mine site: Crushing Circuit Dust Suppression System, Crushed Ore Dust Suppression System, Reagent Circuit, Gland Water Tank (if required), and Reverse Osmosis (RO) System that will provide potable water for personnel use (drinking, showers, etc.).

10.1.2 Fire Water Supply

The Fire Water Reserve Tank will be filled by fresh water wells. This tank supplies water to fire fighting piping system and hydrants that will be located throughout the concentrator site. A diesel-powered back-up pump will also be connected to the Fire Water reserve Tank piping system in case there is a power outage and fire water is required at the mine site.

10.1.3 Reclaim Process Water Supply

The Reclaim Process Water Tank will obtain water from the following water sources: Cu Concentrate Thickener Overflow, Tailings Thickener Overflow, Tailings Filtrate Return Tank, Underground Mine water and the Fresh Water

Pumps (if required). Process water from the Reclaim Process Water Tank will be pumped and distributed to the following areas of the concentrator and mine site: SAG Mill Circuit, Primary Ball Mill Circuit, Re-Grind Ball Mill Circuit, Flotation Circuit, Milk-of-Lime Circuit, and high pressure Wash Water Circuit.

10.1.4 Gland Water Supply

The Gland Water Tank will be filled by water from the Fresh Water Tank through a Duplex Filter system. The Gland Water Tank will provide water for the all of the shaft seals on all of the pumps that require seal water.

10.1.5 Potable Water Supply

Fresh water from Fresh Water will be pumped through a RO plant and pumped out for drinking water needs and for personnel showering and emergency shower requirements.

10.2 Air Supply

Dual air compressors (one operating and one standby) with Wet Air Receivers and a Plant Air Dryer and Dry Air Receiver will be mounted in a separate room within the concentrator building to facilitate noise suppression when the compressors are in operation. Both air compressors will be air-cooled. Air from the Wet Air receiver will be distributed to the plant air header to be directed to the desired equipment and equipment areas. Air from the Dry Air receiver will be distributed to the plant Instrumentation and Control purposes.

Two Air compressors complete with Air Dryer and Air Receivers and will be provided in the existing Dry Tailings Facility. These units will be installed in a small building for weather protection. Both air compressors will be air-cooled and controlled by local control by a plant operator. Air from these Air Compressors will be distributed to the air header to be directed to the Cu Concentrate Filter Press and the Tailings Filter Press for blowing out Filter Cake.

11.0 Diesel and Gasoline Storage & Distribution

Diesel and Gasoline will be delivered by truck and transferred into the Diesel and Gasoline Storage Tanks that will be located near the concentrator and Dry Tailings Facility. Diesel and gasoline from the Diesel and Gasoline Storage Tanks will be pumped to the various vehicles as required.

12.0 Fugitive Dust Particles and Gases

12.1 Water Spray

To mitigate the release of dust particles into the atmosphere, fresh water will be sprayed on the ore at strategic points in the Crushing Circuit Dust Suppression System and Crushed Ore Dust Suppression System where dry ore is either being crushed, conveyed or transferred in order to mitigate the release of dust particles into the atmosphere.

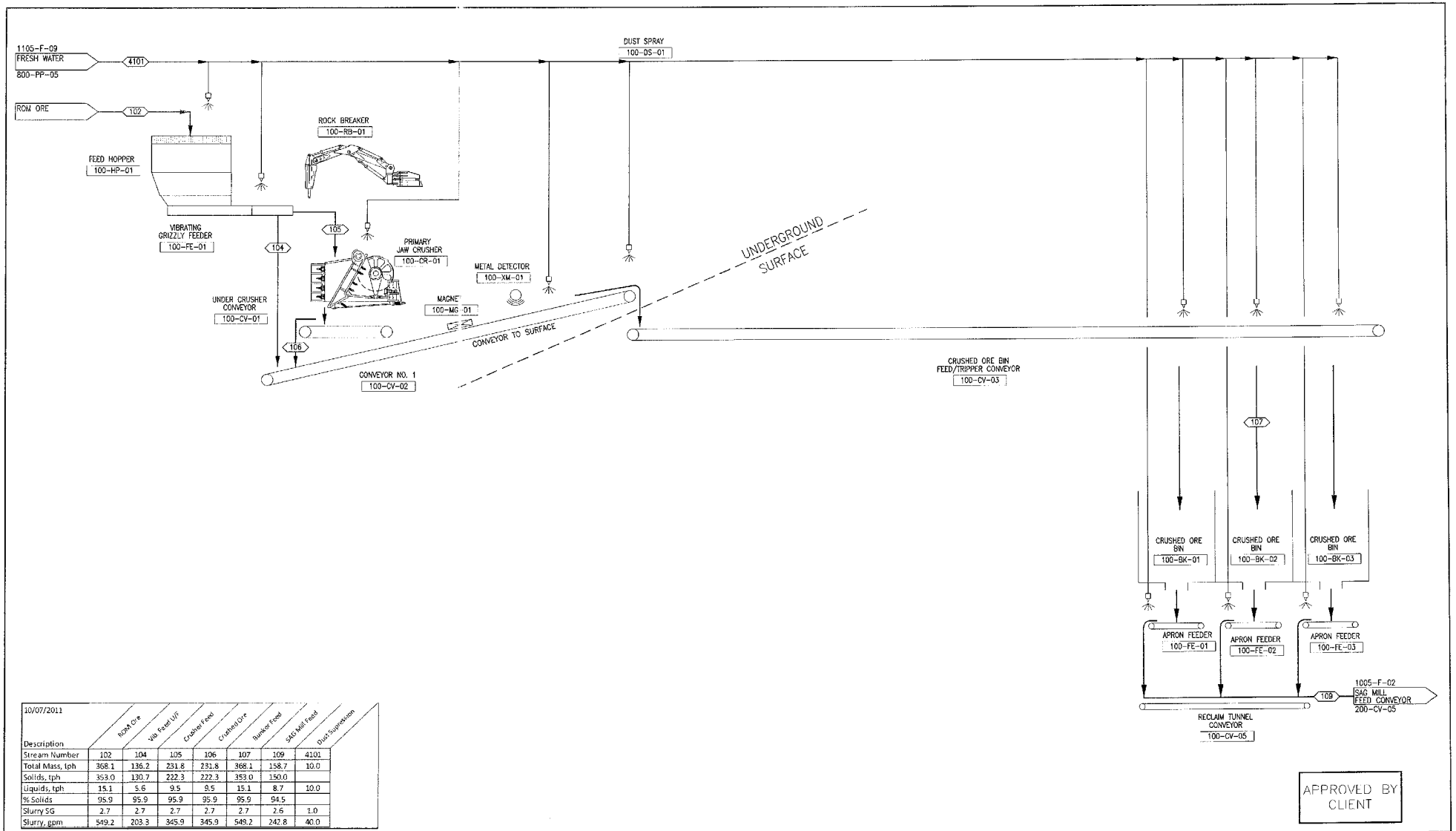
12.2 Air Circulation

The Concentrator building will be equipped with a forced draft air circulation system to provided 4 to 6 air changes per hour. The Reagent storage and mixing room in the concentrator will also be equipped with a Ventilation System to provide 4 to 6 air changes per hour to purge any fugitive reagent dust particles or off-gases.

The Metallurgical Laboratory will also be equipped with a Ventilation System in order to capture any fugitive dust particles or off-gases resulting from processing ore samples.

ORACLE RIDGE MINING, LLC

PROCESS FLOW DIAGRAMS



APPROVED BY CLIENT

10/07/2011

Description	ROM Ore	Vib Feed U/F	Crusher Feed	Crushed Ore	Bunker Feed	SAG Mill Feed	Dust Suppression
Stream Number	102	104	105	106	107	109	4101
Total Mass, tph	368.1	136.2	231.8	231.8	368.1	158.7	10.0
Solids, tph	353.0	130.7	222.3	222.3	353.0	150.0	
Liquids, tph	15.1	5.6	9.5	9.5	15.1	8.7	10.0
% Solids	95.9	95.9	95.9	95.9	95.9	94.5	
Slurry SG	2.7	2.7	2.7	2.7	2.7	2.6	1.0
Slurry, gpm	549.2	203.3	345.9	345.9	549.2	242.8	40.0

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE
		I	ISSUE FOR REVIEW	OC	JIK	07/OCT/11

NO	REVISIONS	BY	APP	DATE
H	ISSUED FOR AIR PERMITTING	OC	JIK	06/OCT/11
G	ISSUED FOR AIR PERMITTING	CS	JIK	28/SEPT/11
F	ISSUED FOR CLEINT REVIEW	CS	NdM	13/SEPT/11
E	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
D	ISSUED FOR CLIENT APPROVAL	OC	NdM	11/JUL/11
C	STREAM NUMBERS ADDED & SHEET RENUMBERED	CS	NdM	16/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
A	ISSUE FOR CLIENT REVIEW	CS	JIK	25/APR/11

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LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

CRUSHING FLOWSHEET

DATE.TIME LAST MODIFIED	DRAWING NO.	REV.
07 OCT 2011 - 1428	11005-F-01	1

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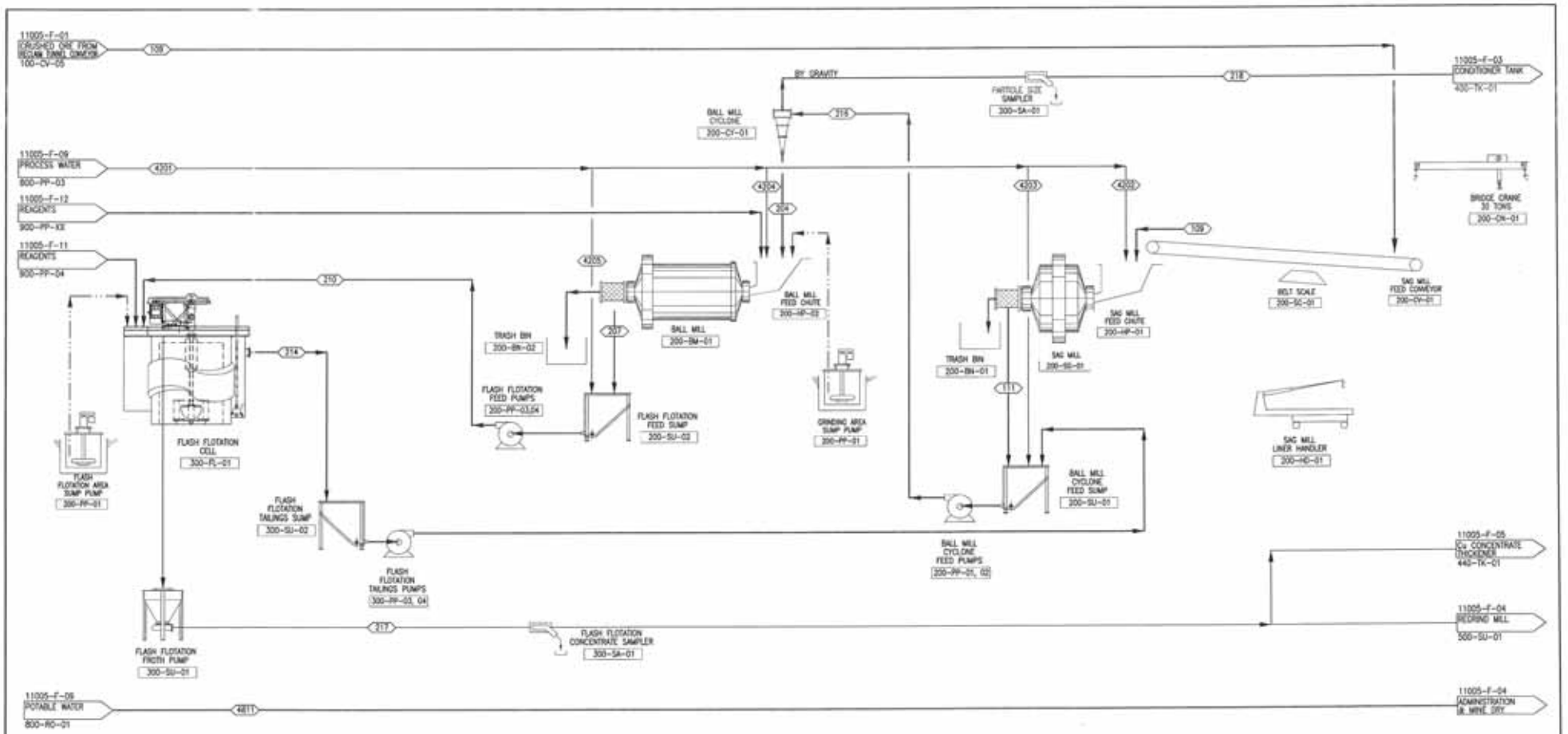

10/06/2011 Description	SAG Mill Feed	SAG Mill Discharge	Cyclone O/F	Ball Mill Discharge	Flash Flot. Feed	Flash Flot. Tails	Cyclone Feed	Flash Flot. Conc.	Cyclone O/F	Process Water Grinding	SAG Dilution Water	SAG Discharge Dilution	Ball Dilution Water	Ball Discharge Dilution	Admin & Mine Dry Water
Stream Number	109	111	204	207	210	214	216	217	218	4201	4202	4203	4204	4205	4811
Total Mass, tph	158.7	200.0	563.7	544.0	711.9	702.9	904.4	9.5	360.7	207.7	41.3			166.4	0.4
Solids, tph	150.0	150.0	369.4	369.4	369.4	367.2	517.2	2.3	147.8	0.0	0.0			0.0	
Liquids, tph	8.7	50.0	174.3	174.6	342.5	335.7	387.2	7.3	213.0	207.7	41.3			166.4	0.4
% Solids	94.5	75.0	67.9	67.9	51.9	52.2	57.2	23.7	41.0	0.0	0.0	0.0	0.0	0.0	
Slurry SG	2.6	2.0	1.8	1.8	1.5	1.5	1.6	1.2	1.4	1.0	1.0	1.0	1.0	1.0	1.0
Slurry, gpm	242.8	407.9	1,210.5	1,211.9	1,888.7	1,854.1	2,268.0	31.6	1,057.3	830.9	165.1			665.8	1.7

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE

NO	REVISIONS	BY	APP	DATE
F	ISSUED FOR CLIENT REVIEW	CS	NWM	13/SEPT/11
E	ISSUED FOR PERMITTING	CS	NWM	09/SEPT/11
D	ISSUED FOR CLIENT APPROVAL	DC	NWM	11/JUL/11
C	STREAM NUMBERS ADDED/SHEET RENUMBERED	CS	NWM	16/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
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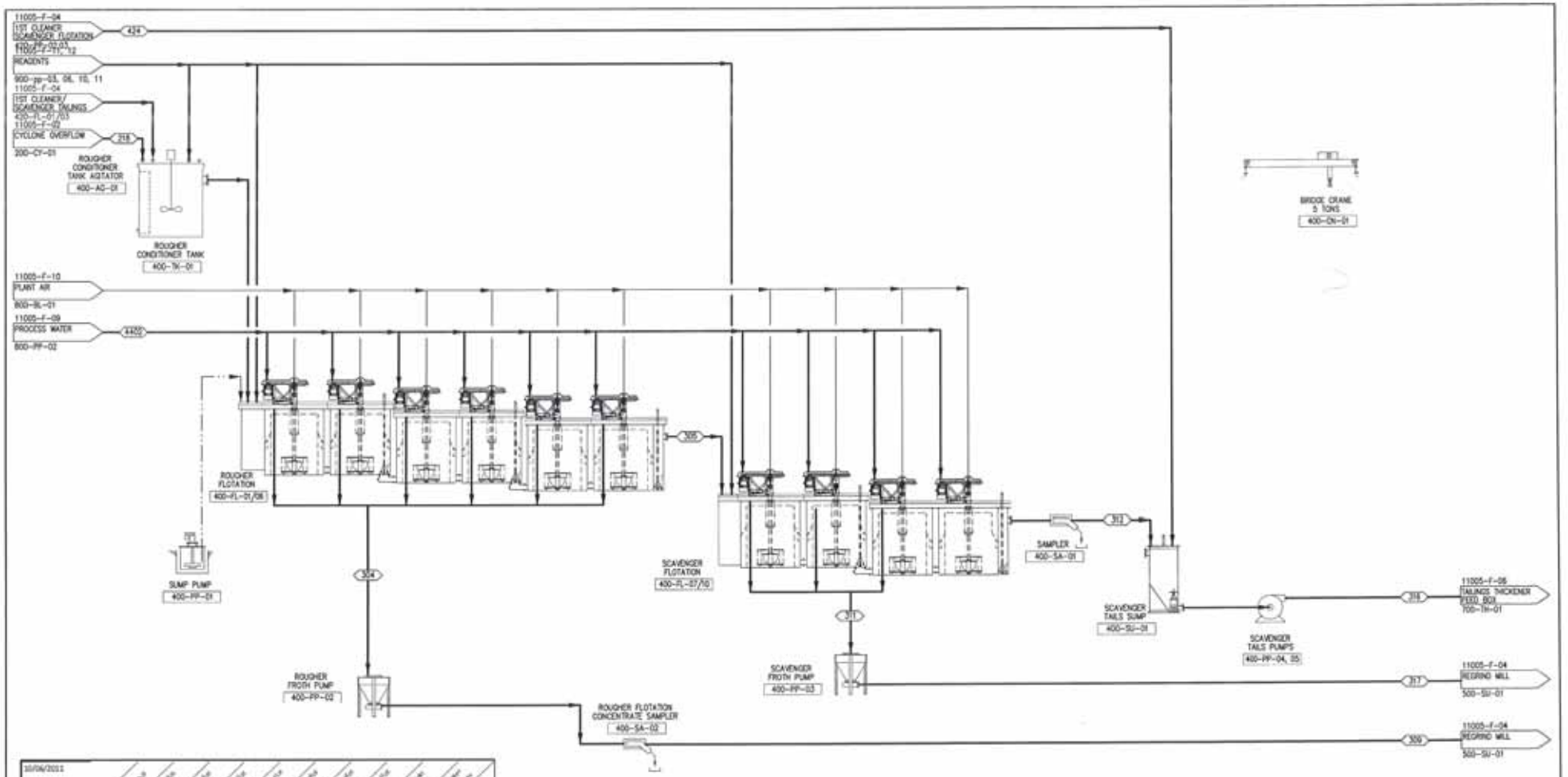
LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

GRINDING FLOWSHEET

DATE TIME LAST MODIFIED	DRAWING NO.	REV.
13 SEP 2011 1300	11005-F-02	G

SCALE: (D) N.T.S.



10/06/2011 Description	Stream Number	Total Mass, tph	Solids, tph	Liquids, tph	% Solids	Slurry SG	Slurry, gpm
Rougher Feed Liq.	218	360.7	147.8	212.9	41.0	1.4	1,057.5
Rougher Feed Solids	304	64.5	14.4	50.0	22.4	1.2	217.3
Rougher Feed Total	305	303.0	133.3	169.7	44.0	1.4	867.2
Rougher Tails Liq.	309	64.5	14.4	50.0	22.4	1.2	217.3
Rougher Tails Solids	311	8.3	1.9	6.4	22.7	1.2	27.4
Rougher Tails Total	312	297.0	131.4	165.6	44.3	1.4	869.0
Scavenger Feed Liq.	316	298.5	131.4	167.1	44.0	1.4	895.0
Scavenger Feed Solids	317	8.3	1.9	6.4	22.7	1.2	27.4
Scavenger Feed Total	424	52.8	7.3	45.1	14.7	1.1	230.6
Scavenger Tails Liq.	4402	7.5		7.5	0.0	1.0	30.3
Rougher Feed Total							
Process Water Add'l Flow							

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DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE

NO	REVISIONS	BY	APP	DATE
H	ISSUED FOR CLIENT REVIEW	OC	NWM	06/OCT/11
G	ISSUED FOR CLIENT REVIEW	CS	NWM	13/SEPT/11
F	ISSUED FOR PERMITTING	CS	NWM	09/SEPT/11
E	ISSUED FOR CLIENT APPROVAL	OC	NWM	11/JUL/11
D	STREAM NUMBERS ADDED & SHEET RENUMBERED	CS	NWM	16/JUN/11
C	ISSUE FOR CLIENT REVIEW	CS	JJK	08/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JJK	25/APR/11
A	ISSUE FOR CLIENT REVIEW	CS	JJK	23/MAR/11

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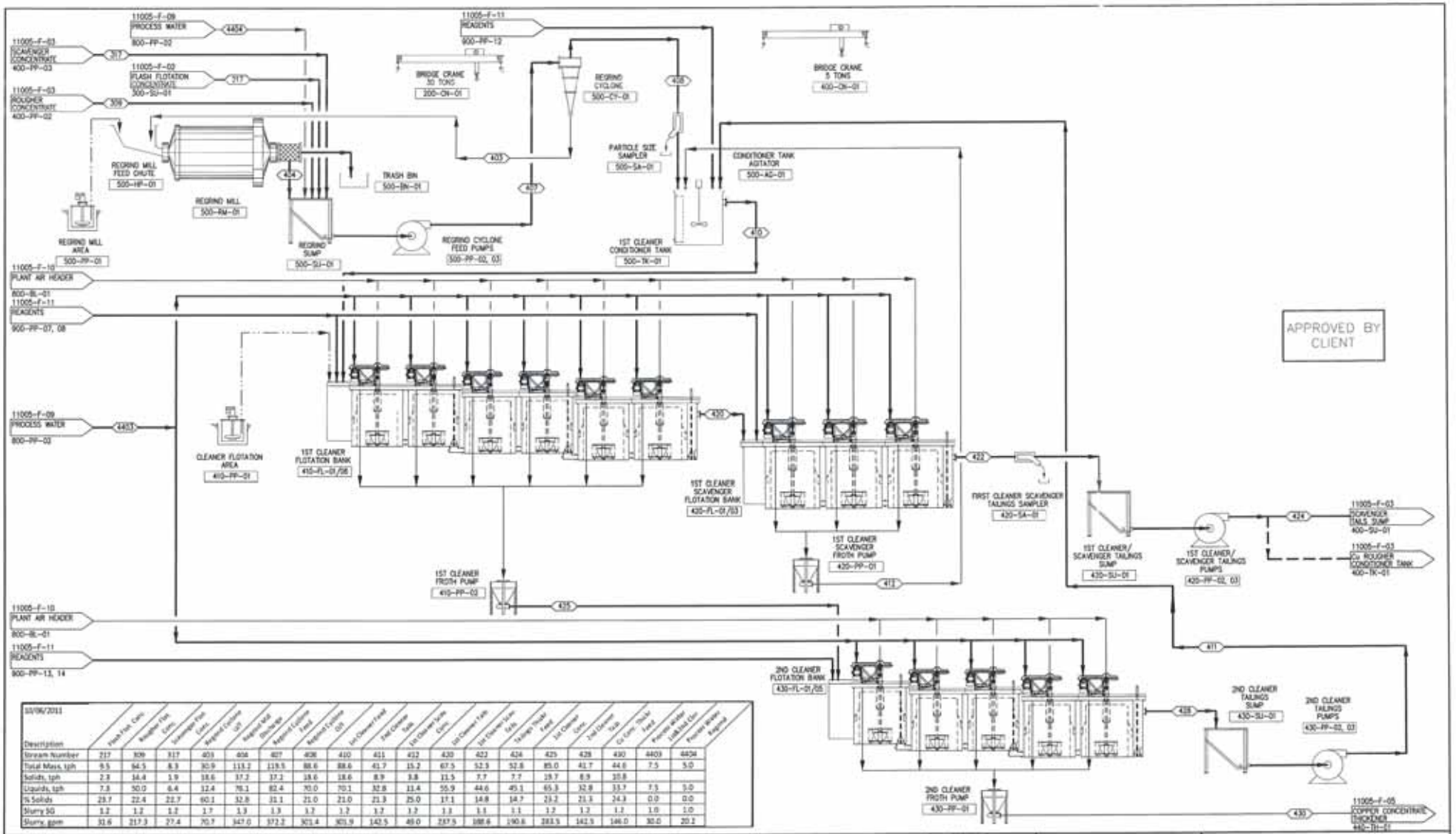
ORACLE RIDGE MINING, LLC

ROUGHER & SCAVENGER FLOTATION FLOWSHEET

DATE,TIME LAST MODIFIED	DRAWING NO.	REV.
13 SEPT 2011 1100	11005-F-03	H

SCALE: (S) N.T.S.



10/06/2011 Description	Flash Flot. Conc.	Rougher Flot. Conc.	Scavenger Flot. Conc.	Regrind Cyclone U/F	Regrind Mill Discharge	Regrind Cyclone Feed	Regrind Cyclone O/F	1st Cleaner Feed	2nd Cleaner Scale	1st Cleaner Scale Conc.	1st Cleaner Tails	1st Cleaner Scale Scale	Storage Thickener Feed	1st Cleaner Conc.	2nd Cleaner Scale	Cu Conc. Thicker Feed	Process Water Inlet Rougher Clnr	Process Water Regrind
Stream Number	217	309	317	403	404	407	408	410	411	412	420	422	424	425	428	430	4403	4404
Total Mass, tph	9.5	64.5	8.3	30.9	113.2	119.5	88.6	88.6	41.7	15.2	67.5	52.3	52.8	85.0	41.7	44.6	7.5	5.0
Solids, tph	2.3	16.4	1.9	18.6	37.2	37.2	18.6	18.6	8.9	3.8	11.5	7.7	7.7	19.7	8.9	10.8		
Liquids, tph	7.3	50.0	6.4	12.4	75.1	82.4	70.0	70.1	32.8	11.4	55.9	44.6	45.1	65.3	32.8	33.7	7.5	5.0
% Solids	23.7	22.4	22.7	60.1	32.8	31.1	21.0	21.0	21.3	25.0	17.1	14.8	14.7	23.2	21.1	24.3	0.0	0.0
Slurry SG	1.2	1.2	1.2	1.7	1.3	1.3	1.2	1.2	1.2	1.2	1.1	1.1	1.1	1.2	1.2	1.2	1.0	1.0
Slurry, gpm	31.6	217.3	27.4	70.7	347.0	372.2	301.4	301.9	142.5	49.0	237.5	188.6	190.6	283.5	142.5	146.0	30.0	20.2

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE
		H	ISSUED FOR CLIENT REVIEW	DC	NdM	06/OCT/11
		G	ISSUED FOR CLIENT REVIEW	CS	NdM	13/SEPT/11
		F	ISSUED FOR PERMITTING	CS	NdM	08/SEPT/11
		E	ISSUED FOR CLIENT APPROVAL	CS	NdM	23/JUN/11
		D	STREAM NUMBERS ADDED & SHEET RENUMBERED	CS	NdM	16/JUN/11
		C	ISSUE FOR CLIENT REVIEW	CS	JK	08/JUN/11
		B	ISSUE FOR CLIENT REVIEW	CS	JK	25/APR/11
		A	ISSUE FOR CLIENT REVIEW	CS	JK	23/MAR/11

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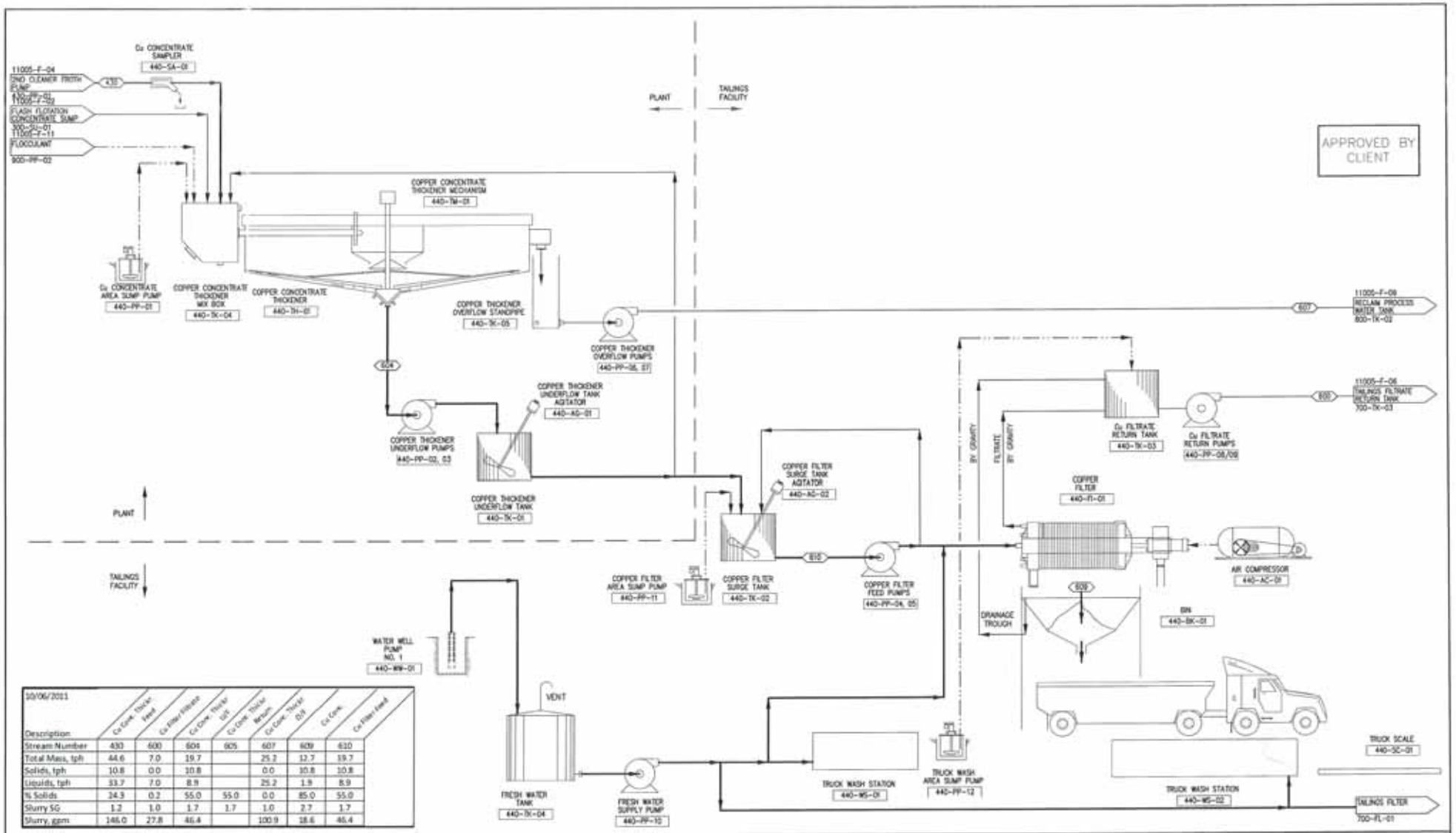
LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

REGRIND MILL & COPPER CLEANER FLOTATION FLOWSHEET

DATE, TIME LAST MODIFIED	DRAWING NO.	REV.
13 SEPT 2011 1100	11005-F-04	H

SCALE: (0) N.T.S.



10/06/2011

Description	Cu Conc. Thicker Feed	Cu Filter Filtrate	Cu Conc. Thicker U/F	Cu Conc. Thicker O/F	Cu Conc. Thicker Return	Cu Conc. Thicker O/F	Cu Conc.	Cu Filter Feed
Stream Number	430	600	604	605	607	609	610	
Total Mass, tph	44.6	7.0	19.7		25.2	12.7	19.7	
Solids, tph	10.8	0.0	10.8		0.0	10.8	10.8	
Liquids, tph	33.7	7.0	8.9		25.2	1.9	8.9	
% Solids	24.3	0.2	55.0	55.0	0.0	85.0	55.0	
Slurry SG	1.2	1.0	1.7	1.7	1.0	2.7	1.7	
Slurry, gpm	146.0	27.8	46.4		100.9	18.6	46.4	

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE

NO	REVISIONS	BY	APP	DATE
H	ISSUED FOR AIR PERMITTING	OC	LA	06/OCT/11
G	ISSUED FOR AIR PERMITTING	CS	JK	28/SEPT/11
F	ISSUED FOR CLIENT REVIEW	CS	NdM	13/SEPT/11
E	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
D	ISSUED FOR CLIENT APPROVAL	OC	NdM	11/JUL/11
C	ISSUE FOR CLIENT REVIEW	CS	JK	06/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JK	25/APR/11
A	ISSUE FOR CLIENT REVIEW	CS	JK	22/MAR/11

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ENGINEER	L. APODACA	
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PROCESS CHECK		
MECH. CHECK		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
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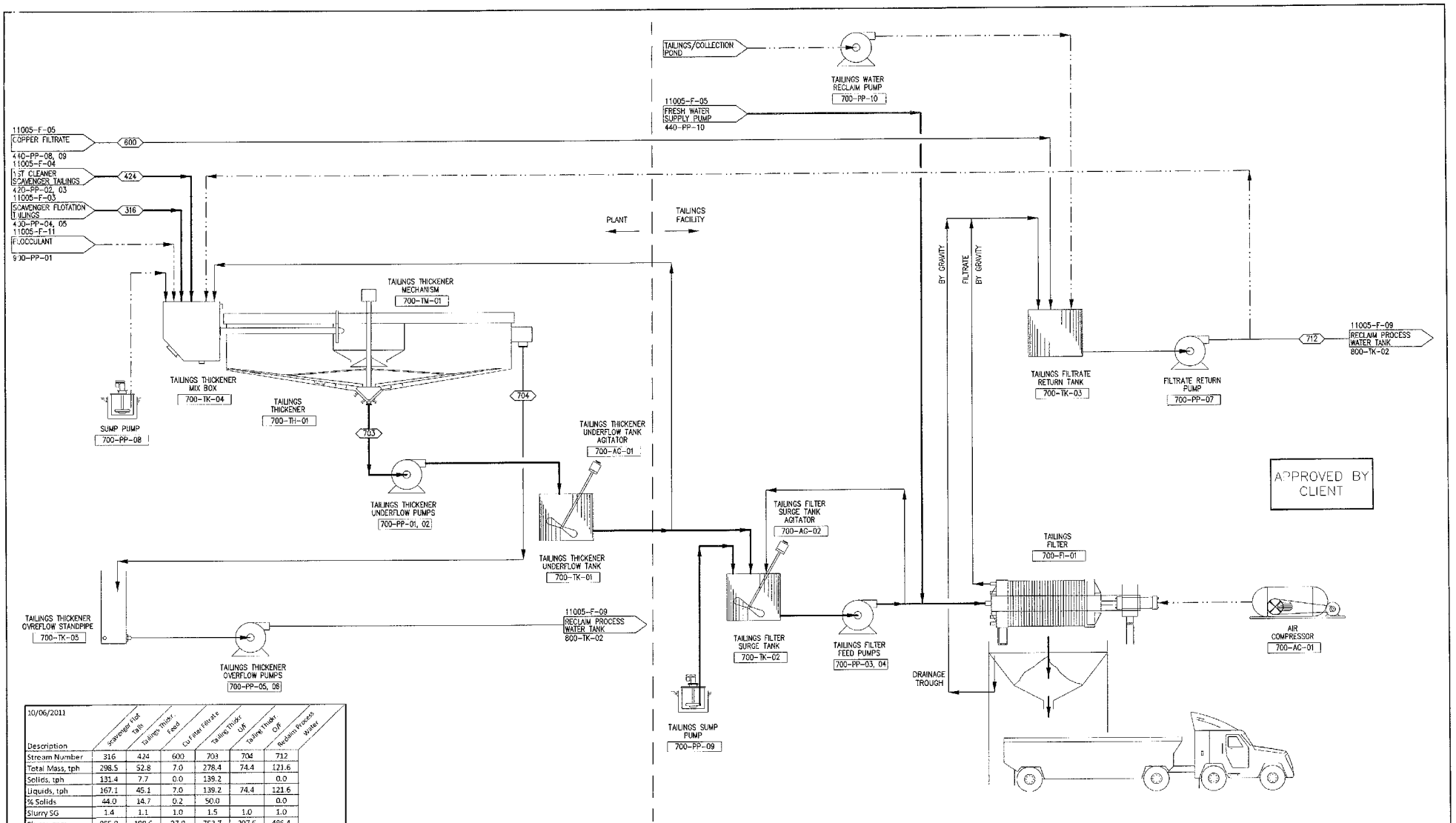
LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

COPPER THICKENER & FILTER PRESS FLOWSHEET

DATE/TIME LAST MODIFIED	DRAWING NO.	REV.
06 OCT 2011 – 10:40	11005-F-05	H

SCALE: (S) N.T.S.



10/06/2011

Description	Scavenger Flot	Talls	Tailings Thicker Feed	Cu Filter Filtrate	Tailing Thicker O/F	Tailing Thicker O/F	Reclaim Process Water
Stream Number	316	424	600	703	704	712	
Total Mass, tph	298.5	52.8	7.0	278.4	74.4	121.6	
Solids, tph	131.4	7.7	0.0	139.2		0.0	
Liquids, tph	167.1	45.1	7.0	139.2	74.4	121.6	
% Solids	44.0	14.7	0.2	50.0		0.0	
Slurry SG	1.4	1.1	1.0	1.5	1.0	1.0	
Slurry, gpm	855.0	190.6	27.8	753.7	297.6	486.4	

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE	NO	REVISIONS	BY	APP	DATE
		I	ISSUE FOR CLIENT REVIEW	OC	JIK	06/OCT/11	H	ISSUED FOR AIR PERMITTING	CS	JIK	28/SEPT/11
							G	ISSUED FOR CLEINT REVIEW	CS	NdM	13/SEPT/11
							F	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
							E	ISSUED FOR CLIENT APPROVAL	OC	NdM	11/JUL/11
							D	STREAM NUMBERS ADDED	CS	NdM	16/JUN/11
							C	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
							B	ISSUE FOR CLIENT REVIEW	CS	JIK	25/APR/11
							A	ISSUE FOR CLIENT REVIEW	CS	JIK	23/MAR/11

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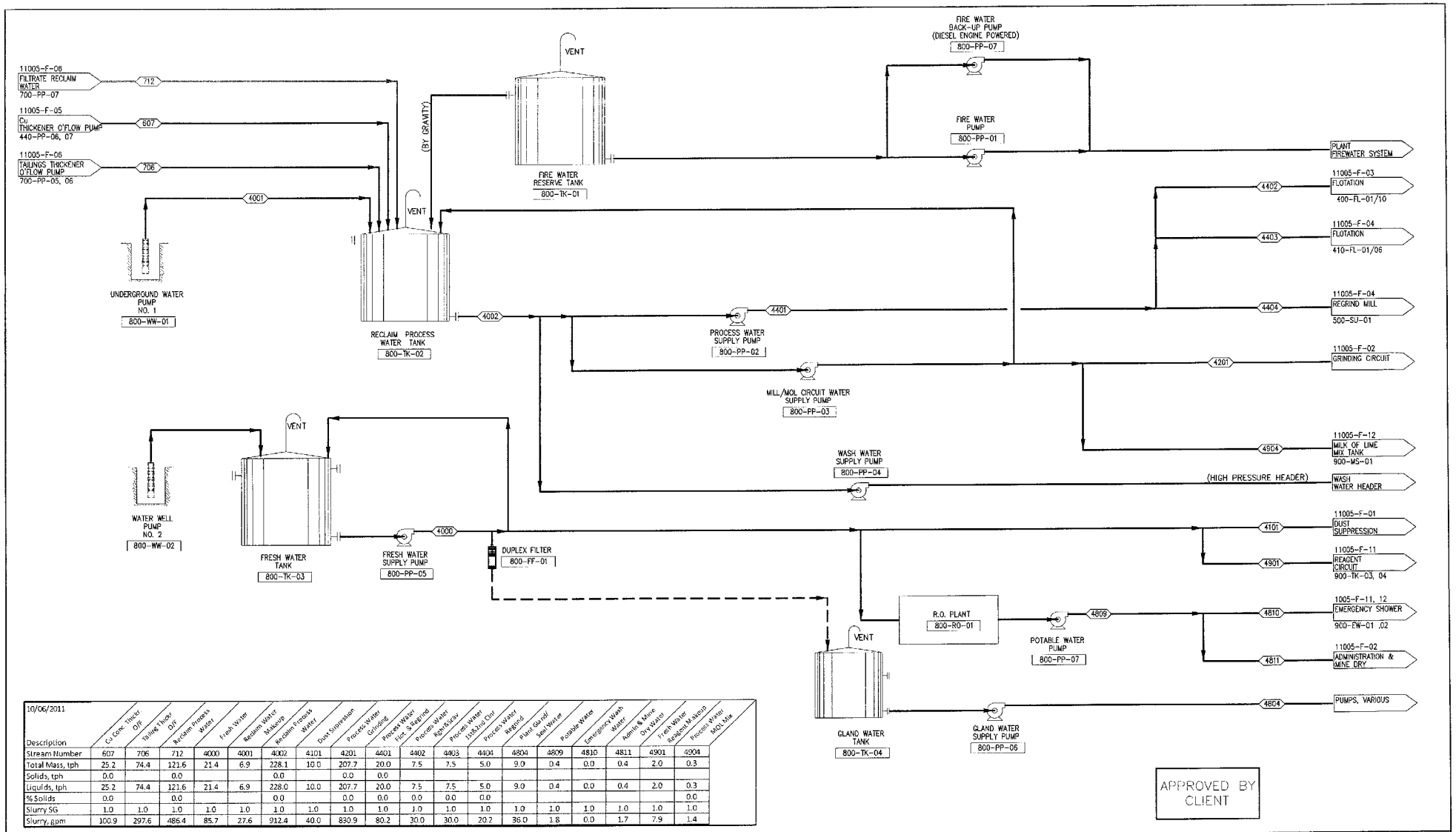
LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

TAILINGS THICKENER & FILTER PRESS FLOWSHEET

DATE,TIME LAST MODIFIED	DRAWING NO.	REV.
28 SEPT 2011 0900	11005-F-06	I

SCALE: (D) N.T.S.



10/06/2011 Description	Cu Conc. Thickener O/F	Tailing Thickener O/F	Reclaim Process Water	Fresh Water	Reagents Water Makeup	Reclaim Process Water	Dust Suppression	Process Water Grinding	Process Water Flot. & Regrind	Process Water Rgh/Scav	Process Water 1st&2nd Clnr	Process Water Regrind	Plant Gland Seal Water	Potable Water	Emergency Wash Water	Aspirin & Mine Dry Water	Fresh Water Reagent Makeup	Process Water MOL Mix
Stream Number	607	706	712	4000	4001	4002	4101	4201	4401	4402	4403	4404	4804	4809	4810	4811	4901	4904
Total Mass, tph	25.2	74.4	121.6	21.4	6.9	228.1	10.0	207.7	20.0	7.5	7.5	5.0	9.0	0.4	0.0	0.4	2.0	0.3
Solids, tph	0.0		0.0			0.0		0.0	0.0									
Liquids, tph	25.2	74.4	121.6	21.4	6.9	228.0	10.0	207.7	20.0	7.5	7.5	5.0	9.0	0.4	0.0	0.4	2.0	0.3
% Solids	0.0		0.0			0.0		0.0	0.0	0.0	0.0	0.0						0.0
Slurry SG	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Slurry, gpm	100.9	297.6	486.4	85.7	27.6	912.4	40.0	830.9	80.2	30.0	30.0	20.2	36.0	1.8	0.0	1.7	7.9	1.4

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DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE

NO	REVISIONS	BY	APP	DATE
G	ISSUED FOR CLEINT REVIEW	OC	NdM	06/OCT/11
F	ISSUED FOR CLEINT REVIEW	CS	NdM	13/SEPT/11
E	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
D	ISSUED FOR CLIENT APPROVAL	CS	NdM	11/JUL/11
C	STREAM NUMBERS ADDED	CS	NdM	15/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
A	ISSUE FOR CLIENT REVIEW	CS	JIK	26/APR/11

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ENGINEER	L. APODACA	
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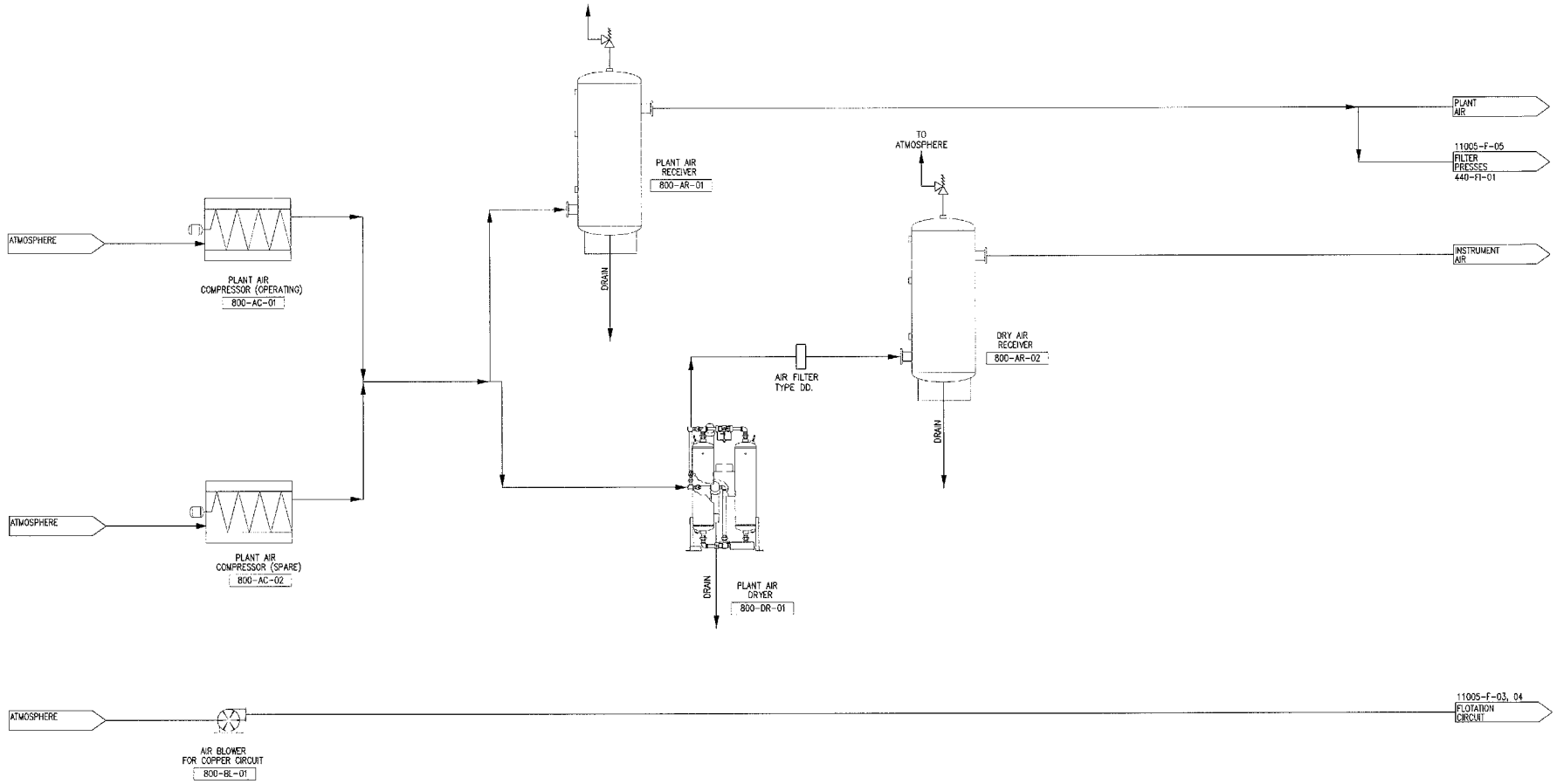
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

WATER STORAGE & DISTRIBUTION FLOWSHEET

DATE.TIME LAST MODIFIED	DRAWING NO.	REV.
13 SEPT 2011 1100	11005-F-09	G
SCALE: (D) N.T.S.		



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DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE	NO	REVISIONS	BY	APP	DATE
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							F	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
							E	ISSUED FOR CLIENT APPROVAL	OC	NdM	11/JUL/11
							D	ISSUED FOR CLIENT APPROVAL	CS	NdM	23/JUN/11
							C	ISSUED FOR CLIENT APPROVAL	CS	NdM	16/JUN/11
							B	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
							A	ISSUE FOR CLIENT REVIEW	CS	JIK	26/APR/11

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ENGINEER	L. APODACA	
DRAWN BY	C.SPICER	26/APR/11
P.M. CHECK	N. DE MEL	
PROCESS CHECK		
MECH. CHECK		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

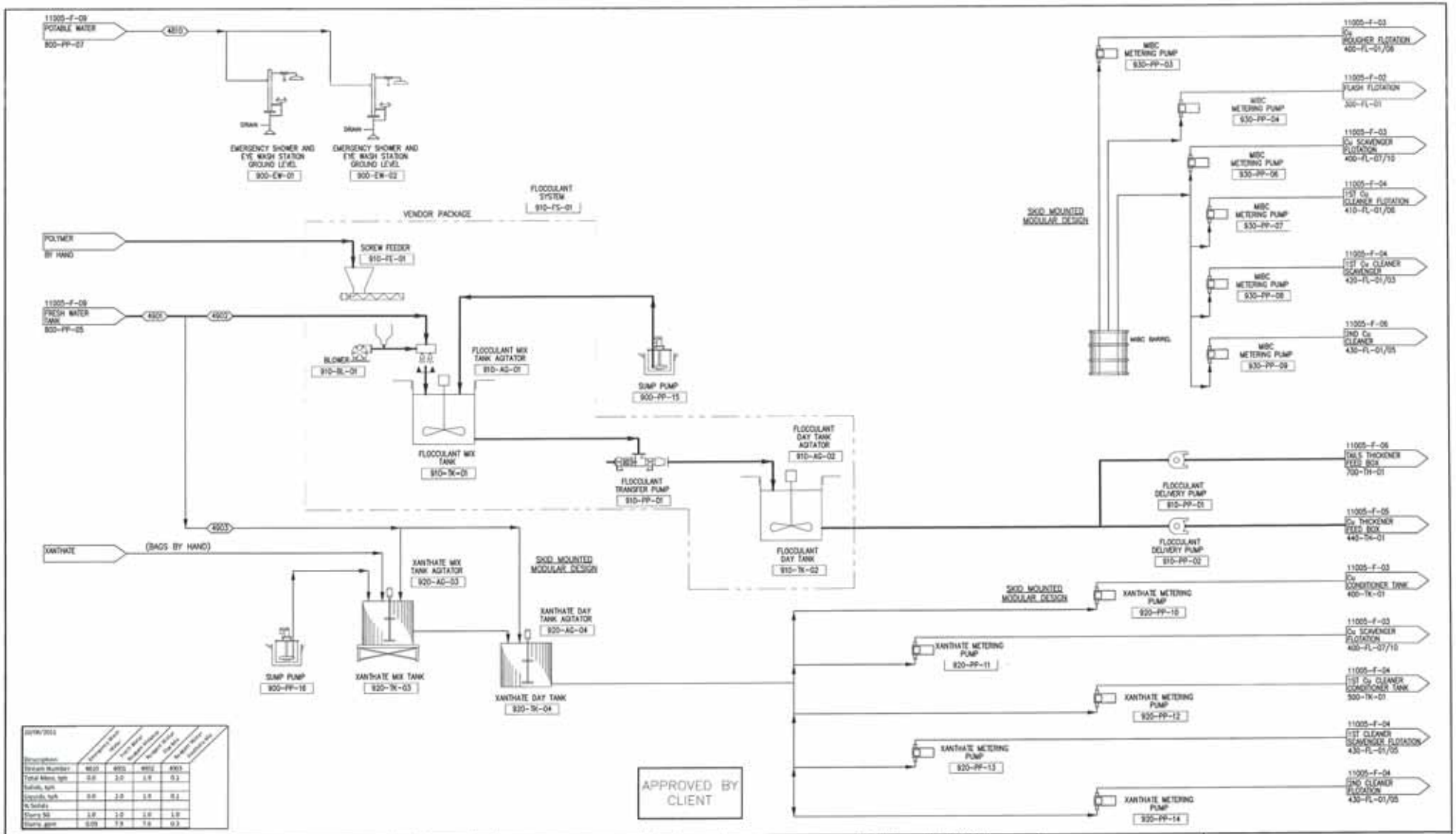
LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

PLANT AIR & FLOTATION AIR DISTRIBUTION FLOWSHEET

DATE.TIME LAST MODIFIED	DRAWING NO.	REV.
23 JUN 2011 0900	11005-F-10	G

SCALE: (D) N.T.S.



22/06/2011	Emergency Shower Water	Fresh Water Reagent Dilution	Reagent Dilution Fresh Water	Reagent Dilution Recycled Water
Description				
Stream Number	4010	4001	4002	4003
Total Mass, tph	0.0	2.0	1.9	0.1
Solids, tph				
Liquids, tph	0.0	2.0	1.9	0.1
% Solids				
Slurry Mt	1.0	1.0	1.0	1.0
Slurry, gpm	0.09	7.9	7.6	0.3

DRAWING NO.	REFERENCE DRAWING TITLE	NO.	REVISIONS	BY	APP.	DATE

NO	REVISIONS	BY	APP.	DATE
G	ISSUED FOR CLIENT REVIEW	DC	NdM	06/OCT/11
F	ISSUED FOR CLIENT REVIEW	CS	NdM	13/SEPT/11
E	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
D	ISSUED FOR CLIENT APPROVAL	DC	NdM	11/JUL/11
C	ISSUED FOR CLIENT APPROVAL	CS	NdM	15/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
A	ISSUE FOR CLIENT REVIEW	CS	JIK	28/APR/11

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ENGINEER	L. APODACA	
DRAWN BY	C.SPICER	28/APR/11
P.M. CHECK	N. DE MIL	
PROCESS CHECK		
MECH. CHECK		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

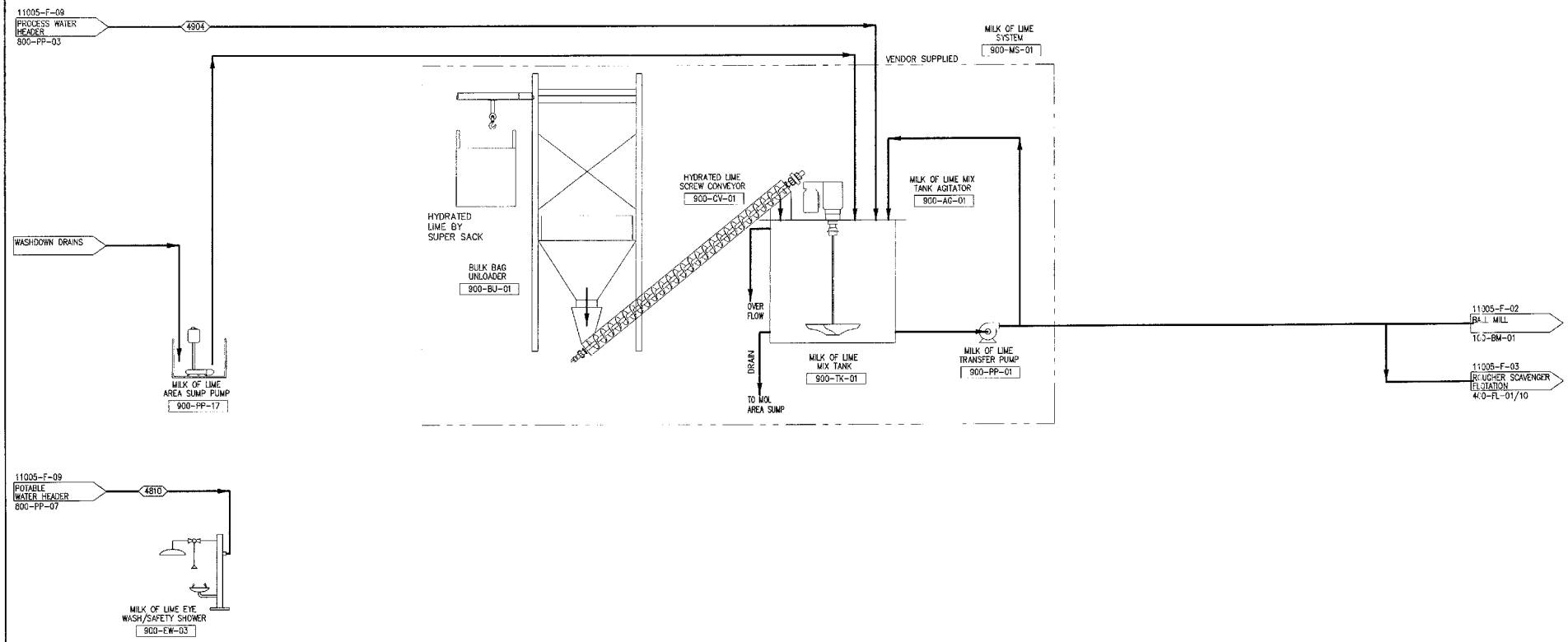
LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

REAGENT MIXING & DISTRIBUTION MIX FLOWSHEET

DATE/TIME LAST MODIFIED	DRAWING NO.	REV.
13 SEPT 2011 1100	11005-F-11	G

SCALE: (D.N.T.S.)



10/06/2011 Description	Emergency Wash Water	Process Water MOL Mix
Stream Number	4810	4904
Total Mass, tph	0.0	0.3
Solids, tph		
Liquids, tph	0.0	0.3
% Solids		0.0
Slurry SG	1.0	1.0
Slurry, gpm	0.03	1.35

APPROVED BY CLIENT

DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE

NO	REVISIONS	BY	APP	DATE
G	ISSUED FOR CLEINT REVIEW	OC	NdM	06/OCT/11
F	ISSUED FOR CLEINT REVIEW	CS	NdM	13/SEPT/11
E	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11
D	ISSUED FOR CLIENT APPROVAL	OC	NdM	11/JUL/11
C	ISSUED FOR CLIENT APPROVAL	CS	NdM	16/JUN/11
B	ISSUE FOR CLIENT REVIEW	CS	JIK	08/JUN/11
A	ISSUE FOR CLIENT REVIEW	CS	JIK	27/APR/11

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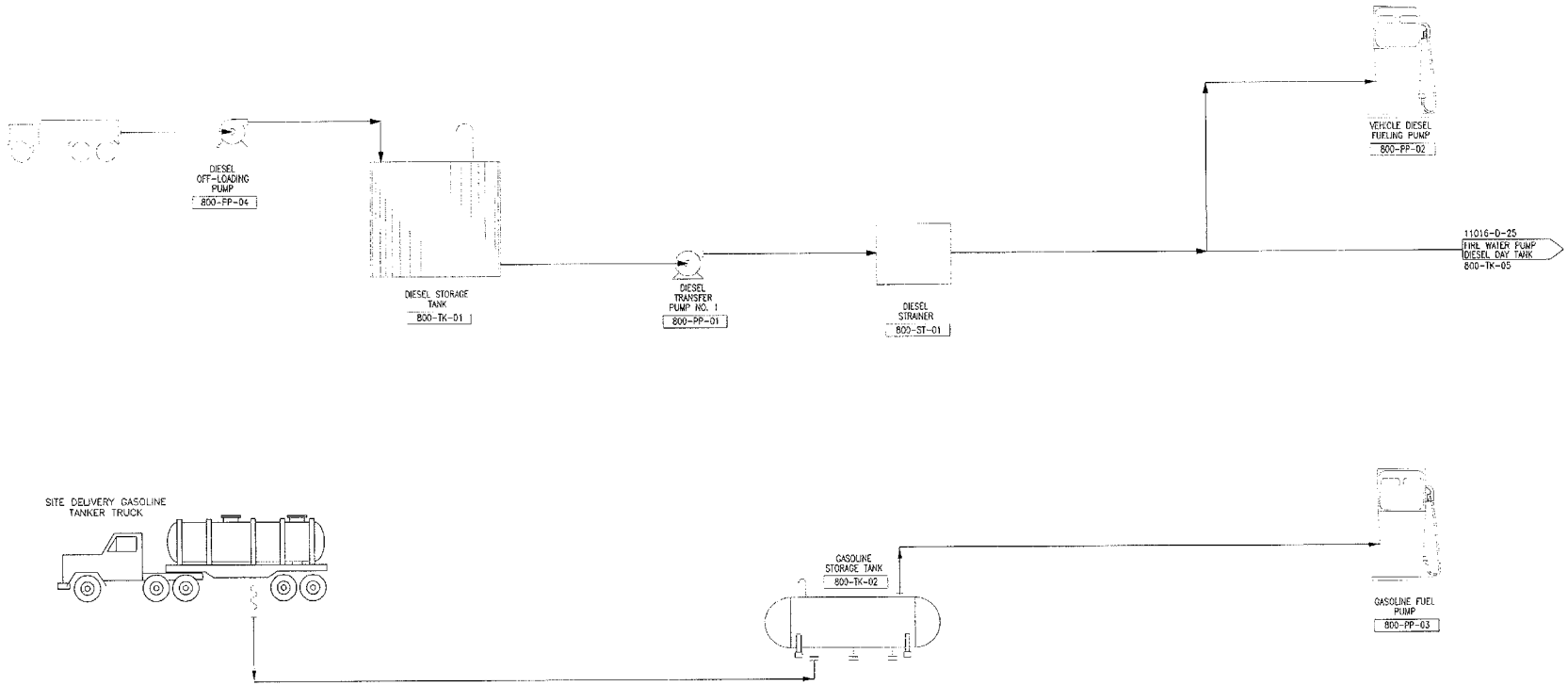
ENGINEER	L. APODACA	
DRAWN BY	C.SPICER	27/APR/11
P.M. CHECK	N. DE MEL	
PROCESS CHECK		
MECH. CHECK.		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

MILK OF LIME STORAGE & DISTRIBUTION FLOWSHEET

DATE.TIME LAST MODIFIED	DRAWING NO.	REV.
13 SEPT 2011 1200	11005-F-12	G
SCALE: (D) N.T.S.		



DRAWING NO.	REFERENCE DRAWING TITLE	NO	REVISIONS	BY	APP	DATE	NO	REVISIONS	BY	APP	DATE
							B	ISSUED FOR CLEINT REVIEW	CS	NdM	13/SEPT/11
							A	ISSUED FOR PERMITTING	CS	NdM	09/SEPT/11

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ENGINEER	L. APODACA	
DRAWN BY	C.SPICER	07/SEPT/11
P.M. CHECK	N. DE MIL	
PROCESS CHECK		
MECH. CHECK		
STRUCT. CHECK		
ELECT. CHECK		
INST. CHECK		
CLIENT APPROVAL		

LYNTEK INCORPORATED

ORACLE RIDGE MINING, LLC

FUEL STORAGE & DISTRIBUTION FLOWSHEET

DATE TIME LAST MODIFIED	DRAWING NO.	REV.
09 SEPT 2011 1100	11005-F-13	B

SCALE: (D) N.T.S.

ORACLE RIDGE MINING, LLC

EQUIPMENT LIST

PRELIMINARY
ORACLE RIDGE
EQUIPMENT LIST

10/6/2011

Revision 7

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
		JAW CRUSHER CIRCUIT & CRUSHED ORE HANDLING		**JAW CRUSHING SYSTEM & UNDERGROUND CRUSHED ORE HANDLING CIRCUIT**							
11005-F-01, Rev. G	100-DS-01	Dust Spray/Collection System	1 ea.	System piping W/ spray bars & Nozzles		14.9	20.0	14.9	20.0	$50,000.00	Local Supply
11005-F-01, Rev. G	100-HP-01	Feed Hopper	1 ea.	Rock Box type feed hopper, 5.0m x 5.0m x 3.0m, steel plate						$30,000.00	Local Supply
11005-F-01, Rev. G	100-FE-01	Vibrating Grizzly Feeder	1 ea.	48" x 27' Apron Feeder with Static Grizzly		22.4	30.0	22.4	30.0	$95,000.00	Simplex
11005-F-01, Rev. G	100-FE-01	Support Structure	1 ea.	Simplex carbon steel structure including crusher feed chute, by-pass chute, discharge chute, walkways, platform and ladders						$100,000.00	Simplex
11005-F-01, Rev. G	100-RB-01	Rock Breaker	1 ea.	3,500 lb. Class Rock Breaker, Pedestal Type		74.6	100.0	74.6	100.0	$45,000.00	Simplex
11005-F-01, Rev. G	100-CR-01	Primary Jaw Crusher	1 ea.	Nordberg Jaw Crusher Model C100, 30"x42", 220 STPH capacity (based on 12 hrs. operation), with replaceable jaw plates, steel support structure and 150 Hp Premium Efficient motor		111.9	150.0	111.9	150.0	$220,000.00	Metso
11005-F-01, Rev. G	100-CV-01	Jaw Crusher Under-crusher Conveyor	1 ea.	Simplex Model SXTC 54" Wide x 50 ft. Long Conveyor with dust cover and 15 Hp Premium Efficient motor.		11.2	15.0	11.2	15.0	$65,000.00	Simplex
11005-F-01, Rev. G	100-MG-01	Stationary Magnet	1 ea.	Metal Detector (10kW)		10.0	13.4	10.0	13.4	$20,000.00	Eriez
11005-F-01, Rev. G	100-XM-01	Metal Detector	1 ea.	Metal Detector						$25,000.00	
11005-F-01, Rev. G	100-CV-02	Conveyor to Surface	1 ea.	36" Wide x 1500' Long Incline Conveyor, assume 13 degree ramp, assume 340' vertical lift.		111.9	150.0	111.9	150.0	$592,500.00	Simplex
11005-F-01, Rev. G		Crusher/Conveyor Control Room	1 ea.	Control Room with MCC and Deluxe Operator Control Module						$125,000.00	Simplex
				Sub-Total Kw/Hp		**356.9**	**478.4**	**356.9**	**478.4**		
		SURFACE CONVEYORS AND CRUSHED ORE BINS		**SURFACE CONVEYORS AND CRUSHED ORE STORAGE BIN SYSTEM**							
11005-F-01, Rev. G	100-CV-03	Crushed Ore Bin Feed/Tripper Conveyor	1 ea.	36" Wide x 380' Long Feed/Tripper Conveyor		37.3	50.0	37.3	50.0	$250,000.00	Simplex
11005-F-01, Rev. G	100-BK-01	Crushed Ore Storage Bin No. 1	1 ea.	4,000 ST (Live) Capacity Concrete Bin - 50' Wide x 50' Long x 65' High with draw-point outlet for Apron Feeder						$900,000.00	Local Supply
11005-F-01, Rev. G	100-BK-02	Crushed Ore Storage Bin No. 2	1 ea.	4,000 ST (Live) Capacity Concrete Bin - 50' Wide x 50' Long x 65' High with draw-point outlet for Apron Feeder						$900,000.00	Local Supply
11005-F-01, Rev. G	100-BK-3	Crushed Ore Storage Bin No. 3	1 ea.	4,000 ST (Live) Capacity Concrete Bin - 50' Wide x 50' Long x 65' High with draw-point outlet for Apron Feeder						$900,000.00	Local Supply
11005-F-01, Rev. G	100-FE-01	Apron Feeder No. 1	1 ea.	Simplex 36" Wide x 20' Long Apron Feeder with Load hopper, Discharge chute, Drive drum, Discharge drum, Gearbox, and 15 Hp Premium Efficient motor with VFD and Feedbox.	**VFD**	11.2	15.0	11.2	15.0	$170,000.00	Simplex
11005-F-01, Rev. G	100-FE-02	Apron Feeder No. 2	1 ea.	Simplex 36" Wide x 20' Long Apron Feeder with Load hopper, Discharge chute, Drive drum, Discharge drum, Gearbox, and 15 Hp Premium Efficient motor with VFD and Feedbox.	**VFD**	11.2	15.0	11.2	15.0	$170,000.00	Simplex
11005-F-01, Rev. G	100-FE-03	Apron Feeder No.3	1 ea.	Simplex 36" Wide x 20' Long Apron Feeder with Load hopper, Discharge chute, Drive drum, Discharge drum, Gearbox, and 15 Hp Premium Efficient motor with VFD and Feedbox.	**VFD**	11.2	15.0	11.2	15.0	$170,000.00	Simplex
11005-F-01, Rev. G	100-CV-05	Reclaim Tunnel Conveyor	1 ea.	36" Wide x 160' Long Reclaim Tunnel Conveyor		18.7	25.0	18.7	25.0	$180,000.00	Simplex
				Sub-Total Kw/Hp		**89.5**	**120.0**	**89.5**	**120.0**		
		SAG MILL		**SAG MILL CRUSHING/ GRINDING CIRCUIT**							
11005-F-02, Rev. G	200-CV-01	SAG Mill Feed Conveyor	1 ea.	36" Wide x 80' Long Feed Conveyor	**VFD**	18.7	25.0	18.7	25.0	$125,000.00	Simplex
11005-F-02, Rev. G	200-SC-01	Belt Scale for SAG Mill Feed Conveyor	1 ea.	0.25% Accuracy Belt Scale						$11,000.00	Ramsey
11005-F-02, Rev. G	200-HP-01	SAG Mill Feed Chute	1 ea.	Mild Steel, AR Plate lined, 136 STPH New Feed Capacity						$25,000.00	Local Supply
11005-F-02, Rev. G	200-SG-01	SAG Mill	1 ea.	SAG Mill 18' x 9', 3,000 STPD capacity		1492.0	2000.0	1,492.0	2,000.0	$4,000,000.00	Metso
11005-F-02, Rev. G	200-SG-01	SAG Mill Gear Lube System	1 ea.	Included w/SAG Mill for bull and pinion gears, pinions and trunnions		3.7	5.0	3.7	5.0	Included above	Metso
11005-F-02, Rev. G	200-SG-01	SAG Mill Jacking System	1 ea.	Included with SAG Mill		7.5	10.0	10.0	10.0	Included above	Metso
11005-F-02, Rev. G	200-SG-01	SAG Ball Mill Inching Drive	1 ea.	Included with SAG Mill		7.5	10.0	7.5	10.0	Included above	Metso
11005-F-02, Rev. G	200-BN-01	SAG Mill Trash Bin	1 ea.	2 m^3 capacity, carbon steel bin						$5,000.00	Local Supply

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
11005-F-02, Rev. G	200-SU-01	Ball Mill Cyclone Feed Sump	1 ea.	Trapezoidal Sump - 4.5m Long x 3.5m Wide x 3m High constructed of carbon steel w/AR steel liners (4 min. retention time)						$50,000.00	Local Supply
11005-F-02, Rev. G	200-PP-01	Ball Mill Cyclone Feed Pump	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, hard-iron centrifugal pump		14.9	20.0	14.9	20.0	$15,000.00	Metso
11005-F-02, Rev. G	200-PP-02	Ball Mill Cyclone Feed Pump - Standby	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, hard-iron centrifugal pump		14.9	20.0			$15,000.00	Metso
				Sub-Total Kw/Hp		**1559.1**	**2090.0**	**1546.8**	**2070.0**		
		BALL MILL		**BALL MILL GRINDING CIRCUIT**							
11005-F-02, Rev. G	200-HP-02	Primary Ball Mill Feed Chute	1 ea.	Mild Steel, AR Plate lined, 136 STPH capacity						$35,000.00	Local Supply
11005-F-02, Rev. G	200-BM-01	Primary Ball Mill	1 ea.	Ball Mill 12.5' x 20.4', 3,000 STPD New Feed Capacity		1491.4	2000.0	1,491.4	2,000.0	$3,152,800.00	Metso
11005-F-02, Rev. G	200-BM-01	Primary Ball Mill Gear Lube System	1 ea.	Included w/mill for bull and pinion gears, pinions and trunnions		3.7	5.0	3.7	5.0	Included above	Metso
11005-F-02, Rev. G	200-BM-01	Primary Ball Mill Jacking System	1 ea.	Included with mill		7.5	10.0	7.5	10.0	Included above	Metso
11005-F-02, Rev. G	200-BM-01	Primary Ball Mill Inching Drive	1 ea.	Included w/mill		7.5	10.0	7.5	10.0	Included above	Metso
11005-F-02, Rev. G	200-BN-02	Primary Ball Mill Trash Bin	1 ea.	2 m^3 capacity, carbon steel bin						$5,000.00	Local Supply
11005-F-02, Rev. G	200-CY-01	Primary Ball Mill Hydrocyclones	3 ea.	Four (4) Krebs gMax 26 Hydrocyclones (3 operating, 1 spare), gum rubber lined with rubber-lined steel vortex finder, isolation valves,						$125,000.00	Krebs
11005-F-02, Rev. G	200-SA-01	Primary Ball Mill Cyclone Overflow Particle Size Sampler	1 ea.	Heath and Sherwood Particle Size Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
11005-F-02, Rev. G	200-PP-01	Grinding Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-02, Rev. G	200-SU-02	Flash Flotation Feed Sump	1 ea.	Trapezoidal Sump - 4.5m Long x 3.5m Wide x 3m High constructed of carbon steel w/AR steel liners (5 min. retention time)						$50,000.00	Local Supply
11005-F-02, Rev. G	200-PP-03	Flash Flotation Feed Pump	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, rubber-lined centrifugal pump		14.9	20.0	14.9	20.0	$15,000.00	Metso
11005-F-02, Rev. G	200-PP-04	Flash Flotation Feed Pump - Standby	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, rubber-lined centrifugal pump		14.9	20.0			$15,000.00	Metso
11005-F-02, Rev. G	200-CN-01	Grinding Area Bridge Crane	1 ea.	30 ton capacity, complete with rails and controls		7.5	10.0	7.5	10.0	$75,000.00	Wazee Electric
11005-F-02, Rev. G	200-HD-01	SAG Mill Liner Handler	1 ea.	McLellan Mill Liner Handling System		37.3	50.0	37.3	50.0	$310,000.00	McLellan Industries
				Sub-Total Kw/Hp		**1599.9**	**2,145.5**	**1,585.0**	**2,125.5**		
		FLASH FLOTATION		**FLASH FLOTATION CIRCUIT**							
11005-F-02, Rev. G	300-FL-01	Flash Flotation Cell	1 ea.	One (1) 20 m3 Tank Cell		37.3	50.0	37.3	50.0	$235,000.00	Metso
11005-F-02, Rev. G	300-SU--01	Flash Flotation Froth Pump	1 ea.	Metso Vertical Froth Pump (Bowl), Model VF 80, 3" Discharge		3.7	5.0	3.7	5.0	$6,000.00	Metso
11005-F-02, Rev. G	300-SU-02	Flash Flotation Tailings Sump	1 ea.	Trapezoidal Sump - 4.5m Long x 3.5m Wide x 3m High constructed of carbon steel w/AR steel liners (5 min. retention time)						$50,000.00	Local Supply
11005-F-02, Rev. G	300-PP-03	Flash Flotation Tailings Pump	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, rubber-lined cetrifugal pump		14.9	20.0	14.9	20.0	$15,000.00	Metso
11005-F-02, Rev. G	300-PP-04	Flash Flotation Tailings Pump - Standby	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, rubber-lined cetrifugal pump		14.9	20.0			$15,000.00	Metso
11005-F-02, Rev. G	300-SA-01	Flash Flotation Concentrate Sampler	1 ea.	Heath and Sherwood Metallurgical Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
11005-F-02, Rev. G	300-PP-01	Flash Flotation Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
				Sub-Total Kw/Hp		**86.2**	**115.5**	**71.2**	**95.5**		
		Cu ROUGHER FLOTATION		**Cu ROUGHER FLOTATION CIRCUIT**							
11005-F-03, Rev. H	400-TK-01	Rougher Flotation Conditioning Tank	1 ea.	8' Diameter x 9.5' High Conditioner tank						$20,000.00	Local Supply
11005-F-03, Rev. H	400-AG-01	Rougher Flotation Conditioning Tank Agitator	1 ea.	8' Diameter x 9.5' High Condtiioner mechanism with dual propellers		14.9	20.0	14.9	20.0	$30,000.00	MixPro
11005-F-03, Rev. H	400-FL-01/06	Rougher Flotation Cells	6 ea.	Six (6) 5m3 Tank Cells, forced air, with Premium Efficient Motors, arranged F-2-I-2-I-2-D		7.5	10.0	45.0	60.0	$347,000.00	Metso
11005-F-03, Rev. H	400-PP-02	Rougher Froth Pump	1 ea.	Metso Vertical Froth Pump (Bowl), Model VF100, 4" Discharge		5.6	7.5	5.6	7.5	$21,870.00	Metso
11005-F-03, Rev. H	400-SA-02	Rougher Flotation Concentrate Sampler	1 ea.	Heath and Sherwood Metallurgical Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
				Sub-Total Kw/Hp		**28.4**	**38.0**	**65.9**	**88.0**		
		Cu SCAVENGER FLOTATION		**Cu SCAVENGER FLOTATION CIRCUIT**							
11005-F-03, Rev. F	400-FL-07/10	Scavenger Flotation Cells	4 ea.	Four (4) 5m3 Tank Cells, forced air, with Premium Efficient Motors arranged F-2-I-2-D		18.6	25.0	74.6	100.0	$232,000.00	Outotec
11005-F-03, Rev. F	400-PP-03	Scavenger Froth Pump	1 ea.	Metso Vertical Froth Pump (Bowl), Model VF100, 4" Discharge		7.5	10.0	7.5	10.0	$21,870.00	Weir

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
11005-F-03, Rev. H	400-SU-01	Scavenger Flotation Tailings Sump	1 ea.	Round Sump - 3.0m Diameter x 2.5m High, lined with AR steel plate (4.5 min. retention time)						$25,000.00	Local Supply
11005-F-03, Rev. H	400-PP-04	Scavenger Flotation Tailings Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM100, 4" x 3", rubber-lined centrifugal pump		7.5	10.0	7.5	10.0	$10,000.00	Metso
11005-F-03, Rev. H	400-PP-05	Scavenger Flotation Tailings Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM100, 4" x 3", rubber-lined centrifugal pump		7.5	10.0			$10,000.00	Metso
11005-F-03, Rev. H	400-SA-01	Scavenger Flotation Tailings Sampler	1 ea.	Heath and Sherwood Metallurgical Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
11005-F-03, Rev. H	400-PP-01	Rougher/Scavenger Flotation Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-03, Rev. H	400-CN-01	Flotation Area Bridge Crane	1 ea.	5 ton capacity, complete with rails and controls		5.6	7.5	5.6	7.5	$10,000.00	Wazee Electric
				Sub-Total Kw/Hp		**61.9**	**83.0**	**110.4**	**148.0**		
		REGRIND BALL MILL		**REGRIND BALL MILL GRINDING CIRCUIT**							
11005-F-04, Rev. H	500-HP-01	Re-Grind Ball Mill Feed Chute	1 ea.	Mild Steel, AR Plate lined, 12 STPH capacity						$20,000.00	Local Supply
11005-F-04, Rev. H	500-RM-01	Re-Grind Ball Mill	1 ea.	Ball Mill 5' x 9'		111.9	150.0	111.9	150.0	$1,250,000.00	Metso
11005-F-04, Rev. H	500-SU-01	Re-Grind Ball Mill Discharge Sump	1 ea.	Trapezoidal Sump - 2.5m Long x 2.5m Wide x 1.75m High constructed of carbon steel wAR steel liners (5 min. retention time)						$25,000.00	Local Supply
11005-F-04, Rev. H	500-PP-02	Re-Grind Ball Mill Cyclone Feed Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM100, 4" x 3", Hard Metal slurry pump		7.5	10.0	7.5	10.0	$10,000.00	Metso
11005-F-04, Rev. H	500-PP-03	Re-Grind Ball Mill Cyclone Feed Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM100, 4" x 3", Hard Metal slurry pump		7.5	10.0			$10,000.00	Metso
11005-F-04, Rev. H	500-CY-01	Re-Grind Ball Mill Cyclones	1 ea.	Three (3) Krebs gMax 6 Hydrocyclones (2 operating, 1 spare), gum rubber lined with rubber-lined steel vortex finder, isolation valves,						$35,000.00	Krebs
11005-F-04, Rev. H	500-SA-01	Re-Grind Ball Mill Cyclone Particle Size Sampler	1 ea.	Heath and Sherwood Particle Size Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
11005-F-04, Rev. H	500-PP-01	Re-Grind Ball Mill Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-04, Rev. H	500-BN-01	Re-Grind Ball Mill Trash Bin	1 ea.	2 m^3 capacity, carbon steel bin						$5,000.00	Local Supply
				Sub-Total Kw/Hp		**142.1**	**190.5**	**134.7**	**180.5**		
		Cu 1ST CLEANER FLOTATION		**Cu 1ST CLEANER FLOTATION CIRCUIT**							
11005-F-04, Rev. H	500-TK-01	1st Cleaner Flotation Conditioning Tank	1 ea.	5' dia x 6.5' high, Agitated Tank						$8,000.00	Local Supply
11005-F-04, Rev. H	500-AG-01	1st Cleaner Flotation Conditioning Tank Agitator	1 ea.	5' dia x 6.5' high mechanism with dual propellers		7.5	10.0	7.5	10.0	$15,000.00	MixPro
11005-F-04, Rev. H	410-FL-01/06	1st Cleaner Flotation Cells	6 ea.	Six (6) 1.5m3 Tank Cells, forced air, with Premium Efficient Motors, arranged F-2-I-2-I-2-D		5.6	7.5	33.6	45.0	$289,000.00	Metso
11005-F-04, Rev. H	410-PP-02	1st Cleaner Froth Pump	1 ea.	Metso Vertical Froth Pump (Bowl), Model VF 80, 3" Discharge		3.7	5.0	3.7	5.0	$19,400.00	Metso
11005-F-04, Rev. H	410-PP-01	Cleaner Flotation Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
				Sub-Total Kw/Hp		**31.7**	**42.5**	**59.7**	**80.0**		
		Cu 1ST CLEANER/ SCAVENGER FLOTATION		**Cu 1ST CLEANER/SCAVENGER FLOTATION CIRCUIT**							
11005-F-04, Rev. H	420-FL-01/03	1st Cleaner/Scavenger Flotation Cells	3 ea.	Three (3) 1.5m3 Tank Cells, forced air, with Premium Efficient Motors arranged F-1-I-2-D		5.6	7.5	16.8	22.5	$250,000.00	Metso
11005-F-04, Rev. H	420-PP-01	1st Cleaner/Scavenger Froth Pump	1 ea.	Metso Vertical Froth Pump (Bowl), Model VF80, 3" Discharge		3.7	5.0	3.7	5.0	$19,400.00	Metso
11005-F-04, Rev. H	420-SU-01	1st Cleaner/Scavenger Tailings Sump	1 ea.	Round Sump, 5' dia x 7' deep						$8,000.00	Local Supply
11005-F-04, Rev. H	420-PP-02	1st Cleaner/Scavenger Tailings Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2", rubber-lined centrifugal pump;		3.7	5.0	3.7	5.0	$8,590.00	Metso
11005-F-04, Rev. H	420-PP-03	1st Cleaner/Scavenger Tailings Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2", rubber-lined centrifugal pump;		3.7	5.0			$8,590.00	Metso
11005-F-04, Rev. H	420-SA-01	1st Cleaner/Scavenger Tailings Sampler	1 ea.	Heath and Sherwood Metallurgical Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
				Sub-Total Kw/Hp		**17.2**	**23.0**	**24.6**	**33.0**		
		Cu 2ND CLEANER FLOTATION		**Cu 2ND CLEANER FLOTATION CIRCUIT**							
11005-F-04, Rev. H	430-FL-01/05	2nd Cleaner Flotation Cells	5 ea.	Five (5) 1.5m3 Tank Cells, forced air, with Premium Efficient Motors arranged F-2-I-2-I-1-D		5.6	7.5	28.0	37.5	$289,000.00	Metso
11005-F-04, Rev. H	430-PP-01	2nd Cleaner Froth Pump	1 ea.	Metso Vertical Froth Pump (Bowl), Model VF80, 3" Discharge		3.7	5.0	3.7	5.0	$19,400.00	Metso
11005-F-04, Rev. H	430-SU-01	2nd Cleaner Flotation Tailings Sump	1 ea.	Round Sump, 5' dia x 7' deep						$8,000.00	Local Supply
11005-F-04, Rev. H	430-PP-02	2nd Cleaner Flotation Tailings Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2" rubber-lined centrifugal tailings pump;		2.2	3.0	2.2	3.0	$8,590.00	Metso
11005-F-04, Rev. H	430-PP-03	2nd Cleaner Flotation Tailings Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2" rubber-lined centrifugal tailings pump;		2.2	3.0			$8,590.00	Metso

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
				Sub-Total Kw/Hp		**13.8**	**18.5**	**33.9**	**45.5**		
		COPPER CONCENTRATE THICKENER		**COPPER CONCENTRATE CIRCUIT**							
11005-F-05, Rev. G	440-TH-01	Copper Concentrate Thickener Tank	1 ea.	20' Diameter x 8' Side Wall Depth, High-Rate feedwell, mild steel, sloped bottom, w/discharge cone.						$167,500.00	Delkor
11005-F-05, Rev. G	440-TM-01	Copper Concentrate Thickener Mechanism	1 ea.	Hydraulic Power Pack w/motor, rake lift, rakes, shaft, bridge, walkway, bed level indicator, rake height probe, and control panel		3.7	5.0	3.7	5.0	Included above	Delkor
11005-F-05, Rev. G	440-PP-02	Copper Conc. Thickener U/Flow Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2", rubber-lined centrifugal pump		2.2	3.0	2.2	3.0	$8,590.00	Metso
11005-F-05, Rev. G	440-PP-03	Copper Conc. Thickener U/Flow Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2", rubber-lined centrifugal pump		2.2	3.0	2.2	3.0	$8,590.00	Metso
11005-F-05, Rev. G	440-TK-05	Copper Thickener O-flow Standpipe	1 ea.	Round Sump, 5' dia x 7' deep						$8,000.00	Local Supply
11005-F-05, Rev. G	440-PP-06	Copper Thickener O-flow Pump	1 ea.	Peerless Water Pump, 1.5" x 3" centrifugal pump		1.1	1.5	1.1	1.5	$5,000.00	Peerless
11005-F-05, Rev. G	440-PP-07	Copper Thickener O-flow Pump	1 ea.	Peerless Water Pump, 1.5" x 3" centrifugal pump		1.1	1.5			$5,000.00	Peerless
11005-F-05, Rev. G	440-SA-01	Copper Concentrate Sampler	1 ea.	Heath and Sherwood Metallurgical Sampler		0.4	0.5	0.4	0.5	$34,000.00	Heath & Sherwood
11005-F-05, Rev. G	440-TK-01	Copper Thickener Underflow Tank	1 ea.	8' Diameter x 9.5' High mix tank						$10,000.00	Local Supply
11005-F-05, Rev. G	440-AG-01	Copper Thickener Underflow Tank Agitator	1 ea.	8' Diameter x 9.5' High mixing mechanism with dual propellers		14.9	20.0	14.9	20.0	$25,000.00	MixPro
11005-F-05, Rev. G	440-PP-01	Copper Thickener Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
				Sub-Total Kw/Hp		**40.7**	**54.5**	**39.5**	**53.0**		
		COPPER CONCENTRATE FILTER		**COPPER CONCENTRATE FILTRATION CIRCUIT**							
11005-F-05, Rev. G	440-TK-02	Copper Filter Surge Tank	1 ea.	8' Diameter x 9.5' High mix tank						$10,000.00	Local Supply
11005-F-05, Rev. G	440-AG-02	Copper Filter Surge Tank Agitator	1 ea.	8' Diameter x 9.5' High mixing mechanism with dual propellers		14.9	20.0	14.9	20.0	$25,000.00	MixPro
11005-F-05, Rev. G	440-PP-04	Copper Filter Feed Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2" rubber-lined centrifugal pump		2.2	3.0	2.2	3.0	$8,590.00	MixPro
11005-F-05, Rev. G	440-PP-05	Copper Filter Feed Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM75, 3" x 2" rubber-lined centrifugal pump		2.2	3.0			$8,590.00	MixPro
11005-F-05, Rev. G	440-FI-01	Copper Dewatering Filter Press (Membrane-style)	1 ea.	Micronics 800mm x 800mm x 36 Chambers Pressure Filter, mixed-pack plate configuration, 20 ft3 slurry capacity and total filtration area of 393 ft2 with Micrologic PLC Control System		3.7	5.0	3.7	5.0	$107,000.00	Micronics
11005-F-05, Rev. G	440-PP-11	Copper Filter Surge Tank Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-05, Rev. G	440-TK-03	Copper Filtrate Return Tank	1 ea.	10' Diameter x 11.5' High Tank						$30,000.00	Local Supply
11005-F-05, Rev. G	440-PP-08	Copper Filtrate Return Pump	1 ea.	Peerless Water Pump, 1.5" x 3" centrifugal pump		1.1	1.5	1.1	1.5	$5,000.00	Peerless
11005-F-05, Rev. G	440-PP-09	Copper Filtrate Return Pump - Standby	1 ea.	Peerless Water Pump, 1.5" x 3" centrifugal pump		1.1	1.5			$5,000.00	Peerless
11005-F-05, Rev. G	440-AC-01	Copper Filter Air Compressor	1 ea.	Atlas Copco Model GA55VSD AFF-13 screw compressor with built-in refridgerant dryer rated at 65 l/s @ 7.15 bar with 55 kW (75 Hp) motor		56.0	75.0	56.0	75.0	$55,000.00	Atlas Copco
11005-F-05, Rev. G	440-BK-01	Copper Concentrate Storage Bin	1 ea.	Copper Concentrate Storage Bin (20' Wide x 20' Deep x 20' High w/1.25' Thick Walls)						$50,000.00	Local Supply
11005-F-05, Rev. G	440-WS-01	Truck Wash Station (Entrance)	1 ea.	Automated Wheel-washing System complete with sprays, sump, pumps, and control panel		18.7	25.0	18.7	25.0	$75,000.00	Neptune
11005-F-05, Rev. G	440-WS-02	Truck Wash Station (Exit)	1 ea.	Automated Wheel-washing System complete with sprays, sump, pumps, and control panel		18.7	25.0	18.7	25.0	$105,000.00	Neptune
11005-F-05, Rev. G	440-SC-01	Truck Scale	1 ea.	Heavy Duty Ground Hugger Motor Truck Scale System						$45,000.00	Cardinal
11005-F-05, Rev. G	440-PP-12	Copper Truck Wash Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-05, Rev. G	440-TK-04	Fresh Water Tank	1 ea.	8' Diameter x 9.5' High Tank						$10,000.00	Local Supply
11005-F-05, Rev. G	440-PP-10	Fresh Water Supply Pump	1 ea.	Peerless Water Pump, 2" x 3" centrifugal pump		2.2	3.0	2.2	3.0	$5,500.00	Peerless
11005-F-05, Rev. G	440-WW-01	Water Well Pump No. 1	1 ea.	Peerless Water Well Pump		3.7	5.0	3.7	5.0	$10,000.00	Peerless
				Sub-Total Kw/Hp		**154.4**	**207.0**	**151.1**	**202.5**		
		TAILINGS THICKENER		**TAILINGS THICKENER CIRCUIT**							
11005-F-06, Rev. H	700-TK-04	Tailings Thickener Mix Box	1 ea.								
11005-F-06, Rev. H	700-TM-01	Tailings Thickener Mechanism	1 ea.	Gear box, Hydraulic Power-pack w/motor, rake lift, rakes, shaft, superstructure, walkway, bed level indicator, rake height probe, and		7.5	10.0	7.5	10.0	$384,000.00	Delkor
11005-F-06, Rev. H	700-TH-01	Tailings Thickener Tank	1 ea.	40' Diameter x 10' Side Wall Depth, High-Rate feedwell, mild steel, sloped bottom, w/discharge cone.						Included above	Delkor
11005-F-06, Rev. H	700-PP-05	Tailings Thickener O/Flow Pump	1 ea.	Peerless Water Pump, 2" x 3" centrifugal pump		2.2	3.0	2.2	3.0	$5,500.00	Peerless

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
11005-F-06, Rev. H	700-PP-06	Tailings Thickener O/Flow Pump - Standby	1 ea.	Peerless Water Pump, 2" x 3" centrifugal pump		2.2	3.0			$5,500.00	Peerless
11005-F-06, Rev. H	700-TK-05	Tailings Thickener O-flow Standpipe	1 ea.	Round Sump, 8' dia x 10' deep						$15,000.00	Local Supply
11005-F-06, Rev. H	700-PP-01	Tailings Thickener U/Flow Pump	1 ea.	Metso Horizontal Slurry Pump, Model HM100, 6" x 4" rubber-lined centrifugal pump		11.2	15.0	11.2	15.0	$15,000.00	Metso
11005-F-06, Rev. H	700-PP-02	Tailings Thickener U/Flow Pump - Standby	1 ea.	Metso Horizontal Slurry Pump, Model HM100, 6" x 4" rubber-lined centrifugal pump		11.2	15.0	11.2	15.0	$15,000.00	Metso
11005-F-06, Rev. H	700-PP-08	Tailings Thickener Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-06, Rev. H	700-TK-01	Tailings Thickener Underflow Tank	1 ea.	15' Diameter x 16.5' High Mix Tank						$25,000.00	Local Supply
11005-F-06, Rev. H	700-AG-01	Tailings Thickener Underflow Tank Agitator	1 ea.	15' Diameter x 16.5' High mixing mechanism with dual propellers		37.3	50.0	37.3	50.0	$50,000.00	MixPro
				Sub-Total Kw/Hp		**86.5**	**116.0**	**84.3**	**113.0**		
		TAILINGS FILTER		**TAILINGS FILTRATION CIRCUIT**							
11005-F-06, Rev. H	700-TK-02	Tailings Filter Surge Tank	1 ea.	15' Diameter x 16.5' High Mix Tank						$25,000.00	Local Supply
11005-F-06, Rev. H	700-AG-02	Tailings Filter Surge Tank Agitator	1 ea.	15' Diameter x 16.5' High mixing mechanism with dual propellers		37.3	50.0	37.3	50.0	$50,000.00	MixPro
11005-F-06, Rev. H	700-PP-03	Tailings Filter Feed Pump	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, rubber-lined cetrifugal pump		14.9	20.0	14.9	20.0	$15,000.00	Metso
11005-F-06, Rev. H	700-PP-04	Tailings Filter Feed Pump - Standby	1 ea.	Horizontal Centrifugal Slurry Pump, 6" x 4", HM150, rubber-lined cetrifugal pump		14.9	20.0			$15,000.00	Metso
11005-F-06, Rev. H	700-FI-01	Tailings Dewatering Filter Press (Membrane-style)	1 ea.	Micronics 1500mm x 2000mm x 120 Chambers Filter Press, mixed-pack plate configuration, 401 ft3 slurry capacity and total filtration area of 6,146 ft2 with Micrologic PLC Control System		7.5	10.0	7.5	10.0	$553,900.00	Micronics
11005-F-06, Rev. H	700-AC-01	Tailings Filter Air Compressor	1 ea.	Atlas Copco Model GA55VSD AFF-13 screw compressor with built-in refridgerant dryer rated at 65 l/s @ 7.15 bar with 55 kW (75 Hp) motor		56.0	75.0	56.0	75.0	$55,000.00	Atlas Copco
11005-F-06, Rev. H	700-TK-03	Tailings Filtrate Return Tank	1 ea.	20' Diameter x 21.5' High Tank						$40,000.00	Local Supply
11005-F-06, Rev. H	700-PP-07	Tailings Filtrate Return Pump	1 ea.	Peerless Water Pump, 8" x 10" centrifugal pump		37.3	50.0	37.3	50.0	$20,000.00	Peerless
11005-F-06, Rev. H	700-PP-08	Tailings Filtrate Return Pump - Standby	1 ea.	Peerless Water Pump, 8" x 10" centrifugal pump		37.3	50.0	37.3	50.0	$20,000.00	Peerless
11005-F-06, Rev. H	700-BK-01	Dewatered Tailings Storage Bin	1 ea.	Dewatered Tailings Storage Bin (30' Wide x 20' Deep x 20' High w/1.25' Walls)						$90,000.00	Local Supply
11005-F-06, Rev. H	700-PP-10	Tailings Water Reclaim Pump	1 ea.	Peerless Water Pump, 2" x 3" centrifugal pump		2.2	3.0	2.2	3.0	$5,500.00	Peerless
11005-F-06, Rev. H	700-PP-09	Tailings Filtration Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
				Sub-Total Kw/Hp		**222.3**	**298.0**	**207.4**	**278.0**		
		WATER STORAGE AND DISTRIBUTION SYSTEMS		**WATER STORAGE & DISTRIBUTION SYSTEMS**							
		Process Water Distribution System									
11005-F-09, Rev. G	800-TK-02	Reclaim Process Water Tank	1 ea.	20' Diameter x 30' High carbon steel tank, welded or bolted construction						$50,000.00	Local Supply
11005-F-09, Rev. G	800-PP-02	Process Water Supply Pump	1 ea.	Peerless Water Pump, 3" x 4"		18.7	25.0	18.7	25.0	$10,000.00	Peerless
11005-F-09, Rev. G	800-PP-03	Mill/MOL Circuit Water Supply Pump	1 ea.	Peerless Water Pump, 3" x 4"		18.7	25.0	18.7	25.0	$10,000.00	Peerless
11005-F-09, Rev. G	800-PP-04	Wash Water Supply Pump (High Pressure)	1 ea.	Peerless Water Pump, 4" x 6"		18.7	25.0	18.7	25.0	$10,000.00	Peerless
11005-F-09, Rev. G	800-WW-01	Underground Water Pump	1 ea.	Peerless Water Pump, 3" x 4"		14.9	20.0	14.9	20.0	$10,000.00	Peerless
		Gland Water Distribution System									
11005-F-09, Rev. G	800-TK-04	Gland Water Tank	1 ea.	15' Diameter x 20' High carbon steel tank, welded or bolted construction						$35,000.00	Local Supply
11005-F-09, Rev. G	800-PP-06	Gland Water Supply Pump	1 ea.	Peerless Water Pump, 1" x 2"		11.2	15.0	11.2	15.0	$6,000.00	Peerless
11005-F-09, Rev. G	800-FF-01	Duplex Filter	1 ea.	Cartridge Filter System						$5,000.00	ISC
		Fire Water System		**Fire Water System**							
11005-F-09, Rev. G	800-TK-01	Fire Water Reserve Tank	1 ea.	30' Diameter x 30' High carbon steel tank, welded or bolted construction. Included Above						$25,000.00	Local Supply
11005-F-09, Rev. G	800-PP-01	Fire Water Pump	1 ea.	6' x 5' Water Pump		18.7	25.00	18.7	25.0	$15,000.00	Peerless
11005-F-09, Rev. G	800-PP-07	Fire Water Back-up Pump System	1 ea.	Fire Water Feed Pump System, skid-mounted, complete with pump, diesel engine, fuel tank, and controls		56.0	75.0	56.0	75.0	$120,000.00	Janssen
		Fresh Water Supply System		**Fresh Water System**						$50,000.00	Local Supply

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
11005-F-09, Rev. G	800-TK-03	Fresh Water Storage Tank	1 ea.	20' Diameter x 30' High carbon steel tank, welded or bolted construction						$25,000.00	Local Supply
11005-F-09, Rev. G	800-PP-05	Fresh Water Supply Pump	1 ea.	Peerless Water Pump, 3" x 4"		18.7	25.0	18.7	25.0	$10,000.00	Peerless
11005-F-09, Rev. G	800-WW-02	Well Water Pump	1 ea.	Peerless Water Pump, 3" x 4"		18.7	25.0	18.7	25.0	$10,000.00	Peerless
11005-F-09, Rev. G	800-RO-01	R/O System	1 ea.	30,000 GPD Reverse Osmosis System		0.2	0.3	0.2	0.3	$65,000.00	Flexeon
11005-F-09, Rev. G	800-PP-07	Potable Water Pump	1 ea.	Peerless Water Pump, 2" x 3" centrifugal pump		2.2	3.0	2.2	3.0	$5,500.00	Peerless
				Sub-Total Kw/Hp		**196.4**	**263.3**	**196.4**	**263.3**		
		REAGENTS MIXING AND DISTRIBUTION SYSTEMS		**REAGENTS MIXING AND DISTRIBUTION CIRCUITS**							
		Sodium Isopropyl Xanthate (SIPX) or Potassium Amyl Xanthate (PAX)									
11005-F-11, Rev. G	920-TK-03	Xanthate Mix Tank	1 ea.	2.5m Diameter x 2.5m High, Carbon steel construction, flat bottom with baffles, clips, stiffening rings, and support steel,						$10,000.00	Local Supply
11005-F-11, Rev. G	920-AG-03	Xanthate Mix Tank Agitator	1 ea.	MixPro Model 11GTC-1-230		2.2	3.0	2.2	3.0	$8,000.00	MixPro
11005-F-11, Rev. G	920-TK-04	Xanthate Day Tank	1 ea.	2.5m Diameter x 2.5m High, Carbon steel construction, flat bottom with baffles, clips, stiffening rings, and support steel,						$10,000.00	Local Supply
11005-F-11, Rev. G	920-AG-04	Xanthate Mix Tank Agitator	1 ea.	MixPro Model 11GTC-1-230		2.2	3.0	2.2	3.0	$8,000.00	MixPro
11005-F-11, Rev. G	920-PP-10	Xanthate Metering Pump to Cu Rougher Conditioner	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	920-PP-11	Xanthate Metering Pump to Cu Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	920-PP-12	Xanthate Metering Pump to Cu 1st Cleaner Conditioner	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	920-PP-13	Xanthate Metering Pump to Cu 1st Cleaner/Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	920-PP-14	Xanthate Metering Pump to Cu 2nd Cleaner Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	900-PP-16	Reagent Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-11, Rev. G	900-EW-01	Emergency Shower & Eye Wash Station	1 ea.	Emergency Shower and Eyewash Shower Assembly						$5,000.00	Grainger
11005-F-11, Rev. G	900-EW-02	Emergency Shower & Eye Wash Station	1 ea.	Emergency Shower and Eyewash Shower Assembly						$5,000.00	Grainger
		Methyl Isobutyl Carbinol (MIBC)									
11005-F-11, Rev. G	930-PP-04	MIBC Metering Pump to Flash Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	930-PP-03	MIBC Metering Pump to Rougher Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	930-PP-05	MIBC Metering Pump to Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	930-PP-06	MIBC Metering Pump to Cu 1st Cleaner Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	930-PP-07	MIBC Metering Pump to Cu 1st Cleaner/Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-11, Rev. G	930-PP-08	MIBC Metering Pump to Cu 2nd Cleaner Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
		Hydrated Lime System (CaOH2)									
11005-F-12, Rev. G	900-MS-01	Complete Hydrated Lime System - Vendor Supplied	1 ea.	Hydrated Lime System, complete with Bulk Bag Un-loader, electric beam hoist for super-sack, electric vibrator, screw feeder, mix tank		7.5	10.0	7.5	10.0	$165,000.00	Merrick
11005-F-12, Rev. G	900-BU-01	Bulk Bag Unloader	1 ea.	Bulk Bag Unloader, included above							
11005-F-12, Rev. G	900-CV-01	Hydrated Lime Screw Conveyor	1 ea.	Hydrated Lime Screw Conveyor, included above							
11005-F-12, Rev. G	900-TK-01	Milk-of-Lime Mix Tank	1 ea.	Milk-of-Lime Mix Tank, included above							
11005-F-12, Rev. G	900-AG-01	Milk-of-Lime Mix Tank Agitator	1 ea.	Milk-of-Lime Mix Tank Agitator, included above							

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
11005-F-12, Rev. G	900-PP-01	Milk-of-Lime Transfer Pump	1 ea.	Milk-of-Lime Transfer Pump, included above							
11005-F-12, Rev. G	900-PP-17	Milk of Lime Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
11005-F-12, Rev. G	900-EW-03	Emergency Shower & Eye Wash Station	1 ea.	Emergency Shower and Eyewash Shower Assembly						$5,000.00	Grainger
		Sodium Hydrosulfide (NaHS)									
11005-F-13, Rev. A	940-TK-01	NaHS Mix Tank	1 ea.	2.5m Diameter x 2.5m High, Carbon steel construction, flat bottom with baffles, clips, stiffening rings, and support steel,						$10,000.00	Local Supply
11005-F-13, Rev. A	940-AG-01	NaHS Mix Tank Agitator	1 ea.	MixPro Model 11GTC-1-230		2.2	3.0	2.2	3.0	$8,000.00	MixPro
11005-F-13, Rev. A	940-TK-02	NaHS Day Tank	1 ea.	2.5m Diameter x 2.5m High, Carbon steel construction, flat bottom with baffles, clips, stiffening rings, and support steel,						$10,000.00	Local Supply
11005-F-13, Rev. A	940-AG-02	NaHS Mix Tank Agitator	1 ea.	MixPro Model 11GTC-1-230		2.2	3.0	2.2	3.0	$8,000.00	MixPro
11005-F-13, Rev. A	940-PP-01	NaHS Metering Pump to Cu Rougher Conditioner	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	940-PP-02	NaHS Metering Pump to Cu Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	940-PP-03	NaHS Metering Pump to Cu 1st Cleaner Conditioner	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	940-PP-04	NaHS Metering Pump to Cu 1st Cleaner/Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	940-PP-05	NaHS Metering Pump to Cu 2nd Cleaner Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model MDD021-30-CB-M4-SE-11: Milroyal D low flow disc diaphragm pump featuring a simplex pump head with a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
		Aero Froth (AF65)									
11005-F-13, Rev. A	950-PP-01	AF65 Metering Pump to Flash Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	950-PP-02	AF65 Metering Pump to Rougher Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	950-PP-03	AF65 Metering Pump to Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	950-PP-04	AF65 Metering Pump to Cu 1st Cleaner Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	950-PP-05	AF65 Metering Pump to Cu 1st Cleaner/Scavenger Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
11005-F-13, Rev. A	950-PP-06	AF65 Metering Pump to Cu 2nd Cleaner Flotation	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$5,000.00	LMI
		Floc Mix system		**For Copper Concentrate and Tailings Thickeners**							
11005-F-11, Rev. G	910-FS-01	Velodyne Polymer Mixing System	1 ea.	Velodyne Hydramax model D-100S-B4-1 Polymer Mix, Complete Vendor package		1.9	2.5	1.9	2.5	$75,000.00	Velodyne
11005-F-11, Rev. G	910-FE-01	Screw Feeder	1 ea.	Volumetric Screw Feeder, SS, 8.7 to 87 RPM			0.5		0.5		
11005-F-11, Rev. G	910-BL-01	Regenerative Blower	1 ea.	90 cfm Blower w/Inlet Air Filter		1.9	2.5	1.9	2.5		
11005-F-11, Rev. G	910-TK-01	Flocculant Mix Tank	1 ea.	1.25m Diameter x 1.5m High, SS construction, flat bottom, with baffles, clips, stiffening rings, and support steel,						Included above	Velodyne
11005-F-11, Rev. G	910-AG-01	Flocculant Mix Tank Agitator	1 ea.	316 SS mix shaft and impeller		2.2	3.0	2.2	3.0	Included above	Velodyne
11005-F-11, Rev. G	910-PP-01	Flocculant Transfer Pump	1 ea.	Velodyne Hydramax model D-100S-B4-1 Polymer Mix Vendor package		2.2	3.0	2.2	3.0	Included above	Velodyne
11005-F-11, Rev. G	910-TK-02	Flocculant Day Tank	1 ea.	2.0m Diameter x 2.1m High, SS construction, flat bottom, with baffles, clips, stiffening rings, and support steel,						Included above	Velodyne
11005-F-11, Rev. G	910-AG-02	Flocculant Day Tank Agitator	1 ea.	316 SS mix shaft and impeller		2.2	3.0	2.2	3.0	Included above	Velodyne
11005-F-11, Rev. G	910-PP-02	Flocculant Delivery Pump to Cu Concentrate Thickener	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$3,000.00	LMI
11005-F-11, Rev. G	910-PP-01	Flocculant Delivery Pump to Tailings Thickener	1 ea.	Milton Roy Diaphragm Metering Pump Model RA11-07-15-FR-SE-SE-M2-NN: Mroy A pump model utilizing a simplex pump head featuring a 316SS liquid end.		0.4	0.5	0.4	0.5	$3,000.00	LMI
11005-F-11, Rev. G	910-PP-15	Flocculant Area Sump Pump	1 ea.	Sala (Metso) Vertical Sump Pump Model VS 80, 4" discharge		14.9	20.0	14.9	20.0	$10,500.00	Metso
				Sub-Total Kw		**80.6**	**108.5**	**80.6**	**108.5**		

DRAWING NO.	EQUIPMENT NUMBER	EQUIPMENT NAME	QTY	EQUIPMENT DESCRIPTION	Motor VFD	KW each	HP each	Total Kw	Total Hp	Equip. Price	Source
		UTILITIES									
		FLOTATION AIR		**FLOTATION AIR**							
11005-F-10, Rev. H	800-BL-01	Cu Flotation Circuit Air Blower	1 ea.	Spencer blower complete with filter-silencer, throttle valve, check valve and calibrated ammeter		29.8	40.0	29.8	40.0	$50,000.00	Spencer
11005-F-10, Rev. H	800-BL-02	Cu Flotation Circuit Air Blower (Spare)	1 ea.	Spencer blower complete with filter-silencer, throttle valve, check valve and calibrated ammeter		29.8	40.0	29.8	40.0	$50,000.00	Spencer
		PLANT AIR		**PLANT AIR**							
11005-F-10, Rev. H	800-AC-01	Plant Air Compressor (Operating)	1 ea.	Atlas Copco Model GA55VSD AFF-13 screw compressor with built-in refridgerant dryer rated at 65 l/s @ 7.15 bar with 55 kW (75 Hp) motor		56.0	75.0	56.0	75.0	$55,000.00	Atlas Copco
11005-F-10, Rev. H	800-AC-02	Plant Air Compressor (Spare)	1 ea.	Atlas Copco Model GA55VSD AFF-13 screw compressor with built-in refridgerant dryer rated at 65 l/s @ 7.15 bar with 55 kW (75 Hp) motor		56.0	75.0	56.0	75.0	$55,000.00	Atlas Copco
11005-F-10, Rev. H	800-AR-01	Plant Air Receiver	1 ea.	Atlas Copco Model LV 2011L Air Receiver constructed of galvanized carbon steel with 2000 liter capacity at 11 bar pressure. Includes safety relief valve, pressure gauge, and drain valve						$5,000.00	Atlas Copco
11005-F-10, Rev. H	800-AR-02	Dry Air Receiver	1 ea.	Atlas Copco Model LV 111 CE Air Receiver constructed of galvanized carbon steel with 120 liter capacity at 11 bar pressure. Includes safety relief valve, pressure gauge, and drain valve						$5,000.00	Atlas Copco
11005-F-10, Rev. H	800-DR-01	Plant Air Dryer	1 ea.	Atlas Copco Model CD3 BSP Adsorption Dryer						$2,000.00	Atlas Copco
				Sub-Total Kw		**171.6**	**230.0**	**171.6**	**230.0**		
		ELECTRICAL		**MOTOR CONTROL CENTER**							
		Low/High Voltage Motor Controls	1 ea.	Motor Control Centor for low/high voltage motors that are located in the Concentrator						$400,000.00	Siemens
		STANDBY POWER									
TBD	170-GE-01	Emergency Standby Generator	1 ea.	Standby diesel powered skid mounted generator set rated at 1500 kw (standby), 415/3/50 complete w/ 1000 gallon fuel tank, instrumentation, electrical control system						$350,000.00	Wagner Power Systems
		FUEL									
11005-F-14, Rev. C	800-TK-02	Gasoline Fuel Tank	1 ea.	10,000 gallon Highland Tank gasoline tank, 10' Diameter x 17' High, double-wall, cone-top construction						$50,000.00	Highland Tank
11005-F-14, Rev. C	800-TK-01	Diesel Fuel Tank	1 ea.	10,000 gallon Highland Tank diesel tank, 10' Diameter x 17' High, double-wall, cone-top condtruction						$50,000.00	Highland Tank
		BUILDINGS									
TBD		Concentrator Building	1 ea.	**TBD**						$1,500,000.00	Local Supply
TBD		Metallurgical Laboratory w/Equipment	1 ea.	**TBD**		37.3	50.0	37.3	50.0	$250,000.00	Local Supply
TBD		Construction Office	1 ea.	**TBD**		18.7	25.0	18.7	25.0	$150,000.00	Local Supply
TBD		Main/Administration Building	1 ea.	**TBD**		7.5	10.0	7.5	10.0	$150,000.00	Local Supply
TBD		Warehouse	1 ea.	**TBD**		18.7	25.0	18.7	25.0	$250,000.00	Local Supply
		Truck Shop	1 ea.	**TBD**		37.3	50.0	37.3	50.0	$250,000.00	Local Supply
				Sub-Total Kw		**119.4**	**160.0**	**119.4**	**160.0**		
				TOTAL ESTIMATED POWER				**5128.8**	**6872.7**		
				TOTAL ESTIMATED EQUIPMENT COSTS						**$23,497,360.00**	

ORACLE RIDGE MINING, LLC

INSIGNIFICANT ACTIVITIES

LIST OF INSIGNIFICANT ACTIVITIES		
No.	**ACTIVITY**	**JUSTIFICATION**
1	• Landscaping, building maintenance, or janitorial activities. • Gasoline storage tanks with capacity of ten thousand gallons or less. • Diesel and fuel oil storage tanks with capacity of forty thousand gallons or less. • Batch mixers with rated capacity of five cubic feet or less. • Internal combustion (IC) engine-drive compressors, IC engine-driven electrical generator sets, and IC engine-driven water pumps used only for emergency replacement of standby service. • Lab equipment used exclusively for chemical and physical analyses. • Any other activity which the control officer determines is not necessary, because of its emissions due to size or production rate, to be included in an application in order to determine all applicable requirements and to calculate and fee under this title. • Manual cleanup around conveyor belts and chutes.	Pima County Code (PCC) Title 17, Chapter 17.04.340.A.114
2	**Plant maintenance and upkeep activities that are not conducted as part of a manufacturing process and are not related to the source's primary business activity, including but not limited to:** • Small equipment operations such as bobcats and backhoes and other small earth moving activities used as part of facility cleanup and materials haulage. • Tailing dam maintenance. • General startup and shutdown of process and pollution control equipment including maintenance activities.	EPA White Paper No. 1 (July 10, 1995)
3	Manually operated equipment used for buffering, polishing, carving, cutting, drilling, machining, routing, sawing, surface grinding or turning and associated venting hoods.	EPA White Paper NO. 2(July 10, 1995) A.A.C. R18-2-101.54
4	Individual points of emission activities as follows: • Individual sampling points, analyzers, and process instrumentation, whose operation may result in emissions. • Individual equipment that is transportable or activities within a facility established for testing units prior to sale or for purpose of research. • Individual flanges, valves, pump seals, pressure relief valves and other individual components that have potential for leaks (Source must comply with the applicable regulations).	ADEQ Policy 000.015 - Insignificant Activities for Copper Smelters. *(Similar to-be-confirmed with PDEQ for non-smelter Copper Mining Facilities)*
5	HVAC vents.	EPA White Paper NO.1 (July 10,1995).
6	Copper Concentrate Filtering.	De-water copper concentrate contains at least 10 percent moisture; at this moisture content, the concentrate is too moist to create dust.
7	Malfunction of process and pollution control equipment outside the normal operation scenarios.	EPA White Paper NO.1 (July 10, 1995) - Malfunctions last for short periods of time and are quickly corrected which results in insignificant increases in emissions.
8	General Research activities such as testing water mist/spray controls for dust abatement.	EPA White Paper NO.1 (July 10, 1995) - General research activities are conducted with the goal of reducing dust emissions, any research activities that do not reduce emissions would be discontinued.
9	General Vehicle refueling.	EPA White Paper NO.1 (July 10, 1995) - Limited emissions expected to result as a result of these activities.